EXHIBIT H
CONTRACT FORMS

CONTRACT FORMS

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

FULL SET OF UNIFORM GENERAL CONDITIONS WILL BE SIGNED AT CONTRACT TIME

PUERTO RICO VERDE

UNIFORM GENERAL CONDITIONS FOR PUBLIC WORKS CONTRACTS

INDEX

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

MRGIL

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

Proyecto OMEP/DEPR, Fondos Federales

I. DISPOSICIONES PARA EL PROCESO DE SUBASTA Y ADJUDICACIÓN DE CONTRATO:

A. Cada licitador deberá someter su propuesta digitalmente al correo electrónico: subastas@de.pr.gov, el día 8 de junio de 2023, en o antes de las 11:00 am y fisicamente ante la Junta de Subasta en original y una copia.

B. Cada licitador cotizará un precio unitario por todos los trabajos incluidos como parte de este contrato, según solicitado en el formulario de tabla de ofertar. Se requiere además que cada licitador someta, para el acto de apertura de esta subasta, todos los precios solicitados en el formulario de tabla de ofertar, **así como el itinerario de progreso solicitado. La entrega de dichos formularios, debidamente cumplimentados 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. **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 JUNTA DE SUBASTA 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 Juanta de Subasta se reservará el derecho de adjudicar dicho contrato considerando además los siguientes criterios:**

1. **<u>Desglose de Costos:</u> Costo total de cada partida incluida en este contrato,** según solicitadas como parte de su propuesta para esta subasta.

2. **<u>Experiencia del licitador:</u> 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. **<u>Solvencia Económica</u>: Capacidad financiera**, de acuerdo con lo dispuesto en la evaluación técnica realizada por la Junta de Subasta, la cual se basa en la información suministrada en el Estado Financiero Auditado sometido por el licitador.

4. **<u>Personal Técnico:</u> 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. **<u>Equipo Adecuado:</u> 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 correspondie

C

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. La Junta de Subasta 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, especi icaciones, términos y condiciones establecidas en el Pliego y sus anejos, bajo las condiciones más avorables para el 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 irma de este sin que medie responsabilidad alguna para el 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 al 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 el 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. Servicios e Instalaciones Existentes:

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 NO realizará trabajo alguno que considere adicional al contrato sin la autorización previa, por escrito, 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. Cumplimiento con Códigos y Reglamentos:

1. **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.

2. **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..

3. **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.

4. **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.

5. **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.

6. **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.

7. **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.

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 2de 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 no le requerirá al Contratista** la instalación de una oficina temporera de inspección. De considerarse necesario, el Contratista deberá coordinar, con el representante designado de la OMEP/DEPR, el uso (en forma temporera) de algún salón de conferencia existente o espacio de oficina disponible para estos fines.

III. DISPOSICIONES TÉCNICAS PARA LOS TRABAJOS INCLUIDOS EN CONTRATO:

A. 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.

B. 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.

C. Trabajos Civiles y Arquitectónicos:

1. **El Contratista deberá reparar todas las grietas identificadas** *(Ubicación de Grietas en Superficies a Repararse)* de acuerdo con las instrucciones del Ingeniero encargado o representante del proyecto.

2. **Los trabajos para la instalación del techo** en *galvalum* 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 *galvalum*, gauge 24 (mínimo), pintado en color terracota 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.

D. 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.

E. Impermeabilización de Techos: Disposiciones Técnicas.

1. **OMEP/DEPR sólo aceptará, como sistemas de impermeabilización iguales a los especificados**, aquellos sistemas basados en la instalación de algún tipo de membrana sobre las superficies existentes, que cumpla 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 <u>no</u> 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.

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. Si la obra es exenta de permiso de construccion, deberacontar con la solicitud de la misma debidamente aprobada.
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:**

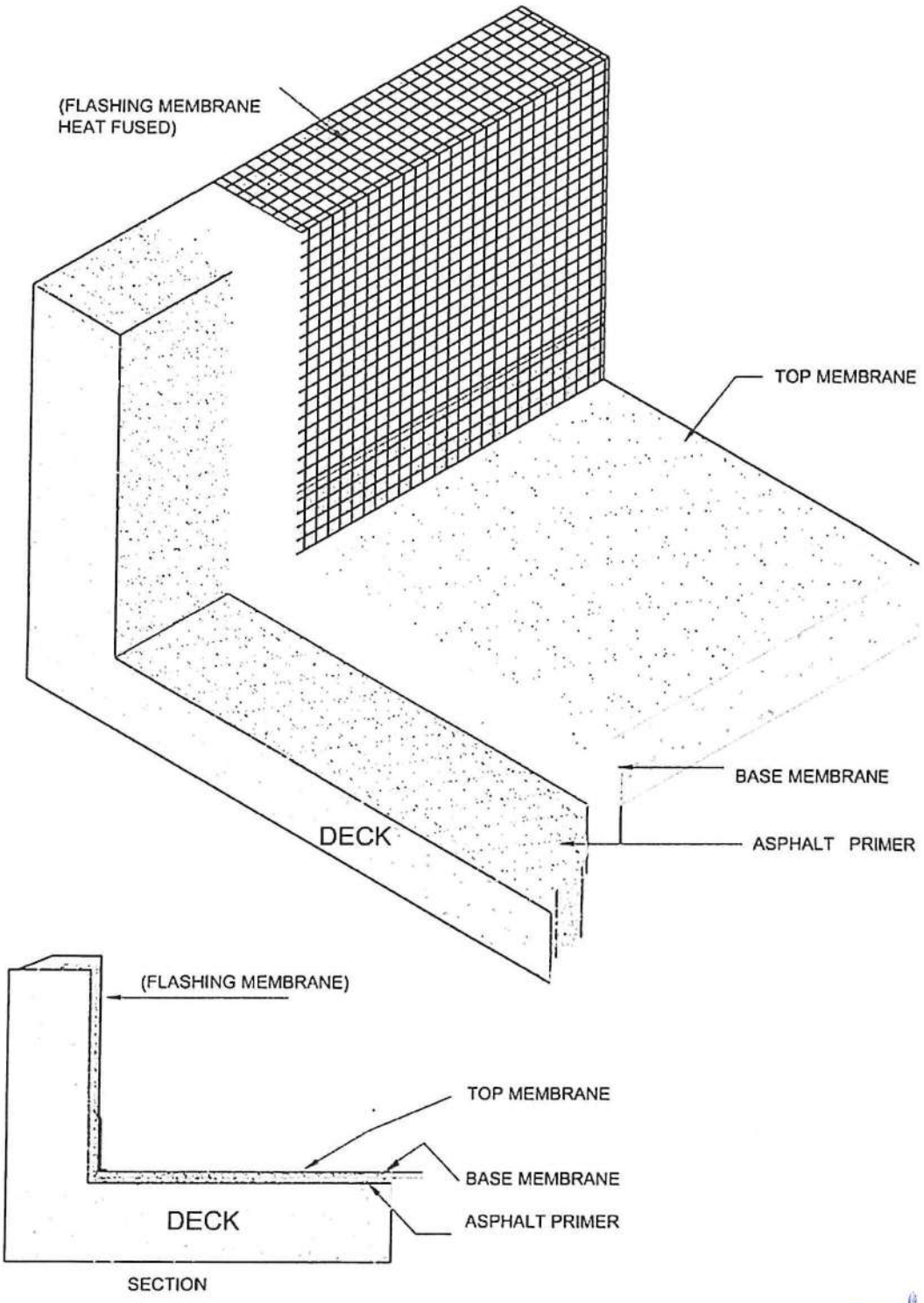
1. **Permiso de Construcción Certificado** expedido por la OGPE o el Municipio Autónomo correspondiente (según sea el caso), en cumplimiento con los requisitos establecidos para el mismo, incluyendo la notificación correspondiente al permiso de construcción (en la cual se pagan los sellos del CIAPR y los aranceles de rentas internas), necesaria para obtener la aprobación de este. *Si la obra es exenta de permiso de construccion, debera contar con la solicitud de la misma debidamente aprobada.*
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
REFERENCE TECHNICAL SPECIFICATIONS

FOR REFERENCE ONLY

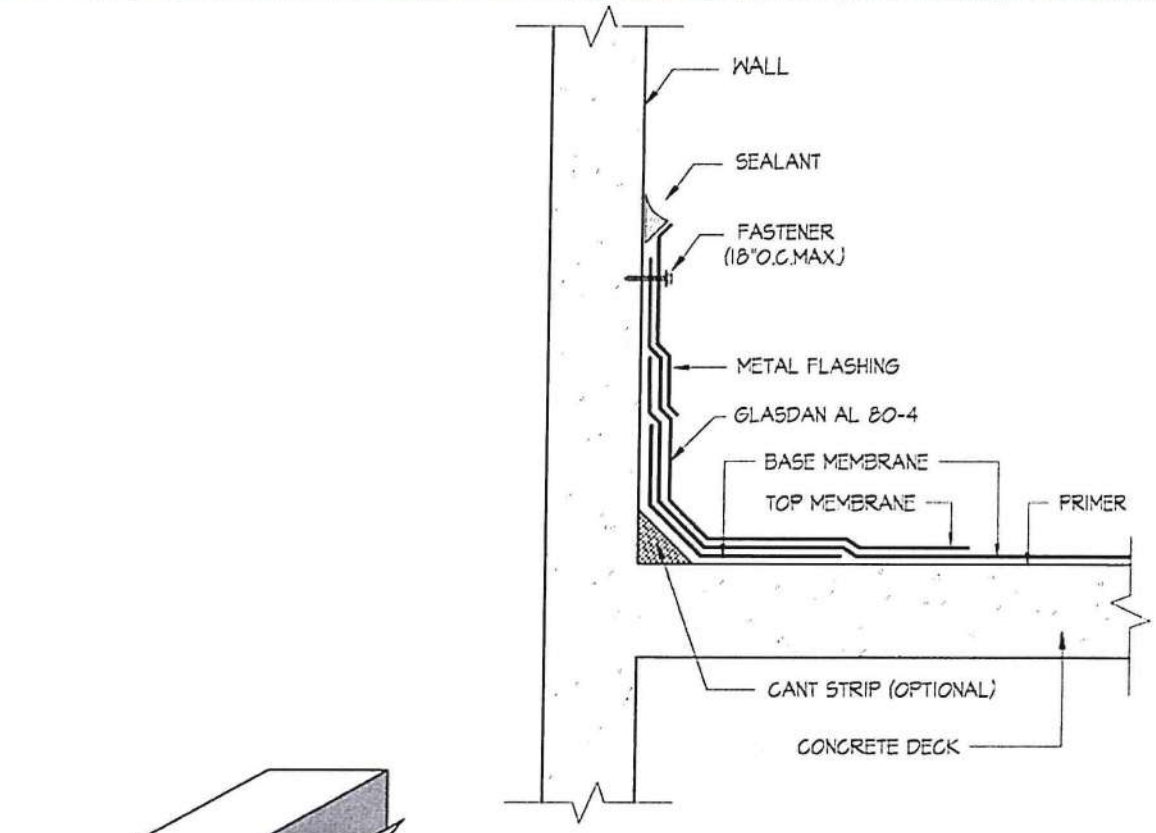


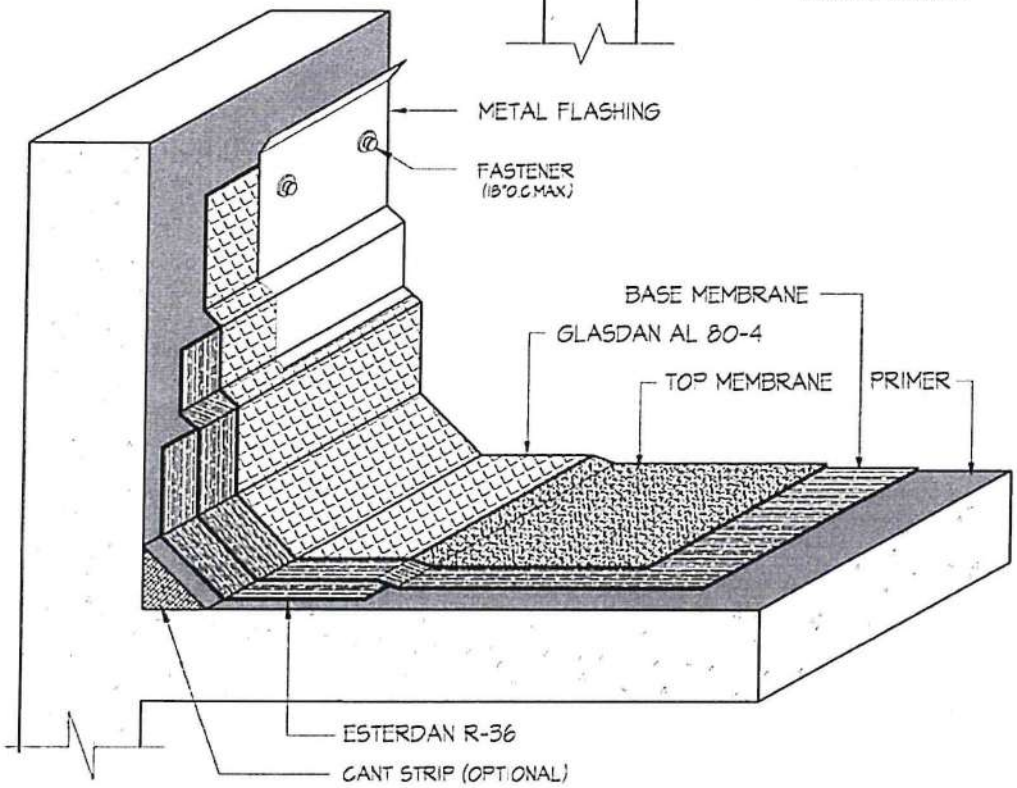
DETALLE #1

ANEJO 2

MAGR.

FOR REFERENCE ONLY

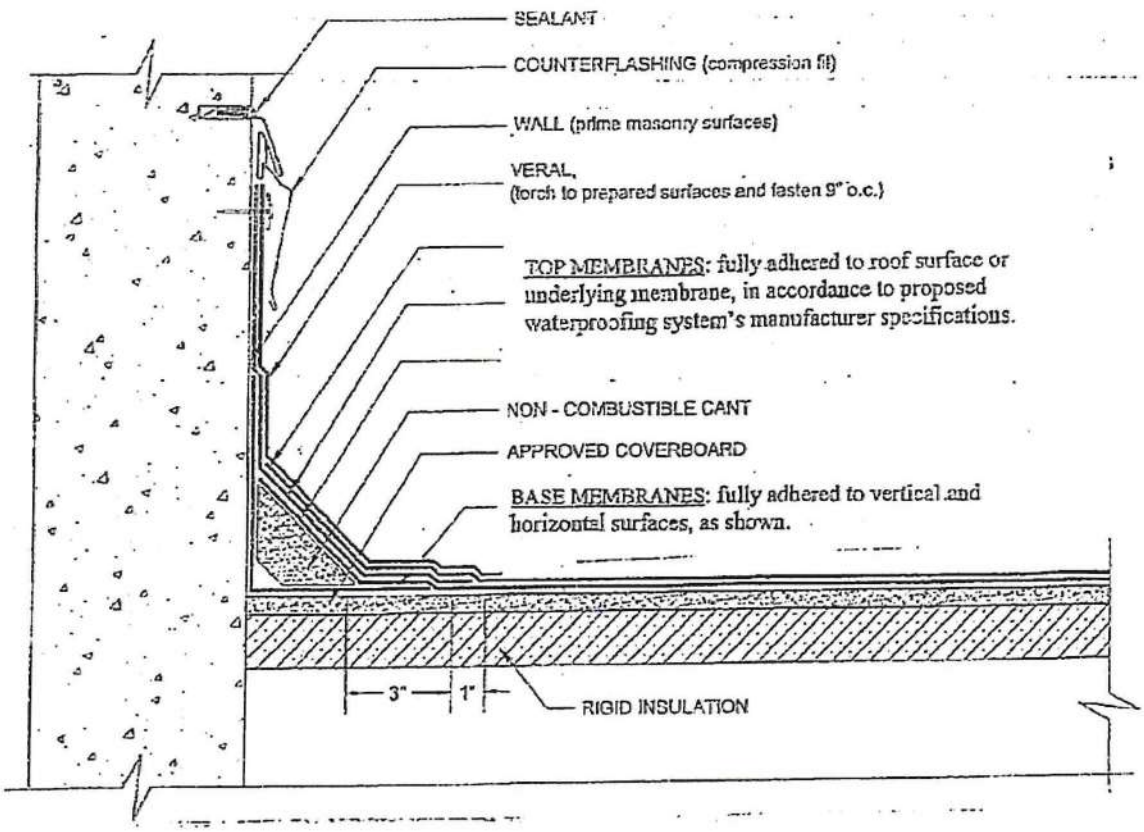




DETALLE #2

MAGL

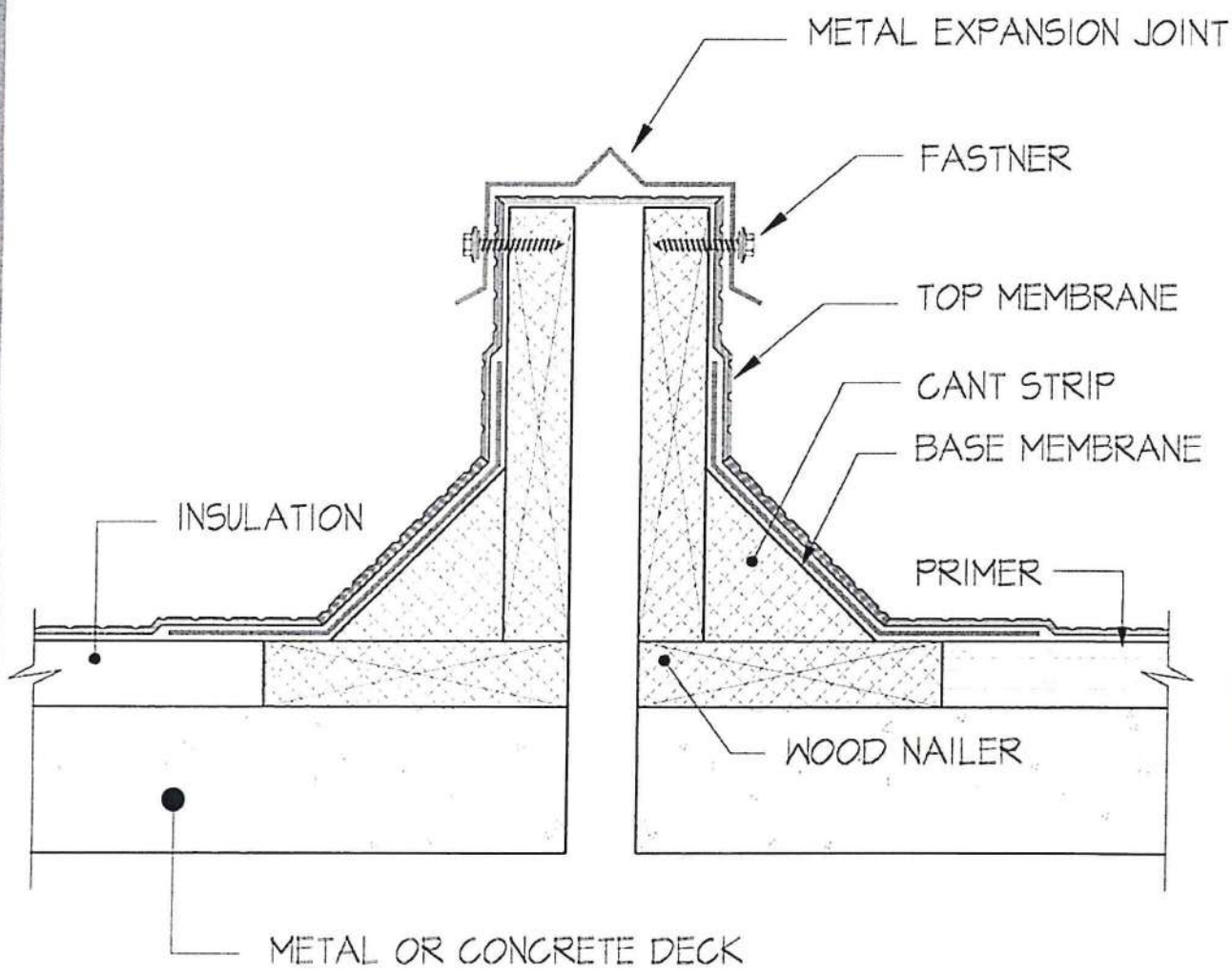
FOR REFERENCE ONLY



DETALLE #3

MAGIL

FOR REFERENCE ONLY



DETALLE #4

PROJECT:

EXPANSION JOINT DETAIL

MAGIN

ANEJO 3

FOR REFERENCE ONLY

Coverage	1 gal. yields 231 cu. in. (3,785 cm³) of epoxy paste adhesive. 1 gal. (3.8 L) mixed with 1 gal. (3.8 L) by loose volume of oven-dried aggregate yields approximately 346 cu. in. (5,670 cm³) of epoxy mortar.
Packaging	1 gal. and 3 gal. (11.4 L) units.

How to Use

Surface 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, and any other contaminants. **Preparation Work: Concrete** - Should be cleaned and prepared to achieve a laitance and contaminant free, open textured surface by blastcleaning or equivalent mechanical means. **Steel** - Should be cleaned and prepared thoroughly by blastcleaning.
Mixing	Pre-mix each component. Proportion 1 part Component 'B' to 1 part 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 which can be used within its pot life. Prior to mixing, material should be conditioned to 65°-85°F (18°-29°C). 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, and mix until uniform in consistency.
Application	**As a structural adhesive -** Apply the neat mixed Sikadur 31, HI-Mod Gel to the prepared substrates. Work into the substrate for positive adhesion. Secure the bonded unit firmly into place until the adhesive 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.
Limitations	▪ **THE NTSB HAS STATED THAT THIS PRODUCT IS APPROVED FOR SHORT TERM LOADS ONLY AND SHOULD NOT BE USED IN SUSTAINED TENSILE LOAD ADHESIVE ANCHORING APPLICATIONS WHERE ADHESIVE FAILURE COULD RESULT IN A PUBLIC SAFETY RISK. CONSULT A DESIGN PROFESSIONAL PRIOR TO USE.** ▪ Components of original 2:1 mix ratio formulation of Sikadur 31, Hi-Mod Gel cannot be cross-mixed with components of Sikadur 31, HI-Mod Gel (NEW 1:1 Mix Ratio) formulation. ▪ Minimum substrate and ambient temperature 40°F (4°C). ▪ Do not thin. Solvents will prevent proper cure. ▪ When preparing an epoxy mortar, 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. ▪ Not an aesthetic product. Color may alter due to variations in lighting and/or UV exposure.
WARNING	**Component 'A' - IRRITANT, SENSITIZER.** Contains epoxy resin, silica, and calcium carbonate. Causes eye irritation. May cause skin/respiratory irritations. Prolonged and/or repeated contact with skin may cause allergic reaction/sensitization. Harmful if swallowed. **Deliberate concentrations of vapors for purposes of inhalation is harmful and can be fatal.** **Component 'B' - CORROSIVE, SENSITIZER, IRRITANT.** Contains Amines, silica quartz (sand), and calcium carbonate. Contact with skin and eyes causes severe burns. Causes eye/skin/respiratory irritation. Prolonged and/or repeated contact may cause allergic reaction/sensitization. Harmful if swallowed. **Deliberate concentrations of vapors for purposes of inhalation is harmful and can be fatal.** Cured material, if sanded, may result in exposure to a chemical known to the State of California to cause cancer.
First Aid	**Eyes** - Hold eyelids apart and flush thoroughly with water for 15 minutes. **Skin** - Remove contaminated clothing. Wash skin thoroughly for 15 minutes with soap and water. **Inhalation** - Remove person to fresh air. **Ingestion** - Do not induce vomiting. Contact a physician. **In all cases, contact a physician immediately if symptoms persist.**
Handling & Storage	Avoid direct contact with eyes and skin. Wear chemical resistant gloves/goggles/clothing. Avoid breathing vapors. Use with adequate general and local exhaust ventilation. Use a properly fitted NIOSH approved respirator. Wash thoroughly after handling product. Remove contaminated clothing and launder before reuse. Store product in a closed container in a cool, dry place.

Clean Up

Avoid contact. Wear chemical resistant clothing/gloves/goggles. In absence of adequate ventilation, use a properly fitted NIOSH respirator. Uncured material can be removed with solvent. Follow solvent manufacturer's instructions for use and warnings. Cured material (when Component 'A' combined with Component 'B') can only be removed mechanically. In case of spill, ventilate area and contain spill. Collect with absorbent material. Dispose of in accordance with current, applicable local, state and federal regulations.

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Product Data Sheet
Edition 7.2003
Identification no. 350
Sikadur 35, Hi-Mod LV

Sikadur® 35, Hi-Mod LV

High-modulus, low-viscosity, high-strength epoxy grouting/sealing/binder adhesive

Description

Sikadur 35, Hi-Mod LV is a 2-component, 100% solids, moisture-tolerant, low-viscosity, high-strength, multi-purpose, epoxy resin adhesive. It conforms to the current ASTM C-881 and AASHTO M-235 specifications.

Where to use

- Pressure-injection of cracks in structural concrete, masonry, wood, etc.
- Grouting bolts, dowels, pins, 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.

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 for flooring systems.

Typical Data *(Material and curing conditions @ 73°F (23°C) and 50% R.H.)*

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.**

Color Clear, amber.

Mixing Ratio Component A : Component B=2:1 by volume.

Viscosity (Mixed) Approximately 375 cps.

Pot Life Approximately 25 minutes. (60 gram mass)

Tack Free Time (3-5 mils) Neat

40°F (4°C)	73°F (23°C)	90°F (32°C)
14-16 hrs.	3-3.5 hrs.	1.5-2 hrs.

		Neat		Mortar
Tensile Properties (ASTM D-638)				
7 day	Tensile Strength	8,900 psi (61.4 MPa)	14 day	840 psi (5.8 MPa)
	Elongation at Break	5.4%		0.3%
14 day	Modulus of Elasticity	4.1×10^5 psi (2,800 MPa)		7.6×10^5 psi (5,200 MPa)
Flexural Properties (ASTM D-790)				
14 day	Flexural Strength (Modulus of Rupture)	14,000 psi (96.6 MPa)		2,200 psi (15.2 MPa)
	Tangent Modulus of Elasticity in Bending	3.7×10^5 psi (2,600 MPa)		9.5×10^5 psi (6,500 MPa)
Shear Strength (ASTM D-732)				
14 day	Shear Strength	5,100 psi (35.2 MPa)		2,300 psi (15.9 MPa)
Heat Deflection Temperature (ASTM D-648)				
7 day	[fiber stress loading = 264 psi (1.8 MPa)]	124°F (51°C)		129°F (54°C)

Bond Strength (ASTM C-882): Hardened concrete to hardened concrete

2 day	(moist cure)	Bond Strength	4,000 psi (27.6 MPa)
14 day	(moist cure)	Bond Strength	2,900 psi (20.0 MPa)
2 day	(dry cure)	Bond Strength	2,800 psi (19.3 MPa)

Water Absorption (ASTM D-570) 7 day (24 hour immersion) 0.27 %

Compressive Properties (ASTM D-695)

Compressive Strength, psi (MPa)	Neat			Mortar (1:5)		
	40°F (4°C)	73°F (23°C)	90°F (32°C)	40°F(4°C)	73°F (23°C)	90°F (32°C)
4 hour	-	-	-	-	-	800 (5.5)
8 hour	-	180 (1.2)	3,200 (22.1)	-	-	4,100 (28.3)
16 hour	-	4,500 (31.1)	6,300 (43.5)	-	400 (2.8)	5,700 (39.3)
1 day	-	6,000 (41.4)	9,100 (62.8)	120 (0.8)	5,000 (34.5)	6,900 (47.6)
3 day	4,000 (27.6)	10,700 (73.8)	10,500 (72.5)	6,200 (42.8)	6,800 (46.9)	7,000 (48.3)
7 day	6,800 (46.9)	11,000 (75.9)	10,500 (72.5)	6,300 (43.5)	7,900 (54.5)	8,800 (60.7)
14 day	10,300 (71.1)	12,000 (82.8)	10,500 (72.5)	6,800 (46.9)	8,500 (58.7)	8,800 (60.7)
28 day	12,400 (85.6)	13,000 (89.7)	10,500 (72.5)	7,000 (48.3)	8,600 (59.3)	8,800 (60.7)

Compressive Modulus

Neat		Mortar	
7 day	3.2×10^5 psi (2,200 MPa)	28 day	8.1×10^5 psi (5,600 MPa)

Coverage	1 gal. yields 231 cu. in. of adhesive and grout. 1 gal. of adhesive, when mixed with 5 gal. by loose volume of oven-dried aggregate, yields approximately 808.5 cu. in. of epoxy mortar.
Packaging	3 gal. units; 1 gal. units, 2/case; 12 fl.-oz. units, 12/case.

How to Use

Surface 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.
Preparation Work:	**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 oven-dried aggregate to 1 part of the mixed Sikadur 35, Hi-Mod LV and mix until uniform in consistency.
Application	**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 anchor bolts, dowels and pins** - Annular space around bolt should not exceed 1/8-in. (3 mm); depth of embedment is typically 10-15 times the bolt diameter. Grout with neat Sikadur 35, Hi-Mod LV. **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.
Limitations	▪ Minimum substrate and ambient temperature 40°F (4°C). ▪ Do not thin with solvents. Consult Technical Service. ▪ 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.
Caution	**Component 'A' - Irritant; Sensitizer** - Contains epoxy resin. Can cause skin sensitization after prolonged or repeated contact. Skin and eye irritant. High concentrations of vapor may cause respiratory irritation. Avoid skin contact. Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. In case of exceedance of PELs, use an appropriate, properly fitted NIOSH approved respirator. Remove contaminated clothing. Consult MSDS for more detailed information. **Component 'B' - Corrosive; Sensitizer** Contains amines. Contact with eyes or skin may cause severe burns. Can cause skin and/or respiratory sensitization after prolonged or repeated contact. Skin and eye irritant. High concentrations of vapor may cause respiratory irritation. Avoid skin contact. Use only with adequate ventilation. Use of safety goggles and chemical-resistant gloves is recommended. In case of exceedance of PELs, use an appropriate, properly fitted NIOSH approved respirator. Remove contaminated clothing. Consult MSDS for more detailed information.
First Aid	**Eyes:** Hold eyelids apart and flush thoroughly with water for 15 minutes. **Skin:** Remove contaminated clothing. Wash skin thoroughly for 15 minutes with soap and water. **Inhalation:** Remove person to fresh air. **Ingestion:** Do not induce vomiting. **In all cases, contact a physician immediately if symptoms persist.**
Clean Up	Ventilate area. Confine spill. Collect with absorbent material. Dispose of in accordance with current, applicable local, state and federal regulations. Uncured material can be removed with approved solvent. Cured material can only be removed mechanically.

KEEP CONTAINER TIGHTLY CLOSED — KEEP OUT OF REACH OF CHILDREN
NOT FOR INTERNAL CONSUMPTION — FOR INDUSTRIAL USE ONLY
CONSULT MATERIAL SAFETY DATA SHEET FOR MORE INFORMATION

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 technical data sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor.

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

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QUALITY ISO 9001 9002 ACHIEVEMENT

MAGL

Product Data Sheet
Edition 7.9.2008
Identification no. 06E2
Sikagard 550W Elastocolor

Sikagard® 550W Elastocolor

High performance, anti-carbonation, crack-bridging coating

Description	Sikagard 550W Elastocolor is a elastomeric, crack-bridging, anti-carbonation, acrylic protective coating. Sikagard 550W Elastocolor provides protection to reinforced concrete from the ingress of carbon dioxide and other aggressive gasses. It offers high resistance to chlorides and other waterborne salts and excellent UV light resistance. Sikagard 550W Elastocolor will not act as vapor barrier and will enhance the aesthetic appearance of the structure.
Where to Use	Protective, crack-bridging coating for concrete, mortar, stucco, masonry, and exterior finishing systems subject to cracking/dynamic movement. On building and civil engineering structures subject to cracking. As the top coat in complete repair and protection systems.
Advantages	▪ Can bridge dynamically moving cracks ▪ Excellent carbonation barrier ▪ Water vapor permeable ▪ Provides resistance to weathering, frost and deicing salts ▪ Crack bridging properties maintained at low temperatures ▪ Excellent long term UV light resistance ▪ Can be applied by brush, roller, or airless spray ▪ Good color stability ▪ Extremely resistant to dirt pick up and mildew ▪ Nontoxic, nonflammable as a system ▪ Easily maintained silk finish
Coverage	Theoretical yield per coat: 100 sq. ft./gal/coat. Recommended 'wet' film thickness: 16 mils/coat. Recommended 'dry' film thickness: 8 mils/coat. Normal coating system is two coats at a total dry film thickness of 16 mils. Consumption is dependent on porosity of substrate. In addition, allowance must be made for surface profile, unavoidable variation in applied film thickness, loss and waste. Sikagard Elastic Base Coat can be used as a first coat in a two coat system of Sikagard 550W Elastocolor.
Packaging	5 gallon, re-closable plastic pails.

Typical Data *(Material and curing conditions at 73°F (23°C) and 50% R.H.)*

Shelf Life	2 years in original unopened container.
Storage Conditions	Store dry at 40°-95°F (4°-35°C) Condition material to 60°-75°F (15°-25° C) before using. Protect from freezing. If frozen discard.
Colors	469 standard colors. Custom color-matching available.
Pot Life	Indefinite, provided proper care is taken in protecting the system from moisture, freezing, contamination, or evaporation.

Solids Content	**by weight**	**by volume**
Smooth 550W	62%	55%
Sikagard 552W	20%	17%

Tensile Properties (ASTM D-412 modified)

Tensile Strength	190 psi
Elongation at Break	820% at 73°F (23°C)
Tensile Strength at 0°F (-18°C)	1000 psi
Elongation at Break at 0°F (-18°C)	340%

Waiting Time (between coats) and Curing Rates	**45°F (8°C)**	**68°F (20°C)**	**85°F (30°C)**
Sikagard 552W Primer+Sikagard 550W	24 hours	12 hours	6 hours
Sikagard 550W	12 hours	8 hours	6 hours
Rain resistant (at 75% R.H.)	24 hours	4 hours	2 hours

(Note: Overcoating old coatings will increase the waiting times by 100%)

Water Vapor Diffusion (at 16 mils = 400 microns dry film thickness)
μ - value H_2O (diffusion coefficient) = 2,146
SdH_2O (equivalent air thickness) = 2.6 ft. (0.8 m)

Carbon dioxide diffusion (at 16 mils = 400 microns dry film thickness)

	***After 2,000 hours**
μ - value CO_2 (diffusion coefficient) =	214,000
R (equivalent air thickness) =	299 ft. (91 m)
Sc (Equivalent concrete thickness) =	9 inches (23 cm)

*accelerated weathering

Crack-Bridging (at 16 mils = 400 microns DFT)

Static (at -4°F/-20°C)	30 mils (0.75 mm)
Dynamic>1000 cycles (at -4°F/-20°C)	12 mils (0.3 mm)

Moisture Vapor Permeability (ASTM E-96) 14.5 Perms

Resistance to Wind Driven Rain (TT-C-555B) No passage of water through the coating

Flame Spread and Smoke Development (ASTM E-84-94)
Flame Spread: 5 Smoke Development: 5 Class Rating: A

Weathering (ASTM G-23) 10,000 hours Excellent, no chalking or cracking

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How to Use

Surface preparation	All surfaces to be coated must be dry, clean, sound, and frost free with curing compound residues and any other foreign matter removed. An open textured sandpaper like surface is ideal (CSP-3). Where necessary, surfaces should be prepared mechanically by blast cleaning or high speed pressure waterjetting. Allow adequate time for drying. Bugholes, cracks or irregularities of substrate should be filled and leveled with SikaTop, MonoTop or acrylic surface fillers as appropriate.
Priming	All porous areas or concrete with excessive porosity shou'd be primed using Sikagard 552W Primer or SikaLatex R to allow easy application of Sikagard 550W Elastocolor.
Mixing	Stir all materials to ensure uniformity using a slow speed (400-600 rpm) drill and "Jiffy style mixing paddle. To minimize color variation when using multiple units, blend two pails of Sikagard 550W Elastocolor. Use one pail and maintain the second pail to repeat this procedure (boxing) for the entire application.
Application	Any areas of glass or other surfaces should be masked. Recommended application temperatures (ambient and substrate) 45° - 95°F (7°-35°C). Sikagard 550W Elastocolor can be applied by brush, roller, or spray over entire area moving in one direction. At lower temperatures and high humidity, waiting time will be prolonged. At higher temperatures, work carefully to maintain a wet edge. As with all coatings job site mock-ups should always be completed to confirm acceptability of workmanship and material. **NOTE:** To achieve a dry film thickness of 16 mils, two coats should be anticipated. For maximum adhesion, (especially on porous substrates) the use of Sikagard 552W is recommended. Sikagard 552W primer can be applied by brush or roller. Brushing provides more even and pore free coats and better penetration.
Limitations	▪ Not designed for use as a traffic bearing surface ▪ Substrates must be dry prior to application ▪ Minimum age of concrete prior to application is 14 days, depending on curing and drying conditions (moisture content must be below 5%) ▪ Minimum age of SikaTop or MonoTop prior to application is three days, depending on curing and drying conditions (moisture content must be below 5%) ▪ Allow sufficient time for substrate to dry after rain or other inclement conditions ▪ Protect from freezing. If frozen, discard ▪ Sikagard 550W Elastocolor should not be applied at relative humidity greater than 90%, or if rain is forecast within the specified rain resistance period ▪ Maximum crack width 1/32" ▪ During application, regular monitoring of the wet film thickness and material consumption is advised to ensure that the correct layer thickness is achieved. When over-coating existing coatings, compatibility and adhesion testing is recommended ▪ When over-coating Sikaflex sealants, a prime coat of Sikagard 550W Elastocolor accent base coat may be necessary over the sealant to minimize dirt pick up on cured coating. ▪ Do not store Sikagard 550W Elastocolor in direct sunlight for prolonged periods ▪ Strong winds can cause shrinkage if material is applied at lower temperatures ▪ Ensure that the primer is thoroughly dry before over-coating to prevent formation of bubbles and blisters, particularly in warmer weather ▪ Not recommended for roofing
Caution	**IRRITANT:** Contains Zinc Oxide (CAS #1314-13-2). May cause eye/skin/respiratory irritation. May be harmful if swallowed. **Strictly follow all usage, handling and storage instructions.**
Handling and Storage	Avoid direct contact. Wear personal protective equipment (chemical resistant goggles/gloves/clothing) to prevent direct contact with skin and eyes. Use only in well ventilated areas. Open doors and windows during use. Use a properly fitted NIOSH respirator if ventilation is poor. Wash thoroughly with soap and water after use. Remove contaminated clothing and launder before reuse.
First Aid	**Eyes:** Hold eyelids apart and flush thoroughly with water for 15 minutes. **Skin:** Remove contaminated clothing. Wash skin thoroughly for 15 minutes with soap and water. **Inhalation:** Remove to fresh air. **Ingestion:** Do not induce vomiting. Dilute with water. Contact physician. **In all cases contact a physician immediately if symptoms persist.**
Clean Up	Use personal protective equipment (chemical resistant gloves/ goggles/clothing). Without direct contact, remove spilled or excess product and placed in suitable sealed container. Dispose of excess product and container in accordance with applicable environmental regulations.

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REFERENCE TECHNICAL SPECIFICATIONS

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

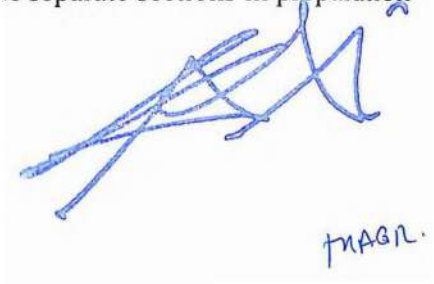
A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

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.

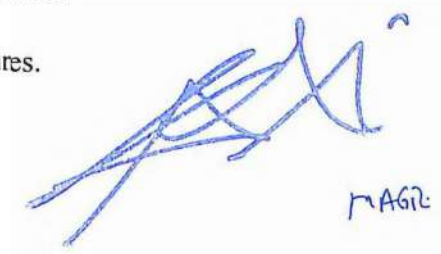
D. Record minutes and distribute copies within 4 days after meeting to participants.

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.

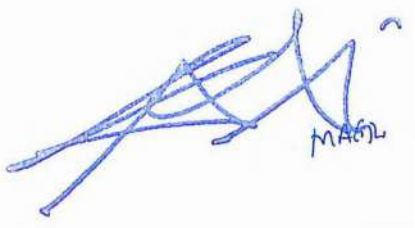
D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
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.

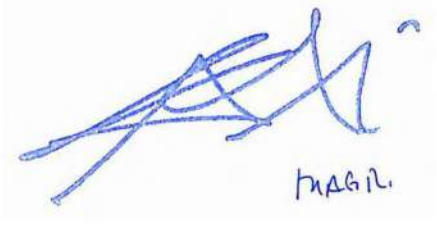
D. Cut masonry and concrete materials using masonry saw or core drill.

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.

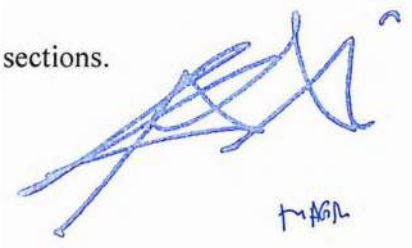
J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

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.

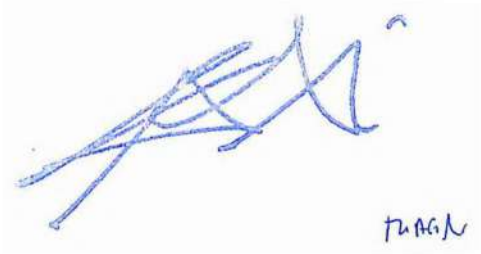
L. Where change of plane of 1/4 inch (6mm) or more occurs, request instructions from Architect/Engineer.

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

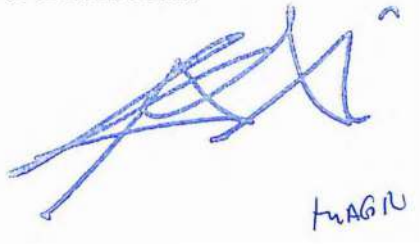
A. Transmit each submittal with Architect/Engineer accepted form.

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.

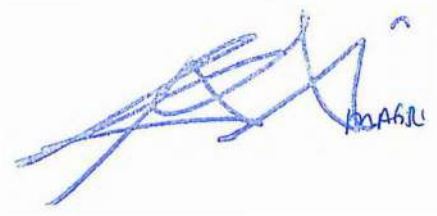
F. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

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

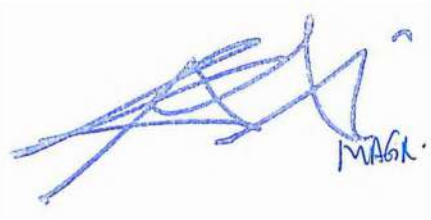
A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to Architect/Engineer in quantities specified for Product Data.

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.

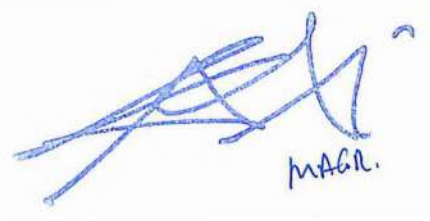
2 PRODUCTS

Not Used.

3 EXECUTION

Not Used.

END OF SECTION



SECTION 01400 QUALITY REQUIREMENTS

GENERAL

1.1 SECTION INCLUDES

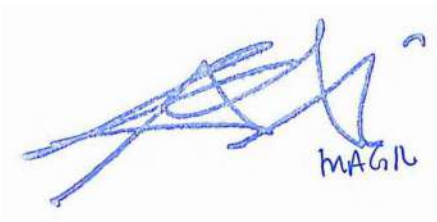
1. Quality control and control of installation.
2. Tolerances
3. References.
4. Mock-up requirements.
5. Testing and inspection services.
6. Examination.
7. Preparation.

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.

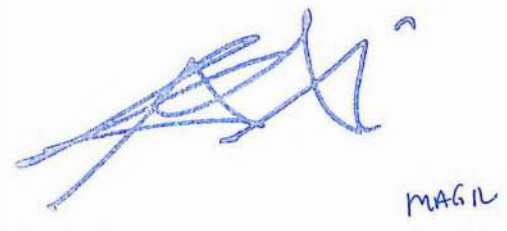
2. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

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.

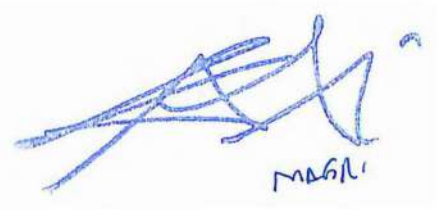
3. Testing, inspections and source quality control may occur on or off project site.

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.

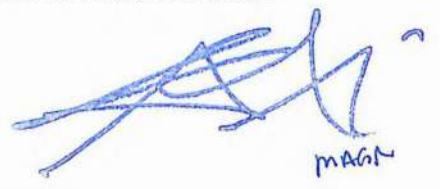
4. Verify utility services are available, of correct characteristics, and in correct locations.

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 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.

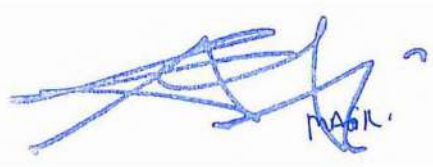
D. Removal of utilities, facilities, and controls.

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

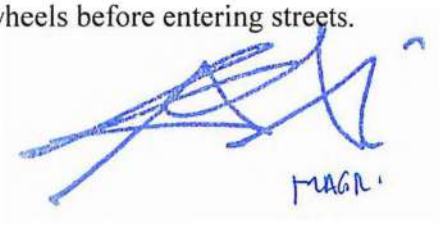
A. Construct temporary access roads from public thoroughfares to serve construction area.

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.

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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.

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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

MAGR.

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.

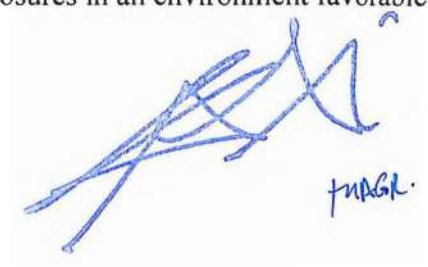
C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

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.

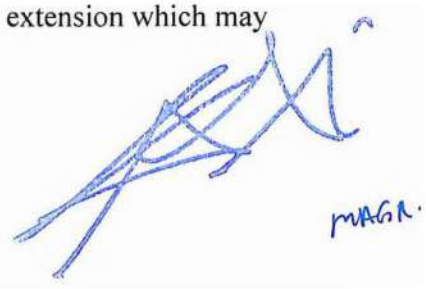
1.6 PRODUCT SUBSTITUTION PROCEDURES

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.

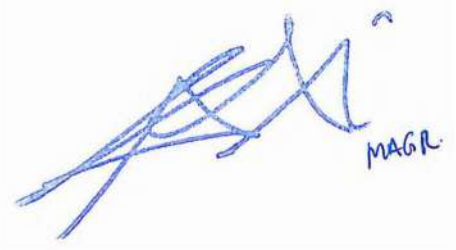
2 PRODUCTS

Not Used

3 EXECUTION

Not Used.

END OF SECTION



SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

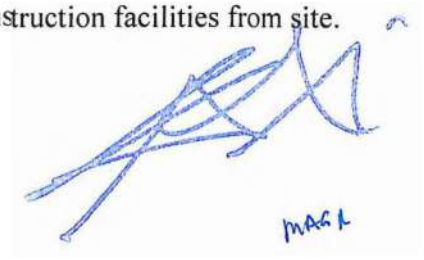
1. Closeout procedures.
2. Final cleaning.
3. Protecting installed construction.
4. Project record documents.
5. Operation and maintenance data.
6. Spare parts and maintenance products.

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.

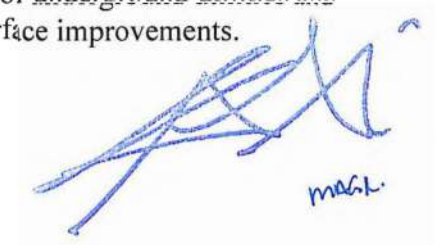
2. Ensure entries are complete and accurate, enabling future reference by Owner.

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

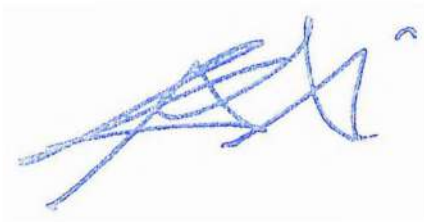
1. Submit data bound in 8-1/2 x 11 inch text pages, capacity expansion binders with durable plastic overs.

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.



MAG L.

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.

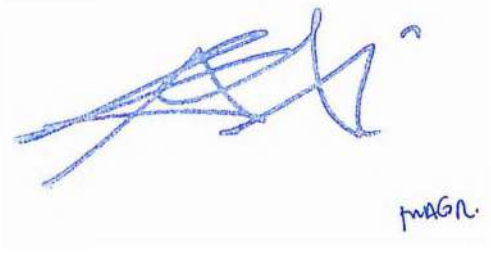
PART 2 PRODUCTS

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.

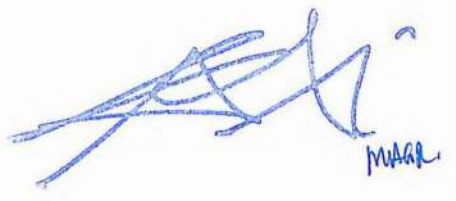
D. Erect temporary covered passageways as required by authorities having jurisdiction.

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.

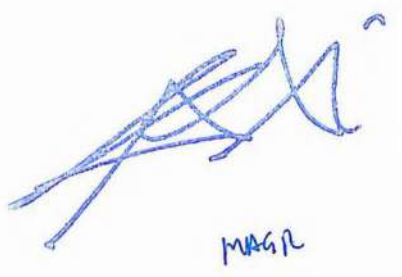
3. Remove indicated exposed pipe and ductwork in it's entirely.

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.

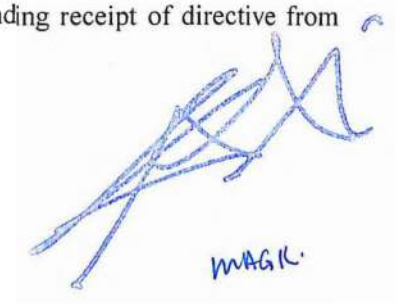
3.3 DEMOLITION

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.

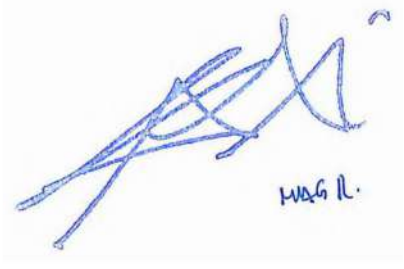
C. Burning of removed materials is not permitted on project site.

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 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

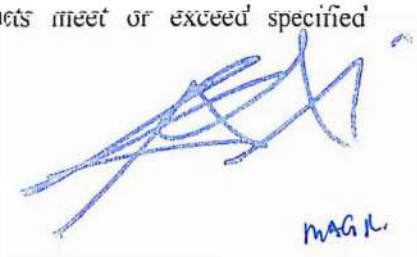
A. ASTM A82 Cold Drawn Steel Wire for Concrete Reinforcement.
B. ASTM A615/A615M Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
C. ASTM A616/A616M Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
D. ASTM A617/A617M Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
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

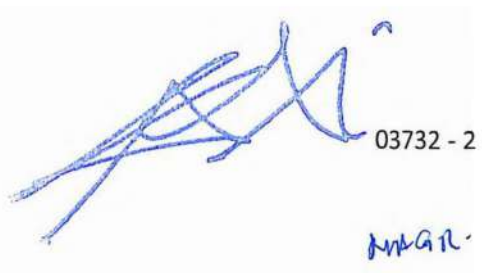
A. Epoxy Resin: Two-part epoxy adhesive containing 100 percent solids, meeting the following minimum characteristics:

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.

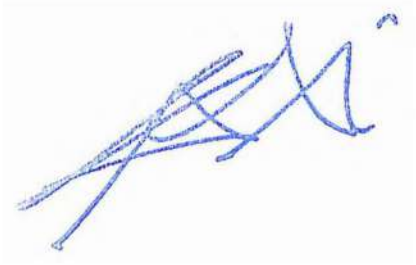
3.6 APPLICATION – CEMENTITIOUS MORTAR

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



CONCRETE RESTORATION SYSTEMS

Spec Component SC-001-1102

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

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.

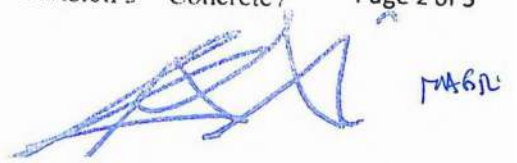
2.03 Performance Criteria

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 21.6×10^5 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



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 10^4 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: 1.0 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.

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 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 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.

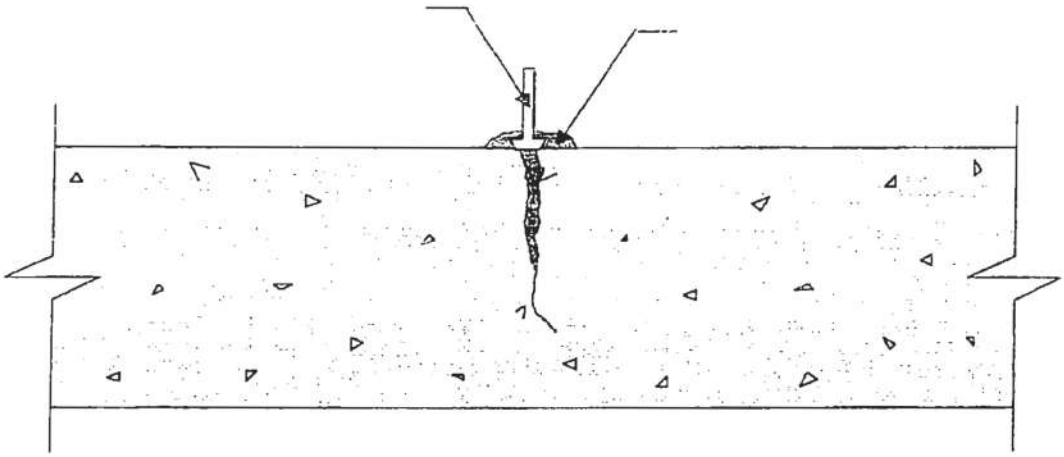
3.02 Cleaning

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.

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

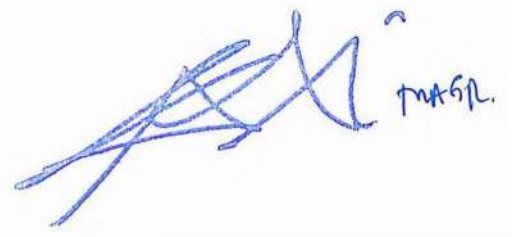
A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

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".

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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.

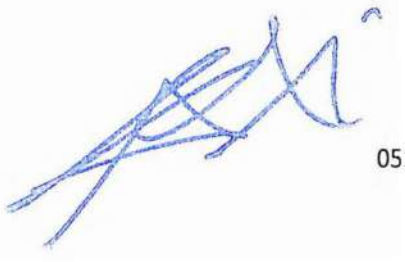
1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship of steel surfaces 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".



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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.

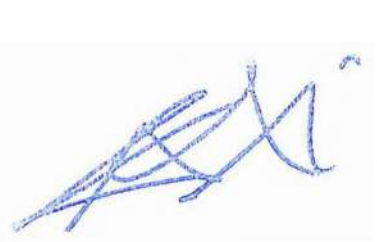
1. Finish: Plain, uncoated.
2. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.
3. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
4. Direct-Tension Indicators: ASTM F 959, Type 325.

    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.

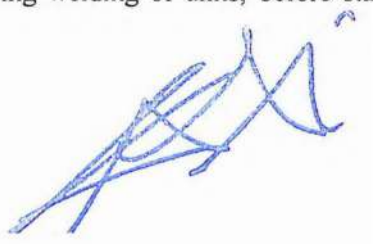
B. Metallic, Shrinkage-Resistant Grout: Premixed, factory-packaged, ferrous aggregate grout, complying with ASTM C 1107, of consistency suitable for application, and a 30 minute working time.

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.



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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.

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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".

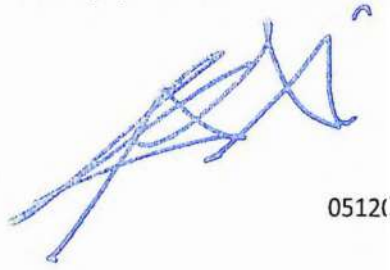
C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

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.



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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.

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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.

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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".

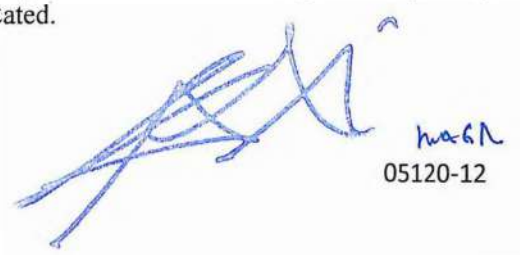
1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
2. Bolts: ASTM A 490 (ASTM A 490M) high-strength bolts, unless otherwise indicated.
3. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Connection 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

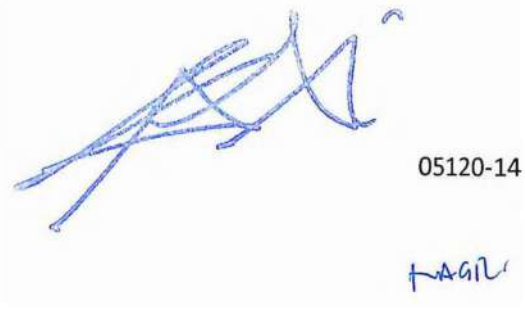
A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

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 05310

STEEL DECK

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. Roof deck.
2. Acoustical roof deck.
3. Cellular roof deck.
4. Composite floor deck.
5. Cellular deck floor systems with electrical distribution.
6. Non-composite form deck.
7. Non-composite vented form deck.

B. Related Sections include the following:

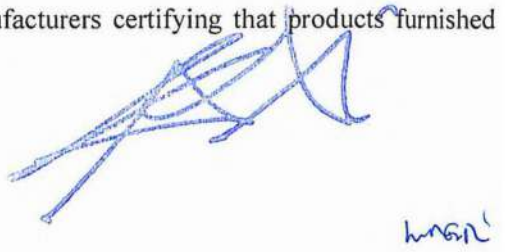
1. Division 3 Section "Cast-in-Place Concrete" for concrete fill and reinforcing steel.
2. Division 3 Section "Insulating Concrete Decks" for lightweight insulating concrete fill.
3. Division 5 Section "Structural Steel" for shop-welded shear connectors.
4. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
5. Division 9 Section "Painting" for repair of painted deck.
6. Division 9 Section "Special Coatings" for repair of deck special coatings.
7. Division 16 Section "Underfloor Raceway" for preset inserts, activation kits, after-set inserts, service fittings, headier ducts, and trench header ducts used with cellular deck floor systems.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.



D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Mechanical fasteners.
2. Acoustical roof deck.

F. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E# 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations for Cellular Deck Floor Systems with Electrical Distribution: Obtain cellular floor deck units and compatible electrical components, such as preset inserts, activation kits, after set inserts, service fittings, header ducts, and trench header ducts, from the same manufacturer. Electrical components are specified in Division 16 Section "Underfloor Raceway".

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel", and AWS D1.3, "Structural Welding Code-Sheet Steel".

E. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

F. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-formed Steel Structural Members".

G. Electrical-Raceway Units: Provide UL-labeled cellular floor deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.

H. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.6 COORDINATION

A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 7 Section "<**Insert title of applicable roofing Section**>" to ensure protection of insulation strips against damage from effects of weather and other causes.

B. Coordinate layout and installation of trench headers, preset inserts, duct fittings, and other components specified in Division 16 Section "Underfloor Raceway" with installation of cellular metal floor deck.

PART 2 – PRODUCTS

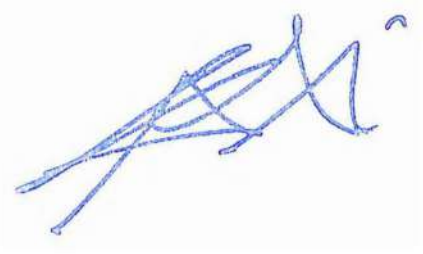
2.1 MANUFACTURERS

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. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:

a. BHP Steel Building Products USA Inc.
b. Consolidated Systems, Inc.
c. Epic Metals Corp.
d. Marlyn Steel Products, Inc.
e. Nucor Corp.; Vulcraft Div.
f. Rood Deck, Inc.
g. United Steel Deck, Inc.
h. Verco Manufacturing Co.
i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.



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2. Cellular Floor Deck with Electrical Distribution

    a. BHP Steel Building Products USA Inc.
    b. Centria.
    c. Consolidated Systems, Inc.
    d. United Steel Deck, Inc.
    e. Walker Systems, Inc.; Div. of Wiremold, Inc.

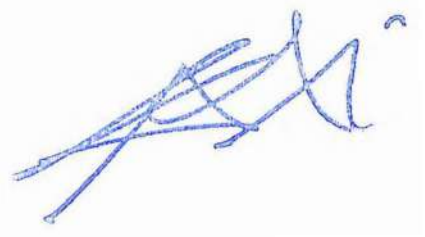
2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck", in SDI Publication No. 29, and the following:

1. Prime-Painted Steel Sheet: ASTM A 611, Grade [C] [D] [E] minimum, shop primed with gray or white baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), [G60 (Z180)] [G90 (Z275)] zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TTP-664.
4. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 33 (230) minimum, AZ50 (AZ150) aluminum-zinc alloy coating.
5. Deck Profile: [Type NR, narrow rib] [Type IR, intermediate rib] [Type WR wide rib] [Type 3DR, deep rib] [Long span].
6. Cellular Deck Profile: [Type WR, wide rib] [Type 3DR, deep rib] [Long span], with bottom plate.
7. Profile Depth: [1-½ inches (38 mm)] [2 inches (51 mm)]]3 inches (76 mm)] [4-112 inches (114 mm)] [6 inches (152 mm)] [7-½ inches (190 mm)].
8. Design Uncoated-Steel Thickness: [0.0295 inch (0.75 mm)] [0.0358 inch (0.91 mm)] [0.0474 inch (1.20 mm)] [0.0598 inch (1.52 mm)] [0.0747 inch (1.90 mm)].
9. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: [0.0474/0.0474 inch (1.20/1.20 mm)] [0.0474/0.0598 inch (1.20/1.52 mm)] [0.0598/0.0474 inch (1.52/1.20 mm)] [0.0598/0.0598 inch (1.52/1.52 mm)].
10. Span condition: [Simple span] [Double span] [Triple span or more] [As indicated].
11. Side Laps: [Overlapped] [Interlocking seam] [Overlapped or interlocking seam at Contractor's option].

2.3 ACOUSTICAL ROOF DECK

A. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck", in SDI Publication No. 29, and the following:



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1. Prime-Painted Steel Sheet: ASTM A 611, Grade [C] [D] [E] minimum, shop primed with gray or white baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), [G60 (z180)] [G90 (Z275)] zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TTP-664.
4. Aluminum-Zinc Alloy-Coated Steel sheet; ASTM A 792/A 792M, Structural Steel (SS), Grade 33 (230) MINIMUM, AZ50 (AZ150) aluminum-zinc alloy coating.
5. Deck Profile: [Type WR, wide rib] [Type 3DR, deep rib] [Long span], with bottom plate.
6. Cellular Deck Profile: [Type WR, wide rib] [Type 3DR, deep rib] [Long span], with bottom plate.
7. Profile Depth: [1-½ inches (38 mm)] [2 inches (51 mm)] [3 inches 76 mm)] [4-½ inches (114 mm)] [6 inches (152 mm)] [7-½ inches (190 mm)].
8. Design Uncoated –Steel Thickness: [0.0295 inch (0.75 mm)] [0.0358 inch (0.91 mm)] [0.0474 inch (1.20 mm)] [0.0598 inch (1.52 mm)].
9. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: [0.0358/0.0358 inch (0.91/0.91 mm)] [0.0358/0.0474 inch (0.91/1.20 mm)] [0.0474/0.0358 inch (1.20/0.91 mm)] [0.0474/0.0474 inch (1.20/1.20 mm)] [0.0598/0.0598 inch (1.52/1.52 mm)].
10. Span Condition: [Simple span] [Double span] [Triple span or more] [As indicated].
11. Side Laps: [Overlapped] [Interlocking seam] [Overlapped or interlocking seam at Contractor's option].
12. Acoustical Perforations: [Deck units with manufacturer's standard perforated vertical webs] Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck].
13. Sound-Absorbing Insulation: Manufacturer's standard pre-molded roll or strip glass fiber or mineral fiber. <Insert actual physical properties and thicknesses of insulation>.
14. Factory install sound-absorbing insulation into cells of cellular deck according to manufacturer's written instructions.
15. Acoustical Performance: NRC [0.75] [0.80] [0.90], tested according to ASTM C 423.

2.4 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck", in SDI Publication No. 29, the minimum section properties indicated, and the following:

1. Prime-Painted Steel Sheet: ASTM A 611, Grade [C] [D] [E] minimum, with top surface phosphatized and unpainted and bottom surface shop primed with gray or white baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), [G60 (z180)] [G90 (Z275)] zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; with unpainted top and bottom surface cleaned, pretreated, and primed with manufacturers baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

4. Profile Depth: [1-½ inches (38 mm)] [2 inches (51 mm)] [3 inches (76 mm)] [As indicated].
5. Deign Uncoated-Steel Thickness: [0.0295 inch (0.75 mm)] [0.0358 inch (0.91 mm)] [0.0474 inch (1.20 mm)] [0.0598 inch (1.52 mm)].
6. Span Condition: [simple span] [Double span] [Triple span or more] [As indicated].

2.5 CELLULAR DECK FLOOR SYSTEMS WITH ELECTRICAL DISTRIBUTION

A. Cellular Deck Floor Systems with Electrical Distribution: Fabricate steel sheet cellular floor deck panels, consisting of a ribbed top section welded to a lower flat-bottom sheet with interlocking side laps, to comply with "SDI Specifications and Commentary for Cellular Deck Floor Systems with Electrical Distribution", in SDI Publication No. 29. Fabricate deck to the minimum section properties, width of panel, number and area of cells per panel indicated, and the following:

1. Cellular Deck Type: [Composite] [Non-composite].
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), [G60 (Z180)] [G90 (Z275)] zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; with bottom surface cleaned, pretreated, and primed with manufacturer's baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
4. Profile Depth: [1-½ inches (38mm)] [2 inches (51 mm)] [3 inches (76 mm)] [As indicated].
5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: [0.0358/0.0358 inch (0.91/0.91 mm)] [0.0358/0.0474 inch (0.91/1.20 mm)] [0.0358/0.0598 inch (0.91/1.52 mm)] [0.0474/0.0358 inch (1.20/0.91 mm)] [0.0474/0.0474 inch (1.20/1.20 mm)] [0.0474/0.0598 inch (1.20/1.52 mm)] [0.0598/0.0474 inch (1.52/1.20 mm)] [0.0598/0.0598 inch (1.52/1.52 mm)].
6. Span Condition: [Simple span] [Double span] [Triple span or more] [As indicated].
7. Factory-punch holes, of size and arrangement [recommended by deck manufacturer] [indicated], into each deck cell at present inserts and header duct locations.

2.6 NON-COMPOSITE FORM DECK

A. Non-composite Steel Form Deck: Fabricate ribbed-steel sheet non-composite form deck panels to comply with "SDI Specifications and Commentary for Non-Composite Steel Form Deck, "in SDI Publication No. 29, the minimum section properties indicated, and the following:

1. Uncoated Steel Sheet: ASTM A 611, Grade [C] [D] [E] minimum.
2. Prime-Painted Steel Sheet: ASTM A 611, Grade [C] [D] [E] minimum, [top and] bottom surface shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
3. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade [33 (230)] [40 (275)] [80 (550)], (G60 (Z180)] [G90 (Z275)] zinc coating.
4. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade [33 (230)] [80 (550)], G60 (Z180) zinc coating; cleaned, pretreated, and primed

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with manufacturer's baked-on, lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

5. Profile Depth: (9/16 inch (14 mm)] [15/16 inch (24 mm)] [1-5/16 inches (33 mm)] [1-½ inches (38 mm)].
6. Design Uncoated-Steel Thickness: [0.0149 inch (0.38 mm)] [0.0179 inch (0.45 mm)] [0.0239 inch (0.61 mm)] [0.0295 inch (0.75 mm] [0.0358 inch (0.91 mm)] [0.0474 inch (1.20 mm)] [0.0598 inch (1.52 mm)].
7. Span Condition: [Simple span] [Double span] [Triple span or more] [As indicated].
8. Side Laps: [Overlapped] [Interlocking seam] [Overlapped or interlocking seam at Contractor's option].

2.7 NON-COMPOSITE VENTED FORM DECK

A. Non-composite Vented Steel Form Deck: Fabricate ribbed-and vented-steel sheet non-composite form deck panels to comply with " SDI Specifications and Commentary for Non-Composite Steel Form Deck, "in SDI Publication No. 29, and the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade [33 (230)] [40 (275)] [80 (550)], [G60 (Z180)] [G90 (Z275)] zinc coating.
2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade [33 (230)] [80 (550)], G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's baked-on, led-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
3. Profile Depth: [9/16 inch (14 mm)] [15/16 inch (24 mm)] [1-5/16 inches (22 mm)] [1-½ inches (38 mm)].
4. Design Uncoated-Steel Thickness: [0.0149 inch (0.38 mm)] [0.0179 inch (0.45 mm)] [0.0239 inch (0.61 mm)] [0.0295 inch (0.75 mm)] [0.0358 inch (0.91 mm)] [0.0474 inch (1.20 mm)] [0.0595 inch (1.52 mm)].
5. Span Condition: [Simple span] [Double span] [Triple span or more] [As indicated].
6. Side Laps: [Overlapped] [Interlocking seam] [Overlapped or interlocking seam at Contractor's option].
7. Vent Slot Area: Manufacturer's standard vent slots providing 1-½ percent open area.

2.8 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter.

D. Rib Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

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F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile [indicated] [recommended by SDI Publication No. 29 for overhang and slab depth].

H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch (1.52 mm)] [0.0747 inch (1.90 mm)] thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch (76-mm) wide flanges and [level] [sloped] recessed pans of 1-½ inch (38-mm) minimum depth. For drains, cut holes in the field.

L. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

M. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.

N. Galvanizing Repair Paint: [ASTM A 780] [SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight].

O. Repair Paint: Lead-and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 – EXECUTION

3.1 EXAMINATION

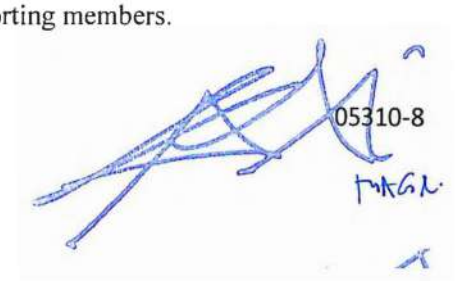
A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate decking bundles to prevent overloading of supporting members.



D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-½ inches (38 mm) long, and as follows:

1. Weld Diameter: [5/8 inch (16 mm)] [¾ inch (19 mm)], nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds [18 inches (450 mm) apart, maximum] [12 inches (305 mm) apart in the field of the roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions of FM Loss Prevention Data Sheet 1-28] [as indicated].
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of ½ of the span or [18 inches (450 mm)] [36 inches (910 mm)], and as follows:

1. Mechanically fasten with self-drilling No. 10 (4.8 mm) diameter or larger carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-½-inch (38-mm) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-½ inches (38 mm), with end joints as follows:

1. End Joints: [Lapped 2 inches (51 mm) minimum] [Butted] [Lapped 2 inches (51 mm) minimum or butted at Contractor's option].

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches 9305 mm) apart with at least 1 weld at each corner.

E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in Division 7 Section "<Insert title of applicable roofing Section>".

3.4 FLOOR DECK INSTALLATION

A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: [5/8 inch (16 mm)] [3/4 inch (19 mm)], nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of ½ of the span or 36 inches (910 mm), and as follows:

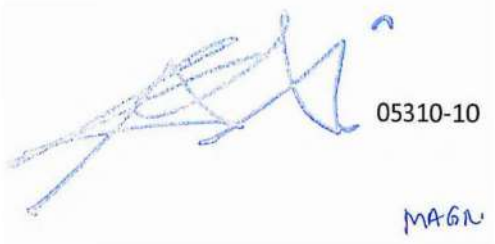
1. Mechanically fasten with self-drilling No. 10 (4.8-mm) diameter or larger carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-½ inch (38 mm) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of [1-½ inches (38 mm)] <Insert another minimum end bearing if required>, with end joints as follows:

1. End Joints: [Lapped] [Butted] [Lapped or butted at Contractor's option].

D. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arch shields after welding shear connectors.

E. Pour Stops and Girder fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.



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F. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.

G. Cellular-Raceway Deck Floor Systems with Electrical Distribution: Install cellular floor system with deck assembled form [all-cellular units] [alternating cellular units with non-cellular composite units] [units indicated].

1. Maintain smooth cellular-raceway interiors free of welds or mechanical fasteners.

H. Install piercing hanger tabs not more than 14 inches (355 mm) apart in both directions, within 9 inches (228 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. Field welds will be subject to inspection.

C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:

1. Shear connector stud welds will be visually inspected.
2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

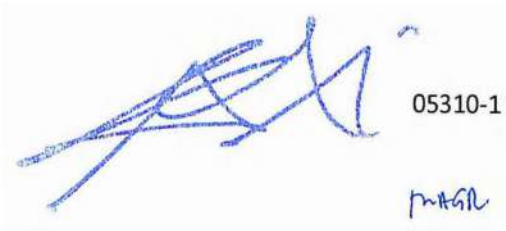
E. Remove and replace work that does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on [both surfaces] [top surface] of prime-painted deck immediately after installation, and apply repair paint.

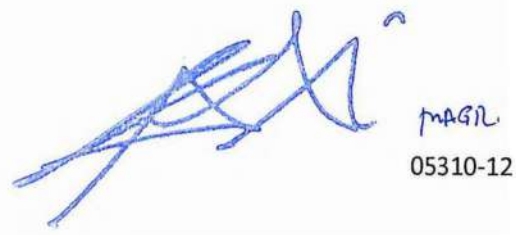


1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 9 Section "<Insert applicable field painting Section title>".

C. Repair Painting: Wire brushing, cleaning and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 9 Section "<Insert applicable field painting Section title>".

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310



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.

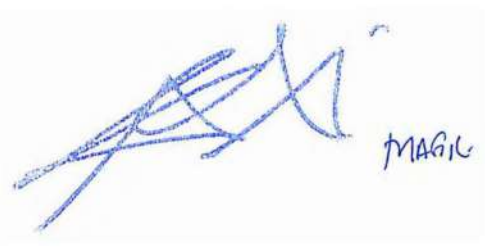
B. Related Sections: The following Sections contain requirements that relate to this Section:

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.

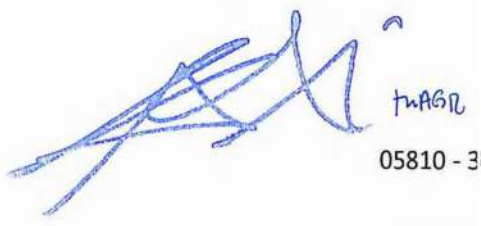
G. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.

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

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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.

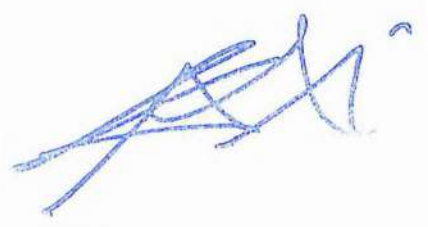
K. Foam Seal: Non-extruded, low-density, cross-linked, nitrogen-blown ethylene vinyl acetate polyethylene copolymer foam; *Evazote* 380 E.S.P. Provide adhesive for installation recommended by the manufacturer.

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).



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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.

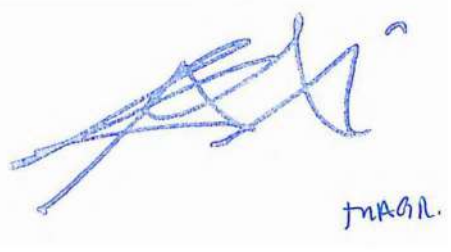
5. High-Performance Organic Coating: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply 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

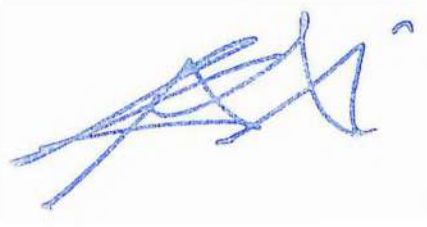
A. Manufacturer's Instructions: In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for phases of Work, including preparing substrate, applying materials, and protecting installed units.

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.



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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

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SECTION 07220 - LIGHTWEIGHT INSULATING CONCRETE ROOF INSULATION
rev. 8/7/2010

PART 1: GENERAL

1.01 SECTION INCLUDES:

A. Lightweight Insulating Concrete Application to Prepared Substrate

1.02 RELATED SECTIONS

A. Section [-----] - Testing Laboratory Services

B. Section [-----] - Rough Carpentry

C. Section [-----] - Roof Deck

D. Sections [7526 / 7541] - Roofing

E. Section [-----] - Sheet Metal Flashing and Trim

F. Section [-----] - Sprayed Fire Protection

1.03 REFERENCE STANDARDS

References in these specifications to standards, test methods and codes, are implied to mean the latest edition of each such standard adopted. The following is an abbreviated list of associations, institutions, and societies which may be used as references throughout these specifications.

ASTM	American Society for Testing and Materials Philadelphia, PA
FM	Factory Mutual Engineering and Research Norwood, MA
UL	Underwriters Laboratories Northbrook, IL

1.04 SUBMITTALS

All submittals which do not conform to the following requirements will be rejected.

A. Submittal of Equals: Submit lightweight insulating concrete systems to be considered as equals to the specified roof system no less than 10 days prior to bid date. Primary lightweight insulating concrete systems which have been reviewed and accepted as equals to the specified system will be listed in an addendum prior to bid date; only then will equals be accepted at bidding. Submittals shall include the following:

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1. Submit manufacturer's instructions for proper placement of the proposed lightweight insulating concrete roof insulation system.

2. Submit documentation confirming compliance with FM 1-195 PSF Windstorm Resistance Classification utilizing the specific roof membrane system proposed for use on this project.

   a) Submit documentation confirming that the specific expanded polystyrene proposed for use on this project is approved by Factory Mutual for use in conjunction with the proposed lightweight insulating concrete system.

3. Submit a letter from the supplier of the proposed lightweight insulating concrete system confirming that the expanded polystyrene used as a component in the lightweight insulating concrete system is to be furnished by the supplier of the proposed lightweight insulating concrete system.

4. Submit shop drawings including a roof plan, roof slopes, and thickness of insulation.

5. Submit a sample copy of the warranty covering the proposed lightweight insulating concrete system.

6. Submit a sample copy of the roof system guarantee covering the proposed lightweight insulating concrete system and roof membrane system.

7. Submit a letter from the roof membrane manufacturer confirming the intention to issue the roof system guarantee covering the proposed lightweight insulating concrete system and roof membrane system at project completion.

8. Submit a letter from the proposed lightweight insulating concrete system supplier confirming that the Contractor is approved to install the proposed lightweight insulating concrete system.

1.05 QUALITY ASSURANCE

A. **Acceptable Contractor:** The contractor must be certified in writing prior to bid by the supplier to install the proposed lightweight insulating concrete system and specified roof membrane system for single source warranty.

B. **Agency Approvals:** The proposed lightweight insulating concrete system shall conform to the following requirements. No other testing agency approvals will be accepted.

   1. **Underwriters Laboratories:** Tested by Underwriters Laboratories in accordance with the procedures of ASTM E 119 and listed in the most recent Underwriters Laboratories Fire Resistance Directory. Lightweight insulating concrete roof insulation components are defined by Underwriters Laboratories under sections CCVW for foamed plastic and CCOX for floor or roof - topping mixture in the latest edition of the Underwriters Laboratories Fire Resistance Directory.

   2. **Factory Mutual:** Tested by Factory Mutual Research and listed in the most recent Factory Mutual Approval Guide as non-combustible or Class 1, and for 1-540 windstorm

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classification utilizing the specific roof membrane system proposed for use on this project.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. **Delivery:** Deliver materials in the supplier's original unopened packages, fully identified as to manufacturer, brand or other identifying data and bearing the proper Underwriters Laboratories label.

B. **Storage:** Store Insulcel concentrate at temperatures between 52°F and 80°F (11° - 27° C). Expanded polystyrene board should not be stored in areas of standing water prior to application but can be exposed to rainwater before application. Boards must be clean and free from foreign substances.

1.07 PROJECT/SITE CONDITIONS

A. Requirements Prior to Job Start

1. **Notification:** Give a minimum of 5 days notice to the Owner and manufacturer prior to commencing any work and notify both parties on a daily basis of any change in work schedule.

2. **Permits:** Obtain all permits required by local agencies and pay all fees which may be required for the performance of the work.

3. **Safety:** Familiarize every member of the application crew with all fire and safety regulations recommended by OSHA, NRCA and other industry or local governmental groups.

B. Environmental Requirements

1. **Precipitation:** Do not apply materials during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure that materials and building interiors are protected from possible moisture damage or contamination.

2. **Temperature Restrictions:** When air temperatures of 40°F (4.4°C) or above are predicted to occur within the first 24 hours after placement, normal mixing and application procedures may be used.

1.08 WARRANTY/GUARANTEE

A. **Insulation System Warranty:** Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with the insulation system manufacturer's 10 year labor and materials warranty. The insulation system warranty shall include the composite roof deck system consisting of pregenerated foam and polystyrene insulation panels. All repair or replacement costs covered under the guarantee shall be borne by the insulation system manufacturer. The guarantee shall be a term type, without deductibles or limitations on coverage amount, and be issued at no additional cost to the Owner. Specific items covered during the term of the insulation system warranty include:

1. The actual resistance to heat flow through the roof insulation will be at least 80% of the design thermal resistance, provided that the roofing membrane is free of leaks.

2. The roof insulation will remain in a reroofable condition should the roof membrane require replacement (excluding damage caused by fastener pullout during removal of the old membrane.)

3. The Insulating Concrete Warranty will not limit, by geographic location, the owners rights for claims, actions, and/or proceedings.

4. The roof insulation material will not cause structural damage to the building as a result of expansion from thermal or chemical action.

   > Lightweight Ten Year Roof Insulation Performance Warranty

B. Roof System Guarantee: Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with a labor and materials endorsement to the roof membrane manufacturer's guarantee confirming that a single guarantee covers both the lightweight insulating concrete system and the roof membrane/flashing system. The roof system guarantee shall include both the roofing and flashing membrane, and the specified new lightweight insulating concrete system consisting of pregenerated foam, patented-pre-formed polystyrene panels, base sheet, and base sheet fasteners. All repair or replacement costs covered under the guarantee shall be borne by the roof membrane/flashing manufacturer. The guarantee shall be for a 10 year term, without deductibles or limitations on coverage amount, and be issued at no additional cost to the Owner. Specific items covered under the roof system guarantee include:

1. The actual resistance to heat flow through the roof insulation will be at least 80% of the design thermal resistance, provided that the roofing membrane is free of leaks;

2. The roof insulation will remain in a reroofable condition should the roof membrane require replacement (excluding damage caused by fastener pullout during removal of the old membrane.)

3. The roof insulation will remain in place even if the roof membrane sustains wind damage covered by the guarantee.

4. The base sheet, base sheet fasteners and polystyrene panels will be covered by the guarantee.

5. The roof system guarantee will not limit, by geographic location, the Owner's rights for claims, actions, and/or proceedings.

6. The roof insulation material will not cause structural damage to the building as a result of expansion from thermal or chemical action.

   > Ten year Roof System Guarantee

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PART 2: PRODUCTS

2.01 MATERIALS

A. **Acceptable Manufacturer:** Provide a lightweight insulating concrete roof insulation system incorporating pregenerated foam and expanded polystyrene board supplied by a single manufacturer.

- RT Insucel or Insucel Roof Insulation System by Siplast Engineered Lightweight Roofing Insulation.

2.02 SYSTEM DESCRIPTION

A. **Lightweight Concrete System Description:** Provide materials used in the lightweight concrete roof insulation system conforming to the following.

1. Galvanized Metal Deck: Corrugated steel decking incorporating a pre-applied galvanized coating conforming to a minimum Class G-60 as specified in ASTM A 525 and having slots in the flutes equal to a minimum of 0.5% of the deck area. Metal deck shall be Ga. 22 Type B deck at 80 ksi.

2. Concrete roof decks shall be clean and free of any surface contaminents, minimum 3,000 PSI strength. New concrete decks will be allowed to cure for a minimum of 28 days prior to any roofing.

2. Portland Cement: Portland cement conforming to Type I, II, or III as defined by ASTM C 150.

3. Foam Concentrate: Protein based foam concentrate conforming to ASTM C 869 and ASTM C 796.

4. Expanded Polystyrene Insulation Board: Expanded polystyrene (EPS) insulation board having a nominal density of 1 pcf (16 kg/m^3) defined as Type I by ASTM C 578 and containing approximately 3% open area. Each bundle of board shall be delivered to the job site with clear identification as to manufacturer and shall carry the Factory Mutual approval label and the Underwriter's Laboratories Classified label on each bundle.

5. Water: Potable water that is clean and free of deleterious amounts of acid, alkali and organic materials.

2.03 MIX DESIGN

A. **Density:** Mix Portland cement and pregenerated foam with water to achieve a wet density ranging from 38 to 48 pcf (609 to 769 kg/m^3), resulting in a minimum dry density of 30 pcf (481 kg/m^3) and minimum compressive strength of *200-300* psi (1469-2070 kPa).

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PART 3: EXECUTION

3.01 EXAMINATION

A. **General:** Ensure that all surfaces to receive lightweight insulating concrete are free of oil, grease, paints/primers, loose mill scale, dirt, or other foreign substances. Where necessary, cleaning or other corrections of surfaces to receive lightweight insulating concrete is the responsibility of the party causing the unacceptable condition of the substrate.

B. **Substrate Acceptance:** With the general contractor present, examine surfaces to receive the roof insulation system and determine that the surfaces are acceptable prior to placement of the lightweight insulating concrete system.

3.02 PREPARATION

A. **General:** Remove water or any other substance that would interfere with bonding of the lightweight concrete system.

3.03 APPLICATION

A. **General:** Provide equipment and application procedures conforming to the material supplier's application instructions.

B. **Application:** Place a 1/8-1/2 inch (3-12.5 mm) minimum thickness of lightweight insulating concrete slurry over substrate deck before embedding the specified expanded polystyrene insulation panels. Place a minimum 1 inch (25 mm) thickness of expanded polystyrene insulation panels as shown in the approved shop drawings and in a brick-like pattern within 30 minutes of applying the insulating concrete slurry coat to the substrate. The maximum allowable expanded polystyrene insulation panel step in a stair-step design is 1 inch (25 mm). The following day place a 2 inch (51 mm) minimum thickness of the lightweight insulating concrete over the top of the expanded polystyrene insulation panels.

C. **Thermal Resistance:** Install the specified lightweight insulating concrete system to provide for an **[average]** thermal value of **R-15** or as shown on the architectural details/drawings.

D. **Slope:** Install the specified lightweight insulating concrete system to provide for a minimum positive roof slope of **[1/4]** inch per foot (**[2]** %). See the structural drawings for slope provided by the roof framing system.

3.04 FIELD QUALITY CONTROL

A. **Protection:** Avoid roof-top traffic over the roof insulation system until one can walk over the surface without creating surface damage.

B. **Compressive Strength Testing:** The Architect has the option to select an independent testing laboratory to randomly sample the top placement of insulating concrete to verify the thickness and density, and to secure and test compressive strength cylinders in accordance with ASTM C 495. The Owner will be responsible for the cost and engagement of the independent testing laboratory services.

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C. **Application Monitoring:** Monitor the thickness and wet density of the lightweight insulating concrete at the time of placement to determine conformance to the manufacturer's requirements. Monitor the placement of proper thickness of polystyrene insulation board in accordance with the contract documents.

D. **Fastener Withdrawal Testing:** Conduct a base ply fastener pull test 3 or more days following the application of the lightweight insulating concrete to ensure a minimum withdrawal resistance of 40 pounds (18 kg) per fastener.

3.05 PATCHING

A. **Patching:** Perform all patching and repairing of insulating concrete using Zono-Patch or other materials approved by the lightweight insulating concrete supplier.

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SECTION 07526

MODIFIED BITUMEN SHEET ROOFING
(For Concrete Decks / Assembly # 1-RC)

PART 1 - GENERAL

1.01 SUMMARY

A. Modified Bitumen Sheet Roofing
B. Modified Bitumen Flashings
C. Roof Accessories
D. Walkways
E. Surfacing

1.02 RELATED SECTIONS

A. Division 6 Section Carpentry: Wood Nailers.
B. Division 7 Section Flashing and Sheet Metal: Metal Counter Flashings.
C. Division 7 Section Roof Specialties: Roof Hatches, Prefabricated Curbs.
D. Division 7 Section Sealants: Caulks, Sealants.
E. Division 15 Section Drainage and Vent Systems: Roof Drains.

1.03 REFERENCES

A. ASTM-American Society for Testing and Material
B. AWPB-American Wood Preservers' Bureau
C. ASTM D41-Asphalt Primer Used in Roofing
D. NRCA-National Roofing Contractors Association
E. ASTM D2178-Asphalt Glass Felt Used in Roofing
F. ASTM D312-Asphalt Used in Roofing
G. UL-Underwriters Laboratories, Fire Classification
H. SMACNA-Sheet Metal and Air Conditioning Contractors National Association
I. ASTM D1227-Asphalt Emulsion as a Roof Coating
J. ASTM D1863-Mineral Aggregate
K. ASTM D2824-Aluminum Pigmented Asphalt Roof Coating

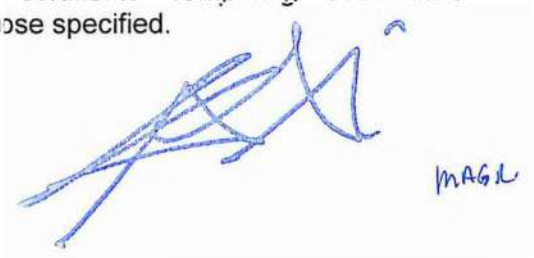
1.04 REGULATORY REQUIREMENTS

A. UL Classification: Class A
B. Factory Mutual (FM) System Classification: 1-705
C. Additional Test Agencies & Building Code Requirements: As applies

1.05 SUBMITTALS

A. Submit product data for: All components to be used, *i.e.*: Primer, Membranes, Coatings, *et al*
B. When materials are specified or a particular make or trade name is specified, it shall be indicative of a standard required. Bidder proposing substitutes shall submit the following:

1. Written application with explanation of why it should be considered.
2. Accredited testing laboratory certificate comparing substitute's physical/performance attributes to those specified.



3. Smallest standard package of adhesive, coating, mastic, sealant, ply sheet, fastener(s) and flashing materials.
4. Three job references available for inspection where substitutes were used under similar conditions.

C. Only substitutions approved in writing by Owner prior to scheduled installation will be considered.

1.06 QUALITY ASSURANCE

A. Manufacturer
1. Shall provide local Technical Sales Representative to make start-up inspection and in-progress site inspections at regular intervals.
2. Shall provide final inspection of completed roofing system and issuance of the warranty.

B. Contractor
1. Roofing contractor shall be a registered applicator by the Manufacturer.
2. Contractor shall retain a workmanship warranty for the specified system within the manufacturer's warranty.
3. Strict adherence to the manufacturer's most current published specifications are to be followed. Deviations must be approved in writing by the architect and manufacturer prior to installation.

C. Designation of Responsible Personnel

D. Walkover Inspection
1. Attendance: Representative of Owner/Architect, General Contractor, Roofing Contractor and Manufacturer's Technical Representative.

E. Final Inspection
1. Will be scheduled by roofing contractor upon job completion.
2. Attendance: Representative of Owner/Architect, General Contractor, Roofing Contractor and Membrane Manufacturer's Technical Representative.
3. Minimum agenda:
a) Walkover inspection.
b) Identification of problems which may impede issuance of warranty.
c) Creation of punch list.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials.
1. Deliver and store materials under provisions of Section 01600.

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2. Deliver materials to job-site in new, dry, unopened and well marked containers showing product and manufacturer's name, production date and/or product code. All materials delivered shall be on pallets.
3. Deliver materials in sufficient quantity to allow continuity of work.

B. Storage of Materials.

1. Storage of plies to be protected from water or extreme humidity.
2. Store all roll roof materials on end to prevent their becoming deformed/damaged. Discard rolls which have flattened, creased or otherwise damaged.
3. Place materials on pallets which are at least four (4) inches above the ground. Do not stack pallets.
4. Rooftop Storage: Disperse materials to avoid concentrated loading.
5. Cover top and sides of all exterior stored materials with canvas tarpaulin (not polyethylene). Secure tarpaulin.

C. Material Handling.

1. Handle plies to avoid bending, tearing or other damage during transportation and installation.
2. Material handling equipment shall be selected and operated so as not to damage existing construction or applied roofing. Do not operate or situate material handling equipment in location(s) that will hinder smooth flow of vehicular or pedestrian traffic.

D. Safety Requirements.

1. All application, material handling and associated equipment shall conform to and be in conformance with OSHA safety requirements.
2. Comply with Federal, State, Local and Owner fire safety requirements.
3. Maintain fire extinguishers within easy access whenever power tools, kettles or torches are being used.

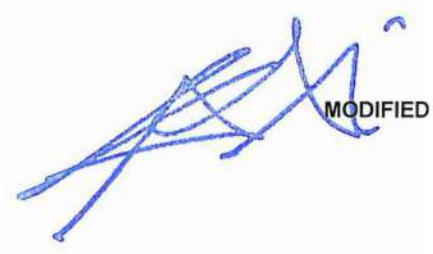
1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing membrane during inclement weather.
B. Do not apply roofing membrane to damp or frozen substrates.
C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.

1.09 WARRANTY

A. Manufacturer shall provide:

Ten (10) years for Material Only.



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PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. *Danosa Caribbean, Inc. (www.danosapr.com), Lot 29, C Street, Luchetti Industrial Complex Bayamon, PR 00961*

B. Approved Substitutions.

2.02 SHEET MATERIALS

A. Modified Bitumen Base Sheet: **Glasdan R-36.** SBS Modified Bitumen Membrane base membrane with a fiberglass mat reinforcement, protected with a burn-off film and or silica sand on either side. 3 mm. ASTM-D-6163-98 Type I Grade S

B. Modified Bitumen Membrane: **Glasdan RM-4.** SBS Modified Bitumen top membrane with a fiberglass mat reinforcement, finished with ceramic granule as top protection surface area and burn-off film or silica sand on the other side. ASTM-D-6163-98 Type I Grade G 3.6 mm

C. Flashing Membrane: **Glasdan AL-80-4.** (SBS) Modified Bitumen flashing membrane with a fiberglass mat reinforcement, finished with aluminum clad top protection surface area and burn-off film on the other side. ASTM-D-6298-98 3.6 mm

2.03 BITUMINOUS MATERIAL

A. Asphalt Primer: ASTM D41, Primer.
B. Elastomeric Adhesive: ASTM D3019, Richport Modified Cold Adhesive.
C. Elastomeric Mastic: ASTM D4586, Richport Cold Flash Adhesive.
D. Aluminum Coating: ASTM D2824, Richport Aluminum Roof Coating.
E. Asphalt Emulsion: ASTM D1227, Richport Modified Asphalt Emulsion.

2.04 RELATED MATERIALS

A. Sealant: One-part urethane.
B. Cants: Perlite, ASTM C 728, 4" face.
C. Prefabricated Roof Hatches
D. Traffic Surfacing: approved equal to DAN-O-PAD by *Danosa Caribbean, Inc.*
E. Lead boots and flashing; ASTM B-29, 4 lb. per square foot.
F. Roof Penetrations protection: approved equal to Chem-Curb by *Danosa Caribbean, Inc.*
G. Grease Containment: approved equal to Grease Guard by *Danosa Caribbean, Inc.*

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PART 3 - EXECUTION

3.01 EXAMINATION AND PROTECTION

A. Inspection

1. Verify installation conditions as satisfactory to receive work.
2. Do not install new roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.
3. Check projections, curbs and deck for inadequate anchorage, foreign material, moisture, or unevenness that would prevent quality of execution of the new roofing system.

B. General Workmanship

1. Substrate: Free of foreign particles prior to laying roof membrane.
2. Phased application: Not permitted, all plies shall be completed each day.
3. Confine equipment, storage of materials, debris and the operations and movement of workers within the limits agreed upon for the project.
4. Where wheeled or other traffic over partially completed roofing is unavoidable, provide adequate exterior protection to the roof.
5. Wrapper and package materials: Not to be included in roof system.
6. All metal and masonry shall be asphalt primed before fully adhering flashing sheets.
7. Mechanical Fasteners: Seated firmly with fastener heads flush or below surface.
8. Base flashing height is not less than eight (8) inches above finished surface.

C. Protection

1. Contractor shall be responsible for protection of property during course of work. Lawn, shrubbery, paved areas and building shall be protected from damage at no extra cost.
2. Roofing and flashing shall be installed and sealed in a watertight manner on same day of installation or upon the arrival of inclement weather.
3. At the end of each work day, partial installation shall be sealed with water stops along edges to prevent water entry.
4. At the start of each work day, drains within daily work area shall be plugged. Plugs are to be removed at end of each work day or before arrival of inclement weather.
5. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day or before arrival of inclement weather.
6. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface and equipment movement. Move equipment and ground storage areas as work progresses.

D. Surface Preparation

1. Remove all existing roof membrane, insulation and flashings down to the deck and curbs.
2. Verify structural integrity of the deck. Notify the Architect of any deck or curb deficiency.

3. Remove deteriorated or damaged wood blocking and install new treated wood blocking to match existing. See detail drawings.

3.02 ROOF MEMBRANE APPLICATION

Substrate must be suitable to receive and hold roof system materials.
Prime all deck surfaces with asphalt primer at 1 gallon per 100 to 200 square feet and allow to dry.
Starting at the low point, install modified bitumen membrane by **Torch.**

A. *Work Area Preparation:*
   1. Adequate ventilation is required; enough ventilation such that personnel exposures to hazardous concentration of airborne contaminants are maintained at or below the allowable levels specified by OSHA or NIOSH.
      a. Special care should be taken when torch welding is done in close or confined spaces due to possible concentration of contaminants and potential oxygen depletion. Appropriate precautions shall be observed. Use of mechanical ventilation to force air movement or use of approved respirators may be required.
   2. All roof openings and edges should be protected or guarded in conformity with OSHA standards.
   3. In awareness of other personnel in the torch welding area is mandatory, in tight quarters; only one (1) torch should be used.
   4. The installer needs to have previously noted the locations of all pipes, curbs, or other roof top projections before working with torch welding.
   5. Removal of combustible debris from the application area before the torch welding application begins is mandatory.
   6. Appropriate precautions should be taken when torch welding in the proximity of gas pipe joints, HVAC coupling joints, or electrical service lines.
   7. A base roofing ply shall cover all flammable materials (e.g. wood walls and wood fiber cant) before the torch welding application begins.
   8. No torch welding shall be done unless the surrounding atmosphere is nonflammable and unless combustibles are moved away or properly protected from fire hazards.
   9. Combustible materials which are present on a roof. Such as material wrappers, solvents, primers and roof cements shall be moved to a designated safe location.
   10. Combustible materials which are present on a roof and are not movable shall be protected from fire hazards.
   11. Combustible materials present on adjoining building surfaces (e.g. Shake shingles or wood siding) should be protected by covering with fire retardant blankets or a protective shield.
   12. Sufficient fire extinguishing equipment shall be ready for use where torch welding roof work is being done. The fire extinguishing

equipment should be portable fire extinguishers (Type ABC). In addition, buckets of sand and pails of water are advisable. Portable fire extinguishers shall be of the size and type required by local codes. A minimum of one 20 lbs. fire extinguisher per torch or torching machine should be on the roof at all times at the torching location. Special care shall be taken to check all fire extinguishers prior to and at the completion of the day's work to make sure they are full and operable.

B. *Application:*

1. Start at the low point of the roof and progress to the high point. The membrane shall be installed perpendicular to the slope of the roof except when the slope exceeds 3" per foot. At vertical surfaces, abutting the roof, the membrane shall extend to the cant and must be heat welded to the underlying membrane previously installed.
    a. On slopes of more than three inches per foot, the seams should run parallel to the slope of the roof.
2. All overlaps at the membrane seam shall be installed so as to have "up" slope laps over "down" slope laps.
3. Danosa membranes shall never be applied by any method except with a propane torch or electric heat welding devices designed for application modified bitumen.
    a. Flammable and solvent-based material (e.g. plastic cement) should not be exposed to flame.
    b. When re-roofing, wood and fiber cant strips are extremely flammable and should be removed or protected.
    c. Restaurant and food service exhaust vents can contain grease (*Grease Guard* grease containment system is recommended for these areas). All intake fans should be shut off during application with special care taken to keep torches away from openings. Exhaust vents for laundromats in condominiums, apartments and other multiple tenant dwellings can contain lint and debris. Open flames should be kept clear of all vents.
4. Membranes must not be applied during adverse weather or without precautionary measures in temperatures below 40° F.
5. The coiled membrane shall be unrolled approximately 15 feet, aligned, then the propane torch flame applied to the exposed outer surface of the coiled membrane until the bitumen reaches the proper application temperature, causing to develop a slight sheen. Care should be taken to avoid overheating which may result in damage to or improper adhesion of the membrane. The flame should be moved from side to side and up the lap edge while the membrane is slowly unrolled and adhered to the underlying surface. Subsequent shift of the roll shall be avoided after heating has begun. When complete, the remaining membrane shall be re-rolled and installed in the same manner. All end laps must be staggered so that no adjacent end laps coincide.

6. The end laps shall be lapped six inches (6"), and the side laps must be lapped four inches (4"). A bitumen bleed-out approximately ¼" to ½" must be obtained at all seam areas.
    a. To ensure the proper ½" flow of bitumen at the seam areas, a roller may be used. The man using roller should follow behind the torch man no more than 4 feet nor less than 3 feet to be sure that membrane will be in condition to produce proper bleed-out.
7. The seam can be rolled with a hand roller or troweled with heated trowel. When one end is complete, re-roll the opposite end not yet torched, and install in the same manner.
8. All end laps should be staggered a minimum of 15 feet.
9. All LP-Gas cylinders shall be secured in a cylinder storage area at the end of each work day.
10. All crews shall make a safety check of all equipment and LP-Gas cylinders prior to, and at the completion of the day's work
11. A fire watch shall be implemented on a daily basis after torch applications are completed. The job foreman or other designated personnel shall walk the area of application at the end of the day, checking for hot spots on the roof. A fire watch shall be conducted for a minimum of one hour after the last torch is shut off for the day.

C. *Seaming:*

1. The bleed out of bitumen is troweled to insure a complete seal and watertight integrity.
2. Proper troweling is achieved by using a heated trowel. The seam area and trowel should be heated simultaneously.
3. Use heated trowel to achieve a smooth and watertight seam at all overlaps.

3.03 FLASHINGS

A. Modified Bitumen Flashings:

1. Set perlite cant in elastomeric mastic or mechanically attach.
2. Install new roofing two inches minimum beyond top edge of cant.
3. Prime the wall surface with asphaltic primer.
4. Adhere flashing membrane completely to roofing membrane. Lap sheeting ends six (6) inches. Ensure complete bond without wrinkles or voids.
5. Membrane coverage - Sufficient so that after being installed, membrane will be eight (8) inches minimum up the parapet wall. It will extend at least six (6) inches beyond to edge of the cant onto the roof surface.
6. See detail drawings for individual flashing requirements.

3.04 DAILY WATERSTOP TIE-IN

A. End of day

1. Remove debris from top ply of felt along termination, width eighteen (18) inches.

2. Adhere twelve (12) and eighteen (18) inch wide ply sheets from exposed deck to applied roofing with a continuous 1/16" inch thick application of water cut-off mastic. Extend eighteen (18) inch wide felt three (3) inches on both sides of the twelve (12) inch felt.

B. Beginning of next day's work

1. Remove temporary connection by cutting felts evenly along edge of existing roof system.

3.05 FIELD QUALITY CONTROL

A. Repair of deficiencies

1. Installations or details noted as deficient during Final Inspection must be repaired and corrected by applicator.

3.06 CLEANING

A. Immediately upon job completion, roof membrane and flashing surfaces shall be cleaned of debris.

B. Contractor shall be responsible for the cost of all clean-up procedures.

END OF SECTION 07526

SECTION 07620

FLASHING AND SHEET METAL

1. SCOPE

A. Work Included: Provide flashing and sheet metal not specifically described in other sections of these Specifications but required to prevent penetration of water through the exterior shell of the building.

2. QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. In addition to complying with pertinent codes and regulations, comply with pertinent recommendation contained in current edition of "Architectural Sheet Metal Manual" published by the Sheet Metal and Air-Conditioning Contractors National Association (SMACNA).

C. Standard commercial items may be used for flashing trim, reglet and similar purpose provided such items meet or exceed the quality standards specified.

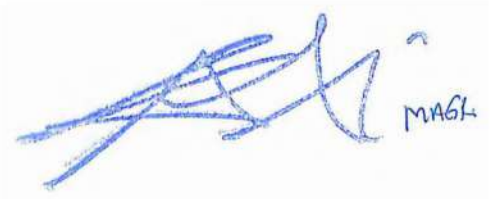
3. SUBMITTALS

A. Product data: Within thirty-five (35) calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.



4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

4. MATERIAL AND GAGES

A. Where sheet metal is required, and no material or gage is indicated on the Drawings, provide the highest quality and gage commensurate with the referenced standards.

5. ALUMINUM

A. Provide 0.032 300 3-H-14 mill finish aluminum sheet metal complying with FSQQ A-250/2C and ASTM-B-247-86

6. NAILS, RIVETS, AND FASTENERS

A. Use only 3/16" x 1" long closed & done aluminum head rivets and aluminum flat washers with neoprene facing, as required on Contract Documents.

7. ELECTRODES

A. Shall comply with AWS "Specifications for Aluminum and Aluminum Alloy Covered ARC Welding Electrodes", welding process.

8. WELDING

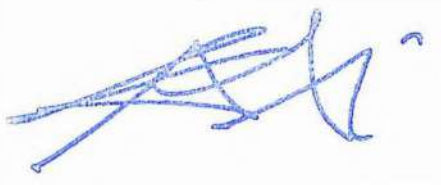
A. Welding process shall be gas metal ARC Welding with shielding gas (*Heliare* by *Union Carbide* in Argon Atmosphere-High Frequency). Follow the requirements of the AWS "Structural Welding Code-Aluminum".

9. OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

10. SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.



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11. WORKMANSHIP

A. General:

1. Form sheet metal accurately and to the dimensions and shapes required, finishing molded and broken surfaces with true, sharp, straight lines and angles, and where intercepting other members, coping to an accurate fit and soldering securely.

2. Unless otherwise specifically permitted by the Architect or PBA representative, turn exposed edges back ½".

B. Form, fabricate, and install sheet metal so as adequately provide for expansion and contraction in the finished Work.

C. Weatherproofing:

1. Finish water-light and weather-right where so required.

2. Make lock seams work flat and true to line, sweating full of solder.

3. Make lock seams and lap seams, when soldered, at least ½" wide.

4. Where lap seams are no soldered, lap according to pitch, but in no case less than 3".

5. Make flat and lap seams in the direction of flow.

D. Joints:

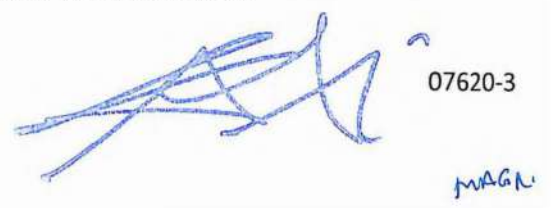
1. Joints parts with rivets or sheet metal screws where necessary for strength and stiffness.

2. Provide suitable water-light expansion joints for runs of more than forty feet (40'-0"), except where closer spacing is indicated on the Drawings or required for proper installation.

E. Nailing:

1. Whenever possible, secure metal by means of clips or cleats, without nailing through the exterior metal.

2. In general, space nails, rivets, and screws not more than 8" apart and, where exposed to the weather, use lead washers.



3. For nailing into wood, use barbed roofing nails 1-14" long bye 11 gage.

4. For nailing into concrete, use drilled plugholes and plugs.

12. ENBEDMENT

A. Embed metal in connection with roofs in a solid be of sealant, using materials and methods described in Section 07900 and/or Section 07951 of these Specifications or the other materials and methods approved in advance by the Architect or PBA representative.

13. SOLDERING

A. General:

1. Thoroughly clean and tin the joint materials prior to soldering.

2. Perform soldering slowly with a well heated copper, in order to heat the seams thoroughly and to completely fill them with solder.

3. Perform soldering with a heavy soldering copper of blunt design, properly tinned for use.

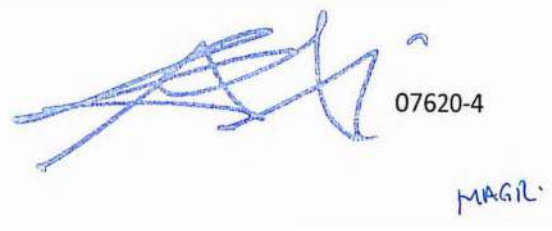
4. Make exposed soldering on finished surfaces near, full flowing and smooth.

B. After soldering, thoroughly wash acid flux with a soda solutions.

14. TESTS

A. Upon request of the PBA representative, demonstrate by hose or standing water that the flashing and sheet metal are completely watertight.

END OF SECTION



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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.

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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.

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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".

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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.

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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.

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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.

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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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Section 07951 – SEALANTS AND CALKING

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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Section 07951 – SEALANTS AND CALKING

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.

Section 07951 – SEALANTS AND CALKING

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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Section 07951 – SEALANTS AND CALKING

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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Section 07951 – SEALANTS AND CALKING

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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Section 07951 – SEALANTS AND CALKING

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.

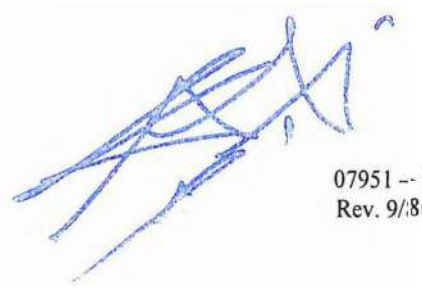
14. Submittals:

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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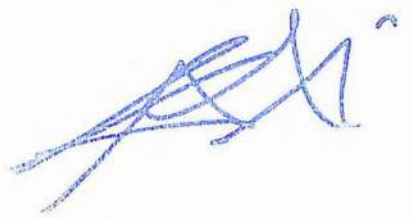
Section 07951 – SEALANTS AND CALKING

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.



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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:

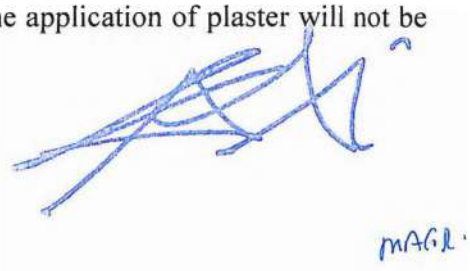
General Requirements:

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.

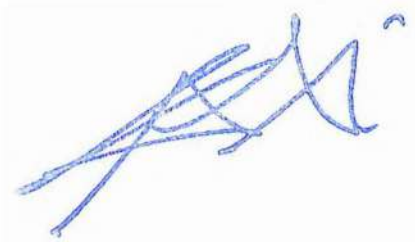
Plaster Proportions: (By volume)

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.



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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:

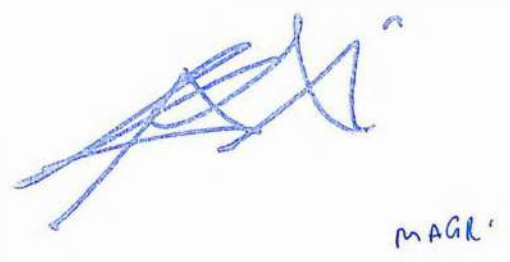
Surfaces shall be free of loose or deteriorated areas, clean and free of dust, loose particles, and foreign matter.

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 09310: INTEGRAL TILES

1. SCOPE

A) Provide ceramic tile where shown on the drawings, as specified in the drawings and herein, and as needed for a complete and proper installation.

2. QUALITY ASSURANCE

A) Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B) Provide manufacturer's Master Grade Certificate stating type and location of each tile material in this section.

C) Provide materials obtained from only one source for each type of tile and color to minimize variations in appearance and quality.

3. SUBMITTALS

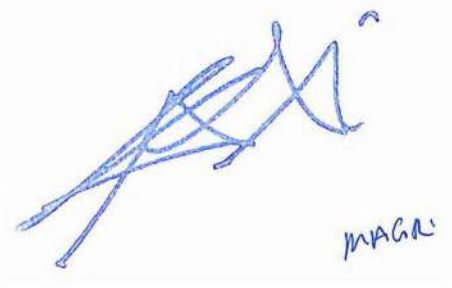
A) Product data: Within five (5) calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this section.
2. Manufacturers' specifications and other data needed to prove compliance with the specified requirements.
3. Samples of each type, class, and color of ceramic tile required, not less than 12" square, mounted on plywood or hardboard backing, and grouted as specified.

B) Except when specifically exempted by the P.B.A., submit Master Grade Certificates for each shipment of ceramic tile prior to arrival of the job site.

4. HANDLING

A) Delivery and Storage.



1. Deliver all materials of this section to the job site in their original unopened containers with all labels intact and legible at time of use.
2. Store all material unde3r cover in a manner to prevent damage and contamination; store only the specified materials at the job site.

B) Protection
1. Use all means necessary to protect tile materials before, during and after installation and to protect the installed work and materials of all other trades.

C) Replacement
1. In the event of damage, immediate3ly make all repairs and replacements necessary to the approval of the P.B.A. and at no additional cost to the Owner.

5. PRODUCTS

A) Integral Tiles
1. Provide integral tile and accessories complying with Tile Council of America Specification 137.1, in colors and patterns selected by P.B.A. from standard colors and patterns of the approved manufacturers.
2. Floor tile shall have a coefficient of friction not less than 0.50 when tested in accordance with ASTM F489, ASTM F609, and the National Bureau of Standards Technical Note 895.
3. For base, provide tiles specified in the drawings.

B) Provide standard accessory shapes as follows:
1. Floors = Cove base
2. Jambs = Bullnose

C) Setting Materials
1. Comply with pertinent recommendations contained in the Tile Council of America "Handbook for Ceramic Tile Installation".
2. Provide setting material as specified in the drawings and meeting the following requirements:

a. Portland cement mortar:
1. Materials:
a. Portland cement complying with ASTM C150, type I or II.
b. Sand complying with ASTM C144.
c. Clean potable water.
2. Where used on floors, provide a job-mix of one part Portland cement to six parts sand.

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PRODUCTS (Cont.)

b. Dry set mortar:
   1. Provide a commercially prepared mixture of Portland cement, sand, and additives imparting water-retentively, for use as a bond coat for setting tile.
   2. Comply with ANSI A1I8.1; except where specifically indicated on the drawings or directed in advance by P.B.A., provide conductive dry set mortar complying with ANSI A1I8.2.

c. Latex-Portland cement mortar:
   1. Provide a commercially prepared mixture of Portland cement and special latex additive for a use as a bond coat for setting tile.
   2. Comply with ANSI A1I8.4.

d. Epoxy mortar:
   1. Provide a commercially prepared mortar system employing epoxy resin and epoxy hardener portions.
   2. Comply with ANSI A118.3.

e. Modified epoxy emulsion mortar:
   1. Provide a commercially prepared mortar system employing emulsified epoxy resins and hardeners with Portland cement and silica sand.
   2. Secure the P.B.A. specific approval of the proposed material prior to use.

f. Furan mortar:
   1. Provide a commercially prepared mortar system consisting of furan resin and furan hardener portions.
   2. Secure the P.B.A. specific approval of the proposed material prior to use.

g. Epoxy adhesive:
   1. Provide an adhesive system employing epoxy resin and epoxy hardener portions formulated for thin-setting of tile on floors.
   2. Provide a product licensed by the Tile Council of America, and bearing that license symbol.

h. Organic adhesive:
   1. Provide a prepared organic material, ready to use ho with no further addition of liquid or powder, which cures or sets by evaporation.

MAGR.

PRODUCTS (Cont.)

2. Comply with ANSI AI36.1, using type I where exposed to prolonged water presence and using type II at all other locations. Special tile setting mortars will be considered by P.B.A. when complete technical data is submitted in advance.

D) Grout Comply with pertinent recommendations
1. Contained in the Tile Council of America "Handbook for Ceramic tile Installation" in colors selected by P.B.A. from standard colors available from the approved manufacturers.
2. Provide grout as specified drawings and meeting the following requirements:

a. Sand-Portland cement grout:
1. Materials:
a. Portland cement complying with ASTM C150, type I or II.
b. Sand complying with ASTM C144.
c. Hydrated lime complying with ASTM C206.
d. Clean potable
2. Where this grout is indicated on the drawings, or is otherwise directed or required, provide a job-mix consisting of :
a. For joints less than 1/8!1 wide: One part cement to one part fine graded sand.
b. For joints 1/8!1 to ½!1 wide: One part cement to two parts fine graded sand.
c. For joints wider than 2!1: One part cement to three parts fine graded sand.
d. Up to 1.5 part lime may be added. Commercial Portland cement grout:
1. Provide a commercially prepared mixture of Portland cement and other ingredients producing a water-resistant, dense, uniformly colored material.
2. Secure the P.B.A. specific approval of the proposed material prior to use.

b. Dry-set grout:
1. Provide a commercially prepared mixture of Portland cement and additives producing water-retentivity, and suit-able for grouting all floors subject to ordinary use.
2. Provide a product licensed by the Tile Council of America, and bearing that license symbol.

c. Latex-Portland cement grout:
1. Provide a commercially prepared mixture.

MAGR

PRODUCTS (Cont.)

2. Secure the P.B.A. specific approval of the proposed material prior to use.

d. Mastic grout:
   1. Provide a commercially prepared grouting composition designed to be used directly from the container, not requiring damp curing, and with high flexibility and stain resistance.

e. Furan resin grout:
   1. Provide a commercially prepared grout system consisting of furan resin and hardener portions, specifically formulated for chemical resistance.
   2. Secure the P.B.A. specific approval of the proposed product prior to use.

f. Epoxy grout:
   1. Provide a grout system employing epoxy resin and hardener portions, with coarse silica filler permitted, especially formulated for industrial and commercial use where chemical resistance is of paramount importance.
   2. Provide a product licensed by the Tile council of America, and bearing that license symbol.

g. Silicone rubber grout:
   1. Provide an engineered elastomeric grout system for interior use employing a single component non-slumping silicone rubber which, upon curing, is resistant to staining, moisture, mildew, cracking, crazing, and shrinking.
   2. Secure the P.B.A. specific approval of the proposed product prior to use.

h. Other Materials:
   1. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of P.B.A.

6. SURFACE

A) Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

7. INSTALLATION

A) General:
1. Comply with ANSI AI08.11, ANSI AI08.2, and the "Handbook for Ceramic Tile Installation" of the tile Council of America, except as otherwise directed by P.B.A. or specified herein.
2. Maintain minimum temperature limits and installation practices recommended by materials manufactures.
3. Do not install tile floors over membrane until the membrane has been tested and accepted.

B) Except where otherwise indicated on the drawings or drawings directed by P.B.A. setting beds for walls and floors.

C) Limits of tile:
1. Extend tile into recesses and under equipment and fixtures to form a complete covering without interruptions.
2. Terminate tile neatly at obstruction edges, and corners, without disruption of pattern or joint alignment.

D) Joining pattern:
1. Lay tile in grid pattern unless otherwise indicated on the drawings or directed by P.B.A.
2. Align joints when adjoining tiles on floor, base and trim, are the same size.
3. Layout tile work, and center the tile fields both directions in each space.
4. Adjust to minimize tile cutting.
5. Provide uniform joint widths.

E) Provide expansion and control joints where shown on the drawings, and where otherwise recommended by the "Handbook for Ceramic Tile Installation" of the tile Council of America.

F) Grouting:
1. Follow grout manufacturer's recommendations as to grouting procedures and precautions.

G) Cleaning:
1. Upon completion of placing and grouting, clean the work of this section in accordance with recommendations of the manufacturers of the materials used.
2. Protect metal surfaces, cast iron, and vitreous items from effects of acid cleaning.
3. Flush surfaces with clean water before and after cleaning.
4. Surfaces clean and free from cracked chipped, unbounded, and otherwise defective.

8. PROTECTION AND CLEANING

A) Protection:
1. Apply to all clean, complete tile walls and floors a protective coat of neutral cleaner solution, 1 part cleaner to 1 part water.
2. In addition, cover all tile work with heavy duty, non-staining construction paper, market in placed.

B) Cleaning:
1. It shall be the contractor's sole responsibility to properly protect all tile work from damage or defacement of whatever nature until final inspection and acceptance of the work.
2. Just prior to final inspection and acceptance remove all protective coverings and wash and clean tile to the satisfaction of P.B.A.

9. COMPLIANCE

A) The Contractor must verify that the specified material will meet the requirements of Class I Interior Floor Finish as specified in the National Fire Protection Association's Life Safety Code, latest edition (NFPA 10C). If the specified material does not meet this requirement notify P.B.A. immediately.

10. FINAL ACCEPTANCE

A) For final acceptance of the works specified under this section deliver to P.B.A. a letter signed by an officer of the firms manufacturing the tiles certifying that the materials delivered to the project comply in all respects with the provisions of this section of the Specifications and Drawings. Also the Contractor must certified that the materials have been installed following manufacturer's recommendations and will meet the specified floor finish requirements.

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SECTION 09310: CERAMIC TILES

I. SCOPE

A) Provide ceramic tile where shown on the drawings, as specified in the drawings and herein, and as needed for a complete and proper installation.

2. QUALITY ASSURANCE

A) Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B) Provide manufacturer's Master Grade Certificate stating type and location of each tile material in this section.

C) Provide materials obtained from only one source for each type of tile and color to minimize variations in appearance and quality.

3. SUBMITTALS

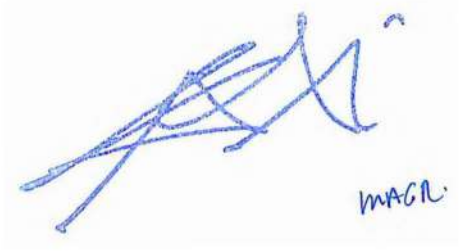
A) Product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this section.
2. Manufacturers' specifications and other data needed to prove compliance with the specified requirements.
3. Samples of each type, class, and color of ceramic tile required, not less than 12" square, mounted on plywood or hardboard backing, and grouted as specified.

B) Except when specifically exempted by the Rene Acosta-Arquitectos, submit Master Grade Certificates for each shipment of ceramic tile prior to arrival of the job site.

4. HANDLING

A) Delivery and Storage



4 HANDLING (CONT.)

1. Deliver all materials of this section to the job site in their original unopened containers with all lables intact and legible at time of use.
2. Store all material under cover in a manner to prevent damage and contamination; store only the specified materials at the job site.

B) Protection
1. Use all means necessary to protect tile materials before, during and after installation and to protect the
installed work and materials of all other trades.

C) Replacement
1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Rene Acosta-Arquitectos
and at no additional cost to the Owner.

5. PRODUCTS

A) Ceramic Tiles
1. Provide ceramic tile and accessories complying with Tile Council of America Specification 137.1, in colors and patterns selected by the Rene Acosta-Arquitectos from standard colors and patterns of the approved manufacturers.
2. Floor tile shall have a coefficient of friction not less than 0.50 when tested in accordance with ASTM F489, ASTM F609, and the National Bureau of Standards Technical Note 895.
3. For base, counterstops, and wall surfaces, provide ceramic specified in the drawings.

B) Provide standard accessory shapes as follows:
1. Wall = In corner square and bullnose cap of waistcoat,
2. Floors = Cove base,
3. Curbs = Bullnose and cove,
4. Jambs = Bullnose.

C) Setting Materials
1. Comply with pertinent recommendations contained in the Tile Council of America "Handbook for Ceramic Tile Installation".

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5 PRODUCTS (CONT.

2. Provide setting material as specified in the drawings and meeting the following requirements:

a. Portland cement mortar:
1. Materials:

a. Portland cement complying with ASTM C150, type I or II.
b. Sand complying with ASTM C144.
c. Building paper complying with Fed Spec - B-790.
d. Galvanized steel diamond mesh weighing 3.4 lbs. per sq. yd.
e. Hydrated lime complying with ASTM C206.
f. Clean potable water.
g. Paper-backed metal lath complying with Fed Spec QQ-L-101 may be used in lieu of the combined mesh and building paper called for above.

2. Where used on floors, provide a job-mix of one part Portland cement to six parts sand.

3. Where used on walls, provide a job: mix of one part Portland cement to five parts sand, with 1/2 part lime, except where other proportions are approved in advance by the Rene Acosta-Arquitectos.

b. Dry set mortar:
1. Provide a commercially prepared mixture of Portland cement, sand, and additives imparting water-retentively, for use as
a bond coat for setting tile.
2. Comply with ANSI AlI8.1; except where specifically indicated on the drawings or directed in advance by the Rene Acosta-Arquitectos, provide conductive dry-set mortar complying with ANSI AlI8.2.
Latex-Portland cement mortar:

1. Provide a commercially prepared mixture of Portland cement and special latex additive for

c. use as a bond coat for setting tile.
2. Comply with ANSI AlI8.4.

Epoxy mortar:
1. Provide a commercially prepared mortar system employing epoxy resin and epoxy hardener portions.
d. 2. Comply with ANSI Al18.3 .

MAGR.

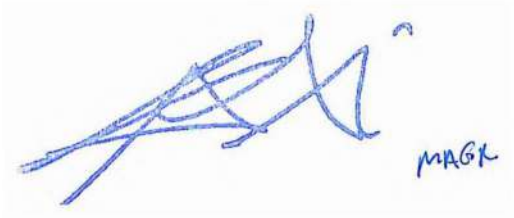
PRODUCTS (CONT.)

e. Modified epoxy emulsion mortar:
1. Provide a commercially prepared mortar system employing emulsified epoxy resins and hardeners with portland cement and silica sand.
2. Secure the Rene Acosta-Arquitectos's specific approval of the proposed material prior to use.

f Furan mortar:
1. Provide a commercially prepared mortar system consisting of furan resin and furan hardener portions.
2. Secure the Rene Acosta-Arquitectoss specific approval of the proposed material prior to use.

g. Epoxyadhesive:
1. Provide an adhesive system employing epoxy resin and epoxy hardener portions formulated for thin-setting of *tile* on floors, walls and counters with epoxy as the major binder.
2. Provide a product licensed by the Tile Council of America, and bearing that license symbol.

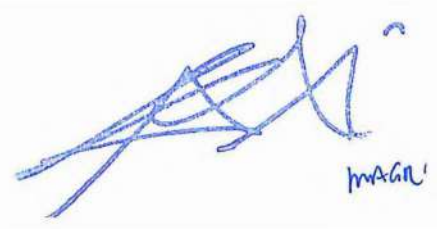
h.Organic adhesive:
1. Provide a prepared organic material, ready to use ho with no further addition of liquid or powder, which cures or sets by evaporation.
2. Comply with ANSI AI36.1, using type I where exposed to prolonged water presence and using type II at all other locations.
Special *tile* setting mortars will be considered by the Rene Acosta-Arquitectos when complete technical data is submitted in advance.
D) Grout Comply with pertinent recommendations contained in the .Tile Council of America "Handbook for Ceramic Tile Installation" in colors selected by the Rene Acosta-Arquitectos from standard colors available from the approved manufacturers. Provide grout as specified drawings and meeting the
2. following requirements:
a. Sand-Portland cement grout: .
1. Materials:
a. Portland cement complying with ASTM C150, type I or II.
b. Sand complying with ASTM C144.
c. Hydrated lime complying with ASTM C206.
d. Clean potable.
2. Where this grout is indicated on the drawings,
or is otherwise directed or required, provide a job-mix consisting of:
a. For joints less than 1/8!1 wide: One part cement to one part fine graded sand;
b. For joints 1/8!1 to 1/2!1 wide: One part cement to two parts fine graded sand;
c. For joints wider than 2!1: One part cement to three parts fine graded sand;
d. Up to 1/5 part lime may be added. Commercial portland cement grout:



1. Provide a commercially prepared mixture of portland cement and other ingredients producing a water-resistant, dense, uniformly colored material.
b. 2. Secure the Rene Acosta-Arquitectos's specific approval of the proposed material prior to use.
Dry-set grout:
1. Provide a commercially prepared mixture of portland cement and additives producing water-retentivity, and suit -able for grouting all walls and floors subject to
c. ordinary use.
2. Provide a product licensed by the Tile Council of America, and bearing that license symbol.
Latex-portland cement grout:
1. Provide a commercially prepared mixture. 2. Secure the Rene Acosta-Arquitectos's specific approval
of the proposed material prior to use. Mastic grout:
d 1. Provide a commercially prepared grouting .composition designed to be used directly from
the container, not requiring damp curing, and with high flexibility and stain resistance.
Furan resin grout:
e. 1. Provide a commercially prepared grout system consisting of furan resin and hardener portions, specifically formulated for
chemical resistance.
2. Secure the Rene Acosta-Arquitectos's specific approval of the proposed product prior to use.
g. Epoxy grout:
1. Provide a grout system employing epoxy resin and hardener portions, with coarse silica filler permitted, especially formulated for industrial and commercial use where chemical resistance is of paramount importance.
2. Provide a product licensed by the Tile Council
of America, and bearing that license symbol. *Silicone* rubber grout:
1. Provide an engineered elastomeric grout system
h for interior use employing a single component non-slumping silicone rubber which, upon curing, is resistant to staining, moisture, mildew, cracking, crazing, and shrinking.
2. Secure the Rene Acosta-Arquitectos's specific approval of the proposed product prior to use.
E) Other Materials
1. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Rene Acosta-Arquitectos.

6. SURFACE

A) Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.



7. INSTALLATION

A) General:

1. Comply with ANSI AI08.1, ANSI AI08.2, and the "Handbook for Ceramic Tile Installation" of the Tile Council of America, except as otherwise directed by the Rene Acosta-Arquitectos or specified herein. .

2. Maintain minimum temperature limits and installation practices recommended by materials manufactures.

3. Do not install tile floors over membrane until the membrane has been tested and accepted.

B) Except where otherwise indicated on the the drawings or drawings directed by the Rene Acosta-Arquitectos setting beds for walls and floors.

C) Limits of tile:

1. Extend tile into recesses and under equipment and fixtures to form a complete covering without interruptions.

2. Terminate tile neatly at obstruction, edges, and corners, without disruption of pattern or joint alignment.

D) Joining pattern:

1. Lay tile in grid pattern unless otherwise indicated on the drawings or directed by the Rene Acosta-Arquitectos.

2. Align joints when adjoining tiles on floor, base, trim, and walls are the same size.

3. Layout tile work, and center the tile fields both directions in each space or on each wall area.

4. Adjust to minimize tile cutting.

1: 5. Provide uniform joint widths

E) Provide expansion and control joints where shown on the drawings, and where otherwise recommended by the "Handbook for Ceramic Tile Installation" of the Tile Council of America.

F) Grouting:

1. Follow grout manufacturer's recommendations as to grouting procedures and precautions.

G) Cleaning:

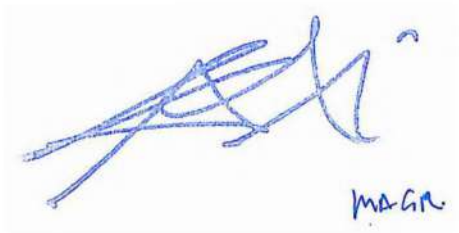
1. Upon completion of placing and grouting, clean the work of this section in accordance with recommendations of the manufacturers of the materials used.

2. Protect metal surfaces, cast iron, and vitreous items from effects of acid cleaning.

3. Flush surfaces with clean water before and after cleaning.

e. surfaces clean and free from cracked, , chipped, unbounded, and otherwise defective

9. PROTECTION AND CLEANING



A) Protection :
1. Apply to all clean, complete tile walls and floors a protective coat of neutral cleaner solution, 1 part cleaner to 1 part water.
2. In addition, cover all tile work with heavy duty, non-staining construction paper, masket in placed.

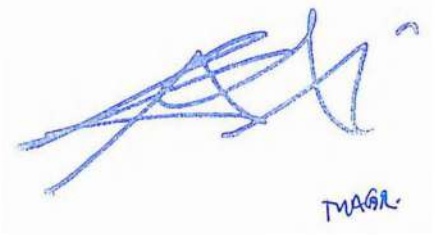
B) Cleaning:
I. It shall be the Contractor's sole responsibility to properly protect all tile work from damage or defacement of whatever nature until final inspection and acceptance of the work.
2. Just prior to final inspection and acceptance remove all protective coverings and wash and clean tile to the satisfaction of the Rene Acosta-Arquitectos.

10. COMPLIANCE

A) The Contractor must verify that the specified material will meet the requirements of Class I Interior Floor Finish as specified in the National Fire Protection Association's Life Safety Code, latest edition (NFPA 1OC) .If the specified material does not meet this requirement notify the Rene Acosta-Arquitectos immediately.

11. FINAL ACCEPTANCE

A) For final acceptance of the works specified under this section deliver to the Rene Acosta-Arquitectos a letter signed by an officer of the firms manufacturing the tiles certifying that the materials delivered to the project comply in all respects with the provisions of this section of the Specifications and Drawings. Also the Contractor must certified that the materials have been installed following manufacturer's recommendations and will meet the specified floor finish requirements.



SECTION 09311

GLAZED WALL TILE AND CERAMIC MOSAIC TILE

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 glazed wall tile and ceramic mosaic tile work is shown on the drawings and in schedules.

3. QUALITY ASSURANCE:

   Manufacturing Standards:

   Provide tile equal to or exceeding the Standard Grade Requirements of ANSI A 137.1.

   When using setting and grouting materials manufactured under TCA license, provide identification and formula number on each container.

   Provide materials obtained from only one source for each type of tile and color to minimize variations in appearance and quality.

4. SUBMITTALS:

   Manufacturer's Data:

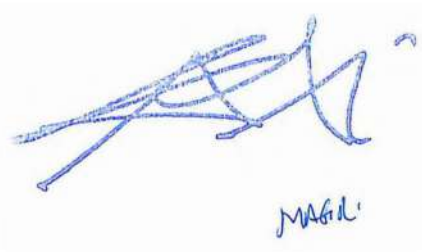
   Submit two (2) copies of manufacturer's specifications and installation instructions for all materials required, except bulk materials. Include certifications and other data as may be required to show compliance with these specifications.

   Samples:

   Submit, for approval of PBA, three (3) samples of each type and color of tile required, not less than 12" square on plywood or hardboard backing, and grouted as required.

   Certificate:

   Provide manufacturer's Master Grade Certificate stating type and location of each different material.



5. PROTECTION:

Take all precautions necessary to protect work of other sections from damage. If plaster and mortar mixing is done in the building, provide waterproof protection under mixer, mixing boxes and water barrels. Should soiling or spattering occur, remove with a dry brush before plaster sets.

Deliver, store and handle all materials to prevent inclusion of foreign matter and water and to prevent damage. Until time of use, packaged materials shall be kept in original, unopened containers with seals unbroken and labels intact.

Close off work spaces to traffic and other work for 48 hours after completion of tile work.

Do not allow newly tiled floors to be walked upon or worked on without using knee boards larger than 4 square feet.

Protect tile work with Kraft paper from damage until acceptance of the project or portion of the project in which tile work is located.

6. JOB CONDITIONS:

Installer must examine the substrate and the conditions under which tile is to be installed. Notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

Surfaces to be tiled shall be plumb, dry, clean, oil-free and waxy films.

Install hangers, bucks, electrical and mechanical work, which are to be in or behind tile, and complete plastered ceilings before tile installation.

7. MATERIALS:

Glazed Wall Tile:

Use "Standard Grade" units complying with ANSI A 137.1. Size, color and pattern shall be as shown on the drawings or as selected by the PBA. Provide cushion edge units. Tile shall have a glazed finish.

Trim and Special Shapes:

Provide out and in angles, bullnoses, coves and trim shapes at head, jamb and sills of opening, of same material and finish as glazed wall tile.

Ceramic Mosaic Tile:

Use "Standard Grade" units, complying with ANSI A 137.1. Size, color and pattern shall be as shown on the drawings or as selected by the PBA. Finish shall be unglazed. Provide cushion edge units and factory=mount tile onto sheets with mesh, dot, net, or other backing method.

Cement:

Portland Cement, ASTM C 150, Type I. Use white cement for grouting.

Lime for Scratch Coat:

Hydrated, ASTM C 206, Type S.

Lime for Tile Work:

Hydrated, ASTM C 207, Type S.

Sand for Scratch Coat:

ASTM C 33, natural or manufactured sand, well graded from coarse to fine.

Sand for Tile:

ASTM C 144, washed clean and graded. For grout, use white sand passing a #16 sieve.

Water: Potable and non-saline.

8. MORTAR AND GROUT:

The Contractor has the option of using any of the following materials as long as he complies with the requirements set forth here.

Portland Cement Mortar for Setting Ceramic Floor Tile: Comply with ANSI A 108.1 and A 108.2. 1 part Portland cement and 6 parts dry sand (by volume). Use enough water so that when mortar surface is stroked with a trowel, surface assumes a smooth, slickened appearance.

Portland Cement Mortar for Setting Wall Tile: One (1) part of cement, one half (½) of one part of lime, and five (5) parts of sand (by volume). Use the necessary amount of water.

Portland Cement Mortar for Scratch Coat: One (1) part of cement, one fifth (1/5) of one part of lime, and five (5) parts of sand (by volume). Use the necessary amount of water.

Dry-Set Mortar: Pre-sanded Portland cement and additives complying with ANSI A 118.1. Provide TCA Formula 763 for glazed wall tile and TCA Formula 759 for ceramic mosaic tile installations, as required.

Latex-Portland Cement Mortar: Latex modified Portland cement thin-set mortar complying with ANSI A 118.4.

Portland Cement Grout: One (1) part white Portland cement to 1 part fine graded sand.

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Commercial Cement Grout: Proprietary comp9ounjd of Portland cement and additives, factory-blended to decrease shrinkage and increase moisture resistance.

Products offered by manufacturers to comply with the requirements for modified Portland cement grout include the following:

Hydroment Ceramic Tile Grout: *The Upco Co.*

L & M Acid – R, Grout; L & M – *Surco Co.*

Dry-set Grout: Proprietary compound composed of Portland cement and additives formulated for the type of tile installed.

Products offered by manufacturers to comply with the requirements for dry-set grout include the following:

Tile-Mate Grout; *The Upco Co.*

Dry Cure; L & M – *Surco Co.*

Latex-Portland Cement Grout: Proprietary composed of Portland cement with latex additive for a more flexible and less permeable grout. Manufacturers offering products to comply with the requirements for latex grout include the following:

Flexible Grout Additive; L & M – *Surco Company.*

9. INSTALLATION:

General:

Comply with the ANSI standard installation specifications A 108.1 through A 108.7 and the Tile Council of America "Handbook for Ceramic Tile Installation", except as otherwise specified.

Mortar Set Glazed Wall Tile: ANSI A 108.1.

Portland Cement Mortar Set Ceramic Mosaic Tile: ANSI A 108.2.

Dry-Set Portland Cement Mortar Wall and Floor Tile: ANSI A 108.5.

Organic Adhesive Set Wall Tile: ANSI A 108.4.

Handle, store, mix and apply proprietary setting and grouting materials in compliance with the manufacturer's instructions.

Extend tile work into recesses and under equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignment.

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Cut and drill tile and trim shapes accurately without damage. Rub all exposed cut edges smooth with abrasive stone.

Grind and fit tile carefully at intersection, against trim finish and at built in fixtures and accessories. Fit tile accurately around outlets, pipes, fixtures and fittings so that plates, escutcheons and collars will overlap cuts.

Jointing Pattern:

Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are the same size. Layout tile work and center tile fields both directions in each space or on each wall area so that no tile is less than one-half size. Adjust to minimize tile cutting. Provide uniform joint widths.

Cleaning:

Clean grout and setting materials from face of tile while materials are workable. Leave tile face clean and free of all foreign matter.

Unglazed tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 10 days after installation.

Leave finished installation clean and free of cracked, chipped, broken, un-bonded, or otherwise defective tile work.

END OF SECTION 09311

CONCRETE RESTORATION SYSTEMS

Sikagard 550W Elastocolor

DIVISION 9 - FINISHES

Section 09830 Elastomeric Coatings

Part 1 - General

1.01 Summary

A. This specification describes the coating of substrates with an elastomeric, crack bridging, anti-carbonation, protective coating.

1.02 Quality Assurance

A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001:2008 certified and have in existence a recognized ongoing qaulity assurance 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 receiveed product training by a manufacturer's representative.

C. Install materials in accordance with all safety and weather conditions required by 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 45°F (7°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 material.

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.

Part 2 - Products

2.01 Manufacturer

A. Sikagard 559W Elastocolor, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio, 43302 is considered to conform to the requirements of this specification.

B. **Sikagard Elastic Base Coat (Smooth & Textured)**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio, 43302 is considered to conform to the requirements of this specification.

C. **Sikagard 552W Primer or SikaLatex R**, 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. Elastomeric Acrylic Coating:

1.Product shall be 100% Acrylic Emulsion with the following properties:

a. Water vapor permeable

b. Can bridge dynamically moving cracks

c. Crack bridging properties maintained at low temperatures

d.The material shall be resistant to dirt pick-up and mildew

B. Elastomeric Acrylic Smooth & Textured Base Coating:

1.Product shall be 100% Acrylic Emulsion with the following properties:

a. Water vapor permeable

b. Can bridge dynamically moving cracks

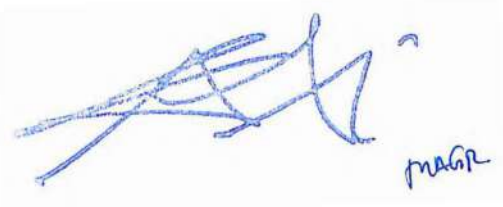
c. Crack bridging properties maintained at low temperatures

C. Adhesion Promoter / Surface Conditioner

1.Product shall be a water-based, acrylic primer with the following properties:

a. Solids content 12.5% -20% by volume

b. Recoat time 4 – 24 hours



2.03 Performance Criteria

A. Properties of the elastomeric Sikagard 550W Elastocolor acrylic coating:

1. Pot Life: indefinite
2. Tack Free Time 6 Hours @ 73°F, 50% Relative Humidity. Final Cure < 24 Hours
3. Carbon Dioxide Diffusion: μCO_2 214,000 Carbon Dioxide Diffusion Resistance at 16 mils (400 microns) $SdCO_2$ = 299 ft. (equivalent air thickness) i.e. Approx. 9-in. of standard concrete cover.
4. Water Vapor Diffusion: μH_2O 2,146 Water Vapor Diffusion Resistance at 16 mils SdH_2O = 2.6 ft. (0.8m) (equivalent air thickness)
5. Moisture Vapor permeability (ASTM E96) 14.3 perms
6. Tensile Properties (ASTM D-412 Modified)

   7 day-Tensile strength 190 psi (1.3 MPa) - Elongation at break 820% - 340% @ 0°F (-18°C)
7. Crack Bridging(at 16 mils = 400 microns DFT
   a. Static (at –4°F/-20°C) 30 mils (0.75mm)
   b. Dynamic>1000 cycles(at –4°F/-20°C) 12 mils (0.30mm)
8. Resistance to wind driven rain (TT-C-555B): No passage of water through coating
9. Weathering (ASTM G-23) 10,000 hours excellent, no chalking or cracking.
10. Solids Content: by weight – 62% by volume – 55%
11. Flame Spread and Smoke Development (ASTM E-84-94)

    Flame Spread 5 Smoke Development 5 Class Rating A

Note: Tests above were performed with the material and curing conditions @ 71°F – 75°F and 45-55% relative humidity.

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Part 3 – Execution

3.01 Surface Preparation

A. Substrate must be clean, sound, and free of surface contaminants. Remove dust, laitance, grease, oils, curing compounds, form release agents and all foreign particles by mechanical means. Substrate shall be in accordance with ICRI Guideline No. 03732 for coatings and fall within CSP1 to CSP3.

3.02 Mixing and Application

A. Mixing: Stir materials to ensure uniformity using a low speed (400-600 rpm) drill and paddle. To minimize color variation, blend two batches of material.(boxing)

B. Crack detail: Recommended application temperatures 10° - 100°F (4°-38°)

Small defects and cracks (non-structural): Cracks 10 – 20 mils. Apply Surface Filler "Brush Grade" generously over the center of the cracks. Feather material to zero over a two-inch wide area. Allow a minimum 24 hours to cure before overcoating.

Large defects and cracks (non-structural): Cracks >20mils. Rout to 1/4-in wide by 1/4-in. deep. Blow out cut with oil-free compressed air. Fill slot with Surface Filler "Knife Grade" allowing for a small crest to remain. This will compensate for any shrinkage that might occur. **NOTE:** *Sikaflex-1a.-2c, or -15LM, polyurethane sealant may be used in place of Knife Grade Surface Filler.* Allow 24 hours-minimum cure before over coating.

C. Coating Application: Apply by brush, roller, or spray over entire area moving in one direction. A minimum of two coats are required. Each coat should be applied at a rate not to exceed 100 sq. ft. per gallon. Total dry film thickness shall be a minimum 8 - 10 dry mils per coat. Allow a minimum of 2 hours prior to re-coating.

D. When applying the coating, never stop the application until the entire surface has been coated. Always stop application at an edge, corner, or joint. Never let a previously coated film dry; always coat into a wet film. Always apply the coating at a 45° angle to an edge, corner, or joint.

E. If substrate has been previously coated and presents a "chalky" condition, apply 1 coat of Sikagard 552W or SikaLatex R, primer/surface conditioner by brush, roller, or spray at a rate not to exceed 300 sq. ft. per gallon.

F. Adhere to all limitations and cautions for the elastomeric acrylic coating in the manufacturers printed literature.

3.03 Cleaning

A. The uncured elastomeric acrylic coating can be cleaned from tools with water. The cured elastomeric acrylic coating can only be removed mechanically.

B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

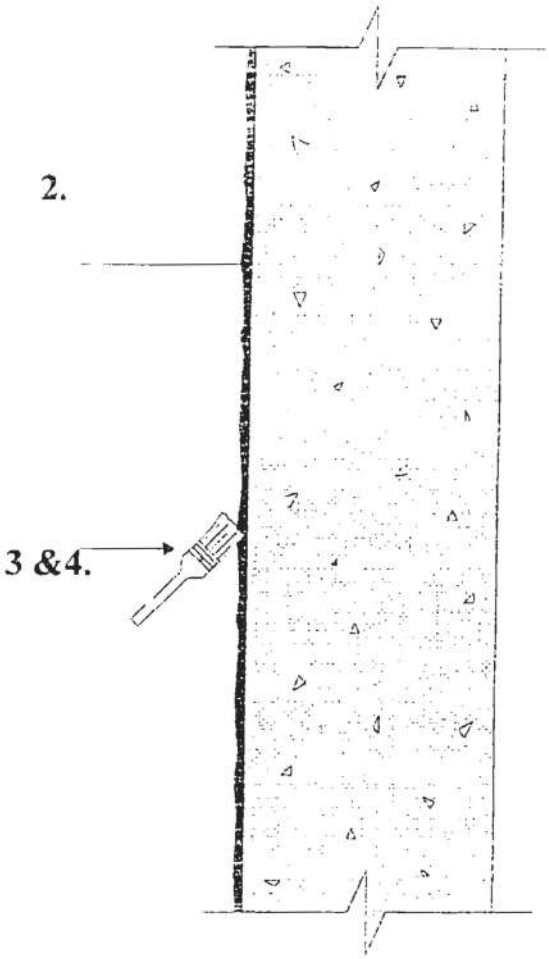
SC-058 Sikagard 550W Elastocolor, Anti-Carbonation Crack-bridging Coating

1. Substrate must be dry, clean and sound.

2. Condition surface with Sikagard 552W or SikaLatex R(as needed)

3. Apply base coating as needed

4. Apply Sikagard 550W Elastocolor by brush, roller or spray over entire area moving in one direction.



Concrete Restoration Systems by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071

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professional or contractor for a particular project bears the sole responsibility for the preparation and approval of the specifications and determining their suitability for a particular project or application.

Prior to each use of any Sika product, the user must always read and follow the warnings and instructions on the product's most current Technical Data Sheet, product label and Material Safety Data Sheet which are available at www.sikaconstruction.com or by calling (201) 933-7452. Nothing contained in any Sika 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 Technical Data Sheet, product label and Material Safety Data Sheet prior to product use.

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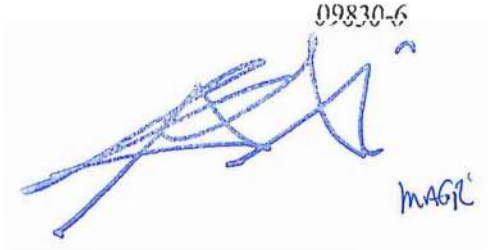


SECTION 09900 – PAINTING

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 whether or not 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.

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.

Also, for such fabricated components as architectural woodwork, wood casework, and shop fabricated or factory built mechanical and electrical equipment or accessories.

SECTION 09900 – PAINTING

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.

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.

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.

Operating Parts and Labels

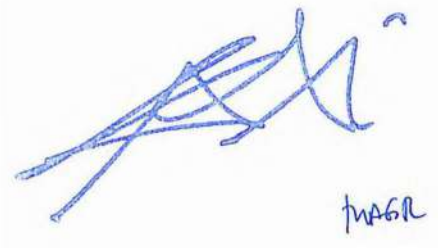
Do not paint any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sink-ages, sensing devices, motor and fan shafts, unless otherwise indicated.

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

Site Conditions

Starting of painting work will be construed as the Applicator's acceptance of the surfaces within any particular area. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.



SECTION 09900 – PAINTING

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.

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.

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.

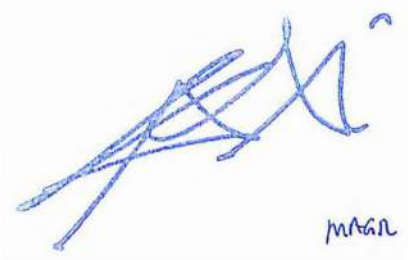
Clean Up

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.

Colors

Prior to beginning work, the PBA will furnish a color schedule to the Contractor.



SECTION 09900 – PAINTING

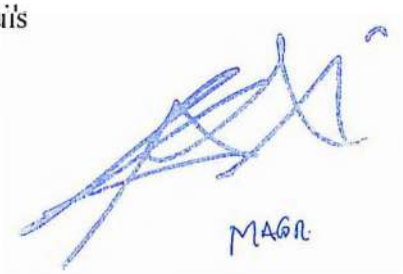
5. MATERIAL – PAINT TECHNICAL DATA:

(a) **100 % Acrylic Flat Exterior Paint**

Vehicle Type	100% Acrylic with Mildew Resistant and fungus Resistant
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	≥ 50%
Percent of Solid by Volume	≥ 35%
Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.)	350 – 450 sq. ft/gal.
Recommended Film Dry Thickness	> 1.2 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 5 Hours
Volatile Organic Compounds (VOC)-Grams/Liters	< 80 g/l

(b) **Acrylic Flat Interior Paint**

Vehicle Type	Vinyl Acrylic Latex and
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	≥ 42%
Percent of Solid by Volume	≥ 25%
Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.)	350 – 450 sq. ft/gal.
Recommended Film Dry Thickness	> 1.2 mils



SECTION 09900 – PAINTING

- **Acrylic Flat Interior Paint (Cont.')**

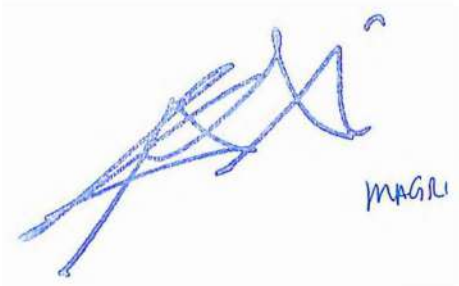
Viscosity (KU)	> 87 Krebs Units (KU)
Drying Time to Touch (Hr.)	No more than 1 Hour
Drying Time to Recoat (Hr.)	No more than 5 Hours
Volatile Organic Compounds (VOC)-Grams/Liters	< 80 g/l

(c) 100% Acrylic Semi – Gloss Exterior Paint

Vehicle Type	Vinyl Acrylic Latex
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	≥ 45%
Percent of Solid by Volume	≥ 35%
Coverage per Gallon at Recommended Film Thickness (Range-Sq. Ft.)	350 – 400 sq. ft/gal.
Recommended Film Dry Thickness	> 2.0 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 5 Hours
Volatile Organic Compounds (VOC)-Grams/Liters	≤ 150 g/l

(d) **Acrylic Low Odor Egg Shell Interior Paint**

Vehicle Type	Vinyl Acrylic Latex
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	≥ 45%

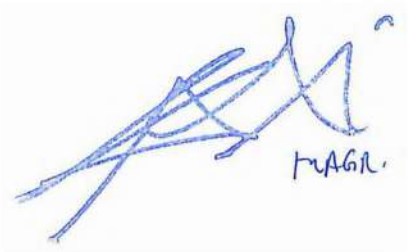


• **Acrylic Low Odor Egg Shell Interior Paint (Cont.')**

Percent of Solid by Volume	≥ 35%
Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.)	350 – 400 sq. ft/gal.
Recommended Film Dry Thickness	> 2.0 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 5 Hours
Volatile Organic Compounds (VOC)-Grams/Liters	≤ 50 g/l

(e) **Acrylic No Odor Egg Shell Interior Paint**

Vehicle Type	Vinyl Acrylic Latex
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	≥ 45%
Percent of Solid by Volume	≥ 35%
Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.)	350 – 400 sq. ft/gal.
Recommended Film Dry Thickness	> 2.0 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 5 Hours
Volatile Organic Compounds (VOC)-Grams/Liters	0 g/l

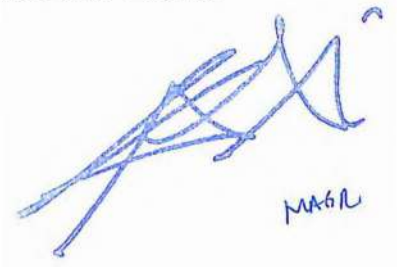


(f) **Enamel Paint For Metals**

Vehicle Type	Alkyd Oil Resin
Percent of Solid by Weight	≥ 60%
Percent of Solid by Volume	≥ 45%
Coverage per Gallon at Recommended Film Thickness (Range – Sq. Ft.)	400 – 500 sq. ft/gal.
Recommended Film Dry Thickness	> 3 mils
Viscosity (KU)	> 70 Krebs Units (KU)
Drying Time to Touch (Hr.)	No more than 4 Hours
Drying Time to Recoat (Hr.)	No more than 12 Hours
Volatile Organic Compounds (VOC)–Grams/Liters	≤ 420 g/l

(g) **Water Base Enamel Paint for Metals**

Vehicle Type	Acrylic
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	≥ 45%
Percent of Solid by Volume	≥ 35%
Coverage per Gallon at Recommended Film Thickness (Range-Sq. Ft.)	200-250 sq. ft/gal.
Recommended Film Dry Thickness	≥ 3 mils
Viscosity (KU)	≥ 85 Krebs Units
Drying Time to Touch (Hr.)	No more than 1 Hour
Drying Time to Recoat (Hr.)	No more than 4 Hours



SECTION 09900 – PAINTING

- **Water Base Enamel Paint for Metals (Cont.')**

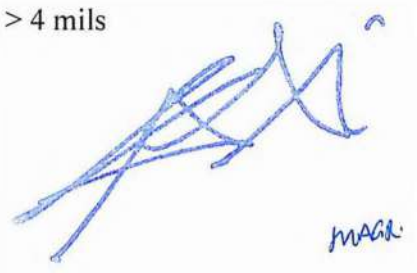
Volatile Organic Compounds (VOC)-Grams/Liters	< 200 g/l

(h) **Traffic Paint**

Vehicle Type	Acrylic
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	> 65%
Percent of Solid by Volume	> 50%
Coverage per Gallon at Recommended Film Thickness (Range-Sq. Ft.)	300 – 350 linear feet @4"
Recommended Film Dry Thickness	≥ 3 mils
Viscosity (KU)	> 90 Krebs units
Drying Time to Touch	No more than 30 Minutes
Drying Time to Traffic (Hr.)	No more than 1 Hour
Volatile Organic Compounds (VOC)-Grams/Liters	< 200 g/l

(i) **100% Acrylic Floor Paint**

Vehicle Type	100% Acrylic or Modified Urethane
Pigment Type	Titanium Dioxide
Percent of Solid by Weight	≥ 69%
Percent of Solid by Volume	≥ 50%
Coverage per Gallon at Recommended Film Thickness (Range-Sq. Ft.)	280 – 340 sq. ft/gal.
Recommended Film Dry Thickness	> 4 mils



100% Acrylic Floor Paint (Cont.')

Viscosity (KU)	> 90 Krebs units
Drying Time to Touch	No more than 30 Minutes
Drying Time to Recoat (Hr.)	No more than 1 Hour
Volatile Organic Compounds (VOC)-Grams/Liters	≤ 150 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 in excess of 100° 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.

SECTION 09900 – PAINTING

- **SURFACE PREPARATION (Cont.')**

• Cementitious Materials (Cont.')

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 smooth 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.

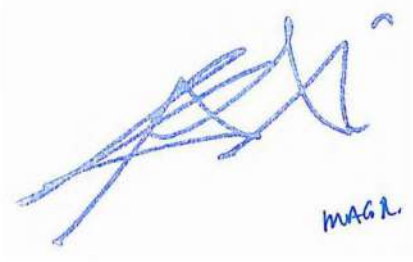
Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other approved sealer, before application of the priming coat.

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.



SECTION 09900 – PAINTING

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

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.

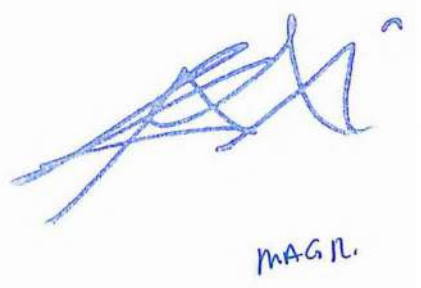
"Exposed surfaces" shall mean areas visible when permanent of built in fixtures, grilles, etc., area in place in areas scheduled to be painted.

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.

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.



SECTION 09900 – PAINTING

- **APPLICATION (Cont.')**

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 is 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.

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.

SECTION 09900 – PAINTING

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 where 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

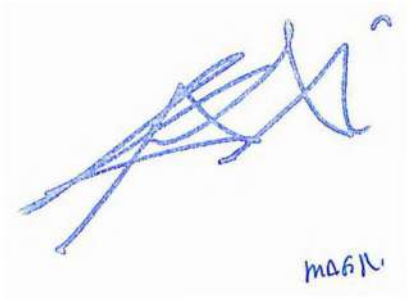
Second coat – Filler tinted to match stain if required by species of wood

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



SECTION 09900 – PAINTING

11. SURFACES TO BE PAINTED (Cont.')

f. Wainscots indicated to receive polyurethane finish

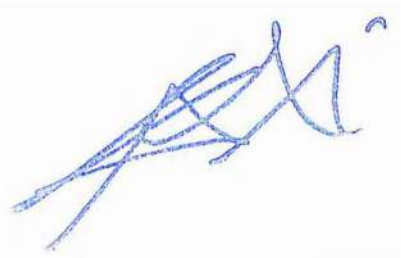
Two (2) coats polyurethane paint

12. GUARANTEE:

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 product, and shall, without additional charges, replace any paint work or paint products/materials which develop defects, except as a consequence 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 form the manufacturer of paint products (to be purchased and applied on project's wall/floor surfaces included on contract) which guarantee that the aforementioned products is 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 the aforementioned period.



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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:

MDGR.

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.

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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.

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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:

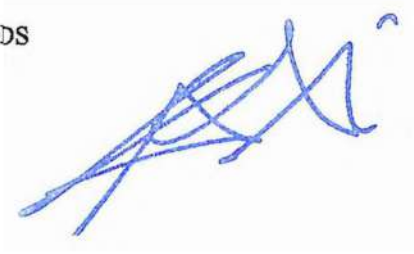
   a. Perfection Corp.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Co., Inc.
   d. Victaulic Co. of America.

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.

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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.

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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.

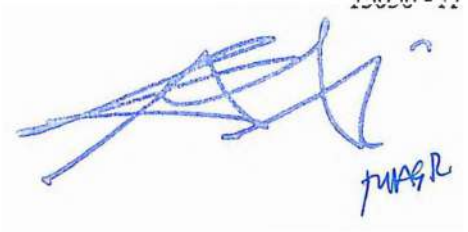
T. Verify final equipment locations for roughing-in.

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.

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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.

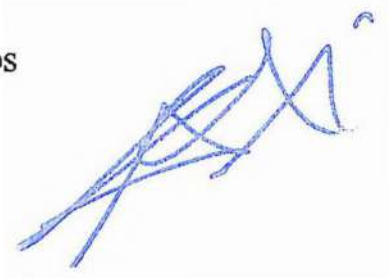
E. Place grout, completely filling equipment bases.

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".

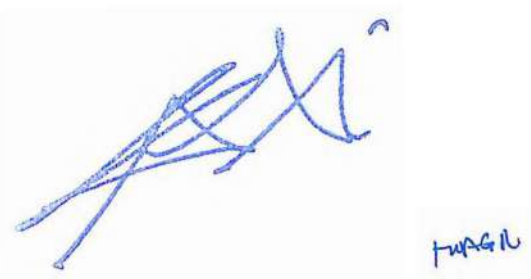
1.4 PERFORMANCE REQUIREMENTS

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.

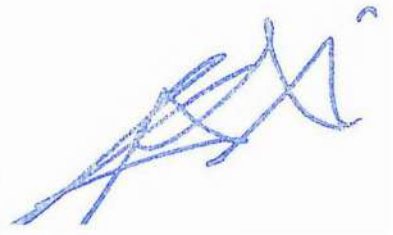
D. Grout: ASTM C 1107, Grade B, factory-mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

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.



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• 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.

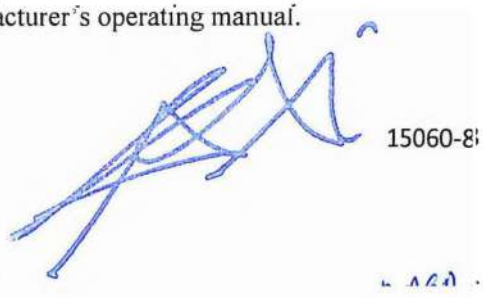
1. Field assemble and install according to manufacturer's written instructions.

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 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.

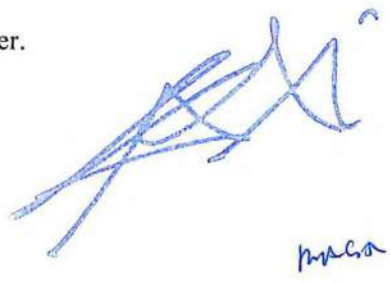
F. The following are industry abbreviations for plastic and other piping materials:

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:

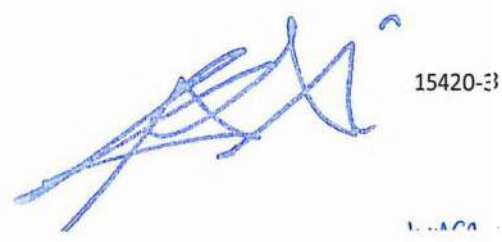
1. 1-½-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
2. 2 to 4-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
3. 5 and 6-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
4. 8-Inch NPS: PVC plastic pipe, PVC socket 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

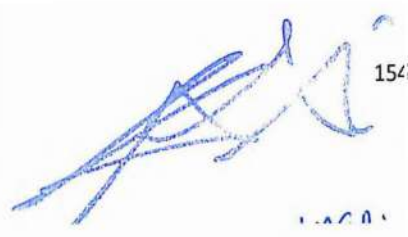
A. Refer to Division 2 Section "Sewerage and Drainage" for sanitary and storm sewer piping.

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".

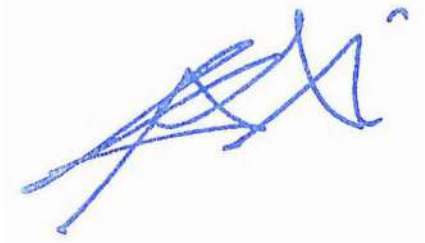
B. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-tum, double Y-branch and 1/8-bend fittings if 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.



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• 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.

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• 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

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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.

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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.

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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.

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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.

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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:

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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:

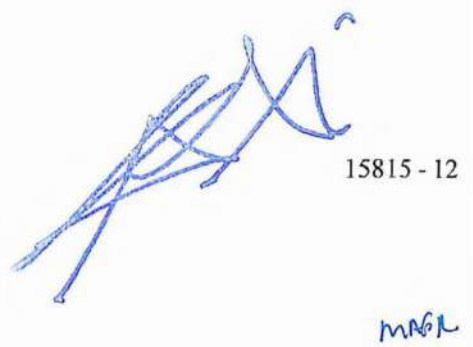
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being 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.

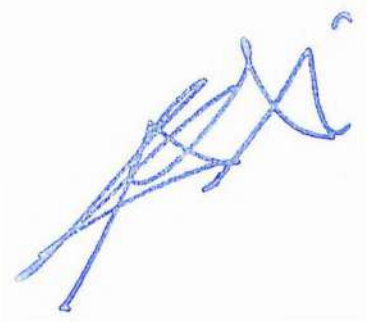
1.3 SUBMITTALS

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.

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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.

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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.

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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.

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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).

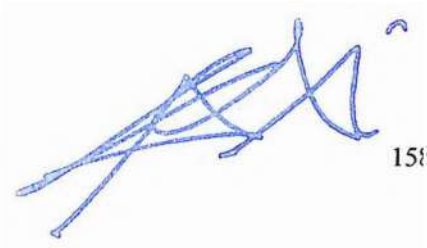
2.10 FLEXIBLE DUCTS

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).



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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.

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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.

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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

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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.

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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

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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

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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.

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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.

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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.

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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

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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.

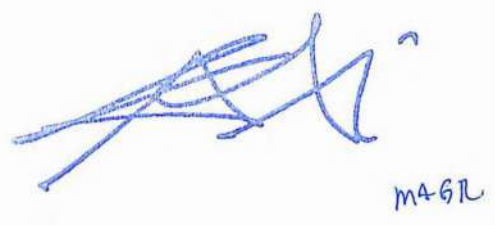
2. GENERAL REQUIREMENTS

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:

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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.

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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.

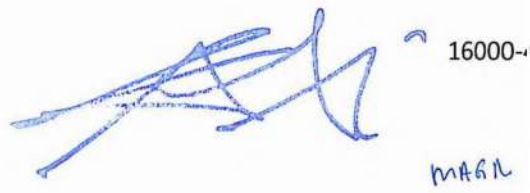
a. The Contractor shall test all the wiring and shall leave the electrical installation free of grounds, shorts, etc.

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

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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.

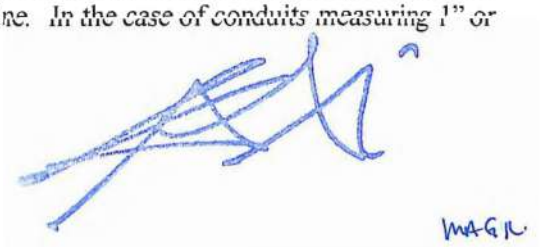
6. In those cases where the conduits are run exposed, they shall be installed in a neat and workman-like manner at right angles and parallel to the walls and partitions. Threaded conduit fittings shall be used with the outlet boxes in all such cases.

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) 90° 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

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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.

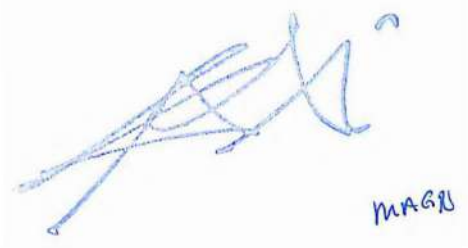
4. The wall outlet boxes for convenience outlets, switches, and other devices shall measure 4"x4"x 2⅛" minimum with K.O. to fit the conduits. The outlet boxes shall be equipped with raised covers of the required height and gang to bring them flush with the finished wall surface. The installation of raised 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

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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.

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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%

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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.

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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 22°F (minus 30°C) for single lamp ballast.

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4. Normal ambient operating temperature: 104°F (40°C).

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.

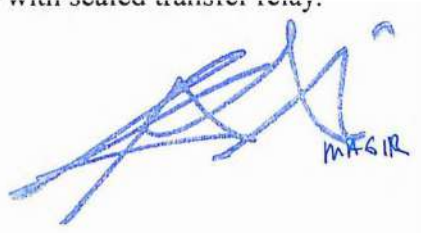
C. Self-Powered Exit Signs (Battery Type):

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.

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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 4100°K, 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 3600°K, 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.

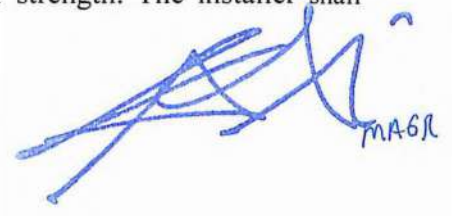
• PART III – EXECUTION

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:

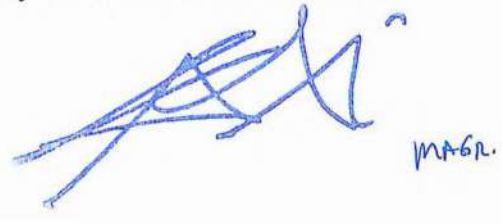
1. Pendants and Rods: Where longer than 48 inches (1,200 mm.), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one-point and tubing or rod for suspension for each unit length of fixture chassis, including 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

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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 90°C 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.

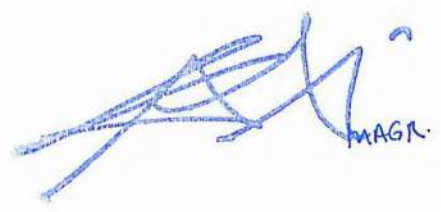
6. All conductors shall be continuous from outlet to outlet, and so splices shall be made except in the boxes. The conductors in the outlets shall be of sufficient length to allow making all the device connections without any strain.

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.

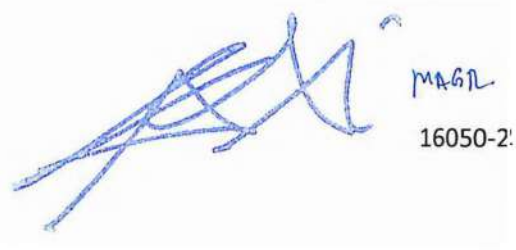
9. When used for underground installation, all conductors or cables, regardless of the type, shall be protected by schedule 40 PVC conduits of the adequate size per NEC. They shall also be embedded in a concrete encasement of a minimum thickness of four inches (4") on all sides. All underground feeders or branch circuits shall be RHw-2, XLP 90°C 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 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.

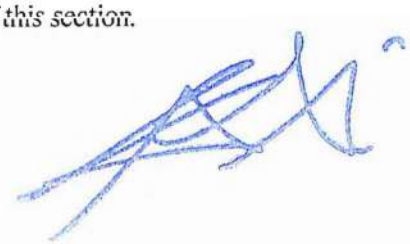
1.3 QUALITY ASSURANCE

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.



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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.

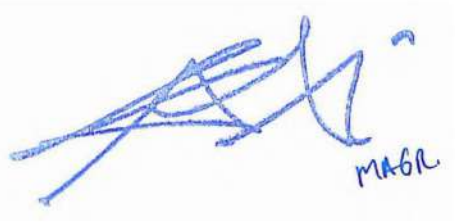
PART 2 – EXECUTION

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.

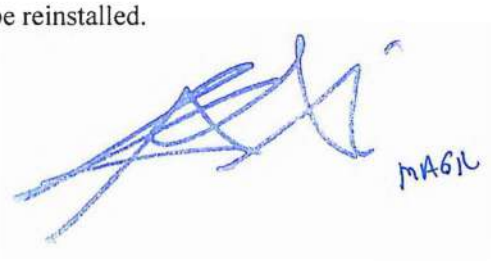
H. Perform work on energized equipment or circuits with experienced and trained personnel.

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.

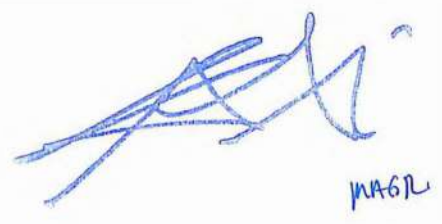
C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

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

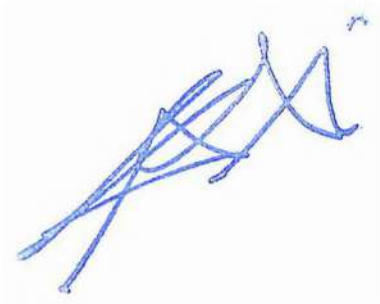


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EXHIBIT L

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

GOBIERNO DE PUERTO RICO
DEPARTAMENTO DE EDUCACIÓN

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS DE PUERTO RICO

REQUIREMENTS FOR THE DESIGN-BUILD SCOPE OF WORK

This project requires a Design-Build (DB) project delivery method for several scopes of work, including but not limited to, ADA-compliant bathrooms, ADA-compliant access ramps, 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, specifications, construction methodology and submittals of materials, as applicable.

Proponent's A/E Responsibilities for Design/Build Scope of Work

1. The A/E must produce the drawings and specifications in accordance with professional architectural/engineering practices and current PR Building Codes.

2. The A/E must also provide any additional design criteria necessary for project development (not limited to supporting calculations, equipment guide list, materials, etc.), so that the Team can provide construction drawings and specifications.

3. The A/E must determine design choices based on incorporating standards into the construction drawings and specifications.

4. During the construction phase, the A/E shall work with OMEP to participate in construction inspections and assist in the review of:
   a. Construction Document submittals, including specifications and design calculations (the A/E must 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 in accordance with standard professional practice and prevailing codes.

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 must 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 must prepare and submit 100 per cent complete construction specifications in accordance with standard professional practice.

4. The construction specifications must include the ASTM specification, or 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.

The General Contractor ('Contractor') Responsibilities

1. The General Contractor supervises, inspects, and directs the Project from start to finish based on the project scope. For this purpose, the Contractor must assign the Project Manager (PM) who is in charge of the overall project during both design and construction phases. 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 shall ensure that the entire project complies with all the specifications as outlined in the contract 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 of 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.

3. Before launching the project, the Contractor will be equipped with enough resources to complete construction processes. Basic project needs include 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 is responsible for the successful completion of the project in terms of scope, time schedule, cost, safety, and other project-related details. The Contractor will set and observe the project progress schedule to adhere to the time in contract. The project progress schedule can be altered by unprecedented changes and adjustments during the project execution phase. It is highly recommended the use of Critical Path Method Chart for the evolution control of the project. 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 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 will 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 must 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 shall prepare and submit shop drawings, product data, and samples during construction as required by the OMEP. 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 OMEP.

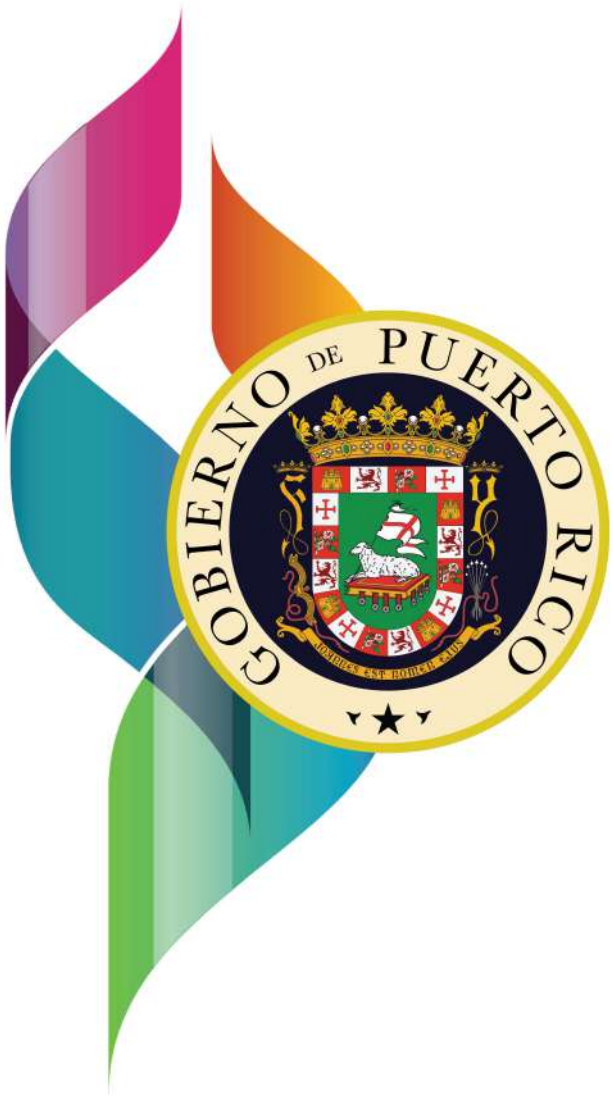
9. Project Record Drawings: The Contractor will maintain a set of construction documents (field as-built drawings) to record actual construction changes during the construction process. The project record drawings will always be available for review by OMEP and/or its authorized representative.

10. Project Close-out: The Contractor must 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.

Manual de Identidad
Gobierno de Puerto Rico

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%