OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS
DEPARTAMENTO DE EDUCACIÓN

INVITACIÓN A SOMETER PROPUESTAS

NÚMERO DE PROCESO DE COMPRA: CI-2023-07-06-4321
PROYECTO DE MEJORAS A PLANTA FÍSICA

54684 - ESC. MARIA E ARCHEVAL SALAMO DE VALDES

MUNICIPIO DE PONCE

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Gobierno de Puerto Rico
Departamento de Educación

Oficina para el Mejoramiento de las Escuelas Públicas

Fecha de Publicación: 2 de agosto de 2022

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

NÚMERO DE PROCESO DE COMPRA CI-2023-07-06-4321
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En adición a las disposiciones legales indicadas en el párrafo primero anterior, este proceso se lleva a cabo de conformidad con la Ley 85 del 29 de mayo de 2018 (Ley de la Reforma Educativa de Puerto Rico), la OE-2022-023 promulgada por el Gobernador de Puerto Rico el 25 de marzo de 2022, que extendió las disposiciones de la OE-2021-021 del 16 de marzo de 2021.

El proyecto consiste en mejoras físicas al plantel escolar y otros edificios del Departamento de Educación de Puerto Rico "DEPR"). Los documentos relacionados a este procedimiento, incluyendo cualquier adendum, aclaración o contestación a preguntas, se publicarán en el portal cibernético del DEPR. Todo el trabajo para realizar deberá estar de acuerdo con el Pliego (según definido el término en este documento) de este procedimiento competitivo. Los contratistas deberán someter sus propuestas por correo electrónico a **omepcentralcompras@de.pr.gov**, conforme a las Instrucciones, el día **16 de agosto de 2022 vía el correo electrónico antes mencionado. La apertura de las propuestas se realizará el 17 de agosto de 2022 en las oficinas de OMEP Central. NO SE REQUIERE LA PRESENCIA DE LOS CONTRATISTAS PARA LA REAPERTURA.**

NOTA: Todos los prospectos licitadores deberán asistir a una reunión de pre-subasta y visita de inspección compulsoria que se llevará a cabo el 4 de agosto de 2022 a las 10:00am. El lugar de esta reunión será la escuela María E. Archeval Sálamo De Valdés ubicada en Ponce. Toda pregunta se someterá mediante correo electrónico dirigida al Departamento de Compras a omepcentralcompras@de.pr.gov en **o antes del 9 de agosto de 2022. Las preguntas se responderán en o antes de 12 de agosto de 2022 vía correo electrónico.**

Este proyecto se sufragará total o parcialmente con fondos asignados por la Federal Emergency Management Agency ("FEMA") y con fondos CDBG del Department of Housing and Urban de los Estados Unidos ("HUD"), administrados por

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el Departamento de la Vivienda del Gobierno de Puerto Rico ("Vivienda"). En virtud de ello aplican ciertas disposiciones de ley federal que se incluyen en este documento y que el Proponente deberá observar. Dichas disposiciones se encuentran en el **EXHIBIT G**. Al someter una Propuesta bajo esta licitación el proponente acuerda aceptar y observar las disposiciones aplicables, las cuales se incluirán en el contrato que será suscrito entre el contratista agraciado y la OMEP.

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

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

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INSTRUCCIONES A LOS CONTRATISTAS

I. TÉRMINOS DEFINIDOS

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

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

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II. ALCANCE DE LOS TRABAJOS

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

III. PRESENTACIÓN DE PROPUESTAS

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

IV. COPIAS DE LOS DOCUMENTOS

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

V. ITINERARIO DE PROYECTO – TABLA T-1

Actividad	Lugar	Itinerario
Reunión Pre-Proceso de Compra (compulsoria)*	N/A	N/A
Fecha y hora límite para radicar propuestas	OMEP Central	VER INVITACIÓN
Apertura	OMEP Central	VER INVITACIÓN, NO SE REQUIERE PRESENCIA DE LOS LICITADORES

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

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

VI. CORRESPONDENCIA Y COMUNICACIONES

- Cualquier pregunta o comunicación relacionada a este trabajo deberá realizarse vía correo electrónico al correo del Departamento de Compras: omepcentralcompras@de.pr.gov.
- Refiérase a la nota que se incluye en la página #2 de este documento.
- Toda pregunta y/o correspondencia con referencia al trabajo deberá ser identificada como sigue:

Número de proyecto «TEMA ESPECÍFICO DE LA COMUNICACIÓN»

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

- i. Todas las comunicaciones a la OMEP referente a este trabajo serán realizadas conforme a lo establecido en la Sección VI de este documento. Ningún agente, abogado, o cualquiera que actúe en representación del Contratista, comenzará comunicación alguna relacionada a este proyecto con la OMEP.
- ii. La OMEP está comprometida con un proceso justo y abierto para que los potenciales Contratistas reciban la información sobre el proceso competitivo de solicitud de propuestas. Los Potenciales Proponentes y cualquier miembro de su Equipo no discutirán o se comunicarán, directa o indirectamente, con cualquier otro potencial Contratista y/o director,oficial, empleado, consultor, asesor, agente o representante de cualquier otro potencial Contratista, incluyendo cualquier miembro(s) de el/los equipo(s) de susodicho(s) Contratista(s) con relación a la preparación, contenido y representación de su propuesta. No Colusión: Las Propuestas serán sometidas sin conexión alguna, conocimiento, comparación de información o arreglo, con cualquier otro potencial Contratista y/o director, oficial, empleado, consultor, asesor, agente o representante de otro potencial Contratista, incluyendo cualquier miembro del equipo del potencial Contratista.
- iii. Cualquier violación a las restricciones impuestas en esta sección con relación a las comunicaciones podrá constituir base para descualificación de un Contratista en cualquier momento.

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VII. CUALIFICACIÓN DEL CONTRATISTA

- Para demostrar sus cualificaciones para realizar el Trabajo, cada Contratista deberá someter, juntoa su Propuesta, todo documento adicional que aquí se requiera.
- Será necesario que durante los pasados cinco (5) años el Contratista haya completado trabajos similares a los que propone hacer para completar el Trabajo. Evidencia de dicha experiencia debe ser incorporada como parte del **EXHIBIT C** de su Propuesta.
- De conformidad con la OE-2022-23 del 25 de marzo de 2022, el proponente agraciado deberá certificar por escrito que cualquier donativo político, según dicho término es definido en la Ley Número 222-2011, según enmendada, conocida como "Ley para la Fiscalización del financiamiento de campañas políticas en Puerto Rico" realizado por el contratista (y en caso de que sea una persona jurídica, sus accionistas, miembros, dueños y oficiales) se ha hecho de conformidad con la ley.
- Certificado de Elegibilidad del RUL
  - i. Según establecido por la Ley número 73 del 19 de julio de 2019, es requisito cumplir con el Certificado de Elegibilidad emitido por la Administración de Servicios Generales (ASG), el cual acredita que el Licitador cumple con los requisitos establecidos por la ASG para que sea parte del Registro Único de Licitadores.
  - ii. El Licitador deberá incluir en la Oferta copia de la certificación de la ASG, la cual debe incluir el nombre de su entidad en el Registro Único de Licitadores (RUL). Si el RUL no es válido al momento de la radicación de la Oferta, el Licitador podrá someter un Certificado vigente del RUL dentro de los diez **(10) días** posteriores a la fecha límite establecido para radicar Ofertas.
- Fianza de Licitación (Bid Bond) según requerido en este documento.
- Certificados de existencia de seguros con límites indicados en este documento.
- Certificación del Contratista indicando que el alcance de trabajo será realizado dentro del periodo de tiempo de ejecución establecido para este proyecto
- Documento que evidence número de registro en DUNS Number del System for Award Management (SAM)
- Propuesta económica con desglose de costos.
- Acreditaciones ambientales requeridas en la Sección XI
- Estados financieros- se solicita estado financiero del último año auditado y certificado por un Contador Público Autorizado durante los quince (15) meses previos a la fecha de apertura de este proceso competitivo. El documento debe incluir los siguientes componentes:
  - i. Balance Sheet-Assets, liabilities, and equity
  - ii. Income Statement: Revenue and expenses
  - iii. Statement of Retained Earnings: Indicate retained earnings from prior years v. current
  - iv. Statement of cash flow:
  - v. Notes to financial statements and Schedules

VIII. DISPONIBILIDAD DE TERRENOS PARA EL TRABAJO

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

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IX. TIEMPO DEL TRABAJO

- El alcance de trabajo para las escuelas se completará dentro de una duración total de sesenta **(180)** días calendarios a partir de la fecha de "Notice to Proceed" al Contratista, excluyendo un periodo de "close out" con una duración de 45 días calendarios. Las penalidades o daños líquidos aplicables a tardanzas injustificadas se determinarán de conformidad con las disposiciones del Reglamento 9230 de la Administración de Servicios Generales.
- El contratista será responsable de realizar durante los primeros treinta (30) días calendarios posterior a la Orden de Comienzo 'Notice to Proceed' un proceso expedito de someter y obtener la aprobación de equipos mecánicos, eléctricos y de plomería que tengan un tiempo de fabricación y entrega de larga duración. Se requerirá la participación de los suplidores de equipos del Contratista en el proceso.

X. COORDINACIÓN DE LOS TRABAJOS

- El Contratista será responsable de llevar a cabo el Trabajo de modo tal que se asegure la compatibilidad del Trabajo y la Coordinación de todas las labores relacionadas a dicho Trabajo, así como del acceso al Lugar del Proyecto con el Trabajo de otros Contratistas que realicen labores relacionadas al Trabajo o en la vecindad inmediata del Lugar. Será responsabilidad del contratista coordinar los trabajos con cada director escolar.
- El Contratista proveerá e instalará Letrero o Rótulo de Inversión de acuerdo con **EXHIBIT N**. OMEP someterá las especificaciones del letrero.

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

- Cumplimiento con los documentos del Pliego
  i. El Contratista deberá cumplir con todos los requisitos y proveer la documentación requerida a fin de que su Propuesta sea considerada para evaluación.
  ii. **El incumplir con cualquiera de los requisitos será considerado como un Licitador no responsivo.**
  La Propuesta incorporará todos los documentos solicitados como parte del Pliego, incluyendo aquellos emitidos vía Adenda. **Favor referirse a la Hoja de Cotejo de Propuesta para el orden en el cual deben ser presentados los documentos.**
  iii. Los documentos incluidos como parte de los *Exhibits*, así como cualquier data adicional relacionada a los mismos, deberán ser completados y ejecutados según sea requerido por cada uno de estos por parte del Contratista o su representante autorizado
  iv. **Todo proponente deberá incluir las siguientes cualificaciones ambientales junto a cada propuesta:**
     1. Certificación de Plomo de la EPA -Lead EPA RRP (Renovation, Reparation and Paint).
     2. Evidencia de certificación en Manejo de Plomo 2 horas (Two hours course of Asbestos Awareness)
     3. Evidencia de certificación Manejo de seguridad en manejo de hongo- (Two hours course of safety Mold Awareness).
     4. Certificación de 30 horas OSHA (General o construcción) del supervisor designado por el contratista. Plan de seguridad específico al alcance de trabajo del proyecto.

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v. **Revisión de Pliegos:**
1. Lugar del Proyecto: Será la responsabilidad de cada contratista antes de someter su propuesta revisar:

vi. El examinar detenidamente los Pliegos, Adenda publicada y cualquier data relacionada al proyecto debidamente identificado en el Alcance de Trabajo.

vii. Visitar el lugar para familiarizarse con las condiciones locales que pudieran afectar el costo, progreso, cumplimiento o entrega del trabajo y estar familiarizado y tener entendimiento sobre las condiciones físicas, locales, y relativas al lugar donde se realizará el Trabajo y que pudieran afectar el costo, progreso, cumplimiento o entrega de este, conforme al Alcance de los Trabajos del **EXHIBIT A.**

viii. El considerar todas aquellas leyes estatales y federales aplicables que pudieran afectar el costo, progreso, cumplimiento o entrega del Trabajo.

ix. El notificar prontamente por escrito al representante autorizado de la OMEP de todos los conflictos, errores, ambigüedades, o discrepancias que el Contratista haya descubierto en o dentro de los Pliegos y cualquier otra data relacionada o documentos.

x. El corroborar que la información y data contenida en los Pliegos con respecto a utilidades e infraestructura existentes o contiguas al Lugar está basada en la información y data suministrada a la OMEP y/o el representante de la OMEP por los dueños de dichas utilidades e infraestructura. La OMEP y el representante autorizado de la OMEP no asumen responsabilidad por la exactitud o integridad de dicha información o data, a menos que en los Pliegos se informe expresamente lo contrario.

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

xii. Preguntas y Solicitudes de interpretación o clarificación

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

Interpretaciones o aclaraciones consideradas como necesarias por parte del OMEP en respuesta a dichas preguntas, serán emitidas vía Adenda y publicadas en la página web del DEPR que haya cumplido con las reuniones obligatorias. Solo aquellas preguntas respondidas formalmente mediante Adenda escrita serán vinculantes. Interpretaciones orales y otras interpretaciones o clarificaciones no tendrán efecto legal alguno.

b. A modo de que haya un tiempo de respuesta razonable para la OMEP, dichas comunicaciones escritas deben ser sometidas no más tarde de la fecha establecida en la Sección V. Esto permitirá a la OMEP un tiempo razonable para evaluar las solicitudes y formular respuestas.

c. Si un Contratista entiende que asuntos específicos no son suficientemente descritos o explicados en los documentos del Pliego, o que un conflicto o discrepancia existe en el Pliego del proyecto, o con cualquier ley, ordenanza, regla, regulación, u otro estándar o requerimiento estatal o federal, el Contratista deberá notificarlo a la OMEP mediante

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comunicación escrita para informar sobre la situación y solicitar a OMEP una clarificación, conforme al procedimiento establecido en este Pliego.

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

a. Enmienda al Pliego

La OMEP se reserva el derecho de enmendar el Pliego en cualquier momento.

b. Cualquier enmienda a este Pliego será descrita por escrito en una Adenda que se publicará en la página web del DEPR.

c. Toda Adenda se convertirá en parte de este Pliego. El Contratista reconocerá el recibo de cada Adenda en el **EXHIBIT B**.

d. Formulario de Propuesta y Declaración del Contratista

i. El Formulario de Propuesta y la Declaración del Contratista se anejan como **EXHIBIT A** y **EXHIBIT B**, respectivamente.

ii. Todos los blancos del Formulario de Propuesta y la información del Contratista deben ser completados por escrito en **tinta azul**, a maquinilla o computadora.

iii. Una Propuesta sometida por un Contratista que es una Corporación, deberá ser formalizada por su presidente, vicepresidente o cualquier otro representante autorizado. En el último de los casos, debe venir acompañado con evidencia de la autoridad delegada para firmar dicho documento con el nombre corporativo (Resolución corporativa).

iv. El sello corporativo deberá estar incluido como anejo y autenticarse por parte del (la) secretario(a) o asistente de secretario(a) de la Corporación.

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

- Todos los nombres deberán estar escritos o impresos en tinta negra debajo de la firma.

i. La dirección postal, número de teléfono, dirección de correo electrónico y número de facsímil para comunicaciones relacionadas al Contratista, deberán ser provistas.

ii. Aquellos Contratistas que no están organizados bajo las leyes del Estado Libre Asociado de Puerto Rico deben proveer evidencia de las autorizaciones correspondientes para llevar a cabo negocio como una entidad foránea en Puerto Rico.

iii. El precio de la Propuesta deberá considerar las cantidades que el Contratista entienda necesarias como parte de los costos generales (‘overhead’) y ganancia (‘profit’) de los allowances (si alguno) detallados en los documentos de contrato.

- Formato de propuesta

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

i. Será preparada enteramente en el idioma español, salvo aquellos documentos o formularios de la OMEP que hayan sido entregados en idioma inglés.

ii. Usar tamaño de letra mínimo de doce (12).

iii. Usar un tipo de letra legible, tal como Arial, Calibri o Times New Roman.

iv. Toda la información solicitada deberá ser incluida en la propuesta, ya sea cumpliendo todos los formularios provistos en este pliego o anejando la documentación requerida como parte de esta.

v. Los documentos deberán estar firmados en **tinta azul**.

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vi. La primera hoja de la propuesta deberá ser la Hoja de Cotejo que se incluye como parte de estas instrucciones.
vii. Los documentos deben estar en el mismo orden en el cual se estipula la Hoja de Cotejo.
viii. La propuesta debe ser enviada vía correo electrónico: omepcentralcompras@de.pr.gov. El título del correo electrónico debe ser el Número de Proceso de Compra.

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NOTA: Cada propuesta se enviará por separado vía correo electrónico. Por ejemplo, si va a someter propuesta para Escuela A y Escuela B, enviará un correo electrónico para cada una de ellas. El título de cada correo será el número de Proceso de Compra y el nombre de la escuela.

- Cualquier Propuesta entregada después de la fecha y hora indicadas en la Sección 5, será considerada como tardía, rechazada y devuelta sin abrir.

i. La propuesta debe ser sometida en formato PDF y debe ser un documento descargable al momento de enviarla. No se aceptarán documentos enviados a través de un (link) o enlace electrónico. Se aceptarán documentos comprimidos (ZIP) o segmentados en varios documentos en PDF, de ser necesario.
ii. Todas las Propuestas se convertirán en propiedad de la OMEP al momento en que sean sometidas.
iii. Las propuestas permanecerán cerradas hasta tanto se lleve a cabo la apertura.

XII. MODIFICACIÓN Y RETIRO DE PROPUESTAS

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

XIII. APERTURA

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

XIV. EVALUACIÓN

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

XV. SOLICITUD DE RECONSIDERACIÓN

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

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i. La notificación de adjudicación recoge expresamente los términos de reconsideración y revisión judicial.

XVI. ADJUDICACIÓN

- OMEP adjudicará de acuerdo con las leyes y reglamento aplicables.
  - La OMEP se reserva el derecho de (a) rechazar una o todas las Propuestas, incluyendo, sin limitación, el derecho a rechazar todas aquellas Propuestas que sean de No conformidad, no responsivas, no balanceadas o condicionadas y (b) rechazar la Propuesta de cualquier Contratista si la OMEP entiende que no será en el mejor de los intereses el hacer una adjudicación a dicho Contratista, ya sea porque este no está cualificado o posee una dudosa capacidad financiera o falla en reunir cualquier otro estándar pertinente o criterios establecidos por la OMEP. La OMEP también se reserva el derecho de dispensar toda formalidad que no involucre precio, tiempo o cambios en el Trabajo y negociar los términos contractuales con el Contratista Agraciado. Discrepancias entre la multiplicación de unidades de Trabajo y precios unitarios serán resueltos a favor de los precios unitarios. Discrepancias entre la suma indicada y cualquier columna de cifras y la suma correcta que de ella surja, será resuelta a favor de la suma correcta. Discrepancias entre lo escrito y las cifras, serán resueltas a favor de la parte escrita.
    i. Si la compra se adjudica, la misma será adjudicada al Contratista Técnicamente Cualificado con la propuesta más baja. Un Contratista Técnicamente Cualificado significa un Contratista responsable y responsivo, cuya propuesta reúne los requisitos de las presentes Instrucciones y cuya evaluación por parte de la OMEP le indica a la OMEP que la adjudicación a dicho Contratista será en el mejor de los intereses del Trabajo. Al evaluar las Propuestas para determinar al Contratista Técnicamente Cualificado, la OMEP considerará: (a) las cualificaciones, récord de cumplimiento e integridad, tal como lo indica en este Pliego y sus anejos, especialmente Cuestionario al Contratista, aquí anejado como **EXHIBIT C**, incluyendo, sin limitarse, al cumplimiento con los requisitos mínimos establecidos en dicho Cuestionario al Contratista y (b) si la Propuesta cumple con los requisitos prescritos en estas Instrucciones. Si se determina que el Contratista que somete la aparente Propuesta más baja, no cumple con ser un Contratista Técnicamente Cualificado, dicha Propuesta será rechazada y el Contrato será otorgado al Contratista Técnicamente Cualificado con la siguiente Propuesta más baja.
    ii. La OMEP podrá conducir cualquier investigación según lo estime necesario para asistir en la evaluación de cualquier Propuesta y establecer la responsabilidad, cualificaciones y capacidad financiera de los Contratista a ejecutar y proveer el Trabajo de acuerdo con los Pliegos y a satisfacción de la OMEP, dentro del tiempo identificado.
- La OMEP hará llega mediante comunicación escrita la Notificación de Adjudicación a todos los contratistas por correo electrónico. La misma será notificada por correo electrónico a cada proponente.

XVII. SEGUROS Y FIANZAS DEL CONTRATO

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

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

1. Póliza de la Corporación del Fondo del Seguro del Estado.
2. Responsabilidad General Comercial:

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

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

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

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

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

- Todos los seguros antes descritos deberán ser, según sea posible, de la misma compañía de seguros.
  i. Las compañías de seguro utilizadas deberán tener licencia y estar debidamente autorizadas para llevar a cabo negocios en Puerto Rico. Deben tener una sólida reputación económica y estar clasificadas como "A" bajo el Best Key Rating Guide.
  ii. Todos los seguros serán a favor de y endosarán al ELA, el Departamento de Educación, a la OMEP y su designado Representante.
  iii. Las pólizas incluirán:
    - Breach of Warranty Clause
    - Waiver of Subrogation (Waiver and/or Release of Subrogation)
    - Additional Insured Clause
    - Hold Harmless Agreement
    - 90 days cancellation Clause
  iv. Acuerdo de Indemnización- El Contratista accede y pacta el proteger, defender, e indemnizar y liberar de responsabilidad a OMEP y a cualquiera de sus representantes o agentes, de y en contra de cualquier o toda reclamación, acción, obligación, pérdida y costos relacionados a cualquier o toda pérdida o daño (incluyendo, sin limitar lo antes dicho, lesiones o muerte a personas y daños a la propiedad) que sean alegados por lo que en realidad haya sufrido cualquier persona o personas y que sean alegados por o en realidad surja de o sea incidental al Trabajo, servicios o actividades del Contratista o cualquiera de sus subcontratistas bajo el Contrato, incluyendo, sin limitar lo antes dicho, todos los actos u omisiones de los oficiales, empleados y agentes del Contratista y cualquiera de sus subcontratistas en conexión a cualquier instalación, tarea o trabajo, lícito o no o dentro del alcance de su trabajo.

- **Fianzas**

  i. **Garantía de Licitación (BID BOND): SE SOLICITARÁ BID BOND PARA ESTE PROCESO EQUIVALENTE AL 5% DEL MONTO TOTAL DE LA COTIZACIÓN.** Los licitadores deberán presentar una Fianza de Licitación por la cantidad del 5% del monto de la oferta que deberá suplir el Contratista a favor de la OMEP como fianza para asegurar la oferta de todas las obligaciones que pretende contraer el Contratista bajo los documentos de contrato. Esta fianza permanecerá en efecto hasta tanto sea adjudicado y contratada la obra que esta asegura y sea emitida la fianza de pago y cumplimiento, salvo según sea provisto por parte de las Leyes o Reglamentos o los documentos de contrato. **El Contratista deberá presentar un original de cada una de las fianzas requeridas, debidamente firmadas por un representante autorizado del afianzador**. Todas las fianzas deberán ser emitidas por una compañía de seguros debidamente licenciada y autorizada a hacer negocios en Puerto Rico.

    a. Las cantidades provistas en los BID BOND están sujetas a verificación durante el proceso de Compra. Es responsabilidad de cada contratista verificar las cantidades. OMEP se reserva el derecho de revisar las ofertas en los casos en que las cantidades verificadas en el campo varíen más del 10 % de las cantidades enumeradas en el paquete de ofertas

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iii. **Fianza de Cumplimiento (*Performance Bond*):** Se requiere del licitador agraciado una Fianza de Ejecución por la cantidad del 100% (cien por ciento) del monto del contrato que deberá suplir el Contratista a favor de la OMEP y del Departamento de Educación de Puerto Rico como fianza del fiel cumplimiento de todas las obligaciones contraídas por el Contratista bajo los documentos de contrato. Esta fianza permanecerá en efecto hasta un año después de la fecha en que el último pago venza o hasta tanto se cumpla el plazo para completar cualquier corrección según especificado en contrato, cualquiera de las que venza más tarde, salvo según sea provisto por parte de las Leyes o Reglamentos o los documentos de contrato. El Contratista deberá presentar un original de cada una de las fianzas requeridas, debidamente firmadas por un representante autorizado del afianzador. Todas las fianzas deberán ser emitidas por una compañía de seguros debidamente licenciada y autorizada a hacer negocios en Puerto Rico.

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

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

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

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

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

XVIII. FIRMA DE CONTRATO

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

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

XIX. AVISO PARA PROCEDER

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

XX. DAÑOS LÍQUIDOS/INCENTIVO POR TERMINACIÓN TEMPRANA

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

XXI. PAGO DE PATENTE Y/O ARBITRIOS MUNICIPALES

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

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HOJA DE COTEJO DE PROPUESTA

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS

Instrucciones: Al completar la documentación requerida en las Instrucciones, favor de completar esta Hoja de Cotejo para asegurar que está sometiendo cada ítem solicitado. Utilice esta lista para organizar la secuencia de la documentación previo a su encuadernación y entrega. El Contratista deberá iniciar en tinta azul en el margen izquierdo de cada ítem confirmando así su inclusión en la Propuesta presentada.

Inicial de Contratista	Ítem No.	Exhibit No.	Descripción del documento
	1	A	Formulario De Propuesta (Bid Form)
	2	B	Declaración de Contratista (El Contratista reconocerá el recibo de Adenda descrita en el **EXHIBIT B**).
	3	C	Cuestionario del Contratista
	4	D	Recibo Y Cumplimiento Del Código Anticorrupción Para El Nuevo Puerto Rico
	5	E	Non-Collusive Affidavit
	6	F	Documentos necesarios para presentar la Solicitud de Pago Final Por El Contratista a OMEP
	7	G	Disposiciones Generales Aplicables a Proyectos Sufragados Total o Parcialmente con fondos provistos por FEMA o fondos CDBG provistos por HUD
OTROS DOCUMENTOS			
	8	H	Contract Forms
	9	I	Uniform General Conditions
	10	J	Condiciones Especiales Suplementarias
	11	K	Reference Technical Specifications
	12	L	Buy America Executive Order
	13	M	Requirements for Design-Build
	14	N	Project Identification Sign Guidelines
	15	O	Proposed Site Logistic & Phasing Plan
	16	P	Report and Run
	17	Q	Nota Aclaratoria Proceso Ambiental
	-	-	Buscar los anejos H al Q que están publicados en https://de.pr.gov/omep/ titulado: 1 Anejos proyecto B2S ESSER (1). Los anejos son parte de los pliegos del Proceso de Compra**.**

Nombre _____ **Fecha** _____

Firma _____ **Número de seguro social** _____

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

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

EXHIBIT A
FORMULARIO DE PROPUESTA (BID FORM)

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

Alcance de Trabajo			
Número de Proceso de Compra	**CI-2023-07-06-4321**	**Nombre de Contratista**	
Nombre de la Escuela y Código	**ESC. MARIA E ARCHEVAL SALAMO DE VALDES (54684)**	**Firma/Fecha**	
Descripción		**Unidad**	**Costo**
Plomería		**LS**	$
Electricidad y Refrigeración		**LS**	$
Generales		**LS**	$
Especialidades		**LS**	$
Partidas manuales adicionales		**LS**	$
Seguros (Insurance)		**LS**	$
Fianzas (Bonds)		**LS**	$
Impuestos (Taxes; Municipal + State)		**LS**	$
		TOTAL	$

Nota: El desglose es una guía para la cotización de los trabajos y no será el desglose final para emitir cualquier certificación de pago. Es responsabilidad del contratista verificar las cantidades en visita de campo.
****EL CONTRATISTA ES RESPONSABLE DE LOS COSTOS DE TRANSPORTE MARITIMOS, AÉREOS Y/O TERRESTES A USARSE. ****
***Los costos deberán considerar arbitrios, seguros, patentes, ‘’overhead’’, ganancias, etc.**
**** Será responsabilidad del contratista corroborar las cantidades a cotizar para estos trabajos.**
*****El desglose de los trabajos a realizarse serán adjuntados al dorso**

_____ _____
Nombre de contratista **Fecha**

_____ _____
Firma **Número de seguro social patronal**

EXHIBIT B

DECLARACIÓN DEL CONTRATISTA

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

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

_____

_____

A. Información

a. Fecha para la cual se estableció: _____

b. La siguiente persona está autorizada para obligar legalmente al Contratista en aquellos asuntos referentes a la Compra Informal y al contrato: _____

c. Título: _____

d. Teléfono: _____

e. Facsímil: _____

f. Dirección postal:

g. Correo electrónico para recibir notificaciones de OMEP:

_____

h. Experiencia previa de la empresa y de sus representantes y oficiales, según requerido en el documento de Condiciones Especiales Suplementarias (**EXHIBIT J**) en la parte I, inciso F (2).

i. Experiencia del personal técnico según solicitado en las Condiciones Especiales Suplementarias (**EXHIBIT J**) en la Parte I, inciso F (4).

j. Equipo adecuado: Proveer resumen de inventario de herramientas, materiales y equipo disponible de conformidad con lo requerido en las Condiciones Especiales Suplementarias (**EXHIBIT J**), Parte I, inciso F (5)

k. Número de identificación de impuestos federales (Seguro Social Patronal): _____

l. El Contratista es un(a): (marque con una equis)
Único propietario_____Corporación _____

Sociedad _____ Otro (especifique) _____

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

_____

n. Nombre y dirección postal de la fiadora

_____

_____

o. Nombre y dirección del agente local:

_____

_____

_____

Iniciales

B. Instrucciones al Contratista

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

_____

Iniciales del Contratista

C. Adenda

El Contratista hace constar que recibió la siguiente adenda:

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

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

_____

Iniciales del contratista

D. Visita a localización del proyecto

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

E. Plan de Seguridad

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

_____
(Firma del individuo)

_____
(Nombre impreso del individuo)

_____

_____
(Dirección Postal)

EXHIBIT C
CUESTIONARIO AL CONTRATISTA

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS
(OMEP)

Nombre: _____

Fecha: _____

A. Experiencia previa

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

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

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

Nombre comercial 1: _____años

Nombre comercial 2: _____años

Nombre comercial 3: _____años

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

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

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

B. Récord de Cumplimiento e Integridad

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

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

Nombre de proyecto: _____

Cliente o dueño

Nombre de cliente o dueño: _____

Dirección de cliente o dueño: _____

Persona de contacto:

Nombre de persona de contacto: _____

Título: _____

Número de teléfono y facsímil: _____

Descripción de trabajo: _____

_____

_____

Cuantía de contrato: $_____

Razón para el default: _____

Fecha de terminación: _____

Día de juicio: _____

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

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

_____Sí _____No

Si la respuesta a esta pregunta es "Sí", especifique la fecha o fechas de duración de la demanda, acción, investigación o proceso judicial; la naturaleza específica de la demanda, acción, investigación o proceso judicial; la cuantía de los fondos envueltos, si alguna; los nombres de las partes envueltas; los nombres y direcciones postales completas de las cortes y agencias del orden público involucradas; el título y el número de caso de la demanda, acción, investigación o proceso judicial; la disposición o status actual; y cualquier sentencia, multa o penalidad impuesta.

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

_____

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

_____

Cuantía de los fondos envueltos:

_____

Nombres de las partes envueltas:

_____

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

_____

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

_____

Disposición o status actual:

_____

Sentencia, multa o penalidad impuesta:

_____

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

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

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

Descripción de los proyectos involucrados:
_____

Tiempo de contrato para cada proyecto:
_____

Cuantía total de los daños evaluados en cada proyecto:
_____

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

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

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

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

Cliente o dueño
Nombre: _____

Dirección postal: _____

Persona de contacto

Nombre: _____

Título: _____

Número de teléfono y facsímil: _____

Naturaleza del proyecto: _____

_____

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

_____

_____

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

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

_____

_____

_____

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

C. Experiencia del personal y otros

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

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

D. CAPACIDAD ECONÓMICA

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

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

E. GARANTIA

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

NO APLICA A SERVICIOS PROFESIONALES O NO PROFESIONALES

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

F. FECHA DE ENTREGA DE LA OBRA

¿SE COMPREMETE EL LICITADOR A ENTREGAR LA OBRA AL 100% DE CUMPLIMIENTO CON LOS CODIGOS DE CONSTRUCCION VIGENTES DENTRO DEL PERIODO REQUERIDO DE 180 DÍAS CALENDARIO? (SI o NO) _____

SI ESTIMA QUE NO PUEDE COMPLETAR LA OBRA DENTRO DEL PERIODO DE 180 DÍAS CALENDARIOS INDICAR NUMERO DE DIAS CALENDARIO QUE LE TOMARA REALIZAR EL ALCANCE TOTAL DE LO INDICADO EN EL PROCESO DE COMPRA UNA VEZ ENTREGADA LA ORDEN DE PROCEDER. _____ DIAS. ADVERTENCIA: EL PROVEER UN NÚMERO SUPERIOR DE DÍAS CALENDARIO PARA COMPLETAR LA OBRA PUEDE AFECTAR LA EVALUACIÓN DE LA PROPUESTA DEL CONTRATISTA.

G. DISPONIBILIDAD DEL BIEN O SERVICIO Y COSTOS ASOCIADOS

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

De responder NO, donde están disponible actualmente_____

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

De responder NO, donde están disponible actualmente_____

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

_____

_____

_____

_____

EXHIBIT D

RECIBO Y CUMPLIMIENTO DEL CÓDIGO ANTICORRUPCIÓN PARA EL NUEVO PUERTO RICO

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS
(OMEP)

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

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

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

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

EXHIBIT E
NON-COLLUSIVE AFFIDAVIT

Commonwealth or Puerto Rico _____, being first duly sworn,

deposes says:

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

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

proposed contract; and that all statement in said proposal or bid are true. In the City of _____, Puerto Rico, this _____ day of _____, 2021.

_____
Name of Bidder

_____
Signature of Bidder's Representative

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

(NOTARIAL SEAL) _____
NOTARY PUBLIC

EXHIBIT F

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

OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS

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

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

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

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

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

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

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

_____ _____

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

EXHIBIT G

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

1. **DISPOSICIONES REQUERIDAS POR LEY SE ENTIENDEN INCORPORADAS**

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

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

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

4. **REQUISITOS DE INFORMAR**

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

5. **ACCESO A RÉCORDS**

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

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

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

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

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

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

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

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

8. **DERECHOS SOBRE INVENTOS CREADOS BAJO CONTRATO O ACUERDO**

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

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

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

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

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

11. SECCIÓN 504 DE LA LEY DE REHABILITACIÓN DE 1973

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

12. LEY DE DISCRIMEN POR EDAD DE 1975

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

13. PROHIBICIÓN DE EJERCER, SUSPENSIÓN Y FALTA DE ELEGIBILIDAD

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

14. CONFLICTOS DE INTERÉS

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

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

15. SUBCONTRATOS

Al subcontratar, el Contratista solicitará y contratará con dichos subcontratistas de un modo que provea competencia justa. Algunas de estas situaciones que se consideran restrictivas a la competencia incluyen, pero no están limitadas a:

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

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

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

16. CESIÓN

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

17. INDEMNIZACIÓN

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Igual Oportunidad para Trabajadores con Discapacidades:

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

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

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

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

4) El CONTRATISTA acuerda postear en sitios conspicuos, disponibles a empleados y a solicitantes de

empleo, avisos en la manera dispuesta por el Asistente del Secretario de los Programas de Cumplimiento de Contratos Federales, provisto por o a través del oficial contratante. Tales avisos indicarán los derechos de los aplicantes y empleados, así como de la obligación del CONTRATISTA bajo la leyde tomar acción afirmativa para emplear y avanzar en el empleo a empleados cualificados y solicitantes con incapacidades. El CONTRATISTA debe asegurarse que los solicitantes y empleados con discapacidades estén informados de los contenidos del aviso (ej. El CONTRATISTA puede hacer que se lea el aviso a un individuo discapacitado visual, o puede bajar el aviso posteado para que una persona en silla de ruedas pueda leerlo).

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

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

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

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

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

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

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

4) El CONTRATISTA enviará a cada unión laboral o representante de trabajadores con los que tiene un acuerdo colectivo u otro contrato o entendimiento, un aviso para ser provisto por el oficial contratante de la agencia, dando aviso a la unión laboral o representante de trabajadores de los compromisos del CONTRATISTA bajo la Sección 202 de la Orden Ejecutiva 11246 de 24 de septiembre de 1965, y posterará copias del aviso en sitios conspicuos disponibles a los empleados y solicitantes al empleo.

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

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

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

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

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

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

Según utilizado en esta certificación, el término “facilidades segregadas” significa cualesquiera áreas de espera, áreas de trabajo, baños y cuartos de baño, restaurantes y otras áreas de comer, relojes de fichar, vestuarios y otras áreas de almacenaje o vestimenta, estacionamientos bebederos, áreas de recreación o entretenimiento, transportación y facilidades de vivienda provistas para empleados que son segregadas por

directriz explícita o son, de hecho, segregados basado en raza, color, religión u origen nacional por hábito, costumbre local o cualquier otra razón.

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

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

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

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

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

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

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

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

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

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

1) No se han pagado o se pagarán fondos federales apropiados, por o de parte del SUBRECIPEINTE, a ninguna persona por influenciar o intentar influenciar un oficial o empleado de una agencia, un Miembro del Congreso de los Estados Unidos, un oficial o empleado del Congreso, o un empleado de un Miembro de Congreso en relación con la adjudicación de cualquier contrato Federal en la concesión de cualquier subvención Federal, la concesión de cualquier préstamo Federal, el otorgamiento de cualquier acuerdo cooperativo, y la prórroga, continuación, renovación, enmienda o modificación de cualquier contrato, subvención, préstamo o acuerdo cooperativo.

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

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

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

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

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

28. SECCIÓN 3 DE LA LEY DE VIVIENDA Y DESARROLLO COMUNITARIO DE 1968
(Según requerido por los umbrales aplicables)

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

2) Las partes de este Contrato acuerdan cumplir con los reglamentos de HUD en 24 C.F.R. Parte 135, que implementan la Sección 3. Según evidenciado por el otorgamiento de este Contrato, las partes

certifican que no tienen ningún impedimento contractual o de otro tipo que les impida cumplir con los reglamentos de la Parte 135.

3) El CONTRATISTA acuerda enviar a cada organización laboral o representante de trabajadores con quien el CONTRATISTA tenga un acuerdo colectivo u otro entendimiento, si alguno, un aviso notificando a la organización laboral o representante de trabajadores de los compromisos del CONTRATISTA bajo estacláusula de Sección 3 y posteará copias del aviso en sitios conspicuos en el sitio de trabajo donde ambos empleados y solicitantes para posiciones de entrenamiento y empleo puedan ver el aviso. El aviso describirá la preferencia de Sección 3, esbozará un número mínimo y títulos de trabajo sujetos a contratación, disponibilidad de posiciones de aprendizaje y entrenamiento, las cualificaciones de cada uno, y el nombre y localización de la(s) persona(s) tomando las solicitudes para cada una de las posiciones; y la fecha que se anticipe comience el trabajo.

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

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

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

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

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

29. LEY DE VIVIENDA JUSTA

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

30. LEY DE CONSERVACIÓN DE ENERGÍA

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

31. LEY HATCH

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

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

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

32. ESTÁNDARES DE SALUD Y SEGURIDAD

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

33. PERSONAL

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

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

34. RETENCIÓN DE SALARIOS

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

35. RECLAMACIONES Y DISPUTAS SOBRE TARIFAS DE SALARIOS

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

36. DISCRIMEN POR CIERTOS ASUNTOS LABORALES

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

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

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

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

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

38. INTERÉS DE CIERTOS OFICIALES FEDERALES

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

39. INTERÉS DE CONTRATISTA

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

40. ACTIVIDAD POLÍTICA

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

41. ACTIVIDAD RELIGIOSA

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

42. LEY DE PROTECCIÓN CONTRA INUNDACIONES DE 1973

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

43. PINTURA A BASE DE PLOMO

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

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

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

SPECIAL CONDITIONS

ACV Repairs & Operation
Instituto Tecnológico de Ponce
Project No. DE-54684 (PBA- 8565)

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I. SCOPE OF WORK

The project includes, but is not limited to the repair and operation of ACV system, consisting mainly on the following items of work:

A. Provide all labor, materials, equipment, tools and services as required to satisfactorily complete all the ACV repairs and subsequent operation of the system at the project indicated at section 1.3 in accordance with the technical specifications and any applicable laws, regulations and Codes and standards not included or mentioned in these.

B. Specific Work Scope

1. **Provide and replace damaged fans located at air handling units (AHU) located at Buildings A, C and D conforming technical specifications and included in the schedules R-1, R-3, and R-4.**
2. **Provide and replace the damaged variable frequency drives of the air handling units included on schedule R-1, R-3, R-4 conforming technical specifications.**
3. **Upgrade the conventional magnetic starter for reduced voltage solid-state starter indicated on schedules R-1, R-3 and R-4.**
4. **Provide and replace the microprocessor control module of the HVAC system on each building as indicated on schedules R-1, R-2, R-3, R-4, and R-6 conforming technical specifications.**
5. **Provide HVAC cleaning services to each building indicated on schedule R-7 and technical specifications.**
6. **Provide HVAC Test, adjusting and balance services to each building main duct (use as reference schedule R-7 and technical specifications).**
7. **Provide and install UVC light emitter system to each air handling unit and packaged rooftop units as indicated on schedules R-1, R-2, R-3, R-4 and R-6 and conforming technical specifications.**
8. **Provide air filters to each Air handling unit and Packaged rooftop unit as indicated on schedules R-1, R-2, R-3, R-4, and R-6**
9. **Provide and replace the required sensors, thermometers, pressure gauges, smoke detectors, control valves, pressure differential switches, relays, transmitters, and any other accessories on the air handling units, package rooftop unit or split systems indicated on schedule R-1, R-2, R-3, R-4, R-5, R-6, and R-7.**
10. **Provide and replace package rooftop units and required accessories located at Buildings B and G conforming technical specifications. See schedules R-2 and R-6.**
11. **Provide and replace split system and related accessories located at Building E conforming technical specifications. See schedule R-5.**

12. **Provide and replace mini-split system and related accessories located at Building G conforming technical specifications. See schedule R-6.**
13. **Replace electric motors on air handling units as indicated on schedules R-1, R-3 and R-4.**
14. **Replace cooling coils on air handling units as indicated on schedules R-1, R-3 and R-4.**
15. **Replace driven belts on air handling units as indicated on schedule R-1, R-3 and R-4.**
16. **Provide and replace pumps, control system and related accessories on the sanitary sewage system.**
17. **Removal and disposal of all waste and debris in strict accordance with the latest local, state, and federal environmental laws and regulations. These works include the mandatory recycling of metal parts and refrigerant gas (R-22), in compliance with the aforementioned laws and regulations.**
18. **Provide start-up operation and system diagnostic services conforming technical specifications section 23 01 00.51.**
19. **Provide all the documents that evidence the guarantees on the equipment or services conforming technical specifications section 23 01 00.51.**

C. **Allowance:_Establish $150,000.00 for the allowance to provide for hidden project damages and/or any required system diagnostics with a representative technician from Trane of PR. In addition, include as part of this allowance any leak repair, anticorrosion treatment for structural elements, and repair any unaccounted damages present on the ACV equipment or the sanitary sewage system.**

All project's works shall be performed in strictly accordance with attached sections of technical specifications, Supplementary Special Conditions (*Condiciones Especiales Suplementarias*) and all related Contract Documents, in compliance with all latest applicable local, state and federal codes, laws and regulations.

II. LOCATION

The entire work of this project shall be accomplished at the existing site of **"Instituto Tecnológico de Ponce, located at Ponce Bypass, Street # 2, Km. 23.5, Ponce, Puerto Rico.**

GPS coordinates: 17.99 90 76 N, -66.62 97 12 W

III. PRE-BID MEETING AND SITE INSPECTION

All prospective bidders shall attend to mandatory pre-bid meeting and inspection visit to María E. Archeval Sálamo de Valdés *School* site & facilities. Both will be held on June 30, 2022. The purpose of this meeting & site inspection will be to become acquainted

to the particular conditions and restrictions of building areas where contract works must be performed, in accordance to stipulations indicated on Article 2.3 of Instructions to Bidders. **All prospective bidders shall sign the official attendance list provided by the PBA designated representative during aforementioned meeting and site inspection.**

IV. TIME FOR COMPLETION

The entire work shall be completed within **one hundred eighty (180) calendar days,** from the date of written notice issued to the Contractor to proceed with the work.

V. LIQUIDATED DAMAGES

Should the Contractor or, the Surety in case of Termination for Cause, fails to complete all the work within the time specified in the Contract or as extended by the written authorization of the Owner, a deduction of the amount stipulated in the Article 9.5.1 of Uniform General Conditions for Public Works Contract and the Agreement will be made for each and every calendar day that such work remains uncompleted after the expiration of the time limit to execute the Work as described on 9.1.4 of Uniform General Conditions for Public Works Contract. This amount will be deducted by Owner from any money due or that may become due the Contractor or his Surety under the Contract. The amount stipulated in Article 9.5.1 and the Agreement, or otherwise if otherwise specified in the Contract Documents, as the case may be, shall be considered and treated not as penalty, but as a total, fixed and agreed liquidated damages due the Owner by the Contractor or, by the Surety in case of Termination for Cause, for and including but not limited to, public inconvenience, obstruction to traffic interference with and/or loss of business, increase of engineering, inspection and administrative cost to the Owner; and other costs and expenses which have caused an expenditure of public funds, resulting from the Contractor's, or in case of Termination for Cause of the Surety's, failure to complete the work within the time specified in the contract.

VI. DISTRIBUTION OF DOCUMENTS AND DRAWINGS

All prospective bidders will be responsible to obtain any number of sets of aforementioned documents and specifications, according to instructions and dates schedule indicated on Invitation to Bids submitted by PBA. **Digital copies of project's documents and specifications (recorded on compact disks – CD) will be available at the PBA Bids Coordinator Office (Attn. Mr. Manuel Rivera Ayala)**, located on 6th Floor, North Building, Roberto Sánchez Vilella Government Office Center (Minillas Government Center), Santurce, Puerto Rico.

VII. SPECIAL CLAUSES IN PROJECT CONTRACTS

A. The Contractor shall contract the human resources, necessary technical help, materials and supplies within the Municipality where the work object of this contract will be carried out. If it is not possible to contract the human resources, necessary technical help, materials and supplies in the area, as an alternative, said services can be contracted out of the Municipality, as long as it is made clear to the Owner's satisfaction that pertinent effort has been made to obtain same without success.

B. The Contractor is required to comply with Law 109, approved on July 12, 1985, which makes it mandatory the use of construction materials manufactured in Puerto Rico in the construction, reconstruction, conservation or reparation works on public buildings financed with public funds.

C. The Contractor is required to comply with applicable stipulations indicated on the official memos identified as *Carta Circular 141-17* and *Carta Circular 144-17*, issued by State Budget and Management Office (*Oficina de Gerencia y Presupuesto*) on January 30, 2017 and March 10, 2017, respectively. Texts of both memos are included as part of Contract Documents under the section identified as Related Laws (Part II).

D. **The Contractor is required to comply** with applicable stipulations indicated on Administrative Bulletin OE-2018-33, related to an Executive Order of the Governor of Puerto Rico, in order to increase the minimum wage of construction workers, to bring into force the laws requiring the use of cement produced in Puerto Rico and to require the use of labor agreements in publicly funded construction projects. Signed copy of aforementioned bulletin is included as part of Contract Documents under the section identified as Related Laws (Part II).

E. The Contractor is required to comply with all applicable stipulations of the following laws of the Commonwealth of Puerto Rico:

1. **Law No. 117, approved on July 4, 2006,** known as *Ley de Justicia Contributiva 2006*, which impose state and municipal taxes identified as *Impuesto de Venta y Uso (IVU)*.

2. **Law No. 72, approved on May 29, 2015,** which amends several articles of Puerto Rico Internal Revenue Code, some of them related to aforementioned state and municipal taxes.

F. The Contractor must comply with following laws of the Commonwealth of Puerto Rico, which texts are included as part of Contract Documents under the section identified as Related Laws (Part I):

1. **Law No. 105, approved on August 6, 1996** (*Ley Uniforme para la Contratación de Proveedores de Acarreo de Agregados o Materias Análogas y de Servicio de Grúas por Agencias Gubernamentales*), which makes mandatory to Contractors of Government Agencies and Public Corporations of the Commonwealth of Puerto Rico, the request of the corresponding documentation and authorization from Public Services Commission (*Comisión de Servicio Público*) to all suppliers of hauling services and aggregate/fill material transportation.

2. **Law No. 458, approved on December 29, 2000,** as amended by Law No. 84 of July 29, 2001, which prohibits the award of any public bid or contract to a natural or legal person previously convicted for fraud or misappropriation of public funds.

3. **Law No., 84, approved on June 18, 2002,** which stipulates the Code of Ethics

for Contractors, Supplier and Petitioners of Economic Assistance from Governmental Agencies of the Commonwealth of Puerto Rico.

4. **Law No. 85, approved on June 18, 2002** (Amendment to Articles 2 and 14 of *Ley de la Administración de Servicios Generales, según enmendada*) that stipulates the mandatory enrollment for Contractors and Suppliers of Products and Non-Professional Services to the Unique Bidders' Registry (*Registro Único de Licitadores*) issued by General Services Administration (*Administración de Servicios Generales*).

5. **Law No. 14, approved on January 8, 2004** (*Ley para la Inversión en la Industria Puertorriqueña*), as amended, that stipulates the public policy and defines parameters to promotes the purchase of local manufactured products and the acquisition of services offered by local firms or companies settled in Puerto Rico, by Government Agencies and Public Corporations of the Commonwealth of Puerto Rico, derogating former Law No. 42 of August 5, 1989.

VIII. CERTIFICATIONS

The following certifications form part of this contract and shall be submitted by the Contractor **at the date and time previously established on contract documents for the opening of bid proposals:**

A. Certification of Eligibility from the Unique Bidders' Registry (*Registro Unico de Licitadores*) of the General Services Administration (*Administración de Servicios Generales*), according to the stipulations of Law No. 85, approved on June 18, 2002 (Amendment to Articles 2 and 14 of *Ley de la Administración de Servicios Generales, según enmendada*).

B. DUNS Number – System for Award Management (SAM).

C. EPA Repair and Painting Rule Certification (RRP Rule).

D. Asbestos Awareness Training/Course Certification (in accordance with related OSHA and EPA regulations).

E. OSHA 300A Certifications – Years 2019 and 2020.

F. Certification of Investment Parameters for Products or Materials manufactured (extracted, produced, assembled, packed or distributed) in Puerto Rico (if applies), in accordance to the stipulations of government purchases' preferential policy, as stated on Law No. 14, approved on January 8, 2004, and as amended by Law No. 184, approved on December 12, 2007.

IX. FINANCIAL STATEMENT

A. It is mandatory to all prospective bidders, at the moment the Bid Proposal is submitted, **to include one of the following statements**:

1. **Copy of last financial statement, duly audited and certified** by a Public Certified Accountant (*Contador Público Autorizado* - C.P.A.) on a date not older than fifteen (15) months prior to the bid opening date.

Copy of revised financial statement, prepared on a date not older than fifteen (15) months prior to the bid opening date, in compliance with all requirements indicated on Article I of Supplementary Special Conditions (Condiciones Especiales Suplementarias).

B. Both financial statements must also include the following key components:

1. **Balance Sheet** – Assets, liability and equity.
2. **Income Statement –** Revenue and expenses.
3. **Statement of Retained Earnings –** Reconciles retained earnings from prior to current year.
4. **Statement of Cash Flow –** Where did cash come from and where did it go.
5. **Notes to Financial Statement and Schedules.**

Each bidder shall submit, at the bid opening date and time, the original bid documents (or copy, whichever applies) required to accompany y the corresponding bid proposal for this project, in hard copy format (paper), with one (1) additional copy of all of them in digital format (PDF recorded on compact disk - CD). **The PBA will only accept originals for Bid Bond (Bid Forms No. 2 & 2a) and Proposal Forms (Bid Form No. 7 – four (4) pages), duly signed and sealed, as required on the corresponding forms.**

X. CONTRACTOR'S REQUEST FOR SUBSTITUTION

The Contractor shall reproduce, at his own expense, enough copies of the form ***Contractor's Request for Substitution*** **(one (1) page)**, as hereinafter provided, and should use it every time that he proposes the substitution of materials and equipment in lieu of the materials and equipment already specified. The Contractor will be responsible to strictly follow the stipulations as stated for in the ***Contractor's Request for Substitution*** for his own submittals, including also, Subcontractor's submittals. Submittals not complying with these stipulations shall not be accepted by the PBA and will be returned to the Contractor without further action.

XI. PROJECT IDENTIFICATION SIGN: SUPPLEMENTARY SPECIFICATION 661

A. DESCRIPTION:

SCOPE - This work shall consist in furnishing, erecting, maintaining and removing **16' x 8'** project identification signs, in accordance with these specifications and in conformity with the design, dimensions, materials and locations shown on the construction drawings or established by the Project Engineer or Government Agency representative.

B. MATERIALS:

Each sign and supporting frame shall be constructed of good quality new lumber as follows:

1. **Frame** - Shall be dry No. 1 grade lumber, sound, squared, surfaced four sides, free of loose knots or decay. It may be Douglas fir, spruce, oak or cypress conforming to AASHTO M 168. Lumber shall be pressure treated with pentachlorophenol or chromate copper arsenate in conformity with the standards of the American Wood Preservers Association (AWPA).

2. **Sign Panel** - Shall be ½" thickness exterior type, high density plywood, resin-bonded, B-B grade or better as per the National Bureau of Standards Specification PS-1 for construction plywood. It shall be laminated with vinyl or aluminum at both sides.

3. **Printing - Full Color UV Cure Digital Printing Process**, with a minimum resolution of 720 DPI. Printing shall be warranted for a minimum of three years.

4. **Hardware** - Bolts, nuts, washers and hardware for erecting the sign assembly shall be aluminum or galvanized steel.

C. PROJECT REQUIREMENTS:

1. **The Contractor shall furnish and erect** the number of signs indicated in the contract documents. If not so indicated, the Government Agency promoting the project will determine the number of signs to be installed.

2. **Signs shall be erected** at the locations shown on the plans or indicated by the Engineer. They shall be so placed as to not obstruct the visibility of traffic signs.

3. **The Contractor shall maintain** the signs in good condition throughout the full construction period, repainting and repairing then as necessary.

4. **After the construction work** is completed and accepted the Contractor shall remove the signs from the project site unless otherwise directed by the Engineer.

D. METHOD OF MEASUREMENT:

1. **Project identification signs** shall be measured by the number of individual units furnished, erected and installed.

2. **The maintenance, repainting and repairing** of the signs during the full project period and the removal of it after the construction work is completed will not be measured for payment but will be subsidiary obligation under this specification.

E. BASIC OF PAYMENT:

1. **The quantity of project** identification signs determined as provided above shall be paid for at the contract unit price per unit for the pay item listed below that is included in the contract. Such price and payment shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to satisfactorily complete the item as required by the specifications.

2. **Payment will be made under:**

Pay Item	**Pay Unit**
Project Identification Sign	each

XII. REFERENCE DRAWINGS ACCOMPANYING SPECIFICATIONS

A. The following mechanical (A/C) drawings and photos has been submitted herewith on *PDF* format for REFERENCE PURPOSES ONLY, as complement of technical specifications:

1. **See attached list for full code numbering and drawing name included.**

B. All reference drawings are property of the P.B.A. and shall not be used for any purpose other than that contemplated by the technical specifications and related Contract Documents.

C. The attached technical specifications serve to establish the guidelines for conditions, products and execution methods; however it may happen that products improvements or changes in codes and standards have occurred and are not reflected in these. In such a case, the latest product updates or changes in codes and standards will prevail unless specifically stated otherwise.

D. If the specification of any product, service or execution method is not included in the technical specifications, then the most restrictive applicable codes and standards will be followed.

1. **See the attached list for technical specifications included for the project.**

XIII. ADDITIONAL CLAUSES TO THIS CONTRACT

A. It is mandatory condition for this bid that all prospective bidders must have at least five (5) years of experience in the furnishing and installation of air conditioning (A/C) system for institutional and/or commercial facilities. Also, PBA requires that all prospective bidders must have experience with the performing of improvements to A/C system at existing facilities to be in use during project's time for completion, including replacement of A/C units and related mechanical/electrical equipment & accessories. **Written documents certifying the requested experiences shall be included** as part of Statement of Bidder's Qualifications (Bid Forms 5, 5a, 5b,

5c, 5d, 5e & 5f) submitted on bid opening date.

B. The prospective bidders shall be responsible to acquaint with particular conditions, restrictions, difficulties and any other relevant matters related with the work to be performed on existing building facilities. This procedure shall be accomplished during pre-bid meeting or at further visits to project's site (prior to the bid opening date), in accordance to the stipulation indicated on Article 2.3 of Instructions to Bidders.

C. The Contractor shall be responsible to verify the dimensions and exact location of existing equipment and related mechanical, electric, electronic & accessories, to be removed and replaced as part of the Contract (in accordance to Supplementary Special Conditions' clauses). Also, the Contractor must verify the location, voltage and characteristics of existing building's electrical system equipment & utilities available to energize aforementioned units.

D. The prospective bidders shall be responsible for determining actual quantities, measurements and site conditions for estimating any part of the work necessary to complete the project works to be quoted.

E. The Contractor shall contract only qualified personnel with inspected equipment to perform hoisting and rigging lift operations for this project. Prior to commencing any hoisting and rigging lift operation on site, the contractor shall submit a detailed hoisting and rigging lift plan to the PBA for approval. This plan must comply with all applicable provisions of OSHA 29 CFR 1926.251 and law No. 55, approved on August 4, 1997 (*Ley para Reglamentar, Certificar, y Licenciar la Inspección de Grúas de Construcción e Industriales*). The Contractor shall attach to this plan evidence of all equipment inspection reports with all the participating riggers' qualifications and experience. The Contractor is responsible, at his own expense, to coordinate and provide all planning, labor, and equipment to develop and execute any Traffic Control Plan (TCP) needed to perform, in a safely manner, all hoisting and rigging activities on site.

SECTION 23 01 00.51

AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

(REV 05/22)

PART 1. GENERAL

1.1. SUMMARY

1.1.1. Section Includes:

1.1.1.1. This section provides the general requirements and guidelines for maintenance practice on the ACV systems located at the **Instituto Tecnologico de Ponce** and included in contract agreement.

The work to be accomplished consist of furnishing all labor, products, tools, equipment, supervision, and services necessary for:

All necessary troubleshooting, adjustments, or parts replacement in accordance with the original equipment manufacturer's recommended procedures and performance criteria for the air conditioning equipment.

Provide a preventive maintenance program in accordance with the corresponding maintenance schedule and original equipment manufacturer's recommended procedures and performance criteria for the air conditioning equipment.

All necessary refrigerant gas charge in accordance with the procedures and performance criteria recommended by the original equipment manufacturer for the air conditioning equipment.

Contractor shall provide full maintenance of air conditioning equipment for a safe, reliable, available, and proper operation of the air conditioning systems.

1.1.2. Product furnished:

All products (materials and parts) to be furnished and installed under these specifications shall meet the drawings and schedules.

All materials to be furnished under these specifications shall be manufactured conforming UL or FM certification or any kind of regulation indicated by the Puerto Rico Building Code, Puerto Rico Existing Building Code, Puerto Rico Mechanical Code and Puerto Rico Fire Code.

1.1.3. Related Requirements:

SECTION 01 11 00 - SUMMARY OF WORK

SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.2. PRICE AND PAYMENT PROCEDURES:

1.2.1. Allowances

(Not Used)

1.2.2. Unit Prices:

Air Conditioning Operation and Maintenance Contractor shall submit a unit price for each type of air conditioning equipment included in this agreement.

Unit price shall consider and include all the requirements of these specifications.

Unit price shall be used (if necessary) for future equipment added to the contract.

1.2.3. Alternates

(Not Used)

1.2.4. Measurement and Payment:

1.2.4.1. Monthly Invoices:

All invoices shall be submitted for approval to DEPR / OMEP or PBA's authorized representative in the Instituto Tecnologico de Ponce Administration office.

Air Conditioning Operation and Maintenance Contractor shall submit to the DEPR / OMEP or PBA a monthly invoice within five (5) working days of the last day of each month, in arrears, for services performed pursuant to this Agreement.

Air Conditioning Operation and Maintenance Contractor shall submit only one bill per month for operation and maintenance services included in contract.

1.2.4.2. Liquid Damages:

The DEPR/OMEP or PBA will make deductions from the invoices for any time that any equipment is out of service for more than 5 days and the breakdown, damage or failure is the responsibility of the Maintenance Contractor under the terms of this contract and specifications.

The DEPR/OMEP or PBA will make deductions from the invoices for any working day that any of the air conditioning technician are not present (absence from work) in the campus.

Refer to **Schedule O&M-1** for details of monthly discount fees for equipment out of service or employee absence.

The DEPR / PBA will stop the monthly payment for any equipment out of service when Maintenance Contractor fail and abandon repairs without justification. DEPR / OMEP / PBA will consider an abandon of repair, when:

Failure to comply with any of the above requirements will be sufficient reason not to proceed with the payment of full monthly invoices.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

AABC - Associated Air Balance Council

ACI - American Concrete Institute

ACOMC - Air Conditioning Operation and Maintenance Contractor

AHRI - Air-Conditioning, Heating, and Refrigeration Institute

AHJ- Authority Having Jurisdiction

ACV – Air Conditioning and Ventilation

ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

ANSI- American National Standards Institute

ARI - American Refrigeration Institute

ASME- American Society of Mechanical Engineers

CIAPR – Colegio de Ingenieros y Agrimensores de Puerto Rico

DEPR – Department of Education of Puerto Rico

EPA - Environmental Protection Agency

FM Approvals - Factory Mutual Laboratories

NADCA: National Air Duct Cleaners Association

NEC- National Electrical Code.

NEMA - National Electrical Manufacturers Association

NFPA- National Fire Protection Association

OMEP – Oficina mejoramiento Escuelas Públicas

PBA- Public Buildings Authority

PRBC – Puerto Rico Building Code

PRECC – Puerto Rico Energy Conservation Code

PREBC – Puerto Rico Existing Building Code

PRMC – Puerto Rico Mechanical Code

PRPC – Puerto Rico Plumbing Code

PROSHA – Puerto Rico Occupational Safety & Health Administration

UL - Underwriters Laboratories Inc

1.3.2. Definitions:

1.3.2.1. External Definitions are:

All listed in ASHRAE standards

All listed in the PRFC.

All listed in the PRBC

All listed in the PEBC

All listed in the PRMC

All listed in the PRECC

1.3.2.2. Maintenance contract definitions are:

Barricade – A temporary structure to restrict access to working area.

Brand new – any manufactured product (part or material) never used or installed.

Capacity - The load that the equipment is designed and installed to operate.

Confined Space – An area that has adequate size and configuration for employee entry; and has a limited means for entry and exit; and is not designed for continuous occupancy.

Force Majeure – Strikes, fires, floods, earthquake and aftershocks, severe rain, severe storm, hurricane, lighting, or any other circumstances out of control of DEPR / OMEP / PBA and/or Air Conditioning Operation and Maintenance Contractor (ACOMC).

Jumpers – A temporary means of bypassing or shunting an electrical circuit.

Air Conditioning Operation and Maintenance Contractor - stands for the organization, registered in Puerto Rico to operate as mechanical contractor, installer, maintainer, and repairer, who has been contracted by the PBA to perform air conditioning equipment maintenance works and related activities.

Material Safety Data Sheets (MSDS) – A document that identifies the hazards, safe handling and emergency procedures for each individual hazardous chemical used in the workplace.

Not-Existing Product - Any product not installed and never existed in the air conditioning system when the maintenance contract begins.

Occupational Safety & Health Administration (OSHA) –Federal agency under the Department of Labor that publishes and enforces safety and health regulations for most businesses and industries in the United States and Puerto Rico.

Authorized representatives – any DEPR / OMEP / PBA employee who has authority to make decisions or recommendations. Includes:

Secretary of Department of Education of Puerto Rico

OMEP Executive Director

PBA Executive Director

Any official appointed to represent the aforementioned

Regular working hours –

For this agreement regular working hours are:

7 AM to 4 PM between Mondays to Friday.

Or as indicated by DEPR / OMEP

Shall – Indicates a mandatory requirement.

Should – Indicates a recommendation, but not a mandatory requirement.

Waste material – Any residual component (parts or material) removed from any ACV system and not intended to be used again due to aging, deterioration, degradation or worn-out. It also means, residual components not reclaimed in any recycling program of parts manufacturers. Waste materials will be disposed of in accordance with local, state, or federal regulations.

Vandalism - The intentional and malicious destruction or damage of the property of others.

1.3.3. Reference Standards:

ASHRAE –

Guideline 11-2021 -Field Testing of HVAC Control Components

Standard 15-2019, Safety Standard for Refrigeration Systems

Standard 34-2019, Designation and Safety Classification of Refrigerants

Standard 62.1-2019, Ventilation for Acceptable Indoor Air Quality

Standard 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings

Standard 100-2018, Energy Efficiency in Existing Buildings

Standard 180-2018 -- Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems (ACCA Co-sponsored)

Standard 185.2-2020 -- Method of Testing Ultraviolet Lamps for Use in HVAC&R Units or Air Ducts to Inactivate Microorganisms on Irradiated Surfaces

American National Standards Institute (ANSI)

ASME International (ASME)

American Society for Testing and Materials (ASTM)

American Water Works Association (AWWA)

International Code Council (ICC)

National Electrical Code, NFPA 70 (NEC)

National Electrical Manufacturer's Association (NEMA)

National Fire Protection Association (NFPA)

National Sanitary Foundation (NSF)

Occupational Safety and Health Act (OSHA)

Puerto Rico Occupational Safety and Health Act (PROSHA)

1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Coordination:

1.4.1.1. Contract Term

The technical specifications and the agreement are effective for one (1) year starting upon date of Notice to Proceed and just after the final acceptance of the works required at the **section 23 01 00.61 – Air Conditioning Systems Repairs**.

To ensure continuous service, this agreement will be renewed for a four (4) successive one (1) year periods, unless either party to this agreement, timely serves written notice upon the other party of its intention not to continue with the agreement. The agreement will be renewed based on the availability of funds.

Agreement extensions will be based on the same specifications and conditions as the initial Term.

Air Conditioning Operator and Maintenance Contractor shall have a Project Maintenance Manager or coordinator.

Project Maintenance Manager or Coordinator shall be responsible for the supervision of all maintenance activities under contract.

Project Maintenance Manager or Coordinator shall be responsible for all documents related to this contract.

Project Maintenance Manager or Coordinator shall be responsible for explaining to mechanics and technicians the scope of contract and activities included. The explanation shall be just after Notice to Proceed and with the assistant of DEPR / OMEP / PBA representative.

All phases of works under this contract shall be coordinated with DEPR / OMEP / PBA authorized representatives and the Instituto Tecnologico de Ponce academic staff.

1.4.2. Kick off Meetings:

Conduct a kick off meeting or work conference at Project site before each major activity that requires coordination with other stakeholders (PBA, DEPR, OMEP, Others).

Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

Reporting: Distribute minutes notes of the meeting to each party present and to other parties requiring information.

Do not proceed with installation or works if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the work and reconvene the conference at earliest feasible date or time.

Sequencing:

The ACOMC shall meet and cooperate with the DEPR / OMEP / PBA representatives to schedule and sequence this work so as to ensure meeting scheduled completion dates and avoid delaying other portions of the work. Work requiring special sequencing shall be at no additional cost to the DEPR / OMEP / PBA and shall have no impact on the schedule

1.4.3. Scheduling:

Air conditioning operation and maintenance contractor (ACOMC) shall have a **Project manager, Maintenance Contract Coordinator** or **Contract Manager** to serve as the Point of Contact (POC).

Project Manager, Maintenance Contract Coordinator or Manager shall be responsible for the supervision (representing the contractor) of all maintenance

activities under contract.

Project Manager, Maintenance Contract Coordinator or Manager shall be responsible for all documents related to this contract.

Project Manager, Maintenance Contract Coordinator or Manager shall be responsible for explaining to his mechanics and technicians the scope of contract and activities included. The explanation shall be just after Notice to Proceed and with the assistant of DEPR / OMEP or PBA representatives.

All phases of works under this contract shall be coordinated with DEPR / OMEP or PBA authorized representatives.

In case of any conflicting conditions between these specifications and building plans, or layouts, as far as dimensions, general arrangement, or any other **physical parameter** is concerned, Maintenance Contractor shall give precedence to the building plans or layouts over these Maintenance Specifications.

Any conflicting condition between these Maintenance Specifications and building plans or equipment layouts, concerning any other feature of the work, **not dimensional, or location wise**, the Maintenance Contractor shall give precedence to these Maintenance Specifications over the building plans or layouts.

The ACOMC must have the knowledge, experience, tools, special services tools, drawings, materials and parts, transportation, and all other facilities required and necessary to adjust, repair, replace, test, prevent damages and provide adequate full programmed service and preventive maintenance for air conditioning equipment.

DEPR / OMEP or PBA will not accept excuses for lack of tools or materials from maintenance Contractor that do not permit air conditioning equipment be in operation.

Regular working hours –

For the purpose of this agreement regular working hours are:

7 AM to 4 PM between Mondays to Friday.
Or as indicated by DEPR / OMEP

1.5. SUBMITTALS ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

1.5.1. Action Submittals:

Safety Plan:

The Air Conditioning Maintenance Contractor shall submit a Safety Plan for approval of DEPR / OMEP or PBA. Safety plan shall include, but not limited to:

Emergency phones number of supervisor and managers.

Confined Space Program.

Hazard Communication Program

Fire Protection Program.

Lockout – Tagout program.

Recent safety trainings to mechanics and technician's seminars.

Environmental Plan:

The Air Conditioning Maintenance Contractor shall submit an Environmental Plan for approval of DEPR / OMEP or PBA. Environmental Plan shall include, but not limited to:

Oil Spill Prevention Program.

Hazard Materials Waste Disposal

EPA Refrigerant Management Program

1.5.2. Product Data:

1.5.2.1. Materials:

When new materials are required and necessary, maintenance contractor shall submit two copies (2) of materials including:

MSDS when necessary.

Manufacturer name or brand.

Brochures

Typical uses

Open book price

1.5.2.2. Parts:

When parts replacement is required and necessary, maintenance contractor shall submit two copies (2) of materials including:

Drawings and/or photos (PDF format as standard).

Manufacturer's name and model.

Part number.

Installation recommendation.

Electrical characteristics

Mechanical characteristics.

Open book price.

1.5.3. Qualification Statements:

Qualifications of maintenance contractor:

The Maintenance Contractor shall submit:

Evidence that it possesses the qualifications, abilities, capacity, facilities, and resources to accomplish the work as set forth in these specifications, all to the satisfaction of DEPR / OMEP or PBA.

Evidence of registration from the Department of State of Puerto Rico corporates list and good standing.

Evidence of being in the air conditioning maintenance business and maintained a maintenance service organization in Puerto Rico for at least the last five years with continuous and immediate experience in the maintenance of air conditioning equipment of the type that is installed in the facilities.

A list of five (5) customer reference in Puerto Rico where it has provided such maintenance service on contracts and equipment similar in size and scope.

Customer references shall include customer's name, address, and contact person and phone number.

Air conditioning technicians:

Submit two (2) copies of qualifications and experience of each A/C technician to be deployed or visiting the buildings.

Submittal shall include:

Basic experience resumes with education and trainings.

Good Conduct Certificate from the Police Department of Puerto Rico.

Negative certification of the sexual offenders list of the Department of Justice of Puerto Rico.

Trainings and certifications in last year.

1.6. CLOSEOUT SUBMITTALS

1.6.1. Operation and Maintenance Data

Operation and Maintenance Manual:

For equipment and systems to include in operation and maintenance manuals.

1.6.2. Warranty Documentation

The maintenance contractor will provide all the documents that evidence the guarantees on the equipment or services.

1.6.3. Record Documentation

As-Built Drawings:

For recording installed conditions that deviate from design documents.

1.6.4. Software

The maintenance contractor will provide all the software that is necessary for the operation of the VFD or any other control devices of the air conditioning system.

1.7. MAINTENANCE MATERIAL SUBMITTALS

1.7.1. Spare Parts

Air Conditioning Maintenance Contractor will provide a list of spare parts required to keep the performance of the equipment without interruptions or delays. The list will include, but not limited to:

Belts

Fuses

Refrigerants

Lubricants

Others

1.7.2. Tools

The maintenance contractor will have all the tools of common use and specialized to provide service immediately and without delays.

1.8. QUALITY ASSURANCE

Regulatory requirements:

Maintain and provide a refrigerant management record that complies with EPA requirements and regulations.

Maintain and provide a testing record that complies with NFPA 90A and PRFC requirements and regulations.

1.8.1. Qualifications

Licensed Professionals:

The air conditioning maintenance contractor will provide the professional license and registration of:

Air conditioning technicians (including the EPA refrigerants handling license)

Electricians

Engineers

Architects

Any other required by law or regulations.

1.9. DELIVERY, STORAGE, AND HANDLING

Storage and Handling Requirements

Parts and material shall be stored and handle according to manufacturer's instructions. The DEPR, OMEP or PBA will not accept any parts or materials with evidence of damages.

1.10. FIELD / SITE CONDITIONS

1.10.1. General Conditions:

School environment with children, academic and administrative staff.

Air conditioning equipment mostly located on the roofs of buildings.

Very hot and dry environment.

1.10.2. Existing Conditions (Pre-Bid Inspection Meeting):

Bidders shall examine each air conditioning equipment to determine the condition of the equipment and the accuracy of the information shown for the schedules.

For purposes of the operation and maintenance phase, all air conditioning equipment must be in perfect operating condition

1.10.3. Air conditioning Maintenance Contractors Conditions Transition Meetings (to be used at the contract termination):

There are two transition meetings for gathering information about air conditioning equipment conditions. The first meeting shall be 30 days before contract termination. The second meeting shall be 2 days after initiate the new maintenance contract.

Meetings are compulsory and shall assist the Incoming Air conditioning maintenance contractor, Outgoing Air conditioning maintenance contractor, DEPR / OMEP and/or PBA representatives.

The objective of meetings it's to get in knowledge of the actual conditions of air conditioning equipment and report any deficiencies.

Incoming air conditioning maintenance Contractor shall inspect very carefully all section and components of equipment.

Incoming air conditioning maintenance contractor shall pay special attention to:

General:

Fuses (rate)

Disconnected means

Electrical jumpers

Burned electronic boards

Lamps or LED's

Buttons

Indicators or monitors

Sensors

Thermometer and pressure gauges

Drawings, schematics, and services manuals

Equipment general performance

Oil leaks

Refrigerant leaks

Water leaks

Belts

Condenser coils damages

Evaporator's coils damages

Fans and blowers damages

Control valves operation

Filter conditions

Unusual noises

Incoming air conditioning maintenance contractor shall indicate any deficiencies found. Any deficiencies shall be discussed with Outgoing air conditioning maintenance contractor for clarifications and solutions.

If Outgoing air conditioning maintenance contractor accepts any deficiencies as indicated and if it's impossible to solve in the moment or in reasonable time, these deficiencies shall be included in Transition Report for Incoming air conditioning maintenance contractor.

Cost of deficiencies indicated in Transition Report shall be charged or discounted of any account of the Outgoing air conditioning maintenance contractor.

Failure of Incoming air conditioning maintenance contractor to submit a report of deficiencies will result in that any claim for additional work will be not considered in the future.

In case of hidden deficiencies, those that in the air conditioning industry cannot be detected despite due diligence, the DEPR/ OMEP or PBA will evaluate each one case by case.

1.11. WARRANTY AND BOND

1.11.1. Bonds:

Performance Bonds:

A Performance Bond in the minimum amount of 100% of the contract amount totaling the duration of contract is required under this contract to guarantee the faithful performance of the contract and all obligations arising there under. This

Performance Bond shall be renewed proportionally if the service contract is renewed.

1.11.2. Warranty:

Special Warranty:

Materials:

Any material used in maintenance works shall be guaranteed for at least one (1) year.

The starting date of guarantee period shall be the effective date of work completion and accepted by the DEPR / OMEP or PBA.

Air Conditioning Maintenance Contractor shall repair or replace any material non-conforming with safety requirements and equipment performance standard after installation in the guarantee period.

Air Conditioning Maintenance Contractor shall repair or replace any material installed and deteriorated during the guarantee period.

Any work under guaranteed claim shall include labor and materials.

Any work under guaranteed claim shall be at no cost to the DEPR / OMEP or PBA.

Parts:

Any part used in maintenance works shall be guaranteed for at least one (1) year.

The starting date of guarantee period shall be the effective date of work completion and accepted by DEPR / OMEP or PBA.

Air Conditioning Maintenance Contractor shall repair or replace any part non-conforming to safety requirements and air conditioning equipment performance standard after installation in the guarantee period.

Any work under guaranteed claim shall include labor and parts.

Any work under guaranteed claim shall be at no cost to PBA.

PART 2. PRODUCTS (PARTS AND MATERIALS)

2.1. GENERAL:

2.1.1. Parts and Materials Included:

Any parts and/or materials required for adjustment, repair or replacement of air conditioning equipment shall be included in this contract at no additional cost to the DEPR / OMEP or PBA. Specific exceptions are indicated in section 2.2.4. This contract is **Full Maintenance** type.

2.2. SUPPLIED PRODUCTS

2.2.1. New Products (Not- existing Products):

When new materials or parts will be introduced to air conditioning systems, these material or parts shall be brand new and of the most suitable grade for the purpose intended.

Any new material or parts shall be from original manufacturer or as recommended by the original manufacturer.

Any notice from air conditioning maintenance contractor in the form of promotional literature on new equipment, improvements (as perceived by Maintenance contractor) on air conditioning equipment, new maintenance methods and procedures proposed by maintenance contractor shall be considered for evaluation and analysis.

DEPR / OMEP or PBA is not legally required to continually updating the air conditioning equipment every time the maintenance contractor submits a "beware notice on unsafe situation" or proposals. Maintenance Contractor shall be sure that proposed material, parts, or upgrades are not included in this maintenance contract before submitting a proposal.

2.2.2. Proposals Price:

When Not-Existing product shall be acquired and installed in the air conditioning systems, the proposal shall include an **OPEN PRICE BOOK** for each product included.

When proposal exceed of $2,000, air conditioning contractor shall submit an original part or material proposal from manufacturer or supplier.

The air conditioning maintenance contractor shall include in the proposal the labor fees for works related to installation of parts.

The labor fees will be broken down into hours and staff (employees to be assigned to jobs).

If at the end of the work the stipulated hours were not used, then a deduction will be made to the purchase order and invoice.

If additional labor hours are required to complete the job, then additional labor fees will be charged to the contractor.

The air conditioning maintenance contractor shall include in the proposal 15% of the total cost of product and labor fees to compensate for overhead and profit.

The standard hourly rate for maintenance personnel included in an additional work proposal will be $50.

2.2.3. Existing Products

Because of use, existing parts and components may need to be repair or replace, due to deterioration, wearing or failure, in such cases, the air conditioning maintenance contractor will follow these guidelines:

Repairs:

The DEPR / OMEP or PBA will accept repairs of parts as first way of solution, but in case of recurrent failure or downtime, the air conditioning maintenance contractor must replace the part or parts with a new one.

If repair, the air conditioning maintenance contractor will be responsible for UL or FM certification and any other certification or testing required by any regulatory agency for the parts or materials to be repaired.

Any design change of the equipment components, which can save the operation of the equipment, must have a manufacturer's certification or a professional engineer's certification. This clause will apply with special attention to electronic boards or electronic parts.

Replacement:

When necessary or required the replacement of materials and parts, these shall be brand new and of the most suitable grade for the purpose intended.

Any replaced material or parts shall be from original manufacturer or as recommended by the original manufacturer or industry standards.

In case of materials or parts manufacturer’s substitution. The air conditioning maintenance contractor shall consult in written to DEPR / OMEP or PBA before proceeds.

Consult section 1.9 for information included in submittals.

2.2.4. Parts and materials Not - included:

Any parts and/or materials required in connection with vandalism, improper use of equipment, terrorism, force majeure, or any other act out of control of air conditioning maintenance contractor shall not be at the expense of the maintenance contractor after DEPR / OMEP or PBA evaluation, analysis and assessments.

Vandalism:

The air conditioning maintenance contractor shall not be required, except as noted herein, to make repairs in connection to proven vandalism or improper use of the air conditioning equipment air conditioning equipment by persons other than the air conditioning maintenance contractor (representative and/or employees). The DEPR / OMEP / PBA reserves the right to make a final determination as to responsibility.

When an act of vandalism occurs, a complaint shall be file at the corresponding Police Department Station. A complaint number will be required before proceeding with repairs.

External paint and finishes (doors, locks and windows) of machine rooms are not included.

New components, parts or materials as recommended or required by insurance company or any authority with jurisdiction and classified as Not-Existing Product are not included.

2.3. OWNER SUPPLY SERVICES / UTILITIES / PREMISES:

2.3.1. General:

Water, electric power, and internet will be provided by the DEPR / OMEP / PBA for use by the air conditioning contractor in connection with air conditioning maintenance activities.

2.3.2. Warehouse and storage:

The air conditioning maintenance contractor could keep tools, parts, material, and other product in the machine rooms of each building.

The security of storage of tools, parts, materials, or product shall be the responsibility of the air conditioning maintenance contractor.

2.4. SPARE PARTS:

2.4.1. In Site (in building) spare parts:

Air conditioning maintenance contractor shall keep in each machine room sufficient stock of parts for immediate adjustment and repair of air conditioning equipment. Parts shall include, but will not limited to:

Belts

Condenser fan assembly

Refrigerant

Air conditioning oil

Lubricants

Electric motors

Contactors

Fuses

Switches

Lamps and LEDs

Others as recommended by air conditioning equipment manufacturer's

2.4.2. Air conditioning maintenance contractor warehouse spare parts:

Fast moving parts - air conditioning maintenance contractor shall keep in its warehouse fast moving parts accessible for immediate repair or replacement within 4 hours.

Special or dedicated parts – If special parts are not available in stock, air conditioning maintenance contractor shall be capable to import parts in one weeks or less.

The air conditioning maintenance contractor shall promptly notify the DEPR / OMEP or PBA in writing including all relevant information concerning any actual or potential situation that may adversely affect delivery of materials, labor performance, or any other obligation of maintenance contractor under the terms of the contract. The absence of this communication will prevent the maintenance contractor from requesting time extensions for compensation against time lost in contract.

The communication shall be using electronic mail (email) or fax.

As necessary DEPR / OMEP or PBA will require copy of purchase orders and invoice from manufacturer when ordering parts.

When replacement of electrical part is necessary, verify the correct voltage before ordering **(means, double check)**.

When discrepancy in available voltage is found, verify the causes for it. Correct any inherent problem before ordering new parts.

Shape and weight:

When replacement is necessary new parts shall be similar in shape and weight to the ones removed.

PART 3. – EXECUTION

3.1. SERVICE SCHEDULE:

3.1.1. Air Conditioning Technicians (in site):

Objective:

The air conditioning maintenance contractor will assign two (2) air conditioning technicians to be present in the Instituto Tecnologico de Ponce facilities.

- In case case, one of them shall be an authorized license by the state.

Schedule – 7 AM to 4 PM, Mondays to Friday

Or as indicated by DEPR / OMEP.

The main objective is to keep the air conditioning system equipment in the most reliable and available condition and to respond to any type of emergency without delay.

Resident Technicians shall perform any maintenance task as necessary while present in the building (preventive, corrective, breakdown, others).

Air conditioning maintenance contractor is responsible for assign other technician to the campus in case of absence, if not invoice deduction will proceed conforming Section 1.2.4.2

3.1.2. Routine maintenance:

Air conditioning technicians shall inspect and provide preventive maintenance using the maintenance guidelines included in **Schedule O&M-2** as a minimum standard.

The air conditioning technicians shall inspect and provide maintenance to each air conditioning equipment included in the **Schedule O&M-3, O&M-4, O&M-5, O&M-6, O&M-7 O&M-8 and O&M-9**.

Work required in connection to this contract (preventive maintenance) shall be performed during regular working hours, Monday to Friday.

When required or necessary, maintenance task can be done on Saturdays, Sundays, or holydays. The Air Conditioning Maintenance Contractor shall not charge for these visits.

All scheduled downtime or major corrective maintenance shall be notified to the DEPR / OMEP or PBA for approval, with a minimum of 5 working days prior to works.

Scheduled downtime or major corrective maintenance shall only be approved, conditioned approved or refused by DEPR or OMEP representatives.

During monthly preventive maintenance activities, Air Conditioning Maintenance Contractor shall adjust, clean, repair or replace parts and materials required for most optimal performance, according to the strictest of the following:

Standards and recommendations of the manufacturer's or AHJ.

3.1.3. AHJ standards and recommendations.

3.1.3.1. DEPR / OMEP / PBA guidelines.

Minimum routine maintenance schedules and activities are indicated in Schedule O&M-2 for different type of air conditioning equipment to indicated intervals.

3.1.4. Breakdown maintenance (emergency response):

The Air Conditioning Maintenance Contractor shall be available for breakdown maintenance (emergency response), twenty-four hours (24 hrs.), seven days a week, during the term of the contract.

Breakdown maintenance (emergency response) will be required when the staff assigned to the Instituto Tecnologico de Ponce cannot perform these due to complexity, difficulty, or specialized knowledge requirements.

The Air Conditioning Maintenance Contractor shall provide rapid breakdown maintenance service (emergency response) in response to a request by

telephone, fax, email or otherwise, from the DEPR / OMEP / PBA authorized representative or Instituto Tecnologico de Ponce academic staff.

Breakdown maintenance (emergency response) service shall restore Air conditioning equipment to operating conditions at no additional cost, regardless of the time of day.

Air Conditioning Maintenance Contractor shall respond on-site to normal Breakdown maintenance (emergency response) within two (2) hours, during regular working hours, and within three (3) hours after regular working time.

In the event of an emergency response situation, where actual or imminent physical or psychological harm to students or Department of Education personnel, or where air conditioning equipment is a threat, the Air Conditioning Maintenance Contractor shall respond immediately with the assigned personnel at the Instituto Tecnologico de Ponce. There are no additional costs for this service to the DEPR / OMEP / PBA.

In the event of a catastrophic failure and the repair cannot be completed within the times agreed upon in these specifications, the air conditioning maintenance contractor will provide temporary cooling to the affected premises. There is no charge to DEPR / OMEP / PBA for temporary cooling.

3.2. EXAMINATION

3.2.1. Verification of Conditions:

Air conditioning maintenance contractor must inspect each air conditioning equipment installation and must be acquainted with the existing physical and operating condition of the installations.

Each air conditioning technicians shall be aware of existing conditions, as stated in the original proposal.

3.2.2. Site Safety:

After visiting and inspecting the project as per Section 3.2.1 and prior to perform any kind of work, air conditioning maintenance contractor shall notify in writing to the DEPR /OMEP or PBA of any dangerous or otherwise objectionable condition in the structures, equipment or any other installation or facility or adjacent to the work site, which in opinion of the maintenance contractor will adversely affect the safety of his work and/or his work schedules

3.3. PREPARATION

3.3.1. Protection of In-Place Conditions

Before any work, air conditioning maintenance contractor technicians, shall install barricades in all accesses to machine room, if doors have to be open for any situation or condition.

3.3.2. Demolition / Removal

The air conditioning maintenance contractor may, at its own expense and only after written authorization from DEPR / OMEP or PBA, alter or change an existing configuration or arrangement of an existing structure or area, and after completing its work, shall restore the structure or area to its original condition or as directed in writing by the DEPR / OMEP or PBA.

3.4. ERECTION / INSTALLATION / APPLICATION

3.4.1. Special Techniques

The Air Conditioning Maintenance Contractor shall be responsible for providing specialized equipment and/or tools as required for the successful execution of this contract. Any hoisting and/or uplifting of heavy equipment or parts shall be the responsibility of Maintenance Contractor. Air conditioning debris, garbage or not necessary materials shall be immediately removed from building site by Maintenance Contractor.

3.4.2. Interface with Other Work

The Air Conditioning Maintenance Contractor will take precautions in order to not disturb the operations of buildings and the academic activities.

3.5. REPAIR / RESTORATION / RE-INSTALLATION

3.5.1. If the Air Conditioning Maintenance Contractor needs to remove a component or part from any equipment, for the purpose of repair, replace and/or upgrade; the following procedure shall be followed:

Prove and explain to DEPR / OMEP or PBA supervisor or representative, the existing conditions of components or parts.

The air conditioning maintenance contractor shall obtain written authorization from DEPR / OMEP / PBA or Building Administrator or representative.

DEPR / OMEP or PBA will provide a fill-out form for this purpose.

The authorization shall include full description of the component; including, but not limited to:

Location of the equipment from which the part was removed.

Equipment ID (tag)

Description

Physical parameters

Part number - OEM

Name plate data

Other information as necessary

The authorization shall include the following additional information.

Parts expected return date. This is very important because the DEPR / OMEP or PBA shall use this information to examine liquidated damages claims.

Reasons to remove parts from equipment.

Name of technician that removed the part and moved the part away from the project.

Date of authorization.

Describe the conditions of the returned part after being subjected to the applicable process of repair or modifications.

The DEPR / OMEP / PBA or Building Administrator or representative shall sign attesting the date in which the part was removed from the project for repair.

The DEPR / OMEP / PBA or Building Administrator or representative shall sign attesting the date in which the repair or modified part was returned to the project.

3.6. FIELD / SITE QUALITY CONTROL

3.6.1. Field / Site Tests and Inspections:

3.6.1.1. General:

There are three (3) levels of air conditioning maintenance activities inspections for quality assurance.

Maintenance contract works immediate inspections.

This inspection level consists of direct observation of works performed by maintenance contractor.

Review of logbook and work orders

Review of main repairs reports

Temperature measurement and conform in the air-conditioned spaces

Internal DEPR / OMEP / PBA inspections. As required.

Internal Air conditioning inspection will be performed by qualified and licensed air conditioning technicians and engineers.

Maintenance contract works audit. As required.

Review of all the documents that make up the contract and comparison with the expected performance.

3.6.2. Non-Conforming Work

3.6.2.1. Defective, faulty or Incomplete Works:

In the event that the Air Conditioning Maintenance Contractor is NOT able to correct or repair any deficiency found in the air conditioning system that is the object of this contract, within sixty (30) calendar days after the repair request is registered in the log book or work order system, whatever the

cause or does not respond to calls, the DEPR/OMEP or the PBA may decide at their sole discretion to hire, by any other means they deem convenient, the required services. In the aforementioned event, charges for services provided by others will be paid by DEPR/OMEP or PBA and reimbursed by the Air Conditioning Maintenance Contractor.

3.6.3. Manufacturer Services

3.6.3.1. Subcontractor Services:

The Air Conditioning Maintenance Contractor may not use subcontractors to perform any services authorized under these specifications.

Notwithstanding the foregoing, the maintenance contractor may use designated subcontractors approved in advance by DEPR / OMEP or PBA to perform the maintenance services only when those activities are related to the necessary knowledge of the equipment manufacturer. Maintenance contractor must obtain DEPR / OMEP / PBA prior written consent to change or add subcontractors. Maintenance contractor shall be responsible for directing the work of the approved subcontractors and for any compensation due to subcontractors. DEPR / OMEP / PBA assumes no responsibility whatsoever concerning such compensation.

3.7. ADJUSTING

3.7.1. The Air Conditioning Maintenance Contractor shall be responsible for making immediate adjustments or corrections that fall within the scope of operation and maintenance required by these specifications at no additional cost to the DEPR / OMEP or PBA.

3.7.2. This includes but is not limited to:

Adjusting chillers controls.

Adjusting AHU’s controls.

Adjusting RTU’s controls

Adjusting the BAS software, e.g., correcting set points.

Reloading programs.

Restoring equipment being operated manually to automatic operation (this does not include changing established sequences of operation or programming sequences);

Applying lubricants.

Cleaning fan housings, fans, coils, dampers, air handling unit (AHU) Sections, and equipment rooms; and replacing consumable parts or components.

3.8. PERFORMANCE:

3.8.1. After any adjustment, repair or replacement Maintenance Contractor shall maintain the air flow, air temperature, chilled water temperature chilled water pressure and other parameters as designed and installed.

After any adjustment, repair or replacement Maintenance Contractor shall maintain a conform conditions in any air conditioned space.

3.9. CLEANING

3.9.1. Waste Management:

Any waste disposal shall be according to any applicable law of Commonwealth of Puerto Rico or United States of America.

Any waste disposal shall be according to Puerto Rico Environmental Quality Board (JCA) and Environmental Protection Agency (EPA) regulations.

Maintenance contractor and/or the sub-contractors shall keep the work area including storage areas, free from accumulation of waste materials.

The Maintenance contractor shall remove any waste materials produced by maintenance works.

Removal of waste materials shall be after any maintenance work completion.

After completing the work, the Maintenance contractor and/or sub-contractors shall remove from the work premises, any rubbish, tools, scaffolding equipment, and materials, which are not property of the DEPR / OMEP or PBA.

Upon completion of the work, the Maintenance contractor and/or subcontractors shall leave the work area in a clean, neat, and orderly condition, satisfactory to the DEPR / OMEP / or PBA.

3.9.2. Cleaning working areas:

The Maintenance contractor shall always keep machine rooms and machinery in clean condition and free of waste materials.

3.10. CLOSEOUT ACTIVITIES

3.10.1. Demonstration Training

3.11. ATTACHMENTS

END SECTION 23 01 00.51

Schedules

Schedule O&M-1

Schedule O&M-2

Schedule O&M 3 to 9

SCHEDULE O&M-1

DAY	DISCOUNT CHARGE	CUMULATIVE
1	3.333%	3.333%
2	3.333%	6.666%
3	3.333%	9.999%
4	3.333%	13.332%
5	3.333%	16.665%
6	3.333%	19.998%
7	3.333%	23.331%
8	3.333%	26.664%
9	3.333%	29.997%
10	3.333%	33.330%
11	3.333%	36.663%
12	3.333%	39.996%
13	3.333%	43.329%
14	3.333%	46.662%
15	3.333%	49.995%
16	3.333%	53.328%
17	3.333%	56.661%
18	3.333%	59.994%
19	3.333%	63.327%
20	3.333%	66.660%
21	3.333%	69.993%
22	3.333%	73.326%
23	3.333%	76.659%
24	3.333%	79.992%
25	3.333%	83.325%
26	3.333%	86.658%
27	3.333%	89.991%
28	3.333%	93.324%
29	3.333%	96.657%
30	3.333%	99.990%

SCHEDULE O&M-2

Alcance de Trabajos y Servicios

(Scope of Works and Services)

Instituto Tecnológico de Ponce

Sistemas de ACV – Operación y Mantenimiento

Guías generales de mantenimiento

Diario – Semanal – Mensual – Trimestral - Anual

1. **General:**
   a. Técnicos de refrigeración. Técnico titular más ayudante.
      i. Requisitos básicos:
         1. Técnico de refrigeración con licencia y colegiado
         2. El ayudante puede ser técnico de refrigeración o perito electricista. En ambos casos colegiados.
         3. Carta de buena conducta.
         4. No figurar en el registro de ofensores sexuales.
      ii. Conocimientos básicos:
         1. Capacidad y conocimientos para poder reemplazar compresores de refrigeración de capacidades entre 5 Tons hasta 60 Tons.
         2. Capacidad y conocimientos para interpretar diagramas eléctricos
         3. Capacidad física para subir escaleras verticales hasta 45 pies.
   b. Horario:
      i. Lunes a viernes de 7:00 AM a 3:30 PM
      ii. Disponibilidad para ser llamado fuera de horas laborables (on call)
   c. Tareas generales:
      i. Proveer servicios continuos de operación y mantenimiento a los sistemas de aire acondicionado del complejo educativo para mantener el mas alto grado de confiabilidad y disponibilidad de los equipos según las especificaciones de mantenimiento preventivo enumeradas del 2 al 7.

ii. Inspeccionar y dar mantenimiento a los sistemas de distribución de aire acondicionado, difusores TF, rejillas de retorno, reguladores de flujo de aire (dampers), sensores, otros.

iii. Poner en funcionamiento o apagar cualquier equipo según requerido por el personal del complejo educativo, necesidad o conveniencia.

iv. Atender cualquier llamada de servicio dentro del complejo educativo para inspecciones, evaluaciones, ajustes o reparaciones con el menor tiempo de espera posible.

2. Edificio A:

a. Unidades de refrigeración de Agua Helada (Chillers):

i. Diario –

1. Inspección general de operación (ruidos inusuales, vibración excesiva, conexiones flojas).
2. Lectura de temperatura de agua helada (entrada y salida) en tubería – remplazar termómetro si estuviera defectuoso.
3. Lectura de presión de agua helada (entrada y salida) en tubería – reemplazar indicador de presión si estuviera defectuoso.
4. Inspección visual de fugas de refrigerante.

ii. Semanal –

1. Verificación de presiones del refrigerante según indicado en el panel de control.
2. Verifique la mirilla de la línea de líquido. El flujo de refrigerante que pasa por las mirillas debe ser transparente. Las burbujas en el refrigerante indican una carga de refrigerante baja o una caída de presión excesiva en la línea de líquido. Una restricción en la línea a veces se puede identificar por un diferencial de temperatura notable entre los dos lados de la restricción. A menudo se puede formar escarcha en la línea en este punto. En caso necesario verifique los puntos de fuga de refrigerante o la causa de la caída de presión excesiva. Refiérase al manual de operación y mantenimiento.
3. Verificar carga de refrigerante. Anadir si fuera necesario.
4. Verificación amperaje y voltaje de cada compresor según indicado en el panel de control

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.

2. Inspección visual de los interruptores eléctricos de seguridad (disconectivos).
3. Medir y verificar el “superheat”. Refiérase al manual de operación y mantenimiento.
4. Medir y verificar el “subcooling”.

iv. Anual –

1. Inspección motores eléctricos - lectura directa de la resistencia de aislamiento (Megger test) de todos los motores de los compresores.
2. Verificar carga de refrigerante y nivel de aceite. Refiérase al manual de operación y mantenimiento.
3. Coordinar con el laboratorio de muestras de aceite para que se haga prueba de humedad y acidez.
4. Verificar y medir la caída en presión en el filtro de aceite.
5. Remueva, verifique y limpie los filtros de partículas (strainer) en la tubería de agua fría.
6. Pintar cualquier parte estructural que muestre signos de corrosión (limpiar y ligar antes)

b. Unidades Condensadoras (Condensing units):

i. Diario –

1. Remover con cepillo suave la basura acumulada en las serpentinas de las unidades condensadoras.
2. Inspección visual operación de abanicos.
3. Inspección visual de fugas de refrigerante.

ii. Semanal –

1. Lavar con agua las serpentinas de las unidades condensadoras. (Esta tarea es recomendada para que se realice los viernes).
    a. Se debe utilizar rociador normal de jardín – NO SE DEBE UTILIZAR MAQUINA DE LAVADO A PRESION.
    b. Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.
2. Inspección visual de disconectivos eléctricos de seguridad.

iv. Anual –

1. Inspección motores eléctricos - lectura de la resistencia de aislamiento (Megger test) de todos los abanicos.
2. Verificación de tornillos – reajustar según necesario
3. Pintura de estructura (chassis) y rotulación.

c. Manejadoras de Aire (Air handling units – AHU):

i. Diario –

1. Inspección visual de operación. Poner atención especial a ruidos inusuales, vibración excesiva, olores objetables.
2. Lectura de temperatura de agua helada (entrada y salida) en la tubería – reemplazar termómetro si estuviera defectuoso.
3. Lectura de presión de agua helada (entrada y salida) en tubería – reemplazar indicador de presión si estuviera defectuoso.
4. Lectura de diferencial de presión (aka: caída en presión, Magnehelic) de filtros y serpentina de enfriamiento.

ii. Semanal –

1. Verificación de ajuste de correas de abanico. Ajustar si fuera necesario.
2. Inspección de los abanicos.
3. Verificación de los filtros.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) – solamente dos tiros (shots) de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Inspección y limpieza de los drenajes de agua condensada en la serpentina de enfriamiento (P trap).

iv. Trimestral –

1. Reemplazo de filtros de cartón.
2. Limpieza de la bandeja de agua condensada en la serpentina de enfriamiento.
3. Verificar el ajuste de los tornillos de la base del motor. Ajustar si fuera necesario.

4. Verificar el ajuste de los tornillos de las cajas de bolas (bearings). Ajustar si fuera necesario.
5. Verificar el ajuste de las conexiones eléctricas del motor. Ajustar si fuera necesario.
6. Verifique las condiciones de los reguladores de flujo de aire dampers).
7. Verifique las condiciones de las juntas de las compuertas.
8. Verificar las condiciones de las conexiones flexibles de los conductos de aire (canvas).

v. Anual –

1. Lavado de serpentina de enfriamiento.
    a. Usar maquina de lavado de presión de 1,200 PSI o menos y apuntar de frente a las aletas de enfriamiento (fins). Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.
2. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.
3. Inspeccionar la estructura exterior de la manejadora (casing) por cualquier condiciona anormal o corrosión. Poner atención especial al piso. Lijar y pintar según requerido.
4. Inspeccionar el abanico. Poner atención especial a corrosión y/o daños estructurales como soldaduras desgastadas o quebradas, desgaste de aspas u otros.

d. Bombas de Agua Fría (Chill water pumps):

i. Diario –

1. Inspección general de operación.
    a. Atención especial a fugas de agua por sello.
    b. Atención especial a ruidos de cajas de bolas.
    c. Atención especial a ruidos inusuales en tubería de agua fría.
2. Lectura de presión de agua helada (entrada y salida).

ii. Semanal –

1. Verificación del interruptor eléctrico de seguridad (disconectivo) y el panel de control - Operación manual y automática.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) de la bomba – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación visual del acoplamiento (couplig). Manualmente rote los ejes y observe el desplazamiento. Reemplazar en caso de que fuera necesario.

iv. Anual –

1. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor de la bomba.
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.

e. Válvulas control de agua fría (BY PASS water manifold control valves):

i. Diario –

1. Verifique la operación de las válvulas automáticas. Poner atención especial a ruidos inusuales.
2. Verificar la caída en presión en el panel de control.

ii. Semanal –

1. Verificar las válvulas de servicios. Cerrar y abrir y observar operación.

iii. Mensual –

1. Verificar y lubricar con WD-40 u otro similar el mecanismo de unión entre la válvula y el actuador.

iv. Anual –

1. Realzar prueba directa de operación (manual) al motor actuador y observar operación. Reemplazar actuador si fuera necesario.

f. **Abanicos de suplir aire o extractores**:

i. Diario –

1. Inspección visual de operación. Atención especial a ruidos inusuales o vibración excesiva.

ii. Semanal –

1. Verificación de ajuste de correas en caso de que sea el mecanismo de propulsión. Ajustar o reemplazar según necesario.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) del abanico – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación del abanico – Poner atención especial a corrosión, alineamiento, elementos estructurales deteriorados o desgastados.
3. Verificación de soportes (springs). Lubricar con WD-40 u otro similar.

iv. Anual –

1. Limpieza general
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
3. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.

g. **Sistema de Control Central (Building Main Control System**)

i. Diario –

1. Verificar los parámetros de operación del panel de control central.
2. Verificar los parámetros de operación de los VFD.
3. Verificar la operación del abanico de ventilación de los VFD's.

ii. Semanal –

1. Limpiar y remover polvo y sucio del panel de control central y los VFD.
2. Alternar operación de automático a manual y observar

3. Edificio B

a. Unidades de Paquete de Techo (RTU):

i. Diario –

1. Inspección visual interior. Poner atención especial a ruidos inusuales, vibración excesiva, olores objetables
2. Remover con cepillo suave la basura acumulada en las serpentinas de las unidades condensadoras (hojas, papeles, plumas, otros).
3. Inspección visual de la operación de abanicos del condensador.
4. Inspeccion visual de fugas de refrigerante.
5. Lectura de diferencial de presión (aka: caída en presión, Magnehelic) de filtros y serpentina de enfriamiento.

ii. Semanal –

1. Verificación de ajuste de correas de abanico – reemplazar en caso de que sea necesario.
2. Inspección del abanico del evaporador
3. Verificación de los filtros.
4. Lavar con agua las serpentinas condensadoras. (Esta tarea es recomendada para que se realice los viernes).
    a. Se debe utilizar rociador normal de jardín – NO SE DEBE UTILIZAR MAQUINA DE LAVADO A PRESION.
    b. Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.
2. Inspección visual del interruptor eléctrico de seguridad (disconectivos).
3. Lubricación de cajas de bolas (bearings) – solamente dos tiros (shots) de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
4. Inspección y limpieza de los drenajes de agua condensada en la serpentina de enfriamiento (P trap).

iv. Trimestral –

1. Reemplazo de filtros de cartón.

2. Limpieza de la bandeja de agua condensada en la serpentina de evaporación.
3. Verificar el ajuste de los tornillos de la base del motor. Ajustar si fuera necesario.
4. Verificar el ajuste de los tornillos de las cajas de bolas (bearings). Ajustar si fuera necesario.
5. Verificar el ajuste de las conexiones eléctricas del motor. Ajustar si fuera necesario.
6. Verifique las condiciones de los reguladores de flujo de aire dampers) y el varillaje.
7. Verifique las condiciones de las juntas de las compuertas.

v. Anual –

1. Lavado de serpentina de la evaporadora y condensador.
   a. Usar máquina de lavado de presión de 1,200 PSI o menos y apuntar de frente a las aletas de enfriamiento (fins). Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.
2. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) de los motores de abanicos y compresores.
3. Inspeccionar la estructura exterior de la unidad (casing) por cualquier condiciona anormal o corrosión. Poner atención especial al piso. Lijar y pintar según requerido.
4. Inspeccionar el abanico. Poner atención especial a corrosión y/o daños estructurales como soldaduras desgastadas o quebradas, desgaste de aspas u otros.
5. Verificación de tornillos – reajustar según necesario

b. Sistema de Control Principal (Main control system)

i. Diario –

1. Verificación de operación automática y manual.

c. Abanicos de suplir aire o extractores:

i. Diario –

1. Inspección visual de operación. Atención especial a ruidos inusuales o vibración excesiva.

ii. Semanal –

1. Verificación de ajuste de correas en caso de que sea el mecanismo de propulsión. Ajustar o reemplazar según necesario.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) del abanico – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación del abanico – Poner atención especial a corrosión, alineamiento, elementos estructurales deteriorados o desgastados.
3. Verificación de soportes (springs). Lubricar con WD-40 u otro similar.

iv. Anual –

1. Limpieza general
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
3. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.

4. Edificio C

a. Unidades de refrigeración de Agua Helada (Chillers):

i. Diario –

1. Inspección general de operación (ruidos inusuales, vibración excesiva, conexiones flojas).
2. Lectura de temperatura de agua helada (entrada y salida) en tubería – remplazar termómetro si estuviera defectuoso.
3. Lectura de presión de agua helada (entrada y salida) en tubería – reemplazar indicador de presión si estuviera defectuoso.
4. Inspección visual de fugas de refrigerante.

ii. Semanal –

1. Verificación de presiones del refrigerante según indicado en el panel de control.
2. Verifique la mirilla de la línea de líquido.

a. El flujo de refrigerante que pasa por las mirillas debe ser transparente. Las burbujas en el refrigerante indican una carga de refrigerante baja o una caída de presión excesiva en la línea de líquido. Una restricción en la línea a veces se puede identificar por un diferencial de temperatura notable entre los dos lados de la restricción. A menudo se puede formar escarcha en la línea en este punto. En caso necesario verifique los puntos de fuga de refrigerante o la causa de la caída de presión excesiva. Refiérase al manual de operación y mantenimiento.

3. Verificar carga de refrigerante. Anadir si fuera necesario.
4. Verificación amperaje y voltaje de cada compresor según indicado en el panel de control

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.
2. Inspección visual de los interruptores eléctricos de seguridad (disconectivos).
3. Medir y verificar el “superheat”. Refiérase al manual de operación y mantenimiento. Esta función posiblemente está incluida en el control.
4. Medir y verificar el “subcooling”. Refiérase al manual de operación y mantenimiento. Esta función posiblemente está incluida en el control.

iv. Anual –

1. Inspección motores eléctricos - lectura directa de la resistencia de aislamiento (Megger test) de todos los motores de los compresores.
2. Verificar carga de refrigerante y nivel de aceite. Refiérase al manual de operación y mantenimiento.
3. Coordinar con el laboratorio de muestras de aceite para que se haga prueba de humedad y acidez.
4. Verificar y medir la caída en presión en el filtro de aceite.
5. Remueva, verifique y limpie los filtros de partículas (strainer) en la tubería de agua fría.
6. Pintar cualquier parte estructural que muestre signos de corrosión (limpiar y ligar antes)

b. Unidades Condensadoras (Condensing units):

i. Diario –

1. Remover con cepillo suave la basura acumulada en las serpentinas de las unidades condensadoras.
2. Inspección visual operación de abanicos.
3. Inspección visual de fugas de refrigerante.

ii. Semanal –

1. Lavar con agua las serpentinas de las unidades condensadoras. (Esta tarea es recomendada para que se realice los viernes).
    a. Se debe utilizar rociador normal de jardín – NO SE DEBE UTILIZAR MAQUINA DE LAVADO A PRESION.
    b. Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.
2. Inspección visual de disconectivos eléctricos de seguridad.

iv. Anual –

1. Inspección motores eléctricos - lectura de la resistencia de aislamiento (Megger test) de todos los abanicos.
2. Verificación de tornillos – reajustar según necesario
3. Pintura de estructura (chassis) y rotulación.

c. Manejadoras de Aire (Air handling units – AHU):

i. Diario –

1. Inspección visual de operación. Poner atención especial a ruidos inusuales, vibración excesiva, olores objetables.
2. Lectura de temperatura de agua helada (entrada y salida) en la tubería – reemplazar termómetro si estuviera defectuoso.
3. Lectura de presión de agua helada (entrada y salida) en tubería – reemplazar indicador de presión si estuviera defectuoso.
4. Lectura de diferencial de presión (aka: caída en presión, Magnehelic) de filtros y serpentina de enfriamiento.

ii. Semanal –

1. Verificación de ajuste de correas de abanico. Ajustar si fuera necesario.
2. Inspección de los abanicos.
3. Verificación de los filtros.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) – solamente dos tiros (shots) de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Inspección y limpieza de los drenajes de agua condensada en la serpentina de enfriamiento (P trap).

iv. Trimestral –

1. Reemplazo de filtros de cartón.
2. Limpieza de la bandeja de agua condensada en la serpentina de enfriamiento.
3. Verificar el ajuste de los tornillos de la base del motor. Ajustar si fuera necesario.
4. Verificar el ajuste de los tornillos de las cajas de bolas (bearings). Ajustar si fuera necesario.
5. Verificar el ajuste de las conexiones eléctricas del motor. Ajustar si fuera necesario.
6. Verifique las condiciones de los reguladores de flujo de aire dampers).
7. Verifique las condiciones de las juntas de las compuertas.
8. Verificar las condiciones de las conexiones flexibles de los conductos de aire (canvas).

v. Anual –

1. Lavado de serpentina de enfriamiento.
    a. Usar máquina de lavado de presión de 1,200 PSI o menos y apuntar de frente a las aletas de enfriamiento (fins). Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.
2. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.

3. Inspeccionar la estructura exterior de la manejadora (casing) por cualquier condiciona anormal o corrosión. Poner atención especial al piso. Lijar y pintar según requerido.
4. Inspeccionar el abanico. Poner atención especial a corrosión y/o daños estructurales como soldaduras desgastadas o quebradas, desgaste de aspas u otros.

d. Bombas de Agua Fría (Chilled water pumps):

i. Diario –

1. Inspección general de operación.
   a. Atención especial a fugas de agua por sello.
   b. Atención especial a ruidos de cajas de bolas.
   c. Atención especial a ruidos inusuales en tubería de agua fría.
2. Lectura de presión de agua helada (entrada y salida).

ii. Semanal –

1. Verificación del interruptor eléctrico de seguridad (disconectivo) y el panel de control - Operación manual y automática.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) de la bomba – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación visual del acoplamiento (coupling). Manualmente rote los ejes y observe el desplazamiento. Reemplazar en caso de que fuera necesario.

iv. Anual –

1. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor de la bomba.
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.

e. Válvulas control de agua fría (BY PASS water manifold control valves):

i. Diario –

1. Verifique la operación de las válvulas automáticas. Poner atención especial a ruidos inusuales.

2. Verificar la caída en presión en el panel de control.

ii. Semanal –

1. Verificar las válvulas de servicios. Cerrar y abrir y observar operación.

iii. Mensual –

1. Verificar y lubricar con WD-40 u otro similar el mecanismo de unión entre la válvula y el actuador.

iv. Anual –

1. Realzar prueba directa de operación (manual) al motor actuador y observar operación. Reemplazar actuador si fuera necesario.

f. Abanicos de suplir aire o extractores:

i. Diario –

1. Inspección visual de operación. Atención especial a ruidos inusuales o vibración excesiva.

ii. Semanal –

1. Verificación de ajuste de correas en caso de que sea el mecanismo de propulsión. Ajustar o reemplazar según necesario.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) del abanico – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación del abanico – Poner atención especial a corrosión, alineamiento, elementos estructurales deteriorados o desgastados.
3. Verificación de soportes (springs). Lubricar con WD-40 u otro similar.

iv. Anual –

1. Limpieza general
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
3. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.

g. Sistema de Control Central (Building Main Control System)

i. Diario –

1. Verificar los parámetros de operación del panel de control central.
2. Verificar los parámetros de operación de los VFD.
3. Verificar la operación del abanico de ventilación de los VFD's.

ii. Semanal –

1. Limpiar y remover polvo y sucio del panel de control central y los VFD.
2. Alternar operación de automático a manual y observar

5. Edificio D

a. Unidades de refrigeración de Agua Helada (Chillers):

i. Diario –

1. Inspección general de operación (ruidos inusuales, vibración excesiva, conexiones flojas).
2. Lectura de temperatura de agua helada (entrada y salida) en tubería – remplazar termómetro si estuviera defectuoso.
3. Lectura de presión de agua helada (entrada y salida) en tubería – reemplazar indicador de presión si estuviera defectuoso.
4. Inspección visual de fugas de refrigerante.

ii. Semanal –

1. Verificación de presiones del refrigerante según indicado en el panel de control.
2. Verifique la mirilla de la línea de líquido.
    a. El flujo de refrigerante que pasa por las mirillas debe ser transparente. Las burbujas en el refrigerante indican una carga de refrigerante baja o una caída de presión excesiva en la línea de líquido. Una restricción en la línea a veces se puede identificar por un diferencial de temperatura notable entre los dos lados de la restricción. A menudo se puede formar escarcha en la línea en este punto. En caso necesario verifique los puntos de fuga de refrigerante o la causa de la caída de presión excesiva. Refiérase al manual de operación y mantenimiento.
3. Verificar carga de refrigerante. Anadir si fuera necesario.

4. Verificación amperaje y voltaje de cada compresor según indicado en el panel de control

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.
2. Inspección visual de los interruptores eléctricos de seguridad (disconectivos).
3. Medir y verificar el “superheat”. Refiérase al manual de operación y mantenimiento.
4. Medir y verificar el “subcooling”.

iv. Anual –

1. Inspección motores eléctricos - lectura directa de la resistencia de aislamiento (Megger test) de todos los motores de los compresores.
2. Verificar carga de refrigerante y nivel de aceite. Refiérase al manual de operación y mantenimiento.
3. Coordinar con el laboratorio de muestras de aceite para que se haga prueba de humedad y acidez.
4. Verificar y medir la caída en presión en el filtro de aceite.
5. Remueva, verifique y limpie los filtros de partículas (strainer) en la tubería de agua fría.
6. Pintar cualquier parte estructural que muestre signos de corrosión (limpiar y ligar antes)

b. Unidades Condensadoras (Condensing units):

i. Diario –

1. Remover con cepillo suave la basura acumulada en las serpentinas de las unidades condensadoras.
2. Inspección visual operación de abanicos.
3. Inspección visual de fugas de refrigerante.

ii. Semanal –

1. Lavar con agua las serpentinas de las unidades condensadoras. (Esta tarea es recomendada para que se realice los viernes).
    a. Se debe utilizar rociador normal de jardín – NO SE DEBE UTILIZAR MAQUINA DE LAVADO A PRESION.
    b. Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO

UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.
2. Inspección visual de disconectivos eléctricos de seguridad.

iv. Anual –

1. Inspección motores eléctricos - lectura de la resistencia de aislamiento (Megger test) de todos los abanicos.
2. Verificación de tornillos – reajustar según necesario
3. Pintura de estructura (chassis) y rotulación.

c. Manejadoras de Aire (Air handling units – AHU):

i. Diario –

1. Inspección visual de operación. Poner atención especial a ruidos inusuales, vibración excesiva, olores objetables.
2. Lectura de temperatura de agua helada (entrada y salida) en la tubería – reemplazar termómetro si estuviera defectuoso.
3. Lectura de presión de agua helada (entrada y salida) en tubería – reemplazar indicador de presión si estuviera defectuoso.
4. Lectura de diferencial de presión (aka: caída en presión, Magnehelic) de filtros y serpentina de enfriamiento.

ii. Semanal –

1. Verificación de ajuste de correas de abanico. Ajustar si fuera necesario.
2. Inspección de los abanicos.
3. Verificación de los filtros.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) – solamente dos tiros (shots) de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Inspección y limpieza de los drenajes de agua condensada en la serpentina de enfriamiento (P trap).

iv. Trimestral –

1. Reemplazo de filtros de cartón.

2. Limpieza de la bandeja de agua condensada en la serpentina de enfriamiento.
3. Verificar el ajuste de los tornillos de la base del motor. Ajustar si fuera necesario.
4. Verificar el ajuste de los tornillos de las cajas de bolas (bearings). Ajustar si fuera necesario.
5. Verificar el ajuste de las conexiones eléctricas del motor. Ajustar si fuera necesario.
6. Verifique las condiciones de los reguladores de flujo de aire dampers).
7. Verifique las condiciones de las juntas de las compuertas.
8. Verificar las condiciones de las conexiones flexibles de los conductos de aire (canvas).

v. Anual –

1. Lavado de serpentina de enfriamiento.
    a. Usar máquina de lavado de presión de 1,200 PSI o menos y apuntar de frente a las aletas de enfriamiento (fins). Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.
2. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.
3. Inspeccionar la estructura exterior de la manejadora (casing) por cualquier condiciona anormal o corrosión. Poner atención especial al piso. Lijar y pintar según requerido.
4. Inspeccionar el abanico. Poner atención especial a corrosión y/o daños estructurales como soldaduras desgastadas o quebradas, desgaste de aspas u otros.

d. Bombas de Agua Fría (Chilled water pumps):

i. Diario –

1. Inspección general de operación.
    a. Atención especial a fugas de agua por sello.
    b. Atención especial a ruidos de cajas de bolas.
    c. Atención especial a ruidos inusuales en tubería de agua fría.

2. Lectura de presión de agua helada (entrada y salida).

ii. Semanal –

1. Verificación del interruptor eléctrico de seguridad (disconectivo) y el panel de control - Operación manual y automática.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) de la bomba – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación visual del acoplamiento (coupling). Manualmente rote los ejes y observe el desplazamiento. Reemplazar en caso de que fuera necesario.

iv. Anual –

1. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor de la bomba.
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.

e. Válvulas control de agua fría (BY PASS water manifold control valves):

i. Diario –

1. Verifique la operación de las válvulas automáticas. Poner atención especial a ruidos inusuales.
2. Verificar la caída en presión en el panel de control.

ii. Semanal –

1. Verificar las válvulas de servicios. Cerrar y abrir y observar operación.

iii. Mensual –

1. Verificar y lubricar con WD-40 u otro similar el mecanismo de unión entre la válvula y el actuador.

iv. Anual –

1. Realzar prueba directa de operación (manual) al motor actuador y observar operación. Reemplazar actuador si fuera necesario.

f. Abanicos de suplir aire o extractores:

i. Diario –

1. Inspección visual de operación. Atención especial a ruidos inusuales o vibración excesiva.

ii. Semanal –

1. Verificación de ajuste de correas en caso de que sea el mecanismo de propulsión. Ajustar o reemplazar según necesario.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) del abanico – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación del abanico – Poner atención especial a corrosión, alineamiento, elementos estructurales deteriorados o desgastados.
3. Verificación de soportes (springs). Lubricar con WD-40 u otro similar.

iv. Anual –

1. Limpieza general
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
3. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.

g. Sistema de Control Central (Building Main Control System) -

i. Diario –

1. Verificar los parámetros de operación del panel de control central.
2. Verificar los parámetros de operación de los VFD.
3. Verificar la operación del abanico de ventilación de los VFD's.

ii. Semanal –

1. Limpiar y remover polvo y sucio del panel de control central y los VFD.
2. Alternar operación de automático a manual y observar

6. Edificio E

a. Unidad Mini-Split:

i. Semanal –

1. Remover con cepillo suave la basura acumulada en las serpentinas de las unidades condensadoras.
2. Inspección visual operación de abanicos.
3. Inspección visual de fugas de refrigerante
4. Lavar filtro.
5. Verificación y limpieza tubería de descarga de condensado en la evaporadora.

ii. Trimestral –

1. Limpieza de serpentina de la evaporadora.
2. Verificar carga de refrigerante. Recargar según necesario.

iii. Anual –

1. Inspección motores eléctricos - lectura de la resistencia de aislamiento (Megger test) de los motores de abanicos y compresores.

7. Edificio G

a. Unidades de Paquete de Techo (RTU):

i. Diario –

1. Inspección visual interior. Poner atención especial a ruidos inusuales, vibración excesiva, olores objetables
2. Remover con cepillo suave la basura acumulada en las serpentinas de las unidades condensadoras (hojas, papeles, plumas, otros).
3. Inspección visual de la operación de abanicos del condensador.
4. Inspección visual de fugas de refrigerante.
5. Lectura de diferencial de presión (aka: caída en presión, Magnehelic) de filtros y serpentina de enfriamiento.

ii. Semanal –

1. Verificación de ajuste de correas de abanico – reemplazar en caso de que sea necesario.
2. Inspección del abanico del evaporador
3. Verificación de los filtros.
4. Lavar con agua las serpentinas condensadoras. (Esta tarea es recomendada para que se realice los viernes).

a. Se debe utilizar rociador normal de jardín – NO SE DEBE UTILIZAR MAQUINA DE LAVADO A PRESION.

b. Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.

iii. Mensual –

1. Inspección de fugas de refrigerante con detector electrónico.
2. Inspección visual de disconectivos eléctricos de seguridad.
3. Lubricación de cajas de bolas (bearings) – solamente dos tiros (shots) de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
4. Inspección y limpieza de los drenajes de agua condensada en la serpentina de enfriamiento (P trap).

iv. Trimestral –

1. Reemplazo de filtros de cartón.
2. Limpieza de la bandeja de agua condensada en la serpentina de evaporación.
3. Verificar el ajuste de los tornillos de la base del motor. Ajustar si fuera necesario.
4. Verificar el ajuste de los tornillos de las cajas de bolas (bearings). Ajustar si fuera necesario.
5. Verificar el ajuste de las conexiones eléctricas del motor. Ajustar si fuera necesario.
6. Verifique las condiciones de los reguladores de flujo de aire dampers) y el varillaje.
7. Verifique las condiciones de las juntas de las compuertas.

v. Anual –

1. Lavado de serpentina de la evaporadora y condensador.

a. Usar máquina de lavado de presión de 1,200 PSI o menos y apuntar de frente a las aletas de enfriamiento (fins). Se puede utilizar jabón suave como detergente de lavar platos o limpiadores de uso general (Dr. Mecánico), en ambos casos debe estar diluido 50%-50%. BAJO NINGUN CONCEPTO EL TECNICO

UTILIZARA LIMPIADORES COMERCIALES DE LIMPIAR SERPENTINAS DE ENFRIAMIENTO (coil cleaners) O ACIDOS.

2. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) de los motores de abanicos y compresores.
3. Inspeccionar la estructura exterior de la unidad (casing) por cualquier condiciona anormal o corrosión. Poner atención especial al piso. Lijar y pintar según requerido.
4. Inspeccionar el abanico. Poner atención especial a corrosión y/o daños estructurales como soldaduras desgastadas o quebradas, desgaste de aspas u otros.
5. Verificación de tornillos – reajustar según necesario

vi. Sistema de Control Principal (Main control system)

1. Diario –
   a. Verificación de operación automática y manual.

b. Unidades Mini-Split:

i. Semanal –

1. Remover con cepillo suave la basura acumulada en las serpentinas de las unidades condensadoras.
2. Inspección visual operación de abanicos.
3. Inspección visual de fugas de refrigerante
4. Lavar filtro.
5. Verificación y limpieza tubería de descarga de condensado en la evaporadora.

ii. Trimestral –

1. Limpieza de serpentina de la evaporadora.
2. Verificar carga de refrigerante. Recargar según necesario.

iii. Anual –

1. Inspección motores eléctricos - lectura de la resistencia de aislamiento (Megger test) de los motores de abanicos y compresores.

c. Abanicos de suplir aire o extractores:

i. Diario –

1. Inspección visual de operación. Atención especial a ruidos inusuales o vibración excesiva.

ii. Semanal –

1. Verificación de ajuste de correas en caso de que sea el mecanismo de propulsión. Ajustar o reemplazar según necesario.

iii. Mensual –

1. Lubricación de cajas de bolas (bearings) del abanico – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
2. Verificación del abanico – Poner atención especial a corrosión, alineamiento, elementos estructurales deteriorados o desgastados.
3. Verificación de soportes (springs). Lubricar con WD-40 u otro similar.

iv. Anual –

1. Limpieza general
2. Solo si tiene copas de engrase - lubricación de cajas de bolas (bearings) del motor – solamente dos tiros de la engrasadora o hasta cuando se observe una pequeña salida de grasa por el sello exterior de la caja de bola. Limpiar excedente de grasa.
3. Inspección motor eléctrico - lectura de la resistencia de aislamiento (Megger test) del motor del abanico.

SCHEDULE O&M-3

BUILDING A - ACV EQUIPMENT DATA

NUM	TAG	DESCRIPTION	SPECIFICATIONS
1	RM-1	CHILLER	88 TONS
2	RM-2	CHILLER	88 TONS
3	CU-1	CONDENSING UNIT	90 TONS
4	CU-2	CONDENSING UNIT	90 TONS
5	AHU-1	AIR HANDLING UNIT	23 TON / 7,500 CFM / 3.5 IN WG
6	AHU-2	AIR HANDLING UNIT	16 TON / 4,610 CFM / 3 IN WG
7	AHU-3	AIR HANDLING UNIT	42 TON / 10,050 CFM / 3 IN WG
8	AHU-4	AIR HANDLING UNIT	45 TON / 14,990 CFM / 4 IN WG
9	P-1	CHILL WATER PUMP	135 GPM/80 TDH
10	P-2	CHILL WATER PUMP	135 GPM/80 TDH
11	F-1	FAN	470 CFM @ 0.375 IN WG
12	F-2	FAN	925 CFM @ 0.375 IN WG
13	F-3	FAN	925 CFM @ 0.375 IN WG
14	F-4	FAN	1,270 CFM @ 0.375 IN WG
15	F-5	FAN	2,740 CFM @ 0.25 IN WG
16	F-6	FAN	2,500 CFM @ 0.25 IN WG
17	F-7	FAN	2,500 CFM @ 0.25 IN WG
18	F-8	FAN	2,500 CFM @ 0.25 IN WG
19	F-9	FAN	2,940 CFM @ 0.375 IN WG
20	F-10	FAN	1,275 CFM @ 0.375 IN WG
21	F-11	FAN	2,000 CFM @ 0.375 IN WG
22	F-12	FAN	2,000 CFM @ 0.125 IN WG
23	Control	Building A Control System	BACnet protocol, include vales, sensors, trasmitters, flow meters, thermometers, pressure gauges and others related
24	MS-1	MINI SPLIT UNIT	36,000 BTU @ 500 CFM

SCHEDULE O&M-4

BUILDING B - ACV EQUIPMENT DATA

NUM	TAG	DESCRIPTION	SPECIFICATIONS
1	PU-1	RTU DX UNIT	106 MBH / 3400 CFM
2	PU-2	RTU DX UNIT	183 MBH / 6000 CFM
3	PU-3	RTU DX UNIT	183 MBH / 6000 CFM
4	PU-4	RTU DX UNIT	183 MBH / 6000 CFM
5	PU-5	RTU DX UNIT	183 MBH / 6000 CFM
6	PU-6	RTU DX UNIT	183 MBH / 6000 CFM
7	PU-7	RTU DX UNIT	183 MBH / 6000 CFM
8	PU-8	RTU DX UNIT	183 MBH / 6000 CFM
9	PU-9	RTU DX UNIT	183 MBH / 6000 CFM
10	PU-10	RTU DX UNIT	183 MBH / 6000 CFM
11	PU-11	RTU DX UNIT	183 MBH / 6000 CFM
12	PU-12	RTU DX UNIT	183 MBH / 6000 CFM
13	PU-13	RTU DX UNIT	183 MBH / 6000 CFM
14	F-1	FAN	450 CFM @ 0.375 IN WG
15	F-2	FAN	4,260 CFM @ 0.125 IN WG
16	F-3	FAN	4,260 CFM @ 0.125 IN WG
17	F-4	FAN	315 CFM @ 0.375 IN WG
18	F-5	FAN	2,025 CFM @ 0.375 IN WG
19	F-6	FAN	315 CFM @ 0.375 IN WG
20	Control	Building B Control System	BACnet protocol, include valves, sensors, trasmitters, flow meters, thermometers, pressure gauges and others related

SCHEDULE O&M-5

BUILDING C - ACV EQUIPMENT DATA

NUM	TAG	DESCRIPTION	SPECIFICATIONS
1	RM-1	CHILLER	112 TONS
2	RM-2	CHILLER	130 TONS
3	RM-3	CHILLER	112 TONS
4	CU-1	CONDENSING UNIT	125 TONS
5	CU-2	CONDENSING UNIT	125 TONS
6	CU-3	CONDENSING UNIT	125 TONS
7	AHU-1	AIR HANDLING UNIT	45 TON / 12,200 CFM / 3.75 IN WG
8	AHU-2	AIR HANDLING UNIT	18 TON / 7,550 CFM / 3 IN WG
9	AHU-3	AIR HANDLING UNIT	63 TON / 20,645 CFM / 3.75 IN WG
10	AHU-4	AIR HANDLING UNIT	35 TON / 10,000 CFM / 3.5 IN WG
11	AHU-5	AIR HANDLING UNIT	25 TON / 6,000 CFM / 3.75 IN WG
12	AHU-6	AIR HANDLING UNIT	58 TON / 13,000 CFM / 3.75 IN WG
13	AHU-7	AIR HANDLING UNIT	42 TON / 13,000 CFM / 3.75 IN WG
14	AHU-8	AIR HANDLING UNIT	15 TON / 4,400 CFM / 3 IN WG
15	P-1	CHILL WATER PUMP	170 GPM / 90 TDH
16	P-2	CHILL WATER PUMP	170 GPM / 90 TDH
17	P-3	CHILL WATER PUMP	170 GPM / 90 TDH
18	F-1	FAN	4,500 CFM @ 0.375 IN WG
19	F-2	FAN	5,800 CFM @ 0.125 IN WG
20	F-3	FAN	840 CFM @ 0.375 IN WG
21	F-4	FAN	50 CFM @ 0.375 IN WG
22	F-5	FAN	840 CFM @ 0.375 IN WG
23	F-6	FAN	840 CFM @ 0.375 IN WG
24	F-7	FAN	545 CFM @ 0.375 IN WG
25	F-8	FAN	1.010 CFM @ 2 IN WG
26	F-9	FAN	1.010 CFM @ 2 IN WG
27	F-10	FAN	1.010 CFM @ 2 IN WG
28	F-11	FAN	410 CFM @ 0.25 IN WG
29	F-12	FAN	2,480 CFM @ 0.375 IN WG
30	F-13	FAN	2,500 CFM @ 0.375 IN WG
31	F-14	FAN	2,500 CFM @ 0.375 IN WG

SCHEDULE O&M-5

BUILDING C - ACV EQUIPMENT DATA

NUM	TAG	DESCRIPTION	SPECIFICATIONS
32	F-15	FAN	2,500 CFM @ 0.375 IN WG
33	F-16	FAN	2,500 CFM @ 0.375 IN WG
34	F-17	FAN	2,500 CFM @ 0.375 IN WG
35	F-18	FAN	832 CFM @ 0.5 IN WG
36	F-19	FAN	1,570 CFM @ 2 IN WG
37	F-20	FAN	585 CFM @ 0.25 IN WG
38	F-21	FAN	2,350 CFM @ 0.25 IN WG
39	F-22	FAN	2,385 CFM @ 0.25 IN WG
40	F-23	FAN	1,845 CFM @ 0.25 IN WG
41	F-24	FAN	1,815 CFM @ 0.25 IN WG
42	F-25	FAN	2,000 CFM @ 0.125 IN WG
43	Control	Building C Control System	BACnet protocol, include vales, sensors, trasmitters, flow meters, thermometers, pressure gauges and others related
44	MS-1	MINI SPLIT UNIT	36,000 BTU @ 500 CFM
45	MS-2	MINI SPLIT UNIT	36,000 BTU @ 500 CFM

SCHEDULE O&M-6

BUILDING D - ACV EQUIPMENT DATA

NUM	TAG	DESCRIPTION	SPECIFICATIONS
1	RM-1	CHILLER	112 TONS
2	RM-2	CHILLER	112 TONS
3	CU-1	CONDENSING UNIT	125 TONS
4	CU-2	CONDENSING UNIT	125 TONS
5	AHU-1	AIR HANDLING UNIT	47 TON / 9,845 CFM / 3.5 IN WG
6	AHU-2	AIR HANDLING UNIT	27 TON / 8,500 CFM / 3.5 IN WG
7	AHU-3	AIR HANDLING UNIT	5 TON / 1,600 CFM / 3.5 IN WG
8	AHU-4	AIR HANDLING UNIT	9 TON / 1,600 CFM / 3.5 IN WG
9	AHU-5	AIR HANDLING UNIT	27 TON / 8,500 CFM / 3.5 IN WG
10	AHU-6	AIR HANDLING UNIT	5 TON / 1,600 CFM / 3.5 IN WG
11	AHU-7	AIR HANDLING UNIT	9 TON / 1,750 CFM / 3.5 IN WG
12	AHU-8	AIR HANDLING UNIT	32 TON / 10,800 CFM / 3.5 IN WG
13	AHU-9	AIR HANDLING UNIT	13 TON / 3,600 CFM / 3.75 IN WG
14	AHU-10	AIR HANDLING UNIT	10 TON / 2,400 CFM / 3.5 IN WG
15	P-1	CHILL WATER PUMP	170 GPM / 90 TDH
16	P-2	CHILL WATER PUMP	170 GPM / 90 TDH
17	AS-1	AIR SEPARATOR	600 GPM
18	XT-1	EXPANSION TANK	57 GAL
19	F-1	FAN	850 CFM @ 0.375 IN WG
20	F-2	FAN	555 CFM @ 0.375 IN WG
21	F-3	FAN	345 CFM @ 0.375 IN WG
22	F-4	FAN	8,000 CFM @ 0.5 IN WG
23	F-5	FAN	4,000 CFM @ 1.25 IN WG
24	F-6	FAN	4,000 CFM @ 1.25 IN WG
25	F-7	FAN	790 CFM @ 0.375 IN WG
26	F-8	FAN	1,190 CFM @ 0.375 IN WG
27	F-9	FAN	790 CFM @ 0.375 IN WG
28	F-10	FAN	1,190 CFM @ 0.375 IN WG
29	F-11	FAN	790 CFM @ 0.375 IN WG
30	F-12	FAN	1,600 CFM @ 0.375 IN WG
31	F-13	FAN	2,500 CFM @ 0.25 IN WG
32	F-14	FAN	2,500 CFM @ 0.25 IN WG
33	F-15	FAN	2,000 CFM @ 0.375 IN WG
34	F-16	FAN	2,000 CFM @ 0.125 IN WG
35	F-17	FAN	1,190 CFM @ 0.375 IN WG
36	F-18	FAN	1,190 CFM @ 0.375 IN WG
37	F-19	FAN	1,600 CFM @ 0.375 IN WG
38	F-20	FAN	1,400 CFM @ 1 IN WG
39	F-21	FAN	2,500 CFM @ 0.25 IN WG
40	Control	Building D Control System	BACnet protocol, include vales, sensors, trasmitters, flow meters, thermometers, pressure gauges and others related
41	MS-1	MINI SPLIT UNIT	36,000 BTU @ 500 CFM

SCHEDULE O&M-7

BUILDING E - ACV EQUIPMENT DATA

NUM	TAG	DESCRIPTION	SPECIFICATIONS
1	MS-1	MINI SPLIT UNIT	60 MBH / 2,000 CFM
2	F-101	FAN	5,900 CFM @ 0.25 IN WG

SCHEDULE O&M-8

BUILDING G - ACV EQUIPMENT DATA

NUM	TAG	DESCRIPTION	SPECIFICATIONS
1	PU-1	RTU DX UNIT	92 MBH / 3000 CFM / 0.8 IN WG
2	PU-2	RTU DX UNIT	96 MBH / 3000 CFM / 0.8 IN WG
3	MS-1	MINI SPLIT UNIT	16 MBH / 400 CFM
4	MS-2	MINI SPLIT UNIT	14 MBH / 400 CFM
5	F-1	FAN	270 CFM @ 0.375 IN WG
6	F-2	FAN	290 CFM @ 0.375 IN WG

SCHEDULE O&M-9

OTHER RELATED EQUIPMENT

NUM	TAG	DESCRIPTION	SPECIFICATIONS
1	SP-1	SEWAGE PUMP	100 GPM @ 28 TDH
2	SP-2	SEWAGE PUMP	100 GPM @ 28 TDH
3	SP CONTROL	CONTROL SYSTEM	PLC / RELAYS
4	F-1	FAN	1,134 CFM @ 0.25 IN WG

SECTION 23 01 00.61
AIR CONDITIONING SYSTEM REPAIRS
(REV 05/22)

PART 1. GENERAL

1.1. SUMMARY

1.1.1. Section Includes:

1.1.2. This section provides the general requirements and guidelines for general repairs on the ACV systems located at the Instituto Tecnologico de Ponce.

1.1.2.1. The work to be accomplished consist of furnishing all labor, products, tools, equipment, supervision, and services necessary for:

All repairs, parts replacement, and any necessary work to complete the task indicated on schedules R-1, R-2, R-3, R-4, R-5, R-6 and R-7

All necessary refrigerant gas loading in accordance with the original equipment manufacturer's recommended procedures and performance criteria for each air conditioning chiller-condenser unit, Package rooftop units o split systems.

All necessary mechanical work in accordance with the procedures and performance criteria recommended by the original manufacturer for each air conditioner equipment.

All necessary electrical works in accordance with the original equipment manufacturer's recommended procedures and performance criteria for each air conditioning equipment or devices.

All necessary works in the control system in accordance with the original equipment manufacturer's recommended procedures and performance criteria for each air conditioning equipment.

All necessary mechanical, electrical and control system's works in accordance with the original equipment manufacturer's recommended procedures and performance criteria for the sanitary sewage pump system.

1.1.3. Products Furnished:

All products (materials and parts) to be furnished and installed under these specifications shall meet the drawings and schedules R-1, R-2, R-3, R-4, R-5, R-6 and R-7.

1.1.4. Related Requirements

SECTION 01 11 00 - SUMMARY OF WORK

SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

SECTION 26 29 23 - VARIABLE SPEED DRIVES

SECTION 33 32 11 - FIELD-ERECTED WASTEWATER PUMPING STATIONS

1.2. PRICE AND PAYMENT PROCEDURES:

1.2.1. Allowances

$200,000 for hidden damages or unforeseen incidental works.

1.2.2. Prices

Air Conditioning Contractor shall submit a lump sum price for the repairs of air conditioning equipment as indicated on schedules R-1, R-2, R-3, R-4, R-5, R-6 and R-7.

Lump sum price shall consider and include all the requirements of these specifications and including, but not limited to insurance, bonds, transportation, specialized tools, mobilizations, demolition, waste and debris disposition, permits, taxes, freight, and overhead.

1.2.3. Measurement and Payment

1.2.3.1. Payment certifications:

All payment certifications shall be submitted for approval and processing to DEPR / OMEP or PBA's authorized representative.

Air Conditioning Operation and Maintenance Contractor shall submit to the DEPR / OMEP or PBA a payment certification when the repairs of any equipment included in the schedules R-1, R-2, R-3, R-4, R-5, R-6 and R-7 is completed and the air conditioning equipment is in use and provide the building or zone the required conform conditions.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms

AABC - Associated Air Balance Council

ACC - Air Conditioning Contractor

AHRI - Air-Conditioning, Heating, and Refrigeration Institute

AHJ- Authority Having Jurisdiction

ACV – Air Conditioning and Ventilation

ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

ANSI- American National Standards Institute

ARI - American Refrigeration Institute

ASME- American Society of Mechanical Engineers

CIAPR – Colegio de Ingenieros y Agrimensores de Puerto Rico

DEPR – Department of Education of Puerto Rico

EPA - Environmental Protection Agency

FM - Factory Mutual Laboratories

NADCA - National Air Duct Cleaners Association

NEC- National Electrical Code.

NEMA - National Electrical Manufacturers Association

NFPA- National Fire Protection Association

OMEP – Oficina Mejoramiento Escuelas Públicas

PBA- Public Buildings Authority

PRBC – Puerto Rico Building Code

PRECC – Puerto Rico Energy Conservation Code

PREBC – Puerto Rico Existing Building Code

PRMC – Puerto Rico Mechanical Code

PRPC – Puerto Rico Plumbing Code

PROSHA – Puerto Rico Occupational Safety & Health Administration

UL - Underwriters Laboratories Inc

1.3.2. Definitions

1.3.2.1. External Definitions are:

All listed in ASHRAE standards

All listed in the PRFC

All listed in the PRBC

All listed in the PEBC

All listed in the PRMC

All listed in the PRECC

1.3.3. Reference Standards

AMCA 203 (1990; R 2011) Field Performance Measurements of Fan Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 62.1 (2010) Ventilation for Acceptable Indoor Air Quality

ASHRAE HVAC APP IP HDBK (2016) HVAC Applications Handbook, I-P Edition

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002; 6th ed) National Standards for Total System Balance

AABC MN-4 (1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PROCEDURAL STANDARDS (2015) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1780 (2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition

SMACNA 1858 (2004) HVAC Sound and Vibration Manual - First Edition

SMACNA 1972 CD (2012) HVAC Air Duct Leakage Test Manual - 2nd Edition

1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Coordination

1.4.1.1. All repair work will begin as soon as the contractor receives notice to proceed (NTP). The works will be coordinated with the DEPR / OMEP or PBA designated representative or work inspector contracted or designated for the agencies.

1.4.1.2. Additionally, the works will be coordinated with the project supervisor, the school Director, and the ORE Director.

1.4.2. Kick-off Meetings:

1.4.2.1. The kick-off meeting will be held before 10 working days after the award notification.

1.4.2.2. In the kick-off meeting the DEPR / OMEP / PBA will submit to the air conditioning contractor with the official **Notice to Proceed**.

1.4.2.3. The kick-off meeting will be held at the Instituto Tecnologico de Ponce facilities.

1.4.2.4. In the kick-off meeting must be present:

a) Air Conditioning Contractor Official representative

b) Air Conditioning Contractor Project Manager

c) DEPR Official representative

d) OMEP official representative

e) PBA Official representative

f) Contracted Inspector (if any)

g) ORE Director

h) School Director

i) Any other stakeholder as indicated or required by DEPR or OMEP

1.4.3. Sequencing

1.4.3.1. The main project / works sequency is:

a) Reconnaissance inspections and familiarization with the air conditioning system and the identification of the electrical panels and the control system. Inspections can take from 3 to 5 days.

b) Main equipment's Air Conditioning troubleshooting and diagnostics.

c) Submittals and documentation

d) Parts, material, and equipment orders

e) Perform Air conditioning equipment repairs

f) Partial start up

g) Interim maintenance

h) HVAC system cleaning

i) HVAC system balancing.

j) Warranty (1 year)

k) Operation and maintenance contract

1.4.4. Scheduling

1.4.4.1. Due to the urgency of repairs, the air conditioning contractor can work on repairs Monday through Sunday from 7 am to 6 pm. However, the air conditioning contractor must be careful not to disrupt school activities during regular academic hours (Monday through Friday).

1.4.4.2. The tentative repair Schedule is:

a) Building A and D (mechanical, electrical and controls) and sanitary sewage pump system.

b) Building B and C (mechanical, electrical and controls)

c) Building E and G (mechanical and controls)

1.5. SUBMITTALS ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

1.5.1. Product Data

Provide submittal of fans assembly

Provide submittal of VFD, soft starter and main control system (BACnet protocol as standard)

Provide submittal of chilled water control valves

Provide submittal of service valves

Provide submittal of control instrumentation including, but not limited to:

Thermometers

Pressure gauges

Pressure differential gauges and switches (Magnehelic)

Provide submittal of RTU units of building B

Provide submittal of RTU units of Building G

Provide submittal of MS unit of building A, C, D, E and G

1.5.2. Shop Drawings

Provide shop drawing of fans configuration

Provide shop drawings of RTU units at building B and G

1.5.3. Certificates

1.5.3.1. (pending)

1.5.4. Delegated Design Submittals

If there is any change to the existing control sequence, please provide the submittal of a new control configuration or sequence stamped by the professional engineer who prepared or designed it.

1.5.5. Test and Evaluation Reports

After completing the troubleshooting and diagnostic provide a chillers-condenser performance and refrigerant leakage report

Provide testing, adjusting and balancing report

Provide HVAC cleaning report

1.5.6. Manufacturers' Instructions

1.5.6.1. Provide Manufacturers' Instructions for the fan assemblies.

1.5.6.2. Provide Manufacturers' Instructions for the control valves installation.

1.5.6.3. Provide Manufacturers' Instructions for VFD installation and wiring.

1.5.6.4. Provide Manufacturers' Instructions for the soft starter installation and wiring.

1.5.7. Special Procedure Submittals

Provide submittal of progress schedule

Provide submittal of breakdown for payment

Provide submittal of safety plan

Provide submittal of environmental plan

1.5.8. Qualification Statements

Provide certification of air conditioning contractor technicians.

Provide submittal of the HVAC cleaning contractor

Provide submittal of the Testing, adjusting and balance contractor

1.6. CLOSEOUT SUBMITTALS

1.6.1. Warranty Documentation

1.6.1.1. Provide submittal of the warranty letter and documents

1.6.1.2. Provide password to equipment or any a special access key.

1.6.2. Software

1.6.2.1. Provide submittal of any software or special programming of the control system.

1.7. MAINTENANCE MATERIAL SUBMITTALS

1.7.1. Spare Parts

1.7.1.1. Provide submittal including lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.7.2. Operation and maintenance data:

1.7.2.1. Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal.

1.8. QUALITY ASSURANCE

1.8.1. Qualifications

1.8.1.1. HVAC cleaning companies are required 10 years of experience performing cleaning activities in projects with similar characteristics.

1.8.1.2. HVAC testing, adjusting and balance companies are required 10 years of experience performing TAB activities in projects with similar characteristics

1.8.1.3. Manufacturers

a) Acceptable manufacturer for air handling unit fan's assemblies are:

Greenheck

Loren Cook

Penn

Other as Engineer or DEPR / OMEP / PBA representative approval.

1.8.1.4. Licensed Professionals:

a) Air conditioning technicians:

Puerto Rico air conditioning license

EPA refrigerant handling license

b) Engineers:

Professional engineer license and CIAPR member

1.9. DELIVERY, STORAGE, AND HANDLING

1.9.1. Storage and Handling Requirements

1.9.1.1. Parts and material shall be stored and handle according to manufacturer's instructions. The DEPR / OMEP or PBA will not accept any parts or materials with evidence of damages.

1.10. FIELD / SITE CONDITIONS

1.10.1. General Conditions

School environment with children, academic and administrative staff.

Air conditioning equipment mostly located on the roofs of buildings.

Very hot and dry environment.

Some work areas are located on roofs and elevated sites with fall hazards.

1.10.2. Existing Conditions (Pre-Bid Inspection Meeting):

If the examination determines that additional repairs to those indicated in the specifications are required, the bidder must mention it in the pre-bid meeting, and they will be included by means of an addendum. All repairs must be included in the price as indicated by DEPR/OMEP or PBA on the proposal sheet. The price of the proposal must indicate the cost of the repairs.

1.10.3. WARRANTY AND BOND

1.10.3.1. General:

After finishing any type of repair work, the air conditioning contractor shall guarantee performance of air conditioning equipment and systems as indicated by manufacturer and requested by DEPR / OMEP / PBA.

1.10.3.2. Bonds:

a) Performance Bonds:

A Performance Bond in the minimum amount of 100% of the contract amount totaling the duration of contract is required under this contract to guarantee the faithful performance of the contract and all obligations arising there under. This Performance Bond shall be renewed proportionally if the service contract is renewed.

1.10.4. Special Warranty

Any material and parts used in repair works shall be guaranteed for at least one (1) year.

The starting date of guarantee period shall be the effective date of repair completion and accepted by the DEPR, OMEP or PBA.

The air conditioning contractor shall repair or replace any material or part non-conforming with safety requirements and equipment performance standard after installation in the guarantee period.

The air conditioning Contractor shall repair or replace any material or part installed and deteriorated during the guarantee period at no cost to the agencies (DEPR, OMEP or PBA).

Any work under guarantee claim shall include labor, materials and parts.

PART 2. PRODUCTS

2.1. OWNER-FURNISHED OR OWNER-SUPPLIED PRODUCTS

None

2.2. ASSEMBLIES, COMPONENTS, EQUIPMENT

2.2.1. Description

2.2.1.1. Fans

a) See section 23 34 16

2.2.1.2. Variable Frequency Drives

a) See section 26 29 23

2.2.1.3. Reduced voltage solid state starter

a) See section 26 29 13.16

2.2.1.4. Package rooftop units

a) See section 23 75 16

2.2.1.5. Control system

a) See section 23 09 23.11

2.2.1.6. Valves

a) See section 23 05 23

2.2.1.7. UVC light emitter

a) See section 23 05 66

2.2.1.8. Split systems

a) See section 23 81 26.13

2.2.1.9. Cooling coils

a) Provide access to cooling coil at both sides of air handling units.

b) Cooling coil connection shall extend 5 inches minimum from air handling unit casing.

c) Cooling coil capacities shall be certified by manufacturer using AHRI standard 410. Certification shall include:

Cooling capacity

Air Pressure drop

Water flow pressure drop

d) Cooling coils shall provide cooling capacity as indicated in schedule table at rated water flow.

e) Cooling coil fins shall have a minimum thickness of 0.0075 inches.

f) Cooling coil fins shall be fabricated in aluminum.

g) Cooling coils, tubes shall be seamless copper with nominal wall thickness of 0.025 inches.

h) Cooling coil tube shall be of minimum 5/8” outside diameter.

i) Cooling coil assemblies shall be removable through access panels.

j) Contractor shall intend to select cooling coil with less fins per inches as actual AHU’s, Verify resulting AHU footprint.

2.2.1.10. Filter section at AHU:

a) Filter section with front loading frames and clips.

b) Filters shall be UL 900 listed

c) Filters shall be MERV 13.

d) Consult with Engineer to include pre-filter section with reusable and washable cartridges (Bo-Air as standard) equivalent to MERV 2-4.

e) Manufacturer shall install differential pressure meter to read pressure drop across filter banks.

2.2.1.11. Electric motors:

a) High efficiency motors (per NEMA Standard) shall be provided and shall be

b) compatible with standard motor frames.

c) All motors 1.0 kW and over, unless specified differently, shall be T-frame, A.C. Three Phase and equal to Motor Efficiency Level as tested to the most recent issue of IEEE 112B.

d) Provide squirrel cage induction motors built to NEMA MGI.

e) The minimum requirement for 3 phase motors shall be NEMA Design B, Class B insulated for maximum 40 deg. C ambient.

f) Select motors for quiet continuous operation to suit loads imposed by equipment.

g) Recognize that motor horsepower specified and scheduled are minimum sizes.

h) Include extra costs for larger motors, starters, power wiring and additional control wiring if larger motors are required per Contractor's actual approved submittals.

i) Provide motor enclosures as follows:

- Open drip-proof, 1.15 service factor for motors protected from the weather and moisture entertainment to operate satisfactorily at maximum temperature and moisture levels of surrounding air for motors located in air streams.
- Totally enclosed fan cooled 1.15 service factor for motors in all other locations
- Provide explosion proof motors where scheduled.

j) Equip motors 18 kW and larger, as well as those smaller but with longer than 10 second starting time, with inherent overheat protection, consisting of thermistors, one for each phase, embedded in the stator windings. Extend wires out to motor terminal box, ready for field wiring into the starter holding coil circuit.

k) Provide motors to operate with variable speed drives supplied according to Section 15075 and to meet the following:

- Rated for VSD duty
- Be operable from a pulse width modulated (PWM) waveform and shall not
- saturate while operating at up to 110% of the nameplate voltage.
- At least Class F insulation.
- Cast frame construction.
- Must be capable of running at 10% full rated speed with the VSD output
- provided by the drives supplied under Section 15075.
- Provided with thermal sensors imbedded in the windings with connections extended to the motor terminal box. For motor sizes up to and including 18.6 kW, the thermal sensors may be thermistors. For larger sizes, provide RTDs

(Resistive Temperature Device). Embed sensors in that part of the windings which is in the iron for response to both copper and iron temperature.

2.2.1.12. Sanitary sewage pumps

a) See section 33 32 11

PART 3. EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions

3.1.1.1. The air conditioning contractor must inspect each equipment and systems installation and must be acquainted with the existing physical and operating condition of the installations.

3.1.2. Site Safety:

3.1.2.1. After visiting and inspecting the project and prior to perform any kind of work the air conditioning contractor shall notify in writing to the DEPR, OMEP or PBA representatives of any dangerous or otherwise objectionable condition in the structures, equipment or any other installation or facility or adjacent to the work site, which in opinion of the air conditioning contractor will adversely affect the safety of his work and/or his work schedules.

3.1.3. Evaluation and Assessment (troubleshooting)

3.1.3.1. If after examination and troubleshooting it is determined that the original repairs and requirements are not necessary, a credit will be given and the funds will be used for other equipment or improvement..

3.2. PREPARATION

3.2.1. Protection of In-Place Conditions

3.2.1.1. Before any work, the air conditioning contractor technicians, shall install barricades in all accesses to working areas.

3.2.2. Demolition / Removal

3.2.2.1. The air conditioning contractor may at his own expense and only after written authorization from the DEPR, OMEP or PBA alter or change an existing configuration or arrangement of an existing structure or area, and after completion of the work, shall restore the structure or area to its original condition or as directed in writing by the DEPR, OMEP or PBA.

3.3. ERECTION / INSTALLATION / APPLICATION /

3.3.1. Special Techniques

3.3.1.1. Install new fan assemblies according to the manufacturer instructions and recommendations.

3.3.1.2. New fan assemblies shall be located as indicated in drawings

3.3.1.3. New fan assemblies shall be supported according with manufacturer instruction.

3.3.1.4. Install new cooling coils according to the manufacturer instruction.

3.3.1.5. Install driven belts according manufacturer instruction, provide ¼ inch deflection after final adjustment.

3.3.1.6. Install bearing

3.3.1.7. Contractor shall paint pipes and equipment as indicated by Engineer.

3.3.1.8. Use arrow decals to indicated water flow direction. Decals shall include:

a) CHWS for chilled water supply

b) CHWR for chilled water return

3.3.1.9. Rigging of fan assemblies shall be according to manufacturer's instruction and recommendation.

3.3.1.10. Rigging and lifting of any equipment of material shall be according to OSHA standards and regulations.

3.3.1.11. As indicated provide and install access ladders conforming the OSHA standards.

3.3.2. Interface with Other Work

3.3.2.1. The air conditioning contractor shall take precautions in order to not disturb the operations of buildings, especially academics activities.

3.4. REPAIR / RESTORATION / RE-INSTALLATION

3.4.1. Building A

Perform repairs of chillers, condensing units, pumps, air handling units, exhaust fans, supply fans and control system conforming the Schedule R-1

Troubleshoot and test water chillers and remote condenser, submit report.

3.4.2. Building B

Perform the replace of RTU units conforming the Schedule R-2 and mechanical drawings.

Perform the replace of fans conforming the Schedule R-2 and mechanical drawings.

3.4.3. Building C

Perform repairs of chillers, condensing units, pumps, air handling units, exhaust fans, supply fans and control system conforming the Schedule R-3

Troubleshoot and test water chillers and remote condenser, submit report.

3.4.4. Building D

Perform repairs of chillers, condensing units, pumps, air handling units, exhaust fans, supply fans and control system conforming the Schedule R-4

Troubleshoot and test water chillers and remote condenser, submit report.

3.4.5. Building E

3.4.5.1. Perform the replacement of mini-split system and fan conforming the Schedule R-5

3.4.6. Building G

Perform the replace of RTU units conforming the Schedule R-6 and mechanical drawings.

Perform the replace of fans conforming the Schedule R-6 and mechanical drawings.

Perform the replacement of mini-split system and fan conforming the Schedule R-6 and mechanical drawings.

3.4.7. Other related works or activities

3.4.7.1. HVAC System Cleaning

Proceed to perform the HVAC system cleaning conforming the technical specifications section 23 01 30.51 in all buildings.

Do not begin cleaning the HVAC system until all repair work is complete and the system is in full operating condition and placed in service. The contractor will proceed with the cleanup of the HVAC system in those completed buildings.

3.4.7.2. HVAC System Testing, Adjusting and Balancing (TAB)

DO NOT BEGIN TAB ACTIVITIES UNTIL HVAC SYSTEM CLEANING WORK IS COMPLETED

Proceed to perform the HVAC system testing, adjusting, and balancing conforming the technical specifications section 23 05 93 in all buildings.

3.4.7.3. Sanitary Sewage System

a) Proceed to perform the Sanitary sewage system repairs conforming the technical specifications section 33 32 11 in the sanitary sewage pumps room.

b) Sanitary sewer system repairs are performed separately from HVAC system repairs, the contractor can begin such work as soon as notified to proceed.

3.5. FIELD / SITE QUALITY CONTROL

3.5.1. Field Tests and Inspections

3.5.2. Non-Conforming Work

3.5.2.1. In the event that the air conditioning contractor completes a repair and subsequent deficiencies are found, then the contractor will have 5 days to make the necessary adjustments and corrections.

3.6. SYSTEM STARTUP

3.6.1. An air conditioning contractor trained representative (engineer or technician) shall be available on site for start-up of each air handling units after repairs completion.

3.6.2. Start-up services shall be provided for as long a time as is necessary to provide proper operation of repaired equipment's and systems.

3.6.3. Contractor's personnel and TAB contractor's representative shall adjust and balance water flow to design conditions indicated in these specifications and/or drawings.

3.6.4. The air conditioning contractor representative shall train at least four (4) employees of DEPR, OMEP or PBA in the operation, maintenance and troubleshooting of air handling units, VFD operation and soft starter operation.

3.6.5. Training shall be include:

Operation workshop

Full description of maintenance procedures.

Troubleshooting tips and guidelines.

Spare parts discussion.

Mechanical adjustment.

Contractor shall submit four (4) maintenance and operation manual to DEPR, OMEP or PBA representative.

3.7. ADJUSTING

3.7.1. See section 23 05 93

3.8. CLEANING

3.8.1. After all repairs are made, the contractor will leave all work areas clean and debris must to be removed.

3.8.2. If necessary, the contractor will install a waste container.

3.9. MAINTENANCE

3.9.1. Provide services, materials and equipment as necessary to maintain the entire system in an operational state as indicated for a period of one year from the date of final acceptance of the project. Minimize impacts on facility operations.

3.10. ATTACHMENTS

END OF SECTION 23 01 00.61

Schedules:

Schedule R-1
Schedule R-2
Schedule R-3
Schedule R-4
Schedule R-5
Schedule R-6
Schedule R-7

SCHEDULE R-1

BUILDING A

Tag	Task	Repair - task description
RM-1	1	Perform complete chiller performance assessment including refrigerant leak test and megger test. Submit report
	2	Replace thermometers
	3	Replace pressure gauges
RM-2	1	Perform complete chiller performance assessment including refrigerant leak test and megger test. Submit report
	2	Replace thermometers
	3	Replace pressure gauges
CU-1	1	Perform complete condensing unit performance assessment including refrigerant leak test .
CU-2	1	Perform complete condensing unit performance assessment including refrigerant leak test .

SCHEDULE R-1

BUILDING A

Tag	Task	Repair - task description
AHU-1	1	Provide and replace fan assembly with motor
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers
AHU-2	1	Provide and replace fan assembly with motor
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers

SCHEDULE R-1

BUILDING A

Tag	Task	Repair - task description
AHU-3	1	Provide and replace fan assembly with motor
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace the Bypass Safety Switch System with accessories and NEMA 4X enclosure
	8	Provide and replace Magnehelic pressure differential indicators
	9	Provide and replace service valves
	10	Provide and replace pressure gauges
	11	Provide and replace thermometers
AHU-4	1	Provide and replace fan assembly with motor
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace the Bypass Safety Switch System with accessories and NEMA 4X enclosure
	8	Provide and replace Magnehelic pressure differential indicators
	9	Provide and replace service valves
	10	Provide and replace pressure gauges
	11	Provide and replace thermometers

SCHEDULE R-1

BUILDING A

Tag	Task	Repair - task description
P-1	1	Provide and replace pressure gauges
P-2	1	Provide and replace pressure gauges
	2	Provide and replace electric starter contactor with interlocks
Waterflow control manifold (by pass)	1	Provide and replace water control valves with actuator
	2	Provide and replace four (4) Dwyer Capsu-Photohelic®Pressure Switch/Gage
	3	Provide and replace other switches, relays and accesories in the operation of water control flow manifold
	4	Provide and replace service valves
	5	Provide and replace pressure gauges
ACV Building Main Control System	1	Provide and replace (upgrade) of main control console Barber-Colman -Network 8000 and related accessories.
Air separator	1	Provide and replace air vent
Expansion tank	1	Provide and replace expansion tank bag (bladder)
F-1	1	Provide and replace fan with adapter (as required) and accessories.
F-2	1	Provide and replace fan with adapter (as required) and accessories.

SCHEDULE R-1

BUILDING A

Tag	Task	Repair - task description
F-3	1	Provide and replace fan with adapter (as required) and accessories.
F-4	1	Provide and replace fan with adapter (as required) and accessories.
F-5	1	Provide and replace fan with adapter (as required) and accessories.
F-6	1	Provide and replace fan with adapter (as required) and accessories.
F-7	1	Provide and replace fan with adapter (as required) and accessories.
F-8	1	Provide and replace fan with adapter (as required) and accessories.
F-9	1	Provide and replace fan with adapter (as required) and accessories.
F-10	1	Provide and replace fan with adapter (as required) and accessories.
F-11	1	Provide and replace fan with adapter (as required) and accessories.
F-12	1	Provide and replace fan with adapter (as required) and accessories.

SCHEDULE R-1

BUILDING A

Tag	Task	Repair - task description
General Building A chilled water piping	1	Provide and replace piping air vents
Building A A/C machine room	1	Provide and replace machine room access door
	2	Provide and install roof access ladder
	3	Provide paint and services for machine room internal painting
Building A Elevators machine room	1	Provide and install Mini-split unit
	2	Provide and install roof access ladder

SCHEDULE R-2

BUILDING B

Tag	Task	Repair - task description
PU-1	1	Provide and replace RTU, including roof curb and accessories
	2	Provide and install access ladder
PU-2	1	Provide and replace RTU, including roof curb and accessories
PU-3	1	Provide and replace RTU, including roof curb and accessories
PU-4	1	Provide and replace RTU, including roof curb and accessories
PU-5	1	Provide and replace RTU, including roof curb and accessories
PU-6	1	Provide and replace RTU, including roof curb and accessories
PU-7	1	Provide and replace RTU, including roof curb and accessories
PU-8	1	Provide and replace RTU, including roof curb and accessories

SCHEDULE R-2

BUILDING B

Tag	Task	Repair - task description
PU-9	1	Provide and replace RTU, including roof curb and accessories
PU-10	1	Provide and replace RTU, including roof curb and accessories
PU-11	1	Provide and replace RTU, including roof curb and accessories
PU-12	1	Provide and replace RTU, including roof curb and accessories
PU-13	1	Provide and replace RTU, including roof curb and accessories
F-1	1	Provide and replace fan with adapter (as required) and accessories.
F-2	1	Provide and replace fan with adapter (as required) and accessories.

BUILDING B

Tag	Task	Repair - task description
F-3	1	Provide and replace fan with adapter (as required) and accessories.
F-4	1	Provide and replace fan with adapter (as required) and accessories.
F-5	1	Provide and replace fan with adapter (as required) and accessories.
F-6	1	Provide and replace fan with adapter (as required) and accessories.
RTU Main control system	1	Provide and replace (upgrade) ACV Central control console

BUILDING C

Tag	Task	Repair - task description
RM-1	1	Perform complete chiller performance assessment including refrigerant leak test and megger test. Submit report
	2	Replace thermometers
	3	Replace pressure gauges
RM-2	1	Perform complete chiller performance assessment including refrigerant leak test and megger test. Submit report
	2	Replace thermometers
	3	Replace pressure gauges
RM-3	1	Perform complete chiller performance assessment including refrigerant leak test and megger test. Submit report
	2	Replace thermometers
	3	Replace pressure gauges
CU-1	1	Perform complete condensing unit performance assessment including refrigerant leak test . Submit report

BUILDING C

Tag	Task	Repair - task description
CU-2	1	Perform complete condensing unit performance assessment including refrigerant leak test . Submit report
CU-3	1	Perform complete condensing unit performance assessment including refrigerant leak test . Submit report
AHU-1	1	Provide and install fan belts and motor pulley
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace the Bypass safet Switch System with accessories and NEMA 4X enclosure
	10	Provide and replace pressure gauges
	11	Provide and replace thermometers

BUILDING C

Tag	Task	Repair - task description
AHU-2	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and install a maintenance platform
	10	Remove and dispose existing fan damper and actuator
	11	Provide and replace pressure gauges
	12	Provide and replace thermometers
AHU-3	1	Provide and replace fan assembly with motor
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace the Bypass safet Switch System with accessories and NEMA 4X enclosure
	10	Provide and replace pressure gauges
	11	Provide and replace thermometers

BUILDING C

Tag	Task	Repair - task description
AHU-4	1	Provide and install washable and reusable air filters.
	2	Provide and install UVC emitter kit
	3	Provide and replace water control valve with actuator
	4	Provide and install Soft starter
	5	Provide and replace VFD
	6	Provide and replace the Bypass safet Switch System with accessories and NEMA 4X enclosure
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers
AHU-5	1	Provide and install washable and reusable air filters.
	2	Provide and install UVC emitter kit
	3	Provide and replace water control valve with actuator
	4	Provide and install Soft starter
	5	Provide and replace the chilled water cooling coil
	6	Provide and replace Magnehelic pressure differential indicators
	7	Provide and replace service valves
	8	Provide and replace pressure gauges
	9	Provide and replace thermometers

BUILDING C

Tag	Task	Repair - task description
AHU-6	1	Provide and install washable and reusable air filters.
	2	Provide and install UVC emitter kit
	3	Provide and replace water control valve with actuator
	4	Provide and install Soft starter
	5	Provide and replace VFD
	6	Provide and install electric motor
	7	Provide and replace the Bypass safet Switch System with accessories and NEMA 4X enclosure
	8	Provide and replace Magnehelic pressure differential indicators
	9	Provide and replace service valves
	10	Provide and replace pressure gauges
	11	Provide and replace thermometers
AHU-7	1	Provide and replace fan assembly with motor
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace the Bypass safet Switch System with accessories and NEMA 4X enclosure
	8	Provide and replace Magnehelic pressure differential indicators
	9	Provide and replace service valves
	10	Provide and replace pressure gauges
	11	Provide and replace thermometers

BUILDING C

Tag	Task	Repair - task description
AHU-8	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace Magnehelic pressure differential indicators
	7	Provide and replace service valves
	8	Provide and replace pressure gauges
	9	Provide and replace thermometers
P-1	1	Provide and replace pressure gauges
	2	Clean-remove rust and paint stuctural base
P-2	1	Provide and replace pressure gauges
	2	Clean-remove rust and paint stuctural base
P-3	1	Provide and replace pressure gauges
	2	Clean-remove rust and paint stuctural base

BUILDING C

Tag	Task	Repair - task description
F-1	1	Provide and replace fan with adapter (as required) and accessories.
F-2	1	Provide and replace fan with adapter (as required) and accessories.
F-3	1	Provide and replace fan with adapter (as required) and accessories.
F-4	1	Provide and replace fan with adapter (as required) and accessories.
F-5	1	Provide and replace fan with adapter (as required) and accessories.
F-6	1	Provide and replace fan with adapter (as required) and accessories.
F-7	1	Provide and replace fan with adapter (as required) and accessories.
F-8	1	Provide and replace fan with adapter (as required) and accessories.
F-9	1	Provide and replace fan with adapter (as required) and accessories.
F-10	1	Provide and replace fan with adapter (as required) and accessories.
F-11	1	Provide and replace fan with adapter (as required) and accessories.
F-12	1	Provide and replace fan with adapter (as required) and accessories.
F-13	1	Provide and replace fan with adapter (as required) and accessories.

BUILDING C

Tag	Task	Repair - task description
F-14	1	Provide and replace fan with adapter (as required) and accessories.
F-15	1	Provide and replace fan with adapter (as required) and accessories.
F-16	1	Provide and replace fan with adapter (as required) and accessories.
F-17	1	Provide and replace fan with adapter (as required) and accessories.
F-18	1	Provide and replace fan with adapter (as required) and accessories.
F-19	1	Provide and replace fan with adapter (as required) and accessories.
F-20	1	Provide and replace fan with adapter (as required) and accessories.
F-21	1	Provide and replace fan with adapter (as required) and accessories.

BUILDING C

Tag	Task	Repair - task description
F-22	1	Provide and replace fan with adapter (as required) and accessories.
F-23	1	Provide and replace fan with adapter (as required) and accessories.
F-24	1	Provide and replace fan with adapter (as required) and accessories.
F-25	1	Provide and replace fan with adapter (as required) and accessories.
Waterflow control manifold (by pass)	1	Provide and replace water control valves with actuator
	2	Provide and replace four (4) Dwyer Capsu-Photohelic®Pressure Switch/Gage
	3	Provide and replace other switches, relays and accesories in the operation of water control flow manifold
	4	Provide and replace service valves
	5	Provide and replace pressure gauges
ACV Building Main Control System	1	Provide and replace (upgrade) of main control console Barber-Colman -Network 8000 and related accessories.
Air separator	1	Provide and replace air vent
Expansion tank	1	Provide and replace expansion tank bag (bladder)
General Building C chilled water piping	1	Provide and replace piping air vents

SCHEDULE R- 3

BUILDING C		
Tag	**Task**	**Repair - task description**
Building C A/C machine room	1	Provide and replace machine room access doors
	2	Provide and install roof access ladder
	3	Provide paint and services for machine room internal painting
Building C Elevators machine rooms	1	Provide and install Mini-split unit at elevator machine room-passenger
	2	Provide and install roof access ladder elevator machine room-passenger
	3	Provide and install Mini-split unit at elevator machine room - service
	4	Provide and install roof access ladder elevator machine room-service

BUILDING D		
Tag	**Task**	**Repair - task description**
RM-1	1	Perform complete chiller performance assessment including refrigerant leak test and megger test. Submit report
	2	Replace thermometers
	3	Replace pressure gauges
RM-2	1	Perform complete chiller performance assessment including refrigerant leak test and megger test. Submit report
	2	Replace thermometers
	3	Replace pressure gauges
CU-1	1	Perform complete condensing unit performance assessment including refrigerant leak test . Submit report
	2	Provide and instal fan motor assembly.
CU-2	1	Perform complete condensing unit performance assessment including refrigerant leak test . Submit report

BUILDING D		
Tag	**Task**	**Repair - task description**
AHU-1	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace Magnehelic pressure differential indicators
	7	Provide and replace service valves
	8	Provide and replace pressure gauges
	9	Provide and replace thermometers
AHU-2	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Remove existing damper assembly and actuator
	8	Provide and replace Magnehelic pressure differential indicators
	9	Provide and replace service valves
	10	Provide and replace pressure gauges
	11	Provide and replace thermometers

BUILDING D		
Tag	**Task**	**Repair - task description**
AHU-3	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers
AHU-4	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace Magnehelic pressure differential indicators
	7	Provide and replace service valves
	8	Provide and replace pressure gauges
	9	Provide and replace thermometers

BUILDING D		
Tag	**Task**	**Repair - task description**
AHU-5	1	Provide and replace fan with motor
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers
AHU-6	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers
	11	Provide lighting at AHU's machine room

BUILDING D		
Tag	**Task**	**Repair - task description**
AHU-7	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace Magnehelic pressure differential indicators
	7	Provide and replace service valves
	8	Provide and replace pressure gauges
	9	Provide and replace thermometers
AHU-8	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers

BUILDING D		
Tag	**Task**	**Repair - task description**
AHU-9	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace VFD
	7	Provide and replace Magnehelic pressure differential indicators
	8	Provide and replace service valves
	9	Provide and replace pressure gauges
	10	Provide and replace thermometers
AHU-10	1	Provide and install fan belts
	2	Provide and install washable and reusable air filters.
	3	Provide and install UVC emitter kit
	4	Provide and replace water control valve with actuator
	5	Provide and install Soft starter
	6	Provide and replace Magnehelic pressure differential indicators
	7	Provide and replace service valves
	8	Provide and replace pressure gauges
	9	Provide and replace thermometers
	10	Provide lighting at AHU's machine room

BUILDING D		
Tag	**Task**	**Repair - task description**
P-1	1	Provide and replace pressure gauges
P-2	1	Provide and replace pressure gauges
F-1	1	Provide and replace fan with adapter (as required) and accessories.
F-2	1	Provide and replace fan with adapter (as required) and accessories.
F-3	1	Provide and replace fan with adapter (as required) and accessories.
F-4	1	Provide and replace fan with adapter (as required) and accessories.
F-5	1	Provide and replace fan with adapter (as required) and accessories.
F-6	1	Provide and replace fan with adapter (as required) and accessories.
F-7	1	Provide and replace fan with adapter (as required) and accessories.
F-8	1	Provide and replace fan with adapter (as required) and accessories.
F-9	1	Provide and replace fan with adapter (as required) and accessories.
F-10	1	Provide and replace fan with adapter (as required) and accessories.

BUILDING D		
Tag	**Task**	**Repair - task description**
F-11	1	Provide and replace fan with adapter (as required) and accessories.
F-12	1	Provide and replace fan with adapter (as required) and accessories.
F-13	1	Provide and replace fan with adapter (as required) and accessories.
F-14	1	Provide and replace fan with adapter (as required) and accessories.
F-15	1	Provide and replace fan with adapter (as required) and accessories.
F-16	1	Provide and replace fan with adapter (as required) and accessories.
F-17	1	Provide and replace fan with adapter (as required) and accessories.
F-18	1	Provide and replace fan with adapter (as required) and accessories.
F-19	1	Provide and replace fan with adapter (as required) and accessories.
F-20	1	Provide and replace fan with adapter (as required) and accessories.

SCHEDULE R-4

BUILDING D		
Tag	**Task**	**Repair - task description**
Waterflow control manifold (by pass)	1	Provide and replace water control valves with actuator
	2	Provide and replace four (4) Dwyer Capsu-Photohelic®Pressure Switch/Gage
	3	Provide and replace other switches, relays and accesories in the operation of water control flow manifold
	4	Provide and replace service valves
	5	Provide and replace pressure gauges
ACV Building Main Control System	1	Provide and replace of main control console Barber-Colman -Network 8000 and related accessories.
Air separator	1	Provide and replace air vent
Expansion tank	1	Provide and replace expansion tank bag (bladder)
General Building D chilled water piping	1	Provide and replace piping air vents
Building D A/C machine room	1	Provide and replace machine room access doors
	2	Provide and install roof access ladder
	3	Provide paint and services for machine room internal painting
Building D Elevators machine room	1	Provide and install Mini-split unit
	2	Provide and install roof access ladder

SCHEDULE R-5

BUILDING E		
Tag	**Task**	**Repair - task description**
MS-1	1	Replace MS-1, including fan coil and condenser unit
F-101	1	Provide and replace fan with adapter (as required) and accessories.

SCHEDULE R-6

BUILDING G		
Tag	**Task**	**Repair - task description**
PU-1	1	Provide and replace RTU including roof curb
PU-2	1	Provide and replace RTU including roof curb
MS-1	1	Provide and replace MS-1, including evaporator and condenser unit
MS-2	1	Provide and replace MS-1, including evaporator and condenser unit
F-1	1	Provide and replace fan with adapter (as required) and accessories.
F-2	1	Provide and replace fan with adapter (as required) and accessories.
Building G A/C	1	Provide and install roof access ladder

SCHEDULE R-7

OTHER RELATED WORKS OR ACTIVITIES

Tag	Task	Repair - task description
HVAC CLEANING SERVICES	1	Building A HVAC Cleaning Services
	2	Building B HVAC Cleaning Services
	3	Building C HVAC Cleaning Services
	4	Building D HVAC Cleaning Services
	5	Building G HVAC Cleaning Services
TESTING, ADJUSTING AND BALANCING WORKS	1	Building A Testing, adjusting and balancing works
	2	Building B Testing, adjusting and balancing works
	3	Building C Testing, adjusting and balancing works
	4	Building D Testing, adjusting and balancing works
	5	Building E Testing, adjusting and balancing works
	6	Building G Testing, adjusting and balancing works
SANITARY SEWAGE SYSTEM	1	Provide and replace sanitary sewage pumps with accessories
	2	Provide and replace sanitary sewage system control system
	3	Provide and replace exhaust fan (XP motor) and related accessories

SECTION 23 01 30.51

HVAC AIR DISTRIBUTION SYSTEM CLEANING

(REV 5/22)

PART 1. GENERAL

1.1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 62.1 (2010) Ventilation for Acceptable Indoor Air Quality

NATIONAL AIR DUCT CLEANERS ASSOCIATION (NADCA)

NADCA HVAC Inspection Manual (2005) Procedures for Assessing the Cleanliness of Commercial HVAC Systems

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA AH112 (1993) Cleaning Fibrous Glass or Lined Sheet Metal Ducts

NAIMA AH122 (2006) Cleaning Fibrous Insulated Duct Systems - Recommended Practices

NAIMA AH127 (1999) Facts About the Impact of Duct Cleaning on Internal Duct Insulation

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1966 (2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety -- Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 402-C-01-001 (2001) IAQ Building Education and Assessment Tool (I-BEAM)

EPA 402-F-91-102 (1991) Building Air Quality: A Guide for Building Owners and Facility Managers

UNDERWRITERS LABORATORIES (UL)

UL 181 (2013; Reprint Apr 2017) UL Standard for Safety Factory-Made Air Ducts and Air Connectors

UL 181A (2013; Reprint Mar 2017) Standard for Safety Closure Systems for Use with Rigid Air Ducts

UL 181B (2013; Reprint Mar 2017) UL Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors

1.2. RELATED SECTIONS:

1.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.4. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.5. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.6. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.7. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.8. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.9. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

1.2.10. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.11. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.12. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.2.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. DEFINITIONS

1.3.1. NADCA Standards

Perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (ACR and NADCA HVAC Inspection Manual).

a All terms in this specification are defined as stated in the NADCA Standards.

b Follow NADCA Standards without modification or deviation.

1.4. SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval andfor information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Record of Existing Conditions [; G]

Coordination Plan [; G]

NADCA Firm [; G]

NADCA Team Assistants [; G]

NADCA Air System Cleaning Specialist (ASCS) [; G]

NADCA Supervisor Qualifications [; G]

Records of Experience in the Field of HVAC System Cleaning [; G]

NADCA Work Execution Schedule [; G]

SD-03 Product Data

Safety Data Sheets (SDS) [; G]

SD-06 Test Reports

Testing Procedures Summary [; G]

Gravimetric Analysis [; G]

Post-Project Report [; G]

1.5. QUALITY CONTROL

1.5.1. NADCA Firm

Submit information certifying that the NADCA firm is a first-tier subcontractor who is not affiliated with any other company participating in work on this contract, including furnishing equipment. Further, submit the following, for the firm, to Contracting Officer for approval:

a Independent NADCA firm:

NADCA Firm: NADCA registration number and expiration date of current certification.

NADCA Supervisor Qualifications: Name and copy of NADCA supervisor certificate and expiration date of current certification.

NADCA Air System Cleaning Specialist (ASCS): Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of HVAC cleaning work in the field for not less than 3 years immediately preceding this contract's bid opening date.

NADCA Team Assistants: Names and documented evidence that each field technician has satisfactorily assisted a NADCA team field leader in performance of HVAC cleaning work in the field for not less than one year immediately preceding this contract's bid opening date.

Current Certificates: Ensure registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the HVAC cleaning work, in a timely manner so that there is no lapse in registration or certification. NADCA agency or NADCA team personnel without a current registration or current certification are not to perform HVAC cleaning work on this contract.

b TAB Team Members: NADCA team approved to accomplish work on this contract are full-time employees of the NADCA firm. No other personnel is allowed to do HVAC cleaning work on this contract.

c Replacement of NADCA Team Members: Replacement of members may occur if each new member complies with the applicable personnel qualifications, and each is approved by the Contracting Officer.

1.5.2. Experience

Submit records of experience in the field of HVAC system cleaning. Bids will only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

1.5.3. Equipment, Materials and Labor

Possess and furnish all necessary equipment, materials and labor to adequately perform the specified services and comply with the applicable provisions of NADCA General Specifications for the Cleaning of Commercial HVAC Systems and ASHRAE 62.1.

a Assure that all employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and Safety Data Sheets (SDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., comply with applicable national safety codes and standards.

b Maintain a copy of all current SDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.

c Submit all Safety Data Sheets (SDS) for all chemical products proposed used in the cleaning process, including all VOC ratings.

1.5.4. Licensing

Provide proof of maintaining the proper license(s), if any, as required to do work in Puerto Rico. Comply with all Federal, State and local rules, regulations, and licensing requirements.

1.5.5. Health And Safety

1.5.5.1. Safety Standards

Comply with all applicable Federal, State, and local requirements for protecting the safety of the contractors' employees, building occupants, and the environment. In particular, follow all applicable standards of the Occupational Safety and Health Administration (OSHA) when working in accordance with this specification.

1.5.5.2. Occupant Safety

Employ no processes or materials in such a manner that introduce additional hazards into occupied spaces.

1.5.5.3. Disposal of Debris

Dispose of all debris removed from the HVAC System in accordance with applicable Federal, State, and local requirements.

1.6. PROJECT/SITE CONDITIONS

1.6.1. Mechanical Drawings

Obtain one copy of the following documents:

a Project drawings and specifications

b Approved construction revisions pertaining to the HVAC system

c Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

Submit a NADCA Work Execution Schedule to the Contracting Officer within 10 working days of the contract award.

1.6.2. Site Conditions

The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts (except ceiling plenums and mechanical room) to the air handling unit (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (ACR and NADCA HVAC Inspection Manual).

a All terms in this specification have their meaning defined as stated in the NADCA Standards.

b Follow NADCA Standards with no modifications or deviations being allowed. Remove visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

3.1. PREPARATION

3.1.1. HVAC System Inspections and Site Preparations

3.1.1.1. HVAC System Evaluation

Prior to the commencement of any cleaning work, perform a visual inspection of the HVAC system in the presence of the Contracting Officer to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. Notify the Contracting Officer 10 days prior to the planned inspection.

Document damaged system components found during the inspection and submit to the Contracting Officer, clearly labeled "Record of Existing Conditions."

3.1.1.2. Site Evaluation and Preparations

Conduct a site evaluation, and establish a specific, coordination plan which details how each area of the building is protected during the various phases of the project.

3.2. APPLICATION

3.2.1. General HVAC System Cleaning Requirements

3.2.1.1. Containment

Collect debris removed during cleaning and take precautions to ensure that debris is not otherwise dispersed outside the HVAC system during the cleaning process.

3.2.1.2. Particulate Collection

Where the Particulate Collection Equipment (PCE) is exhausting inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or greater). When the PCE is exhausting outside the building, undertake mechanical cleaning operations only with PCE, including adequate filtration to contain debris removed from the HVAC system. When the PCE is exhausting outside the building, take precautions to locate the equipment down wind and away from all air intakes and other points of entry into the building.

3.2.1.3. Controlling Odors

Take all reasonable measures to control offensive odors and/or mist vapors during the cleaning process.

3.2.1.4. Component Cleaning

Employ cleaning methods such that all HVAC system components are Visibly Clean as defined in applicable standards. Upon completion, return all components to those settings recorded just prior to cleaning operations.

3.2.1.5. Air-Volume Control Devices

Mark the position of dampers and any air-directional mechanical devices inside the HVAC system prior to cleaning and, upon completion, restore to their marked position.

3.2.1.6. Service Openings

Utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection. Utilize the existing service openings already installed in the HVAC system where possible.

Create other openings where needed, created and resealed in conformance with NADCA Standard 05. Place closures so they do not significantly hinder, restrict, alter the air-flow within the system, or compromise the structural integrity of the system. Properly insulate closures to prevent heat loss/gain or condensation on surfaces within the system. Conform construction techniques used in the creation of openings to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards. Cutting service openings into flexible duct is not permitted. Disconnect flexible duct at the ends as needed for proper cleaning and inspection.

Reseal rigid fiber glass duct-board duct systems in accordance with NAIMA recommended practices; NAIMA AH112, NAIMA AH122, and NAIMA AH127. Only closure techniques which comply with UL 181, UL 181A, or UL 181B are suitable for fiber glass duct system closures.

Clearly mark all service openings, capable of being re-opened for future inspection or remediation, and report their location in project report documents.

3.2.1.7. Ceiling Sections (Tile)

Carefully remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process. Replace any damaged ceiling sections caused by the removal at no cost to the Government.

3.2.1.8. Air Distribution Devices (Registers, Grilles and Diffusers)

Clean all air distribution devices.

3.2.1.9. Air Handling Units, Terminal Units, Blowers and Exhaust Fans

Ensure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas for cleaning include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. Remove all visible surface contamination deposits in accordance with NADCA Standards.

Clean all air handling unit (AHU) internal surfaces, components and condensate collectors and drains.

Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.

Clean all coils and related components, including evaporator fins.

3.2.1.10. Duct Systems

Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.

Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing NADCA Cleaning Verification Testings Standards.

3.2.2. Mechanical Cleaning Methodology

3.2.2.1. Source Removal Cleaning Methods

Clean the HVAC system using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. Select Source Removal methods which will render the HVAC System Visibly Clean and capable of passing NADCA cleaning verification methods Standards and other specified standards and tests, in accordance with all general requirements. Use no cleaning method, or combination of methods, which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

Incorporate the use of vacuum collection devices that are operated continuously during cleaning for all methods used. Connect a vacuum device to the downstream end of the section being cleaned through a predetermined opening. Use a vacuum collection device of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

Equip all vacuum devices exhausting air inside the building, including hand-held vacuums and wet-vacuums, with HEPA filters (minimum efficiency).

Equip all vacuum devices exhausting air outside the facility with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system, in a manner that does not allow contaminants to re-enter the facility. Release of debris outdoors which violates any outdoor environmental standards, codes or regulations is not allowed.

All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

3.2.2.2. Methods of Cleaning Fibrous Glass Insulated Components

Thoroughly clean glass [thermal] [acoustical] insulation elements present in any equipment or ductwork with HEPA vacuuming equipment. Clean while the HVAC system is under constant negative pressure, and not permitted to

get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

Do not use cleaning methods that cause damage to fibrous glass components or renders the system capable of passing Cleaning Verification Tests NADCA Standards.

3.2.2.3. Damaged Fibrous Glass Material

If there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, identify them to the Contracting Officer for replacement.

When requested or specified, remediate exposed damaged insulation in air handlers and/or ductwork requiring replacement.

3.2.2.4. Replacement Material

If replacement of fiber glass materials is required, conform all materials to applicable industry codes and standards, including those of UL and SMACNA 1966.

Replacement of damaged insulation is not covered by this specification.

3.2.2.5. Cleaning of Coils

Use any cleaning method which renders the coil visibly clean and capable of passing NADCA Coil Cleaning Verification Standards. Coil drain pans are subject to Non-Porous Surfaces Cleaning Verification. Maintain operability of the drain for the condensate at all times. Do not damage, displace, inhibit heat transfer, or cause erosion of the coil surface or fins, and conform to coil manufacturer recommendations when available. Thoroughly rinse coils with clean water to remove any latent residues.

3.2.2.6. Antimicrobial Agents and Coatings

Only apply antimicrobial agents if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.

Perform application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants after the removal of surface deposits and debris.

Use only antimicrobial agents registered by the U.S. Environmental Protection Agency (EPA 402-F-91-102 and EPA 402-C-01-001) specifically for use within HVAC system.

Apply antimicrobial agents in strict accordance with manufacturer's instructions.

Use only antimicrobial coating products, for both porous and non-porous surfaces, which are EPA registered, water soluble solutions with supporting efficacy data and SDS records.

Apply antimicrobial coatings according to manufacturer's instructions. Spray coatings directly onto interior ductwork surfaces, rather than "fog" downstream onto surfaces. Achieve a continuous film on the surface treated by the coating application and apply in strict accordance with manufacturer's minimum millage surface application rate standards for effectiveness.

3.3. FIELD QUALITY CONTROL

3.3.1. CLEANLINESS VERIFICATION

3.3.1.1. General

Verification of HVAC System cleanliness is determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including antimicrobial agents and coatings.

3.3.1.2. Visual Inspection

Visually inspect the HVAC system to ensure that no visible contaminants are present.

If no contaminants are evident through visual inspection, consider the HVAC system clean; however, further verification of the system cleanliness through gravimetric or wipe testing analysis testing may be requested at the discretion of the Contracting Officer.

If visible contaminants are evident through visual inspection, re-clean those portions of the system where contaminants are visible, and subject to re-inspection for cleanliness.

3.3.1.3. Gravimetric Analysis

At the expense of the Contractor, test sections of the HVAC system for cleanliness using the NADCA Vacuum Test (gravimetric analysis) as specified in applicable NADCA Standards. Ensure levels of debris collected are equal to or less than acceptable levels defined in applicable NADCA Standards.

If gravimetric analysis determines that levels of debris are equal to or lower than those levels specified, the system is considered clean and to have passed cleanliness verification.

If gravimetric analysis determines that levels of debris exceed those specified in applicable NADCA standards, the system will not be considered clean, and re-cleaning of those sections of the system which failed cleanliness verification will be required at the expense of the HVAC system cleaning contractor.

Perform cleanliness verification immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

3.3.1.4. Verification of Coil Cleaning

Cleaning is to restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA HVAC Inspection Manual Standards).

3.3.2. Post-Project Report

At the conclusion of the project, provide a Testing Procedures Summary and Post-Project Report indicating the following:

Success of the cleaning project, as verified through visual inspection and gravimetric analysis.

Areas of the system found to be damaged and/or in need of repair.

End of Section 23 01 30.51

SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all work to be performed at the Instituto Tecnologico de Ponce – ACV repairs, operation and Maintenance.

B. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Exterior: Piping, ductwork, and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

C. Abbreviations/Acronyms:

1. ac: Alternating Current
2. AC: Air Conditioning
3. ACU: Air Conditioning Unit
4. ACR: Air Conditioning and Refrigeration
5. AI: Analog Input
6. AISI: American Iron and Steel Institute
7. AO: Analog Output
8. ASJ: All Service Jacket
9. AWG: American Wire Gauge
10. BACnet: Building Automation and Control Networking Protocol
11. BAg: Silver-Copper-Zinc Brazing Alloy
12. BAS: Building Automation System
13. BCuP: Silver-Copper-Phosphorus Brazing Alloy
14. bhp: Brake Horsepower
15. Btu: British Thermal Unit
16. Btu/h: British Thermal Unit Per Hour
17. CDA: Copper Development Association
18. C: Celsius
19. CD: Compact Disk
20. CFM: Cubic Foot Per Minute

21. CH: Chilled Water Supply
22. CHR: Chilled Water Return
23. CLR: Color
24. CO: Carbon Monoxide
25. COR: Contracting Officer's Representative
26. CPD: Condensate Pump Discharge
27. CPM: Cycles Per Minute
28. CPVC: Chlorinated Polyvinyl Chloride
29. CRS: Corrosion Resistant Steel
30. CTPD: Condensate Transfer Pump Discharge
31. CTPS: Condensate Transfer Pump Suction
32. CW: Cold Water
33. CWP: Cold Working Pressure
34. CxA: Commissioning Agent
35. dB: Decibels
36. dB(A): Decibels (A weighted)
37. DDC: Direct Digital Control
38. DI: Digital Input
39. DO: Digital Output
40. DVD: Digital Video Disc
41. DN: Diameter Nominal
42. DWV: Drainage, Waste and Vent
43. EPDM: Ethylene Propylene Diene Monomer
44. EPT: Ethylene Propylene Terpolymer
45. ETO: Ethylene Oxide
46. F: Fahrenheit
47. FAR: Federal Acquisition Regulations
48. FD: Floor Drain
49. FED: Federal
50. FG: Fiberglass
51. FGR: Flue Gas Recirculation
52. FOS: Fuel Oil Supply

53. FOR: Fuel Oil Return
54. FSK: Foil-Scrim-Kraft facing
55. FWPD: Feedwater Pump Discharge
56. FWPS: Feedwater Pump Suction
57. GC: Chilled Glycol Water Supply
58. GCR: Chilled Glycol Water Return
59. GH: Hot Glycol Water Heating Supply
60. GHR: Hot Glycol Water Heating Return
61. gpm: Gallons Per Minute
62. HDPE: High Density Polyethylene
63. Hg: Mercury
64. HOA: Hands-Off-Automatic
65. hp: Horsepower
66. HPS: High Pressure Steam (414 kPa (60 psig) and above)
67. HPR: High Pressure Steam Condensate Return
68. HW: Hot Water
69. HWH: Hot Water Heating Supply
70. HWHR: Hot Water Heating Return
71. Hz: Hertz
72. ID: Inside Diameter
73. IPS: Iron Pipe Size
74. kg: Kilogram
75. klb: 1000 lb
76. kPa: Kilopascal
77. lb: Pound
78. lb/hr: Pounds Per Hour
79. L/s: Liters Per Second
80. L/min: Liters Per Minute
81. LPS: Low Pressure Steam (103 kPa (15 psig) and below)
82. LPR: Low Pressure Steam Condensate Gravity Return
83. MAWP: Maximum Allowable Working Pressure
84. MAX: Maximum

85. MBtu/h: 1000 Btu/h
86. MBtu: 1000 Btu
87. MED: Medical
88. m: Meter
89. MFG: Manufacturer
90. mg: Milligram
91. mg/L: Milligrams Per Liter
92. MIN: Minimum
93. MJ: Megajoules
94. ml: Milliliter
95. mm: Millimeter
96. MPS: Medium Pressure Steam (110 kPa (16 psig) through 414 kPa (60 psig))
97. MPR: Medium Pressure Steam Condensate Return
98. MW: Megawatt
99. NC: Normally Closed
100. NF: Oil Free Dry (Nitrogen)
101. Nm: Newton Meter
102. NO: Normally Open
103. NOx: Nitrous Oxide
104. NPT: National Pipe Thread
105. NPS: Nominal Pipe Size
106. OD: Outside Diameter
107. OSD: Open Sight Drain
108. OS&Y: Outside Stem and Yoke
109. PC: Pumped Condensate
110. PID: Proportional-Integral-Differential
111. PLC: Programmable Logic Controllers
112. PP: Polypropylene
113. PPE: Personal Protection Equipment
114. ppb: Parts Per Billion
115. ppm: Parts Per Million
116. PRV: Pressure Reducing Valve \

117. PSIA: Pounds Per Square Inch Absolute
118. psig: Pounds Per Square Inch Gauge
119. PTFE: Polytetrafluoroethylene
120. PVC: Polyvinyl Chloride
121. PVDC: Polyvinylidene Chloride Vapor Retarder Jacketing, White
122. PVDF: Polyvinylidene Fluoride
123. rad: Radians
124. RH: Relative Humidity
125. RO: Reverse Osmosis
126. rms: Root Mean Square
127. RPM: Revolutions Per Minute
128. RS: Refrigerant Suction
129. RTD: Resistance Temperature Detectors
130. RTRF: Reinforced Thermosetting Resin Fittings
131. RTRP: Reinforced Thermosetting Resin Pipe
132. SCFM: Standard Cubic Feet Per Minute
133. SPEC: Specification
134. SPS: Sterile Processing Services
135. STD: Standard
136. SDR: Standard Dimension Ratio
137. SUS: Saybolt Universal Second
138. SW: Soft water
139. SWP: Steam Working Pressure
140. TAB: Testing, Adjusting, and Balancing
141. TDH: Total Dynamic Head
142. TEFC: Totally Enclosed Fan-Cooled
143. TFE: Tetrafluoroethylene
144. THERM: 100,000 Btu
145. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
146. THWN: Thermoplastic Heat & Water-Resistant Nylon Coated Wire
147. T/P: Temperature and Pressure
148. USDA: U.S. Department of Agriculture

149. V: Volt
150. VAC: Vacuum
151. VA: Veterans Administration
152. VAC: Voltage in Alternating Current
153. VA CFM: VA Construction & Facilities Management
154. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
155. VAMC: Veterans Administration Medical Center
156. VHA OCAMES: Veterans Health Administration – Office of Capital Asset Management Engineering and Support
157. VR: Vacuum condensate return
158. WCB: Wrought Carbon Steel, Grade B
159. WG: Water Gauge or Water Column
160. WOG: Water, Oil, Gas

1.2 RELATED SECTIONS

A. SECTION 01 11 00 - SUMMARY OF WORK
B. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE
C. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS
D. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING
E. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING
F. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT
G. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC
H. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC
I. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC
J. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS
K. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)
L. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS
M. SECTION 26 29 23 - VARIABLE SPEED DRIVES.

1.3 REFERENCE STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

B31.1-//2018// .....Power Piping

B31.9-//2014// .....Building Services Piping

ASME Boiler and Pressure Vessel Code:

BPVC Section IX-//2019// Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):

A36/A36M-//2014//.....Standard Specification for Carbon Structural Steel

A575-//1996(R2018)// .....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc.:

SP-58-//2018// .....Pipe Hangers and Supports-Materials, Design, Manufacture, Selection, Application, and Installation

SP-127-//2014a// .....Bracing for Piping Systems: Seismic–Wind–Dynamic Design, Selection, and Application

E. National Fire Protection Association (NFPA):

NFPA 70-2017… .....National Electrical Code (NEC)

NFPA 101-2018.....Life Safety Code

1.4 SUBMITTALS

A. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 05 00, COMMON WORK RESULTS FOR HVAC”, with applicable paragraph identification.

B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor’s responsibility to ensure all submittals meet the DEPR / OMEP / PBA specifications and requirements and it is assumed by the agencies that all submittals do meet the contract specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the specifications and there was no variance approval the Contractor shall correct at no additional cost or time to the Government even if a submittal was approved.

C. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical shall be the Contractor's responsibility to design, supply, and install at no additional cost or time to the Government. DEPR / OMEP / PBA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

D. Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed contract documents, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

E. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together. Coordinate and properly integrate materials and equipment to provide a completely compatible and efficient installation.

F. Samples: Samples will not be required.

G. Coordination/Shop Drawings:

1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
2. The coordination/shop drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems.
3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.
4. In addition, for HVAC systems, provide details of the following:

a. Mechanical equipment rooms.

b. Hangers, inserts, supports, and bracing.

c. Pipe sleeves.

d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

H. Manufacturer's Literature and Data: Include full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. Submit under the pertinent section rather than under this section.

1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the COR.
2. Submit electric motor data, soft starter and variable speed drive data with the driven equipment.
3. Equipment and materials identification.
4. Fire-stopping materials.
5. Hangers, inserts, supports and bracing. Provide complete stress analysis for variable spring and constant support hangers.
6. Wall, floor, and ceiling plates.

I. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan shall include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

J. HVAC Maintenance Data and Operating Instructions:

1. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:

a. Include complete list indicating all components of the systems.

b. Include complete diagrams of the internal wiring for each item of equipment.

c. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

K. Provide copies of approved HVAC equipment submittals to the TAB and Commissioning subcontractor (if included in the project).

1.5 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Equipment Vibration Tolerance:

1. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.
2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 5 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer workstation, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
2. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 23 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

8. Important: Use of asbestos products or equipment or materials containing asbestos is prohibited.

E. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material and removal by the Contractor and no additional cost or time to the Government.

F. Execution (Installation, Construction) Quality:

1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract documents to the COR for resolution. Provide written hard copies and computer files on CD or DVD of manufacturer’s installation instructions to the COR with submittals prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received and approved by the DEPR / OMEP / PBA. Failure to furnish these recommendations is a cause for rejection of the material.

2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to, all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to the COR for resolution. Failure of the Contractor to resolve, or point out any issues will result in the Contractor correcting at no additional cost or time to the Government.

3. Complete coordination/shop drawings shall be required in accordance with Article, SUBMITTALS. Construction work shall not start on any system until the coordination/shop drawings have been approved by DEPR / OMEP / PBA.

4. Workmanship/craftsmanship will be of the highest quality and standards. The DEPR / OMEP / PBA reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Government.

G. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Large equipment such as chillers, cooling towers, fans, and air handling units if shipped on open trailer trucks shall be covered with shrink on plastics or waterproof tarpaulins that provide protection from exposure to rain, road salts and other transit hazards. Protection shall be kept in place until equipment is moved into a building or installed as designed.
3. Repair damaged equipment in first class, new operating condition and appearance; or replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost or time to the Government.
4. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
5. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.
6. Protect plastic piping and tanks from ultraviolet light (sunlight).

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, DEPR / OMEP / PBA approved substitutions and construction revisions shall be in electronic version on CD or DVD. All aspects of system operation and

maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing Contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:

   1. As-built drawings are to be provided, with a copy of them on PDF and AutoCAD version.

D. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the campus facilities.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the contract.

C. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 70 to 75 degrees F minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by DEPR / OMEP / PBA. Maintain all egress routes and safety systems/devices.

D. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Equipment and components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions must be approved by the DEPR / OMEP / PBA but may be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 V-BELT DRIVES

A. Type: standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, rating and selection standards: Association for Rubber Products Manufacturers ARPM IP-20 and ARPM IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:

1. Material: Pressed steel, or close-grained cast iron.
2. Bore: Fixed or bushing type for securing to shaft with keys.
3. Balanced: Statically and dynamically.
4. Groove spacing for driving and driven pulleys shall be the same.

I. Drive Types, Based on ARI 435:

1. Provide adjustable-pitch //or fixed-pitch// drive as follows:

a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.

b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.

2. Provide fixed-pitch drives for drives larger than those listed above.
3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

J. Final Drive Set: If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.4 SYNCHRONOUS BELT DRIVES

A. Type: ARPM synchronous belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, rating and selection standards: ARPM IP-24 and ARPM IP-27.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single belt of manufacturer's standard width for the application.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:

1. Material: Pressed steel, or close-grained cast iron.
2. Bore: Fixed or bushing type for securing to shaft with keys.
3. Balanced: Statically and dynamically.

I. Final Drive Set: The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by fan law calculation. If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.5 DRIVE GUARDS

A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling unit casings.

B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; all edges shall be hemmed and ends shall be bent into flanges and the flanges shall be drilled and attached to pump base with minimum of four 6 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gauge sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (1 inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.

D. Materials: Sheet steel, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

E. Access for Speed Measurement: 25 mm (1 inch) diameter hole at each shaft center.

2.6 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.7 ELECTRIC MOTORS

A. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.8 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 29 23.11 , Variable Frequency Drives for specifications.

B. Coordinate variable speed motor controller communication protocol with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

C. Provide variable speed motor controllers with or without a bypass contactor as indicated in contract drawings.

D. The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.

E. Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

F. Controller shall not add any current or voltage transients to the input ac power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the ac power system.

2.9 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the contract documents and shown in the maintenance manuals.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 5 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 5 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: Label all instrumentation, temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 6 mm (1/4 inch) for service designation on 19-gauge 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
2. Valve lists: Typed or printed plastic coated card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
3. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color-coded thumb tack in ceiling.

2.10 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Supports for Roof Mounted Items:

1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 by 100 mm (2 by 4 inches) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 275 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
2. Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

B. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.

C. Attachment to Concrete Building Construction:

1. Concrete insert: MSS SP-58, Type 18.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. Attachment to Steel Building Construction:

1. Welded attachment: MSS SP-58, Type 22.
2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. Attachment to existing structure: Support from existing floor/roof frame.

F. Attachment to Wood Construction: Wood screws or lag bolts.

G. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

H. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (12 gauge), designed to accept special spring held, hardened steel nuts. Trapeze hangers are prohibited for use for steam supply and condensate piping.

   1. Allowable hanger load: Manufacturers rating less 91 kg (200 pounds).
   2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

I. Supports for Piping Systems:

   1. Select hangers sized to encircle insulation on insulated piping. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
   2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):

      a. Standard clevis hanger: Type 1; provide locknut.
      b. Riser clamps: Type 8.
      c. Wall brackets: Types 31, 32 or 33.
      d. Roller supports: Type 41, 43, 44 and 46.
      e. Saddle support: Type 36, 37 or 38.
      f. Turnbuckle: Types 13 or 15. Preinsulate.
      g. U-bolt clamp: Type 24.
      h. Copper Tube:

         1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non-adhesive isolation tape to prevent electrolysis.
         2) For vertical runs use epoxy painted or plastic-coated riser clamps.

3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.

4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for plastic piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

3. High and Medium Pressure Steam (MSS SP-58):

a. Provide eye rod or Type 17 eye nut near the upper attachment.

b. Piping 50 mm (2 inches) and larger: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.

J. Pre-insulated Calcium Silicate Shields:

1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.

2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.

3. Shield thickness shall match the pipe insulation.

4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.

a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal. Provide for an adequate vapor barrier in chilled lines.

b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

2.11 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

B. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.

2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations through beams or ribs are prohibited, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of COR.

D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.12 DUCT PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 450 mm (18 inches) high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly.

2.13 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.

D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the COR.

E. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.14 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.15 ASBESTOS

A. Important: Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. The coordination/shop drawings shall be submitted for review. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Equipment coordination/shop drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors,

control devices. All gauges and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the contract documents.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill is prohibited, except as permitted by COR where working area space is limited.
2. Locate holes to avoid interference with structural members such as slabs, columns, ribs, beams or reinforcing. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
3. Do not penetrate membrane waterproofing.

F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

G. Electrical Interconnection of Instrumentation or Controls: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Devices shall be located so they are easily accessible for testing, maintenance, calibration, etc. The COR has the final determination on what is accessible and what is not. Comply with NFPA 70.

H. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Use concrete and non-shrink grout 20 MPa (3000 psig) minimum.

J. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

K. Install steam piping expansion joints as per manufacturer's recommendations.

L. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and data/telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall not be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 feet) above the equipment or to ceiling structure, whichever is lower (NFPA 70).

M. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance or inspections, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or time to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to motors, fans, pumps, belt guards, transformers, high voltage lines, conduit and raceways, piping, hot surfaces, and ductwork. The COR has final determination on whether an installation meets this requirement or not.

3.3 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Article, ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.4 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service requirements as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Follow approved rigging plan.

G. Restore building to original condition upon completion of rigging work.

3.5 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels designed by a structural engineer, secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the COR.

B. Use of chain pipe supports; wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above are prohibited. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-58. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:

   1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.

   2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Chiller foundations shall have horizontal dimensions that exceed chiller base frame dimensions by at least 150 mm (6 inches) on all sides. Structural contract documents shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

3.6 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the contract documents, shall be provided by the Contractor after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Debris accumulated in the area to the detriment of plant operation is prohibited. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the DEPR / OMEP / PBA, and Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. All indicated valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these contract documents. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. The following material and equipment shall not be painted:

a. Motors, controllers, control switches, and safety switches.

b. Control and interlock devices.

c. Regulators.

d. Pressure reducing valves.

e. Control valves and thermostatic elements.

f. Lubrication devices and grease fittings.

g. Copper, brass, aluminum, stainless steel and bronze surfaces.

h. Valve stems and rotating shafts.

i. Pressure gauges and thermometers.

j. Glass.

k. Nameplates.

3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats. This may include painting exposed metals where hangers were removed or where equipment was moved or removed.
6. Paint shall withstand the following temperatures without peeling or discoloration:

a. Condensate and Feedwater: 38 degrees C (100 degrees F) on insulation jacket surface and 121 degrees C (250 degrees F) on metal pipe surface.

b. Steam: 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (374 degrees F) on metal pipe surface.

7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.
8. Lead based paints are prohibited.

3.8 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16 inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Attach ceiling grid label on ceiling grid location directly underneath above-ceiling air terminal, control system component, valve, filter unit, fan etc.

3.9 MOTOR AND DRIVES

A. Use synchronous belt drives only on equipment controlled by soft starters or variable frequency drive motor controllers without a bypass contactor. Use V-belt drives on all other applications.

B. Alignment of V-Belt Drives: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

C. Alignment of Synchronous Belt Drives: Set driving and driven shafts parallel and align so that the corresponding pulley flanges are in the same plane.

D. Alignment of Direct-Connect Drives: Securely mount motor in accurate alignment so that shafts are per coupling manufacturer’s tolerances when both motor and driven machine are operating at normal temperatures.

3.10 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. Field-check all devices for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings or devices. A minimum of 0.95 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to COR in unopened containers that are properly identified as to application.

C. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

D. All lubrication points shall be extended to one side of the equipment.

3.11 STARTUP, TEMPORARY OPERATION AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Startup of equipment shall be performed as described in equipment specifications..

3.12 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost or time to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

D. No adjustments may be made during the acceptance inspection. All adjustments shall have been made by this point.

3.13 COMMISSIONING

A. Provide commissioning documentation.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.14 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative as required to instruct each DEPR / OMEP / PBA personnel responsible in operation and maintenance of the system.

END OF SECTION 23 05 00

SECTION 23 05 23

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1. GENERAL

1.1. SUMMARY

1.1.1. Section includes:

1.1.1.1. This section provides the general requirements for valves to be installed at Instituto Tecnológico de Ponce.

1.1.2. This Section includes general duty valves common to most mechanical piping systems. This section describes valves, balancing valves, automatic flow control valves, pressure-reducing valves, specialty valves, safety shutoff valves, pressure relief/bypass valves, and water relief valves.

1.1.3. Special purpose valves are specified in individual piping system specifications.

1.1.4. Furnish and install required valves, conforming in all aspects to the specifications, schedules and plans or drawings.

1.1.5. Furnish and install any accessories required by valves as recommended by manufacturer or distributors and is not specific in drawings. Check with Engineer for approval.

1.2. RELATED SECTIONS

a) SECTION 01 11 00 - SUMMARY OF WORK

b) SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

c) SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

d) SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

e) SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

f) SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

g) SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

h) SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

i) SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

j) SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

k) SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

l) SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

m) SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. REFERENCES STANDARDS

a) ASME: American Society of Mechanical Engineers

b) ASME BPVC Section IV: Rules for Construction of Heating Boilers

c) MSS: Manufacturers Standardization Society

1.4. SUBMITTALS

1.4.1. Submit three (3) copies of data for each type of valve to be installed.

1.4.1.1. Submittal shall include manufacturer data:

a) Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

b) Submit shop drawings, and maintenance data for products specified in this section.

1.5. QUALITY ASSURANCE:

1.5.1. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

1.5.2. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.6. DELIVERY, STORAGE, AND HANDLING

1.6.1. Preparation For Transport: Prepare valves for shipping as follows:

1.6.2. Ensure valves are dry and internally protected against rust and corrosion.

1.6.3. Protect valve ends against damage to threads, flange faces, and weld end preps.

1.6.4. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.

1.6.5. Storage: Use the following precautions during storage:

1.6.6. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

1.7. Protect valves from weather.

1.7.1. Store valves indoors.

1.7.1.1. Maintain valve temperature higher than the ambient dew point temperature.

1.7.1.2. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

1.7.2. Handling:

1.7.2.1. Use a sling to handle valves whose size requires handling by crane or lifting valves to avoid damage to exposed valve parts.

PART 2. PRODUCTS

2.1. GENERAL

2.1.1.1. All instances of each valve type shall be of one manufacturer.

2.1.1.2. All gate, globe, ball, butterfly, and check valves shall meet MSS standards.

2.1.1.3. Bronze gate, globe, ball, and check valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

2.1.1.4. Full lug and grooved butterfly valves shall be suitable for bi-directional dead-end service at full rated pressure without the use or need of a downstream flange.

2.1.1.5. Valves in insulated piping: Have stem extensions and the following features:

a) Gate Valves: Rising-stem type.

b) Ball Valves: Have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied, Nibco Nib-seal or equal, handle extension.

c) Butterfly valves: Have extended necks.

2.2. GATE VALVES

2.2.1. Acceptable Manufacturers: Jenkins, Crane, Hammond, Nibco, Vogt, or equal.

2.2.2. Bronze Gate: Bronze body, bronze trim, screwed, bronze screwed bonnet, copper-silicone bronze rising stem, solid wedge, malleable iron h/w, 150 psi SWP, 300 psi CWP, Nibco T-134. With soldered ends, Nibco S-134.

2.2.3. Iron Gate, OS&Y: Cast iron body, bronze trim, flanged, OS and Y pattern, solid wedge, 125 psi SWP, 200 psi CWP, Nibco F-617-O.

2.2.4. Bronze Gate, High Pressure: Bronze body, bronze trim, screwed, bronze union bonnet, copper-silicone bronze rising stem, solid wedge, malleable iron h/w, 300 psi SWP, 600 psi CWP, Nibco T-174-A.

2.2.5. Iron Gate, High Pressure: Iron body, bronze trim, flanged, rising stem, OS and Y pattern, solid wedge, 250 psi SWP, 500 psi CWP, Nibco F-667-O.

2.2.6. Iron Gate, High Pressure, Steam: Iron body, Class 800, Body-A 105, NPT x NPT, Vogt 12111.

2.3. GLOBE VALVES

2.3.1. Acceptable Manufacturers: Jenkins, Crane, Hammond, Nibco, Vogt, or equal.

2.3.2. Bronze Globe and Angle Globe: Bronze body, bronze-mounted, screwed, bronze union bonnet, copper-silicone bronze rising stem, TFE disc, malleable iron h/w, 150 psi SWP, 300 psi CWP, Nibco T-235-Y (globe) or T-335-Y (angle). With soldered ends, Nibco S-235-Y (globe).

2.3.3. Bronze Globe and Angle Globe High Pressure: Bronze body, stainless steel disc, bronze union bonnet, copper-silicone bronze rising stem, malleable iron h/w, 300 psi SWP, 600 psi CWP, Nibco T-276-AP (globe) or T-376-AP (angle).

2.3.4. Iron Globe: Iron body, bronze-mounted, flanged, OS and Y pattern, bronze disc, 125 psi SWP, 200 psi CWP, Nibco F-718-B.

2.3.5. Iron Globe, High Pressure: Iron body, bronze mounted, flanged, OS and Y pattern, renewable stainless steel disc, 250 psi SWP, 500 CWP, Nibco F-768-B.

2.4. CHECK VALVES

2.4.1. Acceptable Manufacturers:

2.4.1.1. Swing Check: Jenkins, Crane, Hammond, Nibco, Vogt, or equal.

2.4.1.2. Silent Check: Jenkins, Mueller, Metraflex, Nibco, or equal.

2.4.1.3. Spring Check: Nibco, or equal.

2.4.2. Horizontal Bronze Swing Check: Bronze body, bronze-mounted, screwed, TFE disc, 150 psi SWP, 300 psi CWP, Nibco T-433-Y. With soldered ends, Nibco S-433-Y.

2.4.3. Horizontal Bronze Swing Check, High Pressure: Bronze body, bronze-mounted, screwed, regrinding bronze disc, 300 psi SWP, 1000 psi CWP, Nibco T-473-B.

2.4.4. Horizontal Iron Swing Check: Iron body, bronze-mounted, flanged, regrinding bronze disc and seat ring, 125 psi SWP, 200 psi CWP, Nibco F-918-B.

2.4.5. Vertical and Silent Spring Check Valves: Iron body, stainless steel spring, water type, globe style, to fit class 125 flanges, 200 psi CWP, Nibco W-910-B, with flanged ends, Nibco F-910-B. To fit class 250 flanges, 400 psi CWP, Nibco W-960-B, with flanged ends, Nibco F-960-B.

2.4.6. Bronze Spring Check Valves: Bronze body, stainless steel spring, screwed, PTFE disc, 125 psi SWP, 250 psi CWP, Nibco T-480-Y. With soldered ends, Nibco S-480-Y.

2.5. BALL VALVES

2.5.1. Acceptable Manufacturers: Jenkins, Nibco, Apollo, Crane, or equal.

2.5.2. Bronze Ball: Bronze body, brass ball, threaded, with handle, teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem

packing, 600 psi CWP, 150 psi SWP, Nibco T-585-70. With soldered ends, Nibco S-585-70.

2.6. BUTTERFLY VALVES

2.6.1. Acceptable Manufacturers: Jenkins, Nibco, Emerson, Victaulic, or equal.

2.6.2. Ductile iron body, aluminum-bronze disc and one-piece stainless steel shaft, copper bushing, with lever handle and locking feature on valves 6 inches and smaller, gear operator on valves 8 inches and larger; treaded lug or grooved end type, EPDM liner or disc, 200 psi CWP, Nibco LD 2000 (lug style), Nibco GD-4765 (grooved ends). Do not use fasteners and pins to attach stem to disc.

2.7. BALANCING VALVES

2.7.1. Acceptable Manufacturers: DeZurik, Bell & Gossett, Armstrong, Taco, Wheatley, Flow Design, Nibco, or equal.

2.7.2. Calibrated: Bronze body, brass ball, differential pressure readout valves with integral checks, calibrated plate, integral pointer, suitable for tight shutoff, memory stops, threaded or soldered ends, 175 psi water, Bell & Gossett CB.

2.7.3. Venturi Balancing Valves: Bronze and brass construction, 400 psi WOG at 250ºF, large ported ball valve with memory stop. Teflon seats and packing, blow-out proof stem and nut, P/T type pressure taps with safety caps, calibrated venture to measure flow rates ± 2 percent, Flow Design Accusetter.

2.7.4. Automatic Flow Control Valves:

2.7.4.1. Acceptable Manufacturers: Griswold “Flow Con SH,” or pre-bid approved equal.

2.7.4.2. Provide automatic pressure compensating adjustable flow control valves complete. 125 psig operating pressure.

2.7.4.3. Factory set and calibrate within 5 percent of indicated water flow rate. Provide taps for measuring of flows with quick disconnect valves. Field adjustable flow rate with adjustable flow control cartridge.

2.7.4.4. Provide identification tags for each valve indicating type, flow characteristics, etc.

2.8. PRESSURE REDUCING VALVES

2.8.1. Pressure Reducing Valve (Chilled Water and Heating Water Closed Hydronic System Feed):

2.8.1.1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, Cash Acme, or equal.

2.8.1.2. Description: Self-filling type with low inlet pressure check valve, removable strainer, adjustable range, and set point as indicated on the drawings.

2.8.1.3. Construction: Iron body for steel piping installation, brass body for copper piping installation. All working parts shall be brass.

2.8.1.4. Size: As shown on the drawings.

2.9. SPECIALTY VALVES

2.9.1. Drain Valves and Manual Air Vents: Bronze ball valve, garden hose end, brass cap and chain 3/4-inch size, bronze cast body, chrome-plated full port ball, threaded with handle, Teflon seat, threaded body, packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP, Nibco T-585-70-HC, or equal.

2.9.2. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch, Conbraco 41 series, or pre-bid approved equal.

2.10. WATER RELIEF VALVES (CLOSED HYDRONIC SYSTEMS)

2.10.1. Acceptable Manufacturers: Kunkle, Bell & Gossett, Armstrong, Cash Acme, or equal.

2.10.2. Description: Bronze or steel body, stainless steel or bronze trim, pressure settings to 160 psi at 250ºF, in accordance with Section IV of ASME code, size in accordance with the manufacturer's recommendations based on code, setting as indicated, Kunkle Models 19, 20, and 200.

2.10.3. For use on closed loop hydronic systems to prevent over pressurization of the system due to thermal expansion.

2.11. MODULATING CONTROL VALVES

2.11.1. Pressure-independent and pressure-dependent motorized control valves as specified under Section 230900.

PART 3. EXECUTION

3.1. EXAMINATION:

3.1.1. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.

3.1.2. Actuate valve through an open close and close open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.

3.1.3. Examine threads on both the valve and the mating pipe for form (i.e., out of round or local indentation) and cleanliness.

3.1.4. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper

size, material composition suitable for service, and freedom from defects and damage.

3.1.5. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

3.1.6. Replace defective valves with new valves.

3.2. INSTALLATION

3.2.1. Provide valves at connections to equipment where shown on the drawings or where required for equipment isolation.

3.2.2. Install all valves accessible and same size as connected piping.

3.2.3. Provide separate support for valves where necessary.

3.2.4. Grooved type valve end connections may be used in lieu of flanged on services where mechanical pipe couplings and fittings are specified.

3.2.5. Provide drain valves in all low points in the piping system, at coils and equipment and as indicated.

3.3. APPLIED LOCATIONS

3.3.1. In piping 2 inches and smaller, chilled water, heating water, and industrial cold water.

3.3.1.1. Bronze gate.

3.3.1.2. Bronze globe.

3.3.1.3. Bronze swing check. If pump discharge, use spring check.

3.3.1.4. Ball valve.

3.3.2. In piping 2 inches and smaller, high pressure steam, low pressure steam, condensate, and pumped condensate.

3.3.2.1. Iron gate, high pressure, steam.

3.3.2.2. Bronze globe, high pressure.

3.3.2.3. Bronze swing check, high pressure.

3.3.2.4. Bronze spring check and condensate pump discharge.

3.3.3. In piping 2 1/2 inches and larger, chilled water, heating water, and industrial cold water.

3.3.3.1. Iron gate.

3.3.3.2. Iron globe.

3.3.3.3. Iron swing check. If pump discharge, use spring check.

3.3.3.4. Butterfly.

3.3.4. In piping 2 1/2 inches and larger, high pressure steam, low pressure steam, high pressure condensate, and pumped condensate.

3.3.4.1. Iron gate, high pressure.

3.3.4.2. Iron globe, high pressure.

3.3.4.3. Iron swing check.

3.3.4.4. Silent spring check valve and condensate pump discharge.

3.3.5. Calibrated balancing valves 3 inches and smaller, on constant flow chilled water and hot water heating where indicated on the drawings.

3.3.6. Venturi Balancing Valve: In constant flow hot water heating systems at air terminal units.

3.3.7. Eccentric plug valves 4 inches and larger, in constant flow chilled and hot water heating systems. Provide water flow meter at all eccentric plug valves where indicated on the drawings.

3.3.8. Provide gauge cock for all pressure gauges.

3.3.9. Automatic Flow Control Valves:

3.3.9.1. Install in piping loops to unit heaters, cabinet unit heaters, finned tube radiators and other heating devices where hot water flow through unit is controlled by pressure dependent, 2-position, motorized control valves.

3.3.9.2. Install in piping loops where indicated on the drawings and in accordance with manufacturer's recommendations to limit maximum flow in loops to the design flow indicated on the drawings.

3.4. DRAIN VALVES AND MANUAL AIR VENTS

3.4.1. Install at high points, low points, and where shown on the drawings, for proper venting and draining of hydronic systems.

3.4.2. Insulate valves in chilled water systems to prevent condensation.

3.5. VALVE IDENTIFICATION

3.5.1. Identify valves to indicate their function and system served. See Section 230553.

3.6. CHAIN OPERATORS

3.6.1. All valves in equipment rooms or fan rooms used for equipment or coil isolation and more than 8 feet above floor shall be installed with stem horizontal and equipped with chain wheels and chains extending to 6 feet above floor.

3.7. PRESSURE REDUCING VALVE (CLOSED LOOP HYDRONIC SYSTEM FEED)

3.7.1. Install where indicated and in accordance with the manufacturer's recommendations with 3-valve bypass.

3.8. WATER RELIEF VALVES

3.8.1. Water Relief Valves: Install where indicated and in accordance with the manufacturer's instructions. Pipe discharge to nearest floor drain using Schedule 40 steel pipe.

END OF SECTION 23 05 23

SECTION 23 05 66

ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

PART 1. GENERAL

1.1. SUMMARY

1.1.1. Section includes:

1.1.1.1. This section provides the general requirements for UVC light emitter to be installed in the AHU's and RTU's at Instituto Tecnológico de Ponce.

1.1.1.2.

1.2. RELATED REQUIREMENTS

1.2.1. Comply with all other sections, as applicable. Refer to other Divisions for coordination of work with other portions of work.

1.2.1.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.1.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.1.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.1.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.1.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.1.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.1.7. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.1.8. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.1.9. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

1.2.1.10. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.1.11. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.1.12. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.2.1.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. SYSTEM DESCRIPTION OF WORK

1.3.1. Provide and install ultraviolet (UV) light arrays and all associated accessories intended for use as part of another manufacturer's air handling unit or mounted in the ductwork as shown on the plans, details, and equipment schedules.

1.4. QUALITY ASSURANCE

1.4.1. All equipment and materials shall be new and of the best quality.

a) All equipment and materials shall be installed as recommended by the manufacturer.

1.4.2. Certifications:

a) Device shall be certified to comply with all US Environmental Protection Agency's (EPA) FIRFA Act requirements (Note: All manufactured products must be registered and marked with the EPA registration number).

b) Device shall be certified by an NRTL laboratory (UL, ETL, etc.) to meet UL Standards 1598, 153, & 1995; CSA Standard C22.2 No.9-M1989, and UL/CSA harmonized Standard C22.2 No. 236M90 /UL1995.

c) Device shall be certified by manufacturer to achieve a minimum kill rate per air pass for specified control contaminant as noted in the schedule.

d) Control contaminant to be SARS-CoV-2 (COVID-19).

1.5. SUBMITTALS

1.5.1. Product Data: Submit manufacturer's technical product data for UV light arrays including:

a) Data sheet for each type and configuration of UV light array and accessory furnished; indicating construction, sizes, electrical requirements and mounting details.

b) Product drawings detailing all physical, electrical and control requirements.

c) Statement on the manufacturer's letterhead confirming the specified kill rate of the control contaminant per the schedule.

1.5.2. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.

1.6.2. Store in original cartons and protect from weather and construction work traffic.

1.6.3. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7. COORDINATION:

1.7.1. If UVC emitter are not furnished with the equipment, then coordinate with equipment's manufacturer to determine the best locations and limitation for proper installation.

1.7.2. UVC emitter will be installed just after the HVAC system cleaning, but before the testing, adjusting and balancing works.

1.8. WARRANTY

1.8.1. Lighting Array structure and all associated accessories shall be warranted against defects in material and workmanship for five years after shipment.

1.8.2. UVC emitters shall be warranted by the UVC fixture manufacturer for a period of eighteen months after shipment or 12 months from owner acceptance, whichever is longer. Labor to replace equipment under warranty shall be provided by the installing contractor.

PART 2. PRODUCTS

2.1. ULTRAVIOLET LIGHT ARRAYS

2.1.1. UVC Fixture Manufacturer Requirements:

a) Submit certification data from UL or ETL. Manufacturers without certification shall not be acceptable.

b) Submit EPA registration number as required by the EPA FIFRA Act (7 U.S.C §136 et seq. 1996). Manufacturers without EPA FIFRA registration and proper EPA fixture markings shall not be acceptable.

c) Submit manufacturer's certificate of compliance to required kill rate per air pass of control contaminant.

2.1.2. Design Requirement:

a) UVC fixture shall be installed where indicated on the plans in sufficient quantity as to provide distribution of line-of-sight UVC energy to achieve desired minimum kill rate per air pass.

b) When possible, UVC fixtures shall be installed downstream ('wet' side) of cooling coils so as to irradiate coil fins, drain pan, fan motor, and plenum surfaces. Upstream installations are acceptable.

c) UVC fixture shall be sized to provide minimum disinfection of all ventilated air at moving air speeds listed on the equipment schedule; and at air temperatures from 0°C/32°F to 60°C/140°F.

d) UVC fixtures / components (lamps, ballasts, switches, etc.) must be engineered for high-humidity locations. All exposed wiring connectors within the AHU must be **liquid tight and NEMA 3R** quick-connects and

disconnects. All wiring and connectors must be fully encased into a protective metal covering such as EMT, flexible MC cable, or liquid tight / seal tight type flexible conduit. Exposed wiring is prohibited within the AHU. UVC ballasts must be easily accessible for replacement without removal / disassembly of the UVC fixture.

e) UVC fixture mounting structure shall feature tool-less, quick removal of lamp rows for coil /motor maintenance. This feature must be installed in conjunction with quick connect / disconnects.

2.1.3. UV Light Array General Requirements

a) Device shall be designed and certified for use inside an HVAC system.

b) Device UV Germicidal Lamps shall provide 360º air path disinfection, unless otherwise noted.

c) Device shall include stainless steel lamp clip holders to secure lamp ends and prevent lamp vibration. Device mounting frame shall be constructed from aluminum or stainless steel. Device shall self-regulate to operate at all input voltages from 120V through 460V, 60Hz.

d) Device shall be shipped as a complete system with all accessories required to form a complete unit, including door switch, power safety switch, signage, lockouts, reflectors, and other accessories as noted in the schedule.

2.1.4. Ultraviolet Lamps:

2.1.4.1. Lamp(s) shall generate peak output at 253.7 nanometers.

2.1.4.2. Manufacturer's data sheets (MSDS) must include lamp data, lamp intensity, and maximum mercury content. Mercury content of the UVC lamp shall be at or below 5 mg / lamp (max) and shall be included on MSDS. Lamp(s) shall be "chill- corrected" to generate stated UVC output within air moving at scheduled air velocity on equipment schedule, with air temperature down to 40º F, and shall generate a minimum average dosage as scheduled. Lamp(s) shall NOT introduce ozone. Limits above UL867-2007 standards shall not be acceptable.

2.2. Lamp(s) shall be compact, single-ended twin tube design with no external wires in the air path. Lamp life shall be rated at 12 months minimum of service life. Lamp depreciation not to exceed 20% at rated life. Manufacturer shall provide UVC- resistant eyewear and gloves to facilitate lamp handling during service. Manufacturer shall provide lamp-recycling services and a certificate of lamp recycling in compliance with EPA requirements. All additional costs for collection /recycling services must be included in submittal documents.

a) Provide protective lamp sleeve to prevent accidental lamp breakage in airstream. Light output rating shall include associated de-rate for protective coating and still meet minimum control contaminant kill rate.

2.2.2. Ballasts:

a) Ballasts shall have no PCBs, shall be UL Listed, and specific for the UVC germicidal lamp provided.

b) Electronic ballast shall be listed as 'programmed start', and prioritized in relationship to the UV equipment.

c) Ballasts shall be high power factor, class P, Sound Rating A, Type 1 Outdoor, RoHS compliant.

2.3. Electronic ballasts shall be "Suitable for Air Handling Spaces" and shall meet the harmonic distortion requirements of ANSI at a minimum operating temperature of –20 degrees F.

2.3.1. Safety Features:

a) Device shall employ an integral Safety Interlock Switch for primary access door/panel and all access doors/panel with line of sight to the UV light array to interrupt power to the UV lights when the unit access door is opened. A lockout device is required for each external switch. These door safety switches are to be wired in series.

b) Device shall incorporate signage that meet or exceed UL & OSHA personal safety requirements, and in adequate quantities to provide warnings on all UVC access doors, both primary and secondary.

2.3.2. Quality Assurance:

a) The UVC Air Disinfection System shall be a product of an established manufacturer within the USA and shall be made of at least 80% USA sourced raw materials and components. Less than 80% US content is not acceptable.

b) Ozone-generating lamps shall not be used. Max allowable O2 chamber test concentration shall be 0.007 PPM. Peak O2 concentration @ 2 inches from the lamp shall be no more than 0.0042 PPM.

2.3.3. Controls:

a) Provide dry contacts for on/off status alarm indication output to the building Energy Management System (EMS).

b) Provide light quantity radiometer sensors, with every array (one per unit), to measure the light output and associated intensity from the light array. Radiometers shall be factory calibrated and be manufacturer's standard sensor offering. Sensor shall provide 4-20mA or 2-10 VDC measurement output signal to building EMS.

2.3.4. Acceptable Manufacturers:

a) FreshAire UV

b) UVR

PART 3. EXECUTION

3.1. DELIVERY & PROTECTION

3.1.1. Contractor to perform installation and start-up to include installation of all accessories as required to make a complete and operating system.

3.1.2. All equipment shall be handled carefully to avoid damage and be protected from exposure to the weather and dirt. All equipment shall be examined upon delivery to the site and evidence of abuse, damage, or exposure to weather and dirt shall be grounds for refusal to accept individual pieces of equipment. Rejected items shall be replaced promptly at no cost to the Owner.

3.2. UV LIGHT ARRAY INSTALLATION

3.2.1. Coordinate the electrical services and control wiring with the Electrical Contractor and HVAC contractor. The manufacturer of each item of equipment shall provide complete wiring diagrams to the Electrical Systems Installer and shall provide drawings indicating all required external wiring and arrangement of all field connections.

3.2.2. UVC Equipment installation must provide simple access in such a way that routine maintenance and lamp change shall be performed without UV fixture disassembly and without the use of tools.

3.2.3. Contractor must install only UVC products properly marked with EPA registration numbers.

3.3. COMMISSIONING & TRAINING

3.3.1. Manufacturer must provide installation instructions and commissioning assistance, including training, parts manuals, maintenance and technical assistance, and safety information to help maintain the UVC system at peak operational efficiency.

END OF SECTION 23 05 66

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC
(11/15)

PART 1. GENERAL

1.1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S1.4 (1983; Amendment 1985; R 2006) Specification for Sound Level Meters (ASA 47)

ASA S1.11 PART 1 (2014) American National Standard Electroacoustics – Octave-Band and Fractional-Octave-Band Filters – Part 1: Specifications

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 203 (1990; R 2011) Field Performance Measurements of Fan Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 62.1 (2010) Ventilation for Acceptable Indoor Air Quality

ASHRAE HVAC APP IP HDBK (2016) HVAC Applications Handbook, I-P Edition

ASHRAE HVAC APP SI HDBK (2019) HVAC Applications Handbook, SI Edition

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002; 6th ed) National Standards for Total System Balance

AABC MN-4 (1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV (2006) Procedural Standards for Measurements and Assessment of Sound and Vibration

NEBB PROCEDURAL STANDARDS (2015) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1780 (2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition

SMACNA 1858 (2004) HVAC Sound And Vibration Manual - First Edition

SMACNA 1972 CD (2012) HVAC Air Duct Leakage Test Manual - 2nd Edition

1.2. RELATED SECTIONS

1.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.7. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.8. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.9. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

1.2.10. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.11. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.12. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.2.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. DEFINITIONS

a AABC: Associated Air Balance Council

b COTR: Contracting Officer's Technical Representative

c DALT: Duct air leakage test

d DALT'd: Duct air leakage tested

e HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling

f NEBB: National Environmental Balancing Bureau

g Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."

h Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.

i Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.

j Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.

k Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).

l TAB: Testing, adjusting, and balancing (of HVAC systems)

m TAB'd: HVAC Testing/Adjusting/Balancing procedures performed

n TAB Agency: TAB Firm

o TABB: Testing Adjusting and Balancing Bureau

1.21.1. Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

1.4. WORK DESCRIPTION

The work includes duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of existing heating, ventilating, and cooling (HVAC) air and water distribution systems including equipment and performance data, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

Conduct DALT and TAB of the indicated existing systems and equipment and submit the specified DALT and TAB reports for approval. Conduct DALT testing in compliance with the requirements specified in SMACNA 1972 CD, except as

supplemented and modified by this section. Conduct DALT and TAB work in accordance with the requirements of this section.

1.4.1. Air Distribution Systems

Test, adjust, and balance system[s] (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.4.2. Water Distribution Systems

TAB system[s] in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to water distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. At Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated before systems are TAB'd.

Terminate piping insulation immediately adjacent to each flow control valve, automatic control valve, or device. Seal the ends of pipe insulation and the space between ends of pipe insulation and piping, with waterproof vapor barrier coating.

After completion of work under this section, insulate the flow control valves and devices as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.4.3. TAB SCHEMATIC DRAWINGS

Show the following information on TAB Schematic Drawings:

a A unique number or mark for each piece of equipment or terminal.

b Air quantities at air terminals.

c Air quantities and temperatures in air handling unit schedules.

d Water quantities and temperatures in thermal energy transfer equipment schedules.

e Water quantities and heads in pump schedules.

f Water flow measurement fittings and balancing fittings.

g Ductwork Construction and Leakage Testing Table that defines the DALT test requirements, including each applicable HVAC duct system ID or mark, duct pressure class, duct seal class, and duct leakage test pressure. This table is included.in the specifications.

Submit three copies of the TAB Schematic Drawings and Report Forms to the Contracting Officer, no later than 21 days prior to the start of TAB field measurements.

1.4.4. Related Requirements

1.5. SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval and / or for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Records of Existing Conditions; G

SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms; G

SD-03 Product Data

Equipment and Performance Data; G

TAB Related HVAC Submittals; G

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB team engineer.

SD-06 Test Reports

Completed Pre-Final DALT Report; G

Certified Final DALT Report; G

SD-07 Certificates

Independent TAB Agency and Personnel Qualifications; G

DALT and TAB Submittal and Work Schedule; G

TAB Pre-Field Engineering Report; G

1.6. QUALITY ASSURANCE

1.6.1. Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Contracting Officer for approval:

a Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

b TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.

c Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

3.1. WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section.

3.2. PRE-DALT/TAB MEETING

Meet with the Contracting Officer's technical representative (COTR)and the designing engineer of the HVAC systems, inspector engineer, supervisor or Department of Education of Puerto Rico representative to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3. DALT PROCEDURES

3.3.1. Instruments, Consumables and Personnel

Provide instruments, consumables and personnel required to accomplish the DALT field work. Follow the same basic procedure specified below for TAB Field Work, including maintenance and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship, and

treatment of deficiencies. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing prior to the COTR's duct selection field visit.

3.3.2. Ductwork To Be DALT'd

From each duct system indicated as subject to DALT, the COTR will randomly select sections of each completed duct system for testing by the Contractor's TAB Firm. The sections selected will not exceed 20 percent of the total measured linear footage of duct systems indicated as subject to DALT. Sections of duct systems subject to DALT will include 20 percent of main ducts, branch main ducts, branch ducts and plenums for supply, return, exhaust, and plenum ductwork.

It is acceptable for an entire duct system to be DALT'd instead of disassembling that system in order to DALT only the 20 percent portion specified above.

3.3.3. DALT Testing

Perform DALT on the HVAC duct sections of each system as selected by the COTR. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in SMACNA 1972 CD.

In spite of specifications of SMACNA 1972 CD to the contrary, DALT ductwork of construction class of 3-inch water gauge static pressure and below if indicated to be DALT'd. Complete DALT work on the COTR selected ductwork within 48 hours after the particular ductwork was selected for DALT. Separately conduct DALT work for large duct systems to enable the DALT work to be completed in 48 hours.

3.3.4. Completed Pre-Final DALT Report

3.3.5. Quality Assurance - COTR DALT Field Acceptance Testing

In the presence of the COTR and TAB team field leader, verify for accuracy Pre-final DALT Report data selected by the COTR. For each duct system, this acceptance testing shall be conducted on a maximum of 50 percent of the duct sections DALT'd.

Further, if any data on the Pre-final DALT report form for a given duct section is out-of-tolerance, then field acceptance testing shall be conducted on data for one additional duct section, preferably in the same duct system, in the presence of the COTR.

3.3.6. Additional COTR Field Acceptance Testing

If any of the duct sections checked for a given system are determined to have a leakage rate measured that exceeds the leakage rate allowed by SMACNA Leak Test Manual for an indicated duct construction class and sealant class, terminate data checking for that section. The associated Pre-final DALT Report

data for the given duct system will be disapproved. Make the necessary corrections and prepare a revised Pre-final DALT Report. Reschedule a field check of the revised report data with the COTR.

3.3.7. Certified Final DALT Report

3.3.8. Prerequisite for TAB Field Work

Do not commence TAB field work prior to the completion and approval, for all systems, of the Final DALT Report.

3.4. TAB PROCEDURES

3.4.1. TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the the requirements of AABC MN-1 or SMACNA 1780 (TABB) and SMACNA 1858 (TABB),except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Conduct TAB work, including measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC MN-4, or NEBB TABES and NEBB MASV, or SMACNA 1780 (used by TABB) and SMACNA 1858 sound measurement procedures, except as supplemented and modified by this section.

3.4.2. Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.4.3. TAB Air Distribution Systems

3.4.3.1. Units With Coils

Report heating and cooling performance capacity tests for hot water, chilled water, DX and steam coils for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

a For air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of AABC MN-4, Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with AABC MN-4, Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

b For units with capacities of 7.5 tons (90,000 Btu) or less, such as fan coil units, duct mounted reheat coils associated with VAV terminal units, and unitary units, such as through-the-wall heat pumps:

Determine the apparent coil capacity by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; submit the calculations with the coil reports.

3.4.3.2. Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, variable air volume boxes, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

3.4.3.3. Rooftop Air Conditioning

Rooftop air conditioning systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

For refrigeration compressors/condensers/condensing units/evaporators, report data as required by NEBB, AABC, and TABB standard procedures, including refrigeration operational data.

3.4.3.4. Heating and Ventilating Units

Heating and ventilating unit systems including fans, coils, ducts, plenums, roof vents, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.5. Makeup Air Units

Makeup air unit systems including fans, coils, ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.6. Return Air Fans

Return air fan system including fan ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.7. Fan Coils

Fan coil unit systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

3.4.3.8. Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.4.4. TAB Water Distribution Systems

3.4.4.1. Chilled Water

Chilled water systems including chillers, condensers, cooling towers, pumps, coils, system balance valves and flow measuring devices.

For water chillers, report data as required by AABC, NEBB and TABB standard procedures, including refrigeration operational data.

3.4.4.2. Heating Hot Water **(NOT USED IN THIS PROJECT)**

Heating hot water systems including boilers, hot water converters (e.g., heat exchangers), pumps, coils, system balancing valves and flow measuring devices.

3.4.4.3. Dual Temperature Water

Dual temperature water systems including boilers, converters, chillers, condensers, cooling towers, pumps, coils, and system balancing valves, and flow measuring devices.

3.4.5. Sound Measurement Work

3.4.5.1. Areas To Be Sound Measured

In the following spaces, measure and record the sound power level for each octave band listed in ASHRAE HVAC APP IP HDBK Noise Criteria:

a All HVAC mechanical rooms, including machinery spaces and other spaces containing HVAC power drivers and power driven equipment.

b All spaces sharing a common barrier with each mechanical room, including rooms overhead, rooms on the other side of side walls, and rooms beneath the mechanical room floor.

3.4.5.2. Procedure

Measure sound levels in each room, when unoccupied except for the TAB team, with all HVAC systems that would cause sound readings in the room operating in their noisiest mode. Record the sound level in each octave band. Attempt to mitigate the sound level and bring the level to within the specified ASHRAE HVAC APP IP HDBK noise criteria goals, if such mitigation is within the TAB team's control. State in the report the ASHRAE HVAC APP IP HDBK noise criteria goals. If sound level cannot be brought into compliance, provide written notice of the deficiency to the Contractor for resolution or correction.

3.4.5.3. Timing

Measure sound levels at times prescribed by AABC or NEBB or TABB.

3.4.5.4. Meters

Measure sound levels with a sound meter complying with ASA S1.4, Type 1 or 2, and an octave band filter set complying with ASA S1.11 PART 1. Use measurement methods for overall sound levels and for octave band sound levels as prescribed by NEBB.

3.4.5.5. Calibration

Calibrate sound levels as prescribed by AABC or NEBB or TABB, except that calibrator emitting a sound pressure level tone of 94 dB at 1000 hertz (Hz) are also acceptable.

3.4.5.6. Background Noise Correction

Determine background noise component of room sound (noise) levels for each (of eight) octave bands as prescribed by AABC or NEBB or TABB.

3.4.6. TAB Work on Performance Tests Without Seasonal Limitations

3.4.6.1. Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the cooling systems.

3.4.6.2. Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.4.6.3. Sound Measurements

Comply with the paragraph SOUND MEASUREMENT WORK, specifically, the requirement that a room must be operating in its noisiest mode at the time of sound measurements in the room. The maximum noise level measurements could depend on seasonally related heat or cooling transfer equipment.

3.4.7. TAB Work on Performance Tests With Seasonal Limitations

3.4.7.1. Performance Tests

3.4.7.2. Season Of Maximum Load

3.4.7.3. Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor

ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.4.7.4. Sound Measurements

Comply with the paragraph SOUND MEASUREMENT WORK, specifically, the requirement that a room must be operating in its noisiest mode at the time of sound measurements in the room. The maximum noise level measurements could depend on seasonally related heat or cooling transfer equipment.

3.4.8. Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air and water flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Contracting Officer for direction.

3.4.9. Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph WORKMANSHIP, provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.4.10. TAB Reports

3.4.11. Quality Assurance - COTR TAB Field Acceptance Testing

3.4.11.1. TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COTR, random selections of data (water, air quantities, air motion, [sound level readings]) recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COTR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: All chillers, boilers, return fans, computer room units, and air handling units (rooftop and central stations).

Group 2: 25 percent of the VAV terminal boxes and associated diffusers and registers.

Group 3: 25 percent of the supply diffusers, registers, grilles associated with constant volume air handling units.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply fans, exhaust fans, and pumps.

Further, if any data on the TAB Report for Groups 2 through 5 is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, additional group data verification is required in the presence of the COTR. Verify TAB Report data for one additional piece of equipment in that group. Continue this additional group data verification until out-of-tolerance data ceases to be found.

3.4.11.2. Additional COTR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COTR.

3.4.11.3. Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

3.5. MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.6. 3.6 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

End of Section 23 05 93

SECTION 23 09 23.11

DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1. GENERAL

1.1. SUMMARY

1.1.1. This section provides the requirements for the repair and upgrade of the existing Digital Control System and related equipment and materials to be installed at the Instituto Tecnológico de Ponce Buildings A, B, C, D and G.

1.1.2. Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration, and installation for complete building automation system (also identified as BMS, Direct Digital Control System For HVAC) including all necessary hardware and all operating and applications software as required for the complete performance of the Work, as shown on the Drawings, as specified herein.

1.1.3. Network level (Management Level) components of the system – workstations, servers, etc. shall communicate using the BACnet protocol, as defined by ASHRAE Standard 135-2020. No gateways shall be used for communication to controllers furnished under this section.

1.1.4. At a minimum, provide controls for the following:

1.1.4.1. Air Handling Units

1.1.4.2. Chilled water system including pumps, chillers, and remote condensing units

1.1.4.3. Exhaust and Supply Fans

1.1.4.4. Package rooftop units

1.1.4.5. Power wiring to DDC devices, smoke control dampers and BAS panels except as otherwise specified.

1.1.4.6. Smoke detection system and fire/smoke dampers

1.1.4.7. Variable Frequency Drives

1.1.4.8. Reduced voltage solid state starters

1.1.4.9. AHU's door switches

1.1.4.10. UVC emitters

1.1.4.11. Any other component required to be included and not indicated in the specifications.

1.1.5. Except as otherwise noted, the control system shall consist of all necessary Ethernet Network Controllers, Standalone Digital Control Units, Room Controllers, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Except as otherwise specified, provide operators for equipment such as dampers if the equipment manufacturer does not provide these. Coordinate requirements with the various Contractors.

1.1.6. The BAS system supplier shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.

1.1.7. All interlocking wiring, wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. When the BAS system is fully installed and operational, the BAS system supplier and representatives of the Owner will review and check out the system – see System Acceptance and Testing section of this document. At that time, the

BAS system supplier shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.

1.1.8. Provide services and manpower necessary for commissioning of the system in coordination with the HVAC Contractor, Balancing Contractor and DEPR / OMEP / PBA representative.

1.1.9. All work performed under this section of the specifications will comply with all governing codes, laws and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor, with guidance from the engineer, shall submit a proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.

1.2. RELATED SECTIONS

1.2.1. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units. Depending on the scope of the project, the complete specification may have numerous sections that interface to this section, including several from Division 25, 26, & 28.

1.2.2. Additional related sections and sub-sections can apply.

1.2.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.2.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.2.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.2.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.2.7. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.2.8. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.2.9. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

1.2.2.10. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.2.11. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.2.12. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.2.2.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES.

1.3. REFERENCES

1.3.1. General, Code Compliance: The code listed below form a part of this Specification to the extent referenced. The codes are referred to in the text by the basic designation only. The edition/revision of the referenced code shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

1.3.1.1. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.

1.3.1.2. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.

1.3.1.3. All wiring shall conform to the National Electrical Code.

1.3.1.4. All smoke dampers shall be rated in accordance with UL 555S.

1.3.1.5. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.

1.3.1.6. Comply with FCC, Part 68 rules for telephone modems and data sets.

1.4. DEFINITIONS

1.4.1. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.

1.4.1.1. Standard

a) ASHRAE: American Society Heating, Refrigeration, Air Conditioning Engineers

b) AHU: Air Handling Unit

c) BACnet: Building Automation Controls Network

d) BMS: Building Management System

e) DDC: Direct Digital Control

f) GUI: Graphical User Interface

g) HVAC: Heating, Ventilation, and Air Conditioning

h) IEEE: Institute Electrical Electronic Engineers

i) MER: Mechanical Equipment Room

j) PID: Proportional, Integral, Derivative

k) VAV: Variable Air Volume Box

1.4.1.2. Communications and protocols

a) ARP: Address Resolution Protocol

b) BACnet: Building Automation and Control Networks

c) CORBA: Common Object Request Broker Architecture

d) CSMA/CD: Carrier Sense Multiple Access/Collision Detect

e) DDE: Dynamic Data Exchange

f) FTP: File Transfer Protocol

g) FTT: Free Topology Transceivers

h) HTTP: Hyper Text Transfer Protocol

i) IIOP: Internet Inter-ORB Protocol

j) IP: Internet Protocol

k) LAN: Local Area Network

l) LON: Echelon Communication – Local Operating Network

m) MS/TP: Master Slave Token Passing

n) OBIX: Open Building Information Exchange

o) ODBC: Open Database Connectivity

p) ORB: Object Request Broker

q) SNVT: Standard Network Variables Types

r) SQL: Structured Query Language

s) UDP: User Datagram Protocol

t) XML: eXtensible Markup Language

1.4.1.3. Controllers

a) ASD: Application Specific Device

b) AAC: Advanced Application Controller

c) ASC: Application Specific Controller.

d) CAC: Custom Application Controller.

e) DCU: Distributed Control Unit

f) LCM: Local Control Module

g) MC: MicroControllers

h) MPC: Multi-purpose Controller

i) NSC: Network Server Controller

j) PEM: Package Equipment Module

k) PPC: Programmable Process Controller

l) RC: Room controller

m) SDCU: Standalone Digital Control Units

n) SLC: Supervisory Logic Controller

o) UEC: Unitary Equipment Controller

p) VAVDDC: Variable Air Volume Direct Digital Controller

1.4.1.4. Tools and Software

a) AFDD: Automated Fault Detection and Diagnostic

b) APEO: Automated Predictive Energy Optimization

c) DR: Demand Response

d) CCDT: Configuration, Commissioning and Diagnostic Tool

e) BPES: BACnet Portable Engineering Station

f) LPES: LON Portable Engineering Station

g) POT: Portable Operator's Terminal

h) PEMS: Power and Energy Management Software

i) MTBF: Mean Time Between Failure

1.5. SYSTEM DESCRIPTION

1.5.1. In accordance to the scope of work, the system shall also provide a graphical, web-based, operator interface that allows for instant access to any system through a standard browser. The contractor must provide PC-based programming workstations, operator workstations and microcomputer controllers of modular design providing distributed processing capability and allowing future expansion of both input/output points and processing/control functions.

1.5.2. For this project, the system shall consist of the following components:

1.5.2.1. Administration and Programming Workstation(s): The BAS system supplier shall include Operation software and architecture as described in Part 2 of the specification. These workstations must be running the standard workstation software developed and tested by the

manufacturer of the network server controllers and the standalone controllers. No third party front-end workstation software will be acceptable. Workstations must conform to the B-OWS BACnet device profile.

1.5.2.2. Web-Based Operator Workstations: The BAS system supplier shall furnish licenses for web connection to the BAS system. Web-based users shall have access to all system points and graphics, shall be able to receive and acknowledge alarms, and shall be able to control setpoints and other parameters. All engineering work, such as trends, reports, graphics, etc. that are accomplished from the WorkStation shall be available for viewing through the web browser interface without additional changes. The web-based interface must conform to the B-OWS BACnet device profile. There will be no need for any additional computer based hardware to support the web-based user interface.

1.5.2.3. Ethernet-based Network Router and/or Network Server Controller(s): The BAS system supplier shall furnish needed quantity of Ethernet-based Network Server Controllers as described in Part 2 of the specification. These controllers will connect directly to the Operator Workstation over Ethernet at a minimum of 100mbps, and provide communication to the Standalone Digital Control Units and/or other Input/Output Modules. Network Server Controllers shall conform to BACnet device profile B-BC. Network controllers that utilize RS232 serial communications or ARCNET to communicate with the workstations will not be accepted. Network Controllers shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Building Controllers (B-BC).

1.5.2.4. Standalone Digital Control Units (SDCUs): Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment.

1.5.3. The Local Area Network (LAN) shall be either a 10 or 100 Mpbs Ethernet network supporting BACnet for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Server Controllers (NSCs), user workstations and a local host computer system.

1.5.4. The Enterprise Ethernet (IEEE 802.3) LAN shall utilize Carrier Sense Multiple/Access/Collision Detect (CSMA/CD), Address Resolution Protocol (ARP) and User Datagram Protocol (UDP) operating at 10 or 100 Mbps.

1.5.5. The system shall enable an open architecture that utilizes ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. Native support for the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol are required to assure that the project is fully supported by the HVAC open protocols to reduce future building maintenance, upgrade, and expansion costs.

1.5.6. The system shall enable an architecture that utilizes a MS/TP selectable 9.6-76.8 KBaud protocol, as a common communication protocol between controllers and integral ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. The AAC shall be capable of communicating as a MS/TP device or as a BACnet IP device communicating at 10/100 Mbps on a TCP/IP trunk. The ANSI / ASHRAE™ Standard 135-2004, BACnet protocol is required to assure that the project is fully supported by the leading HVAC open protocol to reduce future building maintenance, upgrade, and expansion costs.

1.5.7. The software tools required for network management of the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol must be provided with the system. Original drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans and are required to meet the functional intent, shall be provided without additional cost to the Owner. BACnet clients shall comply with the BACnet Operator Workstation (B-OWS) device profile; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet IP or MS/TP.

1.5.8. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and dampers and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives, reduced voltage solid state starters, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.

1.5.8.1. The supplied system must incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs. The system shall not require JAVA to be enabled in the browser.

1.5.8.2. Data shall reside on a supplier-installed server for all database access.

1.5.8.3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network.

1.5.9. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office. The approved manufacturer's local field office shall have a minimum of 10 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer when requested. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 50 miles of the site with factory certified technicians and engineers, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.

1.5.10. Provide the Commissioning, configuration and diagnostic tool (CCDT), color display personnel computer, software, and interfaces to provide uploading/downloading of High Point Count Controllers (AAC), Unitary Equipment Controllers (UEC) and VAV controllers (VAVDDC), monitoring all BACnet objects, monitoring overrides of all controllers physical input/output points, and editing of controller resident time schedules.

1.6. SUBMITTALS

1.6.1. General:

1.6.1.1. Submit three (3) copies of data, materials, equipment and devices for each building. A submittal package shall be furnished to the DEPR / OMEP / PBA Engineer or representative for approval prior to factory assembly of the drive. The submittal package shall consist of the following

a) All shop drawings shall be prepared in Visio Professional or AutoCAD software. In addition to the drawings, the Contractor shall furnish a CD containing the identical information. Drawings shall be B size or larger. All documents will be submitted at the original application ad PDF.

b) Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typical will be allowed where appropriate.

c) Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.

d) Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be

bound or in a three ring binder with an index and tabs. Diagrams shall be on 11" by 17" foldouts. If color has been used to differentiate information, the printed copies shall be in color.

1.6.1.2. Because the project is repair-oriented, upgrade-oriented, and requires completion to be as soon as possible, pre-submittal meetings will be held with contractors, fabricators, HVAC and control consultants, and sales representatives to discuss specifications and drawings to reach consensus and agreements before the presentation of official documents.

1.6.1.3. If there are no meetings prior to the submittals or no agreements are reached, then The DEPR / OMEP / PBA Engineer will make corrections to submittals, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

a) The following is a list of post construction submittals that shall be updated to reflect any changes during construction and re-submitted as "As-Built".

- System architecture drawing.
- Layout drawing for each control panel
- Wiring diagram for individual components
- System flow diagram for each controlled system
- Instrumentation list for each controlled system
- Sequence of control
- Binding map
- A matrix sheet detailing all system addresses and communication settings for the following:

  All IP network addresses & settings

  All BMS device addresses & communication settings
- Operation and Maintenance Manuals

b) Information common to the entire system shall be provided. This shall include but not be limited to the following.

- Product manuals for the key software tasks.
- Operating the system.
- Administrating the system.
- Engineering the operator workstation.
- Application programming.
- Engineering the network.
- Setting up the web server.
- Report creation.
- Graphics creation.
- All other engineering tasks.
- System Architecture Diagram.
- List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.

- Define the task.
- Recommend a frequency for the task.
- Reference the product manual that includes instructions on executing the task.
- Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
- Licenses, guarantees, and warranty documents for equipment and systems.
- Submit one copy for each building, plus two extra copies.

c) Information common to the systems in a single building shall be provided.

- System architecture diagram for components within the building annotated with specific location information.
- As-built drawing for each control panel.
- As-built wiring design diagram for all components.
- Installation design details for each I/O device.
- As-built system flow diagram for each system.
- Sequence of control for each system.
- Binding map for the building.
- Product data sheet for each component.
- Installation data sheet for each component.
- Submit two copies for each building and two extra copies.

d) Software shall be provided:

- Submit a copy of all software installed on the servers and workstations.
- Submit all licensing information for all software installed on the servers and workstations.
- Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
- Submit all licensing information for all of the software used to execute the project.
- All software revisions shall be as installed at the time of the system acceptance.
- Firmware Files
- Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project.
- This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.
- Submit a copy of all application files that were created during the execution of the project.
- Submit a copy of all graphic page files created during the execution of the project.

1.7. QUALITY ASSURANCE

1.7.1. The building automation contractors must to be in the business of installing direct digital control building automation systems for a minimum of 10 years.

1.7.1.1. The Building Management System contractor shall have a full-service facility within 50 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The contractor's technicians shall be fully capable of providing instructions and routine emergency maintenance service on all system components.

1.7.2. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.

1.7.3. The BAS system supplier shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives.

1.7.4. The BAS system supplier shall provide a technician for the necessary time required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS system supplier shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract.

1.7.5. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded.

1.7.6. Required elements of the startup testing include:

1.7.6.1. Measurement of voltage sources, primary and secondary

1.7.6.2. Verification of proper controller power wiring.

1.7.6.3. Verification of component inventory when compared to the submittals.

1.7.6.4. Verification of labeling on components and wiring.

1.7.6.5. Verification of connection integrity and quality (loose strands and tight connections).

1.7.6.6. Verification of bus topology, grounding of shields and installation of termination devices.

1.7.6.7. Verification of point checkout.

1.7.6.8. Each I/O device is landed per the submittals and functions per the sequence of control.

1.7.6.9. Analog sensors are properly scaled and a value is reported

1.7.6.10. Binary sensors have the correct normal position and the state is correctly reported.

1.7.6.11. Analog outputs have the correct normal position and move full stroke when so commanded.

1.7.6.12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.

1.7.6.13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).

1.7.6.14. Documentation of Loop tuning (sample rate, gain and integral time constant).

1.7.7. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following.

1.7.7.1. Graphics navigation.

1.7.7.2. Trend data collection and presentation.

1.7.7.3. Alarm handling, acknowledgement and routing.

1.7.7.4. Time schedule editing.

1.7.7.5. Application parameter adjustment.

1.7.7.6. Manual control.

1.7.7.7. Report execution.

1.7.7.8. Automatic backups.

1.7.7.9. Web Client access.

1.7.8. A Startup Testing Report and a Performance Verification Testing Report shall be provided upon test completion.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1.1. Contractor shall store, protect and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

1.8.1.2. Contractor shall inspect and report concealed damage to carrier within 48 hours.

1.8.1.3. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris and traffic. Heat enclosures to prevent condensation.

1.8.1.4. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices and finish. Lift only by installed lifting eyes.

1.9. COORDINATION

1.9.1. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

1.9.2. Coordinate equipment from other sections to achieve compatibility with equipment that interfaces with those systems.

1.9.3. Coordinate supply of conditioned electrical circuits for control units and operator workstation.

1.9.4. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases.

1.9.5. Coordinate with the IT department (DEPR / OMEP / PBA) on locations for, Ethernet communication cabling and TCP/IP addresses.

1.9.6. ownership

1.9.6.1. The Owner shall retain licenses to software for this project.

1.9.6.2. The Owner shall sign a copy of the manufacturer’s standard software and firmware licensing agreement as a condition off this contractor. Such license shall grant use of all programs and application software to the Owner as defined by the manufacturer’s license agreement but shall protect the manufacturer’s rights to disclosure of Trade Secrets contained within such software.

1.9.6.3. The licensing agreement shall not preclude the use of the software by individuals under contract to the owner for commissioning, servicing or altering the system in the future. Use of the software by individuals under contract to the owner shall be restricted to use on the owner’s computers and only for the purpose of commissioning, servicing, or altering the installed system.

1.9.6.4. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:

a) Server and workstation software

b) Application programming tools

c) Configuration tools

d) Network diagnostic tools

e) Addressing tools

f) Application files

g) Configuration files

h) Graphic files

i) Report files

j) Graphic symbol libraries

k) All documentation

1.9.7. Work by others

1.9.7.1. The BAS system supplier shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.

1.9.7.2. The BAS system supplier shall furnish all Control Valves, Flow Meters, Sensor Wells and other similar equipment for installation by the Mechanical Contractor and/or others.

1.9.7.3. The BAS system supplier shall provide field supervision to the designated contractor for the installation of the following:

1.9.7.4. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.

1.9.7.5. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.

1.9.7.6. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1.10. WARRANTY

1.10.1. All components, system software, and parts furnished and installed by the BMS system supplier shall be guaranteed against defects in materials and workmanship for 1 year of substantial completion. Labor to repair, reprogram, or replace these components shall be furnished by the BMS system supplier at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BMS system supplier shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 standard working hours.

PART 2. PRODUCTS

2.1. SYSTEMS / ASSEMBLIES / MANUFACTURED UNITS / EQUIPMENT / COMPONENTS / PRODUCT TYPES / MATERIALS

2.1.1. MANUFACTURERS

2.1.1.1. Basis of Design Product: Subject to compliance with requirements, provide products by one of the following:

a) Electric Components
- Based on market availability, compatible with other components and approved by AHJ

b) Electronic Components
- Based on market availability, compatible with other components and approved by AHJ.

c) Direct Digital Control Systems Field Controller Devices:
- ABB
- Allen-Bradley
- Eaton
- General Electric
- Schneider Electric
- Siemens
- Square D
- Toshiba
- Yaskawa
- Or approved equal.

2.1.2. DESCRIPTION

2.1.2.1. General

a) The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.

b) The system shall be designed with a top-level 10/100bT Ethernet network, using the BACnet/IP protocol.

2.1.2.2. BACnet MS/TP, BACnet IP, and Web Services shall be native to the NSCs. There shall not be a need to provide multiple NSCs to support all the network protocols, nor should there be a need to supply additional software to allow all three protocols to be natively supported.

2.1.2.3. A sub-network of SDCUs using the BACnet IP, BACnet MS/TP shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.

2.1.2.4. The TCP/IP layer connects all of the buildings on a single Wide Area Network (WAN) isolated behind the Instituto Tecnologico de Ponce campus firewall. Fixed IP addresses for connections to the campus WAN shall be used for each device that connects to the WAN.

2.1.2.5. The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN). Workstations can manage a single LAN (or building), and/or the entire system with all portions of that LAN maintaining its own, current database.

2.1.2.6. All NSCs, Workstation(s) and Servers shall be capable of residing directly on the Departamento de Educacion Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NSC's, Workstation(s), and Server(s) shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system.

2.1.2.7. System Expansion

a) The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.

b) Web-based operation shall be supported directly by the NSCs and require no additional software.

c) The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.

2.1.2.8. All Network Server Controllers must natively support the BACnet IP and, BACnet MS/TP protocols.

2.1.3. **OPERATOR WORKSTATION REQUIREMENTS**

2.1.3.1. General

a) The operator workstation portion of the BAS shall consist of one or more full-powered configuration and programming workstations.

b) The programming and configuration workstation software shall allow any user with adequate permission to create and/or modify any or all parts of the NSC database.

c) All configuration workstations shall be personal computers operating under the Microsoft Windows operating system. The application software shall be capable of communication to all Network Server Controllers and shall feature high-resolution color graphics, alarming, trend charting. It shall be user configurable for all data collection and data presentation functions.

d) A minimum of 1 physical Workstation shall be allowed on the Ethernet network. In this client/server configuration, any changes or additions made from one workstation will automatically appear on all other workstations since the changes are accomplished to the databases within the NSC. Systems with a central database will not be acceptable.

2.1.3.2. Administration/Programming Workstation, Enterprise Server, and Enterprise Central Requirements

a) The workstation shall consist of the following:

- Processor

  Minimum: i7 2.0 GHz

  Recommended: 3.0 GHz or higher

- Memory

  Minimum: 4GB

  Recommended: 8GB or higher

- Operating systems:

  Microsoft Windows 10 64-bit (Pro or Enterprise)

Microsoft Windows Server 2012 R2 64-bit (Standard, Datacenter, Essentials, or Foundation)

- Serial port, parallel port, USB port
- 10/100MBPS Ethernet NIC
- 20 GB hard disk
- DVD drive
- High resolution (minimum 1280 x 1024), 32" flat panel display
- Optical mouse and full function keyboard
- Audio sound card and speakers
- Required additional software:

  Microsoft .Net 4.5
- License agreement for all applicable software.

2.1.3.3. Web-Based Operator PC Requirements

a) Any user on the network can access the system, using the following software:

- Internet Explorer 11
- Google Chrome

2.1.3.4. General Administration and Programming Workstation Software

a) System architecture shall be truly client server in that the Workstation shall operate as the client while the NSCs shall operate as the servers. The client is responsible for the data presentation and validation of inputs while the server is responsible for data gathering and delivery.

b) The workstation functions shall include monitoring and programming of all DDC controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments.

c) Programming of SDCUs shall be capable of being done either off-line or on-line from any operator workstation. All information will be available in graphic or text displays stored at the NSC. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

2.1.3.5. User Interface:

a) The BAS workstation software shall allow the creation of a custom, browser-style interface linked to the user when logging into any workstation. Additionally, it shall be possible to create customized workspaces that can be assigned to user groups. This interface shall support the creation of "hot-spots" that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface must be able to be configured to become a user's "PC Desktop" – with all the links that a user needs to run other applications. This, along with the Windows user security capabilities, will enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BAS software, but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shutdown the active alarm viewer and/or unable to load software onto the PC.

b) System shall be able to automatically switch between displayed metric vs. imperial units based on the workstation/webstations localization.

c) The BMS workstation/web stations shall be capable of multiple language display, including English, or Spanish. The multiple languages shall not require additional add on software from the standard workstation installer and shall be selectable within said workstation.

d) Workstation shall indicate at all times the communication status between it and the server.

2.1.3.6. User Security

a) The software shall be designed so that each user of the software can have a unique username and password. This username/password combination shall be linked to a set of capabilities within the software, set by and editable only by, a system administrator. The sets of capabilities shall range from View only, Acknowledge alarms, Enable/disable and change values, Program, and Administer. The system shall allow the above capabilities to be applied independently to each and every class of object in the system. The system must allow a minimum of 5 users to be configured per workstation. Additionally, the software shall enable the ability to add/remove users based upon Microsoft Windows Security Domains that enable the customer IT department to assist in user access.

b) Additional requirements include mandatory change of passwords:

- At first logon with default credentials

c) No general accounts, one account per user

d) Capability to integrate and use Windows Active Directory for user log on credentials

e) Include a timed auto log off feature

f) Use TLS 1.2 encryption or higher

g) Capability to use blacklisted and whitelisted IPs/MAC addresses to gate access

h) All devices and software that support HTTP shall allow disabling the HTTP access and require access via HTTPS.

i) All devices that have web portals for the configuration of IP addresses and other configuration attributes shall have the ability, through commands issued, to disable this service upon completion. A direct connection method with ASCII commands shall enable this service again if changes need to be applied. Loss of power or cycling the device shall not reverse this command. Disabling this web portal eliminates the security risk and the need for updating security patches.

j) All devices shall support SNMP V3 monitoring of network performance and stack statistics for the purpose of managing denial of service attacks

k) The Integrated Control Platform shall support the feature to alarm on a predetermined period of time until the default password for each device is changed from the default factory setting.

l) The Integrated Control Platform shall support encrypted password authentication for all web services whether serving or consuming.

2.1.3.7. Configuration Interface

a) The workstation software shall use a familiar Windows Explorer style interface for an operator or programmer to view and/or edit any object (controller, point, alarm, report, schedule, etc.) in the entire system. In addition, this interface shall present a “network map” of all controllers and their associated points, programs, graphics, alarms, and

reports in an easy to understand structure. All object names shall be alphanumeric and use Windows long filename conventions.

b) The configuration interface shall also include support for user defined object types. These object types shall be used as building blocks for the creation of the BAS database. They shall be created form the base object types within the system input, output, string variables, setpoints, etc., alarm algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of user defined object types shall be able to be set up as a predefined aggregate of subsystems and systems. The configuration interface shall support copying/pasting and exporting/importing portions of the database for additional efficiency. The system shall also maintain a link to all "child" objects created. If a user wishes to make a change to a parent object, the software shall ask the user if he/she wants to update all of the child objects with the change.

2.1.3.8. Color Graphic Displays

a) The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These graphics shall contain point information from the database including any attributes associated with the point (engineering units, etc.). In addition, operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.

b) Requirements of the color graphic subsystem include:

- At a minimum, the user shall have the ability to import .gif, .png, .bmp, .jpeg, .tif, and CAD generated picture files as background displays, and layering shall be possible.
- The system shall support HTML5 enabled graphics.
- It shall be possible for the user to use JavaScript to customize the behavior of each graphic.
- The editor shall use Scalable Vector Graphics (SVG) technology.
- A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, ad graphs which can be "dropped" on a graphic through the use of a software configuration "wizard". These objects shall enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels.
- Support for high DPI icons shall be included and automatically chosen if viewing on a high definition display such as Retina or 4K displays.
- Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.
- Status changes or alarm conditions must be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
- Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators must be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.
- It shall be possible to create and save graphical components and JavaScript code in reusable and transferrable, customized libraries.
- Graphics should rescale based on whatever monitor or viewing device is being used.
- Be able to create graphics on varying layers that can be moved and repeated.

- Be able to create graphics within varying window panes that can be moved and/or re-referenced. For example, creating the graphical menu within a pane and referencing it on every graphics page, therefore not rebuilding thus allowing for a single spot for updates that get pushed to all the pages that reference it.
- The ability to create re-usable cascading menus.
- The ability to have multiple instances of a graphic and edit one instance to change all.

2.1.3.9. The software shall allow for the automatic collection of data and reporting from any controller or NSC. The frequency of data collection shall be user-configurable.

2.1.3.10. Alarm Management

a) The software shall be capable of accepting alarms directly from NSCs or controllers, or generating alarms based on evaluation of data in controllers and comparing to limits or conditional equations configured through the software. Any alarm (regardless of its origination) will be integrated into the overall alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports.

b) Alarm management features shall include:

- A minimum of 1000 alarm notification levels at the NSC, workstation, and webstation levels. At the Enterprise level the minimum number of active and viewable alarms shall be 10,000. Each notification level will establish a unique set of parameters for controlling alarm display, distribution, acknowledgment, keyboard annunciation, and record keeping.
- Automatic logging in the database of the alarm message, point name, point value, source device, timestamp of alarm, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).
- Playing an audible sound on alarm initiation or return to normal.
- Sending an email page to anyone specifically listed on the initial occurrence of an alarm. The ability to utilize email paging of alarms shall be a standard feature of the software using Simple Mail Transfer Protocol (SMTP) with support for secure email using Simple Mail Transfer Protocol Secure (SMTPS) No special software interfaces shall be required and no email client software must be running in order for email to be distributed. The email notification shall be able to be sent to an individual user or a user group.
- Individual alarms shall be able to be re-routed to a user at user-specified times and dates. For example, a critical high temp alarm can be configured to be routed to a Facilities Dept. workstation during normal working hours (7am-6pm, Mon-Fri) and to a Central Alarming workstation at all other times.
- An active alarm viewer shall be included which can be customized for each user or user type to hide or display any alarm attributes.
- The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms.
- The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of causes for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.
- The active alarm viewer can be configured such that an operator must confirm that all of the steps in a check list have been accomplished prior to acknowledging the alarm.

- The active alarm viewer shall, if filtered, show the quantity of visible and total number of alarms that are not equal to 'normal' and the quantity of disabled and hidden alarms.
- The alarm viewer can be configured to auto hide alarms when triggered.
- An operator shall have the capability to assign an alarm to another user of the system.
- Time schedules shall be able to be used to set control notifications to users.
- An operator shall have the capability to save and apply alarm favorites.
- Alarm notifications must support multiple distribution methods within one notification.

2.1.3.11. Report Generation

a) The Reports Server shall be able to process large amounts of data and produce meaningful reports to facilitate analysis and optimization of each installation.

b) Reports shall be possible to generate and view from the operator Workstation, and/or Webstation, and/or directly from a reports-only web interface.

c) A library of predefined automatically generated reports that prompt users for input prior to generation shall be available. The properties and configurations made to these reports shall be possible to save as Dashboard reports, so that the configurations are saved for future used.

d) It shall be possible to create reports standard tools, such as Microsoft Report Builder 2.0 or Visual Studio, shall be used for customized reports.

e) Additional reports or sets of reports shall be downloadable, transferrable, and importable

f) All reports shall be able to be set up to automatically run or be generated on demand.

g) Each report shall be capable of being automatically emailed to a recipient in Microsoft Word, Excel, and/or Adobe .pdf format.

h) Reports can be of any length and contain any point attributes from any controller on the network.

i) Image management functionality shall be possible to enable the system administrators to easily upload new logos or images to the system.

j) It shall be possible to run other executable programs whenever a report is initiated.

k) Report Generator activity can be tied to the alarm management system, so that any of the configured reports can be displayed in response to an alarm condition.

l) Minimum supplied reports shall include:

- Activities Per User Report
- Alarm Amount by Category Report
- Alarm Amount by Type Report
- Alarms Per Sever Report
- Current Alarm Report
- Most Active Alarm Report
- System Errors Per Server Report
- Top Activities Report

- Top Alarms Report
- Top System Errors Report
- Trend Log Comparison Report
- User Logins Report

m) Minimum Energy Reports shall include:

- Energy Monitoring Calendar Consumption Report: Shall provide an interactive report that shows the energy usage on one or multiple selected days.
- Energy Monitoring Consumption Breakdown Report: Shall provide a report on energy consumption broken down using sub-metering.
- Energy Monitoring Consumption Report: Shall show the energy consumption against a specified target value.

2.1.3.12. Scheduling

a) From the workstation, it shall be possible to configure and download schedules for any of the controllers on the network.

b) Time of day schedules shall be in a calendar style and viewable in both a graphical and tabular view.

c) Schedules shall be programmable for a minimum of one year in advance.

d) To change the schedule for a particular day, a user shall simply select the day and make the desired modifications.

e) Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.

f) It shall be possible to assign a lead schedule such that shadow/local schedules are updated based upon changes in the Lead.

g) It shall be possible to assign a list(s) of exception event days, dates, date ranges to a schedule.

h) It shall be possible to view combined views showing the calendar and all prioritized exemptions on one screen.

i) It should accommodate a minimum of 16 priority levels.

j) Values should be able to be controlled directly from a schedule, without the need for special program logic.

2.1.3.13. Programmer's Environment

a) Programming in the NSC shall be either in graphical block format or line-programming format or both.

b) Programming of the NSC shall be available offline from system prior to deployment into the field. All engineering tasks shall be possible, except, of course, the viewing of live tasks or values.

c) The programmer's environment will include access to a superset of the same programming language supported in the SDCUs.

d) NSC devices will support both script programming language as well as the graphical function block programming language. For both languages, the programmer will be able to configure application software for custom program development, and write global control programs. Both languages will have debugging capabilities in their editors.

e) It shall be possible to save custom programs as libraries for reuse throughout the system. A wizard tool shall be available for loading programs from a library file in the program editor.

f) It shall be possible to view graphical programming live and real-time from the Workstation.

g) The system shall be capable of creating 'binding templates' allowing the user to bind multiple points to multiple objects all at once.

h) Key terms should appear when typing (IntelliType).

i) Applications should be able to be assigned different priorities and cycle times for a prioritized execution of different function.

j) The system shall be able to create objects that allow common objects such as power meters, VFD drives, etc. to be integrated into the system with simple import actions without the need of complicated programming or configuration setups.

2.1.3.14. Saving/Reloading

a) The workstation software shall have an application to save and restore NSC and field controller memory files.

b) For the NSC, this application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.

2.1.3.15. Audit Trail

a) The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.

b) It shall be possible to view a history of alarms, user actions, and commands for any system object individually or at least the last 5000 records of all events for the entire system from Workstation.

c) The event view shall support viewing of up to 100,000 events.

d) It shall be possible to save custom filtered views of event information that are viewable and configurable in Workstation.

e) It shall be capable to search and view all forced values within the system.

2.1.3.16. Fault Tolerant Enterprise Server Operation (Top level NSC)

a) A single component failure in the system shall not cause the entire system to fail. All system users shall be informed of any detectable component failure via an alarm event. System users shall not be logged off as a result of a system failure or switchover.

2.1.4. **NETWORK SERVER CONTROLLERS (NSC)**

2.1.4.1. Network Router Controllers shall combine both network routing functions, control functions, and server functions into a single unit.

2.1.4.2. The BACnet NSC shall be classified as a "native" BACnet device, supporting the BACnet Network Server Controller (B-BC) profile. Controllers that support a lesser profile such as B-SA are not acceptable. NSCs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Network Server Controllers (B-BC).

2.1.4.3. The Network Server Controller shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NRS.

2.1.4.4. The NSCs shall be capable of whitelisting IPs to restrict access to a pre-defined list of hosts or devices.

2.1.4.5. Whitelisting of file extensions for documents shall be capable.

2.1.4.6. Encrypted and authenticated communication shall be configurable for non-open protocol communications using TLS 1.2.

2.1.4.7. The NSCs shall support Simple Network Management Protocol version 3 (SNMPv3) for monitoring of the NSCs using a Network Management Tool.

2.1.4.8. The NSCs shall support remote system logging for used by System Information and Event Monitoring (SIEM) software.

2.1.4.9. They shall also be responsible for monitoring and controlling their own HVAC equipment such as an AHU or chillers.

2.1.4.10. They shall also contain graphics, trends, trend charts, alarm views, and other similar presentation objects that can be served to workstations or web-based interfaces. A sufficient number of NSCs shall be supplied to fully meet the requirements of this specification and the attached point list.

2.1.4.11. It shall be capable of executing application control programs to provide:

a) Calendar functions

b) Scheduling

c) Trending

d) Alarm monitoring and routing

e) Time synchronization by means of an Internet site including automatic synchronization

f) Memory:

- The operating system of the controller, application programs, and all other portions of the configuration database, shall be stored in non-volatile, FLASH memory. Servers/Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.

g) Each NRC shall provide the following on-board hardware for communication:

- Two 10/100b Ethernet for communication to Workstations, other NRCs, IP field bus controllers, other SDCUs, and onto the internet.

  The two Ethernet ports shall support active switch and BACnet/IP communication protocols.

  Support IPv4 addressing

  Ethernet port 1 shall support static or DHCP client configuration for communication to Workstation or other NSCs

  Ethernet port 2 shall support switch mode or DHCP server to set addressing of DHCP client devices

  It shall be possible to disable Ethernet port 2

  In DHCP server mode, the Ethernet port 2 shall support 50 BACnet/IP field controllers in daisy chain configuration directly from the port

Each NSC shall be able to support a total of 250 IP SDCUs in daisy chain configuration (5 sub networks via switch)

If using RSTP (Rapid Spanning Tree Protocol) with a managed switch (with IEEE 802.1W or IEEE 802.1Q-2014 support), Ethernet port 2 shall support up to 39 devices

Each NSC shall be able to support a total of 234 IP SDCUs in RSTP configuration (6 sub networks via managed switch)

Where a switch is needed, use an EtherWAN EX63402-01B, or other equal and approved equivalent.

- Two RS-485 ports for communication to BACnet MSTP bus (software configurable)
- One device USB port
- One host USB port

h) The NS shall conform to a small footprint no larger than 100W x 125H x 75D mm (3.94W x 4.92H x 2.95D in).

2.1.4.12. Modular Expandability:

a) The system shall employ a modular I/O design to allow expansion. Input and output capacity is to be provided through plug-in modules of various types. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.

b) One shall be able to “hot-change” (hot-swap) the I/O modules preserving the system on-line without any intervention on the software; addressing and configuration shall be automatic.

c) If for any reason the backplane of the modular I/O system were to fail, I/O module addresses will be protected.

2.1.4.13. Hardware Override Switches:

a) All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

2.1.4.14. Universal Input Temperatures

a) All universal inputs directly connected to the NSC via modular expansion shall be capable of using the following thermistors for use in the system without any external converters needed.

- 10 kohm Type I (Continuum)
- 10 kohm Type II (I/NET)
- 10 kohm Type III (Satchwell)
- 10 kohm Type IV (FD)
- Linearized 10 kohm Type V (FD w/11k shunt)
- Linearized 10 kohm (Satchwell)
- 1.8 kohm (Xenta)

- 1 kohm (Balco)
- 20 kohm (Honeywell)
- 2.2 kohm (Johnson)

2.1.4.15. Local Status Indicator Lamps:

a) The NSC shall provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each input or output, provide LED indication of the value of the point (On/Off). The LED indication shall support software configuration to set whether the illumination of the LED corresponds to On or Off or whether the color when illuminated is Red or Green.

2.1.4.16. Real Time Clock (RTC):

a) Each NSC shall include a real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. Each NSC will allow for its own UTC offset, depending upon the time zone. When the time zone is set, the NSC will also store the appropriate times for daylight savings time.

b) The RTC date and time shall also be accurate, up to 30 days, when the NSC is powerless.

c) No batteries may be used to for the backup of the RTC.

2.1.4.17. Power Supply:

a) The 24 VDC power supply for the NSCs shall provide 30 watts of available power for the NSC and associated IO modules. The system shall support the use of more than one power supply if heavily power consuming modules are required.

b) The power supply, NSC, and I/O modules shall connect power wise and communication wise via the separate terminal base allowing for ease of replacement and no separate or loose wiring.

2.1.4.18. Automatic Restart After Power Failure:

a) Upon restoration of power after an outage, the NSC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.

2.1.4.19. Data Retention:

a) During a power failure, the NSC shall retain all programs, configuration data, historical data, and all other data that is configured to be retained. There shall be no time restriction for this retention and it must not use batteries to achieve it.

2.1.4.20. Software Specifications

a) The operating system of the controller, application programs, and all other portions of the configuration database such as graphics, trends, alarms, views, etc., shall be stored in non-volatile, FLASH memory. There will be no restrictions placed on the type of application programs in the system. Each NSC shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.

b) Each NSC shall have an available capacity of 4 GB of memory. This shall represent 2 GB for application and historical data and 2 GB dedicated for backup storage.

2.1.4.21. User Programming Language:

a) The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be either a script-based structured text or graphical function block based and fully programmable by the user. The language shall be structured to allow for the configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, and histories. Users shall be able to place comments anywhere in the body of either script or function block programs.

b) Network Server Controllers that use a “canned” program method will not be accepted.

2.1.4.22. Control Software:

a) The NSC shall have the ability to perform the following pre-tested control algorithms:

- Proportional, Integral plus Derivative Control (PID)
- Two Position Control
- Digital Filter
- Ratio Calculator
- Equipment Cycling Protection

2.1.4.23. Mathematical Functions:

a) Each controller shall be capable of performing basic mathematical functions (+, -, *, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.

2.1.4.24. NSCs shall have the ability to perform any or all of the following energy management routines:

a) Time of Day Scheduling

b) Calendar Based Scheduling

c) Holiday Scheduling

d) Temporary Schedule Overrides

e) Optimal Start

f) Optimal Stop

g) Night Setback Control

h) Enthalpy Switchover (Economizer)

i) Peak Demand Limiting

j) Temperature Compensated Duty Cycling

k) CFM Tracking

l) Heating/Cooling Interlock

m) Hot/Cold Deck Reset

n) Chilled Water Reset

o) Condenser Water Reset

p) Chiller Sequencing

2.1.4.25. History Logging:

a) Each NSC controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. A minimum of 1000 logs, with a minimum of 100,000 records, shall be stored. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to a higher level NSC long term archiving based upon user-defined time intervals, or manual command.

b) For extended trend logging a minimum of 1500 trends shall be capable, with a minimum number of 600,000 records within.

c) Management of a power meter replacement to ensure meter log data is accurate shall be possible in the NSC.

d) Every hardware input and output point, hosted within the NSC and attached I/O modules, shall be trended automatically without the requirement for manual creation, and each of these logs shall log values based upon a change of value and store at least 500 trend samples before replacing the oldest sample with new data.

e) The presentation of logged data shall be built into the server capabilities of the NSC. Presentation can be in time stamped list formats or in a chart format with fully configurable pen colors, weights, scales and time spans.

f) Tooltips shall be present, magnetic, and visible based on users preference.

g) Comments shall be visible whenever viewing the trend log list.

h) System shall give indication of memory usage and be able to alert the user if too many logs are allocated.

2.1.4.26. Alarm Management:

a) For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms will be tested each scan of the NSC and can result in the display of one or more alarm messages or reports.

b) There is no limit to the number of alarms that can be created for any point

c) Alarms can be configured to be generated based upon a single system condition or multiple system conditions.

d) Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc. These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.

e) The alarm management system shall support the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists shall also be possible in order to present to an operator a suggested mode of troubleshooting. When acknowledging an alarm, it shall be possible to assign it to a user of the system such that the user is notified of the assignment and is made responsible for the alarm resolution.

f) Alarms must be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

2.1.4.27. Embedded Web Server

a) Each NSC must have the ability to serve out web pages containing the same information that is available from the WorkStation. The development of the screens to accomplish shall not require any additional engineering labor over that required to show them at the WorkStation itself.

b) The NSC shall be configurable to logging all Embedded Web Server access attempts

c) The NSC shall have the option to redirect HTTP based Embedded Web Server connections to secure, HTTPS connections.

d) The NSC shall authenticate and authorize all users connecting to the Embedded Web Server

e) The NSC shall provide to ability to configure an automatic logoff for Embedded Web Server users that have not had any activity for an adjustable time period.

2.1.5. **BACNET IP FIELDBUS CONTROLLERS**

2.1.5.1. Controllers – BACnet/IP Protocol

a) All BACnet/IP Fieldbus controllers shall be BACnet Testing Laboratory listed (v12 or later) as specified BACnet Advanced Application Controller (B-AAC)

b) All BACnet/IP Fieldbus controllers shall use the following communication specifications and achieve performance as specified herein:

- All controllers shall be able to communicate peer-to-peer without the need for a NSC
- Any BACnet/IP Fieldbus controllers on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.

2.1.5.2. The BACnet/IP Fieldbus controllers shall be equipped with 2x 10/100bT Ethernet communication ports with active switch and will support BACnet/IP communication protocols with the following configurations:

a) Supporting IPv4 addressing

b) Supporting Static IP setting, DHCP client and Auto-IP address acquision

c) It shall be possible to disable Ethernet port 2

2.1.5.3. Topologies

a) BACnet/IP Fieldbus controllers shall support daisy chain topology of up to 50 controllers. In case of any disruption to the communication, a system alarm shall notify the NSC/BMS of the point disruption has occurred.

b) BACnet/IP Fieldbus Controllers shall support RSTP loop whereby up to 39 controllers are supported.

- In case of any disruption there shall be no communication interruption
- In case of any disruption there shall be system alarms that will inform the operator of the disruption

2.1.5.4. Performance

a) Each BACnet/IP Fieldbus Controllers shall have a 32-bit microprocessor operating at 500 MHz and support a BACnet protocol stack in accordance with the ANSI/ASHRAE Standard 135-2008 and the BACnet Device Profile supported.

b) They shall be multi-tasking, real-time digital control processors consisting of communication controllers, controls processing, power supplies with built-in inputs and outputs.

2.1.5.5. Programmability

a) The BACnet/IP Fieldbus controllers shall support both script programming language and graphical that will be consistent with the NSC.

b) The control program will reside within the same enclosure as the input/output circuitry, that reads inputs and controls outputs

c) All control sequences programmed into the BACnet/IP Fieldbus Controllers shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

d) BACnet/IP Fieldbus controllers shall communicate with the Network Server Controller (NSC) via a BACnet/IP connection at a baud rate of not less than 100 Mbps

e) BACnet/IP Fieldbus controllers shall support a dedicated communications port for connecting and supplying power to a matching room temperature and/or humidity sensor and/or CO2 and/or presence detector that does not utilize any of the I/O points of the controller.

f) BACnet/IP Fieldbus controllers (Excluding VAV) shall support an add-on display to supply and provide access in real-time for monitoring inputs and overriding of outputs

g) The override functionality must be supported by a dedicated processor to assure reliable operation (overriding of output)

h) Each BACnet/IP Fieldbus controller shall have sufficient memory, to support its own operating system and databases, including:

- Control processes
- Energy management applications
- Alarm management
- Historical/trend data
- Maintenance support applications
- Custom processes
- Manal override monitoring

i) Each BACnet/IP Fieldbus controller shall support local trend data up to 2x the built-in I/O and at a minimum be capable of holding 5 days @ 15 min intervals locally.

j) The BACnet/IP Fieldbus controller analog or universal input shall use a 16 bit A/D converter.

k) The BACnet/IP Fieldbus controller analog or universal output shall use a 10 bit D/A converter.

l) Built-in I/O: each BACnet/IP Fieldbus controllers shall support:

- At minimum 8 and up to 20 configurable IO channels to monitor and to control the following types of inputs and outputs without the addition of equipment inside or outside the DDC Controller cabinet.
- Universal Inputs – the following thermistors for use in the system without any external converters needed.

  10 kohm Type I (Continuum)

  10 kohm Type II (I/NET)

  10 kohm Type III (Satchwell)

  10 kohm Type IV (FD)

  Linearized 10 kohm Type V (FD w/11k shunt)

  Linearized 10 kohm (Satchwell)

1.8 kohm (Xenta)

1 kohm (Balco)

20 kohm (Honeywell)

2.2 kohm (Johnson)

PT100 (Siemens)

PT1000 (Sauter)

Ni1000 (Danfoss)

- Analog inputs

  Current Input - 0-20 mA

  Voltage Input 0-10 Vdc
- Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
- Digital outputs
- Analog outputs of 4-20 mA and/or 0-10 Vdc

m) Real Time Clock (RTC):

- Each BACnet/IP Fieldbus controller shall include a real time clock, accurate to +/-1 minute per month. The RTC shall provide the following: time of day, day, month, year, and day of week.
- The RTC date and time shall also be accurate, up to 7 days, when the BACnet/IP Fieldbus controller is powerless.
- No batteries may be used to for the backup of the RTC.

n) If used, The BACnet/IP Fieldbus controller for Variable Air Volume (VAV) applications

- The BACnet/IP Fieldbus controller for VAV applications shall include a built-in 'flow thru' differential pressure transducer
- The VAV differential pressure transducer shall have a measurement range of 0 to 1 in. W.C. and measurement accuracy of ±5% at 0.001 to 1 in. W.C. and a minimum resolution of 0.001 in. W.C., insuring primary air flow conditions shall be controlled and maintained to within ±5% of setpoint at the specified minimum and maximum air flow parameters
- The BACnet/IP FieldBus controller for VAV applications shall support a dedicated commissioning tool for air flow balancing
- The BACnet/IP Fieldbus controller for VAV applications shall require no programing for air balancing algorithm
- All balancing parameters shall be synchronized in NSC

o) Each BACnet/IP Fieldbus controller shall have a minimum of 10% spare capacity for each point type represented on the controller for future point connection

p) Power Requirements.: 24VDC (21 to 33 VDC) and 24 VAC +/-20% with local transformer power

2.1.5.6. Commissioning Tool - The BACnet/IP Fieldbus controller shall be supported via a dedicate mobile based commissioning tool for configuration, programming, air balancing and I/O checkout

a) The Commissioning Tool shall be supported across: iOS, Android and Windows 10 platforms

b) The Commissioning Tool shall be available for download on App Store, Google Store and Windows Store

c) Commissioning Tool Interface to BACnet/IP Fieldbus controllers shall be via a Bluetooth adapter interface through the Intelligent Space Sensor or via a Wi-Fi access point on the LAN

d) Functionality

- Device Configuration – the Commissioning Tool shall be able to set or edit all Network configurations associated with the BACnet/IP Fieldbus controller
- Programming – The Commissioning Tool shall be able to load offline engineered applications directly in to the controller directly
- Air Balancing

  The Commissioning Tool shall allow the air balancer to manually control the action of the actuator including the following function: open VAV damper, close VAV damper, open all VAV dampers, and close all VAV dampers.

  The Commissioning Tool shall be able to generate Air Balancing report
- IO Checkout

  The Commissioning Tool shall be able to support overriding of the outputs and reading value of inputs live

  The Commissioning Tool shall be able to support generation of I/O checkout report
- There shall be no limit to the number of Commissioning Tools that can be used on a network segment, however, one connection per controller is recommended

2.1.5.7. Intelligent Space Sensors - The BACnet/IP Fieldbus controller shall support a dedicated RJ45 communication port to communicate and power up to 4 intelligent wall mount sensors without the use of on board inputs or outputs

a) The Intelligent Space Sensor shall communicate with the BACnet/IP Fieldbus controller through the sensor port and via category 5 or category 6 cable

b) The Intelligent Space Sensor shall provide 2 RJ45 communication ports that will allow communication with parent BACnet/IP Field controller upstream and additional Intelligent Space Sensors downstream

c) The Intelligent Space Sensor shall provide ambient space condition sensing without the use of hardware I/O

2.1.5.8. Each Intelligent Space Sensor shall provide a color touch display with:

a) Minimum 61 mm (2.4”) by 61 mm (2.4”) display

b) Backlit

2.1.5.9. The Intelligent Space Sensor shall be capable of displaying measured space temperature from 0 to 50 °C (32 to 122 °F) with accuracy of ±0.2 °C (±0.4 °F) selectable for 0.1 or 1 degree display resolution of °F or °C

a) Sensing Element: 10k Type 3 Thermistor

b) Accuracy of ±0.2 °C (±0.4 °F)

c) Resolution: 0.1 or 1 degree display resolution

d) Range: 0 to 50 °C (32 to 122 °F)

2.1.5.10. The Intelligent Space Sensor shall have the option for humidity sensor support sensing humidity from 0 % RH to 100 % RH Digital humidity indication (selectable for 0.1 or 1% RH with selectable display resolution of 0.1 or 1 % RH

a) Accuracy: ±2 % RH

b) Resolution: 0.1 or 1 % RH

c) Range: 0 % RH to 100 % RH

2.1.5.11. The Intelligent Space Sensor shall have the option for support of CO2 sensor with display resolution with 0 to 2000 ppm resolution

a) Accuracy: ±30 ppm ±2% of measured value

b) Range: 0 to 2,000 ppm

c) Operating elevation: 0 to 16,000 ft.

d) Temperature dependence: 0.11% FS per ˚F

e) Stability: <2% of FS over life of sensor (15 years)

f) Sensing method: Non-dispersive infrared (NDIR), diffusion sampling

2.1.5.12. The Intelligent Space Sensor shall have the option for motion sensor

2.1.5.13. Display options: The Intelligent Space Sensor shall be capable of displaying the following elements:

a) Space temperature

b) Cooling space temperature set point

c) Heating space temperature set point

d) Current heating or cooling mode

e) Current occupancy mode

f) Fan speed

g) Current time

2.1.6. **BACNET FIELDBUS AND BACNET SDCUS**

2.1.6.1. Networking

a) IP Network: All devices that connect to the WAN shall be capable of operating at 10 megabits per second or 100 megabits per second.

b) IP To Field Bus Routing Devices

- A Network Server Controller shall be used to provide this functionality.
- These devices shall be configurable locally with IP crossover cable and configurable via the IP network.
- The routing configuration shall be such that only data packets from the field bus devices that need to travel over the IP level of the architecture are forwarded.

2.1.6.2. Field Bus Wiring and Termination

a) The wiring of components shall use a bus or daisy chain concept with no tees, stubs, or free topology.

b) Each field bus shall have a termination resistor at both ends of each segment.

c) The field bus shall support the use of wireless communications.

2.1.6.3. Repeaters

a) Repeaters are required to connect two segments.

b) Repeaters shall be installed in an enclosure. The enclosure may be in an interstitial space.

2.1.6.4. Field Bus Devices

a) General Requirements

- Devices shall have a light indicating that they are powered.
- Devices shall be locally powered. Link powered devices (power is furnished from a central source over the field bus cable) are not acceptable.
- Application programs shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration parameter settings. (Battery backup, flash memory, etc.)

2.1.6.5. Advance Application Controllers (B-AAC)

a) The key characteristics of a B-AAC are:

- They have physical input and output circuits for the connection of analog input devices, binary input devices, pulse input devices, analog output devices, and binary output devices. The number and type of input and output devices supported will vary by model.
- They may or may not provide support for additional input and output devices beyond the number of circuits that are provided on the basic circuit board. Support for additional I/O shall be provided by additional circuit boards that physically connect to the basic controller.
- The application to be executed by a B-AAC is created by an application engineer using the vendor's application programming tool.
- If local time schedules are embedded, the B-AAC shall support the editing of time schedule entries from any BACnet OWS that supports the BACnet service for writing of time schedule parameters.
- If local trend logging is embedded, the B-AAC shall support the exporting of trend log data to any BACnet OWS that supports the read range BACnet service for trending.
- If local alarm message initiation is embedded, the B-AAC shall:

  Deliver alarm messages to any BACnet OWS that supports the BACnet service for receiving alarm messages and is configured to be a recipient off the alarm message.

  Support alarm acknowledgement from any BACnet OWS that supports the BACnet service for executing alarm/event acknowledgement,
- Shall support the reading of analog and binary data from any BACnet OWS or Building Controller that supports the BACnet service for the reading of data.
- Shall support the control of the out of service property and assignment of value or state to analog and binary objects from any BACnet OWS that supports writing to the out of service property and the value property of analog and binary objects.
- Shall support the receipt and response to Time Synchronization commands from a BACnet Building Controller.
- Shall support the "Who is" and "I am." BACnet services.
- Shall support the "Who has" and "I have." BACnet services.

b) Analog Input Circuits

- The resolution of the A/D chip shall not be greater than 0.01 Volts per increment. For an A/D converter that has a measurement range of 0 to 10 VDC and is 10 bit, the resolution is 10/1024 or 0.00976 Volts per increment.
- For non-flow sensors, the control logic shall provide support for the use of a calibration offset such that the raw measured value is added to the (+/-) offset to create a calibration value to be used by the control logic and reported to the Operator Workstation (OWS).
- For flow sensors, the control logic shall provide support for the use of an adjustable gain and an adjustable offset such that a two point calibration concept can be executed (both a low range value and a high range value are adjusted to match values determined by a calibration instrument).
- For non-linear sensors such as thermistors and flow sensors the B-AAC shall provide software support for the linearization of the input signal.

c) Binary Input Circuits

- Dry contact sensors shall wire to the controller with two wires.
- An external power supply in the sensor circuit shall not be required.

d) Pulse Input Circuits

- Pulse input sensors shall wire to the controller with two wires.
- An external power supply in the sensor circuit shall not be required.
- The pulse input circuit shall be able to process up to 20 pulses per second.

e) True Analog Output Circuits

- The logical commands shall be processed by a digital to analog (D/A) converter chip. The 0% to 100% control signal shall be scalable to the full output range which shall be either 0 to 10 VDC, 4 to 20 milliamps or 0 to 20 milliamps or to ranges within the full output range (Example: 0 to 100% creates 3 to 6 VDC where the full output range is 0 to 10 VDC).
- The resolution of the D/A chip shall not be greater than 0.04 Volts per increment or 0.08 milliamps per increment.

f) Binary Output Circuits

- Single pole, single throw or single pole, double throw relays with support for up to 230 VAC and a maximum current of 2 amps.
- Voltage sourcing or externally powered triacs with support for up to 30 VAC and 0.5 amps at 24 VAC.

g) Program Execution

- Process control loops shall operate in parallel and not in sequence unless specifically required to operate in sequence by the sequence of control.
- The sample rate for a process control loop shall be adjustable and shall support a minimum sample rate of 1 second.
- The sample rate for process variables shall be adjustable and shall support a minimum sample rate of 1 second.
- The sample rate for algorithm updates shall be adjustable and shall support a minimum sample rate of 1 second.

- The application shall have the ability to determine if a power cycle to the controller has occurred and the application programmer shall be able to use the indication of a power cycle to modify the sequence of controller immediately following a power cycle.

h) Local Interface

- The controller shall support the connection of a portable interface device such as a laptop computer or vendor unique hand-held device. The ability to execute any tasks other than viewing data shall be password protected. Via this local interface, an operator shall be able to:

  Adjust application parameters.

  Execute manual control of input and output points.

  View dynamic data.

2.1.6.6. Application Specific Devices

a) Application specific devices shall have fixed function configurable applications.

b) If the application can be altered by the vendor's application programmable tool, the device is an advanced application controller and not an application specific device.

c) Application specific devices shall be BTL certified.

2.1.7. **DDC SENSORS AND POINT HARDWARE**

2.1.7.1. Temperature Sensors

a) All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of –30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.

b) Room Sensor: Standard space sensors shall be available in an off-white enclosure made of high impact ABS plastic for mounting on a standard electrical box.

- Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
- Where a local display is specified, the sensor shall incorporate an LCD display for viewing the space temperature, setpoint and other operator selectable parameters. Using built in buttons, operators shall be able to adjust setpoints directly from the sensor.

c) Duct Probe Sensor: Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Useable in air handling applications where the coil or duct area is less than 14 square feet.

d) Duct Averaging Sensor: Averaging sensors shall be employed in ducts which are larger than 14 square feet. The averaging sensor tube shall contain at least one thermistor for every 3 feet, with a minimum tube length of 6 feet. The averaging sensor shall be constructed of rigid or flexible copper tubing.

e) Pipe Immersion Sensor: Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Provide sensor probe length suitable for application. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications.

f) Outside Air Sensor: Provide the sensing element on the building's north side. Sensing element shall be fully encapsulated in potting material within a stainless steel probe.

Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure. Operating range -40 to 122 F,

g) Important: A pneumatic signal shall not be allowed for sensing temperature.

2.1.7.2. Humidity Wall Transmitter

a) Transmitters shall be accurate to +/- 2 % at full scale.

b) Transmitter shall have replaceable sensing element.

c) Sensor type shall be thin-film capacitive.

d) Sensor element shall contain multipoint calibration on-board in nonvolatile memory

e) Operating range shall be 0 - 100% RH noncondensing, 50 to 95 F

f) Output shall be field selectable 4-20 mA or 0-5/0-10 VDC.

g) Transmitter shall accept 12-30 VDC or 24 VAC supply power.

h) Transmitter shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box.

i) Transmitter shall have option of having an LCD display

j) Transmitter shall have option of being NIST certified

k) Transmitter shall have option of an integrated temperature sensor

2.1.7.3. Humidity Duct Transmitter

a) Transmitters shall be accurate to +/- 2 % at full scale.

b) Transmitter shall be fully encapsulated in potting material within a stainless steel probe.

c) Transmitter shall have replaceable sensing element.

d) Sensor type shall be thin-film capacitive.

e) Sensor element shall contain multipoint calibration on-board in nonvolatile memory

f) Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F

g) Output shall be 4-20 mA or 0-5/0-10 VDC.

h) Transmitter shall accept 12-30 VDC or 24 VAC supply power.

i) Transmitter shall have option of being NIST certified

j) Transmitter shall have option of an integrated temperature sensor

2.1.7.4. Humidity Outdoor Transmitter

a) Transmitters shall be accurate to +/- 2% at full scale.

b) Transmitter shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure.

c) Transmitter shall have replaceable sensing element.

d) Sensor type shall be thin-film capacitive.

e) Sensor element shall contain multipoint calibration on-board in nonvolatile memory

f) Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F

g) Output shall be 4-20 mA or 0-5/0-10 VDC.

h) Transmitter shall accept 12-30 VDC or 24 VAC supply power.

i) Transmitter shall have option of being NIST certified

j) Transmitter shall have option of an integrated temperature sensor

2.1.7.5. Carbon Dioxide Wall Transmitter:

a) Sensor type shall be Non-dispersive infrared (NDIR).

b) Accuracy shall be ±30 ppm ±2% of measured value with annual drift of ±10 ppm. Minimum five year recommended calibration interval.

c) Repeatability shall be ±20 ppm ±1% of measured value

d) Response Time shall be <60 seconds for 90% step change

e) Outputs shall be field selectable Analog: 4-20mA or 0-5/0-10VDC, Protocol: BACnet with SPDT Relay 1A@30VDC or temperature setpoint slider

f) Transmitter shall accept 12-30 VDC or 24 VAC supply power.

g) Temperature Range: 32° to 122°F (CO2 only)

h) Output range shall be programmable 0-2000 or 0-5000 ppm

i) Transmitter shall be available in an off white enclosure for mounting on a standard electrical box.

j) Transmitter shall have an option of an LCD display for commissioning and provide additional faceplate to conceal LCD display where occupants may misinterpret CO2 readings.

k) Transmitter shall have option of an integrated temperature sensor and/or humidity sensor

2.1.7.6. Carbon Dioxide Duct Transmitter:

a) Sensor type shall be Non-dispersive infrared (NDIR).

b) Accuracy shall be ±30 ppm ±2% of measured value with annual drift of ±10 ppm. Minimum five year recommended calibration interval.

c) Repeatability shall be ±20 ppm ±1% of measured value

d) Response Time shall be <60 seconds for 90% step change

e) Outputs shall be field selectable Analog: 4-20mA or 0-5/0-10VDC with SPDT Relay 1A@30VDC

f) Transmitter shall accept 12-30 VDC or 24 VAC supply power.

g) Temperature Range: 32° to 122°F

h) Output range shall be programmable 0-2000 or 0-5000 ppm

i) Enclosure shall not require remote pickup tubes and make use of integrated H-beam probe to channel air flow to sensor.

j) Enclosure lid shall require no screws and make use of snap on features for attachment

k) Enclosure shall be made of high impact ABS plastic

l) Transmitter shall have option of an LCD display

m) Transmitter shall have option of an integrated temperature sensor and/or humidity sensor

2.1.7.7. Air Pressure Transmitters.

a) Sensor shall be microprocessor profiled ceramic capacitive sensing element

b) Transmitter shall have 14 selectable ranges from 0.1 – 10” WC

c) Transmitter shall be +/- 1% accurate in each selected range including linearity, repeatability, hysteresis, stability, and temperature compensation.

d) Transmitter shall be field configurable to mount on wall or duct with static probe

e) Transmitter shall be field selectable for Unidirectional or Bidirectional

f) Maximum operating pressure shall be 200% of design pressure.

g) Output shall be field selectable 4-20 mA or 0-5/0-10 VDC linear.

h) Transmitter shall accept 12-30 VDC or 24 VAC supply power

i) Response time shall be field selectable T95 in 20 sec or T95 in 2 sec

j) Transmitter shall have an LCD display

k) Units shall be field selectable for WC or PA

l) Transmitter shall have provision for zeroing by pushbutton or digital input.

m) Transmitter shall be available with a certification of NIST calibration

2.1.7.8. Liquid Differential Pressure Transmitters:

a) Transmitter shall be microprocessor based

b) Transmitter shall use two independent gauge pressure sensors to measure and calculate differential pressure

c) Transmitter shall have 4 switch selectable ranges

d) Transmitter shall have test mode to produce full-scale output automatically.

e) Transmitter shall have provision for zeroing by pushbutton or digital input.

f) Transmitter shall have field selectable outputs of 0-5V, 0-10V, and 4-20mA.

g) Transmitter shall have field selectable electronic surge damping

h) Transmitter shall have an electronic port swap feature

i) Transmitter shall accept 12-30 VDC or 24 VAC supply power

j) Sensor shall be 17-4 PH stainless steel where it contacts the working fluid.

k) Performance:

- Accuracy shall be ±1% F.S. and ±2% F.S. for lowest selectable range
- Long term stability shall be ±0.25%
- Sensor temperature operating range shall be -4° to 185°F
- Operating environment shall be 14° to 131°F; 10-90% RH noncondensing
- Proof pressure shall be 2x max. F.S. range
- Burst pressure shall be 5x max. F.S. range

l) Transmitter shall be encased in a NEMA 4 enclosure

m) Enclosure shall be white powder-coated aluminum

n) Transmitter shall be available with a certification of NIST calibration

o) Transmitter shall be preinstalled on a bypass valve manifold

2.1.7.9. Current Sensors

a) Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in split core models and offer either a digital or an analog signal to the automation system.

2.1.7.10. Current Status Switches for Constant Load Devices

a) General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on constant loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.

b) Visual LED indicator for status.

c) Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 0.5 A to 175 A.

d) Normally open current sensor output. 0.1A at 30 VAC/DC.

2.1.7.11. Current Status Switches for Constant Load Devices (Auto Calibration)

a) General: Microprocessor based, self-learning, self-calibrating current switch. Calibration-free status for both under and overcurrent, LCD display, and slide-switch selectable trip point limits. At initial power-up automatically learns average current on the line with no action required by the installer

b) Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 2.5 A to 200 A.

c) Display: Backlit LCD; illuminates when monitored current exceeds 4.5A

d) Nominal Trip Point: ±40%, ±60%, or on/off (user selectable)

e) Normally open current sensor output. 0.1A at 30 VAC/DC.

2.1.7.12. Current Status Switches for Variable Frequency Drive Application

a) General: Microprocessor controlled, self-learning, self-calibrating current sensor to detect motor undercurrent and overcurrent situations such as belt loss, coupling shear, and mechanical failure on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory and relearn.

b) Visual LED indicator for status.

c) Alarm Limits: ±20% of learned current in every 5 Hz freq. band

d) Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 1.5 A to 150 A and from 12 to 115 Hz.

e) Normally open current sensor output. 0.1A at 30 VAC/DC.

2.1.7.13. Liquid Flow, Insertion Type Turbine Flowmeter:

a) General: Turbine-type insertion flow meter designed for use in pipe sizes 1 1/2” and greater. Available in hot tap configuration with isolation valves and mounting hardware to install or remove the sensor from pipeline that is difficult to shut down or drain

b) Performance:

- Accuracy ±1% of rate over optimum flow range; ≥10 upstream and ≥5 downstream straight pipe diameters, uninterrupted flow
- Repeatability ±0.5%
- Velocity Range: 0.3 to 20 FPS
- Pressure Drop 0.5 psi or less @ 10 ft/sec for all pipe sizes 1.5” dia and up
- Pressure Rating: 1000 psi @ 70°F

c) Maximum Temperature Rating: 300°F

d) Materials: Stainless Steel or Brass body; Stainless steel impeller

e) Transmitter:

- Power Supply: 12 - 30VAC or 8 - 35VDC.

  Output: 4-20 mA or Scaled Pulse
- Temperature Range: 14° to 150°F
- Display: 8 character 3/8" LCD (Optional)
- Enclosure: NEMA 4, Polypropylene with Viton® sealed acrylic cover

2.1.7.14. Liquid Flow/Energy Transmitter, Non-invasive Ultrasonic (Clamp-on):

a) General: Clamp-on digital correlation transit-time ultrasonic flow meter designed for clean liquids or liquids containing small amounts of suspended solids or aeration. Optional temperature sensors for BTU calculations.

b) Liquid: water, brine, raw sewage, ethylene, glycol, glycerin, others. Contact manufacturer for other fluid compatibility

c) Pipe Surface Temperature: Pipe dia 1/2” to 2”:-40-185°F; Pipe dia > 2”: -40-250°F

d) Performance:

- Flow Accuracy:

  Pipe dia 1/2” to 3/4” 1% of full scale

  Pipe dia 1” to 2” 1% of reading from 4-40 FPS

  Pipe dia 2” to 100” 1% of reading from 1-40 FPS

e) Flow Repeatability ±0.01% of reading

f) Velocity Range: (Bidirectional flow)

- Pipe dia 1/2” to 2” 2 to 40 FPS
- Pipe dia 2” to 100” 1 to 40 FPS

g) Flow Sensitivity 0.001 FPS

h) Temperature Accuracy (energy): 32-212°F; Absolute 0.45°F; Difference 0.18°F

i) Temperature Sensitivity: 0.05°F

j) Temperature Repeatability: ±0.05% of reading

k) Transmitter:

- Power Supply: 95 to 264 VAC, 47 to 63 Hz or 10 to 28 VDC.
- Output: TCP/IP Ethernet/IP BACnet/IP
- Temperature Range: -40 to +185°F
- Display: 2-line backlit LCD with keypad
- Enclosure: NEMA 4, (IP65), Powder-coated aluminum, polycarbonate

l) Agency Rating: UL 1604, EN 60079-0/15, CSA C22.2, CSA Class 1 (Pipe > 2”)

2.1.7.15. Analog Electric/Pneumatic Transducer:

a) General: Micro-controlled poppet valve for high accuracy and with no air loss in the system. Field configurable for pressure sensing in multiple applications.

b) Power Supply: 22-30VDC, 20-30VAC

c) Control Input: 4-20mA, 0-10V, 0-5V; jumper selectable

d) Performance:

- Accuracy: 1% full scale; combined linearity, hysteresis, repeatability
- Compensated Temperature Range: 25° to 140°F
- Temp Coefficient: ±0.05%°C
- Operating Environment: 10-90% RH, non-condensing; 25° to 140°F

e) Supply Pressure: 45 psig max.

f) Manual Override: Jumper selectable mode, digital pushbutton adjust

g) Alarm Contact: 100mA@30VAC/DC (Optional)

h) Control Range 0-20 psig or 3-15 psig; jumper selectable

i) Pressure Differential 0.1 psig (supply to branch)

j) Pressure Indication Electronic, 3-1/2 digit LCD

k) Housing: Mounted on standard SnapTrack; Optional clear dust cover

2.1.7.16. Control Valves

a) See section 23 05 23

2.1.7.17. Control Valve Actuators

a) ½" to ¾" Ball Valve Actuators

- Size for torque required for valve close-off pressure for system design.
- Coupling: Direct coupled to valve body without use of external devices/tools
- Auxiliary End Switch (optional) to be SPST 24 Vac/Vdc,101 mA to 5 mA maximum on selected two-position models.
- Controller Signal Two-position, Floating or Proportional (0…5 Vdc, 0…10 Vdc, 5…10 Vdc, or 4…20 mA dc). Design allows for change via DIP switches without removal of cover.
- Manual operating lever and position indicator must be standard.
- Power Requirements: 24 Vac for floating, proportional, and 110…230 Vac for two position multi-voltage types
- Actuators must be available with either Spring Return (SR) or Non-Spring Return (NSR) models.
- Wiring (depending on model) Removable Terminal Block, 10 ft. (3.05 m) Plenum Cable, 18 in. (45 cm) Appliance Wire
- Locations must be rated NEMA 2, IEC IP31. (Indoor Use Only.) Actuators with terminal block or plenum cable leads are plenum rated per UL file number E9429.
- Agency Listings: ISO 9001, cULus, and CE.

b) ½" to 3" 2-way and ½" to 2" 3-way Ball Valves Actuators

- Size for torque required for valve close-off pressure for system design.
- Actuators are to be available in spring return (SR) and non-spring return (NSR) models. Spring Return (SR) actuators are to provide a choice to return direction.

- Actuators are to be available in models for two-position, floating and proportional control.
- All actuator models are to be equipped with pigtail leads, manual override, and auxiliary switch(es)
- Operating temperatures' Floating Non-Spring Return (NSR) with 33 lb.-in. of torque must be -25 to 130 °F (-32 to 55°C). All other actuators are to -22 to 140 °F (-30 to 60 °C)
- Actuators must be NEMA 2 rated.
- Agency Listings: ISO 9001, cULus, and CE.

c) ½" to 2" Bronze, Linear Globe Valve Actuators /67 or 78 lbs. force

- Actuator must have bi-color LED status indication for motion indication, auto calibration and alarm notification.
- When the actuator is properly mounted must have a minimum of a NEMA 2 (IP53) rating.
- Actuators are to be non-spring return.
- Actuators are to be floating (used for two-position) or proportional models.
- Proportional models will have optional models with a position output signal with field selectable 2…10 Vdc and 0…10 Vdc input signals and selectable input signal direct or reverse acting.
- Actuator must have auto calibration which provides precise control by scaling the input signal to match the exact travel of the valve stem
- Actuators must come in models with Pulse Width Modulated (PWM) with field selectable 0.59 to 2.93 sec and 0.1 to 25.5 sec input signal ranges with a position output signal
- Actuators must have manual override with automatic release.
- Models with position feedback output signal include field selectable 2…10 Vdc or 0…5 Vdc output signal
- Removable wiring screw terminal with ½" conduit opening.
- Actuator agency Listings: cUL-us LISTED mark, NEMA 2, NEC class 2 FCC part-15 class B, Canadian ICES-003, ESA registered, Plenum rated per UL 20430

d) ½" to 2" Bronze, Linear Globe Valve Actuators/105 lbs. force

- Actuators must have Two- Position, Floating, and Proportional models.
- Proportional models will a controller input signal of either a 0…10 Vdc, 2…10 Vdc, 4…20 mAdc, 0…3 Vdc, or 6…9 Vdc. Control function direct/reverse action is switch selectable on most models.
- Actuator force is to be 105 lb. (467 newton) with ½" (13 mm) nominal linear stroke
- Power requirements 24 Vac, 120 Vac or 230 Vac depending on model.
- Actuator housings rated for up to NEMA 2/ IP54.
- Actuator is to have overload protection throughout stroke.
- Actuator must automatically set input span to match valve travel.
- Actuator must have manual override to allow positioning of valve and preload.
- Actuator is to be spring return.
- Actuator is to mount directly to valves without separate linkage.
- Actuator agency Listings: UL 873, CUL: UL

e) ½” to 2” Bronze, Linear Globe Valve Actuators/220 lbs. force

- Actuators must have Two- Position for a SPST controller, Floating for a SPST controller, and Proportional models will a controller input signal of either a 0…10 Vdc, 2…10 Vdc, 4…20 mAdc, or 6…9 Vdc. Control function direct/reverse action is jumper selectable
- Actuator is to be spring return.
- Actuator will have 220 lb. force (979 newton) with ½” (13 mm) or 1” (25 mm) nominal linear stroke
- Feedback on proportional model with 2…10 Vdc (max. 0.5 mA) output signal or to operate up to four like additional slave actuators.
- Actuator must automatically set input span to match valve travel
- Actuator is to have a 24 Vac power supply on Two-position and Proportional models and 120 Vac on Two-position models.
- Actuator housings rated for up to NEMA 2/ IP54
- Actuator must have manual override to allow positioning of valve and preload
- Actuator is to mount directly to vales without separate linkage.
- Actuator agency Listings: UL 873, CUL: UL

f) ½” to 2” Bronze, Linear Globe Valve Actuators with linkage SR

- Actuators with 35, 60, 133, or 150 lb.-in of force depending on model.
- Actuator housings rated for up to NEMA 2/ IP54 with a 150 lb.-in. rated a NEMA 4.
- Actuators are to be spring return.
- Actuators are to have Two-position, Floating and Proportional models.
- Actuators must have overload protection throughout rotation.
- Actuator have an optional built-in auxiliary switch to provide for interfacing or signaling on selected models.
- Actuator agency listings: UL-873, C22-2 No.24-83, CUL0

g) ½” to 2” Bronze Body, Linear Globe Valve Actuators with linkage SR & NSR

- Actuators are to be either floating SPDT control or proportional control 0…10, 2…10 Vdc or 4…20 mA with a 500-ohm resistor included.
- Actuators are to be direct/reverse with selectable DIP switches.
- Actuators are to have 90 lb. (400N), 180 lb. (800N), or 337 lb. (1500N) of force on Non-Spring Return (NSR) 157 lb. of force on the Spring Return model. Note: Not every actuator is for every valve.
- Actuators are to be powered with 24 Vac or 24 Vdc.
- All Non-Spring Return (NSR) actuators are to be NEMA 2, vertical mount only. Spring Return (SR) actuators are to have NEMA 4 models.
- Actuators must have manual override to allow positioning of the valve.
- Actuators must have selectable valve sequencing and flow curves of either equal percentage or linear.
- Actuators must have feedback.
- Actuators must have internal torque protection throughout stroke.

- 90°F (32°C) ambient at 366°F (186°C) fluid temperature
- Actuator agency listings (North America) UL873, cULus, RCM, CE

h) 2 ½" to 6" Cast Iron Flanged Globe Valve Linear Actuators with linkage

- Actuators are to be either floating SPDT control or proportional control 0…10, 2…10 Vdc or 4…20 mA with a 500-ohm resistor included.
- Actuators are to direct/reverse acting with selectable DIP switch.
- Actuators are to have 180 lb. (800N) or 337 lb. (1500N) of force.
- Actuators will need a 24 Vac or Vdc power supply.
- Actuators are to be rated NEMA 2, vertical mount only.
- Actuators must have manual override to allow positioning of the valve.
- Actuators must have selectable valve sequencing and flow curves of either equal percentage to linear. A 2…10 Vac feedback.
- Actuators must have Internal torque protection throughout stroke.
- 90°F (32°C) ambient at 366°F (186°C) fluid temperature
- Actuator agency listings (North America) UL873, cULus, RCM, CE

i) 2" to 18" 2-Way and 2" to 16" 3-Way Linear Butterfly Valve Actuator with linkage NSR

- The butterfly valve actuators are to be Non-Spring Return (NSR) two-position and proportional taking 0…10 Vdc or 4…20 mA models. All Actuators are to be NEMA 4, manual override (hand wheel) two auxiliary switches, and built-in heater.
- Actuator close-offs and CVs must be appropriate for the valve size in a typical HVAC application.
- Actuators must be available in 24 Vac and 120 Vac models.
- Actuators must have Internal wiring isolation for parallel wiring multiple units that eliminates the risk of feedback from one actuator to another.
- Proportional models must have feedback of 0…10 Vdc or 4…20 mA.
- Actuator operating temperature shall be -40…150°F (-40…60°C).
- Actuator agency listings (North America) UL, CSA and CE

j) 2" to 4" 2-Way and 3-Way Butterfly Valve Actuators SR

- The butterfly valve actuators are to be Spring Return (SR) two-position and proportional taking 2…10 Vdc or 4…20 mA models. All Actuators are to be NEMA 2.
- Actuator close-offs and CVs must be appropriate for the valve size in a typical HVAC application.
- Actuators must be available in 24 Vac models.
- Actuators shall have two SPDT auxiliary switch models.
- Actuators must have [Internal wiring isolation for parallel wiring multiple units that eliminates the risk of feedback from one actuator to another.
- Proportional models must have feedback of 2…10 Vdc or 4…20 mA.
- Actuator agency listings (North America) UL, CSA and CE

k) 2" to 6" 2-Way and 3-Way Butterfly Valve Actuators NSR

- The butterfly valve actuators are to be Non-Spring Return (NSR) two-position and proportional taking 0…10 Vdc or 4…20 mA models. All Actuators are to be NEMA 2.
- Actuator close-offs and CVs must be appropriate for the valve size in a typical HVAC application.
- Actuators must be available in 24 Vac models.
- Actuators shall have two SPDT auxiliary switch models.
- Actuators must have [Internal wiring isolation for parallel wiring multiple units that eliminates the risk of feedback from one actuator to another.
- Proportional models must have feedback of 2…10 Vdc or 4…20 mA.
- Actuator agency listings (North America) UL, CSA and CE

2.1.7.18. Dampers

a) Automatic dampers, furnished by the Building Automation Contractor shall be single or multiple blade as required. Dampers are to be installed by the HVAC Contractor under the supervision of the BAS system supplier. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the Sheet Metal Contractor.

b) Damper frames are to be constructed of 13 gauge galvanized sheet steel mechanically joined with linkage concealed in the side channel to eliminate noise as friction. Compressible spring stainless steel side seals and acetyl or bronze bearings shall also be provided.

c) Damper blade width shall not exceed eight inches. Seals and 3/8 inch square steel zinc plated pins are required. Blade rotation is to be parallel or opposed as shown on the schedules.

d) For high performance applications, control dampers will meet or exceed the UL Class I leakage rating.

e) Provide opposed blade dampers for modulating applications and parallel blade for two position control.

2.1.7.19. Damper Actuators

a) Direct-coupled type non-hydraulic designed for minimum 100,000 full-stroke cycles at rated torque.

b) Direct-coupled damper actuators must have a five-year warrantee.

c) Size for torque required for damper seal at maximum design conditions and valve close-off pressure for system design.

d) Overload protected electronically throughout rotation except for selected Floating actuators the have a mechanical clutch.

e) Spring Return Actuators: Mechanical fail safe shall incorporate a spring-return mechanism.

f) Non-Spring Return Actuators shall stay in the position last commended by the controller with an external manual gear release to allow positioning when not powered.

g) Power Requirements: 24Vac/dc or 120Vac (as system requirements)

h) Proportional Actuators controller input range from 0…10 Vdc, 2…10 Vdc or 4…20 mA models.

i) Housing: Minimum requirement NEMA type 2

j) Actuators with a microprocessor should not be able to be modified by an outside source (cracked or hacked).

k) Actuators of 133 and 270 lb.-in. of torque or more should be able to be tandem mount or "gang" mount.

l) Agency Listings: ISO 9001, cULus, CE and CSA

2.1.7.20. Smoke Detectors

a) Air duct smoke shall operate at air velocities from 300 feet per minute to 4000 feet per minute.

b) The smoke detector shall utilize a photoelectric detector head.

c) The housing shall permit mechanical installation without removal of the detector cover.

d) The detectors shall be listed by Underwriters Laboratories and meet the requirements of UL 268A.

2.1.7.21. Airflow Measuring Stations

a) Provide a thermal anemometer using instrument grade self heated thermistor sensors with thermistor temperature sensors.

b) The flow station shall operate over a range of 0 to 5,000 feet/min with an accuracy of +/- 2% over 500 feet/min and +/- 10 ft/min for reading less than 500 feet/min.

2.1.8. **ELECTRICAL POWER MEASUREMENT**

2.1.8.1. Electrical Power Monitors, Single Point (Easy Install):

a) General: Consist of three split-core CTs, factory calibrated as a system, hinged at both axes with the electronics embedded inside the master CT. The transducer shall measure true (rms.RMS) power demand real power (kW) consumption (kWh). Conform to ANSI C12.1 metering accuracy standards.

b) Voltage Input: Load capacity as shown on drawings. 208-480 VAC, 60 Hz

c) Maximum Current Input: Up to 2400A

d) Performance:

- Accuracy: +/- 1% system from 10% to 100% of the rated current of the CT's
- Operating Temperature Range: 32-140°F, 122°F for 2400A.

e) Output: 4 to 20 mA, Pulse. or Modbus RTU

f) Ratings:

- Agency: UL508 or equivalent
- Transducer internally isolated to 2000 VAC.
- Case isolation shall be 600 VAC.

g) Accessories: BACnet communications gateway

2.1.8.2. Electrical Power Monitors, Single Point (High Accuracy):

a) General: Revenue grade meter. Measures voltage, amperage, real power (kW), consumption (kWh), and reactive power (kVARar), and power factor (PF) per phase and total load for a single load. Factory calibrated as a system using split core CT's. Neutral voltage connection is required.

b) Voltage Input: 208-480 VAC, 60 Hz

c) Current Input: Up to 2400A

d) Performance:

- Accuracy: +/- 1% system from 2% to 100% of the rated current of the CT's
- Operating Temperature Range: 32-122°F

e) Output: Pulse, BACnet, Modbus RTU

f) Display: Backlit LCD

g) Enclosure: NEMA 1

h) Agency Rating: UL508 or equivalent

2.1.8.3. Electrical Power Monitors, Single Point (High Accuracy/Versatility):

a) General: Revenue grade meter. Measures voltage, amperage, real power (kW), consumption (kWh), reactive power (kVAR), apparent power (kVA) and power factor (PF) per phase and total load for a single load. Available with data logging , Bi-directional (4-quadrant) metering, and pulse contact accumulator inputs.

b) Voltage Input: 90-600 VAC, 50/60 Hz, 125-300 VDC

c) Current Input: 5A – 32,000A, selectable 1/3V or 1V CT inputs

d) Performance:

- Accuracy shall be +/- [0.2%][0.5%] revenue grade
- Operating Temperature Range: -22-158°F

e) Output shall be BACnet

f) Display: Backlit LCD

g) Enclosure: NEMA 4x optional

h) Agency Rating: UL508, ANSI C12.20

2.1.8.4. Electrical Power Monitors, Multiple Point (92 loads, High Accuracy):

a) General: Revenue grade meter. Measures volts, amps, power and energy for each circuit. 1/4 amp to 200 amp monitoring. 4 configurable alarm threshold registers

b) Voltage Input: 90-277 VAC, 60 Hz

c) Current Input: 5A – 32,000A, 1/3V CT inputs

d) Performance:

- Accuracy: +/- 0.5% meter (split core), +/- 1% system from 1/4-100A (solid core)
- Operating Temperature Range: 32-140°F

e) Output: Modbus RTU

f) Agency Rating: UL508, ANSI C12.10, IEC Class 1

PART 3. EXECUTION

3.1. EXAMINATION (WORK PREPARATION)

3.1.1. In addition to the requirements specified herein, execution shall be in accordance with the requirements of other specification sections and drawings.

3.1.2. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.

3.1.3. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Government representative (DEPR /

OMEP / PBA) and/or the Engineer, 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.

3.1.4. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.1.5. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.

3.1.6. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

3.1.7. Demolition

3.1.7.1. Remove controls which do not remain as part of the new building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The DEPR / OMEP / PBA representative will inform the Contractor of any equipment which is to be removed that will remain the property of the Government. All other equipment which is removed will be disposed of by the Contractor conforming Puerto Rico Environmental Laws and the United States Environmental Protection Agency (EPA).

3.1.8. Access to Site

3.1.8.1. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the DEPR / OMEP / PBA Representative.

3.1.9. Code Compliance

3.1.9.1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications and wiring requirements of codes and standards will prevail for work as indicate at codes and standards.

3.2. SYSTEM ACCEPTANCE TESTING

3.2.1. All application software will be verified and compared against the sequences of operation.

3.2.2. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.

3.2.3. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.

3.2.4. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.

3.2.5. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

3.3. INSTALLATION

3.3.1. Hardware Installation Practices for Wiring

3.3.1.1. All controllers are to be mounted vertically and per the manufacturer's installation documentation.

3.3.1.2. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.

3.3.1.3. Important: A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.

3.3.1.4. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.

3.3.1.5. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.

3.3.1.6. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.

3.3.1.7. Wires are to be kept a minimum of three (3) inches from hot water, or condensate piping.

3.3.1.8. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.

3.3.1.9. Wire will not be allowed to run across telephone equipment areas.

3.3.1.10. Provide fire caulking at all rated penetrations.

3.3.2. Installation Practices for Field Devices

3.3.2.1. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.

3.3.2.2. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.

3.3.2.3. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.

3.3.2.4. Water line mounted sensors shall be removable without shutting down the system in which they are installed.

3.3.2.5. If used, for duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.

3.3.2.6. If used, for building static pressure sensors, the high-pressure port shall be inserted into the space via a metal tube. Pipe the low-pressure port to the outside of the building.

3.3.3. Wiring, Conduit, and Cable

3.3.3.1. All wire will be copper and meet the minimum wire size and insulation class listed below:

a) Power - 12 Gauge - 600 Volt

b) Class One - 14 Gauge Std. - 600 Volt

c) Class Two - 18 Gauge Std. - 300 Volt

d) Class Three - 18 Gauge Std. - 300 Volt

e) Communications - Per Mfr.

3.3.3.2. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.

3.3.3.3. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.

3.3.3.4. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2-inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.

3.3.3.5. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment.

3.3.3.6. Important: Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.

3.3.3.7. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.

3.3.3.8. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.

3.3.3.9. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.

a) Only glass fiber is acceptable, no plastic.

b) Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS system supplier shall submit to the DEPR / OMEP / PBA Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

3.3.4. Enclosures

3.3.4.1. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.

3.3.4.2. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.

3.3.4.3. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.

3.3.4.4. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.

3.3.4.5. Important: All outside mounted enclosures shall meet the NEMA-4X rating.

3.3.4.6. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

3.3.5. Identification

3.3.5.1. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.

3.3.5.2. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.

3.3.5.3. Junction box covers will be marked to indicate that they are a part of the BAS system.

3.3.5.4. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.

3.3.5.5. All I/O field devices inside FIP's shall be labeled.

3.3.6. Existing Controls.

3.3.6.1. Existing controls which are to be reused must each be tested and calibrated for proper operation. Existing controls which are to be reused and are found to be defective requiring replacement, will be noted to the Owner. The Owner will be responsible for all material and labor costs associated with their repair.

3.3.7. Location

3.3.7.1. The location of sensors is per mechanical drawing, architectural drawings and /or latest codes and standards.

3.3.7.2. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light, and diffuser air streams.

3.3.7.3. If used, outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.

3.3.7.4. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.3.8. Software Installation

3.3.8.1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third-party software necessary for successful operation of the system.

3.4. TRAINING

3.4.1. The BAS system supplier shall provide both on-site and classroom training to the Owner's representative and maintenance personnel per the following description:

3.4.2. On-site training shall consist of a minimum of (40) hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include

3.4.2.1. System Overview

3.4.2.2. System Software and Operation

3.4.2.3. System access

3.4.2.4. Software features overview

3.4.2.5. Changing setpoints and other attributes

3.4.2.6. Scheduling

3.4.2.7. Editing programmed variables

3.4.2.8. Displaying color graphics

3.4.2.9. Running reports

3.4.2.10. Workstation maintenance

3.4.2.11. Viewing application programming

3.4.2.12. Operational sequences including start-up, shutdown, adjusting and balancing.

3.5. FIELD QUALITY CONTROL

3.5.1. Control System Switch-over

3.5.1.1. As possible, the demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices, but if not possible then contractor will provide appropriate transition in the installation of new sensors, equipment and devices.

3.5.1.2. Switch-over from the existing control system to the new system will be fully coordinated with the DEPR / OMEP / PBA representative. A representative of the Government will be on site during switch-over.

3.5.1.3. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.

3.5.2. Database Configuration.

3.5.2.1. The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

3.5.3. Color Graphic Displays.

3.5.3.1. Unless otherwise directed by the owner, the Contractor will provide color graphic displays as depicted in the mechanical drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

3.5.4. Reports.

3.5.4.1. The Contractor will configure a minimum of 4 reports for the owner. These reports shall, at a minimum, be able to provide:

3.5.4.2. Trend comparison data

3.5.4.3. Alarm status and prevalence information

3.5.4.4. Energy Consumption data

3.5.4.5. System user data

3.5.5. Point to Point Checkout.

3.5.5.1. Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.

3.5.5.2. In case of wireless devices, the signal strength recorded during checkout shall be reported.

3.5.6. Controller and Workstation Checkout.

3.5.6.1. A field checkout of all controllers and front-end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

3.5.7. Documentation

3.5.7.1. As built software documentation will include the following:

a) Descriptive point lists

b) Application program listing

c) Application programs with comments.

d) Printouts of all reports.

e) Alarm list.

f) Printouts of all graphics

g) Commissioning and System Startup

h) An electronic copy of all databases, configuration files, or any type of files created specifically for each system.

3.6. CLEANING

3.6.1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

END OF SECTION 23 09 23

SECTION 23 34 16

CENTRIFUGAL FANS FOR HVAC

PART 1. GENERAL

1.1. SUMMARY

1.1.1. Section includes:

1.1.1.1. This section provides the requirements for centrifugal fans and related equipment and materials to be installed at Instituto Tecnológico de Ponce.

1.1.1.2. The general purpose of this application is to replace existing damaged centrifugal fans located in various AHUs on campus and explore alternatives to upgrading to a direct drive fan.

1.1.1.3. Furnish and install centrifugal fans according to drawing schedules and existing configuration and dimensions.

1.2. RELATED SECTIONS

1.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.7. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.8. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.9. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.10. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.11. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.12. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.2.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. REFERENCES STANDARDS

1.3.1. ABMA: American Bearing Manufacturer's Association

1.3.2. AMCA: Air Movement and Control Association.

1.3.3. AMCA 99-2408 Operating Limits for Centrifugal Fans

1.3.4. AMCA 203 AMCA Fan Application Manual – Troubleshooting AMCA 204 Balance Quality and Vibration Levels for Fans AMCA 210 Laboratory Method of Testing Fans for Rating AMCA 300 Reverberant Room Method for Sound Testing of Fans

1.3.5. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.

1.3.6. NFPA: National Fire Protection Association

1.3.7. NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals NFPA 70: National Electrical Code

1.3.8. NFPA 79: Electrical Standard for Industrial Machinery NFPA 99: Health Care Facilities

1.3.9. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems NFPA 91: Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids

1.3.10. UL Compliance: Provide centrifugal fan electrical components which have been listed and labeled by UL.

1.3.11. ASTM: American Society for Testing and Materials ASTM D1735 water fog

1.3.12. ASTM B117 salt spray

1.3.13. ASTM D3359 adhesion

1.3.14. ASTM G152 and G153 for carbon arc light apparatus for exposure of non-metallic material.

1.4. SUBMITTALS

1.4.1. Product Data: Catalog sheets; include rated capacities of each unit, dimensional data, operating weights, accessories, material finishes and installation instructions. Submittal will included:

1.4.1.1. Capacities and Characteristics:

a) Total Airflow: See Schedule on plans

b) External Static Pressure: See Schedule on plans

c) Housing Material: Aluminum.

d) Wheel Material: Aluminum.

e) Brake Horsepower: See Schedule on plans

f) Drive Type: See Schedule on plans

g) Fan Rpm: See Schedule on plans

h) Motor:

- Motor Enclosure: Open, drip proof, totally enclosed, fan cooled.
- Efficiency: Premium efficient.

1.4.2. Shop Drawings: Manufacturer's detailed dimensional drawings showing equipment, assemblies, dimensions, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

1.4.3. Quality Control Submittals:

1.4.3.1. Certified fan performance curves.

1.4.3.2. Certified fan sound power levels of Fan in each of the 8 Octive Bands as per current AMCA Bulletin #300-67 for Sound Testing of Air Moving Devices.

1.4.4. Contract Closeout Submittals:

1.4.4.1. Operation and Maintenance Data: Deliver 3 copies covering the installed products, to the DEPR / OMEP / PBA Representative.

1.4.4.2. Equipment vibration readings confirming vibration isolation schedule specified.

1.5. QUALITY ASSURANCE

1.5.1. Regulatory Requirements:

1.5.1.1. Each fan shall bear AMCA Seal indicating that fans comply with AMCA 211, Certified Ratings Program - Air Performance, and AMCA 311, Certified Sound Ratings Program for Air Moving Devices.

1.5.1.2. Operating Limits: Classify according to AMCA 99-2408.

1.5.1.3. Sound power level ratings shall comply with AMCA Standard 301, Method for Calculating Fan Sound Ratings from Laboratory Test Data.

1.6. DELIVERY, STORAGE, AND HANDLING

1.6.1. Deliver fans as factory-assembled units to the extent allowable by shipping limitations, with protective crating and coverings.

1.6.2. Disassemble and reassemble units as required for movement to the final locations in accordance with manufacturer's printed instructions.

1.6.3. Lift and support units at the manufacturer's designated lifting or supporting points.

1.7. COORDINATION

1.7.1. Coordinate size and location of structural-steel support members.

1.8. WARRANTY

1.8.1. Provide 1-year unconditional labor and parts warranty on any component of the units.

PART 2. PRODUCTS

2.1. GENERAL

2.1.1. Fans shall be dynamically balanced and factory-tested and certified in accordance with applicable AMCA test codes. All Fans shall be certified AMCA Class I to III. .

2.1.2. Fans shall be furnished complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. Direct driven fans are preferred however for motors/assemblies using V-belt drives shall be furnished with adjustable rails or heavy duty double pull style (two bolt pull) bases.

2.1.3. Fans shall be selected at design condition operating points with the design CFM falling in the range of 60 to 75%. In all cases, the professional service provider shall evaluate system conditions and select the optimum fan type and configuration based on efficiency, system curve, and fan characteristics at all anticipated design conditions. Fan motor BHP to account for drive losses and field conditions.

2.1.4. Preferred Variable Frequency Drives, the design operating point shall be at or to the right of the peak efficiency point or peak efficiency system curve. Total Efficiency (TE) of the fan selection shall equal or exceed 55 percent at the design point.

2.1.5. Air handling fan preference shall be double width, double inlet with backward inclined centrifugal airfoil blades.

2.1.6. Use OSHA approved belt guards that totally enclose the entire drive and permit easy removal for replacement of belts. Construct guards of expanded metal to allow for ventilation and provide tachometer openings at shaft locations. Fan capacity shall account for restrictions caused by protected housing/screening.

2.1.7. Provide AMCA spark resistant construction option: A, B, or C as required by project conditions for handling flammable or explosive vapors. Drive set shall be comprised of non-static belts for use in an explosive. Bearings located out of air or gas stream, fan equipped with explosion-proof motor.

2.1.8. Provide a minimum of two coats epoxy coating finish as a minimum for non corrosive applications. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D1735 water fog; ASTM B117 salt spray; ASTM D3359 adhesion; and ASTM G152 and G153 for carbon arc light apparatus for exposure of non-metallic material.

2.1.9. Fans exposed to fume and other corrosive exhaust air as required by project conditions shall be constructed of materials compatible with the chemicals being transported in the air through the fan.

2.1.10. Exhaust Stack Discharge shall be in a vertical up-draft direction at a minimum of 10 ft. above adjacent roof lines and located with respect to

surrounding air inlets as to avoid contaminant re- entry. Exit velocity shall have a minimum exit velocity of 3000 fpm and a maximum velocity of 4000 fpm. Design discharge static pressure loss should strive to maintain one (1) inch water gauge or less.

2.1.11. Provide latest standard NEMA Premium Efficiency rated motor for compatibility with variable frequency drives where applicable. Select non-overloading motors at all points on the RPM operating curve. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at static pressure. Motor furnished with fan shall not operate into motor service factor in any of these cases.

2.2. FANS

2.2.1. Provide centrifugal fans built to AMCA Standard 99-2408 Class I to III construction (minimum) similar to existing units or to match the total static pressure and CFMs.

2.2.2. Provide factory-assembled and tested Direct Driven or Belt driven (project specific) centrifugal fans, factory fabricated, assembled, finished and tested; consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structures. For this application direct driven fan are preferred, consult with soft starter and VFD seller representative to proper equipment selection match.

2.2.3. Equip fan unit with unitary base, frame and assembly.

2.3. HOUSINGS

2.3.1. Materials and Fabrication: Formed and reinforced steel curved scroll housing panels, spun metal or die formed inlet cones to provide a streamlined flow into the wheel, and the doors or panels for access to internal parts and components.

2.3.1.1. Bracing: Steel angle or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

2.3.1.2. Construct inlet and outlet of fan for project connection and orientation.

2.3.1.3. Housing Drain Connection: One inch threaded steel pipe coupling welded to low point of fan scroll, with threaded steel plug and non-galling lubricant applied to threads.

2.3.1.4. Provide weather covers and weather-resistant enamel finish for fans installed outdoors.

2.4. WHEELS

2.4.1. Fans to use airfoil blades welded to spun wheel cones unless otherwise indicated.

2.5. SHAFTS

2.5.1. Turned, ground, and polished hot-rolled steel with keyway and drive end counter sunk for tachometer readings. Close tolerances shall be

maintained where the shaft makes contact with the bearing. Ship with protective coating of lubricating oil. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower.

2.5.1.1. Size shaft so that first critical speed is at least 25 percent over maximum operating speed.

2.5.1.2. Shaft heat slinger for fans handling high temperature air or gas.

2.6. BEARINGS

2.6.1. Ball, roller, or taper roller type with double locking collars and split two-piece, cast iron housing. Select bearings in accordance with ABMA Standards for Ball and Roller Bearings and for maximum operating speed and horsepower for construction level.

2.6.1.1. All Bearings: Shall be “Heavy Duty” rated, grease lubricated, ball or roller self-aligning, pillow block type housing with grease seal. Bearings shall be selected for a minimum AMBA bearing rated life of not less than 200,000-hrs operation at maximum cataloged operating speed. Furnish bearings with pressure relief type external grease fittings. Bearings shall be factory lubricated. Both unit bearings shall have the same bore, type and manufacturer. At least one of the bearings shall be fixed. The bearing supports shall be removable for access to and removal of the fan wheel.

2.6.2. In addition to respective fan type bearing criteria, provide an auto-greaser on all applications in which bearings are inaccessible due to being platform mounted or physically located in a remote location, which would otherwise require special OSHA regulated access. Extended copper lube lines may be used to allow “line of sight” connection between bearing and auto-greaser.

2.7. BELT DRIVEN FANS

2.7.1. When belt drive option is selected and unless otherwise indicated, Original Equipment Manufacturer (OEM) Serial number – matched oil resistant, non-sparking, and non-static V-belt drive set(s) shall be selected and provided. Belts shall be applied in matched sets. V-belts shall be matched multiple A, B or C belts having a rating of not less than 150 percent of the motor nameplate horsepower. (Multi-groove pulleys using 2, 3 or 4 grooves shall be provided with matching companion pulleys such that the belts are properly aligned.)

2.7.2. Service Factor:

2.7.2.1. Design belt drive to operate at the horsepower equivalent to the highest BHP of the fan multiplied by service factor of 1.5.

2.7.3. Fan Pulleys: Cast iron or cast steel with interchangeable split, tapered bushing, dynamically balanced at factory prior to assembly.

2.7.4. Motor Pulleys:

2.7.4.1. No adjustable pitch adjustment type, only fixed pitch type.

2.7.4.2. Distance between fan shaft and motor shaft :

a) Minimum sheave size – nothing under four inches (4”).

b) Distance – two and a haft times the largest sheave size.

2.7.5. Belt Guards: Comply with OSHA and SMACNA requirements.

2.7.6. Include provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.7.7. Motor Mount: Heavy duty double pull style (two bolt pull) adjustable for belt tensioning.

2.8. VIBRATION LIMITS

2.8.1. Each fan \ wheel shall be statically and dynamically Factory balanced. Complete fan assembly shall be factory balanced statically and dynamically in accordance with AMCA Standard 204.

2.8.2. Each Complete fan assembly shall be Field balanced statically and dynamically in accordance with AMCA Standard 204 and shall be statically and dynamically Field balanced to the equivalent balance grade based on the conditions stated as follows.

2.8.2.1. Each Constant Volume fan assembly shall be test run at the factory at the specified fan RPM and vibration signatures shall be taken on each bearing in three planes; horizontal, vertical, and axial. The maximum allowable fan vibration shall be the lower of either that stated under this sub-paragraph entitled “Balancing Fan and Drive Assemblies” or 0.20 in./sec peak velocity, filter-out reading as measured at the fan RPM. This report shall be provided concurrently with the unit shipment.

2.8.2.2. Fans incorporating variable frequency drives shall be balanced for inverter duty operation. The fan shall be balanced over the entire range of fan operation i.e. 30 percent to 110 percent of design operation to the more stringent of:

a) Grade G2.5 per ANSI S2.19 (ISO 1940/1) - Balance Quality Requirements of Rigid Rotors.

b) Complete fan assembly shall be factory balanced statically and dynamically in accordance with AMCA Standard 204.

- Filter-in measurement (all fan assemblies) shall be taken in the horizontal and vertical planes on the drive and opposite-drive sides of the fan shaft.

  Fans using variable frequency drives - Measurements shall not exceed 2.0 mils in any plane at or below 750 rpm and shall not exceed .0785 inches/sec in any plane beyond 750 rpm for inverter duty fans.

- Filter-out measurements (all fan assemblies) shall be taken in the horizontal, vertical and axial planes on the drive and opposite-drive sides of the fan shaft.

  Fans using variable frequency drives - Measurements shall not exceed 2.8 mils in any plane at or below 750 rpm and shall not exceed .110 inches/sec in any plane beyond 750 rpm for inverter duty fans.

2.9. ACCESSORIES

2.9.1. Provide accessories per the following requirements:

2.9.1.1. Access Doors: Provide access door in scroll housing, with latch-type handles, flush mounted for un-insulated housings, and raised-mounted for insulated housings.

2.9.1.2. Backdraft Dampers: Provide gravity-actuated dampers on fan discharge, counterweighted, with interlocking aluminum blades with felt edges in steel frame.

2.9.1.3. Drain Connections: Provide minimum 1 inch threaded coupling drain connection at lowest point of housing.

2.9.1.4. Extended Grease Lines: Extend grease lines from bearings to outside of inlet duct flange, terminate with grease fitting.

2.9.1.5. Heat Slingers: Provide metal disc between bearings and fan wheel, to dissipate heat from shaft.

2.9.1.6. Split Housings: Provide flanged, horizontally split housings as required by project conditions.

2.9.1.7. Weather Hoods: Provide protective weather hood with stamped vents over motor and drive compartment.

2.9.1.8. Screens: Provide manufacturer's standard screens on fan inlet and outlet where exposed to operating and maintenance personnel for safety.

2.9.1.9. Fan Guards: Specify guards on inlets and outlets not connected to ductwork, constructed of expanded metal in removable frame.

PART 3. EXECUTION

3.1. EXAMINATION

3.1.1. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of fans. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.1.2. Do not operate fans until ductwork is clean, filters, if any, are in place and bearings are lubricated.

3.1.3. Field Measurements: Verify dimensions and clearances by field

measurements.

3.2. INSTALLATION

3.2.1. Fans shall be installed with the applicable NFPA standard and in accordance with manufacturer's printed installation instructions.

3.2.2. Fans shall be located, arranged and installed with clearances for inspection and maintenance.

3.2.2.1. Provide clearance for complete wheel and shaft removal as per manufacturer's manual recommendations and structural support clearance.

3.2.2.2. Provide ancillary equipment.

3.2.3. Floor Mounted Fans: Support fans on concrete mechanical equipment pads with vibration isolation devices.

3.2.4. Provide inlet screens on fans with non-ducted fan inlets. If fan has inlet bearing, install screen on inboard side of bearing.

3.2.5. Vibration Isolation Bases:

3.2.5.1. Coordinate size and location of bases with the Work of related contracts.

3.2.6. Electrically connect Fan motor per latest National Electrical Safety Code and other applicable codes as a guide in establishing wiring. Provide liquid tight flexible connector and conduit. Provide support to avoid any type of contact with surfaces and edges.

3.3. FIELD QUALITY CONTROL

3.3.1. Inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

3.3.2. Pre-start Up:

3.3.2.1. Remove shipping blocking, and bracing.

3.3.2.2. Verify lubrication for grease bearings and other moving parts.

3.3.2.3. Set dampers in connected ductwork in proper position.

3.3.2.4. Belt Driven Fans: Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guard.

3.3.2.5. Provide equipment and apparatus required for performing inspections and tests.

3.3.2.6. Field Inspections:

a) Prior to initial operation, inspect the vibration isolators for conformance to drawings, specifications, and manufacturer's data and instructions.

b) Check for vibration and noise transmission through connections,

piping, ductwork, foundations, and walls.

c) Check connector alignment before and after filling of system and during operation.

d) Correct misalignment without damage to connector and in accordance with manufacturer's recommendations.

3.3.2.7. Rebalance, adjust, or replace equipment with noise or vibration levels in excess of those given in the equipment specifications, or equipment manufacturer's data.

3.3.3. Start Up:

3.3.3.1. Energize motor, verify proper operation of drive system, and fan wheel.

3.3.3.2. Belt Driven Fans:

a) Adjust fan pulley to indicate initial rpm, further adjust pulley to obtain system design conditions if required. Align fan and motor sheaves to allow belts to run true and straight.

b) Replace fan and motor pulleys if required to achieve design conditions.

c) Replace variable sheaves with fixed permanent sheaves after air balance.

d) Measure and record motor voltage and amperage.

3.4. DEMONSTRATION

3.4.1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 34 16

SECTION 23 40 00
HVAC AIR CLEANING DEVICES

PART 1. GENERAL

1.1. SUMMARY:

1.1.1. Section Includes:

1.1.1.1. This section provides the requirements for HVAC air cleaning devices and combination to be installed in various air conditioning equipment at Instituto Tecnológico de Ponce.

1.1.1.2. This section describes the design, performance and installation of an air cleaning devices intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.1.1.3. The purpose of this application is to replace existing filters with higher efficiency filters and to provide a combination of new air filtration technologies to be installed in various AHUs on campus to achieve the removal or significant reduction of different pathogens (viruses, bacteria, fungi, germs) and stop their spread.

1.1.1.4. For those AHUs and RTUs that will not be replaced, the selection of the new combination of air cleaning devices will be based on the design or existing air pressure drop. In no event shall the design or existing air pressure drop, or actual motor full load amps will be exceeded.

1.1.1.5. For those AHUs and RTUs that will be replaced, the selection of the new combination of air cleaning devices will be based on the capacity of the electrical feeder. In no case will the new drop in air pressure cause the capacity of the electrical feeder to be exceeded.

1.1.1.6. The standard pre-selected air filtration configuration is:

a) Pre-filter: Washable / reusable filter

b) Filter: Disposable MERV 13 filter

c) Bipolar Ionization

d) Anti-Microbial Ultraviolet Light Emitters

1.1.1.7. Devices includes:

a) Activated carbon filters.

b) Extended surface rigid air filter with synthetic media.

c) Disposable panel filters.

d) Washable and reusable filters

e) Filter gages.

f) Anti-Microbial Ultraviolet Light Emitters – See section 23 05 66 for details.

g) Bipolar Ionization.

1.2. RELATED SECTIONS:

1.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.7. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.8. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.9. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.10. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.11. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.12. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.2.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. REFERENCES STANDARDS:

1.3.1. The following codes and standards are referenced throughout. In most cases, the edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1.3.2. Air-Conditioning and Refrigeration Institute:

1.3.2.1. ARI 850 - Commercial and Industrial Air Filter Equipment.

1.3.3. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1.3.3.1. ASHRAE Standards 62 - Standards for Ventilation and Indoor Air Quality

1.3.3.2. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

1.3.4. Underwriters Laboratories Inc.:

1.3.4.1. UL 586 - High-Efficiency. Particulate, Air Filter Units.

1.3.4.2. UL 867 - Electrostatic Air Cleaners.

1.3.4.3. UL 900 - Air Filter Units.

1.3.4.4. UL2998 Environmental Claim Validation Procedure (ECVP)

1.3.4.5. UL 2043 Standard for Safety Fire Test for Heat and Visible Smoke Release

1.3.4.6. National Electric Code NFPA 70

1.3.4.7. ISO 16000 International Standard for Indoor Air Quality Testing Methods

1.4. SUBMITTALS

1.4.1. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

1.4.2. Product Data: Submit data on filter media, filter performance data, dimensions, and electrical characteristics.

1.4.3. Submit performance data for this application including **initial pressure drop, recommended replacement pressure drop, and maximum pressure drop**.

1.4.4. Manufacturer's Installation Instructions: Submit assembly and change-out procedures.

1.4.5. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4.6. Copy of UL 867 and UL 2998 independent ozone test.

1.4.7. Operating & Maintenance Data: Submit O&M data and recommended spare parts list.

1.5. QUALITY ASSURANCE AND STANDARDS

1.5.1. The Air Purification System shall be a product of an established manufacturer in the USA.

1.5.2. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

1.5.3. Uni-polar ion generators shall not be acceptable. “Plasma” particulate filters shall not be acceptable.

1.5.4. Projects designed using ASHRAE Standard 62.1 IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1 to validate acceptable indoor air quality at the outside air quantity scheduled.

1.5.5. The Air Purification Technology shall have been tested by UL or Intertek/ETL to prove conformance to UL 867 and UL2998 including the ozone chamber testing and peak ozone test for electronic devices.

1.5.6. All manufacturers shall submit their independent UL 867/2998 test data with ozone results to the engineer during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.

1.6. PRODUCT DELIVERY, STORAGE AND HANDLING

1.6.1. Delivery of products shall be in factory fabricated shipping cartons. Identify on outside of carton the type of product contained within. Avoid crushing or bending.

1.6.2. Store in original cartons and protect from weather and construction work traffic.

1.6.3. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7. WARRANTY

1.7.1. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twelve months after acceptance by owner. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

1.7.2. Provide one-year minimum.

PART 2. PART 2 - PRODUCTS

2.1. ACTIVATED CARBON FILTERS

2.1.1. Manufacturer:

2.1.1.1. Flanders.

2.1.1.2. Camfil-Farr.

2.1.1.3. American Air Filter.

2.1.1.4. Other as DEPR / OMEP / PBA Engineer approval

2.1.2. Assembly: Galvanized steel unit incorporating extruded aluminum tracks to accommodate filter servicing trays in deep V arrangement arranged for upstream downstream side servicing with disposable panel pre-filter.

2.1.2.1. Nominal Size: 12 x 24 x 29 inches or 24 x 24 x 29 inches.

2.1.3. Media:

2.1.3.1. Activated Carbon Density: 34 lb./cu ft, pellets or granular to 6 x 10 Tyler mesh screen.

2.1.3.2. Carbon Tetrachloride Activity: Minimum 60 percent; in thin bed.

2.1.3.3. Trays: Nominal size 24 x 24 x 5/8 inches thick.

2.1.3.4. Carbon: 1.42 cu ft per 1000 cfm nominal airflow capacity.

2.1.4. Rating: 500 fpm face velocity, 0.45 inch WG resistance.

2.2. EXTENDED SURFACE RIGID AIR FILTER WITH SYNTHETIC MEDIA.

2.2.1. Description: Efficiencies as listed by ASHRAE 52.2: MERV 15 (90-95%); MERV 14 (80- 85%)

2.2.2. Manufacturer:

2.2.2.1. Flanders.

2.2.2.2. Camfil-Farr.

2.2.2.3. American Air Filter.

2.2.2.4. Other as DEPR / OMEP / PBA Engineer approval

2.2.3. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced synthetic fabric or fine, glass fiber laminated to synthetic backing.

2.2.3.1. Frame: Stainless steel.

2.2.3.2. Nominal size: 24 x 24 inches

2.2.3.3. Nominal thickness: As required for scheduled efficiency rating.

2.2.4. Tested per ASHRAE 52.1:

2.2.4.1. Dust spot efficiency: See schedule on drawings.

2.2.4.2. Weight resistance: See schedule on drawings.

2.2.4.3. Initial resistance at 500 fpm face velocity: See schedule on drawings.

2.2.4.4. Recommended final resistance: See schedule on drawings.

2.3. DISPOSABLE PANEL FILTERS

2.3.1. Description: Factory-fabricated, dry, extended-surface filters with stainless steel holding frames.

2.3.2. Manufacturers:

2.3.2.1. Tridem.

2.3.2.2. Camfil-Farr.

2.3.2.3. American Air Filter.

2.3.2.4. Other as DEPR / OMEP / PBA Engineer approval

2.3.3. Media: Synthetic glass fibrous material and other media pleated, UL Class II, 25-30 percent efficiency (MERV 8) formed into deep-V-shaped pleats and held by self-supporting wire grid.

2.3.3.1. Nominal Size: 24 x 24 inches.

2.3.3.2. Thickness: 1 or 2 inch (as required to meet air pressure drop limitations).

2.3.4. Media and Media-Grid Frame: Nonflammable glass fiber, synthetics and other media to ensure adequacy for jet fuel.

2.3.5. Performance Rating:

2.3.5.1. Face Velocity: 500 fpm.

2.3.5.2. Initial Resistance: 0.15 inch WG.

2.3.5.3. Recommended Final Resistance: 0.50 inches WG.

2.3.6. Duct-Mounting Frames: Stainless steel with gaskets and fasteners and suitable for bolting together into built-up filter banks.

2.3.6.1. Manufacturer:

a) Pyramid Filters.

b) Perkins Thermal Systems.

c) Guru Filtration System.

d) Other as DEPR / OMEP / PBA Engineer approval

2.4. WASHABLE AND REUSABLE FILTERS

2.4.1. Manufacturer:

2.4.1.1. BoAir

2.4.1.2. Aire Care

2.4.1.3. Other as DEPR / OMEP / PBA Engineer approval

2.4.2. Provide nonwoven synthetic-fabric-type filtering element, supported on rigid pleats of suitable grid material, with a nominal overall depth of 2-inches.

2.4.3. Seal filter element into an enclosing aluminum frame of rigid chipboard.

2.4.4. Verify initial pressure drop at a face velocity of 500 fpm is 0.22-inch wg , with average dust-spot efficiency of 18 percent and arrestance of 95 percent when filter is operated to a final pressure drop of 1-inch wg .

2.5. FILTER GAGES

2.5.1. Manufacturers:

2.5.1.1. Dwyer (as standard).

2.5.1.2. Trerice.

2.5.1.3. Weiss.

2.5.1.4. Other as DEPR / OMEP / PBA Engineer approval

2.5.2. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case. Furnish vent valves, black figures on white background, front calibration adjustment, range 0-3.0 inch WG 2 percent of full scale accuracy.

2.5.3. Accessories: Static pressure tips with integral compression fittings, 1/4 inch plastic tubing, 2-way or 3-way vent valves.

2.6. ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS

2.6.1. See section 23 05 66 for details

2.7. BIPOLAR IONIZATION

2.7.1. Manufacturers

2.7.1.1. Plasma Air International.

2.7.1.2. Aerisa.

2.7.1.3. AtmosAir.

2.7.2. Performance Criteria

2.7.2.1. Effectively inactivating microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).

2.7.2.2. The bipolar ionization system shall be capable of controlling gas phase contaminants generated from human occupants as well as products of combustion of jet fuel.

2.7.2.3. Capable of reducing static space charges.

2.7.2.4. Capable of reducing common VOCs encountered in buildings.

2.7.2.5. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.

2.7.2.6. Equipment shall be capable of performing in non-condensing atmospheres at temperatures up to 140 degrees F.

2.7.2.7. Reducing space particle counts.

2.7.2.8. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.

2.7.3. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.

2.7.4. Airflow rates may vary through the full operating range of a VAV system. The quantity of air exchange shall not be increased due to the air purification system requirements.

2.7.5. Velocity Profile: The air purification device shall not have a maximum velocity profile.

2.7.6. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions to the air purification system.

2.7.7. Provide 1-year warranty.

2.7.8. Equipment Requirements

2.7.8.1. The bipolar ionization units shall include all power supplies, ion generating tubes, gaskets, indicators, switches, fuses, and accessories necessary for safe and efficient operation.

2.7.8.2. All duct mounted applications shall include a mounting frame permanently attached to the duct. Ionization units shall be attached to the mounting frame.

2.7.8.3. Ionization Tubes shall be UL or ETL listed and bear the UL or ETL mark and have a useful life of 17,000 hours before replacement is required.

2.7.8.4. The manufacturer shall provide ionization tubes of appropriate size and quantity for each air handling system to meet the requirements for the system.

2.7.8.5. All exposed metallic parts of ionization tubes shall be stainless steel.

2.7.8.6. Ionization units shall be suitable for duct mounting or air handling unit plenum

mounting.

2.7.8.7. Ionization units shall be plenum rated per UL 2043.

2.7.8.8. Ionization unit output shall be user adjustable from approximately 50-100%. There shall be a minimum of five levels of adjustment.

2.7.8.9. An integral differential pressure switch shall be provided on duct mounted one-and two- tube units. Additional controls such as field mounted pressure switches or control relays shall be included as part of the ionization equipment scope.

2.7.9. Electrode Specifications (Bi-polar Ionization):

a) Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.

b) Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.

c) Ionization output when tested in the occupied space shall be a minimum of 800 to 1500 negative ions/cm3.

d) Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum.

e) Tube type ionizers shall not be accepted.

2.7.10. Installation Requirements

2.7.10.1. Ionization units shall be installed per manufacturer's installation instructions.

2.7.11. Electrical Requirements

2.7.11.1. The electrical power wiring to the ionization units shall be detached without the use of tools to facilitate servicing of the equipment.

2.7.11.2. Ionization units shall be available for 120 and 240 volt applications.

2.7.11.3. The maximum power required for multi tube ionization units shall be 50 watts.

2.7.11.4. The electrical contractor shall provide shall a junction box with single outlet within 4 feet of the ionization equipment.

PART 3. EXECUTION

3.1. INSTALLATION

3.1.1. Install filters with felt, rubber, or neoprene gaskets to prevent passage of unfiltered air around filters.

3.1.2. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.

3.1.3. Do not operate fan system until temporary filters are in place. Replace temporary filters used during construction and testing, with clean set.

3.1.4. Install filter gages on filter banks with separate static pressure tips upstream and downstream of filters.

3.1.5. Install filters in accordance with manufacturer's recommendations.

3.2. TRAINING

3.2.1. Provide minimum of 12 hours of classroom and hands on training to DEPR / OMEP / PBA staff.

END OF SECTION 23 40 00

SECTION 23 75 16
PACKAGED ROOFTOP COOLING UNITS

PART 1. GENERAL:

1.1. SUMMARY:

1.1.1. Section Includes:

a) This section provides the requirements for Package rooftop unit and related equipment and materials to be installed at **Instituto Tecnológico de Ponce**.

b) Provide and replace package rooftop units, conforming all aspects to the specifications, schedules and plans or drawings.

c) Furnish and install any accessories required by Package rooftop unit operation as recommended by manufacturer or distributors and not specific in drawings. Check with Engineer for approval.

d) Additional accessories include:

Roof curb adapter (if necessary)

Duct works for proper connection between new supply and return and existing duct (transition).

Smoke detectors

Balancing damper

Main control system

e) Provide and replace main control center in accordance with Package rooftop unit starting sequence.

f) Removing the existing Package rooftop unit as indicated by Engineer or DEPR / OMEP / PBA representative.

g) Testing, adjusting, balancing and HVAC system cleaning works.

h) Final disposition of removing equipment and material conforming any law of local and federal agencies (OSHA, EPA, PREQB, other).

1.2. RELATED WORK:

A. SECTION 01 11 00 - SUMMARY OF WORK

B. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

C. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

D. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

E. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

F. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

G. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

H. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

I. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

J. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

K. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

L. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

M. SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. REFERENCES (RELATED STANDARDS):

1.3.1. ARI- Air Conditioning and Refrigeration Institute

a) ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

b) ARI 270 - Sound Rating of Outdoor Unitary Equipment.

c) ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

1.3.2. ASHRAE- American Society of Heating, Refrigeration and Air conditioning Engineers

a) ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

b) ASHRAE 15- Refrigeration system safety.

c) ASHRAE 33 - Methods of testing cooling and heating coils.

d) ASHRAE 62.1, Section 5 - Systems and Equipment and Section 7 - Construction and Startup

1.3.3. ASTM- American society for Testing Materials

1.3.4. NFPA- National Fire Protection Association

a) NFPA 70 - National Electrical Code (NEC).

b) NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

1.3.5. NEMA- National Electric Manufacturers Association

1.3.6. UL- United Laboratories

a) UL 1995 - Heating and Cooling Equipment

1.3.7. OSHA- Office of Safety and Health Act

1.3.8. EPA- Environmental Protection Agency

1.4. SUBMITTALS:

1.4.1. Submit three (3) copies of data for Package roof top units.

1.4.2. Submittal shall include manufacturer data:

a) Package unit capacities, weight, accessories, electrical requirements, and wiring diagrams.

b) Manufacturer drawing showing component layout, piping configuration, connection size, overall dimension, and field clearances.

c) Psychometric chart and performance data at design temperatures and thermal loads (table and graphic).

d) Fan performance curves.

e) Data of filter media, filter performance, filter assembly and frames.

f) Installation recommendations.

g) Complete description of controls with sequencing data and wiring diagrams.

1.4.3. After Package roof top unit submittal approval send four (4) copies of:

a) Operation manuals.

b) Maintenance manuals, including troubleshooting.

c) Parts manual with exploded part list for each Package roof top unit.

d) Recommended list of spare parts.

1.5. QUALITY ASSURANCE:

1.5.1. Qualifications:

a) Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project

b) Kickoff Meetings: Conduct kickoff meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5.2. DELIVERY, STORAGE, AND HANDLING:

a) Inspect Package roof top unit delivered to site for damages

b) Store with minimum handling and comply with manufacturer's instruction for rigging, loading-unloading and transportation.

c) Store and protect as indicated by manufacturer against weather or vandalism.

d) Do not store Package roof top unit directly on ground.

e) Keep materials and equipment free of debris and dirt.

1.6. COORDINATION:

a) Coordinate layout and installation of units with school or building staff.

b) Coordinate Package roof top unit installation with others contractor as electrical contractor, roofing contractor, HVAC cleaning contractor, Balancing contractor and/or architectural and engineering firm consultants.

c) Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.7. WARRANTY

A. Provide 1-year unconditional labor and parts warranty on any component of the units.

B. Provide 5 years unconditional parts warranty on compressor units.

C. Submit warranty documentation and certification after start-up.

PART 2. PRODUCTS:

2.1. PACKAGE ROOFTOP UNITS - GENERAL

a) Furnish and install where shown and scheduled on the plans, packaged rooftop units with design features as indicated within this specification. The units shall be provided and installed in strict accordance with the specifications and codes and standards.

b) All units shall be complete with all components and accessories as specified. Any exceptions must be clearly defined. The contractor shall be responsible for any additional expenses that may occur due to any exception made.

c) The Contractor shall be responsible for all modifications required to existing systems due to use of equipment by alternate manufacturer.

d) Package rooftop unit (PRTU) shall be drawn thru type.

e) PRTU shall be single-zone purpose.

f) PRTU shall to complaint with ARI- 340/360 or latest edition.

g) Vibration isolation shall be supply at each fan-motor supports. Spring type is recommended.

h) Package rooftop unit (PRTU) shall use R-410a refrigerant type.

2.1.2. Components:

a) Casing

b) Fans

c) Compressor

d) Evaporator Cooling coils

e) Condenser coils

f) Condenser fan and motors

g) Dampers

h) Fresh air intake

i) Bearing and Drives

j) Filters

k) Anti-Microbial Ultraviolet Light Emitters (aka UVC light)

l) Electric motors

m) Others

2.1.3. Capacities:

a) Supply CFM shall be as indicated in drawings schedules (AC B-4 / Page 196).

b) Cooling coil capacity shall be as indicated in drawing schedules (AC B-4 / Page 196).

c) External static pressure shall be as indicated in drawing schedules (AC B-4 / Page 196).

d) Fresh air quantity shall be indicated in drawing schedules.

e) Package roof top unit shall be capable to supply air equal or below to 57 ^{o}F db at rated conditions.

f) Package rooftop unit shall be rated to 95 ^{o}F condenser ambient temperature (**No exception**).

g) Package roof top unit shall have an 13 EER (energy efficiency ratio) or better.

2.1.4. Acceptable manufacturers are (in alphabetic order):

a) Allied

b) Carrier

c) Daikin-McQuay

d) Johnson Control (York)

e) Lennox

f) Trane

g) Other as Engineer approval.

2.2. COMPONENTS:

2.2.1. Casing:

a) Interior casing will be 18 ga. thickness and G-90 Galvanized steel

b) External casing shall be fabricated of galvanized steel. Gauge 18 or better.

c) External casing shall be fabricated with removable panels and mechanical fastened.

d) Sections shall be assembled with compression gaskets between each frame member.

e) Casing leaks shall be no more than 0.5 CFM / ft^2 of exposed cabinet area.

f) Casing panels shall withstand a positive or negative 4 in wg of static pressure without visible deflection.

g) Casing shall be **double wall type**. If double wall is not available 2" close cell insulation with aluminum cover liner is acceptable. Plastic it's not acceptable for lining purpose.

h) Provide access door of galvanized steel and flush mounted. Access door shall be gasketed and easy to remove. Hinged door.

i) Provide drain pan under cooling coil section and internally sloped. Drain pan shall be of **304 stainless steel**. Condensate connection shall be 1" minimum.

j) Full perimeter heavy gauge galvanized steel base rail

k) Rigging holes on all four corners

2.2.2. Fans:

a) Fans shall be backward inclined.

b) As possible the fan-motor assembly will be direct drive.

c) Manufacturer shall dynamically balance fan assembly.

d) Fan and motor shall be internally mounted in a steel base with mechanism for vibration absorption.

e) Manufacturer shall certificate that fan rpm area under critical speed.

f) Fan speed shall not be more than 1,800 RPM, consult Engineer to other speeds.

g) Face velocity shall be less than 400 ft/min.

2.2.3. Compressors:

a) Compressor will be Scroll type.

b) Resiliently mounted on rubber mounts for vibration isolation

c) Overload Protected

d) Internal excessive current and temperature protection

e) Isolated from condenser and evaporator fan air streams

f) Refrigerant cooled

g) Crankcase heaters

h) High-capacity filter/driers

i) High pressure switches

j) Low pressure switches

2.2.4. Evaporator Cooling Coils:

a) Evaporator cooling coil will be furnished with balanced port thermal expansion valves, low pressure protection on each compressor circuit, pressure and leak tested to 500 psi.

b) Evaporator cooling coil will be Al-Cu construction. Aluminum fins mechanically bonded to copper tubes.

c) Provide access (**DOORS**) to evaporator cooling coil at both sides of Package roof top unit.

d) Evaporator cooling coil fins shall have a minimum thickness of 0.0075 inches.

e) Evaporator cooling coils, tubes shall be seamless copper with nominal wall thickness of 0.025 inches.

f) Evaporator cooling coil assemblies shall be removable through access panels.

g) Evaporator cooling coil shall be direct expansion design.

2.2.5. Condenser coil:

a) Condenser coil will be Al-Cu construction. Aluminum fins mechanically bonded to copper tubes.

b) Condenser coil will be copper tube construction**. Micro-channel condenser coil is NOT ACCEPTABLE.**

c) Condenser coils are high pressure leak tested at manufacturing facility

d) Condenser coil fins shall have a minimum thickness of 0.0075 inches.

e) Condenser coils, tubes shall be seamless copper with nominal wall thickness of 0.025 inches.

f) Condenser coils shall have corrosion protective coating. **Red Oxide treatment is not acceptable.** Corrosion protective coating shall be for **severe marine environment purpose**.

2.2.6. Condenser fan and motors:

a) Condenser fans shall be direct drive motors.

b) Condenser fans shall be propeller type.

c) Condenser fans shall include a heavy-duty safety guard.

d) Condenser fans motors shall be totally enclosed (TEFC).

2.2.7. Dampers (fresh air and return):

a) Dampers blades shall be of galvanized steel.

b) Dampers blades rods and connectors shall be galvanized steel or stainless steel.

c) Damper blades shall rotate 90º and required one actuator.

2.2.8. Fresh air intake:

a) Provide fresh air intake, manually operate to supply the required CFM as indicated in drawings and schedules.

b) Provide mesh grill to prevent entry of insects or rodents

2.2.9. Bearings and Drives:

a) Since the specified motor and fan are direct connected, belt drive mechanisms are not accepted.

2.2.10. Filter section:

a) Filter section with side loading frames and clips.

b) Filters shall be UL 900 listed

c) The filter will be MERV 13. Check with DEPR / OMEP / PBA or an authorized representative, if washable / reusable air filters are available in combination with MERV 13 disposable filters.

d) Manufacturer shall install differential pressure meter to read pressure drop across filter banks.

2.2.11. Anti-Microbial Ultraviolet Light Emitters (aka UVC light)

a) Refer to Section 23 05 66 for details

2.2.12. Electric motors:

a) Electric motor shall be 460 V, 3 Ø, 60 Hz (contractor have to make a field voltage check before ordering,(**MEANS DOUBLE CHECK**).

b) Electric motor shall be total enclosed fan cooled (TEFC) type.

c) Service factor for electric motor shall be 1.2.

d) Provide factory mounted disconnected switch.

2.2.13. Unit Operating Controls and Local Control System:

a) Provide microprocessor control system with the same starting sequence configuration that existing.

b) Provide low-voltage, adjustable thermostat to control compressor and condenser fan, and supply fan to maintain temperature setting.

- Include system selector switch ON-COOL-OFF and fan control switch (ON-AUTO).
- Provide thermostat controller for the stages required to proper control of roof top unit.
- Locate temperature sensing element (if required) on air return duct, next of exit of room routing thru top roof package unit.

c) 7 days, 24 hours programming capacity.

d) Touch screen configuration capability. Large display with backlight.

e) Temperature control of +/- 1ºF of cooling range.

f) Provide 1 year warranty.

2.2.14. Others:

2.2.14.1. Equipment or materials included in this section are:

a) Use PVC (copper type L DWV is acceptable) for drain and discharge to nearest roof drain.

b) Roof Curb. Roof curb shall be 14” high, full perimeter curb with wood nailer (if necessary).

PART 3. EXECUTION

3.1. WORK PREPARATION:

a) Contractor shall remove the existing Package roof top units.

b) Removing include electrical connection and plumbing connections not necessary for futures works or new equipment. Consult Engineer or PBA representative for complete scope of removing scope.

c) Final disposition of removed equipment and material shall in accordance with Puerto Rico environmental standards and regulations, and EPA.

d) Contractor shall coordinate any work with PBA representative or Engineer.

e) Contractor shall coordinate any work to be executing out of regular offices hours as required by Engineer or PBA representative.

f) Contractor shall be responsible by all necessary permissions and taxes in the transportation from distributor or fabrication facilities to installation site.

g) Contractor shall be responsible for handling and disposal of any kind of hazardous material find it in the pre-bid visit or in the installation process. Contractor must pay attention and disposal to any phaseout refrigerants as R-22.

3.2. INSTALLATION:

a) Install Package rooftop unit according to the manufacturer instructions and recommendations.

b) Package rooftop unit shall be located as indicated in drawings or existing site.

c) Package rooftop unit shall be supported according with manufacturer instruction.

d) If Package rooftop units do not fit (match) the existing supply and return duct the contractor shall be responsible for the replacement of the existing roof curb. The replacement of the roof curb includes:

- Repair of the roofing system around the new roof curb up to 3 ft from the border.
- Modifications to the supply and return duct to fit (match) the new package rooftop unit.
- Do not increase the existing Package rooftop unit high.

e) Contractor shall paint pipes and equipment as indicated by Engineer.

f) Air duct shall be insulated with white top termination.

g) Any water line for firefighting purpose shall be safety red (if used).

h) Rigging of Package roof top unit shall be according to manufacturer's instruction and recommendation.

i) Rigging and lifting of any equipment of material shall be according to OSHA standards and regulations.

3.3. FIELD QUALITY CONTROL

3.3.1. Manufacturer's Field Service:

3.3.1.1. If more than 2 units are installed, then engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

3.3.2. Tests and Inspections:

a) Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

b) Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

c) Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3.2.2. Remove and replace malfunctioning units and retest as specified above.

3.3.2.3. Prepare test and inspection reports.

3.3.2.4. Proceed with Test, adjusting and balancing works as indicated in section 23 05 93 and just after HVAC cleaning.

a) Use the Associated Air Balance Council (AABC) standards (last edition) for balancing works.

b) Balancing and adjustment shall be within 5% of design parameters.

c) Balancing works are limited to air side and readings shall be taken next of transitions of new duct and existing ones.

3.3.2.5. Complete commissioning pre-functional testing and functional testing as part of this work.

3.3.2.6. After starting and performance test, change filters.

3.4. START-UP:

a) Service factory trained representative (engineer or technician) shall be available on site for start-up of Package rooftop unit.

b) Factory start-up services shall be provided for as long a time as is necessary to provide proper operation of units.

c) Package roof top unit shall be factory charged with the specified refrigerant and oil.

d) The factory representative shall train at least four (4) employees of PBA in the operation, maintenance and troubleshooting of Package roof top unit.

e) Contractor shall submit four (4) maintenance and operation manual to PBA representative or Engineer.

3.5. ADJUSTING

a) Condensing units shall perform at cooling capacities and efficiencies as indicate in drawing or plans.

b) The cooling capacity tolerance shall not be less than 95% of published ratings.

c) See section 23 05 93 for more details regarding adjusting procedures and methods.

3.6. CLEANING

a) Parts recovery - Contractor shall coordinate with PBA staff to remove from facilities any parts useful to other equipment or spare. Parts include compressors, motors, controls, others.

b)

3.7. CLOSEOUT ACTIVITIES:

3.7.1. Demonstration:

a) Contractor shall perform the standard run test under the supervision of Engineer or PBA representative. Data of test shall be certified and submitted to Engineer.

b) Contractor shall submit four (4) copies of certificate results of balancing test and adjustment by third party contractor.

c) Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

3.7.2. Demonstration Training

a) Schedule training with DEPR / OMEP / PBA, provide at least 7-day prior notice to Engineer Engage a factory-authorized service representative to train Owner's maintenance personnel.

b) Train DEPR / OMEP / PBA maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

3.8. MAINTENANCE

a) Submit to PBA representative or Engineer three (3) sets of maintenance and operation manuals

b) Review data in the maintenance manuals.

c) Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals.

END OF SECTION 23 75 16

SECTION 23 81 26.13

SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

PART 1 - GENERAL

1.1. SUMMARY:

1.1.1. Section Includes:

a) This section provides the general requirements for Mini-Split/Duct Free units to be installed at the **Instituto Tecnológico de Ponce**.

b) Split-System Air-Conditioning Units 5 Tons and Less

c) Furnish and install mini-splits/duct free systems units and related products as indicated in products section and / or shop drawings.

1.2. RELATED SECTIONS:

1.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.7. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.8. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.9. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.10. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

1.2.11. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.12. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.2.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES

1.3. REFERENCES (RELATED STANDARDS):

1.3.1. Air-Conditioning, Heating and Refrigeration Institute (AHRI) Publications:

210/240 “Unitary Air-Conditioning and Air-Source Heat Pump”

410 “Forced-Circulation Air-Cooling and Air-Heating Coils”

1060 "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Heat Equipment"

1.3.2. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Publications:

15 "Safety Code for Mechanical Refrigeration”

62.1 “Ventilation for Acceptable Indoor Air Quality (ANSI Approved)”

90.1 “Energy Code for Commercial and High-Rise Residential Buildings”

1.3.3. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)

B117 "Standard Practice for Operating Salt Spray (Fog) Apparatus"

1.3.4. National Fire Protection Association (NFPA) Publications:

ANSI/NFPA 70, “National Electrical Code”

1.3.5. OSHA Standards

1.4. SUBMITTALS:

1.4.1. Product Data:

a) Submit three copies (3) of product data including manufacturer's technical product data, rated capacities of selected model, clearly indicating dimensions, weights (shipping, installed, and operating), required clearances, furnished specialties and accessories; and installation and start-up instructions.

b) Submit three (3) set of operation and maintenance data and parts list for each MSDF kind unit, controls, and accessories; "trouble-shooting" maintenance guide; plus servicing, and preventative maintenance schedule and procedures.

c) Submit wiring diagrams for power and control wiring required for final installation of MSDF units and controls. Make clear differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.5. QUALITY ASSURANCE:

1.5.1. AHRI Certification: Units and their components shall be factory tested according to the applicable portions of AHRI 1060, " Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Heat Equipment," and AHRI 410, "Forced Circulation Air-Cooling and Air-Heating Coils," and shall be listed and bear the label of the Air-Conditioning, Heating and Refrigeration Institute (AHRI)."

1.5.2. UL and NEMA Compliance: Provide motors required as part of air-handling units that are listed and labeled by UL and comply with applicable NEMA standards.

1.5.3. Comply with NFPA 70 for components and installation.

1.5.4. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

a) The Terms "Listed" and "Labeled": As defined in the NFPA National Electrical Code, Article 100.

1.5.5. Comply with ASHRAE/IESNA Standard 62.1-2004, Section 7 – "Construction and Startup

1.6. DELIVERY, STORAGE, AND HANDLING

a) Deliver units as factory-assembled units with protective crating and covering.

b) Coordinate delivery of units in sufficient time to allow movement into building.

c) Handle roof mounted units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

1.7. COORDINATION

a) Coordinate layout and installation of units and wall or ceiling construction, where unit penetrates wall or ceiling, or is supported by it.

b) Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.8. WARRANTY

a) General Warranty: The manufacturer shall warrant all equipment for a period of one (1) year from date of substantial completion. Extended warranty specified in this Article shall not deprive Owner of other rights Owner 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 of the Contract Documents.

b) One-year parts, 5-year compressor limited warranty

c) Extended Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.

Extended Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.

1.9. .

PART 2 - PRODUCTS

2.1. SYSTEM

2.1.1. System description:

a) Outdoor-mounted, air-cooled split system. Outdoor section suitable for on the ground, rooftop, balcony, or under-deck installation. Unit shall consist of a scroll compressor, an air-cooled coil, propeller-type draw-through

outdoor fan, full refrigerant charge, and control box. Unit shall discharge air horizontally. Units shall function as the outdoor component of an air-to-air cooling system.

b) Indoor direct expansion fan coil that can be, console or under-ceiling mounted. Fan coil shall be shipped complete with heat exchanger coil, fan, fan motor, piping connectors, electrical controls, infrared remote-control system, expansion valve, thermostat and wall, or ceiling mounting brackets. Fan shall be centrifugal blower type with air intake in the bottom of the unit and discharge in the front.

2.1.2. Acceptable manufacturers:

a) Air-Con

b) Carrier- A United Technology Company

c) Daikin-McQuay

d) Fedders Corporation

e) Hitachi Corporation

f) Lennox Industries

g) Life's Good (LG)

h) TGM

i) Trane Co.

j) Mitsubishi Electric-HVAC Division

k) Samsung Electronics America- HVAC Division

l) York International Corporation

m) Other equal as specifications

2.2. INDOOR UNIT (Evaporator):

2.2.1. General:

2.2.1.1. Direct expansion, ceiling-suspended fan coil. Fan coil shall be shipped complete with cooling coil, fan, fan motor, piping connectors, electrical controls, expansion valve, solid-state - electromechanical control system, and ceiling mounting brackets.

2.2.1.2. Components:

a) Unit Cabinet:

b) Fans:

c) Cooling coils

d) Expansion valve

e) Motors

f) Controls

g) Filters

2.2.2. Unit Cabinet:

a) Cabinet shall be zinc-coated bonderized steel finished with a baked enamel paint.

b) Inlet grilles shall be attractively styled, high-impact polystyrene. Matching mounting brackets shall be provided.

2.2.3. Fans:

a) Fan shall be centrifugal blower type with air intake in the bottom rear of the unit and discharge in the front.

b) Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

c) Automatic, motor-driven vertical air sweep shall be provided standard.

2.2.4. Cooling coils:

a) Coils shall be copper tube with aluminum fins and galvanized steel tube sheets.

b) Fins shall be bonded to the tubes by mechanical expansion.

c) A drip pan under the coil shall have a drain connection for hose attachment to remove condensate.

d) Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal expansion valve. Comply with AHRI 210/240.

e) Water Coil (when fan coil used with central chilled water system): Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.

2.2.5. Motors:

a) Motors shall be permanently lubricated ball bearing with inherent overload protection.

b) Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

c) Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

2.2.6. Controls:

a) Controls shall consist of a solid-state electromechanical control system which shall control space temperature, determine optimum fan speed.

b) The temperature control range shall be from 65 ^{o}F to 85 ^{o}F.

c) The unit shall have the following functions as a minimum:

An automatic restart after power failure at the same operating conditions as at failure.

Non-programmable thermostat to provide cooling set points and day/nigh setback modes.

Filter status indication after 250 hours of indoor fan operation.

Cooling mode to provide modulating fan speed based on difference between temperature set point and space temperature.

Fan only operation to provide room air circulation when no cooling is required.

A 50-ft indoor to outdoor control connection cable shall be provided with the fan coil unit.

Fan speed control shall be user-selectable: high, medium, low, or automatic operation during all operating modes.

A time delay shall prevent compressor restart in less than 1 or 4 minutes (adjustable)

2.2.7. Filters:

a) Unit shall have filter track with factory-supplied cleanable filters.

2.2.8. Electrical conditions:

a) Unit shall operate on 208 v, 60 Hz power supply as specified on the equipment schedule.

b) Power and control connections shall have terminal block connections.

2.2.9. Capacities:

2.2.9.1. Unit's schedules:

NOMINAL CAPACITY TONS	CAPACITY BTU/HR	CFM	EER	SOUND RATING (db)			
				INDOOR POWER	INDOOR PRESSURE	OUTDOOR POWER	OUTDOOR PRESSURE
1.50	18,000.00	500.00	11.00	57.20	48.90	59.50	51.20
2.00	23,000.00	600.00	11.20	58.20	50.10	63.20	54.90
2.50	30,000.00	840.00	11.00	68.40	60.10	59.50	51.20
3.00	34,000.00	840.00	10.50	68.40	60.10	64.50	56.20
4.00	47,000.00	1,200.00	10.80	67.30	59.00	65.40	57.10
5.00	58,500.00	1,600.00	11.20	70.10	61.80	65.80	57.50

a) Air Entering Condenser 95 ºF (Dry Bulb)

b) Air Entering Evaporator 80 ºF (Dry Bulb)

c) Air Entering Evaporator 67 ºF (Wet Bulb)

2.2.10. Special Features (Field Installed):

2.2.10.1. Internal Condensate Pump:

a) The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. The lift capability of the condensate pump shall be 20 inches. Float control shall be in the condensate sump to shut unit down in case of pump malfunction.

2.2.10.2. Indoor Guard Kit:

a) Kit shall include a guard for the discharge grille to prevent objects from entering the air sweep mechanism.

2.3. OUTDOOR UNIT (Condenser)

2.3.1. General:

2.3.1.1. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, full charge of refrigerant, and special features required prior to field start-up.

2.3.1.2. Components:

a) Unit Cabinet

b) Fan

c) Compressor

d) Coil

e) Refrigeration componets

f) Controls

2.3.2. Unit Cabinet:

a) Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked-enamel finish.

b) Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.

c) Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.

2.3.3. Fans:

a) Outdoor fans shall be direct-drive propeller type and shall discharge air vertically. Fans shall induce air through the outdoor coil.

b) Outdoor fan motors shall be totally enclosed, single-phase motors with class B insulation and permanently lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.

c) Shaft shall have inherent corrosion resistance.

d) Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.

e) Outdoor fan openings shall be equipped with protection grille over fan and coil.

2.3.4. Compressor:

a) Compressor shall be scroll type.

b) Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over temperature and over current. Scroll compressors shall also have high discharge gas temperature protection if required.

c) Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.

d) Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.

2.3.5. Outdoor Coil:

a) Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes, which are cleaned, dehydrated, and sealed.

2.3.6. Refrigeration Components:

2.3.6.1. Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, pressure relief, and a full charge of refrigerant.

2.3.7. Controls:

2.3.7.1. Operating controls shall be factory selected, assembled, and tested. The minimum control functions shall include the following:

a) Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.

b) Automatic restart on power failure.

c) Safety lockout if any outdoor unit safety is open.

d) A time delay control sequence provided through the fan coil board, thermostat, or controller.

e) High-pressure and liquid line low-pressure switches.

f) Liquid line low-pressure switches.

g) Automatic outdoor-fan motor protection.

h) Start capacitor and relay (single-phase units without scroll compressors).

2.3.7.2. Safeties:

a) Operating safeties shall be factory assembled. The minimum safety functions shall include the following:

Compressor motor current and temperature overload protection.

High-pressure relief.

Outdoor fan failure protection.

2.3.8. Electrical conditions:

a) Unit electrical power shall be a single point connection.

b) All power and control wiring must be installed per NEC and all local building codes.

c) High and low voltage shall be terminal block connections.

d) Unit voltage shall be similar to the available building voltage, check before ordering.

PART 3 - EXECUTION

3.1. WORK PREPARATION

a) Contractor shall coordinate any work with PBA representative or Engineer.

b) Contractor shall verify available voltage and current rating before ordering any equipment (**means double check**).

c) Contractor shall coordinate any work to be executing out of regular offices hours.

d) Contractor shall be responsible by all necessary permissions and taxes in the transportation from distributor or fabrication facilities to installation site.

e) Contractor shall inspect the site for details prior to installation.

3.2. INSTALLATION

a) Install MSDF units in accordance with manufacturers installation instructions.

b) Install units plumb and level, firmly anchored in locations indicated in drawings or plans.

c) Contractor shall install vibration pads or isolators as indicated by manufacturer.

d) Maintain manufacturer's recommended clearances around of MSDF units.

e) Connect refrigerant piping to unit; maintain required access to unit.

f) Install furnished field-mounted accessories.

3.3. FIELD QUALITY CONTROL

3.3.1. Manufacturer's Field Service:

3.3.1.1. If more than 5 units are installed, then engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

3.3.2. Tests and Inspections:

a) Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

b) Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

c) Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.3.2.2. Remove and replace malfunctioning units and retest as specified above.

3.3.2.3. Prepare test and inspection reports.

3.3.2.4. Complete commissioning pre-functional testing and functional testing as part of this work.

3.3.2.5. After starting and performance test, change filters.

3.4. START – UP

3.4.1. Provide services of manufacturer's authorized service engineer or technician to start-up service and to instruct owner's personnel in operation and maintenance of MSDF.

a) The basic operation training includes any personnel of Education Department as Teachers, Director, or Maintenance staff

3.4.2. Start-up MSDF units, in accordance with manufacturer's start-up instructions.

a) Test controls and demonstrate compliance with requirements.

b) Replace damaged or malfunctioning controls and equipment.

3.5. ADJUSTING

a) Condensing units shall perform at cooling capacities and efficiencies as indicate in drawing or plans.

b) The cooling capacity tolerance shall not be less than 95% of published ratings.

3.6. CLEANING

a) Contractor shall coordinate with PBA staff to remove from facilities any parts useful to other equipment or spare. Parts include compressors, motors, controls, others.

b)

3.7. CLOSEOUT ACTIVITIES

3.7.1. Demonstration:

a) Contractor shall perform the standard run test under the supervision of Engineer or PBA representative. Data of test shall be certified and submitted to Engineer.

b) Contractor shall submit four (4) copies of certificate results of balancing test and adjustment by third party contractor.

c) Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

3.7.2. Demonstration Training

a) Schedule training with DEPR / OMEP / PBA, provide at least 7-day prior notice to Engineer Engage a factory-authorized service representative to train Owner's maintenance personnel.

b) Train DEPR / OMEP / PBA maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

3.8. MAINTENANCE

a) Submit to PBA representative or Engineer three (3) sets of maintenance and operation manuals

b) Review data in the maintenance manuals.

c) Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals.

END OF SECTION 23 81 26.13

SECTION 26 29 13.16
REDUCED-VOLTAGE SOLID STATE STARTERS

PART 1 - GENERAL

1.1. SUMMARY:

1.1.1. Section Includes

a) This section provides the requirements for reduced voltage solid state starter (RVSS) and related equipment and materials to be installed at Instituto Tecnológico de Ponce.

b) Furnish and install reduced voltage solid state starter (RVSS), conforming all aspects to the specifications, schedules and plans or drawings.

c) Furnish and install any accessories required by reduced voltage solid state starter (RVSS) operation as recommended by manufacturer or distributors and not specific in drawings. Check with Engineer for approval.

d) This specification describes the performance, functional specifications, and fabrication details for a digital reduced voltage, stepless, solid state motor starter that shall provide a selectable voltage ramp, current limit or torque ramp (all standard) method of soft starting 3-phase AC induction motors.

e) The motor starter shall be self-contained and house the solid-state controller, motor overload protection, an integral bypass contactor and a disconnect means as required on the drawings, in one enclosure.

1.2. RELATED SECTIONS

1.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.7. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.8. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.9. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.10. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

1.2.11. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.12. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.13. SECTION 26 29 23 - VARIABLE SPEED DRIVES.

1.3. SUBMITTALS

1.3.1. Submit shop drawings and product data for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location and customer order number.

1.3.2. Units shall be shipped with a complete set of documentation to include the following items:

a) Complete schematics and wiring diagrams

b) Enclosure outline drawings

c) System instruction manuals

d) Contactor and disconnect system data, if applicable

e) All of the above will be required at the time of approval.

1.3.3. Installation, Operation and Maintenance Data

a) Manufacturer shall provide a copy of installation, operation and maintenance procedures to owner

1.4. RELATED STANDARDS:

1.4.1. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1.4.1.1. NFPA 70 - (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

1.4.2. UNDERWRITERS LABORATORIES (UL)

1.4.2.1. UL 489 - (2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

1.4.2.2. UL 61800-5-1 - (2016) Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy

1.4.2.3. UL 50 – UL Standard for Safety for Enclosures for Electrical Equipment

1.4.2.4. UL 508A – UL Standard for Safety for Industrial Control Panels

1.4.3. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

a) NEMA 250 - (2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

b) NEMA ICS 1 - (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

c) NEMA ICS 3.1 - (2019) Guide for the Application, Handling, Storage, Installation and Maintenance of Medium-Voltage AC Contactors, Controllers and Control Centers

d) NEMA ICS 6 - 1993; R 2016) Industrial Control and Systems: Enclosures

e) NEMA ICS 7 - (2020) Adjustable-Speed Drives

f) NEMA ICS 7.2 - (2015) Application Guide for AC Adjustable Speed Drive Systems

g) NEMA ICS 61800-2 - (2005) Adjustable Speed Electrical Power Drive Systems Part 2: General Requirements - Rating Specifications for Low Voltage Adjustable Frequency A.C. Power Drive Systems

h) NEMA MG 1 - (2018) Motors and Generators

1.5. QUALITY ASSURANCE

1.5.1. Schematic Diagrams

1.5.1.1. Submit diagrams showing circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

1.5.2. Interconnecting Diagrams

1.5.2.1. Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

1.5.3. Standard Products

1.5.3.1. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a) Have been in satisfactory commercial or industrial use for 20 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b) Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 20-year period.

c) Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts

of the item need not be the products of the same manufacturer unless stated in this section.

1.5.4. Manufacturer Qualifications: Engage a firm with at least 20 years of experience in manufacturing motor controllers.

a) All incoming material shall be inspected and/or tested for conformance to quality assurance.

b) Power semiconductors shall be fully tested for proper electrical characteristics (dv/dt, di/dt, etc.).

c) All subassemblies shall be inspected and/or tested for conformance to venders engineering and quality assurance specifications.

d) Printed circuit boards shall be burned in for a minimum of 48 hours at 60°C.

e) The complete unit shall be functionally tested under load before shipment to assure proper operation per specification. Complete test reports shall be available upon request

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Deliver products in factory labeled packages.

1.6.2. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

1.6.3. Contractor shall inspect and report concealed damage to carrier within 48 hours.

1.6.4. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.

1.6.5. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

1.6.6. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in controller and if necessary, apply temporary heat where required to obtain suitable service conditions.

1.7. WARRANTY

1.7.1. The manufacturer warranties the materials and workmanship of the Reduced-Voltage Solid State Starter (RVSS) to be free from defect. The complete system

must be warranted by the manufacturer for a period of one year after start-up or eighteen (18) months after shipment, whichever occurs first. Replace any component failing to perform its function as specified and documented at no additional cost to the Government (DEPR / OMEP / PBA). Items replaced must be warranted for an additional period of at least one year from the date that it becomes functional again.

PART 2 - PRODUCTS

2.1. SYSTEMS / ASSEMBLIES / MANUFACTURED UNITS / EQUIPMENT / COMPONENTS / PRODUCT TYPES / MATERIALS

2.1.1. MANUFACTURERS:

2.1.1.1. Approved manufacturers listed below are allowed on condition of meeting the specified conditions including the available space for the equipment (including Code required working clearances).

a) ABB

b) Allen-Bradley

c) Eaton

d) General Electric

e) Schneider Electric

f) Siemens

g) Square D

h) Toshiba

i) Other as Engineer approval

2.2. DESCRIPTION:

2.2.1. Locations and intended use:

a) Refer to drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.

b) Reduced Voltage Solid State Starter will be located in an existing NEMA 4X combination motor starter controller enclosure. The purpose of upgrading the traditional motor starter to the reduced voltage motor starter is to prevent mechanical damage to belts and / or fans and to provide the most reliable performance of air handling units (AHUs).

c) The soft starter shall be capable of operating a NEMA induction motor driving a fan with a full load current equal to or less than the continuous output current rating of the soft starter.

d) The soft starter will work in combination with an inverter selector, VFD and a central microprocessor ACV system controller.

2.2.2. Design Specifications

2.2.2.1. Power Ratings

a) Input: 200 – 460V ±15%, 3 phase, 60Hz ± 10%. Unit(s) will operate with any incoming phase sequence.

b) Output: Reduced voltage 3 phase AC derived from phase-angle and, ramped to full voltage.

c) Current Rating(s): Shall be, at a minimum, capable of the motor Full Load Amps for the Horsepower(s) indicated on the drawings, including any Service Factors.

d) Current ratings of starter chassis must be based on manufacturer's data showing they were tested at 50°C (122 oF). Units with current ratings tested at 40°C (104 oF) will be sufficiently oversized to match this requirement and prospective alternate bidders will provide proof of this over sizing prior to receiving approval to bid.

e) Output Overload Capacity: Shall be as follows, based upon motors indicated on the drawings and specified elsewhere.

- For units used on motors where Class 10 overload protection is required, the soft starter shall be callable of delivering 550% of the motor FLA for 10 seconds.
- For units used on motors where Class 20 overload is required, the soft starter shall be capable 500% of motor FLA for 20 seconds
- If the motor is capable of Class 30 protection, the soft starter shall be capable of delivering 550% current for 30 seconds.

f) Continuous duty rating shall be for the motor FLA plus + 15%.

g) Lighter duty rated starters are not acceptable

h) SCCR (Short Circuit Current Rating) Listing: Combination starter units shall be UL listed to withstand the Available Fault Current of the system as indicated on the drawings or as determined prior to installation. For retrofit applications, both the soft starter and circuit breaker shall be supplied so that the SCCR rating of the combination is capable of withstanding the Available Fault Current. SCCR ratings in combination with the Circuit Breaker shall be published and supplied by the manufacturer with submittals.

i) Control Power: 120VAC, 60Hz provided by a Control Power Transformer with primary and secondary fusing, adequate to operate all associated devices in each starter.

2.2.2.2. Power Current Switching Devices (SCRs)

a) PIV Ratings: Minimum 2.5 times nominal line voltage.

b) Protection: RC snubber network circuits on each phase assembly and MOV protective devices on the gate circuits.

c) Efficiency: 98.5% through SCRs, 99.97% when bypass is engaged.

2.2.2.3. Bypass Contactor: All units shall have an integral Bypass Contactor to shunt motor power around the SCRs when at full speed. The soft starter shall include all necessary control circuitry to accomplish this without the need for external timers and engage the Bypass Contactor only when the microprocessor has determined that the motor has reached speed.

a) Overload Protection shall be integral and continuous so that it is in the motor circuit at all times, even when the Bypass Contactor is engaged.

b) Decel Interlocking shall be integral to allow the soft starter to automatically disengage the Bypass Contactor when a Decel command is given.

c) Units which use external Bypass Contactors will be considered but shall still meet the all of the above control and protection conditions. They shall also meet the SCCR ratings as required above.

2.2.2.4. Ambient Conditions

a) Temperature: As a standard of unit design quality, starter shall be documented to show that the open chassis design has been tested for 0 – 50° C (-32 to 122° F) operation. Enclosed units shall be designed for 0 – 40° C ambient unless indicated elsewhere. Perform temperature test before submittal.

b) Humidity: 0 – 95% RH, non-condensing.

2.2.3. Product Features

2.2.3.1. Solid state reduced voltage motor starters shall be selected based on electric motor horsepower (Hp) and FLA electric motor and 140ºF ambient temperature, or pre-approved equal modified to meet the requirements of this specification. The starter shall be complete with the following standard features and adjustments.

2.2.3.2. Acceleration Control shall be fully adjustable in programming to match any application, but in specific: fans. As a minimum, starter shall come complete with the following settings:

a) Ramp Type: To ensure maximum flexibility in matching any unforeseen load conditions in the field, the starter shall provide all of the following methods of closed loop acceleration ramp control: Voltage Ramp, Current Limit Only (Current Step) or Closed Loop Torque. In addition, the soft

starter shall be capable of being programmed to start the motor Across-the-Line for testing purposes. To avoid problems in commissioning once the field application conditions are known, any starter that has limited ramp choices will not be acceptable.

b) Starting Torque: Initial torque output shall be programmable as either Voltage or Torque output depending on the selected ramp profile, and adjustable between 50-200% of motor Full Load Torque.

c) Maximum Current Limit: To ensure acceptability to power conditions and reliability of starting under any circumstance that the motor can function in, a Current Limit function shall be available in all starting ramp modes, adjustable between 150 and 550% of the unit rating. Starters which do not provide Current Limit in all starting modes will not be acceptable.

d) Ramp Time: The time between Initial Torque and Full Output shall adjustable between 1 and 360 seconds.

e) Kick Start: To provide for starting of difficult loads, the starter shall include a Breakaway Pulse (Kick Start) feature that will apply a high output for a short time on initial start command. The Kick Start voltage level shall be adjustable from 40 – 100% voltage, for 0.1-2 seconds max.

f) Motor heating function that will maintain motor above dew point when a run signal is not applied. Functions by passing a small amount of DC current through the motor windings on motors which include a thermistor or PTC temperature device.

g) Slow Speed Jog: For checking rotation at start-up or other testing procedures, the starter shall provide a programmable Slow Speed Jog feature, initiated by the Operator Interface or via input. The Slow Speed Jog output shall be programmable as a percentage of the base motor speed, not exceeding 21%.

2.2.3.3. Deceleration Control (Controlled Ramp Down): To facilitate the controlled deceleration of pumps and other loads, Decel Torque Control and/or Pump Control shall be built in and selectable with the following adjustments, all of which are independent of any Acceleration Ramp settings:

a) Deceleration Ramp Time: adjustable from 0 – 360 seconds to allow gentle controlled deceleration in excess of the natural coast-to-stop time of the load.

b) Stop Torque Level, adjustable from 10-100% to automatically turn off the starter when the output torque has reached a desired level, i.e. when a check valve has closed.

2.2.3.4. Selectable Ramp Profiles: To accommodate changeable conditions, the starter shall provide 3 separately adjustable ramp profiles, selectable via a dry contact closure. Each ramp will provide all of the above features.

2.2.3.5. Motor and Load Protection shall be integral to the starter assembly. All current referenced protection features shall be automatically calculated from

the motor nameplate FLA as entered by the user. All time based protection features shall have retentive memory so that they remain active should the power fail and be restored. Starter shall provide the following functions:

a) Thermal Overload shall be provided by the on-board microprocessor control based on inverse time-current trip curves as defined by NEMA trip curve Classes. The trip curves classes shall be programmable from between Class 5 and Class 30 and the starter shall be UL listed to provide each individual class. As the most important protection feature of a starter, the overload protection shall be based on a Motor Thermal Model retained in memory and provide the following features:

- Retentive Thermal Memory shall be used to ensure that the overload protection does not loose track of motor temperature after the power is lost or shut down. Upon reapplication of power, the microprocessor shall be updated as to the motor thermal state. This feature shall be capable of being over ridden for emergency re-start applications.
- Manual or Automatic Reset shall be selectable in programming to provide for automatic reset in unattended remote applications.
- Thermistor Input shall be provided in case the motor or equipment arrives with integral Thermistors to monitor temperature. The Thermistor input shall provide for a motor thermal temperature monitoring that will bias the Motor Thermal Model mentioned above based on actual motor temperature.
    - ❖ The Thermistor monitoring circuit shall detect broken or shorted field devices or wiring.
    - ❖ Units without this feature shall provide external Thermistor Protection Relays if necessary and provide a way for the soft starter to display a Thermistor Trip independently of a Motor Overload trip.

b) Phase-Loss Protection shall be standard and shut down the starter if current through any leg drops to 20% of the programmed motor FLA or less, independent of line voltage levels.

- For purposes of testing with smaller motors, each starter shall be capable of having the motor FLA adjusted down to 20% of the unit Max Amp rating so that this feature will not trip if a load less than 20% of that setting is connected (i.e. 4% of unit max. rating).

c) Phase Current Imbalance shall be used to bias the Motor Thermal Model so that the tripping curve reflects the additional motor heating caused by the imbalance.

- The “Pick-up Point” of this feature shall be programmable or able to be defeated so that nuisance tripping can be avoided.

d) Ground Fault Protection shall be included which will prevent a start-up if any phase is connected to Ground or trip while running.

e) Over Current / Shear Pin Protection shall be provided. This Over Current trip shall be adjustable at lower levels than the Thermal Overload protection for the purpose of protecting mechanical components from undue shock when rapid unexpected load changes occur.

- Adjustment level shall be from 50% to 150% of the programmed motor FLA

f) Under Current / Load Loss Protection shall shut down the starter on an adjustable Under Current condition. This shall be programmable as follows:

- Adjustment level shall be from 19% to 100% of the programmed motor FLA

g) Multiple motors (2) shall be capable of being accommodated in case the soft starter is temporarily connected to a spare motor where the motor protection parameters differ, and the primary motor will be used again. Selection between the motor profiles shall be via the Operator Interface or communications port.

h) Over and Under Voltage Protection will cause a trip if the voltage dips or surges beyond the unit tolerance limits for both the line voltage and the control voltage, differentiating the trip cause between the two systems on the Operator Interface Display.

2.2.3.6. Starter Protection shall be provided to maintain reliability of both the equipment and the circuit components, with the following features:

a) Shorted SCR / Welded Contactor Detection shall be standard. This function must automatically prevent the next start when at least one SCR is shorted or the Bypass Contactor is welded.

b) Starter Overtemp Trip shall be built-in and protect the SCRs from excessive heat build-up in the heat sink. This function shall also detect a broken wire or defective sensor.

2.2.3.7. Conformal coatings shall be factory applied to all circuit boards and circuit board components that allow and/or benefit from such treatments.

2.2.3.8. Control Location shall be programmable to be any of the following choices: Control (Digital) Inputs, Operator Interface / keypad, PC via serial comm. port., PLC via Profibus or Profinet or Profinet interface or PC via Profibus or Profinet interface. The Operator Interface display shall graphically indicate which control point being used.

a) When remote control via the Profibus or Profinet interface is being used, the ability to override that control point via digital input will be provided for testing or troubleshooting.

2.2.3.9. Input / Output features shall be as follows:

a) Four (4) Inputs shall be provided for the control and option selection of the starter as follows. All input and control devices shall be 24VDC control from a built-in power supply, requiring only dry contact closures. All I/O termination points shall incorporate easily removable terminal blocks to facilitate quick change-out or troubleshooting isolation in the field.

- Input commands shall be programmable for any one of the following functions; Motor Right (Fwd), Motor Left (Rev), Parameter Set 1, 2 or 3, Trip Reset, Quick Stop, Slow Speed, Emergency Restart, and Local Override for allowing local control when using Serial Communications as the control point.

b) Four (4) Output Relays shall be provided; three outputs shall be Form A (SPST), the fourth shall be Form C (SPDT), all rated for 240VAC, 3 Amps max.

- Each relay shall be fully programmable for any one of the following functions: PIO Output 1, PIO Output 2, Input Status (1-4), Run up (Accelerating), Operation/bypass, coasting down, On time motor (Running), Motor-on commanded, DC braking Contactor, Group warning (no trip), Group error (Fault trip), Bus error, Device (starter) error, Power on, Ready to start.

2.2.3.10. Operator Interface panel shall be included which provides simple to use adjustment and status indication on a dead-front shroud of the starter. This panel shall be capable of being remotely mounted up to 10ft (3 meters) away from the starter chassis, such as on the front door of the enclosure.

a) Adjustments shall be made by keypad with tactile feedback keys for high noise environments. No binary coded dipswitches shall be used for programming. Pass code protection shall be available to prevent unauthorized changes to the programming.

b) Graphical User Display shall be backlit LCD for long life and visibility in low contrast environments. Display shall have a minimum of 4 lines of alpha-numeric characters, programmable in 4 languages and capable of displaying all digits in displayed parameter so that operators do not need to calculate current values over 999A.

2.2.3.11. Metering functions shall be provided through the Alpha-Numeric Display for indicating the following;

a) Output Current for each individual phase. Indicating range to be 0.0 – 9999 amps

b) Voltage: Phase-to-phase and Phase-to-ground voltages shall be available for display

c) Frequency, for use in generator operation diagnostics.

d) Motor Thermal Status to indicate heat build-up in the motor. Range shall be 0 – 100% of the motor thermal capacity and count up towards 100% while heating.

e) Elapsed Time shall indicate the number of hours that the starter has been in a Run condition, maximum 100,000 hours.

f) Start Counter, indicating the number of Run commands given.

2.2.3.12. Serial Communications shall be available feature and supplied as required to used and work with other devices (VFD and / or microprocessor control center).

a) Communications protocol shall be similar to VFD and microprocessor center.

b) PC interface and software shall be available either through the local programming port via USB connection, or over the system netwok.

2.2.3.13. Historical Data shall be recorded and displayed, plus made available for communication. It shall be retained in non-volatile memory for viewing by service personnel later.

a) History shall include fault conditions experienced by the starter and peak running details

2.3. MECHANICAL CONSTRUCTION

2.3.1. Enclosure shall contain the digital solid state controller and disconnect means as required, f not possible to install at the existing location.

2.3.1.1. Rating shall be as indicated on the drawings.

a) NEMA 1 enclosed units shall be ventilated, with fan forced cooling where necessary. Cooling fans shall be impedance protected and ball bearing construction for continuous use. Use this alternative for machine room installation.

b) NEMA 3R enclosed units shall be either ventilated or provided with an external enclosure and any necessary cooling accessories as determined by the manufacturer, depending on sizing, to meet the ambient operating conditions as indicated elsewhere.

c) NEMA 4X enclosed units shall be sealed to prevent ingress of contaminants and supplied with any necessary cooling accessories as determined by the manufacturer, to meet the ambient operating conditions as indicated elsewhere. Use this alternative for external installation and near to the AHU.

2.3.2. Power Terminations shall be made on factory supplied mechanical lugs of sufficient size to accommodate the required wire for the line and load. Lugs are to be clearly marked as Line (L1, L2, L3) and Load (T1, T2, T3) and with appropriate tightening torque specifications.

2.3.3. Control Terminations to the soft start main unit shall be on terminal strips that can be removed easily without the need to special tools.

2.4. SPARE PARTS

2.4.1. A recommended spare parts list, and associated pricing, will be supplied with each different solid state reduced voltage starter. The manufacturer will provide representation and local support to the job site. A list of authorized service centers will also be provided upon request.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. The Contractor shall install all equipment in accordance with the contract drawings and manufacturers recommendations and manuals.

3.1.1.1. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.

3.1.1.2. Install fuses in fusible switches.

3.1.1.3. Select and install overload heater elements in motor controllers to match installed motor characteristics.

3.1.1.4. The FLA motor amps shall be input into the starter memory via the keypad

3.1.1.5. Adjust all circuit breakers, switches, access doors and operating handles for free mechanical and electrical operation as described in manufacturer’s instructions.

3.1.1.6. Clean interiors of all enclosed electrical equipment to remove construction debris, dirt, and shipping materials.

3.1.1.7. Repaint scratched or marred exterior surfaces to match original finish.

3.2. ADJUSTMENT AND CLEANING

3.2.1. Start Up Procedures

3.2.1.1. All starters will come with a “Quick Start” feature to allow simple commissioning for general applications so that only minor adjustments are necessary in the field to match specific conditions. Start up procedures shall be intuitive and simple enough so as not to require factory assistance or training. Basic start up shall include entering of motor data and Overload selection, then basic application data such as load type. Additional features will only be activated when necessary.

3.2.2. Adjustments

3.2.2.1. To facilitate ease of initial setup, all necessary adjustments shall be capable of being made without the need for pass codes. Pass code use shall be optional at users discretion. All settings and adjustments shall not require a battery back-up for retention.

3.2.3. Training

3.2.3.1. All necessary training for operator personnel shall be simple enough to be performed by local factory representatives if desired.

3.2.4. Software

3.2.4.1. A software package shall be available for full programming via a PC running under MS Windows OS, connectable via a USB cable to the soft starter. Advanced versions that allow on-line monitoring and programming across the Profibus or Profinet connection shall also be available or supplied if indicated elsewhere.

3.2.5. The Contractor shall perform necessary field adjustments of the equipment to place the equipment in final operating condition. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

3.3. TESTING

3.3.1. Perform factory and installation tests in accordance with applicable NEC, NEMA and UL requirements.

3.4. WARRANTY

3.4.1. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of invoice.

END OF SECTION 26 29 13.16

SECTION 26 29 23

VARIABLE SPEED DRIVES FOR HVAC APPLICATIONS

PART 1. GENERAL

1.1. SUMMARY

1.1.1. Section Includes

a) This section provides the requirements for variable speed drives and related equipment and materials to be installed at Instituto Tecnológico de Ponce.

b) Provide and replace variable speed drives, conforming all aspects to the specifications, schedules and plans or drawings. See schedules VSD-1, VSD-2 and VSD-3.

c) Provide and install any accessories required by variable speed drives operation as recommended by manufacturer or distributors and not specific in drawings. Check with Engineer for approval.

d) This specification provides the requirements for an adjustable frequency drive, herein referred to as drive, factory integrated with branch circuit protection, power circuit components, control components and door mounted operator devices into an enclosure, herein referred to as drive panel, for variable torque fan and pump applications.

e) This section covers ac voltage source, space vector pulse width modulated (PWM) type variable frequency drives for general or high-performance constant or variable torque loads as shown on the project drawings or noted in project motor list.

f) Equipment provided under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer, unless the engineer notes exceptions.

g) Governing Standards. Each variable frequency drive shall be designed, constructed and tested in accordance with the applicable standards of NEMA, ANSI, UL and IEEE and shall be designed for installation in accordance with the NEC. The drives shall be UL listed.

h) The VSD system shall fit in the space indicated on the drawings.

1.2. RELATED SECTIONS

1.2.1. SECTION 01 11 00 - SUMMARY OF WORK

1.2.2. SECTION 23 01 00.51 - AIR CONDITIONING SYSTEMS OPERATION AND MAINTENANCE

1.2.3. SECTION 23 01 00.61 AIR CONDITIONING SYSTEM REPAIRS

1.2.4. SECTION 23 01 30.51 - HVAC AIR DISTRIBUTION SYSTEM CLEANING

1.2.5. SECTION 23 05 11 - COMMON WORK RESULTS FOR HVAC

1.2.6. SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

1.2.7. SECTION 23 05 66 - ANTI-MICROBIAL ULTRAVIOLET LIGHT EMITTERS FOR HVAC DUCTS AND EQUIPMENT

1.2.8. SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.2.9. SECTION 23 09 23.11 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

1.2.10. SECTION 23 34 16 - CENTRIFUGAL FANS FOR HVAC

1.2.11. SECTION 23 75 16 - PACKAGED ROOFTOP COOLING UNITS

1.2.12. SECTION 23 81 26.13 - SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS (MINI-SPLITS/DUCT FREE SYSTEMS)

1.2.13. SECTION 26 29 13.16 - REDUCED-VOLTAGE SOLID STATE STARTERS

1.3. REFERENCES STANDARD

1.3.1. Institute of Electrical and Electronics Engineers (IEEE)

a) IEEE 519 – 2014 Standard for Harmonic Control in Electric Power Systems

1.3.2. NFPA- National Fire Protection Association

a) NFPA 70® – National Electric Code® (NEC®)

1.3.3. UL- United Laboratories

a) UL 50 – UL Standard for Safety for Enclosures for Electrical Equipment

b) UL 508C – UL Standard for Safety for Power Conversion Equipment

c) UL 508A – UL Standard for Safety for Industrial Control Panels

d) UL 489 – (2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

e) UL 61800-5-1 – (2016) Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy

1.3.4. NEMA- National Electric Manufacturers Association

a) NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

b) NEMA – Application Guide for AC Adjustable Speed Drive Systems

c) NEMA ICS 7 – (2020) Adjustable-Speed Drives

d) NEMA ICS 7.1 – Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems

e) NEMA ICS 61800-2 – (2005) Adjustable Speed Electrical Power Drive Systems Part 2: General Requirements - Rating Specifications for Low Voltage Adjustable Frequency A.C. Power Drive Systems

1.4. SUBMITTALS

1.4.1. Submit three (3) copies of data for VFD equipment. A submittal package shall be furnished to the DEPR / OMEP / PBA Engineer for approval prior to factory assembly of the drive. The submittal package shall consist of the following:

a) Elementary diagrams showing factory power and control wiring along with field wiring connections for line and load power connections and control wiring connections.

b) Outline diagrams showing the overall enclosure and mounting dimensions with front and side views and weights as a minimum. The outline drawings shall also include conduit entry/exit locations along with intended conduit sizes.

c) Voltage, horsepower, current rating and product features will be furnished from standard catalog sheets.

1.4.2. INSTALLATION, OPERATION AND MAINTENANCE DATA

a) Manufacturer shall provide a copy of installation, operation, and maintenance procedures to owner.

b) Instruction manual shall include programming manuals, wiring diagrams, operating and maintenance instructions.

1.5. QUALITY ASSURANCE

1.5.1. Manufacturer shall have specialized in the manufacture and assembly of low voltage control panels for 25 years.

1.5.2. Low voltage drives shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article 1.03 of this specification.

1.5.3. All drives shall be 100% factory tested to ensure proper performance.

1.5.4. All drives are insulation tested (i.e., Hi-pot) at their input and output terminal connections.

1.5.5. All drives are load tested at $\geq$ 100% of their nominal operating current at assorted speed references.

1.5.6. All drive panels will be functionally tested to ensure proper operation.

1.5.7. Schematic assemblies

1.5.7.1. Submit diagrams showing circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

1.5.8. Interconnecting Diagrams

1.5.8.1. Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

1.5.9. Installation Drawings

1.5.9.1. Show floor plan of each site, with VFD's and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes. Submit drawings for government approval prior to equipment construction or integration. Immediately record modifications to original drawings made during installation for inclusion into the as-built drawings.

1.5.10. Standard Products

1.5.10.1. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a) Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b) Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c) Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.11. The entire VFD system, as described in Part 2, shall be factory assembled and system tested by the VFD manufacturer to assure a properly coordinated system.

1.6. DELIVERY, STORAGE and HANDLING

1.6.1. Contractor shall store, protect and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

1.6.2. Contractor shall inspect and report concealed damage to carrier within 48 hours.

1.6.3. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris and traffic. Heat enclosures to prevent condensation.

1.6.4. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices and finish. Lift only by installed lifting eyes.

1.7. PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

1.7.1. Follow (standards) service conditions before, during and after installation.

1.7.2. Equipment shall be located in machine room. Indoor locations shall be protected to prevent moisture from entering enclosure.

1.7.3. The drive panel shall be designed to operate in an ambient temperature range from 0°C to 40°C.

1.7.4. Storage temperatures shall be between -25°C to 65°C.

1.7.5. The drive panel shall be suitable for operation at altitudes up to 3,280 feet without de-rating.

1.8. WARRANTY

1.8.1. The manufacturer warrants the materials and workmanship of the drive to be free from defect for a period of thirty-six (36) months from date of shipment.

PART 2. PRODUCT

2.1. SYSTEMS / ASSEMBLIES / MANUFACTURED UNITS / EQUIPMENT / COMPONENTS / PRODUCT TYPES / MATERIALS

2.1.1. MANUFACTURERS

2.1.1.1. Approved manufacturers listed below are allowed on condition of meeting the specified conditions including the available space for the equipment (including Code required working clearances).

a) ABB

b) Allen-Bradley

c) Eaton

d) General Electric

e) Schneider Electric

f) Siemens

g) Square D

h) Toshiba

i) Yaskawa

j) Other as Engineer approval

2.2. DESCRIPTION

2.2.1. Locations and intended use:

2.2.2. Refer to drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and voltage ratings of devices, components and assemblies; interrupting and withstand ratings of devices, buses, and components; and other required details.

2.2.3. Variable Speed Drives will be located in an existing machines room. The purpose of adding last technology and features to the original configuration is to

provide the most reliable performance and to reduce the Total Harmonic Voltage Distortion.

2.2.4. Regulator technology shall be software configurable to either V/Hz or Sensorless Dynamic Torque Vector.

2.2.5. The drive shall use a fix voltage and frequency AC line to generate an adjustable voltage and frequency to control the motor.

2.2.6. The drive will convert the AC mains to a fixed DC voltage using full wave bridge diode or SCR rectifiers.

2.2.7. Extremally important characteristic:

a) The drive will use power semiconductors (IGBTs) to change the fixed DC voltage to an adjustable voltage and frequency to control the motor. The drive shall be an IGBT based PWM type AC drive capable of operating a squirrel cage induction motor with a full load current equal to or less than the continuous output rating of the drive.

b) IGBT gate control design shall be utilized to reduce motor terminal dv/dt and allow for motor cable lead lengths as follows without the need for drive output reactors or filters on 460V rated drives.

c) Drives must use active front end drive technologies with DC bus capacitors to meet IEEE 519 low harmonics and be capable of producing full motor nameplate voltage for improved harmonic mitigation.

2.2.8. Motors with 1000V insulation ratings may be located up to 49 ft in cable length from the output of the drive.

2.2.9. Motors with 1600V insulation ratings may be located up to 984 ft in cable length from the output of the drive.

2.2.10. All drive panels and enclosures will meet UL 508A and will be UL / cUL listed.

2.2.11. The drive panel shall include a fused input disconnect with a through-the-door handle interlocked to the enclosure door to provide a local and lockable means of removing all AC input power from the drive panel.

2.2.12. Branch circuit protection fuses shall be provided to protect the drive. Fuses shall be sized to provide proper branch circuit protection and be coordinated with other power circuit components.

2.2.13. The drive panel shall be a NEMA Type 1 enclosure. Electronic boards will include conformal coating to meet ANSI/ISA S71.04-1985, Classes G3 and GX.

2.2.14. The drive panel will include door mounted operator devices and keypad to facilitate programming, control functions and diagnostics.

2.2.15. The drive shall have an EMC / RFI filter meeting A2 standards.

2.2.16. Loss of Speed Reference control shall be supplied and will enable the drive to run at a preset speed in the event of the loss of a non-zero based analog signal speed reference.

2.2.17. When required because drive location, the drive panel will include a drive output contactor.

2.2.18. When required the drive panel will include a drive output contactor and drive bypass starter with Class 20 or 30 motor overload relay. The output and bypass contactors will be mechanically and electrically interlocked to prevent operating at the same time.

2.2.19. When required the drive panel will include a drive isolation contactor, a drive output contactor and a drive bypass starter with Class 20 or 30 motor overload relay. The output and bypass contactors will be mechanically and electrically interlocked to prevent operating at the same time. The drive isolation contactor will allow for removal of line power to the drive while running the motor with line voltage.

2.3. ELECTRICAL RATINGS

2.3.1. Provide equipment rated as indicated on drawings or as specified below.

2.3.2. The drive shall be sized for [variable torque applications] [constant torque applications with the ability to be applied to variable torque loads].

2.3.3. Input voltage ratings shall be 460VAC +/-10%. However, there may be possible discrepancies with the available voltage, the indicated voltage and the existing drive model indicated voltage, the contractor must perform a field verification with electrician and technical personnel (**MEANS DOUBLE CHECK WITH THIRD PARTY CONFIRMATION**). Do not proceed to order new units until submittal is approved. Submittal must include field verification certification.

2.3.3.1. Voltage confirmation include:

a) Government (Owner) representative – DEPR / OMEP / PBA

b) ACV Contractor technical staff

c) Driver sales representative – Third party

2.3.4. Input frequency shall be 60Hz +/-5%.

2.3.5. The drive panel will have a fault withstand rating of 100k AIC for fusible disconnect style devices.

2.3.6. Displacement power factor of the drive shall be 0.98 lagging or higher.

2.3.7. Drive efficiency at rated load shall be 98% or higher depending on the drive's switching frequency setting and rating.

2.3.8. The drive panel output current ratings shall be capable continuous operation at a minimum of 100% rated motor full-load current in accordance with NEC® Table 430.150.

2.3.9. Output voltage shall be programmable for a motor rating of 208VAC to 480VAC with the actual maximum output voltage equal to the input voltage.

2.4. PROTECTIVE FEATURES

2.4.1. The drive shall provide protection against AC line and DC bus overvoltage and undervoltage conditions.

2.4.2. The drive shall provide protection against phase to phase and phase to ground short circuits.

2.4.3. The drive shall monitor and protect against adverse drive thermal conditions.

2.4.4. If indicated in drawings schedules, the drive shall contain a Fire Override Mode that ignores all drive protective features and keeps motor running. This function can be enabled and assigned to a logic input in the event the drive's operation is deemed critical and must continue to run regardless of fault conditions.

2.4.5. The drive shall have a programmable Torque Limiting function for both acceleration (driving) and deceleration (braking). For deceleration, braking torque limit shall be programmable to automatically extend the deceleration time to avoid over-voltage trips on large inertia loads.

2.4.6. The drive shall contain a programmable inverse time thermal overload function UL-508C listed and as required by the 2005 National Electric Code® (NEC®), article 430.126, with load and speed sensitive motor overload protection and thermal memory retention in the event of an unintentional power loss or via intentional shutdown.

2.4.7. The drive will include automatic high ambient de-rate functionality to prevent drive thermal overloads.

2.4.8. The drive will include automatic motor overload de-rate functionality to prevent motor thermal overloads.

2.4.9. The drive shall contain LED indication of DC bus voltage, which, when lit signifies potentially dangerous voltage is present on the DC bus.

2.4.10. The drive shall provide for programming up to 4 Jump / Skip Frequencies with a user defined bandwidth.

2.4.11. The drive shall protect against internal memory and CPU errors and internal and serial communication errors.

2.5. FEATURES AND ADJUSTMENTS

2.5.1. In addition to programmable motor characteristics, the drive shall contain a motor Auto-tune feature that determines the connected motor characteristics to optimize operation.

2.5.2. The drive panel will be factory programmed to operate all specified optional devices.

2.5.3. The drive will have the required macros that can be used to set configuration of the drive for common variable torque applications as indicated by the control contractor or control consultant.

2.5.4. The drive shall be capable of storing and reloading 4 user programs to the keypad.

2.5.5. The drive shall be capable of at least 4 different acceleration and 4 different deceleration rates. Each acceleration and deceleration rate shall be independently adjustable from 0.01 to 3600 seconds.

2.5.6. The drive shall contain selectable acceleration and deceleration patterns - linear, S-curve and non-linear - to meet the starting and stopping characteristics of the applied load.

2.5.7. The drive shall record and store in its memory run status and fault type of the past 10 faults for diagnostic assistance. For the two most recent faults, the drive will record at the time of trip the motor input volts, amps, frequency, speed reference, DC bus voltage and date and time of fault.

2.5.8. In the event of a momentary power failure, the drive shall contain 4 different selectable stopping modes.

2.5.9. The drive shall be capable of starting into a rotating load (forward or reverse) and shall smoothly accelerate or decelerate to the speed reference set point without experiencing the drive tripping on a fault or a component failure.

2.5.10. The drive shall be capable of automatically resetting low level faults with 2 to 5 restart attempts at adjustable intervals of 0 to 600 seconds.

2.5.11. The drive shall contain a selectable energy savings function that, when selected, automatically reduces the drive output voltage at steady state operation to the level only required to meet the torque requirement of the load. This function shall automatically deactivate during acceleration or deceleration of the load.

2.5.12. The drive shall provide selectable slip compensation, which will sense output current and adjust output frequency, to improve motor speed fluctuations. This function is to be adjustable over a range of -500 to 500% of nominal motor speed.

2.5.13. The drive will provide closed loop speed / torque control as standard.

2.5.14. The drive shall be capable of stopping by selectable DC injection braking. DC injection braking will have a braking level that is adjustable from 0 to 100%, a programmable starting frequency 0.0 Hz to the drive's Motor Speed High Limit setting and a programmable braking time of 0.0 to 60.0 seconds.

2.5.15. The drive will track and display kw Hours, Operating Hours, and Running Hours.

2.5.16. The drive shall have both low and high frequency limits programmable from 0 to the drive's maximum output frequency.

2.5.17. The drive shall accept and follow a selectable external analog speed reference of 0-10VDC, -10-+10VDC, 0-20mA, or 4-20mA with signal inversion.

2.5.18. The drive shall provide an adjustable 0-20ma or 4-20ma analog output signal that is proportional to output frequency, output current, output torque, load factor, input power or another user selected functionality.

2.6. OPERATOR CONTROLS

2.6.1. The drive's control power for digital inputs will be 24VDC.

2.6.2. The drive protects its internal 10vdc and 24vdc power supplies from short circuits and overloads by automatically reducing its voltage.

2.6.3. All drives will include pull a-part terminals for drive control connections.

2.6.4. The drive panel shall have a control terminal strip for field I/O wiring.

2.6.5. The drive will include two enable inputs.

2.6.6. The drive will include 4 to 7 programmable logic inputs.

2.6.7. The drive will include 2 to 4 programmable logic outputs.

2.6.8. The drive will include 2 to 5 programmable relay outputs.

2.6.9. The drive will include 2 to 4 programmable and scalable analog inputs.

2.6.10. The drive will include 3 programmable and scalable analog outputs.

2.6.11. All drive panel door mounted operators will be 22mm industrial rated devices.

2.6.12. Operator controls and indicating devices shall include Drive Keypad Power On Light, Hand-Off-Auto Switch and Drive Run and Fault Lights.

2.7. KEYPAD INTERFACE

2.7.1. The drive shall contain a backlit graphic liquid crystal display (LCD) and shall display 6 alphanumeric lines providing display for programming, diagnostics, I/O check, operation status and copy functions. The LCD display shall provide indication of output current, output voltage, output frequency, frequency reference, motor speed, line speed, kW power consumption, feedback value and calculated torque value. The LCD display shall function independently of the programming mode to allow programming and monitoring of the drive simultaneously.

2.7.2. The keypad shall be common for the entire horsepower and input voltage ratings and shall be capable of copying (uploading and downloading) 4 sets of drive parameters between the different horsepower and voltage ratings.

2.7.3. The drive keypad will include help functions for integrated parameter and diagnostic assistance.

2.7.4. The drive keypad allows for 2 levels of password protection with independent password.

2.7.5. The drive will support multiple languages with English as the default.

PART 3. EXECUTION

3.1. EXAMINATION

3.1.1. The contractor shall perform the following procedures:

3.1.2. Examine installation area to assure there is enough clearance to install panel.

3.1.3. Check concrete pads and mounting surfaces for uniformity and level surface.

3.1.4. Inspect for any physical damage

3.1.5. Verify that equipment is ready to install.

3.1.6. Verify field measurements are as shown on Drawings or instructed by manufacturer.

3.1.7. Verify that required utilities and control interfaces are available, in proper location and ready for use.

3.1.8. Beginning of installation means installer accepts conditions.

3.2. INSTALLATION

3.2.1. The contractor shall perform the installation.

3.2.2. The contractor shall install drives in accordance with standards listed in Article 1.3 of this specification.

3.2.3. Install per manufacturer's instructions outlined in installation, operation, and maintenance documentation.

3.2.4. Install required safety labels.

3.3. FIELD QUALITY CONTROL

3.3.1. Field inspection, startup, and testing to be performed by a Manufacturers Certified Representative.

3.3.2. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

3.3.3. The VFD Manufacturer Certified Startup Representative shall make an inspection of the equipment including those components necessary to the direct operation of the system. All test and report costs shall be borne by the supplier. The inspection technician shall prepare a checkout report, and a copy of the original VFD startup forms shall be submitted to the Owner, and a copy shall be registered with the equipment manufacturer. The report shall include, but not be limited to:

a) A complete list of equipment installed and wired.

b) Indication that all equipment is properly installed and functions and conforms to these Specifications.

c) Physical tests of each individual device. This includes voltage phase-to-phase on input and output, and current on each phase of input and output conductors.

d) When Bypass option is required, provide written copy of Motor Nameplate Full-Load amperage, Overload Heater setting or model number, and manufacturers' heater chart.

e) Serial numbers, locations by device and model number for each installed device.

f) That wiring connections to all equipment shows the installer observed the National Electrical Code.

g) That the supervisory wiring of the equipment connected to a supervised circuit is operating and has met the satisfaction of inspecting officials.

h) Technicians name, certificate number and date.

i) The manufacturer shall supply all technical assistance with respect to any changes necessary to ensure a complete, workable system. During the period of inspection by the manufacturer, the electrical Contractor shall make available electricians for whatever changes deemed necessary by the manufacturer at the Contractor's cost.

j) After system installation and after initial system test is completed, equipment shall be demonstrated to satisfy the requirements of this Specification prior to the Operational Acceptance Test:

k) Operational Acceptance Test: An operational test of not less than 30 consecutive days shall be conducted on the complete and total installed and operational system to demonstrate that it is functioning properly in accordance with all requirements of this Specification. The correct operation of all equipment shall be demonstrated as well as the operation and capabilities of all sequences, reports, diagnostics, and all other software

3.4. START-UP AND TRAINING

3.4.1. Manufacturer shall have Factory Trained personnel at Field locations convenient to the installation site, available for Troubleshooting and/or Start-Up assistance.

3.4.2. Drive operational and maintenance Training and/or Start-Up Service shall be provided to the DEPR / OMEP / PBA staff and including building maintenance staff.

3.4.3. Product installation must be complete prior to Start-Up Services being provided.

3.4.4. Personnel performing Start-Up must check / adjust drive settings circuit breakers, overload relay, switches, doors, operating handle for proper mechanical and/or electrical operation.

3.4.5. ADJUSTMENTS AND CLEANING

3.4.5.1. Remove debris from drives and wipe dust and dirt from all components

END OF SECTION 26 29 23

SCHEDULE VSD-1

BUILDING A
FAN SPEED CONTROL SYSTEM AND STARTING METHOD RETROFIT SCHEDULE

TAG	EXISTING CONTROL SYSTEM		RETROFIT TO		
	CONTROL	REDUNDANCY	CONTROL	REDUNDANCY	STARTING METHOD
AHU-1	VFD	DAMPER	VFD		RVSS
AHU-2	VFD	DAMPER	VFD		RVSS
AHU-3	VFD	DAMPER	VFD		RVSS
AHU-4	VFD	DAMPER	VFD		RVSS

LEGEND:

VFD= VARIABLE FREQUENCY DRIVE (aka VSD)

RVSS= REDUCED VOLTAGE SOLID STATE STARTER

SCHEDULE VSD-2

BUILDING C
FAN SPEED CONTROL SYSTEM AND STARTING METHOD RETROFIT SCHEDULE

TAG	EXISTING CONTROL SYSTEM		RETROFIT TO		
	CONTROL	REDUNDANCY	CONTROL	REDUNDANCY	STARTING METHOD
AHU-1	VFD	DAMPER	VFD		RVSS
AHU-2	VFD	DAMPER	VFD		RVSS
AHU-3	VFD	DAMPER	VFD		RVSS
AHU-4	VFD	DAMPER	VFD		RVSS
AHU-5	NO USED	NO USED			RVSS
AHU-6	VFD	DAMPER	VFD		RVSS
AHU-7	VFD	DAMPER	VFD		RVSS
AHU-8	NO USED	NO USED			RVSS

LEGEND:

VFD= VARIABLE FREQUENCY DRIVE (aka VSD)

RVSS= REDUCED VOLTAGE SOLID STATE STARTER

SCHEDULE VSD-3

BUILDING D
FAN SPEED CONTROL SYSTEM AND STARTING METHOD RETROFIT SCHEDULE

TAG	EXISTING CONTROL SYSTEM		RETROFIT TO		
	CONTROL	REDUNDANCY	CONTROL	REDUNDANCY	STARTING METHOD
AHU-1	NO USED	NO USED			RVSS
AHU-2	VFD	DAMPER	VFD		RVSS
AHU-3		DAMPER	VFD		RVSS
AHU-4	NO USED	NO USED			RVSS
AHU-5	VFD	DAMPER	VFD		RVSS
AHU-6		DAMPER	VFD		RVSS
AHU-7	NO USED	NO USED			RVSS
AHU-8	VFD	DAMPER	VFD		RVSS
AHU-9		DAMPER	VFD		RVSS
AHU-10	NO USED	NO USED			RVSS

LEGEND:

VFD= VARIABLE FREQUENCY DRIVE (aka VSD)

RVSS= REDUCED VOLTAGE SOLID STATE STARTER

SECTION 33 32 11
SANITARY SEWAGE GRINDER PUMP UNITS

PART 1 GENERAL

1.1. SUMMARY

1.1.1. Section Includes

1.1.1.1. This section provides the requirements for Wetwell Grinder Pump Station(s) and related equipment and materials to be installed at Instituto Tecnológico de Ponce.

1.1.2. Provide the accessories required for pump operations and controls including valves and lifting accessories.

1.1.3. Provide wet well emptying and cleaning service. Provide emptying service while repairs are in progress.

1.2. REFERENCES

1.2.1. National Electric Code - N.E.C.

1.2.2. National Electric Safety Code.

1.3. SYSTEM DESCRIPTION

1.3.1. Operating Conditions

1.3.1.1. The pumps shall be capable of delivering 100 GPM against a rated total dynamic head of 28 feet. The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valves be allowed to create a false apparent head.

1.4. SUBMITTALS

1.4.1. Product Data/Source Quality:

1.4.1.1. Manufacturer's literature and specifications, as applicable, for products specified in this Section.

1.4.1.2. Shop Drawings adequate for control panel fabrication, installation and maintenance shall be submitted and approved prior to manufacturer. Drawings shall include:

1.4.1.3. Elementary control (ladder) diagram.

1.4.1.4. Interconnection wiring (schematic) diagram.

1.4.1.5. Interior and exterior panel component layout drawings.

1.4.1.6. Dimensioned outline drawing of the enclosure with mounting supports.

1.4.1.7. Component catalog cuts and Contractor's installation drawings.

1.4.2. Testing Procedures:

1.4.2.1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER and CFPUA approval prior to commencing testing.

1.4.3. Manufacturer Certificates:

1.4.3.1. Certificates of compliance with referenced standards, where applicable, including those of AWWA and others required by Engineer.

1.4.4. Closeout submittals

1.4.4.1. Project Record Documents:

1.4.4.2. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.

1.4.4.3. Record actual locations of piping mains, valves, connections, thrust restraints, elevations, and other utilities found and not indicated on design plans.

1.4.5. Operations and Maintenance Data:

1.4.6. Furnish complete operations and maintenance manuals for materials in accord Product Requirements.

1.5. DELIVERY, STORAGE AND HANDLING

1.5.1. Deliver, store, protect and handle products to site in accordance with Manufacturers recommendations.

1.5.2. The grinder pump unit shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump unit shall be listed by Underwriters Laboratories, Inc. to be safe and appropriate for the intended use.

1.6. QUALITY ASSURANCE AND MANUFACTURER

1.6.1. Grinder pump stations, complete with all appurtenances, shall form an integral system, and as such, shall be supplied by one grinder pump station manufacturer. The Contractor shall be responsible for the satisfactory operation of the entire system. The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems.

1.6.2. The company shall submit detailed installation and user instructions for its product, submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts. The Manufacturer shall provide, upon request, a reference and contact list from ten of its largest contiguous grinder pump installations of the type of grinder pumps described within this specification.

1.6.3. The equipment furnished hereunder shall be the product of a company experienced in the design and manufacture of grinder pumps specifically

designed for use in low pressure systems. All manufacturers proposing equipment for this project shall have at least 10 years of experience in the design and manufacture of units of identical size(s) and performance to the specified units.

1.6.4. All manufacturers proposing equipment for this project must also have not less than 500 successful installations of sanitary sewer systems utilizing grinder pumps of like type to the grinder pumps specified herein. An installation is defined as a minimum of 25 pumps discharging into a common force main which forms a sanitary sewer system.

1.7. WARRANTY

1.7.1. The grinder pump Manufacturer shall provide a warranty on the complete station and accessories including, but not limited to, control panels, valves, pump components, and wetwell, for a period of twenty-four (24) months after notice of the DEPR / OMEP / PBA acceptance, but no greater than 27 months after receipt of shipment. The Authority will not accept any equipment found to be defective and Manufacturer will be required to replace any defective equipment with new material. Any manufacturing defects found during the warranty period will be reported to the Manufacturer by the Authority and will be corrected by the Manufacturer at no cost to the Authority.

PART 2 PRODUCTS

2.1. PUMPS

2.1.1. All pumps must be submersible type pumps located within the wet well.

2.1.2. The pumps must be of the type that can be removed without entering the wet well.

2.1.3. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal.

2.1.4. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied.

2.1.5. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer.

2.1.6. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.2. GRINDER

2.2.1. The grinder shall be placed immediately below the pumping elements and shall

be direct- driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth.

2.2.2. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.

2.2.3. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

2.2.3.1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

2.2.3.2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.

2.2.3.3. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.

2.2.3.4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

2.2.4. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of “foreign objects,” such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

2.3. MOTOR

2.3.1. As a maximum, the motor shall be a 4 HP, 1800 RPM, 480 Volt 60 Hertz, 3 Phase. In the event that existing pump nameplate data differs from that specified herein, the nameplate data shall prevail.

2.3.2. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability.

2.3.3. The wet portion of the motor armature must be 300 Series stainless. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

2.4. MECHANICAL SEAL

2.4.1. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.5. WET WELL AND INTEGRAL ACCESSWAY

2.5.1. Wet well shall be a custom molded high density polyethylene as supplied by Grinder Pump manufacturer. Along with the wet well, an integral access way shall be high density polyethylene of a grade selected for environmental stress cracking resistance.

2.5.2. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be 0.250” thick (minimum). All seams created during tank construction are to be thermally welded and factory tested for leak tightness. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

2.6. CHECK VALVE

2.6.1. The pump discharge shall be equipped with a factory installed, gravity operated, flapper- type integral check valve built into the stainless steel discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The valve shall be rated for continuous operating pressure of 235 psi. Ball-type check

valves are unacceptable due to their limited sealing capacity in slurry applications.

2.7. ANTI-SIPHON VALVE

2.7.1. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper- type integral anti-siphon valve built into the stainless steel discharge piping.

2.7.2. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure.

2.7.3. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

2.8. CORE UNIT

2.9. The grinder pump station shall have a cartridge type, easily removable core assembly consisting of pump, motor, grinder, all motor controls, check valve, anti-siphon valve, level controls, electrical quick disconnect and wiring.

2.10. The core unit shall be installed in the basin by the manufacturer. Field assembly of the pump and controls into the basin is not acceptable because of potential workmanship issues and increased installation time.

2.11. In some cases, stations taller than 96” may be shipped on their side without the cores assembled in the basin for freight purposes but this is the only exception. The core unitshall seal to the tank deck with a stainless steel latch assembly.

2.12. The latch assembly must be actuated utilizing a single quick release mechanism requiring no more than a half turn of a wrench. The watertight integrity of each core unit shall be established by a 100 percent factory test at a minimum of 5 PSIG.

2.13. CONTROLS

2.13.1. All necessary motor starting controls shall be located in the SS NEMA 4X. The wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. The level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable.

2.13.2. The level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. The level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. The use of PVC for the level sensing housing is not acceptable.

2.13.3. Non-fouling wastewater level controls for controlling pump operation shall be

accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance.

2.13.4. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily- exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.

2.13.5. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit.

2.13.6. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue.

2.13.7. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes.

2.13.8. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

2.14. ALARM/DISCONNECT PANEL

2.15. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel. The enclosure shall not exceed 12.5" W x 16" H x 7.5" D.

2.16. The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp, single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

2.17. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:

2.18. When liquid level in the sewage wet-well rises above the alarm level, the contacts on the alarm pressure switch activate, audible and visual alarms are activated, and the redundant pump starting system is energized.

2.19. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.

2.20. Visual alarm remains illuminated until the sewage level in the wet-well drops below the “off” setting of the alarm pressure switch.

2.21. The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5"

2.22. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

2.23. The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.

2.24. SERVICEABILITY

2.24.1. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.25. SAFETY

2.26. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc. to be safe and appropriate for the intended use. UL listing of components of the station, or third-party testing to UL standard are not acceptable.

2.26.1. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards,

and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third- party testing to NSF standard is not acceptable.

2.27. SPARE PARTS

2.27.1.1. Any required for the sanitary sewage pump manufacturer.l.

PART 3 EXECUTION

3.1. FACTORY TEST

3.1.1. Each grinder pump shall be submerged and operated for 1.5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti- siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps is not acceptable. Certified test results shall be available upon request showing the operation of each grinder pump at two different points on its curve. Additional validation tests include: integral level control performance, continuity to ground and acoustic tests of the rotating components.

3.2. INSTALLATION

3.2.1. Each grinder pump unit shall be installed in accordance with the Manufacturer's instructions. Installation shall include all internal and external piping, concrete anchoring (as required), connection of electrical components and incidentals.

3.3. COMMISSIONING AND ACCEPTANCE TESTING

3.3.1. The Manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the installation, placement and wiring of each station, perform field tests as specified herein, and instruct the Authority's personnel in the operation and maintenance of the equipment before the stations are accepted by the Authority.

3.4. **Commissioning Period:** Manufacturer's technicians shall inspect the installation of each grinder pump unit to render an opinion as to if the grinder pump unit was installed in accordance with the Manufacturer's instructions. Technician shall provide written confirmation to the Authority for each grinder pump unit that states that the grinder pump unit appears to have been installed correctly and is ready for operation. If the grinder pump unit is not found by the Technician to be ready for operation, the Technician shall provide a written detailed description of issues that need to be resolved. Commissioning Period shall be considered complete after the Technician has provided their written opinion on the acceptability of the installation of each grinder pump unit. Manufacturer's technician(s) shall provide a minimum of one (1) hour in the field per grinder pump unit in order to complete

commissioning activities.

3.4.1. **Acceptance Testing:** Manufacturer's technicians shall perform the required tests on each grinder pump station. Manufacturer's technician(s) shall provide a minimum of one

3.4.1.1. hour in the field per grinder pump station in order to complete acceptance testing activities. Acceptance Testing activities shall be performed on a separate site visit than the commissioning activities.

3.5. All equipment and materials necessary to perform testing shall be the responsibility of the INSTALLING CONTRACTOR. This includes, as a minimum, a portable generator and power cable (if temporary power is required), water in each basin (filled to a depth sufficient to verify the high level alarm is operating), and opening of all valves in the system. These steps shall be completed prior to the qualified factory trained technician(s) arrival on site.

3.6. Upon completion of the installation and commissioning activities, the authorized factory technician(s) will perform the following test on each station:

3.7. Make certain the discharge shut-off valve in the station is fully open.

3.8. Turn ON the alarm power circuit and verify the alarm is functioning properly.

3.9. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.

3.10. Consult the Manufacturer's Service Manual for detailed start-up procedures.

3.11. Upon successful completion of the acceptance testing, the Manufacturer shall submit to the Authority a start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

3.12. OPERATION MANUALS

3.12.1. Manufacturer shall provide a separate Operation and Maintenance Manual to the Authority for each unit provided.

END OF SECTION 3 32 11

GOBIERNO DE PUERTO RICO
DEPARTAMENTO DE EDUCACIÓN
OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS DE PUERTO RICO

Escuela: MARIA E. ARCHEVAL SALAMO DE VALDES (54684)

Municipio: PONCE

 # de Subasta: CI-2023-07-06-4321

Región: PONCE

SUMMARY - BREAKDOWN

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
GENERAL	PROJECT SIGN	1	EA					
	MOBILIZATION	1	LS					
	Service under construction (repairs) - Inspection	1	LS					
	Service under construction (repairs) - Commissioning	1	LS					
	Project Allowance	1	LS			$150,000.00	$150,000.00	
	MUNICIPAL TAXES AND STATE TAX	1	EA					
	PAYMENT & PERFORMANCE BOND	1	EA					
	INSURANCE BONDS	1	EA					
SITE WORKS and Others	ACV System cleaning as indicated in the SoW	1	LS					
	Machine rooms cleaning and painting	1	LS					
	Chiller's machine room door replacement	1	LS					
	TESTING AND VALIDATION (BALANCE)	1	LS					
	CRANE TRUCK SERVICE	1	LS					
	TRANSPORTATION (highway)	1	EA					
EQUIPMENT MECH. Repairs	Building A	1	LS					
	Building B	1	LS					
	Building C	1	LS					
	Building D	1	LS					
	Building E	1	LS					
	Building G	1	LS					
	Sanitary sewage grinders pumps replacement	1	LS					
				SUBTOTAL				

GOBIERNO DE PUERTO RICO
DEPARTAMENTO DE EDUCACIÓN
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BUILDING A - REPAIRS BREAKDOWN

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
SITE WORKS	AHU-1 construction of service platform (metal)	1	LS					
EQUIPMENT MECH.	RM-1 88 TONS	1	LS					
	RM-2 88 TONS	1	LS					
	CU-1 90 TONS	1	LS					
	CU-2 90 TONS	1	LS					
	AHU-1 23 TON / 7,500 CFM / 3.5 IN WG	1	LS					
	AHU-2 16 TON / 4,610 CFM / 3 IN WG	1	LS					
	AHU-3 42 TON / 10,050 CFM / 3 IN WG	1	LS					
	AHU-4 45 TON / 14,990 CFM / 4 IN WG	1	LS					
	P-1 135 GPM/80 TDH	1	LS					
	P-2 135 GPM/80 TDH	1	LS					
	F-1	1	LS					
	F-2	1	LS					
	F-3	1	LS					
	F-4	1	LS					
	F-5	1	LS					
	F-6	1	LS					
	F-7	1	LS					
	F-8	1	LS					
	F-9	1	LS					
	F-10	1	LS					
	F-11	1	LS					
	F-12	1	LS					
PIPING AND ACC.	AHU-1 water control valve	1	EA					
	AHU-2 water control valve	1	EA					
	AHU-3 water control valves	1	EA					
	AHU-4 water control valves	1	EA					
	BY PASS water manifold control valves	4	EA					
	Others AHU's temperature gauges, pressure gauges and magnahelics	1	LS					
	UVC Light and Ionization Sysrems	1	LS					
EQUIPMENT ELEC.	CU-1 90 TONS	1	EA					
	CU-2 90 TONS	1	EA					
	AHU-1 VFD and soft starter	1	EA					
	AHU-2 VFD and soft starter	1	EA					
	AHU-3 VFD and soft starter	1	EA					
	AHU-4 VFD and soft starter	1	EA					
	Building Main control System	1	LS					
	Others AHU's sensors and switches	1	LS					
	Others electrical controls related (SS, CB, Enclosures)	1	LS					
				SUBTOTAL				

GOBIERNO DE PUERTO RICO
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BUILDING B - REPAIRS BREAKDOWN

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
SITE WORKS	PU-1 access ladder	1	LS					
EQUIPMENT MECH.	PU-1 106 MBH / 3400 CFM	1	LS					
	PU-2 183 MBH / 6000 CFM	1	LS					
	PU-3 183 MBH / 6000 CFM	1	LS					
	PU-4 183 MBH / 6000 CFM	1	LS					
	PU-5 183 MBH / 6000 CFM	1	LS					
	PU-6 183 MBH / 6000 CFM	1	LS					
	PU-7 183 MBH / 6000 CFM	1	LS					
	PU-8 183 MBH / 6000 CFM	1	LS					
	PU-9 183 MBH / 6000 CFM	1	LS					
	PU-10 183 MBH / 6000 CFM	1	LS					
	PU-11 183 MBH / 6000 CFM	1	LS					
	PU-12 183 MBH / 6000 CFM	1	LS					
	PU-13 183 MBH / 6000 CFM	1	LS					
	F-1	1	LS					
	F-2	1	LS					
	F-3	1	LS					
	F-4	1	LS					
	F-5	1	LS					
	F-6	1	LS					
	UVC Light and Ionization Sysrems	1	LS					
EQUIPMENT ELEC.	Main control system	1	EA					
	Others electrical controls related (SS, CB, Enclosures)	1	EA					
				SUBTOTAL				

GOBIERNO DE PUERTO RICO
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OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS DE PUERTO RICO

BUILDING C - REPAIRS BREAKDOWN

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
SITE WORKS	AHU-8 construction of service platform (metal)	1	LS					
EQUIPMENT MECH.	RM-1 112 TONS	1	LS					
	RM-2 112 TONS	1	LS					
	RM-3 112 TONS	1	LS					
	CU-1 125 TONS	1	LS					
	CU-2 125 TONS	1	LS					
	CU-3 125 TONS	1	LS					
	AHU-1 45 TON / 12,200 CFM / 3.75 IN WG	1	LS					
	AHU-2 18 TON / 7,550 CFM / 3 IN WG	1	LS					
	AHU-3 63 TON / 20,645 CFM / 3.75 IN WG	1	LS					
	AHU-4 35 TON / 10,000 CFM / 3.5 IN WG	1	LS					
	AHU-5 25 TON / 6,000 CFM / 3.75 IN WG (cooling coil)	1	LS					
	AHU-6 58 TON / 13,000 CFM / 3.75 IN WG	1	LS					
	AHU-7 42 TON / 13,000 CFM / 3.75 IN WG	1	LS					
	AHU-8 15 TON / 4,400 CFM / 3 IN WG	1	LS					
	P-1 170 GPM / 90 TDH	1	LS					
	P-2 170 GPM / 90 TDH	1	LS					
	P-3 170 GPM / 90 TDH	1	LS					
	F-1	1	LS					
	F-2	1	LS					
	F-3	1	LS					
	F-4	1	LS					
	F-5	1	LS					
	F-6	1	LS					
	F-7	1	LS					
	F-8	1	LS					
	F-9	1	LS					
	F-10	1	LS					
	F-11	1	LS					
	F-12	1	LS					
	F-13	1	LS					
	F-14	1	LS					
	F-15	1	LS					
	F-16	1	LS					
	F-17	1	LS					
	F-18	1	LS					
	F-19	1	LS					
	F-20	1	LS					
	F-21	1	LS					
	F-22	1	LS					
	F-23	1	LS					
	F-24	1	LS					
	F-25	1	LS					
	UVC Light and Ionization Sysrems	1	LS					
PIPING AND ACC.	AHU-1 45 TON / 12,200 CFM / 3.75 IN WG / water control valve	1	LFT					
	AHU-2 18 TON / 7,550 CFM / 3 IN WG / water control valve	1	LFT					
	AHU-3 63 TON / 20,645 CFM / 3.75 IN WG / water control valve	1	LFT					
	AHU-4 35 TON / 10,000 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-5 25 TON / 6,000 CFM / 3.75 IN WG / water control valve	1	LFT					
	AHU-6 58 TON / 13,000 CFM / 3.75 IN WG / water control valve	1	LFT					
	AHU-7 42 TON / 13,000 CFM / 3.75 IN WG / water control valve	1	LFT					
	AHU-8 15 TON / 4,400 CFM / 3 IN WG / water control valve	1	LFT					
	BY PASS water manifold control valves	4	EA					
	Others AHU's temperature gauges, pressure gauges and magnahelics	1	LS					
EQUIPMENT ELEC.	AHU-1 45 TON / 12,200 CFM / 3.75 IN WG / VFD and soft starter	1	EA					
	AHU-2 18 TON / 7,550 CFM / 3 IN WG / VFD and soft starter	1	EA					
	AHU-3 63 TON / 20,645 CFM / 3.75 IN WG / VFD and soft starter	1	EA					
	AHU-4 35 TON / 10,000 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-5 25 TON / 6,000 CFM / 3.75 IN WG / VFD and soft starter	1	EA					
	AHU-6 58 TON / 13,000 CFM / 3.75 IN WG / VFD and soft starter	1	EA					
	AHU-7 42 TON / 13,000 CFM / 3.75 IN WG / VFD and soft starter	1	EA					
	AHU-8 15 TON / 4,400 CFM / 3 IN WG / VFD and soft starter	1	EA					
	Building Main control System	1	LS					
	Others AHU's sensors and switches	1	LS					
	Others electrical controls related (SS, CB, Enclosures)	1	LS					
				SUBTOTAL				

GOBIERNO DE PUERTO RICO
DEPARTAMENTO DE EDUCACIÓN
OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS DE PUERTO RICO

BUILDING D - REPAIRS BREAKDOWN

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
EQUIPMENT MECH.	RM-1 112 TONS	1	LS					
	RM-2 112 TONS	1	LS					
	CU-1 125 TONS	1	LS					
	CU-2 125 TONS	1	LS					
	AHU-1 47 TON / 9,845 CFM / 3.5 IN WG	1	LS					
	AHU-2 27 TON / 8,500 CFM / 3.5 IN WG	1	LS					
	AHU-3 5 TON / 1,600 CFM / 3.5 IN WG	1	LS					
	AHU-4 9 TON / 1,600 CFM / 3.5 IN WG	1	LS					
	AHU-5 27 TON / 8,500 CFM / 3.5 IN WG	1	LS					
	AHU-6 5 TON / 1,600 CFM / 3.5 IN WG	1	LS					
	AHU-7 9 TON / 1,750 CFM / 3.5 IN WG	1	LS					
	AHU-8 32 TON / 10,800 CFM / 3.5 IN WG (bearing)	1	LS					
	AHU-9 13 TON / 3,600 CFM / 3.75 IN WG	1	LS					
	AHU-10 10 TON / 2,400 CFM / 3.5 IN WG	1	LS					
	P-1 170 GPM / 90 TDH	1	LS					
	P-2 170 GPM / 90 TDH	1	LS					
	F-1	1	LS					
	F-2	1	LS					
	F-3	1	LS					
	F-4	1	LS					
	F-5	1	LS					
	F-6	1	LS					
	F-7	1	LS					
	F-8	1	LS					
	F-9	1	LS					
	F-10	1	LS					
	F-11	1	LS					
	F-12	1	LS					
	F-13	1	LS					
	F-14	1	LS					
	F-15	1	LS					
	F-16	1	LS					
	F-17	1	LS					
	F-18	1	LS					
	F-19	1	LS					
	F-20	1	LS					
	UVC Light and Ionization Sysrems	1	LS					
PIPING AND ACC.	AHU-1 47 TON / 9,845 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-2 27 TON / 8,500 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-3 5 TON / 1,600 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-4 9 TON / 1,600 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-5 27 TON / 8,500 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-6 5 TON / 1,600 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-7 9 TON / 1,750 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-8 32 TON / 10,800 CFM / 3.5 IN WG / water control valve	1	LFT					
	AHU-9 13 TON / 3,600 CFM / 3.75 IN WG / water control valve	1	LFT					
	AHU-10 10 TON / 2,400 CFM / 3.5 IN WG / water control valve	1	EA					
	BY PASS water manifold control valves	4	EA					
	Others AHU's temperature gauges, pressure gauges and magnahelics	1	LS					
EQUIPMENT ELEC.	AHU-1 47 TON / 9,845 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-2 27 TON / 8,500 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-3 5 TON / 1,600 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-4 9 TON / 1,600 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-5 27 TON / 8,500 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-6 5 TON / 1,600 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-7 9 TON / 1,750 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-8 32 TON / 10,800 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	AHU-9 13 TON / 3,600 CFM / 3.75 IN WG / VFD and soft starter	1	EA					
	AHU-10 10 TON / 2,400 CFM / 3.5 IN WG / VFD and soft starter	1	EA					
	Building Main control System	1	LS					
	Others AHU's sensors and switches	1	LS					
	Others electrical controls related (SS, CB, Enclosures)	1	LS					
				SUBTOTAL				

GOBIERNO DE PUERTO RICO
DEPARTAMENTO DE EDUCACIÓN
OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS DE PUERTO RICO

BUILDING E - REPAIRS BREAKDOWN

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
EQUIPMENT MECH.	MS-1 5 TONS Elevator machine room's Mini split	1	LS					
	F-101 replacement	1	EA					
				SUBTOTAL				

GOBIERNO DE PUERTO RICO
DEPARTAMENTO DE EDUCACIÓN
OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS DE PUERTO RICO

BUILDING G - REPAIRS BREAKDOWN

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
EQUIPMENT MECH.	PU-1 92 MBH / 3000 CFM / 0.8 IN WG	1	LS					
	PU-2 92 MBH / 3000 CFM / 0.8 IN WG	1	LS					
	MS-1 16 MBH / 400 CFM	1	LS					
	MS-2 14 MBH / 400 CFM	1	LS					
	F-1	1	LS					
	F-2	1	LS					
	UVC Light and Ionization Sysrems	1	LS					
				SUBTOTAL				

GOBIERNO DE PUERTO RICO
DEPARTAMENTO DE EDUCACIÓN
OFICINA PARA EL MEJORAMIENTO DE LAS ESCUELAS PÚBLICAS DE PUERTO RICO

SANITARY SEWAGE GRINDER PUMPIMNG SYSTEM

SECTION DESCRIPTION	DESCRIPTION	QTY.	UNIT	UNIT/COST MATERIAL	UNIT/COST TOOLS	UNIT/COST LABOR	COST	SECTION SUBTOTAL
SITE WORKS	Empty pit	1	LS					
EQUIPMENT MECH.	Sanitary Sewage pump 1 replacement	1	LS					
	Sanitary Sewage pump 2 replacement	1	LS					
	F-1 replacement	1	LS					
EQUIPMENT ELEC. CONTROLS	Replacement of control system	1	LS					
				SUBTOTAL				

Firma de Contratista

NÚM. AGENCIA: 081

CONTRATO

PARA LA ADQUISICIÓN DE BIENES Y SERVICIOS EN SITUACIONES DE EMERGENCIA O DESASTRES DECLARADOS POR EL GOBERNADOR(A)

PRIMERA PARTE

AGENCIA: OFICINA PARA EL MEJORAMIENTO A LAS ESCUELAS PUBLICAS

REGIÓN OMEP CENTRAL NUM. CONTRATO: _____

NOMBRE DEL **FUNCIONARIO** QUE COMPARECE EN EL CONTRATO:

LIC. JESUS GONZALEZ CRUZ

SEGUNDA PARTE

NOMBRE DEL **SUPLIDOR:** _____

Nombre de la Persona que Comparece en el Contrato: _____

Dirección Física: _____

Dirección Postal: _____

Seguro Social: _____ Teléfono: _____Celular: _____

Número de Registro Único de Licitador de ASG: _____ Número de SAM _____

----------**CLÁUSULAS**----------

1. El suplidor se compromete, en caso de que surja una situación de emergencia o desastre en toda la isla o en algún pueblo o región, así declarada por el Gobernador(a), a suplir al Gobierno, luego de recibir la Orden de Compra bajo el Procedimiento Especial del Plan de Emergencia Nacional, los productos, equipos y materiales incluidos en el Anejo 1 de este Contrato, a los precios ofrecidos o a los establecidos por D.A.C.O., al momento de la emergencia, el que sea menor. El suplidor se compromete a servir los artículos o servicios, sujeto a que las condiciones físicas, climatológicas, de comunicaciones no lo impidan, o el estado del negocio, almacén y empresa no se haya visto afectado por el desastre en cuestión.
2. Anejo 1- "Lista de precios de servicios, productos, equipos y materiales que ofrece el suplidor", el cual debe incluir con el contrato.
3. El Suplidor reconoce y acepta que la prestación de bienes o servicios objeto de este contrato está condicionada a que el(la) Gobernador(a) de Puerto Rico decrete un estado de emergencia y la entidad contratante requiera de éste la referida prestación.
4. Ningún comprador podrá requerirle al suplidor, venta bajo este contrato de no existir una situación de emergencia declarada por el Gobernador, y si el suplidor efectúa ventas, no podrá requerir pago alguno.
5. La Administración de Servicios Generales, establece que para las compras efectuadas bajo este contrato no se exigirá fianza de licitación ni de ejecución.
6. Este contrato estará en vigor durante un año natural a partir de la fecha de su otorgamiento. Sin embargo, toda orden de compra u contrato que se levante de confomidad a este acuerdo no puede exceder del término que dure la emergencia. En caso que la misma exceda de (3) meses, las órdenes de compra o contratos que conllevan impacto presupuestario podrán ser extendido por un término de (3) mese adcionales. De sobrepasar el término, las adquiciones deben ser tramitada de confomidad con los procesos ordinarios de compras y lictaciones.

----------**CLAÚSULAS MANDATORIAS**----------

-----**UNO: CLÁUSULA DE SERVICIOS INTERAGENCIALES:** ----------
----Las partes contratantes reconocen y aceptan que los servicios contratados podrán ser brindados a cualquier entidad de la Rama Ejecutiva con la cual la entidad contratante realice un acuerdo interagencial o por disposición directa de la Secretaría de la Gobernación. Estos servicios se realizarán bajo los mismos términos y condiciones consignados en este contrato. Para efectos de esta cláusula, el término "entidad de la Rama Ejecutiva" incluye a todas las agencias del Gobierno de Puerto Rico, así a las como las instrumentalidades y corporaciones públicas y a la Oficina del Gobernador.
-----**DOS: TERMINACIÓN DE CONTRATO**: ----------
-----**A.** La Secretaría de la Gobernación tendrá la facultad para dar por terminado el presente contrato en cualquier momento, de levantarse o requerirse bienes o servicios en respuesta a una emergencia. Todo aquel contrato de servicios profesionales o comprados en exceso de **DIEZ MIL DÓLARES ($10,000.00)** dólares que no incluya la cláusula de servicios interagenciales y/o la cláusula de terminación se entenderá como desautorizado, por lo que será nulo desde su inicio, incluyendo aquellos contratos otorgados en casos de emergencia, según definido en el inciso (c) de la Sección VI de este Memorando Número 2017-001 de la Oficina de Secretaria de la Gobernación/ Carta Circular 141-17 Oficina de Gerencia y Presupuesto**.** ----------
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-----**B.** La negligencia, abandono de deberes e incumplimiento de las cláusulas de este contrato o conducta impropia del Suplidor, constituirá causa suficiente para dar por terminado el contrato inmediatamente sin necesidad de previa notificación.

-----**C**. La entidad contratante podrá resolver este contrato antes de su vencimiento, mediante notificación escrita con acuse de recibo al Suplidor, con diez (10) días de antelación a la fecha de resolución, sin que por ello incurran las partes en obligación alguna. La entidad contratante podrá resolver el presente contrato en cualquier momento y sin notificación previa cuando entienda es en el mejor interés público. ----------
-----La entidad contratante podrá resolver este contrato sin notificación previa en caso de que el Suplidor resulte convicto por los delitos contra el erario, la fe y la función pública o que involucren fondos o propiedad pública en la jurisdicción estatal o federal. ----------
-----**TRES: PENSIÓN ALIMENTARIA**: ----------
-----El Suplidor viene obligado a cumplir con la Certificación de Cumplimiento Patronal o Individual de la Administración para el Sustento de Menores (ASUME), conforme establece la Ley Número 5 de 1996, según enmendada. ----------
___ El Suplidor presentó al momento de suscribir este contrato la Certificación de Estado de Cumplimiento requerida como patrono y/o la Certificación Negativa de Caso o Certificación de Estado de Cuenta requerida. ----------
___ El Suplidor certifica como ***patrono*** que al momento de suscribir este contrato no tiene obligación de efectuar pagos de pensión alimentaria. ----------
___ El Suplidor certifica como ***patrono*** que al momento de suscribir este contrato tiene obligación de efectuar pagos de pensión alimentaria y se encuentra al día o tiene un plan de pago aprobado con el que está cumpliendo. ----------
____El Suplidor certifica como ***persona*** que al momento de suscribir este contrato no tiene obligación de efectuar pagos de pensión alimentaria. ----------
____ El Suplidor certifica y garantiza como ***persona*** que al momento de suscribir este contrato tiene obligación de efectuar pagos de pensión alimentaria y se encuentra al día o tiene un plan de pago aprobado con el que está cumpliendo. ----------
-----El Suplidor expresamente reconoce que ésta es una condición esencial del contrato y de no ser correcta en todo o en parte la anterior certificación, será causa suficiente para que la entidad contratante pueda resolver el contrato y el Suplidor tendrá que devolver toda la suma de dinero recibida bajo este contrato. ----------
-----**CUATRO: SUSTENTO DE PERSONAS DE EDAD AVANZADA:** ----------
-----El Suplidor certifica que: ----------
_____Tiene la obligación y está en cumplimiento con las obligaciones que le fueron impuestas mediante orden judicial y/o administrativa, de conformidad con las disposiciones de la Ley Núm. 168 de 2000, conocida como Ley para el----------
Fortalecimiento del Apoyo Familiar y Sustento de Personas de Edad Avanzada. ----------
_____ No tiene obligación de aportar económicamente o de cumplir con alguna obligación por orden judicial o----------
administrativa para con una persona de edad avanzada. ----------
-----El Suplidor conoce que certificar información falsa la expone a la resolución inmediata del contrato. ----------
-----**CINCO**: **ANTIDISCRIMEN**: ----------
El Suplidor se compromete a no discriminar por motivo de raza, color, sexo, origen o condición social, edad, ideas políticas o religiosas o cualquier otra causa discriminatoria en la prestación de los servicios objeto de este contrato. La Ley Núm. 46 de 2002 tipifica como delito y añade razones por las que no se puede discriminar contra una persona, tales como orientación sexual, género, origen étnico, estatus civil, nacimiento e impedimento físico y/o mental. ----------
----**SEIS: INTERÉS PECUNIARIO**: ----------
-----El Suplidor declara que a su mejor saber y entender, ninguna persona servidora pública de la entidad contratante o integrante de sus unidades familiares, persona funcionaria o empleada de la entidad contratante tiene interés pecuniario alguno, directa o indirectamente en el presente contrato (Ley de Ética Gubernamental de 2011 según enmendada).----------
-----El Suplidor certifica que a su mejor saber y entender, no existe conflicto o incompatibilidad entre las obligaciones contraídas en este contrato y las obligaciones contraídas con otras personas, corporaciones públicas, agencias o entidades

del Gobierno de Puerto Rico. El Suplidor hace expreso reconocimiento de su deber de no tener ningún interés profesional ni particular en cualquier asunto que sea incompatible o represente un conflicto de interés entre él y la entidad contratante. ----
-----El Suplidor certifica que: ----------
-----Ninguna persona empleada de la entidad contratante tiene interés pecuniario en este contrato, compra o transacción comercial, ni tampoco ha tenido en los últimos cuatro (4) años interés pecuniario directa o indirectamente en este negocio.--
----Ninguna persona empleada de la entidad contratante le solicitó o aceptó, directa o indirectamente, para ella ni para un integrante de su unidad familiar ni para cualquier persona, regalos, gratificaciones, favores, servicios, donativos, préstamos o cualquier otra cosa de valor monetario.----------
-----Ninguna persona servidora pública le solicitó, directa o indirectamente, para ella ni para un integrante de su unidad familiar ni para cualquier otra persona, negocio o entidad, bien alguno de valor económico, incluyendo regalos, préstamos, promesas, favores o servicios, a cambio de que su actuación influenciara a favor del Suplidor. ----------
-----El Suplidor certifica que no tiene relación de parentesco dentro del cuarto grado de consanguinidad ni del segundo por afinidad, con ninguna persona servidora pública que tenga facultad para influenciar y participar en las decisiones institucionales de la entidad contratante----------
-----**SIETE: FUNCIONARIO DE GOBIERNO**: ----------
-----El Suplidor declara que no es funcionario o empleado del Gobierno de Puerto Rico ni de ninguna de sus agencias o entidades, por lo cual certifica que no recibe pago o compensación alguna por servicios prestados bajo nombramiento en otra agencia, organismo, dependencia, corporación pública o municipio de Puerto Rico. ----------
OCHO: ORDEN EJECUTIVA OE 2001-73: ----------
-----El Suplidor deberá presentar facturas que, en cumplimiento de la Orden Ejecutiva 2001-73, deben contener la siguiente certificación:----------

> *"Bajo pena de nulidad absoluta certifico que ninguna persona servidora pública de la Administración de Servicios Generales es parte o tiene algún interés en las ganancias o beneficios producto del contrato objeto de esta factura y, de ser parte o tener interés en las ganancias o beneficios producto del contrato, ha mediado una dispensa previa. La única consideración para suministrar los servicios objeto del contrato ha sido el pago acordado con el representante autorizado de la agencia. El importe de esta factura es justo y correcto. Los servicios han sido prestados y no han sido pagados".* ----------

-----Ninguna agencia o departamento de la Rama Ejecutiva pagará factura alguna que no contenga la certificación antes indicada. ----------
-----La entidad peticionaria certifica haber entregado copia fiel y exacta del original de la Orden Ejecutiva 2001-73 al momento de la firma de este contrato. ----------
-----Las facturas deberán ser sometidas para pago no más tarde de los primeros diez (10) días del mes siguiente al cual se rindieron los servicios. Conforme a la Carta Circular 1300-22-18, todas las facturas deberán ser registradas en el Registro de Facturas en Línea. El Suplidor igualmente deberá presentar las facturas en papel no más de diez (10) días luego de terminado el período o fecha de entrega del bien o servicio, según las disposiciones de la Carta Circular 1300-02-10 del 14 de julio de 2009. ----------
-----**NUEVE**: **CONTRIBUCIONES SOBRE INGRESOS:** ----------
-----El Suplidor certifica y garantiza que al momento de suscribir este contrato: ----------
_____ Rindió su planilla de contribución sobre ingresos durante los cinco (5) años previos (SC-6088), su planilla sobre la propiedad mueble (Certificación de Planillas de Contribución sobre la Propiedad Mueble), su planilla sobre el impuesto de ventas y uso durante los últimos sesenta (60) periodos contributivos (Certificación de Radicación de Planillas del Impuesto sobre Ventas y Uso-IVU) y, cualquier otra que le sea requerida por ley. ----------
_____ No tiene deuda: de contribución sobre ingresos (SC-6096), de impuesto sobre ventas y uso-IVU (SC-2927), sobre la propiedad mueble (Certificación de Deuda por todos los conceptos o Certificación Negativa de Propiedad Mueble o----------
Inmueble), por otros conceptos o de arbitrios al Gobierno de Puerto Rico. ----------
_____ Tiene una deuda contributiva por concepto de:_____ que está pagando de acuerdo con con los términos y condiciones del plan de pago que le fue autorizado por el Departamento de Hacienda (SC-6096– contribuciones sobre ingreso o SC-2927– del impuesto sobre ventas y uso-IVU) o Centro de Recaudación de Ingresos Municipales (CRIM) el día _____ de _____de _____.----------
_____ Presentó Certificación de Registro como Patrono y las certificaciones expedidas por el Departamento del Trabajo y Recursos Humanos de que no tiene deuda de Seguro por Desempleo, de Seguro por Incapacidad temporera y/o de Seguro Seguro Social Choferil (lo(s) que aplique(n)).----------
_____ Tiene deuda de Seguro por Desempleo, Seguro por Incapacidad temporera y/o Seguro Social Choferil (lo(s) que aplique(n)) y se encuentra acogida a un plan de pago con cuyos términos y condiciones está cumpliendo. ----------
_____ Tiene deuda con el Departamento de Hacienda y/o con el Centro de Recaudación de Ingresos Municipales (CRIM) y no está acogido a un plan de pago por lo que se compromete a cancelarla(s) mediante retención con cargo a los pagos que tiene derecho a recibir conforme al contrato. ----------
_____ Está exenta del pago de contribución sobre ingresos de conformidad con la opinión administrativa de 22 de julio de 1996 y disfruta de exención contributiva bajo las disposiciones de la Sección 1101 (4) del Código de Rentas Internas de Puerto Rico de 2011, enmendado que no ha sido revocada o enmendada y se encuentra en pleno vigor.

-----El Suplidor expresamente reconoce que esta cláusula es una condición esencial de este contrato y de no ser correcta en todo o en parte la anterior certificación, esto será causa suficiente para que la entidad contratante pueda resolver el contrato y el Suplidor tenga que reembolsar toda suma de dinero recibida como resultado de este contrato. ----------

-----**DIEZ:** Toda documentación solicitada se hace formar parte de este contrato. Según se disponga mediante regulaciones aplicables y/o ordens ejecutivas----------

----------**CLÁUSULAS PARTICULARES**----------

-----**ONCE:** El Suplidor se compromete a cumplir con las disposiciones del Artículo III de la Ley Número 2 de 2018, conocida como Código de Ética para Contratistas, Suplidores y Solicitantes de Incentivos Económicos de las Agencias Ejecutivas del Gobierno de Puerto Rico. ----------

-----**DOCE: CONFIDENCIALIDAD**: ----------

-----El Suplidor reconoce la naturaleza confidencial de toda información interna, no pública, de negocios y de sistemas de información relacionada con el funcionamiento de la entidad contratante y del Gobierno de Puerto Rico, sus agencias, corporaciones o municipios que le sea provista para la prestación de sus servicios profesionales. ----------

----- El Suplidor se compromete a mantener en estricta confidencialidad toda información obtenida por razón de los servicios contratados, excepto en caso de que la información le fuere previamente conocida, sea de conocimiento público o sea provista por terceras personas que no estén obligadas a mantener la información confidencial. ----------

----- El Suplidor mantendrá bajo estricta confidencialidad todo documento, material, información o dato que la entidad contratante le provea, no pudiendo en ningún caso hacerlos públicos ni facilitarlos a terceras personas sin previamente obtener el consentimiento escrito de la entidad contratante. ----------

-----**TRECE:** Todo documento cursado entre las partes durante el transcurso de esta contratación, así como todo programa y documento emitido por las partes relacionado al contrato y toda correspondencia, informes o material pertinente resultado de los servicios que ha prestado el Suplidor, serán de propiedad exclusiva de la entidad contratante y no podrán ser usados para ningún otro propósito sin el consentimiento escrito de la entidad contratante. ----------

-----Se establece que todo material y documento de trabajo podrá ser reproducido y utilizado por la entidad contratante para uso interno con sus empleados y, que los informes y análisis relacionados con las tareas a realizar bajo este contrato serán propiedad de la entidad contratante.----------

-----**CATORCE:** El Suplidor hace constar que a su mejor saber y entender no es objeto de investigación o procedimiento civil o criminal por hechos relacionados con algunos de los delitos mencionados en la cláusula que sigue. Además, hace constar que conoce su deber de informar a la entidad contratante cualquier situación que ocurra durante la etapa previa al otorgamiento del contrato y durante su vigencia que tenga relación con los delitos que se mencionan a continuación.

-----**QUINCE**: **DEPARTAMENTO DE JUSTICIA**: ----------

-----Conforme a la **Carta Circular 2009-01 del 9 de marzo de 2009** del Departamento de Justicia, El Suplidor certifica, acepta y reconoce lo siguiente por lo cual estampa sus iniciales en cada uno de los incisos: ----------

_____1. Que no ha sido convicto ni se ha encontrado causa probable para su arresto por ningún delito contra el erario, la fe o la función pública, contra el ejercicio gubernamental o que involucre fondos o propiedad pública; ----------

_____2. Que ni ella ni alguno de sus accionistas, socios u oficiales ha sido convicto ni se ha encontrado causa probable para su arresto por ningún delito contra el erario, la fe o la función pública, contra el ejercicio gubernamental o que involucre fondos o propiedad pública; ----------

_____3. Que se resolverá el contrato en caso de que se encuentre causa probable para su arresto por la comisión de un delito contra el erario, la fe o la función pública, contra el ejercicio gubernamental o que involucre fondos o propiedad pública, en el ámbito federal o estatal. ----------

_____4. Su deber de informar de manera continua y durante la vigencia del contrato cualquier hecho que se relacione con la conducción de cualquier investigación por la comisión de un delito contra el erario, la fe o la función pública, contra el ejercicio gubernamental o que involucre fondos o propiedad pública, en la jurisdicción federal o estatal. Se establece que esta obligación es de naturaleza continua durante todas las etapas de la contratación y ejecución del contrato. ----------

_____5. Que durante los diez (10) años previos a la formalización del contrato no ha cometido delito contra el erario, la fe o la función pública, contra el ejercicio gubernamental o que involucre fondos o propiedad pública, en la jurisdicción federal o estatal. En los casos donde no se haya determinado la causa probable para arresto, alegación de culpabilidad ni acusación contra el Suplidor**,** pero se hayan realizado expresiones o admisiones de delito, el jefe de agencia tendrá que remitir el asunto al Secretario del Departamento de Justicia quien realizará las determinaciones y recomendaciones pertinentes en cuanto a esta parte. ----------

_____6. Además, certifica que no tiene litigios en proceso en contra de alguna entidad gubernamental. ----------

-----**DIECISÉIS**: El Suplidor hace constar que el nombre de esta entidad no ha sido excluido de participar en los contratos cuyos fondos provienen de asignaciones federales, según verificado en la lista de entidades excluidas y/o suspendidas que publica la Administración de Servicios Generales del Gobierno Federal (GSA). ----------

-----**DIECISIETE:** Todos los documentos del sistema de contabilidad estarán disponibles en todo momento para ser auditados por la entidad contratante o su representante autorizado, por la Oficina del Contralor de Puerto Rico y las agencias federales

concernientes. Estos documentos serán retenidos por el término de seis (6) años. La presente cláusula será de estricto cumplimiento. ----------

-----El incumplimiento será causa suficiente para rescindir inmediatamente este contrato. ----------

-----**DIECIOCHO:** El Suplidor autoriza a representantes del General Accounting Office (GAO) de los EEUU el acceso, inspección y transcripción de sus libros de contabilidad, documentos y registros directamente relacionados con el propósito de este contrato y para propósitos exclusivamente de auditoria. ----------

DIECINUEVE: El Suplidor certifica que no ha incurrido en conducta deshonrosa, que no es adicto habitual y excesivo de sustancias controladas y/o bebidas alcohólicas; que no ha sido convicto por delito grave o por cualquier delito que implique depravación moral y, no ha sido destituido del servicio público. De haber incurrido en alguna de dichas causas inhabilitantes deberá presentar la Resolución relacionada.----------

-----Si durante la vigencia del contrato el Suplidor incurriera en alguna de las causas inhabilitantes, la entidad peticionaria podrá resolver inmediatamente sin necesidad de notificación previa.----------

VEINTE: El Suplidor certifica que no tiene pleitos vigentes contra el Gobierno de Puerto Rico y/o sus funcionarios. ----------

VEINTIUNO: El Suplidor acepta recibir los pagos por bienes o servicios prestados mediante transferencia electrónica. A tales efectos, este se obliga a completar el Modelo SC 733, "Autorización y Acuerdo para Pago Electrónico de Suplidores". --------

VEINTIDÓS: SEPARABILIDAD: ----------Las partes estipulan que las cláusulas y condiciones de este contrato son independientes y separadas entre sí y que la nulidad de una o más de las cláusulas no afectará la validez de las demás cláusulas y condiciones aquí establecidas las cuales se obligan a cumplir.-

VEINTITRÉS: Toda notificación o comunicación que tengan las PARTES a su haber por motivo de este Contrato, se consignará en documento escrito y será enviada a la dirección que aparece debajo de las firmas en este Contrato, salvo que las PARTES notifiquen un cambio de dirección. ----------

----------**ACEPTACIÓN**----------

-----Las **PARTES** comparecientes afirmamos haber leído este contrato en todas y cada una de sus partes y lo encontramos redactado conforme a lo convenido, por lo cual lo aceptamos y lo ratificamos en la plenitud de su contenido y para que así conste lo firmamos en la última página y escribimos nuestras iniciales al margen de todas. ----------

En_____, Puerto Rico, hoy ____ de _____ de _____. ----------

_____	_____
Firma del Jefe de la Agencia o su Representante Autorizado	**Firma del Suplidor**

*Anejar resolución corporativa que autorice la comparecencia a este contrato, si aplica.