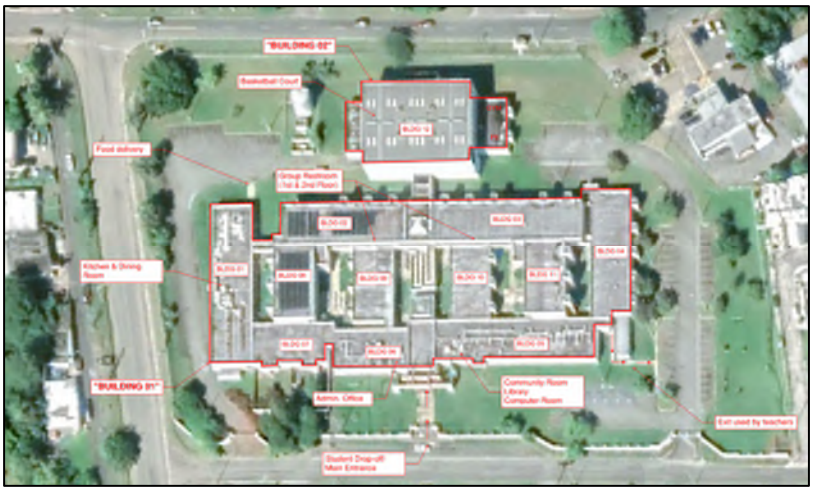
NÚMERO DE SUBASTA: CI-2022-04-04-4242
PROYECTO DE REPARACIONES GENERALES



35907 - DON LUIS MUÑOZ MARÍN
FELIZA RINCÓN, CARR. 3-979, CEIBA, PR 00742
MUNICIPIO DE CEIBA

OMEP
Oficina Para el Mejoramiento de Escuelas Públicas
PO Box 195644 San Juan, Puerto Rico 00919-5644.
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DEPARTAMENTO DE EDUCACIÓN
GOBIERNO DE PUERTO RICO

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INVITACIÓN A SOMETER PROPUESTAS

Gobierno de Puerto Rico
Departamento de Educación

Oficina para el Mejoramiento de las Escuelas Públicas

Fecha de Publicación: 8 de agosto del 2022

Conforme a la Resolución Conjunta Núm. 3 de 28 de agosto de 1990, que creó la Oficina para el Mejoramiento de las Escuelas Públicas de Puerto Rico ("OMEP") adscrita al Departamento de Educación de Puerto Rico ("DEPR") y el Reglamento #9230 titulado "Reglamento Uniforme de Compras y Subastas de Bienes, Obras y Servicios No Profesionales de la Administración de Servicios Generales del Gobierno de Puerto Rico" del 18 de noviembre de 2020, la Oficina para el Mejoramiento de las Escuelas Públicas (OMEP) está solicitando propuestas para el siguiente proyecto:

NÚMERO DE SUBASTA: CI-2022-04-04-4242
PROYECTO DE REPARACIONES GENERALES
35907 - DON LUIS MUÑOZ MARÍN
MUNICIPIO DE CEIBA

En adición a las disposiciones legales indicadas en el párrafo primero anterior, este proceso se lleva a cabo de conformidad con la Ley 85 del 29 de mayo de 2018 (Ley de la Reforma Educativa de Puerto Rico), la OE-2022-023 promulgada por el Gobernador de Puerto Rico el 25 de marzo de 2022, que extendió las disposiciones de la OE-2021-021 del 16 de marzo de 2021.

El proyecto consiste en mejoras físicas al plantel escolar y otros edificios del Departamento de Educación de Puerto Rico "DEPR"). Los documentos relacionados a este procedimiento, incluyendo cualquier addendum, aclaración o contestación a preguntas, se publicarán en el portal cibernético del DEPR. Todo el trabajo para realizar deberá estar de acuerdo con el Pliego (según definido el término en este documento) de este procedimiento competitivo. La reunión compulsoria de pre-subasta se realizará el **18 de agosto del 2022 a las 10:00 AM** en la Esc. Don Luis Muñoz Marín localizada en Feliza Rincón, Carr. 3-979, Ceiba, PR 00742. Durante dicha reunión los proponentes podrán realizar preguntas pero la contestación oficial de OMEP se publicará en la pagina cibernética del DEPR. Los contratistas deberán someter sus propuestas por correo electrónico a omepcentralcompras@de.pr.gov, conforme a las Instrucciones, el día **22 de septiembre del 2022 vía el correo electrónico antes mencionado antes de las 11:59 pm. La apertura de las propuestas se realizará el 23 de septiembre del 2022 en las oficinas de OMEP Central. NO SE REQUIERE LA PRESENCIA DE LOS CONTRATISTAS PARA LA REAPERTURA.**

NOTA: Toda pregunta se someterá mediante correo electrónico dirigida al Departamento de Compras a omepcentralcompras@de.pr.gov en o antes del **1 de septiembre del 2022** antes de las 11:59pm. Las contestaciones se publicarán en el portal cibernético del DEPR.

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Este proyecto se sufragará total o parcialmente con fondos asignados por la Federal Emergency Management Agency ("FEMA") y con fondos CDBG del Department of Housing and Urban de los Estados Unidos ("HUD"), administrados por el Departamento de la Vivienda del Gobierno de Puerto Rico ("Vivienda"). En virtud de ello aplican ciertas disposiciones de ley federal que se incluyen en este documento y que el Proponente deberá observar. Dichas disposiciones se encuentran en el **EXHIBIT G**. Al someter una Propuesta bajo esta licitación el proponente acuerda aceptar y observar las disposiciones aplicables, las cuales se incluirán en el contrato que será suscrito entre el contratista agraciado y la OMEP.

La OMEP se reserva el derecho de aceptar o rechazar cualquier propuesta y de recomendar la adjudicación de la compra bajo aquellas condiciones que sean las más favorables para la OMEP. Todo contratista invitado e interesado en someter su Propuesta, deberá cumplir con las provisiones del Pliego de Subasta, así como de entregar los documentos en o antes de la fecha y hora límite establecidas.

Cualquier cambio en ley o reglamento durante el término del Contrato, incluyendo, sin limitación, cualquier cambio en ley de impuestos aplicable, que cause un aumento en los costos de suplir cualquier producto o servicio a OMEP deberá ser responsabilidad del Contratista, y OMEP no estará obligada a hacer pagos adicionales o a pagar cualquier suma adicional más allá del Precio del Contrato.

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INSTRUCCIONES A LOS CONTRATISTAS

I. TÉRMINOS DEFINIDOS

Los términos utilizados en estas Instrucciones a los contratistas que están definidos en los Documentos de Contrato aquí incluidos tendrán los mismos significados asignados. Algunos términos adicionales utilizados en estas Instrucciones tendrán sus respectivos significados según indicados a continuación y los cuales serán aplicables tanto en su uso singular como plural.

- **Addendum (adenda-plural)**- Un documento de clarificación emitido por OMEP/DEPR previo a la ejecución del contrato de construcción y que modifica o interpreta los Pliegos mediante la adición, eliminación, clarificación o corrección.
- **OMEP u Oficina**- Significa la "Oficina para el Mantenimiento de las Escuelas Públicas", según dispuesto en la Resolución Conjunta Núm. 3 de 28 de agosto de 1990, según enmendada.
- **DEPR** – Departamento de Educación de Puerto Rico.
- **Oficina Central de OMEP**- oficina ubicada en la Calle Ángel Buonomo #360, Suite 102 de la Urbanización Industrial Tres Monjitas en Hato Rey, San Juan, Puerto Rico 00919.
- **Representante Autorizado**- Representante autorizado para obligar al proponente en aquellos asuntos relacionados a la Solicitud de Propuestas, y el Contrato.
- **Desglose de costos** - Se refiere al costo total de la propuesta, detallado por los distintos elementosincluidos en el trabajo descrito en el Desglose de costos.
- **Pliegos** -Colectivamente, las Instrucciones a los contratistas, los Exhibits (incluyendo, pero sin limitarse a: Formulario de Propuesta y Declaración del contratista) y los Documentos de ContratoDichos documentos pueden ser provistos por la OMEP en formato electrónico o texto, data, gráficos y demás.
- **Propuesta**- Es una oferta completa y presentada de manera adecuada para ejecutar el Trabajo porlas sumas allí estipuladas, sometidas de acuerdo con el Pliego. La Propuesta constituirá la oferta sometida por el contratista interesado en participar la invitación de propuestas.
- **Fecha límite radicar Propuestas** - Ver Sección 5.
- **Formulario de Propuesta (Bid Form)** - documento titulado "Formulario de Propuesta" incluido como **EXHIBIT A o de permitirse, aquel documento del contratista en el que se haga la oferta de la obra a contratarse.**
- **Contratista**- Persona natural o jurídica, debidamente cualificada para participar como postor, presentando una propuesta.
- **Instrucciones a contratista**- Conjunto de instrucciones que forman parte del Pliego emitidopor la OMEP.
- **Notificación de Adjudicación-** Comunicación por escrito emitido por la OMEP al Contratista agraciado en donde se le comunica la adjudicación del contrato.
- **Orden de Comienzo** - Comunicación por escrito emitido por la OMEP al Contratista agraciado en donde se le comunica la fecha hábil de comienzo para la implementación del Alcance de Trabajo contratado. También conocido por "Notice to Proceed"
- **Reglamento-** Se refiere el reglamento #9230, Reglamento Uniforme de Compras y Subastas de Bienes, Obras y Servicios No Profesionales de la Administración de Servicios Generales del Gobierno de Puerto Rico del 18 de noviembre de 2020.
- **Declaración del Contratista**- Documento titulado "Declaración del Contratista" aquí anejado como **EXHIBIT B.**
- **Contratista agraciado**- Aquel contratista que está Técnicamente Cualificado con el "Mejor Valor" y a quien la OMEP (basado en la evaluación técnica y económica) adjudica el Contrato.

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II. ALCANCE DE LOS TRABAJOS

- Se refiere al alcance descrito en el **EXHIBIT A.**
- **TODOS LOS ALCANCES DE TRABAJO DEBEN SER REALIZADOS CONFORME A LOS CODIGOS DE CONSTRUCCION VIGENTES EN PUERTO RICO Y LAS LEYES Y REGLAMENTACIONES AMBIENTALES Y DE SEGURIDAD OCUPACIONAL VIGENTES Y APLICABLES.**
- **Al momento de preparar sus propuestas los licitadores deben tomar en cuenta los requerimientos de las Condiciones Especiales Suplementarias que forman parte de este Pliego como EXHIBIT J.**

III. PRESENTACIÓN DE PROPUESTAS

- El Contratista, al presentar su propuesta, representa que:
  i. El contratista ha leído y entiende que los Pliegos y los Documentos de Contrato, que se relacionan al Trabajo para el cual se somete la Propuesta, y para otras partes del Trabajo, si alguna, que esté siendo evaluada.
  ii. La propuesta se hace conforme a los Pliegos del Proyecto.
  iii. El contratista ha visitado el lugar del Trabajo, se ha familiarizado con las condiciones físicas locales bajos las cuales el Trabajo debe llevarse a cabo y ha correlacionado las observaciones del Contratista con aquellos requisitos de los Documentos de Contrato.
  iv. La propuesta se basa en el Trabajo, los materiales, equipo y sistemas requeridos por los Pliegos, sin excepción.

IV. COPIAS DE LOS DOCUMENTOS

- Dichos pliegos tienen que ser usados al preparar las propuestas. Ni la OMEPni sus representantes asumen responsabilidad alguna por cualquier error o malas interpretacionesque resulten del uso de Pliegos incompletos.
- OMEP y sus representantes, al hacer disponible copia de los Pliegos en los términos anteriormente expuestos, lo hacen con el propósito de obtener Propuestas para el Contrato y ello no confiere o concede una licencia u otro derecho en o con respecto a los Pliegos del proyecto para cualquier otro propósito.

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V. ITINERARIO DE PROYECTO – TABLA T-1

Actividad	Lugar	Itinerario
Reunión Pre-Subasta (compulsoria)*	Esc. Don Luis Muñoz Marín	18 de agosto del 2022 @ 10:00 am
Fecha y hora límite para radicar propuestas	OMEP Central	VER INVITACIÓN
Apertura	OMEP Central	VER INVITACIÓN, NO SE REQUIERE PRESENCIA DE LOS LICITADORES

***** El ausentarse a dicha reunión constituirá razón para descalificar al contratista.

- Itinerario
  i. Un resumen del itinerario de las actividades de mayor relevancia asociadas a este proceso competitivo se incluye en la tabla T-1. Las fechas y actividades están sujetas a cambio y pueden ser revisadas mediante la publicación Adenda. Se reitera que fallar en llegar a la hora y lugar citados para la reunión pre compra/visita de site y/ouna vez comenzada la reunión, será razón suficiente para descalificar a cualquier contratista.
  ii. Representantes de la OMEP estarán presentes para discutir el Trabajo durante la Reunión Pre-Subasta y Visita al site. Minutas de las Reunión Pre-Subasta y Visita al site, pasarán a formar parte de los documentos del proyecto como Adenda. El representante autorizado de la OMEP transmitirá a todos los Contratistas un récord de dicha Addenda, según la OMEP lo estime necesario, en respuesta a las preguntas que surjan en la Reunión Pre-Subasta y Visita al site. Cualquier respuesta transmitida verbalmente, no será válida ni tendrá fuerza legal**.**

VI. CORRESPONDENCIA Y COMUNICACIONES

- Cualquier pregunta o comunicación relacionada a este trabajo deberá ser realizarse vía correo electrónico al correo del Departamento de Compras: omepcentralcompras@de.pr.gov.
- Toda pregunta se someterá mediante correo electrónico dirigida al Departamento de Compras a omepcentralcompras@de.pr.gov en o antes del **1 de septiembre del 2022** antes de las 11:59pm. No se aceptarán preguntas fuera de este término.
- Toda pregunta y/o correspondencia con referencia al trabajo deberá ser identificada como sigue:

Número de proyecto «TEMA ESPECÍFICO DE LA COMUNICACIÓN»

Nota: Cualquier violación de esta política referente a comunicaciones podrá ser base para el rechazo de una Propuesta en cualquier momento.

i. Todas las comunicaciones a la OMEP referente a este trabajo serán realizadas conforme a lo establecido en la Sección VI de este documento. Ningún agente, abogado, o cualquiera que actúe en representación del Contratista, comenzará comunicación alguna relacionada a este proyecto con la OMEP.

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ii. La OMEP está comprometida con un proceso justo y abierto para que los potenciales Contratista reciban la información sobre el proceso competitivo de solicitud de propuestas. Los Potenciales Proponentes y cualquier miembro de su Equipo no discutirán o se comunicarán, directa o indirectamente, con cualquier otro potencial Contratista y/o director, oficial, empleado, consultor, asesor, agente o representante de cualquier otro potencial Contratista, incluyendo cualquier miembro(s) de el/los equipo(s) de susodicho(s) Contratista(s) con relación a la preparación, contenido y representación de su propuesta No Colusión: Las Propuestas serán sometidas sin conexión alguna, conocimiento, comparación de información o arreglo, con cualquier otro potencial Contratista y/o director, oficial, empleado, consultor, asesor, agente o representante de otro potencial Contratista, incluyendo cualquier miembro del equipo del potencial Contratista.

iii. Cualquier violación a las restricciones impuestas en esta sección con relación a las comunicaciones podrá constituir base para descualificación de un Contratista en cualquier momento.

VII. CUALIFICACIÓN DEL CONTRATISTA

- Para demostrar sus cualificaciones para realizar el Trabajo, cada Contratista deberá someter, juntoa su Propuesta, todo documento adicional que aquí se requiera.
- Será necesario que durante los pasados cinco (5) años el Contratista haya completado trabajos similares a los que propone hacer para completar el Trabajo. Evidencia de dicha experiencia debe ser incorporada como parte del **EXHIBIT C** de su Propuesta.
- De conformidad con la OE-2022-23 del 25 de marzo de 2022, el proponente agraciado deberá certificar por escrito que cualquier donativo político, según dicho término es definido en la Ley Número 222-2011, según enmendada, conocida como "Ley para la Fiscalización del financiamiento de campañas políticas en Puerto Rico" realizado por el contratista (y en caso de que sea una persona jurídica, sus accionistas, miembros, dueños y oficiales) se ha hecho de conformidad con la ley.

- Certificado de Elegibilidad del RUL
  i. Según establecido por la Ley número 73 del 19 de julio de 2019, es requisito cumplir con el Certificado de Elegibilidad emitido por la Administración de Servicios Generales (ASG), el cual acredita que el Licitador cumple con los requisitos establecidos por la ASG para que sea parte del Registro Único de Licitadores.
  ii. El Licitador deberá incluir en la Oferta copia de la certificación de la ASG, la cual debe incluirel nombre de su entidad en el Registro Único de Licitadores (RUL). Si el RUL no es válido al momento de la radicación de la Oferta, el Licitador podrá someter un Certificado vigente del RUL dentro de los diez **(10) días** posteriores a la fecha límite establecido para radicar Ofertas.
- Fianza de Licitación (Bid Bond) según requerido en este documento.
- Certificados de existencia de seguros con límites indicados en este documento.
- Certificación del Contratista indicando que el alcance de trabajo será realizado dentro del periodo de tiempo de ejecución establecido para este proyecto

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- Documento que evidence número de registro en DUNS Number del System for Award Management (SAM)
- Propuesta económica con desglose de costos.
- Acreditaciones ambientales requeridas en la Sección XI

- Estados financieros- se solicita estado financiero del último año auditado y certificado por un Contador Público Autorizado durante los quince (15) meses previos a la fecha de apertura de este proceso competitivo. El documento debe incluir los siguientes componentes:
  i. Balance Sheet-Assets, liabilities, and equity
  ii. Income Statement: Revenue and expenses
  iii. Statement of Retained Earnings: Indicate retained earnings from prior years v. current
  iv. Statement of cash flow:
  v. Notes to financial statements and Schedules

VIII. DISPONIBILIDAD DE TERRENOS PARA EL TRABAJO

- Los terrenos sobre los cuales el Trabajo se llevará a cabo, las servidumbres de paso y otras tierras designadas para uso por parte del Contratista para llevar a cabo el Trabajo están identificados en los Pliegos. Cualquier terreno adicional y/o acceso requerido para facilidades temporeras de construcción,equipo de construcción o almacenamiento de materiales y equipo -si aplica- a ser incorporado en el Trabajo, deberán ser obtenidos y pagados por parte del Contratista. Las servidumbres para construcciones o cambios permanentes, si alguno, deben ser obtenidos y pagos por parte de la OMEP,a menos que esté indicado lo contrario en los Pliegos.

IX. TIEMPO DEL TRABAJO

- El alcance de trabajo para ambas escuelas se completará dentro de una duración total de doscientos **(200)** días calendarios a partir de la fecha de "Notice to Proceed" al Contratista, excluyendo un periodo de "close out" con una duración de 45 días calendarios. Las penalidades o daños líquidos aplicables a tardanzas injustificadas se determinarán de conformidad con las disposiciones del Reglamento 9230 de la Administración de Servicios Generales.
- **Se incluye un itinerario de trabajo sugerido para la fase de construcción indicando duraciones estimadas por edificios. El contratista seleccionado será responsable de desarrollar y someter para aprobación dentro de los primeros quince (15) días posteriores al "Notice to Proceed" un itinerario de trabajo detallado indicando fases y logística con metas y fechas de entregas por edificio.** El contratista agraciado realizará el trabajo en fases. El contratista deberá someter los diseños para aprobación por fase.
- El contratista será responsable de realizar durante los primeros treinta (30) días calendarios posterior a la Orden de Comienzo 'Notice to Proceed' un proceso expedito de someter y obtener la aprobación de equipos mecánicos, eléctricos y de plomería que tengan un tiempo de fabricación y entrega de larga duración. Se requerirá la participación activa de los suplidores de equipos del Contratista en el proceso.

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PRELIMINARY PHASING SCHEDULE	Nov	Nov	Nov	Nov	Dec	Dec	Dec	Dec	Jan	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Apr	Apr	Apr	Apr	May	May	May	May
Activity Description	WK-1	WK-2	WK-3	WK-4	WK-5	WK-6	WK-7	WK-8	WK-9	WK-10	WK-11	WK-12	WK-13	WK-14	WK-15	WK-16	WK-17	WK-18	WK-19	WK-20	WK-21	WK-22	WK-23	WK-24	WK-25	WK-26	WK-27	WK-28	WK-29
#35907 - Luis Muñoz Marin (Ceiba)																													
PHASE 1																													
Building 02																													
Building 01-06																													
PHASE 2																													
Building 01-05																													
Building 01-07																													
PHASE 3																													
Building 01-08																													
Building 01-09																													
PHASE 4																													
Building 01-10																													
Building 01-11																													
PHASE 5																													
Building 01-03																													
Building 01-04																													
PHASE 6																													
Building 01-01																													
Building 01-02																													
PHASE 7																													
Site																													

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DE DEPARTAMENTO DE EDUCACIÓN GOBIERNO DE PUERTO RICO

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X. COORDINACIÓN DE LOS TRABAJOS

- El Contratista será responsable de llevar a cabo el Trabajo de modo tal que se asegure la compatibilidad del Trabajo y la Coordinación de todas las labores relacionadas a dicho Trabajo, así como del acceso al Lugar del Proyecto con el Trabajo de otros Contratistas que realicen labores relacionadas al Trabajo o en la vecindad inmediata del Lugar. Será responsabilidad del contratista coordinar los trabajos con cada director escolar.

- El Contratista proveerá e instalará Letrero o Rótulo de Inversión de acuerdo a **EXHIBIT N**. OMEP someterá las especificaciones del letrero.

XI. REQUISITOS Y PROCEDIMIENTOS RELACIONADOS A LA PRESENTACIÓN DE LAS PROPUESTAS

- Cumplimiento con los documentos del Pliego
  i. El Contratista deberá cumplir con todos los requisitos y proveer la documentación requerida a fin de que su Propuesta sea considerada para evaluación.
  ii. **El incumplir con cualquiera de los requisitos será considerado como un Licitador no responsivo.**
  La Propuesta incorporará todos los documentos solicitados como parte del Pliego, incluyendo aquellos emitidos vía Adenda. **Favor referirse a la Hoja de Cotejo de Propuesta para el orden en el cual deben ser presentados los documentos.**
  iii. Los documentos incluidos como parte de los *Exhibits*, así como cualquier data adicional relacionada a los mismos, deberán ser completados y ejecutados según sea requerido por cada uno de estos por parte del Contratista o su representante autorizado
  iv. **Revisión de Pliegos:**
  1. Lugar del Proyecto: Será la responsabilidad de cada contratista antes de someter su propuesta revisar:
  v. El examinar detenidamente los Pliegos, Adenda publicada y cualquier data relacionada al proyecto debidamente identificado en el Alcance de Trabajo.
  vi. Visitar el lugar para familiarizarse con las condiciones locales que pudieran afectar el costo, progreso, cumplimiento o entrega del trabajo y estar familiarizado y tener entendimiento sobre las condiciones físicas, locales, y relativas al lugar dondese realizará el Trabajo y que pudieran afectar el costo, progreso, cumplimiento o entregade este, conforme al Alcance de los Trabajos del **EXHIBIT A.**
  vii. El considerar todas aquellas leyes estatales y federales aplicables que pudieran afectar el costo, progreso, cumplimiento o entrega del Trabajo.
  viii. El notificar prontamente por escrito al representante autorizado de la OMEP de todos los conflictos, errores, ambigüedades, o discrepancias que el Contratista haya descubierto en o dentro de los Pliegos y cualquier otra data relacionada o documentos.
  ix. El corroborar que la información y data contenida en los Pliegos con respecto a utilidades e infraestructura existentes o contiguas al Lugar está basada en la informacióny data suministrada a la OMEP y/o el representante de la OMEP por los dueños de dichas utilidades e infraestructura. La OMEP y el representante autorizado de la OMEP no asumen responsabilidad por la exactitud o integridad de dicha información o data, a menos que en los Pliegos se informe expresamente lo contrario.

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x. El notificar por escrito a la OMEP, dentro de un plazo de 24 horas contados a partir del recibo de los documentos, de cualquier conflicto, error, ambigüedad y/o discrepancia sobre la cual el Contratista advenga en conocimiento en los Pliegos, data relacionada y cualquier Adenda publicada.

xi. Preguntas y Solicitudes de interpretación o clarificación
   a. Los contratistas podrán solicitar una aclaración o interpretación de cualquier aspecto o requerimiento contenido en este Pliego, mediante comunicación escrita y no más tarde de laFecha límite establecida para someter preguntas sobre el Pliego, según la Secciones V y VI.

   Interpretaciones o aclaraciones consideradas como necesarias por parte del OMEP en respuesta a dichas preguntas, serán emitidas vía Adenda y publicadas en la página web del DEPR que haya cumplido con las reuniones obligatorias. Solo aquellas preguntas respondidas formalmente mediante Adenda escrita serán vinculantes. Interpretaciones orales y otras interpretaciones o clarificaciones no tendrán efecto legal alguno.
   b. A modo de que haya un tiempo de respuesta razonable para la OMEP, dichas comunicaciones escritas deben ser sometidas no más tarde de la fecha establecida en la Sección V. Esto permitirá a la OMEP un tiempo razonable para evaluar las solicitudes y formular respuestas.
   c. Si un Contratista entiende que asuntos específicos no son suficientemente descritos o explicados en los documentos del Pliego, o que un conflicto o discrepancia existe en el Pliegodel proyecto, o con cualquier ley, ordenanza, regla, regulación, u otro estándar o requerimiento estatal o federal, el Contratista deberá notificarlo a la OMEP mediante comunicación escrita para informar sobre la situación y solicitar a OMEP una clarificación, conforme al procedimiento establecido en este Pliego.

- Adenda también podrá ser emitida para modificar los Pliegos según lo entienda necesario la OMEP.
   a. Enmienda al Pliego

   La OMEP se reserva el derecho de enmendar el Pliego en cualquier momento.
   b. Cualquier enmienda a este Pliego será descrita por escrito en una Adenda que se publicará en la página web del DEPR.
   c. Toda Adenda se convertirá en parte de este Pliego. El Contratista reconocerá el recibo de cada Adenda en el **EXHIBIT B**.
   d. Formulario de Propuesta y Declaración del Contratista
      i. El Formulario de Propuesta y la Declaración del Contratista se anejan como **EXHIBIT A** y **EXHIBIT B**, respectivamente.
      ii. Todos los blancos del Formulario de Propuesta y la información del Contratista deben sercompletados por escrito en **tinta azul**, a maquinilla o computadora.
      iii. Una Propuesta sometida por un Contratista que es una Corporación, deberá ser formalizadapor su

      presidente, vicepresidente o cualquier otro representante autorizado. En el último de los casos, debe venir acompañado con evidencia de la autoridad delegada para firmar dicho documento con el nombre corporativo (Resolución corporativa).
      iv. El sello corporativo deberáestar incluido como anejo y autenticarse por parte del (la)

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secretario(a) o asistente de secretario(a) de la Corporación.

v. Una propuesta sometida por un Contratista que es una sociedad deberá ser formalizada anombre de la Sociedad por uno de los socios, cuyo título y dirección oficial de la Sociedad debe aparecer debajo del área de la firma.

- Todos los nombres deberán estar escritos o impresos en tinta negra debajo de la firma.
  - i. La dirección postal, número de teléfono, dirección de correo electrónico y número de facsímil para comunicaciones relacionadas al Contratista, deberán ser provistas.
  - ii. Aquellos Contratistas que no están organizados bajo las leyes del Estado Libre Asociado de Puerto Rico deben proveer evidencia de las autorizaciones correspondientes para llevar acabo negocio como una entidad foránea en Puerto Rico.
  - iii. El precio de la Propuesta deberá considerar las cantidades que el Contratista entienda necesarias como parte de los costos generales (‘overhead’) y ganancia (‘profit’) de los allowances (si alguno) detallados en los documentos de contrato.

- Formato de propuesta

  Para garantizar la uniformidad de los requisitos específicos y la pronta referencia entre todas las Propuestas, el formato deberá ceñirse a los siguientes parámetros:

  i. Será preparada enteramente en el idioma español, salvo aquellos documentos o formularios de la OMEP que hayan sido entregados en idioma inglés.
  ii. Usar tamaño de letra mínimo de doce (12).
  iii. Usar un tipo de letra legible, tal como Arial, Calibri o Times New Roman.
  iv. Toda la información solicitada deberá ser incluida en la propuesta, ya sea cumpliendo todos los formularios provistos en este pliego o anejando la documentación requerida como parte de esta.
  v. Los documentos deberán estar firmados en **tinta azul**.
  vi. La primera hoja de la propuesta deberá ser la Hoja de Cotejo que se incluye como parte de estas instrucciones.
  vii. Los documentos deben estar en el mismo orden en el cual se estipula la Hoja de Cotejo.
  viii. La propuesta debe ser enviada vía correo electrónico: omepcentralcompras@de.pr.gov . El título del correo electrónico debe ser el Número de Subasta.

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NOTA: Las propuestas que incluyen dos escuelas o más se enviarán combinadas vía correo electrónico. Por ejemplo, cuando se vaya someter propuesta para Escuela A y Escuela B, se enviará un solo correo electrónico que incluya ambas escuelas. El título del correo será el número de subasta y el nombre de la(s) escuela(s).

- Cualquier Propuesta entregada después de la fecha y hora indicadas en la Sección 5, será considerada como tardía, rechazada y devuelta sin abrir.
  - i. La propuesta tienes que ser sometida en formato PDF.
  - ii. Todas las Propuestas se convertirán en propiedad de la OMEP al momento en que sean sometidas.
  - iii. Las propuestas permanecerán cerradas hasta tanto se lleve a cabo la apertura.

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XII. MODIFICACIÓN Y RETIRO DE PROPUESTAS

- Una vez sometida la propuesta, la misma no podrá ser modificada. Cualquier contratista podrá retirar su propuesta antes de la fecha de apertura.

XIII. APERTURA

- Las propuestas sometidas serán abiertas por la oficina de compras en las oficinas de OMEP Central, enla fecha indicada en el Itinerario descrito en la Sección V.

XIV. EVALUACIÓN

- Posterior a la radicación y apertura, las Propuestas serán evaluadas por la OMEP conforme a los criterios establecidos en este documento. La OMEP hará la recomendación final basada en costo (lowest bidder) que cumpla con toda la presentación de todos los documentos e información requerida y que llene los requisitos de experiencia y estabilidad financiera necesarios para realizar los trabajos requeridos para el proyecto. La información quedará plasmada en un resumen de Propuestas.

XV. SOLICITUD DE RECONSIDERACIÓN

- Cualquier Contratista adversamente afectado por una decisión de la OMEP que esté relacionada al Trabajo, incluyendo el rechazo de una Propuesta y la adjudicación del Contrato, podrá someter una solicitud de reconsideración conforme a las provisiones de la Ley 38 del 30 de junio de 2017, mejor conocida como la Ley de Procedimientos Administrativos Uniforme del Gobierno de Puerto Rico.
    i. La notificación de adjudicación recoge expresamente los términos de reconsideración y revisión judicial.

XVI. ADJUDICACIÓN

- OMEP adjudicará de acuerdo con las leyes y reglamento aplicables.

- La OMEP se reserva el derecho de (a) rechazar una o todas las Propuestas, incluyendo, sin limitación, el derecho a rechazar todas aquellas Propuestas que sean de No conformidad, no responsivas, no balanceadas o condicionadas y (b) rechazar la Propuesta de cualquier Contratista si la OMEP entiende que no será en el mejor de los intereses el hacer una adjudicación a dicho Contratista, ya sea porque este no está cualificado o posee una dudosa capacidad financiera o fallaen reunir cualquier otro estándar pertinente o criterios establecidos por la OMEP. La OMEP también se reserva el derecho de dispensar toda formalidad que no involucre precio, tiempo o cambios en el Trabajo y negociar los términos contractuales con
el Contratista Agraciado. Discrepancias entre la multiplicación de unidades de Trabajo y precios unitarios serán resueltos afavor de los precios unitarios. Discrepancias entre la suma indicada y cualquier columna de cifrasy la suma correcta que de ella surja, será resuelta a favor de la suma correcta. Discrepancias entrelo escrito y las cifras, serán resueltas a favor de la parte escrita.

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i. Si la compra se adjudica, la misma será adjudicada al Contratista Técnicamente Cualificado con la propuesta más baja. Un Contratista Técnicamente Cualificado significa un Contratista responsable y responsivo, cuya propuesta reúne los requisitos de las presentes Instrucciones y cuya evaluación por parte de la OMEP le indica a la OMEP que la adjudicación adicho Contratista será en el mejor de los intereses del Trabajo. Al evaluar las Propuestas para determinar al Contratista Técnicamente Cualificado, la OMEP considerará: (a) las cualificaciones,récord de cumplimiento e integridad, tal como lo indica en este Pliego y sus anejos, especialmente Cuestionario al Contratista, aquí anejado como **EXHIBIT C**, incluyendo, sin limitarse, al cumplimiento con los requisitos mínimos establecidos en dicho Cuestionario al Contratista y (b) si la Propuesta cumple con los requisitos prescritos en estas Instrucciones. Si se determina que el Contratista que somete la aparente Propuesta más baja, no cumple con ser un Contratista Técnicamente Cualificado, dicha Propuestaserá rechazada y el Contrato será otorgado al Contratista Técnicamente Cualificado con la siguiente Propuesta más baja.

ii. La OMEP podrá conducir cualquier investigación según lo estime necesario para asistir en la evaluación de cualquier Propuesta y establecer la responsabilidad, cualificaciones y capacidad financiera de los Contratista a ejecutar y proveer el Trabajo de acuerdo con los Pliegos y a satisfacción de la OMEP, dentro del tiempo identificado.

- La OMEP hará llegarmediante comunicación escrita la Notificación de Adjudicación a todos los contratistas por correo electrónico. La misma será notificada por correo electrónico a cada proponente.

XVII. SEGUROS Y FIANZAS DEL CONTRATO

- Cuando el Contratista reciba por parte de la OMEP la notificación de adjudicación de contrato para realizar el trabajo objeto de esta compra, éste deberá entregar en un término no mayor de diez (10) días los documentos que evidencien los Seguros que se indican a continuación:

i. Liability Insurance – Conforme al Contrato, el Contratista agraciado deberá, como parte de los documentos de contratación, obtener, pagar por y mantener vigente en todo momentodurante el término establecido y/o enmendado en que se realicen los trabajos objeto de este proyecto, a través de compañías y agencias aceptables para la OMEP los siguientes seguros y/o pólizas:

1. Póliza de la Corporación del Fondo del Seguro del Estado.

2. Responsabilidad General Comercial:

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Cubiertas	Límites
I. Commercial General Liability	$1,000,000.00
• General Aggregate	$2,000,000.00
• Products and Complete Operation	$1,000,000.00
• Personal Injury and Advertising	$1,000,000.00
• Each Occurrence	$1,000,000.00
• Fire Damage	$1,000,000.00
• Medical Expense	$1,000,000.00
II, Employer's Liability Gap	
Bodily Injury by Accident • Each Employee • Each Accident	 $1,000,000.00 $1,000,000.00
III. **Bodily Injurty by Disease** Each employee Each Accident	 $1,000,000.00 $1,000,000.00
II. Personal Property under care, custody, and control:	$1,000,000.00

3. Seguro de Compensación contra Accidentes en el Trabajo
4. Póliza Comprensiva de autos para autos utilizados por el contratista y sus agentes empleados y subcontratistas con cubiertas de: auto liability, Physical damages, Hired/borrowed vehicles y Non-owned auto liability

Límites:
Auto liability: $1,000,000.00
Physical Damages: $1,000,000.00
Medical Payments: $10,000.00
La cubierta de auto comenrcial debe tener los siguientes símbolos:
Liability Coverage: 1 Physical Damages: 2 y 8 Hired-Borrowed Auto: 8 Non-owned Auto Liability: 9

5. Póliza de responsabilidad de impericial profesional en el caso de profesionales que posean licencias: $1,000,000.00
6. Umbrella: $10,000,000.00
7. *Owner's Protective Liability Insurance*

ii. Builder's Risk – Conforme al Contrato, el Contratista agraciado proveerá Builder's Risk Policy por la cantidad total adjudicada. Dicho seguro estará vigente durante todo el periodo del proyecto y hasta la aceptación del mismo por parte de OMPE/DEPR.

- Todos los seguros antes descritos deberán ser, según sea posible, de la misma compañía de seguros.

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i. Las compañías de seguro utilizadas deberán tener licencia y estar debidamente autorizadaspara llevar a cabo negocios en Puerto Rico. Deben tener una sólida reputación económica y estar clasificadas como "A" bajo el Best Key Rating Guide.
ii. Todos los seguros serán a favor de y endosarán al ELA, el Departamento de Educación, a la OMEP y su designado Representante.
iii. Las pólizas incluirán:
- Breach of Warranty Clause
- Waiver of Subrogation (Waiver and/or Release of Subrogation)
- Additional Insured Clause
- Hold Harmless Agreement
- 90 days cancellation Clause

iv. Acuerdo de Indemnización- El Contratista accede y pacta el proteger, defender, e indemnizar y liberar de responsabilidad a OMEP y a cualquiera de sus representantes o agentes, de y en contra de cualquier o toda reclamación, acción, obligación, pérdida y costosrelacionados a cualquier o toda pérdida o daño (incluyendo, sin limitar lo antes dicho, lesionesa o muerte a personas y daños a la propiedad) que sean alegados por lo que en realidad hayasufrido cualquier persona o personas y que sean alegados por o en realidad surja de o sea incidental al Trabajo, servicios o actividades del Contratista o cualquiera de sus subcontratistas bajo el Contrato, incluyendo, sin limitar lo antes dicho, todos los actos u omisiones de los oficiales, empleados y agentes del Contratista y cualquiera de sus subcontratistas en conexión a cualquier instalación, tarea o trabajo, lícito o no o dentro del alcance de su trabajo.

- **Fianzas**

i. **Garantía de Licitación (BID BOND): SE SOLICITARÁ BID BOND PARA ESTE PROCESO EQUIVALENTE AL 5% DEL MONTO TOTAL DE LA COTIZACIÓN.** Los licitadores deberán presentar una Fianza de Licitación por la cantidad del 5% del monto de la oferta que deberá suplir el Contratista a favor de la OMEP como fianza para asegurar la oferta de todas las obligaciones que
pretende contraer el Contratista bajo los documentos de contrato. Esta fianza permanecerá en efecto hasta tanto sea adjudicado y contratada la obra que esta asegura y sea emitida la fianza de pago y cumplimiento, salvo según sea
provisto por parte de las Leyes o Reglamentos o los documentos de contrato. **El Contratista deberá presentar un original de cada una de las fianzas requeridas, debidamente firmadas porvun representante autorizado del afianzador**. Todas las fianzas deberán ser emitidas por una compañía de seguros debidamente licenciada y autorizada a hacer negocios en Puerto Rico.
a. Las cantidades provistas en los BID BOND están sujetas a verificación durante el proceso de subasta. Es responsabilidad de cada contratista verificar las cantidades. OMEP se reserva el derecho de revisar las ofertas en los casos en que las cantidades verificadas en el campo varíen más del 10 % de las cantidades enumeradas en el paquete de ofertas

iii. **Fianza de Cumplimiento (*Performance Bond*):** Se requiere del licitador agraciado una Fianza de Ejecución por la cantidad del 100% (cien por ciento) del monto del contrato que

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deberá suplir el Contratistaa favor de la OMEP y del Departamento de Educación de Puerto Ricocomo fianza del fiel cumplimiento de todas las obligaciones contraídas por el Contratista bajo los documentos de contrato. Esta fianza permanecerá en efecto hasta un año después de la fecha en que el último pago venza o hasta tanto se cumpla el plazo para completar cualquier corrección según especificado en contrato, cualquiera de las que venza más tarde, salvo según sea provisto por parte de las Leyes o Reglamentos o los documentos de contrato. El Contratista deberá presentar un original de cada una de las fianzas requeridas, debidamente firmadas por un representante autorizado del afianzador. Todas las fianzas deberán ser emitidas por una compañía de seguros debidamente licenciada y autorizada a hacer negocios en Puerto Rico.

iv. **Fianza de Pago (*Payment Bond*):** El licitador agraciado presentará una Fianza de Pago por la cantidad del 100%(cien por ciento) del monto del contrato que deberá suplir el Contratista como fianza para el pago de todas las obligaciones contraídas por el Contratista bajo los documentos de contrato.Esta fianza permanecerá en efecto hasta un año después de la fecha en que el último pago venza o hasta tanto se cumpla el plazo para completar cualquier corrección según especificadoen contrato, cualquiera de las que venza más tarde, salvo según sea provisto por parte de las Leyes o Reglamentos o los documentos de contrato.

v. El Contratista deberá presentar un original de cada una de las fianzas requeridas, debidamente firmadas por un representante autorizado del agente afianzador. Todas las fianzas deberán ser emitidas por una compañía de seguros debidamente licenciada y autorizada a hacer negocios en Puerto Rico.

vi. Todas las fianzas deberán ser sometidas por parte del Contratista y acompañadas por los siguientes documentos:
   1.“Power of attorney in fact”
   2. “Acknowledgement of surety”
   3. Copia de la licencia emitida por parte de la Oficina del Comisionado de Seguros de Puerto Rico

vii. Toda fianza y/o seguro requeridos por los Pliegos para ser adquiridos y mantenidos por el Contratista, deberán ser obtenidas de compañías fiadoras o aseguradoras debidamente autorizadas y acreditadas (con licencia) en el Estado Libre Asociado de Puerto Rico para ejercer y emitir fianzas y seguros para los límites y cubiertas aquí requeridos.

viii. El Contratista deberá proveer certificaciones de pago y certificados originales de seguro para todas las pólizas, firmadas por un representante autorizado de la aseguradora, demostrando toda la cubierta necesaria.

XVIII. FIRMA DE CONTRATO

- Cuando la OMEP emita la Notificación de Adjudicación, la misma estará acompañada de una copia de los requisitos para formalizar el contrato, así como de la copia original sin firmar del mismo, que será suscrito entre la OMEP y el Contratista Agraciado. Dentro del término de diez (10) días a contados a partir del recibo de la Notificación de Adjudicación, el Contratista deberá entregar cualquier otro documento requerido como parte de este, así como las Fianzas de Pago y Cumplimiento, los segurosdel contratista y las certificaciones sobre contribuciones especificados. Dentro de ese mismo tiempo, elContratista Agraciado coordinará con OMEP para la firma del

OMEP
PO Box 195644 San Juan, Puerto Rico 00919-5644.
Tel. (787) 281-7575
DEPARTAMENTO DE EDUCACIÓN

El Departamento de Educación no discrimina de ninguna manera por razón de edad, raza, color, sexo, nacimiento, condición de veterano, ideología política o religiosa, origen o condición social, orientación sexual o identidad de género, discapacidad o impedimento físico o mental; ni por ser víctima de violencia doméstica, agresión sexual o acecho.

Contrato y para poner sus iniciales en los documentos del contrato. Dentro del término de diez (10) días posterior a la fecha de la firma del contrato por ambas partes, OMEP hará entrega al Contratista de una copia del contrato registrado y susrespectivos anejos. Asimismo, cada contrato deberá estar acompañado por lo siguiente: dibujos, especificaciones, y cualquier otro documento necesario para la compleción de los trabajos.

XIX. AVISO PARA PROCEDER

- Una vez el Contratista seleccionado haya satisfecho la documentación solicitada en el párrafo anterior, la OMEP comunicará a través de una **Notificación de Proceder** la fecha hábil para que el contratista comience las tareas descritas en el Alcance de Trabajo. **El Contratista no podrá comenzar los trabajos sin esta orden.**

XX. DAÑOS LÍQUIDOS/INCENTIVO POR TERMINACION TEMPRANA

- Las disposiciones contractuales para los daños líquidos por demoras y/o incumplimiento de contrato se describen en el reglamento #9230, Reglamento Uniforme de Compras y Subastas de Bienes, Obras y Servicios No Profesionales de la Administración de Servicios Generales del Gobierno de Puerto Rico del 18 de noviembre de 2020, cuyo documento se hace formar parte de este Pliego.

XXI. PAGO DE PATENTE Y/O ARBITRIOS MUNICIPALES

- De aplicar, será la responsabilidad exclusiva del Contratista asegurarse si existe la responsabilidad depagar impuestos y/o contribuciones municipales por el Trabajo por el cual se contrata. En todo caso, se solicitará evidencia de pago, o certificado negativo de la Oficina de Finanzas del Municipio donde el Trabajo como un documento requerido para procesar el pago al Contratista.
- **DE APLICAR, SERA RESPONSABILIDAD DEL CONTRATISTA CONTEMPLAR EL PAGO DE ARBITRIOS, PATENTES, SEGUROS Y ROTULOS EN SUS COSTOS.**
- El contratista debe incluir nomina certificada a la hora de procesar a factura.

OMEP
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Tel. (787) 281-7575
DEPARTAMENTO DE EDUCACIÓN

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HOJA DE COTEJO DE PROPUESTA

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS

Instrucciones: Al completar la documentación requerida en las Instrucciones, favor de completar esta Hojade Cotejo para asegurar que está sometiendo cada ítem solicitado. Utilice esta lista para organizarla secuencia de la documentación previo a su encuadernación y entrega. El Contratista deberá iniciar en tinta azul en el margen izquierdo de cada ítem confirmando así su inclusión en la Propuesta presentada. En caso de que falte alguno de los documentos requeridos (1 a 10) en la propuesta del Contratista, la oferta se considerará incompleta y no responsiva.

Inicial de Contratista	Item No.	Descripción
DOCUMENTOS DE PROPUESTA REQUERIDOS		
	1	**EXHIBIT A** - Formulario De Propuesta (Bid Form) y Ficha Técnicas (Cut Sheets)
	2	**EXHIBIT B** - Declaración de Contratista (Certificar recibo de Adenda)
	3	**EXHIBIT C** - Cuestionario del Contratista
	4	**EXHIBIT D** - Recibo Y Cumplimiento Del Código Anticorrupción Para El Nuevo Puerto Rico
	5	**EXHIBIT E** - Non-Collusive Affidavit
	6	Certificación de la ASG en Registro Único Licitadores (RUL)
	7	Fianza de Licitación (Bid Bond)
	8	Número de registro en DUNS (System for Award Management – SAM)
	9	Estado financiero auditado (15 meses previo a subasta)
	10	Resolución corporativa (Certificate of Corporate Principal)
OTROS DOCUMENTOS DE REFERENCIA		
	11	**EXHIBIT F** - Documentos necesarios para presentar la Solicitud de Pago Final Por El Contratisa a OMEP
	12	**EXHIBIT G** - Disposiciones Generales Aplicables a Proyectos Sufragados Total o Parcialmente con fondos provistos por FEMA o fondos CDBG provistos por HUD
	13	**EXHIBIT H** - Contract Forms
	14	**EXHIBIT I** - Uniform General Conditions
	15	**EXHIBIT J** - Condiciones Especiales Suplementarias
	16	**EXHIBIT K** - Reference Technical Specifications
	17	**EXHIBIT L** - Buy America Executive Order
	18	**EXHIBIT M** - Requirements for Design-Build
	19	**EXHIBIT N** - Project Identification Sign Guidelines
	20	**EXHIBIT O** - Proposed Site Logistic & Phasing Plan
	21	**EXHIBIT P** - Report and Run
	22	**EXHIBIT Q** - Nota Aclaratoria Proceso Ambiental

Nombre _____ **Fecha** _____

Firma _____ **Número de seguro social** _____

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Exhibit A

Formulario de Propuesta (Bid Form)

EXHIBIT A

FORMULARIO DE PROPUESTA (BID FORM)

1.2 Esta sección describe el alcance de los trabajos a ser cotizados:

Alcance de Trabajo			
Número de Subasta	**CI-2022-04-04-4242**	**Nombre de la Escuela y Código**	**Esc. Don Luis Muñoz Marín (35907)**
Descripción		**Unidad**	**Costo**
Diseño y Permisos		**LS**	$
Supervisión y visitas durante la construcción		**LS**	$
Site		**LS**	$
Edificios		**LS**	$
Condiciones Generales (General Conditions)		**LS**	$
Seguros (Insurance)		**LS**	$
Fianzas (Bonds)		**LS**	$
Impuestos (Taxes; Municipal + State)		**LS**	$
		SUBTOTAL	$
Allowance - HazMat Mitigation (Asbestos & Lead Based Paint)		**LS**	$30,000
Allowance - Mold Remediation / Termite Treatment		**LS**	$20,000
		GRAND TOTAL	$

Nota: El desglose es una guía para la cotización de los trabajos y no será el desglose final para emitir cualquier certificación de pago. Es responsabilidad del contratista verificar las cantidades en visita de campo.
****EL CONTRATISTA ES RESPONSABLE DE LOS COSTOS DE TRANSPORTE MARITIMOS, AÉREOS Y/O TERRESTES A USARSE. ****

1) **Los costos deberán considerar arbitrios, seguros, patentes, "overhead", ganancias, etc.**
2) **Será responsabilidad del contratista corroborar las cantidades a cotizar para estos trabajos.**
3) **El desglose de los trabajos a realizarse serán adjuntados al dorso.**
4) **Esta Propuesta tendrá una vigencia de sesenta (60) días a partir de la fecha de apertura de propuestas.**
5) **El total de la propuesta deberá ser sometido redondeando al dólar más cercano. Ósea, sin utilizar centavos.**

_____ _____

Nombre de contratista **Fecha**

_____ _____

Firma **Número de seguro social patronal**

EXHIBIT A
FORMULARIO DE PROPUESTA (BID FORM)
DON LUIS MUÑOZ MARÍN

SITE - ARCHITECTURAL & CIVIL WORKS

Item No.	Description	Quantity	Unit	Total
1	Repair Cement plaster on concrete fence, school front.	1	LS	$
2	Remove and replace ornamental steel fence, school front. (1 span - 10ft x 6ft)	1	EA	$
3	Remove and replace galvanized steel double gates, parking. (24ft x 7ft)	2	EA	$
4	Remove and replace chain link fence north and west side of school along perimeter wall. (height varies)	1	LS	$
5	Remove and replace barbed wire on top of chain link fence, north and west side of school.	1	LS	$
6	Replace galvanized hinges of steel parking gate.	6	EA	$
7	Replace pedestrian galvanized steel gate. (Kinder - BLDG 07)	1	EA	$
8	Paint all site surfaces including, but not limited to,curbs,wheelstops,traffic/parking lines, traffic symbols,low walls, fences and gates.	1	LS	$
9	Backfill and compact with engineering soil for leveling uneven area due to minor soil erosion, kitchen area. (exterior Dining Hall area)	1	LS	$
10	Backfill and compact with engineering soil for leveling uneven area due to minor soil erosion, kindergarten playground area	1	LS	$
11	Mill and resurface kitchen parking. (patch damaged asphalt next to BLDG 01)	1	LS	$

Subtotal: $ _____

SITE - MECHANICAL & ELECTRICAL WORKS

Item No.	Description	Quantity	Unit	Total
12	Remove parking luminaires, Cobra type. replace with new LED equivalent fixtures, including all electrical components and connections required for a complete, code compliant installation.	6	EA	$
13	**ALLOWANCE** - Paint, install signs and repair/service of electrical substation.	1	LS	$ 5,000.00

Subtotal: $ _____

BUILDING 01 - ARCHITECTURAL & CIVIL WORKS

Item No.	Description	Quantity	Unit	Total
	Potable Water Tank			
14	**ALLOWANCE** - Paint exterior of water tank, chlorination and repair/service, 50,000 gallons steel tank.	1	LS	$ 10,000.00
15	Replace pump room steel door 8 FT X 3 FT. (louver door, frame and hardware)	1	EA	$
16	Replace/ repair tank anchoring points.	12	EA	$
17	Replace tank level meter.	1	EA	$
	Kitchen, Storage and Dining Hall			
18	Concrete floor repair, storage area.	1	LS	$
19	Replace Dining Hall doors, frames and hardware double interior/exterior (8' X 3'	4	EA	$
20	Replace aluminum security windows (30 IN X 60 IN.)	1	LS	$
	Academic Building			
21	Replace steel louvered double door, hardware and frame (72 IN X 96 IN.)	1	EA	$
22	Repair cement plaster Kindergarten A2 wall.	1	LS	$
23	Replace aluminum louvers 4 FT X 4 FT A/C rooms exterior walls.	41	EA	$
24	Replace classrooms windows interior glass panels 2 FT X 2 FT.	1	LS	$
25	Repair concrete floor. (Classroom A22 - 3ft x 3ft)	1	LS	$
26	Replace classrooms steel doors with vision glass, frame and hardware frame (8 FT X 3 FT)	5	EA	$
27	Replace bathroom partitions 30 IN X 48 IN.(Phenolic panels)	33	EA	$
28	Replace door vision glass panels in classrooms doors 3 IN X 24 IN.	2	EA	$
29	Repair expansion joint	1	LS	$
30	Mold remediation in Classroom A7.	1	LS	$
31	Replace steel door closer.	1	EA	$
32	Repair exposed concrete rebars.	1	LS	$
33	Repair/install new metal grid anchors on second floor hallway.	32	EA	$
34	Repair/install ramp railing anchors.	20	EA	$
	Paint - Building 01			
35	Pressure wash and paint building exterior. (All areas and surfaces)	1	LS	$
36	Pressure wash and paint building interior. (All areas and surfaces)	1	LS	$

Subtotal: $ _____

BUILDING 01 - ROOF WATERPROOFING WORKS

Item No.	Description	Quantity	Unit	Total
37	Repair/ install new metal roof in rest area.	1	LS	$
38	Remove existing waterproofing and install new code compliant waterproofing system, including complete roof drainage system (gutters, scuppers, downspouts, etc.), temporary removal and reinstallation of HVAC system(s), raising of existing MEP piping as necessary to meet minimum height code, and installing new tie down/anchoring to secure existing roof equipment.	1	LS	$

Subtotal: $ _____

BUILDING 01 - MECHANICAL & ELECTRICAL WORKS

Item No.	Description	Quantity	Unit	Total
	Kitchen, Storage and Dining Hall			
39	Remove existing and replace with new Walk-in Cooler and Walk-in Freezer (14 FT X 10 FT X 8 FT) refrigeration system. (motor and components). Similar to existing equipment or approved equal.	2	EA	$
40	Replace existing Packaged Type A/C Unit Dining Area Trane THC 24 1 C 3, ducts exposed insulated above roof. 20 TON, with similar to existing equipment or approved equal, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	1	EA	$
41	Replace kitchen supply fan F2 LOREN COOK 180 ASP-T. Similar to existing equipment or approved equal.	1	EA	$
42	Replace storage supply fan F3 LOREN COOK 100 ASP-T. Similar to existing equipment or approved equal.	1	EA	$
	Academic Building			
43	Replace Chemistry Lab exhaust fan LOREN COOK 100 C 2B. Similar to existing equipment or approved equal.	1	EA	$
44	Replace existing Package Type A/C Unit at Community Room Trane TCH 037 C 3, 3 Tons, with similar to existing equipment or approved equal, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	1	EA	$
45	Replace existing Package Type A/C Unit at Library Trane TCH 103 C 3, ducts exposed, insulated above roof. 8.5 Tons, with similar to existing equipment or approved equal, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	1	EA	$
46	Replace existing Package Type A/C Unit at Language Lab Trane TCH 074 C 3, 6 Tons, with similar to existing equipment or approved equal, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	1	EA	$
47	Replace existing Package Type A/C Unit at Computer Room Trane TCH 103 C 3, 8.5 tons, with similar to existing equipment or approved equal, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	1	EA	$

BUILDING 01 - MECHANICAL & ELECTRICAL WORKS

Item No.	Description	Quantity	Unit	Total
48	Replace Package Type A/C Unit at Administration Offices Trane TCH 121 C 3, ducts exposed, insulated above roof. 1 EA, 10 Tons, with new code compliant system, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	1	EA	$
49	Install new (non-existing) A/C minisplit unit in Server Room, 12,000 BTU. including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	1	EA	$
50	Replace 2 FT X 4 FT fluorescent luminaire with new LED equivalent fixtures, including all electrical components and connections required for a complete, code compliant installation.	41	EA	$
51	A/C minisplit 5 TON, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	3	EA	$
52	Replace existing pumps system (3 pumps, power and control panel, 75 GPM,170 TDH, 7.5 HP) with new equipment similar or approved equal to existing.	1	LS	$
53	Replace existing 30 KW electrical generator feeding Potable Water Tank with new equipment similar or approved equal to existing.	1	EA	$

Subtotal: $ _____

BUILDING 02 (BASKETBALL COURT) - ARCHITECTURAL & CIVIL WORKS

Item No.	Description	Quantity	Unit	Total
	Paint			
54	Pressure wash and paint cement plaster wall.	7200	LS	$
55	Pressure wash and paint building exterior. (All areas and surfaces)	*	LS	$
56	Pressure wash and paint building interior. (All areas and surfaces)	*	LS	$
57	Paint interior floor lines.	*	LS	$
58	Replace/repair basketball court siding and windows.	1	LS	$
59	Replace steel doors, hardware and frames, 8 FT X 3 FT, boys' and girls' restrooms.	6	EA	$
60	Replace bathroom partitions doors, 30 IN X 60 IN. (phenolic panels)	4	EA	$
61	Replace, equal or better, basketball board motors and controller.	2	EA	$
62	Replace stage chair lifter.	1	EA	$
63	Replace door lock, stage.	1	EA	$
64	Replace steel doors, frames and hardware 8 FT X 3 FT.	7	EA	$
65	Replace roll up door 10 FT X 12 FT.	1	EA	$
66	Replace double steel doors, frame and hardware, 8FT X 3 FT.	2	EA	$
67	Repair cement plaster, basketball court hallway.	20	SF	$

Subtotal: $ _____

BUILDING 02 (BASKETBALL COURT) - ROOF WATERPROOFING WORKS

Item No.	Description	Quantity	Unit	Total
68	Replace/ repair basketball court roofing area with new code compliant roofing system.	*	LS	$

Subtotal: $ _____

BUILDING 02 (BASKETBALL COURT) - MECHANICAL & ELECTRICAL WORKS

Item No.	Description	Quantity	Unit	Total
69	Replace 1 FT X 4 FT fluorescent luminaires with new LED equivalent fixtures, including all electrical components and connections required for a complete, code compliant installation.	6	EA	$
70	Replace existing basketball court Exhaust Fans, LOREN COOK 48 HEF 10B, 19,500 CFM. Similar to existing equipment or approved equal.	4	EA	$
71	Replace existing stage spotlights and replace with new LED equivalent fixtures, including all electrical components and connections required for a complete, code compliant installation.	4	EA	$
72	Replace court luminaires, 400 W MH with new LED equivalent fixtures, including all electrical components and connections required for a complete, code compliant installation.	16	EA	$

BUILDING 02 (BASKETBALL COURT) - MECHANICAL & ELECTRICAL WORKS

Item No.	Description	Quantity	Unit	Total
73	Replace existing water fountains with hi-low drinking fountain type to meet ADA.	1	EA	$
74	Replace existing A/C units at classrooms (5 TON) with new code compliant system, including all mechanical and electrical components, connections and waterproofing required for a complete, code compliant installation.	2	EA	$

$ _____

Notes:

1) Items in gray require a Design-Build project delivery method and shall comply with ***Exhibit M*** *of the Bid Documents.*

2) This Bid will remain subject to acceptance for sixty (60) days after the Bid Opening date.

3) This Bidder accepts to perform all Work as specified or indicated in the Bidding Documents for the prices submitted in Exhibit A (Bid Form) and within the times indicated in the Instructions to Bidders.

4) Pricing for crack repairs to be based on the ***"Typical Recommended Repairs"*** *included in* ***Exhibit K****.*

5) As part of the backup documentation Bidders are to provide cut sheets of the products making up the basis of their proposal including: A) Generator, B) Water fountain, C) Light fixtures, D) Plumbing fixtures, E) Kitchen equipment, F) HVAC equipment, G) Doors, Frames & Hardware, and H) Roofing system.

_____ _____

Name **Date**

_____ _____

Signature **Employer Identification Number**

INSERT BACK UP DOCUMENTATION - ITEM A - GENERATOR

INSERT BACK UP DOCUMENTATION - ITEM B - WATER FOUNTAIN

INSERT BACK UP DOCUMENTATION - ITEM C - LIGHT FIXTURES

INSERT BACK UP DOCUMENTATION - ITEM D - PLUMBING FIXTURES

INSERT BACK UP DOCUMENTATION - ITEM E - KITCHEN EQUIPMENT

INSERT BACK UP DOCUMENTATION - ITEM F - HVAC EQUIPMENT

INSERT BACK UP DOCUMENTATION - ITEM G - DOORS, FRAMES & HARDWARE

INSERT BACK UP DOCUMENTATION - ITEM H - ROOFING SYSTEM

Exhibit B

Declaración de Contratista

EXHIBIT B

DECLARACIÓN DEL CONTRATISTA

A: Oficina para el Mejoramiento de las Escuelas
Públicas: omepcentralcompras@de.pr.gov
PO Box 195644, San Juan, Puerto Rico 00919-5644

De: (Nombre de Contratista/Nombre de Representante Autorizado/Dirección Postal)

_____

_____

A. Información

a. Fecha para la cual se estableció: _____
b. La siguiente persona está autorizada para obligar legalmente al Contratista en aquellos asuntos referentes a la Compra Informal y al contrato: _____
c. Título: _____
d. Teléfono: _____
e. Facsímil: _____
f. Dirección postal:
g. Correo electrónico para recibir notificaciones de OMEP:

_____

h. Experiencia previa de la empresa y de sus representantes y oficiales, según requerido en el documento de Condiciones Especiales Suplementarias (**EXHIBIT J**) en la parte I, inciso F (2).
i. Experiencia del personal técnico según solicitado en las Condiciones Especiales Suplementarias (**EXHIBIT J**) en la Parte I, inciso F (4).
j. Equipo adecuado: Proveer resumen de inventario de herramientas, materiales y equipo disponible de conformidad con lo requerido en las Condiciones Especiales Suplementarias (**EXHIBIT J**), Parte I, inciso F (5)
k. Número de identificación de impuestos federales (Seguro Social Patronal): _____
l. El Contratista es un(a): (marque con una equis)
Único propietario_____Corporación _____

Sociedad _____ Otro (especifique) _____

m. Nombre de la compañía de seguros portadora del seguro de responsabilidad pública:

_____

n. Nombre y dirección postal de la fiadora

_____

_____

o. Nombre y dirección del agente local:

_____

_____

_____

Iniciales

B. Instrucciones al Contratista

El Contratista hace constar que recibió y examinó todos los documentos que se hacen formar parte de estas Instrucciones a los Contratista para el proyecto objeto de este proyecto.

_____

Iniciales del Contratista

C. Adenda

El Contratista hace constar que recibió la siguiente adenda:

Adenda Núm.	**Fecha de publicación**
1.	
2.	
3.	
4.	

Certifico haber recibido la adenda relacionada a este proyecto y declaro que acepto esta adenda y que cada cambio, si alguno, presentado como parte de la(s) misma(s) ha sido considerado en el costo del proyecto presentado en esta propuesta.

_____

Iniciales del contratista

D. Visita a localización del proyecto

El Contratista hace constar que ha visitado, examinado y evaluado la localización y condiciones de terreno destinados para este proyecto.

E. Plan de Seguridad

El Contratista se compromete a hacer cumplir con un Plan de Seguridad adecuado para este tipo de Trabajo y que instalará aquellos rótulos que sean necesarios durante el desarrollo del Trabajo.

_____
(Firma del individuo)

_____

(Nombre impreso del individuo)

_____

_____

(Dirección Postal)

Exhibit C

Cuestionario del Contratista

EXHIBIT C
CUESTIONARIO AL CONTRATISTA

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS
(OMEP)

Nombre: _____

Fecha: _____

A. Experiencia previa

¿POSEE EL LICITADOR EXPERIENCIA EN PROVEER BIENES Y/O SERVICIOS SIMILARES A LOS INCLUIDOS EN EL ALCANCE DE ESTA COMPRA? (SI o NO) _____

¿POSEE EL LICITADOR ALGUNA LICENCIA, ENTRENAMIENTO O CUALIFICACION NECESARIA PARA EJECER EL ALCANCE DE ESTA COMPRA? (SI o NO) _____.
EN CASO AFIRMATIVO, FAVOR DE PROVEER LAS LICENCIAS, ENTRENAMIENTOS O CUALIFICACIONES NECESARIA.

¿Cuántos años ha estado el Comprador bajo el (los) nombre(s) comercial(es) actual(es)?

Nombre comercial 1: _____años

Nombre comercial 2: _____años

Nombre comercial 3: _____años

Nota: La experiencia será tomada en cuenta como parte de la adjudicación de esta compra. Cuando hayan actuado como subcontratistas para los tipos de trabajos arriba especificados, los Contratistas deberán indicar, asimismo, el monto total del subcontrato.

SOLO INCLUYA EN LA SIGUIENTE TABLA LA REALIZACION DE TRABAJOS SIMILARES AL ALCANCE DE ESTA COMPRA.

Nombre de Proyecto/Año	Descripción de proyecto (tipo, método de construcción)	Monto del contrato	Nombre, Dirección, Teléfono, y Fax del Dueño/Referencia

B. Récord de Cumplimiento e Integridad

a. ¿Ha tenido el Contratista una terminación de contrato por 'default' o incumplimiento?
_____Sí _____No
¿O se ha llevado un juicio en contra del contratista en cualquier corte durante el periodo de cinco años previo a la fecha de entrega de propuestas?
_____Sí _____No

Si la respuesta a cualquiera de estas preguntas es "Sí", incluya para cada contrato envuelto en dicha situación el nombre y dirección postal del Cliente o Dueño, así como nombre de persona de contacto, título, número de teléfono y de facsímil, la naturaleza del trabajo, la cuantía del contrato, la razón para el 'default' y el día de terminación o juicio.

Nombre de proyecto: _____

Cliente o dueño

Nombre de cliente o dueño: _____

Dirección de cliente o dueño: _____

Persona de contacto:

Nombre de persona de contacto: _____

Título: _____

Número de teléfono y facsímil: _____

Descripción de trabajo: _____

_____

_____

Cuantía de contrato: $_____

Razón para el default: _____

Fecha de terminación: _____

Día de juicio: _____

Si se requiere espacio adicional para proveer esta información, incorpore una hoja aparte. La información adicional asociada al Récord de Cumplimiento e Integridad se incluye en el Anejo _____.

b. ¿Ha estado el Contratista involucrado en alguna demanda, acción, investigación o proceso judicial criminal, civil o administrativo que haya sido comenzado, esté pendiente a comenzar, haya sido resuelto o concluido durante el periodo de cinco años previo a la Fecha Límite para presentar propuestas?
_____Sí _____No

Si la respuesta a esta pregunta es "Sí", especifique la fecha o fechas de duración de la demanda, acción, investigación o proceso judicial; la naturaleza específica de la demanda, acción, investigación o proceso

judicial; la cuantía de los fondos envueltos, si alguna; los nombres de las partes envueltas; los nombres y direcciones postales completas de las cortes y agencias del orden público involucradas; el título y el número de caso de la demanda, acción, investigación o proceso judicial; la disposición o status actual; y cualquier sentencia, multa o penalidad impuesta.

Naturaleza especifica de la demanda, acción, investigación o proceso judicial:

_____

Fecha de la demanda, acción, investigación o proceso judicial:

_____

Cuantía de los fondos envueltos:

_____

Nombres de las partes envueltas:

_____

Nombres y direcciones postales completas de las cortes y agencias del orden público involucradas:

_____

Título y el número de caso de la demanda, acción, investigación o proceso judicial:

_____

Disposición o status actual:

_____

Sentencia, multa o penalidad impuesta:

_____

Si se requiere espacio adicional para proveer esta información, incorpore una hoja aparte. La información adicional asociada al Record de Cumplimiento e Integridad continúa en el Anejo _____.

c. ¿Ha estado el Contratista involucrado en algún proyecto en el cual daños por errores u omisiones hayan sido evaluados durante el periodo de cinco años previo a la Fecha Límite para presentar propuestas?

_____Sí _____No

Si la respuesta a esta pregunta es "Sí", someta una descripción de los proyectos involucrados, el tiempo de contrato para cada proyecto, la cuantía total de los daños evaluados en cada proyecto, y una explicación con la(s) razón(es) por lo cual se produjo una evaluación de daños en cada caso.

Descripción de los proyectos involucrados:

_____

Tiempo de contrato para cada proyecto:

_____

Cuantía total de los daños evaluados en cada proyecto:

_____

Explicación con la(s) razón(es) por lo cual se produjo una evaluación de daños en cada caso: _____

Si se requiere espacio adicional para proveer esta información, incorpore una hoja aparte. La información adicional asociada al Récord de Cumplimiento e Integridad continúa en el Anejo _____.

d. ¿Ha fallado el Contratista en completar un proyecto durante el periodo de cinco años previo a la Fecha Límite para presentar propuestas?
_____Sí _____No

Si la respuesta a esta pregunta es "Sí", incluya para cada contrato(s) relacionado(s) a dicho(s) proyecto(s), el nombre del Cliente o Dueño, así como su dirección postal, nombre de contacto de la persona, título, número de teléfono y facsímil, naturaleza del proyecto, y la razón por la cual no se completó el trabajo.

Cliente o dueño
Nombre: _____

Dirección postal: _____

Persona de contacto

Nombre: _____

Título: _____

Número de teléfono y facsímil: _____

Naturaleza del proyecto: _____

_____

Razón(es) por la(s) cual(es) no se completó el trabajo:

_____

_____

Si se requiere espacio adicional para proveer esta información, incorpore una hoja aparte. La información adicional asociada al Récord de Cumplimiento e Integridad continúa en el Anejo _____.

Incluya una descripción sobre cualquier tipo de línea de negocio sobre la cual el Contratista tenga interés

_____

_____

_____

Nota: Las excepciones no necesariamente resultarán en la negación de una adjudicación, pero serán consideradas al momento de determinar la responsabilidad del Contratista. Proveer información falsa podría resultar en una acusación criminal o sanciones administrativas.

C. Experiencia del personal y otros

Provea el brochure del contratista con evidencia de proyectos similares realizados en los últimos cinco (5) años.

Provea una lista de las facilidades de construcción, equipo y cualquier otro recurso que el Contratista posea para la realización de los trabajos de esta Propuesta.

D. CAPACIDAD ECONOMICA

¿POSEE EL CAPACIDAD ECONOMICA PARA PROVEER LOS BIENES Y/O SERVICIOS INCLUIDOS EN EL ALCANCE DE ESTA COMPRA? (SI o NO) _____

Favor proveer último informe de los estados financieros su empresa o negocio.

E. GARANTIA

LA OMEP REQUIERE QUE LAS OBRAS Y BIENES SEAN GARANTIZADAS POR UN MINIMO DE TRES ANOS INCLUYENDO MATERIALES, PIEZAS Y LABOR.

NO APLICA A SERVICIOS PROFESIONALES O NO PROFESIONALES

FAVOR DE INCLUIR UN CERTIFICADO DE GARANTIA JUNTO CON LOS PLIEGOS DE SUBASTA FIRMADO Y SELLADO POR SU EMPRESA O NEGOCIO QUE CUBRA EL MINIMO REQUERIDO POR OMEP.

F. FECHA DE ENTREGA DE LA OBRA

¿SE COMPREMETE EL LICITADOR A ENTREGAR LA OBRA AL 100% DE CUMPLIMIENTO CON LOS CODIGOS DE CONSTRUCCION VIGENTES DENTRO DEL PERIODO REQUERIDO DE 200 DÍAS CALENDARIO? (SI o NO) _____

SI ESTIMA QUE NO PUEDE COMPLETAR LA OBRA DENTRO DEL PERIODO DE 200 DÍAS CALENDARIOS INDICAR NUMERO DE DIAS CALENDARIO QUE LE TOMARA REALIZAR EL ALCANCE TOTAL DE LO SUBASTADO UNA VEZ ENTREGADA LA ORDEN DE PROCEDER. _____ DIAS. ADVERTENCIA: EL PROVEER UN NÚMERO SUPERIOR DE DÍAS CALENDARIO PARA COMPLETAR LA OBRA PUEDE AFECTAR LA EVALUACIÓN DE LA PROPUESTA DEL CONTRATISTA.

G. DISPONIBILIDAD DEL BIEN O SERVICIO Y COSTOS ASOCIADOS

¿El bien o servicio está disponible en Puerto Rico? (SI o NO) _____

De responder NO, donde están disponible actualmente_____

Existen piezas de repuesto del bien ofrecido en Puerto Rico (SI o NO) _____

De responder NO, donde están disponible actualmente_____

FAVOR DE DESCRIBIR AQUELLOS COSTOS RELACIONADOS A LA IMPLEMENTACION DEL ALCANCE DE ESTA COMPRA QUE A SU MEJOR ENTENDER NO HAYAN SIDO INCLUIDOS O CONSIDERADOS Y PROVEA UN ESTIMADO DE TAL COSTO. (Ejemplo gastos de transportación, consumo de combustible, gastos de mantenimiento, etc)

_____

_____

_____

_____

_____

Exhibit D

Recibo y Cumplimiento del Código Anticorrupción para el nuevo Puerto Rico

EXHIBIT D

RECIBO Y CUMPLIMIENTO DEL CÓDIGO ANTICORRUPCIÓN PARA EL NUEVO PUERTO RICO

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS
(OMEP)

Yo, _____, mayor de edad, y residente de_____, certifico por mí y por _____, el Contratista, so pena de perjurio, que a mi mejor entendimiento y creencia:

En el cumplimiento a la Ley Núm. 2 de 4 de enero de 2018 según enmendada, y en representación del Contratista acredito haber recibido copia DEL CÓDIGO ANTICORRUPCIÓN PARA EL NUEVO PUERTO RICO.
Luego de revisar la misma, certifico en nombre del Contratista que no hay impedimento legal identificado en mencionada ley que impida el otorgamiento de un contrato entre las partes.

Para que así conste, formo la presente certificación en _____, Puerto Rico, hoy _____ de _____ de _____.

_____ _____

Firma del Contratista o su representante Nombre en letra de molde

Exhibit E

Non-Collusive Affidavit

EXHIBIT E
NON-COLLUSIVE AFFIDAVIT

Commonwealth or Puerto Rico _____, being first duly sworn,

deposes says:

That he is _____ **(an individual, a partner of partnership or an officer of a corporation, etc.)**

of the party making the foregoing proposal or bid, that such proposal or bid is genuine and not collusive or sham; that said bidder has not collude, conspired, connived or agreed, directly or indirectly, with any bidder, or person, to put in a sham bid or to refrain from bidding; that he has not in any manner, directly or indirectly, sought by agreement or collusion, or communication, or conference, with any person, or fix the price of affiant or of any other bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any bidder, or to secure any advantage against the _____
(Name of Owner)

Proposed contract; and that all statement in said proposal or bid are true. In the City of _____, Puerto Rico, this _____ day of _____, 2022.

_____
Name of Bidder

_____
Signature of Bidder's Representative

AFFIDAVIT NUMBER _____
Sworn and subscribed to before me in the place and date above stated by
_____ of legal age an personally known to me.

(NOTARIAL SEAL) _____
NOTARY PUBLIC

Certificación de la ASG en Registro Único de Licitadores (RUL)

Fianza de Licitación
(Bid Bond)

Número de registro en DUNS (System for Award Management - SAM)

Estado Financiero Auditado (15 meses previo a subasta)

Resolución Corporativa

EXHIBIT F

DOCUMENTOS NECESARIOS PARA PRESENTAR LA SOLICITUD DEPAGO FINAL POR EL CONTRATISA A OMEP

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS

Para el pago del Trabajo, el Contratista deberá cumplir con lo siguiente:

1. Según lo requiere la Ley Núm. 1 del 3 de enero de 2012, también conocida como la Ley de Ética Gubernamental de Puerto Rico de 2011, cada Solicitud para Pago debe incluir una certificación escrita declarando que ningún oficial o empleado de OMEP, sus subsidiarias o afiliadas, derivaránu obtendrán ningún beneficio o ganancia de cualquier tipo de este Contrato, con el reconocimientode que las facturas que no incluyan esta certificación no serán pagadas. Esta certificación debe leercomo sigue:

   > **"Nosotros certificamos bajo pena de nulidad que ningún servidor público de OMEP derivará u obtendrá ningún beneficio o ganancia de cualquier tipo de la relación contractual en la cual se basa esta factura. Si dicho beneficio o gananciaexistiera, la renuncia requerida ha sido obtenida antes de entrar a este Contrato.La única consideración para recibir a cambio de la entrega de bienes o serviciosprovistos es el precio acordado que ha sido negociado con un representante autorizado de OMEP. La cantidad total mostrada en esta factura es verdadera y correcta. Los servicios profesionales han sido prestados, y ningún pago ha sido recibido."**

2. Que, acompañado su Solicitud de Pago Parcial, el contratista acompañará los siguientes documentos requeridos:
   a. Solicitud de Pago
   b. Facturas por los servicios prestados (original y detallada; con dirección y números deteléfono);
   c. Desglose de Costo (Plantilla con costos, original y firmado por las partes)
   d. Informe de inspección con fotos del Trabajo certificado (originales, claras y detalladas);
   e. Fotos del rótulo en la Obra;
   f. Evidencia de permisos gestionados y obtenidos para el proyecto;
   g. Seguros actualizados (CFSE, Payment and Performance Bond, General Liability, y cualquier otro requerido por OMEP)

3. Que, acompañado su Solicitud de Pago Final, el contratista acompañará los siguientes documentosrequeridos:
   a. Solicitud de Pago
   b. Facturas por los servicios prestados (original y detallada; con dirección y números deteléfono);
   c. Desglose de Costo (Plantilla con costos, original y firmado por las partes)
   d. Informe de inspección final con fotos del Trabajo certificado (originales, claras y detalladas);

e. Fotos del rótulo en la Obra;
f. Evidencia de permisos gestionados y obtenidos para el proyecto;
g. Seguros actualizados (CFSE, Payment and Performance Bond, General Liability, y cualquier otro requerido por OMEP);
h. Carta de aceptación final de la obra de parte del Representante Autorizado de OMEP;
i. Evidencia de pago de patente y/o arbitrio de construcción por el (los) Municipio(s) correspondiente(s) para el Trabajo (solo si aplica, en caso de que no aplique, el contratista deberá someter certificación del Municipio en donde evidencie que no procede dicho pago);
j. Certificación de Servicios (No deuda) actualizada de Rentas Internas Federal
k. Consentimiento del Fiador de la Obra para pago final (relevo de parte de la aseguradora).
l. Declaración Jurada sobre no deuda con suplidores y/o materialistas.
m. Copia de la certificación de registro del contrato ante la Oficina del Contralor, así como dec
n. Cualquier enmienda realizada al mismo

Para que así conste, formo la presente certificación en_____, Puerto Rico, hoy _____de _____de 20___.

_____ _____

Firma del Contratista o su representante **Nombre en letra de molde**

EXHIBIT G

DISPOSICIONES GENERALES APLICABLES A PROYECTOS SUFRAGADOS TOTAL O PARCIALMENTE CON FONDOS PROVIDOS POR FEMA O FONDOS CDBG PROVISTOS POR HUD

1. DISPOSICIONES REQUERIDAS POR LEY SE ENTIENDEN INCORPORADAS

Cada disposición de ley y cláusula requerida por ley a ser incorporada en este Pliego y el contrato resultante de este proceso competitivo se entenderá incorporada aquí y el documento se leerá y hará cumplir como si estuvieranincluidas aquí, y si por algún error u otra razón cualquiera de esas disposiciones noestuviese incorporada aquí, o no estuviese correctamente incorporada, entonces,tras la aplicación de cualquier parte, se enmendará el Pliego o contrato inmediatamente para hacer tal incorporación o corrección.

2. CUMPLIMIENTO ESTATUTARIO Y REGULATORIO: El Contratista cumplirá con todas las leyes y reglamentos aplicables al Programa de Subvención en Bloque para el Desarrollo Comunitario para la Recuperación anteDesastres asignados por la Ley de Asignaciones Suplementarias Adicionales para Ayuda en Casos de Desastres, 2017 (Pub. L. 115-56), aprobada el 8 de septiembre de 2017 (Ley de Asignaciones), según enmendada, incluyendo pero no limitado a lasCirculares de Presupuesto de la Oficina de Manejo, que pueden impactar la administración de fondos y/o esbozar ciertos principios de costos, incluyendo si sepermiten ciertos gastos.

3. **INCUMPLIMIENTO CON LOS TÉRMINO DE ESTE EXHIBIT**: OMEP y el DEPR se reservan el derecho de todos los remedios administrativos, contractualeso legales, incluyendo pero no limitado a la suspensión o terminación de este Contrato, encasos en que el Contratista o cualquiera de sus subcontratistas viole o incumpla cualquiera de los términos de este Contrato. Si el Contratista o cualquiera de sus subcontratistas viola o incumple cualquiera de los términos del Contrato, podrían estar sujetos a las sanciones y penalidades que sean apropiadas. Los deberes y obligaciones impuestas por los documentos del Contrato, y los derechos y remedios disponibles en virtud del mismo, serán además de y no una limitación a cualesquiera otros deberes, obligaciones, derechos y remedios de otra forma impuestos o disponibles en ley.

4. REQUISITOS DE INFORMAR

El Contratista completará y someterá todos los informes, de la manera y conformeal programa, como pueda requerir OMEP, el DEPR y/o el Gobierno de Puerto Rico. El Contratista cooperará con todos los esfuerzos para cumplir con los requisitos y obligaciones de HUD sobre informes, incluyendo, pero no limitado a 24 C.F.R. §§85.40-41 (o 84.50-52, de ser aplicable) y 570.507, cuando aplique.

5. ACCESO A RÉCORDS

El Gobierno de Puerto Rico, OMEP, el DEPR, el Departamento de Vivienda, HUD, el Contralor General de los Estados Unidos, o cualquiera de sus representantes debidamente autorizados, tendrá, en cualquier momento y de tiempo en tiempo durante horas de trabajo regulares, acceso a cualquier producto, libros, documentos, papeles y récords del Contratista que estén relacionados a este Contrato, con el propósito de inspección, auditorías, exámenes y sacar extractos, copias y transcripciones.

6. **EMPRESAS PEQUEÑAS Y MINORITARIAS, EMPRESAS QUE PERTENECEN A MUJERES Y EMPRESAS EN AREAS DE EXCESO DE MANO DE OBRA:**

7. El Contratista tomará los pasos necesarios afirmativos para asegurarse que las empresas minoritarias, empresas que pertenecen a mujeres y las empresas en áreas de exceso de mano de obra sean subcontratadas cuando sea posible. Las medidas para ello incluyen, pero no están limitados a:

   (i) Colocar empresas pequeñas y minoritarias y empresas que pertenecen a mujeres calificadas en listas de búsqueda;

   (ii) Asegurar que las empresas pequeñas y minoritarias y empresas que pertenecen a mujeres sean solicitadas cuando sean posibles fuentes;

   (iii) Dividir los requisitos totales, cuando sea económicamente viable, en tareas o cantidades más pequeñas para permitir participación máxima de empresas pequeñas y minoritarias y empresas que pertenecen a mujeres;

   (iv) Establecer programas de ejecutoria, cuando el requisito lo permita, que promueva la participación de empresas pequeñas y minoritarias y empresas que pertenecen a mujeres; y

   (v) Usar los servicios y asistencia de la Administración de Pequeñas Empresas, y de la Agencia para el Desarrollo de Empresas de Minorías del Departamento de Comercio los Estados Unidos.

8. DERECHOS SOBRE INVENTOS CREADOS BAJO CONTRATO O ACUERDO

Los Contratos o acuerdos para que se lleve a cabo trabajo experimental, de desarrollo o de investigación proveerá para los derechos del Gobierno Federal y el Contratista sobre cualquier invento resultante conforme a 37 CFR Parte 401, “Derechos a Inventos Creados por Organizaciones sin Fines de lucro y Pequeñas Empresas Bajo Subvenciones de Gobierno, Contratos y Acuerdos Cooperativos”, y cualesquiera reglamentos de implementación emitidos por HUD.

9. TITULO VI DE LA LEY DE DERECHOS CIVILES DE 1964

El Contratista cumplirá con las disposiciones del Título VI de la Ley de DerechosCiviles de 1964, que prohíbe la discriminación basada en raza, color, u origen nacional en cualquier programa o actividad que reciba fondos Federales u otra asistencia financiera. Los Programas que reciben fondos Federales no pueden distinguir entre individuos basado en raza, color u origen nacional, directa o indirectamente en los tipos, cantidades, calidad u oportunidad de los servicios delprograma, asistencias o beneficios que proveen o de la forma en que los proveen. Esta prohibición aplica a discrimen intencional, así como a procedimientos, criterios o métodos de administración que aparentan ser neutras pero tienen un efecto discriminatorio en individuos por su raza, color u origen nacional. Las políticas y prácticas que tienen tal efecto deben eliminarse a menos que se pueda demostrar que fueron necesarias para lograr un propósito legítimo no-discriminatorio.

10. SECCIÓN 109 DE LA LEY DE LA VIVIENDA Y DESARROLLO COMUNITARIO DE 1974

El Contratista cumplirá con las disposiciones de la Sección 109 de la Ley de la Vivienda y Desarrollo Comunitario de 1974. Ninguna persona en los Estados Unidos será excluida de participar en, ni denegada los beneficios de, o será sujeta a discrimen bajo ningún programa o actividad financiada en todo o en parte por fondos hechos disponibles bajo este título en base a raza, color, origen nacional o género. La Sección 109 además provee que el discrimen basado en edad bajo La Leyde Discrimen por Edad de 1975 o en cuanto a otro individuo incapacitado que deotra forma cualificaría, está prohibido según provisto en la Sección 504 de la Ley de Rehabilitación de 1973, según enmendada.

11. SECCIÓN 504 DE LA LEY DE REHABILITACIÓN DE 1973

El Contratista cumplirá con la Sección 504 de la Ley de Rehabilitación de 1973 (29 U.S.C. § 794), según enmendada, y cualesquiera reglamentos aplicables. El Contratista acuerda que ningún individuo cualificado con un impedimento,será excluido de participar en, denegado los beneficios de, o de otra manera sujetoa discrimen bajo ningún programa o actividad que recibe asistencia financiera del HUD, exclusivamente por su incapacidad.

12. LEY DE DISCRIMEN POR EDAD DE 1975

El Contratista cumplirá con la Ley de Discrimen por Edad de 1975 (42 U.S.C. § 6101*y siguiente*s), según enmendada, y cualesquiera reglamentos aplicables. Ninguna persona en los Estados Unidos será por razón de su edad excluida de participar en,denegada los beneficios de, o será sujeta a discrimen bajo cualquier programa o actividad que recibe asistencia económica Federal.

13. PROHIBICIÓN DE EJERCER, SUSPENSIÓN Y FALTA DE ELEGIBILIDAD

El Contratista representa y garantiza que a éste y a sus subcontratistas no les está prohibido ejercer, no están suspendidos o de otra forma excluidos o no elegibles de participar en programas de asistencia Federal sujetos a 2 C.F.R. Parte 2424.

14. CONFLICTOS DE INTERÉS

El Contratista le notificará a OMEP/DEPR tan pronto como sea posible si este Contrato ocualquier aspecto relacionado al trabajo anticipado bajo este Contrato levanta un conflicto de interés real o potencial (según definido en 2 C.F.R. Parte 215 and 24 C.F.R.§ 85.36 o 84.42, de ser aplicable). El Contratista explicará el conflicto de interés real o potencial por escrito en suficiente detalle para que OMEP/DEPR pueda evaluartal conflicto real o potencial.

El Contratista proveerá a OMEP/DEPR cualquier información necesaria para plenamente evaluar y atender tal conflicto de interés real o potencial. El Contratista aceptará cualquier estrategia razonable de mitigación de conflicto que ponga en vigor OMEP/DEPR, incluyendo, pero no limitado al uso de contratista(s) independiente(s) para llevar a cabo la porción del trabajo que da base al conflicto de interés actual o potencial.

15. SUBCONTRATOS

Al subcontratar, el Contratista solicitará y contratará con dichos subcontratistasde un modo que provea

competencia justa. Algunas de estas situaciones que se consideran restrictivas a la competencia incluyen, pero no están limitadas a:

(i) Poner requisitos irrazonables en firmas para que cualifiquen para hacer negocios;
(ii) Requerir experiencia y fianzas innecesarias;
(iii) Prácticas de precios no competitivas entre firmas o entre Compañías afiliadas;
(iv) Adjudicaciones no competitivas a consultores que están en contratos con anticipo;
(v) Conflictos de intereses organizacionales;
(vi) Especificar solo un producto de marca en vez de permitir un producto igual que se ofrezca y describir el cumplimiento de otros requisitos relevantes de la adquisición; y
(vii) Cualquier acción arbitraria en el proceso de adquisición.

El Contratista representa a OMEP/DEPR que todo el trabajo se llevará a cabo por personal con experiencia en la profesión y áreas de pericia apropiadas y aplicables,tomando en cuenta la naturaleza del trabajo a llevarse a cabo bajo este Contrato.

El Contratista incluirá estas Disposiciones Generales en cada subcontrato emitido por éste, para que tales disposiciones obliguen a cada uno de sus subcontratistas, así como el requisito de "flow down" de dichos términos para todos los subcontratistas de nivel bajo.

16. CESIÓN

El Contratista no cederá ningún interés en este Acuerdo, y no transferirá ningún interés en el mismo (ya sea por cesión o novación) sin aprobación previa escrita de OMEP/DEPR.

17. INDEMNIZACIÓN

El Contratista compensará, defenderá y eximirá de responsabilidad al Gobierno de Puerto Rico, OMEP/DEPR, sus agentes y empleados, de y contra cualquiera y todas reclamaciones, acciones, casos, cargos y sentencias que surjan de o estén relacionadas a la negligencia o mal comportamiento intencional del Contratista en llevar a cabo los servicios bajo este Contrato.

18. LEY COPELAND "CONTRA COMISIONES ILICITAS" (Aplicable a todos los contratos de construcción o reparación)

Los salarios del personal realicen trabajos bajo este Contrato serán pagados incondicionalmente y no menos de una vez al mes sin reducción de salario o rebateen cualquier cuenta excepto solo aquellas deducciones de salario que sean obligatorias por ley o permisibles por los reglamentos aplicables emitidos por el Secretario del Trabajo de acuerdo a la Ley Copeland "Contra Comisiones ilícitas" de13 de junio de 1934 (48 Stat. 948; 62 Stat. 740; 63 Stat. 108; Titulo 18 U.S.C. § 874; y Titulo 40 U.S.C. § 276c). El CONTRATISTA cumplirá con todos los reglamentos "Contra Comisiones Ilícitas" aplicables e insertará disposiciones apropiadas en todos los subcontratos cubriendo el trabajo bajo este Acuerdo para asegurar el cumplimiento por los subcontratistas con tales reglamentos, y será responsable de la presentación de los afidávits requeridos a los subcontratistas excepto cuando el Secretario del Trabajo pueda específicamente proveer variaciones de o exenciones de los requisitos de esto.

19. LEY DE HORAS DE TRABAJO Y ESTÁNDARES DE SEGURIDAD
(Contratos de construcción aplicables excediendo $2,000 y contratos que exceden $2,500.00 que emplean mecánicos u obreros)

El CONTRATISTA cumplirá con las Secciones 103 y107 de la Ley de Horas de Trabajo Contratado y Estándares de Seguridad (40 U.S.C. §§ 327-330) según suplementado por los reglamentos del Departamento del Trabajo de los Estados Unidos (29 C.F.R. Parte 5). Todos los obreros y mecánicos empleados por CONTRATISTA o subcontratistas recibirán compensación de horas extra de acuerdo con y sujeto a las disposiciones de la Ley de Horas de Trabajo y estándares de Seguridad, y los CONTRATISTA y subcontratistas cumplirán con todos los reglamentos emitidos conforme a dicha leyy con otras leyes y reglamentos federales aplicables sobre los estándares laborales.

LEY DAVIS-BACON: Aplicable a contratos de construcción que exceden $2,000 cuando es requerido por legislación de programa Federal.)

El CONTRATISTA cumplirá con la Ley Davis Bacon (40 U.S.C. §§ 276a a 276a-7) según es suplementada por los reglamentos del Departamento de Trabajo (29 C.F.R. Parte 5). Todos los obreros y mecánicos que son empleados por CONTRATISTAS o subcontratistas, incluyendo empleados de otros gobiernos, en trabajo de construcción asistido bajo este Contrato, y sujeto a las disposiciones de las leyes y reglamentos federales listados en este párrafo, serán pagados salarios a tarifas no menores de aquellas prevalecientes en construcciones similares en la localidad según determinado por el Secretario del Trabajo de acuerdo con la Ley Davis-Bacon.

Semestralmente, el CONTRATISTA someterá el Formulario HUD 4710 (Informe Semestral de Cumplimiento de Estándares Laborales) (Informe Semi-Anual de Cumplimiento con Estándares Laborales) a OMEP/DEPR.

20. TERMINACIÓN POR CAUSA
(Aplicable a contratos que exceden $10,000)

Si, por alguna causa, el CONTRATISTA no cumple oportuna y adecuadamente sus obligaciones bajo este Contrato, o si el CONTRATISTA viola cualesquiera de las cláusulas,acuerdos o estipulaciones de este Contrato, OMEP/DEPR inmediatamente tendrá el derecho de terminar este Contrato dando aviso escrito al CONTRATISTA de tal terminación y especificando la fecha efectiva de ello, al menos cinco (5) días antes de la fecha de efectividad de tal terminación. En tal caso, todos los documentos completados o sin completar, data, estudios, encuestas, dibujos, mapas, modelos,fotografías e informes preparados por el CONTRATISTA bajo este Contrato, a la opción de OMEP/DEPR, se convertirán en propiedad de OMEP/DEPR y el SUBREICPIENTE tendrá derecho a recibir justa y equitativa compensación por cualquier trabajo satisfactoriamente completado en lo sucesivo. A pesar de ello, el CONTRATISTA no será relevado de su responsabilidad frente al Gobierno del Puerto Rico y OMEPR/DEPR por daños sostenidos por el Gobierno de Puerto Rico y/o OMEP/DEPR por virtud de cualquier incumplimiento del Contrato por el CONTRATISTA, y el Gobierno de Puerto Rico y/o OMEP/DEPR.

21. TERMINACIÓN FOR CONVENIENCIA
(Aplicable a contratos que exceden $10,000)

OMEP/DEPR puede terminar este Contrato en cualquier momento dando aviso previo de al menos diez (10) días por escrito al CONTRATISTA. Si OMEP/DEPR termina este Contrato según provisto aquí, se le pagará al CONTRATISTA por el tiempo provisto y gastos incurridos hasta la fecha de terminación.

22. SECCIÓN 503 DE LA LEY DE REHABILITACIÓN DE 1973 (Aplicable a contratos que exceden $10,000)

El CONTRATISTA cumplirá con la Sección 503 de la Ley de Rehabilitación de 1973 (29 U.S.C. § 793), según enmendada, y cualesquiera otros reglamentos aplicables.

Igual Oportunidad para Trabajadores con Discapacidades:

1) El CONTRATISTA no discriminará contra cualquier empleado o solicitante de empleo por incapacidad fisca o mental en cuanto a cualquier posición para la que el empleado o solicitante esté cualificado. El CONTRATISTA acuerda tomar acción afirmativa para emplear, avanzar en empleo y de otra manera tratar alos individuos cualificados que tengan impedimentos sin discrimen basado en su impedimento físico o mental en todas las prácticas del empleo, incluyendo lassiguientes:

   (i) Procedimientos de reclutamiento, mercadeo, y solicitud de empleo;
   (ii) Contratar, actualizar, ascender, conceder permanencia, degradar, trasferir, despedir, terminar, derecho a regresar del despido y re-contratar;
   (iii) Tarifas de pago y cualquier otra forma de compensación y cambios en compensación;
   (iv) Asignaciones de trabajo, clasificaciones de trabajo, estructuras organizacionales, descripciones de posición, líneas de progresión y listas de antigüedad;
   (v) Pedidos de licencias, licencia por enfermedad y cualquier otra licencia;
   (vi) Beneficios complementarios disponibles por el empleo, sean o no administrados por el CONTRATISTA;
   (vii) Selección y apoyo económico para entrenamiento, incluyendo aprendizaje, reuniones profesionales, conferencias y otras actividades relacionadas, y selección para pedidos de licencias para entrenamiento;
   (viii) Actividades auspiciadas por el CONTRATISTA incluyendo programas sociales o recreacionales; y
   (ix) Cualquier otro término, condición o privilegio de empleo.

2) El CONTRATISTA acuerda cumplir con las reglas, reglamentos y órdenes relevantes del Secretario del Trabajo emitidas conforme a la Ley.

3) En caso de incumplimiento del CONTRATISTA con los requisitos de esta cláusula,pueden tomarse acciones por incumplimiento conforme a las reglas, reglamentos y órdenes relevantes del Secretario del Trabajo emitidas conforme a la Ley.

4) El CONTRATISTA acuerda postear en sitios conspicuos, disponibles a empleadosy a solicitantes de empleo, avisos en la manera dispuesta por el Asistente del Secretario de los Programas de Cumplimiento de Contratos Federales, provisto por o a través del oficial contratante. Tales avisos indicarán los derechos de los aplicantes y empleados, así como de la obligación del CONTRATISTA bajo la leyde tomar acción afirmativa para emplear y avanzar en el empleo a empleados cualificados

y solicitantes con incapacidades. El CONTRATISTA debe asegurarseque los solicitantes y empleados con discapacidades estén informados de los contenidos del aviso (ej. El CONTRATISTA puede hacer que se lea el aviso a un individuo discapacitado visual, o puede bajar el aviso posteado para que una persona en silla de ruedas pueda leerlo).

5) El CONTRATISTA notificará a cada organización de trabajo o su representante de trabajadores con los que tiene un acuerdo colectivo u otro entendimiento contractual, que el CONTRATISTA está obligado por los términos de la Sección 503 de la Ley de Rehabilitación de 1973, según enmendada, y está comprometido a tomar acción afirmativa para emplear y avanzar en el empleoa individuos con discapacidades físicas y mentales.

6) El CONTRATISTA incluirá las disposiciones de esta cláusula en cada subcontrato u orden de compra en exceso de $10,000, a menos que esté exento por las reglas,reglamentos u órdenes del Secretario emitidas de acuerdo a la Sección 503 de la Ley, según enmendada, para que tales disposiciones sean obligatorias para cada subcontratista o suplidor. El CONTRATISTA tomará dicha acción con respecto a cualquier subcontrato u orden de compra que disponga el Asistente del Secretario del Trabajo para el Cumplimiento de Programas Federales para hacer cumplir tales disposiciones, incluyendo acción por incumplimiento.

23. IGUAL OPORTUNIDAD DE EMPLEO
(Aplicable a contratos de construcción y subcontratos excediendo $10,000)

El CONTRATISTA cumplirá con la Orden Ejecutiva 11246 de 24 de septiembre de 1965, intitulada "Igual Oportunidad de Empleo," según enmendada por la Orden Ejecutiva 11375 de 13 de octubre de 1967, y según suplementada en los reglamentos del Departamento del Trabajo (41 CFR capítulo 60).
Durante el término de este Acuerdo, el CONTRATISTA acuerda a lo siguiente:

1) El CONTRATISTA no discriminará contra ningún empleado o solicitante de empleo debido a raza, color, religión, sexo u origen nacional. El CONTRATISTA tomará acción afirmativa para asegurarse que los solicitantes de empleo tengan empleo, y que los empleaos sean tratados sin ningún reparo por su raza, color,religión, sexo u origen nacional. Tal acción incluirá, pero no está limitada a, lo siguiente: empleo, actualización, degradación, o transferencia; reclutamiento o mercadeo de reclutamiento; cese de actividades o despido; tarifas a pagar u otras formas de compensación; y selección para entrenamiento, incluyendo aprendizaje.

2) El CONTRATISTA posteará en sitios conspicuos, disponibles a empleados y solicitantes de empleo, avisos a ser provistos por el Oficial Contratante esbozandolas disposiciones de esta cláusula de no-discriminación. El CONTRATISTA entonces indicará que todos los solicitantes cualificados serán considerados parael empleo sin reparo por raza, color, religión, sexo u origen nacional.

3) El CONTRATISTA indicará, en todos los requerimientos o anuncios para empleados puestos por o de parte del CONTRATISTA que todos los solicitantes cualificados serán considerados para el empleo sin reparo por raza, color, religión, sexo u origen nacional.

4) El CONTRATISTA enviará a cada unión laboral o representante de trabajadores con los que tiene un acuerdo colectivo u otro contrato o entendimiento, un avisopara ser provisto por el oficial contratante

de la agencia, dando aviso a la uniónlaboral o representante de trabajadores de los compromisos del CONTRATISTA bajo la Sección 202 de la Orden Ejecutiva 11246 de 24 de septiembre de 1965, y posterará copias del aviso en sitios conspicuos disponibles a los empleados y solicitantes al empleo.

5) El CONTRATISTA cumplirá con todas las disposiciones de la Orden Ejecutiva 11246de 24 de septiembre de 1965, y de las reglas, reglamentos y ordenes relevantes del Secretario del Trabajo.

6) El CONTRATISTA proveerá toda la información e informes requeridos por la Orden Ejecutiva 11246 de 24 de septiembre de 1965, y por las reglas, reglamentos yórdenes del Secretario del Trabajo, o de acuerdo a los mismos, y permitirá accesoa libros, récords y cuentas por la agencia contratante y el Secretario del Trabajo para propósitos de investigación para evaluar cumplimiento con tales reglas, reglamentos y órdenes.

7) En caso del incumplimiento del CONTRATISTA con la cláusula de no discrimen de este Contrato o con cualesquiera de dichas reglas, reglamentos u órdenes, este Contrato puede cancelarse, terminarse o suspenderse en todo o en parte y el CONTRATISTA puede declararse inelegible para otros contratos de gobierno de acuerdo con los procedimientos autorizados en la Orden Ejecutiva 11246 y otras sanciones que puedan imponerse y remedios invocados según provisto en la Orden Ejecutiva 11246 de 24 de septiembre de 1965, o por regla, reglamento u orden del Secretario del Trabajo, o según de otra manera se provea por ley.

8) El CONTRATISTA incorporará las disposiciones de 1 a 7 referidas arriba en cada subcontrato u orden de compra a menos que esté exento por las reglas, reglamentos u órdenes del Secretario del Trabajo de manera que tales disposiciones obliguen a tal subcontratista. El CONTRATISTA tomará dicha acción con respecto a cualquier subcontrato u orden de compra que la agencia contratante pueda disponer como medio de hacer cumplir dichas disposiciones incluyendo sanciones por incumplimiento, provisto, sin embargo que en caso que el CONTRATISTA se involucre con, o sea amenazado con, litigio por un subcontratista o suplidor como resultado de tal dirección por la agencia contratante, el CONTRATISTA puede solicitar al Gobierno de los Estados Unidos a entrar en dicho litigio para proteger los intereses de los Estados Unidos.

24. CERTIFICACIÓN DE FACILIDADES NO SEGREGADAS (Aplicable a contratos de construcción que exceden $10,000)

El CONTRATISTA certifica que no mantiene o provee para sus establecimientos, y que no permite a los empleados a proveer sus servicios en ninguna localización bajo su control, donde se mantengan facilidades segregadas. Se certifica que no mantendrá o proveerá para empleados ningunas facilidades segregadas en ninguno de sus establecimientos, y que no permitirá a los empleados a proveer sus servicios en ninguna localización bajo su control donde se mantengan facilidades segregadas. El CONTRATISTA acuerda que un incumplimiento de estacertificación es una violación a la cláusula de igual oportunidad de este Acuerdo.

Según utilizado en esta certificación, el término “facilidades segregadas” significa cualesquiera áreas de espera, áreas de trabajo, baños y cuartos de baño,restaurantes y otras áreas de comer, relojes de fichar, vestuarios y otras áreas dea almacenaje o vestimenta, estacionamientos bebederos, áreas de recreación o entretenimiento, transportación y facilidades de vivienda provistas para empleados que son segregadas por directriz explícita o son, de hecho, segregados basado en raza, color, religión u origen nacional por hábito, costumbre local o cualquier otra razón.

El CONTRATISTA además acuerda que (excepto donde lo ha obtenido para periodos de tiempo específicos) obtendrá una certificación idéntica de subcontratistas propuestos antes de adjudicar subcontratos excediendo de $10,000 que no están exentos de las disposiciones de la cláusula de igual oportunidad; que retendrá dichas certificaciones en sus récords; y que va a enviar el aviso que precede a dichos subcontratistas propuestos (excepto cuando dichos subcontratistas propuestos han sometido certificaciones idénticas para periodos de tiempo específicos).

25. CERTIFICACIÓN DE CUMPLIMIENTO CON LEYES DE AIRE Y AGUA LIMPIA
(Aplicable a contratos que exceden $100,000)

El CONTRATISTA y todos los subcontratistas cumplirán con los requisitos de la Ley de Aire Limpio, según enmendada, 42 U.S.C. § 1857 y siguientes, la Ley Federal deControl de Contaminación del Agua, según enmendada, 33 U.S.C. § 1251 y siguientes, y los reglamentos de la Agencia de Protección Ambiental con respecto alas mismas, en 40 C.F.R. Parte 15 y 32, según enmendada, Sección 508 de la Ley deAgua Limpia (33 U.S.C. § 1368) y la Orden Ejecutiva 11738.

Además de los requisitos que preceden, todos los contratistas y subcontratistas no exentos proveerán al dueño, lo siguiente:

1) Una estipulación por el CONTRATISTA o subcontratistas de que cualquier facilidad a ser utilizada en la ejecución de cualquier contrato o subcontrato no exento, no está listada en el Sistema de Listas de Partes Excluidas conforme a 40 C.F.R. 32 o en la Lista de Facilidades en Incumplimiento emitida por la Agenciade Protección Ambiental (EPA) conforme a 40 C.F.R. Parte 15, según enmendada.

2) Acuerdo por el CONTRATISTA de cumplir con todos los requisitos de la Sección 114 de la Ley de Aire Limpio, según enmendada, (42 U.S.C. § 1857 c-8) y la Sección 308 de la Ley Federal para el Control de Contaminación del Agua, según enmendada, (33 U.S.C. § 1318) relacionadas a la inspección, monitoreo, entrada, informes e información, así como todos los otros requisitos especificados en dicha Sección 113 y Sección 308 y todos los reglamentos y guías emitidas en virtud de ellas.

3) Una estipulación de que, como condición para la adjudicación del Contrato, se le dará pronto aviso de cualquier notificación recibida del Director, Oficina de Actividades Federales, EPA, indicando que una facilidad utilizada, o que va a ser utilizada para Contrato, está bajo consideración para ser listada en Sistema de Listas de Partes Excluidas o la Lista de EPA de Facilidades en Incumplimiento.

4) Acuerdo por el CONTRATISTA de que él o ella incluirá, o hará que se incluyan, loscriterios y requisitos del párrafo (1) al (4) de esta sección en cada subcontrato no exento y requiriendo que el CONTRATISTA tome la acción que pueda disponer el Gobierno como medio de hacer cumplir tales disposiciones.

26. ANTI-CABILDEO
(Aplicable a contratos que exceden $100,000)

Mediante el otorgamiento de este Contrato, el CONTRATISTA certifica que, hasta donde sabe y conoce:

1) No se han pagado o se pagarán fondos federales apropiados, por o de parte del SUBRECIPEINTE, a

ninguna persona por influenciar o intentar influenciar un oficial o empleado de una agencia, un Miembro del Congreso de los Estados Unidos, un oficial o empleado del Congreso, o un empleado de un Miembro de Congreso en relación con la adjudicación de cualquier contrato Federal en la concesión de cualquier subvención Federal, la concesión de cualquier préstamo Federal, el otorgamiento de cualquier acuerdo cooperativo, y la prórroga, continuación, renovación, enmienda o modificación de cualquier contrato, subvención, préstamo o acuerdo cooperativo.

2) Si cualesquiera fondos que no sean los fondos Federales apropiados han sido pagados o serán pagados a cualquier persona por influenciar o tratar de influenciar a un oficial o empleado de cualquier agencia, un Miembro del Congreso, un oficial o empleado del Congreso, o un empleado de un Miembro del Congreso en relación con este contrato Federal, subvención, préstamo o acuerdo cooperativo, el CONTRATISTA completará y someterá el Formulario Estándar-LLL "Formulario de Divulgación para Reportar Cabildeo", de acuerdocon sus instrucciones.

3) El CONTRATISTA requerirá que el lenguaje de esta certificación sea incluido en los documentos de adjudicación para todas las adjudicaciones en todos los niveles (incluyendo subcontratos, subvenciones, y contratos bajo subvenciones, préstamos y acuerdos cooperativos) y que todos los Contratistas certificarán y divulgarán de conformidad.

Esta certificación es una representación de hecho material en la cual se descansó al hacerse o entrar en esta transacción. La presentación de esta certificación es unprerrequisito para hacer o entrar en esta transacción impuesto por el Titulo 31 CFR 1352 Cualquier persona que no presente la certificación requerida estará sujeta a una penalidad civil de no menos de $10,000 y no más de $100,000 para cada incumplimiento.

27. REQUISITOS DE FIANZA

(Aplicable a los contratos de construcción y mejora de facilidades que excedan $100,000) .

Los requisitos de fianza se encuentran en la sección XVII del Pliego principal.

28. SECCIÓN 3 DE LA LEY DE VIVIENDA Y DESARROLLO COMUNITARIO DE 1968

(Según requerido por los umbrales aplicables)

1) El trabajo por llevarse a cabo bajo este Contrato está sujeto a los requisitos de la Sección 3 de la Ley de la Vivienda y Desarrollo Comunitario de 1968, según enmendada, 12 U.S.C. § 1701u (Sección 3). El propósito de la Sección 3 es asegurar que el empleo y las oportunidades generadas por la asistencia HUD o proyectos asistidos por HUD cubiertos por la Sección 3, serán, al mayor grado posible, dirigidos hacia personas de ingresos bajos o bien bajos, particularmente personas que son recipientes de asistencia de HUD para vivienda.

2) Las partes de este Contrato acuerdan cumplir con los reglamentos de HUD en 24 C.F.R. Parte 135, que implementan la Sección 3. Según evidenciado por el otorgamiento de este Contrato, las partes certifican que no tienen ningún impedimento contractual o de otro tipo que les impida cumplir con los reglamentos de la Parte 135.

3) El CONTRATISTA acuerda enviar a cada organización laboral o representante detrabajadores con quien el CONTRATISTA tenga un acuerdo colectivo u otro entendimiento, si alguno, un aviso notificando a la organización laboral o representante de trabajadores de los compromisos del

CONTRATISTA bajo estacláusula de Sección 3 y posteará copias del aviso en sitios conspicuos en el sitiode trabajo donde ambos empleados y solicitantes para posiciones de entrenamiento y empleo puedan ver el aviso. El aviso describirá la preferencia deSección 3, esbozará un número mínimo y títulos de trabajo sujetos a contratación,disponibilidad de posiciones de aprendizaje y entrenamiento, las cualificacionesde cada uno, y el nombre y localización de la(s) persona(s) tomando las solicitudes para cada una de las posiciones; y la fecha que se anticipe comience el trabajo.

4) El CONTRATISTA acuerda incluir esta cláusula de Sección 3 en cada subcontratosujeto a cumplimiento con reglamentos en 24 C.F.R. Parte 135, y acuerda tomar acción adecuada, según provisto en una disposición aplicable del subcontrato o en esta cláusula Sección 3, tras encontrar que el subcontratista está en violación de los reglamentos en 24 C.F.R. Parte 135. El CONTRATISTA no subcontratará con ningún subcontratista cuando el CONTRATISTA tenga aviso o conocimiento de que el subcontratista ha sido hallado en violación con losreglamentos en 24 C.F.R. Parte 135.

5) El CONTRATISTA certificará que cualesquiera posiciones de empleo vacante, incluyendo posiciones de entrenamiento, que sean ocupadas: (1) tras el CONTRATISTA ser seleccionado, pero antes de la otorgación del contrato, y (2) con personas que no sean aquellos a quienes los reglamentos de 24 C.F.R. Parte 135 requieren que sean dirigidas, no fueron ocupadas para eludir las obligacionesdel CONTRATISTA bajo 24 C.F.R. Parte 135.

6) El incumplimiento con los reglamentos de HUD en 24 C.F.R. Parte 135 puede resultar en sanciones, terminación de este Contrato por incumplimiento, y prohibición de ejercer o suspensión de futuros contratos asistidos por HUD.

7) Con respecto al trabajo llevado a cabo con relación a la asistencia de vivienda para Indígenas que cubre la Sección 3, la Sección 7(b) de la Ley de Autodeterminación de Indígenas y Asistencia Educativa (25 U.S.C. § 450e) también aplica para el trabajoa llevarse a cabo bajo este Acuerdo. La Sección 7(b) requiere que al mayor grado posible: (i) se le dé preferencia y oportunidades de entrenamiento y empleo a los indígenas y (ii) se le dé preferencia en la adjudicación de contratos y subcontratos a organizaciones Indígenas y Empresas de Indígenas. Las partes de este Contrato que estén sujetas a las disposiciones de la Sección 3 y Sección 7(b)acuerdan cumplir con la Sección 3 al mayor grado posible, pero no en derogación del cumplimiento con la Sección 7(b).

8) Para contratos que exceden $100,000, el CONTRATISTA someterá el FormularioHUD 60002 (Sección 3 Informe de Resumen) a cada semestre, a pesar del requisito de informar anualmente esbozado en las instrucciones de ese formulario

29. LEY DE VIVIENDA JUSTA

El CONTRATISTA cumplirá con las disposiciones de la Ley de Vivienda Justa de 1968,según enmendada. La Ley prohíbe la discriminación en la venta o alquiler de vivienda, el financiamiento de vivienda o la provisión de servicios de corretaje contra cualquier persona por raza, color, religión, sexo, origen nacional, discapacidad o estatus familiar. La Ley de Equidad en la Vivienda prohíbe el discrimen contra individuos basado en raza, color, religión, sexo u origen nacional en la venta, renta, alquiler u otra disposición de propiedades residenciales, o en el uso u ocupación de vivienda asistida con fondos Federales.

30. LEY DE CONSERVACIÓN DE ENERGÍA

El CONTRATISTA cumplirá con los estándares mandatorios y políticas relacionadas ala eficiencia de energía según contenidos en el plan de conservación de energía del Gobierno de Puerto Rico, emitido en cumplimiento con la Ley de Conservaciónde Energía (42 U.S.C. 6201 *y siguientes*).

31. LEY HATCH

El CONTRATISTA acuerda a cumplir con los estándares mandatorios y políticas sobrela Ley Hatch, Ley Pública 94-163, según enmendada.

La Ley Hatch aplica a actividades políticas de ciertos empleados estatales y locales.Como Contratista, usted puedellevar a cabo cualquiera de las siguientes actividades: ser candidato en elecciones no partidistas, asistir a reuniones y convenciones políticas; contribuir dinero; hacer campaña en elecciones partidistas; y tener un trabajo en partidos políticos.

El CONTRATISTA no puede hacer las siguientes actividades: ser un candidato en las elecciones partidistas; utilizar influencia oficial para interferir en las elecciones; coaccionar contribuciones políticas de subordinados en apoyo de partidos políticoso candidatos; la oficina procurador especial opera un sitio web que ofrece guía sobre asuntos de la ley Hatch.

32. ESTÁNDARES DE SALUD Y SEGURIDAD

El Contratista acuerda cumplir con las Secciones107 y 103 de la Ley Horas de Trabajo y Estándares de Seguridad. La sección 107 de la Ley es aplicable al trabajo de construcción y provee que ningún trabajador o mecánico será requerido a trabajar en alrededores o en condiciones de trabajo que no son sanitarias, o resultan arriesgadas o peligrosas a su salud y seguridad según determinado bajo los estándares de construcción, seguridad y salud promulgados por el Secretario del Trabajo. Estos requisitos no aplican a la compra de suministros o materiales o artículos ordinariamente disponibles en el mercado abierto o contratos para transportación.

33. PERSONAL

El CONTRATISTA representa que tiene o asegurará a su propio costo, todo el personalrequerido para llevar a cabo los servicios bajo este Contrato. Esto no incluye a los empleados o contratistas de OMEP/DEPR. Todos los servicios requeridos serán llevados a cabo por el CONTRATISTA o bajo su supervisión,

y todo el personal en el trabajo estará plenamente cualificado y estará autorizado o permitido a llevar a cabo dichos servicios bajo la ley estatal y local. Ninguna persona que esté cumpliendo una sentencia en una institución penal o correccional será empleada para trabajar bajo este Contrato.

34. RETENCIÓN DE SALARIOS

En el cumplimiento de este Contrato, si hubiera pago insuficiente de salarios por el CONTRATISTA o por cualquier subcontratista de éste, OMEP/DEPR podrá retener de cualquier pago debido al Contratista una cantidad suficiente para pagar a los empleados la diferencia entre los salarios adeudados y los salarios realmente pagados a dichos empleados por el total de horas trabajadas. Las cantidades retenidas pueden ser desembolsadas por OMEP/DEPR en sustitución del CONTRATISTA o subcontratista a los empleados a quienes se les debe.

35. RECLAMACIONES Y DISPUTAS SOBRE TARIFAS DE SALARIOS

Las reclamaciones y disputas sobre tarifas de salarios o clasificaciones de personal profesional o técnico llevando a cabo trabajo bajo este Contrato será prontamente reportada por escrito por el CONTRATISTA a OMEP/DEPR para su decisión. la cual será final con respecto al mismo.

36. DISCRIMEN POR CIERTOS ASUNTOS LABORALES

Ninguna persona empleada en los servicios cubiertos por este Contrato puede ser despedida o de ninguna manera discriminada porque él o ella ha presentado una reclamación o iniciado o ha causado el inicio de un procedimientoo, ha testificado o está a punto de testificar en cualquier procedimiento bajo o relacionado a los estándares laborales aplicables a su patrono.

37. INTERÉS DE LOS MIEMBROS DE LA AGENCIA PÚBLICA LOCAL Y OTROS

El CONTRATISTA acuerda establecer salvaguardas para prohibir a los empleados utilizar posiciones para un propósito que sea o dé la apariencia de estar motivado por un deseo de ganancia personal para ellos u otros, particularmente aquellos con quienes tienen lazos familiares, de negocios, u otros. El CONTRATISTA estará consciente de y evitará cualquier violación de las leyes que prohíben a oficiales y empleados gubernamentales tener o deber cualquier interés o participación, individualmente o como agente o empleado de cualquier persona o corporación, ya sea directa o indirectamente, en cualquier contrato hecho o que se permitió hacer por las autoridades gubernamentales de dicha municipalidad para la construcción o hacer cualquier obra pública, o para la venta o compra de cualesquiera materiales, suministros o propiedades de cualquier naturaleza, o para cualquier otro propósito, o en cualquier subcontrato que surja de ahí o relacionado con ello, o recibir, directa o indirectamente, cualquier porción o participación de cualquier dinero u otra cosa pagada para la construcción o hacer cualquier obra pública, o para la venta o compra de cualquier propiedad, o tras cualquier otro contrato hecho por las autoridades gubernamentales, o subcontrato que surja poreso o relacionado con eso.

El CONTRATISTA también estará consciente de y evitará cualquier violación a las leyes de Puerto Rico que prescriben una penalidad criminal para cualquier oficial público que tenga interés en

cualquier contrato aprobado por la junta de la cual él o ella es miembro durante el tiempo en que él o ella fuera miembro y por un año luego de terminar sus funciones oficiales.

38. INTERÉS DE CIERTOS OFICIALES FEDERALES

Ningún miembro ni delegado al Congreso de los Estados Unidos, incluyendo al Comisionado Residente de Puerto Rico, podrá tener participación en los trabajos o emolumentos derivados de este Contrato ni ningún beneficio que surja de ahí.

39. INTERÉS DE CONTRATISTA

El CONTRATISTA declara y certifica que no tiene interés ni adquirirá ningúninterés, directo o indirecto, en el Contrato o proyecto objeto del Contrato o en ninguna de las parcelas objeto del proyecto ni ningún otro interés que pueda confligir de cualquier modo con el trabajo bajo el Contrato. El CONTRATISTA además acuerda que ninguna persona que tenga tal interés será empleada bajo este Contrato.

40. ACTIVIDAD POLÍTICA

El CONTRATISTA cumplirá con las disposiciones de la Ley Hatch (5 U.S.C. 1501 *y siguientes*), que limita la actividad política de lo contratistas y sus empleados.

41. ACTIVIDAD RELIGIOSA

El CONTRATISTA acuerda abstenerse de utilizar cualesquiera fondos relacionados a este Contrato para actividades inherentemente religiosas prohibidas por 24 CFR 570.200(j), tales como culto, instrucción religiosa, o conversión.

42. LEY DE PROTECCIÓN CONTRA INUNDACIONES DE 1973

El CONTRATISTA se asegurará que los procedimientos y mecanismos sean puestos en vigor para el cumplimiento con todos los requisitos de seguro contra inundaciones según esbozado en la Ley de Protección Contra Inundaciones de 1973, 24 C.F.R. §570.605.

43. PINTURA A BASE DE PLOMO

El CONTRATISTA debe cumplir con los reglamentos sobre pintura a base de plomo que se encuentran en 24 C.F.R. § Parte 35 en PREVENCION DE ENVENENAMIENTOCON PINTURA A BASE DE PLOMO EN CIERTAS ESTRUCTURAS RESIDENCIALES en cuanto a todas las unidades de viviendas asistidas utilizando fondos CDBG-DR.

44. INGENIERIA DE VALOR
(Aplicable a contratos de construcción que exceden $2,000 cuando requerido porlegislación Federal del Programa.)

El CONTRATISTA debe de cumplir con los reglamentos sobre el enfoque sistemático y organizado de analizar funciones de los sistemas, equipos, facilidades, servicios y materiales para asegurar que logren sus funciones esenciales al más bajo costo consistente con ciclo de vida en ejecución, fiabilidad, calidad, y seguridad, conforme a 24 C.F.R. § 200.318.(g).

EXHIBIT H
CONTRACT FORMS

CONTRACT FORMS

No.	DESCRIPTION	PAGES
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3	Certificate as to Individual Principal (for Performance Bond)	2
4	Acknowledgement of Surety (Power of Attorney Required)	3
5	Payment Bond	4, 4a
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7	Certificate as to Individual Principal (for Payment Bond)	5
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PERFORMANCE BOND

(See Instructions)

KNOW ALL MEN BY THESE PRESENTS, That we _____

_____

(here in after called the Principal), as Principal, and _____ corporation organized and existing under laws of _____ and authorized to transact business under the laws of the Commonwealth of Puerto Rico, (hereinafter called the Surety), as Surety, are held and firmly bound unto _____

_____

_____

(here in after call the Obligee) in the penal sum of _____

_____($_____ _____), lawful money of the United States of America, for the payment of which, well and truly to be made, the Principal and said Surety bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal has entered into a certain written contract with the Obligee, dated the _____ day of _____, for _____

_____

_____

_____which contract is by reference made a part hereof, and is hereinafter referred to as the contract.

NOW, THEREFORE, if the Principal shall perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the Obligee, with or without notice to the Surety, and during the life of any guarantee required under the contract, and shall also perform and fulfill all the undertakings, convenience, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived then this obligation shall be void and of no effect; otherwise to remain in full force and effect.

Signed and sealed this _____ day of _____, _____.

_____
Principal

_____
Surety

Attest: _____ By: _____
Attorney-in-fact

PERFORMANCE BOND

INSTRUCTIONS:

1. This form is authorized for use in connection with contracts for construction work or the furnishing of supplies or services. There shall be no deviation from this form.

2. The full legal name and business address of the Principal shall be inserted in the space designated "Principal" on the face of this form. The bond shall be signed by an authorized person. Where such personal is signing in representative capacity (e.g. an attorney-in-fact), but is not a member of the firm, partnership or joint venture, or an officer of the corporation involved, evidence of his authority must be furnished.

3. The attorney-in-fact signing for the surety must hold a current power of attorney filed with the Commissioner of Insurance of Puerto Rico. Copy of this document must be attached; if not available, a certification by the Commissioner of Insurance will suffice.

4. Corporations executing the bond shall affix their Corporate Seals.

5. The name of each person signing this bond should be typed in the space provided.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the foregoing Performance Bond, that _____
Name of Principal's Representative
who signed this Bond on behalf of the Principal, was then _____ of said Corporation, that said Bond was
(Title of Position)
duly signed for and on behalf of said Corporation by authority of its governing body, and is within the scope of its corporate powers, this _____ day of _____ at _____, Puerto Rico.

(Corporate Seal) _____
(Signature of Secretary)

- - - - - - - - - - - - - - -

CERTIFICATE AS TO INDIVIDUAL PRINCIPAL

On the _____ day of _____, appeared before me of _____, of _____
(Name of Principal) (Address)
_____
_____, _____ of legal age and personally known to me and upon each stated to have executed the foregoing Performance Bond.

(Notary Seal) _____
(Notary Public)

PERFORMANCE BOND
ACKNOWLEDGEMENT OF SURETY

ISLAND OF PUERTO RICO
CITYOF SAN JUAN

On this _____ day of _____, _____, before me, the subscriber, a Notary Public of the city of _____, Puerto Rico, duly commissioned and qualified _____ _____, came to me personally known to be the officer who executed the preceding instrument, and he acknowledges execution of the same, and being by me duly sworn, deposed, and said, that he is the said officer of the company aforesaid, and that his signature as such officer was duly affixed and subscribed to said instrument by authority and direction of the said Company given in the Power of Attorney* executed by said company on the _____ day of _____, _____, the original of which is on file in the office of the Superintendent of Insurance or Puerto Rico.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at the City of _____, Puerto Rico the day and year first above written.

_____
(NOTARY PUBLIC)

(Notaries Seal)
*Power of Attorney

The Bid Bond must be accompanied by a copy of a current, valid power of Attorney from the Surety to the person issuing the bond on behalf of the Surety.

PAYMENT BOND

(See Instructions)

KNOW ALL MEN BY THESE PRESENTS, that we _____ _____ (hereinafter called the Principal) as Principal and _____ a corporation organized and existing under the laws of _____ _____ and authorized to transact business under the laws of the Commonwealth of Puerto Rico, (hereinafter called the Surety), as Surety, are held and firmly bound unto _____ _____ _____ (hereinafter called the Obligee) in the penal sum of _____ _____ ($_____), lawful money of the United States of America, for the payment of which, well and truly to be made, the Principal and said Surety bind ourselves our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ day of _____, _____ for _____ _____ which contract is by reference made a part hereof, and is hereinafter referred to as the contract.

PAYMENT BOND

NOW, THEREFORE, if the Principal shall promptly make payment to all persons supplying labor and material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, the above obligation shall be void; otherwise to remain in full force and effect.

Signed and sealed this _____ day of _____, _____.

_____
Principal

_____
Surety

Attest: _____ By: _____
Attorney – in - fact

PAYMENT BOND

INSTRUCTIONS:

1. This form for the protection of persons supplying labor and material shall be used whenever a payment bond is required. There shall be no deviation from this form.

2. The full legal name and business address of the Principal shall be inserted in the space designated "Principal" on the face of this form. The bond shall be signed by an authorized person. Where such person is signing in a representative capacity (e.g. an attorney-in-fact), but is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved, evidence of his authority must be furnished.

3. The attorney-in-fact signing for the surety must hold a current power of attorney filed with the Commissioner of Insurance of Puerto Rico. Copy of this document must be attached; if not available, a certification by the Commissioner of Insurance will suffice.

4. Corporations executing the bond shall affix their Corporate Seals.

5. The name of each person signing this bond should be typed in the space provided.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the foregoing Materials and Payment Bond, that _____
Name of Principal's Representative

who signed this Bond on behalf of the Principal, was then _____ of said Corporation, by authority of its governing
(Title of Position)

body, and is within the scope of its corporate powers, this _____ day of _____, _____ at _____.

(Corporate Seal) _____
(Signature of Secretary)

CERTIFICATE AS TO INDIVIDUAL PRINCIPAL

On the _____ day of _____, _____, appeared before me

_____, of
(Name of Principal)

_____,
(Address)

_____ of legal age and personally known to me and upon oath
(Occupation)

stated to have executed the foregoing Payment Bond.

(Notaries Seal) _____
(Notary Public)

PAYMENT BOND

ACKNOWLEDGEMENT OF SURETY

ISLAND OF PUERTO RICO
CITY OF SAN JUAN

On this _____ day of _____, _____, before me, the subscriber, a Notary Public of the city of _____, Puerto Rico, duly commissioned and qualified came _____ as attorney in fact of the _____, to me personally known to be the officer who executed the preceding instrument, and he acknowledges execution of the same, and being by me duly sworn, deposed, and said, that he is the said officer of the Company aforesaid, and the Power of Attorney* executed by said Company on the _____ day of _____, _____ the original of which is on file in the office of the Superintendent of Insurance of Puerto Rico.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at the city of _____, Puerto Rico the day and year first above written.

(Notaries Seal)

_____
Notary Public

*Power of Attorney

The Bid Bond must be accompanied by a copy of a current, valid Power of Attorney form the Surety to the person issuing the bond on behalf of the Surety.

DEPARTAMENTO DE TRANSPORTACIÓN Y OBRAS PÚBLICAS
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
GOBIERNO DE PUERTO RICO

DEPARTAMENTO DE ESTADO

Número: 7998
Fecha: 3 de marzo de 2011
Aprobado: Hon. Kenneth D. McClintock
Secretario de Estado

Por: Eduardo Arosemena Muñoz
Secretario Auxiliar de Servicios

EXHIBIT I

UNIFORM GENERAL CONDITIONS

for

Public Works Contracts in Puerto Rico

PUERTO RICO VERDE

UNIFORM GENERAL CONDITIONS FOR PUBLIC WORKS CONTRACTS

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GOVERNMENT OF PUERTO RICO
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

UNIFORM GENERAL CONDITIONS FOR PUBLIC WORKS CONTRACTS

PART A. INTRODUCTION

ARTICLE 1 –LEGAL BASIS; APPLICATION

1.1 Legal Basis. The Secretary of Transportation and Public Works, in accordance with the powers conferred upon him by Law No. 198 of May 15, 1943, as amended by Law No. 131 of September 2, 2010 and Law No. 170 of August 12, 1988, as amended, hereby enacts the following regulations to establish the applicable legal framework for the contracting and management of all public works.

1.2. Application. The provisions of these Regulations shall be applicable to all contracts for public works executed by all government agencies, departments, public corporations and instrumentalities.

PART B. UNIFORM GENERAL CONDITIONS

ARTICLE 1 -DEFINITIONS AND TERMINOLOGY

1.1 Defined Terms

1.1.1 Wherever used in the Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1.1.1.1. Agreement (or Contract) - The written instrument, which is evidence of the agreement between Owner and Contractor covering the Work.

1.1.1.2. Application for Payment - The form acceptable to Owner which is to be used by Contractor during the course of the Work in requesting progress or final payment and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

1.1.1.3. Architect/Engineer - The Architect or Engineer, referred herein as Architect/Engineer, is the collegiate professional licensed to practice architecture, engineering or surveying in the Commonwealth of Puerto Rico and is referred to throughout the Contract Documents. It is the Architect or Engineer authorized by the Owner for the preparation of all construction documents, plans and specifications and to submit such documents for the approval of the related public agency. The Architect/Engineer may designate an authorized representative. The Architect/Engineer is the individual or entity named as such in the Agreement.

1.1.1.4. Architect/Engineer's Consultant - An individual or entity having a contract with the Architect/Engineer to furnish services as Architect/Engineer's independent professional and collegiate consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

1.1.1.5. Bonds - Performance and Payment bonds and other instruments of surety required in the Contract Documents.

MAGR.

1.1.1.6. Certificate of Final Acceptance - Certificate issued by the Owner, or its duly authorized representative to Contractor indicating the date that the Work reached Final Acceptance.

1.1.1.7. Certificate of Substantial Completion - Certificate issued by the Owner, or its duly authorized representative, to the Contractor indicating the date that Substantial Completion was achieved for the Work.

1.1.1.8. Change in Law – Change in Law shall include: (i) the enactment or adoption by any legislative, regulatory, executive or administrative body of the Commonwealth of Puerto Rico or of the United States of America of any law, or any change or amendment to any law, in force as of the bid opening date, (ii) any change in the interpretation thereof which is final and not subject to administrative or judicial review, which cannot be complied with by a party without incurring in additional costs.

1.1.1.9. Change Order - A written order issued by the Owner, or its duly authorized representative, to the Contractor, signed by both parties, covering, additions, deletions, and/or revisions in the Work and/or an adjustment in the Contract Price and/or the Contract Time, if any, issued on or after the Effective Date of the Agreement. In Unit Price Contracts, a Change Order can also reflect a change in the number of items, as well as an increase or decrease, contained in the proposal. In Lump Sum Contracts, it reflects an order for additional or less work.

1.1.1.10. Claim - A claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be made by written notice and in accordance with Article 11.5. The responsibility to substantiate Claims shall rest with the party making the Claim.

1.1.1.11. Commonwealth - The Commonwealth of Puerto Rico.

1.1.1.12. Construction Change Directive – A Construction Change Directive is a written order signed by the Owner, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Price or Contract Time, or both. The Owner may, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Price and Contract Time adjusted accordingly. A Construction Change Directive shall be used only in the absence of total agreement on the terms of the Change Order, Extra Work Order or Work Change Directive, and shall be paid with the monthly Progress Payment according to the method indicated in Article 10.1.2.3.

1.1.1.13. Contract (or Agreement) - The entire and integrated written Agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

1.1.1.14. Contract Documents - The Contract Documents establish the rights and obligations of the parties and include: (i) the Agreement, (ii) addenda (which pertain to the Contract Documents), (iii) Contractor's bid or proposal (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award), (iv) the Notice to Proceed, (v) the Bonds, (vi) these General Conditions, (vii) the Supplementary Conditions, (viii) the Special Provisions, (ix) the Specifications, (x) the Drawings as the same are more specifically identified in the Agreement, including Standard Drawings, if applicable and (xi) Instructions to Bidders. It shall also include: (i) all Written Amendments, (ii) Change Orders and Extra Work Orders, (iii) Work Change Directives, (iv) Field Orders and (v) Architect/Engineer's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this Article are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by Owner to Contractor are not Contract Documents, unless otherwise specified in the bid documents.

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1.1.1.15. Contract Item or Pay Item - A portion of Work specifically described and for which a price either unit or lump sum is provided. It includes the performance of all Work and the furnishing of labor, equipment and materials described in the Specifications.

1.1.1.16. Contract/Project Limits - The area, including Site and off-Site, within which the Work is to be performed.

1.1.1.17. Contract Price - See Contract Sum.

1.1.1.18. Contract Sum - It is the Contract Price as stated in the Agreement and is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents subject to additions and deductions, stipulated in the Contract Documents.

1.1.1.19. Contract Time or Time - It is the period of time allotted in the Contract Documents for Substantial Completion of the Work.

1.1.1.20. Contract Unit - A major subdivision of the construction Project identified as such in the Contract Documents.

1.1.1.21. Contracting Officer - The Contracting Officer is the authorized representative of the Owner under the Contract Documents.

1.1.1.22. Contractor - The Contractor is the person or organization that contracts with the Owner for the performance of the Work described in the Contract Documents. The term Contractor, identified as such in the Agreement, means the Contractor or his authorized representative. In cases of Design-Build Contracts, the term Contractor shall also signify the Design-Builder Contractor.

1.1.1.23. Cost of the Work - See section 10.2 for definition.

1.1.1.24. Day - The word "day" shall constitute a calendar day of twenty-four (24) hours measured from midnight to the next midnight.

1.1.1.25. Design-Build Contracts – Shall be those contracts where the Contractor undertakes the duty to design the Work, in addition to performing the duties of Contractor.

1.1.1.26. Design-Builder Contractor – Shall be the Contractor in Design-Build Contracts, who in addition to having all duties of Contractor has the duty to design the Work, as specified in the Contract Documents.

1.1.1.27 Dispute – Any Claim, dispute or other disagreement involving the interpretation of the Contract Documents, a change in the Contract Sum, and or a change in the Contract Time, and other matters in question arising out of, or relating to the Contract or the breach thereof, except for Claims which have been waived by lack of proper notice and/or the making or acceptance of final payment as provided in Articles 13.7.2 and 13.9.1

1.1.1.28. Drawings or Plans - The approved drawings and supplementary drawings showing the location, character, dimensions, and details of the Work to be done which are part of the Contract Documents.

1.1.1.29. Effective Date of the Agreement - The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the parties to the Contract.

1.1.1.30. Engineer or Architect - See Architect/Engineer.

1.1.1.31. Equal or Similar and Substitute - "Similar or Equal" or "Substitute", when used in relation to materials, parts, machinery, equipment, formulas of the Project and/or anything to them related, shall mean that they be of substantially the same quality, form, appearance, resistance, endurance, efficiency, capacity, safety, specifications and any other quality inherent, or related, to them as they are indicated in the drawings and/or specifications of the Contract.

1.1.1.32. Equipment - All machinery and implements, together with the necessary supplies for upkeep and maintenance, and all tools and apparatus necessary for the proper construction and acceptable completion of the Work.

1.1.1.33. Extra Work - An item of Work not provided for in the Contract as awarded but found by the Owner or its duly authorized representative necessary for the satisfactory completion of the Contract within its generally intended scope.

1.1.1.34. Extra Work Order - Is a written order issued by the Owner to Contractor and signed by both parties in a unit price contract concerning the performance of the Work or furnishing of materials involving Extra Work. It authorizes a change in the Work, adjustments in the Contract Price and/or Contract Time for services, or Work, for which there is no basis of payment, either direct or indirect, provided in the proposal, or Contract, or if the resulting overruns, or underruns, of any item, or items, exceed certain percentages. Extra Work Orders apply only to unit price contracts. Such Extra Work may be performed at agreed prices or as provided in Section 10.2 of these General Conditions.

1.1.1.35. Federal Agency - Any agency of the government of the United States of America or its succeeding agency.

1.1.1.36. Field Order - A written order issued by the Owner that requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Time.

1.1.1.37. Final Acceptance - Shall mean the acceptance of the Work by the Owner after the final inspection as evidenced by the Certificate of Final Acceptance sent to Contractor by Owner.

1.1.1.38. Force Account Work - Additional Work that is paid for based on the Cost of the Work as defined in Article 10.2.

1.1.1.39. Force Majeure - Means an act of God; earthquake; tidal wave; hurricane; act of the public enemy; war; blockade; public riot; lighting; fire; flood; explosion; a strike, excluding strikes and any other activity or demonstration by Owner's personnel that does not interfere directly with the Work; and any other cause, whether of the kind specifically enumerated herein or otherwise, which is not reasonably within the sole control of Contractor. A rain, windstorm flood or other natural phenomenon of normal intensity for the particular locality shall not be construed as Force Majeure.

1.1.1.40. Hazardous Environmental Condition - The presence at the Site of asbestos, PCBs, petroleum, hazardous waste, or radioactive material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

1.1.1.41. Hazardous Waste - The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 U.S.C. §6903) as amended.

1.1.1.42. Holidays - Saturdays, Sundays and the legal holidays listed below on which the Contractor will not be allowed to perform Work under the Contract except as otherwise ordered or authorized in writing by the Owner. All other Holidays not listed below will be considered working days. Also, if any of the listed holidays falls on a Sunday, the following Monday will be considered a holiday.

New Year's Day	January 1
Three Kings Day	January 6
Good Friday	Variable
Independence Day	July 4
Constitution Day	July 25
Labor Day	First Monday of September
Election Day (when occurring)	Tuesday after 1st Monday in November
Thanksgiving	Fourth Thursday in November
Christmas Day	December 25

1.1.1.43. Laboratory - The material testing laboratory of the Owner or any other testing laboratory which may be approved by the Owner or its duly authorized representative.

1.1.1.44. Laws and Regulations; Laws or Regulations - Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

1.1.1.45. Liens - Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

1.1.1.46. Major and Minor Contract Items - Any item having a Contract value equal to or greater than five per cent (5%) of the original Contract amount shall be considered as a major item. All the other Contract items shall be considered as minor items. A minor item may become a major item when the minor item is increased to the extent that the total cost of the item is equal to or greater than five per cent (5%) of the original Contract amount.

1.1.1.47. Materials - Any substances specified for use in the construction of the Project and its appurtenances.

1.1.1.48. Milestone - A principal event specified in the Contract Documents related to an intermediate completion date or time prior to the Substantial Completion of the whole Work.

1.1.1.49. Notice of Award - The written notice by the Owner to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

1.1.1.50. Notice to Proceed - A written notice issued by the Owner to the Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform the Work under the Contract Documents. Such Notice to Proceed shall identify the persons included in article 5.2.2. Unless otherwise agreed by the parties, all permits and/or endorsements to be furnished by the Owner needed to start construction of the Project must be obtained prior to issuance of the Notice to Proceed.

1.1.1.51. OCIP - see Owner-Controlled Insurance Program.

1.1.1.52. Off-Site Work - Work to be performed outside of the of the Project's limits.

1.1.1.53. Owner - The Owner is the Department, Agency, Public Corporations, or any other instrumentality of the Commonwealth of Puerto Rico as identified in the Agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Owner means the Owner or his authorized representative. It shall also mean any person, or entity, named as such in the Contract Documents.

1.1.1.54. Owner-Controlled Insurance Program - also known as "OCIP". An insurance program under which

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Commercial General Liability, Excess General Liability, Builder's Risk, and Contractor's Pollution Liability coverage are procured or provided by the Owner for the Contractor, Subcontractors of any tier, who have been properly enrolled, while performing operations at the Project Site.

1.1.1.55. Owner's Representative – One or more persons or entity designated by the Owner, who will perform the functions of the Owner as described in these General Conditions. The Owner's Representative may employ Project Inspectors and/or other assistants to perform any function, duty or responsibility, as delegated by the Owner's Representative, including but not limited to the detailed inspections of performance of any or all portions of the Work.

1.1.1.56. Partial Utilization - Use by Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

1.1.1.57. Pay Item - See Contract Item.

1.1.1.58. Payment Bond - The security required to be furnished by the Contractor and his Surety and approved by the Owner to guarantee the payment of all persons or entities supplying labor, material and equipment in the prosecution of the Work or services required for completion of the Contract.

1.1.1.59. Performance Bond - The security required to be furnished by the Contractor and his Surety and approved by the Owner to guarantee the completion of all the requirements of the Contract.

1.1.1.60. Plans - See Drawings.

1.1.1.61. Project – The total construction of which the Work to be performed under the Contract Documents is the whole, or part.

1.1.1.62. Project Inspector - The professional, duly licensed and collegiate Engineer or Architect, or a legally qualified entity, contracted and/or designated by the Owner and/or the Owner's Representative to perform, as a Project Inspector, the continuous on Site inspection of any or all portions of the Work.

1.1.1.63. Project Manager- The professional licensed and collegiate Engineer or Architect, designated in accordance with the Contract as the Contractor's authorized representative who is made by Contractor responsible for and placed in charge of the Work.

1.1.1.64. Project Manual - The bound documentary information prepared for bidding and constructing the Work.

1.1.1.65.Project Schedule- A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Work within the Contract Times, as required by Article 6.4 of these General Conditions.

1.1.1.66. Reasonable Close Conformity - Compliance with reasonable and customary manufacturing and construction tolerances when working tolerances are not specified. When working tolerances are specified, reasonably close conformity means compliance with such working tolerances. Without detracting from the complete and absolute discretion of the Owner or its duly authorized representative to insist upon compliance with such tolerances, the Owner or its duly authorized representative may, at his sole option and reasonable discretion, accept variations beyond such tolerances when and where they will not materially affect the value or utility of the Work and the interests of the Owner.

1.1.1.67. Reference Specifications - Specifications issued by other official and/or professional organizations that are referred to and made part of the Owner's specifications and other Contract Documents. Unless otherwise specifically indicated in the Contract Documents, references cited shall be the edition of such specifications in effect at the time the Project is advertised for bids/proposals.

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1.1.1.68. Right of Way - A general term denoting land, property, easement or interest therein, usually in a strip, acquired for the Project or for the benefit of another project or public utility.

1.1.1.69. Samples - Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

1.1.1.70. Shop Drawings or Working Drawings - All drawings, diagrams, schedules, and other data or information, which are specifically prepared or assembled by or for the Contractor and submitted by Contractor to illustrate some portion of the Work.

1.1.1.71. Site - Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner that are designated for the use of Contractor. It shall also mean areas for the performance of off-site work, if same is required in the Contract Documents.

1.1.1.72. Special Conditions - Special requirements, regulations or direction, covering conditions peculiar to a particular project. Special Conditions shall prevail over particular provisions of these General Conditions only when such option is provided in any particular Article of these General Conditions by the use of words such as "unless otherwise indicated in the Contract Documents..." In all other instances these General Conditions shall prevail over any conflicting provision contained in the Special Conditions.

1.1.1.73. Specialty Item - A Contract Item, which is specifically identified in the Contract Documents as exempted from the computations to determine the total amount of the Work that the Contractor may be authorized to subcontract.

1.1.1.74. Specifications - That part of the Contract Documents consisting of written Technical Specifications, descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable to the Work.

1.1.1.75. Standard Drawings - See Standard Plans.

1.1.1.76. Standard Plans (or Standard Drawings) - Drawings approved for repetitive use, showing details to be used where appropriate, included in the Plans or published as a separate document.

1.1.1.77. Standard Specifications - The set of specifications approved by the Owner for general application and repetitive use.

1.1.1.78. Subcontractor - A Subcontractor is an individual or entity that has a direct contract with the Contractor to perform any of the Work at the Site. The term Subcontractor as referred throughout the Contract Documents means the Subcontractor or his authorized representative.

1.1.1.79. Substantial Completion - The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of the Owner, or its authorized representative, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

1.1.1.80. Supplemental Agreement - A written agreement executed by the Contractor and Owner supplementing the Contract to cover Extra Work and/or changes and/or changed conditions incidental to and necessary for the acceptable completion or the Project.

1.1.1.81. Supplemental Specifications - Approved additions and/or revisions to the Standard Specifications, including Technical Specifications.

1.1.1.82. Supplementary Conditions - That part of the Contract Documents that amends, or supplements, where allowed, these General Conditions.

1.1.1.83 Supplier - A manufacturer, fabricator, supplier, distributor, materialmen, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work.

1.1.1.84. Surety - The insurance or bonding corporation or other legal entity, other than the Contractor, authorized to do business in Puerto Rico, bound with and for the Contractor for the proposal guaranty and/or the Payment Bond and/or the Performance Bond, or other bonds and insurances required by the Contract Documents.

1.1.1.85. Technical Specifications - The directions, provisions and requirements setting forth, or relating to, the performance of the Work and to the kind and quality of materials and labor to be furnished under the Contract for the execution of the Project. Any entity making changes in the Technical Specifications and/or Plans and Drawings, must perform so complying with all laws, codes, rules and regulations applying to them.

1.1.1.86. Underground Facilities/Utilities - All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any easements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

1.1.1.87. Unit Price Work - Work to be paid for based on unit prices.

1.1.1.88. Utility - A public or privately owned agency or entity and the lines and facilities for producing, transmitting or distributing data or voice communications, power, electricity, gas, oil, gasoline, water, sewer and similar commodities for public or private use.

1.1.1.89. Work - The entire construction referred to in the Agreement and the performance of the services identified to be provided in the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce and make workable such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

1.1.1.90. Work Change Directive - A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by the Owner and recommended by the Architect/Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Time but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Time.

1.1.1.91. Work Order - A written order, signed by the Owner, or its duly authorized representative, which requires performance of a specific contractual issue by the Contractor without negotiation of any sort. If Contractor is not in agreement with the Work Order, he may present a Claim as established in Article 11.5.

1.1.1.92. Working Day - A calendar day, exclusive of Saturday and Sunday and designated legal holidays. All periods of time under the Contract Documents shall be measured in calendar days, unless Working Days are specified.

1.1.1.93. Working Drawings - See Shop Drawings.

1.1.1.94. Written Amendment - See Supplemental Agreement.

1.2 Other Terms - The Owner's manuals and sets of regulations contain additional terms, not included above, which are used in the plans and other Contract Documents. Such terms shall be interpreted as defined in the Owner's manuals and sets of regulations.

1.3 Terminology

1.3.1 Intent of Certain Terms or Adjectives.

1.3.1.1. Unless otherwise indicated in the Contract Documents, whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Architect/Engineer as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to Architect/Engineer any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of these General Conditions and the Contract Documents.

1.3.2 Deficient.

1.3.2.1. The word "deficient," when modifying the word "Work," refers to Work, or part of it, that is unsatisfactory, faulty, or defective in that it does not conform to the Contract Document or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to Owner's Representative's recommendation of final payment, unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with these General Conditions.

1.3.3 Furnish, Install, Perform, Provide.

1.3.3.1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use, assembling, or installation and in usable or operable condition.

1.3.3.2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position, said services, materials, or equipment complete and ready for intended use.

1.3.3.3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

1.3.3.4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "install", "perform" and/or, "provide" is implied.

1.3.4 Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - CONTRACT DOCUMENTS

2.1 Intent and Interpretation of Contract Documents

2.1.1 The Contract Documents constitutes the Contract. The Contract Documents represent the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral, including the bidding documents. The Contract Documents may be amended or modified as set forth in section 2.6.

2.1.2 The intent of the Contract Documents is to provide for the construction and completion of the Work described.

2.1.3 The Contractor shall furnish all labor, materials, equipment, tools, transportation and supplies required to complete the Work in accordance with the plans, specifications and terms of the Contract Documents.

2.1.4 The relationship which the parties intend to create under the Contract Documents is that of principal and independent Contractor and nothing herein is intended or shall be construed, so as to create a relationship of any kind, form or manner, such as but not limited to partnership, co-venturers, or employment between the Owner and Contractor, unless clearly otherwise expressed in the Contract Documents.

2.2 Order of Precedence of Contract Documents

2.2.1 The Contract Documents for each particular Project shall specify the order of precedence among the diverse documents that form the Contract Documents, except for the order of precedence of the General Conditions which may not be altered unless allowed to be altered by means of the Special Conditions as described in Article 1.1.1.72. If no such order of precedence is established in the Contract Documents for the Project, the following order shall be followed:

2.2.1.1. Agreement (which shall include the Bonds and required insurance policies).

2.2.1.2. Dated Contractor's Proposal

2.2.1.3. All addenda issued prior to Bid Date. Unless no conflict exist between addenda, the issuance of a subsequent addendum will supersede all previously issued addenda.

2.2.1.4. Instructions to Bidders

2.2.1.5. The General Conditions of the Contract, (except where in accordance with Article 1.1.1.72 they are allowed to be changed by the Special Conditions).

2.2.1.6. Special Conditions.

2.2.1.7. Plans or Drawings

2.2.1.8. The Standard Drawings.

2.2.1.9. Specifications.

2.2.1.10. Technical Specifications.

2.2.1.11. Supplemental Specifications.

2.2.1.12. Standard Specifications.

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2.3 Written Interpretations

2.3.1 Provided reasonable time is granted to Owner, written interpretations necessary for the proper execution or progress of the Work in the form of drawings, or otherwise, will be issued with reasonable promptness by the Owner, its designated representative, or Architect/Engineer so as not to adversely affect the critical path of the Project Schedule.

2.3.2 Contractor may make written request to the Owner, Owner's Representative, or the Architect/Engineer for such interpretations, when deemed necessary for the proper progress of the Work.

2.3.2.1. Such interpretations shall be consistent with and reasonably inferable from the Contract Documents and may be effected by Field Orders.

2.3.2.2. Interpretation drawings are not necessarily changes in the Work.

2.3.3 Except as may otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

2.3.3.1. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

2.3.3.2. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

2.4 Execution and Correlation

2.4.1. The Agreement shall be signed by the Owner and Contractor or their authorized representatives. The other component parts of the Contract Documents, if not signed by the Owner or Contractor, shall be marked by their authorized representative.

2.4.2 By executing the Contract Documents, the Contractor represents that he has visited the Contract Limits within the Site, familiarized himself with the local conditions under which the Work is to be performed, correlated his observations with the requirements of Contract Documents, and accepts the same.

2.4.2.1 The Owner warrants that it has submitted all the necessary documents required of Owner to be submitted to the appropriate governmental agencies needed for the prosecution of the Work, as required by applicable laws and regulations.

2.4.3 The Owner and the Contractor acknowledge that no service or Work under the Contract Documents will be performed until both parties duly sign the Contract and the Notice to Proceed is issued.

2.4.3.1. No payment and/or disbursement will be made or paid for services rendered in violation of this clause.

2.4.4 The Contract Time.

2.4.4.1. The Contract Time must be specifically expressed on the Contract.

2.4.4.2. The Contract Time will be extended by the same number of days in which the term to execute the Work is extended by Change Orders or by any other mean allowed or permitted by the Contract or Contract Documents.

2.4.4.3. Furthermore, the parties agree that no Work or service will be performed or received beyond Final Acceptance of the Contract.

2.4.4.4. No payment and/or disbursement will be made or paid for services rendered in violation of this clause.

2.4.5 The Contract Documents are complementary, and what is required by anyone shall be as obligatory as if required by all. The intention of the Contract Documents is to include all labor, materials, equipment and other items as provided on these General Conditions necessary for the proper execution and completion of the Work.

2.4.5.1. It is not intended that Work not covered under any heading, section, branch, class or trade of the Specifications shall be supplied unless it is required elsewhere in the Contract Documents.

2.4.5.2. The organization of the Specifications in divisions, sections, articles, and the arrangement of drawings shall not control the Contractor in dividing the Work among subcontractors or in establishing the extent of Work to be performed by any trade.

2.5 Review of Contract Documents and Field Conditions by Contractor.

2.5.1 Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents with each other and check and verify pertinent dimensions and quantities therein and all applicable field measurements.

2.5.2 Contractor shall promptly report in writing to Owner any conflict, error, ambiguity, inconsistency, discrepancy, or omission that Contractor may discover and shall obtain a written interpretation or clarification from Owner before proceeding with any Work affected by said conflict, error, ambiguity, inconsistency, discrepancy or omission.

2.5.2.1. However, Contractor shall not be liable to Owner for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents, unless Contractor failed to report it to the Owner with sufficient time for the Owner to provide a solution before the critical path of the Project is affected.

2.5.2.2. If the Contractor performs any construction activity in violation of this Article 2.5, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the costs attributed to correction.

2.5.2.3. The Owner shall provide a solution to any reported conflict, error, ambiguity, discrepancy, or omission and if such solution adversely affects cost or the critical path of the Project, Owner will adjust Contract Price and Contract Time accordingly.

2.6 Amending and Supplementing Contract Documents

2.6.1 The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one (1) or more of the following ways:

2.6.1.1. a Written Amendment;

2.6.1.2. a Change Order;

2.6.1.3. an Extra Work Order; or

2.6.1.4. a Work Change Directive.

2.6.2 The requirements of the Contract Documents may be supplemented and minor variations and deviations in

the Work may be authorized, by one (1) or more of the followings ways:

2.6.2.1. a Field Order;

2.6.2.2. Owner's, or his authorized representative's, approval of a Shop Drawing or Sample; or

2.6.2.3. Owner's, his authorized representatives, or Architect/Engineer's written interpretation or clarification.

2.6.3 A modification may be made only after execution of the Contract.

2.7 Copies Furnished, Ownership and Reuse of Documents

2.7.1. The Contractor will be furnished, free of charge, four (4) complete copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction. If Contractor so requests it, Owner will also furnish, free of charge, if available, an electronic file in PLT format (plot to File) so that the Contractor may make the copies of plans and/or drawings that he needs to build the Project. If such electronic files are not available, the Owner shall allow the Contractor to prepare electronic files and to print, at Contractor's cost, but without additional payment to Owner or Architect/Engineer, those copies needed for use by Contractor.

2.7.2. All Drawings, Specifications and copies thereof furnished by the Owner, Architect/Engineer, or Owner's Representative are, and shall remain, property of the Owner.

2.7.2.1. The Contractor can make copies of all the Drawings, Specifications, and other Contract Documents without permission, and without the payment of any fees or royalties, to the Owner, Architect/Engineer, or Owner's Representative as long as they are necessary for use in the execution of the Work.

2.7.3. Contractor and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with Owner:

2.7.3.1. shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Owner, Architect/Engineer or Engineer's Consultant, including electronic media editions; and

2.7.3.2. shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extension of the Project or any other project without written consent of Owner.

2.7.4 This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 3- BONDS AND INSURANCE

3.1 General- For Owners with OCIP

3.1.1 The Contractor shall not commence work under the Contract until he has obtained the various insurances policies and bonds specified in the Owner's Controlled Insurance Program. Owner shall provide to Contractor an exact copy of the applicable Owner Controlled Insurance Program manual together with the Contract Documents.

3.2 General- For Owners without OCIP.

3.2.1 The Contractor shall not commence work under the Contract until he has obtained the various

insurances and bonds specified in this section and has submitted to the Owner certificates of insurance (and other evidence requested by Owner) evidencing his compliance with the various insurance requirements set forth in this Article.

3.2.1.1. Unless otherwise indicated in the Contract Documents, Contractor must, within ten (10) calendar days from the Notice of Award, provide to Owner, in form satisfactory to Owner as provided in detail in this Article, the following:

3.2.1.1.1. Performance Bond

3.2.1.1.2. Payment Bonds

3.2.1.1.3. Workmen's Compensation Insurance Policy issued by The Puerto Rico State Insurance Fund and all Social Insurances required by law.

3.2.1.1.4. General Liability Insurance

3.2.1.1.5. Business Auto Policy

3.2.1.1.6. Contract Works Policy (Builder's Risk)

3.2.1.1.7. Installation Floater Policy (when applicable)

3.2.2 Notwithstanding the requirements set forth in this Article, the Owner may opt out of part of the requirements included in this Article and require any and all other policies that it understands are needed for its particular construction projects, including other policies not required herein.

3.2.2.1. However, such decision to opt out of part of the requirements of this Article must be written and signed by the Owner stating particularly the reasoning behind it Such written decision must be made part of Owner's Project file.

3.2.3. The insurance and bond policies required herein shall be obtained from insurance and surety companies complying with the requirements of Puerto Rico's Insurance Commissioner.

3.2.3.1. Prior to Bid announcement Date, Owner will publish a list of unacceptable insurance and bonding companies so that Contractor has knowledge of which companies are not authorized to provide insurances or bonds for the Work. Unless otherwise indicated in the Contract Documents, the Contractor must obtain an endorsement naming the Owner as an additional insured in each of the required insurance policies in this Article (as applicable).

3.2.4 The Contractor shall, throughout the performance of Work under the Contract and until the Final Acceptance of the Project, maintain current, and in effect all the required insurance, except the Contract Works Policy (Builder's Risk), which shall terminate on the date of Substantial Completion.

3.2.4.1. If on the termination date of any of the policies, the Project is still under construction and the Contractor has not renewed the policies, the Owner can renew them and deduct the amount paid for the premium, and applicable costs from the next payment, only if Contractor does not remedy and provide timely evidence of coverage.

3.2.5. Insurance coverage in the minimum limit amounts set forth herein shall not be construed to release the

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Contractor from liability in excess of such coverage limit. Contractor must give thirty (30) calendar days written notice to Owner before any policy coverage is changed, canceled or not renewed and shall cause the insurance carrier to do the same.

3.2.6 Acceptance of Insurance; Option to Replace. If either Owner or Contractor has any objection to the coverage afforded by or to other provisions of the insurance required to be purchased and maintained by the other party in accordance with this Article on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within twenty (20) days after receipt of the certificates of insurance and bonds (or other such evidence) required by Article 3.1.1.

3.2.6.1. Owner and Contractor shall each provide to the other such additional information with respect to insurance provided as the other may reasonably request.

3.2.6.2. If either party fails to purchase or maintain all of the insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure prior to the start of the Work, or of such failure is to maintain, prior to any change in the required coverage.

3.2.6.3. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent insurance to protect such other party's interest at the expense of the party who was required to provide such coverage, and a Change Order (or Extra Work Order in a unit price Contract) shall be issued to adjust the Contract Price accordingly.

3.2.7. If Owner finds it necessary or convenient to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in section 14.5 no such use or occupancy shall commence before the insurers providing the property insurance pursuant to section 3.6 have acknowledged notice thereof and in writing effected any changes in coverage needed thereby.

3.2.7.1. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

3.2.7.2. If the Owner accepts, occupies, or uses a portion, or portions, of the Work for its intended use, or whatever use he deems necessary or convenient, it is the Owner's responsibility to insure the property comprising said portion, or portions of the Work.

3.2.7.3. If the Contractor obtained the Contract Works Policy (Builder's Risk) for the Work, the Owner may request that Contractor continues to carry said insurance and will pay the cost, as a Change Order, based on the proportion of the occupied area versus the total Project area.

3.2.7.4. If requested by Contractor, the Owner shall supply copy of its insurance policy, and/or certificate of insurance evidencing that said portion, or portions, of the Work now under the Owner's care, custody and control is properly insured.

3.3 Performance, Payment, and Other Bonds

3.3.1. Unless otherwise stated in the Contract Documents, the Contractor must, within ten (10) calendar days from the date of Notice of Award, furnish and file with the Owner, in form satisfactory to, and with Sureties approved by the Owner, the following:

3.3.1.1. Performance Bond to guarantee the faithful performance of the Contract, in an amount equal to at least fifty percent (50%), but not more than one hundred percent (100%) of the Contract Sum, as stated in the Supplementary General Conditions of the Contract. If none is stated, the amount shall be one hundred percent

(100%) of the Contract Sum.

3.3.1.2. Payment Bond, including Labor Bond in an amount equal to at least fifty percent (50%), but not more than one hundred percent (100%) of the Contract Sum, as stated in Supplementary General Conditions of the Contract. If none is stated, the amount shall be one hundred percent (100%) of the Contract Sum.

3.3.1.3. A separate and additional Payment Bond in an amount equal to the requirements of Law No. 111, approved June 22, 1961, as it may be amended in the future, payable to the Secretary of Labor of the Commonwealth of Puerto Rico to guarantee payment to laborers and employees of the Contractor.

3.3.1.4. Contractor shall also furnish such other Bonds as are required by the Contract Documents.

3.3.2. The Payment and Performance Bonds shall remain in effect as follows:

3.3.2.1. Under the Performance Bond: one (1) year after the date when the final payment becomes due for warranty work, as stipulated in the warranty clause, or as provided otherwise by Laws or Regulations or by the Contract Documents.

3.3.2.2. Under the Payment Bond: six (6) months after the retainage is paid in full to the Contractor, except as provided otherwise by Laws or Regulations or by the Contract Documents.

3.3.3 All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations. All Bonds must be signed by an attorney in fact duly authorized by the Commissioner of Insurance of Puerto Rico, and must be accompanied by a certified copy of such power of attorney.

3.3.4 If the Surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of the Puerto Rico's Insurance Commissioner, Contractor shall within twenty (20) days thereafter substitute said Bond and Surety with acceptable substitutes.

3.4 Workmen's Compensation Insurance

3.4.1 The Contractor shall provide Worker's Compensation Insurance as required by the "Workers' Compensation Act of the Commonwealth of Puerto Rico". The Contractor shall furnish the Owner a certificate from the State Insurance Fund Corporation covered by the Workers' Compensation Act of the Commonwealth of Puerto Rico.

3.4.2 The Contractor shall also be responsible for compliance with said "Workers' Compensation Act" by all his subcontractors and agents.

3.5 Contractor's Liability Insurance

3.5.1 Contractor shall purchase and maintain the following liability insurance coverage, in an occurrence format, and other insurance as is appropriate for the Work being performed and will provide protection from claims set forth which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

3.5.1.1. Limits. Unless otherwise stated in the Special Conditions of the Contract, the liability insurance limits shall not be less than:

3.5.1.1.1. General Aggregate Limit	$1,000,000
3.5.1.1.2. Products/Completed Operations Aggregate Limit	$1,000,000
3.5.1.1.3. Personal and Advertising Injury Limits	$ 500,000
3.5.1.1.4. Each Occurrence Limit	$ 500,000
3.5.1.1.5. Fire Damage Limit	$ 50,000
3.5.1.1.6. Medical Expense Limit	$ 5,000

3.5.1.2. Claims for damages because of bodily injury, occupational sickness or disease, or death of any person other than Contractor's employees;

3.5.1.3. Claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or (ii) by any other person for any other reason;

3.5.1.4. Claims for damages, other than to the Work itself, because o injury to or destruction of tangible property wherever located, including loss of use resulting there from.

3.5.2 The insurance policies so required by this section 3.4 to be purchased and maintained, unless otherwise specified in the Contract Documents, shall:

3.5.2.1. include at least the specific coverage and be written for no less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater,

3.5.2.2. include complete operations/premises/products insurance;

3.5.2.3. include contractual liability insurance covering Contractor's indemnity obligations under these General Conditions. Unless otherwise specified in the Contract Documents, the indemnity clause shall read as follows:

3.5.2.3.1. The Contractor for itself, agents, employees, successors and assigns agrees to save harmless the Owner, its Officers, Agents, Employees and Architect/Engineer from and against any and all claims, demands and/or suits, except as stated below, whether judicial or extra judicial for any cost whatever arising out or related to the execution of the Contract, and its insurers shall defend the Owner, its officers, agents, Employees and Architect/Engineer from such claims, demands and/or suits and shall bear all the expenses for such defense contemplated within the coverage limits provided by the Contractor's general liability policy, except where such claims, demands and/or suits are due solely to the negligence of the Owner, its Officers, Agents, employees and negligence, errors and/or omissions of the work performed by the Architect/Engineer.

3.5.2.4. include personal & advertising liability.

3.5.2.5 include XCU hazards (Explosion, Collapse, and Underground), as applicable.

3.5.2.6. include Contractor's subcontracted work;

3.5.2.7. include fire damage and medical expenses;

3.5.2.8. remain in effect at least until Final Acceptance and at all times thereafter when Contractor may be correcting, removing or replacing Work; in accordance with section 13.7 and

3.5.2.9. Include Employer's Liability - Stop Gap coverage with a minimum limit of five hundred thousand

dollars ($500,000.00) each personal occurrence and five hundred thousand dollars ($500,000.00) each accident.

3.6 Business Auto Policy

3.6.1 Automobile Liability coverage shall be written to protect the Contractor against all claims for bodily injuries to members of the public and damage to property of others arising from the use of motor vehicles, and shall cover operations on or the site of all motor vehicles, whether they are owned, non-owned or hired.

3.6.2 Unless otherwise stated in the Contract Documents, the liability limits shall not be less than:

3.6.2.1. Bodily Injury: two hundred and fifty thousand dollars ($250,000.00) each person and five hundred thousand dollars ($500,000.00) each occurrence.

3.6.2.2. Property Damage: one hundred thousand dollars ($100,000.00) each occurrence or two hundred and fifty thousand dollars ($250,000.00) combined single limit for bodily injuries and property damage liability.

3.7 Contract Work-Builders Risk Insurance

3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide a Builder's Risk policy for the amount of coverage set in the Contract Documents. The Builders Risk policy will insure against property damage to the building or structure being constructed or erected during the course of construction.

3.7.1.1. The description of covered property should include all fixtures, materials and supplies to be used in or incidental to, the construction. It should also cover equipment, machinery, materials, etc., not yet installed but destined to become a permanent part of the structure, on the Site or at off Site temporary storage locations.

3.7.1.2. This insurance shall be written under an Inland Marine all risk form, including earthquake, windstorm and flood coverage and shall protect the Contractor, Subcontractors, and the Owner and shall contain a waiver of subrogation clause against the insured parties.

3.7.1.3. Coverage shall be for an amount equal to the Contract Sum, unless otherwise specified in the Contract Documents.

3.7.1.4. Coverage shall include expenses incurred in the repair or replacement of any insured property.

3.7.1.5. Coverage shall include materials and/or equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and/or equipment have been included in an Application for Payment recommended by Owner.

3.7.1.6. Coverage shall allow partial utilization of the Work by Owner, if Owner complies with Article 3.2.7, herein

3.7.1.7. Coverage shall include testing and startup.

3.7.1.8. Coverage shall be maintained in effect until Substantial Completion is achieved unless otherwise agreed to in writing by Owner and Contractor with thirty (30) days written notice to each other additional insured to whom a certificate of insurance has been issued.

3.7.1.9. Unless otherwise stated in the Contract Documents, flood coverage limits shall be for the Contract Sum or up to a maximum of $250,000.00, whichever is lower.

3.7.1.10. Deductibles under this Policy shall be no more than:

3.7.1.10.1. Flooding no more than $5,000.00

3.7.1.10.2. For named windstorms, or hurricanes, no more than two percent (2%) of the Contract Sum.

3.7.1.10.3. For Earthquakes, no more than five percent (5%) of the total Contract Sum.

3.7.2. If the Contract Documents specify that Owner shall purchase the Builders Risk policy, said policy shall be under the same or better terms and conditions, than those indicated in section 3.6. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this section 3.6, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order or Written Amendment.

3.7.2.1. Unless otherwise provided in the contract Documents, Owner shall be responsible for the deductible under this policy.

3.7.2.2. Prior to commencement of the Work at the Site, Owner shall in writing advice Contractor whether or not such other insurance has been procured by Owner.

3.7.3. The Contract Documents shall set forth, whenever applicable, which party shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will insure the interest of Owner, Contractor, and Subcontractors, each of whom is deemed to have an insurable interest and each shall be listed as an insured or additional insured. Unless otherwise set forth in the Contract Documents, said insurance, if needed, shall be purchased and paid for, by the Owner.

3.7.4. Receipt and Application of Insurance Proceeds

3.7.4.1. If Owner purchases said insurance, Owner is authorized and shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing to Owner's exercise of this power within fifteen (15) days after the occurrence of loss.

3.7.4.2. Owner shall settle with the insurers in accordance with what is agreed by the parties who own the insurable interest.

3.7.4.3. If no such agreement among the parties in interest is reached, Owner shall, on behalf of all parties, adjust and settle the loss with the insurers.

3.8 Installation Floater Policy

3.8.1. This policy shall be provided by the Contractor when Builders Risk policy does not apply and coverage is required for only a specific type of property during its installation.

3.8.2. The limit of insurance shall include the aggregate value of the Contractor's, Subcontractor's, or Owner's furnished equipment and materials to be erected or installed by the Contractor.

3.8.3. This insurance shall be written under an Inland Marine all risk form, including earthquake, windstorm and flood coverage and shall protect the Contractor, Subcontractors, and the Owner and shall contain a waiver of subrogation clause against the insured parties.

3.9 Subcontractor's and Subcontractor's Liability Insurance.

3.9.1. Unless otherwise indicated in the Contract Documents, the Contractor shall, throughout the performance of Work under the Contract, procure and maintain in effect, and require all Subcontractors and others performing any such Work to procure and maintain in effect, insurance of the types applicable and with limits no less than the minimum amounts specified above, or insure the activity of his Subcontractors in his own policy.

3.10 Owner's Liability Insurance.

3.10.1 In addition to the insurance required to be provided by Contractor under Article 3.4, Owner, at Owner's option, may purchase and maintain Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

ARTICLE 4-SITE

4.1 Availability of Lands

4.1.1. Unless otherwise stated in the Contract Documents, Owner shall furnish the Site.

4.1.1.1. Owner shall notify Contractor of any known encumbrances or restrictions specifically related to use of the Site with which Contractor must comply in performing the Work.

4.1.1.2. Owner will obtain in a manner that does not adversely affect the critical path of the Work the easements for permanent structures or permanent changes to existing facilities.

4.1.1.3. If Contractor and Owner are unable to agree on the entitlement to or on the amount of any adjustment in the Contract Price or Contract Time, or both, as a result of any delay in Owner's complying with the responsibilities indicated above, Contractor may make a Claim therefore as provided in section 11.5.

4.1.2. Contractor shall secure and provide all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.2 Subsurface and Physical Conditions

4.2.1. Reports and Drawings. The Supplementary Conditions identify:

4.2.1.1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Architect/Engineer has used in preparing the Contract Documents; and

4.2.1.2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Architect/Engineer has used in preparing the Contract Documents.

4.2.2. Limited Reliance by Contractor on Technical Data Provided. On lineal type projects, Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are

not part of the Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data", Contractor may not rely upon or make any Claim against Owner, Architect/Engineer, or any of Architect/Engineer's Consultants with respect to:

4.2.2.1. the completeness of such reports and drawings for Contractor's construction purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

4.2.2.2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

4.2.2.3. any Contractor interpretation of, or conclusion drawn from, any "technical data" or any such other data, interpretations, opinions, or information.

4.2.3. Reliance by Contractor on Technical Data Provided. On building construction projects, Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, and such reports and drawings are part of the Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data", Contractor may not rely upon or make any Claim against Owner, Architect/Engineer, or any of Architect/Engineer's Consultants with respect to:

4.2.3.1. the completeness of such reports and drawings for Contractor's construction purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

4.2.3.2. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.3 Differing Subsurface or Physical Conditions

4.3.1. Notice: If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

4.3.1.1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in section 4.2 is materially inaccurate; or

4.3.1.2. is of such a nature as to require a change in the Contract Documents; or

4.3.1.3. differs materially from that shown or indicated in the Contract Documents; or

4.3.1.4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then Contractor, shall promptly, in no event later than 3 working days, after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Article 6.16), notify Owner's Representative, Owner and Architect/Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

4.3.2. Architect/Engineer's and/or Owner's Representative Review. After receipt of written notice as required by the preceding Article, Architect/Engineer and/or Owner's Representative will promptly review the pertinent condition and determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advice Owner in writing of Architect/Engineer's and/or Owner's Representative findings and conclusions.

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4.4. Price and Time Adjustments

4.4.1. The Contract Price, or the Contract Time, or both will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's costs of, or time required for, performance of the Work; subject, however, to the following:

4.4.1.1. such condition must meet any one or more of the categories described in Article 4.3.1; and

4.4.1.2. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of section 11.3.

4.4.2 Contractor shall not be entitled to any adjustment in the Contract Price or Contract Time if:

4.4.2.1. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner in respect of Contract Price and Contract Time by the submission of a Bid or by becoming bound under a negotiated contract; or

4.4.2.2. the existence of such condition could reasonably have been discovered or revealed as a result of any visual examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by Contractor prior to Contractor's making such final commitment; or

4.4.2.3. Contractor failed to give the written notice within the time and as required by Article 4.3.1.

4.4.3 If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price, or Contract Time, or both, a Claim may be made therefore as provided in section 11.5.

4.5 Underground Facilities

4.5.1. Shown or Indicated. The information and/or data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner's Representative, Owner or Architect/Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

4.5.1.1. Owner and Architect/Engineer shall be responsible for the reasonable accuracy or completeness of any such information or data; and

4.5.1.2. the costs of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

4.5.1.2.1. reviewing and checking all such information and data;

4.5.1.2.2. locating all Underground Facilities shown or indicated in the Contract Documents;

4.5.1.2.3. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

4.5.1.2.4. the safety and protection of all such Underground Facilities and repairing any damage thereto

resulting from the Work.

4.5.2. Not Shown or Indicated.

4.5.2.1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Article 14.13), notify said findings in writing to the owner of such Underground Facility, Owner's Representative and Architect/Engineer.

4.5.2.2. Architect/Engineer, Owner's Representative and Owner will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility.

4.5.2.3. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

4.5.2.4. If Owner's Representative concludes that a change in the Contract Documents is required, a Work Change Directive, Change Order or Extra Work Order will be issued to reflect and document such consequences.

4.5.2.4.1. An equitable adjustment shall be made to the Contract Price or Contract Time, or both, if warranted under this Article 4.5.

4.5.2.4.2. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Time, Owner or Contractor may make a Claim therefore as provided in section 11.5.

4.6. Reference Points

4.6.1. In projects requiring construction of buildings, at the beginning of the project, the Owner will set construction stakes establishing sufficient property lines, baseline and a bench mark. These stakes and marks will constitute all the surveying work the Owner will provide for the use of the Contractor. From the above-mentioned stakes and marks, the Contractor shall develop and establish all necessary marks and controls to perform his work. The Contractor will be held responsible for the preservation of original stakes and marks provided by the Owner at the beginning of the project, and if any of these stakes or marks are carelessly or willfully destroyed or disturbed by the Contractor, the cost of replacing them will be at Contractor's expense. The Owner will be responsible for the accuracy of the original lines and marks furnished to the Contractor.

4.6.1.1. In lineal projects, Owner shall provide engineering surveys to establish reference points for construction which, in Architect/Engineer's judgment, are necessary to enable Contractor to proceed with the Work.

4.6.2. Contractor shall be responsible thereafter for establishing the reference points and property monuments in accordance with the survey provided by Owner and laying out the Work, shall protect and preserve the reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall be responsible for replacing the established reference points and property monuments, if affected during construction.

4.6.3. Contractor shall report to Owner's Representative and Architect/Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

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4.7. Hazardous Environmental Condition at Site

4.7.1. Reports, Studies and Drawings. Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Architect/Engineer in the Preparation of the Contract Documents.

4.7.2. Limited Reliance by Contractor on Technical Data Provided. On lineal type projects, Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not part of the Contract Documents. Such "technical data" is identified in the Technical Specifications. Except for such reliance on such "technical data", Contractor may not rely upon or make any Claim against Owner, Architect/Engineer, or any of Architect/Engineer's Consultants with respect to:

4.7.2.1. the completeness of such reports and drawings for Contractor's construction purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

4.7.2.2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

4.7.2.3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.7.3. Reliance by Contractor on Technical Specifications Provided. On building construction projects, unless otherwise indicated in the Contract Documents, Contractor may rely upon the general accuracy of the "technical data" contained in such Technical Specifications and/or Plans and Drawings. Except for such reliance on such "technical data", Contractor may not rely upon or make any Claim against Owner, Architect/Engineer, or any of Architect/Engineer's Consultants with respect to:

4.7.3.1. the completeness of such reports and drawings for Contractor's construction purposes, including any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

4.7.3.2. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.7.4. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site that was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work.

4.7.5. Contractor shall be responsible for Hazardous Environmental Conditions created due to any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

4.7.6. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately:

4.7.6.1. at Owner's cost, secure or otherwise isolate such condition, if it is not the Contractor's fault; or at Contractor's cost, if it is his fault, or anyone for whom Contractor is responsible;

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4.7.6.2. stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by section 6.13 and 14.13); and

4.7.6.3. notify Owner's Representative, Owner and Architect/Engineer and promptly thereafter confirm such notice in writing, no later than 24 hours after the condition has been encountered. Failure to do so shall constituted a waiver of any claim in connection thereto.

4.7.6.3.1. Owner shall promptly consult with Architect/Engineer and/or Owner's Representative concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action.

4.7.7. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner's Representative has obtained any required permits related thereto and delivered to Contractor written notice:

4.7.7.1. specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or

4.7.7.2. specifying any special conditions under which such Work may be resumed safely.

4.7.7.3. If Owner, through Owner's Representative, and Contractor cannot agree as to entitlement to, or on the amount or extent, if any, of any adjustment in Contract Price or Contract Time, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefore as provided in Article 11.5.

4.7.8. If after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner's Representative may order the portion of the Work that is in the area affected by such condition to be deleted from the Work.

4.7.8.1. If Owner, through Owner's Representative, and Contractor cannot agree as to entitlement to, or on the amount or extent, if any, of an adjustment in Contract Price or Contract Time as a result of deleting such portion of the Work, then either party may make a Claim therefore as provided in Article 11.5.

4.7.8.2. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

4.7.9. To the fullest extent permitted by Laws or Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition:

4.7.9.1. was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and

4.7.9.2. were not created by Contractor or by anyone for whom Contractor is responsible.

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4.7.9.3. Nothing in this Article shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

4.7.10. To the fullest extent permitted by Laws or Regulations, Contractor shall indemnify and hold harmless Owner's Representative, Owner, Architect/Engineer, Architect/Engineer's Consultants, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible.

4.7.10.1. Nothing in this Article shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

4.7.11. The provisions of sections 4.2, 4.3 and 4.4 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5-OWNER

5.1 General

5.1.1. Owner's responsibilities and obligations are expressed throughout these General Conditions and are not limited to the ones contained in this Article.

5.1.2. All functions of the Owner will be performed by the Contracting Officer, unless delegated to others in the Contract Documents.

5.1.3. The Contracting Officer may delegate his full authority to another person, and to that effect shall notify the Contractor by written communication.

5.1.4. Unless otherwise specified in the Contract Documents, the person signing this Contract shall be interpreted to mean the Contracting Officer.

5.2 Information and Services Required of the Owner

5.2.1. The Owner shall furnish all available information describing the Project including, but not limited to, physical characteristics, legal limits and utility locations for the Project.

5.2.1.1. Said information should have been made available with reasonable time, and, unless otherwise specified in Bid Documents, prior to bid opening.

5.2.2 Before commencement of the Work, as specified in the Notice to Proceed, the Owner shall inform the Contractor in writing the name of the Owner's Infrastructure Area Director, Architect/Engineer, Contracting Officer, Owner's Representative and Project Inspector, if applicable. Owner reserves the right to change, from time to time, the designated persons or entities and any other designated representative who will perform the functions of the Owner. The Notice to Proceed shall also indicate the day of the week on which Contractor and Owner's Representative shall hold their weekly meeting to discuss matters related to the Project. The Owner's Representative may, from time to time, change said date of the week.

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5.2.3 Furnishing of Right of Way - The Owner will be responsible for obtaining the necessary rights-of-way in advance of construction. Any exceptions will be indicated in the Contract Documents.

5.2.4 Information or services to be provided by Owner shall be furnished by the Owner with reasonable promptness so as to avoid any delay in the orderly programmed progress of the Work.

5.3 Pay Promptly When Due

5.3.1. Owner shall make payments to Contractor promptly when they are due.

5.4 Owner's Right to Stop the Work

5.4.1. The Owner's Representative and/or Owner may in accordance with Article 15.1.2 order the Contractor to stop the Work, or any portion thereof if the Contractor:

5.4.1.1. fails to start (and expeditiously continues) correcting defective work promptly after Contractor is notified in writing by the Owner;

5.4.1.2. persistently fails to supply materials or equipment in accordance with the Contract Documents; or

5.4.1.3. for any other significant reason deemed necessary to insure the proper execution of the Contract until the cause for such order has been eliminated.

5.5 Owner's Right to Carry Out the Work Without Terminating the Employment of the Contractor

5.5.1. If the Contractor persistently neglects to carry out the Work in accordance with the Contract Documents or persistently fails to comply with any provision of the Contract, the Owner, through the Owner's Representative, may, after ten (10) days written notice to the Contractor and Surety, if any, and without prejudice to any other remedy he may have, perform said Work and/or, remedy such deficiencies.

5.5.1.1. In such case, an appropriate deduction for the cost of performing said Work and/or correcting such deficiencies shall be made from the payments then, or thereafter, due the Contractor. If the payments then, or thereafter, due the Contractor are not sufficient to cover such amount, the Contractor and/or surety shall pay the difference to the Owner.

5.5.2. The cost to be charged to Contractor of such Work, repairs or replacement, will be the actual cost incurred by Owner.

5.6 Owner's Right to Clean Up

5.6.1. If a dispute arises between the separate contractors in the Project as to their responsibility for cleaning up as required by these General Conditions, the Owner may, after written notice to Contractor, clean up and charge the cost thereof to the several contractors in the proportion that the Architect/Engineer, or the Owner's Representative, determines equitable. If the Contractor is not in agreement with the cost distribution, he may make a claim as provided in Article 11.5.

5.7 Evidence of Financial Arrangements

5.7.1. Upon Contractor's request, Owner will furnish Contractor reasonable evidence that financial arrangements have been made for the payment of Owners' obligations under the Contract, and that all documentation for said purpose has been filed pursuant to applicable Laws and Regulations.

5.7.1.1. If requested in writing by Contractor, Owner shall supply reasonable written evidence that Owner has complied with these requirements.

5.8 Limitations on Owner's Responsibilities

5.8.1. Unless otherwise provided in the Contract Documents the Owner, through Owner's Representative, shall have no authority over, nor responsibility for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or shall not be held responsible for any failure of Contractor to comply with Laws or Regulations applicable to the performance of the Work. Owner's Representative, or Owner, will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

ARTICLE 6 - CONTRACTOR

6.1 Supervision and Superintendence

6.1.1. Contractor shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

6.1.1.1. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, but Contractor shall not be responsible for the negligence of Owner or Architect/Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction, which is shown or indicated in and expressly required by the Contract Documents.

6.1.1.1.1. When the Contract Documents specify the use of a specific means, method, technique, sequence, or procedure of construction, which is shown or indicated in and expressly required by the Contract Document, such means, method, technique, sequence, or procedure of construction shall be used unless others are authorized by the Owner's Representative.

6.1.1.1.2. If the Contractor desires to use a means, method, technique, sequence, or procedure of construction other than specified in the Contract Documents, he shall request authority from the Owner's Representative to do so.

6.1.1.1.2.1. The request shall be in writing and shall include a description of the methods and equipment proposed and of the reasons for desiring to make the change.

6.1.1.1.2.2. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with the Contract Documents.

6.1.1.1.2.3. If, after trial use of the substituted methods or equipment, the Owner's Representative determines that the Work produced does not meet Contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining Work with the specified methods and

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equipment.

6.1.1.1.2.4. The Contractor shall remove the deficient Work and replace it with Work of specified quality, or take such other corrective action as the Owner's Representative may direct.

6.1.1.1.2.5. No change will be made in the Contract amount for the construction items involved or in Contract Time as a result of authorizing a change in methods or equipment under these provisions.

6.1.1.1.3. Contractor shall be responsible to ascertain that the completed Work complies accurately with the Contract Documents.

6.1.2. Project Manager. Unless otherwise indicated in the Contract Documents, the Contractor shall employ a competent licensed and collegiate architect or engineer, as the Project Manager, and necessary assistants to direct the Work. These assistants shall be in attendance at the project site at all times during the prosecution of the Work. The Project Manager shall be satisfactory to the Owner or his representatives and shall not be changed except with the consent of the Owner, unless the Project Manager proves to be unsatisfactory to the Contractor (and Contractor gives Owner written notice of the specific reason for removal as Project Manager) or ceases to be in Contractor's employ.

6.1.2.1. The Project Manager will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. The Contractor, prior to the start of the Project, will inform the Owner's Representative, if already assigned, or the Owner, if not assigned, the name, authority and responsibilities of the Project Manager and/or Superintendent.

6.1.2.1.1. All communications given or received from the Project Manager shall be binding on Contractor. All communications related to the Contract directed to the Contractor and/or proceeding from the Owner, Architect/Engineer, Owner's Representative and other representatives of the Owner shall be made thru the Project Manager.

6.2 Labor and Working Hours

6.2.1. Contractor shall provide competent, suitably qualified personnel to survey, layout, and construct the Work as required by the Contract Documents.

6.2.1.1. The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ in relation to the Project or the Work any unfit person or anyone not skilled in the task assigned to him.

6.2.1.1.1. The Contractor shall be responsible to the Owner for the acts and omissions of all of his employees and all subcontractors, their agents and employees and all other persons performing any work under a contract with the Contractor.

6.2.1.2. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the Work to full completion in the manner and within the time required in the Contract Documents.

6.2.1.2.1. Workers engaged in special work or skilled work shall have sufficient experience in the performance of such work and in the operation of the equipment and tools to perform it properly and satisfactorily.

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6.2.1.2.2. Any person employed by the Contractor or by a subcontractor who, as determined by the Owner's Representative, does not perform his work in a proper and skillful manner, or is disrespectful, intemperate, disorderly or otherwise objectionable shall, at the written request of the Owner's Representative, be removed forthwith by the Contractor or Subcontractor employing such employee, and such person shall not be employed again on any portion of the Work without the written consent of the Owner's Representative. Owner's Representative shall specify, in writing, the reason for the removal of such person from the jobsite.

6.2.1.2.2.1. Should the Contractor fail to remove such person or persons as required herein, the Owner may withhold payment of estimates which are or may become due, or may suspend the Work by written notice until such orders are complied with.

6.2.2. Except as otherwise required for the safety or protection of persons or the Work or property at the Site, or adjacent thereto, or for completion of daily Work as provided in Article 9.1.2.2.2. or as otherwise stated in the Contract Documents, all Work shall be performed during regular working hours and Contractor will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without Owner's Representative's written consent (which will not be unreasonably withheld).

6.2.2.1. The Contractor shall comply with all the applicable Federal and Commonwealth laws, rules and regulations concerning fair labor practices including minimum wages, work hours, equal employment opportunities, non-discrimination, civil rights, employment of minors, and other labor relation matters.

6.2.2.2. The Contractor shall pay weekly, in lawful money of the United States of America, including payment by check or direct deposit, the entire amount of wages, less legally authorized or mandated deductions, earned by each of the laborers and employees engaged in the work.

6.2.2.2.1. The Contractor shall make available the Project payrolls to the Owner's Representative for inspection and shall submit copies of such payrolls to the Owner's Representative when required.

6.2.2.2.1.1. Any irregularities noted in the Project's payrolls will be brought to the attention of the Contractor by the Owner's Representative for appropriate corrective action and payment of any pending wages. Should the Contractor fail to take the necessary action, he will be subject to such civil and criminal proceedings as provided by law and regulations.

6.2.2.2.1.2. Payment of wages to laborers and employees of the Contractor for their work shall have preference over the payment of other debts of the Contractor, except as otherwise established by law.

6.3 Services, Materials, and Equipment

6.3.1. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

6.3.2. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents.

6.3.2.1. All warranties and guarantees required by the Contract Documents shall expressly benefit Owner.

6.3.2.2. If required by Owner's Representative, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

6.3.2.3. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

6.4 Progress and Other Schedules

6.4.1. Measurement and payment.

6.4.1.1. Unless otherwise specified in the Contract Documents, all costs in connection with the preparation and maintenance of schedules, workplans, submittals and other work specified in this Article 6.4 are to be included and form part of the project's general administrative expenses. Contractor's Cost for said work required in Article 6.4 shall not be paid as a separate pay item in Unit Price contracts or as a Schedule of Values item, in Lump Sum contracts.

6.4.2. General.

6.4.2.1. Progress schedules shall represent a practical plan to complete the Work within the Contract Time, and shall convey the Contractor's intent as to the manner of prosecuting the progress of the Work.

6.4.2.2. The scheduling and execution of construction in accordance with the Contract Documents are the responsibility of the Contractor. The Contractor shall involve and coordinate all Subcontractors and Suppliers in the development and updating of progress schedules.

6.4.2.3. The submittal of progress schedules shall be understood to be the Contractor's representation that the progress schedule meets the requirements of the Contract Documents and that the Work is expected to be executed in the sequence and duration indicated in the progress schedule.

6.4.3. Scheduling format.

6.4.3.1. The Project Schedule shall be computer produced using the Critical Path Method ("CPM") format. The schedule shall be computer generated utilizing an Owner approved project scheduling software, as indicated in the Contract Documents, such as Primavera, Microsoft Project, or SureTrak. The project scheduling software selected shall be used consistently from commencement to Final Acceptance of the Project. If the Contractor desires to use a project scheduling software other than the one specified in the Contract Documents, he shall request authorization from the Owner's Representative to do so, prior to the issuance of the Notice to Proceed. If the Contract Documents do not indicate a specific scheduling program, the Contractor may use any of the three mentioned herein, at his sole option.

6.4.3.2. The Project Schedule shall be updated monthly and submitted as indicated in Article 6.4.4. .

6.4.3.3. The schedule shall show Contract tasks, percent complete, progress bars, baseline schedules, milestones, start and finish dates, and other breakdowns as required by the Owner's Representative. The schedules shall show clearly the sequence of activities and shall list specifically the following activities:

6.4.3.3.1. interim milestones completion dates. Phasing and staging of the Work as specified shall be prominently identified;

6.4.3.3.2. submittals and the Owner's Representative review of submittals;

6.4.3.3.3. acquisition of permits;

6.4.3.3.4. any long lead time (over 60 days) orders for material and equipment;

6.4.3.3.5. work to be performed by other contractors and agencies;

6.4.3.3.6. delivery of Owner's furnished equipment and materials indicated for incorporation in the Work.

6.4.3.4. Descriptions of scheduled activities shall include sufficient detail to identify the work that is to be accomplished.

6.4.3.4.1. The schedule shall contain sufficient activities to clearly show the sequence and interdependencies of the Work. The Owner's Representative may request that additional activities and information be added and from time to time may also require reasonable amendments to the schedule format that result in more clarity as to how the information is presented.

6.4.3.4.2. Activity durations shall be expressed in whole days. Work that is to be performed by Subcontractor shall be clearly defined.

6.4.3.4.3. Critical path activities are those activities with a total float equal to or less than zero. Schedules with negative total float may be found to be impractical by the Owner's Representative.

6.4.3.4.4. A schedule showing that Work that is completed in less than the completion time specified, shall be considered to have float. The float shall be the time between the scheduled completion of the Work and the Contract completion date. Float time shall not be for the exclusive benefit of either the Owner or the Contractor. Float shall be a resource available to both parties.

6.4.3.4.4.1. If according to the critical path of the originally approved Project Schedule any party that generates a float in said critical path, then said float shall belong exclusively to the party generating said float.

6.4.3.4.5. A schedule found to be impractical for the preceding reasons or any other reasons shall be revised by the Contractor and resubmitted.

6.4.4 Submittals.

6.4.4.1. Within thirty (30) days after the effective date of the Notice to Proceed (unless otherwise specified in the Contract Documents), Contractor shall submit to Owner's Representative for its timely review:

6.4.4.1.1. a preliminary progress schedule indicating the times (numbers and days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

6.4.4.1.2. a preliminary schedule of Shop Drawings and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; and

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6.4.4.1.3. a preliminary schedule of values for all of the Work, as specified on Article 13, herein.

6.4.4.2. Submit one (1) electronic copy and the number of hard copies of the Submittals required in Article 6.4 which the Contractor requires to be returned, plus three (3) hard copies which will be retained by the Owner.

6.4.4.3. Schedule submittals will be reviewed by the Owner's Representative, and shall be updated and revised as indicated in section 6.4.6. Re-submittals shall conform to the same requirements as original submittals.

6.4.4.4. The Contractor shall prepare and submit all schedules and schedule analysis reports in electronic as well as hard copies.

6.4.4.5. All progress schedule submittals are subject to review and approval by the Owner's Representative.

6.4.4.5.1. Unless otherwise provided in the Contract Documents, at least ten (10) days before submission of the Application for Payment, a conference, to be attended by Contractor, Owner's Representative, Architect/Engineer, and others as appropriate, will be held to review for purposes of acceptability to Owner's Representative, as provided below, the progress schedules submitted in accordance to Article 6.4.4.1. If said meeting is not held, for reasons other than due to the fault of the Contractor, or if the Owner's Representative does not provide timely approval, or corrections, to the submitted submittals specified in Article 6.4.1., all the previously submitted submittals shall be considered approved, provided Contractor has given notice directly to Owner as required in Article 17.3.2.

6.4.4.5.1.1. Contractor shall have an additional ten (10) days to make corrections and adjustments and to complete and resubmit the schedules. Owner's Representative shall approve said corrections within a period of ten (10) days from the date of re-submittal otherwise they shall be considered approved, provided Contractor has given notice directly to Owner as required in Article 17.3.2.

6.4.4.5.1.1.1. The third progress payment shall not be paid to Contractor until acceptable schedules are submitted to Owner's Representative, or until schedules are considered approved as specified herein.

6.4.4.5.1.1.2. The Progress Schedule will be acceptable to Owner's Representative if in accordance with the Agreement it provides an orderly progression of the Work to completion within any specified Milestones and the Contract Time.

6.4.4.5.1.1.3. Contractor's schedule of Shop Drawings and Sample submittals will be acceptable to Owner's Representative if it provides, in Owner's sole discretion, a workable arrangement for reviewing and processing the required submittals.

6.4.4.6. The first schedule submitted by the Contractor will be reviewed for format, as well as content. The Owner's Representative may request format changes. Once the format has been approved, all subsequent schedules shall be submitted in the approved format.

6.4.5 Four-week work plan.

6.4.5.1. A schedule in calendar time-scaled bar chart format depicting the Contractor's intended work activities for the upcoming four (4) week period shall be submitted on a monthly basis and shall be due on the day of the project's weekly meeting. Each activity of one (1) day or more in duration shall be indicated.

6.4.5.2. Any deviations, such as sequences of work, timing, and durations of activities from the approved Project Schedule, shall be noted and explained in writing.

6.4.5.3. The four (4) week work plan shall be submitted on sheets not less than 8 ½ inches by 11 inches, or as approved by the Owner's Representative.

6.4.6. Review, updates and revisions

6.4.6.1. The Owner's Representative will review and return to Contractor the schedule submittals, with written comments, within the following deadlines counted from the date of receipt.

6.4.6.1.1. Project CPM schedule: 14 calendar days.

6.4.6.1.2. Four (4) week work plan: 8 calendar days.

6.4.6.2. The Contractor shall make all corrections to the Project Schedule requested by the Owner's Representative and resubmit the schedule for approval. If the Contractor does not agree with the Owner's Representative's comments, the Contractor shall provide written notice of disagreement within five (5) days from the receipt of the Owner's Representative's comments. The Owner's Representative's comments on the four (4) week work plan for which the Contractor disagrees shall be resolved in a meeting held for that purpose, if necessary.

6.4.6.3. At least once each month, or often if indicated in the Contract Documents, the Contractor shall submit an updated schedule showing the progress of the Work to date and anticipated activities to be worked on. All updated schedules must comply with Article 6.4.

6.4.6.4. If, according to the approved Project Schedule, the Contractor is thirty (30) or more days behind as to the completion date of any milestone, or the schedule contains thirty (30) or more days of negative float, considering all approved time extensions, the Contractor shall submit a revised schedule, showing a practical plan to complete the Work within the Contract Time.

6.5 Submittals for Approval, Substitutes and/or "Equals"

6.5.1. Submittal for Approval of Materials, Shop Drawings and Samples; Plans and Working Drawings; As-Built Plans.

6.5.1.1. The Contractor shall submit all submittals for approvals of Materials, Shop Drawings and Samples to the Owner's Representative. The Owner's Representative will either perform the review and approval, or forward the Contractor's submittal to the Architect/Engineer's for his review and approval, in accordance with the accepted itinerary for Shop Drawings and Sample submittals.

6.5.1.2. All submittals will be identified as required by Owner's Representative and presented with the number of copies specified in the Contract Documents. If a number is not mentioned, seven (7) copies will be submitted. Of these seven (7) copies, four (4) shall be returned, duly evaluated, to the Contractor.

6.5.1.3. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Owner's Representative the services, materials, and equipment Contractor proposes to provide and to enable Owner's Representative to review the

information for the limited purposes of complying with the requirements of Article 6.17.

6.5.1.4. The Architect/Engineer or the Owner's Representative shall have the following deadlines within which to approve, request additional information or reject any Submittal for Approval of Materials, Shop Drawings and Samples:

6.5.1.4.1. For Materials, Shop Drawings or Samples which are the ones specified in the Contract Documents or are, in the opinion of the Owner's Representative, non-complex Shop Drawings or Materials, the Architect/Engineer or Owner's Representative shall have a period of ten (10) working days.

6.5.1.4.2. For Materials, Shop Drawings or Samples not complying with the requirements indicated in the previous Article, the period shall be twenty (20) working days.

6.5.1.4.3. If no comment by the Architect/Engineer or Owner's Representative is made within said period of time, the Contractor will have the right to Claim if said delay impacts the critical path.

6.5.1.4.4. The above mentioned deadlines can be extended if requested in writing by the Architect/Engineer and/or Owner's Representative as long as approval is made within a time period that does not alter the critical path. Such request for extension shall not be unreasonably denied.

6.5.1.5. Each Sample will be identified clearly as to material, supplier, pertinent data such as catalog numbers, and the use for which it is intended or otherwise as Owner's Representative may require, to enable the Architect/Engineer or the Owner's Representative to review the submittal for the limited purposes of complying with the requirements of Article 6.17.

6.5.1.5.1. The numbers of items each Sample to be submitted will be as specified in the Specifications. If no number of items is mentioned, three (3) samples will be submitted. Of these, three (3) samples, two (2) shall be returned, duly evaluated, to the Contractor.

6.5.2. Where an approval of Materials, Shop Drawing or Samples is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals, any related Work performed, including materials purchases, prior to Owner's Representative or Architect/Engineer's review and approval of the pertinent submittal will be at the sole responsibility of Contractor.

6.5.3. Submittal Procedures.

6.5.3.1. Before delivering each submittal for approvals of Material, Shop Drawing or Sample, Contractor shall have:

6.5.3.1.1. verified that all shop drawing measurements, quantities, shop drawing dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information are in accordance with the Contract Documents and if not in accordance, ascertained that all variations are indicated in the submittal;

6.5.3.1.2. verified all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

6.5.3.1.3. verified all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

6.5.3.1.4. Contractor shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings or Samples and with the requirements of the Work and the Contract Documents.

6.5.3.2. Each submittal shall bear a stamp or specific written indication that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal. If required in the Special Conditions, submittals for Materials and Samples must bear a notarized certificate of compliance.

6.5.3.3. At the time of each submittal, Contractor shall give Owner's Representative specific written notice of such variations, if any, that the submittal for approvals of material, Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication included with the submittal.

6.5.4. The Architect/Engineer or Owner's Representative's Review.

6.5.4.1. Owner's Representative, either himself or through the Architect/Engineer, will perform a timely review, evaluation and comment of Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to Owner's Representative. If no comment by the Owner's Representative is made within the time stated in this Article 6.5 the Contractor will have the right to claim pursuant the provisions of Article 11.5, if said delay impacts the critical path.

6.5.4.1.1. The Architect/Engineer or the Owner's Representative review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

6.5.4.1.2. The Architect/Engineer or the Owner's Representative's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto.

6.5.4.1.2.1. The review and approval of a separate item, as such, will not indicate approval of the assembly in which the item functions.

6.5.4.1.3. The Architect/Engineer or the Owner's Representative's review and approval of Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called the Architect/Engineer or the Owner's Representative attention to each such variation at the time of each submittal as required by Article 6.17 and the Architect/Engineer or the Owner's Representative has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by the Architect/Engineer or the Owner's Representative relieve Contractor from responsibility for complying with the requirements of Article 6.17.

6.5.5. Re-submittal Procedures.

6.5.5.1. Contractor shall make corrections required by the Architect/Engineer or the Owner's Representative and shall return the required copies of materials submittals, the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval.

6.5.6 Substitutes and "Or-equals".

6.5.6.1. Whenever an item or material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Owner's Representative for review under the circumstances described below. The Contractor will present his submittal for approval, indicating whether the item of material or equipment proposed is an Or Equal or a Substitute.

6.5.6.2. "Or-Equal" Items: If in Owner's Representative's sole discretion an item, or material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it will be considered by Owner's Representative as an "or-equal" item, in which case review and approval of the proposed item be accomplished without compliance with the special requirements for approval of the proposed substitute items and be acceptable or acceptable with comments. Owner's Representative's basis for rejection of the item of material or equipment as an "or equal" material shall be written and may be subject to appeal, as specified in Article 11.5 of these General Conditions, by Contractor. For the purposes of this Article, a proposed item of material or equipment will be considered functionally equal to an item so named if:

6.5.6.2.1. In the exercise of reasonable judgment, Owner's Representative determines that:

6.5.6.2.1.1. it is at least equal in quality, durability, appearance, strength, and design characteristics;

6.5.6.2.1.2. it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

6.5.6.2.2. Contractor certifies that:

6.5.6.2.2.1. there is no increase in cost to the Owner; and

6.5.6.2.2.2. it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

6.5.6.2.2.3. Owner's Representative shall make the decision on the "or equal" material with sufficient time so as not to alter the Contractor's Programmed Schedule of the Work. If no comment by the Owner's Representative is made within said period of time, the Contractor will have the right to Claim pursuant the provisions of Article 11.5 if said delay impacts the critical path.

6.5.6.3. Substitute Items

6.5.6.3.1. If in Owner's Representative's sole discretion an item or material or equipment proposed by Contractor does not qualify as an "or-equal" item under Article 6.5.6, it will be considered a proposed substitute item.

6.5.6.3.2. Contractor shall submit sufficient information as provided below to allow Owner's Representative to determine that the item or material or equipment proposed is essentially equivalent to that specified and an acceptable substitute therefore.

6.5.6.3.2.1. Requests for review of proposed substitute items, material or equipment will not be accepted by

Owner's Representative from anyone other than Contractor.

6.5.6.3.3. The procedure for review by Owner's Representative will be as set forth in Article 6.5.6, as supplemented in these General Conditions and as Owner's Representative may decide is appropriate under the circumstances.

6.5.6.3.4. Contractor shall first make written application to Owner's Representative for review of a proposed substitute item, material or equipment that Contractor seeks to furnish or use.

6.5.6.3.4.1. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified.

6.5.6.3.4.2. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's timely achievement of Substantial Completion, whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

6.5.6.3.4.3. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated.

6.5.6.3.4.4. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by Owner's Representative in the evaluation of the proposed substitute item.

6.5.6.3.4.5. Owner's Representative may require Contractor to furnish additional data about the proposed substitute item.

6.5.6.3.5. Owner's Representative shall make the decision on the "substitute" material with sufficient time so as not to alter the critical path. If no comment by the Owner's Representative is made within said period of time, the Contractor will have the right to Claim pursuant the provisions of Article 11.5 if said delay impacts the critical path.

6.5.6.3.6. Owner's Representative's basis for rejection of a "substitute" material shall be written and may be subject to appeal and Claim by Contractor, as specified in Article 11.5.

6.5.6.4. If a Substitute item is approved by the Owner and such change affects the Contract Price, then the Contract Price shall be equitably adjusted.

6.5.7. Substitute Construction Methods or Procedures.

6.5.7.1. If a specific means, method, technique, sequence, or procedure of construction is shown, or indicated in, or expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Owner's Representative.

6.5.7.1.1. Contractor shall submit sufficient information to allow Owner's Representative, in Owner's

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Representative's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. Such submittal shall be made with sufficient time as to allow the Owner's Representative to review it.

6.5.7.1.1.1. The procedure for review by Owner's Representative will be similar to that provided in section 6.5.6 but no Claim may be made by contractor due to untimely evaluation by Owner.

6.5.8. Owner's Representative's Evaluation.

6.5.8.1. Owner's Representative or Architect/Engineer will be allowed a reasonable time, which will not unreasonably delay the critical path of the Work, within which to evaluate each proposal or submittal made pursuant to Article 6.5.

6.5.8.2. Except as provided above. Owner's Representative will be the sole judge of acceptability.

6.5.8.3. No "or-equal" or substitute will be ordered, installed or utilized until Owner's Representative's review is complete, which will be evidenced by written approval by Owner for a substitute or an approved Shop Drawing or an "or-equal."

6.5.8.4. Owner's Representative will advise Contractor in writing of any negative determination.

6.5.8.5. Owner's Representative will charge Contractor for any overtime expenses and other costs incurred in the evaluation of a proposed substitute, similar, or equal materials, unless said proposal was submitted by Contractor with reasonable time as to afford the Owner the time necessary to analyze the submittal without affecting the Project Schedule.

6.5.9. Special Guarantee.

6.5.9.1. Owner's Representative may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

6.5.10. Contractor's Expense.

6.5.10.1. Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.5.11. Approval of Submittals.

6.5.11.1. If within the periods of time provided under this Article 6 for approval of submittals made by the Contractor, the Owner's Representative fails to render his decision as to any submittal and the critical path is adversely affected, the Contractor shall require in writing the approval of the Owner's Representative, who shall have ten (10) working days to issue his decision. If no decision is forthcoming from the Owner's Representative within the stated time, for reasons other than due to the fault of Contractor, the submittal shall be considered approved, provided Contractor has also given the same timely notice directly to Owner required in Article 17.3.2

6.6 Review of Contract Documents

6.6.1. The Contractor shall carefully study and compare the Contract Documents with each other and with

information furnished by the Owner and shall at once report to the Owner, Architect/Engineer, and Owner's Representative any error, inconsistency or omission he may discover.

6.6.1.1. The Contractor shall not be liable to the Owner for any errors, inconsistencies or omissions in the Contract Documents.

6.6.1.2. The Contractor shall not take advantage of any such errors, inconsistencies, or omissions.

6.6.1.3. The Owner's Representative after being notified by the Contractor of such errors, inconsistencies or omissions will make the corrections and interpretations deemed necessary for fulfilling the intent of the Contract Documents, within a reasonable time so as not to alter the programmed progress of the Work. If no comment by the Owner's Representative is made within said time the Contractor will have the right to Claim pursuant the provisions of Article 11.5 if said delay impacts the critical path.

6.7 Patent, Fees and Royalties

6.7.1. Contractor shall pay all license fees and royalties and assume all costs incident to the use, in the performance of the Work or the incorporation in the Work, of any invention, design, process, product, or device which is the subject or patent rights or copyrights held by others.

6.7.2. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner or Architect/Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

6.7.3 To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Architect/Engineer, Architect/Engineer's Consultants, and the officers, directors, partners, employees or agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges or engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.8 Permits

6.8.1. Unless otherwise indicated in the Contract Documents, the responsibilities for securing and paying for permits, governmental fees and licenses for work to be performed are as follows:

6.8.1.1. To obtain the Construction Permit, the Contractor shall pay the premiums to secure the State Insurance Fund policy and the Municipal Construction Taxes, at the rate that is in effect at bid date, unless the Contractor is explicitly not obligated to pay said taxes under the terms and provisions of the Contract Documents, in which case, shall so be specifically stated in the Contract Documents. The Owner shall secure all the Architect or Engineer's and Owner's Representative's certificates necessary and pertinent needed to secure the Construction Permit as well as submit applications and secure the permits for the Plan CES and for the Federal Storm Water Drainage plan, if same is required for the Project.

6.8.1.2. To obtain the Use Permit, the Contractor shall secure the endorsements required for said Use Permit from all government agencies, unless one or more of these cannot be obtained due to circumstances beyond the control of the

Contractor. The Owner must ascertain that the reports required for the Use Permit from the Architect or Engineer and Owner's Representative are duly filed with "Oficina de Gerencia de Permisos" and must also obtain any of the above mentioned endorsements that cannot be obtained due to circumstances beyond the control of Contractor.

6.8.1.3. All payments due, or to become due, to any agency, public or private, for connection to, or improvement of any of said agencies' infrastructure (Impact Fees) shall be paid by the Owner with sufficient time so as not to adversely affect the critical path of the Work.

6.8.1.4. The Contractor shall secure and pay for all incidental permits required for the completion of the Work, unless such incidental permits deviate from the normal procedures, or costs, of the requiring agency and shall do so in a timely manner so as not to adversely affect the critical path of the Work.

6.8.1.5. Any other fees or charges related to permitting to be paid by the Contractor will be indicated in the special conditions.

6.8.1.6. The duties of Owner and of Contactor stated in this Article 6.8 shall be performed in a timely manner as to not adversely affect the critical path of the Work.

6.9 Laws and Regulations

6.9.1. Contractor shall give all notices and comply with all Laws and Regulations applicable to the performance of the Work.

6.9.1.1. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner, nor Owner's Representative nor Architect/Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

6.9.1.2. Should the Contractor observe that the Contract Documents are at variance with any Federal, Commonwealth and Municipal laws, ordinances, rules, regulations, by-laws, and all orders or decrees, he shall promptly notify the Owner's Representative in writing and the Owner's Representative shall instruct the Contractor, also in writing, as to how Contractor is to proceed. Any additional cost and /or extra time incurred by the Contractor to comply with Laws and Regulations enacted after the bid opening date, it may file a claim for equitable adjustment of the Contract Price or the Contract Time or both, as shall any decrease in cost or time resulting therefrom.

6.9.1.3. If the Contractor performs any work knowing it to be contrary to Federal, Commonwealth and Municipal laws, ordinances, rules, regulations, by-laws, orders or decrees, the Contractor shall assume full responsibility therefore, and shall bear all cost arising there from.

6.9.1.4. The Contractor shall save the Owner and its authorized representatives harmless from any claim or liability arising from or based on the infraction or violation of any such laws, ordinances, rules, regulations, by-laws, all orders or decrees, except if the infractions or violations are caused by acts of the Owner, or of Owner's authorized representatives.

6.9.1.5. If Contractor performs any Work knowing or having reason to know that he is acting contrary to said Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred as a consequence thereof. It shall not be Contractor's primary responsibility to make certain

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that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not release Contractor of Contractor's obligations hereunder.

6.10 Taxes

6.10.1. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work and which were in effect at the bid opening date.

6.10.1.1. Among said taxes, the Contractor shall pay the municipal construction taxes applicable to the Project in a timely fashion, but no later than fifteen (15) calendar days after the first partial (certification) payment is made by the Owner to Contractor.

6.10.1.2. If specifically stated in the Contract Documents, the Municipal Construction tax rate may be determined between Owner and the municipal government where the project is to be located, in such case a specific rate shall be established by the mayor and the municipal legislature, and notified to the Contractor before bid time. If no such rate is indicated in the Contract Documents regarding such arrangement between Owner and the municipal government, then the Contractor shall pay at the rates prevailing at the time of the bid.

6.10.1.1.1. The Contractor shall furnish and deliver to the Owner written evidence that said payment(s) was made before the second partial (certification) payment is made by the Owner to Contractor.

6.10.1.1.2. In case that the Contractor does not furnish and deliver said evidence of payment, the Owner shall deduct from said partial (certification) payments the undisputed amount of municipal tax plus any penalties and fines and pay it directly to the municipality.

6.10.1.1.2.1. If the amount of the second partial (certification) payment is not enough to cover the total amount of the municipal tax, the Owner shall continue to deduct from the following partial (certification) payments until the undisputed amount is paid in full.

6.10.1.1.2.2. The direct payment provided for in Article 6.10.1.1.2 shall be effected after the retainage required in Article 13.2.2 is deducted.

6.11 Use of Site and Other Areas

6.11.1. Limitation on Use of Site and Other Areas.

6.11.1.1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment.

6.11.1.1.1. Contractor shall assume full responsibility for any damage to any such land or area, or to the Owner or occupant thereof, or of any adjacent land or areas, resulting from the performance of the Work.

6.11.1.1.2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly resolve the dispute with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

6.11.1.1.3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold Owner, Architect/Engineer, Architect/Engineer's Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them harmless from and against all claims, costs, losses, and damages (including but not limited to all fees and charges or engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Architect/Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

6.11.2. Removal of Debris during Performance of the Work.

6.11.2.1. During the progress of the Work, Contractor shall keep the Site and other areas free from excessive accumulations of waste materials, rubbish, and other debris caused by his operations on the Site.

6.11.2.1.1. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

6.11.3. Cleaning.

6.11.3.1. Prior to Substantial Completion of the Work Contractor shall clean the Site and make it ready for utilization by Owner.

6.11.3.1.1. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

6.11.3.1.1.1. If the Contractor fails to clean up as indicated above, the Owner may do so and the cost thereof shall be charged to the Contractor.

6.11.4. Loading Structures.

6.11.4.1. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.11.4.2. Owner's Representative shall not permit any of the Owner's Other Contractors, his personnel, or any other entity performing work for him directly at the Site, to load any part of any structure in any manner that will endanger the structure, nor shall Owner's Representative subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.11.5. Rights To and Use of Materials Found On the Work.

6.11.5.1. The Contractor, with the prior written approval of the Owner's Representative, may use to perform the Work materials obtained from existing structures at the Site which are to be removed that are determined by the Owner's Representative to be acceptable for a use approved in writing by Owner's Representative.

6.11.5.2. Unless otherwise provided in the Contract Documents, material from any existing structures to be removed may be used temporarily by the Contractor in the erection of new structures.

6.11.5.2.1. If the material is to be salvaged for the Owner, its modification will not be permitted except as approved by the Owner's Representative.

6.11.5.2.2. Unless otherwise specified in the Contract Documents, all soil existing at the Project Site will be considered fit to be used as fill in the performance of the Work if such soil meets the Project's field fill criteria.

6.12 Record Document

6.12.1. Contractor shall maintain in a safe place at the Site one (1) record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Extra Work Orders, Work Change Directives, Field Orders, permits, and written interpretations and clarifications in good order and annotated showing changes made during construction.

6.12.1.1. Said documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Architect/Engineer and the Owner's Representative.

6.12.1.2. If not previously submitted, prior to Final Acceptance, said documents, Samples, and Shop Drawings will be delivered to Owner's Representative for delivery to Owner.

6.13 Safety and Protection

6.13.1. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.13.1.1. all persons on the Site or who may be affected by the Work;

6.13.1.2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

6.13.1.3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

6.13.2. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

6.13.2.1. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

6.13.2.2. All damage, injury, or loss to any property referred to in Articles 6.13.1.2 or 6.13.1.3 caused, directly or indirectly, in whole or in part, by Contractor any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Architect/Engineer or Architect/Engineer's Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or

indirectly employed by any of them).

6.13.2.3. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Owner's Representative has issued a notice to Owner and Contractor of Final Acceptance of the Work (except as otherwise expressly provided in connection with Substantial Completion).

6.13.3. If so provided in the bid documents, the Owner has the right to establish any reasonable monetary penalties for violations of this Section 6.13.

6.14 Safety Representative

6.14.1. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs. The safety representative at the Site may have other duties assigned to him.

6.15 Hazard Communication Programs

6.15.1. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available at the Site in accordance with Laws or Regulations.

6.16 Plans and Working Drawings; As-Built Plans.

6.16.1. Plans and Working Drawings.

6.16.1.1. The detail Plans and Specifications for the Project have been prepared by licensed and collegiate competent Architect/Engineer exercising reasonable care and are intended to show as clearly as is practicable the Work required to be performed. Contractor will rely on the accuracy of said drawings, specifically in their compliance with all applicable codes and regulations in effect on the bid opening date.

6.16.1.1.1. The Contractor realizes, however, that construction details cannot always be accurately anticipated and that in executing the Work, field conditions may require reasonable minor modifications in the details of plans and quantities of Work.

6.16.1.1.1.1. Therefore, all Work must be carried out taking into account the mentioned considerations as well as field conditions, to the satisfaction of the Owner's Representative, and in accordance with his instructions and with the Contract Documents.

6.16.2 Working Drawings

6.16.2.1. The Plans will be supplemented by such Working Drawings as are necessary to adequately control the Work.

6.16.22. Working Drawings for structures shall be furnished by the Contractor and shall consist of such detailed Plans as may be required to adequately control the Work and to complement the Plans furnished by the Owner.

6.16.2.3. They shall include, among others, stress sheets, shop drawings, erection plans, false work plans,

cofferdam plans, bending diagrams for reinforcing steel or any other supplementary plans or similar data required of the Contractor.

6.16.3. Working Drawings and related documents submitted for manufactured and shop-fabricated products shall be accompanied by a certification from the manufacturer that the materials and/or equipment meet all the requirements of the Specifications.

6.16.3.1. In the event that any item is not exactly in accordance with the requirements of the Plans and Specifications, the certificate shall identify and explain each such difference.

6.16.4. Unless otherwise indicated, all Working Drawings are subject to review and acceptance by the Owner's Representative.

6.16.4.1. Such review and acceptance shall not release the Contractor from any of his responsibilities for the safe and successful completion of the Work.

6.16.4.2. The cost of preparing and furnishing all required Working Drawings is included in the Contract Price and no separate payment will be made for such Drawings.

6.17 As Built Record Drawings

6.17.1. The Contractor shall keep at the Site a copy of the Drawings marked in a neat manner that record all changes made during construction.

6.17.1.1. The set of provisional record Drawings shall be kept up to date and submitted for the inspection and approval of the Owner's Representative, at least five (5) days prior to any partial monthly payment, unless otherwise required in the Contract Documents.

6.17.2. Prior to Final Acceptance, the Contractor shall deliver the as built Drawings to the Owner's Representative.

6.17.2.1. These Drawings will be used as the draft for the preparation of the final As Built Drawings for the Project by Architect/Engineer.

6.17.3. The Architect/Engineer will, with the full cooperation of Contractor and of the Owner's representative prepare final as-built record drawings in reproducible form as reasonably required by Owner, to be delivered to the Owner.

6.17.3.1. The Owner will cause the Architect/Engineer to submit, with enough time so as not to adversely alter the critical path of the Work, the revised as-built drawings to the required governmental entities and obtain the approval of an amended Construction Permit, if same is required, and deliver the same to Owner and Contractor. This amended Construction Permit will be used to obtain the Use Permit for the project.

6.18 Notice to Proceed.

6.18.1. After the Agreement has been executed, the Contractor will be formally notified to proceed with the Work or service provided in the Contract Documents.

6.18.1.1. The Notice to Proceed will stipulate the date on which Owner expects the Contractor will begin construction and the date on which Contract Time will commence to run.

6.18.1.2. Pre-Construction Conference.

6.18.1.2.1. Prior to the start of the Project the Owner will summon all interested parties to a Pre-construction Conference in order to organize the start of the work and other matters. If no such conference is summoned by the Owner, and in any event, the Contractor may start the Work on the date stated in the Notice to Proceed.

6.18.2. Prosecution and Progress.

6.18.2.1. After obtaining written permission issued by the Owner, the Contractor may assemble materials and equipment and start preliminary Work as soon as he is notified of the award, but no responsibility for acceptance and payment of the Work so performed shall be assumed by the Owner until and unless the Contract has been executed and the order to proceed issued.

6.18.2.2. The rate of progress in the prosecution of the Work shall be compared in accordance with Articles 4.2 and 4.3 with approved Progress Schedule as the Work progresses.

6.18.2.2.1. If the Contractor is at fault for falling thirty (30) working days or more behind the approved schedule or ten percent (10%) of Contract Time, whichever is less, Contractor shall submit a revised schedule for completion of the Work within the Contract Time and modify his operations, including, but not limited to, working overtime and on Saturdays, Sundays and legal holidays, to providing such additional materials, equipment and labor as necessary to comply with the revised schedule. Any additional cost caused by the modified schedule will be at Contractor's expense.

6.18.2.3. Should the prosecution of the Work be discontinued for any reason, the Contractor shall notify the Owner's Representative at least twenty-four (24) hours in advance of resuming operations.

6.18.3. Conformity with Plans and Specifications.

6.18.3.1. All work performed and materials furnished shall be in reasonably close conformity with the Plans and other Contract Documents requirements.

6.18.3.2. Plan dimensions and Contract Specification values are to be considered the target values to be strived for and complied with as the design values to which any allowed tolerances are applied.

6.18.3.2.1. Materials and workmanship shall be uniform in character and shall be reasonably close to the prescribed target value or to the middle portion of the tolerance range.

6.18.3.3. When the Specifications include an acceptance plan for any construction or characteristic of materials, the acceptance plan will be used by the parties to determine the attainment of Reasonably Close Conformity with plans and specifications and to assign a value to the non-conforming work which does not meet that standard.

6.18.4 Cooperation with Utilities.

6.18.4.1. The Owner will notify all utility companies, all pipe line owners, or other parties affected, and endeavor to have all necessary adjustments of the public or private utility fixtures, pipe lines, and other

appurtenances within or adjacent to the limits of construction, which are not to be performed by the Contractor, made in accordance with the Project construction schedule.

6.18.4.2. Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted, are to be moved by their respective owners except for those to be moved by the Contractor as specifically provided in the Contract Documents.

6.18.4.3. It is understood and agreed that the Contractor has considered in his proposal all of the permanent and temporary utility appurtenances in their present or relocated positions as if same are shown on the plans and that no additional compensation will be considered for any delays, inconvenience, or damages sustained by Contractor due to any interference from the said known utility appurtenances or the operations of moving them, except in the case of failure by a utility to reasonably comply with its responsibility in relocating or adjusting its facility as required.

6.18.4.4. Prior to commencing Work, the Contractor shall make arrangements to protect the properties of all public and private utilities and other property within and adjacent to the Work area, if indicated in the Contract Documents, from damage by his construction operations.

6.18.4.5. Contractor shall cooperate with the utility owners in the removal and rearrangement of any underground or overhead utility lines or facilities to minimize interruption to service and duplication of work by the utility owners.

6.18.4.6. In the event of interruption to water or other utility services as a result of accidental breakage, or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authorities and shall cooperate with them in the restoration of service as promptly as possible.

6.18.4.7. Fire hydrants shall be kept accessible to the Fire Department at all times and no Work shall be undertaken near fire hydrants until provisions for continued service have been made.

6.18.4.8. Contractor shall be responsible for the repair costs of any damage to utility facilities caused by his equipment or operations, except for underground facilities whose existence or approximate location was previously unknown.

6.18.5. Materials.

6.18.5.1. Source of Supply and Quality Requirements.

6.18.5.1.1. The materials used in the Work shall meet all quality requirements of the Contract Documents.

6.18.5.1.2. Unless otherwise provided in the Contract Documents, all materials used in the Work shall be furnished by the Contractor from sources selected by the Contractor.

6.18.5.1.3. Materials will be tested and approved when delivered to the Project or in their final position after incorporation to the Work as provided by the individual specifications.

6.18.5.1.4. At the option of the Owner's Representative, sources of materials may be given preliminary approval before delivery is started.

6.18.5.2. Procurement and Delivery of Materials.

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6.18.5.2.1. The Contractor shall schedule the delivery at the Site of all materials and equipment required for the execution and completion of the Work at a time convenient to him so as to avoid delays in the prosecution of the Work and to allow completion of the Work within the Contract Time specified in the Contract Documents.

6.18.5.3. Earthwork Material Sources.

6.18.5.3.1. Designated Sources.

6.18.5.3.1.1. Specific sources of materials from offsite or onsite locations may be designated on the Plans and described in the Contract Documents.

6.18.5.3.1.2. Unless otherwise provided in the Contract Documents, direct payment will be made for development, preparation, erosion control, hauling and restoration of material sources or related work areas and sites.

6.18.5.3.2. Contractor Sources.

6.18.5.3.2.1. When no materials sources are designated in the Contract Documents, or if the Contractor desires to use materials from sources other than those designated, the Contractor shall be responsible for acquiring the necessary rights to take materials from the sources selected, for determining that the materials meet the specified requirements, and he shall bear all expenses for the exploration, development, erosion control and restoration of such sources, and for all costs of hauling the materials. Contractor will make sure that his sources of materials have the required permits.

6.18.5.4. Contractor's Quality Control.

6.18.5.4.1. The Contractor is responsible for the quality of all materials and workmanship furnished in the construction of the Project.

6.18.5.4.1.1. If specifically required in the Supplementary General Conditions, the Contractor shall provide his own quality control system and procedures including all personnel, equipment, supplies and facilities necessary to obtain samples, perform tests, evaluate test results and adequately control his work in order to insure that all such materials and workmanship meet the Contract requirements.

6.18.5.4.2. The Contractor shall, in all instances, perform his own process control sampling, testing and inspection during all phases of the Work as often and at a rate sufficient to assure that the Work conforms to the Contract requirements.

6.18.5.4.2.1. The Contractor shall insure that all of the testing equipment to be used is properly calibrated and meets the specifications applicable to each specified test procedure.

6.18.5.4.3. The cost of complying with Contractor's quality control obligations referred to in Article 6.18.5.4 is included in the Contract Price and no additional payment will be made therefore.

6.18.5.5. Storage of Materials.

6.18.5.5.1. Materials shall be so stored as to assure the preservation of their quality and fitness for incorporation to the Work.

6.18.5.5.1.1. Stored materials, even though approved before storage, may again be inspected at any time prior to or during their incorporation to the Work.

6.18.5.5.1.2. Stored materials shall be located so as to facilitate their prompt inspection.

6.18.5.5.2. When authorized by the Owner's Representative, portions of the Project Site may be used for storage purposes and for the placing of the Contractor's plant/facilities and equipment provided that they are located so as not to constitute a hazard to the construction of the Project or otherwise.

6.18.5.5.2.1. Any additional space required therefore must be provided by the Contractor at his expense.

6.18.5.5.3. Private property may be used for storage purpose with written permission of the Owner or lessee, and, if requested by the Owner's Representative, copies of such written permission shall be furnished to him.

6.18.5.5.4. All temporary storage areas and plant sites shall be restored to their original condition by the Contractor, at his expense, in a manner acceptable to the Owner's Representative.

6.18.5.6. Handling of Materials.

6.18.5.6.1. All materials shall be handled in such manner as to preserve their quality and fitness for incorporation to the Work.

6.18.5.7. Materials Furnished by the Owner.

6.18.5.7.1. The Contractor shall furnish all materials required to complete the Work, except those indicated in the Contract Documents to be furnished by the Owner.

6.18.5.7.2. Except as provided in Article 6.18.5.7.4, if the material to be furnished by the Owner is to be delivered to the jobsite, the Owner, unless specified otherwise in the Contract Documents, will furnish the material to the Contractor at no cost to the Contractor and the Owner will pay for all transportation, insurance, taxes and other cost related to the furnishing of the material to the jobsite. Cost of unloading is included in the Contract Price and Contractor shall receive no additional compensation for unloading.

6.18.5.7.3. If the material to be furnished by the Owner is to be delivered to the jobsite, the Contract Documents will indicate the delivery schedule. If no such schedule is indicated, the delivery will be made as agreed by the parties. Owner shall program the delivery schedule as not to adversely affect the critical path.

6.18.5.7.4. If the material to be furnished by the Owner is not to be delivered to the jobsite the Contract Documents will indicate the terms and conditions of said delivery. If no terms and conditions are included in the Contract Documents then the cost of delivery to the jobsite is not included in the Contract Price.

6.18.5.7.5. If the material to be furnished by the Owner is not to be delivered to the jobsite the Contract Documents will indicate the date and time of availability of the material. If no such date and time is indicated, the material will be available by agreement as not to impact the critical path.

6.18.5.7.6. The material to be furnished by the Owner will include all ancillary items included in the Technical Specification that describes the material to be furnished by the Owner, unless indicated otherwise in the Contract Documents.

6.18.5.7.7. The Owner warrants that the materials furnished by the Owner to the Contractor are of a quality sufficient for the purpose of their use. The Owner further warrants that the material to be furnished is Equal or Similar to that specified in the Technical Specification that describes the material to be furnished by the Owner.

6.18.5.7.8. The material furnished by the Owner will be of sufficient quantity including normal construction breakage, waste and shrinkage to complete the Work, unless the Contract Documents indicate otherwise.

6.18.5.7.9. The Contractor will be responsible for all Owner furnished materials delivered or made available to him in accordance with the terms and conditions of this section. If due to the fault of the Contractor, the Owner has to supply more material to the Contractor than indicated in the Contract Documents, the Owner may deduct this cost from any Partial Payment or Retainage due to the Contractor.

6.18.5.7.10. If the Owner's Representative has informed in a timely manner, the date or schedule of delivery of the material, the Contractor will be liable for all demurrage charges if he fails to receive the Owner furnished material within the time limit or schedule specified.

6.18.5.7.11. Unless otherwise indicated in the Contract Documents, all costs at jobsite including unloading, handling, warehousing and Installation of the Owner furnished material are included in the Contract Price and Contractor shall not receive additional compensation therefore.

6.18.5.8. Certification of Compliance.

6.18.5.8.1. When a certification of a material or assembly is required by the Contract, each lot of such materials or assemblies delivered to the Site shall be accompanied by certificate of compliance in which the delivered material or assembly is clearly identified.

6.18.5.8.2. Commercially manufactured products shall be accompanied by certificates signed by the manufacturer and, when required, supported by tests performed by the manufacturer. Certified copies of such test results shall be furnished to the Owner's Representative.

6.18.5.8.3. Materials or assemblies accompanied by certificates of compliance may be sampled and tested at any time and if found not to be in conformity with Contract Documents will be subject to rejection at any time whether incorporated to the Work or not.

6.18.5.8.3.1. Removal of such rejected materials will be at the Contractor's expense, unless such materials have been supplied by the Owner and it was Owner's duty to test for conformity with the Contract Documents.

6.18.6 Contractor shall carry on the Work and adhere as reasonably as possible to the Progress Schedule during all Disputes or disagreements with Owner.

6.18.6.1. If the Dispute or disagreement hinders the ability of the Contractor to carry on the Work, the Contractor shall so inform the Owner.

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6.18.6.2. If the Dispute allows more than one course of action to be followed in the prosecution of the Work, the Owner's Representative may instruct the Contractor on the course of action to be followed.

6.18.6.3. No Work shall be delayed or postponed pending resolution of any Disputes or disagreements, except as permitted in section 15.4 or as Owner's Representative and Contractor may otherwise agree in writing.

6.18.7. Limitations on Operations.

6.18.7.1. Unless otherwise specified in the Contract Documents, the Contractor shall not open up new Work to the prejudice or detriment of Work already started.

6.18.7.1.1. In lineal projects, the Owner's Representative may require the Contractor to finish a section on which Work is in progress before Work is started on any additional section, if the opening of such section is essential to public safety or convenience.

6.18.7.1.2. If said order causes the Project to be delayed, the Contract Price and/or Contract Time shall be equitable adjusted.

6.19 Contractor's General Warranty and Guarantee

6.19.1. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be deficient. Contractor's warranty and guarantee hereunder excludes defects or damage after substantial, or partial completion and occupancy caused by:

6.19.1.1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

6.19.1.2. normal wear and tear under normal usage by Owner or individuals or entities for whom Owner is responsible.

6.19.2. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

6.19.2.1. observations by Architect/Engineer and/or Owner's Representative;

6.19.2.2. recommendation by Owner's Representative or payment by Owner of any progress or final payment;

6.19.3. the issuance of a certificate of Substantial Completion by Owner's Representative or any payment related thereto by Owner;

6.19.4. use or occupancy of the Work or any part thereof by Owner;

6.19.3. The Contractor warrants to the Owner that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all Work will be free from faults and defects and in conformance with the Contract Documents for the time periods specified in the Contract Documents or for one (1) year, whichever is

longer, unless otherwise specified in the Contract Documents.

6.19.3.1. If required by the Owner's Representative, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

6.20 Indemnification

6.20.1. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Architect/Engineer, Architect/Engineer's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:

6.20.1.1. is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting there from; and

6.20.1.2. only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

6.20.2. The indemnification obligations of Contractor under section 6.20.1 shall not extend to the Architect/Engineer and Architect/Engineer's Consultants or to their officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them arising out of:

6.20.2.1. errors and/or omissions in the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

6.20.2.2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 Subcontractors, Suppliers and Others

6.21.1. Award of Subcontracts for Portions of The Work.

6.21.1.1. Unless otherwise specified in the Contract Documents the Contractor, as soon as practicable after the signing of the Contract, shall furnish to the Owner's Representative in writing for his acceptance a list of the names of the main Suppliers and Subcontractors proposed for the principal portions of the Work.

6.21.1.1.1. The Owner's Representative shall promptly notify the Contractor in writing if he, after due investigation, has reasonable objection to any Supplier or Subcontractor on such list and does not accept him. Said reasonable objection may include, but are not limited to, previous default by said Subcontractor or Supplier with Owner, a record of flagrant safety violations or an unsatisfactory past performance with Owner.

6.21.1.1.1.1. The Owner's Representative shall specify in writing the reasons for such objection

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6.21.1.1.1.2. If within fifteen (15) calendar days from submittal by the Contractor, the Owner's Representative fails to make objections to any Supplier or Subcontractor on the list, the Contractor shall request the approval of the list by the Owner's Representative who shall have ten (10) days to issue his decision. If no reply is forthcoming from the Owner's Representative within the stated time, the list of Suppliers or Subcontractors shall be deemed approved.

6.21.1.1.2. The Contractor shall not contract with any Supplier or Subcontractor or any person or organization (including those who are to furnish materials or equipment fabricated to a special design) that has been rejected by the Owner's Representative in the manner indicated in Article 6.21.1.1.1, above.

6.21.1.1.3. If the Owner's Representative refuses to accept any Supplier, Subcontractor, person, or organization on a list submitted by the Contractor in response to the requirements of the Contract Documents, the Contractor shall submit an acceptable substitute.

6.21.1.1.3.1. No increase in the Contract Sum shall be allowed for any such substitution of a rejected Subcontractor and/or Supplier or other in accordance with Article 6.21.

6.21.1.1.3.2. No acceptance by Owner's Representative of any such Subcontractor, Supplier, or other individual or entity, whether initially, or as a replacement, shall constitute a waiver of any right of Owner's Representative or Engineer to reject defective Work.

6.21.1.1.4. Unless otherwise specified in the Contract Documents, the Contractor shall execute, with his own forces and organization, Work amounting to not less than twenty-five percent (25%) of the original total Contract Price.

6.21.1.1.4.1. Any items designated in the Contract Documents as "Specialty Trades or Items" shall be deducted from original total cost before computing the amount of the work required to be performed by the Contractor with his own forces and organization

6.21.2. Payments to Subcontractors.

6.21.2.1. The Contractor shall pay each Subcontractor for work performed in the Project in accordance with the terms and conditions stipulated in the contract executed by and between the Contractor and the Subcontractor.

6.21.2.1.1. The Contractor shall also require the Subcontractor to make similar payments to his Sub-Subcontractors.

6.21.3. Flow Down of Applicable Agreement Provisions.

6.21.3.1. The Contractor shall cause the inclusion, in all agreements executed by contractor with Subcontractors and Suppliers, of all applicable provisions of the Agreement with which Subcontractors and Suppliers need to comply for their proper performance on behalf of Contractor, of the duties and obligations imposed by the Contract Documents. Contractor shall also cause Subcontractor and Suppliers to include in their respective agreements with Sub-Subcontractors, and Sub-Suppliers the same duties to flow down to all lower tier agreements such applicable Agreement provisions.

6.21.4. The Contractor shall be considered as an independent contractor for all purposes under the Contract, and no persons engaged or contracted by the Contractor for the performance of Contractor's obligations shall be considered an employees or agents of the Owner.

6.21.5. Contractor shall be fully responsible to Owner's Representative, Owner and Architect/Engineer for all acts and omissions of the Subcontractors, Suppliers, and other such individuals or entities performing or furnishing any of the Work.

6.21.5.1. Nothing in the Contract Documents shall create for the benefit of any Subcontractor or Supplier a contractual relationship between Owner's Representative, Owner or Architect/Engineer, nor shall it create any obligation on the part of Owner's Representative, Owner or Architect/Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws or Regulations.

6.21.6. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other such individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

6.21.7. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Owner's Representative only through Contractor.

6.21.8. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner's Representative, Owner and Architect/Engineer, including required contract provisions applicable to Federal Agency funded projects.

6.21.8.1. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in section 3.6, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights (including subrogation) against Owner, Contractor, Architect/Engineer, Architect/Engineer's Consultants, and all other individuals or entities identified in the Contract Documents to be listed as insured or additional insured (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to Work.

6.21.8.1.1. If the insurers underwriting any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

ARTICLE 7 - ARCHITECT/ENGINEER AND DESIGNATED INSPECTOR

7.1 Administration of the Contract

7.1.1. The Owner will provide general Administration of the Construction Contract, including performance of the functions hereinafter described, through the Owner's Representative.

7.1.2. The Owner, prior to the start of the Project, will inform the Contractor in writing the name of the Owner's Representative. If the Owner's Representative is changed during the course of the project the Owner will inform the Contractor in writing the name of the new Owner's Representative. If the Contractor has valid reasons for objecting said designation, Contractor shall so inform the Owner in writing and, if Owner deems Contractor's reasons valid, a different Owner's representative shall be chosen by the Owner.

7.1.3. The Owner may from time to time change the person or entity designated as Owner's Representative, or may

assume and/or change the functions of the Owner's Representative, and the Architect/Engineer by notifying the Contractor in writing.

7.2 Duties of Architect/Engineer and the Owner's Representative

7.2.1. The Architect/Engineer is the person or entity who prepares the Drawings and Specifications for the Owner and is responsible for the analysis, design, and code compliance of the Project.

7.2.1.1. The Architect/Engineer will make periodic visits to the site to familiarize himself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents.

7.2.1.1.1. Based on on-Site observations, the Architect/Engineer will keep the Owner informed of the progress of the Work, and will endeavor to safeguard the Owner against defects and deficiencies in the Work.

7.2.1.1.2. The Architect/Engineer will be the Owner's representative for technical matters related to the Contract.

7.2.1.1.3. The Architect/Engineer will be the primary interpreter of the plans and specifications.

7.2.1.1.4. The Architect/Engineer and Owner's Representative will not be responsible for the acts or omissions of the Contractor, or any Subcontractor and vice-versa, or any of their agents or employees, or any other persons performing any of the Work.

7.2.2. The Owner's Representative will represent the Owner in the interpretation of all contractual and non-technical matters. The Owner's Representative will have authority to act on behalf of the Owner to the extent provided in the Contract Documents.

7.2.2.1. All communications related to this Contract between the Contractor and Architect/Engineer shall be made thru the Owner's Representative, except that any party may directly communicate orally or by written communication with the others if authorized by the Owner's Representative, or in case of an Emergency.

7.2.2.2. The Owner's Representative may delegate some or all of his functions to Project Inspectors and/or Inspectors.

7.2.2.2.1. The Owner's Representative will inform the Contractor the name of the Project Inspectors and/or Inspectors. If the Contractor has a valid reason for not accepting the designated Project Inspector, he shall so inform the Owner in writing and if Owner deems the reason valid a different Owner's representative shall be chosen by the Owner.

7.2.2.2.2. Inspectors employed by the Owner, the Architect/Engineer and/or the Owner's Representative are authorized to inspect all work done and materials furnished, including the preparation, fabrication or manufacture of the materials to be used.

7.2.2.2.3. Inspectors also have the authority to reject any materials and work until any questions at issue can be resolved.

7.2.2.3. Owner's Representative and/or inspectors are not authorized to alter or waive the provisions of the

Contract, to issue instructions contrary to the plans and specifications, or to act as foremen for the Contractor.

7.2.2.4. Based on his observations and the Contractor's Application for Payment, the Owner's Representative will determine the amount owed to the Contractor and will recommend approval of Payment in such amount.

7.2.2.4.1. If the Owner so requires, Architect/Engineer will also review, and approve, the Contractor's Application for Payment.

7.2.2.5. The Owner's Representative will prepare Change Orders, and Extra Work Orders, in accordance with these General Conditions.

7.2.3. The Owner's Representative, the Architect/Engineer and/or the Owner shall at all times have access to the Work either in preparation or in progress. The Contractor shall provide access to the Work so that at all times Owner's Representative may perform his duties under the Contract Documents, and Contractor shall provide such information and assistance, as is required, to make a complete and detailed inspections.

7.2.3.1. If the Owner's Representative, and/or the Owner, request it, the Contractor, at any time before Final Acceptance of the Work, shall remove or uncover such portions of the finished Work as instructed . After examination, the Contractor shall restore said portions of the Work to the standard required by the specifications.

7.2.3.1.1. Should the Work so exposed and examined prove acceptable, the uncovering, or removing, and the replacing of the covering will be paid by the Owner as extra work; but should the Work so exposed or examined prove unacceptable, the uncovering, removing, remediation and the replacing of the covering will be at the Contractor's expense.

7.2.3.1.2. Any Work done or materials used without supervision or inspection by an authorized Owner's representative may be ordered removed and replaced at the Contractor's expense unless the Owner representative failed to inspect after having been given a written notice of at least two (2) Working Days prior to the date in which Work was performed.

7.2.3.1.3. When any government agency or any utility is to accept or pay for any portion of the Work, its respective representatives shall have the right to inspect the Work. Such inspection shall not make the government agency or utility a party to the Contract. Contractor and Owner shall diligently perform all necessary actions to promote the timely inspection of the Work in a manner that does not affect the critical path.

7.2.3.1.4. The inspection of the Work and materials by the Owner shall not release the Contractor of any of his obligations under the Contract as prescribed in the plans, specifications and other Contract Documents.

7.2.3.1.5. The Owner's Representative will conduct inspections to determine the dates of Substantial Completion and final completion and will receive and review written guarantees and related documents submitted by the Contractor.

7.2.3.1.6. In case of any dispute between the Contractor and any one Project Inspector or Inspector as to materials furnished or the manner of performing the Work, the Project Inspector or the Inspector shall have the authority to reject materials or suspend the work until the question at issue can be referred to and decided by the Owner's Representative, within reasonable promptness, so at not to alter the critical path or modify substantially the float and the programmed progress of the job.

7.2.4. The Owner's Representative will be, in the first instance, the interpreter of the requirements of the Contract

Documents, except as indicated in Article 7.2.1.3. The Owner's Representative will, within a reasonable time, render such interpretations that he, or the Contractor, if so requested, may deem necessary for the proper execution or progress of the Work.

7.2.4.1. All interpretations and decisions of the Owner's Representative shall be consistent with the intent of the Contract Documents. In his capacity as interpreter, he will exercise his best efforts to insure faithful performance under the Contract.

7.2.4.2. Claims, disputes and other matters in question relating to the execution or progress of the Work or the interpretations of the Contract Documents shall be submitted initially to the Owner's Representative for a decision in accordance with Article 11.

7.2.5. The Owner's Representative will have authority to reject work only when such work does not conform to the Contract Documents. Whenever, in his reasonable opinion, he considers it necessary or advisable, to insure the proper implementation of the intent of the Contract Documents, he will have authority to require special inspection or testing of the Work in accordance with Article 12.3 whether or not such Work is then fabricated, installed or completed.

7.2.5.1. However, neither the Owner's Representative's authority to act under this Article, nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Owner, Owner's Representative or Architect/Engineer to the Contractor, any Subcontractor, any of their agents or employees, or any other person performing any of the Work, nor will the Contractor be released from any of his obligations under the Contract.

7.2.5.1.1. The Owner's Representative shall have the authority to stop the Work in whole or in part when such stoppage is necessary to insure the proper execution of the Work and compliance by contractor with the Contract.

ARTICLE 8 - OTHER WORK AND SEPARATE CONTRACTS

8.1 Owner's Right to Award Separate Contract, Perform Work with Owner's Employees and Utility Workers. Related Work at Site

8.1.1. Owner's Right to Award Separate Contract, Perform Work with Owner's Employees and Utility Workers.- Owner may perform other work related to the Project at the Site with Owner's employees, or by awarding separate contracts, or by having the work performed by utility workers. Written notice thereof will be given to Contractor prior to starting any such other work.

8.1.1.1. If the terms and conditions of the work to be performed by Owner's employees, separate contractors or by others, are not described in the Contract Documents prior to the bid, the Contract Time and Sum will be equitably adjusted as a result of said work and any other work to the extent that such work performed by Owner's employees, separate contracts or by others affects the Contractor's Work.

8.1.1.2. If the terms and conditions of the work to be performed by Owner's employees, separate contractors or by others are described in the Contract Documents prior to the bid, then the Contract Time and Sum will be equitably adjusted but only to the extent that said work differs from the work indicated in the Contract Documents that is to be performed by Owner's employees, separate contractors or by others.

8.1.1.3. Should the performance of other work related to the Project at the Site by Owner's employees,

separate contractors, utility workers, that was not indicated in the Contract Documents, cause damages, delays or interferes with the Work being performed by the Contractor, the Owner will assume full responsibility and pay for all costs, expenses, and delays to which the Contractor is subjected caused by the execution and/or performance of said other work described herein if the critical path is adversely affected.

8.1.1.4. In the event one or more contracts are awarded related to the Project, the "contractor" in the contract document in each case, will be the contractor who signs each separate contract.

8.1.1.5. If there is under construction other work for Owner,by written contract or otherwise, adjacent to the limits of the site, the Contractor, if so ordered by the Owner, shall permit access to others performing such work through the Site.

8.1.1.5.1. If Owner authorizes the other contractors performing work adjacent to the Site to use said access Owner shall prescribe limitations and conditions for such use as required to protect Contractor's operations and the Work.

8.1.1.5.1.1. In accordance with this Article 8.1, the Owner will be responsible for any damages, costs, or delays caused to the Contractor by such order.

8.1.1.6. If Owner and Contractor are unable to agree on entitlement to or on the amount or time, if any, of any adjustment in the Contract Price or Contract Time necessary as a result of such other work, a Claim may be made therefore as provided in Article 11.5.

8.1.2. Coordination of the Separate Contracts and Work by Others.

8.1.2.1. Unless otherwise specified in accordance with Article 8.1.2.4, Owner shall be responsible for the coordination of the Work between the Contractor, Owner's employees, the separate contractors and any others, as to the interaction and scheduling of the various work and the proper and safe access to the Site and storage of the equipment and materials of the Contractor, the Owner's employees, the separate contractors and others contracted by Owner.

8.1.2.2. Contractor shall fully cooperate with the Owner in the coordination of the Contractor's Work with that of the Owner's employees, the separate contractors and any work by others as to the interaction and scheduling of the various work and the proper and safe access to the Site and storage of the equipment and materials of the Contractor, the separate contractors and others.

8.1.2.3. The Owner may delegate this coordination, in whole or in part, to a Construction Manager or separate contractor and must give prior notice to Contractor in writing, containing the terms and conditions of this delegation.

8.1.2.3.1. The Construction Manager or the separate contractor will act on behalf of Owner strictly within the limits of such delegation.

8.1.2.4. The Owner may delegate this coordination responsibility in whole or in part to one of the separate contractors or to the Contractor as follows:

8.1.2.4.1. If prior to the bid opening date, the Owner requires that the Contractor be responsible for the coordination of the Owner's employees, separate contracts or any work by others, the Owner will indicate the

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terms and conditions of such obligation in the bid documents and it shall be the Contractor's responsibility to include in the Contract Price whatever costs are required for this coordination of the work.

8.1.2.4.2. If the Owner requires that Contractor be responsible for the coordination of Owner's employees, separate contracts or work by others after the bid has been awarded, the Owner will indicate the terms and conditions of such obligation as a Change Order.

8.1.2.5. Contractor Coordination Meetings:

8.1.2.5.1. If the Owner, or the party with the coordinating responsibility so requires it, the Contractor shall attend coordination meetings with the Owner's employees, separate contractors or others performing work at a site to be determined by the coordinator.

8.1.2.5.1.1. The purpose of the coordination meeting shall be for the Contractor and all separate contractors and/or others performing work to coordinate schedules and construction activities to enable the construction of the different work under the separate contracts to occur on a coordinated, efficient and expeditious manner.

8.1.2.5.1.2. The coordination meeting shall also serve as forum for the Contractor and all separate contractors and/or others performing work at the site to discuss, and try to avoid and try to resolve between and among themselves any conflicts in their respective schedules or construction activities and prevent delays in one contractor's activities caused by another.

8.1.2.5.2. If the different contractors cannot reach an agreement on the coordination of the construction activities and schedule to be followed, the Owner, or his designated coordinating representative, will decide on the course of action to be followed and shall provide the necessary instructions to the Contractor, Owner's employees, separate contractors and others performing work on how to proceed, as a Field Order or, if required, as a Change Order.

8.1.3. Contractor, and any other entity contracted by the Owner to perform direct work related to the Project, shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate such other work with the work of the Contractor or any other entity contracted by the Owner to perform related work on the Project.

8.1.3.1. Contractor, or any other entity contracted by the Owner to perform related work on the Project, shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of Owner and the others whose work will be affected.

8.1.4. The duties and responsibilities of Contractor under this Article are for the benefit of such utility owners and separate contractors to the extent that there are comparable provisions for the benefit of Contractor, including general, supplemental and special conditions, as well as similar insurance and hold harmless clauses, in said direct contracts between Owner and such utility owners and separate contractors.

8.1.4.1. Furthermore, the Owner will verify that the schedule of others contracted to perform related work on the Project does not interfere with the Project Schedule.

8.1.4.1.1. If in order to accommodate the work performed by others contracted by the Owner to perform related work in the Project, the critical path is adversely affected and/or any damage to the Work occurs, the Owner will compensate the Contractor in time and/or adjustment to Contract Price.

8.1.5. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article, Contractor shall promptly inspect such other work and, within ten (10) working days, report to Owner in writing any delays, defects, or deficiencies in such other work that, in his opinion, render it unavailable or unsuitable for the proper execution and results of the Work.

8.1.5.1. Contractor's failure to report will constitute acknowledgement that said work is suitable, except for hidden latent defects in such work.

8.1.5.2. The same rules stated herein will apply if other entities contracted by the Owner to perform related work in the Project depend on Work performed by the Contractor.

8.2 Owner's Right to Award Separate Contract.

8.2.1. The Owner may award separate contracts in connection with other portions of the Project or additional work to the Work covered by the Contract, and if such work affects the Work, Contractor will be notified by Owner in a timely manner of the award of such separate contract.

8.2.1.1. The Owner may assign these separate contracts, as a Change Order, to the Contractor for a fee, as indicated on Article 10.5.

8.2.2. When Separate Contracts are let within the limits of any project, the Owner shall coordinate the work of each contractor so as not to interfere with or hinder the progress or completion of the Work being performed by Separate Contractors.

8.2.2.1. Contractors working on the same Project shall fully cooperate with each other.

8.2.2.2. Furthermore, the Owner will be responsible to verify that the schedule of the Separate Contractors contracted to perform Work on the Project does not interfere with the Contractor's Project Programmed Schedule previously approved for the Project.

8.2.2.2.1. Owner will compensate the Contractor, in time and/or adjustment to Contract Price, if his schedule has to be varied, and/or any damage occurs, to accommodate the work performed by other entities contracted by the Owner to perform related work in the Site.

8.3 Mutual Responsibility of Contractors

8.3.1. Each Contractor involved shall assume all liability, financial or otherwise, in connection with his Contract and shall protect and save harmless the Owner from any and all damages or claims that may arise out of the performance of the Contractor's Work.

8.3.1.1. The Owner will require from each Separate Contractor and other entities working on the Project, Contract Documents, including General, Supplemental and Special Conditions, similar to those executed with the Contractor and to include similar insurance clauses and hold harmless clauses.

8.3.1.2. The Owner will also be responsible to verify that the schedule of the Separate Contractors) and other entities working on the project do not interfere with the Contractor's Project Programmed Schedule previously approved for the Project.

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8.3.2. Should the Contractor cause damage to the work or property of any separate contractor and/or others working on the Project, the Contractor shall, be liable for said damage.

8.3.2.1. If such other separate contractor files a claim against Owner on account of any such damage alleged to have been so sustained, Contractor shall have the right to defend Owner, either by itself or in conjunction with Owner, and Contractor shall compensate Owner for damages, costs and expenses sustained therefore by Owner which are attributable to Contractor.

8.3.2.1.1. If the Contractor is found to be responsible for the alleged defects claimed by the separate contractor and any judgment or award against the Owner arises therefrom, the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorney's fees and court, arbitration costs or other costs which the Owner has therefore incurred.

8.3.2.1.2. If the Contractor is found not to be responsible for the alleged defects claimed by the separate contractor, then the Owner shall pay for any judgment or award against him as well as reimburse the Contractor for all attorney's fees and court or arbitration costs incurred in defending the Owner.

ARTICLE 9-TIME

9.1 Progress and Completion

9.1.1 All time limits stated in the Contract Documents are of the essence of the Contract.

9.1.2 The time limit for the execution of this Contract has been figured out based on the Architect/Engineer and/or Owner's estimate.

9.1.2.1. Such time limit to into consideration all Sundays, legal holidays indicated in Article 1.1.1.4.1, included within the said time limit.

9.1.2.2. The Contractor will be entitled to work premium time (overtime) as required to comply with the schedule of the Project.

9.1.2.2.1. No work shall be performed on Saturdays, Sundays or legal holidays, except in cases of emergency, or unless prior written permission has been granted by the Owner's Representative.

9.1.2.2.1.1. Except in cases of emergency, request for permission to Work on Saturdays, Sundays or legal holidays shall be filed with the Owner's Representative not less than twenty four (24) hours in advance of said date, if the activity affects the critical path and not less than forty eight (48) hours if the proposed activity does not affect the critical path.

9.1.2.2.1.2. Said permission shall not be unreasonably denied.

9.1.2.2.2. Premium time (overtime) necessary in case of emergency, or for completion of daily work, or to comply with the Project schedule, shall be notified to the Project Inspector during the course of the day that said premium time will be worked.

9.1.3. The date of commencement of the Work shall be stated in the Notice to Proceed.

9.1.3.1. The Contractor shall begin the Work on such date of commencement fixed by the Notice to Proceed.

9.1.3.2. The Contractor shall carry out the Work expeditiously with adequate forces and shall complete it within the Contract Time

9.1.3.3. A Notice to Proceed issued without the Owner having furnished all required permits and/or endorsements necessary to commence the Work which fixes a commencement date which cannot be complied with due to the lack of such permits shall constitute a valid basis for a claim by Contractor under Article 11.5 if such act adversely affects the Project's critical path and no concurrent cause of delay by the Contractor is present.

9.1.4. The Contract Time limit to execute the Work until it is substantially complete shall be that number of calendar days resulting from the sum of the original Contract Time and the authorized extensions to the original Contract Time. Said Contract Time shall start to run on the date fixed in the Notice to Proceed (the commencement date) and shall end on the date of Substantial Completion. If the work is Substantially Completed prior to said time limit, the Contractor will have achieved early completion, if Work is not Substantially Completed within said time limit, the Contractor will not have completed the Work on time in accordance with the Contract.

9.1.4.1. Time under the Contract will, stop running on the date of Substantial Completion.

9.2 Change of Contract Time

9.2.1. The Contract Time (or Milestones) may only be changed with a Change Order, Extra Work Order or by a Written Amendment.

9.2.1.1. Any Claim for an adjustment in the Contract Time (or Milestones) shall be based on a written notice submitted by the party making the claim to the Owner in accordance with the provisions of Article 11.5.

9.2.2. Any adjustment of the Contract Time (or Milestones) due to any delay beyond the control of Contractor, will be made in an amount equal to the time lost due to such delay, including its consequences, if a Claim is made therefore as provided in Article 11.5 only if such delay affect the critical path, as reflected in the monthly Progress Schedule.

9.2.2.1. Delays beyond the control of Contractor shall include, but are not limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated on these General Conditions, lack of, or lapse, of any permit, or endorsement, issued by the governmental entities having jurisdiction in the Project which are the responsibility of Owner, fires, floods, epidemics, weather conditions, or acts of God.

9.3 Delays and Extensions of Time

9.3.1. No extension of the Contract Time will be allowed for any reason except as provided below:

9.3.1.1. If satisfactory fulfillment of the Contract with authorized extension and increases requires the performance of Work in greater quantities than those set forth in the proposal so that the total final payment is

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greater than the total original Contract Price, then the time allowance will be equitably adjusted taking into account the amount and difficulty of the additional Work and only if the scope of the Work is increased or the critical path of the Project Schedule is affected.

9.3.1.2. In case of total suspension ordered by the Owner and not due to any fault of the Contractor, the total number of calendar days during which the Work is suspended shall be added to the Contract Time. In case of suspension of part of the Work ordered by the Owner not due to any fault of the Contractor, the Contract Time shall be extended to the extent that the effect that such suspension has on the Contract Time, and only to the extent the critical path of the Project Schedule is affected.

9.3.1.2.1. After Contractor has taken all reasonable steps to minimize Project overhead during the suspension, the Project fixed overhead costs incurred during the suspension by the Contractor will be reimbursed to Contractor by the Owner.

9.3.1.3. In case of damage to the Work due to Force Majeure, the Owner shall equitably adjust Contract Time based on the time required to repair the damage, provided the critical path is affected.

9.3.1.4. In case of delays or interruptions to the Work caused by any act of the Owner, or by any separate Contractor employed by the Owner or by any other cause not attributable to the fault or negligence of the Contractor, then the Contract Time shall be equitably adjusted.

9.3.1.4.1. The Project reasonable fixed overhead costs incurred by the Contractor due to the time extension caused by the acts described in Article 9.3.1.4 ,will be reimbursed to the Contractor by the Owner.

9.3.1.5. Every Change Order, Extra Work Order or Supplemental Agreement, if any, shall include all adjustments to Contract Time and to Contract Price related thereto, if any.

9.3.1.6. Unless otherwise specified in the Contract Documents, additional Contract Time will be allowed due to weather conditions, and their consequences, which render the performance of Work impossible.

9.3.1.7. Except as otherwise stated in this Article 9, where Contractor is prevented from completing any part of the Work within the Contract Time (or Milestones) due to delays beyond the control of both Owner and Contractor, if the critical path of the Project Schedule is affected, an extension of the Contract Time (or Milestones) for a period of time equal to the time lost due to such delay shall be Contractor's sole and exclusive remedy for such delay.

9.3.2. Extension in Contract Time shall not be considered or allowed for the following reasons:

9.3.2.1. Suspensions of Work ordered by the Owner or Owner's Representative due to the fault of the Contractor or his Subcontractor.

9.3.2.2. Unauthorized suspensions of Work by the Contractor.

9.3.2.3. Delays within the control of Contractor.

9.3.2.3.1. Delays attributable to or within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

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9.3.3 All notifications of claims for extension of time shall be made in writing by the Contractor to the Owner's Representative not more than thirty (30) working days after acquiring knowledge of the occurrence of the delay. Once made, the Contractor must supplement such claim by notice to Owner within thirty (30) working days after the event that caused the delay has concluded. If proper notification of a claim or subsequent supplemental notice is not given to Owner, then all related claims regarding increases to Contract Time, and Contract Price will be deemed waived by Contractor.

9.3.3.1. Claims for extension of time shall include:

9.3.3.1.1. the reasons for the time extension as required by the Owner's Representative;

9.3.3.1.2. the operation(s) alleged to have been delayed;

9.3.3.1.3. the calendar dates on which the operation(s) were delayed;

9.3.3.1.4. the number of calendar days by which Contractor requests Contract Time be extended;

9.3.3.1.5. a complete and detailed statement as to how the critical path was affected; and

9.3.3.1.6. a complete and detailed breakdown of adjustment to Contract Price to be claimed due to the claimed time extension, if adjustment to Contract Price is to be claimed.

9.4 Delay Damages

9.4.1. In no event shall Owner or Architect/Engineer be liable to Contractor, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

9.4.1.1. delays caused by or within the control of Contractor; or

9.4.1.2. delays caused by Force Majeure and/or beyond the control of both Owner and Contractor .

9.4.1.3. delays not notified within the time specified in Article 9.3.3 or contrary to Article 9.3.3.1.

9.4.2. Nothing in this Article 9 bars a change in Contract Price to compensate Contractor due to delay, interference, or disruption directly attributable to actions or inactions of Owner or anyone for whom Owner is responsible, provided Contractor complies with the requirements of Articles 9.3.3. and 9.3.3.1.

9.5 Liquidated Damages

9.5.1. Unless otherwise specified in the Contract Documents should the Contractor or, the Surety in case of Termination for Cause, fail to complete all the Work within the time specified in the Contract or as extended by the written authorization of the Owner, a deduction of the amount stipulated herein will be made for each and every calendar day that the Work is not completed after the expiration of the time limit to execute the Work described in Article 9.1.4:

SCHEDULE OF LIQUIDATED DAMAGES		
Original Contract Price		Daily Charge
From More Than	To and Including	
$ 0.00	$ 99,999.99	$ 300.00
$ 100,000.00	$ 499,999.99	$ 400.00
$ 500,000.00	$ 999,999.99	$ 800.00
$ 1,000,000.00	$ 1,999,999.99	$ 1,000.00
$ 2,000,000.00	$ 4,999,999.99	$ 2,000.00
$ 5,000,000.00	$ 9,999,999.99	$ 3,000.00
$ 10,000,000.00	$19,999,999.99	$ 4,000.00
$ 20,000,000.00	$29,999,999.99	$ 5,000.00
$ 30,000,000.00	$39,999,999.99	$6,000.00
$ 40,000,000.00	$49,999,999.99	$7,000.00
Over $50,000,000.00	Unlimited	$8,000.00 or as otherwise indicated in the Special Conditions

9.5.2. This amount will be deducted from any money due or that may become due the Contractor or his Surety by Owner.

9.5.3. The Original Contract Price in the above schedule of Liquidated Damages for unit price projects refers to the total original contract amount including all the units in a multi-unit contract. Liquidated damages will be applied on multi-unit contracts based on the daily charges applicable to the total original contract amount.

9.5.4. The amount stipulated in Article 9.5.1, or otherwise if otherwise specified in the Contract Document, as the case may be, shall be considered and treated not as a penalty, but as a total, fixed, and agreed upon liquidated damages due the Owner by the Contractor or, by the Surety in case of Termination for Cause, for and including but not limited to, public inconvenience, obstruction to traffic, interference with and/or loss of business, increase of engineering, inspection and administrative cost to the Owner; and other costs and expenses which have caused an expenditure of public funds, resulting from the Contractor's, or in case of Termination for Cause of the Surety's, failure to complete the work within the time specified in the Contract.

9.5.5. Permitting the Contractor to continue and finish the Work or any part thereof after expiration of the time limit for Substantial Completion described in Article 9.1.4 shall in no way operate as a waiver of any right or remedy available to Owner under this Contract or at law.

9.6 Early Completion Incentive

9.6.1. Unless otherwise stated in the Contract Documents, should Contractor Substantially Complete the Work before expiration of the Contract Time as extended by the Owner, the Contractor shall receive an incentive pay from the Owner equal to one half (1/2) of the stipulated liquidated damages for each calendar day the Work is Substantially Completed prior to the time limit to complete the Work described in Article 9.1.4.

ARTICLE 10 - CHANGE OF CONTRACT PRICE, COST OF THE WORK AND UNIT PRICE WORK

10.1 Change of Contract Price

10.1.1. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Owner in accordance with Article 11.5.

10.1.2. The value of the Work covered by a Change Order or covered by a Claim for an adjustment in the Contract Price will be determined as follows:

10.1.2.1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of section 10.4); or

10.1.2.2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with section 10.5) or by newly agreed unit prices; or

10.1.2.3. where the Work involved is either: (a) not covered by unit prices contained in the Contract Documents, or (b) agreement as to a lump sum is not reached (under Article 10.1.2.2,) the value of the work shall be computed on the basis of the Cost of the Work (determined as provided in Article 10.2) plus a Contractor's fee for overhead and profit (as provided in Article 10.5).

10.2 Cost of the Work

10.2.1. Costs Included: The term Cost of the Work means the sum of all costs necessarily incurred and paid by Contractor in the proper performance of a change in the Work. When the value of any Work covered by a Change Order, Extra Work Order or Construction Change Directive or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work. Except as otherwise agreed in writing by Owner's Representative, such costs shall be in amounts no higher than those prevailing in the locality of the Project and shall include only the items indicated below:

10.2.1.1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classification agreed upon by Owner's Representative and Contractor.

10.2.1.1.1. Such employees shall include without limitation engineers, superintendents, foremen, and other supervisory, safety, security and clerical personnel employed full time at the Site.

10.2.1.1.2. Payroll costs for employees not working exclusively in connection with the Work shall be apportioned based on their time spent working on the Work.

10.2.1.1.3. Payroll costs shall include, but shall not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, union, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto.

10.2.1.1.4. The expenses of performing Work outside the regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above mentioned costs, to the extent authorized by Owner's Representative.

10.2.1.2. Actual cost of all necessary materials and equipment furnished and incorporated in the Work, including costs of transportation, taxes and reasonable and necessary storage thereof, and Suppliers' field services required in connection therewith.

10.2.1.2.1. All cash discounts with regard to the purchase by Contractor of materials and equipment shall accrue for the benefit of Contractor unless Owner deposits funds with Contractor with which to purchase the materials and equipment, in which case the cash discounts shall accrue to Owner.

10.2.1.2.2. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that these discounts etc. may be obtained.

10.2.1.3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors.

10.2.1.3.1. If required by Owner's Representative, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Architect/Engineer, which bids, if any, will be acceptable.

10.2.1.3.2. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Article 10.2.

10.2.1.4. Reasonable and necessary costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services exclusively related to the Work.

10.2.1.5. Supplemental costs including the following:

10.2.1.5.1. The proportion of reasonable and necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work. Airplane travel shall be on coach class and the car transportation, hotel and subsistence shall be at moderate cost.

10.2.1.5.2. Reasonable cost, including transportation, taxes and maintenance, of all materials, supplies, equipment, machinery, appliances, computers, office, warehousing and temporary facilities exclusively related to the Contract, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

10.2.1.5.3. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner's Representative with the advice of Architect/Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and

removal thereof.

10.2.1.5.3.1. All such costs shall be in accordance with the terms of said rental agreements.

10.2.1.5.3.2. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

10.2.1.5.4. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.

10.2.1.5.5. In such instances (only) where Contractor is insured under OCIP, or where the Owner assumes responsibility for some part of the required projects insurances (such as Builder's Risk) losses and damages (and related expenses) caused by damage to the Work, not compensated by said insurance, sustained by Contractor in connection with the performance of the Work, provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable.

10.2.1.5.5. 1. Such losses shall include settlements made with the written consent and approval of Owner's Representative. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

10.2.1.5.6. The cost of all utilities, telephone, data, fax, internet, security services, fuel, and sanitary facilities within the Site.

10.2.1.5.7. When the Cost of the Work is used to determine the value of a Change Order, or Construction Change Directive, Extra Work Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work.

10.2.1.5.8. An amount of the Contractor's main office overhead costs, when applicable, reached by mutual accord between the parties. If no mutual accord can be reached, the cost for main office overhead shall be computed using the Eichleay case and subsequent case law. If the Contractor does not have financial statements prepared externally by a recognized CPA, he must prepare them in order to be able to present a claim for this purpose.

10.2.2 Costs Excluded: The term Cost of the Work shall not include any of the following items:

10.2.2.1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor who work at Contractor's principal, branch or other office, other than Contractor's office at the Site, for general administration of the Work, all of which are to be considered administrative costs covered by the Contractor's fee, and not specifically included in the agreed upon schedule of job classifications referred to in Article 10.2.1.1 or specifically covered by Article 10.2.1.4.

10.2.2.2. Expenses of Contractor's principal, branch or other offices, other than Contractor's office at the Site.

10.2.2.3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed

for the Work and charges against Contractor for delinquent payments.

10.2.2.4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, or making good any damage to property.

10.2.2.5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Articles 10.2.1.1 and 10.2.1.2, unless proven as a valid reasonable and necessary expense directly and exclusively related to the Project.

10.2.3. Contractor's Fee. When the value of any Work covered by a Change Order/Extra Work Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Article 10.5.

10.2.4 Documentation: Whenever the Cost of the Work for any purpose is to be determined pursuant to Articles 10.2.1 and 10.2.2, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Architect/Engineer, or Owner's Representative, an itemized cost breakdown together with supporting documentation and data.

10.2.5 Time Extension: Whenever additional time is required to perform extra work, said time allotment shall be included as part of the Change Order.

10.2.6 If the requirement specified in Article 10.1.2.3, above, causes a delay in the project completion, the costs of said delays, including project and main office overhead shall be added to the cost of the Work and a reasonable time extension provided under the Contract.

10.3 Cash Allowances

10.3.1 Unless otherwise stated in the Contract Documents, it is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents.

10.3.2 Items covered by allowances shall be supplied for such amount and by such persons or entities as the Owner's Representative may direct, but the contractor shall not be required to employ persons or entities against which the Contractor makes written reasonable objections.

10.3.3 If the allowance covers the cost of only furnishing material or , the allowance should include:

10.3.3.1. The cost to Contractor (less any applicable discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

10.3.3.2. Contractor's costs for unloading and handling on the Site. Labor and installation costs, have been included in the Contract Price.

10.3.4 If the allowances include the cost of furnishing and installing material or equipment to be furnished and installed by the Contractor the allowances include the cost to Contractor (less any applicable discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes plus the total cost of installation including unloading and handling.

10.3.5 If the allowances include the cost of furnishing and installing material or equipment to be furnished and installed by a Subcontractor the allowances include the cost to the Contractor of the subcontractor's price.

10.3.6 Unless otherwise provided in the Contract Documents, insurances and bonds do not form part of the allowance price, but are included as part of the Contract Price.

10.3.7 An appropriate Change Order/Extra Work Order will be issued to reflect any difference in the actual cost of the allowance versus the amount specified in said allowance in the Contract Documents. Said amount will be due to Contractor, or credited to Owner as the case may be, on account of Work covered by allowances, and the Contract Price, and Contract Time, if necessary, shall be correspondingly equitably adjusted. Said Change Order/Extra Work Order will include the costs of bonds, insurances and fee stated in Article 10.5. If the change order is a credit, the amount credited will be the net amount due the Owner.

10.4 Unit Price Work

10.4.1 Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include, for all Unit Price Work, an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

10.4.1.1. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of bids and determining an initial Contract Price.

10.4.1.1.1. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Owner's Representative subject to the provisions of Article 13.2.1.

10.4.2 Each unit price will be deemed to include an amount considered by Contractor in the proposal to be adequate to cover Contractor's overhead and profit for each separately identified item.

10.4.3 Owner and Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 11.5 if:

10.4.3.1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

10.4.3.2. there is no corresponding adjustment with respect any other item of Work; and

10.4.3.3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

10.5 Contractor's Fee: The Contractor's fee for overhead and profit for Work performed under a Change Order/Extra Work Order shall be determined as follows:

10.5.1. a mutually acceptable fixed fee; or

10.5.2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

10.5.2.1. for costs incurred under Articles 10.2.1.1 and 10.2.1.2, the Contractor's fee shall be fifteen (15) percent;

10.5.2.2. for costs incurred under Article 10.2.1.3, 10.2.1.4 and 10.2.1.5, the Contractor's fee shall be ten (10) percent;

10.5.2.3. where one (1) or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Article 10.5.2.1 is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of fifteen (15) percent of the costs incurred by such Subcontractor under Articles 10.2.1.1 and 10.2.1.2 and that any higher tier Subcontractor and Contractor will each be paid a fee often (10) percent of the amount paid to the next lower tier Subcontractor;

10.5.2.4. no fee shall be payable on the basis of costs itemized under Articles 10.1.2.1 and 10.1.2.2;

10.5.2.5. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost; and

10.5.2.6. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed based on the net change in accordance with Article 10.5.2.1 through 10.5.2.5, inclusive.

ARTICLE 11 - CHANGES IN THE WORK

11.1 Authorized Changes in the Work

11.1.1 Without invalidating the Agreement and without notice to any surety, Owner, through the Owner's Representative, may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, an Extra Work Order, Work Change Directive, or a Construction Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved, which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

11.1.2 If there is agreement that said request will include an adjustment either in the Contract Sum, the Contract Time, or both, the adjustment shall be based on one of the following methods:

11.1.2.1. Mutual acceptance of a lump sum properly itemized and supported with sufficient substantiating data and documentation to permit evaluation and mutually acceptance of adjustment to Contract Time, and Contract Price if necessary;

11.1.2.2. Contract Price and Contract Time to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage Contractor's fee; or

11.1.2.3. As provided in Articles 9.2 and 10.

11.1.3 The Owner's Representative shall have authority to order minor changes in the Work not involving any adjustment in the Contract Sum or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents.

11.1.3.1. Such changes shall be made by a written Field Order, or by other written orders.

11.1.3..2. Such changes shall be binding on the Owner and the Contractor.

11.1.3.2.1. If the Contractor is not in agreement that such order does not increase either the Contract Sum or the Contract Time, the Contractor shall promptly present his Claim in the method specified in Article 11.5, herein.

11.1.4. The Owner's Representative may issue written Field Orders covering minor changes in the Work without change in Contract Sum or Contract Time.

11.1.4.1. If the Contractor is not in agreement that such Field Order does not increase either the Contract Sum or the Contract Time, he shall promptly present his claim in the method specified in Article 11.5, herein.

11.1.5. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Time, or both, that should be allowed as a result of a Work Change Directive or a Construction Change Directive, a claim may be made therefore as provided in Article 11.5.

11.2 Unauthorized Changes in the Work

11.2.1. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified, or supplemented, except in the case of an emergency as provided in Article 14.13 or in the case of testing and/or uncovering Work as provided in Articles 12.3 and 12.4.

11.3 Execution of Change Orders and Extra Work Orders

11.3.1. Owner and Contractor shall execute appropriate written Change Orders and/or Extra Work Orders (or Written Amendments) recommended by Owner's Representative covering:

11.3.1.1. changes in the Work, which are:

11.3.1.1.1. ordered by Owner's Representative pursuant to Article 11.1;

11.3.1.1.2. required because of acceptance of defective Work under Article 12.7.1 or Owner's Representative's correction of defective Work under Article 12.8; or

11.3.1.1.3. agreed to by the parties;

11.3.1.2. changes in the Contract Price or Contract Time which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive or a Construction Change Directive; and

11.3.1.3. changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by Owner's Representative pursuant to Article 11.5; provided that in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws or Regulations, but during any such appeal of the Dispute, Contractor shall carry on the Work and adhere to the Progress Schedule and the Owner shall pay for such work performed subject to final resolution of the Dispute.

11.3.1.4. Owner, with the approval of the Change Order/Extra Work Order, shall submit written evidence to the Contractor that the money to pay for said Change Order Work has been assigned to make payment under the Contract.

11.4 Notification to Surety

11.4.1. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to Contract Price or Contract Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be Contractor's responsibility. The penal sum of each applicable Bond will be adjusted to reflect the effect of any such change.

11.4.1.1. Owner shall submit to the pertinent government agencies any documentation required by law or regulation to be submitted for the validity or enforceability of any Change Order Work, and shall provide proof of the proper submittal of said documentation if requested in writing by the Contractor.

11.5 Claims and Disputes

11.5.1. Written notice stating the general nature of each Claim, Dispute, or other matter shall be delivered by Contractor to Owner, through Owner's Representative, promptly (but in no event later than 30 days) after the start of the event giving rise thereto.

11.5.1.1. Notice of the amount or extent of the Claim, Dispute, or other matter with supporting data shall be delivered to the Owner within sixty (60) days after the end of such event (unless Owner's Representative allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter).

11.5.1.2. A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Article 11.1.2.

11.5.1.3. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Article 9.2.2.

11.5.1.4. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event.

11.5.2. If the Dispute is not decided by the Owner's Representative, or said decision notified to Contractor within thirty (30) days following the receipt of the notice of Dispute by the Owner's Representative, the Claim shall be deemed rejected.

11.5.3. Owner's Representative's Decision: Owner's Representative will render a formal decision in writing within thirty (30) days after receipt of the submittal of the Claim. Owner's Representative's written decision regarding the Dispute, or other matter, will be final and binding upon Owner and Contractor unless:

11.5.3.1. An appeal from Owner's Representative's decision is taken within the time limits and in accordance with the dispute resolution procedure set forth in Article 16.

11.5.4. No Claim for an adjustment in Contract Price or Contract Time (or Milestones) will be valid if not submitted in accordance with this section 11.5.

ARTICLE 12 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

12.1 Notice of Defects

12.1.1. Prompt notice of all defective Work of which Owner, Owner's Representative and Architect/Engineer has actual knowledge will be given to Contractor. If no notice is promptly given to Contractor of previously known defective Work, it shall be deemed acceptable to Owner.

12.1.2. All defective Work may be rejected, corrected, or accepted as provided in this Article.

12.2 Access to Work

12.2.1. Owner, Owner's Representative, Architect/Engineer, Architect/Engineer's Consultant, other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. Said access shall be previously coordinated with Contractor.

12.2.1.1. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's Site safety procedures and programs so that they may comply therewith as applicable.

12.3 Tests and Inspections

12.3.1. Inspection of Materials

12.3.1.1. Unless otherwise specified in the Contract Documents, all materials are subject to inspection, sampling, testing, retesting and rejection by the Owner's Representative as provided in the specifications and prior to acceptance of the Work.

12.3.1.2. Any work in which untested and unaccepted materials are used without the approval of the Owner's Representative, except if said material is the one specified in the Contract Documents, will be performed at the Contractor's risk.

12.3.1.1.2.1. Material found to be unacceptable will not be paid for and, if directed by the Owner's Representative, shall be removed at the Contractor's expense.

12.3.1.3. Unless otherwise indicated in the Contract Documents, the sampling of materials for testing will be performed by Owner's Representative personnel or by other personnel designated by the Owner, at Owner's expense.

12.3.1.1.3.1. Where sampling by the Contractor is specified, the samples shall be taken using approved Contractor furnished sampling devices, under the supervision of the Owner's Representative, and at such times or intervals as directed.

12.3.1.1.3.2. When materials are tested by the Owner, copies of the test reports will be furnished to the Contractor. Unless otherwise required in the Contract Documents, tests may or may not be performed by Owner and the Contractor shall not rely on the results of the Owner testing being available for process control.

12.3.1.4. Plant Inspection: Owner's Representative may undertake the inspection of materials at the production plant. In the event plant inspection is undertaken the following conditions shall be met:

12.3.1.1.4.1. The Owner's Representative shall have the cooperation and assistance of the Contractor and the producer with whom he has contracted for materials.

12.3.1.1.4.2. The Owner's Representative shall have full entry at all times to such parts of the plant as may

concern the manufacture or production of the materials being furnished.

12.3.1.1.4.3. Adequate safety measures shall be provided and maintained.

12.3.2 Contractor shall give Owner's Representative timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspections and testing personnel to facilitate required inspections or tests. No delays, or hindrance in the performance of the Work, shall be caused by tardiness in Owner's Representative's inspection of the Work.

12.3.2.1. The Contractor shall submit to the Owner's Representative, within twenty (20) calendar days following the date of Notice to Proceed, the name of the local testing laboratory (ies) proposed for use with respect to the Work.

12.3.2.1.1. The Owner's Representative shall, within ten (10) calendar days after receipt of the submittal of the proposed testing laboratory(ies), approve said laboratory (ies), or submit written reasons for his disapproval.
12.3.2.1.2. If no notice of approval or disapproval is received within said period of time, Contractor shall submit the request for approval to the Chief of Construction or equivalent division head of Owner who shall have ten (10) calendar days to issue his decision. If the Chief of Construction or equivalent division head of Owner does not render his decision within said time, the testing laboratory (ies) will be deemed approved by the Owner's Representative.

12.3.3. Unless otherwise provided in the Contract Documents, Owner's Representative shall employ and pay for the services of independent testing entities to perform all inspections, tests, or approvals required by the Contract Documents except for inspections, tests, or approvals covered by Article 12.3.4. The costs incurred in connection with tests or inspections conducted pursuant to Article 12.4.2.1 shall be paid as provided in Article 12.4.

12.3.3.1 Whenever Contractor is responsible for arranging, obtaining and paying for costs in connection with any inspection, test, or approval required for Owner's Representative's or Architect/Engineer's acceptance of materials, mix designs, or equipment, the inspecting or testing entity shall be submitted for approval by Owner's Representative and the inspection or test shall be performed prior to Contractor purchasing such materials, mix designs, or equipment for incorporation to the Work.

12.3.3.1.1. Unless otherwise indicated in the Contract Documents, such inspections, tests, or approvals shall be performed by organizations acceptable to Owner, Owner's Representative and Architect/Engineer, whose acceptance shall not be unreasonably denied.

12.3.4. If Laws or Regulations of any public body having jurisdiction, at bid opening date, require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Owner's Representative the required certificates of inspection or approval. If said Laws and Regulations are enacted after bid opening date, the costs for said inspections shall be borne by the Owner.

12.4 Uncovering Work

12.4.1. If a portion of the Work, whether or not inspected, tested or approved is covered contrary to the Owner's Representative written request or to requirements specifically expressed in the Contract Documents,

it must, if required in writing by the Owner's Representative be uncovered for the Owner's Representative observation and be replaced or reconstructed at the Contractors expense without change in the Contract Time and Amount.

12.4.2. If a portion of the Work whether or not inspected, tested or approved has been covered and the Owner's Representative had not specifically required its inspection in writing prior to being covered, the Owner's Representative may required its inspection and it shall be uncovered by the Contractor.

12.4.2.1. If it is found that such Work is defective, Contractor shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others.)

12.4.2.2. If however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction.

12.5 Correction or Removal of Deficient Work

12.5.1. Contractor shall correct all deficient Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Owner's Representative's, remove it from the Project and replace it with Work that is not deficient. Contractor shall bear, exclusively, the cost of correcting such deficient Work.

12.6 Correction Period

12.6.1. If within one (1) year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be deficient; or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations, at the Effective Date of the Agreement, as contemplated in Article 6.11.1 is found to be deficient, in all such instances Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

12.6.1. 1. repair such deficient land or areas; or

12.6.1.2. correct such deficient Work or, if the deficient Work has been rejected by Owner, remove it from the Project and replace it with Work that is not deficient, and

12.6.1.3. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or other's land or areas resulting therefrom.

12.6.1.3.1. If Contractor does not, after a ten (10) day written notice from Owner, promptly start complying and diligently comply with the terms of such instructions, (or in an emergency where delay would cause serious risk of loss or damage), Owner may have the deficient Work corrected or repaired or may have the rejected Work removed and replaced, and all costs, arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

12.6.2. In special circumstances where a particular item of equipment is placed in continuous service, at the request of the Owner's Representative, before Substantial Completion of all the Work, the correction period for that item shall start to run from the date that said equipment is placed on service.

12.6.3. Where deficient Work (and damage to other Work resulting there from) has been corrected or removed and replaced under this section 12.6, the correction period hereunder with respect to such Work will be extended for an additional period of one (1) year after such correction or removal and replacement has been satisfactorily completed.

12.7 Acceptance of Non-Compliant Work

12.7.1. If both parties agree, instead of requiring correction or removal and replacement of deficient Work, and Owner (prior to Architect/Engineer's recommendation of final payment) prefers to accept it, Owner may do so.

12.7.1.1. If both parties cannot reach agreement on acceptance of deficient work, then the Contractor shall correct such deficient Work to Owner's satisfaction or either party may make a Claim as provided in Article 11.5.

12.7.2. If any such acceptance occurs prior to Owner's Representative's recommendation of final payment, a Change Order/Extra Work Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted.

12.7.2.1. If the parties are unable to agree as to the amount thereof, either party may Claim as provided in Article 11.5.

12.8 Owner's Right to Correct Deficient Work

12.8.1. If Contractor fails within a reasonable time after written notice from Owner's Representative to start correction of deficient Work or to diligently prosecute correction or to remove and replace rejected Work as required by Engineer in accordance with Article 12.6.1, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to substantially comply with any other provision of the Contract Documents, Owner may, after seven (7) days written notice to Contractor, correct and remedy any such deficiency.

12.8.2. In exercising the rights and remedies under this paragraph. Owner shall proceed expeditiously.

12.8.2.1. In connection with such corrective and remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere.

12.8.2.2. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Architect/Engineer and Architect/Engineer's Consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

12.8.3. All costs incurred or sustained by Owner in exercising the rights and remedies under this Article 12.8 will be

charged to Contractor.

12.8.3.1. If the parties are unable to agree as to the amount of the adjustment, a Claim therefore may be made as provided in Article 11.5.

12.8.3.1.1. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's deficient Work.

12.8.4. Contractor shall not be allowed an extension of the Contract Time (or Milestones) because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Article 12.8.

ARTICLE 13 - PAYMENTS AND COMPLETION

13.1 Proposal Schedule and Schedule of Values

13.1.1. Proposal Schedule (Unit-Price Contracts)

13.1.1.1. In Unit-Price Contracts, the quantities in the proposal schedule are approximate only and the actual quantities to be paid for cannot be determined until the work is performed and accepted. Increases or decreases in the proposal schedule quantities will be considered as normal overruns or underruns, and the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract unit prices for the accepted quantities of work performed.

13.1.1.2. Payments to the Contractor shall be made only for the actual quantities of each contract item, performed and accepted in accordance with the plans and specifications and, if upon completion of the construction, these actual quantities shall show either a decrease or increase from the quantities in the proposal schedule, the contract unit prices will prevail.

13.1.1.2.1. In Unit-Price Contracts, the Contractor will submit for approval to the Owner's Representative a schedule of values for those Lump-Sum bid items only.

13.1.1.2.2. This schedule, when approved by the Owner's Representative, shall be used solely as a basis for the monthly partial payments.

13.1.1.3. If the "Basis of Payment" in the specifications relating to any unit price in the bid schedule requires that said unit price cover and be considered compensation for certain work or material essential to the item, this same work or material will not also be measured or paid for under any other pay item which may appear elsewhere in the Contract Documents.

13.1.2. Schedule of Values (Lump-Sum Contracts)

13.1.2.1. In Lump-Sum Contracts, the Contractor, within fifteen (15) days after the date of the Notice to Proceed, will submit for approval, to the Owner's Representative, a schedule of values prepared in approved forms of the various portions of the Work aggregating the total Contract Sum, divided so as to facilitate monthly partial payments.

13.1.2.2. Each item in the schedule of values shall include its proper share of overhead and profit. Initial disbursements items such as mobilization, temporary facilities, premiums for insurance, and bonds and all cost of government fees and permits required for work, shall be separately itemized to facilitate first partial payment.

13.1.2.3. This schedule, when approved by the Owner's Representative, shall be used solely as a basis for the monthly partial payments and not as unit prices for changes in the Work.

13.1.2.4. The schedule of values shall be approved, or rejected in writing for cause notified to Contractor within fifteen (15) calendar days after receipt by Owner's Representative.

13.1.2.4.1. Any individual item on the schedule of values that is rejected by the Owner's Representative must be properly identified and reason for rejection substantiated and notified to the Contractor within said time period.

13.1.2.4.2. The Owner's Representative may allow certain individual items to appear in the schedule of values as lump sum items. These items must be broken down into individual items prior to request any partial payment regarding said individual item.

13.1.2.5. If the Owner's Representative does not reject the schedule of values as specified herein, then the same shall be deemed approved.

13.2 Progress Payments

13.2.1. Applications for Payments

13.2.1.1. The Progress Payment Period shall be one (1) month long unless otherwise indicated in the Contract Documents. The end of the Progress Payment period shall be the last day of the month unless otherwise established in the Contract Documents. The Contractor does not have to submit an application for payment every month if he so chooses.

13.2.1.2. At least twenty (20) days before the date established for each progress payment, Contractor shall submit to Owner's Representative for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

13.2.1.3. The determination of quantities of acceptable completed Work under the terms of the Contract Documents will be jointly made by the Owner's Representative and Contractor. It will be based on measurements made by them, or their assistants, according to the units of measurement for each item as shown in the schedule of values and by the method indicated in the corresponding specification, if so indicated in said specification for said item.

13.2.1.4. If the requested payment is based on materials and equipment not incorporated in the Work, but delivered and suitably stored at the Site, or at another location, agreed to in writing, the Application for Payment shall also be accompanied by: (i) a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and (ii) evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein. All evidence required herein shall be in form satisfactory to Owner.

13.2.1.4.1. Such advance payment may be made to the Contractor for the cost of materials that are to be incorporated into the work, provided the materials meet the requirements of the plans and specifications and are on hand at the Site or stored in acceptable storage places.

13.2.1.4.1.1. No advance payment will be made on living or perishable plant materials.

13.2.1.4.1.2. In the case of materials that have been purchased by the Contractor, the cost shall be determined by the vendors invoice.

13.2.1.4.1.3. In the case of materials manufactured or obtained by the Contractor through the use of his own workmen or equipment, the cost will be determined by the Owner's Representative in accordance with and based upon that particular unit of the Project in which the materials are to be utilized.

13.2.1.4.2. The Contractor shall present signed receipts or other documentary evidence to prove that the cost of the materials for which he is to receive advance payment has been paid in full or, if the materials have not been paid for, the invoice shall be accompanied by a release from the materials dealer expressing his agreement with the payment for such materials to the Contractor by the Owner.

13.2.1.4.3. If at any time after the Contractor has received advance payment for materials on hand at the Site, the Owner or Owner's Representative obtains evidence indicating that said materials, or any part or parts thereof, are defective, or that said materials, or parts thereof, do not conform to the specifications, the Owner will proceed to deduct from any of the succeeding partial payments due the Contractor for work actually performed, a sum sufficient to cover the cost of the materials, or part or parts thereof, found to be defective.

13.2.1.4.4. Materials for which the Contractor has received advance payment shall be properly housed at the Site or in acceptable storage places in the vicinity of the Project in a secure manner that will insure the preservation of their quality and fitness for the Work.

13.2.1.4.4.1. Moreover, the Contractor shall not withdraw said materials for any purpose other than incorporation into the Project, unless he has written consent from the Owner or Owner's Representative to do so.

13.2.1.4.4.2. Storage and protection costs and the cost of replacing lost or damaged materials shall be borne by the Contractor.

13.2.1.4.5. Approval of partial payments for stockpiled materials will not constitute acceptance of such materials for use in completing items of Work.

13.2.1.4.6. An amount equal to the value of materials incorporated into the Work and for which an advance payment has been made, shall be deducted from the partial estimates.

13.2.1.4.7. Unless otherwise specified in the Contract Documents, Payment shall be made to the Contractor for materials fabricated, pre-cast or otherwise produced for the Project and stored at an approved site in Puerto Rico other than in the immediate vicinity of the Project, provided the Contractor furnish and file with the Owner insurance which shall protect the Contractor and the Owner from all risk of physical loss or damage to these materials.

13.2.1.4.7.1. The amount of such insurance shall not be less than the value of such materials.

13.2.2. Retainage

13.2.2.1. The amount of retainage with respect to progress payments shall be as stipulated in the bid documents.

13.2.2.1.1. Unless otherwise specified in the Contract Documents, such retainage shall be five percent (5%) of each partial payment made to the Contractor.

13.2.2.1.1.1. In cases in which a ten percent (10%) Retainage is required by Owner, then after fifty percent (50%) of the Work has been completed to the Owner's Representative's satisfaction and the Project is on schedule and the quality of Work is satisfactory to the Owner's Representative, all the remaining payments may be made in full.

13.2.2.1.2. Immediately after the Owner's Representative, on the basis of an inspection, has determined and certified that the Work is sufficiently complete, or the Work has been occupied for the use for which it was intended, the Owner will release to the Contractor fifty percent (50%) of the amount previously retained provided the following conditions are met.

13.2.2.1.2.1. A written consent of Surety to make such payment is submitted.

13.2.2.1.2.2. There are no claims to be settled from the Owner to the Contractor.

13.2.2.1.2.3. There are no liquidated damages due.

13.2.2.1.2.3.1. However, at Owner's discretion, the Owner may release to Contractor the difference between fifty percent (50%) of the retainage and the amount of liquidated damages.

13.2.3. Review of Applications

13.2.3.1. The Owner's Representative will review the Application for Payment as soon as it is received and will notify the Contractor within five (5) working days of any exceptions he may have. The Contractor will make the necessary corrections and resubmit the Application.

13.2.3.2. The Owner's Representative will, within seven (7) days of the Contractor's date of submittal or five (5) days from the date of resubmission, if the corrections are acceptable, submit the approved Application for Payment to the Owner with all required documentation and approvals from the Architect/Engineer and the Owner's Representative.

13.2.3.3. Owner's Representative's recommendation of any payment requested in an Application for Payment will constitute a representation by Owner's Representative to Owner, based on Owner's Representative's observations on the Site of the executed Work as an experienced and qualified professional and on Owner's Representative's review of the Application for Payment and the accompanying data and schedules, that to the best of Owner's Representative's knowledge, information and belief.

13.2.3.3.1. the Work has progressed to the point indicated

13.2.3.3.2. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent test called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work, and to any other qualifications stated in the recommendation); and

13.2.3.3.3. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled

in so far as it is Owner's Representative's responsibility to observe the Work.

13.2.3.4. By recommending any such payment, Owner's Representative will not thereby be deemed to have represented that:

13.2.3.4.1. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Owner's Representative in the Contract Documents; or

13.2.3.4.2. that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

13.2.3.5. Neither Owner's Representative's review of Contractor's Work for the purposes of recommending payments nor Owner's Representative's recommendation of any payment, including final payment, will impose responsibility on Owner's Representative to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work.

13.2.3.5.1. Additionally, said review or recommendation will not impose responsibility on Owner's Representative to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

13.2.3.6. Owner's Representative may refuse to recommend in whole or in part of any payment if, in Owner's Representative's reasonable opinion, it would be untruthful to make the representations to Owner referred to in Article 13.2.3.3.

13.2.3.6.1. Owner's Representative may also (i) refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, (ii) revise or (iii) revoke any such payment recommendation previously made, to such extent as may be necessary in Owner's Representative's reasonable opinion to protect Owner from loss because:

13.2.3.6.1.1. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

13.2.3.6.1.2. the Contract Price has been reduced by Written Amendment, Change Orders or Extra Work Orders to the extent that justifies withholding payment;

13.2.3.6.1.3. Owner has been required to correct deficient Work or complete Work and has not yet done so; or

13.2.3.6.1.4. Owner's Representative has actual knowledge of the occurrence of any of the events enumerated in Article 15.2.1.

13.2.4. Payments Becomes Due

13.2.4.1. Unless otherwise specified in the Contract Documents, forty (40) days after Owner's approval of the Application for Payment, with Owner's Representative's recommendation, the amount recommended will become due, and when due, shall be paid by Owner to Contractor.

13.2.5. Reduction in Payment

13.2.5.1. The Owner's Representative, without incurring in liability, may decline to approve any Application for Payment or, because of subsequently discovered evidence or subsequent inspection, he may nullify the whole or any part of any Application for Payment previously issued, to such extent as may be necessary in his opinion to protect the Owner from loss because of:

13.2.5.1.1. Deficient Work not remedied; or

13.2.5.1.2. Failure of the Contractor to comply with any requirements of the Contract Documents.

13.2.5.2. Owner may refuse to make payment of the full amount recommended by Owner's Representative because:

13.2.5.2.1. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

13.2.5.2.2. Liens have been filed in connection with the Work, except where Contractor has delivered a specific Bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

13.2.5.2.3. there are other items entitling Owner to a set-off against the amount recommended; or

13.2.5.2.4. Owner has actual knowledge of the occurrence of any of the events enumerated in Article 13.2.3.6 or 15.2.1.

13.2.5.3. If Owner refuses to make payment of the full amount recommended by Owner's Representative, Owner must give Contractor immediate written notice (with a copy to Owner's Representative) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld.

13.2.5.3.1. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's Representative's satisfaction the reasons for such action.

13.2.5.3.2. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Article 13.2.4.

13.2.5.4. Partial payments may be suspended when in the judgment of the Owner the Work has not proceeded according to the terms of the Contract Documents.

13.2.5.5. If at any time during the construction of the Project, the Owner receives proper notice from a third party stating a claim under Civil Code Article 1489, the Contractor shall settle the claim with the third party within fifteen (15) calendar days from the notice to the Owner and inform the Owner of said settlement or otherwise if Contractor disputes the validity of said claim, post a bond, acceptable to Owner, for the benefit of Owner to protect Owner against liability for payment to the third party under Civil Code Article 1489 in which case partial payment therefore will not be withheld. This will apply in any project where there is no Payment or Performance Bond, or the penal sum of such bond is an amount less than one hundred (100) percent of the Contract Sum.

13.2.5.5.1. If no settlement is reached or a bond is not posted and accepted, the Owner, the Contractor, and the claimant third party shall meet within thirty (30) days after the expiration of the fifteen (15) calendar days to ascertain the amount of the alleged debt.

13.2.5.5.2. Contractor shall then pay within five (5) calendar days the undisputed amount. If no payment is made, the Owner shall retain said amount from the next partial payment and proceed to pay directly the undisputed amount to the third party. If the Contractor posts a bond as provided in Article 13.2.5.5 the Owner will not withhold said amount from Contractor and will not pay the amount to the third party claimant until the Contractor or the third party claimant notify Owner that the dispute among them has been resolved at which time Owner will act accordingly.

13.2.6. Scope of Payment

13.2.6.1. The payment of any partial estimate or of any retained percentage, in no way shall release the obligation of the Contractor to renew or repair any deficient materials used in the construction, or to be responsible for all damage due to such deficiencies.

13.2.6.2. No payment will be made for any unauthorized work.

13.2.6.3. No certificate for a progress payment, nor any progress payment, or any partial or entire use or occupancy of the Project by the Owner shall constitute an acceptance of any Work not in accordance with the Contract Documents.

13.3 Contractor's Warranty of Title

13.3.1. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment, and will pass free and clear of all Liens, Claims, security interests or encumbrances. Contractor also warrants and guarantees that no Work, materials, or equipment covered by an Application for Payment has been acquired by the Contractor, subject to an agreement under which an interest therein, or an encumbrance thereon, is retained by the seller or otherwise imposed by the Contractor or such other person. This will also apply to any other person performing the Work for the Project on behalf of Contractor , or furnishing materials and equipment for the Project.

13.4 Substantial Completion

13.4.1. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Owner's Representative in writing that the entire Work is Substantially Complete (except for items specifically listed by Contractor as incomplete) and request that Owner's Representative issue a Certificate of Substantial Completion. Owner may, at its sole option, request that part of the Work be declared Substantially Complete as provided in Article 13.5.1.

13.4.1.1. Within five (5) working days after such request, Owner, Contractor and Owner's Representative shall make an inspection of Work to determine the state of completion. If within this time period, the Owner's Representative fails to make objections or respond, the Contractor shall request the approval of the Chief of Construction or equivalent division head of Owner which shall have fifteen (15) working days to issue its approval or disapproval of the Certificate of Substantial Completion.

13.4.1.1.1. If Owner's Representative does not consider the Work substantially complete, Owner's Representative will notify Contractor in writing, within five (5) working days after the inspection, giving the reasons therefore.

13.4.1.1.2. If Owner's Representative considers the Work substantially complete, Owner's Representative will prepare and deliver to Owner, within ten (10) working days after the inspection, a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion.

13.4.1.1.3. There shall be attached to the certificate a tentative list of items (punch list) to be completed or corrected before final payment.

13.4.1.2. Owner shall have ten (10) working days after receipt of the tentative certificate during which to make written objection to Owner's Representative as to any provisions of the certificate of Substantial Completion or attached list.

13.4.1.3. If, after considering such objections, indicated on Article 13.4.1.2, Owner's Representative concludes that the Work is not substantially complete, Owner's Representative will within fifteen (15) working days after submission of the tentative certificate of Substantial Completion to Owner notify Contractor in writing, stating the reasons therefore.

13.4.1.4. If, after consideration of Owner's objections, indicated on Article 13.4.1.2, Owner's Representative considers the Work Substantially Complete, Owner's Representative will, within said fifteen (15) working days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised final punch list of items to be completed or corrected). Such final certificate will reflect such changes from the tentative certificate as Owner's Representative believes justified, after consideration of any objections from Owner.

13.4.1.5. At the time of issuance of the certificate of Substantial Completion, Owner will assume all responsibilities with respect to security, operation, safety, and protection of the Work, maintenance, utilities, insurance, and Contractor warranties and guarantees periods will start to run.

13.4.1.6. Unless Owner and Contractor agree otherwise in writing and inform Owner's Representative also in writing prior to Owner's Representative's issuing the definitive certificate of Substantial Completion, Owner's Representative's aforesaid recommendation will be binding on Owner and Contractor until final payment is made.

13.4.2. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion, but Owner shall allow Contractor reasonable access to complete or correct items on the final punch list.

13.5 Partial Utilization

13.5.1 Use by Owner, at Owner's option, of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Owner's Representative, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose, without significant interference with Contractor's performance of the remainder of the Work, may be effected (put to such use) prior to Substantial Completion of all the Work subject to the following:

13.5.1.1. Owner at any time may request Contractor in writing to permit Owner to use any such part of the Work which Owner believes to be ready of its intended use and substantially complete.

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13.5.1.1.1. If Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Owner's Representative that such part of the Work is substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work.

13.5.1.1.2. Contractor at any time may notify Owner and Owner's Representative in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work.

13.5.1.1.2.1. Within a reasonable time (not more than fifteen (15) days) after either party's request, Owner, Contractor, and Owner's Representative shall make an inspection of that part of the Work subject to the request to determine its state of completion.

13.5.1.1.2.2. If Owner's Representative does not consider that part of the Work to be substantially complete, Owner's Representative will notify Owner and Contractor in writing giving the reasons therefore.

13.5.1.1.2.3. If Owner's Representative issues a certificate of Substantial Completion for said part of the Work thereupon all applicable provisions of Article 13.4 shall apply.

13.5.1.1.3. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Article 13.4.1.5 regarding property insurance.

13.6 Final Inspection

13.6.1. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Owner's Representative will, within five (5) working days, make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars this inspection reveals with regard to incomplete or deficient Work.

13.6.1.1. Contractor shall immediately take measures to complete such Work and remedy such deficiencies.

13.7 Final Payment

13.7.1. Application for Payment

13.7.1.1. After Contractor has, in the opinion of Owner's Representative, satisfactorily remedied all incomplete and deficient Work identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents, and other documents required by the Contract, Contractor may make application for final payment following the procedure for progress payments.

13.7.1.2. The final Application for Payment shall be accompanied, except if previously delivered to Owner's Representative, by:

13.7.1.2.1. all documentation, guarantees, Bonds and insurance called for in the Contract; and.

13.7.1.2.2. consent of the surety, if any, to final payment; and

13.7.1.2.3. complete and legally effective releases, or waivers, (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

13.7.1.3. In lieu of the releases or waivers of Liens specified in Article 13.7.1.2.3, if approved by Owner, Contractor may furnish payment receipts or releases in full as part of an affidavit executed by Contractor to the effect that:

13.7.1.3.1. the releases and receipts include all liabilities related to labor, services, material, and equipment for which a Lien could be filed; and

13.7.1.3.2. all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner and Owner's property might in any way be responsible, have been paid or otherwise satisfied.

13.7.1.3.3. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a Bond or other collateral satisfactory to Owner to indemnify Owner against liability related to any such Lien.

13.7.2 Review of Final Application for Payment and Acceptance of the Work.

13.7.2.1. If, on the basis of Owner's Representative's observation of the Work during construction and final inspection, and Owner's Representative's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Owner's Representative is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Owner's Representative will, within fifteen (15) days after receipt of the final Application for Payment, indicate to Owner in writing Owner's Representative's recommendation regarding payment and if payment is recommended present the Application for Payment to Owner, for payment.

13.7.2.1.1. At the same time, Owner's Representative will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Article 13.9.

13.7.2.1.2. Otherwise, within the time specified in Article 13.7.2.1, Owner's Representative will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment. If within said fifteen (15) days after submittal of the final Application for Payment by Contractor the Owner's Representative fails to make objections or respond, the Contractor shall request approval directly from the Owner who shall have fifteen (15) working days to issue approval or disapproval, provided Contractor has also given the same timely notice directly to Owner as required in Article 17.3.2. If no reply is forthcoming from the Owner within the stated time, the final Application for Payment shall be deemed approved.

13.7.3. Final Payment Becomes Due

13.7.3.1. Unless otherwise specified in the Contract Documents, forty (40) days after Owner's approval of the Application for Final Payment, with accompanying documentation, the amount recommended by Owner's Representative will become due, and when due, shall be paid by Owner to Contractor.

13.7.3.2. If payment is not made within the time stated in Article 13.7.3.1., thereafter Owner will pay Contractor interest at the legal rate on the amount due.

13.8 Final Completion Delayed

13.8.1. If, through no fault of the Contractor, final completion of the Work is significantly delayed, and if Owner's

Representative so confirms, Owner shall, upon receipt of Contractor's final Application for Payment and recommendation of Owner's Representative, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted.

13.8.2. If the remaining balance to be held by Owner for Work not fully completed, or corrected, is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in Article 3, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Owner's Representative with Application for such payment.

13.8.2.1. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of any claim or of any right under the Contract.

13.9 Waiver of Claims

13.9.1. The making and acceptance of final payment will constitute:

13.9.1.1. a waiver of all Claims by Owner against Contractor, except for Claims arising from unsettled Liens, from deficient Work appearing after final inspection as the result of failure to comply with the Contract Documents, from special guarantees or from Contractor's continuing obligations under the Contract Documents; and

13.9.1.2. a waiver of all other unsettled Claims by Contractor against Owner, other than those previously made in a timely manner in writing.

13.10 Unilateral Liquidation

13.10.1. The procedures established in this section will be applicable whenever the Contractor is not available in order for the Owner to issue the final payment in accordance with Article 13.7.

13.10.1.1. For purposes of this section, the term "unavailable" shall meant that the Contractor repeteadly fails to answer Owner's requests to meet with the Owner and/or to submit the required documentation under Article 13.7 in order to proceed with the final payment and Project liquidation.

13.10.2. If Contractor is unavailable, Owner shall proceed to issue and process the final application for payment. In order to accomplish this, whenever possible, the Owner will seek to obtain the documentation required under Article 13.7.1.2 and 13.7.1.3.

13.10.2.1. When Owner can not obtain documentation required under Article 13.7.1.2 and 13.7.1.3 such documentation it may be waived by Owner in order to proceed to the issuance of final payment. However, in case of such waiver, Owner may impose those reasonable conditions Owner deems relevant in order to protect Owner's interests and safeguard against claims by third parties.

13.10.3. If after finalizing liquidation of the Contract, payment is due Contractor and Contractor remains unavailable, Owner will retain such payment until Contractor is available to collect such payment. If the Final Payment is negative (i.e., the balance is in favor of the Owner), the Owner shall compensate such amount from any other payment in favor of Contractor, if any, and/or proceed to collect it by any means available.

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ARTICLE 14 - PROTECTION OF PERSONS AND PROPERTY

14.1 Public Convenience and Safety

14.1.1. The Contractor shall at all times conduct the Work in a manner that insures the public safety and convenience and the protection of persons and property.

14.1.1.1. Contractor shall perform the Work in a manner that will not cause unreasonable inconvenience to the general public.

14.1.2. The Contractor shall comply with all laws, rules, codes and regulations applicable to the class of work being performed pertaining to public safety and the protection of persons and property.

14.2 Laws to be Observed

14.2.1 It is the Contractor's responsibility to be fully informed of and comply with all Federal, Commonwealth and municipal laws, ordinances, safety codes and regulations, and all such orders or decrees presently in effect or that may be enacted prior to Final Acceptance or which in any way affect the prosecution of the Work.

14.2.1.1. The Contractor shall at all times observe and comply with all such laws, ordinances, safety codes, regulations, orders and decrees; and shall protect Owner and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself, his employees, his subcontractors, his suppliers, his agents, or the employees of any of them or by anyone for whom Contractor is responsible.

14.2.1.2. When the United States Government pays all or any portion of the cost of the Work, the federal laws and the rules and regulations pursuant to such laws, if applicable, must be observed by the Contractor, and the Work may be subject to the inspection by any appropriate federal agency.

14.2.2. All costs related to compliance with all laws, rules and regulations enacted after bid opening date, shall be paid for by the Owner and any resulting adjustment to the Contract Price or the Contract Time shall be made by a Change Order to the Contract.

14.2.2.1. If Owner's Representative and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of any such adjustment, a Claim may be made therefore as provided in Article 11.5.

14.2.2.2. Payment under this paragraph is contingent to those situations not covered under Article 14.4.4.

14.3 Sanitary, Health and Safety Provisions

14.3.1. The Contractor shall comply with all Federal, Commonwealth and local laws, rules and regulations concerning construction safety and health standards and shall admit without delay any inspector from such health and safety agencies upon presentation of proper credentials.

14.3.2. Contractor shall provide and maintain in orderly sanitary condition such facilities as necessary for the use of his employees, in compliance with the Commonwealth Departments of Health and Labor and other bodies having jurisdiction.

14.3.3. The Contractor shall not require work to be performed under unsanitary, hazardous or dangerous conditions.

14.4 Labor Relations and Wages

14.4.1. The Contractor shall comply with all the applicable Federal and Commonwealth laws, rules and regulations concerning fair labor practices including minimum wages, work hours, equal employment opportunities, non-discrimination, civil rights, employment of minors, and other labor relation matters.

14.4.2. The minimum wage rates to be paid shall be according to the regulations of the Minimum Wage Board of the Puerto Rico Department of Labor as indicated in the latest issue of its mandatory decree at any time during the execution of the Project.

14.4.3. The Contractor shall pay weekly, in lawful money of the United States of America, including payment by check or direct deposit, the entire amount of wages, less legally authorized or mandated deductions, earned by each of the laborers and employees engaged in the Work.

14.4.3.1. The Contractor shall make available to the Owner for inspection the project payrolls and shall submit copies of such payrolls to the Owner when required.

14.4.3.2. Any irregularities noted will be brought to the attention of the Contractor by the Owner for appropriate corrective action and payment of any pending wages.

14.4.3.2.1. Should the Contractor fail to take the necessary action, he will be subject to such civil and criminal proceedings provided by law and regulations.

14.4.3.3. Payment of wages to laborers and employees of the Contractor for their work shall have preference over the payment of other debts of the Contractor, except as otherwise established by law.

14.4.4. If during the term of the Contract, federal minimum wages are increased and said increase is applied to Puerto Rico, or if labor costs and/or fringe benefits are increased by local legislation, the cost of the increase in the Work shall be considered as a Change Order and proven cost increases, including fringe benefits and insurance costs, shall be paid to the Contractor, unless those increases have been legislated, or included as part of a resolution, by either the Commonwealth or Federal Legislative chambers prior to the bid opening date. If after the bid opening date, new local legislation or regulation is imposed which directly increases Contractor's costs of materials or transportation, the Contractor may present a Claim under Article 11.5 for such increases. Such increases in costs must be evidenced and substantiated by the Contractor.

14.4.4.1. If Owner's Representative and Contractor are unable to agree as to entitlement, amount or extent, if any, of any such adjustment under Article 14.4.4, a Claim may be made therefore as provided in Article 11.5.

14.5 Environmental Protection

14.5.1. Contractor shall comply with all Federal, Commonwealth and local environmental laws and regulations.

14.5.1.1. Contractor shall take all necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oil, bitumen, chemicals, or other harmful materials and to prevent pollution of the

atmosphere with particulate or gaseous matter.

14.5.2. Unless otherwise approved in writing by the Owner, construction operations in rivers, streams, lakes and other bodies of water shall be restricted to those areas where channel changes are shown on the plans and to those areas which must be entered for the construction of temporary or permanent structures.

14.5.2.1. Rivers, streams, lakes and reservoirs shall be promptly cleared of all false work, piling, debris, or other obstructions placed therein or caused by the construction operations.

14.5.3. Frequent fording of live streams with construction equipment will not be permitted. Temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary.

14.5.3.1. Unless otherwise approved in writing by the Owner, mechanized equipment shall not be operated in live streams except as may be required to construct channel changes and temporary or permanent structures.

14.5.4. Contractor shall comply with all the requirements regarding soil erosion and water pollution control included in the Environmental Quality Board's regulations, the Owner's other standard specifications, the Plans and other Contract Documents.

14.5.5. If the Contractor should encounter or expose during construction operations any abnormal condition, which may indicate the presence of a hazardous and/or toxic waste, the Contractor shall proceed in accordance with Article 4.7.

14.5.5.1. Abnormal conditions shall include, but shall not be limited, to the following, presence of barrels, discolored earth, metal or wood; obnoxious or unusual odors; visible fumes; excessively hot earth; smoke; or any other condition which appears to be a possible indication of hazardous and/or toxic waste.

14.6 Construction Over or Adjacent to Navigable Waters

14.6.1. All Work and related activity, over, on or adjacent to navigable waters shall be conducted so that free navigation of the waterways will not be interfered with and that the existing navigable depths and clearances will not be impaired except as allowed by permit issued by the U.S. Coast Guard and/or the U.S. Army Corps of Engineers, as applicable.

14.7 Traffic Protection Devices

14.7.1. The Contractor, when applicable, shall provide, erect and maintain all necessary advance warning signs, barricades, suitable and sufficient lights, danger signals, signs, and other traffic control devices; shall provide a sufficient number of watchmen and flag persons, and shall take all necessary precautions for the protection of the Work and the safety of the public in accordance with the plans and other Contract Documents.

14.8 Use of Explosives

14.8.1. When the use of explosives is necessary for the prosecution of the Work, the Contractor shall comply with all the Laws and Regulations concerning the use, storage, transporting, handling and detonating of explosives.

14.8.1.1. The Contractor shall exercise the utmost care with the explosives so as not to endanger life and

property and he shall be responsible for any and all damages that may result from his use of explosives.

14.8.2. Prior to initiating the use of explosives, the Contractor shall submit to the Owner evidence that his comprehensive general liability insurance required under Article 3 provides coverage for the use of explosives and blasting.

14.8.3. Blasting operations shall be conducted under the most careful and experienced supervision. The Contractor shall keep the Owner informed as to his drilling, blasting and demolition operations.

14.8.4. The Contractor shall furnish and erect special signs to warn the public of his blasting operations.

14.8.4.1. Such signs shall be placed at appropriate points within the Project limits, shall be maintained so as to be clearly evident to the public during all critical periods of the blasting operations and, if blasting is by means of electric detonators, shall include a warning statement to have radio transmitters turned off.

14.8.5. The Contractor shall notify each property owner and public utility company having structures in the proximity to the Site and the Work of his intention to use explosives.

14.8.5.1. Such notice shall be given sufficiently in advance to enable the parties being warned to take steps necessary to protect persons and property from injury.

14.9 Protection and Restoration of Property

14.9.1. The Contractor shall be responsible for the preservation of all public and private property, and shall carefully protect from disturbance or damages all land monuments and property marks until the Owner has witnessed or otherwise referenced their location, and shall not move them until directed.

14.9.2 When the Contractor's excavating operations encounter items of archeological interest such as remains of pre-columbine people's dwelling sites or artifacts of historical, paleontological or archeological significance, operations in the vicinity of such findings shall be temporarily discontinued and the Owner notified.

14.9.2.1. The Owner will contact the proper authorities to determine the disposition thereof.

14.9.2.2. When directed by the Owner, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper authorities.

14.9.2.2.1. Such specialized excavation and time delay costs, if any, will be considered and paid for as Extra Work unless the Owner elects to undertake such recovery work by other means.

14.9.2.2.2. If the Owner elects to perform this work by other means, he shall be responsible to the Contractor for costs associated with delay to the Work, only if said delay affects the critical path.

14.9.3 Contractor shall be responsible for all damages or injury to property of any character during the prosecution of the Work resulting from any act, omission, neglect or misconduct in the Contractor's manner or method of executing the Work, or at any time due to deficient work or materials. The Contractor's responsibility will not be released until the Project has been completed and accepted.

14.9.4 When any direct or indirect damage or injury is caused to public or private property by or on account of an

act, omission, neglect or misconduct in the execution of the work, or as a consequence of the non-execution thereof, by Contractor, such property shall be restored at the Contractor's expense to a condition similar or equal to that existing before such damage or injury was caused by repairing, rebuilding or otherwise restoring the same, or Contractor shall make good such damage or injury in a manner acceptable to owner.

14.9.5 Contractor shall comply with all necessary soil erosion and water pollution control measures, as indicated in the Contract Documents, and shall exercise due care in their implementation, to avoid causing erosion and drainage problems in all areas inside and outside the Project construction limits.

14.10 Forest Protection

14.10.1. In carrying out Work or related activity within or adjacent to Commonwealth or National Forests, the Contractor shall comply with all regulations of the Commonwealth Fire Service, Puerto Rico Department of Agriculture, United States Forest Service or other authority having jurisdiction, governing the protection of forests and the carrying out of Work within forests, and shall observe all sanitary laws and regulations with respect to the performance of work in forest areas.

14.10.1.1. Contractor shall keep all areas affected by construction related activities in an orderly condition, dispose of all refuse, obtain permits for the construction and maintenance of all construction camps, stores, warehouses, residences, latrines, cesspools, septic tanks, and other structures in accordance with the requirements of the agency having jurisdiction of the forest.

14.10.2 The Contractor shall take all reasonable precautions to prevent and suppress forest fires and shall require his employees and subcontractors, both independently and at the request of forest officials, to do all that is reasonably within their power to prevent and suppress and to assist in the prevention and suppressing forest fires. They shall make every possible effort to notify a forest official at the earliest possible moment of the location and extent of any fire seen by them.

14.11 Responsibility for Damage Claims

14.11.1. The Contractor shall indemnify and save harmless the Owner as follows:

14.11.1.1. The Contractor for itself, agents, employees, successors and assigns agrees to save harmless the Owner, its Officers, Agents, Employees and Architect/Engineer from and against any and all claims, demands and/or suits, except as stated below, whether judicial or extra judicial for any cost whatever arising out or related to the execution of the Contract, and it's insurers shall defend the Owner, its Officers, agents, Employees and Architect/Engineer from such claims, demands and/or suits and shall bear all the expenses for such defense contemplated within the coverage limits provided by the Contractor's general liability policy, except where such claims, demands and/or suits are due solely to the negligence of the Owner, its Officers, Agents, employees and negligence, errors and/or omissions of the work performed by the Architect/Engineer. In case that the amount to be paid exceeds the policy amount, then the Contractor shall be responsible for the exceeding amount.

14.12 Contractor's Responsibility for Work

14.12.1. Until the final written acceptance of the Work by the Owner, the Work shall be under the charge and care of the Contractor. He shall take every necessary precaution to protect it from injury or damage to any part thereof by the action of the elements or from any other cause whether arising from the execution or non-execution of the Work.

14.12.2. The Contractor shall rebuild, repair, restore and make good any damages to any portion of the Work occasioned by any of the causes indicated in paragraph 14.12.1, above, before its completion and acceptance, and shall bear the expense thereof, except damages to the Work due to unforeseeable causes beyond the control of and without fault or negligence of the Contractor, including but not restricted to acts of God, such as earthquake, hurricane, tidal wave, major flooding or other cataclysmic phenomenon of nature, acts of the public enemy or of the government.

14.12.3. In case of suspension of Work from any cause whatsoever, the Contractor shall be responsible for the Work under the Contract and shall take such precautions as may be necessary to prevent damage to the Project, provide suitable drainage and erect necessary temporary structures, signs or other facilities.

14.12.3.1. During such period of suspension of work, the Contractor shall properly and continuously maintain in acceptable growing conditions all living material in newly established plantings, seeding, and sodding furnished under his contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

14.12.3.2. All costs for the work described above attributable to a suspension by the Owner shall be reimbursed to the Contractor by the Owner.

14.12.3.3. If the temporary suspension of Work is caused by the Contractor, then he will bear the expenses in such event.

14.12.4. When Work is suspended by the Contractor without authorization from the Owner, or is suspended by the Owner due to the fault of the Contractor, the costs of providing the protective measures specified in paragraph 14.12.3, above, during the period of suspension shall be borne by the Contractor.

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14.13 Emergencies

14.13.1. In any emergency affecting the safety of persons or property, the Contractor shall act at his discretion to prevent damage, injury, or loss.

14.13.1.1. Any additional compensation or extension of time claimed by the Contractor on account of emergency Work shall be determined as provided in Article 11. Additional costs incurred by the Contractor in a case of an emergency need not be authorized by the Owner's Representative when there is insufficient time to seek Owner's authorization.

14.13.2. If an emergency affects the safety of persons or property at the Site or property adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Either the Owner or the Contractor can declare an emergency.

14.13.2.1. Contractor shall give Owner's Representative prompt notice if Contractor believes that any significant changes in the Work or variations from what is provided by the Contract Documents have been caused by the emergency or are required as a result thereof.

14.13.2.1.1. If Owner's Representative determines that an amendment to the Contract Price or Contract Time is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive, a Change Order or an Extra Work Order will be issued.

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ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.1 Suspension of Work

15.1.1. At any time and without cause, Owner may, with a minimum of seven (7) calendar days written notice, suspend the Work or any portion thereof for a period of not more than ninety (90) consecutive days by notice in writing to Contractor and Architect/Engineer. Said notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be allowed an adjustment in the Contract Price or an extension of the Contract Time, or both, directly attributable to any such suspension if Contractor makes a timely Claim therefore as provided in Article 11.5. Said adjustment shall be computed based on the following factors:

15.1.1.1. Fixed Project expenses (after all reasonable reduction and mitigation of expenses) for the period of the Work stoppage, such as: (i) the Contractor's and subcontractor's supervisory, administrative, and operations personnel salaries, together with their corresponding fringe benefits and insurance costs if this personnel has been kept in the Contractor's payroll and are not gainfully utilized by Contractor or someone else elsewhere, (ii) utilities, (iii) Project's fixed equipment, and (iv) miscellaneous expenses such as safety, and vigilance.

15.1.1.1.1. At any time during the suspension, the Owner may order the Contractor to demobilize, paying the Contractor the de-mobilization costs and any future mobilization costs to re-start the Project.

15.1.1.1.2. Cancellation costs and cost increases for materials already ordered which had to be canceled and reordered, provided that such costs are not in excess of reasonable market prices.

15.1.1.1.3. Differential increases in labor costs, and its corresponding fringe and insurance benefits, in the Project for the period that the work is stopped.

15.1.1.1.4. Construction equipment use costs for the stoppage period if said equipment remains stationed at the site (idle equipment rates), or transportation costs if the Owner orders in writing that it be removed from the site. If the equipment is owned by the Contractor, he will be paid the cost (depreciation) of said equipment.

15.1.1.1.5. Insurance costs whose rates are based on the time such insurance is in effect, such as Builder's Risk Insurance, for the period that the work is stopped.

15.1.1.1.6. Contractor's overhead and profit in the amount equivalent to fifteen percent (15%) of all expenses detailed above.

15.1.1.1.7. An amount of the Contractor's main office overhead costs (exclusively in this instance and solely related to suspension) reached by mutual accord between the parties or if no mutual accord can be reached, the cost for main office overhead shall be computed using the Eichleay formula using as base the previous two (2) years of Contractor's main office overhead cost taken from the previous two (2) years financial statements which have been externally audited by a recognized CPA. If the Contractor does not have financial statements prepared externally by a recognized CPA, he must prepare them in order to be able to present a claim for this purpose.

15.1.1.1.8. Contractor shall exert his best effort to mitigate the costs included in this Article 15.1.1.

15.1.2. At any time, the Owner's Representative may, with a minimum of seven (7) calendar days written notice, for the following causes suspend the Work or part of the Work due to:

15.1.2.1. the repeated and persistence failure of the Contractor to perform his contractual obligations;

15.1.2.2. the repeated and persistent failure of the Contractor to have sufficient labor and the trades necessary to maintain the quality and progress required in the Contract Documents;

15.1.2.3. the repeated and persistent failure of the Contractor to have sufficient material necessary to maintain the quality and progress required in the Contract Documents;

15.1.2.4. the repeated and persistent failure of the Contractor to have sufficient equipment and type of equipment necessary to maintain the quality and progress required in the Contract Documents.

15.1.3. The Contractor will be responsible for all of his costs due the suspension of the Work indicated in Article 15.1.2 and there will be no increase in Contract Price or extension to the Contract Time as a result of such suspension for cause.

15.1.3.1. The suspension for cause under Article 15.1.2 will last until the Contractor remedies the situation or until termination.

15.1.3.2. The Contractor shall also be responsible for the inspection costs made necessary by overtime work to restore the project to its intended schedule due to delays caused by the actions mentioned in Article 15.1.2. Said costs will consist of the actual cost paid therefore by and to the inspector, if his presence is required or necessary.

15.1.4. At any time, the Owner's Representative or the Contractor may suspend the work or part of the work without advanced notice due to any danger or potential danger that may exist to life, limb or property or any emergency whether on the Site or off the Site.

15.1.4.1. The Contractor will be responsible for all of his costs due the suspension and there will be no time extension to the Contract Time if the suspension is due to the failure of the Contractor to perform his contractual obligations.

15.1.4.2. The Owner will compensate the reasonable costs incurred by Contractor if the suspension is due to causes other than the failure of the Contractor to perform his contractual obligations and such causes are attributable to Owner.

15.1.5. In case of suspension of Work for any cause whatsoever, the Contractor shall be responsible for the Work under the Contract and shall take such precautions as may be necessary to prevent damage to the Project, provide suitable drainage and erect necessary temporary structures, signs or other facilities.

15.1.5.1. During such period of suspension, the Contractor shall properly and continuously maintain in acceptable growing conditions all living material in newly established plantings, seeding, and sodding furnished under his contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

15.1.5.2. When Work is suspended by the Contractor without authorization from the Owner, or is suspended by the Owner due to the causes specified in Article 15.1.2, the costs of providing the protective measures specified in Article 15.1.5. and 15.1.5.1, during the period of suspension shall be borne by the Contractor.

15.1.5.3. The Contractor will be responsible for all of its costs due to the suspension and there will be no time extension to the Contract Time if the suspension is due to the failure of the Contractor to perform its contractual obligations, or other causes attributable to Contractor.

15.1.5.4 The Owner will compensate the reasonable costs incurred by Contractor if the suspension is due to causes other than the failure of the Contractor to perform his contractual obligations and such causes are attributable to Owner.

15.2 Owner May Terminate for Cause

15.2.1. The occurrence of any one or more of the following events will justify termination for cause:

15.2.1.1. Contractor's persistent or repeated failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under the Contract, as adjusted from time to time); or

15.2.1.2. Contractor's egregious disregard of Laws or Regulations of any public body having jurisdiction; or

15.2.1.3. Contractor's persistent or repeated disregard of the authority of Architect/Engineer, Owner or Owner's Representative; or

15.2.1.4. Contractor's persistent and repeated violation of any substantial provisions of the Contract Documents; and does not start curing and without interruption continues to cure same prior to termination.

15.2.1.5. Contractor is adjudged bankrupt, or is a party to a fraud; or

15.2.1.6. Contractor should make a general assignment for the benefit of his creditors; or

15.2.1.7. A receiver be appointed on account of the Contractor's insolvency; or

15.2.1.8. An attachment is made upon a substantial amount the Contractor's properties utilized to perform the Work, and it is not lifted, or the claim otherwise secured, within five (5) working days thereafter; or

15.2.1.9. Contractor persistently fails to make prompt payment to subcontractors, as per Article 6.21.2, or for materials, services, or labor already paid to Contractor by the Owner; or

15.2.1.10. Contractor abandons or discontinues the prosecution of the Work without Owner's written authorization.

15.2.1.10.1 Nevertheless, Contractor may discontinue the prosecution of the Work during: (i) Holy Thursday; (ii) the Friday after Thanksgiving; and (iii) the time period commencing on the Saturday before Christmas Day (December 25) and ending on the Sunday after Three Kings' Day (January 6) without incurring in an event of default due to discontinuance of the Work.

15.2.2. If one or more of the events identified in Article 15.2.1 occur, Owner may, after giving Contractor (and the surety, if any) seven (7) days written notice to cure such default, terminate the services of Contractor, exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools and appliances at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case, Contractor shall not be entitled to receive any further payment until the Work is finished.

15.2.3. In Lump Sum contracts, if the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor.

15.2.4. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Owner's Representative as to their reasonableness and, when so approved by Owner's Representative, incorporated in a Change Order or Extra Work Order. When exercising any rights or remedies under this paragraph Owner shall not be required to obtain the lowest price for the Work performed, but shall assume all reasonable means to complete the work at a reasonable cost.

15.2.5. When Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

15.2.5.1. Termination of the Contract, as stated above, will not release the Contractor of his responsibilities for the Work completed, nor shall said termination release surety from its obligations.

15.3 Owner May Terminate the Contract For Convenience

15.3.1. Upon seven (7) days written notice to Contractor and Architect/Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, elect to terminate the Contract for convenience.

15.3.2. After receipt of notice of termination for convenience from the Owner, the Contractor shall submit, within sixty (60) calendar days of the effective termination date, a Claim for compensation damages and/or costs. In such Claim, if presented, Contractor shall be paid, without duplication of any items, the following:

15.3.2.1. In lump sum contracts, the work performed and accepted by the Owner shall be paid in accordance with the schedule of values approved by the Owner.

15.3.2.2. The actual cost of all acceptable materials for which orders have been placed by the Contractor for use under this Contract, provided that, if required by the Owner, the Contractor shall make every reasonable effort to cancel such orders. If said orders can be canceled, the Owner shall pay for all restocking, or other charges, associated with said cancellation.

15.3.2.3. The actual cost of acceptable raw material ordered or purchased for fabrication, or materials already fabricated, whether those materials are located in the shop, the project, or in transit.

15.3.2.4. The actual amounts paid by the Contractor for construction equipment rentals up to the time of termination, plus any amounts accrued, or payable, under written contracts for the rental of such equipment. Contractor shall make every possible effort to cancel any such contracts. In the event that the rental contracts can be canceled by the Contractor, the Owner shall pay for all reasonable costs incurred directly caused by the rental cancellation. If the equipment is owned by the Contractor, he will be paid the cost (depreciation) of said equipment.

15.3.2.5. The actual costs disbursed by to the Contractor of bonds, insurance, taxes, and deposits required under the Contract, unless previously paid by Owner.

15.3.2.6. Contractor's overhead and profit in the amount equivalent to fifteen percent (15%) of all payments made under Articles 15.3.2.2 to 15.3.2.5.

15.3.2.7. Contractor shall exert his best effort to mitigate the costs mentioned in Articles 15.3.2.2 to 15.3.2.5.

15.3.2.7.1. From the total sum of all the costs indicated in Articles 15.3.2.2 to 15.3.2.6. there shall be deducted all payments therefore previously made and all proper charges to the Contractor in relation therewith.

15.3.3. In the event that the Work is suspended under Article 15.1, thereby stopped for a period of time, and after said suspension is cancelled, the amounts due to the Contractor under the Contract will be first calculated for the suspension period as per Article 15.1 hereunder and then calculated for the cancellation afterwards as per Article 15.3, hereunder. The total amount due the Contractor will be the sum of both.

15.3.4. If the Contract is terminated for convenience, the Owner shall assume all security, and insurance of the project on the effective date of the termination, or cancellation.

15.3.5. Termination of the Contract for convenience, as stated above, will not release Contractor from his responsibilities for the Work completed, nor shall it release his surety of its obligations.

15.3.6. Contractor shall not be entitled to payment on account of loss of anticipated or expected profits or revenues or other economic loss arising out of or resulting from such termination for convenience under this Article 15.3.

15.4 Contractor's Right to Terminate the Contract

15.4.1. The Contractor has the right to Terminate the Contract and recover from the Owner payment for all work executed as specified in Article 15.3.2, herein, if the Owner:

15.4.1.1. substantially stops the work for any reason whatsoever through no act, or fault, of the Contractor for a period of ninety (90) days starting from the written stoppage notice of the Owner and/or the Owner's Representative, or

15.4.1.2. fails to pay the duly approved Request for Payments within eighty (80) calendar days after the same was due.

15.4.2 The foregoing provisions are in addition to, and not in limitation of the rights of the Contractor under any other provisions of the Contract.

ARTICLE 16 - DISPUTE RESOLUTION

16.1 Disputes

16.1.1. In case of any timely Claim, Dispute or other matter involving the interpretation of the Contract Documents, a change in the Contract Sum, and or an Extension of Contract Time, and other matters in question arising out of, or relating to this Contract or the breach thereof, except for Claims which have been waived by the acceptance of final payment, shall be submitted to and decided first by the Owner's Representative as provided in Article 11.5.

16.1.2. If the Dispute submitted to the Owner's Representative as provided for in Article 11.5 is not decided by him within the thirty (30) day period established therein, the Claim shall be deemed rejected.

16.1.3. If the party establishing the Claim is not satisfied with the decision or automatic rejection by the Owner's Representative, the party will have fifteen (15) days to appeal the decision to the Chief of Construction, or equivalent division head, of the Owner.

16.1.4. The Chief of Construction shall have a period of thirty (30) days from the date of receipt of the notice of appeal during which he must render a decision.

16.1.4.1. However, if the Chief of Construction requires additional time to review the Claim, because of the nature or complexity of the Claim or if additional documents and/or information are needed from the Contractor to make a determination, the Chief of Construction shall submit, within five (5) calendar days of receipt of the notice of appeal, a written notice with an estimate of the additional time needed to review said claim and its justification. This additional time, shall not exceed thirty (30) days, unless more time is agreed upon by the parties.

16.1.4.2. If the Chief of Construction does not render a decision within the time allotted, including extensions, then the Claim shall be deemed rejected.

16.1.5. If the Contractor is not satisfied with the decision or automatic rejection by the Chief of Construction, the Claim shall be referred to the Owner and the Contractor. The parties will meet for negotiations within ten (10) working days of the notice of referral of said Claim. If the Dispute has not been resolved within thirty (30) days after said referral (which may be extended by mutual agreement) and subject to any rights to injunctive relief and unless otherwise specifically provided for herein, the parties shall proceed in accordance with Article 16.2.

16.1.6 Contractor shall carry on the Work and adhere to the progress schedule during all Disputes or disagreements with Owner. The Owner will continue making payments under the Contract for Work performed that is not in Dispute.

16.1.7. No Work shall be delayed or postponed pending resolution of any Disputes or disagreement unless Owner and Contractor otherwise agree in writing.

16.2 Remedies

16.2.1. All Disputes not resolved by the method indicated in Article 16.1, upon written agreement of the parties, shall be submitted to non-binding mediation as indicated in Article 16.3. Either party may, at any time, give written notice to the other party that it does not wish to mediate or to continue to mediate a Dispute. Such notice shall conclude the mediation process.

16.2.2. If the parties fail to agree to submit the Dispute to mediation, or one party decides to cancel the mediation after the mediation has started, or if the mediation process does not resolve all Disputed matters, then the remaining Disputes shall be decided by arbitration, upon timely demand for arbitration, notified by one party to the other within ten (10) days after the mediation process has concluded, if the amount of the claim does not exceed the limits established in Article 16.4.1. The mediation process shall conclude on the date notice is delivered by one party to the other stating that the party does not wish to mediate or to continue to mediate. Any undecided Disputes that exceed the limits established in Article 16.4.1, will be decided by the General Court of Justice of Puerto Rico.

16.3 Mediation

16.3.1. If the parties agree to mediate the Dispute they may chose between:

16.3.1.1. a mutually agreed mediation procedure; or

16.3.1.2. a mediation procedure under the supervision of the Bureau of Claim Resolution by Alternate Methods the Office of the General Court of Justice; or

16.3.1.3. a mediation procedure administered by the American Arbitration Association under its Construction Industry Mediation Rules.

16.3.2. All costs incurred as a result of the mediation shall be borne equally by the parties, unless the mediator orders otherwise in accordance to Article 16.3.4.

16.3.3. The parties will be required to exchange their positions as to the Dispute, fully and in good faith, with a detailed description of the facts and of the applicable law and shall fully exchange supporting documents. If after agreeing to mediate a Dispute a party is substantially unprepared to participate in the proceedings, or fails to participate in good faith, the Mediator at his discretion may require said party to pay all or part of the costs of the mediation incurred by the other party due to the non-compliance with this Article.

16.4 Arbitration

16.4.1. Dispules to be arbitrated shall be limited to those Disputes, which when all sums claimed therefore under the Contract are added, total an aggregate sum of five percent (5%) or less of the Contract Price or $500,000.00 or less, whichever is lower. Only such Disputes where the aggregate amount claimed is below said threshold shall be resolved through the arbitration procedures established in this Article 16.4. The aggregate sum shall be determined on the date of the notice of the demand for arbitration taking into consideration all pending Disputes regarding the Contract submitted by the Contractor pursuant to Articles 11.5 and 16. In order to qualify for resolution thru arbitration, all issues and Claims regarding liability and damages relating to a particular Dispute must be submitted together, within the same arbitration proceeding. The parties are specifically prohibited from submitting the issue of liability to arbitration and thereafter submitting the issue of damages (regarding the same Dispute) to another arbitration proceeding or to the court.

16.4.1.1. The $500,000.00 threshold will be adjusted every five (5) years. The adjustment will be based on the Consumer Price Index (CPI) published by the Government of Puerto Rico. The base year for such adjustment shall be the year 2010.

16.4.1.2. If Contractor invokes the provisions of this Article 16.4, but at a later date submits additional Claims to the Owner under the same Contract, pursuant to Article 11.5 and/or Article 16, for an additional sum which, if added to the amount claimed under the original Dispute(s), surpasses the threshold amount established in Article 16.4.1, then said additional Disputes that surpass the threshold may not be submitted to arbitration and shall be decided by the General Court of Justice of Puerto Rico. Nevertheless, the already pending arbitration proceedings under Article 16.4 shall continue until concluded. If additional Disputes are submitted after the arbitration proceedings are concluded and final award has been entered, then the amounts of the original Claims that were arbitrated and concluded shall not count towards the threshold stated in Article 16.4.1.

16.4.2. **Procedure For Binding Arbitration.**

16.4.2.1. Contractor shall submit to the Owner, together with the notice of demand for arbitration of a Dispute, a list of no less than five (5) proposed arbitrators, together with their respective curriculum vitae and a disclosure statement from each as to possible conflicts of interest.

16.4.2.2. Within five (5) working days of receipt of the notice of demand for arbitration, Owner shall either: (i) select one (1) arbitrator from the Contractor's list, or (ii) if all arbitrators proposed by Contractor are unacceptable to Owner, submit to Contractor a list of no less than five (5) proposed arbitrators, together with their respective curriculum vitae and a disclosure statement from each as to possible conflicts of interest.

16.4.2.3. Within five (5) working days of receipt of the Owner's list, contractor shall either: (i) select one (1) arbitrator from such list or (ii) reject all arbitrators from the Owner's list. If within the following ten (10) days the parties cannot agree as to an arbitrator or a panel of arbitrators, then each party within the following five (5) days will unilaterally appoint and notify to the other one arbitrator, and the two (2) arbitrators so appointed shall within ten (10) days after the appointment of both arbitrators select a third arbitrator and notify the Owner and the Contractor of said selection, and the three (3) arbitrators shall constitute the panel of arbitrators that shall decide the Dispute. The arbitrators so appointed or selected need not be on the original lists of arbitrators. Within ten (10) days of the selection of the third arbitrator, each arbitrator shall notify Owner and Contractor their respective curriculum vitae and statement as to possible bias or conflict of interest.

16.4.2.4. The arbitration proceedings shall be conducted under the provisions of the Puerto Rico Arbitration Act, Act No. 376 of May 8, 1951, as amended.

16.4.3. **Award**

16.4.3.1. The award entered need not include written determinations of fact and conclusions of law and the award shall be final and not be reviewable or appealable due to errors of fact or of law. Nevertheless, the arbitrators will endeavor to ascertain the facts and follow the law.

ARTICLE 17 -MISCELLANEOUS

17.1 **Governing Law.** The Contract Documents, and all questions relating to their validity, performance, interpretation and enforcement, shall be governed by and construed in accordance with the laws of the

Commonwealth of Puerto Rico. Any legal action brought concerning the above shall be brought in accordance with the contract and thereafter exclusively in the courts of the Commonwealth of Puerto Rico.

17.2 Federal Funds

17.2.1. When the United States government or any of its agencies finances or pays for all or any portion of the cost of the Work, federal laws and the applicable rules and regulations must be observed by the Contractor. The Owner will identify in the bid documents the program providing such funds.

17.2.2. If the Contract Documents include a specific provisions issued by such federal funding agency in case of conflict with other provisions of the Contract Documents, said federally issued provisions shall govern.

17.2.3. Unless specified elsewhere in the Contract Documents, the funding federal agency is not a party to this Contract.

17.2.4 When the United States government funds Work covered by the Contract Documents, the Work shall be under the supervision of the Owner but subject to the inspection by the appropriate Federal agency and in accordance with the applicable Federal statutes and rules and regulations.

17.2.4.1. Such inspection shall in no way make the Federal Government a party to this Contract and will in no way interfere with the rights of either party hereunder.

17.2.4.2. The Contractor shall extend the same courtesies to the representatives of the Federal government as required to be extended to representatives of the Commonwealth government.

17.3 Notice

17.3.1. Unless otherwise specified in the Agreement or in the Contract Documents, written notice shall be deemed to have been duly served if delivered:

17.3.1.1. to Contractor if delivered in person to the individual, to a member or partner of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

17.3.1.2. to Owner if delivered in person to the Owner's Representative or to the Project Inspector; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice with the requirements established in Article 17.3.2.

17.3.2. All notices whereby a consent, approval or action is required to be performed by the recipient within a specific period shall include, in bold and capitalized font, at the top of the transmittal communication the following legend: "IMPORTANT RIGHTS MAY BE LOST BY FAILURE OF [NAME OF PARTY] TO ACT PROMPTLY. SPECIFIC ACTION(S) AND/OR APPROVAL(S) ARE HEREIN REQUESTED. IN CASE OF AUTOMATIC APPROVAL DUE TO FAILURE TO ACT BY THE RECIPIENT THE NOTICE MUST STATE: THIS SUBMISSION WILL BE DEEMED APPROVED _____ BUSINESS DAYS AFTER RECEIPT BY [NAME OF PARTY] IF REJECTION IS NOT NOTIFIED TO [NAME OF SENDER]."

17.4 Computation of Time. When a period of time is to be computed for any purposes under the Contract Documents, the number of days within such period will exclude the first and include the last day. If the last day of

any such period falls on a Saturday, a Sunday or on a Holiday listed in Article 1.1.1.41, such day will be excluded from the computation.

17.5 Ownership of Documents. Any reports, information, findings, data, or any other documents prepared or assembled by the Contractor regarding the Contract will be the sole property of the Owner and shall not be made available by Contractor to any individual or organization without the prior written approval of the Owner, unless required by court order.

17.6 Personal Liability of Public Officials. In exercising rights or carrying out duties under the Contract, the Owner's Representative, the Contracting Officer, and their authorized representatives shall not be personally liable, it being understood that they act as the agents and representatives of Owner.

17.7 No Waiver of Legal Rights

17.7.1. In Unit Price Contracts, the Owner shall not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the Work (and payment made therefore), from showing the true amount and character of the Work performed and materials furnished by the Contractor, nor from showing that any such measurement, estimate or certificate is untrue or is incorrectly made, nor from showing that the work or materials do not in fact conform to the Contract.

17.7.2. The Owner shall not be precluded or stopped, notwithstanding any such measurement, estimate or certificate and payment in accordance therewith, from recovering from the Contractor or his sureties, or both, such damage as Owner may have sustain by reason of his failure to comply with the terms of the Contract. Neither the acceptance by the Owner or any representative of the Owner nor any payment for or acceptance of the whole or any part of the Work, nor any extension of time, nor any possession taken by the Owner, shall operate as a waiver by Owner of any right hereunder.

17.7.3. A waiver by the Owner, or Contractor, of any breach of the Contract shall not be held to be a waiver as to any other breach.

17.7.4. The Contractor, shall be liable to the Owner for latent defects, fraud, (or such gross mistakes as may amount to fraud), and every contractual warranty or guaranty.

17.8 Cumulative Remedies. The duties and obligations imposed by these General Conditions and the rights and remedies available thereunder are in addition to, and are not to be construed in any way as a limitation of any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this Article will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.9 Successors and Assigns. The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due or to become due to him hereunder, without the previous written consent of the Owner.

17.10 Survival of Obligations. All representations, indemnifications, warranties, and guarantees made in,

required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work and termination or completion of the Agreement.

17.11 **Language.** These Uniform General Conditions were enacted by the Secretary and approved by the Governor of Puerto Rico in the English language, according to the Legislative authorization found in Law No. 1 of January 28, 1993.

17.12 **Amendments.** These Uniform General Conditions shall be amended whenever the Secretary deems it necessary in order to fulfill its purpose.

PART C. ADDITIONAL PROVISIONS

ARTICLE 1: SEPARABILITY CLAUSE; EFFECTIVENESS

1.1 **Separability Clause.** If any provision authorized in these regulations is declared unconstitutional or void by a Court of Competent jurisdiction, the remaining provisions of this Uniform General Conditions shall continue in effect.

1.2 **Effectiveness.** These Uniform General Conditions shall enter into effect thirty (30) days after having been filed and enacted by the Department of State, except with regard to Contracts whose Contract Price is paid by one or more Federal Agency in which case these Uniform General Condition, with regard to such Contracts, shall enter into effect immediately after said Federal Agencies, which provide such funds, consent in writing to their use as part of the Contract Documents. At the time of said effectiveness and from that moment forward, general conditions used and issued by a government agency, department, public corporation and instrumentality, may no longer be validly incorporated in Contracts for public works, with the exception of these Uniform General Conditions.

APPROVED ON February 22, 2011, IN SAN JUAN, PUERTO RICO.

Eng. Rubén Hernández Gregorat, MEM, PE
Secretary
Department of Transportation and Public Works

GOVERNMENT OF PUERTO RICO

CERTIFICATION

Pursuant to Article 1 of law No. 198 of May 15, 1943, as amended, and Article 1 of Law No. 1 of January 28, 1993, I hereby approve these Uniform General Conditions for Public Contracts of the Government of Puerto Rico, as prepared in the English language by the Secretary of Transportation and Public Works and submitted for my consideration on September 14, 2010.

In San Juan, Puerto Rico, this 15th day of October, 2010.

Luis G. Fortuño
Governor

La Fortaleza, San Juan, PR 00901 * PO Box 9020082, San Juan, PR 00902-0082
Tel: (787) 721-7000 * Fax: (787) 722-4300

GOVERNMENT OF PUERTO RICO

CERTIFICATION

Pursuant to Law No. 198 of May 15, 1943, as amended, and Law No. 1 of January 28, 1993 and after compliance with the Puerto Rico Uniform Administrative Procedure Act, Law No. 170 of August 12, 1988, as amended, I hereby approve the final version of the Uniform General Conditions for Public Contracts of the Government of Puerto Rico, as prepared by the Secretary of Transportation and Public Works and submitted for my consideration on February 22, 2011.

In San Juan, Puerto Rico, this 23rd -day of February of 2011.

Luis G. Fortuño
Governor

MAGR.

Exhibit J
CONDICIONES ESPECIALES SUPLEMENTARIAS

REPARACIONES GENERALES
Nueva Urbana de Ciales, Ciales, Puerto Rico - Proyecto (18291)
Jaime Coira Ortiz, Ciales, Puerto Rico - Proyecto (17889)
OMEP/DEPR

I. DISPOSICIONES PARA EL PROCESO DE SUBASTA Y ADJUDICACIÓN DE CONTRATO:

A. Cada licitador deberá someter su propuesta digitalmente al correo electrónico: omepcentralcompras@de.pr.gov, el día 27 de septiembre del 2022 antes de las 11:59 pm.

B. Cada licitador cotizará un precio alzado por todos los trabajos incluidos como parte de este contrato, según solicitado en el formulario de propuesta provisto (**EXHIBIT A**). Se requiere además que cada licitador someta, para el acto de apertura de esta subasta, todos los precios solicitados en el formulario de desglose de costo (**EXHIBIT A**), **así como el itinerario de progreso solicitado. La entrega de dichos formularios debidamente completados en todas sus partes, junto con el itinerario antes mencionado, será requerida para el proceso de evaluación de la subasta,** por lo que no someter estos documentos podría conllevar el considerar su propuesta como una no-responsiva para efectos de dicha evaluación.

C. Cada licitador deberá verificar, con la oficina de finanzas o la dependencia municipal autorizada, la aplicabilidad del pago de los arbitrios y patentes municipales de este proyecto, para incluir el costo correspondiente a los mismos como parte de su propuesta base (*Base Bid*). **De no ser aplicable el pago por dichos arbitrios o patentes,** el Contratista (licitador al cual se le adjudique el contrato) deberá proveer la documentación correspondiente de parte del municipio (certificando la no-aplicabilidad de estos)**, como requisito para proceder con el pago del retenido.**

D. Se requiere que para propósitos de su propuesta base (*Base Bid*), se coticen equipos, materiales, piezas o productos con iguales características (*approved equal*) a los especificados en los documentos del proceso competitivo, según sea el caso. Si el licitador agraciado desea solicitar algún cambio luego de su contratación, el mismo podrá realizarse mediante una solicitud de sustitución (*Request for Substitution - RFS*).

E. Cada licitador deberá considerar en su propuesta base (Base Bid) todas las condiciones existentes en el proyecto, así como todas las particularidades que presenta el sitio (site) en donde se llevarán a cabo los trabajos incluidos en este proyecto.

F. La OMEP/PRDE tiene la intención de adjudicar el contrato al licitador mejor calificado que haya cotizado el precio alzado más bajo por todos los trabajos incluidos en el mismo, según solicitado en el formulario de propuesta correspondiente, y cuya oferta cumpla con todos los requisitos, especificaciones, términos y condiciones establecidas en los documentos del proceso competitivo. **Sin embargo, la OMEP/DEPR se reservará el derecho de adjudicar dicho contrato considerando además los siguientes criterios:**

1. **Desglose de Costos: Costo total de cada partida incluida en este contrato,** según solicitadas como parte de su propuesta para esta subasta.

2. **Experiencia del licitador: Cada licitador deberá tener, como mínimo, cinco (5) años de experiencia en** proyectos de construcción, rehabilitación y/o mejoras a edificios, escuelas o instalaciones gubernamentales que se mantengan en uso durante el desarrollo de dichos trabajos, presentando evidencia de dicha experiencia como parte del formulario Exhibit B. **Es requisito fundamental que cada licitador incluya** tanto la experiencia de la compañía (como empresa) como la de sus representantes y oficiales principales, en los trabajos antes mencionados, así como referencias del personal de contacto (nombre, puesto y números de teléfono) en otras agencias de gobierno, corporaciones públicas o empresas privadas con las cuales el licitador haya establecido una relación contractual para realizar proyectos de rehabilitación, reparaciones o mejoras similares a las antes mencionadas..

3. **Solvencia Económica: Capacidad financiera**, de acuerdo con lo dispuesto en la evaluación técnica realizada por la OMEP/DEPR, la cual se basa en la información suministrada en el Estado Financiero Auditado sometido por el licitador.

4. **Personal Técnico: Experiencia y cualificaciones del personal técnico y administrativo** de la empresa en proyectos de construcción, rehabilitación y/o mejoras a instalaciones físicas en uso, presentando evidencia de lo antes requerido como parte del Exhibit B.

5. **Equipo Adecuado: Es requisito fundamental que cada licitador incluya un resumen del inventario de herramientas, materiales y equipo disponible** para realizar los trabajos incluidos en este contrato, presentando evidencia de lo antes requerido como parte del formulario corresponde.

6. **Comportamiento del Licitador en Proyectos Contratados por la OMEP/DEPR (si alguno)**.

7. **Cumplimiento cabal con la entrega de todos los documentos** y con todos los requisitos solicitados para la apertura de esta subasta.

G. OMEP/DEPR se reserva el derecho de:

1. **Adjudicar dicho contrato a** cualquiera de los subsiguientes postores (restantes licitadores participantes en la subasta) que hayan cumplido con todos los requisitos, especificaciones, términos y condiciones establecidas en el Pliego y sus anejos, bajo las condiciones más favorables para la OMEP/DEPR y en beneficio y conveniencia del mejor interés público, si la licitación con el costo más bajo propuesto ha sido rechazada por incumplimiento en someter la información requerida o en el análisis de dichos documentos.

2. **Rechazar cualquier oferta de los licitadores** que no cumpla con las especificaciones, términos, condiciones e instrucciones de esta subasta o cuando la misma esté condicionada.

3. **Cancelar la adjudicación de cualquier contrato** en cualquier momento antes de la firma de este sin que medie responsabilidad alguna para la OMEP/DEPR.

H. Aunque las Condiciones Generales Uniformes (Uniform General Conditions for Public Works Contracts in Puerto Rico) incluyen en su portada el logo del Departamento de Transportación y Obras Públicas (DTOP), se aclara que las disposiciones contenidas en las mismas aplican, por ley, a todos los proyectos propuestos por agencias y corporaciones públicas del gobierno del Estado Libre Asociado de Puerto Rico

I. El Contratista deberá cumplir con las disposiciones de la Orden Ejecutiva establecida en el Boletín Administrativo OE-2021-023 (Orden Ejecutiva para aumentar el salario mínimo de los trabajadores en proyectos de construcción sufragados con fondos públicos federales de reconstrucción y para derogar los Boletines Administrativos oe-2018-033 y OE-2020-075.

II. DISPOSICIONES RELACIONADAS AL DESARROLLO DEL PROYECTO:

A. Documentación y Procedimientos:

1. **El licitador a quien se le adjudique la buena pro deberá proveerle a la OMEP/DEPR, no más tarde de la fecha de otorgamiento del Contrato**, las fianzas para el pago de sus obligaciones y el cumplimiento fiel del mismo.

2. **Todo cambio que surja durante la ejecución de los trabajos incluidos en contrato,** por recomendación del Contratista o mediante una solicitud formal a la OMEP/DEPR a través de su representante designado o a través del supervisor del proyecto, **deberá informarse por escrito** mediante carta firmada por el Contratista, con la recomendación y la aprobación de la OMEP/DEPR.

3. **Cualquier duda o desacuerdo que tenga el Contratista, deberá dejarlo saber en correspondencia escrita a la OMEP/DEPR.**

4. **Se recuerda que la calidad de los trabajos realizados por los sub-contratistas (si alguno) será responsabilidad del contratista general.** Cualquier diferencia relacionada con estos trabajos, sólo se discutirá con este último, a menos que la OMEP/DEPR considere necesario y conveniente incluir a los sub- contratados por el mismo en dicha discusión.

5. **Se aclara al Contratista que** las extensiones de tiempo de ejecución (*time for completion*) para el proyecto, **que sean solicitadas por motivos de lluvia o inclemencias del tiempo, deberán estar debidamente documentadas y aprobadas** por el representante designado de la OMEP/DEPR, acompañando dicha solicitud con evidencia de la cantidad de lluvia caída en el área donde ubica la Escuela. Para situaciones atmosféricas tales como tormentas, huracanes u otros sucesos extraordinarios, el Contratista someterá a la OMEP/DEPR, por escrito, un plan de emergencia para su evaluación y aprobación.

6. **Para propósito del itinerario del proyecto y del desglose detallado de costos para fines de pago** *(progress schedule and breakdown far payment),* respectivamente, el Contratista podrá considerar hasta un máximo de tres (3) días de "clima severo e inusual" *(severe unusual weather)* por mes. **En ninguna circunstancia se debe considerar este periodo como una extensión automática al tiempo de construcción.**

7. **Se recuerda que la OMEP/DEPR retendrá el diez por ciento (10%) de todas las certificaciones parciales de pago** hasta tanto el Contratista alcance un cincuenta por ciento (50%) de obra terminada y certificada por la propia OMEP/DEPR. Una vez el proyecto supere dicho por ciento de terminación, la OMEP/DEPR se reservará el derecho de continuar o descontinuar dicha retención en las certificaciones subsiguientes. **Esta condición enmienda lo estipulado** en los Artículos13.2.2.1.1 y 13.2.2.1.1.1 de las Condiciones Generales Uniformes (*Uniform General Conditions for Public Works Contracts in Puerto Rico*).

8. El Contratista será responsable de llevar a cabo todos los trabajos incluidos en el proyecto en estrecha coordinación con los funcionarios designados como representantes de la OMEP/DEPR para este proyecto. **Se recuerda que en este proyecto habrá presencia de personal de la OMEP/DEPR inspeccionando y coordinando todas las labores a ser realizadas en la Escuela como parte del proyecto.**

B. <u>Servicios e Instalaciones Existentes</u>:

1. **El Contratista será responsable de verificar en sitio y confirmar**, con el representante designado de la OMEP/DEPR para este proyecto, los siguientes aspectos relacionados con estos trabajos:

    1. **Dimensiones de las áreas** del sitio (*site*) y de las áreas interiores de los edificios de la Superintendencia en donde se realizarán los trabajos incluidos en contrato, así como los materiales, herramientas y equipos necesarios para realizar dichos trabajos.

2. **Ubicación exacta de** la infraestructura existente para el sistema de drenaje pluvial en las áreas de techo del edificio y las áreas del solar impactadas por los trabajos incluidos en contrato.

3. **Ubicación, características y condiciones existentes** de los equipos del sistema de ventilación a ser reemplazados como parte de este contrato.

4. **Ubicación exacta, características y capacidad de carga de** los paneles, equipos y utilidades existentes del sistema de distribución de electricidad, disponibles para energizar las luminarias propuestas para las áreas interiores de la Escuela.

2. De surgir alguna discrepancia entre la infraestructura existente a permanecer y las nuevas instalaciones, unidades o equipos propuestos, el Contratista será responsable de discutir y aclarar la misma con el representante designado de la (OMEP/DEPR), antes de tomar cualquier decisión. **El Contratista <u>NO</u> realizará trabajo alguno que considere adicional al contrato sin la autorización previa, p<u>or escrito</u>, de OMEP/DEPR.**

3. El Contratista deberá coordinar, con el representante designado de la OMEP/DEPR para el proyecto, **el uso de las instalaciones existentes para los servicios sanitarios (baños) y los servicios de energía eléctrica y agua potable** que considere necesarios para la realización de los trabajos incluidos en el proyecto.

C. <u>Cumplimiento con Códigos</u> y <u>Reglamentos</u>:

1. Todo proponente deberá incluir las siguientes cualificaciones ambientales junto a cada propuesta:

1. Certificación de Plomo de la EPA -Lead EPA RRP (Renovation, Reparation and Paint).

2. Evidencia de certificación en Manejo de Plomo 2 horas (Two hours course of Asbestos Awareness)

3. Evidencia de certificación Manejo de seguridad en manejo de hongo- (Two hours course of safety Mold Awareness).

4. Certificación de 30 horas OSHA (General o construcción) del supervisor designado por el contratista. Plan de seguridad específico al alcance de trabajo del proyecto.

2. Las medidas o especificaciones establecidas como *estándares* en reglamentos y códigos vigentes al momento de la firma del contrato, según el uso y aplicación, deberán predominar siempre sobre lo indicado en los Documentos de Contrato, a menos que se especifique lo contrario en los mismos. De especificarse lo contrario, el Contratista deberá confirmar dicha información con el inspector del proyecto y/o representante designado de la OMEP/DEPR para estos trabajos.

3. **Se recuerda que todos los trabajos incluidos en este contrato tendrán que realizarse en conformidad con** todos los códigos, reglamentos y/o resoluciones vigentes que sean aplicables a los mismos, establecidas por las entidades profesionales autorizadas (ACI, ASTM, ASHRAE, NEC, NEMA, etc.), por la Oficina de Gerencia de Permisos y Endosos (OGPE) y por todas las Agencias Gubernamentales Reguladoras del Estado Libre Asociado de Puerto Rico y del Gobierno Federal de los Estados Unidos de Norteamérica con injerencia en dichas actividades..

4. **Se recuerda que tanto las especificaciones técnicas como las hojas de datos provistas como parte de los documentos del Pliego han sido sometidas como referencia con la intención de establecer estándares mínimos de calidad en productos, materiales y métodos o procedimientos de aplicación e instalación.** Los estándares, reglamentos y códigos mencionados en las mismas podrían estar caducados, por lo que cada licitador será responsable de considerar en su propuesta las disposiciones y estándares establecidos en la versión más actualizada de los códigos y reglamentos vigentes (IBC-2018) al momento de someter su cotización.

5. **El Contratista proveerá e instalará** todos los refuerzos estructurales, soportes y anclajes requeridos por los códigos de construcción vigentes (aplicables a estos trabajos), aunque los mismos no se encuentren ilustrados en los planos. Además, el Contratista proveerá e instalará todo alambrado o dispositivo eléctrico y toda conexión mecánica/eléctrica que sea necesaria para que las nuevas unidades de aire acondicionado (si alguna) y las luminarias o equipos eléctricos a ser instalados puedan entrar en operación adecuadamente y la facilidad pueda operar funcionalmente, sin incurrir en costos adicionales, en cumplimiento con todos los códigos aplicables y con la aprobación y aceptación por parte de la OMEP/DEPR. **Esta disposición se mantendrá vigente, aunque cualquiera de los equipos, dispositivos o materiales antes mencionados no haya sido indicado en especificaciones o como parte del alcance del proyecto.**

6. **La OMEP/DEPR se reservará el derecho de requerir al Contratista el sometimiento de literatura, especificaciones o cualquier otra información técnica adicional de las unidades de ventilación y de los equipos eléctricos y mecánicos** que se proponga proveer e instalar en el proyecto, con el fin de evaluar los mismos y someter su correspondiente aprobación como parte de los trabajos incluidos en este contrato.

7. **De surgir alguna discrepancia entre lo existente, lo indicado en los planos de referencia y lo dispuesto en las especificaciones técnicas, anejos o cualquier otro Documento del Pliego** en relación con algún tipo de producto, material, equipo o trabajo especificado, el Contratista deberá considerar que siempre prevalecerán los requisitos y condiciones más restrictivas, incluyendo mayor cantidad y calidad de productos, materiales, accesorios y equipo, mayor nivel de seguridad y el trabajo más complejo o exigente.

8. **La OMEP/DEPR se reservará el derecho de solicitarle al Contratista,** en el momento que así lo considere oportuno y a través de su representante designado**,** la entrega de una certificación en donde se especifique que todos los productos a ser utilizados en el proyecto, así como todos los nuevos materiales provistos e instalados como parte de los trabajos propuestos (incluyendo aquellos instalados en sustitución de materiales existentes a ser removidos), **se encuentran libres de contenido de asbesto y plomo.**

D. Seguridad en la Ejecución de los Trabajos:

1. **El Contratista será responsable de tomar todas las medidas necesarias para proteger las instalaciones o utilidades existentes (a permanecer)** en las áreas afectadas por el desarrollo de la obra y de realizar las reparaciones a aquellas instalaciones o utilidades que sufran daños o sean averiadas por causa de los trabajos o actividades relacionadas al proyecto, según requerido por el representante designado de la OMEP/DEPR. Cualquier ruptura de tuberías, de infraestructura mecánica o de utilidades eléctricas, causada por los trabajos incluidos en este contrato, deberá ser reparada inmediatamente de forma tal que los servicios afectados por dicha condición sean re-establecidos a la mayor brevedad. De no cumplir con lo antes mencionado, la OMEP/DEPR evaluará posibles sanciones económicas a ser reclamadas al Contratista.

2. **El Contratista deberá tomar todas las medidas necesarias para evitar:**

   a. **La propagación de polvo fugitivo** procedente de actividades de remoción selectiva y de acarreo de materiales o escombros, en estricto cumplimiento con las disposiciones establecidas en el **Reglamento para el Control de Contaminación Atmosférica** de la Junta de Calidad Ambiental (JCA) y la reglamentación federal aplicable.

   b. **La utilización de materiales y equipo** que emitan gases y/o residuos tóxicos al ambiente, en estricto cumplimiento con las disposiciones establecidas en el **Reglamento para el Control de Contaminación Atmosférica** de la Junta de Calidad Ambiental (JCA) y la reglamentación federal aplicable.

   c. **La propagación de ruidos** procedentes de las áreas afectadas por los trabajos incluidos en contrato, que excedan los niveles máximos de ruido permitidos por ley, de acuerdo con las disposiciones establecidas en el **Reglamento para el Control de Contaminación por Ruidos** de la Junta de Calidad Ambiental (JCA) y la reglamentación federal aplicable.

d. **La realización de cualquier actividad** que pueda afectar adversamente la salud de los agentes y empleados civiles que laboran en estas instalaciones, así como la salud de los visitantes de la Superintendencia y los residentes de las comunidades aledañas a la misma, en cumplimiento con todas las leyes y reglamentos ambientales, estatales y federales, que sean aplicables. Es de notar que cualquier multa de OSHA notificada a la OMEP/DEPR , como consecuencia, motivada, o relacionada con la conducta del Contratista por trabajos relacionados a este proyecto, **será de la entera responsabilidad de éste. El Contratista será responsable además** del reembolso de los gastos incurridos por OMEP/DEPR en la defensa correspondiente al proceso de apelación de dicha multa.

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3. **El Contratista será responsable de** tomar todas las medidas necesarias para garantizar la seguridad de los agentes, empleados y visitantes en las áreas de las áreas afectadas por los trabajos incluidos en contrato. **De igual forma, el Contratista será responsable de coordinar, con el representante designado de la OMEP/DEPR,** todo lo relacionado con el área de almacenaje de materiales y equipos dentro del sitio del proyecto y todo lo relacionado con la seguridad necesaria para proteger los equipos o materiales almacenados en el mismo, durante el tiempo de ejecución del proyecto.

4 **El Contratista deberá coordinar todas las medidas de seguridad que estime necesarias para delimitar y rotular** las áreas impactadas por los trabajos incluidos en este contrato, así como las áreas dispuestas para almacenaje de materiales y equipos, **de forma tal que se pueda restringir el acceso** a las mismas de empleados civiles no-autorizados, visitantes u otras personas ajenas al proyecto, durante el desarrollo de la obra.

E. <u>Limpieza</u> y <u>Disposición de Materiales</u> y <u>Equipos</u>:

1. **El Contratista deberá proveer el contenedor, camión o medio de almacenamiento y transporte adecuado para disponer, de forma inmediata, de toda la basura, chatarra o escombros que se generen como consecuencia de los trabajos incluidos en contrato**. <u>**No**</u> se permitirá utilizar los contenedores de basura existentes en las instalaciones de la Comandancia para estos fines. **El Contratista coordinará, con el representante designado de la OMEP/DEPR, la ubicación final de los contenedores a utilizarse para dichos fines, así como el horario apropiado para su vaciado.**

2. **Toda la basura, escombros o residuos de materiales removidos deberán ser dispuestos adecuadamente con su contenido por el Contratista** (en un vertedero o lugar autorizado para dicha actividad), de forma tal que, de ser tóxicos o contaminantes, se cumpla con todas las leyes y reglamentos ambientales (estatales y federales) aplicables a estas actividades. **Recae como responsabilidad del Contratista el identificar el contenido del material y disponer del mismo adecuadamente, presentando como evidencia el manifiesto de disposición en original.**

3. **Se aclara que el Contratista no podrá disponer adecuadamente de unidades o equipos del sistema de ventilación** (a ser removidos como parte de este contrato), hasta tanto los técnicos de la OMEP/DEPR seleccionen aquellos dispositivos, materiales o piezas que desean retener en inventario para su re-utilización. **La selección y retención de piezas, dispositivos o materiales para dichos fines podrá ocurrir hasta el día en que el Contratista remueva la unidad o equipo mecánico a ser dispuesto.**

4. **Se aclara que el remanente de la unidad o equipo del sistema de ventilación, así como todos los materiales o piezas en metal que sean removidas** y no vayan a ser reutilizadas por parte de la OMEP/DEPR, serán transportadas por el Contratista a un centro autorizado de reciclaje para su entrega y venta correspondiente. Los recaudos obtenidos por dicha transacción serán devueltos mediante cheque o giro postal a favor de la OMEP/DEPR (entregado directamente a la Oficina de Tesorería), acompañando el pago con una carta que indique el proyecto de procedencia, la región a la cual pertenece el mismo OMEP/DEPR), la razón para la devolución y la cantidad del importe o recaudo. La OMEP/DEPR requerirá además una copia en original del recibo provisto por el centro de reciclaje, como evidencia de la realización del proceso de compraventa antes mencionado.

5. **Se recuerda que el Contratista será responsable de** mantener diariamente todas las áreas de trabajo limpias y libres de basura o escombros, antes de completar su jornada laboral.

F. Horarios de Trabajo:

1. **El Contratista deberá coordinar,** con el funcionario designado como representante de la OMEP/DEPR (supervisor o coordinador del proyecto), **el horario más apropiado (fuera de horas laborables) para realizar los siguientes trabajos:**

    a. **Trabajos que requieran demolición parcial de** elementos estructurales en acero u hormigón (si alguno), demolición parcial de paredes en bloque y/o reemplazo de ventanas, a realizarse en las áreas afectadas por los trabajos incluidos en este contrato.

    b. **Trabajos de acarreo e instalación de unidades de ventilación o** equipos mecánicos/eléctricos que requieran el uso de grúas ubicadas dentro de los predios de la Escuela.

    c. **Trabajos que requieran la desconexión** del suministro total o parcial del servicio de electricidad en instalaciones de la Escuela que no formen parte de los trabajos incluidos en este contrato.

    d. **Transporte y movimiento de materiales** y equipo en los ascensores de carga o cualquier otro ascensor ubicado en dichas instalaciones.

e. **Acarreo y disposición de** basura, chatarra o escombros generados por actividades de remoción o demolición.

De ser necesario realizar alguno de estos trabajos durante horas laborables o durante el horario de operaciones de la Escuela, los mismos deberán estar coordinados y autorizados (por escrito) por el representante designado de la OMEP/DEPR para este proyecto**.**

2. **Con la excepción de los trabajos indicados en la nota anterior** todas las restantes tareas a ser realizadas por el Contratista como parte del alcance (*scope*) de este proyecto podrán llevarse a cabo durante horas laborables (según definidas en las Condiciones Generales Uniformes (*Uniform General Conditions for Public Works Contract*) o durante el horario de operaciones de la escuela **siempre y cuando las mismas no interrumpan o interfieran** con las labores y los servicios que se brindan en estas instalaciones.

3. **Se dispone que, en aquellas áreas interiores de la Escuela que se encuentren completamente desocupadas,** el Contratista podrá realizar trabajos incluidos en el alcance *(scope)* de este proyecto durante horas laborables (según definidas en las Condiciones Generales Uniformes *(Uniform General Conditions for Public Works Contract),* **sin** las restricciones mencionadas en las notas I y 2 de este Inciso "F" y en estrecha coordinación con el representante designado de la OMEP/DEPR para este proyecto.

4. **Se recuerda que de ser necesario realizar cualquier trabajo incluido en contrato,** fuera de horas laborables, en días feriados, en fines de semana, o durante cualquier otro periodo de receso de labores decretado por el Gobernador del Estado Libre Asociado de Puerto Rico o el director ejecutivo de la OMEP/DEPR, **el mismo deberá estar coordinado y autorizado (por escrito) por el representante designado de la OMEP/DEPR para este proyecto**.

G. Instalaciones Temporeras:

1. **Se aclara que la OMEP/DEPR le requiere al Contratista la instalación de una oficina temporera de inspección.** A lo mínimo debe incluir lo siguiente:
   a. Un área mínima de 100 pies cuadrados de espacio accesible, incluyendo una puerta con cerradura, adecuadamente iluminada, con servicio eléctrico y receptáculos para equipo de oficina.
   b. Un escritorio y una silla, una mesa de aproximadamente 3’ x 6’, un archivo de 4 gavetas con cerradura, estante vertical para planos y fotocopiadora compartida.
   c. Aire acondicionado, enchufes eléctricos de 110 V y servicio/conexión compartida a Internet según requerido.
   d. Acceso a agua potable y servicios sanitarios.

III. DISPOSICIONES TÉCNICAS PARA LOS TRABAJOS INCLUIDOS EN CONTRATO:

A. Trabajos Civiles y Arquitectónicos:

1. **El Contratista (Design/Builder) deberá reparar todas las grietas identificadas** *(Ubicación de Grietas en Superficies a Repararse)* de acuerdo con las instrucciones del equipo de diseño del proyecto.

2. **Los trabajos para la instalación del techo** de metal requieren de instalación de tubos 4"x4" como base en las columnas y purlins no menores de 6", de acuerdo con la separación de las columnas. Los paneles del techo en metal serán en zinc, gauge 24 (mínimo), pintado y asegurado con tensores como refuerzo adicional. Además, el Contratista entregará un dibujo de taller *(shop drawing)* para la aprobación de la OMEP/DEPR, cumpliendo con todos los estándares, códigos y reglamentos vigentes que sean aplicables a dicha estructura.

3. **El Contratista proveerá e instalará cerámicas de piso y pared** en varios baños, seleccionando colores similares a los existentes (en caso de no encontrar cerámicas iguales a las instaladas en sitio). El ingeniero del proyecto podrá intervenir en la selección de las nuevas losas que sustituirán a las existentes, con el propósito de crear un diseño armonizado.

4. **El Contratista será responsable de desarrollar documentos de construcción estampados por un profesional de diseño licenciado especificando el método de reparación y uso de materiales apropiados para ejecutar todas las reparaciones en el alcance de trabajo del proyecto.**

5. **De ser requerido por el representante designado de la OMEP/DEPR, el Contratista deberá remover temporeramente,** aquellas tuberías, duetos u otros componentes o equipos del sistema de aire acondicionado, así como todo equipo de comunicaciones (antenas, cableado de TV, etc.) y utilidades del sistema eléctrico (paneles, conductos, cables, etc.) que se encuentren en plena operación (en uso) y anclados a las superficies de los techos y parapetos, previo a la realización de los trabajos incluidos en este contrato. Luego de completados dichos trabajos, el Contratista deberá reinstalar todos los componentes y equipos en la misma ubicación en que se encontraban originalmente. **Tanto la remoción como la reinstalación de dichos equipos y componentes deberán realizarse en coordinación con OMEP/DEPR y en cumplimiento con las directrices del representante designado de la OMEP/DEPR para este proyecto.**

6. **El Contratista deberá tomar todas las medidas que sean necesarias o** requeridas para proteger las superficies de los techos que queden expuestas durante los trabajos con el objetivo de prevenir filtraciones de agua a las áreas interiores del edificio durante periodos de lluvia u otros sucesos imprevistos.

7. **Bajo ningún concepto el Contratista realizará trabajo alguno sin la presencia de un inspector o representante autorizado de la OMEP/DEPR.** Tampoco realizará trabajos si las condiciones ambientales no son propicias. De así hacerlo, se le exigirá y asumirá la responsabilidad por la remoción y disposición del material instalado.

8. El proyecto conlleva reparaciones estructurales inmediatas para poder ocupar los Edificios basado en el calendario escolar, incluyendo columnas cortas identificadas en el reporte estructural.

B. Impermeabilización de Techos: Alcance de Trabajos

La impermeabilización de los techos para el proyecto de referencia incluye, pero no se limita a los siguientes trabajos:

1. **Remoción parcial y disposición adecuada (en vertederos autorizados) del sistema existente de impermeabilización,** incluyendo las membranas, la aislación y todo material foráneo que se encuentre sin anclar a la superficie expuesta de los techos.

2. **Aplicación de tratamiento de sellado de grietas en la superficie de los techos que así lo requieran** y en parapetos o paredes exteriores ubicadas en dichos techos, utilizando materiales y procedimientos iguales (approved equal) a los indicados en las especificaciones técnicas. El Contratista además deberá reparar cualquier otro daño existente a dichas superficies que pueda impedir la completa instalación del nuevo sistema de impermeabilización.

3. **Eliminación de empozamientos de agua en los techos incluidos en contrato mediante el uso de hormigón liviano. Estos trabajos deberán incluir, de ser necesario,** el restablecimiento de la lima hoyas entre los drenajes existentes, la reparación y reacondicionamiento de estos y el reemplazo de aquellos drenajes averiados o inservibles, según lo requiera el representante designado de la OMEP/DEPR.

4. **Adquisición e instalación de un nuevo sistema de impermeabilización de techos igual (approved equal)** a los sistemas indicados en las especificaciones técnicas, según aceptados y aprobados por la OMEP/DEPR. Estos trabajos incluyen además la adquisición e instalación de flashings para las superficies que así lo requieran.

C. Impermeabilización de Techos: Disposiciones Técnicas.

1. **OMEP/DEPR aceptará como sistemas de impermeabilización de techos productos parecidos o similares a los especificados**. Aquellos sistemas basados en la instalación de algún tipo de membrana sobre las superficies existentes cumplirán con los parámetros indicados en las especificaciones técnicas relacionadas. **No se aceptarán sistemas basados en la aplicación de pinturas elastoméricas o asfalto caliente (brea) sobre las superficies a ser**

tratadas.

2. **El Contratista podrá proponer**, mediante el procedimiento establecido para la aprobación de somet1m1entos (submittals), otro sistema de impermeabilización de techos que considere igual (approved equal) al sistema especificado, **siempre y cuando el mismo cumpla estrictamente** con las especificaciones y disposiciones técnicas establecidas para dicho sistema en los Documentos de Contrato, y el mismo sea aceptado y aprobado por la OMEP/DEPR.

3. **El Contratista será responsable de verificar en sitio y confirmar**, con el representante designado de la OMEP/DEPR para este proyecto, los siguientes aspectos relacionados con estos trabajos:

   a) **Dimensiones y ubicación** de las áreas de superficie de los techos en donde se realizarán los trabajos de impermeabilización, así como los materiales, herramientas y equipos necesarios para realizar los mismos.

   b) **Ubicación y condiciones** del equipo e infraestructura existente para los sistemas de aire acondicionado, comunicaciones, distribución de electricidad y drenaje pluvial, en las superficies de los techos en donde se realizarán los trabajos incluidos en este contrato.

4. **Cualquier diferencia entre el área total de superficie a ser impermeabilizada,** según indicada en los Pliegos de subasta , y el área total de los techos, según medida y determinada en el sitio del proyecto, **será verificada y certificada por el representante autorizado de la OMEP/DEPR.** Esta certificación será requerida antes de proceder con la concesión del débito o el crédito al pago del Contratista, según sea el caso, en base al precio unitario por pie cuadrado sometido por este último en la apertura de subasta, como parte de los formularios de Propuesta y Desglose de Costos (Proposal and Cost Breakdown), respectivamente, o el indicado en el desglose detallado para pago de partidas de trabajo *(Breakdown for Payment).*

5. **Previo a la instalación del nuevo sistema de impermeabilización,** el Contratista y el inspector o representante designado de la OMEP/DEPR deberán verificar que:

   a) **Las superficies de los techos han recibido la preparación necesaria y requerida por las especificaciones técnicas y el manufacturero** del nuevo sistema de impermeabilización, eliminando de las mismas todo empozamiento de agua previamente existente.

   b) **Las pendientes requeridas en los techos y las lima hoyas entre los drenajes han sido conservadas o reestablecidas,** según sea el caso, de la forma y manera indicada en las especificaciones técnicas del contrato.

El Contratista no será autorizado a proceder con la realización de los restantes trabajos de impermeabilización de techos, correspondientes a este contrato, hasta tanto el inspector o funcionario designado como representante de la OMEP/DEPR haya verificado y aprobado la preparación de superficies y el restablecimiento de pendientes, respectivamente, y haya emitido por escrito una orden para proceder con la continuación de dichos trabajos. La OMEP/DEPR no será responsable por los gastos en que incurra el Contratista como consecuencia del incumplimiento de esta condición especial.

6. **Todas las membranas del nuevo sistema de impermeabilización deberán instalarse hasta la esquina exterior del tope del parapeto** (refiérase al Detalle Núm. 1 del Anejo 2), anclando las mismas en dicha esquina mediante el uso de un *angular flashing* o el tipo de anclaje (si alguno) recomendado por el manufacturero del sistema propuesto. Queda a discreción del representante designado de la OMEP/DEPR el requerir el empañetado o resanado en aquellos topes cuya superficie se encuentre deteriorada o no apta para anclar las nuevas membranas.

7. **De ser requerido por el representante designado de la OMEP/DEPR, el Contratista deberá remover, temporeramente**, aquellas tuberías, duetos u otros componentes o equipos del sistema de aire acondicionado, así como todo equipo de comunicaciones (antenas, cableado de TV, etc.) y utilidades del sistema eléctrico (paneles, conductos, cables, etc.) que se encuentren en plena operación (en uso) y anclados a las superficies de los techos y parapetos, previo a la realización de los trabajos incluidos en este contrato. Luego de completados dichos trabajos, el Contratista deberá reinstalar todos los componentes y equipos en la misma ubicación en que se encontraban originalmente. **Tanto la remoción como la reinstalación de dichos equipos y componentes deberán realizarse en coordinación con OMEP/DEPR y en cumplimiento con las directrices del representante designado de la OMEP/DEPR para este proyecto.**

8. **El Contratista deberá tomar todas las medidas que sean necesarias o** requeridas para proteger las superficies de los techos que queden expuestas durante los trabajos de impermeabilización, con el objetivo de prevenir filtraciones de agua a las áreas interiores del edificio durante periodos de lluvia u otros sucesos imprevistos.

9. **Bajo ningún concepto el Contratista realizará trabajo alguno sin la presencia de un inspector o representante autorizado de la OMEP/DEPR**. Tampoco realizará trabajos si las condiciones ambientales no son propicias. De así hacerlo, se le exigirá y asumirá la responsabilidad por la remoción y disposición del material instalado.

10. **Se estipula que todo trabajo de impermeabilización de techos realizado como parte de este contrato deberá cumplir** con todas las disposiciones establecidas en el Código Internacional para Edificios Existentes *(International Existing Building Code)* que se encuentre vigente en Puerto Rico al momento de comenzar los mismos. De igual forma, todo trabajo de impermeabilización realizado como parte de este proyecto deberá cumplir con todas las disposiciones vigentes en las leyes y reglamentos estatales y federales que sean aplicables a los mismos.

D. Trabajos Mecánicos:

El Contratista deberá acordar y negociar con los manufactureros la entrega de los extractores de aire y cualquier equipo, material o accesorio complementario, en el tiempo estipulado. En caso de que el retraso en la entrega de dichas unidades o equipo redunde en un incumplimiento del tiempo de ejecución requerido en el Pliego de la subasta (time for completion), será el Contratista quien deberá solicitar el reembolso de los daños líquidos a los manufactureros.

E. Trabajos Eléctricos:

1. **El Contratista será responsable de verificar en sitio y validar** el voltaje eléctrico disponible en las instalaciones existentes para la energización de cada uno de los extractores que serán provistos e instalados como parte de este contrato, antes de proceder con la orden de compra correspondiente a su adquisición. **Se aclara que la OMEP/DEPR quedará relevada de toda responsabilidad en caso de discrepancias en relación con dicho voltaje, según requerido para el equipo seleccionado por el Contratista.**

2. **Se recuerda que el Contratista será responsable de realizar todos los trabajos eléctricos que sean requeridos y/o necesarios** para energizar, a través de la conexión con el sistema y/o utilidades existentes, los nuevos extractores y las nuevas luminarias exteriores a ser provistas e instaladas como parte de este contrato.

3. **Todo trabajo de reparación o reemplazo relacionado a los sistemas de distribución eléctrica y de iluminación,** se llevarán a cabo en cumplimiento con las especificaciones técnicas y con los estándares, reglamentos y códigos eléctricos vigentes, en todas aquellas disposiciones que sean aplicables a los sistemas antes mencionados.

4. **La OMEP/DEPR se reservará el derecho de requerir al Contratista el sometimiento de literatura, especificaciones o cualquier otra información técnica adicional de las luminarias exteriores** que se propongan proveer e instalar en el proyecto, con el fin de evaluar las mismas y someter su correspondiente aprobación como parte de los trabajos incluidos en este contrato.

F. Manejo de Materiales Regulados:

El alcance de las reparaciones propuestas para este proyecto quecontempla la remoción y/o disposición de materiales con contenido de asbesto (MCA) no desmenuzable (non-friable) como parte de los trabajos incluidos en contrato, por lo que la propuesta base (Base Bid) para este proyecto deberá someterse considerando tal condición. Copias de la certificación de terminación de los trabajos de remoción y disposición de MCA y del informe correspondiente al alcance de dichos trabajos, respectivamente, serán entregados al Contratista (licitador agraciado) como parte de los documentos correspondiente al proceso oficial de firma de este contrato.

IV. DISPOSICIONES RELACIONADAS CON PERMISOS Y ENDOSOS:

A. El Contratista deberá preparar y radicar, previo al comienzo de los trabajos incluidos en contrato, todos los documentos necesarios para la aprobación y obtención de los siguientes permisos:

1. **Permiso de Construcción Certificado** expedido por la OGPE o el Municipio Autónomo correspondiente, según sea el caso.

2. **Cualquier otro permiso ministerial o discrecional** relacionado a la etapa de construcción del proyecto (según sea aplicable), otorgado por la Oficina de Gerencia de Permisos y Endosos (OGPE) o el Municipio Autónomo correspondiente, para la realización de estos trabajos.

El Contratista será responsable de sufragar los gastos correspondientes a los trámites de radicación de dichos documentos.

B. El Contratista será responsable de obtener la aprobación ("levantar") y mantener, durante la duración del proyecto, los siguientes permisos:

1. **Permiso de Construcción Certificado** expedido por la OGPE o el Municipio Autónomo correspondiente (según sea el caso), en cumplimiento con los requisitos establecidos para el mismo, incluyendo la notificación correspondiente al permiso de construcción (en la cual se pagan los sellos del CIAPR y los aranceles de rentas internas), necesaria para obtener la aprobación de este.

2. **Todos los permisos ministeriales o discrecionales**, según aplicables y/o requeridos para la realización de este proyecto.

El Contratista será responsable de sufragar los gastos correspondientes a cualquier certificación necesaria para levantar los mismos. En caso de que el proyecto sea exento de alguno de los permisos antes mencionados, el Contratista deberá proveer a la OMEP/DEPR copia de una carta suscrita por la agencia reguladora certificando dicha exención.

C. El Contratista será responsable de realizar los trámites necesarios para la obtención de cualquier otro permiso relacionado a la etapa de desarrollo o ejecución del proyecto, según requeridos por la Junta de Calidad Ambiental (JCA) o cualquier otra agencia del Gobierno del Estado Libre Asociado de Puerto Rico o del Gobierno Federal de los Estados Unidos de Norteamérica, de acuerdo a como se indica en el Artículo 6.8.1.4 de las Condiciones Generales Uniformes (*Uniform General Conditions for Public Works Contracts*).

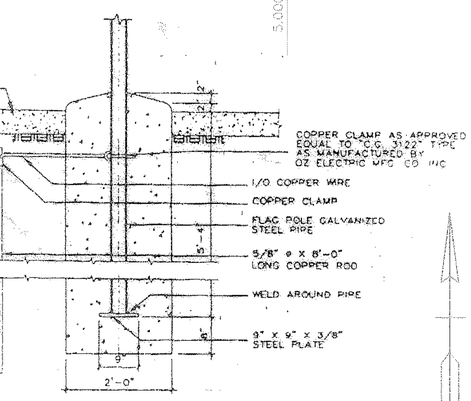
Exhibit K

Key Plans
Typical Recommended Repairs
Reference Technical Specifications

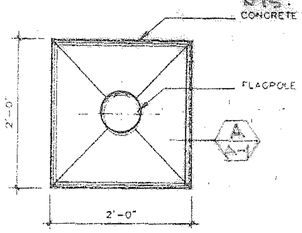
KEY PLANS

Don Luis Muñoz Marín

Don Luis Muñoz Marín (Ceiba) #35907



SECTION
NTS

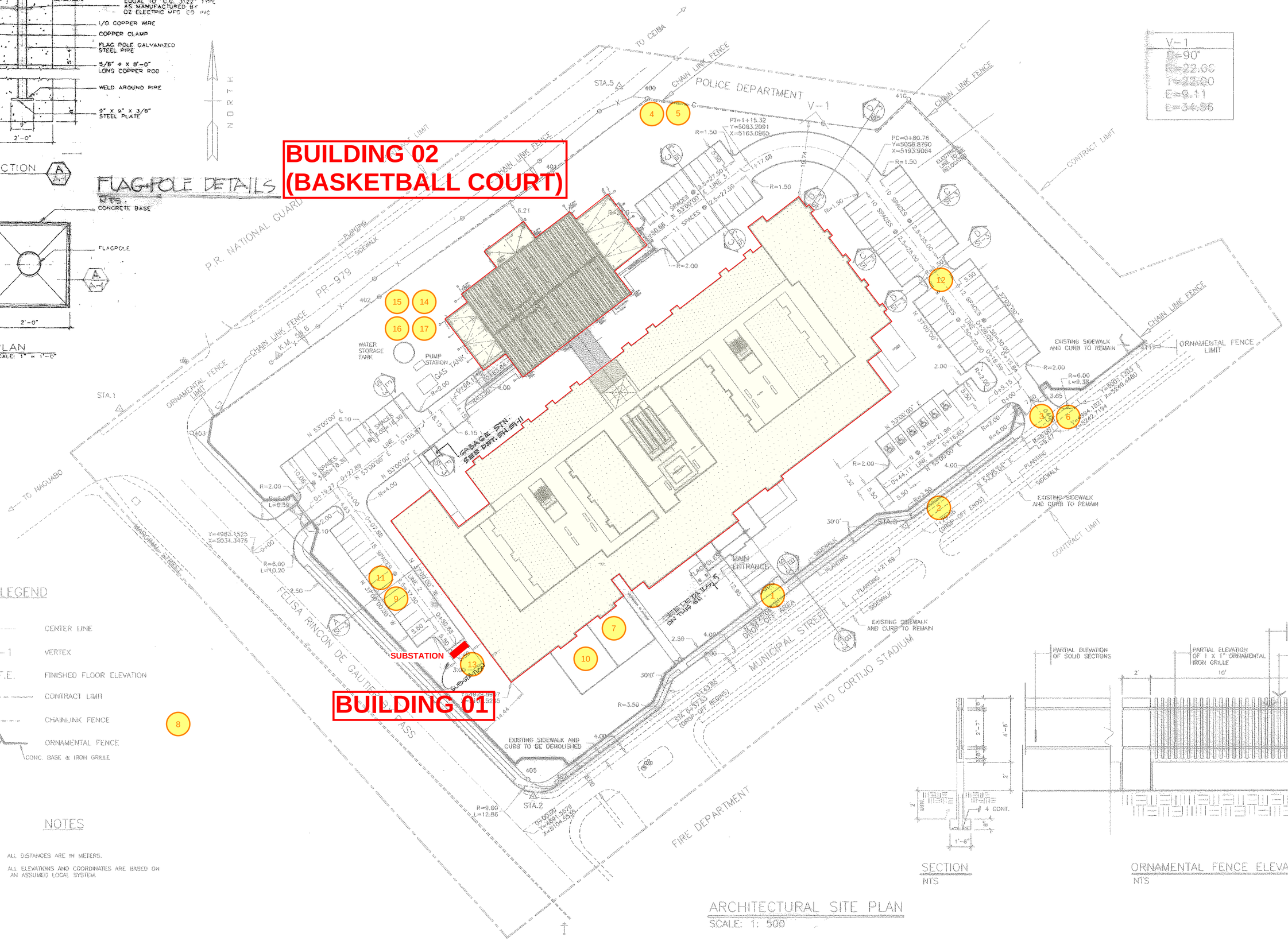


PLAN
SCALE: 1" = 1'-0"

FLAGPOLE DETAILS

NTS.

BUILDING 02 (BASKETBALL COURT)



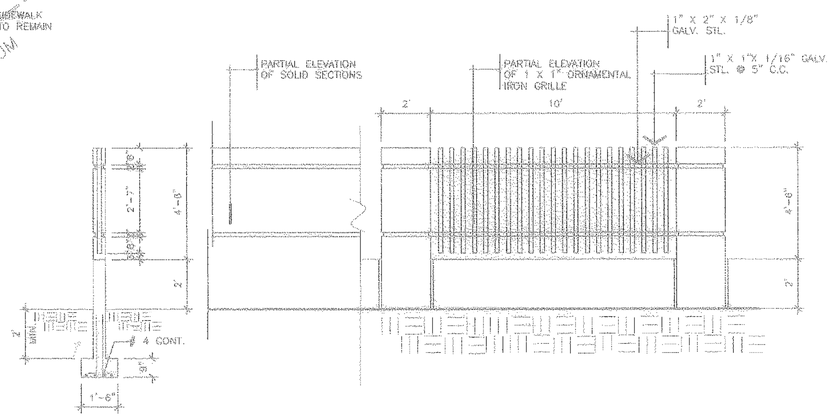
V-1
D=90°
R=22.00
T=22.00
E=8.11
L=34.56

LEGEND

- CENTER LINE
- V-1 VERTEX
- F.F.E. FINISHED FLOOR ELEVATION
- CONTRACT LIMIT
- CHAINLINK FENCE
- ORNAMENTAL FENCE
  - SOLID SECTION @ 6'-6"
  - CONC. BASE & IRON GRILLE

NOTES

1. ALL DISTANCES ARE IN METERS.
2. ALL ELEVATIONS AND COORDINATES ARE BASED ON AN ASSUMED LOCAL SYSTEM.



SECTION
NTS

ORNAMENTAL FENCE ELEVATION
NTS

ARCHITECTURAL SITE PLAN
SCALE: 1: 500

Don Luis Muñoz Marín (Ceiba) #35907

AREA B

AREA C

54 55 56 57 58 59 60 61
62 63 64 65 66 67 68 69
70 71 72 73 74 75

BUILDING 02 (BASKETBALL COURT)

52 53

DRE. DRE. STAGE STO. GYM STORAGE PHYSICAL EDUCATION TEMPERED FIBER PANELS TEMPERED FIBER PANELS ROLLING OVERHEAD DOOR BLEACHERS BLEACHERS STORAGE UNDER BLEACHERS STORAGE UNDER BLEACHERS

134'-0 1/4" 33'-0" 43'-0 7/8" 160'-6 3/4" BLDG. NO 3 49'-2 3/4" 15'-5" 9'-0" 52'-6" 24'-3" 20'-0" 130'-0"

BLDG. NO 2

BLDG 02

BLDG 03

27

SERVICE AREA STORAGE DINING ROOM BLDG. NO 1 CLRM. 800 s/f CLRM. 800 s/f CLRM. 800 s/f CLRM. 1600 s/f CLRM. 800 s/f CLRM. 800 s/f CLRM. 800 s/f CLRM. 800 s/f CLERESTORY ABOVE MUSIC ROOM 800 S/F CLRM. 800 s/f BLDG. NO 4 SCIENCE LAB 800 S/F SCIENCE LAB 800 S/F HEALTH ROOM 800 S/F

BLDG 01

BLDG 02

BLDG 03

BLDG 04

BLDG. NO 8 SPECIAL EDUC. 1200 S/F SPECIAL EDUC. 1200 S/F STAIR NO. 2 BLDG. NO 9 CLRM. CLRM. CLRM. RAMP 34 PLANTING PLAZA PATIO RECREATIONAL 45'-0" x 27'-0" BLDG. NO 10 CLRM. CLRM. CLRM. PLANTING PLAZA BLDG. NO 11 CLRM. CLRM. CLRM. PLANTING

BLDG 08

BLDG 09

BLDG 10

BLDG 11

22 BLDG. NO 7 KINDERGARTEN KINDERGARTEN PATIO PATIO ENTRANCE TO KINDERGARTEN LOBBY LOBBY REPRODUCTION 200 S/F STORAGE 400 S/F COUNSELOR 100 S/F FACULTY 200 S/F DIRECTOR 100 S/F RECEPTION 400 S/F BOYS 144 S/F GIRLS 144 S/F ADMINISTRATION 144 S/F BLDG. NO 6 MAIN ENTRANCE FLAGPOLES COMMUNITY ROOM OFFICE EQUIPMENT STORAGE LIBRARY LADIES GENTLEMEN BOYS GIRLS LANGUAGE LAB 1328 S/F COMPUTERS LAB 1328 S/F BLDG. NO 5 PLANTING AREA

BLDG 07

BLDG 06

BLDG 05

18 19 20 39
40 41 42

33'-0" 8'-0" 78'-0" 8'-6" 61'-11 7/8" 12'-0" 62'-0 7/8" 152'-6 1/8" 36'-3" 14'-6" 32'-3" 29'-9"

FIRST FLOOR PLAN
SCALE: 1/16"=1'-0"

AREA A

AREA D

21 23 24 25 26 28 29 30 31 32 35 36 37 38 43 44 45 46 47 48 49 50 51

Don Luis Muñoz Marín (Ceiba) #35907

AREA B

AREA C

BUILDING 02
(BASKETBALL COURT)

BASKETBALL COURT BLDG.

BLDG 02

BLDG 03

BLDG 10

BLDG 11

BLDG 08

BLDG 09

BLDG 04

BLDG 01

BLDG 07

BLDG 06

BLDG 05

SECURITY PANEL SEE SH. A-90

ROOF ACCESS

STAIR NO. 2

RAMP

PLAZA

RECREATIONAL

PLANTING AREA

ENTRANCE TO KINDERGARTEN

FLAGPOLES

ROOF ACCESS GATE (TYP.) SEE SH. A-90

SEC. PANEL SEE SH. A-90

SECOND FLOOR PLAN
SCALE: 1/16"=1'-0"

AREA A

AREA D

COMMONWEALTH OF PUERTO RICO
PUBLIC BUILDINGS AUTHORITY
SAN JUAN, PUERTO RICO

URBAN ELEMENTARY SCHOOL, AEP 8185
STATE ROAD NO. 979
& FELISA RINCON DE GAUTIER BY-PASS, CEIBA, P. R.

REVISIONS
SYM. DESCRIPTION DATE

REINALDO PEREZ - ARCHITECT
LIC. 2918
CONDADO AVE. #120 PICO CENTER BLDG.
OFFICE 302, SANTURCE, P.R. 00907
TEL (809) 722-8877

DRAWING TITLE
SECOND FLOOR PLAN

SCALE: AS SHOWN
PROJECT NO. AEP 8185
SHEET NO. 19 OF 116
ARCH. PROJ. NO.
DRAWING NO. A-5
DATE 10/6/99

C:\autolisp\2_JOBS\PBS02-2.dwg R=1 JU; 30 15:13:45 1999 VAZQUEZ, PEREZ & ASSOCIATES

TYPICAL RECOMMENDED REPAIRS

TYPICAL RECOMMENDED REPAIRS

At the locations where cracks are showing on the surface remove the plaster and review the concrete/masonry element below to determine if the below crack repairs are warranted. The products referenced in this narrative are for reference only. Contractor may base their proposal on products from other manufacturers that are similar or equal in performance.

I. Concrete Spalls

Two products produced by Sika Corporation can be used to repair the concrete spalls. The products to be used at the contractor's choice are Sika Quick VOH or Sikatop 123 plus. We recommend the Sika Quick VOH unless the product sets too quickly for construction. Below is comparison of the two materials.

- Sika Quick VOH sets much quicker than Sikatop 123 Plus which may cause construction issues if the material hardens too fast.
- Sika Quick VOH is cheaper than Sikatop 123 plus.
- Sika Quick VOH can be installed in 3" lifts versus 1.5" lifts using Sikatop 123 plus.
- Sikatop 123 plus has a 6,000 psi strength versus Sika Quick VOH having 5,500 psi. The 5,500 psi strength is acceptable.
- Sika Quick VOH is a single component material which just needs water added. Sikatop 123 Plus is a 2-component material.

Reference **Appendix A** for detailed installation instructions for the patching materials and the product data sheets. Key details indicated in the instructions include:

- Area should be clean and sound
- Remove contaminations and bond inhibiting materials
- Sawcut around perimeter of repair area to achieve a minimum of 3/8" shoulder and eliminate feathered edges.
- Remove corrosion from rebar by blast cleaning or by mechanical means.
- Saturate the concrete surface but do not leave standing water. This reduces the drying out of the patching material when applied to the concrete.
- Apply the repair mortar in a thin coat pressing to the concrete surface filling all voids including behind reinforcing bars. This serves as the bonding agent.
- Apply the repair mortar not exceeding the maximum lift thickness of 3" for Sika Quick VOH or 1.5" for Sikatop 123 plus. Repeat lifts as required until the repair is completed.
- Cure patch per ACI recommendations directly after finishing using wet burlap and a fine mist of water.

II. Concrete Cracks

Concrete (not masonry) cracks are to be repaired using a combination of products produced by Sika Corporation. The products are Sikadur 31 Hi-Mod Gel which encapsulates the crack and Sikadur 35 Hi-Mod LV which repairs the cracks. Reference **Appendix B Part 3-Execution** for the crack repair procedure and the product data sheets. Key details indicated in the instructions include:

- Set the porting devices into the cracks. The devises are to be installed at an interval which will allow the complete length and depth of the crack to be filled with Sikadur 35.
  - The contractor may use drilled porting devices followed by encasing the crack in Sikadur 31.
  - The contractor may use surface mounted porting devices. Surface mounted porting devises are to be held in place using Sikadur 31.
- Inject Sikadur 35 into the porting devises to completely fill the length and depth of the cracks.

- After the Sikadur 35 has cured the Sikadur 31 product and porting devises are to be removed and the area cleaned.

III. Masonry Cracks

The concrete repair materials are not approved for masonry repairs. The cracks in the masonry are to be repaired by repointing the masonry joints and cracks with Type S masonry mortar. The mortar is to be pressed into the cracks to fill the face shells solid.

Construction

SikaTop 123 Plus

Also to be used for
SikaQuick VOH

Application Instructions

**For Reference Only.
Contractor required to submit products that are approved-similar or equal.**

Sika Corporation

Construction

SikaTop 223 Plus

- Two-component, polymer-modified, portland cement based.
- Fast-setting, non-sag mortar.
- High performance repair mortar for vertical and overhead surfaces.
- Offers the additional benefit of FerroGard 901- A penetrating corrosion inhibitor.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.



Sika Corporation

Construction

SikaTop 123 Plus

- Where to use:
  - On grade, above, and below grade on concrete and mortar.
  - On vertical and overhead surfaces.
  - As a structural repair material for:
    - Parking structures
    - Industrial plants
    - Water/waste water treatment facilities
    - Roads, walkways, bridges, tunnels, dams, ramps, etc.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Construction

SikaTop 123 Plus

- Packaging:
  - “A” Comp: 1 gal Jug of Dispersion.
  - “B” Comp: 44 lb Multi-wall bag.
- Coverage:
  - .39 cu. ft / unit.
  - 674 cu. inches per unit.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika®

Sika Corporation

Construction

Surface Preparation

- Cementitious Substrates:
  - Should be clean and sound.
  - Remove contaminations and bond inhibiting materials from repaired area.
  - Obtain exposed/fractured aggregate surface ~1/16 to 1/8 inch profile (ICRI CSP 5 & above).
  - Substrate must be saturated surface dry (SSD) with no standing water.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Construction

Surface Preparation

- Cementitious Substrates:
  - Surface should be cleaned and roughened to create a profile.



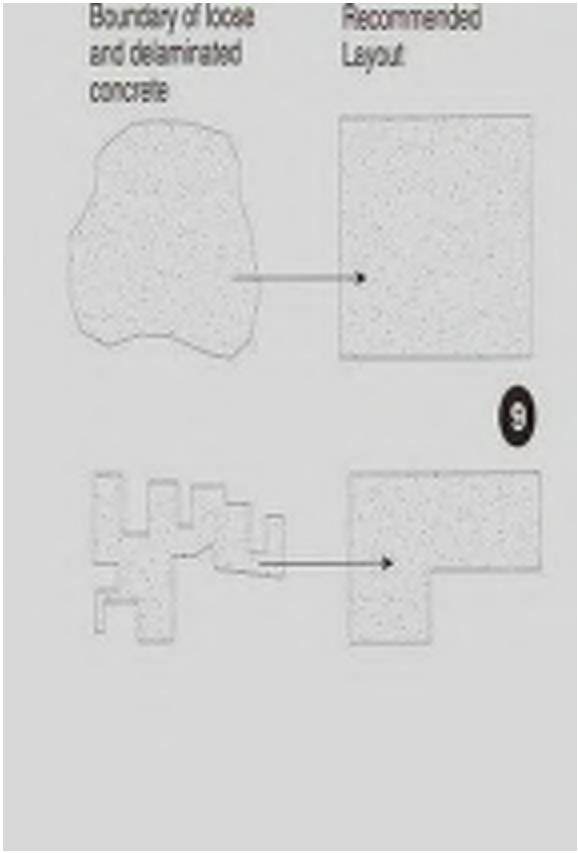
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Contractor required to submit products that are approved-similar or equal.

Sika®

Construction

Surface Preparation

- Saw cut around perimeter of repair area to achieve a minimum 3/8” shoulder.
- Eliminates feathered edges giving a clean repair transition



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

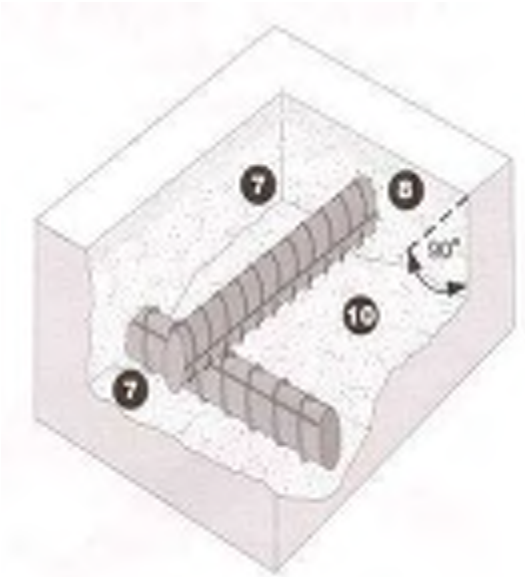
Sika®

Sika Corporation

Construction

Surface Preparation

- Steel:
  - Remove all corrosion and contaminants from exposed steel.
  - Surface should be cleaned thoroughly by blast cleaning or mechanical means.
  - Exposed steel should be cleaned to white steel.
  - If half of the diameter is exposed, chip behind bar, ½" minimum for mortar only.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika®

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Construction

Steel Preparation

- Steel should be cleaned to a bright metal finish.





For Reference Only.
Contractor required to submit products that are approved-similar or equal.

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Construction

Tools Required

- ½” Drill Motor.
- Low speed drill 400-600 rpm.
- Large mixing paddle
- Margin trowel



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Contractor required to submit products that are approved-similar or equal.

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Construction

Mixing

- Pour “A” Component into clean pail.
- Leave approximately 1” of “A” Component in jug.



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Contractor required to submit products that are approved-similar or equal.

Sika®

Sika Corporation

Construction

Mixing

- Add “B” Component to pail with “A” already inside, while mixing continuously.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Construction

Mixing

1. Dispersion ¾ -1 gallon of dispersion/Bag.
2. Start with adding liquid to the mixing container.
3. Slowly add powder.
4. Once all the powder is added mix for **3 minutes**.
5. Do not add any more than the recommended liquid.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika®

Sika Corporation

Construction

Mixing

1. While mixing for 3 minutes stop to scrape down the sides to insure all material is fully mixed.
2. Add additional “A”Comp. liquid for desired consistency.
3. Most cases you will have liquid left.



4. Thorough mixing and proper proportioning is necessary.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika Corporation

Construction

ST 123+ Application

- Apply the mortar to the patch area while the Armatec 110 EpoCem is still wet.



- If Armatec is not used as a bonding agent, SSD the surface and scrub coat the repair mortar into the substrate filling all pores and voids.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika®

Sika Corporation

Construction

ST 123+ Application

- Apply SikaTop repair mortar to patch.
- Press mortar behind rebar and make sure the material is consolidated and compacted fully.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika®

Sika Corporation

Construction

ST 123+ Application

- Complete filling patch area.
- Work mortar from the center of the patch to the outside.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.



Sika Corporation

Construction

Min / Max application thickness

- Neat
  - Min 1/8 inch
  - Max 1.5 inch

- SikaTop 123 Plus cannot be extended with aggregate.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.



Construction

SikaTop 123 Finish

- After filling patch section, allow mortar to set to desired stiffness.
- Then finish with steel, wood, or sponge float to attain look required.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Construction

Sikatop 123+ Finish

- To assist in the finishing of the SikaTop use SikaFilm.
  - SikaFilm is a finishing aid that also retards moisture evaporation.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Construction

SikaTop 123+ Finish

- You can use a steel trowel to attain a smooth surface.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.



Sika®

Sika Corporation

Construction

Sponge Float Finish

- You can use Sponge float to attain a textured surface.







For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika Corporation

Construction

SikaTop Curing

- Cure as per ACI recommendations. Curing is required.
- Moist cure with wet burlap and polyethylene, a fine mist of water.
- Moist curing should commence immediately after finishing.
- Protect newly applied material from direct sun light, wind, rain and frost.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika Corporation

Construction

SikaTop 123 Plus

Sika Technical Data Sheets can be obtained via:

www.sikaconstruction.com

Refer to data sheets for specific information on each Sika product.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Sika Corporation



SIKAQUICK® VOH

FAST SETTING, ONE COMPONENT, CEMENTITIOUS VERTICAL AND OVERHEAD REPAIR MORTAR

- Application up to 3" on vertical surfaces in one layer
- Overhead thickness up to 2"
- Fiber reinforced and polymer modified containing corrosion inhibitor
- Low dust version available

Available in
Bag
44 lbs.



For Reference Only.
Contractor required to submit products that are approved-similar or equal.

BUILDING TRUST

SIKAQUICK® VOH

VERTICAL AND OVERHEAD REPAIR MORTAR

APPLICATIONS

- Fast repairs to overhead and vertical concrete and mortar surfaces on grade, above and below grade.
- Repair material for building facades, parking structures, industrial plants, bridges, etc.
- Fast setting repair material for new construction defects

TYPICAL DATA

- Shelf Life: One year in original, unopened bags
- Storage Conditions: Store dry at 40°-95°F (4°-35°C)
- Product Conditioning: Condition material to 65°-75°F before using.
- Color: Concrete gray
- Mixing Ratio: 6 - 6.5 pints/unit
- Density (Wet mix): ~ 125 lbs. / cu. ft.
- Application Time: Approximately 20 minutes.
- Finishing Time: 20-30 minutes
- Lift Height: Max: 3" Min: 1/8"
- Time Between Lifts: After final set

BENEFITS

- Minimal time required between lifts.
- Fast finishing time
- Available as low dust version
- Time/labor-saving material; application up to 3 inches on vertical surfaces in one layer
- Easy to use; just add water
- High bond strength ensures excellent adhesion
- High early and ultimate strength
- Increased freeze/thaw durability and resistance to deicing salts
- Suitable for exterior and interior applications
- Not a vapor barrier
- Overhead thickness up to 2"
- Fiber reinforced and polymer modified
- Contains corrosion inhibitor

LITERATURE

- Product Data Sheet
- Material Safety Data Sheet

*Always refer to Current Product Data Sheet and MSDS for detailed performance specifications prior to use.



Mix to uniform consistency, no longer than 3 minutes



Moist cure and protect from elements immediately after finishing.



Scrub material into substrate, filling any pores and voids.



Finish with trowel, float, or sponge, depending on desired surface texture.

Note: Advice on specific applications is available from the Technical Service Department of Sika Construction Products Division.

FOR MORE INFORMATION:

Contact Sika: Phone 800.933.SIKA(7452) Website: usa.sika.com

Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
Phone: 201-933-8800
Fax: 201-933-6225

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

BUILDING TRUST

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SIKAQUICK® VOH

VERTICAL AND OVERHEAD REPAIR MORTAR

APPLICATIONS

- Fast repairs to overhead and vertical concrete and mortar surfaces on grade, above and below grade.
- Repair material for building facades, parking structures, industrial plants, bridges, etc.
- Fast setting repair material for new construction defects

TYPICAL DATA

- Shelf Life: One year in original, unopened bags
- Storage Conditions: Store dry at 40°-95°F (4°-35°C)
- Product Conditioning: Condition material to 65°-75°F before using.
- Color: Concrete gray
- Mixing Ratio: 6 - 6.5 pints/unit
- Density (Wet mix): ~ 125 lbs. / cu. ft.
- Application Time: Approximately 20 minutes.
- Finishing Time: 20-30 minutes
- Lift Height: Max: 3" Min: 1/8"
- Time Between Lifts: After final set

BENEFITS

- Minimal time required between lifts.
- Fast finishing time
- Available as low dust version
- Overhead thickness up to 2"
- Easy to use; just add water
- High bond strength ensures excellent adhesion
- High early and ultimate strength
- Increased freeze/thaw durability and resistance to deicing salts
- Suitable for exterior and interior applications
- Time/labor-saving material; application up to 3 inches on vertical surfaces in one layer
- Fiber reinforced and polymer modified
- Contains corrosion inhibitor

LITERATURE

- Product Data Sheet
- Safety Data Sheet
- CSI Specification

*Always refer to Current PDS and SDS for detailed performance specifications prior to use.



Mix to uniform consistency, no longer than 3 minutes



Moist cure and protect from elements immediately after finishing.



Scrub material into substrate, filling any pores and voids.



Finish with trowel, float, or sponge, depending on desired surface texture.

Note: Advice on specific applications is available from the Technical Service Department of Sika Construction Products Division.

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PRODUCT DATA SHEET

SikaTop®-123 Plus

Two-component, polymer-modified, cementitious, non-sag mortar plus Sika FerroGard® 901 penetrating corrosion inhibitor

PRODUCT DESCRIPTION

SikaTop®-123 Plus is a two-component, polymer-modified, Portland cement-based, fast-setting, non-sag mortar. It is a high performance repair mortar for vertical and overhead surfaces and offers the additional benefit of Sika FerroGard® 901, a penetrating corrosion inhibitor included in its formulation.

USES

- On grade, above and below grade on concrete and mortar.
- On vertical and overhead surfaces.
- As a structural repair material for parking structures, industrial plants, walkways, bridges, tunnels, dams and ramps.
- Approved for repairs over cathodic protection systems

CHARACTERISTICS / ADVANTAGES

- Extremely low shrinkage proven by four industry standard test methods.
- High compressive and flexural strengths.
- Increased freeze/thaw durability and resistance to deicing salts.
- Increased density - improved carbon dioxide resistance (carbonation) without adversely affecting water vapor transmission (not a vapor barrier).
- Enhanced with Sika FerroGard® 901, a penetrating corrosion inhibitor - reduces corrosion even in the adjacent concrete.
- Compatible with coefficient of thermal expansion of concrete - Passes ASTM C 884.

APPROVALS / STANDARDS

- USDA certifiable for incidental food contact
- ANSI/NSF Standard 61 potable water approved compliant.
- Tested per ICRI Guidline NO. 320.3R for inorganic repair material data sheet protocol

PRODUCT INFORMATION

Packaging	Component A	1 gal (3.68 L) jug - 4/carton
	Component B	44 lb. (20 kg) bag
Appearance / Color	Gray powder	
Shelf Life	12 months from date of production if stored properly in original, unopened and undamaged sealed packaging	
Storage Conditions	Store dry at 40–95 °F (4–35 °C).	

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Protect Component ‘B’ from moisture. If damp, discard material
Protect Component ‘A’ from freezing. If frozen, discard.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

TECHNICAL INFORMATION

Compressive Strength	1 day		3,000 psi (20.7 MPa)	(ASTM C-109) 73 °F (23 °C) 50 % R.H.
	7 days		4,000 psi (27.6 MPa)	
	28 days		6,000 psi (41.4 MPa)	
Modulus of Elasticity in Compression	2.94 x 10^6 psi			(ASTM C-469)
Flexural Strength	28 days		1,500 psi (10.3 MPa)	(ASTM C-293) 73 °F (23 °C) 50 % R.H.
Splitting tensile strength	28 days		900 psi (6.2 MPa)	(ASTM C-496) 73 °F (23 °C) 50 % R.H.
Tensile Adhesion Strength	28 days		2,000 psi (13.8 MPa)	(ASTM C-882 modified)
	* Mortar scrubbed into substrate at 73 °F (23 °C) and 50 % R.H.			
Pull-Out Resistance	28 days		500 psi (3.4 MPa) Substrate failure	(ASTM C-1583)
Shrinkage	28 days	1x1x11-1/4'' specimen	0.05 %	(ASTM C-157, mod. ICRI 320.3R)
	28 days	3x3x11-1/4'' specimen	0.038 %	
Ring test			> 70 days	(ASTM C-1581)
	Average Max Strain		- 36 µstrain	
	Average Stress Strain		4.92 psi/day	
	Potential for Cracking		Low	
Baenziger block	90 days		No cracking	
Freeze-Thaw Stability	300 cycles		98 %	(ASTM C-666)
Rapid Chloride Permeability	28 days		< 500 C	(ASTM C-1202 AASHTO T-277)

APPLICATION INFORMATION

Fresh mortar density	132 lb/ft_3 (2.2 kg/l)	(ASTM C-138)
Coverage	0.39 ft_3 (0.01 m_3) per bag (Coverage figures do not include allowance for surface profile and porosity or material waste)	
Layer Thickness	**Min.**	**Max.**
	1/8 " (3 mm)	1.5" (38 mm)
Product Temperature	65–75 °F (18–24 °C)	
Ambient Air Temperature	> 45 °F (7 °C)	
Substrate Temperature	> 45 °F (7 °C)	
Set Time	15 - 40 min.	(ASTM C-266)
Final set time	< 60 min.	(ASTM C-266)

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Contractor required to submit products that are approved-similar or equal.

Finishing time	20–60 minutes Note: All times start after adding Component 'B' to Component 'A' and are highly affected by temperature, relative humidity, substrate temperature, wind, sun and other job site conditions.

BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

**For Reference Only.
Contractor required to submit products that are approved-similar or equal.**

DIRECTIVE 2004/42/CE - LIMITATION OF EMISSIONS OF VOC

0 g/l (EPA method 24)

LIMITATIONS

- Do not use solvent-based curing compound.
- Size, shape and depth of repair must be carefully considered and consistent with practices recommended by ACI or ICRI.
- For additional information on substrate preparation, refer to ICRI Guideline No. 310.2R.
- If aggressive means of substrate preparation is employed, substrate strength should be tested in accordance with ACI 503 Appendix A prior to the repair application.
- As with all cement based materials, avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum bars, rails, posts etc. with an appropriate epoxy such as Sikadur® 32, Hi-Mod.

APPLICATION INSTRUCTIONS

SURFACE PREPARATION

Surface preparation

- Surface must be clean and sound. Remove all deteriorated concrete, dirt, oil, grease, and other bond-inhibiting materials from the area to be repaired.
- Be sure repair area is not less than 1/8" (3 mm) in depth.
- Preparation work should be done by high pressure water blast, scabbler or other appropriate mechanical means to obtain an exposed aggregate surface profile of ±1/16" (1.6 mm) (CSP-5).
- To ensure optimum repair results, the effectiveness of decontamination and preparation should be assessed by a pull-off test.
- Saw cutting of edges is preferred and a dovetail is recommended.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.

Priming

- Reinforcing steel: Steel reinforcement should be thoroughly prepared by mechanical cleaning to remove all traces of rust. Where corrosion has occurred due to the presence of chlorides, the steel should be high pressure washed with clean water after mechanical cleaning. For priming of reinforcing steel use Sika® Armatec® 110 EpoCem (consult PDS).

- Concrete Substrate:
  - Prime the prepared substrate with a brush or sprayed

applied coat of Sika® Armatec® 110 EpoCem (consult PDS).
- Alternately, a scrub coat of SikaTop®-123 Plus can be applied prior to placement of the mortar. The repair mortar has to be applied into the wet scrub coat before it dries.

MIXING

- Pour Component 'A' into mixing container.
- Add Component 'B' while mixing continuously.
- Mix mechanically with a low-speed drill (400–600 rpm) and mixing paddle or mortar mixer.
- Mix to a uniform consistency, maximum 3 minutes.
- Manual mixing can be tolerated only for less than a full unit. Thorough mixing and proper proportioning of the two components is necessary.

**For Reference Only.
Contractor required to submit products that are approved-similar or equal.**

APPLICATION

- SikaTop®-123 Plus must be scrubbed into the substrate, filling all pores and voids.
- Force material against edge of repair, working toward center.
- After filling repair, consolidate, then screed.
- Material may be applied in multiple lifts.

Multiple lifts

- Where multiple lifts are required score top surface of each lift to produce a roughened surface for next lift.
- Allow preceding lift to reach initial set, 30 minutes minimum, before applying fresh material.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.
- Scrub fresh mortar into preceding lift.
- Allow mortar or concrete to set to desired stiffness, then finish with wood or sponge float for a smooth surface.

CURING TREATMENT

- As per ACI recommendations for Portland cement concrete, curing is required.
- Moist cure with wet burlap and polyethylene, a fine mist of water or a water based* compatible curing compound (ASTM C-309).
- Curing compounds adversely affect the adhesion of following lifts of mortar, leveling mortar or protective coatings.
- Moist curing should commence immediately after finishing.
- Protect freshly applied mortar from direct sunlight, wind, rain and frost.

* Pretesting of curing compound is recommended.

OTHER RESTRICTIONS

See Legal Disclaimer.

LEGAL DISCLAIMER

- **KEEP CONTAINER TIGHTLY CLOSED**
- **KEEP OUT OF REACH OF CHILDREN**
- **NOT FOR INTERNAL CONSUMPTION**
- **FOR INDUSTRIAL USE ONLY**
- **FOR PROFESSIONAL USE ONLY**

Prior to each use of any product of Sika Corporation, its subsidiaries or affiliates ("SIKA"), the user must always

read and follow the warnings and instructions on the product's most current product label, Product Data Sheet and Safety Data Sheet which are available at usa.sika.com or by calling SIKA's Technical Service Department at 1-800-933-7452. Nothing contained in any SIKA literature or materials relieves the user of the obligation to read and follow the warnings and instructions for each SIKA product as set forth in the current product label, Product Data Sheet and Safety Data Sheet prior to use of the SIKA product.

**For Reference Only.
Contractor required to submit products that are approved-similar or equal.**

SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within the product's shelf life. User determines suitability of product for intended use and assumes all risks. User's and/or buyer's sole remedy shall be limited to the purchase price or replacement of this product exclusive of any labor costs. **NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKA SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. SIKA SHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS.**

Sale of SIKA products are subject to the Terms and Conditions of Sale which are available at https://usa.sika.com/en/group/SikaCorp/termsandconditions.html or by calling 1-800-933-7452.

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Carretera Libre Celaya Km. 8.5
Fracc. Industrial Balvanera
Corregidora, Queretaro
C.P. 76920
Phone: 52 442 2385800
Fax: 52 442 2250537

Spec Component: SC-001-03/10
Sikadur 35, Hi-Mod LV
Sikadur 31, Hi-Mod Gel

DIVISION 3 -CONCRETE
Section 03930 Concrete Rehabilitation
Epoxy-Injected Crack Repair

Part 1 - General

1.01 Summary

A. This specification describes the pressure injection of cracks with an epoxy resin adhesive.

1.02 Quality Assurance

A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001/9002 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.

B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

C. Install materials in accordance with all safety and weather conditions required by the manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 Delivery, Storage, and Handling

A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.

B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.

C. Condition the specified product as recommended by the manufacturer.

1.04 Job Conditions

A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40ºF (5ºC) and rising.

B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified product.

1.05 Submittals

A. Submit two copies of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).

1.06 Warranty

A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

**For Reference Only.
Contractor required to submit products that are approved-similar or equal.**

Part 2 - Products

2.01 Manufacturers

A. **Sikadur 35 Hi-Mod LV**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification.

B. **Sikadur 31 Hi-Mod Gel**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification

2.02 Materials

A. Epoxy resin adhesive for pressure injection of cracks shall be **Sikadur 35 Hi-Mod LV:**

1. Component "A" shall be a modified epoxy resin of the diglycidiether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component "B" shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidiether bisphenol A Type containing suitable viscosity control agents, pigments, and accelerators.
3. The ratio of component A: componet B shall be 2:1 by volume
4. The material shall not contain asbestos.

B. Epoxy resin adhesive for sealing of cracks & porting devices shall be **Sikadur 31 Hi-Mod Gel.:**

1. Component "A" shall be a modified epoxy resin of the diglycidiether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component "B" shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidiether bisphenol A type containing suitable viscosity control agents, pigments, and accelerators.
5. The ratio of Component A: Componet B shall be 1:1 by volume
6. The material shall not contain asbestos.

C. Porting devices as required for either manual or automated application. Porting devices for automated application shall be supplied from maufacturer of the pressure injection equipment.

2.03 Performance Criteria

A. Properties of the mixed epoxy resin adhesive used for the pressure injection grouting::

1. Pot Life: min. 25 minutes (60 gram mass) @ 73° F
2. Tack-FreeTime:

90°F	(32°C)	1.5 to 2 hours
75°F	(24°C)	3 to 3.5 hours
40°F	(5°C)	14-16 hours

3. Viscosity: Approx. 375 cps.
4. Color: Clear, Amber

B. Properties of the cured epoxy resin adhesive used for pressure injection of grout:

1. Compressive Strength (ASTM D-695) .min.
   a 3 day: 10,000 psi (69.9 MPa)
   b. 7 day: 11,000 psi (75.8 MPa)
   c. 28 day: 13,000 psi (89.6 MPa)
   Compressive Modulus, Psi : min.
   a. 7 day 320,000 psi (2,200 Mpa)
2. Shear Strength (ASTM D-732)
   a. 14 day: 5,100 psi (35 MPa)
3. Flexural Strength (ASTM D-790) min.
   a. 14 day: 14,000 psi (97 MPa

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Tangent Modulus of Elasticity in Bending min.

b. 14 day: 370,000 psi (2,600 Mpa)

4. Bond Strength (ASTM C-882)

14 days (moist cure) min.

a. Hardened Concrete to Hardened Concrete: 2,900 psi (15 Mpa)

5. Water Absorption (ASTM D-570) max.

a. 24 hour 0.90%

6. Tensile properties (ASTM D-638) min.

a. 7 day Tensile Strength 8,900 psi (61 Mpa)

Elongation at Break 5.4%

b. 14 day Modulus of Elasticity 4.1×10^5 psi (2,800 Mpa)

C. Properties of the mixed epoxy resin adhesive used for sealing of cracks & porting devices::

1. Pot Life: min. 60 minutes (500 gram mass) @ 73° F
2. Tack-FreeTime: @73°F(23°C) 1.5 – 2.5 hours @ 30 mils thick
   Consistency: Non-Sag paste
3. Color: Concrete Gray

D. Properties of the cured epoxy resin adhesive used for sealing of cracks & porting devices:

1. Compressive Strength (ASTM D-695) .min. @ 73F
   a 1 day: 13,000 psi (89.6 MPa)
   b. 3 day: 14,000 psi (96.5 MPa)
   c. 28 day: 16,000 psi (110.3 MPa)
   Compressive Modulus, Psi : min.
   a. 7 day 795,000 psi (5,485 Mpa)
2. Shear Strength (ASTM D-732)
   a. 14 day: 4,600 psi (31.7 MPa)
3. Flexural Strength (ASTM D-790) min.
   a. 14 day: 6,100 psi (42 MPa)
   Tangent Modulus of Elasticity in Bending .min.
   b. 14 day: 1.67×10^6 psi (11,520 MPa)
4. Bond Strength (ASTM C-882)

   14 day (moist cure) min.

   a. Hardened Concrete to Hardened Concrete 2,900 psi (20 Mpa)

5. Water Absorption (ASTM D-570) max.

   a. 24 hour 0.79%

6. Tensile properties (ASTM D-638) min.

   a. 7 day Tensile Strength 3,300 psi (22.7 Mpa)

   Elongation at Break 0.9%

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Note: Tests above were performed with material & curing conditions at 73F & 45-55% relative humidity.

For Reference Only.
Contractor required to submit products that are approved-similar or equal.

Part 3 - Execution

3.01 Mixing and Application

A. Mixing the epoxy resin adhesive for sealing the cracks & porting devices: Premix each component. Proportion equal parts by volume of Component "A" and Component "B" into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (60 minutes @ 73F).

B. Mixing of the epoxy resin adhesive used for the pressure injection grouting:

1. Manual: Proportion two parts by volume of Component "A" to one part Component "B" into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (20-30 minutes 73F).

C. Placement procedure:

1. The epoxy resin adhesive for sealing the cracks & porting device: Set the porting devices as required by the epuipment manufacturer. Spacing of the porting devices shall be accomplished as required to achieve the travel of the epoxy resin for the pressure injection grouting between ports and fill the cracks to the maximum. On structures open on both sides, provide porting devices on opposite sides at staggered elevations. Apply the mixed epoxy resin adhesive for sealing over cracks and around each porting device to provide an adequate seal to prevent the escape of the epoxy resin adhesive for the injection grouting. Where required by the Engineer, apply the epoxy resin adhesive for sealing in such a manner that minimal defacing or discoloration of the substrate shall result.

2. The epoxy resin adhesive for the pressure injection grouting:

Manual: Load the mixed epoxy resin adhesive for grouting into a disposable caulking cartridge or bulk-loading caulking gun. Inject the prepared cracks with a consant pressure in order to achieve maximum filling & penetration without the inclusion of air pockets or voids in the epoxy resin adhesive. Begin the pressure injection at the widest part of the crack being injected and continue until there is the appearance of epoxy resin adhesive at an adjacent port, thus indicating travel. When travel is indicated, to discontinue or continue the pressure injection from that port should be made by the contractor based on his experience, with the approval of the Engineer. Continue procedure until pressure injectable cracks has been filled.

Automated: Dispense the epoxy resin adhesive for grouting under constant pressure in accordance with prcedures recommended by the equipment manufacturerer as required to achieve maximum filling and penetration of the prepared cracks without the inclusion of air pockets or voids in the epoxy resin adhesive. The pressure injection of single or multiple ports, by use of a manifold system, is possible. This decision should be made by the contractor, with the approval of the Engineer. Continue the approved procedure until all pressure injectable cracks have been filled.

D. If penetration of any cracks is impossible, consult the Engineer before discontinuing the injection procedure. If modification of the proposed procedure is required to fill the cracks, submit said modification in writing to the Engineer for acceptance prior to proceeding.

E. Adhere to all limitations and cautions for the epoxy resin adhesive in the manufacturers current printed literature.

3.02 Cleaning

A. After the epoxy resin adhesive for grouting has cured, the epoxy resin adhesive for sealing cracks and porting devices shall be removed as required by the Engineer. Clean the substrate in a manner to produce a finish appearance acceptable to the Owner.

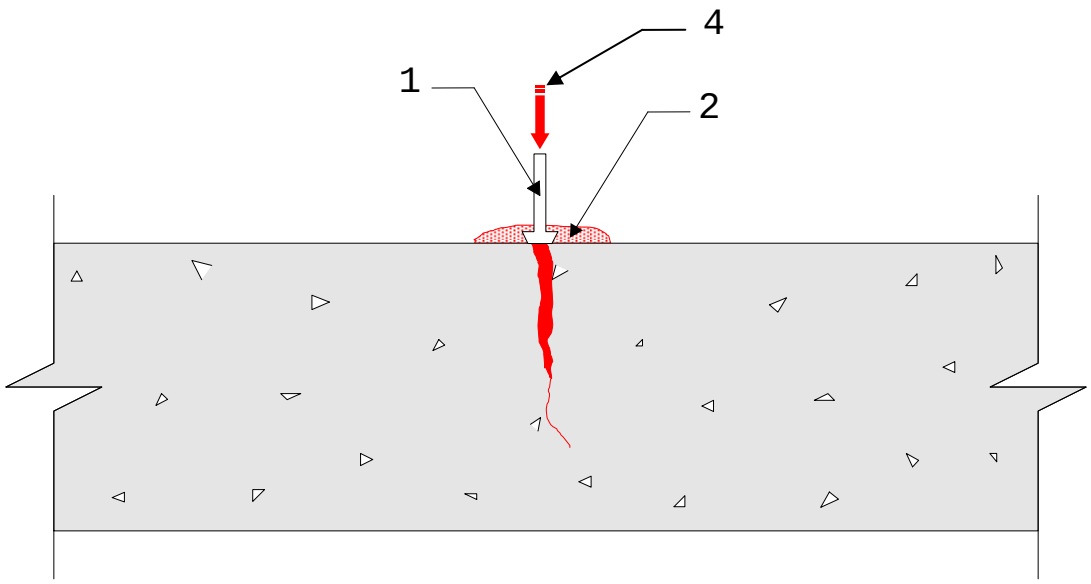
B. The uncured epoxy resin adhesive can be cleaned from tools with approved solvent. The cured epoxy resin adhesive can only be removed mechanically.

C. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

SC001 Sikadur 35, Hi-Mod LV Crack Filler

Sikadur 31, Hi-Mod Gel Cap Seal

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1.Set porting devices over cracks.

2. Place mixed Sikadur 31, Hi-Mod Gel epoxy resin adhesive over cracks and around each injection port a minimum of 1" wide by a ¼" thick.

3. Allow sufficient time for epoxy resin adhesive cap seal to set before injecting.

4. When the cap seal has cured, inject Sikadur 35, Hi-Mod LV with steady pressure.

5. Use automated injection equipment or manual method.

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PRODUCT DATA SHEET

Sikadur®-31 Hi-Mod Gel LPL

High-modulus, high-strength, structural, extended pot life, epoxy paste adhesive

PRODUCT DESCRIPTION

Sikadur®-31 Hi-Mod Gel LPL is a 2-component, 100 % solids, moisture-insensitive, high-modulus, high-strength, structural epoxy paste adhesive. It conforms to the current ASTM C-881, Types I and IV, Grade-3, Class-C and AASHTO M-235 specifications.

USES

Sikadur®-31 Hi-Mod Gel LPL may only be used by experienced professionals.

- Structural bonding of concrete, masonry, metals, wood, etc. to a maximum glue line of 1/8 in. (3mm)
- Seals cracks and around injection ports prior to pressure-injection grouting
- Interior, vertical, and overhead repair of concrete as an epoxy mortar binder
- As a pick-proof sealant around windows, doors, lock-ups etc. inside correctional facilities

CHARACTERISTICS / ADVANTAGES

- Extended pot life
- Moisture-tolerant before, during, and after cure
- High-modulus, high-strength, structural paste adhesive
- Excellent adhesion to concrete, masonry, metals, wood, and most structural materials
- Paste consistency ideal for vertical and overhead applications
- Fast-setting and strength-producing adhesive
- Convenient easy mix ratio A:B = 2:1 by volume

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Contractor required to submit products that are approved-similar or equal.**

PRODUCT INFORMATION

Packaging	3 gal. (11 L) units
Color	Concrete gray
Shelf Life	24 months in original, unopened containers
Storage Conditions	Store dry at 40–95 °F (4–35 °C). Condition material to 65–75 °F (18–24 °C) before using.
Consistency	Non-sag paste

TECHNICAL INFORMATION

Compressive Strength	36 hours	6,400 psi (41.4 MPa)	(ASTM D-695) 73 °F (23 °C) 50 % R.H.
	2 day	7,000 psi (41.4 MPa)	
	3 day	9,000 psi (48.3 MPa)	
Slant Shear Strength	**Bond Strength**	**Hardened Concrete to Hardened Concrete**	(ASTM C-882) 73 °F (23 °C) 50 % R.H.
	2 days	2,000 psi (20.7 MPa)	
	14 day (moist cure)	2,300 psi (20.0 MPa)	
Heat Deflection Temperature	124 °F (51 °C) (7 days [fiber stress loading = 264 psi (1.8 MPa)]		(ASTM D-648)

APPLICATION INFORMATION

Mixing Ratio	Component 'A' : Component 'B' = 2:1 by volume
Coverage	1 gal. yields 231 cu. in. of epoxy paste adhesive and grout. 1 gal. mixed with 1 gal. by loose volume of oven-dried aggregate yields approximately 346 cu. in. of epoxy mortar.
Pot Life	Approximately 120 minutes at 73 °F (23 °C) (gal., L volume) Approximately 60 minutes at at 90 °F (32 °C) (gal., L volume)
Cure Time	**Tack-Free Time:** 6–8 hours

APPLICATION INSTRUCTIONS

SUBSTRATE PREPARATION

Surface must be clean and sound. It may be dry or damp, but free of standing water. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, disintegrated materials and any other contaminants.

Preparation Work: Concrete - Sandblast or use other approved mechanical methods.
Steel - Blast clean or use other equivalent mechanical means to achieve a white metal finish.

MIXING

Pre-mix each component. Proportion 1 part Component 'B' to 2 parts Component 'A' by volume into a clean pail. Mix thoroughly for 3 minutes with Sika paddle on low-speed (400–600 rpm) drill until uniform in color. Mix only that quantity that can be used within its pot life.

To prepare an epoxy mortar: Slowly add up to 1 part by loose volume of an oven-dried aggregate to 1 part of the mixed Sikadur®-31 Hi-Mod Gel LPL and mix until uniform in consistency.

APPLICATION METHOD / TOOLS

As a structural adhesive - Apply the neat mixed Sikadur®-31 Hi-Mod Gel LPL, to the mating or nonmating prepared substrates. Work into the substrate for positive adhesion. Secure the bonded unit firmly into place until the adhesion has cured. Glue line should not exceed 1/8 in. (3 mm).

To seal cracks for injection grouting - Place the neat mixed material over the cracks to be pressure injected and around each injection port. Allow sufficient time to set before pressure injecting.

For interior vertical and overhead patching - Place the prepared mortar in void, working the material into the prepared substrate, filling the cavity. Strike off level. Lifts should not exceed 1 in. (25 mm).

As a pick-proof sealant - Use automated or manual method. Apply an appropriate size bead of material around the area being sealed. Seal with neat Sikadur®-31 Hi-Mod Gel LPL.

LIMITATIONS

- Minimum substrate and ambient temperature 40 °F (4 °C).
- Do not thin. Addition of solvents will prevent proper cure.
- Use oven-dried aggregate only.
- Maximum epoxy mortar thickness is 1 in. (25 mm) per lift.
- Epoxy mortar is for interior use only. Material is a vapor barrier after cure.
- Minimum age of concrete must be 21–28 days, depending upon curing and drying conditions, for mortar applications.
- Porous substrates must be tested for moisture-vapor transmission prior to mortar applications.
- Not for sealing cracks under hydrostatic pressure at the

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time of application.
- Not an aesthetic product. Color may alter due to variations in lighting and/or UV exposure.

BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

OTHER RESTRICTIONS

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ENVIRONMENTAL, HEALTH AND SAFETY

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LEGAL DISCLAIMER

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SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within the product’s shelf life. User determines suitability of product for intended use and assumes all risks. User’s and/or buyer’s sole remedy shall be limited to the purchase price or replacement of this product exclusive of any labor costs. **NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKA SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. SIKA SHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS.**

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PRODUCT DATA SHEET

Sikadur®-35 Hi-Mod LV

High modulus, low viscosity, high strength epoxy grouting/sealing/binder adhesive

PRODUCT DESCRIPTION

Sikadur®-35 Hi-Mod LV is a 2-component, 100 % solids, moisture-tolerant, low-viscosity, high-strength, multipurpose, epoxy resin adhesive. It conforms to the current ASTM C-881, Types I, II, and IV, Grade-1, Class C* and AASHTO M-235 specifications.
*except for gel time

USES

Sikadur®-35 Hi-Mod LV may only be used by experienced professionals.

- Pressure-injection of cracks in structural concrete, masonry, wood, etc.
- Gravity-feed of cracks in horizontal concrete and masonry.
- Epoxy resin binder for epoxy mortar patching and overlay of interior, horizontal surfaces.
- Seal interior slabs and exterior above-grade slabs from water, chlorides, and mild chemical attack; also improves wearability.

CHARACTERISTICS / ADVANTAGES

- Super low viscosity.
- Convenient easy mix ratio A:B = 2:1 by volume.
- Unique, high-strength, structural adhesive for “can’t dry” surfaces.
- Deep penetrating and tenacious bonding of cracks in structural concrete.
- High-early-strength developing adhesive.
- Excellent chemical resistance in flooring systems.

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Contractor required to submit products that are approved-similar or equal.**

PRODUCT INFORMATION

Packaging	3 gal. (11 L) units; 1 gal. (3.8 L) units; 12 fl. oz. (355 ml) units, 12/case
Color	Clear, amber
Shelf Life	2 years in original, unopened containers.
Storage Conditions	Store dry at 40–95 °F (4–35 °C). Condition material to 65–75 °F (18–24 °C) before using.
Viscosity	Approx. 375 cps.

TECHNICAL INFORMATION

Compressive Strength

Neat

	40 °F (4 °C)	73 °F (23 °C)	90 °F (32 °C)	(ASTM D-695) 50 % R.H.
4 hours	-	-	-	
8 hours	-	180 psi (1.2 MPa)	3,200 psi (22.1 MPa)	
16 hours	-	4,500 psi (31.1 MPa)	6,300 psi (43.5 MPa)	
1 day	-	6,000 psi (41.4 MPa)	9,100 psi (62.8 MPa)	
3 days	4,000 psi (27.6 MPa)	10,700 psi (73.8 MPa)	10,500 psi (72.5 MPa)	
7 days	6,800 psi (46.9 MPa)	11,000 psi (75.9 MPa)	10,500 psi (72.5 MPa)	
14 days	10,300 psi (71.1 MPa)	12,000 psi (82.8 MPa)	10,500 psi (72.5 MPa)	
28 days	12,400 psi (85.6 MPa)	13,000 psi (89.7 MPa)	10,500 psi (72.5 MPa)	

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Epoxy Mortar (1: 5)

	40 °F (4 °C)	73 °F (23 °C)	90 °F (32 °C)	(ASTM D-695) 50 % R.H.
4 hours	-	-	800 psi (5.5 MPa)	
8 hours	-	-	4,100 psi (28.3 MPa)	
16 hours	-	400 psi (2.8 MPa)	5,700 psi (39.3 MPa)	
1 day	120 psi (0.8 MPa)	5,000 psi (34.5 MPa)	6,900 psi (47.6 MPa)	
3 days	6,200 psi (42.8 MPa)	6,800 psi (46.9 MPa)	7,000 psi (48.3 MPa)	
7 days	6,300 psi (43.5 MPa)	7,900 psi (54.5 MPa)	8,800 psi (60.7 MPa)	
14 days	6,800 psi (46.9 MPa)	8,500 psi (58.7 MPa)	8,800 psi (60.7 MPa)	
28 days	7,000 psi (48.3 MPa)	8,600 psi (59.3 MPa)	8,800 psi (60.7 MPa)	

Modulus of Elasticity in Compression

	Neat	Mortar	(ASTM D-695) 73 °F (23 °C) 50 % R.H.
7 days	3.2 x 10^5 psi (2,200 MPa)	-	
28 days	-	8.1 x 10_5 psi (5,600 MPa)	

Flexural Strength

	Neat	Mortar	(ASTM D-790) 73 °F (23 °C) 50 % R.H.
14 day	14,000 psi (96,6 MPa)	2,200 psi (15,2 MPa)	

Modulus of Elasticity in Flexure

	Neat	Mortar	(ASTM D-790) 73 °F (23 °C) 50 % R.H.
14 days	3.7 x 10_5 psi (2,600 MPa)	9.5 X 10_5 (6,500 MPa)	

Tensile Strength		**Neat**	**Mortar**	(ASTM D-638) 73 °F (23 °C) 50 % R.H.
	7 days	8,900 psi (61.4 MPa)	840 psi (5.8 MPa)	
Tensile Modulus of Elasticity		**Neat**	**Mortar**	(ASTM D-638) 73 °F (23 °C) 50 % R.H.
	14 days	4.1 X 10^5 psi (2800 MPa)	7.6 X 10_5 psi (5200 MPa)	
Elongation at Break		**Neat**	**Mortar**	(ASTM D-638) 73 °F (23 °C) 50 % R.H.
	7 day	5.4 %	0.3 %	
Tensile Adhesion Strength	2 days	(moist cure)	4,000 psi (27.6 MPa)	(ASTM C-882): Hardened concrete to hardened concrete 73 °F (23 °C) 50 % R.H.
	14 days	(moist cure)	2,900 psi (20.0 MPa)	
	2 days	(dry cure)	2,800 psi (19.3 MPa)	
Shear Strength		**Neat**	**Mortar**	(ASTM D-732) 73 °F (23 °C) 50 % R.H.
	14 days	5,100 psi (35,2 MPa)	2,300 psi (15.9 MPa)	
Heat deflection temperature		**Neat**	**Mortar**	(ASTM D-648) [fiber stress loading = 264 psi (1.8 MPa)]
	7 day	124 °F (51 °C)	129 °F (54 °C)	
Water Absorption	7 days	0.27 %		(ASTM D-570) 73 °F (23 °C) 50 % R.H.

APPLICATION INFORMATION

Mixing Ratio	Component "A": Component "B" = 2:1 by volume.			
Coverage	1 gal. yields 231 in_3 of adhesive and grout. 1 gal. of adhesive, when mixed with 5 gal. by loose volume of oven-dried aggregate, yields approximately 808.5 in_3 of epoxy mortar.			
Pot Life	Approx. 25 minutes (mass of 60 grams)			
Cure Time	**Tack-Free Time**	**40 °F (4 °C)**	**73 °F (23 °C)**	**95 °F (35 °C)**
	(3-5 mils) Neat	14–16 hours	3–3.5 hours	1.5–2 hours

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BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

LIMITATIONS

- Minimum substrate and ambient temperature 40ºF (4ºC).
- Do not thin with solvents. Consult Technical Service at 800-933-7452.
- Use oven-dried aggregate only.
- Maximum epoxy mortar thickness is 1.5 in. (38 mm) per lift.
- Epoxy mortar is for interior use only.
- Do not seal exterior slabs on grade.
- Minimum age of concrete must be 21–28 days, depending on curing and drying conditions, for mortar and to seal slabs.
- Porous substrates must be tested for moisture-vapor transmission prior to application.
- Not for injection of cracks under hydrostatic pressure at the time of application.
- Do not inject cracks greater than 1/4 in. (6 mm) Consult Technical Service.
- Not an aesthetic product. Color may alter due to variations in lighting and/or UV exposure.

ENVIRONMENTAL, HEALTH AND SAFETY

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APPLICATION INSTRUCTIONS

SUBSTRATE PREPARATION

Surface must be clean and sound. It may be dry or damp, but free of standing water. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles and disintegrated materials.
Concrete - Blast clean, shot blast or use other approved mechanical means to provide an open roughened texture.
Steel - Should be cleaned and prepared thoroughly by blast cleaning.

MIXING

Proportion 1 part Component 'B' to 2 parts Component 'A' by volume into a clean pail. Mix thoroughly for 3 minutes with Sika Paddle on low-speed (400–600 rpm) drill until uniformly blended. Mix only that quantity that can be used within its pot life. To prepare an epoxy mortar, slowly add 4–5 parts by loose volume of an ovendried aggregate to 1 part of the mixed Sikadur®-35 Hi-Mod LV and mix until uniform in consistency.

APPLICATION METHOD / TOOLS

To gravity feed cracks - Blow vee-notched crack clean with oil-free compressed air. Pour neat Sikadur®-35 Hi-Mod LV into vee-notched crack. Continue placement until completely filled. Seal underside of slab prior to filling if cracks reflect through.
To pressure-inject cracks - Use automated injection equipment or manual method. Set appropriate injection ports based on system used. Seal ports and crack with Sikadur® 31, Hi-Mod Gel or Sikadur® 33. When the epoxy adhesive seal has cured, inject Sikadur®-35 Hi-Mod LV with steady pressure. Consult Technical Service for additional information.
To seal slabs - Spread neat Sikadur®-35 Hi-Mod LV over slab. Allow penetration. Remove excess to prevent surface film. Seal interior slabs and above-grade exterior slabs only.
For an epoxy mortar - Prime prepared surface with neat Sikadur®-35 Hi-Mod LV. Place prepared epoxy mortar before primer becomes tack-free. Place the epoxy mortar using trowels. Compact and level with vibrating screed or trowels. Finish with finishing trowel. Sikadur®-35 Hi-Mod LV mortar is for interior use only.

OTHER RESTRICTIONS

LEGAL DISCLAIMER

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SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within the product's shelf life. User determines suitability of product for intended use and assumes all risks. User's and/or buyer's sole

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CLARIFYING NOTE: All sections of technical specifications have been provided as PBA reference to stipulates a minimum quality standard for materials, products, and construction/installation procedures. Codes and regulations indicated on such sections should be outdated. Therefore, any prospective bidder must consider, as part of his proposal, all latest federal, state, and local laws, codes, and regulations, applicable for each item of work included on this Contract.

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Pre-installation meetings.

F. Cutting and patching.

G. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

A. Owner and Owner's Representatives will schedule meeting after Notice of Award.

B. Attendance Required: Owner and Owner's Representatives, Representatives of Governmental or other regulatory Agencies, Architect/Engineer and his Consultants, Contractor and Sub-Contractors as Pertinent to Agenda.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing parties in Contract, and Architect/Engineer.
6. Procedures and processing of field decisions, submittals, and substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.

D. Record minutes and distribute copies within 4 days after meeting to participants.

1.4 SITE MOBILIZATION MEETING

A. Owner and Owner's Representatives will schedule meeting at Project site prior to Contractor occupancy.

B. Attendance Required: Owner and Owner's Representatives, Representatives of Governmental or other regulatory Agencies, Architect/Engineer and his Consultants, Contractor and major Subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements and occupancy.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.

10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within 4 days after meeting to participants.

1.5 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.

B. Owner and Owner's Representatives will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

C. Attendance Required: Owner and Owner's Representatives, Job Superintendent, Major Subcontractor and Suppliers, Representatives of Government or other regulatory Agencies, Architect/Engineer As appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

E. Record minutes and distribute copies within 4 days after meeting to participants.

1.6 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.

B. Require attendance of parties directly affecting, or affected by, Work of specific section.

C. Notify Owner and Owner's Representatives, Architect/Engineer four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within 4 days after meeting to participants.

2 PRODUCTS

Not Used.

3 EXECUTION

3.1 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

C. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.

D. Cut masonry and concrete materials using masonry saw or core drill.

E. Restore Work with new products in accordance with requirements of Contract Documents.

F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

H. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

I. Identify hazardous substances or conditions exposed during the Work to Owner and Owner's Representatives, Architect/Engineers for decision or remedy.

3.2 SPECIAL PROCEDURES

A. Materials: As specified in product sections; match existing with new products for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to permit installation of new work and finishes.

G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to original or specified condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Architect/Engineer for review.

L. Where change of plane of 1/4 inch (6mm) or more occurs, request instructions from Architect/Engineer.

M. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

N. Finish surfaces as specified in individual product sections.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Product data.

E. Shop drawings.

F. Samples.

G. Test reports.

H. Certificates.

I. Manufacturer's instructions.

J. Construction photographs.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with Architect/Engineer accepted form.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

E. Schedule submittals to expedite Project, and deliver to Architect/Engineer at [business address. Coordinate submission of related items.

F. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

H. Allow space on submittals for Contractor and Architect/Engineer review stamps.

I. When revised for resubmission, identify changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedules within 15 days after date established in Notice to Proceed.

B. Submit revised Progress Schedules with each Application for Payment.

C. Submit computer generated horizontal bar chart with separate line for each major portion of Work, identifying first work day of each week.

D. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

E. Indicate estimated percentage of completion for each item of Work at each submission.

F. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

G. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

H. Submit submittal dates for shop drawings, product data, and samples, including and dates reviewed submittals will be required from Architect/Engineer. Indicate decision dates for selection of finishes.

I. Indicate delivery dates for products identified under Allowances.

J. Revisions To Schedules:
   1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect including effect of changes on schedules of separate contractors.

1.4 PROPOSED PRODUCTS LIST

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.6 SHOP DRAWINGS

A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01700.

1.7 SAMPLES

A. Samples: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Samples For Selection as Specified in Product Sections:
   1. Submit to Architect/Engineer for aesthetic, color, or finish selection.
   2. Submit samples of finishes from full range of manufacturers' standard colors, textures, and patterns for Architect/Engineer selection.

C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

D. Include identification on each sample, with full Project information.

E. Submit number of samples specified in individual specification sections; Architect/Engineer will retain one sample.

1.8 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.9 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to Architect/Engineer in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.10 CONSTRUCTION PHOTOGRAPHS

A. Submit photographs with Application for Payment.

B. Photographs: two prints; color glossy 8 x 10 inch (200 x 250mm) size; with left edge binding margin for three hole punch.

C. Take two site photographs from differing directions and two interior photographs of building indicating relative progress of the Work, 7 days maximum prior to submitting.

D. Identify each print on back. Identify name of Project, contract number, orientation of view, date and time of view, name and address of photographer, and photographer's numbered identification of exposure.

E. Do not permit prints to be issued for any other purpose without specific written approval from the Engineer/Architect.

F. Require the photographer to retain the negatives for at least one year following Date of Substantial Completion and to provide additional prints to the Owner during that period at the prevailing commercial rates for such prints.

2 PRODUCTS

Not Used.

3 EXECUTION

Not Used.

END OF SECTION

SECTION 01400 QUALITY REQUIREMENTS

GENERAL

1.1 SECTION INCLUDES

1. Quality control and control of installation.
2. Tolerances
3. References.
4. Mock-up requirements.
5. Testing and inspection services.
6. Examination.
7. Preparation.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

1. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
2. Comply with manufacturers' instructions, including each step in sequence.
3. When manufacturers' instructions conflict with Contract Documents, request clarification from Owner’s Representatives before proceeding.
4. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
5. Perform Work by persons qualified to produce required and specified quality.
6. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

1. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

2. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Owner's Representatives before proceeding.

3. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

1. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

2. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.

3. Obtain copies of standards where required by product specification sections.

4. When specified reference standards conflict with Contract Documents, request clarification from Owner's Representatives before proceeding.

5. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 MOCK-UP REQUIREMENTS

1. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

2. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

3. Accepted mock-ups shall be comparison standard for remaining Work.

4. Where mock-up has been accepted Architect and Owner's Representatives and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so Owner's Representatives.

1.6 TESTING AND INSPECTION SERVICES

1. Contractor will employ and pay for services of an independent testing agency or laboratory acceptable to Owner's Representative to perform specified testing.

1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time specialist and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

2. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Owner's Representatives.
   1. Laboratory: Authorized to operate in Puerto Rico.
   2. Laboratory Staff: Maintain full time registered Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

3. Testing, inspections and source quality control may occur on or off project site.

4. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

5. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on Owner's Representatives.

6. Agency Responsibilities:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Owner/s Representatives, in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Owner's Representatives, of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests required by Owner's Representatives.
   7. Attend preconstruction meetings and progress meetings.

7. Agency Reports: After each test, promptly submit five copies of report to Owner's Representatives, Architect/Engineer and to Contractor. When requested Owner's Representatives, provide interpretation of test results. Include the following:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.

4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

8. Limits On Testing Authority:
   1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency or laboratory may not approve or accept any portion of the Work.
   3. Agency or laboratory may not assume duties of Contractor.
   4. Agency or laboratory has no authority to stop the Work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

1. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

2. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

3. Examine and verify specific conditions described in individual specification sections.

4. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

1. Clean substrate surfaces prior to applying next material or substance.

2. Seal cracks or openings of substrate prior to applying next material or substance.

3. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 014219
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with the reference standard of date of issue specified in the individual specification sections, except where a specific date is established by applicable code.

C. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

1.03 3GPP SPECIFICATION - THE 3GPP SPECIFICATIONS (IOT OR MOBILE BROADBAND STANDARD): 5G, GSM (GPRS, EDGE, EDGE+), W-CDMA (HSPA, HSPA+), LTE (LTE-ADVANCED, LTE-ADVANCED PRO), AND UMTS;CURRENT EDITION.

1.04 AA -- ALUMINUM ASSOCIATION, INC.

1.05 AABC -- ASSOCIATED AIR BALANCE COUNCIL

1.06 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

1.07 AASHTO -- AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

1.08 AATCC -- AMERICAN ASSOCIATION OF TEXTILE CHEMISTS & COLORISTS

1.09 ABMA -- AMERICAN BEARING MANUFACTURERS ASSOCIATION, INC.

1.10 ACA -- AMERICAN COATINGS ASSOCIATION

1.11 ACG -- AABC COMMISSIONING GROUP

1.12 ACGIH -- AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

1.13 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

1.14 ACMA -- AMERICAN COMPOSITES MANUFACTURERS ASSOCIATION

1.15 ADC -- AIR DIFFUSION COUNCIL

1.16 AFPA -- AMERICAN FOREST AND PAPER ASSOCIATION

1.17 AGA -- AMERICAN GALVANIZERS ASSOCIATION, INC.

1.18 AGC -- ASSOCIATED GENERAL CONTRACTORS OF AMERICA

1.19 AGMA -- AMERICAN GEAR MANUFACTURERS ASSOCIATION

1.20 AHA -- AMERICAN HARDBOARD ASSOCIATION

1.21 AHRI -- AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE

1.22 AI -- THE ASPHALT INSTITUTE

1.23 AIA -- THE AMERICAN INSTITUTE OF ARCHITECTS

1.24 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

1.25 AISI -- AMERICAN IRON AND STEEL INSTITUTE

1.26 AIST -- ASSOCIATION FOR IRON AND STEEL TECHNOLOGY

1.27 AITC -- AMERICAN INSTITUTE OF TIMBER CONSTRUCTION

1.28 ALI -- AMERICAN LADDER INSTITUTE

1.29 ALSC -- AMERICAN LUMBER STANDARDS COMMITTEE

1.30 AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

1.31 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

1.32 APA -- APA - THE ENGINEERED WOOD ASSOCIATION

1.33 APHA -- AMERICAN PUBLIC HEALTH ASSOCIATION

1.34 API -- AMERICAN PETROLEUM INSTITUTE

1.35 ARI -- AIR-CONDITIONING AND REFRIGERATION INSTITUTE (SEE AHRI)

1.36 ARRA -- ASPHALT RECYCLING AND RECLAIMING ASSOCIATION

1.37 ASA -- ACOUSTICAL SOCIETY OF AMERICA

1.38 ASCA -- ARCHITECTURAL SPRAY COATERS ASSOCIATION

1.39 ASCE -- AMERICAN SOCIETY OF CIVIL ENGINEERS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures 2016.

1.40 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASHRAE (REFR) - ASHRAE Handbook - Refrigeration Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASHRAE (HVACS) - ASHRAE Handbook - HVAC Systems and Equipment Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.41 ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

1.42 ASPE -- AMERICAN SOCIETY OF PLUMBING ENGINEERS

1.43 ASSE -- AMERICAN SOCIETY OF SANITARY ENGINEERING

1.44 ASTM A SERIES -- ASTM INTERNATIONAL

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

1.45 ASTM B SERIES -- ASTM INTERNATIONAL

1.46 ASTM C SERIES -- ASTM INTERNATIONAL

A. ASTM C1036 - Standard Specification for Flat Glass 2021.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

1.47 ASTM D SERIES -- ASTM INTERNATIONAL

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

1.48 ASTM E SERIES -- ASTM INTERNATIONAL

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.49 ASTM F SERIES -- ASTM INTERNATIONAL

1.50 ASTM G SERIES -- ASTM INTERNATIONAL

1.51 AWC -- AMERICAN WOOD COUNCIL

A. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings 2018.

1.52 AWI -- ARCHITECTURAL WOODWORK INSTITUTE

1.53 AWI/AWMAC/WI -- JOINT PUBLICATION OF ARCHITECTURAL WOODWORK INSTITUTE/ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA/WOODWORK INSTITUTE

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

1.54 AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION

1.55 AWPB -- AMERICAN WOOD PRESERVERS BUREAU

1.56 AWS -- AMERICAN WELDING SOCIETY

1.57 AWWA -- AMERICAN WATER WORKS ASSOCIATION

1.58 BHMA -- BUILDERS HARDWARE MANUFACTURERS ASSOCIATION

1.59 BIA -- BRICK INDUSTRY ASSOCIATION

1.60 BICSI -- BUILDING INDUSTRY CONSULTING SERVICE INTERNATIONAL

1.61 BIFMA -- BUSINESS AND INSTITUTIONAL FURNITURE MANUFACTURERS ASSOCIATION

1.62 BOMA -- BUILDING OWNERS AND MANAGERS ASSOCIATION

1.63 C2C -- CRADLE TO CRADLE PRODUCTS INNOVATION INSTITUTE

1.64 CAGI -- COMPRESSED AIR AND GAS INSTITUTE

1.65 CAL -- STATE OF CALIFORNIA

1.66 CARB -- CALIFORNIA AIR RESOURCES BOARD

1.67 CFSEI - COLD-FORMED STEEL ENGINEERS INSTITUTE

1.68 CGA -- COMPRESSED GAS ASSOCIATION

1.69 CHPS -- COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

1.70 CISCA -- CEILINGS & INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION

1.71 CISPI -- CAST IRON SOIL PIPE INSTITUTE

1.72 CLFMI -- CHAIN LINK FENCE MANUFACTURERS INSTITUTE

1.73 CONSENSUSDOCS -- CONSENSUSDOCS, LLC

1.74 CRI -- CARPET AND RUG INSTITUTE

1.75 CRRC -- COOL ROOF RATING COUNCIL

1.76 CRSI -- CONCRETE REINFORCING STEEL INSTITUTE

1.77 CSA -- CSA GROUP (FORMERLY CSA INTERNATIONAL)

1.78 CSI/CSC -- CONSTRUCTION SPECIFICATIONS INSTITUTE/CONSTRUCTION SPECIFICATIONS CANADA

1.79 CTA -- CONSUMER TECHNOLOGY ASSOCIATION (FORMERLY CONSUMER ELECTRONICS ASSOCIATION)

1.80 CTI -- CERAMIC TILE INSTITUTE

1.81 CTI -- COOLING TECHNOLOGY INSTITUTE

1.82 DASMA -- DOOR & ACCESS SYSTEMS MANUFACTURERS' ASSOCIATION, INTERNATIONAL

1.83 DBIA -- THE DESIGN BUILD INSTITUTE OF AMERICA, INC.

1.84 DHI -- DOOR AND HARDWARE INSTITUTE

1.85 DIPRA - DUCTILE IRON PIPE RESEARCH ASSOCIATION

1.86 DOCSIS -- DATA-OVER-CABLE SERVICE INTERFACE SPECIFICATIONS

1.87 EIA -- ELECTRONIC INDUSTRIES ALLIANCE

1.88 EIA -- ENVIRONMENTAL INDUSTRY ASSOCIATION

1.89 EIMA -- EXTERIOR INSULATION MANUFACTURERS ASSOCIATION

A. ANSI/EIMA 99-A - Standard for Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage 2017.

1.90 EJCDC -- ENGINEERS' JOINT CONTRACT DOCUMENTS COMMITTEE

1.91 EJMA -- EXPANSION JOINT MANUFACTURERS ASSOCIATION

1.92 ETG -- ETHERCAT TECHNOLOGY GROUP

1.93 FIELDCOMM GROUP (FFTS) - FOUNDATION FIELDBUS TECHNICAL SPECIFICATIONS;2014.

1.94 FLA -- STATE OF FLORIDA

A. FLA (PAD) - Florida Building Code Online - Product Approval Directory Current Edition.

1.95 FM -- FACTORY MUTUAL GLOBAL

1.96 GA -- GYPSUM ASSOCIATION

1.97 GANA -- GLASS ASSOCIATION OF NORTH AMERICA

1.98 GEI -- GREENGUARD ENVIRONMENTAL INSTITUTE

1.99 GREEN GLOBES -- GREEN BUILDING INITIATIVE

1.100 GREENSEAL -- GREENSEAL, INC.

1.101 GRI -- GEOSYNTHETIC RESEARCH INSTITUTE

1.102 HI -- HYDRAULIC INSTITUTE

1.103 HPDC -- HEALTH PRODUCT DECLARATION COLLABORATIVE

1.104 HPVA -- HARDWOOD PLYWOOD VENEER ASSOCIATION

1.105 HPW -- H.P. WHITE LABORATORY, INC.

1.106 IAAF -- INTERNATIONAL AMATEUR ATHLETIC FEDERATION

1.107 IAPMO -- INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS

1.108 IAS -- INTERNATIONAL ACCREDITATION SERVICE

1.109 ICC -- INTERNATIONAL CODE COUNCIL, INC.

A. ICC (IBC)-2018 - International Building Code 2018.

B. ICC (IEBC) - International Existing Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ICC (IECC) - International Energy Conservation Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ICC (IFC) - International Fire Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ICC (IFGC) - International Fuel Gas Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. ICC (IMC) - International Mechanical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC (IPMC) - International Property Maintenance Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. ICC (IPSDC) - International Private Sewage Disposal Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ICC (IRC) - International Residential Code for One- and Two-Family Dwellings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. ICC (ISPSC) - International Swimming Pool and Spa Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.110 ICC-ES -- ICC EVALUATION SERVICE, INC.

1.111 ICEA -- INSULATED CABLE ENGINEERS ASSOCIATION

1.112 ICRI -- INTERNATIONAL CONCRETE REPAIR INSTITUTE

1.113 IEC -- INTERNATIONAL ELECTROTECHNICAL COMMISSION

1.114 IEEE -- INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS

1.115 IES/IESNA -- ILLUMINATING ENGINEERING SOCIETY

1.116 IETF -- INTERNET ENGINEERING TASK FORCE

1.117 IGMA -- INSULATING GLASS MANUFACTURERS ALLIANCE

1.118 ILI -- INDIANA LIMESTONE INSTITUTE OF AMERICA, INC.

1.119 IMIAWC -- INTERNATIONAL MASONRY INDUSTRY ALL-WEATHER COUNCIL

1.120 ISA -- INSTRUMENT SOCIETY OF AMERICA

1.121 ISDI -- INSULATED STEEL DOOR INSTITUTE

1.122 ISFA - INTERNATIONAL SURFACE FABRICATORS ASSOCIATION

1.123 ISS -- IRON AND STEEL SOCIETY

1.124 ISSFA - INTERNATIONAL SOLID SURFACE FABRICATORS ASSOCIATION

1.125 ISO -- INTERNATIONAL STANDARDS ORGANIZATION

1.126 ITS -- INTERTEK TESTING SERVICES NA, INC.

1.127 ITU-T -- INTERNATIONAL TELECOMMUNICATIONS UNION -TELECOMMUNICATION STANDARDIZATION SECTOR

1.128 IWBI -- INTERNATIONAL WELL BUILDING INSTITUTE

1.129 LPI -- LIGHTNING PROTECTION INSTITUTE

1.130 MBMA -- METAL BUILDING MANUFACTURERS ASSOCIATION

1.131 MFMA -- METAL FRAMING MANUFACTURERS ASSOCIATION

1.132 MIAMI -- MIAMI-DADE COUNTY

A. Miami (APD) - Approved Products Directory; Miami-Dade County Current Edition.

1.133 MPI -- MASTER PAINTERS INSTITUTE (MASTER PAINTERS AND DECORATORS ASSOCIATION)

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.134 MSS -- MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC.

1.135 NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

1.136 NACE -- NACE INTERNATIONAL

1.137 NAGDM -- NATIONAL ASSOCIATION OF GARAGE DOOR MANUFACTURERS

1.138 NASSPA -- NORTH AMERICAN STEEL SHEET PILE ASSOCIATION

1.139 NBBI -- THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

1.140 NBI -- NEW BUILDINGS INSTITUTE

1.141 NCAA -- NATIONAL COLLEGIATE ATHLETIC ASSOCIATION

1.142 NCMA -- NATIONAL CONCRETE MASONRY ASSOCIATION

1.143 NCWPB - NATIONAL CERTIFIED PIPE WELDING BUREAU

1.144 NEBB -- NATIONAL ENVIRONMENTAL BALANCING BUREAU

1.145 NECA -- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

1.146 NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

1.147 NETA -- INTERNATIONAL ELECTRICAL TESTING ASSOCIATION

1.148 NFHS -- NATIONAL FEDERATION OF STATE HIGH SCHOOL ASSOCIATIONS:

1.149 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

1.150 NFRC -- NATIONAL FENESTRATION RATING COUNCIL, INC.

1.151 NIBS -- NATIONAL INSTITUTE OF BUILDING SCIENCES

1.152 NIST -- NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (U.S. DEPARTMENT OF COMMERCE)

1.153 NLA -- NATIONAL LIME ASSOCIATION

1.154 NPA -- NATIONAL PARTICLEBOARD ASSOCIATION

1.155 NPCA -- NATIONAL PAINT AND COATINGS ASSOCIATION

1.156 NRCA -- NATIONAL ROOFING CONTRACTORS ASSOCIATION

1.157 NSF -- NSF INTERNATIONAL (THE PUBLIC HEALTH AND SAFETY ORGANIZATION)

1.158 NSI -- NATURAL STONE INSTITUTE

1.159 NTMA -- NATIONAL TERRAZZO AND MOSAIC ASSOCIATION, INC., THE

1.160 NTMA -- NATIONAL TILE AND MARBLE ASSOCIATION

1.161 NWWDA -- NATIONAL WOOD WINDOW AND DOOR ASSOCIATION (NAME CHANGED TO WDMA)

1.162 ORACLE -- ORACLE INTEGRATED CLOUD APPLICATIONS & PLATFORM SERVICES

1.163 PCA -- PORTLAND CEMENT ASSOCIATION

1.164 PCI -- PRECAST/PRESTRESSED CONCRETE INSTITUTE

1.165 PPI -- PLASTICS PIPE INSTITUTE

1.166 PR - COMMONWEALTH OF PUERTO RICO

A. Puerto Rico Building Code 2018 Ed. - Adopting (ICC) 2018 International Building Code with amendments.

1.167 PTI -- POST-TENSIONING INSTITUTE

1.168 RCSC -- RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS

1.169 RFCI -- RESILIENT FLOOR COVERING INSTITUTE

1.170 SAE -- SAE INTERNATIONAL

1.171 SBCA -- STRUCTURAL BUILDING COMPONENTS ASSOCIATION

1.172 SBCCI -- SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, INC.

1.173 SCAQMD -- SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

1.174 SCS - SCIENTIFIC CERTIFICATION SYSTEMS

1.175 SCTE -- SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS

1.176 SDI -- STEEL DECK INSTITUTE

1.177 SDI -- STEEL DOOR INSTITUTE

1.178 SEFA -- SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION

A. SEFA 2 - Installations 2010.

B. SEFA 3 - Laboratory Work Surfaces 2010.

C. SEFA 7 - Laboratory Fixtures 2010.

D. SEFA 8P - Laboratory Grade Polypropylene Casework 2014.

1.179 SJI -- STEEL JOIST INSTITUTE

1.180 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

1.181 SPIB -- SOUTHERN PINE INSPECTION BUREAU, INC.

1.182 SPRI -- SINGLE PLY ROOFING INDUSTRY

1.183 SSPC -- SOCIETY FOR PROTECTIVE COATINGS

1.184 STI -- STEEL TANK INSTITUTE

1.185 SWRI -- SEALANT, WATERPROOFING AND RESTORATION INSTITUTE

1.186 TCNA -- TILE COUNCIL OF NORTH AMERICA, INC.

1.187 TIA -- TELECOMMUNICATIONS INDUSTRY ASSOCIATION

1.188 TMS -- THE MASONRY SOCIETY

1.189 TPI -- TRUSS PLATE INSTITUTE

1.190 UL -- UNDERWRITERS LABORATORIES INC.

A. UL (FRD) - Fire Resistance Directory Current Edition.

1.191 USGBC -- U.S. GREEN BUILDING COUNCIL

1.192 W3C SSG - WEB OF SERVICES STANDARDS COLLECTION (HTTP, XML, WSDL, UDDI, AND OTHERS);CURRENT EDITION.

1.193 WDMA -- WINDOW AND DOOR MANUFACTURERS ASSOCIATION (FORMERLY NWWDA)

1.194 WI -- WOODWORK INSTITUTE

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

2.01 ATBCB -- US ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD (THE ACCESS BOARD)

2.02 CFR -- CODE OF FEDERAL REGULATIONS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

C. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

2.03 EPA -- ENVIRONMENTAL PROTECTION AGENCY

2.04 FAA -- FEDERAL AVIATION ADMINISTRATION

2.05 FDA -- FOOD AND DRUG ADMINISTRATION

2.06 FEMA -- U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY

2.07 FHWA -- FEDERAL HIGHWAY ADMINISTRATION

2.08 FS -- FEDERAL SPECIFICATIONS AND STANDARDS (GENERAL SERVICES ADMINISTRATION)

2.09 GSA -- U.S. GENERAL SERVICES ADMINISTRATION

2.10 HHS -- U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, CENTERS FOR DISEASE CONTROL AND PREVENTION

2.11 MIL -- MILITARY SPECIFICATIONS AND STANDARDS

2.12 PS -- PRODUCT STANDARDS

2.13 USAB -- UNITED STATES ACCESS BOARD

A. ABA Standards - ABA Accessibility Standards 2004, with Amendments (2015).

2.14 USDA -- UNITED STATES DEPARTMENT OF AGRICULTURE

2.15 USDHUD -- UNITED STATES DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

2.16 USGS -- UNITED STATES GEOLOGICAL SURVEY

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary ventilation.
   4. Temporary Cooling.
   5. Telephone service.
   6. Facsimile service.
   7. Temporary water service.
   8. Temporary sanitary facilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.
   5. Project identification.

C. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Water control.
   4. Erosion and sediment control.

D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

A. Cost: Provide and pay for power service required from utility source as needed for construction operation.

B. Provide temporary electric feeder from electrical service at location as directed. Do not disrupt Owner's use of service.

C. Complement existing power service capacity and characteristics as required for construction operations.

D. Provide power outlets, with branch wiring and distribution boxes located as required. Provide flexible power cords as required for portable construction tools and equipment.

E. Provide meter.

F. Permanent convenience receptacles may not be utilized during construction.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve minimum lighting level of 2 watt/sq ft (21 watt/sq m)].

B. Provide and maintain 1 watt/sq ft (10.8 watt/sq m) lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 watt/sq ft (2.7 watt/sq m) HID lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may not be utilized during construction.

1.4 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.5 TEMPORARY COOLING

A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for temporary offices and construction operations. As describe in the Special Conditions.

1.6 TELEPHONE SERVICE

A. Provide, maintain, and pay for telephone service to field office at time of project mobilization. As describe in the Special Conditions.

1.7 PHOTOCOPIER AND FACSIMILE SERVICE

A. Provide, maintain and pay for photocopier and facsimile service and dedicated telephone line to field office at time of project mobilization.

1.8 TEMPORARY WATER SERVICE

A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.9 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization. As describe in Special Conditions.

B. At end of construction, return existing facilities used for construction operations to same or better condition as original condition.

1.10 FIELD OFFICES AND SHEDS

A. Offices: Weather tight, with lighting, electrical outlets, cooling and ventilating equipment, and equipped with sturdy office furniture, drawing rack, and drawing display table and other items. As describe in the Uniform General Conditions.

B. Provide space for Project meetings, with table and chairs. As describe in the Uniform General Conditions.

C. Provide computer equipments for use by Owner's Representatives as describe in the Uniform General Conditions.

1.11 VEHICULAR ACCESS

A. Construct temporary access roads from public thoroughfares to serve construction area.

B. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

C. Provide unimpeded access for emergency vehicles.

D. Provide and maintain access to fire hydrants and control valves free of obstructions.

E. Provide means of removing mud from vehicle wheels before entering streets.

F. Do not use existing on-site roads for construction traffic.

1.12 PARKING

A. Arrange for and Provide temporary parking areas to accommodate construction personnel, Owner's Representative, and Architect/Engineer.

B. When site space is not adequate, provide additional off-site parking.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

A. Contractor shall provide daily janitorial services.

B. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

C. Remove debris and rubbish from closed or remote spaces, prior to enclosing spaces.

D. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

E. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

F. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 PROJECT IDENTIFICATION

A. Project Identification Sign:
   1. Provide 8 ft by 6 ft (2.4m x 1.8m) project sign of exterior grade plywood and wood frame construction, painted, with exhibit lettering by professional sign painter and self-adhesive corporate logo.

B. Design sign and structure to withstand 60 miles/hr (100 km/hr) wind velocity.

C. Installation:
   1. Install project identification sign within 15 days after date fixed by Notice to Proceed.
   2. Erect at designated location.
   3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
   4. Install sign surface plumb and level, with butt joints. Anchor securely.
   5. Paint exposed surfaces of sign, supports, and framing.

D. Maintenance: Maintain signs and supports clean, repair deterioration and damage.

E. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

1.15 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.16 ENCLOSURES AND FENCING

A. Construction: Design, materials, paints will be selected by Owner's representative.

B. Exterior Enclosures:

1. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.17 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion

1.18 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

B. Remove underground installations to minimum depth of 2 feet (600 mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

2 PRODUCTS

Not Used.

3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Cover products subject to deterioration with impervious sheet covering.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Architect/Engineer will consider requests for Substitutions only within 15 days after date of Owner-Contractor Agreement.

B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Bidder:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:

1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

2 PRODUCTS

Not Used

3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

1. Closeout procedures.
2. Final cleaning.
3. Protecting installed construction.
4. Project record documents.
5. Operation and maintenance data.
6. Spare parts and maintenance products.

1.2 CLOSEOUT PROCEDURES

1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
2. Provide submittals to Architect/Engineer required by authorities having jurisdiction.
3. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

1. Execute final cleaning prior to final project assessment.
2. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
3. Clean debris from roofs, gutters, downspouts, and drainage systems.
4. Clean site; sweep paved areas, rake clean landscaped surfaces.
5. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 PROTECTING INSTALLED CONSTRUCTION

1. Protect installed Work and provide special protection where specified in individual specification sections.

2. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

3. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

4. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

5. Prohibit traffic from landscaped areas.

1.5 PROJECT RECORD DOCUMENTS

1. Maintain on site one set of the following record documents; record actual revisions to the Work:
    1. Drawings.
    2. Specifications.
    3. Addenda.
    4. Change Orders and other modifications to the Contract.
    5. Reviewed Shop Drawings, Product Data, and Samples.
    6. Manufacturer's instruction for assembly, installation, and adjusting.

2. Ensure entries are complete and accurate, enabling future reference by Owner.

3. Store record documents separate from documents used for construction.

4. Record information concurrent with construction progress, not less than weekly.

5. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
    1. Manufacturer's name and product model and number.
    2. Product substitutions or alternates utilized.
    3. Changes made by Addenda and modifications.

6. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
    1. Measured depths of foundations in relation to finish first floor datum.
    2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

7. Submit documents to René Acosta-Arquitectos with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

1. Submit data bound in 8-1/2 x 11 inch text pages, capacity expansion binders with durable plastic overs.

2. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project , and subject matter of binder when multiple binders are required.

3. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

4. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

5. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
    1. Part 1: Directory, listing names, addresses, and telephone numbers of René Acosta-Arquitectos, Contractor, Subcontractors, and major equipment suppliers.
    2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
        1. Significant design criteria.
        2. List of equipment.
        3. Parts list for each component.
        4. Operating instructions.
        5. Maintenance instructions for equipment and systems.
        6. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
    3. Part 3: Project documents and certificates, including the following:
        1. Shop drawings and product data.
        2. Air and water balance reports.
        3. Certificates.
        4. Photocopies of warranties.

1.7 SPARE PARTS AND MAINTENANCE PRODUCTS

1. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

2. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

1.8 PRODUCT WARRANTIES AND PRODUCT BONDS

1. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

2. Verify documents are in proper form, contain full information, and are notarized.

3. Co-execute submittals when required.

4. Include Table of Contents and assemble in three D side ring binder with durable plastic cloth cover.

5. Submit prior to final Application for Payment.

6. Time Of Submittals:
    1. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
    2. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02 41 00

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 SECTION REQUIREMENTS

A. Extent of selective demolition work is indicated on drawings and demolition notes.

1.2 SUBMITTALS

A. Schedule:

1. Submit schedule indicating proposed methods and sequence of operations for selective demolition work to Owner for review prior to commencement of work. Include coordination for shut-off, capping, and continuation of utility services as required, together with detail for dust and noise control protection.

2. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

1.3 JOB CONDITIONS

A. Existing Conditions:

1. The Owner assumes no responsibility for actual condition of items or structures to be demolished.

B. Storage and Sale: Storage or sale of removed items on site will not be permitted.

C. Provide temporary barricades and other forms of protection as required to protect Employees and general public from injury due to selective demolition work.

D. Erect temporary covered passageways as required by authorities having jurisdiction.

E. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

F. Provide temporary weather protection during demolition and removal of existing construction on exterior surfaces and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing building.

G. Remove protections at completion of work.

H. Damage: Promptly repair damages caused to adjacent occupied facilities by demolition work at no cost to Owner.

I. Traffic:

1. Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with other adjacent occupied or used facilities.

2. Do not close, block or otherwise obstruct other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

J. Utilities:

1. Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations.

2. Do not interrupt existing utilities serving occupied or used facilities. Provide temporary services during interruptions to existing utilities.

k. Environmental Controls: Use water sprinkling, temporary enclosures and/or other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

L. Do not use water when it may create hazardous or objectionable conditions such as flooding and pollution.

M. Partial Demolition and Removal: Items indicated to be removed. Contractor shall remove from structure as work progresses.

N. Mechanical Demolition:

1. Disconnect, demolish and remove work as indicated on Construction Drawings.

2. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new product of equal capacity and quality.

3. Remove indicated exposed pipe and ductwork in it's entirely.

4. Remove indicated piping, A/C ducts from project.

5. Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocated.

O. Electrical Demolition:

1. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality and functionality.

• Electrical Demolition (Cont.'):

2. Remove exposed electrical equipment and installations, indicated to be demolished, in their entirely.

3. Remove demolished and removed materials from project site.

4. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 INSPECTION:

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties, which could be misconstrued as damage resulting from selective demolition work; file with Architect prior to starting work.

B. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes.

3.2 PREPARATION

A. Provide weatherproofing closures for exterior openings resulting from demolition work.

B. Locate, identify, stub off and disconnect utility services that are not indicated to remain.

3.3 DEMOLITION

A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

D. If unanticipated mechanical, electrical which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written with accurate details. Pending receipt of directive from

Architect rearrange selective demolition schedule as necessary to continue overall job progress without delay.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose of materials off site.

B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution.

C. Burning of removed materials is not permitted on project site.

3.5 CLEAN-UP AND REPAIR

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

B. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damage by selected demolition work.

END OF SECTION 02 41 00

SECTION 02711

CHAIN LINK FENCES

1. RELATED DOCUMENTS:

   The general provisions of the Contract, including the General and Special Conditions apply to the work specified in this section.

2. DESCRIPTION OF WORK:

   The extent of chain link fences and gates is shown on the drawings.

3. QUALITY ASSURANCE:

   Standards of Manufacture: Comply with the standards of the Chain link Fence Manufacturer's Institute.

   Provide fences and gates as complete unit produced by a single manufacturer including necessary erection accessories, fittings and fastenings.

4. SUBMITTALS:

   Manufacturer's Data: Submit for approval two (2) copies of manufacturer's data, specifications, and installation instructions for chain link fencing and gates.

5. GENERAL:

   Pipe sizes indicated are commercial pipe sizes. Equivalent tubular sections, H-sections or roll-formed sections may be substituted for pipe sections, if acceptable to the P.B.A.

6. MATERIALS AND FABRICATION:

   a. Fabric: No. 9 gage (0.148") steel wires, 2" mesh, with both top and bottom selvages twisted and barbed. Provide one-piece fabric widths for fencing up to 12' high. Fabric finish, galvanized, ASTM A 392, Class I, with not less than 1.2 oz. zinc per square feet.

   b. Rails & Framework: Galvanized steel, ASTM A120, with not less than 1.8 oz. zinc per square feet.

• MATERIALS AND FABRICATION (Cont.):

c. Hardware & Accessories: Galvanized, ASTM A152, with zinc weights per Table I.

d. End, Corner and Pull Posts: Minimum sizes and weights as follows:

1. Up to 6' fabric height, 2.375" O.D. steel pipe, 3.65 lbs. per linear feet.

2. Over 6' fabric height, 2.875" O.D. steel pipe, 5.79 lbs. per linear feet.

e. Line Posts: Space 10'o.c. maximum, unless otherwise shown, of following minimum sizes and weights.

1. Up to 6'fabric height, 1.90" O.D. steel pipe, 2.72 lbs, per linear feet.

2. Over 6' fabric height, 2.375" O.D. steel pipe, 3.65 lbs, per linear feet.

f. Gate Posts: Provide posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

1. Up to 6' wide, 2.875" O.D. pipe.

2. Over 6' and up to 12' wide, 4.0" O.D. pipe.

g. Top and Bottom Rails: 1.660" O.D. pipe, manufacturer longest lengths, with expansion type couplings, approximately 6" long, for each joint. Attach rails securely to each gate, corner, pull, and end post as approved by P.B.A.

h. Post Brace Assembly: Provide manufacturer's standard adjustable brace at gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use 1.660" O.D. pipe for horizontal brace and 0.375" diameter adjustable length diagonal truss rod.

i. Post Tops: Weather tight closure cap, one cap for each post. Furnish caps with openings to permit passage of top rail.

j. Stretcher Bar Bands: Space not over 15"o.c., to secure stretcher bars to end, corner, pull, and gate posts.

k. Extension Arms (when shown): Galvanized pressed steel or galvanized malleable iron, 3 strands of barbed wire.

l. Barbed Wire: Federal Specification RR-F-221, Type A, 12 ½ gauge, galvanized steel wire, 4 point barbs spaced not over 4" on center.

• MATERIALS AND FABRICATION (Cont.):

m. Gates: Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than 8' apart. Fabricate gate perimeter frames of tubular members as follows:

1. Up to 6'-0" high, or leaf width under 8': 1.660" O.D. steel pipe.

2. Over 6'-0" high or leaf width over 8': 1.90" O.D. steel pipe.

Assemble gate frames by welding or with special fittings and rivets, for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. The Contractor shall attach stretchers to gate frame (at not more than 15"o.c.) and hardware to provide security against removal or breakage. Provide diagonal cross-bracing consisting of ⅜" diameter adjustable length truss rods on gates to provide frame rigidity without sag or twist, if required.

n. Gate Hardware: Provide the following hardware and accessories for each gate:

• Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180º gate opening. Provide 1-½ pair of hinges, for each leaf over 6' nominal height or over 8' wide.

• Latch: Forked type or plunger-bar type to permit operation from either side of gate. Provide padlock eye as integral part of latch.

• Padlock: One padlock equal as approved to Yale 871 ½ master keyed with the building locksets.

• Wire Ties: For tying fabric to line posts, use wire ties spaced 12"o.c. For tying fabric to rails and braces, use wire spaced 24"o.c. For tying fabric to tension wire, use hog rings spaced 24"o.c.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

o. Concrete: Comply with applicable requirements of Division 3. Provide concrete with a minimum 28 day compressive strength of 2500 psi.

7. INSTALLATION:

Do not begin installation and erection before final grading is completed, unless otherwise permitted.

a. Excavation: Dig holes for posts of sizes and spacing shown, in firm, undisturbed or compacted soil. Excavate deeper as required for firm support in soft and loose soils, and for posts with heavy lateral loads.

b. Setting Posts: Center and align posts in holes 3" above bottom of excavation. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

c. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

d. Center Rails: Provide center rails only where shown. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

e. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

f. Tension Wire: Install tension wires by weaving through the fabric and tying to each post with not less than 6 gage galvanized wire, or by securing the wire to the fabric.

g. Fabric: Leave approximately 1" between finish grade and bottom selvage, unless otherwise shown. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

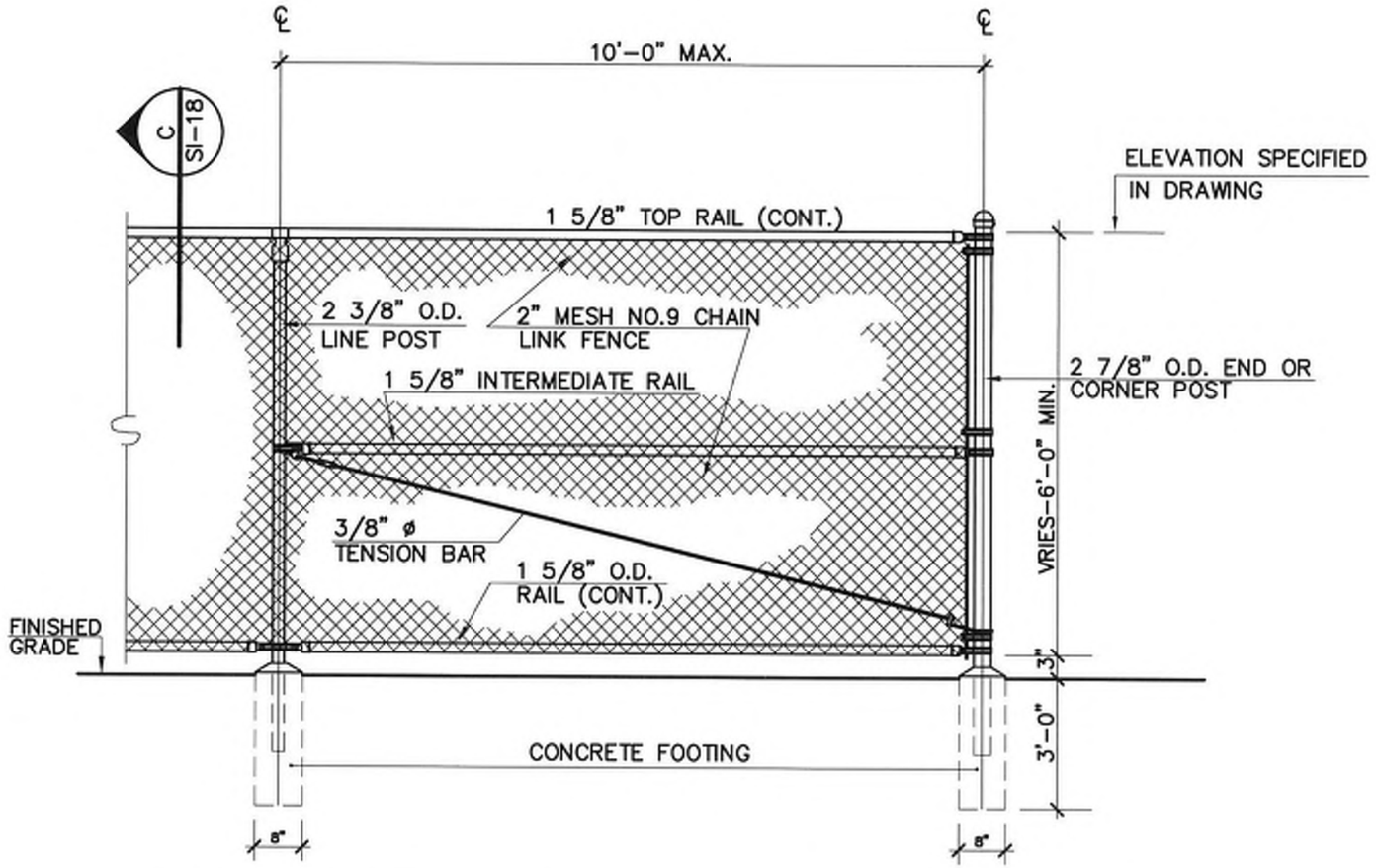
h. Stretcher Bars: Thread through or clamp to fabric 4"o.c., and secure to posts with metal bands spaced 15"o.c.

i. Gates: Install gates plumb, level, and secure for full opening with-out interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.

j. Tire Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two (2) full turns. Bend ends of wire to minimize hazard to persons or clothing.

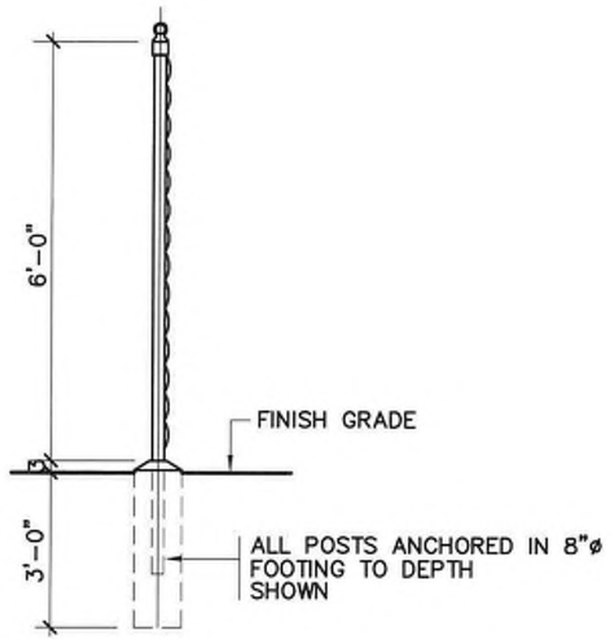
k. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 02711



TYPICAL ELEVATION AT END OR CORNER POST FOR CHAIN LINK FENCE

NOT TO SCALE
NOTE: ELIMINATE TENSION BAR & INTERMEDIATE RAIL IN OTHER CONDITIONS



LINE POST DETAIL

C
SI-18

SCALE: 1/2"=1'-0"

FENCE NOTES:

1. PIPE SIZES INDICATED ARE COMMERCIAL PIPE SIZES.
2. FABRIC – NO.9 GA. (0.148") STEEL WIRES, TWO INCH MESH, WITH BOTH TOP AND BOTTOM SELVAGES TWISTED AND BARBED. PROVIDE ONE PIECE FABRIC WIDTHS FOR FENCING UP TO 12' HIGH. FABRIC FINISH, GALVANIZED, ASTM A 392, CLASS I ,WITH NOT LESS THAN 1.2 OZ. ZINC PER SQ. FT.
3. RAILS & FRAMEWORK – GALVANIZED STEEL, ASTM A 120, WITH NOT LESS THAN 1.8 OZ. ZINC PER SQ. FT.
4. HARDWARE AND ACCESSORIES – GALVANIZED, ASTM A 152, WITH ZINC WEIGHTS PER TABLE I.
5. ALL WELDS SHALL BE COATED WITH ZRC COLD GALVANIZER

SECTION 02763

PAINTED PAVEMENT MARKINGS

1 PART GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Traffic lines and markings.
   2. Legends.
   3. Paint.

B. Related Sections:
   1. Section 02740 Flexible Pavement.

1.2 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM D34 - Standard Guide for Chemical Analysis of White Pigments.
   2. ASTM D126 - Standard Test Methods for Analysis of Yellow, Orange, and Green Pigments Containing Lead Chromate and Chromium Oxide Green.
   3. ASTM D562 - Standard Test Method for Consistency of Paints Using the Stormer Viscometer.
   4. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
   5. ASTM D713 - Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials.
   6. ASTM D969 - Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
   7. ASTM D1301 - Standard Test Methods for Chemical Analysis of White Lead Pigments.
   8. ASTM D1394 - Standard Test Methods for Chemical Analysis of White Titanium Pigments.
   9. ASTM D1475 - Standard test Method for Density of Liquid Coatings, Inks, and Related Products.
   10. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
   11. ASTM D2202 - Standard Test Method for Slump of Sealants.
   12. ASTM D2371 - Standard Test Method for Pigment Content of Solvent-Reducible Paints.
   13. ASTM D2621 - Standard Test Method for Infrared Identification of Vehicle Solids From Solvent-Reducible Paints.
   14. ASTM D2743 - Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography.

1.3 PERFORMANCE REQUIREMENTS

A. Paint Adhesion: Adhere to road surface forming smooth continuous film one minute after application.

B. Paint Drying: Tack free by touch so as not to require coning or other traffic control devices to prevent transfer by vehicle tires within two minutes after application.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit paint formulation for each type of paint.

C. Samples:
   1. Submit eight sample plates of each color of material. After approval, Owner will retain these plates for field comparisons of applied paint.
   2. Submit two gallons and four one quart paint samples accompanied by properly executed test reports.
   3. Submit samples of glass bead in compliance with AASHTO M247.

D. Test Reports: Submit source and acceptance test results in accordance with AASHTO M247.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Puerto Rico Public Work's standard.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum 3 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Invert containers several days prior to use when paint has been stored more than 2 months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

D. Volatile Organic Content (VOC). Do not exceed State or Environmental Protection Agency maximum VOC on traffic paint.

1.9 WARRANTY

A. Section 01700 - Execution Requirements: Requirements for warranties.

B. Furnish three year manufacturer's warranty for traffic paints.

1.10 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements: Requirements for maintenance service.

B. Furnish service and maintenance of traffic paints for three years from Date of Substantial Completion.

2PART PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Manufacturers:
1. "Traffic Paint" by Pervo Paint Company.
2. "Traffic Paint" by Pathmark Traffic Products.
3. Traffic and Zone Marking Paint" by PPG.
4. "Romark Traffic" by Glidden-Durkee.
5. Substitutions: Section 01600 - Product Requirements Not Permitted.

B. Paint: Ready mixed, conventional and fast dry waterborne traffic paints, lead-free, non-toxic, NASSHTO Test Deck, minimum retroreflectance of 100 mcds, durability rating of 6 or more after in place for 9 months; within following limits:

1. Pigment, percent by weight: 60 plus or minus 2.
2. Vehicle, percent by weight: 40 plus or minus 2.
3. Non-Volatile, percent by weight of paint: 76.0.
4. Weight per gallon, pounds (kilograms) minimum 13.0 6.
5. Viscosity: 80-95Kreb Units at 77 degrees F (25 degrees C).
6. Grind (Hegman Guage), minimum Field Tested no tracking time under ambient conditions: 20-90 seconds.
7. Dry Through Time, 15 mils (0.4 mm) wet at 90 percent relative humidity, 72 degrees F (22 degrees C), ASTM D1640: 125 minutes maximum.
8. VOC (Volatile Organic Content): One lbs/gal (120 g/L) maximum.

2.2 EQUIPMENT

A. Continuous Longitudinal Line Application Machine: Use application equipment with following capabilities.
   1. Dual nozzle paint gun to simultaneously apply parallel lines of indicated width in solid or broken patterns or various combinations of those patterns.
   2. Measuring device to automatically and continuously measure length of each line placed, to nearest foot (tenth of meter).

B. Machine Calibration:
   1. Paint Line Measuring Device: Calibrate automatic line length gauges to maintain tolerance of plus or minus 25 feet per mile (4.75 m per km).
   2. Cycle Length/Paint Line Length Timer: Calibrate cycle length to maintain tolerance of plus or minus 6 inches per 40 feet (12mm per m); calibrate paint line length to maintain tolerance to plus or minus 3 inches per 10 feet (25 mm per m).
   3. Paint Guns: Calibrate to simultaneously apply paint binder at uniform rates as specified with an allowable tolerance of plus or minus 1 mil.

C. Other Equipment:
   1. For application of crosswalks, intersections, stop lines, legends and other miscellaneous items by walk behind stripers, hand spray or stencil trucks, apply with equipment meeting requirements of this section. Do not use hand brushes or rollers.

2.3 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test and analyze traffic paints in accordance with ASTM D34, ASTM D126 and ASTM D562.

C. Allow witnessing of factory inspections and test at manufacturer's test facility. Notify Architect/Engineer at least seven days before inspections and tests are scheduled.

3PART EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Do not apply paint to concrete surfaces until concrete has cured for 28 days.

3.2 PREPARATION

A. Maintenance and Protection of Traffic:
1. Provide short term traffic control in accordance with Section 01500.
2. Prevent interference with marking operations and to prevent traffic on newly applied markings before markings dry.
3. Maintain travel lanes between 7: 00 AM to 9: 00 AM, and between 4: 00 PM and 6: 00 PM.
4. Maintain access to existing businesses, and other properties requiring access.

B. Surface Preparation.
1. Clean and dry paved surface prior to painting.
2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.
3. Spot location of final pavement markings as specified and as indicated on Drawings by applying pavement spots 25 feet (8.0 m) on center.
4. Notify Architect/Engineer after placing pavement spots and minimum 3 days prior to applying traffic lines.

3.3 EXISTING WORK

A. Remove existing markings in an acceptable manner. Do not remove existing pavement markings by painting over with blank paint. Remove by methods that will cause least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by removal methods.

B. Clean and repair existing lines and legends.

3.4 APPLICATION

A. Agitate paint for 1-15 minutes prior to application to ensure even distribution of paint pigment.

B. Dispense paint at 110 degrees F (43.3 degrees C) to wet-film thickness of 15 mils (0.4 mm), except dispense edge markings to wet-film thickness of 12 mils (0.3 mm).

C. Apply markings to indicated dimensions at indicated locations.

D. Prevent splattering and over spray when applying markings.

E. Unless material is track free at end of paint application convoy, use traffic cones to protect markings from traffic until track free. When vehicle crosses a marking and tracks it or when splattering or over spray occurs, eradicate affected marking and resultant tracking and apply new markings.

F. Collect and legally dispose of residues from painting operations.

3.5 APPLICATION TOLERANCES

A. Section 01400 - Quality Requirements: Tolerances.

B. Maximum Variation from Wet Film Thickness: 1 mil.

C. Maximum Variation from Wet Paint Line Width: Plus or minus 1/8 inch (3 mm).

D. Maintain cycle length for skip lines at tolerance of plus or minus 6 inches per 40 feet (12 mm per m) and line length of plus or minus 3 inches per 10 feet (25mm per m).

3.6 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements.

B. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

C. Repair lines and markings, which after application and curing do not meet following criteria:
   1. Incorrect Location: Remove and replace incorrectly placed patterns.
   2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
   3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot (300 mm) beyond affected area. Apply new markings on cleaned surface in accordance with this Section.

D. Replace defective pavement markings as specified throughout 3 year warranted period. Replace markings damaged by anti-skid materials, studded tires, tire chains, chemical deicers, or other loss of marking material regardless of cause.

E. A three member team will evaluate warranty provisions. Team will consist of one member from Owner, one member from Contractor, and third person who is mutually acceptable to Owner and Contractor. Any costs for third person will be equally shared between Owner and Contractor. At least once each year, beginning with year after acceptance, team shall:

1. Observe Owner taking readings by retroreflectometer, or review Owner records of such evaluation. The number of readings will be as large as necessary to ensure that minimum criteria are satisfied. Readings will be during period from March 15 through October, when pavement is clean and dry.

2. Determine magnitude of material loss.

F. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need replaced. Provide traffic control as necessary if markings require more detailed evaluation.

G. Replace failed or defective markings in entire section of defective markings within 30 days after notification when any of the following exists during warranty period:

1. Average retroreflectivity within any 528 foot (161 m) section is less than 1225 mcd/m2/1x for white pavement markings and 100 mcd/m2/1x for yellow pavement markings.
2. Marking is discolored or exhibits pigment loss, and is determined to be unacceptable by three member team based on visual comparison with beaded color plates.
3. More than 15 percent of area of continuous line, or more than 15 percent of combined area of skip lines, within any 528 foot (161 m) section of roadway is missing.

H. When eradication of existing paint lines is necessary, eradicate by shot blast or water blast method. Do not gouge or groove pavement more than 1/16 inch (1.5 mm) during removal. Limit area of removal to area of marking plus 1 inch (25 mm) on all sides. Prevent damage to transverse and longitudinal joint sealers, and repair any damage according to requirements in Section 02750 or Section 02740.

I. Maintain daily log showing work completed, results of above inspections or tests, pavement and air temperatures, relative humidity, presence of any moisture on pavement, and any material or equipment problems. Make legible entries in log in ink, sign and submit by end of each work day. Enter environmental data into log prior to starting work each day and at two additional times during day.

3.7 PROTECTION OF FINISHED WORK

A. Section 01700 - Execution Requirements: Requirements for protecting finished Work.

B. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry time.

3.8 SCHEDULES

A. As indicated on drawings.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

1. Section Includes:
    1. Reinforcing bars.
    2. Welded wire fabric.
    3. Reinforcement accessories.

2. Related Sections:
    1. Section 03100 - Concrete Forms and Accessories.
    2. Section 03300 - Cast-in-Place Concrete.

1.2 REFERENCES

1. American Concrete Institute:
    1. ACI 301 - Specifications for Structural Concrete.
    2. ACI 318 - Building Code Requirements for Structural Concrete.
    3. ACI 318M - Metric Building Code Requirements for Structural Concrete.
    4. ACI SP-66 - ACI Detailing Manual.

2. American Society for Testing and Materials:
    1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
    2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
    3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
    4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
    5. ASTM A616/A616M - Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.

3. Concrete Reinforcing Steel Institute:
    1. CRSI - Manual of Standard Practice.
    2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

1. Section 01330 - Submittal Procedures: Submittal procedures.

2. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules.

3. Certificates: Submit AWS qualification certificate for welders employed on the Work.

4. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

5. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

1. Perform Work in accordance with CRSI - Manual of Standard Practice ACI 301.

1.5 COORDINATION

1. Section 01300 - Administrative Requirements: Coordination and project conditions.

2. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

1. Reinforcing Steel: ASTM A615/A615M, 60 ksi (420 MPa) yield grade; deformed billet steel bars, unfinished.

2. Stirrups Steel: ASTM A82, unfinished.

3. Welded Steel Wire Fabric: ASTM A497 Deformed Type; in coiled rolls; unfinished.

2.2 ACCESSORY MATERIALS

1. Tie Wire: Minimum 16 gage annealed type.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

3. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-

coated steel type; size and shape to meet Project conditions.

2.3 FABRICATION

1. Fabricate concrete reinforcement in accordance with CRSI Manual of PracticeACI SP-66, ACI 318 and ANSI/ASTM A184..

2. Weld reinforcement in accordance with AWS D1.4.

3. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. Review location of splices with Architect/Engineer.

PART 3 EXECUTION

3.1 PLACEMENT

1. Place, support and secure reinforcement against displacement. Do not deviate from required position.

2. Do not displace or damage vapor retarder.

3. Accommodate placement of formed openings.

4. Conform to applicable code for concrete cover over reinforcement.

5. Bond and ground reinforcement in accordance with requirements of Section 16060

3.2 FIELD QUALITY CONTROL

1. Section 01400 - Quality Requirements: Testing and Inspection Services.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.

a. Include statement indicating costs for each product having recycled content.

2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for Portland cement or other Portland cement replacements, and for equivalent concrete mixtures that do not contain Portland cement replacements.

C. Design Mixtures: For each concrete mixture.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

F. Welding certificates.

G. Material certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Fiber reinforcement.
5. Admixtures.
6. Water-stops.
7. Curing materials
8. Floor and slab treatments.

9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Epoxy joint filler.
13. Joint-filler strips.
14. Repair materials.

H. Material Test Reports.

I. Floor surface flatness and levelness measurements.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction**,** qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Pre-installation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

1. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class I or Class II zinc coated after fabrication and bending.
2. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

E. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

F. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, deformed steel.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I or Type II or Type I/II, gray.

   a. Fly Ash: ASTM C 618, Class F or C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IS, Portland blast-furnace slag, Type IP, Portland-pozzolan, Type I (PM), pozzolan-modified Portland, and Type I (SM), slag-modified Portland cement.

B. Normal-Weight Aggregates: ASTM C 33, graded.

1. Maximum Coarse-Aggregate Size: **1-1/2 inches (38 mm)** at slabs on grade, **1 inch (25 mm)**, at columns and **3/4 inch (19 mm)** at beams and slabs nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, **3/8-inch (10-mm)** nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, **1 to 2-1/4 inches (25 to 57 mm)** long.

2.6 WATERSTOPS

A. Flexible Rubber Water-Stops: CE CRD-C 513, with factory-installed metal eyelets**,** for embedding in concrete to prevent passage of fluids through joints. Factory fabricated corners, intersections, and directional changes.

B. Chemically Resistant Flexible Water-Stops: Thermoplastic elastomeric rubber water-stops with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricated corners, intersections, and directional changes.

C. Flexible PVC Water-stops: CE CRD-C 572, with factory-installed metal eyelets**,** for embedding in concrete to prevent passage of fluids through joints. Factory fabricated corners, intersections, and directional changes.

D. Self-Expanding Butyl Strip Water-Stops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

E. Self-Expanding Rubber Strip Water-stops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class **C**. Include manufacturer's recommended adhesive or pressure-sensitive tape.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or *kenaf*, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating**,** certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength at 28 days: **4000 psi (27.6 MPa)** w/c= 0.60 at Foundations, walls, and stairs, **3000 psi (20.7 MPa)** w/c = 0.7 at sidewalks, slabs on ground, and miscellaneous architectural elements.
2. Maximum Water-Cementitious Materials Ratio: see item D.1 above.
3. Slump Limit: **4 inches (100 mm) and 8 inches (200 mm)** for concrete with verified slump of **2 to 4 inches (50 to 100 mm)** before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: **5.5** percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: **6** percent, plus or minus 1.5 percent at point of delivery for **3/4-inch (19-mm)** nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than **1.5 lb/cu. yd. (0.90 kg/cu. m)**.

E. Proportion structural lightweight concrete mixture as follows:

1. Minimum Compressive Strength: **3000 psi (20.7 MPa)** at 28 days.
2. Calculated Equilibrium Unit Weight: **110 lb/cu. ft. (1762 kg/cu. m)**, plus or minus 3 lb/cu. ft. (48.1 kg/cu. m) as determined by ASTM C 567.
3. Slump Limit: **4 inches (100 mm),** plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size greater than 3/8 inch (10 mm).
5. Air Content: 7 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size 3/8 inch (10 mm) or less.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than **1.5 lb/cu. yd. (0.90 kg/cu. m)**.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturers' recommended tape.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

E. Water-Stops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, and to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces as indicated or to receive trowel finish, and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, and ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed **1/8 inch (3.2 mm)**.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer, unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 03300

SECTION 03310 CONCRETE WORKS

PART 1 GENERAL

1.1_ RELATED DOCUMENTS:

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division I - Specification sections, apply to work of this section.

1.2 SUMMARY:

A. Extent of concrete work is shown on drawings.

1.3 SUBMITTALS:

A. Product dada: submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Contracting Officer.

B. Shop Drawings; Reinforcement: Submit original shop drawings prepared by registered Professional Engineer for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

C. Shop Drawings; Formwork: Submit shop drawings prepared by a registered Professional Engineer for fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually.

1. Contracting Officer'S review is for general architectural applications and feature only. Design of formwork for structural stability and efficiency is Contractor's responsibility.

D. Samples: Submit samples of materials as requested by Contracting Officer, including names, sources, and descriptions.

E. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test.

F. Materials Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Contracting Officer. Materials certificates shall be signed by manufacturer and contractor, certifying that each material item complies with, or exceeds, specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.4 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

a. ACI 301 "Specifications for Structural Concrete for Buildings".
b. ACE 318 "Building Code Requirements for Reinforced Concrete"
c. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice"

B. Concrete Testing Service: Engage a testing laboratory acceptable to Contracting Officer and Structural Engineer to perform material evaluation test and to design concrete mixes.

C. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractors's expense.

1.4 PROJECT CONDITIONS:

A. Protect adjacent finish materials against spatter during concrete placement.

1.5 PROJECT CONDITIONS:

A. Protect adjacent finish materials against spatter during concrete replacement.

PART 2 PRODUCTS

2.1 FORM MATERIALS:

A. Forms for exposed finish concrete: Plywood, metal, metal framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.

Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use plywood complying with U.S. Product Standard PS-1 "B-B (concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for unexposed finish concrete: plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Forms for textured finish concrete: units of face design, size, arrangement, and configuration to match contracting officer's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

D. Forms for Columns and Supports: metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

E. Form Coatings: provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces.

F. Form Ties: factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave not metal closer than 1-1/2" to surface.

a. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

2.2. REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Galvanized Reinforcing Bars: ASTM A 767, Class I (3.0 oz. Zinc. Psf) hot dip galvanized, after fabrication and bending.

C. Epoxy-Coated Reinforcing Bars: ASTM A 775.

D. Steel Wire: ASTM A 82, plain, cole-drawn steel.

E. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

F. Welded Deformed Steel Wire Fabric: ASTM A 497.

G. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, sporting and fastening reinforcing bases and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I.

B. Use one brand of cement throughout project, unless otherwise acceptable to Contracting Officer.

C. Fly Ash: ASTM C 618, Type C or Type F.

D. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single course for exposed concrete.

a. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

b. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Contracting Officer.

E. Lightweight Aggregates: ASTM C 330.

F. Water: Drinkable.

G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with

other required admixtures.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

a. "Air-Mix", Euclid Chemical Co.
b. "Sika Aer" Sika Corp.
c. "MB-VR or MB-AE", Master Builders.
d. "Darex AEA" or "Daravair", W.R. Grace.
e. "Edoco 2001 or 2002, Edoco Technical Products.
f. "Air-Tite", Gifford-Hill/American Admixtures.

H. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

a. WRDA Hycol, W. R. Grace
b. PSI N, Gifford-Hill/American Admixtures
c. Eucon WR-75, Euclid Chemical. Co.
d. Pozzolith Normal, Master Builders
e. Plastocrete 160, Sika Chemical Corp.
f. Chemtard, Chem-Masters Corp.
g. Pro-Kete, N, Protex Industries, Inc.

I. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G and containing not more than 0.1 percent chloride ions.

a. WRDA 19, or Daracem, W.R. Grace.
b. PSP; Protex Industries, Inc.
c. Super P, Anti-Hydro
d. Sikament; Sika Chemical Corp.
e. Mighty 150, ICI Americas Corp.
f. Eucon 37; Euclid Chemical Corp
g. PSI Super, Gifford-Hill
h. Reheoubuild; Master Builders

J. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, type E, and containing not more than 0.1 percent chloride ions.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

    a. Accelguard 80, Euclid Chemical Co.
    b. Pozzolith High Early; Master Builders
    c. Gilco Accelerator; Gifford-Hill/American Admixtures

K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.

1. Availabe Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

    a. Edoco 20006; Edoco Technical Products
    b. Pozzolith Retarded; Master Builders
    c. Eucon Retarded 75, Euclid Chemical Co.
    d. Daratard; W.R. Grace
    e. PSI R; Gifford-Hill American Admixtures
    f. Plastiment; Sika Chemical Co.
    g. Protard, Protex Industries, Inc.

L. Prohibited Admixtures: Calcium chloride thiocyanate or admixtures containing more than 0.1. percent chloride ions are not permitted.

M. Fibrous Reinforcement: Collated fibrillated, polypropylene fiber for secondary reinforcement of concrete slabs.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

    a. Forta CR; Forta Corp.
    b. Fibermesh; Fibermesh Inc.

2.4. RELATED DOCUMENTS:

A. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Waterstops: Provide flat, dumbbell type or center bulb type waterstops at construction joints and other joints as indicated. Size to suit joints.

C. Rubber Waterstops: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

The Burke Co.

1. Progress Unlimited
2. Williams Products
3. Edoco Technical Products.

D. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
   a. AFCO Products
   b. The Burke Co
   c. Edoco Technical Products
   d. Greenstreet Plastic Products
   e. Harbour Town Products
   f. W.R. Meadows
   g. Progress Unlimited
   h. Schleigel Corp.
   i. Vinylex Corp.

E. Granular Base: Evenly graded mixture of fine and coarse aggregates to provide, when compacted, a smooth and even surface below slabs on grade.

F. Vapor Retarder: Provide vapro retarder cover over prepared base material below slabs on grade. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

1. Polyethylene sheet not less than 8 mils thick.

G. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
   a. Metallic
      1. Vibrofoil, A.C. Horn, Inc.
      2. Metallic Spec. Grout, The Burke Co.
      3. Embeco 636, Master Builders

4. Ferrolith GDS, Sonneborn Rexnord
5. Hi-Mod Grout, Euclid Chemical Co.
6. Kemox G, Sika Chemical Co.
7. Ferrogrout, L&M Const. Chemical Co.
8. Supreme Plus, Gifford-Hill/American Admixtures

a. Non-Metallic
   1. Set Grout, Master Builders
   2. Sonogrout, Sonneborn Rexnord
   3. Euco-NS, Euclid Chemical Co.
   4. Supreme, Gifford-Hill/American Admixtures
   5. Crystex, L & M Const. Chemical Co.
   6. Sure-Grip Grout, Dayton Superior Corp.
   7. Horngrout, A.C. Horn, Inc.
   8. Five Star Grout, U.S. Grout Corp.

2. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

   b. Surfhard, Euclid Chemical Co.
   c. Lapidolith, Sonnerborn-Rexnord.
   d. Saniseal, Master Builders
   e. Burk-O-Lith, The Burke Co.

H. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.

I. Colored Wear-Resistant Finish: Packaged, dry, combination of materials, consisting of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, non-fading mineral oxides, and underground with cement. Color as selected by contracting officer, unless otherwise indicated.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

   a. Colorcron, Master Builders
   b. Harcol Redi-Mixed, Sonneborn-Contech
   c. Surflex, Euclid Chemical Co.
   d. Colorundum, A.C. Horn, Inc.

e. Quartz Plate, L & M Const. Chemical Co.
f. Lithochrome, L.M. Scofield Co.
g. Floorcron, Gifford-Hill American Admixtures

J. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. Per sq. yd., complying with AASHTO M 182, Class 2.

K. Moisture Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper
2. Polyethylene film
3. Polyethylene coated burlap

L. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class a. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft. /gal.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

a. Masterseal, Master Builders.
b. A-H 3 Way Sealer, Anti-Hydro Waterproofing Co.
c. Ecocure, Euclid Chemical Co.
d. Clear Seal, A.C. Horn, Inc.
e. Sealco 309, Gifford-Hill/American Admixtures
f. J-20 Acrylic Cure, Dayton Superior
g. Spartan-Cote; the Burke Co.
h. Sealkure; Toch Div. - Carboline
i. Kure-N-Seal, Sonneborn-Rexnord.
j. Polyclear, Upco Chemical/USM Corp.
k. L & M Cure, L & M Construction Chemicals
l. Klearseal, Set Con Industries
m. LR-152, Protex Industries
n. Hardtop, Gifford-Hill

M. Underlayment Compound: Free flowing, self leveling, pump able cementations base compound.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

a. Flo-Top, Euclid Chemical Co.
b. ACD Purable Underlayment, ACD International Inc.
c. Thoro Underlayment Self-Leveling, thore System Products

N. Bonding Compound: Polyvinyl acetate or acrylic base.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
2. Polyvinyl Acetate (Interior Only):

a. J-40 Bonding Agent; Dayton Superior Corp.
b. Everbond, L & M Construction Chemicals
c. Hornweld, A.C. Horn, inc.
d. Sonocrete, Sonneborn-Rexnord
e. Acrylic bondcrete, The Burke, Co.
f. SBR Latex, Euclid Chemical Co.
g. Daraweld C, W.R.

O. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type", Grade, and Class to suit project requirements.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

a. Thiopoxy, W.R. Grace
b. Epoxtite, A.C. Horn, Inc.
c. Edoco 2118 Epoxy Adhesive, Edoco Technical Prod.
d. Sikadur Hi-Mod, Sika Chemical Corp.
e. Euco Epoxy 452 or 620, Euclid Chemical Co.
f. Patch and Bond Epoxy, The Burke Co.
g. Concressive 1001, Adhesive Engineering Co.

2.5 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use and independent testing facility acceptable to Contracting Officer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
1. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Contracting Officer and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work . Do not begin concrete production until mixes have been reviewed by Contracting Officer. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules.

1. 3000 psi 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained) 0.46 maximum (air-entrained)

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Contracting Officer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Contracting Officer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Contracting Officer before using in work.

D. Admixtures:

1. Use water-reducing admixture or high range water-reducing admixture (super-plasticizer) in concrete as required for placement and work ability.

2. Use high-range water-reducing admixture in pumped concrete, architectural concrete, concrete required to be watertight, and concrete with water/cement ratios below 0.50.

3. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1 ½ percent within following limits:

   a. Concrete structures and slabs exposed or subjected to hydraulic pressure:
      1. 4.5 percent, 1" aggregate
      2. 5.0 percent, 3/4" max. aggregate
      3. 5.5 percent, ½" max. aggregate

   b. Other Concrete (not exposed to hydraulic pressure): 2 percent to 4 percent air.

4. Use admixtures for water-reducing, and set-control in strict compliance with manufacturer's directions.

E. Water-Cement-Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Subjected to hydrostatic pressure; W/C 0.45.

F. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement

as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3".
2. Reinforced foundation systems: not less than 1" and not more than 3".
3. Concrete containing HRWR admixture (super-plasticizer): Not more than 8" after addition of HRWR to site-verified 2"-3" slump concrete.
4. Other concrete: Not less than 1" nor more than 4".

2.6. CONCRETE MIXING:

A. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

PART 3 EXECUTIONS

3.1 GENERAL:

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 FORMS:

A. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

B. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustication, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

Provide crush plates or wrecking plates where striping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for ease removal.

E. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to revive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER INSTALLATION:

A. Following leveling and tamping of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.

B. Lap joints 6" and seal with appropriate tape.

C. After placement of moisture barrier, cover with granular material and compact to depth as shown on drawings.

3.4 PLACING REINFORCEMENT:

A. Comply with Concrete Reinforcing Steel Institute" recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports, and as herein specified.

1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers as required.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces..

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.5 JOINTS:

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Contracting Officer.

B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

1. Joint filler and sealant materials are specified in Division 7 sections of these specifications.

F. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on

ground to form panels of patterns as shown. Use saw cuts 1/8" x 1/4 slab depth or inserts 1/4" wide x 1/4 of slab depth, unless otherwise indicated.

G. Form contraction joints by inserting premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

1. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

H. If joint pattern not shown, provide joints not exceeding15' in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, thirdbays).

1. Joint sealant material is specified in Division-7 sections of these specifications.

3.6 INSTALLATION OF EMBEDDED ITEMS:

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, instructions, and directions provided by suppliers of items to be attached thereto.

B. Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashing in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Edge Forms and Screed Strips for Salbs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.7 PREPARATION OF FORM SURFACES:

A. Clean re-used forms of concrete matrix residue, repair and patch as required returning forms to acceptable surface condition.

B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions
of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Applied in compliance with manufacturer's instructions.

D. Coat steel forms with a non-staining rust preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT:

A Replacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

B. General: comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transportation, and Placing Concrete" and as herein specified.

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be place continuously, provide weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while proceeding layer is still plastic to avoid cold joints.

E. Consolidated placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

H. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

I. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

J. Maintain reinforcing in proper position during concrete placement operations.

K. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

L. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

M. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed to ambient air temperature immediately before embedment in concrete.

N. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

O. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.9 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fin and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: for formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finished to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal.

D. Moisten concrete surfaces and rub with Carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

E. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment.

F. Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.

G. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

H. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES:

A. Scratch Finish: Apply scratch to monolithic slab surfaces that are to receive floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

B. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Ff) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

C. Float Finish: Apply float finish to monolithic slab surface to receive trowel finish and other finishes as hereinafter specified and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

D. After screding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of Ff 18 -Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

F. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidated concrete surface by final hand-trowling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of FF 20 - FL-17. Grind smooth surface defects which would telegraph through applied floor covering system.

G. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

H. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

I. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with contracting officer before application.

J. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water (parts of hardener/water as follows), and apply in 3 coats; first coat 1/3-strength; second coat, ½ strength; third coat, 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats.

K. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions.

L. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

M. Non-slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.

N. After completion of coat finishing, and before starting trowel finish, uniformly spread 25 lbs. Of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

O. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate. Apply curing compound immediately after final finishing.

3.11 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

B. Start final curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures.

Avoid rapid drying at end of final curing period.

D. Curing methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

E. Provide moisture curing by following methods.
   1. Keep concrete surface continuously wet by covering with water.
   2. Continuous water fog spray.
   3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

F. Provide moisture-cover curing as follows:

   1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by water proof tape of adhesive. Immediately repair any holes or tears during curing period using cover material and water proof tape.

G. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:

   1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are completed (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

H. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, water proofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Contracting Officer.

I. Curing Formed Surfaces: Cure formed concrete surfaces including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

J. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs. Floor topping, and other flat surfaces by application of appropriate curing method.

K. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

L. Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

3.12 SHORES AND SUPPORTS:

A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.

B. Extend shoring from ground to roof for structures 4 stories or less, unless otherwise permitted.

C. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

D. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.13 REMOVAL FORMS:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.14 RE-USE OF FORMS:

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to

Contracting Officer.

3.15 MISCELLANEOUS CONCRETE ITEMS:

A. Filling-In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified to blend with in place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast in safety inserts and accessories as shown on drawings. Screed, tamps, and finishes concrete surfaces as scheduled.

F. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as schedule. Maintain accurate location of reinforcing steel during concrete placement

3.16 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Contracting Officer.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

C. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching.

Compact mortar in place and strike-off slightly higher than surrounding surface.

D. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Contracting Officer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

F. Repair of Unformed Surfaces: test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

G. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

I. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Contracting Officer.

J. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

K. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area

continuously moist for not less than 72 hours.

L. Perform structural repairs with prior approval of Contracting Officer or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

M. Repair methods not specified above may be used, subject to acceptance may be achieved by use of specified underlayment material.

N. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. Sampling and testing for quality control during placement of concrete shall include the following, as directed by contracting officer. Contractor shall procure and pay for concrete quality control and testing services by a qualified testing laboratory acceptable to Structural Engineer and Contracting Officer.

B. Sampling Fresh Concrete:"ASTM C 172, except modified for slump to comply with ASTM C 94.

1. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; one for each day's pour of each type of air-entrained concrete.
3. Concrete Temperature: test hourly when air temperature is 80 deg F (27 deg C) and above; and each time a set of compression test specimens made.
4. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
5. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yds. Plus additional sets for each 50 cu yds. Over and above the first 25 cu. yds. Of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

6. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or form each batch if fewer than 5 are used.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
8. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and

no individual strength test result falls below specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to Contracting Officer, Structural Engineer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7 day test and 28 day tests.

D. Nondestructive Testing: Impact hammer, son scope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Contracting Officer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION

SECTION 03 52 16

LIGHTWEIGHT CELLULAR INSULATING CONCRETE (LWIC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions apply to this section.

1.2 SUMMARY

A. This section includes cast-in-place cellular lightweight insulating concrete for roof decks, concrete, steel or approved existing roofing assemblies.

B. Related Sections include:

1. Metal Decking, Division 05000
2. Rough Carpentry, Wood blocking and curbs, Division 06000
3. Roof Membrane, Division 07000 Single Ply Feltback PVC Membranes

1.3 DEFINITIONS

A. *Cellular* Lightweight Insulating Concrete: Low-density concrete produced using preformed foam.

1.4 REFERENCES

A. ASTM C 150, Standard Specification for Portland Cement.

B. ASTM C 138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

C. ASTM C 172, Standard Practice for Sampling Freshly Mixed Concrete.

D. ASTM E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing or Special Inspection.

E. ASTM C 495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.

F. ASTM C 796, Standard Test Method for Foaming Agents for use in Producing Cellular Concrete Using Preformed Foam.

G. ASTM C 869, Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.

H. ASTM C 578, Standard Specification for Rigid Cellular Polystyrene Thermal Insulation.

I. ASTM C 177, Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

J. ASTM C 518, Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

K. ASTM C 513, Standard Test Method for Obtaining and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength.

L. ASTM C 1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.

1.5 SUBMITTALS

A. Product data for the cellular lightweight insulating concrete and the polystyrene insulating board indicating compliance with all applicable Approvals, Standards and required physical property values.

B. Florida Product Approval Number, 2020 Code Version, including HVHZ Approval.

C. Miami Dade County, Notice of Product Acceptance - NOA

D. Shop drawings indicating polystyrene insulation layout and thicknesses, slope and drain locations, high and low point thickness from atop the structural deck.

E. Applicator shall be a firm Approved in writing by the foam concentrate Manufacturer. The Manufacturer provided Approval letter shall mention the project by name.

F. Certificates from manufacturers certifying that each of the following materials comply with referenced standards:

1. Portland Cement
2. Foaming Agent
3. Admixtures
4. Expanded Polystyrene (EPS) Holey Board Insulation 1lb. minimum density.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualification: An independent testing agency shall be qualified in accordance with ASTM C 1077 and ASTM E 329 for testing indicated.

B. FM Global Approval: provide cellular lightweight insulating concrete that has been evaluated by FM Approvals as part of a roof assembly and is listed in the FM RoofNav data base for Class 1 and non-combustible construction.

C. UL Fire Resistance Ratings: where indicated, provide cellular lightweight insulating concrete identical to those assemblies tested for fire resistance per ASTM E 119 and listed in UL's Fire Resistance Directory. The cellular lightweight insulating concrete shall be UL Classified and listed in the current UL Fire Resistant Design Directory under Category COXX, Floor and Roof Topping Mixtures.

D. The Applicator shall submit evidence that the proposed roof system meets the requirements of the local building code (Puerto Rico Building Code 2018) and has been tested and approved or listed by an approved, codified testing organization. These requirements are minimum standards, and no roofing work shall commence without written documentation of the system's compliance.

1.7 DELIVERY AND STORAGE

A. Deliver materials unopened in the manufacturer’s original packaging or by acceptable bulk delivery.

B. Materials shall be identifiable by manufacturers labeling.

C. Where applicable materials shall bear the following Approval Marks:

1. Underwriters Laboratories - UL
2. Factory Mutual - FM
3. Local Building Code Conformance

1.8 PROJECT CONDITIONS

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A. Do not place during precipitation, or when there is a likely expectation that precipitation will occur. Do not place upon surfaces covered with water, debris, or other types of containments.

1.9 WARRANTY / GUARANTEE

A. Upon successful completion of the project, after all post installations have been completed, furnish the Owner a roof deck system manufacturer’s warranty. The warranty shall be a term type and shall be issued to the Owner at no additional cost. Specific items covered under the warranty shall include:

1. The actual resistance to heat flow through the roof insulation will be at least 80% of the designed thermal resistance, provided the insulation is dry and the roof membrane is free of leaks.

2. The roof insulation will remain in a re-roof able condition should the roof membrane require replacement during the original term of the warranty (excluding damage caused by fastener withdrawal during the removal of the roof cover).

3. The roof insulation will not cause structural damage to the building because of expansion from thermal or chemical reaction.

4. The roof insulation will not cause the roof membrane to leak because of vapor pressure build-up from batching (mixing) water used to produce the insulating concrete.

5. The roof insulation warranty period shall be 20 years from the date of substantial completion.

6. All thermoplastic PVC single ply Fleece Back 60 mils minimum membranes fully adhere using water-based adhesives to the LWIC to achieve an FM 1-525 PSF

uplift rating. Initial Solar Reflectance of 85. Membrane manufacture to provide a minimum 20-year NDL single ply warranty over the LWIC.

PART 2 - PRODUCTS

2.1 APPROVED LWIC MANUFACTURERS

A. Manufacturers whose products are listed and meet or exceed the requirements of this specification are approved for use.

B. Basis of Design: Celcore Incorporated, www.celcoreinc.com.

C. Manufacturers listed below may be considered, subject to compliance with the specification:

1. Elastizell, Elastizell.com
2. Mearlcrete, Aerix Industries

2.2 MATERIALS

A. Cement: Portland type I, I/II meeting ASTM C150

B. Water: shall be clean, potable, free from injurious quantities of acid, alkali, salt, oil, organic matter, and other impurities. The maximum permissible chloride level is 250 ppm.

C. Foaming Agent: meeting ASTM C 869 when tested in accordance with ASTM C 796. Foam concentrate shall be labeled bearing FM, UL, and Local Construction Code Compliance. Approval Marks.

D. Admixtures: admixtures shall not be used unless approved in writing by the Foam Manufacturer.

E. Insulating Board: shall be a product of expanded polystyrene meeting ASTM C 578, 1 lb/ft^3 nominal density with holes comprising approximately 3% of the gross surface area. Approved manufacturers include:

1. Carpenter Company: www.carpenter.com
2. Cellofoam North America: www.cellofoam.com
3. Dyplast Products, LLC: www.dyplastproducts.com
4. Insulfoam: www.insulfoam.com
5. All local approved equal meeting specifications.

F. Curing Compound: as required by the insulating concrete manufacturer and applied in accordance with the manufacturer's instructions.

2.3 CELLULAR INSULATING CONCRETE

A. Mix materials in strict accordance with recommendations of the foam manufacturer to yield the proper physical properties. Use the minimum amount of mix water required to produce concrete having good placement and working properties.

B. Mix and pump the cellular lightweight insulating concrete into place using a batch

plant approved by the foam manufacturer. Thoroughly blend all materials before discharging the mixer.

C. Wet cast density: 38-42 lbs/ft³ (+/- 3 lbs/ft³) at the point of placement when sampled in accordance ASTM C 172 except as modified by the applicable sections of ASTM C 495. End of hose wet density shall be determined in accordance ASTM C 138. Do not rod or vibrate sample.

D. Oven dry density: 26 - 36 lbs/ft³ when tested at 28 days in accordance with the applicable sections of ASTM C 495.

E. The cellular insulating concrete shall have *a minimum 28-day compressive strength of 300 -350 psi when tested in accordance with ASTM C 495.*

F. The insulating concrete deck shall be designed to provide an ¼" in 12 slope and ½" tapered crickets to drains. R-value of: R = **20**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Structural Concrete Deck: verify that the surface of the structural concrete deck to receive the cellular insulating concrete is free from any materials, debris, standing water, other coverings and/or substances that may prevent bond.

B. Steel Deck: examine the decking for inadequate anchorage, foreign materials, debris, moisture, or unevenness that would prevent proper application or adequate bond. Report inadequacies for correction. Consult manufacturer for best venting practice.

3.2 PREPARATION

A. Cover and protect all equipment, stands, curbs, drains, etc., prior to beginning placement of the cellular insulating concrete.

B. Protect all elements that interface with or are beneath the insulating concrete placement from application damage or disfigurement.

3.3 INSTALLATION

A. Place a slurry layer of cellular concrete to a minimum thickness of 1/8 inch over top of the approved substrate (concrete, steel or recovering conditions).

B. Immediately place the EPS holey board insulation into the fresh cellular concrete layer in a manner which causes the boards underside to make full contact with the concrete. Cellular concrete shall be caused to enter the keying holes of the board. The insulation board shall be placed in a brick like pattern of staggered joints butted together.

C. When required, install the EPS holey board in a stepped configuration with maximum steps of 1 inch.

D. The installed EPS holey board layer shall be allowed to set overnight undisturbed

prior to receiving topping.

F. Place a minimum 2-inch-thick topping layer of cellular insulating concrete above the insulation board. Screed and hand finished the placement to a smooth surface.

G. Apply curing compound to the surface of the deck after topping placement once the layer has hardened sufficiently to receive foot traffic without causing damage. Curing shall be applied at a rate and in a manner recommended by the foam manufacturer.

3.4 FIELD QUALITY CONTROL

A. End-of-hose wet density checks shall be taken every thirty minutes during placement. Density information shall be recorded by the placement foreman and kept as a written project record. Sampling shall be done in accordance ASTM C 172 except as modified by the applicable sections of ASTM C 495.

B. Cylindrical test specimen shall be cast during each day's placement or at every 5,000 sq/ft of placement. Specimens shall be cast in accordance with the applicable sections of ASTM C 495. Do not rod. A set of test specimens shall be considered (6) 3 x 6 cylinders. (4) specimens of each set shall be tested for compressive strength and (2) shall be for oven-dry density determination. Testing shall be conducted at age 28 days in accordance with ASTM C 495.

C. Retesting for compressive strength and oven dry density, if required, shall be done in accordance with ASTM C 513.

3.5 PROTECTION

A. The installed cellular insulating concrete roof deck shall be protected from work traffic for a minimum of 48 hours after topping placement. The roof deck shall be protected from concentrated loads of construction materials. Load distribution materials such as plywood shall be used by other trades when stocking materials.

B. Coordinate installation of the roof cover such that the installed insulating concrete deck is not exposed for unnecessary extended periods of time. Membrane installation is recommended to begin within 3 to 7 days following roof deck topping placement.

3.6 REPAIRS

A. Where required to provide a surface condition acceptable to receive the roof cover, repairs to smooth the deck surface, correct depressions or fill divots shall be done in accordance with written guidance provided by the foam concentrate manufacturer.

3.7 DEFECTIVE WORK

A. Remove and replace any area of the roof deck placement that fails to comply with the requirements of the foam manufacturer, this specification or applicable product Approvals.

END OF SECTION 03 52 16

SECTION 03732

CONCRETE REPAIR

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation of concrete and application of repair materials.
B. Rehabilitation and Restoration of concrete surfaces.
C. Repair of concrete internal reinforcement.

1.2 RELATED SECTIONS

A. Section 03300 – Cast-In-Place Concrete.
B. Section 04500 – Masonry Restoration and Cleaning.

1.3 REFERENCES

A. ASTM A82 Cold Drawn Steel Wire for Concrete Reinforcement.
B. ASTM A615/A615M Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
C. ASTM A616/A616M Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
D. ASTM A617/A617M Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
E. ASTM C33 Specifications for Concrete Aggregates.
F. ASTM C150 Portland Cement.
G. ASTM C404 Aggregates for Masonry Grouts.
H. ASTM C882 Bond Strength of Epoxy Resin Systems Used with Concrete.
I. ASTM D638 Test Method for Tensile Properties of Plastics.
J. ASTM D695 Compressive Properties of Rigid Plastics.
K. ASTM D790 Flexural Properties of Plastics and Electrical Insulating Materials.
L. AWS D1.4 Structural Welding Code for Reinforcing Steel

1.4 SUBMITTALS FOR REVIEW

A. Section 01300 Submittals: Procedures for submittals.
B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

1.5 SUBMITTALS FOR INFORMATION

A. Section 01300 – Submittals: Procedures for submittals.
B. Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Accurately record actual locations of structural reinforcement repairs, and type of repair.

1.7 QUALITY ASSURANCE

A. Perform welding work in accordance with AWS D1.4.
B. Materials Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
C. Design reinforcement splices under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located or in the Commonwealth of Puerto Rico.
D. Applicator: Company specializing in concrete repair approved by manufacturer.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Section 01600 Material and Equipment: Transport, handle, store, and protect products.
B. Comply with instructions for storage, shelf life limitations, and handling.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

A. Epoxy Resin: Two-part epoxy adhesive containing 100 percent solids, meeting the following minimum characteristics:

Characteristic	Test Method	Results
1. Bond Strength	ASTM C882	2,700 psi. (18.6 MPa)
2. Tensile Strength	ASTM D638	6,600 psi. (45 MPa)
3. Elongation	ASTM D638	2 percent at 7 days at 70 degrees F (21 degrees C)
4. Flexural Strength	ASTM D790	8,000 psi. (45 MPa)
5. Compressive Strength	ASTM D695	6,500 psi. (55 MPa)

B. Bonding Agent: Polyvinyl acetate emulsion, dispersed in water while mixing, non-coagulant in mix, water resistant when cured.
C. Portland Cement: ASTM C150, Type I, grey color.
D. Sand: ASTM C 33; uniformly graded, clean.
E. Water: Clean and potable.
F. Cleaning Agent: Commercial muriatic acid.

2.2 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, 60 *ksi* (414 *mPa*) yield grade billet-steel deformed bars, unfinished finish.
B. Stirrup Steel: ASTM A82.

2.3 MIXING EPOXY MORTARS

A. Mix epoxy mortars in accordance with manufacturer's instructions for purpose intended.
B. Mix components in clean equipment or containers. Conform to pot life and workability limits.

2.4 MIXING CEMENTITIOUS MATERIALS

A. Mix cementitious [mortar] [grout] in accordance with manufacturer's instructions for purpose intended.
B. [Include] [Exclude] bonding agent as additive to mix.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.
B. Beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION

A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination: wire brush using acid; rinse surface and allow to dry.
B. Flush out cracks and voids muriatic acid to remove laitance and dirt. Chemically neutralize by rinsing with water.
C. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than the depth of the crack to be filled or port size diameter no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.
D. For areas patched with epoxy mortar, remove broken and soft concrete ¼ inch (6 mm) deep. Remove corrosion from steel. Clean surfaces mechanically; wash with acid; rinse with water.
E. Sandblast clean the exposed reinforcement steel surfaces. Mechanically cut away damaged portions of bar.

3.3 REPAIR WORK

A. Repair exposed structural, shrinkage, and settlement cracks of concrete as indicated on Drawings by the epoxy injection method.
B. Repair spalls. Fill voids flush with surface. Apply surface finish.
C. Repair reinforcement by welding new bar reinforcement to existing reinforcement. Strength of welded splices and reinforcement to exceed original stress values.

3.4 INJECTION – EPOXY RESIN ADHESIVE

A. Inject adhesive into prepared ports under pressure using equipment appropriate for particular application.
B. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.
C. Remove temporary seal and excess adhesive.
D. Clean surfaces adjacent to repair and blend finish.

3.5 APPLICATION – EPOXY MORTAR

A. Trowel-applied mortar mix to an average thickness of ¼ inches (6mm). Tamp into place filling voids at spalled areas.
B. For patching honeycomb, trowel mortar onto surface, work mortar into honeycomb to bring surface flush with surrounding area. Finish trowel surface to match surrounding area.
C. Cover exposed steel reinforcement with epoxy mortar, feather edges to flush surface.

3.6 APPLICATION – CEMENTITIOUS MORTAR

A. Apply roller coating of bonding agent to dry concrete surfaces. Provide full surface coverage.
B. Apply cementitious mortar by steel trowel to an average thickness of ¼ inches (6mm). Tamp into place filling voids at spalled areas. Work mix into honeycomb.
C. Damp cure cementitious mortar for four days.

3.7 FIELD QUALITY CONTROL

A. Test concrete for calcium chloride content during the execution of the Work.

END OF SECTION 03732

FOR REFERENCE ONLY

CONCRETE RESTORATION SYSTEMS

DIVISION 3 -CONCRETE

Section 03930 – Concrete Rehabilitation
Epoxy-Injected Crack Repair

Part 1 General

1.01 Summary

A. This specification describes the pressure injection of cracks with an epoxy resin adhesive.

1.02 Quality Assurance

A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001/9002 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.

B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

C. Install materials in accordance with all safety and weather conditions required by the manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 Delivery, Storage, and Handling

A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.

B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.

C. Condition the specified product as recommended by the manufacturer.

1.04 Job Conditions

A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40°F (5°C) and rising.

B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified product.

1.05 Submittals

A. Submit two copies of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).

1.06 Warranty

A. Provide a written warranty from the manufacturer against defects of materials for a period of five (5) years, beginning with date of substantial completion of the project.

FOR REFERENCE ONLY

Part 2 - Products

2.01 Manufacturers

A. **Sikadur 35 Hi-Mod LV**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification.

B. **Sikadur 31 Hi-Mod Gel**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification

2.02 Materials

A. Epoxy resin adhesive for pressure injection of cracks shall be **Sikadur 35 Hi-Mod LV:**

1. Component "A" shall be a modified epoxy resin of the diglycidiether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component "B" shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidiether bisphenol A Type containing suitable viscosity control agents, pigments, and accelerators.
3. The ratio of component A: componet B shall be 2:1 by volume
4. The material shall not contain asbestos.

B. Epoxy resin adhesive for sealing of cracks & porting devices shall be **Sikadur 31 Hi-Mod Gel.:**

1. Component "A" shall be a modified epoxy resin of the diglycidiether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component "B" shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidiether bisphenol A type containing suitable viscosity control agents, pigments, and accelerators.
5. The ratio of component A: componet B shall be 2:1 by volume
6. The material shall not contain asbestos.

C. Porting devices as required for either manual or automated application. Porting devices for automated application shall be supplied from maufacturer of the pressure injection equipment.

2.03 Performance Criteria

A. Properties of the mixed epoxy resin adhesive used for the pressure injection grouting::

1. Pot Life: min. 25 minutes (60 gram mass) @ 73° F
2. Tack-FreeTime: 90°F (32°C) 1.5 to 2 hours
   75°F (24°C) 3 to 3.5 hours
   40°F (5°C) 14-16 hours
3. Viscosity: Approx. 375 cps.
4. Color: Clear, Amber

B. Properties of the cured epoxy resin adhesive used for pressure injection of grout:

1. Compressive Strength (ASTM D-695) .min.
   a 3 day: 10000 psi (69.9 MPa)
   b. 7 day: 11000 psi (75.8 MPa)
   c. 28 day: 13000 psi (89.6 MPa)
   Compressive Modulus, Psi : min.
   a. 7 day 21.6 x 10^5 psi (1500 Mpa)
2. Shear Strength (ASTM D-732)
   a. 14 day: 5100 psi (35 MPa)
3. Flexural Strength (ASTM D-790) min.
   a. 14 day: 14000 psi (97 MPa

FOR REFERENCE ONLY

Tangent Modulus of Elasticity in Bending min.
b. 14 day: 3.7 x 10^5 psi (2600 Mpa)

4. Bond Strength (ASTM C-882)

14 days (moist cure) min.
a. Hardened Concrete to Hardened Concrete: 2200 psi (15 Mpa)

5. Water Absorption (ASTM D-570) max.

a. 24 hour 0.90%

6. Tensile properties (ASTM D-638) min.

a. 7 day Tensile Strength 8900 psi (61 Mpa)

Elongation at Break 5.4%

b. 14 day Modulus of Elasticity 4.1 x 10^5 psi (2800 Mpa)

C. Properties of the mixed epoxy resin adhesive used for sealing of cracks & porting devices::

1. Pot Life: min. 30 minutes (60 gram mass) @ 73° F
2. Tack-FreeTime: 75°F (24°C) 2 to 3.5 hours
40°F (5°C) 14-16 hours
3. Consistency: Non-Sag paste
4. Color: Concrete Gray

D. Properties of the cured epoxy resin adhesive used for sealing of cracks & porting devices:

1. Compressive Strength (ASTM D-695) .min. @ 73F
a 1 day: 9000 psi (62.0 MPa)
b. 3 day: 11000 psi (75.8 MPa)
c. 28 day: 12000 psi (82.8 MPa)
Compressive Modulus, Psi : min.
a. 7 day 3.9 x 10^5 psi (Mpa)
2. Shear Strength (ASTM D-732)
a. 14 day: 3400 psi (23.4 MPa)
3. Flexural Strength (ASTM D-790) min.
a. 14 day: 4400 psi (30.3 MPa)
Tangent Modulus of Elasticity in Bending .min.
b. 14 day: 1.6 x 10^5 psi
5. Bond Strength (ASTM C-882)

14 day (moist cure) min.
a. Hardened Concrete to Hardened Concrete 2400 psi (16.6 Mpa)

5. Water Absorption (ASTM D-570) max.

a. 24 hour 0.79%

3. Tensile properties (ASTM D-638) min.

a. 7 day Tensile Strength 3600 psi (24.8 Mpa)

Elongation at Break 0.4%

b. 14 day Modulus of Elasticity 1.0 x 10^5 psi (2800 Mpa)

Note: Tests above were performed with material & curing conditions at 73F & 45-55% relative humidity.

FOR REFERENCE ONLY

Part 3 - Execution

3.01 Mixing and Application

A. Mixing the epoxy resin adhesive for sealing the cracks & porting devices: Premix each component. Proportion two parts by volume of Component "A" to one part Component "B" into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (25-35 minutes 73F).

B. Mixing of the epoxy resin adhesive used for the pressure injection grouting:

1. Manual: Premix each component. Proportion two parts by volume of Component "A" to one part Component "B" into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (20-30 minutes 73F).

C. Placement procedure:

1. The epoxy resin adhesive for sealing the cracks & porting device: Set the porting devices as required by the equipment manufacturer. Spacing of the porting devices shall be accomplished as required to achieve the travel of the epoxy resin for the pressure injection grouting between ports and fill the cracks to the maximum. On structures open on both sides, provide porting devices on opposite sides at staggered elevations. Apply the mixed epoxy resin adhesive for sealing over cracks and around each porting device to provide an adequate seal to prevent the escape of the epoxy resin adhesive for the injection grouting. Where required by the Engineer, apply the epoxy resin adhesive for sealing in such a manner that minimal defacing or discoloration of the substrate shall result.

2. The epoxy resin adhesive for the pressure injection grouting:

Manual: Load the mixed epoxy resin adhesive for grouting into a disposable caulking cartridge or bulk-loading caulking gun. Inject the prepared cracks with a consant pressure in order to achieve maximum filling & penetration without the inclusion of air pockets or voids in the epoxy resin adhesive. Begin the pressure injection at the widest part of the crack being injected and continue until there is the appearance of epoxy resin adhesive at an adjacent port, thus indicating travel. When travel is indicated, to discontinue or continue the pressure injection from that port should be made by the contractor based on his experience, with the approval of the Engineer. Continue procedure until pressure injectable cracks has been filled.

Automated: Dispense the epoxy resin adhesive for grouting under constant pressure in accordance with procedures recommended by the equipment manufacturer as required to achieve maximum filling and penetration of the prepared cracks without the inclusion of air pockets or voids in the epoxy resin adhesive. The pressure injection of single or multiple ports, by use of a manifold system, is possible. This decision should be made by the contractor, with the approval of the Engineer. Continue the approved procedure until all pressure injectable cracks have been filled.

D. If penetration of any cracks is impossible, consult the Engineer before discontinuing the injection procedure. If modification of the proposed procedure is required to fill the cracks, submit said modification in writing to the Engineer for acceptance prior to proceeding.

E. Adhere to all limitations and cautions for the epoxy resin adhesive in the manufacturers current printed literature.

3.02 Cleaning

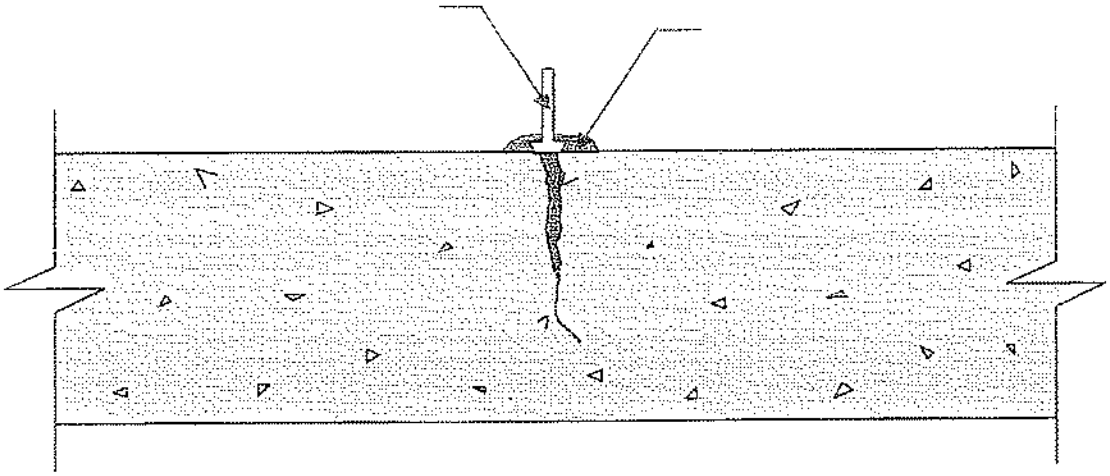
A. After the epoxy resin adhesive for grouting has cured, the epoxy resin adhesive for sealing cracks and porting devices shall be removed as required by the Engineer. Clean the substrate in a manner to produce a finish appearance acceptable to the Owner.

B. The uncured epoxy resin adhesive can be cleaned from tools with approved solvent. The cured epoxy resin adhesive can only be removed mechanically.

C. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

FOR REFERENCE ONLY

SC001 Sikadur® 35 Hi-Mod LV/ Sikadur 31 Hi-Mod Gel Crack Filler / Cap Seal



1. Set porting devices over cracks.
2. Place mixed Sikadur 31, Hi-Mod Gel epoxy resin adhesive over cracks and around each injection port a minimum of 1" wide by a ¼" thick.
3. Allow sufficient time for epoxy resin adhesive cap seal to set before injecting.
4. When the cap seal has cured, inject Sikadur 35, Hi-Mod LV with steady pressure.
5. Use automated injection equipment or manual method.

SECTION 05120

STRUCTURAL STEEL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions

B. Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes structural steel.

B. This Section includes structural steel and architecturally exposed structural steel.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Quality Control” for independent testing agency procedures and administrative requirements.
2. Division 5 Section “Steel Deck” for field installation of shear connectors.
3. Division 5 Section “Metal Fabrications” for loose steel bearing plates and miscellaneous steel framing.
4. Division 9 Section “Special Coatings” for surface preparation and priming requirements.
5. Division 9 Section “Painting” for surface preparation and priming requirements.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Engineering Responsibility: engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicated welds by standard AWS symbols, distinguishing between shop and filed welds, and show size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolt, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant as follows:

a. Category: Category I, conventional steel structures.
b. Category: Category II, complex steel building structures.
c. Fabricator shall be registered with and approved by authorities having jurisdiction.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design".
2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings".

3. AISC's "Specification for Allowable Stress Design of Single-Angle Members".
4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members".
5. AISC's "Seismic Provisions for Structural Steel Buildings".
6. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel".

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Mockups: Prior to installing architecturally exposed structural steel, construct mockups for each form of construction and finish required to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship of steel surfaces and welded and bolted connections.

    a. Coordinate finish painting requirements of mockups with Division 9 Section "Painting".

4. Obtain Architect's approval of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

    a. When directed, demolish and remove mockups from Project site.
    b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Plates, and Bars: As follows:

1. Carbon Steel: ASTM A 36 (ASTM A 36M).
2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A 572 (ASTM A 572M), Grade 50.
3. High-Strength. Low-Alloy Structural Steel: ASTM A 588 (ASTM A 588M), Grade 50, corrosion resistant.

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

C. Hot-Formed Structural Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Weight Class: Standard.
2. Weight Class: Extra strong.
3. Weight Class: Double-extra strong.
4. Finish: Black
5. Finish: Galvanized.
6. Finish: Black, except where indicated to be galvanized.

E. Carbon-Steel Castings: ASTM A 27, Grade 65-35 (ASTM A 27M, Grade 450-240), medium-strength carbon steel.

F. High-Strength Steel Castings: ASTM A 148, Grade 80-50 (ASTM A 148M), (Grade 550-345).

G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D 1.1, Type B.

H. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Un-headed Rods: ASTM A 36 (ASTM A 36M).
2. Un-headed Rods: ASTM A 572, Grade 50 (ASTM A 572M, Grade 345).
3. Un-headed Bolts: ASTM A 687, high strength.
4. Headed Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
5. Headed Bolts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
6. Headed Bolts: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
7. Washers: ASTM A 36 (ASTM A 36M).

I. Non-high Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts: and flat, unhardened steel washers.

1. Finish: Plain, uncoated.
2. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.
3. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.

J. High Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.
2. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.
3. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
4. Direct-Tension Indicators: ASTM F 959, Type 325.

    a. Finish: Plain, uncoated.
    b. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
    c. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50, epoxy coated.

K. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

1. Direct-Tension Indicators: ASTM F 959, Type 490, uncoated.

L. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer Fast-curing, lead- and chromate-fee, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

B. Primer: SSPC-Paint 25; red iron oxide, zinc oxide, raw linseed oil and alkyd primer.

C. Primer, SSPC-Paint 23, Type I, latex primer.

D. Primer SSPC-Paint 15, Type I, red oxide.

E. Primer: Fabricator's standard lead-and chromate-free, non-asphaltic, rust-inhibiting primer.

F. Primer: Non-asphaltic primer complying with SSPC's "Painting System Guide No. 7.00".

G. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DODP-21035A or SSPC-Paint 20.

2.3 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Metallic, Shrinkage-Resistant Grout: Premixed, factory-packaged, ferrous aggregate grout, complying with ASTM C 1107, of consistency suitable for application, and a 30 minute working time.

C. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operation.

6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors: Use automatic end welding of headed-stud hear connectors according to AWS D1.1 and manufacturer's printed instructions.

F. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

H. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

A. Shop installs and tightens non-high strength bolts, except where high-strength bolts are indicated.

B. Shop installs and tightens high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

C. Shop installs and tightens high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Bolts: ASTM A 490 (ASTM A 490M) high-strength bolts, unless otherwise indicated.
3. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

2.6 PREFABRICATED BUILDING COLUMNS

A. Definition: Prefabricated building columns consist of assemblies composed of load-bearing structural steel members encased in manufacturer's standard insulating material for fire protection and wrapped in outer non-load bearing steel sheet enclosures.

B. Fire-Test-Response Characteristics: Provide prefabricated building column assemblies identical to those of assemblies tested for the following fire-resistance ratings per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify columns with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Rating: 4 hours.
2. Fire-Resistance Rating: 3 hours.
3. Fire-Resistance Rating: 2 hours.
4. Fire-Resistance Rating: As indicated.

C. Column Configuration: Provide columns of sizes and shapes indicated. Fabricate connections to comply with details shown or required to suit type of structure indicated.

1. Concrete Fill: Structural concrete, manufacturer's standard mix, with a minimum 28-day compressive strength of 5000 psi (34.5 MPa), machine mixed and mechanically vibrated during placement to produce a concrete core free of voids.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering prefabricated building columns that may be incorporated in the Work include, but are not limited to, the following.

E. Manufacturers: Subject to compliance with requirements, provide prefabricated building columns by one of the following:

1. Black Rock Column, Inc.
2. *Dean Lally* L.P.; *Firetrol* Division.

2.7 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surface embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 “Hand Tool Cleaning”.
2. SSPC-SP 3 “Power Tool Cleaning”.
3. SSPC-SP 5 “White Metal Blast Cleaning”.
4. SSPC-SP 6 “Commercial Blast Cleaning”.
5. SSPC-SP 7 “Brush-Off Blast Cleaning”.
6. SSPC-SP 8 “Pickling”.
7. SSPC-SP 10 “Near-White Blast Cleaning”.
8. SSPC-SP 11 “Power Tool Cleaning to Bare Metal”.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer’s instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, non-asphaltic primer complying with SS PC’s “Painting System Guide No. 7.00” to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 GALVANIZING

A. Hot-Dip Galvanize Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage and independent testing and inspecting agency to perform shop inspections and test and to prepare test reports.

1. Testing agency will conduct and interpret test and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

E. Shop-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

F. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
4. 4. Ultrasonic Inspection; ASTM E 164.

G. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed when visual inspections reveal either less than a continuous 360 degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and gracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

    a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature al time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Finish sections thermally cut during erection equal to a sheared appearance.

I. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten non-high strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

C. Install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Bolts: ASTM A 490 (ASTM A 490M) high-strength bolts, unless otherwise indicated.
3. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.5 PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with AISC specifications referenced in this Section, manufacturer's recommendations, and requirements of the testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 FIELD QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

E. Field-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

F. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrate Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
4. Ultrasonic Inspection: ASTM E 164.

G. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed when visual inspections reveal either less than a continuous 360 degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

3.7 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Division 9, Section "Painting".

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 05120

SECTION 05520 – HANDRAILS AND RAILINGS

1- RELATED DOCUMENTS:

The general provisions of the Contract, including General and Special Conditions, apply to the work specified in this section.

2- DESCRIPTION OF WORK:

The extent of handrails and railing is shown on the drawings.

3- MATERIALS:

Steel Pipe: Standard weight, galvanized, ASTM A-120

4- FABRICATION:

Welded Connections: Cope intersections of rails and posts, excepts where otherwise shown on drawings, weld joints and grind smooth.

Brackets, Flanges and Anchors: Provide galvanized cast metal brackets, flanges and anchors for handrails supports. Furnish inserts as required for anchorage to concrete.

5- INSTALLATION:

Cutting, Fitting and Placement:

Perform cutting, drilling and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

Use welding connectors to join sections of railings. Grind joints smooth.

Adjust railing prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Secure posts and rail ends to building construction as shown on drawings.

Secure handrails to walls with wall brackets. Locate brackets at not more than 8’ – 0” o.c. use anchorage to secure wall brackets to building construction as follows:

For concrete anchorage, use bolt anchor expansion shields and lag bolts. For hollow masonry anchorage, use toggle bolts having square heads.

SECTION 05520 – HANDRAILS AND RAILINGS (Cont.)

6- PAINTING:

Follow indications of Section 09900 for finishing of metals.

7- SUBMITTALS:

Shop Drawings:

Submit shop drawings for the fabrication and erection of handrails and railings. Show anchorage and accessory items. Do not start fabrication until shop drawings are approved in writing.

SECTION 05700

ORNAMENTAL METALS

PART 1 - GENERAL

1.1 SUMMARY:

A. Related Sections:

1. Section 05740 – Ornamental Metal Restoration.

1.2 REFERENCES:

A. American Society for Testing and Materials (ASTM):

1. A 47: Malleable Iron Castings.
2. A 48: Gray Iron Castings.
3. A 576: Steel Bars, Carbon, Hot-Wrought, Special Quality.

B. Copper Development Association (CDA): Standards handbook-Copper and Copper Alloys.

C. Steel Structures Painting Council, National Association of Corrosion Engineers (SSPC): Steel Structures Painting Manual.

1.3 SUBMITTALS:

A. Submit under provisions of Section 01340:

1. Shop Drawings:

a. Show dimensions, sizes, thicknesses, gauges, finishes, joining, attachments and relationship of work to adjoining construction.
b. Show shop and erection details, including connections and fastenings.

2. Samples: Minimum 6 inch long samples of material and profile.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Steel: ASTM A 576.

B. Iron: ASTM A 48, Class 30, or ASTM A 47.

2.2 ACCESSORIES:

A. Fasteners: Material compatible with base metal; countersunk Phillips's flat head where exposed.

B. Paint: primer and touch-up for ferrous metals: SSPC Paint 15, Type 1, red oxide.

C. Anchoring Cement: There Products *Thorogrip* or accepted substitute.

2.3 FABRICATION:

A. Field Measurements: Prior to fabrication of items take required field measurements for correct fit.

B. General:

1. Form metal work to shape and size with sharp lines, angles and arises. Details of metal, details of assembly and support shall give ample strength and stiffness for intended purpose.
2. Include supplementary parts necessary to complete each item.
3. Wherever possible, shops fit and assemble work to eliminate field jointing. Fit joints and intersections accurately with proper fastenings.
4. Fabricate trim from longest lengths possible; locate joints symmetrically. Fit adjacent pieces with hairline joints and aligned surfaces. Space exposed screws evenly and symmetrically. Miter corners and angles of exposed moldings and frames.

C. Rails:

1. Fabricate with minimal joints. Fabricate and finish joints and slope transitions in shop. Joint location is subject to Architect's approval.
2. Miter ends of rail stock at corners and slope transitions.

D. Fastenings:

1. Conceal fastenings wherever possible.
2. Where screws must be used from permanent connections, use flat head type, countersunk, with screw slots filled and finished smooth and flush.

E. Finishes:

1. Steel and iron: Shop paint steel and iron fabrications.
   a. Surface preparation: SSPC SP2 or SP3.
   b. Application: One coat; follow coating manufacturer's directions.
   c. Minimum dry film thickness: 2.0 mils.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install items in accordance with approved Shop Drawings.

B. Install plumb and level, accurately finished, free from distortion and defects.

C. Install metal shapes with hairline joints, free from warp, waves, buckles, scratches and other defects on exposed faces.

D. Install sleeved components with anchoring cement.

E. Isolate dissimilar metals from contact with bituminous paint, non-absorptive gasket, or other approved method.

3.2 ADJUSTING:

A. Clean and touch up shop paint at welded and abraded surfaces.

3.3 SCHEDULE:

A. Ornamental Brass Handrail Components: As manufactured by LAVI Industries, or accepted substitute.

1. Handrail: 2" Ø brass pipe.
2. Railing Posts: 2" Ø brass pipe.
3. Floor Corner Flange: 4" Ø brass lower flange No. 530/2.
4. Tee Ball Fitting: 3 3/16" brass fitting.
5. Angle Ball Fitting: 3 3/16" brass fitting.

B. Ornamental Kiosk's: Fabricate according to drawings in material, profile and design. Drawings indicate general concept; minor modifications will be required to the job conditions and security system electrical adjust requirements.

C. Ornamental Kiosk's Bronze Columns: Fabricate according to drawings in material, profile and design. Drawings indicate general concept; minor modifications will be required to the job conditions and security system electrical adjust requirements.

D. Ornamental Fountain's Bronze Spouts: Fabricate according to drawings in material, profile and design. Drawings indicate general concept; minor modifications will be required to the job conditions and security system electrical adjust requirements.

E. Ornamental Columbus Monument Cast Stone Grate: Fabricate according to drawings in material, profile and design. Drawings indicate general concept; minor modifications will be required to the job conditions and security system electrical adjust requirements.

END OF SECTION

SECTION 05810

EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Parking deck expansion joint cover assemblies.
2. Plaza deck expansion joint cover assemblies.
3. Floor expansion joint cover assemblies.
4. Wall expansion joint cover assemblies.
5. Ceiling expansion joint cover assemblies.
6. Soffit expansion joint cover assemblies.
7. Fire-rated expansion joint cover assemblies.
8. Seismic expansion joint cover assemblies. Equal to *Twinline* model SSR400.
9. Compression seals.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 3 Section “Cast-In-Place Concrete” for cast in anchorage and frames for expansion joints cover assemblies in concrete floors, parking decks, and walls.
2. Division 7 Section “Flashing and Sheet Metal” for sheet metal roof and wall expansion joint systems.
3. Division 7 Section “Roof Accessories” for curb-type expansion joints.
4. Division 7 Section “Joint Sealants” for elastomeric sealants and preformed foam sealants without metal frames.
5. Division 9 Sections for walls, partitions, ceilings, and floor finishes with expansion joints.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of expansion joint cover assembly specified, including manufacturer’s product specifications, installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and installation of expansion joint cover assembly including plans, elevations, section, detail of components, joints, splices, and attachments to other units of Work.

D. Samples for verification purposes in full-size units of each type of expansion joint cover assembly indicated; in sets for each finish, color, texture, and pattern specified, showing full range of variations expected in these characteristics:

1. Install elastomeric material for joints samples to verify color selected.

E. Single-Source Responsibility: Obtain expansion joint cover assemblies specified in this Section from one source from a single manufacturer. Coordinate compatibility with expansion joint cover assemblies specified in other sections.

F. Fire-Test-Response Characteristics: Where indicated, provide expansion joint cover assemblies identical to those assemblies whose fire resistance has been determined per ANSI/UL 263, NFPA 251, U.B.C. 431, or ASTM E 119, including hose stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Not less than the rating of adjacent construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products specified in each Expansion Joint Cover Assemblies Product Data Sheet at end of this Section.

2.2 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), alloy 6061-T6, sheet and plate.

1. Protect aluminum surfaces to be placed in contact with cementitious materials with a protective coating.

B. Bronze: ASTM B 455, alloy C38500 for extrusions; alloy C28000 *Muntz* Metal for plates.

C. Extruded Preformed Seals: Single or multicellular elastomeric profiles as classified under ASTM D 2000, designed with or without continuous, longitudinal, internal baffles. Formed to fit compatible frames, in color indicated or, if not indicated, as selected by ARCHITECT from manufacturer's standard colors.

D. Preformed Sealant: Manufacturer's standard elastomeric sealant complying with ASTM C 920. Use T, factory-formed and-bonded to metal frames or anchor members; in color indicated or, if not indicated, as selected by ARCHITECT from manufacturer's standard colors.

1. Joints 2 inches (50 mm) Wide and Less: Withstand plus or minus 35 percent movement of the joint width without failure.

2. Joints Greater Than 2 inches (50 mm) to 4 inches (100 mm) Wide: Withstand plus or minus 50 percent movement of the joint width without failure.

E. Seismic Seals: Typically for exterior application, two single-layered elastomeric profiles, one interior and one exterior, as classified under ASTM D 2000; retained in a set of compatible frames, in color indicated or, if not indicated, as selected by ARCHITECT from manufacturer's standard colors. At manufacturer's option, omit interior profile for interior application.

F. Fire Barriers: Designed for indicated or required dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Tested in maximum joint width condition with a field splice as a component of an expansion joint cover per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or ASTM e 119, including hose stream test of vertical wall assemblies by a nationally recognized testing and inspecting agency acceptable to authorities having jurisdiction.

G. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 EXPANSION JOINT COVER ASSEMBLIES

A. General: Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated. Provide units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee-joints, comers, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

B. Moisture Barrier: Provide manufacturer's continuous, standard, flexible vinyl moisture barrier under covers at locations indicated.

C. Fire-Rated Joint Covers: Provide manufacturer's continuous standard flexible fire barrier seals at locations indicated to provide fire-resistive rating not less than the rating of adjacent construction.

D. Coverless Fire Barrier: Provide manufacturer's continuous standard flexible fire barrier seals at locations indicated to provide fire-resistive rating not less than the rating of adjacent construction.

E. Metal Floor-to-Floor Joint Cover Assemblies: Provide continuous extruded metal frames of profile indicated with seating surface and raised floor rim or exposed trim strip to accommodate flooring and concealed bolt and anchors embedded in concrete. Provide assemblies formed to receive cover plates of design indicated and to receive filler materials (if any) between raised rim of frame and edge of plate. Furnish depth and configuration to suit type of construction and to produce a continuous flush wearing surface with adjoining finish floor surface:

1. Partially Concealed Cover: Provide one frame on each side of joint, designed to accommodate manufacturer's floor cover plate and filler.
2. Exposed Cover: Provide one frame on each side of joint, designed to support floor plate and filler.
3. Flat Cover Plates: Provide cover plates of profile and wearing surface indicated. Extend flat plates to lap each side of joint.

a. Filler Insert: Furnish abrasive-resistant flexible gasket filler between edge of cover plate and raised rim of frame to accommodate required movement.

4. Fixed Cover Plates: Attach one side of the cover plate to a frame or finished wearing surface, with other side resting on other frame or finished wearing surface to allow free movement.
5. Self-Centering Cover Plates: Concealed centering device with the cover plate secured in or on top of frames as to have free movement on both sides.
6. Floor Cover Plate Wearing Surfaces: Provide cover plates with the following type of wearing surfaces.

a. Plain.
b. Fluted.
c. Recessed to receive full thickness of flooring material.
d. Abrasive plate.
e. Adhesive filled plate.
f. Adhesive strip plate.

F. Floor-to-Wall Joints: Provide one frame on floor side of joint only. Provide wall side frame where required by manufacturer's design.

1. Angle Cover Plates: Attach angle cover plates for floor-to-wall joints to wall with countersunk, flathead exposed fasteners secured to drilled-in-place anchor shields, unless otherwise indicated, at spacing recommended by joint cover manufacturer.

G. Wall, Ceiling, and Soffit Joint Cover Assemblies: Provide interior wall and ceiling expansion joint cover assemblies of same design and appearance. Provide exterior wall and soffit expansion joint cover assemblies compatible with floor expansion joint cover assemblies design and appearance.

1. Fixed Metal Cover Plates: Provide a concealed, continuously anchored frame fastened to wall, ceiling, or soffit only on one side of joint. Extend cover to lap each side of joint and

to permit free movement on one side. Attach cover to frame with cover in close contact with adjacent finish surfaces.

2. Floating Metal Cover Plates: Cover plate secured in or on top of frames to permit free movement on both sides.

3. Self-Centering Cover Plates: Concealed centering device with the cover plate secured in or on top of frames to permit free movement on both sides.

4. Flexible Filler: Secure the approved flexible filler between frames to compress and expand with movement.

H. Joint Cover Assemblies with Preformed Seals: Provide joint cover assemblies consisting of continuously anchored aluminum extrusions and continuous extruded preformed seals of profile indicated or required to suit types of installation conditions shown. Furnish extrusions designed to be embedded in or attached to concrete with lugs. Vulcanize or heat-weld splices (if any) to ensure hermetic joint condition.

1. Cover Plate: Include extruded aluminum cover plate fastened to one side of joint and extend plate to lap each side of joint to permit free movement with cover in close contact with adjacent contact surfaces.

I. Joint Cover Assemblies with Elastomeric Sealant: Provide continuous cover joint assemblies consisting of elastomeric sealant factory-bonded to extruded aluminum frames of profile indicated or required to suit types of installation conditions shown. Provide frames for floor joints with means for embedding in or anchoring to concrete without using exposed fasteners and that will result in exposed surfaces of sealant and aluminum frames finishing flush with adjacent finished floor surface without exposing anchors.

J. Compression Seals: Preformed, elastomeric extrusions having internal baffle system in sizes and profiles shown or as recommended by the manufacturer. Provide lubricant and adhesive for installation recommended by the manufacturer.

K. Foam Seal: Non-extruded, low-density, cross-linked, nitrogen-blown ethylene vinyl acetate polyethylene copolymer foam; *Evazote* 380 E.S.P. Provide adhesive for installation recommended by the manufacturer.

2.4 METAL FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes to products in factory after fabrication. Protect finishes on exposed surfaces before shipment.

B. Aluminum Finishes: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Mill Finish: AA-M10 (unspecified mill finish).

2. Class II, Clear-Anodized Finish: AA-M12C22A31 [Mechanical Finish: as fabricated, non-specular; Chemical Finish: etched, medium matte; Anodic Coating: Class II ARCHITECTURAL, clear film thicker than 0.4 mil (0.01 mm)].

3. Class I, Color-Anodized Finish: AA-M12C22A42/A44 [Mechanical Finish: as fabricated, non-specular; Chemical Finish: etched, medium matte; Anodic Coating: Class I ARCHITECTURAL, film thicker than 0.7 mil (0.02 mm) with integral color or electrolytically deposited color] complying with AAMA 606.1 or AAMA 608.1.

    a. Color: As selected by ARCHITECT from within standard industry colors and color density range.

4. Baked Enamel Finish: AA-C12C42R1x (Chemical finish: cleaned with inhibited chemical; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.

    a. Organic Coating: Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.

    b. Color: As selected by Architect from manufacturer's standard colors.

5. High-Performance Organic Coating: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

    a. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat thermocured system, composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

        1) Resin Manufacturers: Subject to compliance with requirements, provide fluoropolymer coating systems containing resins produced by one of the following manufacturers:
            a) *Ausimont* USA, Inc. (*Hylar* 5000).
            b) Elf Atochem North America, Inc. (*Kynar* 500).

        2) Color and Gloss: As selected by ARCHITECT from manufacturer's standard choices for color and gloss.

6. Factory-Primed Concealed Surfaces: Protect concealed metal surfaces to be placed in contact with concrete or masonry with a shop coat of manufacturer's standard primer on the contact surfaces.

C. Bronze Finish: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

1. Natural Satin Finish: CDA Designation M32, mechanical finish, directional textured, medium satin.

D. Stainless Steel Finishes: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

1. Bright, Cold-Rolled Unpolished Finish: AISI No. 2B finish.
2. Bright, Directional Polish: AISI No. 3 finish.

E. Factory Finish: Manufacturer's standard factory finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Manufacturer's Instructions: In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for phases of Work, including preparing substrate, applying materials, and protecting installed units.

B. Coordinate and furnish anchorages, setting drawings, templates, and instructions for installation of expansion joint cover assemblies to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

3.2 INSTALLATION

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install expansion joint covers. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling. Set floor covers at elevations to be flush with adjacent finished floor materials. Locate wall, ceiling, roof, and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) on center.

B. Continuity: Maintain continuity of expansion joint cover assemblies with a minimum number of end joints and align metal members mechanically using splice joints. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere-flexible filler materials (if any) to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

C. Extruded Preformed Seals: Install seals complying with manufacturer's instructions and with minimum number of end joints. For straight sections provide preformed seals in continual lengths. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer. Apply adhesive, epoxy, or lubricant-adhesive approved by manufacturer to both frame interfaces before installing preformed seal. Seal transitions according to manufacturer's instructions.

D. Elastomeric Sealant Joint Assemblies: Seal end joints within continuous runs and joints at transitions according to manufacturer's directions to provide a watertight installation.

E. Seismic Seals: Install interior seals in continual lengths; vulcanize or heat-weld field splice joints in interior seal material to provide watertight joints using manufacturer's recommended procedures. Install exterior seal in standard lengths. Seal transitions and end joints according to manufacturer's instructions.

F. Fire Barriers: Install fire barriers, including transitions and end joints, according to manufacturer's instructions so that fire-rated construction is continuous.

3.3 CLEANING AND PROTECTION

A. Do not remover protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

END OF SECTION 05810

SECTION 07 22 00

ROOF INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Work shall include, but is not limited to, the following:
   1. Preparation of existing (new) roof deck and all flashing substrates.
   2. Thermal Barrier
   3. Insulation
   4. Cover-board
   5. SBS Modified Bitumen Laminated Cover-board
   6. All related materials and labor required to complete specified roofing necessary to receive specified manufacturer's warranty.

1.02 RELATED SECTIONS

A. Division 010000 – General Requirements
B. Division 011000 – Summary of Work
C. Division 071416 – Cold Fluid-Applied Waterproofing
D. Division 072713 – Modified Bituminous Sheet Vapor Retarders
   Division 075216 – Styrene-Butadiene-Styrene (SBS) Modified Bitumen Membrane Roofing
E. Division 075419 – Polyvinyl-Chloride (PVC) Roofing
F. Division 076200 – Sheet Metal Flashing and Trim

1.03 DEFINITIONS

A. ASTM D 1079-Definitions of Term Relating to Roofing and Waterproofing.
B. The National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, Fifth Edition Glossary.

1.04 REFERENCES

A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Reference Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.
B. AMERICAN STANDARD OF TESTING METHODS (ASTM):
   1. ASTM C 726 - Standard Specification for Mineral Wool Roof Insulation Board.
   2. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Insulation Board.

3. ASTM C 1325 – Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
4. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing.

C. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):
1. ANSI/SPRI FX-1, Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
2. ANSI/SPRI IA-1, Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.
3. ANSI/FM 4474- American National Standard for Evaluating the Simulated Wind Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures.

D. FACTORY MUTUAL (FM):
1. FM 4450 - Approval Standard - Class I Insulated Steel Roof Decks.
2. FM 4470 - Approval Standard - Class I Roof Covers.

E. INTERNATIONAL CODES COUNCIL (ICC):
1. Latest International Building Code (IBC).

F. NATIONAL ROOFING CONTRACTORS' ASSOCIATION (NRCA).

G. UNDERWRITERS LABORATORY (UL):
1. UL 790 Standard Test Methods for Fire Tests of Roof Coverings.
2. UL 1256 – Fire Test of Roof Deck Constructions.

H. PUERTO RICO BUILDING CODE 2018

1.05 ACTION SUBMITTALS

A. Product Data Sheets: Submit manufacturer's product data sheets, installation instructions and/or general requirements for each component.

B. Safety Data Sheets: Submit manufacturer's Safety Data Sheets (SDS) for each component.

C. Sample/Specimen Warranty from the manufacturer and contractor.

D. Shop Drawings: Provide roof plan and applicable roof system detail drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Contractor Certification: Submit written certification from roofing system manufacturer certifying that the applicator is authorized by the manufacturer to install the specified materials and system.

1.07 CLOSEOUT SUBMITTALS

A. Warranty: Provide manufacturers and contractor's warranties upon substantial completion of the roofing system.

1.08 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:
   1. Manufacture shall have 20 years of experience manufacturing roofing materials.
   2. Trained Technical Field Representatives, employed by the manufacturer, independent of sales.
   3. Provide reports in a timely manner of all site visit reports.
   4. Provide specified warranty upon satisfactory project completion.

B. CONTRACTOR QUALIFICATIONS:
   1. Contractor shall be authorized by the manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
   2. Applicators shall have completed projects of similar scope using same materials as specified herein.
   3. Contractor shall provide full time, on-site superintendent or foreman experienced with the specified roof system through satisfactory project completion.
   4. Applicators shall be skilled in the application methods for all materials.
   5. Contractor shall maintain a daily record, on-site, documenting material installation and related project conditions.
   6. Contractor shall maintain a copy of all submittal documents, on-site, available at all times for reference.

1.09 DELIVERY, STORAGE AND HANDLING

A. Refer to each product data sheet or other published literature for specific requirements.

B. Deliver materials and store them in their unopened, original packaging, bearing the manufacturer's name, related standards, and any other specification or reference accepted as standard.

C. Protect and store materials in a dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location.

D. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least 4 in or more above ground level. Carefully cover storage with “breathable” tarpaulins to protect materials from precipitation and to prevent exposure to condensation.

E. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials shall be removed from job site and replaced with new, suitable materials.

1.10 SITE CONDITIONS

A. SAFETY:

1. The contractor shall be responsible for complying with all project-related safety and environmental requirements.
2. Refer to NRCA CERTA recommendations, local codes and building owner’s requirements for hot work operations.

3. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified liquid-applied, or semi-solid roofing materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions.
4. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified hot asphalt-applied materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions.
5. The contractor shall refer to product Safety Data Sheets (SDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.

B. ENVIRONMENTAL CONDITIONS:

1. Monitor substrate temperature and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials. Materials and methods shall be adjusted as necessary to accommodate varying project conditions. Materials shall not be installed when conditions are unacceptable to achieve the specified results.
2. Precipitation and dew point: Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of roofing materials. Ensure all roofing materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.

1.11 PERFORMANCE REQUIREMENTS

A. FIRE CLASSIFICATION:

1. Roof construction performance testing shall be in accordance with UL 1256, FM 4450, or FM 4470 to meet the specified requirements for interior flame spread and fuel contribution.
   a. Roof construction meets requirements of UL 1256, or FM Class 1.

B. ROOF SLOPE:

1. Finished roof slope shall be ¼ inch per foot (2 percent) minimum for roof drainage.

C. ENERGY CONSERVATION REQUIREMENTS:

1. Polyisocyanurate Insulation "R" Value: Shall be determined in accordance with ASTM C1289-11a.

2. Thermal Resistance 'R' for the specified roof insulation system shall include the continuous insulation (ci) above the roof deck.
    a. Total Thermal Resistance R Value, continuous insulation (ci) above-deck: R (20)

PART 2 PRODUCTS

2.01 MANUFACTURER

A. SINGLE SOURCE MANUFACTURER: All roofing materials shall be provided by a single supplier with 20 years or more manufacturing history in the US.
    1. Comply with the Manufacturer's requirements as necessary to provide the specified warranty.
B. PRODUCT QUALITY ASSURANCE PROGRAM: Manufacturer shall be an ISO 9001 registered company.
C. ACCEPTABLE MANUFACTURER:
    1. SOPREMA, located at: 310 Quadral Dr.; Wadsworth, OH 44281; Tel: 800-356-3521; Tel: 330-334-0066; Website: www.soprema.us.
    2. Acceptable Alternate Manufacturers: Hunter, RMax, Atlas

2.02 ROOFING SYSTEM

A. ROOFING SYSTEM BASIS OF DESIGN: The Applicator shall submit evidence that the proposed roof system meets the requirements of the local building code (Puerto Rico Building Code 2018) and has been tested and approved or listed by an approved, codified testing organization. These requirements are minimum standards, and no roofing work shall commence without written documentation of the system's compliance.

2.03 THERMAL INSULATION SYSTEM

A. RIGID INSULATION
    1. POLYISOCYANURATE INSULATION:
        a. Flap Panels: Closed cell polyisocyanurate foam core bonded on each side to a glass fiber-reinforced felt facer.
            i. Thickness: 1.5 in minimum board thickness. Total thickness to meet specified insulation system thermal resistance 'R' value 20.
            ii. Dimensions: 4 x 4 ft or 4 x 8 ft boards
            iii. Meets or exceeds ASTM C1289, Type II, Class 1, (20 psi).
        b. Tapered Panel: Closed cell polyisocyanurate foam core bonded on each side to a glass fiber-reinforced felt facer, tapered to provide slope.
            i. Taper: 1/2 in per foot. Insulation, crickets, and saddles provided with taper as required for positive roof slope.
            ii. Dimensions: 4 x 4 ft boards

B. COVER-BOARD

1. ASPHALTIC ROOF BOARD

a. Mineral fortified, asphaltic roof substrate board with glass fiber facers. For use as roof cover-board and for vertical flashing substrate. ASPHALTIC ROOF BOARD shall be manufactured by the membrane supplier.

i. Thickness: 1/4 in

ii. Dimensions: 4 x 4 ft, and 4 x 8 ft acceptable for mechanical attachment, insulation adhesive or asphalt application.

iii. Water absorption: Less than 1 percent per ASTM D994.

iv. Impact resistance: Included in FM Approvals per 4450/4470 for FM Severe Hail (SH) rating.

v. Compressive strength, psi (kPa) measured at 50 percent compression, per ASTM C472:

a) ¼ in board: 1,320 (9,100)

vi. Puncture resistance, lbf (N) per ASTM E154:

a) ¼ in board: 100 (445)

2. GYPSUM ROOF BOARD

a. Georgia Pacific Gypsum LLC, DensDeck Prime Roof Board: Gypsum core, glass fiber-faced, factory primed, roof Cover-board.

i. Thickness: 1/2 in

ii. Dimensions: 4 x 4 ft or 4 x 8 ft boards.

iii. Facer: Factory primed, glass fiber.

iv. Meets or exceeds ASTM C1177/C1177M.

C. INSULATION CANT AND TAPERED STRIP

1. CANT STRIP, MODIFIED BITUMEN

a. Modified bitumen cant strips.

2. TAPERED EDGE STRIP AND BOARDS:

a. Expanded perlite, blended with binders and fibers.

i. Dimensions: 6 in x 1/2 in, 12 in x 1/2 in, 1 in or 1-1/2 in, 18 in x 1 in or 1-1/2 in. Size as required.

ii. Meets or exceeds ASTM C728.

D. INSULATION ADHESIVE

1. POLYURETHANE FOAM INSULATION ADHESIVE

a. Two-component, polyurethane foam insulation adhesive, applied in ribbons from cartridges or two-component bulk packaging with pump-driven delivery system.

i. Ribbon size: 1/2 in to 3/4 in wide.

ii. Ribbon spacing: As required to meet specified wind uplift resistance performance.

a) Field of Roof (Zone 1): 12 in on-centers

b) Perimeter of Roof (Zone 2): 6 in on-centers

c) Corners of Roof (Zone 3): 4 in on-centers

2.04 ACCESSORIES

A. PRIMERS:

1. PRIMER: Asphalt cut-back primer. Primer for the preparation of substrates for asphalt applications.
   a. Meets or exceeds ASTM D41
   b. VOC content: 350 g/L or less.

B. INSULATION FASTENERS AND PLATES

1. MP FASTENER and INSULATION PLATE: Insulation system fasteners and metal stress plates.
2. HD FASTENER and IN INSULATION PLATE: Insulation system fasteners and metal stress plates.
3. SFS isoweld Fastener and Plate: Non-penetrating membrane fastener and plate.
4. Fastener and Plate: Insulation system fasteners and metal stress plates.

C. BOARD FASTENERS AND PLATES

1. #14 MP Fastener: Membrane base ply fastener.
2. #15 HD Fastener: Membrane base ply fastener.
3. #15 EL Fastener: Membrane base ply fastener.
4. 2 in SEAM PLATE: Membrane base ply seam plate.
5. 2.4 in SEAM PLATE: Membrane base ply seam plate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examination includes visual observations, qualitative analysis, and quantitative testing measures as necessary to ensure conditions remain satisfactory throughout the project.

B. Conduct qualitative insulation adhesive adhesion tests, or quantitative bonded pull tests as necessary to ensure satisfactory adhesion is achieved.

C. The contractor shall examine all roofing substrates including, but not limited to: insulation materials, roof decks, walls, curbs, rooftop equipment, fixtures, and wood blocking.

D. The applicator shall not begin installation until conditions have been properly examined and determined to be clean, dry and, otherwise satisfactory to receive specified roofing materials.

E. During the application of specified materials, the applicator shall continue to examine all project conditions to ensure conditions remain satisfactory to complete the specified roofing system.

3.02 PREPARATION

A. Before commencing work each day, the contractor shall prepare all roofing substrates to ensure conditions are satisfactory to proceed with the installation of specified roofing materials. Preparation of substrates includes, but is not limited to, substrate repairs, securement of substrates, eliminating all incompatible materials, and cleaning.

B. Where conditions are found to be unsatisfactory, work shall not begin until conditions are made satisfactory to begin work. Commencing of work shall indicate contractor's acceptance of conditions.

3.03 PRIMER APPLICATION

A. Apply the appropriate specified primer to dry, compatible substrates as required to enhance adhesion of new specified roofing materials.

B. Apply primer using brush, roller, or sprayer at the rate published on the product data sheet.

C. Project conditions vary throughout the day. Monitor changing conditions, monitor the drying time of primers, and monitor the adhesion of the membrane plies. Adjust primer and membrane application methods as necessary to achieve the desired results.

3.04 INSULATION CONCRETE ADHESIVE APPLICATION

1. Apply the specified two-component insulation adhesive to adhere (Insulation Base Layer, Insulation Layers, Cover-board) to the deck and insulation substrate(s).
2. Follow insulation adhesive product data sheets and published general requirements for installation requirements.
3. Apply insulation adhesive in uniform ribbons, 1/2 in to 3/4 in wide.
4. Immediately install insulation components into insulation adhesive and apply weight to ensure the materials maintain full contact with all ribbons for complete adhesion. Do not allow insulation adhesive to skin-over before placing the insulation materials into the adhesive.
5. Adhere the insulation system to meet the specified wind uplift resistance performance and specified warranty requirements.
6. Minimum insulation adhesive ribbon spacing:
    a. Field of Roof (Zone 1): 12 in on-centers.
    b. Perimeter of Roof (Zone 2): 6 in on-centers.
    c. Corners of Roof (Zone 3): 4 in on-centers.

3.05 INSULATION SYSTEM APPLICATION

A. Follow insulation system component product data sheets, published general requirements and, approvals.

B. Install all insulation system components on clean, dry, uniform and, properly prepared substrates.

C. All insulation system boards shall be carefully installed and fitted against adjoining sheets to form tight joints.

D. Insulation system boards that must be cut to fit shall be saw-cut or knife-cut in a straight line, not broken. Chalk lines shall be used to cut insulation components. Uneven or broken edges shall not be accepted. Remove dust and debris that develops during cutting operations.

E. Stagger successive layers of insulation 12 in vertically and laterally to ensure board joints do not coincide with joints from the layers above and below.

F. Crickets, saddles, and tapered edge strips shall be installed before installing Cover-boards.

G. Install tapered insulation, saddles and crickets as required to ensure positive slope for complete roof drainage.

H. Cover-boards shall be installed to fit tight against adjacent boards. When required by the Cover-board manufacturer, a uniform gap shall be provided between Cover-boards using a uniform guide placed between board joints to form a gap between all boards during installation.

I. The finished insulation system surface shall be tight to, and flush with, adjacent substrates to form a satisfactory substrate to install specified roof membrane and flashings.

J. Install specified cants where required for membrane flashing transitions.

3.06 CLEAN-UP

A. Clean-up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

END OF SECTION

SECTION 075200 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modified bituminous roofing membrane, conventional application.

B. Insulation, flat and tapered.

C. Roofing cant strips and walkway pads.

1.02 REFERENCE STANDARDS

A. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board 2017a (Reapproved 2022).

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022.

C. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).

D. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing 2016a.

E. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method 1983 (Reapproved 2018).

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).

G. ASTM D6163/D6163M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements 2021.

H. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings 2020a.

I. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces 2011 (Reapproved 2019).

J. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

K. FM (AG) - FM Approval Guide current edition.

L. NRCA (RM) - The NRCA Roofing Manual 2022.

M. UL (FRD) - Fire Resistance Directory Current Edition.

N. Puerto Rico Building Code 2018 Ed. - Adopting (ICC) 2018 International Building Code with amendments.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's catalog data for membrane and bitumen materials, base flashing materials, insulation, vapor retarder, and surfacing.
   1. Sustainable Design Submittal: Include testing documentation of solar reflectance index.

B. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.

C. Manufacturer's Installation Instructions: Indicate special procedures.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's qualification statement.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, and approved by manufacturer.

C. The Applicator shall submit evidence that the proposed roof system meets the requirements of the local building code (Puerto Rico Building Code 2018) and has been tested and approved or listed by an approved, codified testing organization. These requirements are minimum standards, and no roofing work shall commence without written documentation of the system's compliance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture; ballast materials may be stored outdoors.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.06 FIELD CONDITIONS

A. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.

B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane to damp deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.07 WARRANTY

A. Correct defective work within a 5 -year period after Date of Substantial Completion.

B. Provide 20-year manufacturer's material warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 ROOFING - CONVENTIONAL APPLICATION

A. Modified Bituminous Membrane Roofing: Two-ply membrane, with insulation.

B. Roofing Assembly Requirements:
   1. Solar Reflectance Index (SRI): 78, minimum, calculated in accordance with ASTM E1980, based on 3-year aged data.
      a. Field applied coating may not be used to achieve specified SRI.
   2. External Fire Exposure Classification: ASTM E108 Class A, UL (FRD) listed.
   3. Internal Fire Spread Classification: Factory Mutual Class 1, FM-approved.
   4. Wind Uplift Performance as per Roofing Application Standard (RAS) No. 128; Florida Building Code.
      a. Roof System Design Pressures calculated as per ASCE 7.
      b. Field of Roof (Zone 1): -88 psf
      c. Perimeter of Roof (Zone 2): -117 psf
      d. Corners of Roof (Zone 3): -160 psf.
   5. Insulation Thermal Resistance (R-Value): 2 minimum; provide insulation of thickness required.
   6. Surfacing: Mineral granules.

C. Acceptable Insulation Types - Constant Thickness Application: Any of the types specified.
   1. Minimum 2 layers of polyisocyanurate board.

2. Top layer of perlite board.

D. Acceptable Insulation Types - Tapered Application: Any of the types specified.
1. Tapered polyisocyanurate board covered with uniform thickness perlite board.

2.02 MEMBRANE AND SHEET MATERIALS

A. Membrane: Polymer modified asphalt, reinforced with nonwoven fabric; granule surfaced; with the following characteristics:
1. Minimum Quality: ASTM D6163/D6163M Type I; styrene-butadiene-styrene (SBS) modified, glass fiber reinforced.
2. Solar Reflectance: 0.78, minimum, initial, and 0.62, minimum, 3-year, certified by Cool Roof Rating Council.
3. Thermal Emissivity: 0.9, minimum, initial, and 0.9, minimum, 3-year, certified by Cool Roof Rating Council.
4. Color: White.
5. Thickness: 138 mils, .138 inch (3.5 mm).
6. Sheet Width: 39.4 inch (1000 mm).

B. Base Sheet: ASTM Type I; asphalt-coated glass fiber; unperforated.

C. Flexible Flashing Material: ASTM-D-6164, Type I; SBS modified, non-woven polyester reinforced and mineral granule top surface.

2.03 BITUMINOUS MATERIALS

A. Bitumen: Asphalt, ASTM D312/D312M Type IV; for adhering insulation, use Type III.

B. Asphalt Primer: ASTM D41/D41M, asphalt type.

C. Asphalt Roof Cement: ASTM D4586/D4586M, Type II, asbestos-free.

2.04 INSULATION

A. Perlite Board Insulation: Expanded perlite mineral aggregate complying with ASTM C728.
1. Board Thickness: 1/2 inch (12.7 mm).
2. Board Edges: Square.
3. Thermal Resistance, R-value (RSI-value): 1.4 (0.25) at 1/2 inch (12.7 mm) nominal thickness.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam complying with ASTM C1289.
1. Classifications:
a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inches (38 mm) thick; Class 1, Grades 1-2-3, 8.4 (1.48) at 75 degrees F (24 degrees C).
2. Board Size: 48 by 96 inches (1,220 by 2,440 mm).
3. Board Thickness: 1.5 inches (37.5 mm).
4. Tapered Board: Slope as indicated; minimum thickness 4.5 inch (114.3 mm); fabricate of fewest layers possible.
5. Board Edges: Square.

2.05 SURFACING MATERIALS - CONVENTIONAL APPLICATION

A. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
1. Composition: Asphaltic with mineral granule surface.
2. Size: Manufacturers standard size.
3. Surface Color: Yellow.

2.06 ACCESSORIES

A. Cant and Edge Strips: Perlite board, compatible with roofing materials ; cants formed to 45

degree angle.

B. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches (152 mm) wide; self adhering.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

D. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - CONCRETE DECK

A. Verify adjacent precast concrete roof members do not vary more than 1/4 inch (6 mm) in height, and grout keys are filled flush.

B. Fill surface honeycomb and variations with latex filler.

C. Do not begin work until elevated concrete substrate has cured at least 28 days and moisture content is five percent or less.
   1. Test for Concrete Moisture Content: No beading water under plastic after 16 hours when tested in accordance with ASTM D4263.
   2. Test for Relative Humidity in Concrete: Not greater than 75 percent when tested in accordance with ASTM F2170.

3.03 INSTALLATION - INSULATION, CONVENTIONAL

A. Attachment of Insulation on metal decks:
   1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instruction and FM (AG) Factory Mutual requirements.
   2. Embed each subsequent layer of insulation into flood coat mopping of hot bitumen in accordance with roofing and insulation manufacturers' instructions.
   3. Use fastener type and fastening pattern as required to achieve wind resistance specified.

B. Attachment of Insulation on concrete decks:
   1. Embed first layer of insulation in flood coat mopping of hot bitumen in accordance with roofing and insulation manufacturers' instructions.
   2. Embed each subsequent layer of insulation into flood coat mopping of hot bitumen in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

C. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.

D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

H. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches (457 mm).

I. Do not apply more insulation than can be covered with membrane in same day.

3.04 INSTALLATION - MEMBRANE

A. Install modified bituminous membrane roofing system in accordance with manufacturer's recommendations and NRCA (RM) applicable requirements.

B. Install membrane; lap and seal edges and ends permanently waterproof.

C. Install smooth, free from air pockets, wrinkles, fish-mouths, or tears. Ensure full bond of membrane to substrate.

D. At end of day's operation, install waterproof cut-off. Remove cut-off before resuming roofing.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 8 inches (203 mm) onto vertical surfaces.
   2. Apply flexible flashing over membrane.

F. Around roof penetrations, mop in and seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and sumps and related flashings.

3.05 FIELD QUALITY CONTROL

A. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

3.06 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 075400
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Flashings.

C. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 035216 - Lightweight Insulating Concrete: Substrate for this section.

B. Section 076200 - Sheet Metal Flashing and Trim: Counterflashings and reglets.

C. Section 077200 - Roof Accessories: Roof-mounted units; prefabricated curbs.

1.03 REFERENCE STANDARDS

A. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method 1983 (Reapproved 2018).

B. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing 2021.

C. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces 2011 (Reapproved 2019).

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

E. FM (AG) - FM Approval Guide current edition.

F. FM DS 1-28 - Wind Design 2016.

G. NRCA (RM) - The NRCA Roofing Manual 2022.

H. NRCA (WM) - The NRCA Waterproofing Manual 2021.

I. Puerto Rico Building Code 2018 Ed. - Adopting (ICC) 2018 International Building Code with amendments.

1.04 SUBMITTALS

A. Product Data: Provide data indicating membrane materials, flashing materials and fasteners.

B. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and walkway pad layout.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Specimen Warranty: For approval.

H. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane to damp deck surface or when precipitation is expected or occurring.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

A. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.

B. Roofing Contractor Warranty:
   1. Warranty Term: 5 years.
   2. For repair and replacement include costs of labor in warranty.

PART 2 PRODUCTS

2.01 ROOFING

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Requirements:
   1. Solar Reflectance Index (SRI): 104, minimum, calculated in accordance with ASTM E1980.
      a. Field applied coating may not be used to achieve specified SRI.
   2. Factory Mutual Classification: Class 1 and windstorm resistance of 1-540, in accordance with FM DS 1-28.
   3. Insulation Thermal Resistance (R-Value): R-20, minimum.

2.02 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type II, sheet contains reinforcing fibers or reinforcing fabrics.
      a. Thickness: 72 mil, .072 inch (1.8 mm), minimum.
   2. Sheet Width: Factory fabricated into widest possible sheets.
   3. Solar Reflectance: 0.83, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
   4. Thermal Emissivity: 0.90, minimum, initial, and 0.79, minimum, 3-year, certified by Cool Roof Rating Council.
   5. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Material recommended by membrane manufacturer.

D. Perimeter Edge Flashing: Material recommended by membrane manufacturer.

E. Separation Sheet: Material recommended by membrane manufacturer.

2.03 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Cant and Edge Strips: As recommended by membrane manufacturer, compatible with roofing materials; cants formed to 45 degree angle.

C. Membrane Adhesive: As recommended by membrane manufacturer.

D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

E. Fasteners and Anchors: Post-galvanized steel, aluminum or stainless steel. Avoid galvanic corrosion when mixing metal types. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins.
   1. Concrete fasteners and anchors: minimum embedment of 1-1/4 inch (32 mm); as approved by membrane manufacturer.
   2. Wood fasteners and anchors used for flashing: minimum embedment of 1 inch (25 mm); as approved by membrane manufacturer.

F. Sealants: As recommended by membrane manufacturer.

G. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - CONCRETE DECK

A. Verify adjacent precast concrete roof members do not vary more than 1/4 inch (6 mm) in height. Verify grout keys are filled flush.

B. Fill surface honeycomb and variations with latex filler.

C. Do not begin work until elevated concrete substrate has cured at least 28 days and moisture content is five percent or less.
   1. Test as Follows:
      a. Concrete Moisture Content: No beading water under plastic after 16 hours when tested in accordance with ASTM D4263.
      b. Relative Humidity in Concrete: Not greater than 75 percent when tested in accordance with ASTM F2170.

3.03 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.04 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate recommended by membrane manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches (76 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (76 mm) . Seal permanently waterproof. Weld cover strips at all seams that do not have a factory selvage edge. .

E. Hot-air weld seam overlaps as per membrane manufacturer's recommendations.

F. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches (102 mm) onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.
   3. Secure flashing to nailing strips at 4 inches (102 mm) on center.
   4. Insert flashing into reglets and secure.

G. Around roof penetrations, seal flanges and flashings with flexible flashing.

H. Install roofing expansion joints where indicated. Make joints watertight.
   1. Install prefabricated joint components in accordance with manufacturer's instructions.

I. Coordinate installation of roof drains and sumps and related flashings.

3.05 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

Thermoplastic PVC Feltback EnergyStar Single Ply Membrane Adhered to LWIC

PART 1 - GENERAL CONDITIONS

1.01 DESCRIPTION

A. Scope of Work: Install a complete Thermoplastic PVC Feltback membrane adhered system including field membrane, base flashings, lightweight insulating cellular concrete and other related metal components. Existing roofing assemblies shall be completely removed.

B. Related Work: The work includes but is not limited to the installation of:
1. Removal of existing roofing and insulation
2. Substrate preparation
3. Roof drains
4. Vapor retarder
5. Insulation
6. Separation layers
7. Roof membrane
8. Fasteners
9. Adhesive for flashings
10. Roof membrane flashings
11. Walkways
12. Metal Flashings
13. Sealants

C. Upon successful completion of work the following warranties may be obtained:
1. Single Source Manufacturer's Warranty
2. Roofing Applicators Limited Labor Warranty

1.02 QUALITY ASSURANCE

A. The completer roofing system shall be applied only by a roofing applicator approved for the manufacturer issuing the single source warranty.

B. A Technical Service Representative will review the installed roof system for the System Warranty requested.

C. All work pertaining to the installation of membrane, flashings, and accessories shall only be completed by Applicator authorized in those procedures. Applicators must be prequalified prior to bidding scope of project.

D. Roofing membrane manufacturer must have a demonstrated performance history of producing PVC roof membranes no less, in duration of years, than the warranty duration specified.

E. Roofing membrane and membrane flashings to be manufactured by membrane supplier and not private labeled.

F. Manufacturer to have a minimum ten years of experience recycling their membranes at the end of their service life back into new membrane products. Provide a minimum of five reference projects completed with new membrane produced from recycled membrane.

G. Applicable code/insurance requirements shall be identified by the Owner or Owner's representative.

1.03 SUBMITTALS

A. At the time of bidding, the Applicator shall submit to the Owner (or Representative) the following:

1. Copies of Specification.

2. Samples of each primary components to be used in the roof system and the manufacturer's current product data sheet for each component.
3. Written approval by the insulation manufacturer (as applicable) for use of the product in the proposed system.
4. Sample copy Manufacture's Corporation warranty.
5. Sample copy of Applicator's warranty.
6. Safety Data Sheets (SDS)
7. Product Data Sheets (PDS)

1.04 CODE REQUIREMENTS

The Applicator shall submit evidence that the proposed roof system meets the requirements of the local building code (Puerto Rico Building Code 2018) and has been tested and approved or listed by an approved, codified testing organization. These requirements are minimum standards, and no roofing work shall commence without written documentation of the system's compliance.

A. System shall be designed to meet the minimum wind design requirements of the applicable version of ASCE 7.

B. Factory Mutual Research Corporation (FM) - Norwood, MA
System shall be designed to meet 4470 requirements and the most recent versions of FM Global LPDS 1-28 and 1-29.

C. Underwriters Laboratories, Inc. - Northbrook, IL
1. Class A Assembly
2. FMG RoofNav# 30112-0-51016 or 30112-0-51017 Windstorm rating.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.

B. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

C. Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean tarpaulins. Unvented tarpaulins are not accepted due to the potential accumulation of moisture beneath the tarpaulin which may affect the membrane weldability.

D. As a rule, all adhesives shall be stored at temperatures around 80°F (27°C) and protected while on the roof. Read product data sheets and instructions contained on adhesive canisters for specific storage instructions.

E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers and read product Safety Data Sheets (SDS).

F. Any materials which the Owner's representative determine to be damaged are to be removed from the job site and replaced at no cost to the Owner.

G. Safety Data Sheets (SDS) shall be always available at the job site.

1.06 JOB CONDITIONS

A. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be heat welded before leaving the job site that day.

B. Temporary overnight tie-ins shall be installed at the end of each day's work and shall be completely removed (including any contaminated materials) before proceeding with the next day's work.

C. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction. Roof and walkways may be slippery when icy, snow covered, or wet. Working on surfaces under these conditions is hazardous. Appropriate safety measures must be implemented prior to working on such surfaces. Always follow OSHA and other relevant fall protection standards when working on roofs.

D. Where applicable, the Applicator shall arrange for pullout tests in accordance with the latest versions of the SPRI/ANSI Standard Field Test Procedures FX-1 and IA-1 for fasteners and adhesives, respectively, to verify condition of the deck/substrate and to confirm expected pullout values.

E. The feltback membrane shall not be installed under the following conditions without consulting manufacturer's Technical Dept. for precautionary steps:

1. The roof assembly permits interior air to pressurize the membrane underside.
2. Any exterior wall has 10% or more of the surface area comprised of opening doors or windows.
3. The wall/deck intersection permits air entry into the wall flashing area.

1.07 BIDDING REQUIREMENTS

A. Pre-Bid Meeting: A pre-bid meeting shall be held with the Owner's Representative and involved trades to discuss all aspects of the project. The Applicator's field representative or roofing foreman for the work shall be in attendance.

B. Site Visit: Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work. All dimensions and quantities shall be determined or verified by the Applicator. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions unless agreed to in advance with the Owner or Owner's Representative.

1.08 WARRANTIES

A. Manufacturer's Warranty: Upon successful completion of the work to the manufacturer's satisfaction and receipt of final payment warranty shall be issued to the Owner.

1. 20 Year System Warranty

B. Contractor 5 Year Labor Warranty

1.09 WARRANTY DURATIONS

A. Membrane manufacturer's warranty shall be in effect for a 20-year duration.

PART 2 - PRODUCTS

2.01 GENERAL

A. Components of the roof system shall be products of the primary membrane manufacturer as indicated on the Detail Drawings and specified in the Contract Documents.

B. Consult respective product data sheets and selection guides for additional information.

2.02 MEMBRANE

A. Membrane shall conform to:
1. ASTM D-4434 (latest version), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II.

B. PVC thermoplastic membrane

1. Type of Membrane
   a) Adhered PVC membrane

b) Adhered Feltback membrane

2. Membrane Thickness
   a) 60 mil (1.5 mm)

C. Color of Membrane

1. Adhered
   a) EnergySmart White or approved equal

b) EnergySmart Reflective Gray or approved equal

2.03 INSULATIONS / ROOF BOARDS

A. Insulation

1. Rigid expanded polystyrene foam insulation board, meeting ASTM C-578 Type II or IX, minimum 20 psi compressive strength.

B. Lightweight Insulating Concrete

1. Celcore LWIC

2. Mearlcrete LWIC

3. Concrecel LWIC

2.04 ATTACHMENT COMPONENTS

A. Membrane Adhesive

1. Single-Step Membrane Adhesive: Water-based dispersion adhesive used to attach membrane.

2. Flashing Adhesive: Solvent-based reactivating adhesive used to attach membrane.

2.05 DECK PRIMERS

A. Vapor Retarder Primer SB: Solvent-based primer used to prime wood, concrete, primed gypsum boards and decks, prior to the application of self-adhered vapor retarders.

B. Vapor Retarder Primer WB: Polymer emulsion water-based primer used to prime wood, concrete, gypsum decks, and approved gypsum boards prior to the application of self-adhered vapor retarders.

C. Vapor Retarder Primer TA: Blend of bitumen and solvent-based primer for use prior to applying torch-applied vapor retarders.

D. Vapor Retarder Primer BE: Bituminous emulsion (water based) primer for use prior to applying torch-applied vapor retarders.

2.06 FLASHING MATERIALS

A. Wall / Curb Flashing

1. PVC Adhered Membrane

2. Flashing Membrane: Used over residual asphalt or other contaminated surfaces.

3. PVC Detail Membrane

4. Polymer Coated Metal

5. Adhesive: Solvent-based reactivating adhesive used to attach membrane to flashing substrate.

B. Perimeter Edge Flashing

1. Polymer clad: 24 gauge, G90 galvanized steel with PVC-coating on one side for heat-weldability.

2. Edge: Two-piece assembly of steel base rail and aluminum or steel snap-on fascia cover with spring clips.

3. Drip Edge: Two-piece assembly of galvanized steel cleat and PVC coated galvanized steel.

4. Coping: Aluminum or steel snap-on coping cover with concealed splice plates.

C. Miscellaneous Flashing

1. PVC circles: round circle patch.

2. Inside Corners – Injection molded inside corner.

3. Outside Corners – Injection molded outside corner.

4. Universal Stack - Injection molded stack/pipe boot to flash pipes, vent stacks and cylindrical penetrations.

5. Split A, B, C - Prefabricated stack/pipe boot open along one side to flash pipes, vent stacks and cylindrical penetrations when access is obstructed.

6. Open Post Flashing - Prefabricated pipe boot open along one side to flash rooftop conduits, pipes, and cylindrical penetrations when access is obstructed.

7. Termination Bar - 3/4” wide extruded aluminum bar used to terminate roofing membranes at walls and edges.

8. Liquid Flashing Primer - Two-component polymethyl methacrylate-based (PMMA) primer used to promote the adhesion of Liquid Flashing SW and Liquid Flashing WW over wood and concrete surfaces.

9. Liquid Flashing Fleece - Non-woven, needle-punched polyester fleece used as the reinforcement for liquid flashing details.

10. Liquid Flashing Catalyst - Reactive agent based on dibenzoyl peroxide to induce curing of \Liquid Flashing SW, Liquid Flashing WW, and Liquid Flashing Primer when mixed.

11. Liquid Flashing SW (summer-grade white)
Two-component polymethyl methacrylate-based (PMMA). The ambient temperature at application must be between 59°F (15°C) and 104°F (40°C). The surface temperature at application must be between 59°F (15°C) and 122°F (50°C).

2.07 WALKWAY PROTECTION

A. Polyester reinforced, 96 mil (2.4 mm) thick, weldable membrane with surface embossment similar to a chevron pattern. Used as a protection layer from rooftop traffic.

B. PVC, 79 mil (2.0 mm) thick, weldable membrane with pyramidal surface embossment. Used as a protection layer from rooftop traffic.

2.08 MISCELLANEOUS ACCESSORIES

A. Aluminum Tap - 2” (51 mm) wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at joints.

B. Perimeter Warning Membrane - 4” (10.2 cm) wide yellow membrane used in required areas.

C. Seam Cleaner
Used to clean adhesive out of seams. It is not to be used as a general membrane cleaner. It is also used to clean metal and reactivate existing Liquid Flashing prior to the application of new Liquid Flashing.

D. Stop - 1” wide extruded aluminum, low profile bar used with certain fasteners to secure membrane to the roof deck or to walls/curbs at terminations, penetrations and at angle changes of the substrate.

2.09 SEALANTS AND PITCH POCKET FILLERS

A. Moisture-cured, one-component polyurethane-based, non-sag elastomeric sealant used in wall, curb and drain terminations. It is also used as a sealant at pipe penetrations and under certain metal flashings or as a pourable sealer pocket filler.

2.10 MISCELLANEOUS FASTENERS AND ANCHORS

All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixed metal type components shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins.

2.11 RELATED MATERIALS

A. Wood Nailer - Code compliant wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on Project Drawings. Thickness of nailers must match the height of the insulation and roof board to achieve a smooth transition.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION CONFERENCE

The Applicator, Owner's Representative/Designer and Manufacturer(s) shall attend a pre-construction conference.

3.02 SUBSTRATE CONDITION

A. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.

B. Applicator shall verify that the work done under related sections meets the following conditions:
1. Roof drains and scuppers have been reconditioned or replaced (as applicable) and installed properly.
2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.

C. The substrate shall be clean, smooth, dry, free of water, ice and snow and free of flaws, sharp edges, loose and foreign material, oil, grease and other contaminants. Roofing shall not start until all defects have been corrected.

3.03 SUBSTRATE PREPARATION

The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code or insurance requirements and in such a manner as to resist all anticipated loads in that location.

A. New Construction

1. Poured Structural Concrete Deck - The surface shall be dry and free of moisture, have a level finish, and shall be free of dust, excess moisture, oil-based curing agents and loose debris. Under no circumstances shall a sealer be used in lieu of a curing agent. Sharp ridges or other projections above the surface shall be removed before roofing. In accordance with the ICRI Technical Guideline No. 310.2R-2013, newly poured concrete surfaces may be finished by forming, wood float, steel or power trowel, or broom finished to meet a concrete surface profile (CSP) of 2 – 5.

2. Poured Lightweight (Cellular or Insulating) Concrete Substrate - The surface shall be installed per lightweight concrete manufacturer's guidelines. The wet and dry densities shall be in accordance with the manufacturer's requirements. Sharp ridges or other projections above the surface shall be removed before roofing.

3. Precast / Prestressed Concrete Panel Deck - The surface shall have a smooth and level finish and shall be free of dust, moisture, oil or loose debris. All joints between precast units shall be grouted. Any differentials in height between precast units shall be feathered for a smooth transition. Sharp ridges or other projections above the surface shall be removed before roofing.

B. Reroofing with Removal of Existing Roofing System

All existing roofing, base flashing, deteriorated wood blocking or deteriorated metal flashings shall be removed. Remove only that amount of roofing and flashing which can be made weathertight with new materials during a one-day period or before the onset of inclement weather.

4. Poured Structural Concrete Deck - The surface shall be dry and free of moisture, have a level finish, and shall be free of dust, excess moisture, and loose debris. Sharp ridges or other projections above the surface shall be removed before roofing. In accordance with the ICRI Technical Guideline No. 310.2R-2013, newly poured concrete surfaces may be finished by forming, wood float, steel or power trowel, or broom finished to meet a CSP of 2 – 5.

5. Poured Lightweight (Cellular or Insulating) Concrete Substrate - Sharp ridges or other projections above the surface shall be removed before roofing. Fastening for recover board shall be into structural deck below insulating fill (see steel/concrete deck requirements).

6. Precast / Prestressed Concrete Deck - The roof deck shall be smooth, even, free of dust, dirt, excess moisture, or oil and be structurally sound. All joints between precast units shall be grouted. Any differentials in height between precast units shall be feathered for a smooth transition. Any deteriorated decking shall be repaired.

C. Recover Over Existing Bitumen Roofing - The Owner's Representative and Applicator shall determine the condition of the existing roof deck and old roof system. Areas with deteriorated decking or wet materials are to be removed and replaced.

3.04 WOOD NAILER INSTALLATION

A. Install continuous code compliant wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Detail Drawings.

B. Wood nailers or wood blocking for penetrations, curbs, or snow protection systems shall be installed prior to the installation of the roof membrane whenever possible.

3.05 INSULATION / EPS ROOF BOARD INSTALLATION

General Criteria:

1. Boards shall be installed according to local building code, insurance requirements, and manufacturer's instructions.
2. Boards shall be neatly cut to fit around penetrations and projections.
3. Install tapered insulation in accordance with insulation manufacturer's shop drawings.
4. Do not install more board than can be covered with membrane by the end of the day or the onset of inclement weather.
5. When two or more layers of insulation and/or roof boards are used, stagger joints at least 12” (30.5 cm) in both directions between layers.

A. Lightweight Insulating Concrete - Install in accordance with selected manufacturer’s guidelines.

3.06 ADHERED FELTBACK PVC MEMBRANE INSTALLATION

The surface of the insulation, roof board, or substrate shall be inspected prior to installation of the feltback PVC 9 oz. roof membrane. The substrate shall be clean, dry, and free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged boards shall be removed and replaced. Tack welding of adhered membrane field sheets for purposes of temporary restraint during installation is not permitted and may result in voiding of manufacturer’s warranty.

A. Single-Step Membrane Adhesive:

1. Apply adhesive direct to substrate, rate may vary depending on porosity of substrate. Do not allow adhesive to skin-over or surface-dry prior to installation of membrane.

2. Refer to Single-Step Membrane Adhesive Product Data Sheet and *Adhered Systems: Water Based Adhesive Installation* section of the Roofing Applicator’s Handbook for detailed installation instructions.

B. Flashing Adhesive 2170

1. Apply adhesive direct to substrate, rate may vary depending on porosity of substrate. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The first layer of adhesive shall be allowed to dry completely prior to installing the membrane.

2. Refer to individual Product Data Sheets (PDS) and *Adhered Systems: Solvent Based Adhesive Installation* section of Manufacturer’s Roofing Applicator’s Handbook for detailed installation instructions.

C. Water based field membrane 2121 Adhesive:

1. Apply adhesive direct to substrate, rate may vary depending on porosity of substrate. Do not allow adhesive to skin-over or surface-dry prior to installation of membrane.

2. Refer to *Adhered Systems: Water Based Adhesive Installation* section of the manufacturer’s Roofing Applicator’s Handbook for detailed installation instructions.

3.07 HOT-AIR WELDING OF MEMBRANE OVERLAPS

A. All membrane overlaps shall be hot-air welded. The membrane shall be clean and dry prior to hot-air welding.

B. Field membrane overlaps for automatic machine-welding will vary in width depending on the plate and fastener combination used. A minimum of 4” (10.2 cm) wide overlap is required when hand-welding details.

C. 1” (25 mm) wide cross-section samples of welded seams shall be taken at least two times a day, once in the morning and once in the afternoon.

D. Refer to *Welding* section of manufacturer’s Roofing Applicator Handbook for detailed installation instructions.

3.08 MEMBRANE FLASHING INSTALLATION

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Manufacturer. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, and smooth surfaces free of dirt, dust, and debris. Use caution to ensure adhesive fumes are not drawn into the building.

A. All flashings should extend a minimum of 8" (20.3 cm) above finished roofing level. Submit requests for exceptions in writing to the Owner's Representative and Manufacturer's Technical Department for signed approval.

B. No bitumen shall be in contact with the membrane.

C. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with perimeter securement. Refer to manufacturer's installation instructions.

D. Flashings shall be terminated according to recommended details.

E. Refer to *Typical Flashing Procedures* section of the Manufacturer's Roofing Applicator Handbook for detailed installation instructions.

3.09 CLAD METAL BASE FLASHINGS / EDGE METAL INSTALLATION

A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and or manufacturer's acceptance. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

B. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:

1. ANSI SPRI ES-1 (latest issue).
2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - latest issue.

C. Pre-formed metal flashing shall be installed according to metal manufacturer's guidelines.

D. Metal, other than that provided by primary manufacturer is not covered under the warranty.

E. Clad and other metal flashings shall be formed and installed per the Detail Drawings. Refer to individual Product Data Sheets (PDS) and *Metal Flashings* section of the membrane manufacturer's Roofing Applicator Handbook for detailed installation instructions.

3.10 WALKWAY INSTALLATION

F. PVC Walkway-20: Probe all existing deck membrane seams which are to be covered by Walkway-20. Install walkway in straight lines by either adhering and welding or just welding to the field membrane.

3.11 TEMPORARY CUT-OFF

A. All flashings shall be installed concurrently with the roof membrane to maintain a watertight condition as the work progresses. All temporary cut-offs shall be constructed to provide a watertight seal. The new membrane shall be carried into the temporary cut-off. Temporary cut-off shall be sealed to the deck or substrate so that water will not be allowed to travel under the new or existing roofing. When work resumes, the contaminated membrane shall be cut out.

B. If inclement weather occurs while a temporary cut-off is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

C. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

3.12 COMPLETION

A. Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of the waterproofing membrane supplier shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Owner's Representative and Membrane Manufacturer prior to demobilization.

B. All Warranties referenced in this Specification shall have been submitted and have been accepted by the owner or owner’s representative at time of contract award.

3.13 DETAILS

A.

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. Work shall include, but is not limited to, the following:
   1. Preparation of existing (new) substrates.
   2. Sheet metal flashings and sheet metal roof edge system.
   3. All related materials and labor required to complete specified roofing necessary to receive specified manufacturer's warranty.

1.02 RELATED SECTIONS

A. Division 011000 – Summary of Work
B. Division 072200 – Roof Insulation
C. Division 072713 – Modified Bituminous Sheet Vapor Retarders
D. Division 075216 – Styrene-Butadiene-Styrene (SBS) Modified Bitumen Membrane Roofing
E. Division 075419 – Polyvinyl-Chloride (PVC) Roofing

1.03 DEFINITIONS

A. ASTM D 1079-Definitions of Term Relating to Roofing, Waterproofing and Waterproofing.
B. The National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, Fifth Edition Glossary.

1.04 REFERENCES

A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Reference Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.
B. AMERICAN STANDARD OF TESTING METHODS (ASTM):
   1. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
   2. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing.
   3. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
C. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)::
   1. ANSI/SPRI/FM 4435/ES-1 Wind Design Standard for Edge System Used with Low Slope Roofing System.

Guide Specification

2. ANSI/SPRI FX-1, Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

D. INTERNATIONAL CODES COUNCIL (ICC):
   1. Latest International Building Code (IBC).

E. NATIONAL ROOFING CONTRACTORS' ASSOCIATION (NRCA) Roofing and Waterproofing Manual.

F. SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION INC. (SMACNA) Architectural Sheet Metal Manual.

G. PUERTO RICO BUILDING CODE 2018

1.05 ACTION SUBMITTALS

A. Product Data Sheets: Submit manufacturer's product data sheets, installation instructions and/or general requirements for each component.

B. Safety Data Sheets: Submit manufacturer's Safety Data Sheets (SDS) for each component.

C. Sample/Specimen Warranty from the manufacturer and contractor.

D. Shop Drawings: Provide roof plan and applicable roof system detail drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Contractor Certification: Submit written certification from roofing system manufacturer certifying that the applicator is authorized by the manufacturer to install the specified materials and system.

1.07 CLOSEOUT SUBMITTALS

A. Warranty: Provide manufacturers and contractor's warranties upon substantial completion of the roofing system.

1.08 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:
   1. Manufacture shall have 20 years of experience manufacturing roofing materials.
   2. Trained Technical Field Representatives, employed by the manufacturer, independent of sales.
   3. Provide reports in a timely manner of all site visit reports.
   4. Provide specified warranty upon satisfactory project completion.

B. CONTRACTOR QUALIFICATIONS:
   1. Contractor shall be authorized by the manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
   2. Applicators shall have completed projects of similar scope using same materials as specified herein.

Guide Specification

3. Contractor shall provide full time, on-site superintendent or foreman experienced with the specified roof system through satisfactory project completion.
4. Applicators shall be skilled in the application methods for all materials.
5. Contractor shall maintain a daily record, on-site, documenting material installation and related project conditions.
6. Contractor shall maintain a copy of all submittal documents, on-site, available at all times for reference.

1.09 DELIVERY, STORAGE AND HANDLING

A. Refer to each product data sheet or other published literature for specific requirements.
B. Deliver materials and store them in their unopened, original packaging, bearing the manufacturer's name, related standards, and any other specification or reference accepted as standard.
C. Protect and store materials in a dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location.
D. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least 4 in or more above ground level. Carefully cover storage with “breathable” tarpaulins to protect materials from precipitation and to prevent exposure to condensation.
E. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials shall be removed from job site and replaced with new, suitable materials.

1.10 SITE CONDITIONS

A. SAFETY:
1. The contractor shall be responsible for complying with all project-related safety and environmental requirements.
2. The contractor shall refer to product Material Safety Data Sheets (MDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.

B. ENVIRONMENTAL CONDITIONS:
1. Monitor substrate temperature and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials. Materials and methods shall be adjusted as necessary to accommodate varying project conditions. Materials shall not be installed when conditions are unacceptable to achieve the specified results.
2. Precipitation and dew point: Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of

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roofing materials. Ensure all roofing materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.

1.11 PERFORMANCE REQUIREMENTS

A. ROOF EDGE SYSTEM:

1. Performance testing shall be in accordance with ANSI/SPRI/FM 4435/ES-1 Wind Design Standard for Edges Systems Used with Low Slope Roofing Systems.
   a. Wind Load Determination:
      i. Perimeter Region:
         a) Horizontal: -0 psf
         b) Vertical: -0 psf
      ii. Corners Region:
         a) Horizontal: -0 psf
         b) Vertical: -0 psf

PART 2 PRODUCTS

2.01 MANUFACTURER

A. PRODUCT QUALITY ASSURANCE PROGRAM: Manufacturer shall be an ISO 9001 registered company. A 'Quality Compliance Certificate (QCC) for reporting/confirming the tested values of the SBS-Modified Bitumen Membrane Materials will be supplied upon request.

B. ACCEPTABLE MANUFACTURER:

C. Contractor shall furnish all sheet metal flashings, counter flashings, roof edge system, and all other related sheet metal flashings, fasteners and sealants necessary to flash and counter flash the specified roofing system at all roof terminations, transitions and penetrations.

D. Sheet metal flashing materials and fasteners shall be compatible with adjacent materials, to accommodate all project related exposures.

E. Pre-Finished (Mill Finished) Sheet Metal Flashing Material: Aluminum

2.02 SHEET METAL FLASHING

A. SHEET METAL, ROOF EDGE SYSTEM:

1. Roof edge system shall include all components and associated fasteners necessary to comply with specified performance requirements. Contractor shall provide all other related fasteners and sealants necessary for the roof edge system.

2. Cantilever Coping: Engineered two-piece fascia system with a formed cleat and metal fascia.
   a. Material: Aluminum

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b. Gauge/Thickness: Minimum .040
c. Finish: Color selected from manufacturer's color chart. Mill-Finished Aluminum.
d. Tested per ANSI/SPRI ES-1 to meet or exceed design pressures at roof edge.
e. FM Approved.

B. SHEET METAL, EXPANSION JOINT SYSTEM:

1. Expansion Joint Roof to Roof: Engineered expansion joint system with formed anchor clips and metal cover.
   a. Material: Aluminum, Galvanized Steel, Stainless Steel
   b. Gauge/Thickness:
   c. Finish: Color selected from manufacturer's color chart. Mill-Finished Aluminum.
2. Expansion Joint Roof to Wall: Engineered expansion joint system with formed anchor clips and metal cover.
   a. Material: Aluminum, Galvanized Steel, Stainless Steel
   b. Gauge/Thickness:
   c. Finish: Color selected from manufacturer's color chart. Mill-Finished Aluminum.

C. SHEET METAL, COUNTERFLASHING SYSTEM:

1. 1PC Counterflashing: Engineered counterflashing system with formed counterflashing.
   a. Material: Aluminum, Galvanized Steel, Stainless Steel
   b. Gauge/Thickness:
   c. Finish: Color selected from manufacturer's color chart. Mill-Finished Aluminum.
2. 2PC Counterflashing: Engineered counterflashing system with formed receiver and counterflashing.
   a. Receiver: Reglet, Surface-Mount, Adaptable Reglet, Adaptable Surface, Thru-Wall
   b. Material: Aluminum, Galvanized Steel, Stainless Steel
   c. Gauge/Thickness:
   d. Finish: Color selected from manufacturer's color chart. Mill-Finished Aluminum.

D. FASTENERS:

1. #9 Stainless Steel Screw w/ Neoprene Washer
   a. Length as required.
2. #12 Galvanized Self-Drilling Screw:
   a. Length as required.
3. Stainless Steel Ring Shank Nails:
   a. Length as required.
4. 3/16" Tapcon Screws:
   a. Length as required.

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5. Flat Head Screw w/ Extruded Washer:
    a. Length as required.

E. GENERAL PURPOSE ROOFING CEMENT AND MASTIC

1. SBS Mastic: Fiber-reinforced, roofing cement, packaged in 5-gallon pails. General purpose roofing cement for low-slope roofing used for sealing sheet metal flashings to SBS membranes.
    a. VOC Content: 190 g/L or less.
    b. Meets or exceeds ASTM D4586, Type I, Class II.
2. SBS Mastic: Fiber-reinforced, roofing cement, packaged in 10.4 oz caulk tubes. General purpose roofing cement for low-slope roofing used for sealing sheet metal flashings to SBS membranes.
    a. VOC Content: 190 g/L or less.
    b. Meets or exceeds ASTM D4586, Type I, Class II.

F. GENERAL PURPOSE SEALANT

1. General purpose, paintable, gun-grade, elastomeric, polyether moisture curing sealant for sealing SBS and PVC membrane terminations, PVDF, horizontal and vertical construction joints.
    a. VOC Content: 20 g/L or less.
    b. Meets or exceeds ASTM C920, Type S, Grade NS, Class 50.
    c. Standard color, custom color.
2. Butyl Sealant: Butyl rubber and polyisobutylene water resistant sealant for concealed sheet metal joints.
3. Butyl Sealant Tape: Butyl rubber and polyisobutylene water resistant sealant tape for concealed sheet metal joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examination includes visual observations, qualitative analysis, and quantitative testing measures as necessary to ensure conditions remain satisfactory throughout the project.

B. The contractor shall examine all roofing substrates including, but not limited to: insulation materials, roof decks, walls, curbs, rooftop equipment, fixtures, and wood blocking.

C. The applicator shall not begin installation until conditions have been properly examined and determined to be clean, dry and, otherwise satisfactory to receive specified roofing materials.

D. During the application of specified materials, the applicator shall continue to examine all project conditions to ensure conditions remain satisfactory to complete the specified roofing system.

3.02 PREPARATION

A. Before commencing work each day, the contractor shall prepare all roofing substrates to ensure conditions are satisfactory to proceed with the installation of

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specified roofing materials. Preparation of substrates includes, but is not limited to, substrate repairs, securement of substrates, eliminating all incompatible materials, and cleaning.

B. Where conditions are found to be unsatisfactory, work shall not begin until conditions are made satisfactory to begin work. Commencing of work shall indicate contractor's acceptance of conditions.

3.03 PRIMER APPLICATION (SBS Modified Bitumen)

A. Examine all substrates, and conduct adhesion peel tests as necessary, to ensure satisfactory adhesion is achieved when adhering membrane to sheet metal flanges.

B. Apply the appropriate specified primer to dry, compatible substrates as required to enhance adhesion of new specified roofing materials.

C. Apply primer using brush or roller at the rate published on the product data sheet.

D. Project conditions vary throughout the day. Monitor changing conditions, monitor the drying time of primers, and monitor the adhesion of the membrane plies. Adjust primer and membrane application methods as necessary to achieve the desired results.

3.04 SHEET METAL FLASHING APPLICATION

A. Refer to manufacturer's sheet metal flashing and roof edge system detail drawings and follow product data sheets and published general requirements for installation instructions.

B. General Requirements:

1. Follow the most recent edition of the SMACNA Architectural Sheet Metal Manual for fabrication and installation requirements.
2. Follow the most recent edition of the NRCA Roofing and Waterproofing Manual for fabrication and installation requirements for specified roofing and flashing.

C. Isolate all metal components from ACQ treated wood or other incompatibles material using specified membrane flashing materials.

D. Appliances such as lightning rods, signs, or antennae shall be separate from the roof edge system.

3.05 GENERAL PURPOSE SEALANT

A. Refer to published installation instructions. Ensure sheet metal and adjacent substrates are clean and free of oils, dust and other incompatible materials.

B. Apply general purpose, paintable, gun-grade, elastomeric, polyether moisture curing sealant to seal SBS and PVC membrane terminations, exposed fasteners, Kynar 500 PVDF, and other compatible sheet metal horizontal and vertical joints, laps and transitions.

3.06 CLEAN-UP

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A. Clean-up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

END OF SECTION

Guide Specification

SECTION 07900

JOINT SEALERS AND WATER REPELLENT COATING

• PART 1.0 GENERAL

1.1 Description

a. Provide all materials, equipment and labor necessary to prepare surfaces and applied new sealants and water repellent coating to exterior masonry & concrete surfaces and metal & glass window/skylight frames, as specified on all related Contract Documents.

b. The requirements of the General and Special Conditions shall govern work in this section.

c. Weather Conditions: Do not proceed with application of sealants and coatings when conditions are outside range recommended by manufacturer.

d. Applied coating to exhibit ability to permit 0.0 percent maximum moisture absorption in material treated.

1.2 Submittals

a. Product Data: Provide details of product description (including manufacturer's data sheets & standard color charts), field quality control test procedures for each coating, sealant and primer to be used, limitations to coating, cautionary procedures required during application and chemical properties, including percentage of solids.

b. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

c. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3 Qualifications

a. Manufacturer: Company must have a minimum of three (3) years documented experience in manufacturing the products specified on this section.

b. Applicator: Contractor and job foreman specialized in performing work described on this section must have a minimum of five (5) years experience applying/installing silicone sealants and water repellent coatings.

1.4 Quality Assurance

a. Compatibility and Adhesion Tests: Contractor shall be responsible for verifying with the product manufacturer that all sealants and coatings to be used are compatible with and will satisfactorily adhere to all substrates. Tests are to be conducted in the field or by submission of representative substrate samples to sealant/coating manufacturer's laboratory.

b. Overall Application: Contractor shall apply material in strict compliance with manufacturer's latest published literature and specifications.

1.5 Mock-Up

a. If requested by the PBA designated representative, the Contractor shall apply/install, on 36" x 36" prepared surface, a sealant/coating mock-up to demonstrate appearance and workmanship technique.

b. Mock-Up shall be done by those personnel who will assign to the project.

c. Mock-Up may not remain as part of the Work.

1.6 Delivery, Storage and Handling

a. Delivery: Deliver materials to job site in original tightly sealed containers or unopened packages, all clearly labeled with the manufacturer's name, product identification and lot numbers.

b. Storage: Store materials out of the weather in their original tightly sealed containers, in accordance with manufacturer's requirements.

1.7 Warranty

a. Upon job completion, provide manufacturer's above-mentioned standard product whether-seal warranty.

b. Upon completion of the job, provide contractor's five (5) year workmanship warranty.

c. All warranties shall be from a single manufacturer, providing single recourse for this project's joint sealers and water repellent coating.

• PART 2.0 PRODUCTS

2.1 Materials

a. Coating: Allguard Elastomeric Coating or FS SS-W-110, silicone resin, colorless, with twenty-eight percent (28 %) minimum solids.

b. Sealant: DOW CORNING 791 or 795 Silicone Building Sealant for various substrates, including but not restricted to **metal window frames, glass, stone, concrete, masonry, metal, EIFS, etc.**

c. Performed Seal: DOW CORNING 123 Silicone Seal. Color to be selected by PBA designated representative.

d. Primer: DOW CORNING 1200 or 1593 Primer Coat. Type recommended by sealant manufacturer and/or based on field mock-up results.

e. Backer Rod: Open cell polyurethane, closed cell polyethylene or Sof-Rod. Use type recommended by sealant manufacturer for each application.

f. Bond Breaker Tape: Pressure sensitive adhesive polyethylene, TEFLON or polyurethane foam tape.

• PART 3.0 EXECUTION

3.1 WATER REPELLENT COATING

3.1.1 Examination

a. Verify joint sealants are installed and cured.

b. Verify surfaces to be coated are dry, clean and free of efflorescence, oil, or other matter detrimental to application of coating.

3.1.2 Preparation

a. Delay work until concrete substrate is cured a minimum of sixty (60) days.

b. Remove loose particles and foreign matter.

c. Remove oil or foreign substance with a chemical solvent which will not affect coating.

d. Scrub and rinse surfaces with water and let dry.

3.1.3 Application

a. Apply coating in accordance with manufacturer's instructions.

b. Apply at a rate of 250-300 sq. ft. / gal. airless spray.

c. Apply in one continuous, uniform coat.

d. Do not apply coating when surface temperature is lower than sixty-five (65) F degrees (19 C degrees) or higher than 100 F degrees (38 C degrees).

3.1.4 Protection to Finished and Adjacent Work

a. Protect adjacent surfaces not scheduled to receive coating.

b. Protect landscaping, property and vehicles.

c. If applied to unscheduled surfaces, remove immediately by a method instructed by coating manufacturer.

3.2 JOINT SEALERS: JOINT REMOVAL & REPLACEMENT

Use Section 3.2 for joints containing failed organic sealant which is sufficiently hardened to grind out without degrading the grinding wheel.

3.2.1 Preparation

a. Cut away the old sealant. Grind with a grinding wheel the failed sealant that new, uncontaminated substrate of the original joint's sidewall is visible to a depth of about ½" to ¾".

b. Blow out all dirt, dust, residue, old sealant, old backer rod, etc., using oil-free and moisture-free compressed air.

c. Mask if necessary.

3.2.2 Examination

a. Contractor shall verify that all joint surfaces are clean, sound, free of defects and that dimensions are within sealant manufacturer's size requirements.

b. Commencement of sealant installation shall be evidence that Contractor has verified compliance of existing conditions.

3.23 Installation

a. If required, apply primer according to manufacturer's instructions.

b. Install appropriate backer rod using blunt or rounded tools to assure uniform depth (½" ± ¼") without puncturing or twisting. Rod shall be a minimum twenty-five percent (25%) oversized. Install bond breaker tape in shallow joints.

c. To obtain full adhesion, sealants require a clean, dry, frost-free surface. Although silicone sealants have excellent wide temperature gunnability, the practical application temperature can be dictated by frost formation on the joint edges, which can begin to occur below 40° F. To assist in the drying of a frost-containing joint, a water soluble solvent such as MKE or IPA should be used.

d. Apply the sealant in a continuous operation using a caulking gun or pump. A positive pressure, adequate to fill the entire joint width, should be used. This can be accomplished by- "pushing" the sealant ahead of the application nozzle. Care must be taken to ensure complete fill of the sealant cavity.

e. Tool the sealant with light pressure before a skin begins to form (typically 10 to 20 minutes). Tooling forces the sealant against the back-up material and the side walls of the joint surfaces. **Do not use liquid tooling aids such as water, soap or alcohol; i.e. isopropyl alcohol (IPA).** These materials may interfere with sealant cure and adhesion and create aesthetic issues.

f. Remove the masking tape before the sealant skins over (within about 15 minutes of tooling).

g. Check adhesion after sealant has cured for 7-14 days (see Quality Assurance).

3.24 Clean-Up

a. Clean adjacent surfaces as work progresses. Leave finished work in neat, clean condition with no evidence of spills onto adjacent surfaces.

3.3 JOINT SEALERS JOINT OVERLAY SEAL

Use this section as guidance where failed joint sealers area reverted or gummy-as in the case of urethanes or butyl caulks-and/or where substrates are likely to be degraded by cutting or grinding-as is EIFS, exterior insulated finish systems.

3.31 Preparation

a. Clean and condition the substrate to assure adhesion. If power washing is not possible, use stiff nylon brush (like a toothbrush) and scrub substrate with a 50/50 blend of clean cloth containing IPI and water (in the case of EIFS) or a more aggressive solvent like xylene (on more resilient substrates) to remove residues of the old caulk and other contaminants. Dry with another dry cloth. Let conditioned substrate air dry for 1-2 hours.

b. Mask if necessary.

3.32 Examination

a. Contractor shall verify that all joint surfaces area clean, sound, free of contamination and the dimensions are within manufacturer's size requirements.

b. Commencement of sealant installation shall be evidence that Contractor has verified compliance of existing conditions.

3.33 Installation

a. Prime according to manufacturer's instructions, if proven necessary in mock-up.

b. When installing silicone seal, select a width that will allow a minimum of 3/8" bond on each side of the joint. Apply silicone building sealant out in approximately 1/4" diameter beads on each side of the joint. Press the extrusion lightly onto the sealant using a roller or block to provide consistent pressure and ensure uniform and continuous contact. Remove masking tape and excess sealant. Apply second bead along each edge and tool into place to adhere edges of silicone seal and soften the edge relief slightly.

c. Coating can be applied directly onto any silicone seal once sealants are cured.

d. Adhesion testing should be performed in about 7-14 days to verify adhesion of sealant and silicone seal to the existing EIFS.

3.34 Clean-Up

a. Clean adjacent surfaces as work progresses. Leave finished work in neat, clean condition with no evidence of spills onto adjacent surfaces.

Section 07951 – SEALANTS AND CALKING

1. Related Documents:

The general provisions of the contract, including General and Special Conditions, apply to the work specified in this section.

2. Description of Work:

The extent of each type of sealant and calking work is shown on the drawings.

The required applications of sealants and calking include, but are not necessarily limited to, the following general locations:

Flashing reglets and retainers
Exterior wall joints
Masonry control joints, exterior and interior
Flooring joints
Isolation joints, between structure and other elements
Joints at penetrations of walls, decks and floors by piping and other services and equipment
Joints between items of equipment and other construction

3. General:

Obtain elastomeric materials from only manufacturers who will, if required, send a qualified technical representative to project movements for the temperature and condition of the project at the time of installation.

Compressibility:

Specific hardnesses and compressibilities are intended to establish requirements for normal or average conditions of installation and use. Wherever a range of hardness or compressibility is available for a product, comply with the manufacturer's recommendations for the specific condition of use, except as otherwise directed.

Color:

Provide each concealed material in manufacturer's standard color which has the best overall performance characteristics for the application shown.

Section 07951 – Sealants and Calking

3. General: (Con'd)

Provide exposed materials Light Grey except where another color is indicated.

Compatibility:

Before purchase of the specified sealant, investigate its compatibility with the joint surfaces, joint fillers and other materials behind or below the joint in the construction. Provide only materials (manufacturer's recommended variation of the specified materials) which are known to be fully compatible with the actual installation condition, as shown by manufacturer's published data or certification.

Provide size and shape of preformed sealant units as shown or, if not shown, as recommended by the manufacturer, either in his published data or upon consulation with his technical representative.

4. One-Component Elastomeric Sealant:

One-Component Polysulfide Sealant:

Polysulfied based, one-part elastomeric sealant, complying with FS TT-S-00230 Class A, Type 2 (non-sag) unless Type 1 is recommended by manufacturer for the application shown.

Provide compound bearing the Thiokol Chemical Corp. seal of approval.

Products offered by manufacturers to comply with the requirements include the following:

Ultratite 102; Cost Pro Seal
Flexiseal 900 Series; DAP, Inc.
Hornflex One-Component; W.R. Grace
Novacalk – 600; Novagard Corp.
Uniparseal; Parr Paint & Sealants
Rubber Calk 5000; Products Research & Chemical
Sonolastic 1-Part; Sonneborn
Thiotok Sealant R.M.; Toch Brothers

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4. One-Component Elastomeric Sealant: (Con'd)

Acid-Type Products offered by manufacturers to comply with the requirements, include the following:

781 Building Sealant; Dow Corning
Silican Construction Sealant; General Electric Co.

5. Preformed Elastomeric Sealants:

Butyl Rubber Sealant Tape:

A partially-vulcanized, self-adhesive, non-staining, elastomeric butyl rubber tape recommended by the manufacturer for waterproof construction when compressed 35% in dynamically-moving joints; not less than 98% solids; no deterioration after 3000 hour test in Atlas Weatherometer.

Products offered by manufacturers to comply with the requirements include the following:

Betaseal 650 Tape; Essex Chemical
Duraribbon 1072; PPG Industries
176 Strucsureglaze; Presstile Interchem
PTI 606; Protective treatments

6. Miscellaneous Materials:

Joint Cleaner:

Provide the type of joint cleaning compound recommended by the sealant or calking compound manufacturer for the joint surfaces to be cleaned.

Joint Primer/Sealer:

Provide the type of joint primer/sealer recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.

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6. Miscellaneous Materials: (Con'd)

Bond Breaker Tape:

Polyethylene tape or other plastic tape as recommended by the sealant manufacturer to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

Sealant Backer Rod:

Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absortive material as recommended for compatibility with sealant by the sealant manufacturer; to control the joint depth for sealant placement, to break bond of sealant at bottom of joint, to form optimum shape of sealant bead on back side, and to provide a highly compressible backer which will minimize the possibiltiy of sealant extrusion when joint is compressed.

7. Joint Surface Preparation:

Clean joint surfaces immediately before installation of sealant or calking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealat or calking compound.

For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unles a laboratory test for durability (bond-cohesion), in compliance with Paragraph 4, 3, 9 of FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

Each concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkanity does not interfere with sealant bond and performance. Each with 5% solution of muriatic acid; neutralize with diluted ammonia solution, rince thoroughly with water and allow to dry before sealant installation.

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7. Joint Surface Preparation: (Con'd)

Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

The installer must examine the joint surfaces, backing, and anchorage of units forming sealant rabbet, and the conditions under which the sealant work is to be performed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the sealant work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

8. Sample Installation:

Prepare a mock-up installation of every major type and use of sealant shown and specified. Install sealant between materials matching those used on the project, complying with conditions similar in every way to anticipated project conditions. Prepare mock-up well in advance of scheduled installation, so that nominal cure-time is allowed and final color adjustments can be made, if necessary.

9. Pre-Installation Meeting:

At Contractor's direction, the sealant installer, Architect, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work shall meet with the Contractor at the project site to review the procedures and time schedule proposed for installation of sealants in coordination with other work. Review every major sealant application required on the project.

10. Weather Conditions:

Do not proceed with installation of liquid sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at extremely low temperatures. Coordinate time schedule with Contractor to avoid delay of project.

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11. Installation:

Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

Install sealant backer rod for liquid elastomeric selants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally o opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cave, so that joint will not trap moisture and dirt.

Install sealants to depths as shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations:

For joints sealed with elastomeric sealants and subject to traffic and other abrasion and identation exposures, fill joints to depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.

For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but not more than ½" deep or less than ¼" deep.

For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

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11. Installation: (Con'd)

Spillage:

Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces including rough textures such as exposed aggregate panels. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer of the sealant/calking compound.

Remove excess and spillage of compounds promptly as the work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage. Do not damage the adjoining surfaces or finishes.

Polysulfide Sealant Installation:

Comply with standards issued by Thiokol Chemical Corp., except wher more stringent requirements have been show or specified, or issued as recommendations by the sealant manufacturer.

12. Cure and Protection:

Cure sealants and calking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

The installer shall advise the Contractor of procedures required for the protection of sealants and calking compounds during the construction period, so that they will be without deterioration or damage (other than normal weathering) at the time or Owner's acceptance.

13. Tests for Performance:

After nominal cure of exterior joint sealants which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a ¾" garden hose held perpendicular to wall face, 2' – 0" from joint, connected to a water system with 30 psi minimum normal water pressure. Move stream of water along joint at an aproximate rate of 20 ft. per min.

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13. Tests for Performance: (Con'd)

Test approximately 5% of total joint system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct tests in the presence of the Architect, who will determine the actual percentage of joints to be tested and the actual period of exposure to water from the hose, based upon the extent of observed leakage, or lack thereof.

Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation as directed.

Wherever nature of observed leakage indicates the possibility of inadequate joint bond strength, P.B.A. may direct that additional testing be performed at a time when joints have been fully cured, folowed by natural exposure through both extreme temperatures and returned to the lowest range of temperature in which it is feasible to conduct testing. Repair or replace work as required.

14. Submittals:

Manufacturer's Data, Sealants and Calking:

Submit 2 copies of manufacturer's specifications, recommendations and installation instructions for each type or sealant, calking compound and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown. Show by transmittal that one copy of each recommendation and installation has been distributed to the Installer.

Samples, Sealants and Calking:

Submit 3, 12" long samples of each color required (except black) for each type of sealant or calking compound exposed to view. Install sample between 2 strips of material similar to or representative of typical surfaces where sealant or compound will be used, held apart to represent typical joint widths.

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14. Submittals: (Con'd)

Guarantee, Sealants:

Submit 2 copies of written guarantee agreeing to repair or replace sealants which fail to perform as air-tight and water-tight joints; or fail in joint adhesion, cohesion, abrasion resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified as an inherent quality of the material by submitted manufacturer's data. Provide guarantee for a period of 1 year, signed by the Installer and Contractor.

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 – GENERAL

1.1 SECTION REQUIREMENTS

A. The Contractor shall provide all material, labor and equipment necessary for this section as required by the drawings and/or herein specified, but not limited to:

1. Hollow Metal Doors.
2. Formed Sheet Steel Frames.
3. Formed Sheet Steel Louvers in Hollow Metal.
4. Reinforcing, Supporting and Attachment devices for work of this section.
5. Underwriter Laboratories, Inc., Labeled Doors and Frames.
6. Reinforcing for Hardware as required.
7. Prime Painting for all doors and frames.

B. All material used in the fabrication of metal doors and frames shall be free form defects impairing their strength, durability or appearance.

1.2 REFERENCED STANDARDS

A. American National Standards Institute (ANSI) in its test editions:

1. ANSI 156.1 - Butts and hinges
2. ANSI 156.2 - Bored & preassembled locks.
3. ANSI 156.3 - Exit devices.
4. ANSI 156.4 - Door control (Closers).
5. ANSI 156.5 - Auxiliary locks.
6. ANSI 156.6 - Architectural trim.
7. ANSI 156.13 - Mortise locks & latches.

8. ANSI 156.16 - Auxiliary hardware.

9. ANSI 156.18 - Materials & finishes.

10. ANSI 117.1 - Providing accessibility and usability for physically Handicapped people.

B. National Builders Hardware Association (NBHA):

1. Recommended Locations for Builders Hardware.

2. Basic Builders Hardware.

C. Builders Hardware Manufacturers Association:

1. Directory of Certified Locks & Latches.

2. Directory of Certified Door Closer.

D. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code.

2. NFPA 80 – Fire Doors and Windows.

3. NFPA 101 – Life Safety Code.

E. Building Code (*Reglamento de Edificación - P.R.*):

1. *Reglamento de Planificación Número 7*.

2. *Enmiendas al Reglamento de Edificación*.

3. UBC-97

F. Código para la Prevención de Incendios del Cuerpo de Bomberos de P.R.

G. ASTM A 153-82 (87) – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

H. ASTM A 366/A 366M-91 – Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

I. ASTM A 525-91b – Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

J. ASTM A 526/A 526M-90 – Standard Specification for Steel, Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

K. ASTM A 568/A 568M-92 – Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

L. ASTM A 569/A 569M-91a – Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.

M. ASTM B 749-85 (91) – Standard Specification for Lead and Lead Alloy sheet, Strip, and Plate Products.

N. ASTM E 152-81a – Standard Methods of Fire Test of Door Assemblies.

O. NFPA 80 – Standard for fire Doors and Windows; National Fire Protection Association.

P. SDI 100 – Recommended Specifications; Standard Steel Doors and Frames; Steel Door Institute.

Q. SDI 105 – Recommended Erection Instructions for Steel Frames; Steel Door Institute.

1.3 SHOP DRAWINGS

A. Submit copies of shop drawings as per section 01 33 23.

1. Drawings shall include sizes, details of construction, anchorage, methods of assembly, hardware details and complete information regarding materials, gauges and finish.

2. Shop drawing revision indicates general conformance with design, but does not relieve contractor of full responsibility for the correctness of the documents furnished or for conformance with the detailed provisions of this specifications.

1.4 SAMPLES

A. Submit for approval corner sections of metal frames and hollow metal doors, indicating all construction details, prime coat for frames and doors. Submit all required accessories and anchors.

1.5 PAINTING

A. All steel doors and frames are to be thoroughly cleaned, primed and filled to present a smooth surface, and given sufficient coats as required to receive finish painting.

1.6 STORAGE

A. Doors and frames shall be stored in upright position under cover at the building site on wood sills or on floors in a manner that will prevent damage.

1.7 LABELED WORK – FIRE PROTECTION

A. Doors and frames requiring labels as indicated on drawings shall meet the requirements for the ratings noted in accordance with the established procedures of the Underwriter Laboratories, Inc., no substitutions allowed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. The products specified under this section are intended to be the products of one single manufacturer. Hardware location, hinge, backsets, etc., shall be the published standards of one manufacturer unless specified differently in the Doors Hardware Section 08 71 00.

B. Products of the following manufacturers, provided they comply with requirements of the contract documents, will be those considered, acceptable:

1. *Amweld*.

2. *North American Door*.

C. All other manufacturers which would like their products to be considered, Contractor shall follows section 01 25 00 – Substitutions.

D. Contractor can purchase the Hollow Metal Doors and Frames from a qualified local manufacturer or U.S. manufacturer's representatives. Qualification of manufacturer is subject to revision by the Architect based on the continued maintenance or quality standards required by Owner, and the ability to service these products.

2.2 MATERIALS

A. Steel Sheets, Galvanized; ASTM A 526 and ASTM A 525, commercial quality, G60 zinc coating mill phosphatized.

2.3 FABRICATION

A. General: Shop-fabricate assemblies to greatest extent possible, assuring that installed units will be without warp, twist, bow or other defect in appearance or function.

B. Exposed Door Faces: Fabricate form cold-rolled steel.

C. Frames: Fabricate from cold-rolled or hot-rolled steel.

D. Edge Channels, Stiffeners and Reinforcements: Fabricate from cold-rolled or hot-rolled steel.

E. Louvers: Fabricate blades from cold-rolled steel and frames from cold-rolled or hot-rolled steel.

F. Perimeter (Exterior) Doors: Fabricate from galvanized steel.

G. Seal top and bottom edges integrally with door construction, or use minimum 16 gauge steel channels to form flush closure.

H. Exposed Screws and bolts: Where required, provide only stainless steel countersunk, flat Phillips-head fasteners.

2.4 STEEL DOORS

A. General: Fabricate steel doors in accordance with requirements of SDI 100.

B. Doors shall be fabricated from Galvanized Steel sheets of gauges herein after specified. Interior doors shall be fabricated from Galvanized Steel.

C. Core Material: All interior doors shall be free of blemishes and spot welding marks with honeycomb core of not more than ¾ inches cell. All exterior doors shall have a polystyrene core.

D. Door Panels: Shall be of 16 gauge or of gauges shown on door schedule in contract drawings, and joined together by means of a positive mechanical interlocking system at door edges.

E. Closure Channels: Top and bottom closure channels of 16 gauge steel running the full width of the door to provide a flush cover top and bottom.

F. Meeting Styles: A flat bar astragal, continuous welded to active leaf of pair, shall be provided at meeting style of door at pair openings.

G. Door Louvers: Sight-proof louvers: Stationary type for interior doors as scheduled; 22 gauge Z-shaped, Y-shaped or inverted V-shaped blades set into 20 gauge frame.

2.5 STEEL FRAMES

A. General: Fabricate steel frames for scheduled openings, in styles and profiles as shown, using concealed fasteners.

B. Frames shall be fabricated from Galvanized steel.

C. Frames shall be of 14 gauge or of gauges shown on door schedule in contract drawings, notched, mitered and mechanically interlocked to a hairline joint at 45 degrees.

D. Guards: Weld protective covers to back of hardware openings at locations where grout, plaster or other materials might interfere with hardware operation.

E. Factory reinforce only for surface applied hardware. Drilling and tapping for surface applied hardware such as exit devices, pulls, closers, holders and escutcheon plates for exit devices and mortise locks, special hinges, pivots and floor closers is to be done at factory.

2.7 FINISH HARDWARE

A. Contractor shall obtain all required templates from hardware supplier and furnish same to hollow metal manufacturer to be used in the fabrication as directed. See hardware section 08 71 00 for detailed information.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Doors shall be installed plumb, straight and true, rigidly secured in place and properly braced. Frames shall be anchored securely to concrete floors.

B. Frame shall be installed plumb, straight and true, rigidly secured in place and properly braced. Frames shall be anchored securely to concrete floors. The frame installer shall be responsible for the squareness of the frames in place.

C. Except for frames located at in place concrete or masonry, place frames prior to the construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchor are set.

D. Install one wall anchor for every hinge provided on frame. Provide no less than three wall anchors per jamb. Submit details of frame anchorage for in place concrete or masonry walls.

E. Do not finally install hardware until all plastering and painting is completed and the building is totally dry.

F. Door silencers shall be installed after installation is completed. Three silencers for single doors and two for head of pair of swing doors.

3.2 MAXIMUM CLEARANCES AT ALL OPENINGS

A.	At Top Rail	1/8 inch
B.	At Hinge and Lock	1/8 inch
C.	At Floor or Saddle	3/8 inch

END OF SECTION 08 11 00

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

A. Flush wood doors; flush configuration; fire rated, non-rated, and acoustical.

1.2 REFERENCES

A. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 191.

B. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada.

C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.

D. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.

F. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials.

G. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.

H. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

I. WDMA NWWDA I.S.1-A - Architectural Wood Flush Doors; Window and Door Manufacturers Association.

1.3 SUBMITTALS

A. See Section 01 33 23 - Submittals.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings; Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, identify cutouts for glazing and louvers.

D. Samples: Submit two samples of door construction, 12 x 12 inch (30 x 30 mm) in size cut from top corner of door.

E. Samples: Submit two samples of door veneer, 12 x 12 inch (30 x 30 mm) in size illustrating wood grain, stain color, and sheen.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

C. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, comply with air leakage requirements of UBC Std 7-2, Part II; with "S" label; if necessary, provide additional gasketing or edge sealing.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.6 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals.

B. Provide warranty for the following term:
1. Exterior Doors: Five (5) years.
2. Interior Doors: Two (2) years.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood & Doors:

1. Eggers Industries: VT- Architectural Wood Doors
2. Substitutions: Submit manufacturer for Architect evaluation.

2.2 DOORS AND PANELS

A. All Doors: See drawings for locations and additional requirements.

1. Quality Standard: WDMA I.S. 1-A, Premium Grade, Heavy Duty performance.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Exterior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated: flush solid core construction.

1. Wood veneer facing with factory opaque finish where indicated on drawings.

C. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.

1. Provide solid core doors at all locations.
2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C or UBC Standard 7-2-97 ("positive pressure"); UL or WH (ITS) labeled without any visible seals when door is open.

2.3 DOOR AND PANEL CORES

A. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above.

B. Sound Retardant Doors: Equivalent to Type PC construction with core as required to achieve rating specified; plies and faces as indicated above.

2.4 DOOR FACINGS

A. Veneer Facing for Opaque Finish: Medium density overlaid plywood.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Fit door edge trim to edge of stiles after applying veneer facing.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings.

E. Cut and configure exterior door edge to receive recessed weather-stripping devices.

F. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

2.6 FACTORY FINISHING

A. Factory finish doors in accordance with approved sample.

B. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors and frames in openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Trim door height by cutting bottom edges to a maximum of ¾ inch (19 mm).

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.3 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.4 SHEDULE - See Drawings.

END OF SECTION 08 14 16

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

A. Hardware for doors.

1.2 RELATED SECTIONS

A. Wood doors - Section 08 14 00.

B. Metal doors and frames - Section 08 11 00.

1.3 REFERENCES

A. American National Standards Institute (ANSI) in its latest edition:

1. ANSI 156.1- Butts and hinges.
2. ANSI 156.2- Bored & preassembled locks.
3. ANSI 156.3- Exit devices.
4. ANSI 156.4- Door control (Closers).
5. ANSI 156.5- Auxiliary locks.
6. ANSI 156.6- Architectural trim.
7. ANSI 156.13- Mortise locks & latches.
8. ANSI 156.16- Auxiliary hardware.
9. ANSI 156.18- Materials & finishes.
10. ANSI 117.1- Providing accessibility and usability for physically handicapped people.

B. National Builders Hardware Association (NBHA):

1. Recommended Locations for Builders Hardware-1975.
2. Basic Builders Hardware - October 1969.

C. Builders Hardware Manufacturers Association:

1. Directory of Certified Locks & Latches.

2. Directory of Certified Door Closers.

D. National Fire Protection Association (NFPA):

1. NFPA 80 - Fire Doors and Windows.

2. NFPA 101- Life Safety Code.

E. Uniform Building Code (UBC-97).

F. Codigo para la Prevencion de Incendios del Cuerpo de Bomberos de Puerto Rico.

G. Americans with Disabilities Act (ADA).

1.4 QUALITY ASSURANCE

A. Hardware shall conform to the following standards:

1. Ball bearing butts shall comply with ANSI A-2112. Plain butts shall comply with ANSI A-2133.

a. Butts on outswinging exterior doors shall have non-removable pins (NRP).

b. All doors with closers shall have ball bearing butts.

2. Locksets and latches shall meet the following minimum ANSI standards:

a. Heavy duty cylindrical locks - ANSI Series 4000, Grade 1, with knob trim, except on handicapped units which shall have lever handle trim.

b. Standard duty cylindrical locks - ANSI Series 4000, Grade 2, with knob trim, except on handicapped units which shall have lever handle trim.

c. Use UL approved locks on labeled fire doors.

3. Door closers shall comply with ANSI Series CO4021, Grade 1 with cast iron case and adjustable backcheck. Closers for reverse bevel doors and all doors opening wards a hallway shall comply with ANSI Series CO2021, Grade 1 and be sized according to the manufacturer's recommendation.

4. Exit devices shall be of the modern push bar type, ANSI Grade 1. All pair openings with a combination mortise and vertical rod device shall be equipped with an openback strike. Pair openings with a combination Rim and vertical rod device and door closers on each door, shall be equipped with a type 21 door coordinator.

1.5 SUBMITTALS

A. The hardware supplier shall submit seven (7) copies of a complete hardware schedule for approval.

1. Preface sheet listing category only and manufacturers name of items being furnished, as shown on drawings.

2. For hardware locations, see drawings.

3. Open description: Single or pair, number, room locations, hand, active leaf, degree of opening, size, material, frame material, and fire rating.

4. Hardware description: Quantity, category, product number, fasteners, and finish.

5. Headings that refer to the specified Hardware Set Numbers.

6. Scheduling sequence shown in Hardware Sets.

7. Product data of each hardware item and shop drawings, where required, for special conditions and specialty hardware.

8. Vertical scheduling format only. Horizontal schedules are not acceptable.

9. Typed copy.

10. Double spacing.

11. Eight and one-half by eleven inch (8 1/2" x 11") sheets.

12. U.S. Standards finish symbols.

B. Samples: Submit sample of each type of builders hardware item proposed for project. If approved, samples may be used in project.

C. Certification: Submit notarized certification indicating that hardware furnished for labeled doors and doors requiring physically handicapped access, complies with requirements of local governing authorities and applicable regulations.

1.6 DELIVERY, STORAGE AND HANDLING

A. Package and deliver hardware items separately and mark each to correspond with heading numbers on hardware schedule.

B. Include necessary instructions, templates, drawings a fasteners for proper installation. Include 10% extra fasteners.

C. Master keys shall be delivered by the hardware supplier directly to the owner.

1.7 SUBSTITUTION

A. As per Section - 01 25 00

B. Equivalent products, as described in section 2.2 of these specifications, are acceptable substitutions. Other manufacturers with equivalent products not listed herein shall submit to the Architect, 15 days prior to Bid Opening Date, all pertinent documentation and full size samples so that the Architect can

properly evaluate the alternate. Those products approved by the Architect will be notified to all prospective bidders by an addendum to the projects specifications before Bid Opening Date.

1.8 JOB CONDITIONS

A. Furnish templates to the hollow metal and frame manufacturer as required for installing the hardware to avoid any delay in fabrication.

B. See Article 3.3 - Locations, and coordinate with templates.

C. Sub-contract the furnishing of builders hardware to a recognized local builders hardware representative for the lockset being furnished. The local hardware supplier must have been furnishing builders hardware for a period of not less than 5 years and must have in his employment an experienced hardware consultant who is available at all reasonable times during the course of the work for project hardware consultation to the owner or Architect. The hardware supplier must carry a substantial inventory of the type and make of the lockset, closer, exit device, etc. being furnished. This inventory must be made available to the owner during the duration of this Contract and for maintenance purposes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General

1. Products are listed in a brand name only to establish a standard of quality.

B. Lock and latches:

1. Corbin/Russwin

2. Best

3. Sargent

C. Door Closers:

1. Corbin/Russwin.

2. Dorma.

D. Manufacturers of other items:

1. Butts: Hager, Stanley or McKinney.

2. Exit Devices: Corbin/Russwin.

3. Floor Closers & Pivots: Dorma, Rixon, McKinney.

4. Overhead Door Holders: Corbin/Russwin, Sargent.

5. Door Pulls: Rockwood, Trimco, Hager.

6. Protective Plates: Rockwood, Trimco, Hager.

7. Bolts: Rockwood, Trimco, Hager.

8. Stops: Rockwood, Trimco, Hager.

9. Electric Strikes: Folger Adam, H.E.S.

10. Thresholds & Weatherstripping: Pemko, National Guard.

2.2 MATERIALS

A. Furnish each category with the products of only one (1) manufacturer; this requirement is mandatory whether various manufacturers are listed or not.

B. Hinges: Furnish one pair of hinges for doors up to 60 inches in height and one additional hinge for each additional 30 inches or fraction thereof. Use 3.5 inch hinges for all 1 3/8 inch thick swing doors. Use 4.5 inch hinges for all 1 3/4 inch thick swing doors up to 36 inches in width. Use 5.0 inch hinges for doors up to 42 inches and 5.0 inch heavy duty hinges for doors over 42 inches in width. Furnish nonremovable pins (NRP) at all reverse bevel doors with keysets.

Furnish wide or special throw hinges where required to clear trims at all swing doors.

Type	Hager	Stanley	McKinney	ANSI
H-1	PB191	1191	F191	T2314	A-2133
H-2	BB191	BB1191	BB191	TB2314	A-5133

C. Flush Bolts: Furnish with 12 inch rods for doors up to six feet high, and with 24 inch rods for doors higher than six feet. Provide two bolts per inactive leaf.

Type	Rockwood	Trimco	Hager
B-1	555	3917	282D
B-2	556	3916	283D

D. Locksets and Latchsets

1. Heavy Duty cylindrical series and function designations for handicapped unit are ANSI, acceptable manufacturers are:

Manufacturer	Series	Design
Corbin/Russwin	CL3300	NZD
Best	9K	15D
Sargent	10	LL

2. Heavy Duty cylindrical series and function designations are ANSI, acceptable manufacturers are:

Manufacturer	Series	Design
Corbin/Russwin	CK4200	GWC
Best	8K	4E
Sargent	9	OB

3. Standard Duty cylindrical series and function designations for handicapped unit are ANSI, acceptable manufacturers are:

Manufacturer	Series	Design

Corbin/Russwin	CL3700	NZD
Best	6K	15D
Sargent	65	LL

4. Standard Duty cylindrical series and function designations are ANSI, acceptable manufacturers are:

Manufacturer	Series	Design
Corbin/Russwin	CK4700	GWC
Best	6K	4E
Sargent	6	OB

5. Cylindrical Deadlocks series and function designations are ANSI, acceptable manufacturers are:

Manufacturer	Series
Corbin/Russwin	DL2000
Best	83T
Sargent	480

6. Padlocks shall have an extruded brass 2" case with 2 5/8" brass shackle, acceptable manufacturers are:

Manufacturer	Series
Corbin/Russwin	PD51
Best	11B772
Sargent	756H

E. Exit Devices: Series and function designations are ANSI, acceptable manufacturers are:

Manufacturer	Series	Design
Corbin/Russwin	ED5000	NZD

F. Closers:

1. Qualities: Fully hydraulic, full rack and pinion action with a high strength cast iron cylinder body. Furnish complete with full covers (when not concealed), forged steel arms, necessary brackets and fasteners. Concealed mounting on all hollow metal doors except on reverse bevel doors, where parallel mount shall be used. Furnish other scheduled accessories. Provide non-handed, non-sized closers at doors requiring handicapped access, adjustable to comply with handicapped opening force requirements. Size closers in accordance with manufacturers directions.

Type	Manufacturer	Series	Arm	ANSI
C-1	Corbin/Russwin	DC3210	Parallel	CO20 21
C-2	Corbin/Russwin	DC3200	Regular	CO20 11

G. Push and Pull Hardware:

1. Flush Pulls: Overall size 3 7/8"x 4 1/2", Base 3 3/8" x 4", depth 7/8" in stainless steel.

2. Push Plates: Plain design, with wrought plate 4"x 16"x 0.050", square corners, beveled edges.

Type	Manufacturer	Model
J300	Trimco	1001-3
J300	Hager	30S.
J303	Trimco	1820.
J303	Hager	120L.

H. Kick Plate: Furnish 10 inches x 0.050 inch x door width less 1 1/2 inches at single doors, and less 1 inch at pairs. Where glass or louver prevent this height, supply with height equal to height of bottom rail less 1 inch. On fire rated openings, height of plate shall not exceed 6 inches. Acceptable manufacturers are Hager and Trimco.

I. Armor Plates: Furnish 34 inches x 0.050 inches x door

width less 3 inches. Install prior to exit devices. Bevel top edges. Drill and countersink screw holes for oval head undercut screws. Acceptable manufacturers Rockwood,Hager and Trimco.

J. Wall Stops: ANSI LO2021. Acceptable manufacturers Rockwood, Hager and Trimco. Provide one per door leaf that has a wall at 90 degree or less of its opening path.

K. Wall Stop/Holder: ANSI LO1291 as manufactured by TRIMCO, Hager and Glynn-Johnson. Provide one per door leaf that has a wall at 90 degree or less of its opening path.

L. Weatherstripping: Apply to head and jamb stops with no cuouts for stop applied hardware.

1. Pemko S88D.

2. Pemko 322 (At sound retardant openings).

M. Thresholds: Cope at jambs. Furnish full wall opening width when frames are recessed.

1. Pemko 171.

2. Pemko 277 (At sound retardant openings).

N. Automatic Door Bottom Seals: Shall be fully mortised on door.

1. Pemko 434AR.

O. Rain Drip: Furnish wall opening width.

1. Pemko 347 x 68AR.

P. Electric Strike: Shall be H.E.S. model 5000 x 24 VAC x US28. Operated from remote reception desk by Push Button PB-7.

2.3 LABEL REQUIREMENTS

A. Furnish Underwriters Laboratories, Inc. approved

hardware items, meeting requirements of NFPA 80, at doors scheduled to be label doors.

2.4 FINISHES

A. Butts and Pivots: 626.

B. Locksets, Deadlock and Latches: 626 (Except MS1852-628).

C. Exit Devices: 630.

D. Closers: Sprayed aluminum to match;626 on Floor Type.

E. Pulls & Plates: 630.

F. Stops/Holders: 626.

G. Thresholds: 628.

H. Flush Bolts: 626.

2.5 KEYING

A. Key, masterkey and grandmaster key in accordance with owner's requirements and approved keying schedule. Furnish 2 change keys for each lock, 10 masterkeys and 2 grandmaster keys.

B. Provide cylinders of the removable core type.Core to be removed with the use of a control key that does not require the lock to be unassembled.Provide temporary construction cores to be used during the construction phase.

C. All cylinders shall be of the high security type with interlocking pins and skew-cut key bitting.

D. Furnish a complete key control system that provides tags for each individual change key and a key cabinet that will hold 150% of the key capacity of the entire project.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine door frames and related items for conditions that would prevent proper application of hardware.

B. Do not proceed until defects are corrected, with approval obtained from owner or his designated representative.

3.2 INSTALLATION

A. Install hardware according to manufacturer's printed instructions and to template dimensions. See Article 1.6 - Product Delivery and Storage regarding conversion of construction cores to final cores.

B. All hardware shall be installed by experienced workmen and left in perfect working condition. Any hardware lost or damaged shall be replaced at no additional cost to the owner.

3.3 LOCATIONS

A. Dimensions are from finish floor to center line of items.

B. This list to be included in Hardware Schedule:

Category	Dimension
Hinges	Door manufacturer stdr.
Flush Bolt Levers	72 inches and 12 inches
Knobs	Door manufacturer stdr.
Exit Device Crossbars	Manufacturer's Template
Push Plates	52inches
Pull Plates	42 inches
Wall Stops	At Head.

3.4 FINAL ADJUSTMENT

A. Provide the services of a representative to inspect material furnished and its installation and adjustment, to make final hardware adjustment, and to instruct the Owner's personnel in adjustment, care and maintenance of the hardware.

KEYING SYSTEM

PROVIDE XC PROPRAITORY CYLINDERS AND KEYS PROTECTED FROM UNAUTHORIZED MANUFACTURE AND DISTRIBUTION BY MANUFACTURER'S UNITED STATES PATENTS.

VERIFY WITH OWNER KEYING SYSTEM.

ALL LOCKS MASTER KEY & CONSTRUCTION KEY 3 KEYS PER LOCK
2 MASTERS KEYS
10 CONSTRUCTION KEYS
FINAL KEY LAY OUT AS PER ARCHITECTS AND/OR OWNER INSTRUCTIONS.
IN PLACES WERE DOORS DO NOT COME IN CONTACT WITH THE WALL
REPLACE WALL STOPS WITH FLOOR ONES, VERIFY WITH ARCHITECT.

APROVED MANUFACTURERS:

1. HINGES - MCKINNEY, HAGER.
2. LOCKS - SARGENT, CORBIN-RUSSWIN.
3. EXIT DEVICES - SARGEN, VON DUPRIN
4. CLOSERS - SARGENT, DORMA, NORTON
5. MISSELANOUS - TRIMCO, ROCKWOOD, IVES, BALDWIN
6. WEATHERSTRIPING - PEMKO, ZERO, REES, NATIONAL GUARD

OTHER MANUFACTURERS COULD BE APPROVED IF REQUEST IS SUBMITTED 15 DAYS PRIOR TO BID.

REGULATORY REQUIREMENTS:

A. CONFORM TO ALL APPLICABLE CODES FOR FIRE RATED DOORS AND FRAMES.

B. CONFORM TO THE APPLICABLE SECTIONS OF CHAPTER 5 OF NFPA 101.

C. CONFORM TO ANSI A117.1 FOR HARDWARE LOCATIONS AND REQUIREMENTS TC MEET ALL HANDICAPPED CODES AND MEET TITLE III PROVISIONS OF THE AMERICAN WITH DISABILITIES ACT.

D. QUANTITIES SHOWN ON THE SCHEDULE ARE FOR REFERENCE ONLY, FINAL COUNT IS BIDDERS RESPONSIBILITY. BIDDERS SHOULD VERIFY FLOOR PLANS AND DOORS SCHEDULE TO DETERMINE FINAL QUANTITIES.

REFERENCES:

MCK = MCKINNEY MFG COMP.	(BUTT HINGES)
SAR = SARGENT & COMP.	(LOCKSETS, EXITS, CLOSERS,)
TRI = TRIANGLE BRASS MANF.	(PUSH, PULL, BOLTS, STOPS,)
PEM = PEMKO.	(WEATHERSTRIPING)
KCS = KEY CONTROLS SYSTEM INC.	(KEY CABINETS)

END OF SECTION 08 71 00

SECTION 08520

ALUMINUM JALOUSIES WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes operable aluminum jalousies windows for exterior locations, as indicated on drawings

1.3 DEFINITIONS

A. Performance class designations shall be in accordance to AAMA/WDMA 101/I.S.2/NAFS:

1. AW: Architectural
2. HC: Heavy Commercial
3. C: Commercial
4. LC: Light Commercial
5. R: Residential

B. Performance grade number shall be in accordance to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot (*pascal*) used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of minimum test size indicated below:

1. Size indicated on drawings.

B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure", based on mean roof heights above grade indicated on Drawings.

    a. Basic Wind Speed: 120 mph (53.3 m/s).

C. Windborne-Debris Resistance: Provide aluminum windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing aluminum windows identical to those specified, according to the latest ASTM code and requirements of authorities having jurisdiction.

D. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 ºF (67 ºC), ambient; 180 ºF (100 ºC) material surfaces.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Window System Operators: Show locations, mounting, and details for installing operator components and controls.

C. Samples for Initial Selection: for units with factory-applied color finishes.

1. Include similar samples of hardware and accessories involving color selection.

D. Samples for Verification; for aluminum windows and components required, prepared on Samples of size indicated below.

1. Operable Window: Full-size unit with factory-applied finish.
2. Hardware: Full-size units with factory-applied finishes.
3. Weather Stripping.

E. Product Schedule: for aluminum windows. Use same designations indicated on Drawings.

F. Warranty: Special Warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

2. Engineering Responsibility: Preparation of data for aluminum windows, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source form a single manufacturer.

D. Products Options: Information on Drawings and in Specifications establishes requirements for aluminum windows; aesthetic effects and performance characteristics. Aesthetic effects area indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fall in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
c. Faulty operation of movable sash and hardware.
d. Deterioration of metals, other materials, and metal finishes beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Valcor / Samcor
2. *Air Master* Manufacturing Corp.
3. Tamcor Corp.
4. Submit local manufacturer for approval.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 24,000-psi (165-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe serviced conditions; provide sufficient strength to withstand design pressure indicated.

E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.

F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

G. Replaceable Weather Seals: Comply with AAAMA 701/702.

H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOW

A. Window Type: As indicated on Construction Documents.

B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS.

C. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

D. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to ASTM E 1423.

E. Solar Heat-Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.55, determined according to NFRC 200 procedures.

F. Sound Transmission Class (STC): Provide aluminum windows rated for not less than 35 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

G. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/WDMA 101/I.S.2/NAFS, Air Infiltration Test.

H. Water Resistance: No water leakage as defined in AAMA/WDMA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test.

I. Forced-Entry Resistance: Comply with Performance Grade 40 requirements when tested according to ASTM F 588.

2.4 BLADES

A. Louver Blades: Louver blades shall be approved equal to standard factory-installed aluminum blades system from *Titanica* window, model 600A, thickness of 0.062", manufactured by *Valcor / Samcor*. Blade system must produces weather-tight seal and complies with requirements for windborne-debris resistance and all aforementioned requirements for this project.

2.5 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.

B. Counterbalancing Mechanism: Comply with AAMA 902.

C. Sill Cap/Track: Extruded-aluminum track with natural anodized finish, of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.

D. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

E. Roller Assemblies: Low-friction design.

F. Butterfly-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.

1. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.

G. Four-or Six-Bar Friction Hinges ("projected Out-Swing" windows): Comply with AAMA 904.

1. Locking mechanism and handles for manual operation.

H. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.

I. Pole Operators (where applies): Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches (1500 mm) above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches (1800 mm) above floor.

2.6 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully

integrate with window frame. Locate screens on inside of window and provide for each operable exterior sash or ventilator.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.040-inch (1.0-mm) wall thickness.
2. Finish: Match aluminum window members.

C. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch-(0.28-mm-) diameter, coated aluminum wire.

2.7 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

1. Provide thermal-break construction that has been in use for not less than three years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.
2. Provide thermal barriers tested according to AAMA 505; determine the allowable design shear flow per the appendix in AAMA 505.
3. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.

C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

D. Weep Holes: provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Sub-frames (where applies): Provide sub-frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062 inch (1.6 mm) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide sub-frames capable of withstanding design loads of window units.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather-tight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather-tight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, by applying same test pressures required to determine compliance with AAMA/WDMA 101/I.S.2/NAFS in Part 1 "Performance Requirements" Article.
2. Test Reports: Shall be prepared according to AAMA 502.

C. Remove and replace non-complying aluminum window and retest as specified above.

4.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather-tight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, dirt, and other substances.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08520

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

E. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of

sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gains and nighttime-sky heat loss.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.

1. Each color of laminated glass.
2. Each type of patterned glass.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

F. Qualification Data: For installers.

G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

H. Product Test Reports: For each of the following types of glazing products:

1. Laminated glass.
2. Coated float glass.

I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type.

C. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Product: Subject to compliance with requirements, provide product specified.
4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
5. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
6. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

a. Products:

1) AFG Industries Inc.; Krystal Klear.
2) Pilkington Building Products North America; Optiwhite.
3) PPG Industries, Inc.; Starphire.
4) Schott Corporation; Amiran.

B. Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:

1. Interlayer: Polyvinyl butyl of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lutes and installation.

a. For polyvinyl butyl interlayers, laminate lutes in autoclave with heat plus pressure.

2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.
3. Glass Products.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lutes in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lutes in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, square-ness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lutes.

G. Provide spacers for glass lutes where length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lutes from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lutes in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lutes in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lutes in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weather-tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lutes and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08800

SECTION 09 29 00

GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

1. The work included in this Section consists of furnishing all labor, materials, and equipment required for the installation of gypsum partitions and wall furring as shown on drawings and specified herein.

2. Related work described elsewhere:

    1. Unit masonry works (Section 04810)
    2. Painting (Section 09900)

1.2 SUBMITTALS

1. Contractor shall submit for the Architect's approval a complete set of shop drawings of each type of assembly.

PART 2 - PRODUCTS

2.1 PRODUCT DELIVERY, STORAGE AND HANDLING

1. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements. Damaged or deteriorated materials shall be removed from the premises.

2.2 PRODUCTS

1. MANUFACTURERS:

    a. US Gypsum, Co.
    b. Gold Bond
    c. Georgia Pacific

2. All materials shall be installed in strict accordance to manufacturer's recommendations. Materials specified herein as reference is from United States Gypsum Company.

    a. Gypsum panels shall be "Firecode C" Sheetrock panels ½" inch thick with square edges, 48 inches wide by 96 inches high (minimum).

    b. Corner reinforcement shall be Dura-A-Bead.

    c. Control joints shall be No. 093.

d. Casing beads shall be series 200.

e. Metal Studs shall be Style CWS, 20 gauge, 3-5/8 inches deep or as called for on drawings.

f. Metal Runners shall be Style CWS, 20 gauge, 3-5/8 inches deep or as called for on drawings.

g. Furring Channels shall be "Z" furring channels, 1-½ inches deep.

h. Joint treatment shall be Perf-A-Tape and All-Purpose Joint Compound.

i. Screws shall be type "S", length as required.

j. Insulation, where called for on drawings, shall be USG "Thermatfiber", 3 inches thick, for gypsum partitions and Owens-Corning 703 "Semi-Rigid Insulation Board", 1-½ inches thick, for gypsum wall furring.

PART 3 - EXECUTION

3.1 For Gypsum Partitions

1. Attach metal runners at floor and to structural elements above with suitable fasteners located 2 inches from each end and spaced 24 inches on center. Position studs vertically, engaging floor and ceiling runners and spaced 24" on center. When necessary, splice studs with 8 inches nested lap and one (1) positive attachment per stud flange. Place studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements. Anchor all studs adjacent to door and window frames, partition intersections, and corners to ceiling and floor runner flanges with fastener tool. Securely anchor studs to jamb and head anchor clips of door by bold or screw attachment. Over doors and windows place horizontally a cut-to-length section of runner, with a web flange bend at each end, and secure with one (1) positive attachment per flange. Position a cut-to-length stud (extending to top runner) at vertical panel joints over door frame header.

2. Apply gypsum panels (parallel to studs). Position all edges over studs for parallel application. Use maximum practical lengths to minimize end joints. Fit ends and edges closely, but not forced together. Stagger joints on opposite sides of partition.

3. Space screws 12 inches O.C. to studs at joints and runners and 8 inches O.C. to studs in field (fire-rated fastening).

4. Power drive with an electric screwdriver so screw heads provide a slight depression below surface of gypsum panels without breaking face paper. Do not drive screws closer than 3/8 inches from edges and ends of board.

5. Apply joint treatment as per manufacturer's recommendations.

3.2 For Gypsum Wall Furring

1. Erect insulation and hold in place with 2 furring channels spaced 24 inches on centers.

2. Except at exterior corners attach narrow flanges of furring channels with concrete stub nails or power driven fasteners spaced 24 inches on centers.

3. At exterior corners attach wide flange of furring channels to wall with short flange extending beyond corner; start furring channel with a 3 inches strip of insulation followed by furring channels in the normal manner.

4. At interior corners, space second channel no more than 12 inches from corner and curt insulation to fit.

5. Hold insulation in plane until gypsum board panels are installed with 10 inches long staple field fabricated from 18 gauge tie wire and inserted through slot in channel.

6. Apply treated wood blocking around window and door openings and as required for attachment and support of fixtures and furnishings.

7. Apply gypsum panels parallel to channels, use maximum practical lengths. Fit ends closely but not forced together.

8. Space screws 16 inches O.C. in field of panels and along abutting edges.

9. Power drive with an electric screwdriver so screw heads provide a slight depression below surface of gypsum panels without breaking face paper. Do not drive screws closer than 3/8 inch from edges and ends of board.

10. Apply joint treatment as per manufacturer's recommendations.

3.3 Clean Up

1. At the completion of the work, remove all rubbish, excess material, scaffolding, tools and equipment from the building, leaving floors broom clean, and ready for the work of other trades.

END OF SECTION 09 29 00

SECTION 09 65 33

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Provide vinyl tile flooring, vinyl bases and an underlayment for the leveling of concrete floors as required and as specified herein and shown on drawings.

B. Related work described elsewhere:

1. Cast-in-Place Concrete Section 03 33 00.

1.2 QUALITY ASSURANCE

A. Manufacturer:

Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives and leveling compounds.

B. Installer's Qualifications:

Engage Installer who is trained and experienced for the installation of this work. No allowance will be made for lack of skill on the part of the tile installer.

C. Product Specification Requirements:

Vinyl floor tile shall conform to Federal Specification SS-T-312B and NFPA 99.

1.3 SUBMITTALS

A. Product Data:

Submit manufacturer's technical data for each type of resilient flooring and accessories.

B. Samples:

Submit manufacturer's color charts in form of actual sections of resilient flooring, including accessories, showing full range of colors and patterns available, for each type of resilient flooring required.

C. Certification:

Installer shall submit certification that substrate has been properly prepared for receiving the installation of the resilient flooring.

1.4 EXTRA MATERIALS

A. Furnish not less than one box for each 25 boxes or fraction thereof, for each type, color, pattern and size installed. Materials shall be from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong World Industries

B. Amtico International

C. Substitutions: As per approved substitution by Architect.

2.2. VINYL COMPOSITION TILE FLOORING

A. Provide vinyl composition tile Type IV, asbestos free. Class 1 with a flame spread less than 0.75.

B. Tile Size: 1/8 inch x 12 inches x 12 inches.

C. Armstrong excelon imperial texture.

2.3 VINYL COMPOSITION TILE ACCESSORIES

A. Vinyl Wall Base:

Provide vinyl cove base with matching end stops and preformed or molded corner units. Base shall be 0.085 gauge and 4 inches in height (or as otherwise shown on the drawings). Base shall bought in 100 foot length rolls only. Color to be selected by Architect.

B. Concrete Slab Primer:

Non-staining type as recommended by flooring manufacturer.

C. Leveling and Patching Compounds:

Use fast-setting underlayment as recommended Flooring Manufacturer for leveling of concrete floors.

D. Adhesives:

Use as recommended by flooring manufacturer to suit material and substrate conditions.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer shall inspect subfloor surfaces to determine that they are satisfactory. As satisfactory subfloor surface is defined as one that is smooth, free from cracks, holes, ridges, coatings preventing adhesive bonds and other defects impairing performance or appearance. Do not allow resilient flooring work to proceed until subfloor surfaces are satisfactory. Starting of work will be construed as Installer's acceptance of subfloor surfaces within any particular area.

3.2 PREPARATION

A. Use the underlayment at the entire floor area is necessary for levelling the concrete floors. Apply in single layer and assume a minimum thickness of 1/16 inch and a maximum thickness of ¼ levelling.

B. Concrete floor surface should be clean and free of dirt, oil, grease, plaster, curing compounds and other foreign matter. Concrete floor must be sufficiently cured and free of excessive moisture or hydrostatic pressure. Dampen concrete floors with clean water. Do not leave standing puddles or water. Apply underlayment while floor is still damp with. Allow to dry before underlayment is applied.

C. Apply sufficient pressure to the underlayment with the trowel to secure adequate bonding to the cleaned, damp-mopped.

D. Apply adhesive in compliance with manufacturer's instructions.

3.3 INSTALLATION

A. Install resilient flooring in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals and into closets and similar openings.

B. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of room area of equal width. Adjust as necessary to avoid use of cut widths less than ½ tile at room perimeters. Lay tile with grain running in one direction and square to room axis, unless otherwise indicated.

C. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered.

D. Cut tile neatly around all fixtures. Broken, cracked, chipped, or deformed tiles are not acceptable.

E. Adhere tile flooring to substrate using full spread of adhesive applied in compliance with flooring manufacturer's instructions.

3.4 INSTALLATION OF ACCESSORIES

A. Apply wall base to walls, columns, casework and other permanent fixtures in rooms or areas where base is required.

B. When possible install base of same length as wall so as to minimize joints with preformed corner units.

C. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.

3.5 CLEANING AND PROTECTION

A. Clean floors using appropriate cleaner recommended by manufacturer.

B. Do not wash or wax floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.

C. Remove any excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturers.

D. Protect flooring against damage during construction period.

E. Clean and wax resilient flooring.

END OF SECTION 09 65 33

SECTION 09180 – CEMENT PLASTER

1. RELATED DOCUMENTS:

   The general provisions of the contract including General and Special Conditions, apply to the work specified in this section.

2. DESCRIPTION OF WORK:

   The extent of the Portland cement plaster work is shown on the drawings.

3. GENERAL:

   Delivery and Storage of Materials:

   Except for sand and water, deliver materials to the site in sealed containers or bags fully identified with manufacturer's name, brand, type and grade. Store materials in a dry, well-ventilated space, under cover, off the ground and away from surfaces subject to dampness or condensation.

   Warm Weather Requirements:

   Protect plaster against uneven and excessive evaporation and from strong blasts of dry air, both natural and artificial. Apply and cure plaster as require by climatic and job conditions to prevent rapid dry out. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

   Ventilation Requirements:

   Provide natural or mechanical means of ventilation to properly dry interior plaster during and after application.

   Sample Installation:

   Prior to installation of plaster work, plaster sample section of each type of plaster required for approval of the P.B.A. Demonstrate the proposed range of texture, workmanship, and color if required, to be expected in the complete work.

SECTION 09180 – CEMENT PLASTER

4. MATERIALS:

Bonding Compound:

ASTM C 631 of FS MMM – B 350 or MIL Spec. – 19235.

For exterior use, provide bonding compound which is not affected by moisture on surface or present in plaster base and suitable for temperature conditions at application time.

Aggregate:

Natural or manufactured sand, complying with ASTM C 144, except graded within the following limits (expressed as the minimum and maximum percentage retained by weight on U.S. Standard Sieves, plus or minus 2%); No. 4 Sieve – 0%, No. 8 Sieve – 0 to 16%, No. 16 Sieve – 10 to 40%, No. 30 Sieve – 30 to 65%, No. Sieve – 95 to 100%.

Portland Cement:

ASTM C 150, Type I color gray unless otherwise called for by the finish schedule.

5. INSTALLATION:

General Requirements:

Contractor must examine all surfaces which are to receive plaster and all grounds and other accessories which act as grounds or screeds, and shall notify the P.B.A. in writing, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the plaster work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

Protect continuous work from rusting or soiling as a result of plastering operations.

Mix materials for a minimum of 2 minutes or until all ingredients present a uniform color in the mixer. Use the minimum amount of water required to produce plaster of a workable consistency. Use only clean water, free form impurities which might impair the plaster work.

Hand apply plaster to the specified thickness. Machine application of plaster will not be allowed, except where sprayed-on plaster is specified.

SECTION 09180 – CEMENT PLASTER

INSTALLATION: (CONT.)

Apply plaster to an entire wall or ceiling panel with interruptions occurring only at junctions of plaster planes or at openings or expansion and control joints (if any). Where the distance between such natural interruptions exceeds 20' in either direction, plaster application may be interrupted when the practical application limits is exceeded.

Where plaster abuts frames or other items of metal or wood which act as plaster ground, and plaster is not terminated by a casing bead, tool edge of plaster to produce a small uniform "V" joint.

Wherever a masonry wall abuts or adjoins the concrete framework, tool plaster to produce a "V" joint.

Plaster work shall be finished level, plumb, square, and true, within a tolerance of 1/8 inch in 10 feet, without waves, cracks, blisters, pits, crazing, discoloration, projections, or other imperfections. Plaster work shall be formed carefully around angles and contours, and well up to screeds. Special care shall be taken to prevent sagging. There shall be no visible junction marks in finish coat where one day's work adjoins another. Finished work shall be covered and protected in an approved manner to prevent damage.

Plaster Proportions: (By volume)

Sand	5 ¾	parts
Lime	1	part
Cement	1 1/3	parts

Hair or fiber may be used in the mix for the first (scratch) basecoat applied to metal lath. Do not use more than one pound of hair or fiber per bag of cementitious material. Use goat, cattle or deer hair or pure manila fiber, ½"to 2" long, free from grease, oil, dirt and other impurities.

Accurately measure ingredients, including water, using measuring devices of known volume. Do not use shovel or water buckets as measuring devices. Proportion successive batches alike.

Place coat within a maximum of 2-1/2 hours after mixing, except during hot, dry weather, reduce maximum placing time as required to prevent premature stiffening of plaster.

SECTION 09180 – CEMENT PLASTER

INSTALLATION: (CONT.)

Plaster over Metal Lath:

Apply 3 – coat plaster over all metal lath, with or without solid backing. Apply first (scratch) coat not less than ½" thick and second (brown) basecoat not less than ¼" thick.

Measure thickness of plaster from backplane of metal lath (exclusive of ribs of dimples), except if metal lath is applied over solid base, and measure from face of solid backing.

Apply first basecoat with sufficient material and pressure to form full keys through metal lath and to embed lath with sufficient plaster coverage. After first coat is firm, scratch (score) in one direction only, to provide mechanical bond for second coat. On vertical surfaces, scratch in horizontal direction.

Apply second basecoat with sufficient material and pressure to ensure tight contact with first basecoat. Bring surface to a true, even plane rodding and float to a uniformly rough surface. Fill defects and scratches with plaster.

After the second coat has been allowed to dry slowly for 24 hours, the finish coat shall be applied to a thickness of not less than 1/8" thick, with a san float finish.

Plaster over Concrete or Masonry:

Surfaces shall be free of loose or deteriorated areas, clean and free of dust, loose particles, and foreign matter.

Apply bonding agent to concrete surfaces prior to application of plaster, in accordance with manufacturer's instructions.

Apply plaster in a single coat not less than 3/8" thick, rod to a true, smooth surface and float to an even sand finish.

Moisture Retention Requirements:

Dampen bases, if required, for proper suction. Do not saturate bases and do not apply plaster until visible surface water disappears.

SECTION 09180 – CEMENT PLASTER

INSTALLATION: (CONT.)

Moisture Retention Requirements: (Cont.)

Dampen previous plaster coats which have dried out prior to time for applications of next coat. Dampen with water as required for uniform suction.

The Contractor is responsible for determining the most effective procedure for curing and time lapse between application of coats based on climatic and job conditions. Plaster which is cracked or crazed due to improper timing and curing will not be accepted. Remove and replace unacceptable plaster including plaster base materials, if damaged during removal of defective plaster.

6. CUTTING AND PATCHING:

Cut, parch, repair, and point-up plaster as required and as directed by the P.B.A. Repair cracks and indented surfaces by moistening plaster and filling with new material, troweled or tamped flush with adjoining surfaces. Point-up finish plaster surfaces around items which are built into or penetrate plaster surfaces.

7. CLEANING AND PROTECTION:

Make provisions to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows and other surfaces which are not to be plastered. Repair floors, walls and other surfaces which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of all plaster debris.

Contractor shall be aware of requirements for protection of plaster from deterioration and damage until time of acceptance of the work.

END OF SECTION

SECTION 09900

PAINTING

1. RELATED DOCUMENTS

The general provisions of the contract, including General and Special Conditions apply to the work specified in this section.

2. DESCRIPTION OF WORK

This work includes the painting and finishing of all interior and exterior exposed items and surfaces throughout the project, expect as herein specified. Surface preparation, priming and coats of paint specified are in addition to shop priming and surface treatment specified under other sections, except as otherwise specified.

The work includes the field painting of all bare and covered pipes (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise specified.

The "paint" as used herein means all coating systems materials which includes primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

Paint all exposed surfaces no matter which colors are designated in any "schedule", except where the natural finish of the material is obviously intended and specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors available.

3. PAINTING NOT INCLUDED

The following categories of work are not included as part of the painter-applied finish work, or are included in other sections of these specifications, unless otherwise shown or specified.

a. Shop Priming

Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal items, hollow metal work, and similar items, as well as fabricated components, such as architectural woodwork, wood casework, and shop fabricated, or factory built mechanical and electrical equipment or accessories.

b. Pre-Finished Items

Unless otherwise indicated, do not include painting when factory finishing is specified for such items as (but not limited to) metal toilet enclosure, acoustic materials, architectural woodwork, and casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, doors, and equipment.

c. Concealed Surfaces

Unless otherwise indicated, painting is not required or wall or ceiling surfaces in concealed areas and inaccessible areas, such as foundation spaces, furred areas, pipe spaces, duct shafts, as applicable to this project. Do not paint copper pipe, zinc-coated pipe, and zinc-coated ducts under insulation. Do not paint zinc-coated and copper pipe in concealed spaces.

d. Finished Metal Surfaces

Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require finish painting, except as otherwise specified.

e. Operating Parts and Labels

Do not paint any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sink-ages, sensing devices, motor, and fan shafts, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriters Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

4. GENERAL

a. Site Conditions

Starting of painting work will be construed as the Applicator's acceptance of the surfaces within any area. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

b. Atmospheric Conditions

Exterior paint shall not be applied when the temperature of the surface is below 45 degrees Fahrenheit or above 95 degrees Fahrenheit unless otherwise directed. Interior paint may be applied at any time, provided the surfaces to be painted are dry and the temperature can be kept above 45 degrees Fahrenheit during the application of ordinary paints, and between 65 degrees Fahrenheit and 95 degrees Fahrenheit during the application of enamels and varnishes. Paint shall not be applied during foggy or rainy weather or when, in the opinion of the PBA, the surfaces are not in proper condition for painting.

c. Delivery and Storage

Deliver all materials to the job site in original, new, and unopened packages and containers bearing manufacturer's name and label, and application instructions thereon.

d. Protection

Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing, or replacing, and repainting, as directed by the PBA. Provide “Wet Paint” signs as required to protect newly painted finishes. Remove temporary protective wrappings after completion of painting operations.

e. Clean Up

During the progress of the work, remove from the project all discarded paint materials, rubbish, cans, and rags. Upon completion of painting work, clean all paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

f. Colors

Prior to beginning work, the PBA will furnish a color schedule to the Contractor.

5. MATERIAL – PAINT TECHNICAL DATA:

All proposed paint products and its respective complements (primers, sealers, etc.) to be applied on all project's exposed surfaces (interior and exterior) must be submitted by Contractor for PBA approval. Such products must comply with the following characteristics and parameters:

PRODUCT No.	PRODUCT	SPECIFICATIONS
1	100% Acrylic Flat Exterior Paint	• Product Type: 100% Acrylic • Percent of Solid by Weight: 54% ± 2% • Percent of Solid by Volume: 36% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 400–450 sq. ft./gal. • Recommended Film Dry Thickness: 1.5 mils • Viscosity (KU): ≥ 105 Krebs Units (KU) • Drying Time to Touch (Hr.); No more than 1 Hour • Drying Time to Recoat (Hr.): No more than 4 Hours • Percent of Pigments by Weight: 38% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: <1 g/L
2	100% Acrylic Flat Interior Paint	• Product Type: 100% Acrylic • Percent of Solid by Weight: 56% ± 2% • Percent of Solid by Volume: 38% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 400–450 sq. ft./gal. • Recommended Film Dry Thickness: 1.5 mils • Viscosity (KU): ≥ 110 Krebs Units (KU) • Drying Time to Touch (Hr.); No more than 1 Hour • Drying Time to Recoat (Hr.): No more than 4 Hours • Percent of Pigments by Weight: 41% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: <1 g/L

• MATERIAL - PAINT TECHNICAL DATA (Cont.'):		
PRODUCT No.	**PRODUCT**	**SPECIFICATIONS**
3	Satin Acrylic Paint	• Product Type: Acrylic Resin • Percent of Solid by Weight: 52% ± 2% • Percent of Solid by Volume: 38% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 400–450 sq. ft./gal. • Recommended Film Dry Thickness: 1.5 mils • Viscosity (KU): ≥ 105 Krebs Units (KU) • Drying Time to Touch (Hr.); No more than 1 Hour • Drying Time to Recoat (Hr.): No more than 4 Hours • Percent of Pigments by Weight: 29% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: <100 g/L
4	Acrylic Semi-Gloss Interior Paint	• Product Type: 100% Acrylic • Percent of Solid by Weight: 49% ± 2% • Percent of Solid by Volume: 36% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 400–450 sq. ft./gal. • Recommended Film Dry Thickness: 1.4 mils • Viscosity (KU): ≥ 110 Krebs Units (KU) • Drying Time to Touch (Hr.); No more than 1 Hour • Drying Time to Recoat (Hr.): No more than 4 Hours • Percent of Pigments by Weight: 25.9% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: <50 g/L

• **MATERIAL - PAINT TECHNICAL DATA (Cont.'):**

PRODUCT No.	PRODUCT	SPECIFICATIONS
5	Enamel Paint for Metals	• Product Type: Alkyd Oil Resin • Percent of Solid by Weight: 67% ± 2% • Percent of Solid by Volume: 51% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 450–500 sq. ft./gal. • Recommended Film Dry Thickness: 1.4 mils • Viscosity (KU): ≥ 70 Krebs Units (KU) • Drying Time to Touch (Hr.); No more than 1.5 Hours • Drying Time to Recoat (Hr.): No more than 8 Hours • Percent of Pigments by Weight: 28% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: <400 g/L
6	Traffic Paint	• Product Type: Alkyd Resin • Percent of Solid by Weight: 67% ± 2% • Percent of Solid by Volume: 41% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Ln. Ft.): 350 linear feet (4") • Recommended Film Dry Thickness: ≥3.0 mils • Viscosity (KU): ≥ 70 Krebs Units (KU) • Drying Time to Touch (Hr.): No more than 15 minutes • Drying Time to Recoat (Hr.): No more than 1 Hour • Percent of Pigments by Weight: 54% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: ≤500 g/L

• **MATERIAL - PAINT TECHNICAL DATA (Cont.'):**

PRODUCT No.	PRODUCT	SPECIFICATIONS
7	100% Acrylic Floor Paint	• Product Type: 100% Acrylic • Percent of Solid by Weight: 48% ± 2% • Percent of Solid by Volume: 33% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 400–450 sq. ft./gal. • Recommended Film Dry Thickness: 1.3 mils • Viscosity (KU): ≥ 70 Krebs Units (KU) • Drying Time to Touch (Hr.); No more than 1 Hour • Drying Time to Recoat (Hr.): No more than 4 Hours • Percent of Pigments by Weight: 29% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: ≤200 g/L
8	Primer Change on Base Coat from Oil to Satin or Flat	• Product Type: 100% Acrylic • Percent of Solid by Weight: 53% ± 2% • Percent of Solid by Volume: 36% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 400–450 sq. ft./gal • Recommended Film Dry Thickness: 1.4 mils • Viscosity (KU): ≥ 95 Krebs Units (KU) • Drying Time to Touch (Hr.): No more than 1 Hour • Drying Time to Recoat (Hr.): No more than 2 Hours • Percent of Pigments by Weight: 35% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: ≤100 g/L

• MATERIAL - PAINT TECHNICAL DATA (Cont.'):		
PRODUCT No.	**PRODUCT**	**SPECIFICATIONS**
9	**Primer** Keeping Existing Base Coat (Flat to Flat)	• Product Type: 100% Acrylic • Percent of Solid by Weight: 49% ± 2% • Percent of Solid by Volume: 37% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 400–450 sq. ft./gal • Recommended Film Dry Thickness: 1.3 mils • Viscosity (KU): ≥ 85 Krebs Units (KU) • Drying Time to Touch (Hr.): No more than 1 Hour • Drying Time to Recoat (Hr.): No more than 2 Hours • Percent of Pigments by Weight: 24% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: ≤50 g/L
10	Primer for Galvanized Metals	• Product Type: Alkyd Resin • Percent of Solid by Weight: 60% ± 2% • Percent of Solid by Volume: 45% ± 2% • Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 500–550 sq. ft./gal. • Recommended Film Dry Thickness: 1.4 mils • Viscosity (KU): ≥ 68 Krebs Units (KU) • Drying Time to Touch (Hr.); No more than 15 minutes • Drying Time to Recoat (Hr.): No more than 6 Hours • Percent of Pigments by Weight: 45% ± 2% • Volatile Organic Compounds (VOC) - Grams/Liters: <500 g/L

• **MATERIAL - PAINT TECHNICAL DATA (Cont.'):**		
PRODUCT No.	**PRODUCT**	**SPECIFICATIONS**
11	**Paint for Metals (Acrylic Waterborne)**	• **Product Type: Acrylic** • **Percent of Solid by Weight: 51% ± 2%** • **Percent of Solid by Volume: 40% ± 2%** • **Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.): 640 sq. ft./gal.@ 1 mil** • **Recommended Film Dry Thickness: 1.4 mils** • **Viscosity (KU): 85–90 Krebs Units (KU)** • **Drying Time to Touch (Hr.): 12–15 minutes** • **Drying Time to Recoat (Hr.): 2–4 Hours** • **Percent of Pigments by Weight: 22% ± 2%** • **Volatile Organic Compounds (VOC) - Grams/Liters: <200 g/L**

6. MATERIAL TESTING

The right is reserved by the PBA to engage the services of a testing laboratory to perform all necessary test to verify that the paint submitted for approval by the Contractor complies with the requirements of this specifications.

7. SURFACE PREPARATION

a. General

Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified.
Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Provide cleaning solvents of low toxicity and a flash point more than 100º F. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

b. Cementitious Materials

Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition by sponging the affected surfaces with a zinc sulphate solution of 2 lbs. zinc sulphate per gal. of water, or other acceptable method, before application of paint. Do not paint over surfaces where the moisture content exceeds 8% unless otherwise permitted in the manufacturer's printed directions.

c. Wood

Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooths those finished surfaces exposed to view, and dust off.

Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, face, undersides, and backsides of such wood, including cabinets, counters, cases, paneling, etc. Seal tops and bottoms of wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other approved sealer, before application of the priming coat.

After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

d. Ferrous Metals

Clean non-galvanized, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning, complying with SSPC recommendations.

Touch-up all shop-applied prime coats which have damaged, or bare areas, where required by other sections of these specifications. Wire-brush, solvent clean, and touch up with the same primer as the shop coat.

8. MATERIALS PREPARATION:

Mix and prepare painting materials in strict accordance with the manufacturer's directions.

Store materials (not in actual use) in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surfaces of materials into the material. Remove the film and, if necessary, strain the material before using.

9. APPLICATION:

"Exposed surfaces" shall mean areas visible when permanent of built-in fixtures, grilles, etc., area in place in areas scheduled to be painted.

Apply paint by brush, roller, or spray in accordance with the manufacturer's directions. Spray paint uniformly with suitable equipment.

The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.

Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.

a. Prime Coats

Before application of finish coats, apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn through or other defects due to insufficient sealing.

b. Mechanical Applications

Apply each roller coat to provide the equivalent hiding as brush-applied coats. Use spray application (generally) on wire mesh and similar surfaces where hand brush work would be inferior.

Wherever spray applications are used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of two (2) coats in one pass.

c. Completed Work

Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise indicated. Sand lightly between each succeeding enamel or varnish coat.

10. SUBMITTALS

a. Manufacturer's Data

1. Submit two (2) copies of manufacturer's specifications, including paint label analysis and application instructions for each material specified.

2. List each material and cross reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification. No painting work shall be done until this schedule has been finally approved.

b. Samples

1. On 12" x 12" hardboard, provide two (2) samples of each color and material, with texture to simulate actual conditions. Resubmit each sample as requested until required sheen, color, and texture is achieved.

2. On actual wood surfaces, provide two (2), 4" x 8" samples of each finish as required. Label and identify each as to location and application.

11. SURFACES TO BE PAINTED

The exact locations and limits of the surfaces requiring the various types of finishes shall be as established in the Color Schedule. The paint required for the various types of surfaces shall be as follows:

a. Interior concrete, masonry, or plastered surfaces, except were indicated to receive and enamel finish: Two (2) coats exterior concrete and masonry paint.

b. Interior concrete, masonry, or plastered surfaces, indicated to received enamel finish:

First coat – enamel under coater as recommended by manufacturer

Second and third coats – Semi-gloss enamel

c. Interior woodwork (enamel finish):

First coat – enamel under coater as recommended by the manufacturer

Second and third coats – Semi-gloss enamel

d. Interior woodwork (natural finish):

First coat – Stain if required

Second coat – Filler tinted to match stain if required by species of wood

Third and fourth coats – Semi-gloss varnish

e. Miscellaneous metal items which are specified under other sections to receive finishes as specified under this section or for which finishes are not specified under other sections:

First coat – shop primed; or one (1) coat of primer for galvanized or non-galvanized metal as the case may be

Second and third coats – gloss enamel

f. Wainscots indicated to receive polyurethane finish: Two (2) coats polyurethane paint

12. <u>GUARANTEE</u>:

a. The Contractor shall perform all items of paint work included under this Contract as specified on this section and/ or as recommended by manufacturer's paint products, and shall, without additional charges, replace any paint work or paint products/materials which develop defects, except because of vandalism or acts of God, within five (5) years from the date of final certificate of approval issued by the Public Buildings Authority (PBA).

b. The Contractor shall also be responsible for any or all damages resulting from inadequate surface preparation, improper application procedures or any other work performed without PBA or manufacturer's representative approval. In addition, the Contractor shall, without additional charges, repair all injuries to existing work caused by such conditions to the satisfaction of the PBA.

c. The Contractor shall submit to the PBA an official certification forms by paint products' manufacturer (to be acquired and applied on project's interior/exterior exposed surfaces included on contract) which guarantee that such products are free of defects occur due to faulty manufacture for a period of five (5) years from the date of final certificate of approval issued by the PBA. Also, the manufacturer shall guarantee that they will provide, without additional charges, all paint products, or materials necessary to replace all defective ones during such period.

WHITEBOARDS

(*Pizarra Blanca Para Marcadores*)

a. Whiteboards:

Whiteboards shall be of the composition type, four feet (4') width x eight feet (8') long, having the base made of temper treated ¼" thick hardboard. Panels are tempered on both sides resulting in hardboard impervious to moisture and warping. This panel shall comply with applicable Federal Specifications for similar kind of product.

b. Board Frame & Marker-Trough:

One (1) inch faced heavy-duty wrap-around aluminum frame is affixed to the board, rounded at the corner for maximum strength and safety. A heavy gauge etched marker-trough is provided the full width of the whiteboard. All trim and marker-trough are neat extruded aluminum, etched and anodized with a satin finish.

c. Trim and Accessories:

Fabricate frames and trim of not less than 0.062" thick aluminum alloy, rectangular (four feet (4') long x eight feet (8') width), to suit type of installation. Provide straight, single-length units wherever possible and keep joints to a minimum trim, accessories and fasteners with satin anodized finish AA-M31A31.

d. Fabrication & Assembly:

Provide factory-built whiteboard units. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to the Public Buildings Authority (PBA).

SECTION 10161

LAMINATED PLASTIC TOILET PARTITIONS AND URINAL SCREENS

1. RELATED DOCUMENTS

   The general provisions of the contract, including General and Special Conditions apply to the work specified in this section.

2. DESCRIPTION OF WORK

   The extent of the toilet partition work is shown on the drawings.

3. QUALITY ASSURANCE

   Field Measurements

   Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work.

   Shop Assembly

   Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for transportation and handling limitations. Clearly mark units for reassembly and coordinated installation.

4. SUBMITTALS

   Manufacturer's Data

   Submit 2 copies of catalog cuts of hardware anchors, fastenings and other data as required.

   Shop Drawings

   Submit for approval of PBA shop drawings for the fabrication and erection of toilet partition assemblies. Show all anchorage and accessory items, and finish.

   Samples

   Submit sample of hardware and accessories for approval. Submit 3 samples 6" x 6" of laminated plastic.

5. MATERIALS

Laminated Plastic

NEMA Standard LD-1, minimum 1/16" thick.

Contact Cement

As recommended by laminated plastic manufacturer.

Hardware and Accessories

See details on drawings. All bolts and screws shall be Monel bronze or chromium plated brass with theft – resistant (one-way) type heads and nuts.

Plywood

1" thick Douglas fir, Ext. – DFPA-A-A, immersion treated

6. FABRICATION

Provide doors, panels, screens and pilaster fabricated for the partition system in accordance with details shown on drawings and this specifications. Use one-piece laminated plastic with no splices or joints. Cover all edges with laminated plastic.

7. INSTALLATION

Install partitions rigid, straight, plumb and level, with the panels laid out as shown. Secure panels to supporting walls with not less than 3 angles, attached near top and bottom and at mid height at each face of the panel. Secure pilasters to the floor with ¼" x 2" bolts and expansion shield. Fasten the overhead brace to each pilaster with 2 bolts. Set tops of doors parallel with the overhead brace when doors are in the closed position.

Adjust and lubricate hardware for proper operation after installation. Set hinges on out-swing doors to return to the fully-closed position.

Wall-mounted Screens

Attach in the same way as panels. Set units so as to provide full support and to resist lateral impact.

Protection, Cleaning and Final Adjustments

Protect units during delivery, storage, and after erection so that there will be no indication of use or damage at the time of acceptance. Replace damaged work as directed.

Perform all final adjustments to door hardware of the partition assembly just prior to final inspection. Clean exposed surfaces of partitions, hardware, fittings and accessories.

END OF SECTION 10161

SECTION 10522

EXTINGUISHERS AND CABINETS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of fire extinguishers and cabinets is indicated on architectural drawings.

B. Definition: "Fire extinguishers" as used in this section refers to units which can be hand-carried as opposed to those which are equipped with wheels or to fixed *fire* extinguishing systems.

C. Types of products required include:

1. Fire extinguishers.
2. Fire extinguisher cabinets.
3. Mounting brackets

D. Fixed fire protection systems are specified in Section 15310.

1.3 QUALITY ASSURANCE:

A. Single Source Responsibility: Obtain products in this section form one manufacturer.

B. Coordination: Verify that fire extinguisher cabinets are sized o accommodate fire extinguishers of type and capacity specified herein.

C. UL-Listed Products: Provide new portable fire extinguishers which are UL listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher specified herein.

1.4 SUBMITTALS:

A. Product Data: Submit product data for each type of product included in this section. For fire extinguisher cabinets include roughing-in dimensions and details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, and panel style and materials.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. J.L. Industries
2. *Larsen's* Mfg. Co.
3. Johnson-Lee, Division of W.F. Lee Corp.
4. *Muckle* Manufacturing, Division of *Technico*, Inc.
5. *Watrous*, Inc.

2.2 FIRE EXTINGUISHERS:

A. General: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard which comply with requirements of governing authorities.

B. Abbreviations indicated below to identify extinguisher types related to UL classification and rating system and not, necessarily to type and amount of extinguishing material contained in extinguisher.

C. Carbon Dioxide Type: UL-rated 5-B:C, 5 lb. nominal capacity, in manufacturer's standard enameled metal container for Class B and Class C fires.

D. Carbon Dioxide Type: UL-rated 10-B:C, 10 lb nominal capacity, in manufacturer's standard enameled metal container, for Class B and Class C fires.

E. Multi-Purpose Dry Chemical Type: UL-rated 2A:10B:C, 5 lb. nominal capacity, in enameled steel container, for Class at Class B and Class C fires.

2.3 MOUNTING BRACKETS:

A. Provide manufacturer's standard brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher specified herein, in manufacturer's standard plated finish.

1. Provide brackets for extinguishers not located in cabinets.

2.4 FIRE EXTINGUISHER CABINETS:

A. General: Provide fire extinguisher cabinets where indicated on architectural drawings, or suitable size for housing fire extinguishers, of types and capacities indicated.

B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suite cabinet type, trim.

Painted Finish: Apply painted fin concealed surfaces of cabinet components except other than a painted finish is indicated.

1. Color: Provide colors as selected by Architect manufacturer's standard colors.

2. Preparation: Clean surfaces of dirt, grease, and rust or mill scale.

3. Baked Enamel Finish: Immediately after clean pretreatment, apply cabinet manufacturer's standard enamel finish system to the following surfaces:

   a. Interior of cabinet.
   b. Stainless Steel Finish: AISI No. 4 polished finish, with paper masking to protect finish.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Install items included in this section in locations mounting heights indicated, or if not indicated, at height to comply with applicable regulations of government authorities.

1. Prepare recesses in walls for fire extinguisher cabinet, as required by type, size and style of cabinet and in accordance with manufacturer's instructions.

2. Securely fasten mounting brackets and fire extinguishers cabinets to structure, square and plumb, to comply manufacturer's instructions.

END OF SECTION 10522

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Toilet, bath, shower and washroom accessories.

B. Grab bars.

C. Attachment hardware.

1.2 RELATED SECTIONS

A. Section 09300 - Tile: Ceramic accessories.

1.3 REFERENCES

A. ANSI A117.1 - Safety Standards for the Handicapped.

B. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI A117.1 and ADA code for access for the handicapped.

B. Accessories which conform to U.S. Federal Specifications following is a list of current Federal Specifications for Soap Dispenser, mirrors, washrooms accessories and wall urns and other accessories models which shall be meet or exceed performance criteria established by each Specifications. Selections from this guide should be made by consulting the reference Federal Specification that describes each item listed.

1. Soap Dispensers - Federal Specifications, FF - D - 00396 G (GSA - FSS), February 11, 1972 and prior editions, Soap Dispensers, Type I

2. Mirrors: Federal Specifications, DD - M 00411b (GSA-GSS), April 5, 1968 & Amendment - 1, April 7, 1970, mirrors - class 2, style E metal frame, stainless steel - grade 1 type 304 stainless steel - grade 1 type 304 stainless steel.
3. Wash room accessories : Federal Specifications, WW-P-541/8A (GSA - FSS), October 12, 1971 & Amendment - 1, June 17, 1974, Plumbing Fixtures (Accessories, land use).
    a. Type 1, class I, dispenser toilet tissue mounting R - Recessed style K single roller mounted.
    b. Type 1, class I, dispensers toilet tissue mounting P - Partitions mounted.
4. Federal Specification, WW-P-541b, interim amendment - 6, November 5, 1963, Plumbing Fixtures, land use.
    a. Type 541 : Tumber & toothbrush holder.
    b. Type 452 : Turin Robe Hook
    c. Type 457 : Toilet Paper Holder, Recessed
    d. Type 458 : Grab bar vertical
    e. Type 460 : Soap dish & bar, surfaced mounted
    f. Type 461 : Medicine cabinet, Recessed
5. Federal Specification, WW-P-541b, September 20, 1954, Plumbing fixtures, land use.
    a. Type 416 : Tumbler & tooth brush holder
    b. Type 421 : Double Coat Hook
    c. Type 431 & 431m : metal towel bar
    d. Type I : Class 3, dispensers, paper towel mounting, R -Recessed- Kind e.
    e. Type II : Waste Receptacle mounting R - Recessed.
    f. Type III : Class 2, Medicine cabinets swinging door, mounting R - Recessed
    g. Type IV : Class 1, towel bars surface mounted, concealed.
    h. Type IV : Class 3, Soap dish & bar surfaced mounted, concealed.
    i. Type IV : Class 3, Soap dish & bar surfaced mounted
    j. Type VI : Class 4, Holders, Toothbrush & tumbler surfaced mounted
    k. Type VI : Class 2, Holders Soap Recessed

1.6 PRODUCT, DELIVERY, STORAGE AND HANDLING

A. Delivery items in manufacturer's original unopened protective packing.

B. Store material in original protective packaging to prevent soiling, physical damage, or wetting.

C. Handle so as to prevent damage to finished surfaces.

D. Protection
1. Maintain protective covers on all units until installation is complete.
2. Remove protective covers at final clean-up of installation.
3. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

E. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner at no additional cost.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on product data.

1.8 COORDINATION

A. Coordinate work under provisions of Section 01300.

B. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bobrick Washroom Equipment Inc.

B. Other acceptable manufacturers offering equivalent products.
1. Bradley Plumbing Fixtures.
2. American Dispenser Co., Inc.

2.2 MATERIALS

A. Stainless Steel Sheet: ASTM A167, Type 304.

B. Tubing: ASTM A269, stainless steel.

C. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, and Security type.

D. Expansion Shields: Fiber, lead, or rudder as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

A. Weld and grind joints of fabricated components, smooth.

B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.

C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1-1/2 inches (39 mm) clear of wall surface. Knurl grip surfaces.

D. Shop assemble components and package complete with anchors and fittings.

E. Provide steel anchor plates, adapters, and anchor components for installation.

F. Anchors and Fasteners

Provide anchors and fasteners capable of developing a retaining force commensurate with the strength of the accessory to be mounted, and well suited for use with the supporting construction. Where exposed use fasteners with finish matching the accessory.

G. Finish: All accessory items shall be stainless steel with satin finish.

H. Design is based on use of products manufactured by several Manufacturer's and catalog numbers of that manufacturer are given as an indication of the quality and style required. Equal products by other manufacturer's approved by the Owner will be acceptable in accordance with the General Conditions and Section 01300.

2.4 KEYING

A. Supply 2 keys for each accessory to Owner.

2.5 FINISHES

A. Stainless Steel: No. 4 satin luster finish.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01400.

B. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by the manufacturer.

C. Verify exact location of accessories for installation.

D. Check opening scheduled to receive recessed units for correct dimensions, plumpness of blocking or frames, preparation that would affect installation of accessories.

E. Check areas to receive surface mounted units for conditions that affect installation of accessories.

F. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

G. Do not begin installation of washroom accessories until openings and surfaces are acceptable.

H. Examine the area and conditions under which work of this section will be installed. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

C. Throughout construction of substrate surfaces, use all means necessary to ensure proper and adequate provision for concealed support devices, and for finished openings, to receive the work of this Section.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Drill holes to correct size and application that is concealed by item, with 1/4 in. tolerance.

D. Mount recessed accessories into wall openings with screws through cabinet side into wood blocking, or sheet metal screws into metal frames or expansion bolts for concrete and blocks.

E. Mount surface mounted accessories to back up with toggle bolts, plumb and align.

F. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Owner. Anchoring all components plumb, level, square, and firmly into position for long life under hard use.

3.4 Adjust and clean

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surfaces.

C. Deliver keys and instruction sheets to Owner.

3.5 SCHEDULE

Bathroom accessories shall be furnished and installed in accordance with the Equipment and Accessories Schedule shown on Drawings and the following list.

A. Dwelling units and handicapped dwelling units.
   1. Medicine Cabinet
      a. 16" x 22" Recess mounted with two plastic shelves medicine cabinet.
      b. Polystyrene body material
      c. Reversible
      d. Stainless steel 304 door frame and back door
      e. ¼ float plate mirror
      f. Piano hinge, tire 304 stainless steel (17 long)
      g. Magnetic catch
      h. Type III, class 2 designation

i. Five year guarantee

2. Tooth Brush Holder (See specification 09300)
3. Soap Holder and Grab Bar (See Specification 09300)
4. Curtain Rod
    a. Rod of 18 gauge type 304 satin finish stainless steel
    b. 1¼" O.D.
    c. Flanges of 20 gauge type 305 satin finish stainless steel, 3 1/8" O.D.
    d. Escutcheons snap over flanges to provide permanent vandal - resistant mounting
    e. Concealed mounting
5. Toilet Paper Holders (See Specification 09300)
6. Towel Bar
7. Double Robe Hook
    a. Surface mounted
    b. Project 2" from wall
    c. Satin finish stainless steel
    d. Type 304 stainless steel heavy gauge 18 No. 4
    e. Vandal - resistant escutcheons

B. Handicapped Dwelling Units
1. Grab bars
    a. 1 1/4" dia, heavy duty
    b. Concealed mounting
    c. Heavy duty 18 gauge 304 stainless steel tubing
    d. Welded 11 - gauge 304 stainless steel mounting flanges
    e. Sustain loads over 1300 pounds (Designed and test), double FHA, VA, HEW requirements
    f. Satin finish
    g. For grab bar configuration, and/or length and installation of position see construction drawings.
    h. Supply
    i. Grab bar mounting kits for masonry walls and partition walls (stainless steel machine screws, cap nuts, backing plate, corrosion resistant zinc plating drop in anchors, etc.).
2. Folding Corner Shower Seat
    a. Type 304 stainless steel
    b. Satin finish
    c. 3/4 return edges
    d. Folds to vertical position when not in use

C. Administration Building
1. Toilet Paper Holders : Public Toilets
    a. Single roll toilet tissue dispensers
    b. Theft resistant service
    c. 1/8" thick anodized aluminum
    d. One piece construction with hinged arm and snap lock.
    e. Tumbler lock secures spindles in place
    f. Surface mounted and hold one standard toilet tissue roll
    g. 6 1/2" W x 2" H x 4 7/8" D. Overall dimensions
2. Mirror
    a. Fixed angle tilt mirror w/shelf

b. Type 304 stainless steel polished to No. 8 architectural bright finish
c. 16" w x 24 h @ 40" A.F.F

3. Paper towel dispenser
   a. Surface mounted
   b. 400 multi - fold or 300 c - fold towels capacity
   c. Type 304 stainless steel
   d. Satin finish
   e. Welded construction - seamless
   f. Corners and burr - free edges
   g. Non flexing double panel construction door with full length piano hinges
   h. Tumber locks keyed alike to others units
   i. Rough wall opening 15 5/8" h x 11 1/4" w x 4" d
   j. Top of wall openings 51" from finish floor

4. Liquid Soap Dispenser
   a. Horizontal surface mounted
   b. Push in type value of chrome plated brass with neoprene "O" ring packings
   c. Secured with lock
   d. 40 oz. liquid soap capacity
   e. Heavy gauge type 304 stainless steel
   f. Satin finish
   g. Unit Measures 8 3/16" W x 4 7/8" H x 2 7/8" D Valve Projects 2 1/2"
   h. Top of wall opening in relation to lavatory mounting height

5. Waste Receptacle
   a. Surface mounted
   b. 16.5 gal. capacity
   c. Removable leak proof heavy duty vinyl liner
   d. Hinge Cover
   e. Type 304 stainless steel
   f. Satin finish exposed surfaces
   g. Welded construction with seamless corners
   h. Burr free edges
   i. Unit measures 18" W x 23" H x 9" D
   j. Top of wall opening 45" from finished floor

6. Grab Bars
   a. Horizontal 1 1/4" (32mm) Dia. Stainless Steel
   b. Concealed Mounting
   c. Satin Finish
   d. 36" (914 mm) and 42" (1067 mm) lenghts

2.3 Washrooms accessories

A. Dwelling Units
   1. Medicine Cabinet
   2. Tooth Brush Holder
   3. Soap Holder and Grab Bar
   4. Curtain Rod
   5. Toilet Paper Holder
   6. Towel Bar
   7. Double Robe Hook

B. Handicapped Dwelling Units
   1. Medicine Cabinet

2. Tooth Brush Holder
3. Soap Holder and Grab Bar
4. Curtain Rod
5. Toilet Paper Holder
6. Towel Bar
7. Double Robe Hook
8. Grab Bar : 84" Length @ 36" AFF - Horizontal
9. Grab Bar : 24" Length @ 36" AFF - Horizontal
10. Grab Bar : 60" Length @ 32" AFF - Horizontal
11. Grab Bar : 24" Length @ 40" AFF - Vertical
12. Grab Bar : 30" Length @ 33" AFF - Horizontal and Vertical
13. Grab Bar : 24" Length @ 40" AFF - Vertical
14. Grab Bar : 33" Length @ 36" AFF - Horizontal
15. Grab Bar : 24" Length @ 36" AFF - Horizontal
16. Folding Corner Shower Seat
17. All grab bars shall be 1 1/4" (32 mm) dia., 18 ga. and stainless steel
18. All Grab Bars, will be concealed Mounting Kits on Vandal Proof Screws
19. All grab bars shall be safely grip finish

C. Administration Building Toilets
1. Mirrors (16" x 24")
2. Paper Towel Dispenser
3. Liquid Soap Dispenser
4. Waste Receptacle
5. Sanitary Paper Holders
6. 48 length Handicapped Grab Bar with center post; only one end return
7. Grab Bar 36" and 42" length

END OF SECTION

SECTION 15000

General Specifications for HVAC system Cleaning
(Include special provisions to insulation upgrade)

Part 1 -- Special Provisions

1.01 Qualification of the HVAC System Cleaning Contractor

(A) Membership:

1. The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.

(B) Certification:

1. The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

(C) Supervisor Qualifications:

1. A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.

(D) Experience:

1. The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the **owner**. Bids shall only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

(E) Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.

1. The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors should comply with applicable national safety codes and standards.
2. The contractor shall be responsible for the safety equipment of employees.
3. The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all

other site documentation requirements of applicable OSHA programs and this specification

4. Contractor shall submit to the PBA representative all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.
5. The contractor shall submit the name and experience of the safety manager of the company or present project for PBA approval.
6. The contractor shall submit the name and experience of the Environmental Manager of the company or present project for PBA approval.
7. The contractor shall submit a safety and environmental plan to PBA representative for approval before start any kind of cleaning activity.

(F) Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

1.02 Standards

(A) NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).

1. All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
2. NADCA Standards must be followed with no modifications or deviations being allowed.

1.03 Documents

(A) Mechanical Drawings: Public Buildings Authority (PBA) shall provide the HVAC system cleaning contractor with one copy of the following documents:

1. Project drawings and specifications.
2. Approved construction revisions pertaining to the HVAC system.
3. Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

(B) It is not permitted to contractor to photocopy any part of mechanical drawings, specifications or IAQ assessment without previous authorization of PBA.

(C) It is not permitted to contractor to move outside of building mechanical drawings, specifications or any IAQ assessment without previous authorization of PBA.

Part 2 -- HVAC System Cleaning Specifications and Requirements

2.01. Scope of Work

(A) Scope: This section defines the requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing

in accordance with items specified herein and applicable NADCA Standards.

(B) The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

(C) The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. Parts of the HVAC system include (not limited)

a. return air grilles
b. return air ducts to the air handling unit (AHU)
c. the interior surfaces of the AHU
d. mixing box
e. coil compartment
f. condensate drain pans
g. humidifiers and dehumidifiers
h. supply air ducts
i. fans
j. fan housing
k. fan blades
l. air wash systems
m. spray eliminators
n. turning vanes
o. filters
p. filter housings
q. reheat coils
r. supply diffusers
s. exhaust and ventilation components
t. make-up air systems.
u. Plenums (as design).
v. Carpets (special condition)
w. Others as indicated by Engineer.

2.02. HVAC System Component Inspections and Site Preparations

(A) HVAC System Component Inspections:

1. Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project.
2. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air handling units, a representative sample of the units should be inspected.

(B) The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented

1. Damaged system components found during the inspection shall be documented and brought to the attention of the PBA representative or Engineer.

(C) Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

(D) Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At minimum, such personnel should have an understanding of HVAC system design, and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

2.03 General HVAC System Cleaning Requirements:

(A) Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

(B) Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.

(C) Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.

1. If while cleaning process is in progress and any tenant employee or

representative of tenant is uncomfortable with any kind of odor, contractor have to stop the cleaning process until find out the odor source and correct it.

(D) Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.

(E) Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.

(F) Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.

1. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.
2. Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.
3. Closures must not significantly hinder, restrict, or alter the airflow within the system.
4. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
5. Openings must not compromise the structural integrity of the system.
6. Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.
7. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
8. Rigid fiber glass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiber glass duct system closures.
9. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the PBA representative or Engineer in project report documents.

(G) Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.

(H) Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.

(I) Air handling units, terminal units (VAV, Dual duct boxes, etc.), blowers and exhaust fans: The contractor shall insure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:

1. Clean all air handling units (AHU) internal surfaces, components and condensate collectors and drains.
2. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.
3. Clean all coils and related components, including evaporator fins.

(J) Duct Systems: Contractor shall:

1. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

2.04 Health and Safety

(A) Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.

(B) Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.

(C) Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with **EPA and Puerto Rico Environmental Quality Board requirements.**

2.05 Mechanical Cleaning Methodology

(A) Source Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility.

(B) It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements.

(C) No cleaning method, or combination of methods, shall be used which could

potentially damage components of the HVAC system or negatively alter the integrity of the system.

1. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
2. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters, including hand-held vacuums and wet-vacuums.
3. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.
4. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

(D) Methods of Cleaning Fibrous Glass Insulated Components

1. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be removed by using mechanical methods.

(E) Replaced Fibrous Glass Material

1. Replacement: As requested, Contractor must be capable of remove exposed fibrous glass insulation in air handlers and/or ductwork requiring replacement.
2. Replacement material: all replaced materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
    i. Replace fiber glass insulation with 1" thick, non compressed fiber glass insulation.
    ii. The new insulation material shall have 0.24 Btu-in/ft^2- °f.
    iii. The new insulation material shall have a noise reduction of 0.7/in thick.
    iv. The new insulation material shall have 3 lb/ft^3 or less density.
    v. The new insulation material shall have a fire rating of 25/50 (as ASTM-84 and UL 723).

vi. All insulation edges shall be encapsulated within the panel.

(F) Cleaning of coils

1. Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards).
2. Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available.
3. Coils shall be thoroughly rinsed with clean water to remove any latent residues.

(G) Biocidal Agents and Coatings:

1. Biocidal agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
2. Application of any biocidal agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris and before of installation of new insulation.
3. When used, chemical biocides and coatings shall be applied in strict accordance with manufacturer recommendations and EPA registration listing.
4. Biocidal coatings shall be applied according to manufacturer's instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application.
5. Application of any biocidal coatings shall be in strict accordance with manufacturer's minimum millage surface application rate standards for effectiveness.

2.06 Cleanliness Verification

(A) General:

1. Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.

(B) Visual Inspection: The HVAC system shall be inspected visually to ensure that no visible contaminants are present.

1. If no contaminants are evident through visual inspection, the HVAC

system shall be considered clean; however, the PBA reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.

2. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
3. NADCA vacuum test analysis should be performed by a qualified third party experienced in testing of this nature.
4. Cleanliness verification shall be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

(C) Verification of Coil Cleaning:

1. Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

2.07 Pre-existing System Damage:

(A) Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others.

2.08 Post-project Report:

(A) At the conclusion of the project, the Contractor shall provide a report to the PBA representative or Engineer indicating the following:

1. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
2. Areas of the system found to be damaged and/or in need of repair.

2.09 Applicable Standards and Publications: The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto:

(A) National Air Duct Cleaners Association (NADCA): "ACR-2002, Assessment, Cleaning & Restoration of HVAC Systems," 2001.

(B) National Air Duct Cleaners Association (NADCA): "Understanding Microbial Contamination in HVAC Systems," 1996.

(C) National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services," 2002.

(D) National Air Duct Cleaners Association (NADCA): Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems," 1997.

(E) Underwriters' Laboratories (UL): UL Standard 181.

(F) American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89, "Ventilation for Acceptable Indoor Air Quality".

(G) Environmental Protection Agency (EPA): "Building Air Quality," December 1991.

(H) Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards - Metal and Flexible," 1985.

(I) North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems," 1993.

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

A. GENERAL

1. RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract, including the General Conditions, the Supplementary General Conditions, the Special Conditions, the Supplementary Special Conditions and all Division-1 Specifications sections, apply to the Work of this Sections, and the other sections of Division 15.

2. SUMMARY

2.1 This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

2.1.1 Submittals. Coordination drawings. Record documents. Maintenance manuals. Rough-in. Mechanical installations. Cutting and patching.

2.2 Related Sections: The following sections contain requirements that relate to this section:

2.2.1 Division 15 Section "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT", for factory-installed motors, controllers, accessories, and connections.

2.2.2 Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS", for materials and methods common to the remainder of Division 15, plus general related specifications, including:

a. Access to mechanical installations.

b. Excavation for mechanical installations within the building boundaries, and from building to utilities connections.

3. SUBMITTALS

3.1 General: Follow the procedures specified in Division 1 Section "SUBMITTALS".

3.2 Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.

3.2.1 Shop Drawings – Initial Submittal: 1 additional blue- or black-line prints.

• SUBMITTALS (Cont.'):

3.2.2 Shop Drawings – Final Submittal: 1 additional blue- or black-line prints.

3.2.3 Product Data: 1 additional copy of each item.

3.2.4 Samples: 1 additional as set.

3.3 Additional copies may be required by individual sections of these Specifications.

4. COORDINATION DRAWINGS

4.1 Prepared coordination drawings in accordance with Division 1 Section "PROJECT COORDINATION", to a scale of ¼" = 1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where the space is limited for installation of access and where sequencing and coordination of the Work, including (but not necessarily limited to) the following:

4.1.1 Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:

a. Clearances for installing and maintaining insulation.

b. Clearances for servicing and maintaining equipment, including tube removal, filters removal, and space for equipment disassembly required for periodic maintenance, as recommended by equipment manufacturers.

c. Equipment connections and support details.

d. Exterior wall and foundation penetrations.

e. Fire-rated wall and floor penetrations.

f. Sizes and locations of required concrete pads and bases.

g. Valve stem movement.

4.1.2 Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

4.1.3 Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings, and their relationship to other penetrations and installations.

4.1.4 Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted items.

5. RECORD DOCUMENTS

5.1 Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSE-OUT". In addition to the requirements specified in Division 1, indicate the following installed conditions:

5.1.1 Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 15 Section "MECHANICAL IDENTIFICATION". Indicate actual inverts and horizontal locations of underground piping.

5.1.2 Equipment locations (exposed and concealed), dimensioned from prominent building lines.

5.1.3 Approved substitutions, Contracts Modifications, and actual equipment and materials installed.

5.1.4 Contract Modifications, actual equipment and materials installed.

5.2 Engaged the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 1 Section "FIELD ENGINEERING" to record and verify the locations and invert elevations or underground installations.

6. MAINTENANCE MANUALS

6.1 Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSE-OUT". In addition to the requirements specified in Division 1, include the following information for equipment items:

6.1.1 Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

6.1.2 Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

6.1.3 Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassemble; aligning and adjusting instructions.

6.1.4 Servicing instructions and lubrication charts and schedules.

7. DELIVERY, STORAGE, AND HANDLING

7.1 Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. PRODUCTS

1. NOT APPLICABLE

C. EXECUTION

1. ROUGH-IN:

1.1 Verify final locations for rough-in with field measurements and with the requirements of the actual equipment to be connected.

1.2 Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

2. MECHANICAL INSTALLATIONS

2.1 General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

2.1.1 Coordinate mechanical systems, equipment, and materials installation with other building components.

2.1.2 Verify all dimensions by field measurements.

2.1.3 Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

2.1.4 Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

2.1.5 Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

2.1.6 Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

• MECHANICAL INSTALLATIONS (Cont.'):

2.1.7 Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

2.1.8 Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirement's conflict with individual system requirements, refer conflict to the Architect.

2.1.9 Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

2.1.10 Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practicable, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

2.1.11 Install access panel or doors where are concealed behind finished surfaces. Access panels and doors where are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS".

2.1.12 Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at specified slope.

3. CUTTING AND PATCHING

3.1 General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING". In addition to the requirements specified in Division 1, the following requirements apply:

3.1.1 Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3.2 Perform cutting, fitting, and patching of mechanical equipment and materials required to:

3.2.1 Uncover Work to provide for installation of ill-timed Work.

3.2.2 Remove and replace defective Work.

• CUTTING AND PATCHING (Cont.'):

3.2.3 Remove and replace Work not conforming to requirements of the Contract Documents.

3.2.4 Remove samples of installed Work as specified for testing.

3.2.5 Install equipment and materials in existing structures.

END OF SECTION 15010

SECTION 15030

ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. GENERAL

1. RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract, including the General Conditions, the Supplementary Special Conditions and all Division-1 Specifications sections, apply to the Work of this Section, and the other sections of Division 15.

1.2 Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 16.

2. SUMMARY

2.1 This sections specifies the basic requirements for electrical components that are integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.

2.2 Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are specified within the individual equipment specification sections.

2.3 Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are scheduled on the drawings.

3. REFERENCES

3.1 NEMA Standards MG 1: Motors and Generators.

3.2 NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.

3.3 NEMA Standard 250: Enclosures for Electrical Equipment.

3.4 NEMA Standard KS 1: Enclosed Switches.

3.5 Comply with National Electrical Code (NFPA 70). (Last Edition)

4. SUBMITTALS

4.1 No separate submittal is required. Submit product data for motor, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

5. QUALITY ASSURANCE ELECT. REQUIREMENTS FOR MECH. EQUIP

5.1 Electrical components and materials shall be UL labeled.

B. PRODUCTS

1. MOTORS

1.1 The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1.1.1 Torque characteristic shall be sufficient to satisfactory accelerate the driven loads.

1.1.2 Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.

1.1.3 Two speed motors shall have two separate windings on poly-phase motors.

1.1.4 Temperature Rating: Rate for 40ºC environment with maximum 50ºC temperature rise for continuous duty at full load (Class A Insulation).

1.1.5 Starting capability: Frequency of starts as indicated by automatic control system and not less than five (5) evenly time spaced starts per hours for manually controlled motors.

1.1.6 Service Factor: 1.15 for poly-phase motors and 1.35 for single-phase motors.

1.1.7 Motor construction: NEMA Standard MG 1, general purpose, continuous duty, " Design "B" except "C" where required for high starting torque.

a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.

b. Bearings:

1) Ball or roller bearings with inner and outer shaft seals.

2) Re-greased, except permanently sealed where motor is normally inaccessible for regular maintenance.

• MOTORS (Art. 1.1.7) – Cont.'

3) Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.

4) For fractional horsepower, light duty motors, sleeve type bearings are permitted.

c. Enclosure Type:

1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.

2) Guarded drip-proof motor where exposed to contact by employees or building occupants.

3) Weather protected Type 1 for outdoor use, Type II where not housed.

d. Noise rating: "Quiet".

e. Noise rating: "Quiet", rating on motors located in occupied spaces of building.

f. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as schedule in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "Average Standard Industry Motors", in accordance with IEEE Standard 112, test method B.

g. Nameplate: Indicate the full identification of manufacturer, rating, characteristics, construction, special features and similar information.

2. STARTERS, ELECTRICAL DEVICES, AND WIRING

2.1 MOTOR STARTER CHARACTERISTIC

2.1.1 Enclosure: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have proper class and division.

2.1.2 Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and startup conditions.

2.2 MANUAL SWITCHES SHALL HAVE

2.2.1 Pilot lights and extra positions for multi-speed motors.

2.2.2 Overload protection: Melting alloy type thermal overload relays.

2.3 MAGNETIC STARTERS

2.3.1 Maintained contact push buttons and pilot lights properly arranged for single speed or multi-speed operation as indicated.

2.3.2 Trip-free thermal overload relays, each phase.

2.3.3 Interlocks, pneumatic switches and similar devices as required for coordination with control requirements or Division 15 Controls Sections. 7.1.8 Failure by the Contractor to submit shop drawings in sample time for checking, shall no claim for extension by reason of such default will be allowed.

2.3.4 Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.

2.3.5 Externally operated manual reset.

2.3.6 Under-voltage release or protection.

3. CAPACITORS

3.1 FEATURES

3.1.1 Individual unit cells all welded steel housing each capacitor internally fused non-flammable synthetic liquid impregnate craft tissue insulation aluminum foil electrodes.

3.1.2 KVAR size shall be as required to correct motor power factor to 90 percent or better and shall be installed on all motors 1 horsepower and larger, that have an uncorrected power factor of less than 85 percent at rated load.

3.2 DISCONNECT SWITCHES

3.2.1 Fusible switches: Fused, each phase; general duty; horsepower rated; non-teased quick-make, quick-break mechanism; dead front line side shield; solder-less lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the “Open” position; are quenchers; capacity and characteristics as indicated.

3.2.2 Non-fusible switches: For equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poled and voltage rating as indicated. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

C. EXECUTION (Not Applicable)

END OF SECTION OF 15030

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Mechanical demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: **CPVC and PVC** one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturer:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturer:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Ferneo, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Manufacturers:

    a. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Epco Sales, Inc.
    d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Manufacturers:

    a. Calpico, Inc.
    b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Manufacturers:

    a. Perfection Corp.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co. and d: Pipeline Seal and Insulator, Inc.

2. Sealing Elements: **EPDM** and **NBR** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: **Stainless steel.** Include two for each sealing element.
4. Connecting Bolts and Nuts: **Stainless steel** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: **Polished chrome-plated and rough brass.**

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: **Polished chrome-plated and rough brass.**

E. One-Piece, Stamped-Steel Type: With **set screw or spring clips** and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With **concealed-rivet** hinge, **set screw or spring clips**, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: **One-piece** cast-brass type with polished chrome-plated finish.
    g. Bare Piping at Ceiling Penetrations in Finished Spaces: **One-piece, stamped-steel type with concealed hinge** and set screw.
    h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with **polished chrome-plated** finish.
    i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with **concealed** hinge and **set screw or spring clips**.
    j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with [**set screw**] [**spring clips**] [**set screw or spring clips**].

1. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

   a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with [**concealed**] [**exposed-rivet**] [**concealed or exposed-rivet**] hinge and spring clips.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
   g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with **polished chrome-plated** finish.
   h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with **concealed** hinge and set screw or spring clips.
   i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
   j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
   k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. **Steel** Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
   b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section **"Painting (Professional Line Products)."**

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use [3000-psi (20.7-MPa) 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section " Cast-in-Place Concrete (Limited Applications)]."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.10 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 15050

SECTION 15060

HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
2. Division 13 Sections on fire-suppression piping for fire-suppression pipe hangers.
3. Division 15 Section "Mechanical Vibration Controls and Seismic Restraints" for vibration isolation and seismic restraint devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports".

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

C. Design seismic restraint hangers and supports for piping and equipment.

D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping support and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".

B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:

a. AAA Technology and Specialties Co., Inc.
b. B-Line Systems, Inc.
c. Carpenter & Patterson, Inc.
d. Empire Tool & Manufacturing Co., Inc.
e. Globe Pipe Hanger Products, Inc.
f. Grinnell Corp.
g. GS Metals Corp.

• Article 2.1, B.1: Pipe Hangers (Cont.'):

h. Michigan Hanger Co., Inc.
i. National Pipe Hanger Corp.
j. PHD Manufacturing, Inc.
k. PHS Industries, Inc.
l. Piping Technology & Products, Inc.

2. Channel Support Systems:

a. B-Line Systems, Inc.
b. Grinnell Corp.; Power-Strut Unit
c. GS Metals Corp.
d. Michigan Hanger Co., Inc.; O-Strut Div.
e. National Pipe Hanger Corp.
f. Thomas & Betts Corp.
g. *Unistrut* Corp.
h. *Wesanco*, Inc.

3. Thermal-Hanger Shield Inserts:

a. Carpenter & Patterson, Inc.
b. Michigan Hanger Co., Inc.
c. PHS Industries, Inc.
d. Pipe Shields, Inc.
e. *Rilco* Manufacturing Co., Inc.
f. Value Engineered Products, Inc.

4. Powder-Actuated Fastener Systems:

a. *Gunnebo* Fastening Corp.
b. Hilti, Inc.
c. ITW Ramset/Red Head
d. *Masterset* Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: for piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

• Article 2.2B (Cont.'):

2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-KPa) minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
3. Material for Cold Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
6. Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
8. For Clevis or Band Hanger: insert and shield cover lower 180 degrees of pipe.
9. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28 day compressive strength.

PART 3 – EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

• ARTICLE 3.1: HANGER AND SUPPORT APPLICATIONS (Cont.')

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type I): For suspension of non-insulated or insulated stationary pipes, NPS ½ to NPS 30 (DN15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon or Alloy-Steel, Double-bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS ¾ to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS ½ to NPS 24 (DN15 to DN600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): for suspension of pipes, NPS ½ to NPS 4 (DN15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): for suspension of non-insulated stationary pipes, NPS ¾ to NPS 8 (DN20 to DN200).
7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS ½ to NPS 8 (DN15 to DN200).
8. Adjustable Band Hangers (MSS Type 9): for suspension of non-insulated stationary pipes, NPS ½ to NPS 8 (DN15 to DN200).
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS ½ to NPS 2 (DN15 to DN50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS ⅜ to NPS 8 (DN10 to DN200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS type 12): For suspension of non-insulated stationary pipes, NPS ⅜ to NPS 8 (DN10 to DN80).
12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS ½ to NPS 30 (DN15 to DN750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange and with U-Bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-½ to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): for suspension of pipes, NPS 2-½ to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.

• ARTICLE 3.1C (Cont.'):

19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS ¾ to NPS 20 (DN20 to DN500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS ¾ to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weld-less Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installation with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): for attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.

• ARTICLE 3.1F (Cont.'):

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (675 kg).
    c. Heavy (MSS Type 33): 300 lib (1350 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-¼ inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

• ARTICLE 3.1H (Cont.'):

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange form grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricated from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

• ARTICLE 3.2: HANGER AND SUPPORT INSTALLATION (Cont.')

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," are not exceeded.

K. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span are of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS ¼ to NPS 3-½ (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0/06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    e. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

• ARTICLE 3.1K (Cont.'):

5. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal are welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

• ARTICLE 3.6: PAINTING (Cont.')

B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting".

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15081

DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes semi-rigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 7 Section "Fire-stopping" for fire-stopping materials and requirements for penetrations through fire and smoke barriers.
2. Division 15 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
3. Division 15 Section "Pipe Insulation" for insulation for piping systems.
4. Division 15 Section "Metal Ducts" for duct liner.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Removable insulation sections at access panels.
2. Application of field-applied jackets.
3. Applications at linkages for control devices.

C. Samples: For each type of insulation and field-applied jacket. Identify each Sample, describing product and intended use. Submit 12-inch (300 mm) square sections of each sample material.

1. Manufacturer's Color Charts: Show the full range of colors available for each type of field-applied finish material indicated.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include date of tests.

1.3 SUBMITTALS (Cont.'):

E. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors. Flame-spread rating of 75 or less and smoke-developed rating of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups according to the following requirements, using materials indicated for the completed Work:

1. Include the following mockups:

    a. One 10-foot (3-m) section of rectangular straight duct.
    b. One 90-degree square elbow and one 90-degree radius elbow.
    c. One branch takeoff.
    d. One transition fitting.
    e. Four support hangers.

2. Build mockups with cutaway sections to allow observation of application details for insulation materials, mastics, attachments, and jackets.
3. Build mockups in the location indicated or, if not indicated, as directed by Architect.
4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
5. Obtain Architect's approval of mockups before starting insulation application.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

   a. Certainteed Manson.
   b. *Knauf* Fiberglass GmbH.
   c. Owens-Corning Fiberglas Corp.
   d. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:

   a. *Armstrong World Industries, Inc.*
   b. *Rubatex Corp.*
   c. *Armaflex, Inc.*

3. Closed-Cell Phenolic-Foam Insulation:

   a. *Kooltherm Insulation Products, Ltd*.

4. Calcium Silicate Insulation:

   a. *Owens-Corning Fiberglas Corp.*
   b. *Pabco.*
   c. *Schuller International, Inc*.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from Kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from Kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

D. Closed-Cell Phenolic-Foam Insulation: Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.

E. Calcium Silicate Insulation: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant Kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Jacket Color: White or gray.
3. PVC Jacket Color: Custom color selected

D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209 (ASTM B 209M), and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.

1. Finish: Smooth finish.
2. Finish: Cross-crimp corrugated finish.
3. Finish: Stucco-embossed finish.
4. Finish: Factory-painted finish.
5. Moisture Barrier: 1-mil (0.025-mm) thick, heat-bonded polyethylene and Kraft paper.

2.3 FIELD-APPLIED JACKETS (Cont.'):

E. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A666, Type 304 or 316; 0.10 inch (2.5 mm) thick; and roll stock ready for shop or field cutting and forming to indicate sizes.

1. Moisture Barrier: 1 mil (0.025 mm) thick, heat-bonded polyethylene and Kraft paper.
2. Moisture Barrier: 3 mil (0.075 mm) thick, heat-bonded polyethylene and Kraft paper.
3. Jacket Bands: Stainless steel, Type 304, ¾ inch (19 mm) wide.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz. /sq. yd. (270 g/sq.mt.).

1. Tape Width: 4 inches (100 mm).

B. Bands: ¾ inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
3. Aluminum: 0.007 inch (0.18 mm) thick.
4. Brass: 0.010 inch (0.25 mm) thick.
5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

C. Wire: 0.080 inch (2.0 mm), nickel-copper alloy; 0.062 inch (1.6 mm), soft-annealed, stainless steel; or 0.062 inch (1.6 mm), soft annealed, galvanized steel.

D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

1. Welded Pin Holding Capacity: 100 pd. (45 kg.) for direct pull perpendicular to the attached surface.

E. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 pd. (45 kg) fir direct pull perpendicular to the adhered surface.

F. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions, with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

3.3 GENERAL APPLICATION REQUIREMENTS (Cont.'):

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
    c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.

4. Impale insulation over anchors and attach speed washers.
5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with ½-inch (13 mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch (150 mm) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Space anchor pins as follows:

a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not over-compress insulation during installation.

4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with ½-inch (13 mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch (150 mm) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150mm) o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to ducts and plenums as follows:

1. Follow the manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3.6 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation as follows:

1. Secure each layer of insulation to duct with stainless-steel bands at 12-inch (300 mm) intervals and tighten without deforming the insulation materials.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6 mm), soft-annealed, stainless-steel wire spaced at 12-inch (300 mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300 mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300 mm) intervals.
3. On exposed applications, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging

adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.7 CALCIUM SILICATE INSULATION APPLICATION

A. Apply insulation according to the manufacturer's written instructions and as follows:

1. Secure single layer of insulation to duct with stainless-steel bands. Tighten bands without deforming the insulation material.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6 mm), soft-annealed, stainless-steel wire. Secure outer layer with stainless-steel bands.
3. On exposed applications, without metal jacket, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.8 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50 mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch (1.6 mm) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.9 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting".

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.10 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

3.10 DUCT SYSTEM APPLICATIONS (Cont.'):

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply, return, and outside air ductwork.
2. Indoor exposed supply, return, and outside air ductwork.
3. Outdoor exposed supply and return ductwork.
4. Indoor exposed range-hood exhaust ductwork.
5. Indoor concealed range-hood exhaust ductwork.
6. Indoor exposed oven and dishwasher exhaust ductwork.
7. Indoor concealed oven and dishwasher ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation in the following systems, materials, and equipment:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
5. Flexible connectors.
6. Vibration control devices.
7. Testing agency labels and stamps.
8. Nameplates and data plates.
9. Access panels and doors in air-distribution systems.

3.11 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: round or Rectangular supply and return air ducts, concealed and exposed

1. Material: **Mineral-fiber blanket** 0.75 pounds density.
2. Thickness: **2 inches** (50 mm).
3. Number of Layers: **One**.
4. Field-Applied Jacket: **Foil and paper**.
5. Vapor Retarder Required: **Yes**.

B. Service: Round or Rectangular cold outside-air ducts, concealed and exposed.

1. Material: **Mineral-fiber blanket** 0.75 pounds density.
2. Thickness: **2 inches** (50 mm).
3. Number of Layers: **One**.
4. Field-Applied Jacket: **Foil and paper.**
5. Vapor Retarder Required: **Yes**.

C. Service: Round or Rectangular, range-hood & dishwasher exhaust ducts, concealed & exposed.

1. Material: **Calcium silicate**.
2. Thickness: **2 inches** (50 mm).
3. Number of Layers: **Two**.
4. Field-Applied Jacket: **Glass cloth**.

3.11 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE (Cont.'):

5. Vapor Retarder Required: **Yes**.

3.12 OUTDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Round or Rectangular supply, return & cold outside-air ducts.

1. Material: **Mineral-fiber board** 3 lbs, density.
2. Thickness: **2 inches** (50 mm).
3. Number of Layers: **Two**.
4. Field-Applied Jacket: Glass cloth.
5. Field-Applied Jacket: Foil and paper.
6. Field-Applied Jacket: PVC.
7. Vapor Retarder Required: **Yes**.
8. Field-Applied Jacket: Aluminum.

    a. Aluminum Thickness: 0.032 inch (0.8 mm).
    b. Corrugation Dimension: **2-½ by 5/8 inch (64 by 16 mm).**

END OF SECTION 15081

SECTION 15083

PIPE INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 2 Section “Hydronic Distribution” for loose-fill pipe insulation in underground piping outside the building.
2. Division 2 Section “Steam Distribution” for loose-fill pipe insulation in underground piping outside the building.
3. Division 7 Section “Fire-stopping” for fire-stopping materials and requirements for penetrations through fire and smoke barriers.
4. Division 15 Section “Duct Insulation” for insulation for ducts and plenums.
5. Division 15 Section “Equipment Insulation” for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
6. Division 15 Section “Hangers and Supports” for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
2. Attachment and covering of heat trace inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties and equipment connections.
6. Application of field-applied jackets.

C. Samples: For each type of insulation and jacket. Identify each Sample, describing product and intended use. Submit Samples in the following sizes:

1. Preformed Pipe Insulation Materials: 12 inches (300 mm) long by NPS 2 (DN50).
2. Sheet Form Insulation Materials: 12 inches (300 mm) square.
3. Jacket Materials: 12 inches (300 mm) long by NPS 2 (DN 50).
4. Manufacturer's Color Charts: Show the full range of colors available for each type of field-applied finish material indicated.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

E. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups according to the following requirements, using materials indicated for the completed Work:

1. Include the following mockups:

a. One 10-foot (3 m) section of NPS 2 (DN 50) straight pipe.
b. One 90-degree elbow.
c. One tee fitting.
d. One NPS 2 (DN50) valve.
e. Four support hangers, including hanger shield and insert.
f. One strainer with removable portion of insulation.
g. One reducer.

1.4 QUALITY ASSURANCE (Cont.'):

2. Build mockups with cutaway sections to allow observation of application details for insulation materials, mastics, attachments, and jackets.
3. Build mockups in the location indicated or, if not indicted, as directed by Architect.
4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
5. Obtain Architect's approval of mockups before starting insulation application.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports".

B. Coordinate clearance requirements with piping Installer for insulation application.

C. Coordinate installation and testing of steam or electric heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

    a. *CertainTeed Manson.*
    b. *Knouf Fiber Glass GmbH.*
    c. *Owens-Corning Fiberglass Corp.*
    d. *Schuller International, Inc*.

2. Cellular-Glass Insulation:

    a. *Pittsburgh-Corning Corp*.

3. Flexible Elastomeric Thermal Insulation:

    a. *Armstrong World Industries, Inc.*
    b. *Rubatex Corp*.

4. Polyolefin Insulation:

    a. *Armstrong World Industries, Inc.*
    b. *IMCOA*.

5. Closed-Cell Phenolic-Foam Insulation:

    a. *Kooltherm Insulation Products, Ltd*.

6. Calcium Silicate Insulation:

    a. *Owens-Corning Fiberglass Corp.*
    b. *Pabco.*
    c. *Schuller International, Inc*.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all purpose, vapor-retarder jacket.
2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

    a. Class 1, Grade A for bonding glass cloth and tape to un-faced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to un-faced glass-fiber insulation.
    b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

4. Vapor-Retarder Mastics: Fire-and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.

2.2 INSULATION MATERIALS (Cont.'):

7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

B. Cellular- Glass Insulation: Inorganic, foamed or cellulosed glass, annealed, rigid, hermetically sealed cells, incombustible.

1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class 1.
2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.

C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

D. Polyolefin Insulation: Unicellular polyethylene thermal plastic, preformed pipe insulation. Comply with ASTM C 534, Type I, except for density.

1. Adhesive: As recommended by insulation material manufacturer.

E. Closed-Cell Phenolic-Foam Insulation: Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade I.

F. Calcium Silicate Insulation: Preformed pipe sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C533, Type I.

G. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant Kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Jacket Color: White or gray.
3. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.

D. Heavy PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil (0.75-mm) thick, high-impact, ultraviolet-resistant PVC.

2.3 FIELD-APPLIED JACKETS (Cont.'):

1. Shapes: 45 and 90 degree, short and long radius elbows, tees, valves, flanges, reducers, end caps, soil pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

E. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil (0.5-mm) thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45 and 90 degree, short and long radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

F. Aluminum Jacket: Factory cut and rolled to indicate sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

G. Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicate sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

1. Finish and Thickness: Smooth finish, 0.010 inch (0.25 mm) thick.
2. Moisture Barrier: 1-mil-(0.025 mm) thick, heat-bonded polyethylene and Kraft paper.
3. Elbows: Preformed, 45 and 90 degree, short and long-radius elbows; same material, finish, and thickness as jacket.

H. Stainless-Steel Jacket: ASTM A666, Type 304 or 316; 0.10 inch (2.5 mm) thick; and factory cut and rolled to indicate sizes.

I. Stainless-Steel Jacket: ASTM A666, Type 304 or 316; 0.10 inch (2.5 mm) thick; and roll stock ready for shop or field cutting and forming to indicate sizes.

1. Moisture Barrier: 3-mil (0.075 mm) thick, heat-bonded polyethylene and Kraft paper.
2. Elbows: Gore type, for 45 and 90 degree elbows in same material, finish, and thickness as jacket.
3. Jacket Bands: Stainless steel, Type 304, ¾ inch (19 mm) wide.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz. /sq. yd. (270 g/sq.mt.).

1. Tape Width: 4 inches (100 mm).

B. Bands: ¾ inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A666, Type 304; 0.020 inch (0.5 mm) thick.
2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
3. Aluminum: 0.007 inch (0.18 mm) thick.

4. Brass: 0.010 inch (0.25 mm) thick.
5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

C. Wire: 0.080-inch (2.0 mm), nickel-copper alloy; 0.062 inch (1.6 mm), soft-annealed, stainless steel; or 0.062 inch (1.6 mm), soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

3.3 GENERAL APPLICATION REQUIREMENTS (Cont.'):

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch (75 mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-½ inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

3.3 GENERAL APPLICATION REQUIREMENTS (Cont.'):

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior application tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Fire-stopping and fire-resistive joint sealers are specified in Division 7 Section "Fire-stopping".

T. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6m) to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION (Cont.'):

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve size where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 CELLULAR-GLASS INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.

3.5 CELLULAR-GLASS INSULATION APPLICATION (Cont.'):

3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply pre-molded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.6 FLEXIBLE ELASTOMERIC THERMAL, INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.7 POLYOLEFIN INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. For split tubes, seal longitudinal seams and end joints with manufacturer's recommended adhesive.
3. For self-adhesive insulation, staple longitudinal seams after sealing. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.

3.7 POLYOLEFIN INSULATION APPLICATION (Cont.'):

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of polyolefin pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.8 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

3.8 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION (Cont.'):

C. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded sections of insulation are not available, apply mitered segments of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.9 CALCIUM SILICATE INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with stainless-steel bands at 12 inch (300 mm) intervals and tighten without deforming insulation materials.
2. Apply two layer insulation with joints tightly-butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062 inch (1.6 mm), soft-annealed, stainless steel wire spaced at 12 inch (300 mm) intervals. Secure outer layer with stainless-steel bands at 12 inch (300 mm) intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-settings cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.9 CALCIUM SILICATE INSULATION APPLICATION (Cont.'):

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
4. Finish flange insulation the same as pipe insulation.

C. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded sections of insulation are not available, apply mitered sections of calcium silicate insulation. Secure insulation materials with stainless-steel wire.
3. Finish insulation of fittings the same as pipe insulation.

D. Apply insulation to valves and specialties as follows:

1. Apply mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation the same as pipe insulation.

3.10 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062 inch (1.6 mm) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joints strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-½ inch (40 mm) laps at longitudinal seams and 3 inch (75 mm) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

3.10 FIELD-APPLIED JACKET APPLICATION (Cont.'):

C. Apply PVC jacket where indicated, with 1 inch (25 mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

D. Apply metal jacket where indicated, with 2 inch (50 mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.11 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass cloth jacket as specified in Division 9 Section "Painting".

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.12 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.
7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.13 FIELD QUALITY CONTROL

A. Inspection: Owner will engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements.

B. Inspection: Engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements.

C. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

1. Inspect fittings and valves randomly selected by Architect.
2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.

D. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

E. Reinstall insulation and covers on fitting s and valves uncovered for inspection according to these Specifications.

3.14 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.15 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and recirculated hot water.

1. Operating Temperature: 60 to 140 degrees F (15 to 60 degrees C).
2. Insulation Material: **Flexible elastomeric closed cell phenolic foam**.
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Copper Pipe, ½" to 2½": 1".
    b. Copper Pipe, 3" and Up: 1½".

4. Field-Applied Jacket: **None**.
5. Vapor Retarder Required: **No**.
6. Finish: **None**.

B. Service: Domestic chilled water.

1. Operating Temperature: 35 to 60 degrees F (2 to 15 degrees g C).
2. Insulation Material: **Flexible elastomeric closed-cell phenolic foam**.
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Copper Pipe, ½" to 2½": 1 INCH.
    b. Copper Pipe, 3" and Up: 1½ INCHES.

4. Field-Applied Jacket: **Aluminum**.
5. Vapor Retarder Required: **Yes**.
6. Finish: **None**.

C. Service: Condensate drain piping.

1. Operating Temperature: 35 to 75 degrees F (2 to 24 degrees C).
2. Insulation Material: **Flexible elastomeric**.
3. Insulation Thickness: **1 inch**.
4. Field-Applied Jacket: **None**.
5. Vapor Retarder Required: **Yes**.
6. Finish: **None**.

D. Service: Chilled-water supply and return.

1. Operating Temperature: 35 to 75 degrees F (2 to 24 degrees C).
2. Insulation Material: **Flexible elastomeric Closed-cell phenolic foam.**
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Black Steel Pipe: **½" to 2½": 1 INCH.**
    b. Black Steel Pipe: **3" and Up: 1½ INCHES.**

4. Field-Applied Jacket: **Aluminum**.
5. Vapor Retarder Required: **Yes**.
6. Finish: **None**.

E. Service: Refrigerant suction and hot-gas piping.

1. Operating Temperature: 35 to 50 degrees F (2 to 10 degrees C).
2. Insulation Material: **Flexible elastomeric Closed-cell phenolic foam**.
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Copper Pipe, ½" and Up: 1 INCH

4. Field-Applied Jacket: **Aluminum**.
5. Vapor Retarder Required: **Yes**.
6. Finish: **No**.

F. Service: Heating hot-water supply and return.

1. Operating Temperature: 100 to 200 degrees F (38 to 93 degrees C).
2. Insulation Material: **Cellular glass, with jacket**.
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Black Steel and/or Copper Pipe, ½" to 2½": **1½ INCHES**
    b. Black Steel and/or Copper Pipe, 3" and Up: **2 INCHES**

4. Field-Applied Jacket: **Aluminum**.
5. Vapor Retarder Required: **No**.
6. Finish: **None**.

3.16 EXTERIOR INSULATION APPLICATION SCHEDULE

A. This application schedule is for aboveground insulation outside the building. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.

B. Service: Refrigerant suction.

1. Operating Temperature: 35 to 50 degrees F (2 to 10 degrees C).
2. Insulation Material: **Flexible elastomeric Closed-cell phenolic foam**, such as *Arma-Flex*.
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Copper Pipe, ½" and Up: **1 INCH**.

4. Field-Applied Jacket: **Aluminum None**.
5. Vapor Retarder Required: **Yes**.
6. Finish: **None**.

C. Service: Chilled-water supply and return.

1. Operating Temperature: 35 to 75 degrees F (2 to 24 degrees C).
2. Insulation Material: **Flexible elastomeric Closed-cell phenolic foam**.
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Black Steel and/or Copper Pipe, ½" to 2½": **1 INCH**.
    b. Black Steel and/or Copper Pipe, 3" and Up: **1½ INCHES**.

4. Field-Applied Jacket: **Aluminum**.
5. Vapor Retarder Required: **Yes**.
6. Finish: **None**.

D. Service: Heating hot-water supply and return.

1. Operating Temperature: 100 to 200 degrees F (38 to 104 degrees C).
2. Insulation Material: **Flexible elastomeric Closed-cell phenolic foam**.
3. Insulation Thickness: Apply the following insulation thicknesses:

    a. Copper Pipe, ½" to 2½: **1 INCH**.
    b. Copper Pipe, 3" and Up: **1½ INCHES**.

4. Field-Applied Jacket: **Aluminum**.
5. Vapor Retarder Required: **No**.
6. Finish: **None**.

END OF SECTION 15083

SECTION 15110

VALVES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following general-duty valves:

1. Bronze angle valves.
2. Cast-iron angle valves.
3. Copper-alloy ball valves.
4. Ferrous-alloy ball valves.
5. Ferrous-alloy butterfly valves.
6. High-pressure butterfly valves.
7. Bronze check valves.
8. Gray-iron swing check valves.
9. Ferrous-alloy wafer check valves.
10. Spring-loaded, lift-disc check valves.
11. Bronze gate valves.
12. Cast-iron gate valves.
13. Bronze globe valves.
14. Cast-iron globe valves.
15. Cast-iron plug valves.
16. Resilient-seated, cast-iron, eccentric plug valves.
17. Chain-wheel actuators.

B. Related Sections include the following:

1. Division 2 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 13 fire-suppression piping and fire pump Sections for fire-protection valves.
3. Division 15 Section “Mechanical Identification” for valve tags and charts.
4. Division 15 Section “HVAC Instrumentation and Controls” for control valves and actuators.
5. Division 15 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.

1.3 DEFINITIONS (Cont.'):

2. EPDM: Ethylene-propylene-dyne ter-polymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Poly-tetra-fluoro-ethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetra-fluoro-ethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot and cold-water, **sanitary waste, and storm drainage** piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand-wheels or stems as lifting or rigging points.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-½ (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chain-wheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
3. Hand-wheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.

• 2.2 VALVES, GENERAL (Cont.'):

2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Bronze Angle Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; *Stockham* Div.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corp.

2. Type 2, Bronze Angle Valves with Nonmetallic Disc:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; *Stockham* Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. NIBCO INC.
i. Powell, WM. Co.

3. Type 3, Bronze Angle Valves with Metal Disc and Renewable Seat:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; *Stockham* Div.
e. Grinnell Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.

C. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy hand-wheel.

D. Type 1, Class 125, 150 & 200 Bronze Angle Valves: Bronze body with bronze disc **and union-ring bonnet.**

• 2.3 BRONZE ANGLE VALVES (Cont.'):

E. Type 2, Class 125, 150 & 200 Bronze Angle Valves: Bronze body with **PTFE** or **TFE** disc **and union-ring bonnet.**

F. Type 3, Class 125, 150 & 200 Bronze Angle Valves: Bronze body with bronze disc and renewable seat. **Include union-ring bonnet**.

2.4 CAST-IRON ANGLE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type II, Cast-Iron Angle Valves with Metal Seats:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; *Stockham* Div.
d. NIBCO INC.

C. Cast-Iron Angle Valves, General: MSS SP-85, Type II.

D. Class 125, Cast-Iron Angle Valves: Bronze mounted with gray-iron body and bronze seats.

E. Class 250, Cast-Iron Angle Valves: Bronze mounted with gray-iron body and bronze seats.

2.5 COPPER-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

1. One-Piece, Copper-Alloy Ball Valves:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Div.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. DynaQuip Controls.
f. Grinnell Corporation.
g. Jamesbury, Inc.
h. Kitz Corporation of America.
i. Legend Valve & Fitting
j. NIBCO INC.
k. Watts Industries, Inc.; Water Products Div.

2. Two-Piece, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves;
d. Crane Co.; Crane Valve Group; Stockham Div.
e. DynaQuip Controls.
f. Flow-Tek, Inc.
g. Grinnell Corporation.
h. Hammond Valve.
i. Honeywell Braukmann.
j. Jamesbury, Inc.
k. Jomar International, LTD.
l. Kitz Corporation of America.
m. Legend Valve & Fitting, Inc.
n. Milwaukee Valve Company.
o. Nexus Valve Specialties.
p. NIBCO INC.
q. R & M Energy Systems (Borger, TX).
r. Red-White Valve Corp.
s. Richards Industries; Marwin Ball Valves.
t. Watts Industries, Inc.; Water Products Div.

3. Three-Piece, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. DynaQuip Controls.
c. Grinnell Corporation.
d. Hammond Valve.
e. Jamesbury, Inc.
f. Kitz Corporation of America.
g. NIBCO Inc.
h. PBM, Inc.
i. Red-White Valve Corp.
j. Worcester Controls.

4. Safety-Exhaust, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. DynaQuip Controls.
c. Grinnell Corporation.
d. Hammond Valve.
e. Jamesbury, Inc.
f. Milwaukee Valve Company.
g. NIBCO INC.

C. Copper-Alloy Ball Valves, General: MSS SP-110.

D. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats, and 400-psig (2760-kPa) minimum CWP rating.

• 2.5 COPPER-ALLOY BALL VALVES (Cont.'):

E. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.

F. Three-Piece, Copper-Alloy Ball Valves: Brass or bronze Forged body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.

G. Safety-Exhaust, Copper-Alloy Ball Valves: Two-piece bronze body with exhaust vent opening, chrome-plated ball with vent, blowout-proof stem, locking handle, and working pressure rating **for compressed air of at least 125 psig (860 KPa) or of 400-psig (2760-kPa) CWP**.

2.6 FERROUS-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

1. American Valve, Inc.
2. Conbraco Industries, Inc.; Apollo Div.
3. Cooper Cameron Corp.; Copper Cameron Valves Div.
4. Crane Co.; Crane Valve Group; Stockham Div.
5. Flow-Tek, Inc.
6. Foster Valve Co.
7. Hammond Valve.
8. Jamesbury, Inc.
9. Jomar International, LTD.
10. Kitz Corporation of America.
11. KTM Products, Inc.
12. McCANNA, Incorporated.
13. Milwaukee Valve Company.
14. NIBCO INC.
15. PBM, Inc.
16. Richards Industries; Marwin Ball Valves.
17. Worcester Controls.

C. Ferrous-Alloy Ball Valves: General: MSS SP-72, with flanged ends.

D. Ferrous-Alloy Ball Valves: Class 150, full port.

E. Ferrous-Alloy Ball Valves: Class 300, full port.

2.7 FERROUS-ALLOY BUTTERFLY VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Flangeless, Ferrous-Alloy Butterfly Valves:

    a. American Valve, Inc.
    b. Bray International, Inc.
    c. Cooper Cameron Corp.; Copper Cameron Valves Div.
    d. Crane Co.; Crane Valve Group; Center Line.
    e. Crane Co.; Crane Valve Group; Stockham Div.
    f. Dover Corp.; Dover Resources Company; Norriseal Div.
    g. General Signal; DeZurik Unit.
    h. Grinnell Corporation.
    i. Hammond Valve.
    j. Kitz Corporation of America.
    k. Legend Valve & Fitting, Inc.
    l. Metraflex Co.
    m. Milwaukee Valve Company.
    n. Mueller Steam Specialty.
    o. NIBCO INC.
    p. Process Development & Control.
    q. Red-White Valve Corp.
    r. Techno Corp.
    s. Tyco International, Ltd.; Tyco Valves & Controls.
    t. Watts Industries, Inc.; Water Products Div.

2. Single-Flange, Ferrous-Alloy Butterfly Valves:

    a. American Valve, Inc.
    b. Bray International, Inc.
    c. Cooper Cameron Corp.; Cooper Cameron Valves Div.
    d. Crane Co.; Crane Valve Group; Center Line.
    e. Crane Co.; Crane Valve Group; Jenkins Valves.
    f. Crane Co.; Crane Valve Group; Stockham Div.
    g. Dover Corp.; dover Resources Company; Norriseal Div.
    h. General Signal; DeZurik Unit.
    i. Grinnell Corporation.
    j. Hammond Valve.
    k. Kitz Corporation of America.
    l. Legend Valve & Fitting, Inc.
    m. Metraflex Co.
    n. Milwaukee Valve Company.
    o. Mueller Steam Specialty.
    p. NIBCO INC.
    q. Process Development & Control.
    r. Red-White Valve Corp.
    s. Techno Corp.
    t. Tyco International, Ltd.; Tyco Valves & Controls.
    u. Watts Industries, Inc.; Water Products Div.

3. Flanged, Ferrous-Alloy Butterfly Valves:

    a. Bray International, Inc.
    b. Cooper Cameron Corp.; Cooper Cameron Valves Div.
    c. Grinnell Corporation.
    d. Mueller Steam Specialty.
    e. Tyco International, Ltd.; Tyco Valves & Controls.

4. Grooved-End, Ductile-Iron Butterfly Valves:

    a. Central Sprinkler Co.; Central Grooved Piping Products.
    b. Grinnell Corporation.
    c. Hammond Valve.
    d. McWane, Inc.; Kennedy Valve Div.
    e. Milwaukee Valve Company.
    f. Mueller Steam Specialty.
    g. NIBCO INC.
    h. Victaulic Co. of America.

C. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

D. Flangeless, 200-psig (1380-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one-piece stem.

E. Single-Flange, 200-psig (1380-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one-piece stem.

F. Flanged, 200-psig (1380-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one-piece stem.

G. Grooved-End, 175-psig (1207-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.

2.8 BRONZE CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type I, Bronze, Horizontal Lift Check Valves with Metal Disc:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Stockham Div.
    d. Red-White Valve Corp.
    e. Walworth co.

• 2.8 BRONZE CHECK VALVES (Cont.'):

2. Type 2, Bronze, Horizontal Lift Check Valves with Nonmetallic Disc:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; *Stockham* Div.
    e. Walworth Co.

3. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Red-White Valve Corp.

4. Type 2, Bronze, Vertical Lift Check Valves with Nonmetallic Disc:

    a. Grinnell Corporation.
    b. Kitz Corporation of America.
    c. Milwaukee Valve Company.

5. Type 3, Bronze, Swing Check Valves with Metal Disc:

    a. American Valve, Inc.
    b. Cincinnati Valve Co.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    d. Crane Co.; Crane Valve Group; Jenkins Valves.
    e. Crane Co.; Crane Valve Group; Stockham Div.
    f. Grinnell Corporation.
    g. Hammond Valve.
    h. Kitz Corporation of America.
    i. Legend Valve & Fitting, Inc.
    j. Milwaukee Valve Company.
    k. NIBCO INC.
    l. Powell, Wm. Co.
    m. Red-White Valve Corp.
    n. Walworth Co.
    o. Watts Industries, Inc.; Water Products Div.

6. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. Grinnell Corporation.
    f. Hammond Valve.
    g. McWane, Inc.; Kennedy Valve Div.
    h. Milwaukee Valve Company.

• 2.8 BRONZE CHECK VALVES (Cont.'):

i. NIBCO INC.
j. Red-White Valve Corp.
k. Walworth Co.
l. Watts Industries, Inc.; Water Products Div.

C. Bronze Check Valves, General: MSS SP-80.

D. Type 1, Class 200, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

E. Type 1, Class 200, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

F. Type 2, Class 200, Bronze, and Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

G. Type 2, Class 200, Bronze, and Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

H. Type 3, Class 200, Bronze, and Swing Check Valves: Bronze body with bronze disc and seat.

I. Type 4, Class 200, Bronze, and Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.9 GRAY-IRON SWING CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Gray-Iron Swing Check Valves with Metal Seats:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Flomatic Valves.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.
k. Mueller Co.
l. NIBCO INC.
m. Powell, Wm. Co.
n. Red-White Valve Corp.
o. Walworth Co.
p. Watts Industries, Inc.; Water Products Div.

• 2.9 GRAY-IRON SWING CHECK VALVES (Cont.'):

2. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; *Stockham* Div.
c. Mueller Co.
d. Watts Industries, Inc.; Water Products Div.

3. Grooved-End, ductile-Iron Swing Check Valves:

a. Grinnell Corporation.
b. Mueller Co.
c. Victaulic Co. of America.

C. Gray-Iron Swing Check Valves, General: MSS SP-71.

D. Type I, Class 250, gray-iron, swing check valves with metal seats.

E. Type II, Class 250, gray-iron, swing check valves with composition to metal seats.

F. 175-psig (1207-kPa) CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.10 FERROUS-ALLOY WAFER CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Single-Plate, Ferrous-Alloy, Wafer Check Valves:

a. Gestra, Inc.
b. McWane, Inc.; Kennedy Valve Div.
c. Mueller Co.
d. Techno Corp.
e. Tyco International, Ltd.; Tyco Valves & Controls.
f. Wheatley Gaso, Inc.

2. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; *Stockham* Div.
c. Flomatic Valves.
d. Gestra, Inc.
e. Grinnell Corporation.
f. Gulf Valve Co.
g. Metraflex Co.
h. Mueller Steam Specialty.

• 2.10 FERROUS-ALLOY WAFER CHECK VALVES (Cont.'):

i. NIBCO INC.
j. Red-White Valve Corp.
k. SSI Equipment, Inc.
l. Techno Corp.
m. Val-Matic Valve & Mfg. Corp.
n. Valve and Primer Corp.
o. Watts Industries, Inc.; Water Products Div.

3. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:

a. Crane Co.; Crane Valve Group; Crane Vales.
b. Gulf Valve Co.
c. Valve and Primer Corp.

4. Dual-Plate, Ferrous-Alloy, Double-flanged-Type Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Gulf Valve Co.
c. Techno Corp.

C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

D. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.

E. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

F. Single-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

G. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.

H. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

I. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

2.11 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type I, Wafer Lift-Disc Check Valves:

a. Mueller Steam Specialty.

• 2.11 SPRING-LOADED, LIFT-DISC CHECK VALVES (Cont.'):

2. Type II, compact-Wafer, Lift-Disc Check Valves:

    a. Durabla Fluid Technology, Inc.
    b. Flomatic Valves.
    c. GA Industries, Inc.
    d. Grinnell Corporation.
    e. Hammond Valve.
    f. Metraflex Co.
    g. Milwaukee Valve Company.
    h. Mueller Steam Specialty.
    i. Multiplex Manufacturing Co.
    j. NIBCO INC.
    k. SSI Equipment, Inc.
    l. Val-Matic Valve & Mfg. Corp.
    m. Valve and Primer Corp.

3. Type III, Globe Lift-Disc Check Valves:

    a. Durabla Fluid Technology, Inc.
    b. Flomatic Valves.
    c. GA Industries, Inc.
    d. Grinnell Corporation.
    e. Hammond Valve.
    f. Metraflex Co.
    g. Milwaukee Valve Company.
    h. Multiplex Manufacturing Co.
    i. NIBCO INC.
    j. SSI Equipment, Inc.
    k. Val-Matic Valve & Mfg. Corp.
    l. Valve and Primer Corp.

4. Type IV, Threaded Lift-Disc Check Valves:

    a. Check-All Valve Mfg. Co.
    b. Durable Fluid Technology, Inc.
    c. Grinnell Corporation.
    d. Legend Valve & Fitting, Inc.
    e. Metraflex Co.
    f. Milwaukee Valve Company.
    g. Mueller Steam Specialty.
    h. NIBCO INC.
    i. Watts Industries, Inc.; Water Products Div.

C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

D. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.

• 2.11 SPRING-LOADED, LIFT-DISC CHECK VALVES (Cont.'):

E. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

F. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.

G. Type IV, Class 150, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.12 BRONZE GATE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Bronze, Non-Rising Stem Gate Valves:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; *Stockham* Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Legend Valve & Fitting, Inc.
j. Milwaukee Valve Company.
k. NIBCO INC.
l. Powell, Wm. Co.
m. Red-White Valve Corp.
n. Walworth Co.
o. Watts Industries, Inc.; Water Products Div.

2. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; *Stockham* Div.
f. Grinnell Corporation.
g. Hammond Valve.
h. Kitz Corporation of America.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Powell, Wm. Co.
l. Red-Whire Valve Corp.
m. Walworth Co.

• 2.12 BRONZE GATE VALVES (Cont.'):

3. Type 3, Bronze, Rising-Stem, Split-Wedge Gate Valves:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Grinnell Corporation.
    d. NIBCO INC.

C. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy hand-wheel.

D. Type 1, Class 200, Bronze Gate Valves: Bronze body with non-rising stem and bronze solid wedge **and union-ring bonnet**.

E. Type 2, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge **and union-ring bonnet**.

F. Type 3, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge **and union-ring bonnet**.

2.13 CAST-IRON GATE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Cast-Iron, Non-Rising Stem Gate Valves:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; *Stockham* Div.
    e. Grinnell Corporation.
    f. Hammond Valve.
    g. Kitz Corporation of America.
    h. Legend Valve & Fitting, Inc.
    i. Milwaukee Valve Company.
    j. NIBCO INC.
    k. Powell, Wm. Co.
    l. Red-White Valve Corp.
    m. Walworth Co.
    n. Watts Industries, Inc.; Water Products Div.

2. Type 1, Cast-Iron, Rising –Stem Gate Valves:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.

• 2.13 CAST-IRON GATE VALVES (Cont.'):

d. Crane Co.; Crane Valve Group; *Stockham* Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Kitz Corporation of America.
h. Legend Valve & Fitting, Inc.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Powell, Wm. Co.
l. Red-White Valve Corp.
m. Walworth Co.
n. Watts Industries, Inc.; Water Products Div.

C. Cast-Iron Gate Valves, General: MSS SP-70, Type 1.

D. Class 125, NRS, Bronze-Mounted, and Cast-Iron Gate Valves: Cast-iron body with bronze trim, non-rising stem, and solid-wedge disc.

E. Class 125, OS&Y, Bronze-Mounted, and Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

F. Class 250, NRS, Bronze-Mounted, and Cast-Iron Gate Valves: Cast-iron body with bronze trim, non-rising stem, and solid-wedge disc.

G. Class 250, OS&Y, Bronze-Mounted, and Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

2.14 BRONZE GLOBE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; *Stockham* Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Kitz Corporation of America.
h. Legend Valve & Fitting, Inc.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Powell Wm. Co.
l. Red-White Valve Corp.
m. Walworth Co.

• 2.14 BRONZE GLOBE VALVES (Cont.'):

2. Type 2, Bronze Globe Valves with Nonmetallic Disc:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. Grinnell Corporation.
    f. Hammond Valve.
    g. Kitz Corporation of America.
    h. McWane, Inc.; Kennedy Valve Div.
    i. Milwaukee Valve Company.
    j. NIBCO INC.
    k. Powell, Wm. Co.
    l. Red-White Valve Corp.
    m. Walworth Co.

3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:

    a. Cincinnati Valve Co.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; *Stockham* Div.
    e. Grinnell Corporation.
    f. Hammond Valve.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Walworth Co.

C. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy hand-wheel.

D. Type 1, Class 200, Bronze Globe Valves: Bronze body with bronze disc **and union-ring bonnet**.

E. Type 2, Class 200, Bronze Globe Valves: Bronze body with **PTFE or TFE disc and union-ring bonnet**.

F. Type 3, Class 200, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. **Include union-ring bonnet**.

2.15 CAST-IRON GLOBE VALVES

A. Available Manufacturers.

B. Manufacturers:

1. Type 1, Cast-Iron Globe Valves with Metal Seats:

    a. Cincinnati Valve Co.

• 2.15 CAST-IRON GLOBE VALVES (Cont.'):

b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; *Stockham* Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Kitz Corporation of America.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell, Wm. Co.
k. Red-White Valve Corp.
l. Walworth Co.

C. Cast-Iron Globe Valves, General: MSS SP-85.

D. Type I, Class 125, Cast-Iron Globe Valves: Gray-Iron body with bronze seats.

E. Type 1, Class 250, Cast-Iron Globe Valves: Gray-Iron body with bronze seats.

2.16 CAST-IRON PLUG VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Lubricated-Type, Cast-Iron Plug Valves:

a. Milliken Valve Co.; Inc.
b. Nordstrom Valves, Inc.
c. Olson Technologies; Homestead Div.
d. R & M Energy systems (Tomball, TX).
e. Walworth Co.

2. Non-Lubricated-Type, Cast-Iron Plug Valves:

a. General signal; DeZurik Unit.
b. Grinnell Corporation.
c. Mueller Flow Technologies.
d. Tyco International, Ltd.; Tyco Valves & Controls.
e. Wheatley Gaso, Inc.
f. Xomox Corporation.

C. Cast-Iron Plug Valves, General: MSS SP-78.

D. Class 125 or 150, lubricated-type, cast-iron plug valves.

2.17 RESILENT-SEATED, CAST-IRON, ECCENTRIC PLUG VALVES

A. Available Manufacturers:

B. Manufacturers:

1. General Signal; DeZurik Unit.
2. Milliken Valve Company.
3. Olson Technologies; Homestead Div.
4. Pratt, Henry Company.
5. Val-Matic Valve & Mfg. Corp.

C. Resilient-Seated, Cast-Iron, Eccentric Plug Valves, NPS 2-½ (DN 65) and Smaller: Design similar to MSS SP-108, and rated for 175-psig (1207-kPa) minimum CWP.

D. Resilient-Seated, Cast-Iron, Eccentric Plug Valves, NPS 3 (DN 80) and Larger: MSS SP-108, and rated for 175-psig (1207-kPa) minimum CWP.

1. Resilient Seating Material: Suitable for potable-water service, unless otherwise indicated.

2.18 CHAINWHEEL ACTUATORS

A. Available Manufacturers:

B. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

C. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: **Ductile iron**, of type and size required for valve. **Include zinc coating**.
2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: **Hot-dip, galvanized steel**, of size required to fit sprocket rim.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

• 3.1 EXAMINATION (Cont.'):

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully close. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket in of proper size that its material composition is suitable for service, and that it is free form defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, **or gate, gate, or plug** valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of vales with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water, steam, and steam condensate services.
2. For Copper Tubing, NPS 2-½ to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-½ to NPS 4 (DN 65 to DN 100): Flanged ends.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
7. For Grooved-End, **Copper Tubing and Steel Piping:** Valve ends may be grooved. Do not use for steam or steam condensate piping.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

• 3.3 VALVE INSTALLATION (Cont.'):

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chain-wheel operators on valves **NPS 4 (DN 100)** and larger and more than 96 inches (2400 mm) above floor. Extend chains to **60 inches (1520 mm)** above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: in horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15110

SECTION 15121

PIPE EXPANSION FITTINGS AND LOOPS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Sections includes the following pipe expansion joints and expansion compensation devices for mechanical piping systems:

1. Metal-bellows expansion joints.
2. Expansion compensators.
3. Rubber expansion joints.
4. Flexible-hose expansion joints.
5. Packed slip expansion joints.
6. Flexible ball joints.
7. Pipe bends and loops.
8. Alignment guides and anchors.

1.3 DEFINITIONS

A. BR: Butyl rubber.

B. Buna-N: Nitrile rubber.

C. CR: Chloro-sulfonated polyethylene synthetic rubber.

D. CSM: Chloro-sulfonyl-polyethylene rubber.

E. EPDM: Ethylene-propylene-dyne ter-polymer rubber.

F. NR: Natural rubber.

G. PTFE: Polytetrafluoroethylene plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressure, and temperatures.

B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.5 SUBMITTALS

A. Product Data: for each type of pipe expansion joint and alignment guide indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculation: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Product Certificates: For each type of pipe expansion joint, signed by product manufacturer.

D. Welding certificates.

E. Operation and Maintenance Data: For pipe expansion joints to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code – Steel".
2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirement, provide products by one of the manufacturers specified.

2.2 EXPANSION JOINTS

A. Metal-Bellows Expansion Joints: ASTM F 1120, circular-corrugated-bellows type with external tie rods.

1. Manufacturers:

    a. Adsco Manufacturing, LLC.
    b. Anamet, Inc.
    c. Badger Industries.
    d. Expansion Joint Systems, Inc.
    e. Flex-Hose Co., Inc.
    f. Flexicraft Industries.
    g. Flex-Pression, Ltd.
    h. Flex-Weld, Inc.
    i. Hyspan Precision Products, Inc.
    j. Metraflex, Inc.
    k. Piping Technology & Products, Inc.
    l. Proco Products, Inc.
    m. Senior Flexonics, Inc.; Pathway Division.
    n. Tozen America Corp.
    o. Unaflex Inc.
    p. WahlcoMetroflex.

2. Metal-Bellows Expansion Joints for Copper Piping: **Multiple**-ply phosphor-bronze bellows, copper pipe end connections, and brass shrouds.
3. Metal-Bellows Expansion Joints for Stainless-Steel Waterway: Single-ply stainless-steel bellows, stainless-steel-pipe end connections, and steel shroud.
4. Metal-Bellows Expansion Joints for Steel Piping: **Multiple**-ply stainless-steel bellows, steel pipe end connections, and carbon-steel shroud.
5. Minimum Pressure Rating: 175 psig (1200 kPa), unless otherwise indicated.
6. Configuration: **Double**-bellows type **with base**, unless otherwise indicated.
7. End Connections: **Flanged or weld**.

B. Expansion Compensators: Double-ply corrugated steel, stainless-steel, or copper-alloy bellows in a housing with internal guides, anti-torque device, and removable end clip for positioning.

1. Manufacturers:

    a. Adsco Manufacturing, LLC.
    b. Flexicraft Industries.
    c. Flex-Pression, Ltd.
    d. Flex-Weld, Inc.
    e. Hyspan Precision Products, Inc.
    f. Metraflex, Inc.
    g. Senior Flexonics, Inc.; Pathway Division.
    h. Unaflex Inc.

2. Minimum Pressure Rating: 175 psig (1200 kPa), unless otherwise indicated.

• ARTICLE 2.2A (Cont.):

3. Configuration for Copper Piping: Two-ply phosphor-bronze or stainless-steel bellows and bronze or stainless-steel shroud.
4. Configuration for Steel Piping: Two-ply stainless-steel bellows and carbon-steel shroud.
5. End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: **Solder joint or threaded**.
6. End Connections for Copper Tubing NPS 2-½ to NPS 4 (DN 65 to DN 100): **Solder joint or threaded**.
7. End Connections for Steel Pipe NPS 2 (DN 50) and Smaller: Threaded.
8. End Connections for Steel Pipe NPS 2-½ to NPS 4 (DN 65 to DN 100): **Flanged or Welded**.

C. Rubber Expansion Joints: ASTM F 1123, fabric-reinforced rubber with external control rods and complying with FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors".

1. Manufacturers:

   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex-Weld, Inc.
   d. Garlock Sealing Technologies.
   e. General Rubber Corp.
   f. Mason Industries, Inc.; Mercer Rubber Co.
   g. Metraflex, Inc.
   h. MG Piping Products Co.
   i. Proco Products, Inc.
   j. Red Valve Company, Inc.
   k. Senior Flexonics, Inc.; Pathway Division.
   l. Tozen America Corp.
   m. Unaflex Inc.
   n. Vibration Mountings & Controls, Inc.

2. Arch Type: Multiple arches.

3. Spherical Type: Multiple spheres.

   a. Minimum Pressure and Temperature Ratings for NPS 1-½ to NPS 4 (DN 40 to DN 100): [150 psig (1035 kPa) at 220 deg F (104 deg C).
   b. Minimum Pressure and Temperature Ratings for NPS 5 and NPS 6 (DN 125 and DN 150): [140 psig (966 kPa) at 200 deg F (93 deg C).
   c. Minimum Pressure and Temperature Ratings for NPS 8 to NPS 12 (DN 200 to DN 300): [140 psig (966 kPA) at 180 deg F (82 deg C).

4. Material: Buna-N

5. End Connections: Full-faced, integral, steel flanges with steel retaining rings.

D. Flexible-Hose Expansion Joints: Manufactured assembly with two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.

1. Manufacturers:

    a. Flex-Hose Co., Inc.
    b. Flexicraft Industries.
    c. Flex-Pression, Ltd.
    d. Metraflex, Inc.

2. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder joint end connections.

    a. NPS 2 (DN 50) and Smaller: Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
    b. NPS 2-½ to NPS 4 (DN 65 to DN 100): Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F (2070 kPa at 21 deg C) and 225 psig at 450 deg F (1550 kPa at 232 deg C) ratings.
    c. NPS 2 (DN 50) and Smaller: Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 500 psig at 450 deg F (3450 kPa at 232 deg C) ratings.
    d. NPS 2-½ to NPSW 4 (DN 65 to DN 100): Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F (2890 kPa at 21 deg C) and 315 psig at 450 deg F (2170 kPa at 232 deg C) ratings.

3. Flexible-Hose Expansion Joints for Steel Piping: Carbon-steel fittings with threaded end connections for NPS 2 (DN 50) and smaller and flanged or welded end connections for NPS 2-½ (DN 65) and larger.

    a. NPS 2 (DN 50) and Smaller: Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F (3100 kPa at 21 deg C) and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
    b. NPS 2-½ to NPS 6 (DN 65 to DN 150): Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C) ratings.
    c. NPS 8 to NPS 12 (DN 200 to DN 300): Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
    d. NPS 2 (DN 50) and Smaller: Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F (4830 kPa at 21 deg C) and 515 psig at 600 deg F (3550 kPa at 315 deg C) ratings.
    e. NPS 2-½ to NPS 6 (DN 65 to DN 150): Stainless-steel hoses and double-braid, stainless-steel sheaths with sheaths with 275 psig at 70 deg F (1900 kPa at 21 deg C) and 200 psig at 600 deg F (1380 kPa at 315 deg C) ratings.
    f. NPS 8 (DN 200) and Larger: Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.

E. Packed Slip Expansion Joints: ASTM F 1007, carbon-steel, packing type designed for repacking under pressure and pressure rated for 250 psig at 400 deg F (1725 kPa at 204 deg C) minimum. Include asbestos-free PTFE packing, compound limit stops, and drip connection if used for steam piping.

1. Manufacturers:

    a. Adsco Manufacturing, LLC.
    b. Advanced Thermal Systems, Inc.
    c. Hyspan Precision Products, Inc.

2. Configuration: Double-joint class with base, unless otherwise indicated.
3. End Connections: Flanged or weld ends to match piping system.

F. Flexible Ball Joints: Carbon-steel assembly with asbestos-free composition packing, designed for 360-degree rotation and angular deflection, and 250 psig at 400 deg F (1725 kPa at 204 deg C) minimum pressure rating; complying with ASME Boiler and Pressure Vessel Code: Section II, "Materials", and with ASME B31.9, "Building Services Piping", for materials and design of pressure-containing parts and bolting.

1. Angular Deflection for NPS 6 (DN 150) and Smaller: 30-degree minimum.
2. Angular Deflection for NPS 8 (DN 200) and Larger: 15-degree minimum.
3. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
4. End Connections for NPS 2-½ (DN 65) and Larger: Flanged.
5. Manufacturers:

    a. Advanced Thermal Systems, Inc.
    b. Hyspan Precision Products, Inc.

2.3 ALIGNMENT GUIDES

A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

1. Manufacturers:

    a. Adsco Manufacturing, LLC.
    b. Advanced Thermal Systems, Inc.
    c. Flex-Hose Co., Ing.
    d. Flexicraft Industries.
    e. Flex-Weld, Inc.
    f. Hyspan Precision Products, Inc.
    g. Metraflex, Inc.
    h. Piping Technology & Products, Inc.
    i. Senior Flexonics, Inc.; Pathway Division.

2.4 MATERIALS FOR ANCHORS

A. Steel Shapes and Plates: ASTM A 36/A 36M.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.

C. Washers: ASTM F844, steel, pain, flat washers.

D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened Portland cement concrete, and tension and shear capacities appropriate for application.

1. Stud: Threaded, zinc-coated carbon steel.
2. Expansion Plug: zinc-coated steel.
3. Washer and Nut: zinc-coated steel.

E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened Portland cement concrete, and tension and shear capacities appropriate for application.

1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-componet epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
3. Washer and Nut: Zinc-coated steel.

F. Concrete: Portland Cement Mix, 3000 psi (20.7 MPa) minimum. Refer to Division 3 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.

G. Grout: ASTM C 1107, factory-mixed and packaged, dry, hydraulic-cement, non-shrink, nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 – EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install manufactured, non-metallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors".

B. Install expansion joints of sizes matching size of piping in which they are installed.

C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.2 PIPE BEND AND LOOP INSTALLATION

A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Attach pipe bends and loops to anchors.

1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.3 SWING CONNECTIONS

A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.

C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.4 ALIGNMENT-GUIDE INSTALLATION

A. Install guides on piping adjoining pipe expansion joints and bends and loops.

B. Attach guides to pipe and secure to building structure.

3.5 ANCHOR INSTALLATION

A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.

C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.

D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints or compensators are indicated.

E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION

SECTION 15180

HEATING AND COOLING PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. This section provides the general requirements for heating and/or cooling piping and related equipment or materials to be installed at aforementioned project.

1.02 SCOPE OF WORK

A. Furnish and install heating and cooling pipes, conforming in all aspects to the specifications, schedules and plans or drawings or as indicated by Engineer or PBA representative.

B. Furnish and install any accessories required by heat and cooling pipes for proper operation of the equipment's as recommended by manufacturer or distributors and is not specific in drawings. Check with Engineer or PBA representative for approval.

C. Pipes in this section include:

1. Heating water.
2. Cooling (Chilled) water.
3. Condensate
4. Refrigerant
5. Piping Specialties
    i. Flow measuring devices – Venturi Type.
6. Refrigeration Specialties
    i. Water Treatment Equipment & Materials.
    ii. Glycol makeup units.
    iii. Filter Feeder – Heating and cooling water systems.
    iv. Chemical feed system – Condenser water.
    v. System cleaning.

1.03 RELATED WORKS

A. Section 15050 – Basic Mechanical Materials and Methods.

B. Section 15075 – Mechanical Identification.

C. Section 15083 – Pipe Insulation.

D. Section 15950 – Testing, Adjusting and Balancing.

1.04 RELATED STANDARDS

A. ARI – Air Conditioning and Refrigeration Institute.

B. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers.

C. ASTM – American Society of Testing Materials.

D. NEC – National Electrical Code.

E. NFPA – National Fire Protection Association.

F. NEMA – National Electric Manufacturers Association.

G. UL – United Laboratories.

H. OSHA – Office of Safety and Health Act

I. EPA – Environmental Protection Agency

1.05 SUBMITTALS

A. Submit three (3) copies of data for any kind of pipe expected to be used or indicated in drawing or as specified for any applicable code.

B. Submittal shall include manufacturer data:

1. Weight, physical properties, thermal properties, electrical properties.

2. Drawing showing pipe configuration, connection size, overall dimension and field clearances and pipe requirements.

3. Chemical analysis or material composition.

4. Installation recommendations.

1.06 QUALITY ASSURANCE

A. Inspect pipes delivered to site for damages.

B. Store with minimum handling and comply with manufacturer's instruction for rigging, loading-unloading and transportation.

C. Store and protect as indicated by manufacturer against weather or vandalism.

D. Keep materials and equipment free of debris and dirt.

PART 2 – PRODUCTS

2.01 STEEL PIPE

A. Heating, Cooling and Condenser water pipe allowed for all sizes.

1. ASTM A53, Grade B, seamless Schedule 40.

2. ASTM A106, Schedule 40 (for high temperature).

3. ASTM A120, Not permitted in any service.

2.02 COPPER PIPE & TUBING

1. Heating, Cooling piping allowed on sizes 2½" and smaller only.

2. ASTM B88 Type L hard drawn.

3. Drains and Condensate piping: Type DWV per ASTM-B306 or Type L hard ASTM B88.

4. Refrigerant: Type ACR per ASTM-B280.

5. Size pipe at 5'/100' max. pressure drop.

2.03 FITTINGS

A. For steel pipe: flanged or butt weld for larger sizes, ASTM B31.

B. For copper water or drain: wrought copper or cast bronze. Lead free solder.

C. Refrigerant:

1. Brazed joint or flared.

2. Brazed joints: long radius wrought-copper or forged-brass sweat fittings. Do not use cast sweat-type fittings. Cadmium free filler metal.

3. Flare joints: standard SAE forged brass short-shank.

D. Make all connections between ferrous and non-ferrous material through dielectric unions, fittings or flanges. Install isolation valve upstream of dielectric.

2.05 PRESSURE GAUGES

A. Four and One-half inch minimum face diameter, ¼" NPT brass bottom mount, steel case, adjustable steel pointer, accuracy 1% of full scale or better.

B. Stainless steel case, phosphorous bronze Bourdon tube and corrosion resistant movement.

C. Maximum range: approximately double the expected working pressure of the service.

D. Install with an isolation valve and a drain valve between the gauge and the isolation valve.

E. Install a pressure snubber in services with rapid pressure pulses.

F. White face with black lettering.

G. Calibration adjustment by screwdriver.

H. Acceptable manufacturers:

1. Ashcroft
2. Dwyer
3. Foxboro
4. Honeywell
5. U.S. Gauge
6. Johnson Controls
7. Weiss
8. Duro
9. Other as Engineer approved

2.06 THERMOMETERS

A. Painted vertical metal case with 8" long (min) reading scale, glass or Lucite face, adjustable multi-angle housing and brass separable socket.

B. Bottom or back pipe thread connection.

C. Use thermal wells with heat transfer enhancement compound in piping services.

D. Range (s):

1. Heating Water: 50ºF to 300ºF with 2ºF scale divisions.

2. Cooling Water: 20ºF to 100ºF with 2 ºF scale divisions.

E. Accuracy: 1% of full scale or better.

F. Acceptable manufacturers:

1. Cooper
2. Davis
3. Duro
4. Weiss
5. Foxboro
6. Taylor
7. Other as Engineer approved

2.07 PIPING SPECIALTIES

A. ¼" or ½" MPT pressure temperature taps: Stainless steel for condensate services, brass or bronze for water and air service, extended stem for insulated pipes.

B. Acceptable manufacturers:

1. Universal Lancaster
2. Sisco
3. Peterson Equipment Co.

C. Basket Strainers: Cast iron body with flanged connections and stainless steel easily removable basket, ⅛"" staggered perforations, Hayward Model 72 or similar Kinney, Elliot or Zum.

D. Backflow Preventer:

1. Air gap fittings are the preferred method of preventing backflow. If a preventer is required discuss with the Engineer.

2. Fire Protection entry – Double check assembly.

3. Irrigation service – Vacuum breaker.

E. Automatic Air Vents: High capacity float-type with brass or semi-steel body, copper float and removable top for cleaning.

F. Expansion Tanks: Closed hydro-pneumatic diaphragm or bladder type, welded steel, rated for 125 psig, cleaned, prime coated, steel support saddles.

1. Acceptable expansion tank manufacturers:

i. Amtrol
ii. Armstrong
iii. Bell & Gossett
iv. Taco
v. Other as Engineer approved

G. Air Purger: Line size with automatic vent. Acceptable manufacturer: Amtrol.

H. Air Separators: Tangential type; fabricated, tested and stamped in accordance with the ASME code; cast iron or steel tank, removable galvanized steel strainer, perforated stainless steel all collector tube, 125 psig working pressure.

1. Acceptable manufacturers:

i. Taco
ii. Amtrol
iii. Bell & Gossett
iv. Other as Engineer approved

I. Relief Valves: Bronze or iron body, bronze trim, bronze lifting gear, ASME rated direct spring loaded type, lever operated, non-adjustable factory set discharge pressure.

1. Acceptable Manufacturers:

i. McDonnell-Miller
ii. Bell & Gossett.
iii. Watts
iv. Other as Engineer approved.

J. Combination Check and Shut-off Valves: cast iron body, contoured disc, calibrated balancing adjustment, back-seating valve stem. Install on discharge side of pump with stem up, suitable for 175 psig working pressure and 300 F operating temperature.

K. Pressure Reducing Valve: all bronze, adjustable spring and diaphragm; integral strainer, female thread connections.

1. Acceptable manufacturers of pressure reducing valves:

i. Armstrong
ii. Bell & Gossett
iii. Fisher
iv. Taco
v. Other as Engineer approved.

2.08 REFRIGERATION SPECIALTIES

A. Filter-dryers:

1. Conform to ARI Standard 710.

2. Full flow replaceable core in sizes ½" and larger.

3. Sealed type in sizes smaller than ½".

4. Use desiccant cores that will not plug, cake, channel, or break down, but remove water, acid, and foreign material from the refrigerant.

5. Construct so that no desiccant can pass into the refrigerant lines.

6. Minimum bursting pressure, 1,500 psi.

7. Provide in liquid line to each evaporator.

B. Strainers:

1. Brass or cast iron body.

2. Not less than 60-mesh non-corrodible screen of a free area not less than ten times the pipe diameter.

C. Sight Glass:

1. Provide in the liquid line preceding each expansion valve.

D. Discharge-line oil separator:

1. Rated capacity equal to or greater than that of the compressor.

2. Provide with an oil-float valve assembly or needle valve and orifice assembly, drain-line shutoff valve, and sight glass.

3. Connect oil-return line to the compressor.

E. Charging valves:

1. General purpose type with brass body, flared or solder ends, and removable valve core. Provide quick coupling connection at valve inlet.

F. Flow Measuring Devices:

1. Flow measuring devices 2" and smaller may be a combination measuring device and balancing/shut off valve assembly or a separate venture with a remote balancing valve.

    i. Device shall be non-ferrous pressure die-cast construction with sweat or threaded ends, 300 psi WSP at 250ºF.
    ii. Venturi/ball valve with integral flow measuring tops, adjustable memory set, and full size locking indicating handle.

iii. Orifice-type balancing devices are not acceptable.
iv. Minimum accuracy +/-3%.
v. Acceptable manufacturers:

a) Barco
b) Gerand
c) Preso
d) Flow Design

2. Flow measuring devices 2½" and larger shall consist of a venture unit and separate balancing valve.

i. Cast steel with weld ends or machined steel for butt welding, 150 psi WSP at 250ºF.
ii. Venturi unit shall include manual shut-off valves and quick-disconnect fittings at meter taps and shall be furnished with tags marked with Venturi size, station designations, GPM, and meter reading for GPM.
iii. Orifice-type balancing devices are not acceptable.
iv. Bore sizes shall be selected so that meter read-out at specified flow rate is between 7" and 27" w.g.
v. Minimum accuracy +/-3%.
vi. Acceptable manufacturers:

a) Barco
b) Gerand
c) Preso

3. Meter in High impact case to match Venturi output values.

2.09 WATER TREATMENT EQUIPMENT (**if applies, in accordance to plans**)

A. Chemical Feed System – Condenser Water:

1. Water treatment Subcontractor shall have been in business and providing water treatment services in the geographical area for a minimum of 5 years.

2. System shall be a Total-Dissolved-Solids Bleed and Pulse Feed Treatment System for automatic injection of Biocides and Inhibitors determined by the subcontractor. System shall include but not be limited to: Makeup water meter, Dual Biocide feed with timer control and two positive displacements pumps, Bleed solenoid valve, conductivity controller (bleed or blow-down control by Beta Hydac, Pulsa Feeder or approved equal and automatic blow-down valve.

3. Chemicals shall include but not be limited to: Inhibitor – 360 PPM organophosphate (Aqua Chem. 8031) and Biocide – Level determined by subcontractor (Aqua Chem A576 or approved equal) Clean, Flush and provide complete service for one full cooling season.

• ARTICLE 2.9A (Cont.'):

4. Contractor to furnish for inclusion the O&M manual:

   i. Water test data on chemical concentrations.
   ii. MSDS sheets and manufacturer and supplier of all chemicals used.

PART 3 – INSTALLATION

3.01 WORK PREPARATION

A. Contractor shall remove the existing pipes as indicated by Engineer.

1. Removing includes plumbing connections not necessary for futures works of new equipment's. Consult Engineer or PBA representative for complete scope of removing scope.

2. Final disposition of removed equipment and material shall complaint with Puerto Rico environmental standards and regulations, and EPA.

B. Contractor shall to coordinate any work with PBA representative or Engineer.

C. Contractor shall coordinate any work to be executing out of regular offices hours.

D. Contractor shall be responsible by all necessary permissions and taxes in the transportation from distributor or fabrication facilities to installation site.

E. Contractor shall be responsible for handling and disposal of any kind of hazardous material find it in the pre-bid visit or in the installation process.

3.02 GENERAL

A. Automatic Air Vents shall be installed with ball type isolation valves upstream and unions on vent discharge pipe.

B. Wye type strainers shall be installed upstream of control valves.

C. Coil valves and drains – All heating and cooling coils shall have ball type isolation valves and drain valves with GHT, cap and chain.

D. Test refrigerant pipe in accordance with ARI standards. Pressure test only, Vacuum Testing is not acceptable.

3.03 REFRIGERANT PIPE INSTALLATION

A. Pitch suction lines 1" in 15' toward the compressor, install oil traps, consisting of short radius fittings, at the bases of vertical suction lines.

B. Shop drawings: refrigerant piping sizing, layout and accessories.

3.04 SPECIAL DEVICES (**if applies, in accordance to plans**)

A. Install a pressure-temperature tap on each side of each of equipment as (pump, chillers, cooling towers, AHU, heat transfer device, coils, radiators, radiant panels and others.

B. Install one hydronic balancing valve as defined above in series with each air handling unit coil, heat exchanger, each section of fin tube radiators or radiant panels. A section is defined as that assembly controlled by one stat/temperature control valve combination.

C. Expansion tanks, air separators and other devices heavier than 200 pounds may not be suspended from overhead without written permission from the Structural Engineer.

D. Flow (paddle) Switches are not recommended. They may be used if required by equipment manufacturer. The Engineer shall carefully and fully detail flow switch installation if used.

3.05 VALVES

Provide valves on lines before they enter and after they leave a relatively inaccessible basement, crawl space or trench.

3.06 GAUGES AND THERMOMETERS

Calibrate all gauges and thermometers in the presence of the Engineer prior to installation.

3.07 DIELECTRIC UNIONS

Install dielectric fittings at connections between dissimilar metals. Install an isolation valve upstream of dielectric.

3.08 FILTER FEEDERS

Provide filter feeders in the heating and cooling systems.

3.09 PRE-OPERATIONAL FLUSH AND CLEANING

A. Notify the Engineer five (5) work days in advance of starting the cleaning. Cleaning and flushing of all systems shall take place in the presence of the District Project Manager or his designated representative. "Certification of Work Certificate" documents the cleaning procedure and personnel involved. The designated representative observing the cleaning shall sign the certification. School personnel or custodial staffs are not authorized to witness the procedure.

• ARTICLE 3.09 (Cont.'):

B. Closed piping systems, heating water and chilled water, shall be cleaned using a cold alkaline cleaning solution at normal system pumping pressures. At the Contractors option he may use chemicals furnished by the Owner (at no additional cost to the contractor) or he may use commercially available chemicals furnished by the contractor (at no additional cost to the School District).

1. Owner furnished Cleaning Solution

i. Oz per 100 gal. of system volume

a) Tri-sodium phosphate (alkaline) 16 oz
b) Sodium Hydroxide (alkaline) 1 oz
c) Dawn dishwashing soap (surfactant) 1 oz
d) Sodium Sulfite (oxygen scavenger) 1 oz

C. Contractor Furnished Cleaning Solution

1. Alkaline cleaner supplied by one of the listed water treatment vendors. Submit the cleaner formulation and complete manufacturer instructions on use of the cleaner. The alkaline cleaner shall include sodium hydroxide and tri-sodium phosphate with surfactants and corrosion inhibitors. Follow the manufacturer's recommended concentrations for the system volumes.

D. The cleaning solution must begin with a **minimum pH of 12.0**.

E. Procedure to clean an entire hydronic system (**if applies, in accordance to plans**):

1. Isolate the expansion tank from all cleaning solutions.

2. Fill system with the alkaline cleaning solution. Make sure that the cleaning solution circulates through all piping and heat transfer components in the hydronic system.

3. Circulate the alkaline cleaning solution in any heating water or chilled water system for 48 hours. Repair any leaks while circulating.

4. Drain the alkaline cleaning solution and fill the system with domestic cold water. Circulate and flush as necessary until the circulated rinse water reaches a pH of 8.5 maximum at all end points of the hydronic system.

5. When the rise water has reached 8.5 pH, remove and clean all piping strainers throughout the system. Do not drain the rinse water from the piping system until the propylene glycol is ready to be installed. The District Project Manager or representative must verify and approve the cleanliness of the system. A minimum of three samples will be taken of each hydronic system. The Contractor and the Owner will each retain one sample and one sample will be sent for chemical analysis.

• ARTICLE 3.09 (Cont.'):

6. Drain and partially fill the hydronic system with clean domestic cold water. Install the uninhibited propylene glycol to a concentration of 30%. The Owner will sample and install the water treatment chemicals after the glycol is charged into the system – pH buffer, oxygen scavenger, and corrosion inhibiting surfactant.

7. Before using the glycol feeder, thoroughly clean the tank of dirt, oil, grease, and solids. Fill the tank completely full with domestic cold water and one gallon of chlorine bleach. Allow to stand overnight. Rinse the tank free of chlorine.

8. Fill the glycol feeder with a solution of water and propylene glycol, 30% minimum or +9ºF or lower freeze point. Maintain a full glycol tank (30% minimum) until the system have been thoroughly vented of air and all of the leaks have been repaired. Leave a full tank of 30% PG upon project completion.

9. Submit the "Certification of Work" and the quantity of propylene glycol that was charged into the piping system. Transmit the information to the District Project Manager. Include a copy of the "Certification of Work", the propylene glycol quantity, the MSDS sheets, and the name of the chemical supplier in the O&M Manuals.

10. Glycol feed system(s) – leave tanks filled with a 30% solution Uninhibited Polypropylene Glycol.

11. Provide one (1) hour training on condenser water chemical system.

12. Deliver Venturi flow meter to Project Manager prior to installation of meter.

END OF SECTION

SECTION 15400

PLUMBING

1. SCOPE

All plumbing work and related items necessary to complete the work shown on drawings or specified, or both, are a part of the contract.

2. IMPORTANT NOTES

It shall be the direct responsibility of the Contractor to become acquainted with all the requirements of this project; and such requirements shall be as much a part of this contract as though written herein.

3. RECORD DRAWINGS

The Contractor shall maintain a complete accurate record of any variations or changes to the contract drawings during construction which may be necessary due to field conditions.

4. WORK INCLUDED

All plumbing work (inside and outside the buildings) including all exterior sanitary and water piping. Also the complete gas storage and supply system; and solar water heating systems, if shown in Contract Drawings.

All provisions for metering, as required or shown in the Contract, all sewage treatment facilities and water pumping system, if shown in Contract Drawings.

All waste branches, soil stacks, soil branches, and vent lines within the buildings.

All work in connection with the water installation within buildings, and extending out to, and Drawings. All fixtures specified on drawings as well as excavating and backfilling required for pipe trenches, etc.

All roof flashing required for plumbing work. All work, materials, parts and piping for roof drainage. Everything necessary for the completion and successful operation of the work, whether or not herein definitely specified, or indicated on the drawings, shall be furnished and installed as well and as faithfully as if so specified or so indicated.

SECTION 15400 – PLUMBING (Cont.')

5. COMPLIANCE WITH MUNICIPAL AND COMMONWEALTH REGULATIONS

All work under this Division shall conform in every respect to Rules and Regulations of the Department of Health of Puerto Rico, the P.R. Aqueduct and Sewer Authority and Puerto Rico Environmental Quality Board, if applicable.

6. DRAWINGS

The drawings and specifications are intended to supplement each other so that any detail shown on the drawings & not mentioned in the specifications or vice versa, shall be executed the same as if mentioned in the specifications and shown on the drawings.

Everything necessary for the completions and successful operation of the work, whether or not herein definitely specified or indicated on the drawings, shall be furnished and installed as well and as faithfully as if specified or so indicated.

The Contractor, before installing any of this work, shall see that it does not interfere with the clearances required for finished partitions, walls, etc., as shown in the drawings.

Work installed by the Contractor which interferes with or modifies the architectural or the structural design as shown on the Contract Drawings shall be changed as directed by the Authority and all costs incident to such changes shall be paid by the Contractor.

7. PRIOR TESTS

All concealed work must remain uncovered until required tests have been completed, but in the event that the project constructions schedule requires it, the Contractor shall make arrangement for prior test on the portion of the plumbing work involved. The Authority shall be notified in advance of all prior tests and shall be represented at such tests. The cost of these tests shall be paid by the Contractor.

8. EXCAVATION AND BACKFILL

Trenches for all underground pipe lines shall be excavated to the required depths, and bell holes provided as necessary to insure uniform bearing. Excavations below required depth shall be refilled with sand or gravel firmly compacted. Where rock is encountered, it shall be excavated to a depth 3 inches below the lowermost part of the pipe and the space shall be refilled to grade with sand or gravel and well tamped. After pipe lines have been tested, inspected and approved by the Engineer, the trenches shall be filled with approved fill, which shall be thoroughly tamped, and firmly compacted.

SECTION 15400 – PLUMBING (Cont.')

9. MATERIALS

All inside soil, waste and vent piping and fittings for the building/s sanitary drainage system/s shall be PVC, Schedule 40DWV (Drain, Waste & Vent) pipe and fittings in accordance with latest edition of ASTM Standards D-2665 and D-2466 respectively.

All exterior building sewer piping and fittings (*cloaca exterior*) shall be PVC SDR-35 ASTM 3034 including connections required to the existing sanitary sewer facilities unless otherwise specified in the plumbing site plan approved by the P.R.A.S.A. Joints shall be in accordance with Federal Specifications WW-T-799a (L).

All galvanized piping shall be Schedule 40.

10. SUPPLY PIPING

All water supply pipes within the building shall be embedded in the chases, walls and/or in the floor slabs. When embedded in the floor slabs the pipe lines shall be placed on top of the reinforcing steel. Where copper tubing connects to steel or iron pipe the connections shall be made with dielectric couplings. Sizes for all water distributing piping and connection to fixtures shall be as shown on drawings.

11. SOIL, WASTE AND VENT PIPING

Soil, waste and vent stacks of sizes shown shall be run as indicated on the drawings and shall extend a minimum of six (6) inches above the roof. All offset shall be made at an angle of not more than 45º and all horizontal runs shall have a pitch of not less than 1/8" to the foot unless otherwise approved by the Authority.

Branch, soil, waste and vent connections shall be run to the soil stack, waste stacks or vent stacks as shown or required. Soil, waste, and vent piping shall be run as indicated on the plans.

Changes in directions in drainage or waste piping shall be made by the appropriate use of 45º wye (Y), long or short sweep quarter bends, fifth, sixth, eight or sixteenth bends or by a combination of these or equivalent fittings. Sanitary tees and short quarter bends may be used in drainage or waste lines only where the direction of flow is from the horizontal to the vertical. Long turn fittings shall be used whenever conditions permit. All horizontal ventilation piping shall pitch toward the main.

SECTION 15400 – PLUMBING (Cont.)

12. ROOF DRAINAGE SYSTEM AND INSTALLATION

Materials and parts for roof drains shall be as specified in contract drawings. Interior piping shall be DWV PVC schedule 40 with DWV fittings of PVC 1 type L.

12A. CLEANOUTS

All cleanouts shall be so located and installed so that they may be readily accessible and removable for cleaning the lines, and the plugs shall have their threads well greased to facilitate removal. Cleanouts are specified in Contract Drawings or herein.

13. HOSE BIBBS

Hose bibs are specified in Contract Drawings or herein.

14. GASKETS

Gasket material shall be Full-Faced for Cast Iron Flanges and Raised-Face for Steel Flanges. Select materials to suit the service of the piping system and in accordance to their respective ANSI standard (A 21.11, B16.20 or B16.21). Material chosen will not be detrimentally affected by the chemical and thermal properties of the fluid being carried. Materials containing asbestos are not acceptable.

15. HANGERS, ANCHORS AND GUIDES

All exposed piping shall be supported from the building structure, etc., by means of approved hangers or brackets. Piping shall be supported to maintain required grading and pitch of lines, to prevent vibrations and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.

Pipe hanger shall be secured to construction by approved iron inserts of adjustable type, where hanger locations are determined; after concrete is poured, expansion shields and bolts shall be used. These shall be of approved type.

16. OPEN ENDS

The Contractor shall keep all end of pipes, including those extending above roof, drains, and fixtures closed with caps or plugs so as to prevent dirt of building materials from

SECTION 15400 – PLUMBING (Cont.)

• OPEN ENDS (Cont.')

getting into pipe and traps. All temporary plugs or caps shall be removed at the completion of the work.

17. BRONZE BALL VALVE

At each building service connections and where shown on the drawings the contractor shall furnish properly placed water pipe, three-piece design ball valves, conforming to Federal Specifications WW-V-35, Type II, Class A, Style 1, rated for 400 WOG pressure.

Bronze Ball Valves shall be equal to Nibco three-piece ball valve 595 series for full flow, solder connections. The valves shall be furnished with type 316 stainless steel ball and stem, and with Buna-N Seat.

Sizes for all water distributing piping and connections to fixture shall be as shown on drawings.

All horizontal runs shall pitch toward the main.

18. LOCATION OF PLUMBING IN SLABS, WALLS AND CHASE

No parts of the plumbing shall be permitted to be exposed below the floor slabs, walls or chases. Water closet elbows, shower drain traps and any other part of plumbing shall be of such construction as to permit them to be completely embedded in the floor slabs, walls or chases.

19. TESTS OF PLUMBING SYSTEM

Sanitary Drainage System: The entire piping of sanitary system in each building shall be tested with water and proved tight to the satisfaction of the Engineer before trenches area backfilled, piping covered, or fixtures connected.

For water tests, the connections to yard sewers and the piping of the sanitary system below floors on ground shall be filled with water to the top of a vertical section of pipe ten feet high and the water allowed to stand for at least 30 minutes for inspection, after which, if the lines prove tight, the water shall be drawn off and the fixtures connected. Each vertical stack of the sanitary system, with its branch waste and vent pipes, shall be tested separately.

SECTION 15400 – PLUMBING (Cont.)

• TESTS OF PLUMBING SYSTEM (Cont.')

Water Supply System: The entire water supply system shall be tested to a hydrostatic pressure of 125 pounds per square inch and proved tight at this pressure before trenches area backfilled and before fixtures area installed. Water supply piping, if in any way concealed by structural work, shall be tested to the aforesaid pressure and proved tight before pipes are concealed.

All repairs to piping system shall be made with new material. No caulking on screwed joints, cracks, or holes will be acceptable. Where it becomes necessary to replace pieces of pipe, such replacement shall be the same length as the defective parts.

20. GENERAL REQUIREMENTS

All parts of the plumbing system and associated equipment shall be tested and adjusted to work properly and be left in good operating condition.

All testing instruments, gauges, pumps, and other equipment required or necessary for tests shall be provided by the Contractor.

The Authority shall be notified in advance of all tests, and shall have a representative present. Tests shall be conducted to his entire satisfaction.

All defects disclosed in the work by tests or otherwise shall be made good or the work replaced without additional cost to the Authority.

Tests shall be repeated after any defects disclosed thereby have been made good or the work replaced, if the Authority deems necessary.

21. GENERAL TEST FOR WATER SUPPLY AND PLUMBING SYSTEM

Prior to Requesting Final Inspection, the Contractor shall have the project water distribution system connected to its indicated source of supply and in operation, with all valves fully open. He shall also have installed temporary connections thru the meter box so as to supply running water thru all interior and exterior pipe lines. A complete test shall be made by the Engineer of all bibs, compression stops, shower valves, lawn faucets and other fittings of the plumbing system.

All defective work discovered by this test shall be satisfactorily corrected by the Contractor, before final acceptance of work. All the water consumed during the test shall be at the Contractor's expense.

SECTION 15400 – PLUMBING (Cont.)

22. PLUMBING FIXTURES

General Requirements:

The Contractor shall furnish and install fixtures in accordance with the fixture schedule shown in Contract Drawings. Plumbing fixtures shall be of the best quality.

All material specified to be brass shall be thoroughly cleaned and polished.

Each fixture shall be separately trapped, using the type and size of trap called for under the heading of "Fixture" of the type required by the plumbing code. The traps shall be of approved type.

The Contractor shall erect the roughing-in of the soil, waste and water supply piping strictly in accordance with the sanitary fixtures roughing-in measurements furnished in advance by the designer.

Roughing-in shall include water supply, drainage, and necessary work required for the installation of the fixtures. Floor drains shall be provided at all toilet rooms.

23. FIXTURE CONNECTIONS

All floor connections must comply with the requirements of the local plumbing regulations except where herein otherwise specified. Connections between fixture with a floor outlet and flange shall be made with non-asbestos composition filler which must be a germicide, absolutely gas and fume proof, watertight, stain-proof, which does not harden or dry under any extreme of climatic change, and must adhere to wet surfaces.

24. GUARANTEE

a. The Contractor shall leave the entire plumbing installation included under this Contract in proper working conditions, and shall, without additional charge, replace any work, materials and/or equipment or any of its component parts which develop defects, except from ordinary use, within one (1) year from the date of final certificate of approval issued by the Puerto Rico Aqueduct & Sewer Authority, the P.B.A. and other applicable agencies.

b. The Contractor shall also be responsible for any or all damages resulting from defective materials, and/or equipment, and shall, without additional charge, repair or replace all injuries to existing work caused by such defects or replacements to the satisfaction of the Authority.

SECTION 15400 – PLUMBING (Cont.)

c. The Contractor shall furnish certificates or guarantee from the manufacturers of specialties to the effect that they will furnish new parts, fixtures, materials or equipment where defects occur due to faulty manufacture for a period of one, (1) year from the date of final certificate of approval issued by the Authority.

25. PLUMBING FIXTURES AND BATHROOM ACCESSORIES SCHEDULE

The Contractor shall furnish and install, at proposed male and/or female's restrooms (whichever applies), the plumbing fixtures and bathroom accessories indicated on plans, in accordance to description shown on the following schedule:

NUMBER	DESCRIPTION	HEIGHT	LOCATION	COMMENTS
1	WATER CLOSET	1'-5" top	Toilets	Approved equal or similar to American Standard *Afwall*, 1.128 GPF, manual flush valve, elongated wall mounted.
2	WATER CLOSET FOR THE HANDICAPPED	1'-7" top	Toilets	Same as Number 1 but shall be installed at 19" from top of rim to floor.
3	WATER CLOSET FOR KINDERGARTEN	0'-10" top	Toilets	Approved equal or similar to American Standard *Baby Devoro*, round front flush valve toilet, less seat, 10" rough-in. Rim height at 10".
4	LAVATORY SINK	2'-5" top	Toilets	Approved equal or similar to American Standard *Declyn* wall mount sink, 0.5 GPM, Model 1340.119, pillar tap metering faucet w/ extended spout.
5	LAVATORY SINK FOR THE HANDICAPPED	2'-10" top	Toilets	Same as Number 4 but shall be installed at 34" from floor with automatic closing faucet.

• **PLUMBING FIXTURES & BATHROOM ACCESSORIES SCHEDULE (Cont.'):**

NUMBER	DESCRIPTION	HEIGHT	LOCATION	COMMENTS
6	LAVATORY SINK FOR KINDERGARTEN	1'-10" top	Toilets	Approved equal or similar to American Standard *Lucerne* wall hung lavatory w/ single center faucet hole, Model 0356.421, pillar tap metering faucet w/ extended spout.
7	SINGLE BOWL KITCHEN SINK	As Indicated on Drawings	Office Kitchenette	Approved equal or similar to American Standard Model 145B.301900, 18gauge, 30⅛" x 19⅛"x 9". Strainers shall be American Standard Model 4331013, Brass Body, 3½" outlet, 1½" tail-place.
8	URINAL	1'-0" base	Toilets	Approved equal or similar to American Stand. *Trimbrook.* 0.85-1.0 GPF, Model 6561.017, white vitreous china, blow-out urinal with two (2) wall hanger, ¾" inlet spud.
9	URINAL FOR THE HANDICAPPED	1'-0" base	Toilets	Same as Number 8
10	WATER HEATER	According to Shower Head	Toilets	Tank-less electric water heater, approved equal or similar to *Power Pak Plus* (220v.) manufactured by *Marey*. **To be connected to nearest available electric panel-board.**
11	HAND DRYER	As Indicated on Drawings	Toilets	Approved equal or similar to recessed hand dryer Bobrick Model B-750 w/ auto pilot no-touch sensor. **To be connected to the nearest available electric utility or panel-board.**

• **PLUMBING FIXTURES & BATHROOM ACCESSORIES SCHEDULE (Cont.'):**

NUMBER	DESCRIPTION	HEIGHT	LOCATION	COMMENTS
12	GRAB BAR (24")	3'-0" center	Toilet for Disabled	1¼" diameter, stainless steel, surface mounted with snap flange. Approved equal or similar to Bobrick Model B-5806 series.
13	GRAB BAR (36")	3'-0" center	Toilet for Disabled	1¼" diameter, stainless steel, surface mounted with snap flange. Approved equal or similar to Bobrick Model B-5806 series.
14	MIRROR	3'-4" base	Toilets	Approved equal or similar to Bobrick Model B-165-1824, 18" x 24".
15	TILTED MIRROR FOR THE HANDICAPPED	Complied with ADA	Toilets	Approved equal or similar to Bobrick Model B-293, stainless steel, 18" x 30".
16	MEDICINE CABINET	Complied with ADA	Toilets	Approved equal or similar to Bobrick Model B-297, surface-mounted, heavy-gauge steel w/ mirror and fixed shelves.
17	LAVATORY WATER FAUCET	2'-5" base	Toilets	One-handle, 4" center set, approved equal or similar to American Standard Model Colony-Soft No. 2275.509 (Polished Chrome).
18	KITCHEN SINK FAUCET	As Indicated on Plans	Office Kitchenette	One-metal lever handle, 8-½" spout length, approved equal or similar to American Standard Model Colony-Soft No. 417560.

• **PLUMBING FIXTURES & BATHROOM ACCESSORIES SCHEDULE (Cont.'):**

NUMBER	DESCRIPTION	HEIGHT	LOCATION	COMMENTS
19	SHOWER STALL (Shower Head)	Complied with ADA	Toilets	Soft hand system kit, Approved Equal or Similar to American Standard Model 1662.600.002, ½" pipe conn., 30° spray adjustment, 4-arm handle w/ vandal-proof screws, ½" pipe size.
20	SHOWER SEAT (Folding Corner)	Complied with ADA	Toilets	Approved equal or similar to Bobrick Model B-5193 w/ solidly fused plastic surface and stainless steel frame. Folds to vertical position when not in use.
21	SHOWER CURTAIN ROD	6'-0" top	Toilets	Approved equal or similar to Bobrick Model B-6107 (heavy duty).
22	TOILET PAPER HOLDER	As Indicated on Plans	Toilets	Approved equal or similar to Bobrick Model B-288 (surface mounted).
23	PAPER TOWEL DISPENSER & WASTE RECEPTACLE	Wall Opening at 51" from Finish Floor	Toilets	Approved equal or similar to Bobrick Model B-3944 (recessed mounted).
24	SOAP DISH (For Shower)	As Indicated on Plans	Toilets	Approved equal or similar to Bobrick Model B-4390, stainless steel, heavy duty recessed mounted with bar.
25	LIQUID SOAP DISPENSER	As Indicated on Plans	Toilets	Approved equal or similar to Bobrick Model B-2112 (surface mounted).

• **PLUMBING FIXTURES & BATHROOM ACCESSORIES SCHEDULE (Cont.'):**

NUMBER	DESCRIPTION	HEIGHT	LOCATION	COMMENTS
26	HOSE BIBB	As Indicated on Drawings	Outside Building (On-Site)	Approved equal or similar to Central Brass Model 576, ½"–14 PS, female, lock-shield type with loose key handle.
27	FLOOR DRAIN	N/A	Toilets	Approved equal or similar to J.R. Smith 2010-A, cast iron body with 5" Ø round grate strainer, polished bronze with vandal-proof screws.
28	CLEAN-OUT (Flush with Floor)	N/A	Floor	PVC type body with bronze countersunk plug and access cover approved equal or similar to J.R. Smith series 4810, round frame with scoriated cover, nickel bronze, furnished with vandal-proof screws.
29	WALL TILE	As Indicated on Plans	Toilets	8" x 8" ceramic wall tiles (ivory color), as specified on Sections 09310 and 09311.
30	FLOOR TILE	As Indicated on Plans	Toilets	12" x 12" non-slip ceramic floor tiles (ivory color), as specified on Sections 09310 and 09311.

SECTION 15420

DRAINAGE AND VENT PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.

1.3 DEFINITIONS

A. Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.

B. Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.

C. Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.

D. Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.

E. Force-Main Piping: Drainage piping, under pressure.

F. The following are industry abbreviations for plastic and other piping materials:

1. ABS: Acrylonitrile-butadiene-styrene.
2. EPDM: Ethylene-propylene-dyne polymer, rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Systems: 10-foot head of water.
2. Storm Drainage Systems: 10-foot head of water.

• SYSTEM PERFORMANCE REQUIREMENTS (Cont.')

3. Sewage, Force-Main Piping Systems: 100 psig.

1.5 SUBMITTALS

A. Test Results and Reports: Specified in "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

B. Comply with ASME B31.9, "Building Service Piping", for materials, products, and installation.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials", for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 – PRODUCTS

2.1 PIPES AND TUBES

A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

B. Ductile-Iron Pipe: AWWA C151 with mechanical- or push-on-joint bell and plain spigot end, unless plain, grooved, or flanged ends are indicated.

C. PVC Plastic Pipe: ASTM D 2665, Schedule 40

2.2 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311 drain, waste, and vent pipe patterns.

2.3 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

PART 3 – EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Aboveground, Soil, Waste, and Vent Piping: Use the following:

1. 1-¼ and 1-½ inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
2. 2 to 4 inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
3. 5 and 6 inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
4. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
5. 10-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
6. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, Soil, Waste, and Vent Piping: Use the following:

1. 1-½-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
2. 2 to 4-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
3. 5 and 6-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
4. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
5. 10-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
6. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.

E. Aboveground, Storm Drainage Piping: Use the following:

1. 2 to 4 Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
2. 5 and 6 Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
3. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
4. 10-inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
5. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, Storm Drainage Piping: Use the following:

1. 3-and 4 Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
2. 5 and 6 Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
3. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
4. 10-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
5. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.

• PIPING APPLICATIONS (Cont.')

G. Aboveground, Sewage Force Mains: Use the following:

1. 2 to 4-Inch NPS: Galvanized steel pipe and cast-iron, threaded fittings.
2. 5 and 6-Inch NPS: Galvanized steel pipe and cast-iron, threaded fittings.

H. Underground, Sewage-Force-Main, Service Entrance Piping: Use the following:

1. 4 and 6-Inch NPS: Ductile-iron pipe; ductile-iron, mechanical or push-on-joint fittings; rubber gaskets; and mechanical or push-on joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use gate, ball, or butterfly valves.
2. Throttling Duty: Use globe, ball, or butterfly valves.

B. Grooved-end butterfly valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION, GENERAL

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

A. Refer to Division 2 Section "Sewerage and Drainage" for sanitary and storm sewer piping.

B. Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.

C. Extend building storm drain piping and connect to storm sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building storm drains and building storm sewers.

D. Extend building sanitary drain, force-main piping and connect to sanitary sewer piping in size and location indicated for service entrance into building. Install cleanout, fitting with closure plug or equivalent, inside building.

E. Extend building storm drain, force-main piping and connect to storm sewer piping in size and location indicated for service entrance into building. Install cleanout, fitting with closure plug or equivalent, inside building.

• SERVICE ENTRANCE PIPING INSTALLATIONS (Cont.')

F. Ductile-Iron, Force-Main, Service Entrance Piping: Comply with AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Encase piping with polyethylene film according to ASTM A 674 or AWWA C105.

G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

H. Install wall penetration system at each service entrance pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.

3.6 DRAINAGE AND VENT PIPING INSTALLATION

A. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook", Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".

B. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-tum, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reduces if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.

C. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

D. Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Sanitary Building Drain: 2 percent downward in direction of flow for piping 3-inch NPS and smaller, 1 percent downward in direction of flow for piping 4 inch NPS and larger.
2. Horizontal, Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Storm Building Drain: 1 percent downward in direction of flow.
4. Horizontal, Storm Drainage Piping: 2 percent downward in direction of flow.
5. Vent Piping: 1 percent down toward vertical fixture vent of toward vent stack.

E. Install force mains at elevations indicated.

• DRAINAGE AND VENT PIPING INSTALLATIONS (Cont.')

F. Install engineered, sanitary drainage and vent systems in locations indicated and as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Copper, Sovent, Single Stack: Comply with CDA 402/0, "Brass and Bronze Design Handbook, Single-Stack Plumbing System.
3. Cast-Iron, Sovent, Single Stack, Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
4. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

G. Install engineered, controlled-flow, storm drainage systems in locations indicated. Comply with standards of authorities having jurisdiction.

H. Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

I. Install ABS plastic drainage piping according to ASTM D 2661.

J. Install PVC plastic drainage piping according to ASTM D 2665.

K. Install underground, ABS and PVC plastic drainage piping according to ASTM D 2321.

3.7 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook", Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".

1. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hub-less Joints: Make with rubber gasket and sleeve or clamp.

C. Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. PVC Piping Joints: Join drainage piping according to ASTM D 2665.

E. Handling of Solvent Cements, Primers, and Cleaners: comply with procedures in ASTM F 402 for safe handling during joining of plastic pipe and fittings.

3.8 VALVE INSTALLATION

A. Shutoff Valves: Install shutoff valve on each pump discharge and where indicated. Use gate or ball valves for piping 2-inch NPS and smaller. Use gate or butterfly valves for piping 2-½ inch NPS and larger.

B. Check Valves: Install swing check valve on each pump discharge, downstream from shutoff valve.

3.9 HANGER AND SUPPORT INSTALLATION

A. Install supports according to Division 15 Section "Hangers and Supports".

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum spacing and minimum rod diameters:

1. 1-½ and 2-Inch NPS: Maximum horizontal spacing, 60 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
2. 3-inch NPS: Maximum horizontal spacing, 60 inches with ½-inch minimum rod diameter, maximum vertical spacing, 15 feet.
3. 4 and 5-Inch NPS: Maximum horizontal spacing, 60 inches with 5/8 inch minimum rod diameter, maximum vertical spacing, 15 feet.
4. 6-Inch NPS: Maximum horizontal spacing, 60 inches with ¾-inch minimum rod diameter; maximum vertical spacing, 15 feet.
5. 8 through 12-Inch NPS: Maximum horizontal spacing, 60 inches with 7/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
6. 15-Inch NPS: Maximum horizontal spacing, 60 inches with 1-inch minimum rod diameter, maximum vertical spacing, 15 feet.
7. Spacing for horizontal pipe in 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

E. Install hangers for steel and ductile-iron piping with the following maximum spacing and minimum rod diameters:

1. 1-¼-Inch NPS: Maximum horizontal spacing, 84 inches; 3/8-inch minimum rod diameter, maximum vertical spacing, 15 feet.
2. 1-½-Inch NPS: Maximum horizontal spacing, 108 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
3. 2-Inch NPS: Maximum horizontal spacing, 10 feet with 3/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
4. 2-½-Inch NPS: Maximum horizontal spacing, 11 feet with ½-inch minimum rod diameter, maximum vertical spacing, 15 feet.
5. 3-Inch NPSL: Maximum horizontal spacing, 12 feet with ½-inch minimum rod diameter; maximum vertical spacing, 15 feet.
6. 4 and 5-Inch NPS: Maximum horizontal spacing, 12 feet with 5/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
7. 6-Inch NPS: Maximum horizontal spacing, 12 feet with ¾-inch minimum rod diameter; maximum vertical spacing, 15 feet.
8. 8 through 12-Inch NPS: Maximum horizontal spacing, 12 feet with 7/8-inch minimum rod diameter, maximum vertical spacing, 15 feet.
9. 14 through 18-Inch NPS: Maximum horizontal spacing, 12 feet with 1-inch minimum rod diameter, maximum vertical spacing, 15 feet.

F. Install hangers for ABS and PVC plastic piping with the following maximum spacing and minimum rod diameters:

• HANGER AND SUPPORT INSTALLATION (Cont.')

1. 1-½ and 2-Inch NPS: Maximum horizontal spacing, 48 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
2. 4 and 5-Inch NPS: Maximum horizontal spacing, 48 inches with 5/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
3. 6-Inch NPS: Maximum horizontal spacing, 48 inches with ¾-inch minimum rod diameter; maximum vertical spacing, 48 inches.
4. 8 through 12-Inch NPS: Maximum horizontal spacing, 48 inches with 7/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

3.11 FIELD QUALITY CONTROL

A. Inspect drainage and vent piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

    a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.

• FIELD QUALITY CONTROL (Cont.')

3. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head. Water level must not drop from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
4. Prepare reports for test and required corrective action.

3.12 CLEANING AND PROTECTING

A. Clean interior of piping system. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION

SECTION 15720

AIR HANDLING UNITS

PART 1 - GENERAL

1.01 SUMMARY:

A. This section provides the general requirements for air handling units and related equipment and materials to be installed on proposed expansion to special education classroom at Angelita Cordero Bernard Elementary School.

1.02 SCOPE OF WORK:

A. Furnish and install air handling units, conforming in all aspects to the specifications, schedules and plans or drawings.

B. Furnish and install any accessories required by air handling units operation as recommended by manufacturer or distributors and is not specific in drawings. Check with Engineer for approval.

1. Additional accessories include:

i. Roof culvert

ii. Duct works for proper connection between new supply and return and existing duct.

C. Furnish and install safety switch devices for electric motor in air handling units.

1.03 RELATED WORKS:

A. Section 15082- Equipment Insulation

B. Section 15083- Pipe Insulation

C. Section 15180- Heating and Cooling Piping

D. Section 15950- Testing, Adjusting and Balancing.

1.04 RELATED STANDARDS:

A. ARI- Air Conditioning and Refrigeration Institute

B. ASHRAE- American Society of Heating, Refrigeration and Air conditioning Engineers

C. ASTM- American society for Testing Materials

D. NEC- National Electrical Code

E. NFPA- National Fire Protection Association

F. NEMA- National Electric Manufacturers Association

G. UL- United Laboratories

H. OSHA- Office of Safety and Health Act

I. EPA- Environmental Protection Agency

1.05 SUBMITTALS:

A. Submit three (3) copies of data for air handling units.

B. Submittal shall include manufacturer data:

1. Air handling unit capacities, weight, accessories, electrical requirements and wiring diagrams.
2. Drawing showing component layout, piping configuration, connection size, overall dimension and field clearances and piping requirements.
3. Psychometric chart and performance data at design temperatures and thermal loads.
4. Fan performance curves.
5. Data of filter media, filter performance, filter assembly and frames.
6. Installation recommendations.
7. Complete description of controls with sequencing data and wiring diagrams.

C. After air handling units submittal approval send four (4) copies of:

1. Operation manuals.
2. Maintenance manuals, including troubleshooting.
3. Parts manual with exploded part list for each air handling units.
4. Recommended list of spare parts.

1.06 QUALITY ASSURANCE:

A. Inspect air handling units delivered to site for damages

B. Store with minimum handling and comply with manufacturer's instruction for rigging, loading-unloading and transportation.

C. Store and protect as indicated by manufacturer against weather or vandalism.

D. Do not store air handling units directly on ground.

E. Keep materials and equipment free of debris and dirt.

PART 2 - PRODUCTS

2.01 AIR HANDLING UNITS-GENERAL

A. Air handling units shall be interior type.

B. Air handling units shall be DX-Split type.

C. Air handling units shall be single-zone purpose.

D. Air handling units shall to complaint with ARI-430-99 or latest edition.

E. Vibration isolation shall be supply at each supports. Spring kind is recommended.

F. Warranty by one (1) year in parts and labor.

G. Components:

1. Casing
2. Fans
3. Cooling coils
4. Dampers
5. Bearing and Drives
6. Filters
7. Electric motors
8. Others

H. Capacities:

1. Indoor Supply CFM shall be as indicated in DX-split units – evaporator section schedule.
   i. 1,380 CFM for A/C-01
   ii. 1,605 CFM for A/C-02

2. Cooling coil capacity (operating) shall be as indicated in DX-split units – evaporator section schedule.
   i. 54.02 MBTU for A/C-01
   ii. 61.01 MBTU for A/C-02

3. External static pressure shall be as indicated in DX-split units – evaporator section schedule.
   i. 0.5 in WG for A/C-01
   ii. 0.5 in WG for A/C-02

4. Air handling units shall be capable to supply air equal or below to 58°F at rated conditions.

I. Acceptable manufacturers are (in alphabetic order):

1. Carrier
2. Mc Quay
3. Trane
4. York
5. Other as Engineer approval.

2.02 COMPONENTS:

A. Casing:

1. External casing shall be fabricated of galvanized steel. Gauge 16 or better.
2. External casing shall be fabricate with removable panels and mechanical fastened.
3. Sections shall be assembled with compression gaskets between each frame member.
4. Casing leaks shall be no more than 0.5 CFM / ft^2 of exposed cabinet area.
5. Casing panels shall withstand a positive or negative 4 in wg of static pressure without visible deflection.
6. Casing shall be double wall type.
7. Provide access door of galvanized steel and flush mounted. Access door shall be gasketed and easy to remove.
8. Provide drain pan under cooling coil section. Drain pan shall be of stainless steel 304.

B. Fans:

1. Fans shall be backward inclined.
2. Manufacturer shall dynamically balance fan assembly.
3. Fan and motor shall be internally mounted in a steel base with mechanism for vibration absorption.
4. Manufacturer shall certificate that fan rpm area under critical speed.
5. Fan speed shall not be more than 1,800 RPM, consult Engineer to other speeds.
6. Fan velocity shall be less than 400 ft/min.

C. Cooling coils:

1. Provide access to cooling coil at both sides of air handling units.
2. Cooling coil connection shall extend five inches (5") minimum from air handling unit casing.
3. Cooling coil capacities shall be certify by manufacturer using ARI standard 410. Certification shall include:
    i. Cooling capacity
    ii. Air Pressure drop
4. Cooling coils shall provide cooling capacity as indicated in schedule table at rated conditions.
5. Cooling coil fins shall have a minimum thickness of 0.0075 inches.
6. Cooling coil fins shall be fabricated for marine hard corrosion resistance.
7. Cooling coils, tubes shall be seamless copper with nominal wall thickness of 0.025 inches.
8. Cooling coil tube shall be of minimum 5/8' outside diameter.
9. Cooling coil assemblies shall be removable through access panels.

D. Dampers:

1. Air handling units shall be single-zone purpose.
2. Dampers blades shall be of galvanized steel.
3. Damper blades shall rotate 90° and required one actuator per cooling zone.
4. Zone dampers shall be design, sized and constructed for the full rated flow of the unit.

E. Bearings and Drives:

1. Bearings to be used in fans shall be pillow block type, self-alignment and grease lubricated. Provide external connection for maintenance grease activities.
2. Bearings shall be 200,000 hours life at maximum operating conditions.
3. Shafts used in fans shall be hot rolled steel, solid type, ground and polish.
4. Fan assembly shall be V-belt drive type.
5. V-belts drive shall be of cast iron or steel sheaves.
6. Sheaves shall be dynamically balanced.
7. Power band belts or matching set belts are not recommended.
8. If variable pitch sheaves are used, set belts at mid-position to get the required performance.

9. The minimum belts for drive system shall be two (2).

F. Filter section:

1. Filter section with front loading frames and clips.
2. Filters shall be UL 900 listed
3. Filters shall be reusable, with MERV 7 efficiency, for both units (A/C-01 and A/C-02).
4. Use angle filter arrangement with two inches (2") disposable cartridges.
5. Manufacturer shall install differential pressure meter to read pressure drop across filter banks.

G. Electric motors:

1. Electric motor shall be 208 V, 3 Ø, 60 Hz.
2. Electric motor shall be total enclosed fan cooled (TEFC) type.
3. Service factor for electric motor shall be 1.2.
4. Provide factory mounted disconnected switch.

H. Others:

1. Equipment or materials included in this section are:
   i. Drain piping: Use copper type L DWV for drain and discharge to nearest roof drain.
   ii. Strainers
   iii. Roof Culvert
2. Contractor shall replace any equipment here indicated to proper performance of AHU or as required by Engineer or PBA representative.

PART 3 - EXECUTION

3.01 WORK PREPARATION:

A. Contractor shall to coordinate any work with PBA representative or Engineer.

B. Contractor shall coordinate any work to be executing out of regular working hours.

C. Contractor shall be responsible by all necessary permissions and taxes in the transportation from distributor or fabrication facilities to installation site.

D. Contractor shall be responsible for handling and disposal of any kind of hazardous material find it in the pre-bid visit or in the installation process.

3.02 INSTALLATION:

A. Install air handling units according the manufacturer instructions and recommendations.

B. Air handling units shall be located as indicated in drawings or existing site.

C. Air handling units shall be supported according with manufacturer instruction.

D. Rigging or moving of air handling units shall be according manufacturer's instruction and recommendation.

E. Rigging, lifting or moving of any equipment or material shall be according OSHA standards and regulations.

3.03 START-UP:

A. A service factory trained representative (engineer or technician) shall be available on site for start-up of air handling units.

B. Factory start-up services shall be providing for as long a time as is necessary to provide proper operation of air handling units.

C. Air handling units shall be factory lubricated.

D. The factory representative shall train four (4) employees of PBA in the operation, maintenance and troubleshooting of new split system units & equipment.

E. Contractor shall submit four (4) maintenance and operation manual to PBA representative or Engineer.

3.04 PERFORMANCE:

A. Use the Associated Air Balance Council (AABC) standards (last edition) for balancing works.

B. Manufacturer shall perform the standard ARI run test under the supervision of Engineer or PBA representative. Data of test shall be certified and submitted to Engineer.

C. Balancing and adjustment shall be within 5% of design parameters.

D. For calculations use the standard refrigeration ton (12,000 Btu/hr) and evaporative ton equivalent to 15,000 Btu/Hr as required.

E. Contractor shall submit four (4) copies of certificate results of balancing test and adjustment by third party contractor.

END OF SECTION
15720

SECTION 15781

PACKAGED ROOFTOP COOLING UNITS

PART 1. GENERAL:

SUMMARY:

SCOPE OF WORKS:

RELATED WORK:

A. Not Used

RELATED STANDARDS:

A. ARI- Air Conditioning and Refrigeration Institute
B. ASHRAE- American Society of Heating, Refrigeration and Air conditioning Engineers
C. ASTM- American society for Testing Materials
D. NEC- National Electrical Code

E. NFPA- National Fire Protection Association

F. NEMA- National Electric Manufacturers Association

G. UL- United Laboratories

H. OSHA- Office of Safety and Health Act

I. EPA- Environmental Protection Agency

SUBMITTALS:

A. Submit three (3) copies of data for Roof Top packaged units.

B. Submittal shall include manufacturer data:

1. Package units capacities, weight, accessories, electrical requirements and wiring diagrams.
2. Drawing showing component layout, piping configuration, connection size, overall dimension and field clearances.
3. Psychometric chart and performance data at design temperatures and thermal loads.
4. Fan performance curves.
5. Data of filter media, filter performance, filter assembly and frames.
6. Installation recommendations.
7. Complete description of controls with sequencing data and wiring diagrams.

C. After roof top package units submittal approval send four (4) copies of:

1. Operation manuals.
2. Maintenance manuals, including troubleshooting.
3. Parts manual with exploded part list for each top roof package units.
4. Recommended list of spare parts.

QUALITY ASSURANCE:

A. Inspect roof top package units delivered to site for damages

B. Store with minimum handling and comply with manufacturer’s instruction for rigging, loading-unloading and transportation.

C. Store and protect as indicated by manufacturer against weather or vandalism.

D. Do not store top roof package units directly on ground.

E. Keep materials and equipment free of debris and dirt.

WARRANTY

A. Provide 1 year unconditional labor and parts warranty on any component of the units.

B. Provide 5 years unconditional parts warranty on compressor units.

C. Submit warranty documentation and certification after start-up.

PART 2. PRODUCTS:

ROOF TOP PACKAGE UNITS-GENERAL

A. RTU shall be drawn thru type.

B. RTU shall be single-zone purpose.

C. RTU shall to complaint with ARI- 340/360 or latest edition.

D. Vibration isolation shall be supply at each fan-motor supports. Spring kind is recommended.

E. Components:

1. Casing
2. Fans
3. Compressor
4. Cooling coils
5. Condenser coils
6. Condenser fan and motors
7. Dampers
8. Fresh air intake
9. Bearing and Drives
10. Filters
11. Electric motors
12. Others

F. Capacities:

1. Supply CFM, Cooling coil capacity, External static pressure and Fresh air quantity shall be as indicated in drawings schedules.
2. Roof top package units shall be capable to supply air equal or below to 57 ^{o}F db at rated conditions.
3. Roof top package units shall be rated to 95 ^{o}F condenser ambient temperature (**No exception**).
4. Roof top package units shall have an 11.5 EER (energy efficiency ratio) or better.

G. Acceptable manufacturers are (in alphabetic order):

1. Carrier
2. McQuay
3. Trane

4. York
5. Other as Engineer approval.

COMPONENTS:

A. Casing:

1. External casing shall be fabricated of galvanized steel. Gauge 18 or better.
2. External casing shall be with removable panels and mechanical fastened.
3. Sections shall be assembled with compression gaskets between each frame member.
4. Casing leaks shall be no more than 0.5 CFM / ft^2 of exposed cabinet area.
5. Casing panels shall withstand a positive or negative 4 in wg of static pressure without visible deflection.
6. Casing shall be **double wall type**.
7. Provide 1.5" insulation material between panel. Insulation shall meet NFPA-90A.
8. Pitch roof top for drain.
9. Provide access door of galvanized steel and flush mounted. Access door shall be gasketed and easy to remove.
10. Provide drain pan under cooling coil section and internally sloped. Drain pan shall be of **304 stainless steel**. Condensate connection shall be 1" minimum.

B. Fans:

1. Fans shall be forward / curved inclined.
2. Fan shall be double inlet and double width.
3. Manufacturer shall dynamically balance fan assembly.
4. Fan and motor shall be internally mounted in a steel base with mechanism for vibration absorption.
5. Manufacturer shall to certificate that fan rpm area under critical speed.
6. Fan speed shall not be more than 1,800 RPM, consult Engineer to other speeds.
7. Face velocity shall be less than 400 ft/min.
8. Provide neoprene connection to eliminate vibration transmission.

C. Compressors:

1. Compressor shall be hermetic type, direct drive, internally protected with internal high pressure relief.
2. The hermetic motor shall be suction gas cooled and have a voltage range of +/- 10% of unit name plate voltage.

3. Compressor shall have vibration isolation spring or mounts.

D. Cooling coils:

1. Provide access (**DOORS**) to cooling coil at both sides of top roof package units.
2. Cooling coil fins shall have a minimum thickness of 0.0075 inches.
3. Cooling coils, tubes shall be seamless copper with nominal wall thickness of 0.025 inches.
4. Cooling coil assemblies shall be removable through access panels.
5. Cooling coil shall be direct expansion design.

E. Condenser coil:

1. Cooling coil fins shall have a minimum thickness of 0.0075 inches.
2. Cooling coils, tubes shall be seamless copper with nominal wall thickness of 0.025 inches.
3. Cooling coils shall have corrosion protective coating. Red Oxide treatment is not acceptable. Corrosion protective coating shall be for mild marine environment purpose.
4. Cooling coil shall be direct expansion design.

F. Condenser fan and motors:

1. Condenser fans shall be direct drive motors.
2. Condenser fans shall be propeller type.
3. Condenser fans shall include a heavy duty safety guard.
4. Condenser fans motors shall be totally enclosed (TEFC).

G. Dampers:

1. Dampers blades shall be of galvanized steel.
2. Damper blades shall rotate 90^{o} and required one actuator.

H. Fresh air intake:

1. provide fresh air intake, manually operate to supply the required CFM as indicated in drawings and schedules.

I. Bearings and Drives:

1. Bearings to be used in fans shall be pillow block type, self-alignment and grease lubricated. Provide external connection for maintenance grease activities.
2. Bearings shall be 200,000 hours life at maximum operating conditions.
3. Shafts used in fans shall be hot rolled steel, solid type, ground and polish.
4. Fan assembly shall be V-belt drive type.

5. V-belts drive shall be of cast iron or steel sheaves.
6. Sheaves shall be dynamically balanced.
7. Power band belts or matching set belts are not recommended.
8. If variable pitch sheaves are used, set belts at mid-position to get the required performance.
9. The minimum belts for drive system shall be two (2).

J. Filter section:

1. Filter section with side loading frames and clips.
2. Filters shall be UL 900 listed
3. Filters shall be 30 % efficiency.
4. Use angle filter arrangement with 2 inches disposable cartridges.
5. Manufacturer shall install differential pressure meter to read pressure drop across filter banks.

K. Electric motors:

1. Electric motor shall be 460 V, 3 Ø, 60 Hz (contractor have to make a field voltage check before ordering, **MEANS DOUBLE CHECK**).
2. Electric motor shall be total enclosed fan cooled (TEFC) type.
3. Service factor for electric motor shall be 1.2.
4. Provide factory mounted disconnected switch.

L. Operating controls:

1. Provide low-voltage, adjustable thermostat to control compressor and condenser fan, and supply fan to maintain temperature setting.
    i. Include system selector switch ON-COOL-OFF and fan control switch (ON-AUTO).
    ii. Provide thermostat controller for the stages required to proper control of roof top unit.
    iii. Locate thermostat in room as actual controls. Locate temperature sensing element (if required) on air return duct, next of exit of room routing thru top roof package unit.
2. 7 days, 24 hours programming capacity.
3. Touch screen configuration capability. Large display with backlight.
4. Temperature control of +/- 1^{o}F of cooling range.
5. Provide 5 years warranty.

M. Others:

1. Equipment or materials included in this section are:

i. Use PVC for drain and discharge to nearest roof drain.

ii. Roof Curb. Not Used – Roof Top Unit shall be with similar foot-print as existing unit. In case of different Roof Top Unit, Roof curb shall be 14" high, full perimeter curb with wood nailer.

PART 3. EXECUTION

WORK PREPARATION:

A. Contractor shall remove the existing roof top units.

1. Removing include electrical connection and plumbing connections not necessary for futures works or new equipment. Consult Engineer or PBA representative for complete scope of removing scope.

2. Final disposition of removed equipment and material shall in accordance with Puerto Rico environmental standards and regulations, and EPA.

B. Contractor shall to coordinate any work with PBA representative or Engineer.

C. Contractor shall coordinate any work to be executing out of regular offices hours as required by Engineer or PBA representative.

D. Contractor shall be responsible by all necessary permissions and taxes in the transportation from distributor or fabrication facilities to installation site.

E. Contractor shall be responsible for handling and disposal of any kind of hazardous material find it in the pre-bid visit or in the installation process.

INSTALLATION:

A. Install Roof Top Package Units according the manufacturer instructions and recommendations.

B. Roof Top Package units shall be located as indicated in drawings or existing site.

C. Roof Top package units shall be supported according with manufacturer instruction.

D. Contractor shall paint pipes and equipment as indicated by Engineer.

1. Air duct shall be insulated with white top termination.

2. Any water line for fire fighting purpose shall be safety red (if used).

E. Rigging of top roof package units shall be according manufacturer's instruction and recommendation.

F. Rigging and lifting of any equipment of material shall be according OSHA standards and regulations.

START-UP:

A. Service factory trained representative (engineer or technician) shall be available on site for start-up of top roof package units.

B. Factory start-up services shall be provide for as long a time as is necessary to provide proper operation of units.

C. Top roof package units shall be factory charged with the specified refrigerant and oil.

D. Contractor's personnel and factory representative shall adjust and balance air flow to design conditions indicated in this specifications and/or drawings.

E. The factory representative shall train at least four (4) employees of PBA in the operation, maintenance and troubleshooting of top roof package units.

F. Contractor shall submit four (4) maintenance and operation manual to PBA representative or Engineer.

PERFORMANCE:

A. Use the Associated Air Balance Council (AABC) standards (last edition) for balancing works.

B. Manufacturer shall perform the standard run test under the supervision of Engineer or PBA representative. Data of test shall be certified and submitted to Engineer.

C. Balancing and adjustment shall be within 5% of design parameters.

D. Balancing works are limited to air side and readings shall be taken next of transitions of new duct and existing ones.

E. Contractor shall submit four (4) copies of certificate results of balancing test and adjustment by third party contractor.

END OF SECTION
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SECTION 15801 - GENERAL SPECIFICATIONS FOR AIR CONDITIONING WORK

A. GENERAL

1. RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract, including the General Conditions, the Supplementary General Conditions, the Special Conditions, the Supplementary Special Conditions and all Division -1 Specifications sections, apply to the Work of this Section, and the other sections of Division 15.

2. DEFINITIONS

2.1 "The Contractor" means specifically the Sub-contractor working under his respective section of these specifications.

2.2 "Provide" means to supply, erect, install and connect up in complete readiness for regular operation the particular work referred to.

2.3 "Piping" includes, in addition to pipe, all fittings, valves, hangers and other accessories related to such piping.

2.4 "Concealed" means hidden from sight as in chases, furred spaces, shafts, hung ceiling or embedded construction.

2.5 "Exposed" means concealed as define above. Work in trenches, crawl spaces and tunnels shall be considered "exposed" unless otherwise specifically noted.

2.6 "Law and Ordinances", as used herein shall mean local codes, laws, ordinance, standards, rule or regulations of any nature which are in any way pertinent to or regulatory over the work covered by this section of the specifications.

3. SUMMARY AND INTENT

3.1 It is the intention of the work specifications and drawings to call for finished work, tested and ready for operation all materials, equipment and apparatus shall be new and first class quality.

3.2 Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications or vice-versa, or any accessories or minor details not shown but necessary to make the work complete and perfect in all respect and ready for operation, even if not particularly specified, shall be provided by the Contractor without additional expense to the Owner.

3.3 With submission of bid, the Contractor shall give written notice to the Architect and/or Engineer of any materials, apparatus or omissions believed to be in violation of laws, ordinance, rules or regulations to authorities having jurisdiction.

In the absence of such written notice, it is mutually agreed that the Contractor shall include the cost of providing all systems in accordance with applicable regulations without extra compensation.

3.4 The plans and specifications are complementary to each other, so that material and workmanship indicated for or implied by one and not by the other, shall be supplied and installed as through specifically called necessarily showing in detail or to scale all of the minor items. It shall be the responsibility of the bidders to review and make themselves completely familiar with all architectural, structural, electrical and mechanical drawings and to adjust his work to conform to all conditions indicated on them. Failure of the bidder to fully inform themselves of all conditions and to include in their proposal a sum to cover the same sufficiently, shall not entitle them to an extra.

3.5 All items not specifically mentioned in the specification or in the drawings, but which are necessary to make a complete working installation shall be include in the bidder proposal. Failure of the bidders to do so will not entitle them to an extra.

4. INTERPRETATIONS OF DRAWINGS AND SPECIFICATIONS

4.1 Any questions or disagreements arising as to the true intent of these specifications or the drawings or the kind or quality of work required, thereby shall be decided by the Architect and/or Engineer, whose interpretation thereof shall be final but subject to appeal as prescribed by the General Conditions.

4.2 The specifications and the drawings are intended to be in agreement with each other and to be mutually explanatory. However, they are also intended to be complementary and any work or material called for by either, shall be performed and/or provide as faithfully as if called for by both.

4.3 In cases of disagreement between the drawings and the specifications or within either document itself or between one trade and another, the better quality, greater quantity or more costly work shall be include in the contract price, and the matter referred to the Architect's and/or Engineer's attention for decision and/or adjustment.

5. CONTRACTOR'S PROPOSAL

5.1 The Contractor's proposal must cover all items on the drawings and in the specifications exactly as drawn and specified based only on the manufacturers listed.

5.2 If the Contractor proposes substitution of the equipment of other manufacturers than those specified, he shall attach to his base bid an itemized list of substitutions. Directly opposite of each item, he shall indicate the amount to be added to or deducted from his base bid, if his proposal is accepted. In all instances, such request shall be accompanied by all complete descriptive theory literature and performance data. Failure to furnish that the Contractor agrees to provide all items

exactly as drawing and specified. The information given by each Contractor in the above itemized list will in no way affect the determination of low bidder.

6. QUALIFICATIONS FOR BIDDERS

6.1 Examine drawings relating to work of all trades and become fully informed as to extent and character of required and its relation to all other work in project.

6.2 Before submitting bid, Contractor shall visit the site and examined all spaces conditions. He shall report to the Architect any condition which might prevent him from installing his equipment in the manner intended.

6.3 No consideration or allowance will be granted for failure to visit site or for any alleged misunderstanding of materials to be furnished or work to be done; it being agreed that tender of proposals carriers with it agreement to items and conditions referred to herein or indicated on aforementioned drawings.

7. SUBMITTALS

7.1 SHOP DRAWINGS AND SAMPLES

7.1.1 Prior to delivery to job site, but sufficiently in advance to allow Architect and/or Engineer ample time for review, Contract shall submit for approval five (5) copies each of shop drawings of all equipment, materials, piping, ductwork, and wiring, and further obtain written approval for same before installing any of these items.

7.1.2 Shop drawings shall consist of manufacturer's certified scale drawings, cut or catalogs, including descriptive literature and complete certified characteristic of equipment, showing dimensions, capacity, code requirements, motor and drive testing, as indicated on the drawings or specifications.

7.1.3 Certified performance curves for all fans and water pumping equipment shall be submitted for approval.

7.1.4 A sample of materials or equipment, when requested by the Architect and/or Engineer shall be submitted for approval.

7.1.5 Samples, drawings, specifications, catalogs, etc., submitted for approval, shall be properly labeled, indicating specific service for which material or equipment is to be used, section and article number of specifications governing, Contractor's name and the name of the job.

7.1.6 Catalogs, pamphlets or other documents to describe items on which approval is being requested, shall be specific and identification in catalog, pamphlet, etc., of item submitted will be clearly made in ink. Data of a general nature will not be accepted.

7.1.7 Approval rendered on shop not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that the drawings have been checked in detail. Said approval does not, in any way, relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

7.1.8 Failure by the Contractor to submit shop drawings in ample time for checking, shall not entitle him to an extension of contract time and no claim for extension by reason of such default will be allowed.

7.1.9 Approval rendered on shop drawings for any material, apparatus, devices, and layouts, shall not relieve the Contractor from the responsibility of furnishing same of proper dimension, size, quantity, quality, and all performance characteristics to efficiently perform the requirements and intent of the contract drawings. Such approval shall not relieve the Contractor from responsibility for errors of any sort on the shop drawings. The Contractor shall notify including the reason for the deviation.

7.1.10 Shop drawing scale 1/4"-1-0" minimum shall be submitted for approval for all ductwork, pipe runs, inserts, sleeves, etc., before work is performed.

B. PRODUCTS

1. EQUIPMENT AND MATERIAL

1.1 Furnish and install were indicated on the drawings of all equipment hereinafter specified or shown on the drawings or specifications.

1.2 Capacities of equipment shall be as specified on the drawings or specifications.

1.3 Equipment construction standard shall be as follows: Pressure vessels shall be constructed in accordance with ASME Code; all electrical equipment shall be listed and approved and conform to be latest edition of the NEC; piping, materials, fittings, valves and accessories shall be constructed in accordance with the latest ASTM and ASME Standards for class of work involved. All the equipment and materials shall be new.

1.4 All component parts of each item of equipment or device shall bear the manufacturer's nameplate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate maintenance or replacement. The nameplate of a Sub-Contractor or distributor will not be acceptable.

1.5 All materials and apparatus required for the work shall be new, or first-class quality and shall be furnished, delivered erected, connected and finished inn every detail and shall be so selected and arranged as to fit properly into the building

spaces. Where no specific kind or quality material is given, a first-class standard article as approved by Architect and/or Engineer shall be furnished.

1.6 All item of the same type shall be of the same manufacturer.

2. SUBSTITUTIONS

2.1 Substitutions of material and equipment of brands other than specifically named on the drawings and in the specifications and as provided for in the above paragraph will be approved by the Architect and/or Engineer for the following reasons only:

2.1.1 That the material or equipment proposed for substitution is equal or superior to that specified and that the material or equipment called for on the drawings or in the specifications cannot be delivered to the job in time complete the work in proper sequence to the work or other Contractors, due to conditions beyond control of the Contractor.

2.1.2 To receive consideration, request for substitutions must be accompanied by documentary proof of equality difference in price and delivery, if any, in the form of certified quotations from suppliers of both supplied and proposed equipment. In case of a difference in price, the Owner shall receive, in the form of a credit, all benefit of the difference in cost involved in any substitution.

2.1.3 Should a substitution be approved under the foregoing provisions and should the same subsequently prove to be defective or otherwise unsatisfactory for the service for which it was intended, the Contractor shall, without cost to the Owner and without obligations on the part of the Architect and/or Engineer, replaced the same with the material originally specified.

2.2 Where a Contractor's proposal is accepted to used an item of equipment other than that specified or detailed on the drawings and which required any redesign of structure, partitions, foundations, piping, wiring or of any other part of the mechanical, electrical or architectural layout, all such redesign and all new drawings and details required thereof shall, with the approval of the Architect and Engineer, be prepared by the Contractor at his own expense.

2.3 Where such approved deviation requires a different quantity and arrangement of duct work, piping, wiring, conduit and equipment from that specified or indicated on the drawings, subject to approval of the Architect, the Contractor shall provide any such duct work, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit and any other additional equipment required by the system at no additional cost to the Owner.

C. EXECUTION

1. SYSTEM INSTALLATION

1.1 The installation of systems described in these specifications and plans will be performed by experienced personnel in this type of work, under the supervision of competent foremen and in accordance with the recommended practices of the ASHRAE and those of the manufacturer of the equipment and the materials involved, to obtain not only a functional installation but a neat installation.

1.2 Architect shall have privilege of stopping any work or use of material that in his opinion is not being properly installed and Contractor shall remove all materials delivered, or work erected, which does not comply with contract drawings as directed by the Architect at no additional cost to the Owner.

1.3 Before installing ductwork and/or piping, check plumbing, electrical, architectural and structural drawings against the drawings of the contract and make accurate layouts of ductwork and/or piping.

1.4 Where interference may appear and departures from indicated arrangement are required, this Contractor shall consult with the other trades involved and come to an agreement as to change locations and elevations for the ductwork and/or piping and shall obtain approval from the Architect and/or Engineer for the proposed changes.

1.5 Foundations and supports for all equipment in this Contract shall be furnished by this Contractor, unless otherwise noted on the plans, as required or as recommended by the manufacturer of each piece apparatus.

1.6 The Contractor shall locate, layout and install all holes and sleeves in walls, ceilings, floors, etc., necessary for the installation of his work. The Contractor shall cooperate with the Contractors of the other divisions, giving due and proper notifications regarding all such work.

2. EQUIPMENT INSTALLATION

2.1 Equipment shall be installed as indicated and in accordance with the manufacturer's installation recommendations. Equipment shall fit into spaces assigned.

2.2 Installation which will cause maintenance or operation problems shall be avoided. Items that may required removal for servicing shall be installed with adequate clearance, so as not to require the removal or damaging or other items or their insulation to permit their own removal. Equipment requiring inspection or service shall be accessible. Access doors shall be installed in mechanical equipment as required and as indicated.

2.3 Piping and specialties which are required for the proper completion of work, but which are not indicated, shall be provided as required or as recommended by the manufacturer of the equipment served. Offsets, connections and take-off in piping shall be made within fittings.

2.4 This Contractor shall investigate each space through which equipment must move. Where necessary, equipment shall be shipped from the manufacturer in crated sections of a size suitable for moving through the restricted available spaces. This shall apply to all equipment whether specified or indicated to be provided "knocked down" or not.

3. LAWS, ORDINANCES, PERMITS AND FEES

3.1 The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings (in addition to contract drawings and documents) in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.

3.2 All materials furnished and all work installed shall comply with the rules and recommendations of the National Board of Fire Underwriters, with all requirements of local utility companies, with the recommendations of the Fire Insurance Rating Organization having jurisdiction and with the requirements of all governmental departments having jurisdiction. Cases of discrepancy between the respective requirements shall be referred to the Architect for decision.

4. COORDINATION OF TRADES

4.1 The Contractors shall give full cooperation to the other trades and shall furnish (in writing, with copies to Architect and/or Engineer) information necessary to permit the work of all trades to be installed satisfactorily and with the least possible delay.

4.2 Where the work of the Contractor is to be installed in close proximity to work of the other trades, or where there is evidence that the work of the Contractor is to interfere with the work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. The Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4"-0" clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, he shall make necessary changes in his work to correct the condition without extra care.

5. PROTECTION OF WORK AND PROPERTY

5.1 The Contractor shall be responsible for the maintenance and the protection of all equipment, materials and tools, supplied by him stored or installed on the job site, from loss or damage of all causes until final acceptance by the Architect and /or Engineer.

5.2 The Contractor shall be responsible for the protection of any finished work of other trades from damage or defacement by his operations and must remedy any such damage at his own expense.

6. TEMPORARY OPENINGS

6.1 The Contractor shall ascertain, from his examination of the architectural drawings, whether any special temporary openings in the building will be required for the admission of apparatus provided under his contract and he shall notify the Architect accordingly. In the event of failure of the Contractor to give sufficient notice to the Architect in time to arrange for these openings during construction, the Contractor shall assume all costs of providing such openings thereafter.

7. ACCESSIBILITY

7.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions and the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with the General Contractor and all other Contractors whose work in the same space and shall advise the General Contractor of his requirements. Such spaces and clearances shall, however, be kept to minimum size required.

7.2 The contractor shall install all work so that all parts required are readily accessible for inspection, operation, maintenance and repair, minor deviations from the drawings may be made to accomplish this, but changes of magnitude shall not be made without prior written approval from the Architect and/or Engineer.

7.3 Wherever mechanism requiring access for the operation are concealed in the structure and wherever else indicated on the drawings, the Contractor shall supply access doors of size necessary to provide ready access to the concealed item.

7.4 Where access doors are called for and/or required to maintain, balance or operate the mechanical equipment, this Contractor must furnish on access door. In white plaster ceilings, provide access doors Milcor Style "K" as manufactured by the Inland Steel Products Company. Provide Milcoir Style "M" access doors for unfinished walls. Access doors shall be turned over to the General Contractor for installation.

7.5 Access doors shall be installed in building structure by General Contractor.

8. PIPE EXPANSION

8.1 All pipe connections shall be installed to allow for freedom of movement of the piping during expansions and contraction without springing. Swing joints, expansions loops and expansion joints with proper anchors and guides shall be provide by the Contractor where necessary, and/or when shown on the drawings. Anchors and guides shall be subject to the approval of the Architect.

9. SLEEVES, INSERTS AND ANCHOR BOLTS

9.1 The Contractor shall provide and will be held responsible for he location of any maintaining in proper position all sleeves, inserts and anchor bolts shall be set before concrete is poured and before masonry construction is finished. In the event that failure to do so requires cutting and patching of finished work, it shall be done at the Contractor's expense.

9.2 All pipes and conduits passing through floors, walls or partitions shall be provided with sleeves having an internal diameter of 1" larger than the outside diameter of pipe, conduit or insulation enclosing pipe or conduit.

9.3 Sleeves through foundation walls shall be James B. Clow & Sons No. F-1430 cast iron sleeve with intermediate integral flange. Sleeves shall be set with ends flush with each face of wall. The space between 2" of each face of wall. The remainder space shall be packed and made watertight with a waterproof compound.

9.4 Sleeves through masonry floors or interior masonry walls shall be schedule 40 black steel pipe, set flush with finished wall or ceiling surfaces but extending 1/2" above finished floors.

9.5 Sleeves through interior partitions shall be 22 gauge galvanized sheet steel, set flush with finished surfaces of partitions.

9.6 Inserts shall be individual or strip type of pressed steel or malleable iron construction with accommodation for removable nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment. Individual inserts shall be fee and Mason Manufacturing Company, Fig.190 with attached rods having hooked ends to allow fastening to reinforce rods.

10. COVERING OF WORK

10.1 No pipe, fitting or other of any kind shall be covered up or hidden from view, before it has been examined by the Architect or from other authority having jurisdiction over the same. Any faithful or imperfect work or materials which may be discovered shall be removed and corrected immediately after being condemned and other work and material shall be furnished which shall be satisfactory to the Architect and/or Engineer.

11. MACHINERY GUARDS

11.1 Moving parts of machinery exposed to contact by personnel shall be guarded as required by authorities having jurisdiction by barrier of a type as approved by the Architect and/or Engineer.

11.2 Exposed moving parts such as belts and couplings shall have 3/4" No. 16 gauge expanded metalmesh guards with all edges rounded . Guards shall have a 1-1/4" X 1/8" angle frame properly supported.

11.3 All machinery guards covering the ends of motor or equipment shafts shall have openings for the insertion of a tachometer.

12. TOOLS

12.1 All special tools required for operation and maintenance of equipment shall be furnished and delivered to Owner's Representatives and a receipt obtained.

13. TESTS

13.1 All piping, ductwork, and equipment shall be tested as specified under the various section of the work and additional tests shall be provided, as may be required for approval by all agencies having jurisdiction. Labor, materials, instruments and power required for testing shall be furnished by the contractor unless otherwise indicated under the particular section of the specification.

13.2 Test shall be performed in the presence and to the satisfaction of the Architect and such other parties as may have legal jurisdiction.

13.3 All defective work shall be promptly repaired or replaced and the test shall be repeated until the particular system and component parts thereof receive the approval of the Architect and/or Engineer.

13.4 Any damages resulting from tests shall be repaired and damaged materials replaced, all to the satisfactions of the Architect.

14. NOISE AND VIBRATION ELIMINATION

14.1 All equipment and material installed by the Contractor shall operate under all conditions of load without any sound or vibration which in the opinion of the Architect is objectionable by the Architect and/or Engineer, the Contractor shall eliminate same in the manner approved by the Architect and/or Engineer, at no additional cost to the Owner.

14.2 The particular attention of this Contractor shall be directed to the problem of preventing noise and vibration transmission from mechanical equipment and fan rooms to adjacent emanating from equipment in these rooms be perceptible in adjacent areas. The Contractor shall incorporate in his installation all devices and accessories to accomplish this result. Such devices shall include vibration isolator bases and sound absorber pads, sound insulation, all as may be required. The above also applies to equipment suspended in ceilings or mounted on roof.

14.3 Vibration isolators exposed to the weather shall be equipped with limit stops to resist wind velocity. Steel parts other that springs shall be galvanized; springs shall be cadmium plated or suitable coated to resist corrosion.

14.4 Rubber-in-shear isolators shall be properly housed and provided with adequate facilities for bolting. Single rubber-in-shear shall be molded mound shaped element designed for 1/4" deflection under the imposed load. Double rubber-in-shear shall be two elements described above, assembled in series to provide 1/2" deflection under the imposed load.

14.5 All vibration isolation system shall be guaranteed to have the static deflections as specified and indicated on the drawings. The vibration isolation system shall be installed in accordance with the manufacturer's instructions.

15. RUBBISH

15.1 Work shall be done in such a manner as to maintain a clean construction area and reduce fire hazards to a minimum. The Contractor shall remove his own debris from the site and no accumulation of inflammable combustible will be permitted.

16. CLEANING PIPING, DUCTS AND EQUIPMENT

16.1 The Contractor shall thoroughly clean all piping, ducts and equipment of all foreign substances inside and out before being placed in operation. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstruction material.

16.2 If any part of a system should be stopped by a foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected whether necessary to locate and removed obstruction. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

17. FINAL INSPECTION

17.1 The Contractor should arrange and schedule final inspection of the mechanical work and shall notify the Architect and/or Engineer in writing that the Contractor has thoroughly checked his work and in the opinion of the Contractor is ready for final inspection. This check will include a record of air quantities to each space, balancing of systems, proper function of each place of electrical equipment and individual system.

17.2 During the entire period scheduled for these inspections, the General Contractor, the Sub-Contractor involved and representative of each manufacturer of equipment involved will be present. All of these organizations will have sufficient and competent personnel present so that adjustment can be made to all systems without delay.

17.3 Only after all systems and equipment are inspected and approved in writing and lists of instructions, etc., are submitted, will final payment be made.

18. GUARANTEES

18.1 The Contractor shall guarantee that all work installed will be free from any and all defects and that all apparatus will be develop capacities and characteristics specified and that if during a period of one (1) year from the date of acceptance of work any such defect in workmanship, material or performance appear, he shall immediately replace, repair or otherwise correct the defect or deficiency without cost to the Owner.

18.2 The Contractor shall also replaced or repair to the satisfaction of the Owner any and all damage done to the building or its contents or work of other trades in consequence of work performed in fulfilling guarantee.

18.3 In the event of default on this guarantee by the Contractor, the Owner may have such work done as required and charge the cost to the Contractor.

19. INSURANCE

19.1 The Contractor shall carry and pay for liability and workmen compensation insurance for the duration of this contract and shall protect the Owner against all claims that may arise. All premiums are to be paid by the Contractor and the policies are to cover any and all persons and contingencies in connection with the installation of the work included in this contract. Also a 100% payment and 100% performance bond will be required.

20. SURVEYS AND MEASUREMENTS

20.1 Contractor shall base all measurements, both horizontal and vertical, from established marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

20.2 Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevent following good practice or the intent of the drawings and specifications, he shall notify the Architect and/or Engineer and shall not proceed with his work until he has received instructions from them.

21. SCAFFOLDING, RIGGINGS AND HOISTING

21.1 Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from the premises when no longer required.

22. WATERPROOFING

22.1 Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be approved by Architect before work is done. Contractor shall furnish all necessary caulking and flashing required to make openings absolutely watertight.

23. TESTING AND BALANCING

23.1 Work shall consist of testing, balancing and adjusting of all air and water systems and components called for on the drawings and/or other Contract Documents. This shall be accomplished as follows:

23.1.1 Obtain the required air quantities at various operating conditions of the system to demonstrate compliance with the design. This will require simulation of maximum pressure drops due to dirty filters and wetted cooling coils, and, in the case of variable air volume systems, variation of air volume through the range from minimum to maximum.

23.1.2 Obtain the hot and/or chilled water quantities required by the various components, equipment and devices.

23.2 All work shall performed by an independent test and balance agency under direct supervision of qualified air conditioning and ventilating engineer approved by the consulting engineer and Owner. All instruments used shall have been accurately calibrated within the last six month and maintained in good working order. (Affidavits attesting to the date, method (s) of calibration, and by who calibrated shall be furnished to the Owner's Engineer and/or his Representative. Test And Balance (TAB) Contractor and Owner Representative shall meet at least two (2) weeks prior to the anticipated start of testing to finalize procedures and assure complete understanding of the methods used.

23.3 Testing and balancing shall not begin until systems have been completed and are in full working order. The ventilating and air conditioning Contractor shall put all ventilating and air conditioning equipment into full operation and shall continue the operation of same during each working say of testing and balancing.

23.4 TAB Contractors shall include an extended warranty of ninety (90) days after completion of test and balance work and submissions of the report, during which time the Owner's Representative at his direction may request a recheck or resetting of any outlet, supply air fan, exhaust fan, control valves or balance valves to adjust technicians to assist the Engineer in making any tests he may require during this period.

23.5 Upon the completion of the system, the TAB Contractor shall submit seven (7) copies of the balancing report. In addition, one marked-up set of mechanical drawings indicating and identifying test point locations shall be furnished. Balancing reports shall be done in SMACNA'S, NBB or AABC Forms, as specified on drawings.

23.6 The TAB Contractor shall check all controls for proper calibration and furnish a list of all controls needing adjustment. Any controls needing adjustment shall be attended to by the controls Contractor, and this Contractor shall validate and verify the adjustment repeating the process until satisfactory operation is achieved.

24. RECORD DRAWINGS AND DOCUMENTS

24.1 The Contractor shall keep concurrently with the progress or the installation, a set of "as built" record drawings, consisting of a reproducible marked set of Engineer's drawing with additional sketches as required, denoting and dimensioning accurately all changes in elevation, location and size of material deviating from Engineer's drawing. In addition, all offsets and valves shall be recorded. Upon completion of the work, the Contractor shall deliver to the Architect an up-to-date set of these "as built" record drawings. "As built" drawings must be presented on transparent cloth.

24.2 Before final payment is made, the Contractor shall deliver to the Architect for approval the following items:

24.2.1 Five (5) books with approved equipment submittal data, operation instructions and maintenance instructions.

24.2.2 The following "as built" record drawings and "as built" shop drawings.

a. Original "as built" set (translucent bond or mylar).

b. Five (5) blue or black print sets.

END OF SECTION 15801

SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa), as shown on drawings. Metal ducts include the following:

1. Rectangular ducts and fittings.

B. Related Sections include the following:

1. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. NUSIG: National Uniform Seismic Installation Guidelines.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by the Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Shop Drawings: **CAD-generated and drawn** to 1/4 inch equals 1 foot (1:50) scale. Show fabrication and installation details for metal ducts.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Duct layout indicating sizes and pressure classes.
3. Elevations of top and bottom of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through fire-rated and other partitions.
9. Equipment installation based on equipment being used on Project.
10. Duct accessories, including access doors and panels.
11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Welding certificates.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to **AWS D1.1, "Structural Welding Code--Steel," for hangers and supports, AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.**

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

D. Mockups:

1. Before installing duct systems, build mockups representing pressure classes higher than 3-inch wg (750 Pa). Build mockups to comply with the following requirements, using materials indicated for the completed Work, and include each of the following features and fittings:

a. **Five** transverse joints.
b. **One** access door.
c. **Two** typical branch connections, each with at least one elbow.

d. **Two** typical flexible duct or flexible connector connections for each duct and apparatus.
e. Perform tests specified in Part 3 "Field Quality Control" Article. Modify mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

a. CertainTeed Corp.; Insulation Group.
b. Johns Manville International, Inc.
c. Knauf Fiber Glass GmbH.

d. Owens Corning.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

a. Thickness: 1 inch (25 mm).
b. Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.
c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1) Tensile Strength: Indefinitely sustain a 50-lb- (23-kg-) tensile, dead-load test perpendicular to duct wall.
2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch (3 mm) into airstream.
3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

B. Flexible Elastomeric Duct Liner: Comply with NFPA 90A or NFPA 90B.

1. Manufacturers:

a. Armstrong World Industries, Inc.

2. Materials: Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C 534, Type II, except for density.

a. Thickness: 1 inch (25 mm).
b. Thermal Conductivity (k-Value): 0.24 at 75 deg F (0.034 at 24 deg C) mean temperature.
c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.
d. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

2.4 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber-reinforced fabric.

C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, and Use O.

G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

2. Duct Size: Maximum 30 inches (750 mm) wide and up to 2-inch wg (500-Pa) pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

G. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

I. Secure insulation between perforated sheet metal inner ducts of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

1. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.

J. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used; secure buildouts to duct walls with bolts, screws, rivets, or welds.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: **6-inch wg (1,500 Pa)**.
2. Return Ducts (Negative Pressure): **3-inch wg (750 Pa)**.
3. Exhaust Ducts (Negative Pressure): **2-inch wg (500 Pa)**.

B. All ducts shall be galvanized steel except as follows:

1. Range Hood Exhaust Ducts: Comply with NFPA 96.

a. Concealed: Carbon-steel sheet. Insulated as per section 15081 "Duct Insulation".
b. Exposed: Type 304, stainless steel, gauge 18, minimum with finish to match kitchen equipment and range hood.
c. Weld and flange seams and joints.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install ducts with fewest possible joints.

C. Install fabricated fittings for changes in directions, size, and shape and for connections.

D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.

E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

J. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

K. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches (38 mm).

M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."

N. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to **SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."**

O. Protect duct interiors from the elements and foreign materials until building is enclosed. **Follow SMACNA's "Duct Cleanliness for New Construction."**

P. Paint interiors of metal ducts that do not have duct liner, for 24 inches (600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.3 UNDERSLAB DUCTS, SPECIAL INSTALLATION REQUIREMENTS

A. Verify undamaged condition of ducts before enclosure with fill or encasement.

B. Protect ducts from damage by equipment used in placing fill materials and concrete on or around ducts.

C. Protect duct openings from damage and prevent entrance of foreign materials.

3.4 RANGE HOOD EXHAUST DUCTS, SPECIAL INSTALLATION REQUIREMENTS

A. Install ducts to allow for thermal expansion through 2000 deg F (1110 deg C) temperature range.

B. Install ducts without dips or traps that may collect residues unless traps have continuous or automatic residue removal.

C. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches (38 mm) from bottom; and fit with grease-tight covers of same material as duct.

D. Do not penetrate fire-rated assemblies except as permitted by applicable building codes.

3.5 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

1. For pressure classes lower than 2-inch wg (500 Pa), seal transverse joints.

B. Seal ducts before external insulation is applied.

3.6 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa), but in any case leakage shall not be greater than 5%. Period.
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.9 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.10 CLEANING EXISTING SYSTEMS

A. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Use existing service openings where possible.
2. Create other openings to comply with duct standards.
3. Disconnect flexible ducts as needed for cleaning and inspection.
4. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.
5. Remove and reinstall ceiling sections to gain access during the cleaning process.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.
2. When venting vacuuming system to the outside, use filtrations to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide operative drainage system for washdown procedures.
7. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.

F. Cleanliness Verification:

1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
2. Visually inspect metal ducts for contaminants.
3. Where contaminants are discovered, re-clean and reinspect ducts.

G. Gravimetric Analysis: At discretion and expense of Owner, sections of metal duct system, chosen randomly by Owner, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.

1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal duct system shall be re-cleaned and re-verified.

H. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Ceiling fire dampers.
4. Combination fire and smoke dampers.
5. Turning vanes.
6. Duct-mounting access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

B. Related Sections include the following:

1. Division 13 Section "Fire Alarm" for duct-mounting fire and smoke detectors.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Ceiling fire dampers.
4. Combination fire and smoke dampers.
5. Turning vanes.
6. Duct-mounting access doors.
7. Flexible connectors.
8. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.

3. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems,"

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to **10** percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. Penn Ventilation Company, Inc.
7. Prefco Products, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. Description: Multiple-blade, parallel action gravity balanced, with **center-pivoted** blades of maximum 6-inch (150-mm) width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: **0.063-inch- (1.6-mm-) thick extruded aluminum,** with welded corners **and mounting flange.**

D. Blades: **0.050-inch- (1.2-mm-) thick aluminum sheet.**

E. Blade Seals: **Neoprene.**

F. Blade Axles: **Stainless steel.**

G. Tie Bars and Brackets: **Aluminum.**

H. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Flexmaster U.S.A., Inc.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.

7. Penn Ventilation Company, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- opposed-blade (OBD) design as indicated, standard leakage rating, **with linkage outside airstream,** and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, **galvanized** sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, **galvanized** sheet steel.
3. Aluminum Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
6. Blade Axles: **Stainless steel.**
7. Bearings: **Stainless-steel sleeve**.
8. Tie Bars and Brackets: Aluminum.
9. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, **with linkage outside airstream,** and suitable for horizontal or vertical applications.

1. Steel Frames: **U**-shaped, **galvanized** sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, **galvanized** sheet steel.
3. Aluminum Frames: **U**-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
6. Blade Axles: **Stainless steel.**
7. Bearings: **Stainless-steel sleeve** thrust or ball.
8. Blade Seals: **Neoprene.**
9. Jamb Seals: Cambered **aluminum.**
10. Tie Bars and Brackets: **Aluminum.**

E. Jackshaft: 1-inch- (25-mm-) diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 CEILING FIRE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. CESCO Products.
3. Greenheck.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Prefco Products, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.

B. General Description: Labeled according to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Fusible Links: Replaceable, 165 deg F (74 deg C) rated.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. CESCO Products.
3. Greenheck.
4. Nailor Industries Inc.
5. Penn Ventilation Company, Inc.
6. Ruskin Company.

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Fusible Links: Replaceable, 165 deg F (74 deg C) rated.

D. Frame and Blades: 0.064-inch- (1.62-mm-) thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.

2.7 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, **double** thickness-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

    a. Ductmate Industries, Inc.
    b. Duro Dyne Corp.
    c. METALAIRE, Inc.
    d. Ward Industries, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.8 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

1. Manufacturers:

    a. American Warming and Ventilating.
    b. CESCO Products.
    c. Ductmate Industries, Inc.
    d. Flexmaster U.S.A., Inc.
    e. Greenheck.
    f. McGill AirFlow Corporation.
    g. Nailor Industries Inc.
    h. Ventfabrics, Inc.
    i. Ward Industries, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

    a. Less Than 12 Inches (300 mm) Square: Secure with two sash locks.
    b. Up to 18 Inches (450 mm) Square: Two hinges and two sash locks.

c. Up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches **with outside handles**.
d. Sizes 24 by 48 Inches (600 by 1200 mm) and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch (25-mm) thickness. Include cam latches.

1. Manufacturers:

a. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Pressure Relief Access Door: **Single** wall and duct mounting; fabricated of galvanized sheet metal as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.

1. Manufacturers:

a. American Warming and Ventilating.
b. CESCO Products.
c. Ductmate Industries, Inc.
d. Greenheck.
e. KEES, Inc.
f. McGill AirFlow Corporation.
g. Nexus PDQ.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

F. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Duro Dyne Corp.
2. Ventfabrics, Inc.
3. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip [3-1/2 inches (89 mm)] [5-3/4 inches (146 mm)] wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz. /sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz. /sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz. /sq. yd. (542 g/sq. m).
2. Tensile Strength: 285 lbf/inch (50 N/mm) in the warp and 185 lbf/inch (32 N/mm) in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz. /sq. yd. (474 g/sq. m).
2. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp and 340 lbf/inch (60 N/mm) in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).

2.10 FLEXIBLE DUCTS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. Hart & Cooley, Inc.
4. McGill AirFlow Corporation.

B. Noninsulated-Duct Connectors: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
2. Maximum Air Velocity: 5000 fpm (25.4 m/s).
3. Temperature Range: Minus 100 to plus 435 deg F (Minus 73 to plus 224 deg C).

C. Insulated-Duct Connectors: UL 181, Class 1, 2-ply black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; **polyethylene** vapor barrier film.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20.3 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 28 to plus 79 deg C).

D. Flexible Duct Clamps: **Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action,** in sizes 3 through 18 inches (75 to 450 mm) to suit duct size.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

B. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

D. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

E. Provide test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

G. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers, turning vanes, and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.

4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
5. On sides of ducts where adequate clearance is available.

H. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body Plus Ladder Access: 25 by 17 inches (635 by 430 mm).

I. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches (200 mm) in diameter.
2. Two-Hand Access: 10 inches (250 mm) in diameter.
3. Head and Hand Access: 12 inches (300 mm) in diameter.
4. Head and Shoulders Access: 18 inches (460 mm) in diameter.
5. Body Access: 24 inches (600 mm) in diameter.

J. Install the following sizes for duct-mounting, pressure relief access doors:

1. One-Hand or Inspection Access: **7 inches (175 mm)** in diameter.
2. Two-Hand Access: 10 inches (250 mm) in diameter.
3. Head and Hand Access: 13 inches (330 mm) in diameter.
4. Head and Shoulders Access: 19 inches (480 mm) in diameter.

K. Label access doors according to Division 15 Section "Mechanical Identification."

L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

M. For fans, developing static pressures of 5-inch wg (1250 Pa) and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts **directly or** with maximum 70-inch (1750-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

O. Connect diffusers or light troffer boots to low pressure ducts **directly with a 6" length neck or** with maximum 70-inch (1750-mm) lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with **liquid adhesive plus tape** and **draw bands** on a scooper damper, as shown on the drawings.

Q. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

SECTION 15839 - DUCTWORK

A. GENERAL

1. RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract, including the General Conditions, the Supplementary General Conditions, the Special Conditions, the Supplementary Special Conditions and all Division - 1 Specifications sections, apply to the Work of this Section, and the other sections of Division 15.

2. SUMMARY

2.1 Do all ductwork construction and installation as shown in the drawings. Raise, drop and offset ductwork as require to clear obstructions after notifying Architect/Engineer, and obtaining approval.

B. PRODUCTS

1. MATERIALS

1.1 All ductwork shall be of galvanized steel sheet metal, or stainless steel Ga. 18 construction as specified on drawings.

C. EXECUTION

1. CONSTRUCTION

1.1 Low Pressure Ductwork: Any ductwork whose air velocity does not exceed 2000 FPM and whose static pressure does not exceed 2" WAG. construct in accordance with Smacna's Low Pressure Manual, unless otherwise specified on drawings or in the "Special Ductwork" Section of these specifications.

1.2 Medium Pressure Ductwork: Any ductwork whose air velocity exceeds 2000 FPM and whose static pressure exceeds 2" wg., but is not greater than 6" wg. construct in accordance with Smacna's Medium Pressure Manual, unless otherwise specified on drawings or in the "Special Ductwork" Section of these specifications.

1.3 Any ductwork shown on drawings as flexible shall be "Thermaflex" Type M-KH, insulated or approved equal.

2. DUCT SEALING:

2.1 A11 sheet metal duct joints shall be sealed with BG flame resistance high velocity duct sealant #30-02. Follow Manufacturer's recommendations for application.

3. LEAK TESTING:

3.1 All ductwork shall be tested for leaks according to the procedures descried in Chapter 8 of Smacna's "Manual for Balancing and Adjustment of Air Distribution Systems" unless otherwise specified on drawings total leakage shall not exceed 2.5% of design.

4. SPECIAL DUCTWORK:

4.1 Ductwork exhausting moist air from dishwashers and kitchen hoods shall be made of round stainless steel Ga. 18.

4.2 Pitch horizontal runs toward the hood a minimum of 1/8" ft.

4.3 Duct transitions shall be made flat on bottom.

5. ACCESS DOORS:

5.1 Where necessary in ductwork or casings, suitable access doors, and frames to permit inspection, operation and maintenance of all valves, controls, fire dampers, smoke dampers, manual dampers, automatic dampers, filters sprays bearings, coils or other apparatus concealed behind the sheet metal work shall be provided. All such doors in insulated ducts shall be double panel insulated of not less than No. 230 gauge.

5.2 All access doors in ductwork shall be hung on separate frames on heavy flat hinges and shall be secured in the closed position with ventlok No. 100 cast zinc latch or as approved. Where space conditions preclude the use of hinges a minimum of four heavy window-type latches shall be provided.

5.3 In no case shall access to any items of equipment requiring inspection, adjustment or servicing, require the removal of nuts, bolts, screws, wingnuts, wedges, or any other screwed or loose device. It is the intention that all access doors be hinged and latched.

5.4 Access doors into ducts shall in general not be smaller than 9 inches x 9 inches, except for ductwork of smaller sizes.

5.5 Direct location and setting of access doors in hung ceilings, furred spaces, walls, etc. to provide access to concealed work items requiring maintenance and/or adjustment. Locations of such access doors shall be as approved by the Architect.

6. DAMPERS:

6.1 Fire dampers shall be installed in all ducts piercing and as shown on drawings. Body of fire damper shall be set inside of duct.

6.2 Install fusible link dampers at any other location where necessary to meet U.L. Requirements. Provide conveniently located access doors, of ample size for resetting the dampers. Entire fire damper assembly shall be either galvanized or

painted with one coat of rust inhibiting paint before installation. Fire dampers must be approved by N.F.B.U. and also have approval of all governing authorities.

6.3 Manual dampers, as shown on the drawings and as required shall be installed in the various branches of the ductwork to be used in balancing the system. Note that these dampers shall be separate and independent from the registers hereinafter specified to be set behind supply air grilles. Multiple dampers shall be provided as shown on drawings.

6.4 Manual dampers shall be of the quadrant type, of heavy construction, pivoted to turn easily, and provided with approved operating and locking devices, mounted on outside of the duct in an accessible place. Details as directed.

6.5 Backdraft dampers shall be all aluminum and will be installed as shown on drawings.

7. FLEXIBLE CONNECTIONS

7.1 Fin connections, both at inlet and discharge, shall be made with flexible material so as to prohibit the transfer of vibration from fans to ductwork connecting thereto. Connections shall be made of heavy fire resistive canvas cloth for range hood exhaust fans, and or vinyl and neoprene cloth for conventional systems, except as otherwise required by authorities having jurisdiction and except as otherwise noted below.

7.2 The flexible connections shall be approximately 6 inches long and held and place with heavy metal bands or double hemlock securely attached to prevent any leakage at the connection points.

7.3 The flexible connections at the discharge ends of the fans for the high pressure air conditioning systems shall be of vinyl covered glass fiber, of lengths noted above and fastened as above. It is the intent that these flexible connections shall withstand the operating air pressure, shall not permit air leakage and shall not transmit vibration.

END OF SECTION OF 15839

SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:

1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

C. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

D. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

A. Fixed Face **Register** (Return and Exhaust) (RR-; ER-)

1. Manufacturers:

a. A-J Manufacturing Co., Inc.
b. Anemostat; a Mestek Company.
c. Carnes.
d. Dayus Register & Grille.
e. Hart & Cooley, Inc.; Hart & Cooley Div.
f. Krueger.
g. Nailor Industries of Texas Inc.
h. Metal-Aire Industries.
i. Titus.
j. Tuttle & Bailey.

2. Material: Anodized **Aluminum**.
3. Face Arrangement: 45° Horizontal Vanes.
4. Frame: 1 inch (25 mm) wide.
5. Mounting: **Lay in**.
6. Damper Type: **Adjustable opposed-blade assembly**.

2.3 LINEAR SLOT OUTLETS

A. Linear Slot Diffuser (LSD-):

1. Manufacturers:

a. Air Research Diffuser Products, Inc.
b. Anemostat; a Mestek Company.

c. Carnes.
d. Hart & Cooley, Inc.; Hart & Cooley Div.
e. Krueger.
f. METAL-AIRE, Inc.; Metal Industries Inc.
g. Nailor Industries of Texas Inc
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

2. Material - Shell: Anodized **Aluminum, insulated.**
3. Material - Pattern Controller and Tees: Aluminum.
4. Finish - Pattern Controller: **Baked enamel, black.**
5. Finish - Tees: **Baked enamel, color selected by Architect.**
6. Slot Width: As shown on drawings.
7. Number of Slots: As shown on drawings.
8. Length: **48 inches (1200 mm).**
9. Accessories: **T-bar clips on both sides.**

2.4 CEILING DIFFUSER OUTLETS

A. Perforated Diffuser (PCD-) Variable Air Volume Diffuser (VAV):

1. Manufacturers:

a. Anemostat; a Mestek Company.
b. Carnes.
c. Hart & Cooley, Inc.; Hart & Cooley Div.
d. Krueger.
e. METAL-AIRE, Inc.; Metal Industries Inc.
f. Nailor Industries of Texas Inc.
g. Titus.
h. Therma-Fuser, by Acutherm, Inc.
i. Tuttle & Bailey.

2. Material: Steel backpan and pattern controllers, with **aluminum** face.
3. Finish: **Baked enamel, white.**
4. Face Size: **24 by 24 inches (600 by 600).**
5. Duct Inlet: **Round.** Size as shown on drawings.
6. Face Style: **Flush.**
7. Pattern Controller: **Adjustable with louvered pattern modules at inlet.**
8. Mounting: **Surface or T-bar**, as required, according to type of ceiling.
9. Dampers: **Radial opposed blade.**
10. Accessories:

a. Equaling grid.
b. Plaster ring.
c. Wire guard.
d. Sectorizing baffles.
e. Operating rod extension.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855

SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
6. Measuring sound and vibration.
7. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

M. AABC: Associated Air Balance Council.

N. AMCA: Air Movement and Control Association.

O. CTI: Cooling Tower Institute.

P. NEBB: National Environmental Balancing Bureau.

Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.5 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC.

B. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by NEBB.

C. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.

D. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Engineer's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.
b. Contract Documents examination report.
c. Testing, adjusting, and balancing plan.
d. Work schedule and Project site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

E. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

F. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."

G. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

H. Testing, Adjusting, and Balancing Reports: Use standard forms from SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing."

I. Testing, Adjusting, and Balancing Reports: Use testing, adjusting, and balancing Agent's standard forms approved by the Architect.

J. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.

K. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

L. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

B. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

C. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents described in Division I Section "Project Record Documents."

D. Examine Engineer's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

S. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.

B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

C. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing" and this Section.

D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

E. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, multizone, dual-duct, induction-unit supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each air-handling unit component.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

D. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 VARIABLE-AIR-VOLUME SYSTEMS' ADDITIONAL PROCEDURES

A. Compensating for Diversity: When the total airflow of all terminal units is more than the fan design airflow volume, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the design airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge duct losses.
3. Measure total system airflow. Adjust to within 10 percent of design airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use the terminal unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance systems similar to constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to design airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum design airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum design airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units being tested at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to

design airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 HYDRONIC SYSTEMS' BALANCING PROCEDURES

A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.

E. Adjust balancing stations to within specified tolerances of design flow rate as follows:

1. Determine the balancing station with the highest percentage over design flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance the primary system crossover flow first, then balance the secondary system.

3.11 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.12 CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of design flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator water entering and leaving temperatures, pressure drop, and water flow.
2. Condenser water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by the chiller manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kW.
5. The kW input if factory-installed instrumentation is furnished for measuring kW.
6. Capacity: Calculate in tons of cooling.
7. Air-Cooled Chillers: Verify condenser-fan rotation and record fan data, including number of fans and entering- and leaving-air temperatures.

3.13 COOLING TOWERS

A. Shut off makeup water for the duration of the test, and then make sure the makeup and blow-down systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1. Measure condenser water flow to each cell of the cooling tower.
2. Measure entering- and leaving-water temperatures.
3. Measure wet- and dry-bulb temperatures of entering air.
4. Measure wet- and dry-bulb temperatures of leaving air.
5. Measure condenser water flow rate recirculating through the cooling tower.
6. Measure cooling tower pump discharge pressure.
7. Adjust water level and feed rate of makeup-water system.

3.14 CONDENSING UNITS

A. Verify proper rotation of fans and measure entering- and leaving-air temperatures. Record compressor data.

3.15 HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:

1. Entering- and leaving-water temperatures.
2. Water flow rate in GPM
3. Water pressure drop in Ft.wg.
4. Dry-bulb temperatures of entering and leaving air.
5. Wet-bulb temperatures of entering and leaving air.
6. Airflow I CFM
7. Air pressure drop in In.wg.

B. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperatures at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kW at full load.
6. Fuse or circuit-breaker rating for overload protection.

3.16 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.17 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Verify main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.18 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: ± 5%
2. Air Outlets and Inlets: ± 5%
3. Heating-Water Flow Rate: ± 5%
4. Chilled and Condenser-Water Flow Rate: ± 5%

3.19 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.20 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
6. CFM sa, CFM ra and CFM oa
7. Entering and leaving DB/WB °F of cooling coils
8. Coil Face velocity in FPM.
9. Individual Rooms or areas average DB°F and %RH.
10. Average Return Air DB °F and % RH.
11. Fan ESP and TSP in inches of water.
12. Saturated Evaporator Temperature (SET) on DX Coils
13. Entering Water Temperature (EWT °F) and Temp. Diff. Delta-T in Chilled Water Coils.

14. Chilled Water Coils GPM and WPD in Ft. wg.
15. Pumps GPM and Total Discharge Head (TDH) in Ft.wg.
16. Fan CFM and Total Static Pressure (TSP) in In.wg.
17. Chiller Evaporator or Cooler GPM, LVG/ENT Water Temp. and PD in Ft. wg.
18. Chiller Condenser GPM, EWT/LWT Water Temp. and PD in Ft. wg.
19. Cooling Water GPM, EWT/LWT Water Temp and OA WB°F near the Tower.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of testing, adjusting, and balancing Agent.
3. Project name.
4. Project location.
5. Engineer's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of testing, adjusting, and balancing Agent who certifies the report.
10. Summary of contents, including the following:

    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans and pump performance forms, including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings, including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units and Balancing stations.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.
    i. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
    j. Number of belts, make, and size.
    k. Number of filters, type, and size.

2. Motor Data: Include the following:

    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches (mm), and bore.
    f. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).

3. Test Data: Include design and actual values for the following:

    a. Total airflow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Discharge static pressure in inches wg (Pa).
    e. Filter static-pressure differential in inches wg (Pa).
    f. Preheat coil static-pressure differential in inches wg (Pa).
    g. Cooling coil static-pressure differential in inches wg (Pa).
    h. Heating coil static-pressure differential in inches wg (Pa).
    i. Outside airflow in cfm (L/s).
    j. Return airflow in cfm (L/s).
    k. Outside-air damper position.
    l. Return-air damper position.
    m. Vortex damper position.

G. Apparatus-Coil Test Reports: For apparatus coils, include the following:

1. Coil Data: Include the following:

    a. System identification.
    b. Location.
    c. Coil type.
    d. Number of rows.
    e. Fin spacing in fins per inch (mm o.c.).
    f. Make and model number.
    g. Face area in sq. ft. (sq. m).
    h. Tube size in NPS (DN).

i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data: Include design and actual values for the following:

a. Airflow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outside-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Entering-water temperature in deg F (deg C).
k. Leaving-water temperature in deg F (deg C).
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig (kPa).
n. Refrigerant suction temperature in deg F (deg C).
o. Inlet steam pressure in psig (kPa).

3. Test Data: Include design and actual values for the following:

a. Total airflow rate in cfm (L/s).
b. Entering-air temperature in deg F (deg C).
c. Leaving-air temperature in deg F (deg C).
d. Air temperature differential in deg F (deg C).
e. Entering-air static pressure in inches wg (Pa).
f. Leaving-air static pressure in inches wg (Pa).
g. Air static-pressure differential in inches wg (Pa).
h. Low-fire fuel input in Btuh (kW).
i. High-fire fuel input in Btuh (kW).
j. Manifold pressure in psig (kPa).
k. High-temperature-limit setting in deg F (deg C).
l. Operating set point in Btuh (kW).
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btuh (kW).

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data: Include the following:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btuh (kW).
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.

h. Airflow rate in cfm (L/s).
i. Face area in sq. ft. (sq. m).
j. Minimum face velocity in fpm (m/s).

2. Test Data: Include design and actual values for the following:

a. Heat output in Btuh (kW).
b. Airflow rate in cfm (L/s).
c. Air velocity in fpm (m/s).
d. Entering-air temperature in deg F (deg C).
e. Leaving-air temperature in deg F (deg C).
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data: Include the following:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).

2. Motor Data: Include the following:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
g. Number of belts, make, and size.

3. Test Data: Include design and actual values for the following:

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data: Include the following:

a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. ((sq. m)).
g. Design airflow rate in cfm (L/s).
h. Design velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

K. Air-Terminal-Device Reports: For terminal units, include the following:

1. Unit Data: Include the following:

a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft. ((sq. m)).

2. Test Data: Include design and actual values for the following:

a. Airflow rate in cfm (L/s).
b. Air velocity in fpm (m/s).
c. Preliminary airflow rate as needed in cfm (L/s).
d. Preliminary velocity as needed in fpm (m/s).
e. Final airflow rate in cfm (L/s).
f. Final velocity in fpm (m/s).
g. Space temperature in deg F (deg C).

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data: Include the following:

a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data: Include design and actual values for the following:

a. Airflow rate in cfm (L/s).
b. Entering-water temperature in deg F (deg C).
c. Leaving-water temperature in deg F (deg C).

d. Water pressure drop in feet of head or psig (kPa).
e. Entering-air temperature in deg F (deg C).
f. Leaving-air temperature in deg F (deg C).

M. Packaged Chiller Reports: For each chiller, include the following:

1. Unit Data: Include the following:

a. Unit identification.
b. Make and model number.
c. Manufacturer's serial number.
d. Refrigerant type and capacity in gal. (L).
e. Starter type and size.
f. Starter thermal protection size.

2. Condenser Test Data: Include design and actual values for the following:

a. Refrigerant pressure in psig (kPa).
b. Refrigerant temperature in deg F (deg C).
c. Entering-water temperature in deg F (deg C).
d. Leaving-water temperature in deg F (deg C).
e. Entering-water pressure in feet of head or psig (kPa).
f. Water pressure differential in feet of head or psig (kPa).

3. Evaporator Test Reports: Include design and actual values for the following:

a. Refrigerant pressure in psig (kPa).
b. Refrigerant temperature in deg F (deg C).
c. Entering-water temperature in deg F (deg C).
d. Leaving-water temperature in deg F (deg C).
e. Entering-water pressure in feet of head or psig (kPa).
f. Water pressure differential in feet of head or psig (kPa).

4. Compressor Test Data: Include design and actual values for the following:

a. Make and model number.
b. Manufacturer's serial number.
c. Suction pressure in psig (kPa).
d. Suction temperature in deg F (deg C).
e. Discharge pressure in psig (kPa).
f. Discharge temperature in deg F (deg C).
g. Oil pressure in psig (kPa).
h. Oil temperature in deg F (deg C).
i. Voltage at each connection.
j. Amperage for each phase.
k. The kW input.
l. Crankcase heater kW.
m. Chilled water control set point in deg F (deg C).
n. Condenser water control set point in deg F (deg C).
o. Refrigerant low-pressure-cutoff set point in psig (kPa).
p. Refrigerant high-pressure-cutoff set point in psig (kPa).

5. Refrigerant Test Data: Include design and actual values for the following:

    a. Oil level.
    b. Refrigerant level.
    c. Relief valve setting in psig (kPa).
    d. Unloader set points in psig (kPa).
    e. Percentage of cylinders unloaded.
    f. Bearing temperatures in deg F (deg C).
    g. Vane position.
    h. Low-temperature-cutoff set point in deg F (deg C).

N. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data: Include the following:

    a. Unit identification.
    b. Location.
    c. Unit make and model number.
    d. Manufacturer's compressor serial numbers.
    e. Compressor make.
    f. Compressor model and serial numbers.
    g. Refrigerant weight in lb (kg).
    h. Low ambient temperature cutoff in deg F (deg C).

2. Test Data: Include design and actual values for the following:

    a. Inlet-duct static pressure in inches wg (Pa).
    b. Outlet-duct static pressure in inches wg (Pa).
    c. Entering-air, dry-bulb temperature in deg F (deg C).
    d. Leaving-air, dry-bulb temperature in deg F (deg C).
    e. Condenser entering-water temperature in deg F (deg C).
    f. Condenser leaving-water temperature in deg F (deg C).
    g. Condenser water temperature differential in deg F (deg C).
    h. Condenser entering-water pressure in feet of head or psig (kPa).
    i. Condenser leaving-water pressure in feet of head or psig (kPa).
    j. Condenser water pressure differential in feet of head or psig (kPa).
    k. Control settings.
    l. Unloader set points.
    m. Low-pressure-cutout set point in psig (kPa).
    n. High-pressure-cutout set point in psig (kPa).
    o. Suction pressure in psig (kPa).
    p. Suction temperature in deg F (deg C).
    q. Condenser refrigerant pressure in psig (kPa).
    r. Condenser refrigerant temperature in deg F (deg C).
    s. Oil pressure in psig (kPa).
    t. Oil temperature in deg F (deg C).
    u. Voltage at each connection.
    v. Amperage for each phase.
    w. The kW input.

x. Crankcase heater kW.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm (L/s).
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

O. Cooling Tower or Condenser Test Reports: For cooling towers or condensers, include the following:

1. Unit Data: Include the following:

a. Unit identification.
b. Make and type.
c. Model and serial numbers.
d. Nominal cooling capacity in tons (kW).
e. Refrigerant type and weight in lb (kg).
f. Water-treatment chemical feeder and chemical.
g. Number and type of fans.
h. Fan motor make, frame size, rpm, and horsepower.
i. Fan motor voltage at each connection.
j. Sheave make, size in inches (mm), and bore.
k. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
l. Number of belts, make, and size.

2. Pump Test Data: Include design and actual values for the following:

a. Make and model number.
b. Manufacturer's serial number.
c. Motor make and frame size.
d. Motor horsepower and rpm.
e. Voltage at each connection.
f. Amperage for each phase.
g. Water flow rate in gpm (L/s).

3. Water Test Data: Include design and actual values for the following:

a. Entering-water temperature in deg F (deg C).
b. Leaving-water temperature in deg F (deg C).
c. Water temperature differential in deg F (deg C).
d. Entering-water pressure in feet of head or psig (kPa).
e. Leaving-water pressure in feet of head or psig (kPa).
f. Water pressure differential in feet of head or psig (kPa).
g. Water flow rate in gpm (L/s).
h. Bleed water flow rate in gpm (L/s).

4. Air Data: Include design and actual values for the following:

a. Duct airflow rate in cfm (L/s).

b. Inlet-duct static pressure in inches wg (Pa).
c. Outlet-duct static pressure in inches wg (Pa).
d. Average entering-air, wet-bulb temperature in deg F (deg C).
e. Average leaving-air, wet-bulb temperature in deg F (deg C).
f. Ambient wet-bulb temperature in deg F (deg C).

5. Primary Water Test Data: Include design and actual values for the following:

a. Entering-water temperature in deg F (deg C).
b. Leaving-water temperature in deg F (deg C).
c. Entering-water pressure in feet of head or psig (kPa).
d. Water pressure differential in feet of head or psig (kPa).
e. Water flow rate in gpm (L/s).

6. Secondary Water Test Data: Include design and actual values for the following:

a. Entering-water temperature in deg F (deg C).
b. Leaving-water temperature in deg F (deg C).
c. Entering-water pressure in feet of head or psig (kPa).
d. Water pressure differential in feet of head or psig (kPa).
e. Water flow rate in gpm (L/s).

P. Pump Test Reports: For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.

1. Unit Data: Include the following:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model and serial numbers.
f. Water flow rate in gpm (L/s).
g. Water pressure differential in feet of head or psig (kPa).
h. Required net positive suction head in feet of head or psig (kPa).
i. Pump rpm.
j. Impeller diameter in inches (mm).
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data: Include design and actual values for the following:

a. Static head in feet of head or psig (kPa).
b. Pump shutoff pressure in feet of head or psig (kPa).
c. Actual impeller size in inches (mm).
d. Full-open flow rate in gpm (L/s).

e. Full-open pressure in feet of head or psig (kPa).
f. Final discharge pressure in feet of head or psig (kPa).
g. Final suction pressure in feet of head or psig (kPa).
h. Final total pressure in feet of head or psig (kPa).
i. Final water flow rate in gpm (L/s).
j. Voltage at each connection.
k. Amperage for each phase.

Q. Instrument Calibration Reports: For instrument calibration, include the following:

1. Report Data: Include the following:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.21 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15990

SECTION 16000

ELECTRICAL WORK – GENERAL

1. SCOPE

The work described in this section shall include the furnishing all labor, materials, equipment and services to be rendered, and the installation of the complete electrical distribution system as shown in the accompanying drawings and specified herein. Although the work might not be restricted to these, it shall include the following:

a. High and low-voltage feeders, distribution system for power and lighting, panel-boards, branch circuits, control switches, receptacles outlets, lighting fixtures, and any other system or equipment shown in the drawings necessary for a complete and ready-to-use installation.

b. Grounding system.

c. Exterior underground conduits for power and telephone/CATV systems.

d. All concrete work for the protection of underground conduits.

e. Any other system or part of a system shown in the drawings.

2. GENERAL REQUIREMENTS

a. It shall be the direct responsibility of the Contractor to orient himself and become acquainted with all the requirements of the Puerto Rico Electric Power Authority (PREPA) and the Puerto Rico Telecommunication Regulations Board (JRT-PR) as they may pertain to this project. Such requirements will be as much as part of this contracting as so stated herein.

b. The Contractor shall maintain a complete and accurate record of any variations or changes to the contract drawings that may be necessary during the installation due to field or structural conditions. At termination of the work, and prior to the final payment, the contractor shall deliver these drawings for the architect's approval before liquidation of the contract. The architect shall then incorporate the variations or changes into a set of sepia prints, as originally issued, in such a manner that they will reproduce legibly, and any competent person may readily comprehend them, as well as all the changes and revisions made during the installation of the work. The work to be done in the sepia prints shall be performed by an experienced draftsman. This revised set of sepia prints must be delivered to the owner prior to the receipt of the final payment.

3. DRAWINGS

a. The drawings, which constitute an integral part of this contract, shall serve as the working drawings. They will indicate the general layout of the complete electrical system, i.e. the arrangements of the feeders, circuits, outlets, switches, controls, panel-boards, lighting fixtures and any other work.

b. A field verification of the scale dimensions in the plans will be carried out in the actual locations, and all distances and levels will be governed by the actual field conditions.

c. The Contractor shall review the architectural, structural, and plumbing plans, etc., and shall adjust the electrical work to conform to all conditions indicated thereon.

d. The discrepancies shown between different plans, between plans and actual field conditions or between plans and specifications shall be promptly brought to the attention of the architect or engineer for a decision.

e. All items not specifically mentioned in the specifications or noted in the drawings but that are obviously necessary to make a complete working installation shall be included with no additional cost to the Owner.

f. The Contractor shall submit to the architect or engineer detailed, dimensioned shop drawings covering all items or equipment and brochures of the lighting fixtures. No equipment should be put into manufacture (or ordered) until these shop drawings or brochures have been approved by the architect or engineer.

4. MATERIALS

a. If the materials, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog numbers, such designation will establish the standards of desired quality and style, and shall be the basis for the bid.

b. If the Contractor desires, he (she) may submit a request to use any materials or products other than those specified. The contractor shall provide a list of the proposed substitutions to the owner's representative to determine if such substitutions are equivalent in quality and style to the ones initially specified.

c. The acceptance or rejection of the proposed substitutions shall be subject to the approval by the architect or engineer.

d. The approvals of any submittal shall not relieve the Contractor from the responsibility of furnishing materials and systems of the proper dimensions, capacities, sizes, quantities, quality, and installation details to effectively comply with the requirements and intent of the Contract Documents. Such approval shall not relieve this trade from the responsibility of errors in submittals.

e. All submittals shall be presented sufficiently in advance to the field requirements to allow ample time for checking. No claim for extension of time will be granted by reason of failure in this respect.

5. SAMPLES

a. The Contractor shall submit samples of the following items to the architect or engineer for their approval:

1. Light switches: one of each type.
2. Receptacles and plugs: one of each type.
3. Wire and cable: `1-foot length of each type.
4. Conduit and conduit fittings: one of each type.
5. Switch plates or covers: one of each type.
6. Outlet boxes: one of each type.
7. Cable connectors and bushings: one of each type.
8. Plates: one of each type.
9. Lighting fixtures: one of each type.

b. All materials installed or work performed without the approval of materials will be done at the risk of the contractor, and the cost of removal of such materials of work (if it is judged unsatisfactory for any reason by the owner's representative) shall be done at the expense of the Contractor.

6. CODES, PERMITS AND INSPECTION

a. The Contractor shall contact and coordinate with the nearest PREPA and JRT-PR local offices and the corresponding telecommunications services provider, all the details of the related electrical and telephone/CATV installations for this project before the beginning of such installations.

b. The installation work shall comply with all the laws applying to electrical installation in effect in Puerto Rico, and the latest rules and regulations of the National Electrical Code, the PREPA and the JRT-PR. The Contractor shall obtain all permits and certificates of inspection and pay all the fees necessary for the execution of the work. After completion of the work, the Contractor shall provide to the architect or engineer a certificate of final inspection and approval from the PREPA and the JRT-PR local offices.

7. STANDARDS OF MATERIALS AND WORKMANSHIP

a. All materials and/or equipment described or found necessary for the electrical installation shall be new and free from defects. They shall also be listed by the Underwriters Laboratories (UL), Inc. and the National Electrical manufacturer's Association (NEMA) as conforming to their standards in every case where such standards have been established for the particular type of material in question. The materials shall be in accordance with the PREPA and JRT-PR standards. All materials and/or equipment shall be approved by the architect or engineer.

b. The Contractor shall provide the services of an experienced licensed electrician, who shall constantly be in charge of the work together with skilled workmen, fitters, helpers, and the labor force required to properly unload, transfer, erect, connect, adjust, start, operate, and test the system. The work shall be performed in a workman-like manner and shall be subject to the approval of the architect or engineer.

8. PROGRESS OF THE WORK

The electrical work shall progress in coordination with the progress of the construction work and shall be completed as soon as the conditions of the building will permit.

9. SLEEVES, INSERTS AND OPENING

a. The Contractor shall layout and installs all required materials and/or equipment in advance to the pouring of concrete floors, walls, and roofs. He (she) shall furnish and install all the necessary sleeves or openings through floors or walls required for the passage of all conduits, pipes or ducts to be installed by him (her).

b. The Contractor shall furnish and install the inserts and hangers required to support conduits, pull boxes, etc.

c. If any material and/or equipment is not properly installed, the contractor shall do all the necessary cutting and patching at his (her) own expense to rectify the errors, subject to the approval of the architect or engineer.

10. TESTS

The tests listed below shall be made in the presence of the architect, engineer or owner's representative. All testing instruments and methods shall be subject to the approval of the architect, engineer or owner's representative. All necessary arrangements to obtain all instruments, assistance personnel and materials necessary for the performance of the tests shall be made by the contractor.

a. The Contractor shall test all the wiring and shall leave the electrical installation free of grounds, shorts, etc.

b. The Contractor shall also test all lighting fixtures and electrical apparatus or equipment to be furnished under this section of the specifications.

c. Before and application for final acceptance of the work could be considered, all tests deemed necessary to show proper execution of the work must have been performed and completed in the presence of the architect, engineer or owner's representative. The scheduling for all testing procedures shall be arranged to suit the convenience of the architect, engineer or owner's representative. The scheduling for all testing procedures shall be arranged to suit the convenience of the architect, engineer or owner's representative.

d. The electrical work shall include the provision of any assistance (such as the removal of panel-board trims and junction, and pull boxes covers) deemed necessary for the architect, engineer or owner's representative to demonstrate compliance with the requirements of the drawings and specifications.

e. If the electricity-utilizing equipment supplied by other trades is energized, controlled or otherwise made operative by the electric work wiring systems, the testing to demonstrate the proper functional performance of such wiring systems shall be conducted by the trade responsible for the equipment.

f. Any test required in any section of the electrical specifications that is not listed here shall also be the responsibility of the electrical contractor.

g. Any defects or deficiencies discovered in any of the electrical works shall be corrected by the contractor.

11. TEMPORARY SERVICE

a. The Contractor shall provide and maintain a temporary electric service to be used during the construction period. This service shall comprise with the required number of outlets and extension cords with lamps and guards located as required, together with a supply of wiring-run conveniently located and a temporary main switch with required fuses or breaker. The arrangements for this supply shall be made with PREPA.

b. A temporary service of similar characteristics as the final service shall be provided by the Contractor at his (her) own expense to perform all the tests required by the owner and/or the different trades.

12. GUARANTEE

a. The Contractor shall leave the entire electrical installation included under this contract in proper working conditions. He (She) shall also replace, without additional charge, any work, materials and/or equipment or any of its component parts that develop defects different from ordinary use, within one (1) year from the date of substantial acceptance of the project by the Owner's representative.

b. The Contractor shall also be responsible for any or all damages resulting from defective materials and/or equipment, and shall repair or replace, without additional charge, all damages to the existing work caused by such defects or replacement to the satisfaction of the architect or engineer.

c. The Contractor shall provide a certificate of guarantee from the manufacturers of specialties to the effect that they will furnish new parts or equipment in which defects occur due to faulty manufacture, for a period of one (1) year from the date of substantial acceptance of the project by the Owner's representative.

d. If, at request of the architect or engineer, a part of electrical system is placed in service prior to the date of substantial acceptance, that particular part of the system will then commence its one-year period of guarantee. This guarantee will expire one year after such part of the system was placed in service regardless to the date when the final acceptance or approval (covering the entire system) is granted.

13. RECORD DRAWINGS AND INSTRUCTIONS BOOKLETS

a. The Contractor shall complete an exact detailed record of all changes or variations in the electrical installation that take place during the progress of the work. The records shall

include detailed plans or diagrams of the changes showing the method of connection, wiring diagrams, etc.

b. The architect shall then incorporate into a set of sepia prints supplied by the owner all changes and revisions made during the installation of the work. This set of sepia prints with all changes, additions, and omissions listed thereon shall be returned to the owner upon completion of the contract.

c. The Contractor shall also provide the architect or engineer with three copies of each instruction booklet supplied by the manufacturer with their respective equipment upon the completion of the work.

END OF SECTION 16000

SECTION 16011

PANELBOARDS

1. The Contractor shall supply and install the lighting and power panel-boards as indicated in the drawings.

2. The panel-boards shall be of the dead-front type and shall be equipped with automatic circuit breakers for each branch circuit as shown in the plans. The circuit breakers shall be of the thermal-magnetic type, employing quick-make and quick-break toggle mechanism for manual operation as well as automatic operation. The breaker-operating mechanism and handle shall be trip-free, thus, preventing contacts from being held in a closed position against abnormal overloads or short circuits. The automatic operation shall be indicated by the breaker handle assuming a clearly distinct position form the manual "ON" and "OFF". All circuit breakers shall be of the bolt-on type. Some breakers shall be installed for ground-fault protection where so indicated.

3. The panels shall be provided with copper bus bars, rated at 1000A per square inch, maximum.

4. The panels shall be provided with a ground bus for connecting all ground wires or cables entering or leaving the panel-board. The ground bus shall be similar to the bus used to connect the neutral conductors. Single connectors shall not be used. It shall be a copper bus.

5. The panels shall have main protection when so listed. If not listed, only main lugs of the required capacity shall be supplied.

6. The panels shall be mounted as indicated in the plans in an enclosing cabinet consisting of a code gauge, steel-sheet box with trim and door. The door shall be manufactured from a commercial galvanized steel sheet. The trim shall be manufactured from a one-piece, full-finished sheet (not galvanized) and finished with two coats of paint, the first being a prime coat and the second, a finish coat of neutral gray lacquer. The door shall be equipped with a flush-type4 combination lock and catch, all locks keyed alike. Two keys shall be provided with each lock.

7. The doors shall be supplied with a full-length piano hinge in order to increase the rigidity, strength and attractive appearance of the door.

8. All doors of forty-eight inches (48") or more in height shall be supplied with two (2) flush-type locks.

9. The cabinets shall be of sufficient size to allow a gutter space of, at least, four inches (4") on all sides.

10. The trim shall be fastenee3d to the cabinet by approved adjustable clamps and shall have a door equipped with a chrome-plated latch.

11. The cabinets shall be provided with a suitable schedule form secured in an approved metal frame pocket, with spaces for the names and numbers of the feeders that supply the panel and of every branch circuit originating from the panel. The schedule form shall be protected by a piece of transparent plastic material secured to the metal frame. The contractor shall be responsible for typing out and inserting the schedule form in the metal pocket, and shall indicate the voltage (Example 120/208V).

12. All panel-boards shall have and identifying nameplate mounted on the outside of the trim. Nameplate, including designation and voltage characteristics, shall be laminated phenolic with two inches (2") white letters on black background.

13. When two (2) or more panel-boards or cabinets are shown together in adjacent location, the top of all the panel-boards or cabinets shall be aligned with the top of the biggest one, so that all the tops are exactly at the same height from the finished floor.

14. The circuit breakers, the interior cover and the hot wires shall be identified with the corresponding circuit number.

END OF SECTION 16011

SECTION 16020

CONDUIT WORK

1. All the wiring proposed for installation within the building or structures shall be installed in PVC schedule 40 plastic conduit, except where otherwise EMT conduit, rigid galvanized steel conduit, or metal raceway are deemed required as shown in the drawings. All exposed conduits shall consist of heavy-walled rigid galvanized steel of the size indicated in the drawings. The use of flexible non-metallic conduit (ENT) is not allowed. Exposed conduits above roof shall consist of PVC schedule 80.

2. Where noted in the drawings, all the underground wiring shall be installed in PVC schedule 40 plastic conduit and encased in concrete as noted. Wherever plastic conduit is installed, the contractor will be required to provide and additional wire of green insulation in every section of conduit for grounding purposes only. This wire, as well as the proposed live and neutral wires, and wires for other purposes shall be as described in the CONDUCTORS section of these specifications. The size and general procedures for the installation of these conductors shall follow the descriptions in the Article 250 of the NEC latest edition.

3. The route of the conduits shown in the layouts will be schematic and intended to indicate interconnections between outlets. The exact routing shall be determined at the work site to conform to its structural conditions.

4. The sizes of the conduits or tubing shall be as noted in the drawings and in accordance with the NEC latest edition. Except where otherwise indicated, the minimum size of the conduits shall be three-quarters of an inch (¾").

5. All conduits, outlets, etc., shall be run in a concealed manner, except where otherwise noted in the drawings.

6. In those cases where the conduits are run exposed, they shall be installed in a neat and workman-like manner at right angles and parallel to the walls and partitions. Threaded conduit fittings shall be used with the outlet boxes in all such cases.

7. If the conduits cannot be run in furred ceilings or floor fill, they shall be installed in the neutral axis of the concrete beams or concrete floor construction.

8. All conduits shall be securely fastened to the outlet boxes and panels with approved locknuts and bushings. Special attention shall be given to the full number of threads projecting through the conduit to allow the bushing to butt up tight against the end of the threads. After that, the locknut shall be screwed up to bring the bushing into a firm contact with the box. All joints shall be made with an approved conduit coupling in such a manner that the ends of the conduit shall butt together to make all the joints watertight throughout the system.

9. The conduit run to all panels shall be installed with the fewest possible number of crossings in a straight line between the outlets; bends shall be avoided whenever possible.

10. All bends and offsets in conduits measuring up to ¾" can be performed at the work site if they are made with an approved hickey or conduit-bending machine. In the case of conduits measuring 1" or

more, the elbows or offsets made by the manufacturer shall be used unless the contractor in authorized by the architect or engineer to make them at the work site using a conduit-bending machine that will not deform, crush or damage the conduits. The inside and outside parts of all bends and offsets shall be smooth and free from irregularities. The minimum radius of the bends shall be six times the radius of the conduits.

11. All conduits shall be cut with a hacksaw, and the ends shall be reamed and squared. All threads shall be cut and cleaned before reaming.

12. The maximum length of any conduit run between two outlets, boxes or cabinets shall not exceed 150 ft., including two (2) 90º bends.

13. All conduits shall be provided with metallic bushings in the panel boards, junction boxes, outlet boxes, etc.

14. The bushings for conduits larger than 1" shall be of the metallic and plastic type, with an insulating ring where the conductors touch the bushing. These bushings shall be of the grounded type and shall be grounded.

15. The contractor shall take all possible precautions to prevent the accumulation of dirt, mortar, concrete or any foreign matter within the conduits. Any accumulation of matter shall be properly cleaned before the wiring work is done. If it cannot be cleaned, the conduit shall be replaced at the contractor's expense.

16. To prevent the accumulation of debris, water, and foreign particles, all installed conduits shall be suitably plugged with bushings capped with a metal disk, a plastic cap or any other device approved by the architect or engineer. Paper, tape, wood or concrete plugs will not be permitted. All conduits shall be free of water after the wiring.

17. At the motor terminals and other electrical devices where so required, the contractor shall furnish and install a piece of flexible seal-tight conduit of not less than 24" in length to be connected between the conduit and the motor or device terminals.

18. All exposed conduits shall be properly secured at not more than 5'- 0" centers.

19. The expansion fittings shall be provided in the conduits system where required by the structural conditions.

20. Concrete and watertight conduit fittings shall be used for all EMT conduits.

21. Unless otherwise indicated in the drawings, all exposed conduits below the hung-ceiling level shall consist of heavy-walled, rigid, galvanized steel of the size indicated in the drawings.

22. Unless otherwise indicated in the drawings, all exposed conduits above hung ceiling level shall be EMT type. The use of plastic conduits is not allowed in this area.

23. The openings for conduits and cables crossing through fire-rated wall must be fire-sealed to avoid any possible spread of fire.

END OF SECTION

SECTION 16030

BOXES

1. All outlets, junctions, pull boxes, and fittings shall be galvanized or plated, and shall be installed in a plumb, rigid and satisfactory manner with an alignment tolerance of 1/16".

2. The ceiling outlets in slabs and metal-pan constructions shall consist of 4" octagonal concrete ring with 2½" minimum depth and ¾" K.O. to fit the conduit; include cover with knock-outs. When so advisable, 4" x 4" or larger outlet boxes equipped with a canopy cover may be used instead of the octagonal boxes. The ceiling outlets shall be provide3d with a ⅜" fixture stud when necessary to support the fixtures. The outlet boxes shall be flush with the ceiling surface. A 4" x 4" x 2⅛" box with a cover shall be used in hung ceilings.

3. The wall outlets for lighting fixtures shall consist of 4" octagonal boxes, 2½" in depth (or 4"x4"x 2⅛" boxes) with canopy covers with ⅜" fixture studs and K.O. to fit the conduits.

4. The wall outlet boxes for convenience outlets, switches, and other devices shall measure 4"x4"x 2⅛" minimum with K.O. to fit the conduits. The outlet boxes shall be equipped with raised covers of the required height and gang to bring them flush with the finished wall surface. The installation of raised covers on the boxes prior to the pouring of the concrete to be plastered will be strictly prohibited. In all cases, the raised covers shall be installed after the forms are removed and shall have the same depth as the plaster thickness. If several switches are indicated in adjacent positions, they will be ganged together in an outlet box of the proper size, and only one switch plate will be installed, unless otherwise indicated. If emergency power (red) and normal power (ivory) switches are indicated in adjacent position, they shall not be ganged together; use individual outlet boxes. All wall outlets shall be located at the height indicated in the plans.

5. Wall outlet boxes for electric ranges receptacles shall measure 5"x 5" x 2⅛" with 1"ø knock outs to fit the conduits.

6. Where outlets at different levels are shown adjacent, they shall be installed in one vertical line if possible.

7. The boxes for other outlets (like dryers, special purpose outlets, etc.) shall be of the size and type recommended by the manufacturer of the device. The raised covers shall be of the required size and gang to bring them flush with the finished wall surface. When located on columns or over doors, they shall be set symmetrically to the columns or doors.

8. The contractor shall provide suitable approved junctions or pull boxes when so deemed desirable for the insertion of conductors, or when so indicated. All junctions or pull boxes not over 150 cu. in. in size shall be constructed similarly to the outlet boxes of not less than #12 gauge steel sheet. All junctions or pull boxes over 150 cubic inches in size shall be constructed as same as specified for the panel-boards cabinets, except that the covers will have the same thickness as the boxes secured by screws or bolts instead of hinges.

9. All junctions and pull boxes must be accessible after the completion of the building.

10. The contractor shall provide a #12 (minimum) THHN green bonding jumper to every outlet or junction box for grounding continuity. It shall be connected to the electrical device grounding terminal and to the conduit grounding conductor.

END OF SECTION 16030

SECTION 16040

LIGHTING FIXTURES

• PART I – GENERAL

1.1 SECTION SCOPE:

This section includes all fluorescent, light-emitting diodes (LED) and high intensity discharge (HID) luminaries required for proper illumination of existing facilities (to be rehabilitated or remodeled) and/or new facilities (to be constructed or installed), including fluorescent energy-efficiency ecologic lamps, HID lamps, LED approved lamps, exit signs and emergency lighting units, all in accordance to proposed lighting fixtures schedule indicated on plans and specified mounting hardware, ballasts, lighting fixtures equipment & miscellaneous accessories.

1.2 SUBMITTALS:

A. Product Data: For each type of lighting fixture indicated on plans and arranged in order of fixture designation. Submittals must include data on features, accessories and the following items:

1. Dimensions of fixtures.
2. Certified results of independent laboratory tests for fixtures and lamps in terms of electrical ratings, photometric data and photometric performance.
3. Fluorescent and HID ballasts
4. Emergency lighting unit battery and charger.
5. Types of lamps.

B. Shop Drawings: Show details of non-standard or custom-made fixtures. Indicate dimensions, weights, method of field assembly, components, features and accessories. Submit wiring diagrams indicating detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

C. Samples for Verification: Submit samples of lighting fixtures as indicated on lighting fixture schedule or as directed by inspector or PBA designated representative. Samples must include the following:

1. Lamps: Specified units installed.
2. Ballast: Specified ballast type.
3. Accessories: As specified.

D. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Maintenance Data: For lighting fixture to be included on maintenance manuals, as specified on Division 1 (General Requirements).

1.3 WARRANTY:

A. General Warranty: Special warranty specified on this article shall not deprive PBA of other rights may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements stipulated on aforementioned Contract Documents.

B. Special Warranty for Batteries: Written warranty executed by manufacturer, agreeing to replace rechargeable batteries that fail in materials or workmanship within a manufacturer's standard period not less than ten (10) years from date of Substantial Completion. Full warranty must apply for first year and prorated warranty for the remaining years.

C. Special Warranties for Fluorescent Ballasts: Written warranty executed by manufacturer, agreeing to replace fluorescent ballasts that fail in materials or workmanship within a period of five (5) years from date of manufacture but not less than four (4) years from date of Substantial Completion.

• PART II - PRODUCTS

2.1 FIXTURES AND FIXTURE COMPONENTS – GENERAL:

A. All lighting fixture products incorporated into project's work (luminaries, lamps, ballasts, mounting hardware, related equipment & accessories, etc.) shall be furnished in strict compliance with the drawings, technical specifications, details and all latest applicable electrical codes and regulations.

B. All lighting fixture products incorporated into project's work include, but is not limited to the products indicated on lighting fixtures schedule shown on drawings. All series, models or catalog numbers of the manufacturer shall be indicated to establish standards of quality.

C. The lighting fixtures will be indicated in the drawings by their type. The letter will indicate the basic type. If several fixtures are shown in a room and only one is identified, it shall be understood that the other fixtures are identical.

D. All lighting fixtures to be supplied & installed shall be brand new and approved by the architect, engineer or designated PBA representative, prior to their delivery to the project's site.

E. Lighting fixtures layout and installation (including mounting hardware and trim) must be coordinated with ceiling system and other construction items.

F. All materials and accessories, whether specifically described or not, shall be of the best grade of commercial manufacture and all workmanship shall be first class in every respect.

G. Lighting fixtures' finishes must be manufacturer's standard, unless otherwise indicated. All paint finish must be applied over corrosion-resistant treatment or primer, free of defects. All metallic finish must be corrosion resistant.

H. Wherever practical, the components of built-in lighting arrangements shall be standard products of the same manufacturers designed to be assembled and used together without field alterations.

2.2 FIXTURE COMPONENTS – EQUIPMENT AND ACCESSORIES:

A. Metal Parts: Metal parts must be free from burrs, sharp corners and edges.

B. Sheet Metal Components: Sheet metal components must be on steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Reflecting surfaces: **Minimum reflectance** as follows, unless otherwise indicated:

SURFACE	PERCENT OF REFLECTANCE
White Surfaces	85%
Specular Surfaces	83%
Diffusing Specular Surfaces	75%

SURFACE	PERCENT OF REFLECTANCE
Laminated Silver Metallized Film	90%

D. Lenses, diffusers, covers and globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.

2. Lens thickness: 0.125 inch (3 mm.) minimum, unless grater thickness is indicated.

E. Connectors: Approved solder-less connectors shall be used in making connections in the wiring within the fixtures or in connecting the fixtures wiring to the wiring of the building.

F. Doors, frames and other internal access: Smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange access doors, frames, lenses, diffusers and other pieces to prevent accidental falling during re-lamping and when secured in operating position.

G. Support Components: Support Components must comply with Section 16000 (Electrical Work – General) or Section 26 00 00 (Basic Electrical Materials and Methods), whichever applies, for channel & angle-iron supports and non-metallic & angle supports.

1. Single-Stem Hangers: ½" (12 mm.) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

2. Twin-Stem Hangers: Two (2) ½" (12 mm.) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

3. Rod Hangers: 3/16" (5 mm.) minimum diameter, cadmium-plated, threaded steel rod.

4. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord and locking-type plug.

5. Aircraft Cable Support: Use cable, anchorages and intermediate supports recommended by fixture manufacturer.

2.3 FLUORESCENT LAMP BALLASTS:

A. Unless otherwise indicated, all ballast used in connection with the ecologic T8 fluorescent lighting equipment shall be as follows:

1. Designed for type and quantity of lamps indicated at full light output
2. UL listed, thermally protected, resetting, Class P, **non-PCB**
3. Minimum line transient as shown in IEEE87, Category A and ANSI 62.41.
4. Ballast operates at 120V nominal (108V-132V) - 60 Hz. or 277V nominal (249-305V) – 60 Hz.
5. Meets most recent (latest) Federal Efficiency Standard (Law 100-357).
6. Meets FCC rules/regulations, Part 18, 15J for EMI/RFI.
7. Meets all requirements of ANSI C82.11.
8. Power factor equal or greater than 0.95. Maximum lamp current crest factor of 1.7.
9. Ballast shall be electronic type with equal or less than 10% of total harmonic distortion (THD≤10%).
10. Minimum 5-year ballast manufacturer's warranty, in compliance with special warranty indicated on Article 1.3.
11. A complete application data of the ballast and the submitted fixture shall be included for approval as described.

2.4 HIGH-INTENSITY DISCHARGE LAMP BALLASTS:

A. Unless otherwise indicated, all HID lighting fixtures ballast shall comply with ANSI C82.4 and includes the following parameters:

1. Type: High power factor (HPF) constant wattage.
2. Operating voltage: Must match system voltage.
3. Minimum starting temperature: Minus 22ºF (minus 30ºC) for single lamp ballast.

4. Normal ambient operating temperature: 104ºF (40ºC).

5. Open circuit operation that will not reduce average life.

6. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.

B. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.

2.5 EXIT SIGNS:

A. Exit signs must comply with UL-924. Sign color and lettering size shall comply with specifications issued by authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC operation: LED lamps with not less than 70,000 hours rated lamp life.
2. Additional lamps for DC operation: Two (2) minimum bayonet-base type for connection to external dc source.

C. Self-Powered Exit Signs (Battery Type):

1. Battery: Sealed, maintenance-free, nickel-cadmium type, in compliance with special warranty indicated on Article 1.3.
2. Charger: Integral in a self-contained power pack, fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnect lamps, and battery is automatically recharged and floated on charger.

2.6 EMERGENCY LIGHTING UNITS:

A. Emergency lights must be self-contained units in compliance with UL-924, including the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with not less than ten (10) years nominal life, in compliance with special warranty indicated on Article 1.3.
2. Charger: fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turn lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnect from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnect lamps, and battery is automatically recharged and floated on charge.
4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
5. Integral Time-Delay Relay: Arranged to hold unit on, for fixed interval, after restoring electric power service interrupted by an outage. Provides adequate time delay to permit any existing high-intensity-discharge lamps to restrike and develop adequate output.

2.7 EMERGENCY FLUORESCENT POWER SUPPLY UNIT:

A. Internal Type: Power supply unit must be self-contained, modular, battery-inverter unit factory mounted within fixture body, in compliance with UL-924, including the following features:

1. Test switch and LED indicator light: Visible and accessible without opening fixture or entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type with not less than ten (10) years nominal life, in compliance with special warranty indicated on Article 1.3.
3. Charger: Fully automatic, solid-state constant current type.
4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnect lamps, and battery is automatically recharged and floated on charger.

B. External Type: Power supply unit must be self-contained, modular, battery-inverter unit, in compliance with UL-924, including the following features:

1. Test switch and LED indicator light: Visible and accessible without entering ceiling space.
2. Battery: Sealed, maintenance-free, nickel-cadmium type with not less than ten (10) years nominal life, in compliance with special warranty indicated on Article 1.3.
3. Charger: Fully automatic, solid-state constant current type.
4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnect lamps, and battery is automatically recharged and floated on charger.
5. Housing: NEMA 250, Class 1 enclosure.

2.8 LAMPS:

A. Fluorescent:

1. Unless otherwise indicated, all new fluorescent lamps shall be deluxe color white, energy-saving & ecologic type, T8, correlated color temperature (C.C.T.) of 4100ºK, color rendering index (C.R.I.) equal or greater than 85, with electrode protectors, **approved equal** to product manufactured by Phillips Co., GE Corp. or Sylvania.

2. Lamp Life: Rated average must be 20,000 hours at three (3) hours per start, when used on rapid-start circuits.

B. High Intensity Discharge (HID):

Unless otherwise indicated, all new HID lamps shall be metal-halide, correlated color temperature (C.C.T.) of 3600ºK, color rendering index (C.R.I.) equal or greater than 70, 80% minimum reflecting efficiency, **approved equal** to product manufactured by GE Corp., SIMCAR or manufacturer specified on lighting fixtures schedule.

C. Light-Emitting Diode (LED):

LED lamps will be considered and properly accepted by PBA as substitute of T-8 fluorescent or high-intensity discharge (HID) lamps, as long as proposed LED lamps comply with aforementioned specifications and/or any other specifications submitted for fluorescent or HID lamps on lighting fixtures schedule.

• PART III – EXECUTION

3.1 FIXTURE INSTALLATION:

A. Set level, plumb and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.

B. The vandal-proof luminaries shall be installed strictly according to the manufacturer recommendations and with vandal proof screws.

C. All luminaries that are not vandal-proof shall be installed using the TAPCON Masonry Fastening System. This screw will be placed directly into the concrete and has maximum anchor strength. The installer shall

drill a hole in the concrete (through the mounting holes of the fixture) using a drill bit of the size recommended by the manufacturer. A screw of an approved size shall be used.

D. All rows of fixtures (flush, surface or suspended) shall be installed accurately on straight line. The fastening and suspensions shall be firmly set up so that the lines and lamps will be secured against normal vibrations and will not be affected or distorted by the handling incident of the normal maintenance.

E. Support for Fixtures: In or On Grid-Type Suspended Ceilings

1. Use grid for support
2. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than six (6) inches (150 mm.) from fixture corners.
3. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
4. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two (2) - ¾" (20 mm.) metal channels spanning and secured to ceiling tees.

F. Suspended Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1,200 mm.), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one-point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end. Suspend from cable installed according to fixture manufacturer's written instructions and details on drawings.

G. Air Handling Fixtures: Install with dampers closed.

H. Upon completion of the installation of the lighting equipment, it must be in first-class operating order and in perfect condition. At the time of the final inspection, the equipment must be complete, with the required glassware or reflectors, which must be clean and free from defects.

3.2 CONNECTIONS:

A. Provide a 3"ø hole at the back plate of any surface mounted fluorescent luminaries to access the outlet box.

B. All lighting fixtures shall be grounded. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL-486A and UL-486B.

C. After lighting fixtures and lighting equipment are connected to the wiring system of the building or project, the wiring system and the fixtures or equipment must be test free from short circuits and must show an insulation resistance between conductors and ground, based on minimum load, not less than resistance required by latest edition of NEC.

3.3 FIELD QUALITY CONTROL:

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: As follows

1. Verify normal operation of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
3. Verify normal transfer to battery source and retransfer to normal.
4. Report results in writing.

E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedures until units operate properly.

F. Corrosive fixtures must be replaced during warranty period.

3.4 CLEANING AND ADJUSTING:

A. Clean fixtures internally and externally after installation, using methods and materials recommended by manufacturer.

B. Adjust installed fixtures to provide required light intensities.

END OF SECTION 16040

SECTION 16041

WIRING DEVICES

1. WALL SWITCHES

a. The Contractor shall provide and install all switches as shown in the plans and in accordance with the swing of the doors. All switches shall be located on the strike side of the door, unless otherwise indicated, and at the height indicated in the plans.

b. If several switches are indicated in adjacent position, they shall be ganged together in one outlet box of the proper size and only one switch plate, unless otherwise indicated.

c. If emergency power (red) and normal power (ivory) switches are indicated in adjacent position, they shall not be ganged together. They shall be installed in individual outlet boxes.

d. Except where otherwise indicated, all switches shall be as hereinafter specified.

1. SWITCH

Flush-toggle handles; 20 AMP and 120/277 volts A.C. quiet; back and side wiring, industrial specification grade; heavy duty, tungsten rated, grounding type, with gold-plated, oversize silver-cadmium oxide contacts; grain-oriented, extra-heavy duty phosphor-bronze contact arms; super positive quiet action; extra-large binding head terminal for #10, #12 and #14 wires; rigid steel strap, heavily plated, with washer type plaster ears; switching mechanism, fully enclosed in a reinforced urea-molded body, riveted to mounting. The cover plate shall be no. 302 stainless steel, non magnetic, satin finish.

All switches shall be equal to:

Manufacturers Name	Single Pole	Two Poles	Three-Way	Four-Way
Pass & Seymour	20AC1-I	20AC2-I	20AC3-I	20AC4-I
Hubble	1221I	1222I	1223I	1224I
Leviton	1221-2I	1222-2I	1223-2I	1224-2I
Eagle	2221V	2222V	2223V	2224V
General Electric	5951-2G	5952-2G	5953-2G	5954-2G
Bryant	4901-GI	4902-GI	4903-GI	4904-GI
Arrow Hart	1221I	1222I	1223I	1994I

2. SWITCH WITH PILOT LIGHT

All specifications and catalog series are the same as above except for a red pilot light handle (Switch On, Light On).

3. SWITCH WITH RED COLORED HANDLE

The switches that are energized by emergency circuits shall be red-colored and shall be provided with polycarbonate red-colored plates equal to Slater catalog number SH-95071. All specifications and catalog series are the same as above except for red colored handle.

2. WALL RECEPTACLES

a. The Contractor shall furnish and install all wall receptacles as indicated in the drawings and hereinafter specified.

CONVENIENCE OUTLETS

Three-wires grounding, duplex receptacle industrial specification grade or extra hard use specification grade, heavy duty, weather-proof where indicated in the plans, polarized 20 AMP, 125 volts, back and side wiring, U-ground, NEMA 5-20R type parallel slot, tow-ground terminal screw with: break-off feature for two-circuits wiring; current carrying contacts, securely held in body at four points to maintain rigidity when the break-off is employed; triple wiping phosphor-bronze T-slot contacts; auto ground; body and cap must be of molded urea; terminal screws for #10 and #12 wires; heavily reinforced arc-resistant urea body. The cover plate shall be no. 302 stainless steel, nonmagnetic, satin finish.

b. All receptacles shall be equal to:

Manufacturers Name	20A, Duplex 5-20R	20A, Duplex Tamper Resistant	20A, Combination 125/250 V	20A, GFI	20A, Surge Supp. TVSS
Pass & Seymour	5362-I	SG63-HI	5890-I	2091-SI	6362-ISP
Hubble	5362-I	_____	5492-I	GF8300I	_____
Leviton	5362-I	_____	5844-I	6898-HGI	8380-I
Eagle	5362-V	_____	_____	_____	_____
General Electric	5362-2	GE8300-TI	GE5492-2	SF(R)8322-2	5362-S-2
Bryant	5362-I	_____	5492-I	GFR83FT-I	_____
Arrow Hart	5362-1	_____	5492-1	GF8300I	_____

c. All receptacles that are energized by emergency circuits shall be red-colored and shall be supplied with polycarbonate red-colored plates equal to Slater catalog number SH-95101. All specifications and catalog series shall be the same as above except for red colored face.

d. All the outlets outside the building shall be of the weather-proof type and ground fault-protected, as indicated in the drawings.

e. All outlets for water coolers shall be ground fault protected. In addition, shall have a permanent use type weatherproof cover.

f. The clock receptacles shall be Pass & Seymour 3733-SS.

g. All single receptacles shall be rated 20 Amps (unless otherwise indicated) and shall exhibit the same characteristics of the 20 Amps convenience outlets.

h. Receptacles for clothes dryer, ranges and water heaters shall be equal to:

Manufacturers Name	**30A Dryer 14-30R**	**50A Range 14-50R**	**30A Water Heater 6-30R**
Pass & Seymour	5744	5754	5930
Hubble	9430A	9450A	9330
Leviton	278	279	5372
Eagle	1257	1258	1234
General Electric	4191-3	4181-3	4139
Bryant	9430-FR	9450-FR	9632-FR
Arrow Hart	5744N	_____	5700N

i. Commercial Specification Grade wiring devices are not accepted as substitutes.

j. Surge suppressor to be used for computer and electronic peripherals.

C. DEVICE PLATES

a. All plates for the wall convenience receptacles, switches, telephone, junction box outlets, intercom facilities, etc. shall be no. 302 stainless steel satin finish, of the non-magnetic type.

b. The telephone outlet plates shall be provided with a rubber bushing in the center hole.

END OF SECTION 16041

SECTION 16050

CONDUCTORS

1. The Contractor shall furnish and install all conductors as specified herein and indicated in the drawings.

2. Except where otherwise indicated in the drawings or specified, no conductor shall be smaller than #12 AWG. All conductors shall be stranded.

3. Unless otherwise indicated, all conductors shall be of the moisture and heat resistant type (THHN) rated 600 volts insulation 90ºC Cu.

4. All feeder and branch circuit conductors shall be color-coded as follows:

PHASE	120/208 V	277/480 V
Ø A	Black	Brown
Ø B	Red	Orange
Ø C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

Note: Isolated ground conductors shall be green with yellow stripes.

5. All building wires shall be of the UL approved types. The conductors shall not be over six months old. They shall also be suitable protected from weather or damage during their storage and handling and shall be in first-class condition when installed.

6. All conductors shall be continuous from outlet to outlet, and so splices shall be made except in the boxes. The conductors in the outlets shall be of sufficient length to allow making all the device connections without any strain.

7. All conductors #6 AWG in size or smaller shall be factory-finished in the desired identifying colors.

8. If not factory-finished in the desired color, all conductors #4 AWG in size or larger used in branch circuits shall be identified by using tape in the desired color the last twelve inches (12") of every length conductor.

9. When used for underground installation, all conductors or cables, regardless of the type, shall be protected by schedule 40 PVC conduits of the adequate size per NEC. They shall also be embedded in a concrete encasement of a minimum thickness of four inches (4") on all sides. All underground feeders or branch circuits shall be RHw-2, XLP 90ºC Cu.

10. The Contractor shall provide a ground wire in all motor circuits for grounding purposes. He (she) shall size it according to the latest edition of the National Electrical Code.

11. The Contractor shall provide a #12 THHN green bonding jumper between the receptacles grounding terminal and the grounded outlet box for grounding continuity.

END OF SECTION 16050

SECTION 16060

GROUNDING AND BONDING

1PART GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rod electrodes.
2. Active electrodes.
3. Wire.
4. Grounding well components.
5. Exothermic connections.

B. Related Sections:

1. Section 02590 - Site Electrical: Site related grounding components for buildings and facilities.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.
2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Rod electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. Product Data: Submit data on grounding electrodes and connections.

B. Test Reports: Indicate overall resistance to ground.

1.6 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance with PREPA 's standard.

C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum two years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.9 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

B. Complete grounding and bonding of building prior concrete placement.

2PART PRODUCTS

2.1 ROD ELECTRODES

A. Furnish materials in accordance with PREPA’s standards.

B. Product Description:

1. Material: Copper-clad steel.
2. Diameter: 3/4 inch.

3. Length: 10 feet.

C. Connector: Connector for exothermic welded connection..

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 4/0 AWG.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches by 24 inches long concrete pipe with belled end.

B. Well Cover: Fiberglass with legend "GROUND" embossed on cover.

2.4 EXOTHERMIC CONNECTIONS

A. Furnish materials in accordance with PREPA’s standards.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

3PART EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove surface contaminants at connection points.

3.3 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

C. Install grounding and bonding conductors concealed from view.

D. Install grounding well pipe with cover at rod locations as indicated on Drawings. Install well pipe top flush with finished grade.

E. Install 4/0 AWG bare copper wire in foundation footing as indicated on Drawings.

F. Bond together metal siding not attached to grounded structure; bond to ground.

G. Bond together reinforcing steel and metal accessories in pool and fountain structures.

H. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

I. Connect to site grounding system. Refer to Section 02590.

J. Install continuous grounding using underground artificial station ground by means of driven rods or buried electrodes.

K. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

L. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

M. Install a ground loop as shown on plans consisting of #4/0 AWG bare copper conductor installed at 3 ft. below final grade. Connect to this ground loop the electrical, telephone, cable T V, and antenna grounding electrode conductors using Cadweld connection.

N. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.4 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements, 01700 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART I - GENERAL

A. SUMMARY

1. Section Includes:

    a. Nameplates.
    b. Labels.
    c. Wire markers.
    d. Conduit markers.
    e. Stencils
    f. Underground Warning Tape.
    g. Lockout Devices.

2. Related Sections:

    a. Section 09900 – Paints and Coatings: Execution requirements for painting specified by this section.

B. SUBMITTALS

1. Section 01330 – Submittal Procedures: Submittal procedures.

2. Product Data:

    a. Submit manufacturer's catalog literature for each product required.
    b. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
    c. Submit two samples of each type of identification products applicable to project.
    d. Submit two nameplates, 4 x 4 inch in size illustrating materials and engraving quality.

3. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

C. QUALITY ASSURANCE

1. Perform Work in accordance with PHA standard.

D. QUALIFICATIONS

1. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

2. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

E. DELIVERY, STORAGE, AND HANDLING

1. Section 01600 – Product Requirements: Requirements for transporting, handling, storing, and protecting products.

2. Accept identification products on site in original containers. Inspect for damage.

3. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

4. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

F. ENVIRONMENTAL REQUIREMENTS

1. Section 01600 – Product Requirements: Environmental conditions affecting products on site.

2. Install nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART II - PRODUCTS

A. NAMEPLATES

1. Furnish materials in accordance with PHA standards.

2. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

3. Letter Size:

   a. ⅛ inch high letters for identifying individual equipment and loads.
   b. ¼ inch high letters for identifying grouped equipment and loads.

4. Minimum nameplate thickness: ⅛ inch.

B. LABELS

1. Furnish materials in accordance with standards.

2. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

C. WIRE MARKERS

1. Furnish materials in accordance with PHA standards.

2. Description: Cloth tape, split sleeve, or tubing type wire markers.

3. Legend:

   a. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
   b. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams.

D. CONDUIT AND RACEWAY MARKERS

1. Furnish materials in accordance with PHA standards.

2. Description: Stencils.

3. Color:

   a. 480 Volt System: Black lettering on white background.
   b. 208 Volt System: Black lettering on white background.
   c. Fire Alarm System: Red lettering on white background.
   d. Telephone/CATV System: Blue lettering on white background.

E. STENCILS

1. Furnish materials in accordance with PHA standards.

2. Stencils: With clean cut symbols and letters of following size:

   a. Up to 2 inches Outside Diameter of Raceway: ½ inch high letters.
   b. 2-½ to 6 inches Outside Diameter of Raceway: 1 inch high letters.

3. Stencil Paint: As specified in Section 09900, semi-gloss enamel, colors conforming to the following:

   a. Black lettering on white background.
   b. White lettering on gray background.
   c. Red lettering on white background.
   d. Blue lettering on white background.

F. UNDERGROUND WARNING TAPE

1. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines as per PREPA and JRT regulations.

G. LOCKOUT DEVICES

1. Lockout Hasps:

a. Manufacturers:

1. Substitutions: Section 01600 – Product Requirements.

b. Anodized aluminum hasp with erasable label surface; size minimum 7-¼ x 3 inches.

PART III - EXECUTION

A. PREPARATION

1. Degrease and clean surfaces to receive adhesive for identification materials.

2. Prepare surfaces in accordance with Section 09900 for stencil painting.

B. EXISTING WORK

1. Install identification on existing equipment to remain in accordance with this section.

2. Install identification on unmarked existing equipment.

3. Replace lost nameplates.

4. Re-stencil existing equipment.

C. INSTALLATION

1. Install identifying devices after completion of painting.

2. Nameplate Installation:

a. Install nameplate parallel to equipment lines.
b. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
c. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
d. Secure nameplate to equipment front using screws, rivets, or adhesive.
e. Secure nameplate to inside surface of door on recessed panel-board in finished locations.

f. Install nameplates for the following:

1. Switchboards.

2. Panel-boards.
3. Transformers.
4. Service Disconnect.

3. Label Installation:

   a. Install label parallel to equipment lines.
   b. Install label for identification of individual control device stations.
   c. Install labels for permanent adhesion and seal with clear lacquer.

4. Wire Marker Installation:

   a. Install wire marker for each conductor at panel-board gutters, pull boxes, outlet and junction boxes, and each load connection.
   b. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
   c. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

5. Conduit Raceway Marker Installation:

   a. Install conduit raceway marker for each conduit raceway longer than 6 feet.
   b. Conduit Raceway Marker Spacing: 20 feet on center.
   c. Raceway Painting: Identify conduit using field painting in accordance with Section 09900.

      1. Paint colored band on each conduit longer than 6 feet.
      2. Paint bands 20 feet on center.
      3. Color:

         a. 480 Volt System: Blue.
         b. 208 Volt System: Yellow.
         c. Fire Alarm System: Red.
         d. Telephone/CATV System: Green.

6. Stencil Installation: Apply stencil painting in accordance with Section 09900.

7. Underground Warning Tape Installation: Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable as per PREPA and JRT regulations.

END OF SECTION 16075

SECTION 16095

MINOR ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of existing electrical equipment, (including telephone, and fire alarm) wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.

2. Disposal of materials.

3. Storage of removed materials.

4. Identification of utilities.

5. Salvaged items.

6. Protection of items to remain as indicated on Drawings.

7. Relocate existing equipment to accommodate construction.

1.2 SUBMITTALS

A. Section 01330 – Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work. Describe demolition removal procedures and schedule.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with PHA standard.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01300 – Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.5 SCHEDULING

A. Section 01300 – Administrative Requirements, 01323 – Network Analysis Schedules: Requirements for scheduling.

B. Schedule work to coincide with new construction.

C. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.6 COORDINATION

A. Section 01300 – Administrative Requirements: Requirements for coordination.

B. Conduct demolition to minimize interference with adjacent and occupied building areas.

C. Coordinate demolition work with PHA.

D. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

E. Shut-down Periods

1. Arrange timing of shut-down periods of in service panels with PHA. Do not shut down any utility without prior written approval.

2. Keep shut-down period to minimum or use intermittent period as directed by.

F. Identify salvage items in cooperation with Owner.

PART 2 – EXECUTION

2.1 EXAMINATION

A. Section 01300 – Administrative Requirements: Verification of existing conditions before starting work.

B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

C. Verify termination points for demolished services.

2.2 PREPARATION

A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

B. Temporary egress signage and emergency lighting.

C. Coordinate utility service outages with Utility Company.

D. Beginning of demolition means installer accepts existing conditions.

2.3 DEMOLITION

A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner before disturbing existing installation.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

D. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

E. Reconnect equipment being disturbed by renovation work and required for continue service to nearest available panel.

F. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.

G. Install temporary wiring and connections to maintain existing systems in service during construction.

H. Perform work on energized equipment or circuits with experienced and trained personnel.

I. Remove, relocate, and extend existing installations to accommodate new construction.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

L. Clean and repair existing equipment to remain or to be reinstalled.

M. Protect and retain power to existing active equipment remaining.

N. Cap abandoned empty conduit at both ends.

O. Fill with concrete all holes of outlets, switches, panel-boards, etc.

2.4 EXISTING PANELBOARDS TO REMAIN

A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.

B. Tag unused circuits as spare.

C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.

D. Remove existing wire no longer in use from panel to equipment.

E. Provide new updated directories where more than three circuits have been modified or rewired.

2.5 SALVAGE ITEMS

A. Remove and protect items indicated in Schedule to be salvaged and turn over to PHA.

B. Items of salvageable value may be removed as work progresses. Transport salvaged items form site as they are removed to the warehouse selected by PHA.

2.6 REUSABLE ELECTRICAL EQUIPMENT

A. Carefully remove equipment, materials, or fixtures which are to be reused.

B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

2.7 CLEANING

A. Section 01700 – Execution Requirements: Requirements for cleaning.

B. Remove demolished materials as work progresses. Legally dispose.

C. Keep workplace neat.

2.8 PROTECTION OF FINISHED WORK

A. Section 01700 – Execution Requirements: Requirements for protecting finished Work.

END OF SECTION 16095

SECTION 16485

LIGHTING CONTACTORS

a. Furnish and install where shown a lighting contactor in the plans.

b. The contactors shall be Square D Series 8903 Type S.

c. They shall be Two, Three, Four Poles or as required.

d. The contacts ratings shall be 30, 60, 100, 200 amperes, or as indicated in the plans, for all types of ballast and tungsten lighting, resistive heating and motor loads.

e. They shall be U.L. approved as suitable for purpose specified and shown.

f. The contacts shall be totally enclosed, double break silver cadmium-oxide power contacts. Contacts inspection and replacement shall be possible without disturbing line or load wiring.

g. The wiring shall be straight-through wiring with all terminals clearly marked.

h. The installation shall be exposed type or flush as required.

i. The enclosure shall be NEMA 1, 3R, 4, 4X or 12 as required to meet the conditions of installation.

j. The contactor shall be provided with disconnecting means in the same enclosure if required.

k. The enclosure shall be provided with ON-OFF pushbuttons, control transformer, Hand-Off-Auto Selector Switch, and red indicating light.

l. The coil shall be of the encapsulated type.

END OF SECTION 16485

SECTION 16500

TIME SWITCHES

1. The timer system shall be able to accommodate the varying sunrise and sunset times by simulating them through microprocessor control.

2. The timer system permits the programming of ON/OFF functions related to sunrise and sunset at any point on Earth.

3. Programming must be set for the number of minutes before or after sunrise or sunset.

4. Programming must accommodate a maximum of four hundred (400) programmable control events.

5. The time system shall be capable of accepting adjustable timed override for last minute, nonrecurring program changes without disturbing existing programs.

6. The time system shall be capable of operating up to seven different programs plus daily repeat, timed override, and immediate events.

7. The timer system shall have a panic button that activates programmed emergency operations.

8. The timer system shall provide sequenced restart after power failure.

9. Resolution for timed events shall be one minute

10. Time accuracy is to be based on line frequency (60 Hz).

11. The timer system shall have a power-failure back up provided by a lithium battery with a ten-year shall life that retains programming for two years of accumulated power outages.

12. The timer system shall retain clock accuracy for 72 hour per power failure.

13. The timer system consists of a 24-vac transformer power a low-voltage timer unit that connects to control relay units capable of operating loads (per pole) as follows:

    a) 240 VAC, 6 A, General use.
    b) 24 VDC to 250 VDC, 75 V A resistive.
    c) 24 VDC, 5 A resistive.
    d) 1/10 hp at 120 VAC across line motor starting.
    e) ¼ hp at 240 VAC across line motor starting.
    f) 360 VA pilot duty.

14. Control relay units shall consist of four (4) single poles, normally open maintained contacts with transient protection and four (4) manual override switches.

15. The connection between the timer unit and the control relay units shall be with signal cable (Belden #9640 o equal) ten conductor shielded and jacketed. Data cable not to exceed 1000 feet. A maximum of seven of the control relay units may be wired in series-parallel configuration as desired.

16. The control relay units shall be connected to lighting contactors for load switching. See-lighting contactors.

17. Enclosure type shall be high-impact, high temperature (UL listed) plastic back box with hinged, locking clear plastic front cover. Shall have knockouts of ½ inch.

18. Timer system shall be UL listed as Energy Management Equipment.

19. Availability: The timer system (and its individual components) shall be readily available through local distributors in Puerto Rico.

20. Shall be equal or similar to Leviton model: time clock ALMA 001, transformer TR24, control relay units LCM461.

21. The time switch (as) shall be installed in a terminal cabinet with door and key operated latch. The cabinet dimensions shall be as required.

22. The contractors shall warrant any equipment installed under this specification to be free from defects for a period of two (2) years from date of final acceptance.

23. The contractors shall provide a minimum of four (4) hours training for school district personnel on proper operating procedures for the system.

END OF SECTION 16500

SECTION 16540

FIRE ALARM SYSTEM

A. General Requirements

1. The requirements of the Contract Documents, including the General and Supplementary General Condition and Division 1 – General Requirements shall apply to the work of this section.

2. At the time of bid, all exceptions taken to these Specifications, all variances from these Specifications and all substitutions of operating capabilities or equipment called for in these Specifications shall be listed in writing and forwarded to the Engineer. Any such exception, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

B. Scope

The work covered by this Section of the Specification shall include all labor, equipment, materials and services to furnish and install a complete fire alarm. It shall be complete with all-necessary hardware, software and memory. It shall be possible to permanently modify the software on site by using the integral programmer. The system shall consist of, but no be limited to, the following:

a. Fire alarm control panel Addressable

b. Manual fire alarm stations Addressable.

c. Smoke detectors Addressable.

d. Heat detectors Addressable.

e. Alarm Horn/Strobe

FIRE ALARM SYSTEM (CONT.)

C. Applicable Codes and Standards

1. All equipment shall be U.L. listed for its intended use.

2. NFPA Standards 72.

3. The National Electric Code.

4. All other local codes and authorities having jurisdiction.

D. Related Documents

1. Secure permits and approvals prior to installation.

2. Prior to commencement and after completion of work, notify authorities having jurisdiction.

3. Submit letter of approval for installation before requesting acceptance of system.

E. Related Work

1. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:

   a. Duct smoke detectors shall be furnished, wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors.

   b. Electrical contractors shall furnish conduit.

   c. Fire alarm contractors shall provide wire and Cables.

FIRE ALARM SYSTEM (CONT.)

F. Submittal

1. Provide list of all types of equipment and components provided.

2. Provide description of operation of the system, similar to that provided in part 2 of this Section of the Specifications to include any and all exceptions, variances or substitutions listed at the time of bid. Any such exceptions, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

3. Provide manufacturer's printed product data, catalog cuts description and special installation procedures.

4. Provide samples of various items when requested.

5. Provide shop drawings as follows:

   a. Drawing of the alarm control panel.

   b. Single line riser diagrams showing all equipment and types number and size of all conductors.

G. Warranty

1. Manufacturer shall guarantee the system equipment for a period of one (1) year from date of final acceptance of the system.

2. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

3. The contractor shall warranty all materials, equipment, wiring, devices, installation and workmanship, including service labor for one year from date of acceptance.

4. The supplier and/or contractor shall have sufficient stock of spare parts or devices on hand and have a fully equipped service organization, base in Puerto Rico, capable of guaranteeing response time within (6) hours of service and/or emergency calls. The service shall be available (24) hours a day or (7) days a week, and (365) days a year for the complete installed system.

5. Upon completion of the installation of fire alarm system equipment, the electrical contractor shall provide to the architect a signed written emend, substantially in form as follows: "The undersigned, having engaged as the Electrical Contractor on the project confirms that the fire alarm system equipment was installed in accordance with the wiring diagrams, instructions and directions provided to us by the manufacturer".

H. Products

1. Operation of any alarm-initiating device shall automatically:

   a. Sound all alarm signals throughout the building at the continuous evacuation rate.

   b. Turn on al strobe lights throughout the building.

   c. Turn on the system's red common alarm LED.

   d. Turn on the red zone active LED for the circuit of alarm at the fire alarm control panel.

   e. Start the reset / alarm silence disable timer to guarantee that alarm signals will sound for a minimum period of 1 minute.

   f. Start the alarm signal silence timer to turn the signals off after a minimum period of 20 minutes.

   g. Operate alarm relay contacts to return all elevators to the ground floor.

2. The fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens or grounds on system wiring and shorts across indicating circuit wiring shall automatically:

   a. Sound and audible signal at the fire alarm control panel at 20 SPM. The audible signal shall be capable of being silenced during the trouble condition.

   b. Slow flash a zone trouble LED at 20 SPM to indicate the source of the wire trouble. The visual indication shall remain on until the trouble condition is repaired.

   c. Operate a relay / city tie contact to initiate the transmission of a trouble indication to the central agency.

d. Sound and audible signal at the remote annunciator panel. The audible signal may be silenced during the trouble condition.

3. Subsequent alarms, supervisory signals, or trouble activations shall repeat their respective response sequence.

I. Materials

1. Fire Alarm control panel:

   The addressable fire alarm panels shall be equal to Edwards Systems Technology EST-2 type and shall incorporate all control electronics, relays, and necessary modules and components ins a semi-flush mounted cabinet. The operating controls and zone/supervisory indicators shall be located behind locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified. The cabinet shall be steel, with a gray finish. The assembly shall contain a base panel, system power supply and battery charger with optional modules suitable to meet the requirements of these specifications.

   The system shall be supervised, site programmable, and of modular design with expansion modules to serve up to 192 detector and 188 remote modules, and four notification appliance circuits convertible to power risers to serve remote multiple NAC modules for zoned signal applications.

2. The Manual Station Addressable should be equal to EST Model SIGA-270 with vandal proof cover with horn model ST11100. The SIGA-270 model features the familiar "teardrop" design with simple positive pull action and sturdy die-cast metal body manufactured to strict international quality standards for highest reliability.

3. The Addressable Heat Detector should be equal to an EST Model SIGA HRS. EST's Signature Series Model SIGA-HRS Intelligent Heat Detectors gather analog information from their fixed temperature and / or rate-of-rise heat sensing elements and converts it into digital signals. The detector's on board microprocessor measures and analyses these signals. It compares the information to historical readings and time patterns to make an alarm decision.

FIRE ALARM SYSTEM (CONT.)

4. The Addressable Smoke Detector shall be equal to EST Model SIGA-IPHS. The SIGA-IPHS Intelligent 4D Multisensor Detector gathers analog information from each o its three fire sensing elements (ionization, photoelectric, and heat) and covers it into digital signals. The detector's on-board microprocessor measures and analyzes these signals separately with respect to a four element-time. This technology is called 4D. It compares the information to historical readings, time patterns and several known fire characteristics to make an alarm decision. The microprocessor in each detector shall provide four additional benefits – Self-diagnostics and History log, Automatic device mapping, Stand-alone operation and fast, stable communication and also the following features:

   a. Integrates three (3)- sensing technologies.

   b. Non-volatile memory.

   c. Automatic device mapping.

   d. Electronic Addressing.

   e. Environmental compensation.

   f. Integral microprocessor – Intelligent detector.

   g. Wide 0.67 – 3.70 % / FT. Sensitivity range window: Program the detector to operate at any one of five (5) sensitivity settings within the window.

   h. Pre-Alarm: The detector stores a pre-alarm a sensitivity value to alert local personnel prior to the sensor reaching a full evacuation sensitivity.

   i. Identification of dirty or defective detector.

   j. Automatic day/night sensitivity adjustment: Makes detector more sensitive during inactive nighttime periods.

   k. Stand – Alone operation.

   l. Stable design: Sensitivity remains stable with air velocity up to 500 ft. Min. (2.53 m/sec) making it suitable for direct insertion in low velocity duct applications. Design for high ambient temperature operation up to 100º F (38ºC).

   m. Twin status leads.

n. Standards relay and fault isolator-mounting bases.

o. Design to ISO 9001 standards.

5. The horn and strobe fire annunciators shall be equal to EST Models 692-7A-003. Combination signaling appliances are designed for use with compatible control equipment associate with life safety and communications systems. These high quality EST Horn/Strobes are part of a full line of attractive similarly styled fire alarm Audible/Visual signals. The housing /bezel is finished in "Fire Red" and is made form durable, fire retardant high impact Lexan. These supervised appliances come with wire lead terminals type connections and are available in two flash intensity levels.

J. Acceptable Manufacturers

1. The catalog numbers used are those of Edwards Systems Technology (EST), Farmington, CT, and constitute the type and quality of equipment to be furnished.

2. If equipment of another manufacturer is to be submitted for approval as equal, the contractor shall, at the time of bid, list all exceptions taken to these Specifications, all variances from these Specification and all substitutions of operating capabilities or equipment called for in these Specifications and forward said list to the Engineer. Any such exceptions, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. Final determination of compliance with this Specification shall rest with the Engineer, who, at his discretion, may require proof of performance.

K. Execution

1. Installation:

a. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the manufacturer, approved by the local Fire Department, and shall be installed in rigid, threaded conduit throughout.

b. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all local fire codes.

c. End of Line Resistors: Shall be furnished as required for mounting as directed by the manufacturer.

d. All wiring shall be color coded throughout, to National Electrical Code Standards.

e. The system shall be arranged to receive power from one three wire 120 Vac, 15 A supply. All low voltage operation shall be provided from the fire alarm control panel.

f. Field Quality Control: The system shall be installed and fully tested under the supervision of a trained manufacturer's representative.

g. The system shall be demonstrated to perform all of the functions specified.

2. Test

a. Report of any field testing during installation shall be forwarded the Engineer.

b. Each individual system operation on a circuit by circuit basis shall be tested for its complete operation. The procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the Engineer and the manufacturer.

3. Documentation and Training

a. The contractor shall compile and provide to the owners three (3) complete manuals on the complete system to include operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams and a manufacturer's suggested spare parts list.

b. In addition to the above manuals, the contractor shall provide the services of the manufacturer's trained representative for a period of four (4) hours to instruct the owners' designated personnel on the operation and maintenance of the entire system.

FIRE ALARM SYSTEM (CONT.)

L. Experience and Qualifications

1. The manufacturer of equipment shall have 10 years experience manufacturing similar equipment to that specified. He shall submit names, addresses and telephone numbers of ten similar projects successfully completed.

2. Installing contractor shall have 10 years experience and shall be authorized distributor of the equipment manufacturer. He shall summit similar information to that listed in item one.

3. All technicians on the project shall have a minimum off 2 years experience on similar equipment and shall be factory certified on the specific equipment being installed.

END OF SECTION

SECTION 16600

EMERGENCY GENERATOR

A. Emergency Generator:

1. Diesel Engine-Generator Set:

   4-cycle, 1800 rpm, diesel engine generator set. Generator set ratings: ____ kW, ____ kVA at 0.8 PF, standby rating. System voltage of: _____ volts AC, three phases, four wire, 60 hertz.

2. Prototype Tests and Evaluation:

   Prototype tests shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement. Prototype testing shall comply with the requirements of NFPA 110 for level 1 systems.

3. Performance:

   Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

4. Frequency regulation shall be isochronous form steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

5. The diesel engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable de-rating factors, with the engine-generator set at operating temperature.

6. Motor starting capability shall be a minimum of ____ kVA. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.

7. Engine:

   The engine shall be diesel, 4 cycle, radiator and fan cooled. Minimum displacement shall be ___ cubic inches, with ___ cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

   a) An electronic governor system shall provide automatic isochronous frequency regulation.

Engine (Cont.)

b) Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with 50/50 ethylene glycol/water mixture by the equipment supplier. Rotating parts shall be guarded against accidental contact per OSHA requirements.

c) An electric starter(s) capable of three complete cranking cycles without overheating.

d) Positive displacement, mechanical, full pressure, lubrication oil pump.

e) Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

f) An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element.

g) Replaceable dry element air cleaner with restriction indicator.

h) Flexible supply and return fuel lines.

i) Engine mounted battery charging alternator, 45 ampere minimum, and solid-state voltage regulator.

8. AC Generator

a) The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MGI temperature limits for Class H insulation system for 120/208V and insulation class F for 277/480 V. Actual temperature rise measured by resistance method at full load shall not exceed 80 degrees Centigrade.

b) The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

c) A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

d) Provide two embedded *rtd* per phase and temperature indication equipment.

9. Engine-Generator Set Control:

a) The generator set shall be provided with a microprocessor-based control system which is designed to provide automatic starting, monitoring, and control functions for the generator

set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

b) The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

c) The control shall be UL508 listed, CSA282-M1989 certified, and meet IEC8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9, and IEC Std. 801.2, 801.3., and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE587 for voltage surge resistance.

10. The generator set mounted control shall include the following features and functions:

a) Three position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

b) Red "mushroom-head" push-button EMERGENCY STOP switch. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

c) Push-button RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

d) Push-button PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

11. Generator Set AC Output Metering:

The generator set shall be provided with a metering set including the following features and functions: Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.

12. Generator Set Alarm and Status Message Display:

The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting

conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:

Low oil pressure (alarm)
Los oil pressure (shutdown)
Oil pressure sender failure (alarm)
Low coolant temperature (alarm)
High coolant temperature (alarm)
High coolant temperature (shutdown)
Engine temperature sender failure (alarm)
Low coolant level (alarm or shutdown-selectable)
Fail to crank (shutdown)
Over-crank (shutdown)
Over-speed (shutdown)
Low DC voltage (alarm)
High DC voltage (alarm)
Weak battery (alarm)
Low fuel-day tank (alarm)
High AC voltage (shutdown)
Low AC voltage (shutdown)
Under frequency (shutdown)
Over current (warning)
Over current (shutdown)
Short circuit (shutdown)
Ground fault (alarm) (optional-when required by code or specified)
Over load (alarm)
Emergency stop (shutdown)

In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

13. Engine Status Monitoring:

    a) The following information shall be available from a digital status panel on the generator set control:

    • Engine oil pressure (psi or kPA)

    • Engine coolant temperature (degrees F or C) both left and right bank temperature shall be indicated on V-block engines.

    • Engine oil temperature (degrees F or C)

    • Engine speed (rpm)

Engine Status Monitoring (Cont.)

- Number of hours of operation (hours)
- Number of start attempts
- Battery voltage (DC volts)

b) The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

14. Control Functions:

a) The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.

b) The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

c) The control system shall include an engine governor control, which functions to provide steady state frequency regulations as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

d) The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

e) The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

15. Alternator Control Functions:

a) The generator set shall include an automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from disoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off.

Alternator Control Functions (Cont.):

Adjustments shall be broad range, and made via digital raise-lower switches, with an alpha-numeric LED readout to indicate setting level. The voltage regulation system shall include provisions for reactive load sharing and electronic voltage matching for paralleling applications. Motorized voltage adjust pot is not acceptable for voltage matching.

b) Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator.

c) Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of five (5) seconds.

d) Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

e) An AC over/under voltage monitoring system which responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator –set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

f) A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.

g) When required by National Electrical Code or indicated on project drawings, the control System shall includes a ground-fault monitoring relay. The relay shall be adjustable form 100-1200 amps, and include adjustable time delay of 0-1.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay which will function correctly in system as installed.

16. Control Interfaces for Remote Monitoring:

All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:

a) Form "C" dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.

b) One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.

c) A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

d) A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

e) The control shall be provided with a direct serial communication link for the Lon Works communication network interface as described elsewhere in this specification and shown on the drawings.

17. Base:

a) The engine-generator set shall be mounted on a heavy duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

B. Generator Set Auxiliary Equipment and Accessories:

1. Coolant Heater:

a) Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings.

b) The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

c) The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.

d) The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements.

2. Vibration Isolators:

a) Vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints.

3. Starting and Control Batteries:

   a) Starting battery bank, calcium/lead antimony type, 24 volt DC, sized as recommended by the generator set manufacturer, shall be supplied for each generator set with battery cables and connectors.

4. Exhaust Silencer (s):

   a) Exhaust muffler(s) shall be provided for each engine, size and type as recommended by the generator set manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the generator set manufacturers recommendations and applicable codes and standards.

   b) Contractor shall mount silencer over the unit an approved way so its weight is not supported by the engine.

   c) Flexible exhaust connection shall be provided as required for connection between engine exhaust manifold and exhaust line.

   d) Contractor shall mount and install all exhaust components as required for codes compliance. All components shall be properly sized to assure proper operation without excessive back pressure when installed. Make provisions as required for pipe expansion and contraction.

   e) Contractor shall cover exhaust silencer and all indoor exhaust piping with a proper insulating material approved by the Architect, in a manner not to interfere with flexible exhaust connection.

   f) The location and mounting of exhaust silencer shall be coordinated with the Architect prior to installation.

5. Remote Annunciator:

   Provide and install a 20-light LED remote alarm annunciator with horn, located at reception office, as shown on the drawings and in a location which can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for high battery voltage, low battery voltage, loss of normal power to the charger and low fuel level. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch (es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA 110 3-5.6.2.

6. Battery Charger:

   A UL listed/CSA certified 10 amp voltage regulated battery charger shall be provided for each engine-generator set. The charger may be located in the automatic transfer switch, or may be wall mounted, at the discretion of the installer. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:

   Loss of AC power – red light
   Low battery voltage – red light
   High battery voltage – red light
   Power ON – green light (no relay contact)

   Analog DC voltmeter and ammeter, 12 hour equalize charge timer, AC and DC fuses shall also be provided on the charger.

7. Outdoor Weather-Protective Sound Attenuating Housing (If outdoor mounted):

   a) The generator set shall be provided with a sound-attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of ___ dBA at any location 7 meters from the generator set in a free field environment. Housing shall be gauge 14 #304 stainless steel vandal proof.

   b) The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and pad lockable door latches shall be provided for all doors. Door hinges shall be stainless steel.

   c) The enclosure shall be provided with a critical exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield.

   d) All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color. All surfaces of all metal parts shall be primed and painted.

   e) Painting of hoses, clamps, wiring harnesses, and other nonmetallic service parts shall not be acceptable. Fasteners used shall be stainless steel, and designed to minimize marring of the painted surface when removed for normal installation or service work.

C. Engine Fuel System:

1. Contractor shall provide all fuel system piping, which shall be black iron pipe and shall be sized as required for proper fuel flow to engine. Contractor shall provide all supply, return, vent, and fill lines as required along with all fittings. Provide flexible connections for connections fuel system to engine.

Engine Fuel System (Cont.'):

2. Provide a fuel day tank of minimum 50 gallons capacity, for each generator set. Day tank shall be equipped for automatic unattended operation. The fuel transfer day tank shall be a standard product of the manufacturer of the engine-generator set. The tank shall be UL listed, made of aluminized steel with welded construction, and pressure tested to 3 PSI. The day tank shall incorporate an integral fuel pump and motor; ¼ HP, 120/240 volt, 1-phase, 2 GPM with 20 foot lift. Provide a hand operated pump to bypass the motor driven pump and valves, for emergency use. The fuel day tank control shall be provided with On/Off/Emergency Run Switch, Test/Reset Switch, AC Circuit Breaker, DC Circuit Breaker, and Indicator lamps:

   Ready (green) – AC supply & DC control power available.

   High Fuel (red) – Latching fault, indicates fuel level near overflow, shuts down pump, and closes N/O dry contacts.

   Low Fuel (red) – Latching fault, indicates pump failure or operating float switch failure, Closes N/O dry contacts.

   Low Fuel Shutdown (red) – latching fault, indicates near empty tank, closes N/O contacts which may be used to shutdown generator set to avoid air in the injection system.

   Overflow to basing (red) – Latching fault, indicates fuel in overflow/rupture basin, shuts down pump, closes N/O dry contacts.

   Spare (red) – with N/O and N/C dry contacts

   Pump Running (green)

   Contacts shall be rated not less than 2 amps at 30VDC and 0.5 amps at 120VAC. Provide an overflow/rupture basin for the day tank with a minimum capacity of 150% of the day tank volume. Include and overflow alarm to indicate fuel in the basin.

3. Contractor shall provide a 1000 gals. UL approved, outdoor mounted, fuel storage tank, gauges, valves, tank filler cap with padlock fittings, tank vent fittings, and necessary items to comply with E.P.A. and applicable codes and regulation. The tank shall be ¼" thick, minimum.

4. A low fuel supply and tank leak sensing device, to signal the electric set alarm annunciator panel specified herein, shall be installed in the fuel tank. The sensing device shall be adjusted to signal low fuel level when the tank contains less than a three (3) hour supply. The three hour supply level shall be as recommended by the manufacturer of the electric set. A tank level meter shall be installed in the generator room. Location to be determined by the Architect.

5. Contractor shall leave the storage tank full after the testing and approval of system.

D. Automatic Transfer Switch

1. Transfer Switch Equipment:

   Provide complete factory assembled transfer equipment with electronic controls designed for surge voltage isolation, and including voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts.

2. Transfer Switch Ratings:

   a) Refer to the project drawings form specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosures, and accessories.

   b) All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved. Transfer switches used for fire pump applications shall be specifically listed for that service, per NFPA20.

   c) Main contacts shall be rated for 600 Volts AC minimum.

   d) Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure, in ambient temperatures of -40 to +50 degrees C, relative humidity up 95% (non-condensing), and altitudes up to 10,000 feet (3000M).

   e) Transfer switch equipment shall have withstand and closing rating (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings. The transfer switch and its upstream protection shall be coordinated. The transfer switch shall be third-party listed and labeled for use with the specific protective device(s) installed in the application.

3. Construction:

   a) Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in both positions.

   b) Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms suitable for safe manual operation under load. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de-energized conditions.

   c) Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have are chutes for positive are extinguishing. Are chutes shall have insulating covers to prevent interphase flashover. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

   d) Transfer switches shall be 4-poles, with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be

switched simultaneously using a common crossbar. Equipment using add-on accessory overlapping contacts are not acceptable.

e) Enclosures shall be UL listed. The enclosure shall provide NEC wire bend space. The cabinet door shall be key-locking. Controls on cabinet door shall be key-operated.

f) Transfer switches shall be mounted in enclosures as designated on the drawings. If mounted outdoors, the enclosure shall be NEMA 4 stainless steel. Separate enclosures shall be the NEMA type specified. The cabinet shall provide required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

4. Automatic Controls:

a) Transfer switches shall be provided with a fully automatic control system, and provisions for manual operation as described in this section.

b) Control shall be solid-state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs.

c) Solid-state under-voltage sensors shall simultaneously monitor all phases of both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.

d) Controls shall be provided with solid-state over voltage sensors, adjustable from 100-130% of nominal, to monitor all phases of the normal and emergency sources. Provide adjustable time delay of 0.5 to 2.2 sec.

e) Controls shall be provided with a solid-state over and under frequency sensor to monitor the normal and emergency sources. Pickup bandwidth shall be adjustable from a minimum of +/- 4% to a maximum of +/- 20% of nominal frequency. Dropout shall be +/-5% of nominal wider than pickup frequency bandwidth. Adjustable time delay shall be from 0.1 to 15 sec. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid-state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wire to a field wiring terminal block.

f) Provide Phase Sequence Monitor and Balance module to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.

g) The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 120 seconds.

h) The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable form 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.

i) Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.

j) Power for transfer operation shall be from the source to which the load is being transferred.

k) The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time, as follows:

Source 1 OK
Start Gen Set
Source 2 OK
Transfer Timing
Transfer Complete
Retransfer Timing
Retransfer Complete
Timing for Stop

l) The control shall include remote transfer inhibit and area protection features.

m) Transfer switches shall be equipped with a field adjustable controls to allow the operator to control the transfer switch operating time during switching in both directions. The controls shall control the time the load is isolated from both power sources, to allow load residual voltage to decay before closure to the opposite source. The transfer switch operating speed control feature shall have an adjustable range of 0 to 7.5 seconds. Phase angle monitor is not acceptable substitute for this feature.

5. Front Panel Devices:

Provide devices mounted on cabinet front consisting of:

a) A key-operated selector switch to provide the following positions and functions:

b) Test – Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.

c) Normal – Normal operating position.

d) Retransfer – Momentary position to override retransfer time delay and cause immediate return to normal source, if available.

e) Transfer switch position and source available lamps.

6. Transfer switches shall be equipped with accessories as follows:

   a) Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide with or without load selector switch for the exercise period.

   b) Manual Selector Switch: Provide a manual/automatic retransfer selector switch to provide either automatic retransfer after the retransfer time delay, or a manual retransfer when selected when selected by an operator.

   c) Load Shed: Provide a load shed relay, to move the transfer switch from the emergency position to a neutral position, on receipt of a signal from a remote device.

   d) Signal Module: Provide signal module, to delay the transfer and retransfer of the switch for up to 50 seconds to provide a pre-transfer warning signal contact. Provide signals for the following conditions:

      Source 1 available
      Source 2 available
      Test/exercise
      Backup source available

      Contacts for these functions are to be form C type, rated for 120 VAC or 30 VDC at 4 amps.

E. Warranty:

The complete standby electric power system (equipped with set exerciser and running time mater) shall be warranted for a period of three years or nine hundred operating hours whichever occurs first, from the date of initial start-up. The warranty must be provided by the system manufacturer. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided.

F. Contractor Responsibility:

1. The design of the emergency stand-by unit is based on all electrical load as specified in the contract drawings and specifications and equipment starting sequence.

2. If a substitution of any electrical equipment and/or starting method and/or starting sequence is made then the contractor is required to submit to the Architect technical data demonstrating that the emergency stand-by unit will operate satisfactorily under these new conditions.

3. The approval of any electrical equipment and/or starting method and/or starting sequence as equal to the one specified in contract drawings and specifications do not relieve the contractor of the responsibility to guarantee that the stand-by unit will operate satisfactorily under any different conditions.

Contractor Responsibility (Cont.):

4. Any not satisfactory operation of the stand-by unit because of not complying with above requirements shall be the responsibility of the contractor and any change in the characteristics and/or size of the unit, to comply with above requirements, shall be borne by the contractor.

END OF SECTION 16600

EXHIBIT L

BRIEFING ROOM

Executive Order on Ensuring the Future Is Made in All of America by All of America's Workers

JANUARY 25, 2021 • PRESIDENTIAL ACTIONS

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Policy. It is the policy of my Administration that the United States Government should, consistent with applicable law, use terms and conditions of Federal financial assistance awards and Federal procurements to maximize the use of goods, products, and materials produced in, and services offered in, the United States. The United States Government should, whenever possible, procure goods, products, materials, and services from sources that will help American businesses compete in strategic industries and help America's workers thrive. Additionally, to promote an accountable and transparent procurement policy, each agency should vest waiver issuance authority in senior agency leadership, where appropriate and consistent with applicable law.

Sec. 2. Definitions. (a) "Agency" means any authority of the United States that is an "agency" under section 3502(1) of title 44, United States Code, other than those considered to be independent regulatory agencies, as defined in section 3502(5) of title 44, United States Code.

(b) "Made in America Laws" means all statutes, regulations, rules, and Executive Orders relating to Federal financial assistance awards or Federal procurement, including those that refer to "Buy America" or "Buy American," that require, or provide a preference for, the purchase or acquisition of goods, products, or materials produced in the United States, including iron, steel,

and manufactured goods offered in the United States. Made in America Laws include laws requiring domestic preference for maritime transport, including the Merchant Marine Act of 1920 (Public Law 66-261), also known as the Jones Act.

(c) "Waiver" means an exception from or waiver of Made in America Laws, or the procedures and conditions used by an agency in granting an exception from or waiver of Made in America Laws.

Sec. 3. Review of Agency Action Inconsistent with Administration Policy. (a) The head of each agency shall, as soon as practicable and as appropriate and consistent with applicable law, including the Administrative Procedure Act, consider suspending, revising, or rescinding those agency actions that are inconsistent with the policy set forth in section 1 of this order.

(b) The head of each agency shall, as soon as practicable and as appropriate and consistent with applicable law, including the Administrative Procedure Act, consider proposing any additional agency actions necessary to enforce the policy set forth in section 1 of this order.

Sec. 4. Updating and Centralizing the Made in America Waiver Process. (a) The Director of the Office of Management and Budget (OMB) shall establish within OMB the Made in America Office. The Made in America Office shall be headed by a Director of the Made in America Office (Made in America Director), who shall be appointed by the Director of OMB.

(b) Before an agency grants a waiver, and unless the OMB Director provides otherwise, the agency (granting agency) shall provide the Made in America Director with a description of its proposed waiver and a detailed justification for the use of goods, products, or materials that have not been mined, produced, or manufactured in the United States.

(i) Within 45 days of the date of the appointment of the Made in America Director, and as appropriate thereafter, the Director of OMB, through the Made in America Director, shall:

(1) publish a list of the information that granting agencies shall include when submitting such descriptions of proposed waivers and justifications to the Made in America Director; and

(2) publish a deadline, not to exceed 15 business days, by which the Director of OMB, through the Made in America Director, either will notify the head of the agency that the Director of OMB, through the Made in America Director, has waived each review described in subsection (c) of this section or will notify the head of the agency in writing of the result of the review.

(ii) To the extent permitted by law and consistent with national security and executive branch confidentiality interests, descriptions of proposed waivers and justifications submitted to the Made in America Director by granting agencies shall be made publicly available on the website established pursuant to section 6 of this order.

(c) The Director of OMB, through the Made in America Director, shall review each proposed waiver submitted pursuant to subsection (b) of this section, except where such review has been waived as described in subsection (b)(i)(2) of this section.

(i) If the Director of OMB, through the Made in America Director, determines that issuing the proposed waiver would be consistent with applicable law and the policy set forth in section 1 of this order, the Director of OMB, through the Made in America Director, shall notify the granting agency of that determination in writing.

(ii) If the Director of OMB, through the Made in America Director, determines that issuing the proposed waiver would not be consistent with applicable law or the policy set forth in section 1 of this order, the Director of OMB, through the Made in America Director, shall notify the granting agency of the determination and shall return the proposed waiver to the head of the agency for further consideration, providing the granting agency with a written explanation for the determination.

(1) If the head of the agency disagrees with some or all of the bases for the determination and return, the head of the agency shall so inform the Made in America Director in writing.

(2) To the extent permitted by law, disagreements or conflicts between the Made in America Director and the head of any agency shall be resolved in accordance with procedures that parallel those set forth in section 7 of Executive Order 12866 of September 30, 1993 (Regulatory Planning and Review), with respect to the Director of the Office of Information and Regulatory Affairs within OMB.

(d) When a granting agency is obligated by law to act more quickly than the review procedures established in this section allow, the head of the agency shall notify the Made in America Director as soon as possible and, to the extent practicable, comply with the requirements set forth in this section. Nothing in this section shall be construed as displacing agencies' authorities or responsibilities under law.

Sec. 5. Accounting for Sources of Cost Advantage. To the extent permitted by law, before granting a waiver in the public interest, the relevant granting agency shall assess whether a significant portion of the cost advantage of a foreign-sourced product is the result of the use of dumped steel, iron, or manufactured goods or the use of injuriously subsidized steel, iron, or manufactured goods. The granting agency may consult with the International Trade Administration in making this assessment if the granting agency deems such consultation to be helpful. The granting agency shall integrate any findings from the assessment into its waiver determination as appropriate.

Sec. 6. Promoting Transparency in Federal Procurement. (a) The Administrator of General Services shall develop a public website that shall include information on all proposed waivers and whether those waivers have been granted. The website shall be designed to enable manufacturers and other interested parties to easily identify proposed waivers and whether those waivers have been granted. The website shall also provide publicly available contact information for each granting agency.

(b) The Director of OMB, through the Made in America Director, shall promptly report to the Administrator of General Services all proposed waivers, along with the associated descriptions and justifications discussed in section 4(b) of this order, and whether those waivers have been

granted. Not later than 5 days after receiving this information, the Administrator of General Services shall, to the extent permitted by law and consistent with national security and executive branch confidentiality interests, make this information available to the public by posting it on the website established under this section.

Sec. 7. Supplier Scouting. To the extent appropriate and consistent with applicable law, agencies shall partner with the Hollings Manufacturing Extension Partnership (MEP), discussed in the Manufacturing Extension Partnership Improvement Act (title V of Public Law 114-329), to conduct supplier scouting in order to identify American companies, including small- and medium-sized companies, that are able to produce goods, products, and materials in the United States that meet Federal procurement needs.

Sec. 8. Promoting Enforcement of the Buy American Act of 1933. (a) Within 180 days of the date of this order, the Federal Acquisition Regulatory Council (FAR Council) shall consider proposing for notice and public comment amendments to the applicable provisions in the Federal Acquisition Regulation (FAR), title 48, Code of Federal Regulations, consistent with applicable law, that would:

(i) replace the "component test" in Part 25 of the FAR that is used to identify domestic end products and domestic construction materials with a test under which domestic content is measured by the value that is added to the product through U.S.-based production or U.S. job-supporting economic activity;

(ii) increase the numerical threshold for domestic content requirements for end products and construction materials; and

(iii) increase the price preferences for domestic end products and domestic construction materials.

(b) The FAR Council shall consider and evaluate public comments on any regulations proposed pursuant to subsection (a) of this section and shall promptly issue a final rule, if

appropriate and consistent with applicable law and the national security interests of the United States.

Sec. 9. Updates to the List of Nonavailable Articles. Before the FAR Council proposes any amendment to the FAR to update the list of domestically nonavailable articles at section 25.104(a) of the FAR, the Director of OMB, through the Administrator of the Office of Federal Procurement Policy (OFPP), shall review the amendment in consultation with the Secretary of Commerce and the Made in America Director, paying particular attention to economic analyses of relevant markets and available market research, to determine whether there is a reasonable basis to conclude that the article, material, or supply is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality. The Director of OMB, through the Administrator of OFPP, shall make these findings available to the FAR Council for consideration.

Sec. 10. Report on Information Technology That Is a Commercial Item. The FAR Council shall promptly review existing constraints on the extension of the requirements in Made in America Laws to information technology that is a commercial item and shall develop recommendations for lifting these constraints to further promote the policy set forth in section 1 of this order, as appropriate and consistent with applicable law.

Sec. 11. Report on Use of Made in America Laws. Within 180 days of the date of this order, the head of each agency shall submit to the Made in America Director a report on:

(a) the agency's implementation of, and compliance with, Made in America Laws;

(b) the agency's ongoing use of any longstanding or nationwide waivers of any Made in America Laws, with a written description of the consistency of such waivers with the policy set forth in section 1 of this order; and

(c) recommendations for how to further effectuate the policy set forth in section 1 of this order.

Sec. 12. Bi-Annual Report on Made in America Laws. Bi-annually following the initial submission described in section 11 of this order, the head of each agency shall submit to the Made in America Director a report on:

(a) the agency's ongoing implementation of, and compliance with, Made in America Laws;

(b) the agency's analysis of goods, products, materials, and services not subject to Made in America Laws or where requirements of the Made in America Laws have been waived;

(c) the agency's analysis of spending as a result of waivers issued pursuant to the Trade Agreements Act of 1979, as amended, 19 U.S.C. 2511, separated by country of origin; and

(d) recommendations for how to further effectuate the policy set forth in section 1 of this order.

Sec. 13. Ensuring Implementation of Administration Policy on Federal Government Property. Within 180 days of the date of this order, the Administrator of General Services shall submit to the Made in America Director recommendations for ensuring that products offered to the general public on Federal property are procured in accordance with the policy set forth in section 1 of this order.

Sec. 14. Revocation of Certain Presidential and Regulatory Actions. (a) Executive Order 13788 of April 18, 2017 (Buy American and Hire American), section 5 of Executive Order 13858 of January 31, 2019 (Strengthening Buy-American Preferences for Infrastructure Projects), and Executive Order 13975 of January 14, 2021 (Encouraging Buy American Policies for the United States Postal Service), are hereby revoked.

(b) Executive Order 10582 of December 17, 1954 (Prescribing Uniform Procedures for Certain Determinations Under the Buy-America Act), and Executive Order 13881 of July 15, 2019 (Maximizing Use of American-Made Goods, Products, and Materials), are superseded to the extent that they are inconsistent with this order.

Sec. 15. Severability. If any provision of this order, or the application of any provision to any person or circumstance, is held to be invalid, the remainder of this order and the application of its other provisions to any other persons or circumstances shall not be affected thereby.

Sec. 16. General Provisions. (a) Nothing in this order shall be construed to impair or otherwise affect:

(i) the authority granted by law to an executive department or agency, or the head thereof; or

(ii) the functions of the Director of the Office of Management and Budget relating to budgetary, administrative, or legislative proposals.

(b) This order shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

EXHIBIT M

REQUIREMENTS FOR THE DESIGN-BUILD SCOPE OF WORK

This project requires a Design-Build (DB) project delivery method for performing miscellaneous repairs, including but not limited to, structural repairs, ADA-compliant bathroom renovations, roofing, MEP upgrades and equipment replacement, etc. The Selected Proponent will include as part of the Project Team an Architect/Engineer (A/E) firm who will be responsible for submissions consisting of stamped construction drawings and specifications, construction methodologies and submittals of materials, as applicable.

Proponent's A/E Responsibilities for the Design-Build Scope of Work

1. The A/E shall produce the drawings and specifications in accordance with professional architectural/engineering practices and current PR Building Code.

2. The A/E shall provide any additional design criteria necessary for project development (not limited to supporting calculations, equipment guide list, materials, etc.), so that the Design-Build Team can provide permit construction drawings and specifications.

3. The A/E, in consultation with the OMEP/PRDE and its consultants, shall determine design solutions based on referenced standards and incorporate them into the construction drawings and specifications.

4. During the construction phase, the A/E shall work with OMEP/PRDE to participate in construction inspections and assist in the review of:
   a. Construction Document submittals, including specifications and design calculations (the A/E shall list any deviations from the Contract Documents)
   b. Shop Drawings, Product Data, and Samples (if required)
   c. Test Results, Certificates, and Other Submittals; and
   d. Project Record Documents and Warranties.

General Requirements

1. The A/E shall prepare and submit complete construction documents for review and approval by OMEP/PRDE in accordance with standard professional practice and prevailing codes. The A/E shall submit the construction documents for Review at 90% and 100% stages.

2. The A/E who prepares the construction documents must be a licensed Professional Engineer or a licensed Professional Architect. The professional seal indicating such license by the state shall appear on documents. The A/E whose seal is shown will be known as the architect/engineer (A/E) of record.

3. The A/E shall prepare and submit 100% complete construction specifications in accordance with standard professional practice.

4. The construction specifications shall include the ASTM specification and list an equal or similar name of manufacturer specification with the product name, model number, or other identification as appropriate to clearly identify the product that will be used in the construction of the project.

5. Adherence to PR Law 173: Contractor's Project Manager or superintendent, or Construction Project Supervisor, shall be a Professional licensed engineer (PE) or a Registered Architect (RA) in accordance with PR Law 173, August 12, 1988, as amended.

6. Signing of Agreement: The contract will also have to be signed by the Project Designer included by the proponent as part of their proposal. In the event of a Project Designer change after proposals have been submitted, OMEP/PRDE reserves the right to evaluate the professional qualifications of the proposed Project Designer before award of contract. In the event of a Project Designer change after award of contract, OMEP/PRDE reserves the right to evaluate the professional qualifications of the proposed Project Designer and, if deemed not acceptable, reserves the right to annul the award and not grant the contract.

7. If the design resource is an employee of the proponent, the Proposal will include an employment certification. If design services will be outsourced, the Contractor, to participate in the bidding process, will be required to submit a Designer's authorization certifying inclusion in the proponent's team. In addition, the proponent will include a statement that clearly confirms that the personnel named and offered as design resource will be available and committed to participate in support of this project on a full-time basis. All proponents are required to submit a professional qualifications statement highlighting relevant experience for the design source identified in the proponent's team.

Proponent's General Contractor ('Contractor') Responsibilities

1. The Contractor supervises, inspects, and directs the Project from start to finish based on the project scope. For this purpose, the Contractor shall assign a project manager (PM) who is in charge of the overall project during both design and construction phases The OMEP/PRDE reserves the right to request Contractor to remove a key person of the Project Team who, in OMEP/PRDE's reasonable judgement, fails to perform its obligations in the performance of the portion of the work assigned to such key person. The Contractor is expected to apply the relevant skills and expertise to ensure success during the project development process as specified by the contract documents. The Contractor is tasked with the proper identification and implementation of the methods, techniques, sequences, and procedures of construction as indicated and necessitated by the contract. The Contractor of the DB Team ensures that the entire project complies with all the specifications as outlined in the construction documents.

2. The Contractor is responsible for the supervision and superintendence of all the work in the Project site. To successfully manage all the intricate elements that make up a project ecosystem, the Contractor will plan all project development and details implementation. This involves identifying and estimating various project issues like personnel needs, required materials and equipment, forecasting any potential project changes, highlighting all legal and regulatory issues and requirements, outlining effective safety policies, and implementing a reliable communication strategy with OMEP/PRDE.

3. At the start of the Project (Notice to Proceed) and throughout the entire duration of the work and all its phases, the Contractor will be equipped with enough resources to complete the scope of the work in the contract. To The Contractor shall be responsible to supply competent and skilled workforce for various general and specialized tasks, licensed Sub-Contractor to handle various specialized crafts and trades, supply enough construction materials, and to deploy all required equipment.

4. The Contractor shall be responsible for the successful completion of the project in terms of scope, time schedule, cost, safety, and other project-related details. The Contractor will develop and implement a project schedule that will adhere to the time in contract. The project schedule can be altered by unprecedented changes and adjustments during the project execution phase after a request for time extension has been

duly submitted by the Contractor, and it has been subsequently reviewed and approved by the OMEP/PRDE. It is highly recommended the use of the Critical Path Method for managing, maintaining and updating the project progress schedule. The project management role extends to the project handover stage, which is characterized by warranties and guarantees, for quality assurance purposes. During the construction phase, a Construction Project Supervisor shall be present as long as works are performed inside school premises

5. Legal and Regulatory responsibilities. The Contractor is responsible for the project's compliance with all the necessary legal and regulatory requirements. The Contractor **must obtain or acquire all the necessary permits before proceeding with the project.** There is also the requirement of paying municipal taxes and *arbitrios de construcción,* patent, fees, and other taxes in accordance with municipal, state and federal laws and regulations.

6. Health, Safety and Protection. The project will have a viable safety policy to ensure occupational health and safety in the workplace. The Contractor shall appoint a qualified and highly experienced Safety Officer with a 30 hours certification to ensure total conformance with all the legal, regulatory, and in-house safety procedures and standards. The safety policy must include effective hazard communication programs, risks management strategies, emergency response systems, and other preventive and proactive mechanisms for workplace safety and protection. Contractor shall provide the company's Safety Plan that includes domestic violence, sexual harassment, and atmospheric events and the Exposure Control Plan for COVID-19. Contractor personnel must be instructed over lead-based paints management, asbestos awareness, and mold awareness.

7. The Contractor will prepare and submit shop drawings, product data, and samples during construction as required by the OMEP/PRDE. The shop drawings, product data, and samples must bear the stamp of the licensed architect or engineer of record certifying compliance with the construction documents.

8. Other Submittals: The Contractor shall submit test results, certificates, manufacturer's instructions, manufacturers field reports, etc. as required by the OMEP/PRDE.

9. Project Record Drawings: The Contractor will maintain a set of construction documents (field as-built drawings) to record actual construction changes during the construction process. The set of annotated field drawings will always be available for review by the OMEP/PRDE and/or its authorized representatives.

10. Project Close-out: The Contractor shall comply with the requirements for submission of final as-built drawings, shop drawings, manuals, and other documents as required

EXHIBIT N

Manual de Identidad

Gobierno de Puerto Rico



ROTULACIÓN

Manual de Identidad
Gobierno de Puerto Rico

TIPOGRAFÍAS

Está tipografia se utilizará entodos los titulos o texto destacado.

Montserrat Thin
Montserrat Thin Italic
Montserrat ExtraLight Italic
Montserrat Light
Montserrat Light Italic
Montserrat Regular
Montserrat Regular Italic
Montserrat Medium
Montserrat Medium Italic

Montserrat SemiBold
Montserrat SemiBold Italic
Montserrat Bold
Montserrat Bold Italic
Montserrat Extra Bold
Montserrat Extra Bold Italic

Rótulo tamaño 192”x96”





Ejemplo área blanca (reservada) para logos. De tenerlos colocarlos de abajo para arriba.

PALETA DE COLORES

INFRAESTRUCTURA



570F41
R-87
G-15
B-65

C-58%
M-100%
Y-42%
K-43%

SERVICIOS



546EB5
R-84
G-110
B-181

C-74%
M-58.47%
Y-0%
K-0%

TRANSPORTACIÓN



396C34
R-57
G-108
B-52

C-79%
M-34%
Y-100%
K-25%

VIVIENDA



1799A1
R-23
G-153
B-161

C-80%
M-21%
Y-36%
K-1%

RÓTULOS CONSTRUCCIÓN I SERVICIOS



546EB5
R-84
G-110
B-181

C-73.8%
M-58.47%
Y-0%
K-0%

RÓTULOS CONSTRUCCIÓN I INFRAESTRUCTURA



570F41
R-87
G-15
B-65

C-58%
M-100%
Y-42%
K-43%

RÓTULOS CONSTRUCCIÓN I TRANSPORTACIÓN



396C34
R-57
G-108
B-52

C-79%
M-34%
Y-100%
K-25%

RÓTULOS CONSTRUCCIÓN I VIVIENDA



1799A1
R-23
G-153
B-161

C-80%
M-21%
Y-36%
K-1%

EXHIBIT O
DON LUIS MUÑOZ MARÍN
SITE LOGISTIC & PHASING PLAN

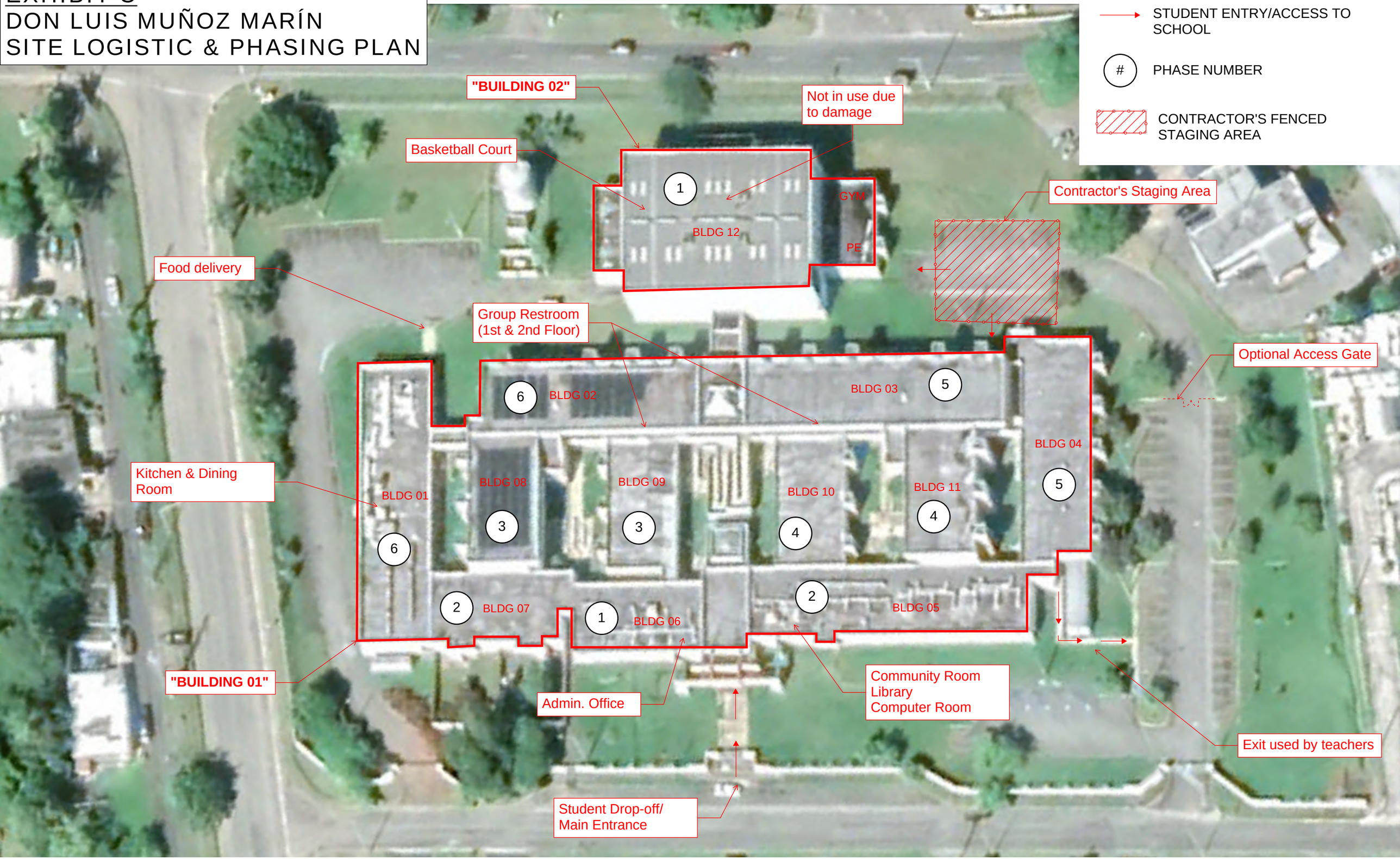


EXHIBIT P

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

FASSt

Esc. Don Luis Muñoz Marín

Ceiba, PR

MDOE 820 – 35907

Created: Tue Oct 21 07:21 2021

GUILLERMO SOSA, ICF-COR3 / ANGEL ORTIZ, AEP



Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

Created: Thu 21 Oct 07:22 2021



.

Created: Thu 21 Oct 08:18 2021

Main facade, east oriented.

(2)

Fass_EscDonLu_211021081835.jpg

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(3)



Fass_EscDonLu_211021081933.jpg

Created: Thu 21 Oct 08:19 2021 Main facade, east oriented.

(4)



Fass_EscDonLu_211021081949.jpg

Created: Thu 21 Oct 08:19 2021 Main facade, east oriented.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(5)



Fass_EscDonLu_211021082337.jpg

Created: Thu 21 Oct 08:23 2021

Main facade, east oriented.

(6)



Fass_EscDonLu_211021083445.jpg

Created: Thu 21 Oct 08:34 2021

Plastering damage in east wall. Please, see next damage for details.

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
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(7)



Fass_EscDonLu_211021083517.jpg

Created: Thu 21 Oct 08:35 2021

Concrete fence. Several plastering damaged. Possible impacted by flying objects. Approximate area: 200 sq. ft.

(8)



Fass_EscDonLu_211021083622.jpg

Created: Thu 21 Oct 08:36 2021

Galvanized steel ornamental fence. East side. Bended. Impacted by flying objects. 1 span 10 ft. x 6 ft. (Typical 1in. x 1in. and 2 in. x 1in. galvanized tubing).

EXHIBIT P
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Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(9)



Fass_EscDonLu_211021083806.jpg

Created: Thu 21 Oct 08:38 2021

Site. Parking. Galvanized steel double gates. Bended. 2ea. x 24 ft. x 7ft. Reparation required. Unknown causes of damage.

(10)



Fass_EscDonLu_211021083958.jpg

Created: Thu 21 Oct 08:40 2021

Site. North side, perimetral chain link fence damage due to wind/impacted by flying objects. Repair needed. Area 130ft. x 12 ft.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
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No. Items: 127

(11)



Fass_EscDonLu_211021084320.jpg

Created: Thu 21 Oct 08:43 2021

Site, north side. 3 lines barb wire on chain link fence missing/ detached. Possible impacted by flying objects. Remove and replace required. 3ea. x 120 l. ft.

(12)



Fass_EscDonLu_211021084412.jpg

Created: Thu 21 Oct 08:44 2021

Same as previous damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
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(13)



Fass_EscDonLu_211021084618.jpg

Created: Thu 21 Oct 08:46 2021

Site. Exterior Basketball court. Siding damage. Details listed below.

(14)



Fass_EscDonLu_211021084650.jpg

Created: Thu 21 Oct 08:46 2021

Site. Exterior Basketball court. Siding damage. Details listed below.

Exterior paint cement plastering area: 7,200 sq. ft.

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
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No. Items: 127

(15)



Fass_EscDonLu_211021084807.jpg

Created: Thu 21 Oct 08:48 2021

Site. West side (back of school). 3ea. x 330 l. ft. Barb wire over chain link fence damaged. Remove and replace required. Possible impacted by flying objects.

(16)



Fass_EscDonLu_211021085044.jpg

Created: Thu 21 Oct 08:50 2021

Site. West . 70 ft. X 12 bended chain link fence due to wind/ impacted by trees branches. Trees needed to be pruned. Repair required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
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No. Items: 127

(17)



Fass_EscDonLu_211021085324.jpg

Created: Thu 21 Oct 08:53 2021

Site. Concrete curb needs to be painted. Included in exterior paint item.

(18)



Fass_EscDonLu_211021085418.jpg

Created: Thu 21 Oct 08:54 2021

Site. East. Substation. Needing maintenance and signing. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
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No. Items: 127

(19)



Fass_EscDonLu_211021085521.jpg

Created: Thu 21 Oct 08:55 2021

Broken hinges in galvanized gate. Refer to next damage, please.

(20)



Fass_EscDonLu_211021085535.jpg

Created: Thu 21 Oct 08:55 2021

Site, east, 2nd galvanized steel gate. 6ea. damaged hinges. Remove and replace. Possible wind damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(21)



Fass_EscDonLu_211021085636.jpg

Created: Thu 21 Oct 08:56 2021

Sites east. Pedestrian gate, access to kindergarten. Damaged, not working properly. Galvanized steel 6ft x 6ft. Possible impacted by flying objects.

(22)



Fass_EscDonLu_211021090213.jpg

Created: Thu 21 Oct 09:02 2021

Basketball court. Roofing from interior. Please see damage details on photo #26.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(23)



Fass_EscDonLu_211021090237.jpg

Created: Thu 21 Oct 09:02 2021

Basketball court. Galvalume (aluminum and zinc) Siding damages. Please, refer to damage #25.

(24)



Fass_EscDonLu_211021090304.jpg

Created: Thu 21 Oct 09:03 2021

Basketball court, supporting photo.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(25)

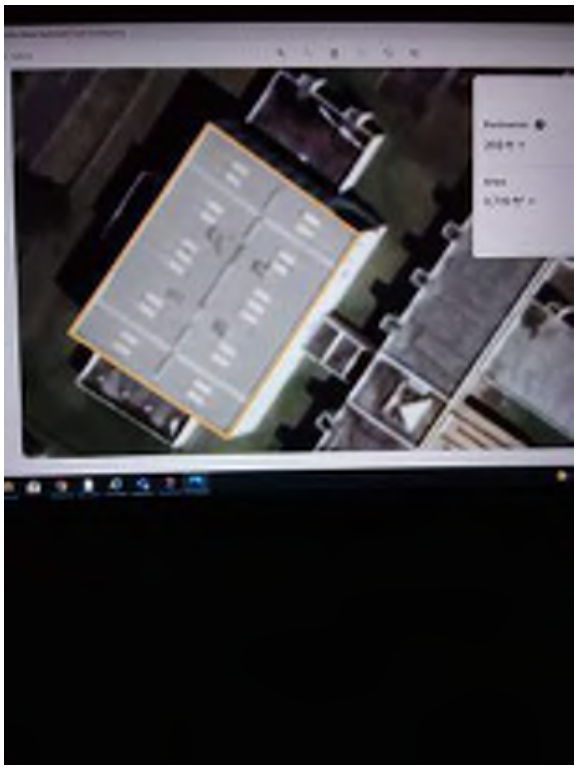


Fass_EscDonLu_211021090329.jpg

Created: Thu 21 Oct 09:03 2021

Basketball court. Siding. Structural beams seem to be OK (Structural assessment required). All other roofing components need to be removed and replace. Siding galvalume material, purlins and windows approximate area 6,000 sq. ft. Main cause of damage: wind and the impact of flying objects.

(26)



Fass_EscDonLu_211025111145.jpg

Created: Mon 25 Oct 11:11 2021

Basketball court roofing area taken by Google Earth. Approximate 9,700 sq. ft. Remove and replace all roofing elements: Galvalume (galvanized steel with a coat of aluminum and zinc), galvanized steel purlins, aluminum channels and gutters. Damage caused due to wind and the impact of flying objects.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(27)



Fass_EscDonLu_211021090630.jpg

Created: Thu 21 Oct 09:06 2021

Basketball court boy's restroom. Clean and sanitize required. High concentration of humidity/mold. Area 300 sq. ft.

(28)



Fass_EscDonLu_211021090735.jpg

Created: Thu 21 Oct 09:07 2021

Basketball court, boys and girls restroom. 6ea. 36in. x 96in. Steel doors, frames and locks damage/rusted/ bended. Remove and replace. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(29)

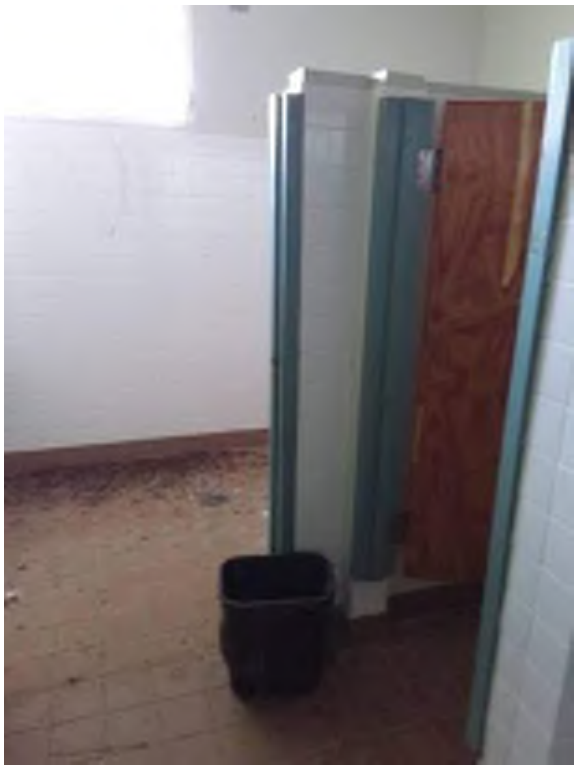


Fass_EscDonLu_211021090759.jpg

Created: Thu 21 Oct 09:08 2021

Basketball court. Boys and girl's restroom. 6ea 12in. x 48in. fluorescent lamps not working. Remove and replace. Possible damage due to power surge.

(30)



Fass_EscDonLu_211021090823.jpg

Created: Thu 21 Oct 09:08 2021

Boys and girls restroom 4ea. 30in. x 60in. partitions doors damage remove and replace. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(31)



Fass_EscDonLu_211021091151.jpg

Created: Thu 21 Oct 09:11 2021

Basketball court . 4ea 4ft. X 4ft. Exhaust fans and motors, not working. Remove and replace. Unknown causes of damage.

(32)



Fass_EscDonLu_211021091301.jpg

Created: Thu 21 Oct 09:13 2021

Basketball court. Electric basket lifted. 2ea. Not working. Unknown manufacturer data. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(33)



Fass_EscDonLu_211021091357.jpg

Created: Thu 21 Oct 09:14 2021

Basketball court. Stage, 1ea. Automatic handicapped chair lifted. Missing. New installation required. Unknown causes of damage.

(34)



Fass_EscDonLu_211021091534.jpg

Created: Thu 21 Oct 09:15 2021

Basketball court. Stage steel door. 1ea. Missing lock. Replace. Unknown causes of damage .

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(35)



Fass_EscDonLu_211021091628.jpg

Created: Thu 21 Oct 09:16 2021

Basketball court, stage 5in. dia. spotlights. Total of 4ea. (2 missing) remove existing, replace 4ea. Unknown causes of damage.

(36)



Fass_EscDonLu_211021091732.jpg

Created: Thu 21 Oct 09:17 2021

Basketball court. Ceiling luminaries. 16ea. not working possible power surge. Remove and replace.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
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(37)



Fass_EscDonLu_211021091933.jpg

Created: Thu 21 Oct 09:19 2021

Basketball court. Classrooms 2ea. Carrier 5 tons A/C units. Not working. Troubleshooting/ repair required. Possible damage due to power surge.

(38)



Fass_EscDonLu_211021092101.jpg

Created: Thu 21 Oct 09:21 2021

Basketball court, classroom steel doors 36in. x 96in. Bended/ rusted. 4ea. Remove and replace. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
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(39)



Fass_EscDonLu_211021092202.jpg

Created: Thu 21 Oct 09:22 2021

Basketball court. Emergency exit steel doors. 3ea 30in. X 96in. Bended not working properly. Remove and replace. Unknown causes of damage.

(40)



Fass_EscDonLu_211021092331.jpg

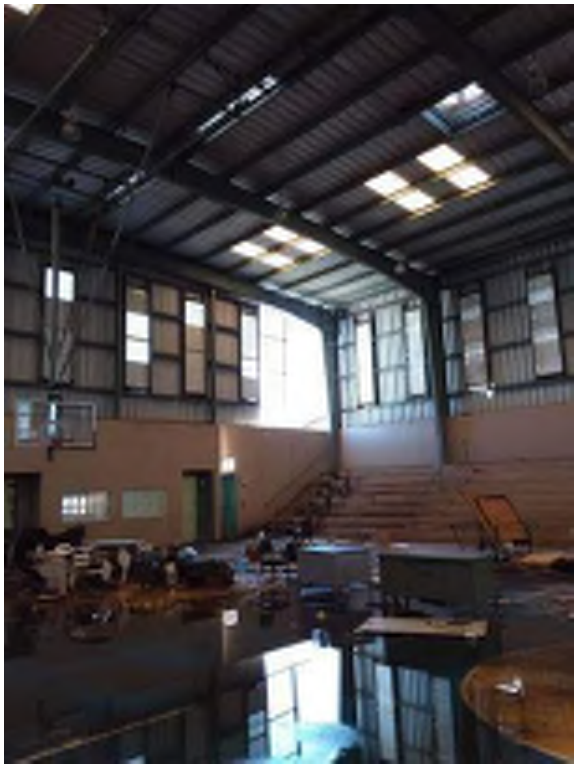
Created: Thu 21 Oct 09:23 2021

Interior paint. Including water blasting, one coat of sealer and two coats of interior water base paint for all cement surfaces and flooring, structural beams require anti corrosion oil base paint. Total area: 15,300 sq. ft. Damage causes wind / rain.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(41)



Fass_EscDonLu_211021092358.jpg

Created: Thu 21 Oct 09:24 2021

Same as previous damage.

(42)



Fass_EscDonLu_211021092437.jpg

Created: Thu 21 Oct 09:24 2021

Basketball court rolling door 1ea, not working 10ft. X 12ft. Remove and replace, unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
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No. Items: 127

(43)



Fass_EscDonLu_211021092626.jpg

Created: Thu 21 Oct 09:26 2021

Basketball court. 1ea. Water cooler. Not working properly. Unknown causes of damage.

(44)



Fass_EscDonLu_211021092701.jpg

Created: Thu 21 Oct 09:27 2021

Basketball court. Interior.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
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No. Items: 127

(45)



Fass_EscDonLu_211021092807.jpg

Created: Thu 21 Oct 09:28 2021

Basketball court. Entrance steel double doors, frames (2ea.) and locks (2ea.) 2ea. 36in. X 96in, not working properly, bended / rusted. Unknown causes of damage.

(46)



Fass_EscDonLu_211021092911.jpg

Created: Thu 21 Oct 09:29 2021

Basketball court hallway. Plastering damaged 20 sq. ft. Repair required. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
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No. Items: 127

(47)



Fass_EscDonLu_211021093124.jpg

Created: Thu 21 Oct 09:31 2021

Cistern . Exterior/ interior clean, dichlorination required. Approximate 50,000 gl. Unknown causes of damage.

(48)



Fass_EscDonLu_211021093226.jpg

Created: Thu 21 Oct 09:32 2021

Cistern, pumps room. 3ea. Missing water pumps. Unknown causes of damage . Replace required.

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
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No. Items: 127

(49)



Fass_EscDonLu_211021093350.jpg

Created: Thu 21 Oct 09:33 2021

Cistern. Level meter damaged. Remove and replace. Possible impacted by flying objects .

(50)



Fass_EscDonLu_211021093445.jpg

Created: Thu 21 Oct 09:34 2021

Cistern. 12ea, anchored points need to be repaired and paint. Rusted. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(51)

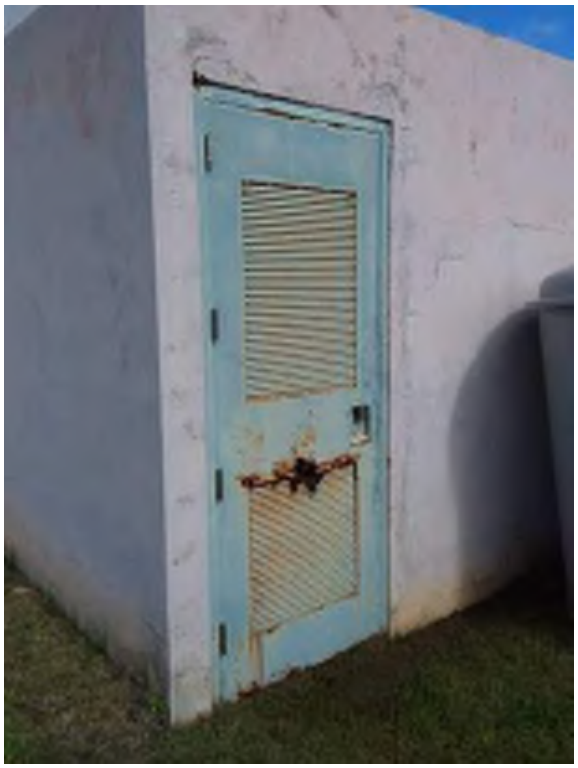


Fass_EscDonLu_211021093546.jpg

Created: Thu 21 Oct 09:35 2021

1ea. School power generator not working. Unknown capacity, damages and it causes. Troubleshooting / repaired required.

(52)



Fass_EscDonLu_211021093736.jpg

Created: Thu 21 Oct 09:37 2021

Cistern water pumps room steel louvered door, frame and lock. 1ea. 36in. X 96in. Rusted, bended. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
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(53)



Fass_EscDonLu_211021093902.jpg

Created: Thu 21 Oct 09:39 2021

Site, south parking. 6ea. luminaries not working. Unknown causes of damage.

(54)



Fass_EscDonLu_211021094140.jpg

Created: Thu 21 Oct 09:41 2021

Site, south, dining hall parking. Asphalt damages. 150ft. x 20ft. Damage due to water accumulation and heavy traffic. Remove and replace.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(55)



Fass_EscDonLu_211021094321.jpg

Created: Thu 21 Oct 09:43 2021

Exterior dining hall. MITIGATION. Need to relocate pluvial water. Leveling required. Area 30ft. x 25ft.

(56)



Fass_EscDonLu_211021094552.jpg

Created: Thu 21 Oct 09:45 2021

Dining hall, storage area. Floor repair. 15ft. x 12ft. Repaired required. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(57)

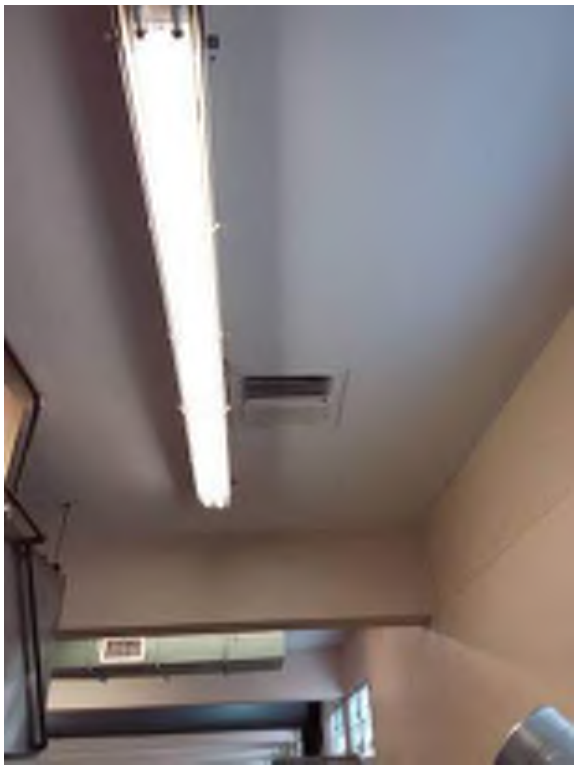


Fass_EscDonLu_211021094713.jpg

Created: Thu 21 Oct 09:47 2021

Dining hall, walking cooler. Not working. 1ea. 14ft. X 10 ft. X 8ft. h. Unknown damage cause. Troubleshooting/repair required.

(58)



Fass_EscDonLu_211021094921.jpg

Created: Thu 21 Oct 09:49 2021

Dining hall. Water infiltration from roof. Area included in school waterproofing treatment.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(59)



Fass_EscDonLu_211021095216.jpg

Created: Thu 21 Oct 09:52 2021

Dining hall. 4ea. double (interior and exterior) steel doors blocked. Not working . Need to be replaced 36in. x 96in. steel door, frames and locks. Interior steel door includes a safety glass 24in. x 30in. vision panel. Unknown causes of damage.

(60)



Fass_EscDonLu_211021095358.jpg

Created: Thu 21 Oct 09:54 2021

Dining hall. 8ea. 30in. X 60in. Aluminum security windows. Not working. Unknown causes of damage. Remove and replace required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(61)



Fass_EscDonLu_211021101408.jpg

Created: Thu 21 Oct 10:14 2021

Dining hall, same previous damage 59/125. Exterior viewed.

(62)



Fass_EscDonLu_211021101458.jpg

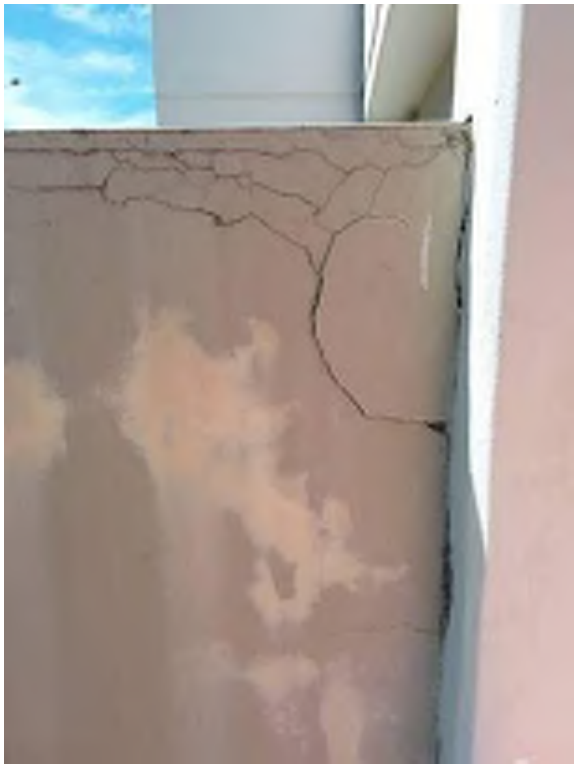
Created: Thu 21 Oct 10:15 2021

Landscape storage 1ea. Double door and frame rusted/ bended not working properly, 76in. X 96in. Unknown damage .

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
Title: Esc. Don Luis Munoz
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(63)



Fass_EscDonLu_211021102514.jpg

Created: Thu 21 Oct 10:25 2021

Kindergarten A2. Plastering in wall 6sq. ft. Unknown causes of damage . Re plastering needed.

(64)



Fass_EscDonLu_211021102818.jpg

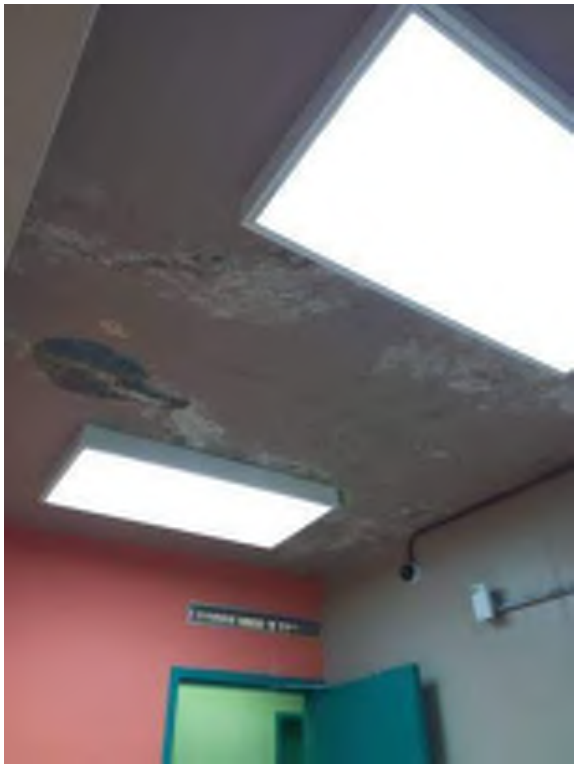
Created: Thu 21 Oct 10:28 2021

Playground. Pounded water , need to relocate pluvial waters. Area 40ft. x 30ft. Possible soil settlement.

EXHIBIT P
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Location: FASSt
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(65)



Fass_EscDonLu_211021103029.jpg

Created: Thu 21 Oct 10:30 2021

Administration. Water infiltration from roof. Included in school waterproofing treatment.

(66)



Fass_EscDonLu_211021103206.jpg

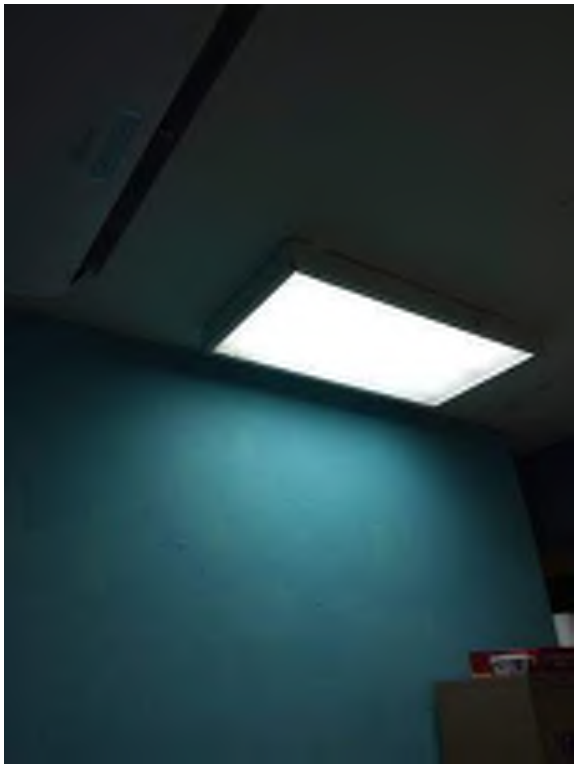
Created: Thu 21 Oct 10:32 2021

Administration. MITIGATION. Server needing low temperature, no A /C unit in room. A/C unit required. Not damage.

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
Title: Esc. Don Luis Munoz
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(67)

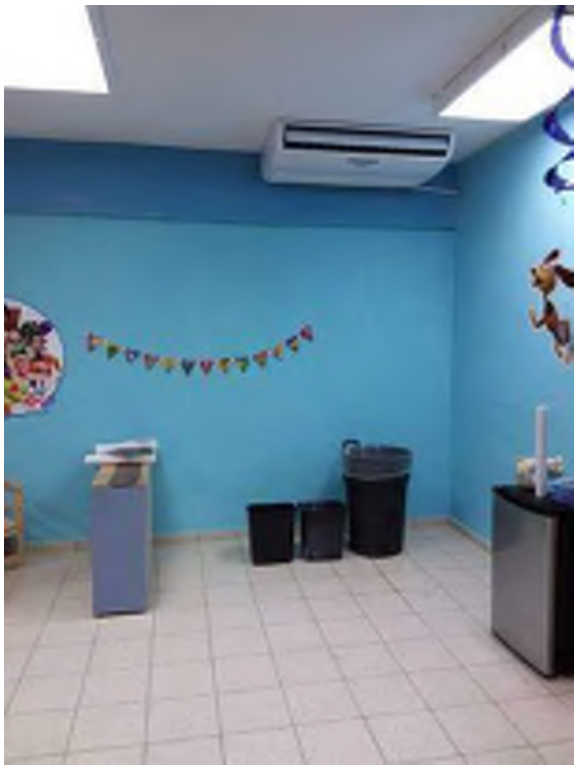


Fass_EscDonLu_211021103433.jpg

Created: Thu 21 Oct 10:34 2021

Administration. 1ea. 2ft. x 4ft. fluorescent lamp rusted due to water infiltration from roof. Replace required.

(68)



Fass_EscDonLu_211021103452.jpg

Created: Thu 21 Oct 10:34 2021

Preschool A33. A/C unit leaking condensation. Maintenance required. Possible lack of maintenance.

EXHIBIT P
Don Luis Muñoz Marín

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Location: FASSt
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(69)



Fass_EscDonLu_211021103827.jpg

Created: Thu 21 Oct 10:38 2021

Main hallway. Water infiltration from roof. Area included in school waterproofing treatment.

(70)



Fass_EscDonLu_211021103946.jpg

Created: Thu 21 Oct 10:39 2021

Classroom A24. Water infiltration from roof. Damage included below.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(71)



Fass_EscDonLu_211021104048.jpg

Created: Thu 21 Oct 10:40 2021

Patio. 12ea. 4ft. X 4ft. Aluminum louvers are eliminated, slots in the inside. Need to install concrete blocks outside to prevent insects. Unknown causes of damage.

(72)



Fass_EscDonLu_211021104246.jpg

Created: Thu 21 Oct 10:42 2021

Classroom A23. 2ea. 24in. X 24in. Vision glass panels broken. Remove and replace. Possible impacted by an object.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
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(73)



Fass_EscDonLu_211021104414.jpg

Created: Thu 21 Oct 10:44 2021

Classroom A22. Floor finishing needed in classroom entrance. 3ft. x 3ft. Unknown causes of damage.

(74)



Fass_EscDonLu_211021104459.jpg

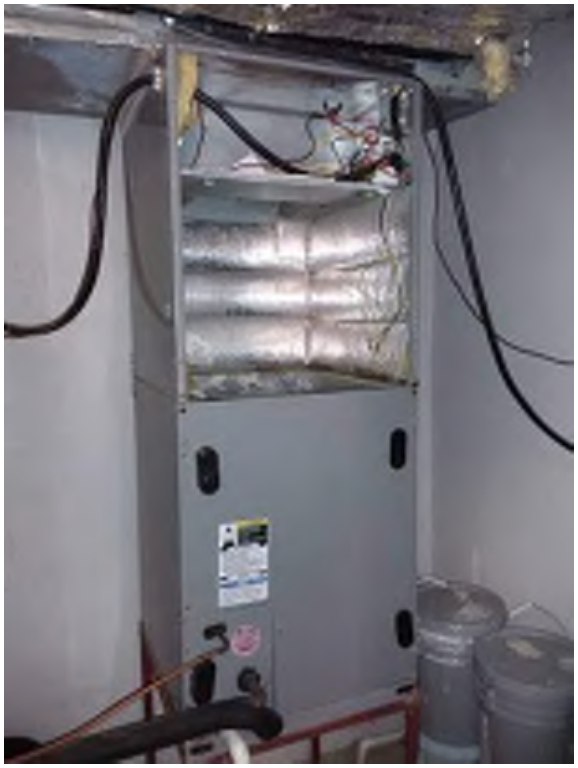
Created: Thu 21 Oct 10:45 2021

Classroom A23. 2ea. 24in. x 24in. vision glass panels broken. Remove and replace. Possible impacted by an object.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
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(75)

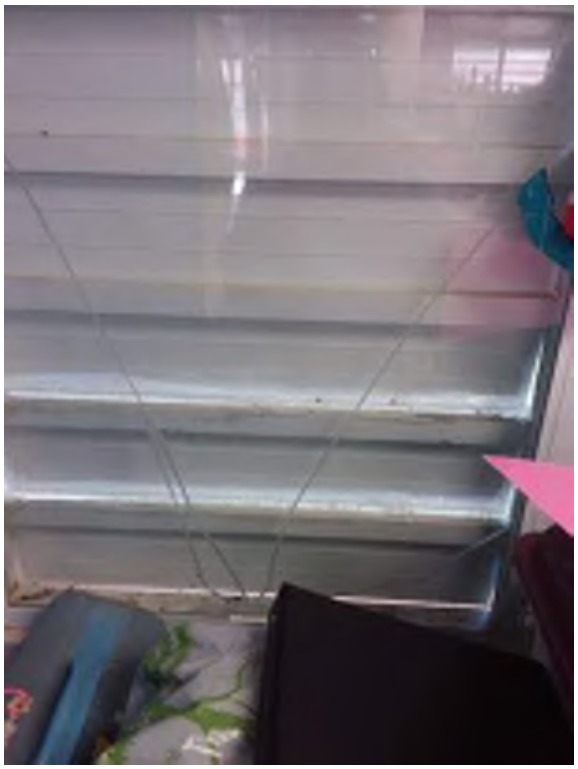


Fass_EscDonLu_211021104556.jpg

Created: Thu 21 Oct 10:45 2021

Classroom A23. *Carrier* 5 tons A/C unit not working. Unknown causes of damage, needing troubleshooting and repair.

(76)



Fass_EscDonLu_211021104815.jpg

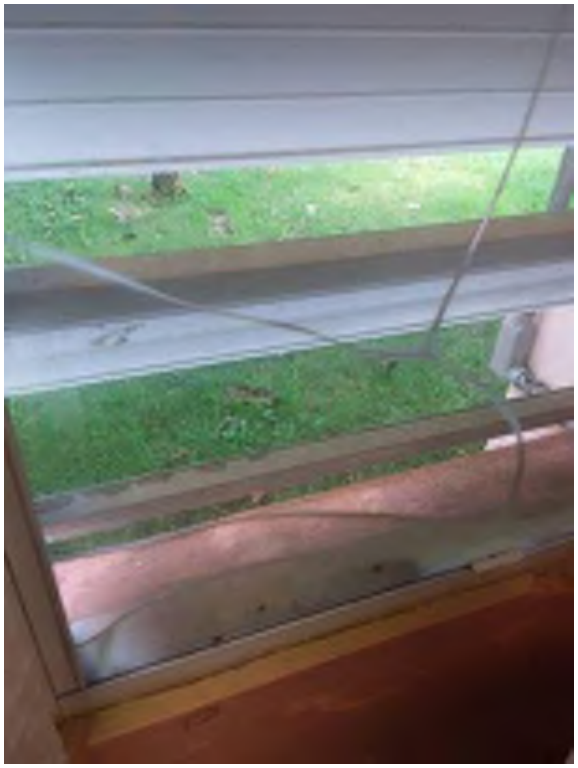
Created: Thu 21 Oct 10:48 2021

Classroom A21, 2ea. 24in x 24in. Vision glass panels, broken. Possible impacted by an object. Remove and replace.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(77)



Fass_EscDonLu_211021105058.jpg

Created: Thu 21 Oct 10:51 2021

Classroom A29. 2ea. 24in. x 24in. vision glass panels broken. Possible impacted by an object. Remove and replace.

(78)



Fass_EscDonLu_211021105258.jpg

Created: Thu 21 Oct 10:53 2021

Classroom A19. *Carrier* A/C unit not working. Troubleshooting and repair required. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(79)

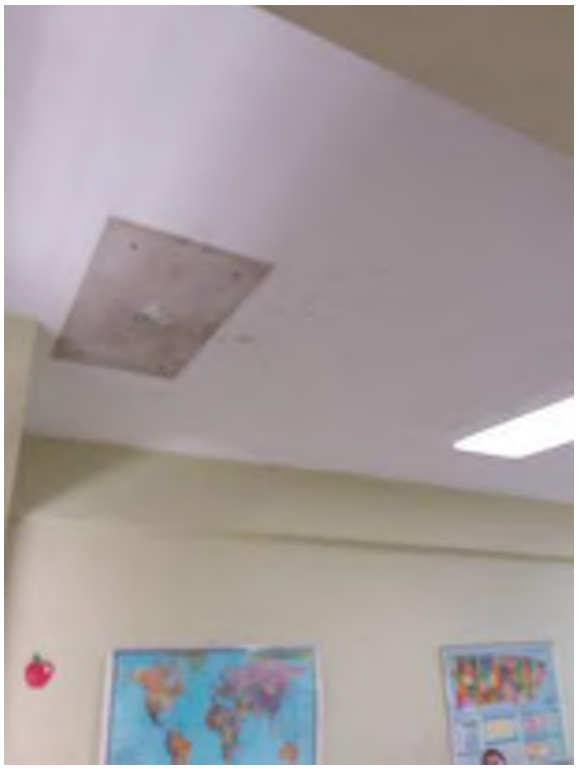


Fass_EscDonLu_211021105411.jpg

Created: Thu 21 Oct 10:54 2021

Classroom A19. 2ea. 24in. X 24in. Vision glass panels broken. Possible impacted by an object. Remove and replace.

(80)



Fass_EscDonLu_211021105515.jpg

Created: Thu 21 Oct 10:55 2021

Classroom A19. 1ea. 2ft. X 4ft. Fluorescent lamps missing. Replace, unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(81)



Fass_EscDonLu_211021105722.jpg

Created: Thu 21 Oct 10:57 2021

Classroom A 18. 1ea. Steel door, frame and lock 36in. X 96in. Rusted and bended. Not working properly. Unknown causes of damage.

(82)



Fass_EscDonLu_211021105921.jpg

Created: Thu 21 Oct 10:59 2021

Belongs to next damage. Included.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(83)

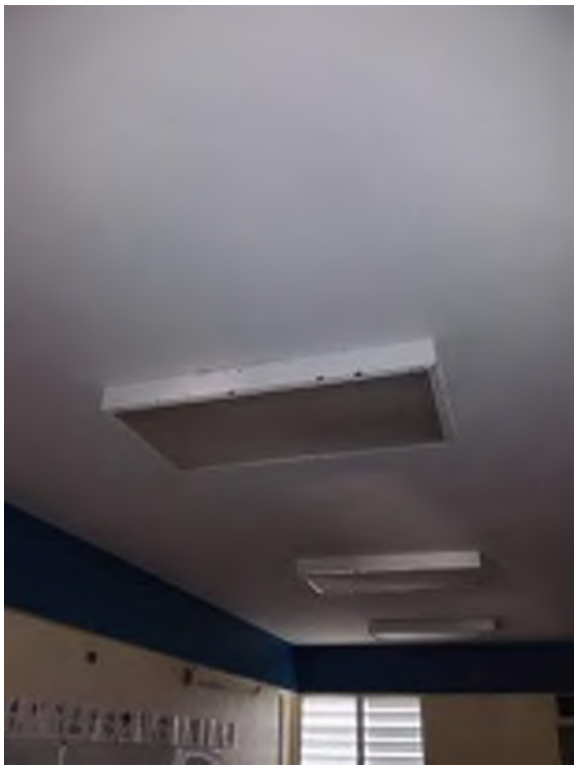


Fass_EscDonLu_211021105948.jpg

Created: Thu 21 Oct 10:59 2021

Classroom A17. 2ea. steel doors 36in x 96in, frames and licks. Rusted and bended. Remove and replace door, frame and locks. Unknown causes of damage.

(84)



Fass_EscDonLu_211021110117.jpg

Created: Thu 21 Oct 11:01 2021

Classroom A17. 5ea. 2ft. X 4ft. Fluorescent lamps rusted due to water infiltration from roof. Remove and replace.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(85)



Fass_EscDonLu_211021110310.jpg

Created: Thu 21 Oct 11:03 2021

First floor (2) girls restroom. 10ea. Partitions doors damaged due to unknown causes 30in. X 48in each door. Remove and place doors, frames and locks.

(86)



Fass_EscDonLu_211021110640.jpg

Created: Thu 21 Oct 11:06 2021

First floor (2) boys restroom. 6ea. Partitions doors 30in. X 48in. Unknown causes of damage. Remove and replace doors, frames and locks required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(87)

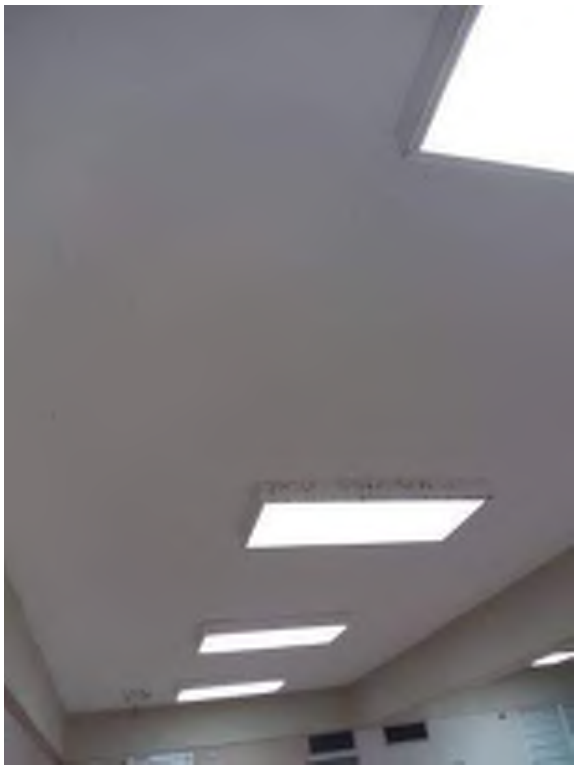


Fass_EscDonLu_211021110756.jpg

Created: Thu 21 Oct 11:07 2021

Classroom Aa16. Steel door 36in. X 96in. Rusted, bended unknown causes of damage. Remove and replace door, frame and lock required.

(88)



Fass_EscDonLu_211021110849.jpg

Created: Thu 21 Oct 11:08 2021

Classroom A16, 1ea, 24in. X 48in. Fluorescent lamp, rusted. Possible damage cause due to water infiltration from roof. Remove and replace lamp required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(89)



Fass_EscDonLu_211021111048.jpg

Created: Thu 21 Oct 11:10 2021

Classroom A19. 8ea. 24in. X 4ft fluorescent lamps rusted due to water infiltration from roof. Remove and replace required.

(90)



Fass_EscDonLu_211021111146.jpg

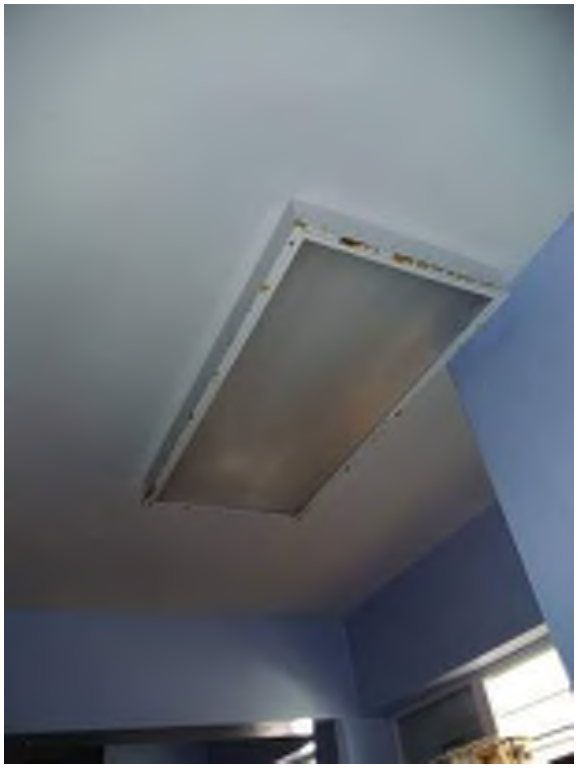
Created: Thu 21 Oct 11:11 2021

Classroom A19, 1ea. Steel door 36in x 96in bended, rusted. vision glass panels broken 3in, 24in. Remove and replace door with vision panel, frame and lock required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(91)



Fass_EscDonLu_211021111321.jpg

Created: Thu 21 Oct 11:13 2021

Classrooms A9 and A8. 4ea. 2ft x 4ft fluorescent lamps are rusted due to water infiltration from roof. Remove and replace required.

(92)



Fass_EscDonLu_211021111723.jpg

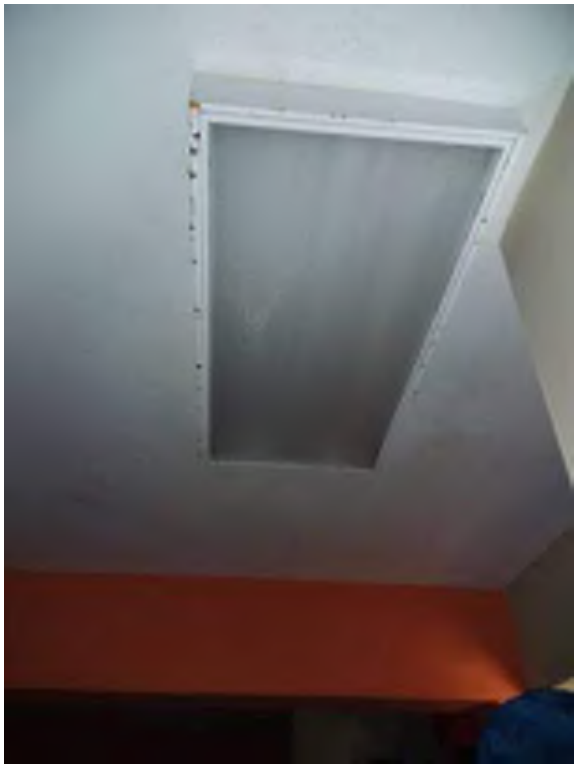
Created: Thu 21 Oct 11:17 2021

Classroom A7, vision glass panels in steel door 3in. X 24in. Broken. Possible impacted by flying objects. Remove and replace .

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(93)



Fass_EscDonLu_211021111904.jpg

Created: Thu 21 Oct 11:19 2021

Classroom A6. 8ea. 2ft. x 4ft. fluorescent luminaries rusted due to water infiltration from roof. Remove and replace required.

(94)



Fass_EscDonLu_211022083205.jpg

Created: Fri 22 Oct 08:32 2021

Hallway, 1ea. 4in. 8ft. Aluminum expansion joint cover . Missing, unknown cause . Repair required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(95)



Fass_EscDonLu_211022083527.jpg

Created: Fri 22 Oct 08:35 2021

Classroom A7, mold due to humidity 37ft. X 32ft 8ea. 2ft. X 4 ft. fluorescent lamps rusted due to high humidity, water infiltration from roof. Included in school waterproofing treatment. Lamps need to be removed and replace.

(96)



Fass_EscDonLu_211022083814.jpg

Created: Fri 22 Oct 08:38 2021

Boys and girls restroom 3ea. 2ft. X 2ft fluorescent lamps rusted. Possible water infiltration from roof. Remove and replace required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(97)



Fass_EscDonLu_211022085319.jpg

Created: Fri 22 Oct 08:53 2021

First floor hallway, expansion joint cover missing. 10 l. ft. x 4in aluminum expansion joint cover needs to be installed. Unknown causes of damage.

(98)



Fass_EscDonLu_211022085450.jpg

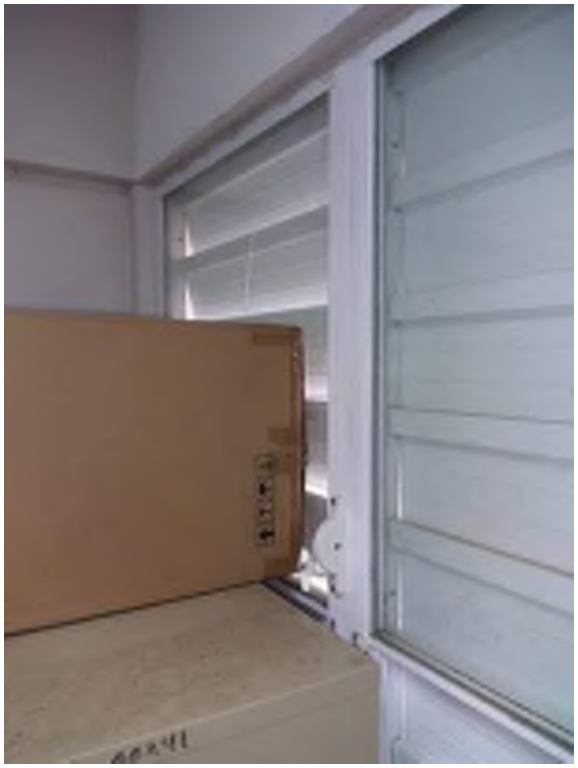
Created: Fri 22 Oct 08:54 2021

Classroom A 28. 8ea, 2 x 4 fluorescent lamps rusted due to water infiltration from roof. Remove and replace required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(99)



Fass_EscDonLu_211022085559.jpg

Created: Fri 22 Oct 08:56 2021

Classroom A 27, 1ea. glass vision panel 24 x 24 broken. Impacted by an object. Remove and replace required.

(100)



Fass_EscDonLu_211022085838.jpg

Created: Fri 22 Oct 08:58 2021

Classroom A26 . Steel door arm missing. Re installed required. Unknown causes of damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(101)



Fass_EscDonLu_211022090158.jpg

Created: Fri 22 Oct 09:02 2021

Second floor. Expansion joint damaged. Included from first floor, cover only. Need to be repair in second floor. Unknown causes of damage.

(102)



Fass_EscDonLu_211022090318.jpg

Created: Fri 22 Oct 09:03 2021

Roof damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(103)



Fass_EscDonLu_211022090342.jpg

Created: Fri 22 Oct 09:03 2021

Roofing. Administration area.

(104)



Fass_EscDonLu_211022090359.jpg

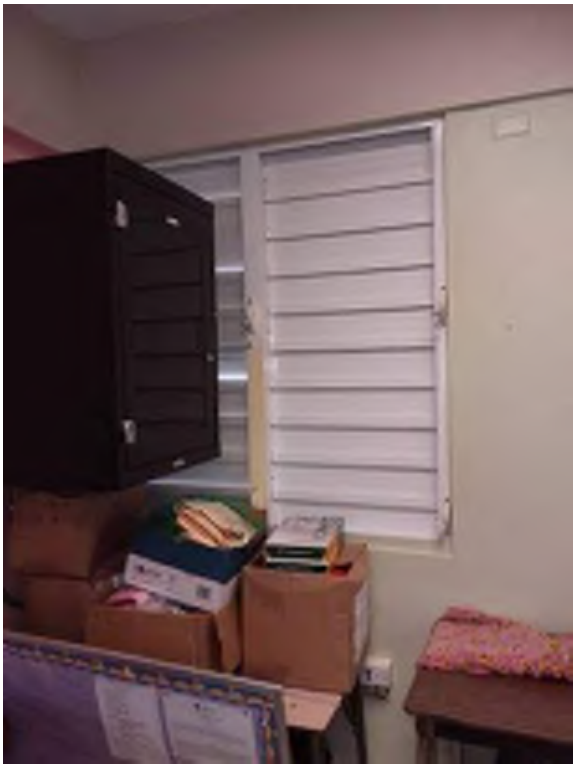
Created: Fri 22 Oct 09:04 2021

Second floor. Exposed floor rebar in several hallway areas. Approximate area: 240 sq. ft.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(105)

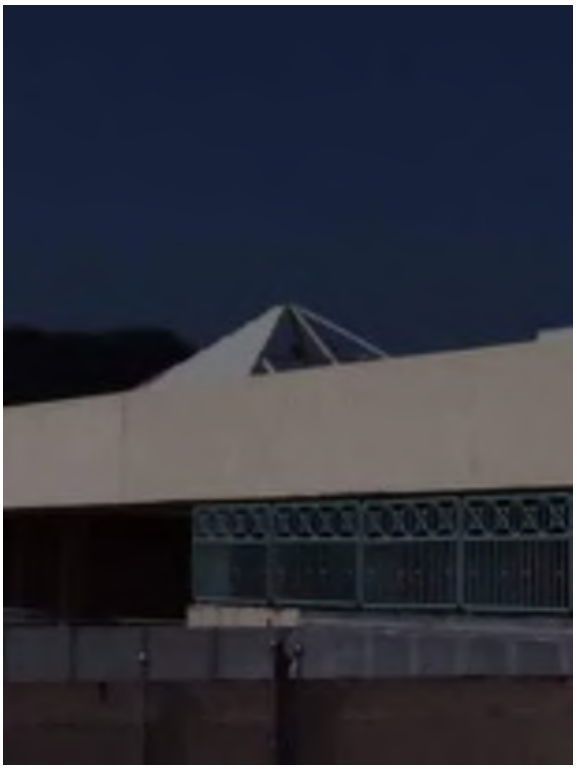


Fass_EscDonLu_211022090450.jpg

Created: Fri 22 Oct 09:04 2021

Classroom B15. 3ea. Glass panels 24in. X 24in missing. Unknown causes of damage. Remove and replace required.

(106)



Fass_EscDonLu_211022090552.jpg

Created: Fri 22 Oct 09:05 2021

Skylight view from second floor. Damages included below.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(107)

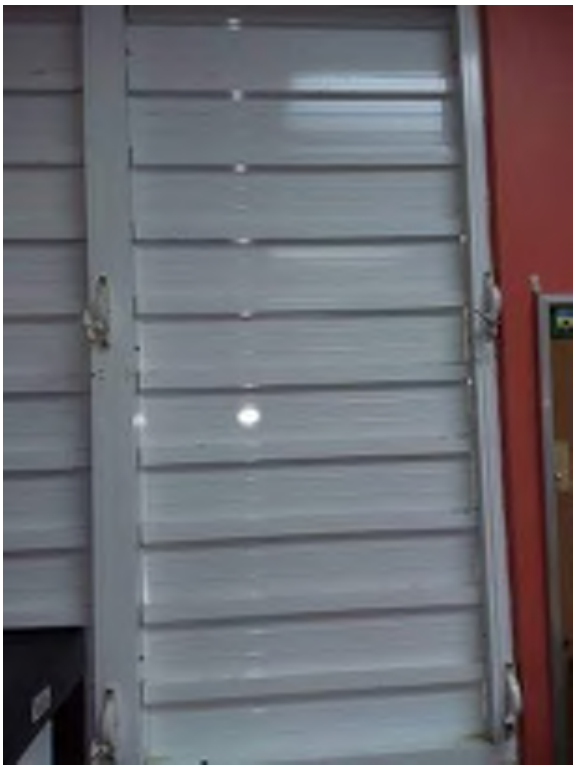


Fass_EscDonLu_211022090607.jpg

Created: Fri 22 Oct 09:06 2021

Exterior. Painting damages.

(108)



Fass_EscDonLu_211022090633.jpg

Created: Fri 22 Oct 09:06 2021

Classroom B14, B13, B11, B10, B8, B6, B3, B2 . 46ea glass panels 24in. x 24in missing/broken. Possible impacted by an object.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(109)



Fass_EscDonLu_211022091155.jpg

Created: Fri 22 Oct 09:11 2021

Second floor, boys restroom exposed rebar, 4ft x 2ft. Included in previous damage 104/125. Unknown causes of damage

(110)



Fass_EscDonLu_211022091256.jpg

Created: Fri 22 Oct 09:12 2021

Second floor boys restroom. 3ea. Partitions doors damaged 30in. x 48in. Unknown causes of damage. Remove and replace required.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(111)

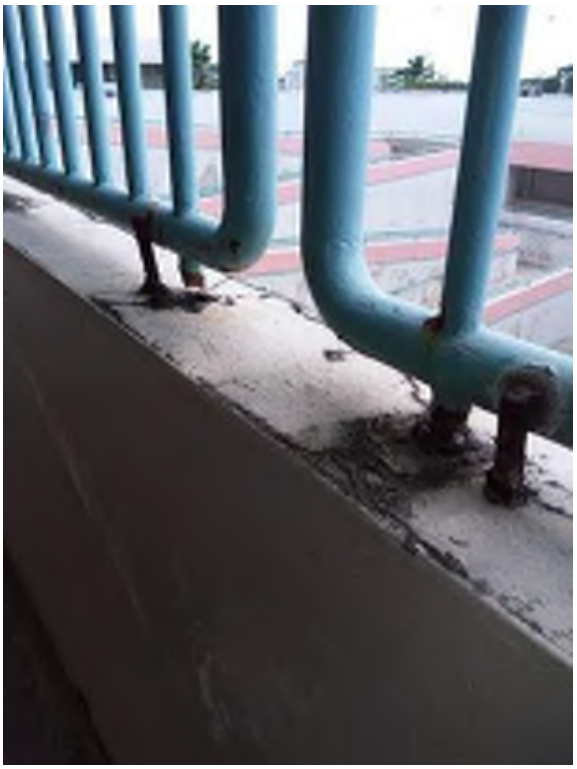


Fass_EscDonLu_211022091448.jpg

Created: Fri 22 Oct 09:14 2021

Second floor, galvanized tubing safety fence rusted. Need to repair for the third time every anchored point, 32ea. Damage due to water accumulation over wall.

(112)



Fass_EscDonLu_211022092410.jpg

Created: Fri 22 Oct 09:24 2021

Same as previous damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
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No. Items: 127

(113)



Fass_EscDonLu_211022092638.jpg

Created: Fri 22 Oct 09:26 2021

Classroom B7. Solar system batteries are OK.

(114)



Fass_EscDonLu_211022091640.jpg

Created: Fri 22 Oct 09:16 2021

Same as previous damage 111 / 125.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
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(115)



Fass_EscDonLu_211022091729.jpg

Created: Fri 22 Oct 09:17 2021

Second floor hallway, several points with exposed rebar. Supporting photo for damage 104 / 125.

(116)



Fass_EscDonLu_211022091837.jpg

Created: Fri 22 Oct 09:18 2021

Second floor. Skylight glass missing. 8ft. x 8ft. Needing re install . Possible damage due to the impact of flying objects.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
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No. Items: 127

(117)



Fass_EscDonLu_211022090908.jpg

Created: Fri 22 Oct 09:09 2021

First floor roof. North side from hallway second floor.

(118)



Fass_EscDonLu_211022091005.jpg

Created: Fri 22 Oct 09:10 2021

Exterior paint .

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
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(119)



Fass_EscDonLu_211022092852.jpg

Created: Fri 22 Oct 09:28 2021

Second floor. Classroom B5, water infiltration from roof. Included damage in waterproofing treatment.

(120)



Fass_EscDonLu_211022093019.jpg

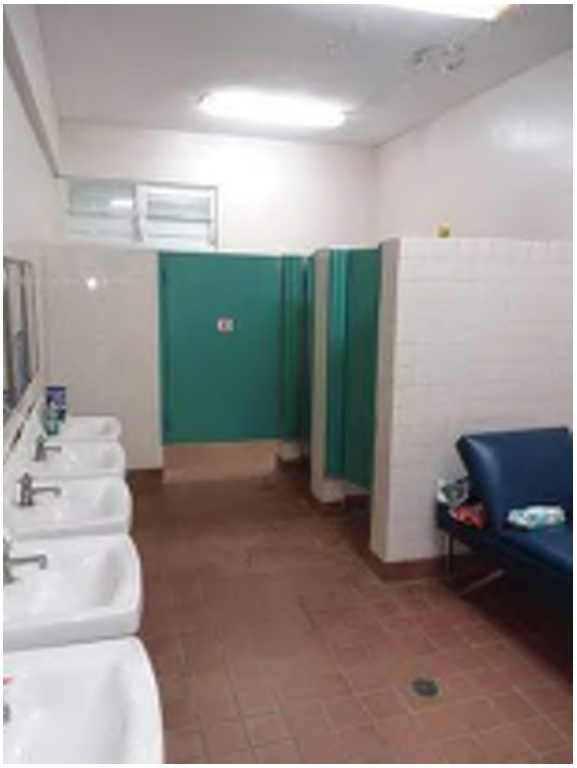
Created: Fri 22 Oct 09:30 2021

Second floor. Girls restroom 5ea. partitions doors 30in. x 48in. damaged. Remove and replace. Damage due to water infiltration from roof and impacted by objects.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
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(121)



Fass_EscDonLu_211022093222.jpg

Created: Fri 22 Oct 09:32 2021

Second floor, boys restroom 3ea. partitions doors 30in. x 48in. damaged. Remove and replace. Damage due to water infiltration from roof and impacted by objects.

(122)



Fass_EscDonLu_211022093637.jpg

Created: Fri 22 Oct 09:36 2021

Second floor classroom B1. Glass vision panel 3in. x 24in. in door broken. Damage caused by the impact of an object.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127

(123)



Fass_EscDonLu_211022094041.jpg

Created: Fri 22 Oct 09:40 2021

Handicapped ramp handrail rusted. Anchored points 20ea. 1.5in. dia. galvanized steel tube. Water accumulation over wall caused the damage.

(124)



Fass_EscDonLu_211022094138.jpg

Created: Fri 22 Oct 09:41 2021

Same as previous damage.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
Location: FASSt
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No. Items: 127

(125)



Fass_EscDonLu_211022094306.jpg

Created: Fri 22 Oct 09:43 2021

Gazebos skylight area infiltration of water. Included in waterproofing treatment item. Skylight has no d

(126)



Fass_EscDonLu_211025170759.jpg

Created: Mon 25 Oct 17:08 2021 Roofing area. Taken by Google Earth, approximate 61,100 sq. ft. Damaged due to strong wind and the impact of flying objects. Removed existing asphalt layer system and replace it.

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
No. Items: 127



Roof, Chemistry Lab. 1ea. Exhaust fan 18in. x 18in not working probably due to power surge. Remove and replace required.

(127)



Roof of Administration area. 6ea. *YORK* 24 tons air handler units damaged. Out of service. Possible damage due to power surge. Remove and replace

(128)

Created: Thu 21 Oct 07:21 2021
Location: FASSt
Title: Esc. Don Luis Munoz
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(129)

Roof. Administration area. Supporting photo for previous damage.



(130)

Roof. Administration area. Air handler's manufacturer/technical data tag.

EXHIBIT P
Don Luis Muñoz Marín

Created: Thu 21 Oct 07:21 2021
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No. Items: 127



(131)

Roof, administration area. Air conduits damage. Approximate 400 l. ft. 24in. x 24in. fiberglass conduits. Remove and replace. Damage cause: humidity/wind.

PAINTING

Exterior painting area includes all cement covered surfaces, not repaired steel doors, gazebo, utilities room, parking lines and curbs. 83,500 sq. ft. need to be water blasted, sealed and covered with two coats of water-based paint. Damaged causes mainly due to heavy rain.

Interior painting area includes all indoor cement covered areas. Clean and apply two coats of water-based paint in 157,000 sq. ft. Damage cause mainly due to humidity.

(132)

PAINTIN

END OF REPORT

EXHIBIT Q

Nota Aclaratoria Proceso Ambiental

Dentro del ámbito de trabajos propuestos que incluyan algún tipo de demolición o alteración en el proyecto, se requiere que el contratista provea un inspector de asbesto y plomo que esté acreditado por el Departamento de Recursos Naturales y Ambientales (DRNA antes Junta de Calidad Ambiental). La función de este inspector es realizar un muestreo ("sampling") limitado a componentes propuestos para cualquier tipo de demolición o alteración que requiera el proyecto.

De no haber presencia de materiales que contienen asbesto y/o de pinturas con base de plomo en dichos componentes evaluados que se identificaron para demolición, entonces el inspector tiene que completar y firmar las certificaciones PGC009 (no presencia de asbesto) y la PGC010 (no presencia de pinturas con base de plomo). La PGC009 se basa en ausencia de materiales sospechosos de contener asbesto o en análisis de Microscopia de Luz Polarizada donde no se detecta asbesto. La PGC010 se basa en lecturas del instrumento portátil de XRF menores a 1.0 mg/cm2 de plomo, o resultados de análisis de hojuelas "chips" de pinturas menores a 1.0 mg/cm2 / 0.5% por peso de plomo o que las superficies no están pintadas. Estas certificaciones son obligadas antes de comenzar las labores que impliquen demolición.

De haber presencia de asbesto y/o pinturas con base de plomo en el o los componentes a demoler y/o alterar como parte del proyecto de columna corta, el contratista tiene que subcontratar el procedimiento ambiental acreditado, para remover o mitigar la pintura con base de plomo o materiales que contienen asbesto, dentro del alcance de demolición propuesto. Este procedimiento ambiental tiene que ser en cumplimiento con los requisitos vigentes aplicables del DRNA en su *Reglamento para el Manejo adecuado de Actividades de Pinturas con Base de Plomo* y el *Reglamento para el Control de la Contaminación Atmosférica-regla 422*.

En ambos escenarios, con o sin hallazgos positivos a asbesto y/o plomo, el inspector también tiene que generar un informe de muestreo "sampling" que incluya resumen ejecutivo y anejos con las lecturas del instrumento XRF, fotos representativas, resultados de análisis de muestras "bulk" para asbesto (si aplica) y acreditaciones de las partes involucradas.