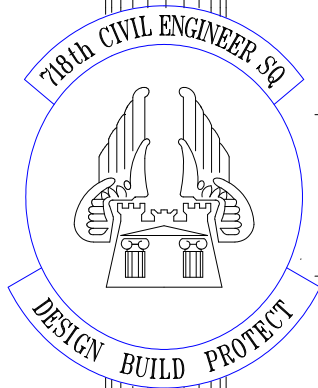


18th CIVIL ENGINEER GROUP
718th CIVIL ENGINEER SQUADRON
KADENA AIR BASE, OKINAWA, JAPAN



Specifications

for project:

ATTACHMENT 1

TECHNICAL SPECIFICATION

FOR

REPAIR MILITARY FAMILY HOUSING, KINSER
HEIGHTS, Camp Kinser, Okinawa, Japan
14 February 2017

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SECTION 01 56 00

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.01 REFERENCES: The publications listed below form a part of this specification to the extent referenced. The Publications are referred to in the text by the basic designation only. The Contractor will comply with applicable laws and regulations of the Government of the United States and Japan, however denominated, including those applicable political subdivisions, departments and other entities, to include but not limited to the following:

A. CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
40 CFR 260-271	Resource Conservation and Recovery Act (RCRA)

B. UNITED STATES AIR FORCE INSTRUCTION (AFI)

AFI 32-1066	Backflow Prevention Program
AFI 32-1067	Water Systems
AFI 32-7006	Environmental Program in Foreign Countries
AFI 32-7041	Water Quality Compliance
AFI 32-7080	Pollution Prevention
AFI 32-7042	Waste Management
AFI 32-7086	Hazardous Waste Management
AFI 48-144	Safe Drinking Water Surveillance Program

C. DEPARTMENT OF DEFENSE INSTRUCTIONS (DoD)

DoD 4715.05-G	Overseas Environmental Baseline Guidance Document (OEBGD)
DoDI 4715.4	Pollution Prevention

D. EXECUTIVE ORDERS

Executive Order 13423	Strengthening Federal Environmental, Energy and Transportation Management
Executive Order 13514	Federal Leadership in Environmental, Energy and Economic Performance

E. HQ USAF POLICIES

HQ USAF/ILE Memorandum	Tracking and Reporting Solid Waste Disposal and Diversion from Landfills, 6 Feb 2001
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F. HQ AFCESA/CE POLICIES

ETL 00-1

Engineering Technical Letter (ETL) 00-1: EPA Guideline Items in Construction and Other Civil Engineering Specifications

G. UNITED STATES FORCES JAPAN

JEGS

Japan Environmental Governing Standards

H. LOCAL REGULATIONS

18WG AMP

18th Wing Asbestos Management Plan

18WG HMMP

18th Wing Hazardous Materials Management Plan

18WG HWMP

18th Wing Admin Plan 544 – Hazardous
Management Plan

18WG ICRMP

18th Wing Integrated Cultural Resources
Management Plan

18WG INRMP

18th Integrated Natural Resources Management Plan

18WG SPRP

18th Wing Admin Plan 545 – Spill Prevention and Response

18WG SWPPP

18th Wing Storm Water Pollution Prevention Plan

I. GOVERNMENT OF JAPAN MINISTRY OF ENVIRONMENT

Air Pollution Control Law

Waste Management and Public Cleansing Law

PCB Special Measures Law

Chemical Substances Control Law

Law of Prevention of Marine Pollution and Marine Disaster

Law for the Conservation of Endangered Species of Wild Fauna and Flora

Law for the Protection of Cultural Properties

E. GOVERNMENT OF JAPAN MINISTRY OF HEALTH, LABOR AND WELFARE

Industrial and Safety Health Law

F. GOVERNMENT OF JAPAN MINISTRY OF LAND INFRASTRUCTURE AND
TRANSPORT AS APPLICABLE

G. OKINAWA PREFECTURAL LAWS AND MUNICIPAL LAWS AS APPLICABLE

1.02 DEFINITIONS:

A. Asbestos Containing Materials (ACM): Any material containing more than 0.1 percent asbestos by weight.

- B. Bulky Waste: Large items of solid waste such as household appliances, furniture, large auto parts, trees, branches, stumps, and other oversize waste whose larger size precludes or complicates their handling by normal solid waste collection, processing or disposal methods.
- C. Construction and Demolition Waste: The waste building materials, packaging and rubble resulting from construction, remodeling, repair and demolition operations on pavements, houses, commercial buildings and other structures.
- D. Food Wastes: The organic residues generated by the handling, storage, sale, preparation, cooking and serving foods commonly called garbage.
- E. Hazardous Material (HAZMAT): Any material that is capable of posing an unreasonable risk to human health, safety, or the environment if improperly handled, stored, issued, transported, labeled, or disposed of because it displays a characteristics listed in JEGS JEGS Chapter 5, Table C5.T1, "Hazardous Materials Characteristics," or the material is listed in JEGS, Appendix 1, Table Ap1.T4, "List of Hazardous Waste/Substances/ Materials." Munitions are excluded.
- F. Hazardous Substance: Any substance having the potential to do serious harm to human health or the environment if spilled or released in reportable quantity. A list of these substances and the corresponding reportable quantities is contained in JEGS Appendix 1, AP1.1, "Characteristics of Hazardous Waste and Lists of Hazardous Waste and Hazardous Material."
- G. Hazardous Waste: A discarded material that may be solid, semi-solid, liquid, or contained gas and either exhibits a characteristic of a hazardous waste as defined in section JEGS AP1.1 or is listed as a hazardous waste in JEGS, Appendix, Tables Ap1.T1 through AP1.T4.
- H. Lead-based Paints (LBP): For paint in liquid form, LBP is defined as paint that contains more than 0.06% or 600 ppm lead by weight in the total non-volatile content of liquid paint. For paint in place, LBP is defined as paint or other surface coatings that contain lead ≥ 1.0 mg/square centimeter or 0.5% (5000 ppm) by weight.
- I. Ozone Depleting Substances (ODS): Those substances listed in JEGS, Chapter 2, Table C2.T1.
- J. Petroleum, Oil and Lubricants (POL): Refined petroleum, oils, and lubricants, including, but not limited to, petroleum, fuel, lubricant oils, synthetic oils, mineral oils, animal fats, vegetable oil, sludge and POL mixed with wastes other than dredged spoil.
- K. Rubbish: A general term for solid waste, excluding food wastes and ashes, taken from residences, commercial establishments and institutions.

- L. Solid Waste: Garbage, refuse, sludge and other discarded materials, including solid, semi-solid, liquid, and contained gaseous materials resulting from industrial and commercial operations and from community activities. It does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluent, dissolved materials in irrigation return flows or other common water pollutants.

PART 2 PROHIBITED PRODUCTS

- 2.01 No Asbestos Containing Materials (ACM): See paragraph 3.01(D)(9)(a).
- 2.02 No Lead or Chromate Based Paints: See paragraph 3.01(D)(10)(a).
- 2.03 No Polychlorinated Bphenyls (PCBs): See paragraph 3.01(D)(1)(a).
- 2.04 No Class I Ozone Depleting Substances (ODS): See paragraph 3.01(D)(1)(a).
- 2.05 No Lead Drinking Water Pipes, Solders, Flux, And Fittings: See paragraph 3.01(D)(2)(b).

PART 3 EXECUTIONS

- 3.01 ENVIRONMENTAL PROTECTION REQUIREMENTS: Contractor shall provide and maintain, during the life of the contract, environmental protection as specified in this part. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Comply with applicable laws and regulations of the Governments of the United States and Japan, however denominated, including those applicable political subdivisions, departments and other entities pertaining to the environment, including, but not limited to, water land, and air pollution. Assurance that subcontractors shall comply withal environmental protection requirements of this section will be the sole responsibility of the prime Contractor. The Contractor shall record any problems in complying with laws, regulations, permit requirements, ordinances, and corrective actions taken. The Contractor shall immediately inform the Contracting Officer (CO) of any environmental problems.
 - A. Applicable Regulations: The Contractor shall determine which Federal, GOJ, JEGS, Prefectural laws, regulations and permits concerning environmental protection, pollution control and abatement are applicable to the Contractor's proposed operations and requirements imposed by those laws, regulations and permits. Whenever there is conflict between Federal, GOJ, JEGS, or Prefectural laws, regulations and permit requirements, the strictest applicable rule applies. The Contractor shall provide a list of applicable laws, regulations and permits to 718 CES/CEAN before starting project work.

- B. Training Program: The Contractor shall implement a training program to ensure that all Contractor are trained in environmental protection requirements. The Contractor shall designate persons(s) to be responsible for environmental protection training of personnel and shall submit the names and qualifications of persons to 718 CES/CEAN before starting project work.
- C. Environmental Representatives: The Contractor shall designate a Primary and an Alternate Environmental representative. Contractor must provide the name, telephone number, and address of the Primary and Alternate Environmental representative to 718 CES/CEAN before starting project work. The Environmental Representative will be responsible for providing all project submittals according to paragraph 3.02 Submittals for coordinating with 718 CES/CEAN on any environmental issues encountered during work.
- D. Environmental Protection Areas
 - 1. Air Emissions & Ozone Depleting Substances
 - a. No Class I Ozone Depleting Substances (ODS): Class I ODS listed in JEGS, Chapter 2, Table C2.T1 are prohibited from being used in construction, remodeling, or maintenance. Contractor must provide certifications that materials utilized during the project do not contain Class I ODS. The purchase of Class I ODS for air conditioning and refrigeration equipment for ground applications is also prohibited by AFI 32-7086 (Paragraph 4.4.3) on all new and/or refurbishing projects. NOTE: Limited exceptions exist for using Class I ODS for airborne equipment with prior approval.
 - b. Class II ODS Approval Request: Class II ODS listed in JEGS, Chapter 2, Table C2.T1 must be first approved by 718 CES/CEAN prior to use.
 - c. All Refrigerant Types: ensure a weatherproof date plate is permanently attached to refrigeration (or air conditioning) equipment, in a location visible to maintenance workers, showing refrigerant type and full charge quantity.
 - d. Generators and Boilers: If generators or boilers are to be installed or replaced as part of the project, the Contractor shall provide 718 CES/CEAN with the heat exchange surface area in square meters for boilers and the fuel oil consumption rate in liters per hour for boilers and generators.
 - e. Particulates: Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials shall be controlled at all times, including weekends and holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow

areas and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or nuisance. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

2. Water Resources

- a. The Contractor shall keep construction activities under surveillance, management and control and shall monitor all waters affected by construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination. Contractor shall prevent oily wastes or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Monitoring of water areas affected by the construction shall be the Contractor's responsibility.
- b. No Lead Drinking Water Pipes, Solder, Flux and Fittings: Materials that contain amounts greater than 0.2% lead for solder or flux and 8.0% lead for pipes and fittings are prohibited from being used in construction, remodeling and maintenance. Contractor must provide certifications that materials utilized do not contain lead to 718 CES/CEAN before starting project work.
- c. Site Specific Storm Water Pollution Prevention Plan: The Contractor shall develop and submit a site specific storm water pollution prevention plan (SWPPP) before starting the project work. The SWPPP must identify Best Management Practices (BMPs) as indicated in JEGS, Chapter 4, Table C4.T3 and include methods and drawings (if applicable) to prevent storm water pollution as specified in the storm waste pollution prevention measures section below.
 - i. Storm Water Pollution Prevention Measures: The Contractor shall use proper control and management techniques to ensure storm water criteria are met in accordance with Federal, JEGS, GOJ. Prefectural and local storm water regulations. As required by JEGS, Chapter 13, erosion/sediment control measures to prevent the discharge of silt into nearby water shall be implemented. Control measures should include the use of vegetative covers, construction of diversion drains, grading management, filter strips, and use of sediment basins. Runoff from the construction site or from storms shall be controlled, retarded and diverted, as indicated on the SWPPP drawings, to protect drainage courses by means of diversion ditches, benches and berms. Berms, dikes, drains, sedimentation basins, grassing and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative. Silt screens must be installed prior to start of

construction. Silt screens and/or other erosion control devices shall be installed on construction sites that are in or near water. Silt screens shall consist of trenched and staked filter fabric and trenched and staked hay bales. Filter fabric must be toed 8 inches into the soil to avoid sediments that would be transported via water under the screen. Hay bales must be placed end to end on the downstream side of the screen and be trenched and staked firmly into the ground. Chinking is usually required to fill gaps between the bales. Silt screens must be maintained properly. Screens and other control devices must be inspected once a week and after any rainfall event totaling in ½ inch or more to ensure they are in good repair and functioning properly. In areas that experience high flow rates, extra precautions will be necessary to stabilize screens. Trenching of hay bale barriers is required to adequately control runoff. A series of screens may have to be installed in waters that are especially turbid to properly filter out sediments. Silt screens will remain in place and properly maintained until the site is properly stabilized with sod or seeding.

- ii. Providing erosion and sediment control measures in accordance with laws and regulations is the Contractor's responsibility. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of construction activities. The area of bare soil exposed at any one time by construction operation should be kept to a minimum. Construct or install temporary and permanent erosion and sediment control BMPs as indicated on the drawings and as specified in the SWPPP. BMPs may include, but not limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels and sedimentation basins. The Contractor's Best Management Practices must also be in accordance with the JEGS and the SWPPP. Remove any temporary measures after the area has been stabilized.
- iii. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Side and back slopes shall be protected as soon as practicable upon completion of rough grading. Earthwork brought final grade shall be finished as indicated.
- iv. The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings, or as directed by the CO. Temporary movement or relocation of the Contractor's facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with

the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

- d. **Waste Water Management Plan:** Prior to the start of site work, the Contractor shall submit to 718 CES/CEAN a Waste Water Management Plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water and water used in flushing of lines. If a settling/retention pond is required, the Plan must include the design of the pond, including drawings, removal plan, and testing requirements for possible pollutants. If disposal is to a sanitary sewer, the Plan must include documentation that the Waste Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge. Contractor is not authorized sewage holding tanks on base and is not authorized to dispose of water from chemical toilets/porta-potties via the installation sewer. When using chemical toilets, plan for procuring a porta-potty/chemical toilet service contract. The porta-potty/chemical toilet service contract must include the correct maintenance, waste collection, transportation and disposal of all porta-potty/chemical toilets and content and include provisions for pest control and elimination of odors. If the project generates wastewater from rinsing tanks, dewatering sites, etc., the Contractor shall ensure proper disposal.
3. **Hazardous Materials**
- a. **Hazardous Material Inventory and Material Safety Data Sheets:** Approval is required before bringing any hazardous materials (HAZMAT) onto the installation. Consult with the Hazardous Materials Pharmacy (HAZMART) at 634-7725 for a determination of whether or not a product is a HAZMAT. Contractors seeking approval to bring HAZMAT onto the installation must submit an AF Form 3952. A Material Safety Data Sheets (MSDS), in English and Japanese must accompany the AF Form 3952. For specific details on information required for submitting an AF Form 3952, contact the HAZMART. The Contractor must coordinate and route the AF Form 3952 through 18th Wing Safety, Fire Department, Bioenvironmental and 718 CES/CEAN. All excess materials and empty containers are the responsibility of the Contractor and shall be removed at the end of the contract. Should Contractor HAZMAT requirements change during the project, the Contractor shall submit a new or revised USAF Form 3952 and obtain approval before bringing the HAZMAT onto the installation.
 - b. **Hazardous Material Storage, Handling and Marking:** HAZMAT must be stored, handled, used and disposed of in accordance with 29 CFR 1910, JEGS Chapter 5 and local regulations. The Contractor shall observe HAZMAT storage practices

in accordance with regulations, policies, plans and procedures employed by the installation. All containers with HAZMAT shall be correctly marked/labeled with DD Form 2522 (DD-2522) or an equivalent label. The label shall include the container's contents, shall be legible and shall be protected from damage (e.g., by covering label with plastic or tape). Labeling requirements apply to all HAZMAT containers, including compressed gas cylinders, fuel containers, acid containers, and ODC containers

- c. Notification of Unexpected Hazardous Material Discovery: All Contractor personnel shall immediately report to the CO and to 718 CES/CEAN any hazardous materials, substances, chemicals or contaminated areas encountered. Additionally, Contractor personnel shall immediately cease w

4. Hazardous Waste

- a. The Contractor shall be considered the primary co-generator for all hazardous wastes generated throughout the duration of the contract. However, all hazardous waste management activities shall be coordinated and approved by 718 CES/CEAN. All hazardous waste, except asbestos, will be delivered to the Kadena Hazardous Waste Storage Facility (HWSF) for tracking and disposal per JEGS, Chapter 6. All hazardous waste must be managed in accordance with the JEGS and applicable laws and regulations of the Government of the United States and Japan, however dominated, including those applicable political subdivisions, departments and other entities. The CO shall contact 718 CES/CEAN if handling procedures for hazardous wastes and materials are unclear. Under no circumstances may hazardous waste be disposed of in the dumpster (18th Wing Admin Plan 544).
- b. Hazardous wastes, including excavated contaminated soil, shall be stored, transported and disposed in accordance with the JEGS and applicable laws and regulations of the Governments of the United States and Japan, however denominated, including those applicable political subdivisions, departments, and other entities, including obtaining necessary local permits, licenses, and approvals. The Contractor shall identify what wastes are hazardous using specific and technical knowledge and/or sampling and analysis. This responsibility also includes preparation of waste profile sheets, packaging, marking and labeling of wastes in accordance with JEGS, Federal, GOJ, Prefectural and local requirements.
- c. All cost of labor, equipment, material and transportation and other services required to comply with applicable laws and regulations of the Governments of the United States and Japan, however denominated, including those applicable political subdivisions, departments, and other entities, governing hazardous waste generation are the responsibility of the Contractor. This requirement extends to

personnel training and the identification, initial accumulation and transportation of hazardous wastes generated during the project.

- d. Hazardous Waste Turn-In Procedures: Contractor must package hazardous waste in a UN approved container labeled in English and Japanese, furnish analytical results, and submit the containers and information to the Kadena HWSF. Kadena HWSF personnel will weigh the containers and complete a waste profile sheet for the material and manifest document (DD Form 1348-1A). If the Contractor does not provide adequate information for the HWSF to receive the hazardous waste, the Contractor shall correct any discrepancies on the spot or remove the unacceptable containers until the deficiencies can be corrected. For further information, call the Kadena Hazardous Waste Program Manager at 634-2600.
- e. Hazardous Waste Records: The Contractor shall maintain sampling, analysis and turn-in records for all hazardous waste generated during the project. These records shall include, but not be limited to: logs of sample locations or container identification data (including time and date of sample collection), analytical results, quality control data provided by the analytical lab pertaining to the sample analyzed, waste profile sheets provided by HWSF personnel for wastes streams turned-in to the HWSF and manifests (DD Forms 1348-1A) for all wastes turned over to the HWSF. Copies of this data shall be submitted to 718 CES/CEAN after the work is completed.

5. Solid Waste

- a. The Contractor shall reduce the amount of solid waste generated by the project to the maximum extent possible. To do so, the Contractor will institute a recycling program in accordance with DoDI 4715.4, AFI 32-7042 and Kadena AB Policy. The project's recycling program will include all Contractor employees and subcontractors. At a minimum, the following items shall be recycled; scrap metal, cardboard, concrete, asphalt, scrap wood, wood pallets, glass and plastic. Green wastes should be mulched or composted. The project site must be left clean and clear of all debris upon completion of work.
- b. Solid Waste Management Plan: To ensure the Contractor understands the solid waste reduction requirements and to comply with AFI 32-7042, paragraph 3.8.1.3, the Contractor is required to submit a Solid Waste Management Plan (SWMP) prior to the start of project work. The SWMP has four (4) sections: Diversions, Procedures, Training and Permits.
 - i. In the Diversion section, provide the dates for the start and end of work, the type of wastes expected to be generated by the project, estimated weights for each type of waste, and the facility or facilities where each waste will be taken.

Also include a list of which wastes will be recycled, estimated weights for each recyclable commodity, and the facility or facilities where each recyclable will be taken.

- ii. There are three procedures to describe in the Procedures section: Separation, Contamination Prevention and Transportation. The Separation Procedures outline how recyclables will be separated from the other wastes, how they will be collected, and where they will be stored at the project site until transported to recycling facilities. The Separation Procedures also detail how other wastes will be collected and where they will be stored at the project site until transported to disposal facilities. Be aware that containers for recyclables and other wastes must meet the requirements in JEGS C7.3.7 and C7.3.8, that storage of recyclables and other wastes must meet JEGS C7.3.4 and that storage of bulky wastes must meet JEGS C7.3.5. Explain in the Contamination Prevention Procedures how recyclables will be kept free from contaminants (recyclables and hazardous or toxic wastes). The Transportation Procedures outline how spills of recyclables or other wastes will be prevented during collection, storage, loading and transportation. They also detail how the recyclables and other wastes will be transported from the project site to the recycling or disposal facility. These procedures also must state how often recyclables and other wastes will be picked up by the transportation company.
 - iii. In the training section, set forth how employees and subcontractors will be trained on solid waste management policies and procedures. Include how training will be documented and who will conduct the training. Also outline any consequences or repercussions for employees or subcontractors that fail to follow the policies and procedures.
 - iv. The final section on the SWMP is the permits, licenses and agreements for the recycling and disposal facilities and for the transportation companies utilized during the project. Include English translations for all documents in this section.
- c. Solid Waste Documentation: During project execution and in accordance with the HQ USAF/ILE Memorandum, *Tracking and Reporting Solid Waste Disposal and Diversion from Landfills*, 6 Feb 01, submit weight tickets or manifests (with English translations) to 718 CES/CEAN for all materials removed from the project site. Weight tickets and manifests shall be submitted during the project every month by the 5th day of the following month. Designate on each document whether the material was disposed of recycled, or reused. Also include any additional or renewal permits, licenses, or agreements as required.

6. Historical and Cultural Resources

Notification of Discovery of Historical or Cultural Items: The Contractor shall immediately report to 718 CES/CEAN any historical and archeological items or human remains discovered in the course of work. Stop work in the immediate area of the discovery until the site is evaluated by 718 CES/CEAN and the CO provides direction. The Contractor shall be responsible for completing official paperwork on the discovery. Contact the 718 CES/CEAN Cultural Resources Manager at 634-2600 for more details.

7. Natural Resources

- a. Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. The Contractor shall confine activities to areas defined by the drawings and specification. Environmental Protections shall be conducted as follows:
 - i. Except in areas indicated in drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, vines, shrubs, grasses, topsoil and land forms without the Contracting Officer's permission. Trees, shrubs, and other vegetation not identified for removal shall be protected against removal, injury, defacing and scarring – no ropes, cables, or guys shall be attached or fastened to any trees for anchorage unless authorized by the Contracting Officer. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources of all times and shall be responsible for any resultant damage.
 - ii. All Banyan trees must be preserved and protected. Banyan trees marks the villages and used as landmarks for the Okinawans. Any Banyan tree requiring requiring destruction or removal must first be coordinated with the 18 CEG/CC or in his absence, 18 CEG/CD. Protect existing trees that are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Remove trees with 30 percent or more of their root systems destroyed
 - iii. Replacement: Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features including reseeding. Exotic plants should not be introduced to the installation and indigenous trees/shrubs should be planted as much as possible. Obtain Contracting Officer approval before replacement.

- iv. Remove traces of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction. Grade temporary roads, parking areas, and similar temporarily used areas to conform to surrounding contours.

8. Polychlorinated Biphenyls (PCBS)

- a. No Polychlorinated Biphenyls (PCBs): Materials (e.g., ballasts, capacitors, transformers, Paper Insulated Lead Covered (PILC) Cable, etc.) that contain PCBs are prohibited from being used in construction, remodeling or maintenance. Contractor must provide manufacturer certifications that materials utilized do not contain PCBs, per JEGS, Chapter 14. Purchase of electrical equipment and transformers containing PCBs is prohibited from Kadena AB. Consult with the Electrical Systems Shop (18 CES/CEOFE) prior to the purchase of any transformer.
- b. Light Ballasts/Capacitors: Contractor must provide a manufacturer certification stating that the ballasts/capacitors used in the project are non-PCB to 718 CES/CEAN and 18 CES/CEOFE. All ballasts/capacitors must be removed from the fixtures. Ballasts/capacitors are to be separated based in country of origin (i.e. made in the US or Japan). Contact 718 CES/CEAN for guidance on turn-in procedures.
- c. Transformers: Contractor shall provide a manufacturer certification stating that the transformers used in the project are non-PCB. Contractor shall sample transformers for the presence of PCBs using a local Japanese laboratory in accordance with Japanese disposal methods. Contractor is required to submit bilingual copies of the sample results and laboratory certifications to 718 CES/CEAN and 18 CES/CEOFE within 30 days of receipt. If lab results indicate any detectable amount of PCB, immediately contact 718 CES/CEAN for guidance including turn-in procedures for transformers.

9. Asbestos:

- a. No Asbestos Containing Materials(ACM): Material that contains asbestos in amounts greater than 0.1% by weight is prohibited from being used in construction, remodeling, or maintenance. Contractor must provide manufacturer certifications that materials utilized do not contain asbestos above 0.1% by weight per GOJ, JEGS, and the Industrial and Safety Health law.
- b. Asbestos Sampling and Analysis Plan: Is historical asbestos sampling data is not available for the building materials to be disturbed, asbestos sampling may be required prior to the start of the project. If the Contractor is required to collect

samples, an Asbestos Sampling and Analysis Plan must be submitted and approved by 718 CES/CEAN & 18 AMDS/SGPB prior to sample collection. Reference special constructions specifications 02 82 14.00 10 Asbestos Hazard Control Activities for specific details.

- c. Asbestos Abatement & Disposal Plan: An Asbestos Abatement and Disposal Plan must be submitted and approved by the 718 CES/CEAN and 18 AMDS/SGPB prior to starting asbestos abatement. Reference special constructions specifications 02 82 14.00 10 Asbestos Hazard Control Activities for specific details.
- d. Asbestos Accident Prevention Plan: If asbestos abatement work is required, the Contractor shall prepare a written comprehensive site-specific Accident Prevention Plan (APP). Reference special constructions specifications 02 82 14.00 10 Asbestos Hazard Control Activities for specific details.
- e. Notification of Unexpected Discovery of Asbestos During Work: If the Contractor discovers previously untested building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall not disturb the suspect material. In such instances, the Contractor shall notify the CO and 718 CES/CEAN immediately. Reference special constructions specifications 02 82 14.00 10 Asbestos Hazard Control Activities for specific details.
- f. Signing of Asbestos Manifest Prior to Leaving the Installation: All asbestos waste shall be manifested and transported in accordance with JEGS 6-3.1(e) and 6-3.10 and applicable GOJ and Prefectural regulations. All asbestos waste leaving the installation to a Japanese facility will be accompanied by a serial numbered manifest to ensure a complete audit trail from point of origin to ultimate disposal. The Contractor and CO must ensure that a designated representative from 718 CES/CEAN signs the manifests prior to any waste being removed from the installation. The CO and 718 CES/CEAN will each maintain a copy of the manifest.
- g. Asbestos Disposal Manifests: A copy of the asbestos disposal manifest indicating final disposal must be provided to 718 CES/CEAN and the CO within 60 days after issuance. It will be kept for a minimum of five years. If a copy of the manifest is not received by the CO within 60 days after issuance, the government will investigate the Contractor's work for transportation or disposal and report the findings to USFJ/J42E.

10. Lead-Based Paint

- a. No Lead or Chromate Base Paints: Paint containing lead or chromate in any

amounts is prohibited from being used in construction, remodeling, or maintenance. Contractor must provide manufacturer certifications that materials utilized are lead and chromate free per JEGS, Chapter 6 & 17.

- b. Lead-Based Paint Sampling Plan: If historical lead-based paint sampling data is not available for the building materials to be disturbed, lead-based paint sampling may be required prior to the start of the project. If the Contractor is required to collect samples, Lead-Based Paint Sampling and Analysis Plan must be submitted and approved by 718 CES/CEAN & 18 AMDS/SGPB prior to sample collection. Reference special constructions specifications 02 82 33.13 20 Removal/Control and Disposal of Paint with Lead for specific details.
 - c. Lead-Based Paint Abatement & Disposal Plan: An Lead-Based Paint Abatement and Disposal Plan must be submitted and approved by the 718 CES/CEAN and 18 AMDS/SGPB prior to starting lead-based paint abatement. Reference special constructions specifications 02 82 33.13 20 Removal/Control and Disposal of Paint with Lead for specific details.
 - d. Lead-Based Paint Clearance Sampling Results: Clearance sampling must be coordinated with 18 AMDS/SGPB for approval prior to tearing down the containment enclosure. The Contractor will provide sample analysis results to the CO, 718 CES/CEAN and 18 AMDS/SGPB. 18 AMDS/SGPB will provide approval for containment tear down. The on-site QA will ensure the site is returned to the base in proper condition and will notify the CO of the site status. 18 AMDS/SGPB and 718 CES/CEAN will not act as QA inspectors on-site.
 - e. Lead Waste Sample Results: The Contractor must analyze lead waste for metals via Toxicity Characteristic Leaching Potential (TCLP) (exempted for Mercury) and provide the sample analysis to 718 CES/CEAN for proper lead waste disposal. Lead waste must be disposed of by 718 CES/CEAN as a hazardous waste. See Section 3.01.D.4 for Hazardous Waste Requirements. If the material is to be recycled, the lead paint may not need to be abated prior to turn-in to the recycle contractor. Coordination between the recycling Contractor and the project Contractor must be established to ensure that the materials will be accepted without lead abatement.
11. Spill Prevention and Response:
- a. The Contractor shall conduct all operations in a manner that prevents spills of the POL and Hazardous Substances. Spill prevention measures are detailed in 18WG SPRP and shall be followed by the Contractor. The Contractor is required to familiarized personnel with spill prevention and response procedures, fire suppression systems, and MSDSs for all materials used and/or stored on the project site. The Contractor shall provide and maintain spill equipment, sufficient

in both type and quantity, at all sites involving the storage, use, or handling of POL and/or hazardous substances.

- b. Site-Specific Contingency Plan(SSCP): An SSCP must be developed for any project at which POL or Hazardous Substances are used and/or stored at the project site. The SSCP shall include spill response procedures, an inventory of POL and/or hazardous substances, probable spill routes, a project site layout diagram, and a spill response equipment inventory. A template SSCP can be obtained from 718 CES/CEAN. The Contractor shall train employees on the contents of the SSCP and the use of spill response equipment and shall document such training.
- c. Spill Reporting: The Contractor shall immediately report all POL or Hazardous Substances spills to the Fire Department (18 CES/CEF) at 911 (if using cell phone dial 098-934-5911), to the CO and to 718 CES/CEAN (634-2600).
- d. Spill Clean-up
 - i. The Contractor is responsible for clean-up of POL and/or hazardous substance spills and disposal of clean-up material. The Contractor shall determine, as quickly as possible, the nature of the spilled substance and implement necessary safety precautions to protect both human health and the environment. Cleanup shall be in accordance with applicable local laws and regulations, as determined by the Fire Department and 718 CES/CEAN, at no additional cost to the US Government and shall only be performed by personnel adequately trained in spill response and cleanup techniques for the severity of the spill incident.
 - ii. Costs incurred from any Contractor spills are the responsibility of the Contractor. If the US Government has to perform emergency spill response and cleanup, due to non-availability of designated personnel or of the spill is beyond the capability of designated personnel, the Contractor shall be held liable for all costs associated with performing said work. The costs of clean up will be subject to contract price offsets in accordance with FAR 32.610 and 32.611. If remaining contract payments are insufficient, the government reserves the right to pursue other offsets or administrative or civil actions to satisfy this.
- e. Contaminated Soil Stockpile Request: If during the spill cleanup the Contractor is required to stockpile contaminated soil for testing prior to disposal, the Contractor shall submit a Contaminated Soil Stockpile Request to 718 CES/CEAN. Upon receipt of request, 718 CES/CEAN will inform the Contractor of an approved stockpile location. Containment and monitoring of the contaminated soil stockpile will be the responsibility of the Contractor and no

additional cost to the Government.

12. Green Procurement:

- a. Green Procurement is the purchase and use of recycled content, environmentally preferable, biobased and energy and water efficient products. Recycled content products are made from or contain recycled materials. Environmentally preferable products have lesser effects on health and the environment, compared to other products with the same purpose. Biobased products are made with biological, agriculture, or forestry materials. Energy-efficient products use less energy than comparable equipment. Water-efficient products use less water than comparable equipment.
- b. The US Environmental Protection Agency (EPA) has developed the Comprehensive Procurement Guidelines (CPG) to help identify recycled content products. The CPG also provides a "Total Recovered Materials Content" percentage that is a range of how much recycled content should be in each item. Per ETL 00-1, CPG-listed items must be purchased at the amounts recommended by the EPA (the Total Recovered Materials Content percentage). The CPG categories are:
 - i. Paper & Paper Products
 - ii. Vehicular Products
 - iii. Construction Products
 - iv. Transportation Products
 - v. Park & Recreation Products
 - vi. Landscaping Products
 - vii. Non-paper Office Products and
 - viii. Miscellaneous Products
- c. A complete list of CPG items and the Total Recovered Material Content percentage can be found at www.epa.gov/cpg. A CPG-listed item does not have to be purchased if it 1) does not meet appropriate performance standards, 2) is not available competitively (from two or more sources), 3) is not available within the reasonable time frame, or 4) is only available at an unreasonable price (cost more than a comparable non-recycled product).
- d. The US Department of Agriculture (USDA) has developed a list of biobased products, similar to that of EPA's CPG for recycled content products. Per EO 13514, we are required to purchase biobased products. The USDA's Biopreferred categories are:
 - i. Construction and Road Maintenance
 - ii. Furniture and Furnishings
 - iii. Housewares and Cleaning

- iv. Industrial Supplies
- v. Landscaping and Agriculture
- vi. Office Supplies
- vii. Personal Care and toiletries
- viii. The Great Outdoors, and
- ix. Utilities

- e. A complete list of biobased products can be found at www.biopreferred.gov.
- f. Recycled content products not listed in the CPG may also be used in the execution of any contract. Look for opportunities to maximize the use of products containing recycled content. Green products can (and should) be used in every construction project (including new construction, addition, renovation, or repair projects) and every service contract.

3.02 SUBMITTALS: All applicable submittals relating to the projects will be submitted in accordance with Section 01010, General Requirements. Approval of submittals will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The Contractor shall obtain approval from the CO **prior** to the start of construction, modification, or demolition for all project facilities and/or equipment.

A. SUBMITTALS REQUIRED BEFORE SITE WORK BEGINS:

1. ENVIRONMENTAL PROTECTION PLAN

- a. The Contractor shall submit an Environmental Protection Plan to 718 CES/CEAN for all projects for review and approval **prior** to commencing construction activities or delivery of materials to site. The Contractor must revise and resubmit the Environmental Protection Plan to properly address 718 CES/CEAN comments before approval will be granted. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues, which the Contractor must address during construction. Issues of concern must be defined within the environmental issue and required construction tasks. Topics or issues which are not identified in Section 01560, but are considered necessary, must be identified and discussed after those items are formally identified.
- b. **The Environmental Protection Plan is due to 718 CES/CEAN a minimum of 14 calendar days before the site work starts.** The Environmental Protection Plan must be submitted in its *entirety*. Individual chapters or incomplete Environmental Protection Plans will not be approved. If changes are required to the Environmental Protection Plan, the Contractor shall resubmit the plan in its *entirety*. The Environmental Protection Plan must be current and must be

maintained onsite by the Contractor. If none of the plans, forms, approval requests, permits or licenses listed under a given chapter is required for the work being accomplished under the project, indicate "NOT APPLICABLE" under each chapter heading. The Environmental Protection Plan must contain the following chapters:

Chapter 1. Applicable Regulations, Training Programs and Environmental Representatives

- List of Applicable Environmental Regulations – See Section 3.01(A)
- Environmental Protection Training Program Point of Contact and Qualifications – See Section 3.04(B)
- Contact Information for Environmental Representatives – See Section 3.01(C)

Chapter 2. Air Emissions & Ozone Depleting Substances

- Certification of No Class I ODS – See Section 3.01(D)(1)
- Approval Request for Class II ODS – See Section 3.01(D)(1)

Chapter 3. Water Resources

- Certification of Pipe, Fittings, Solder and Flux Lead Content – Section 3.01(D)(2)
- Site Specific Storm Water Pollution Prevention Plan – See Section 3.01 (D)(2)
- Waste Water Management Plan – See Section 3.01 (D)(2)

Chapter 4. Hazardous Materials

- USAF Form 3952 – See Section 3.01(D)(3)
- Material Safety Data Sheets – See Section 3.01(D)(3)

Chapter 5. Hazardous Waste

- Hazardous Waste Management Plan – See Section 3.01(D)(4)

Chapter 6. Solid Waste

- Solid Waste Management Plan – See Section 3.01(D)(5)
- Permits/Licenses for Disposal & Recycling Facilities – See Section 3.01(D)(5)

Chapter 7. Fuel Storage Tanks

- Not applicable

Chapter 8. Natural Resources

- Banyan Tree Removal Request (if applicable) – See Section 3.01(D)(7)

Chapter 9. Polychlorinated Biphenyls (PCBs)

- Manufacturer Certification of No PCBs – See Section 3.01(D)(8)

Chapter 10. Asbestos

- Manufacturer Certification of No Asbestos – See Section 3.01(D)(9)
- Asbestos Sampling and Analysis Plan – See Section 3.01(D)(9)
- Asbestos Abatement and Disposal Plan – See Section 3.01(D)(9)
- Asbestos Accident Prevention Plan– See Section 3.01(D)(9)

Chapter 11. Radon

- Not Applicable.

Chapter 12. Lead-Based Paint

- Manufacturer Certification of No Lead or Chromate – See Section 3.01(D)(10)
- Lead-Based Paint Sampling and Analysis Plan – See Section 3.01(D)(10)
- Lead-Based Paint Abatement and Disposal Plan – See Section 3.01(D)(10)

Chapter 13. Spill Prevention and Response

- Site Specific Contingency Plan – Section 3.01(D)(11)

B. SUBMITTALS REQUIRED DURING SITE WORK:

1. Air Emissions & Ozone Depleting Substances – NONE REQUIRED
2. Water Resources – NONE REQUIRED
3. Hazardous Materials
 - Notification of Unexpected Hazardous Material Discovery (if applicable) – See Section 3.01(D)(3)
4. Hazardous Waste
 - Hazardous Waste Sample Results – See Section 3.01(D)(4)
5. Solid Waste
 - Solid Waste Weight Tickets/Manifests – See Section 3.01(D)(5)
 - Additional or Renewed Permits for Disposal & Recycling Facilities – Section 3.01(D)(5)
6. Fuel Storage Tanks – Not Applicable
7. Historical and Cultural Resources
 - Notification of Discovery of Historical or Cultural Items (if applicable) - See Section 3.01(D)(6)
8. Natural Resources – NONE REQUIRED
9. Polychlorinated Biphenyls (PCBs)
 - PCB Transformer or PILC Sample Results - See Section 3.01(D)(9)
 - Lab Certifications to Accompany Sample Results - See Section 3.01(D)(9)

10. Asbestos
 - Notification of Unexpected Discovery of Asbestos During Work - See Section 3.01(D)(9)
 - Signing of Asbestos Manifests Prior to Leaving the Installation - See Section 3.01(D)(9)
11. Radon - Not Applicable
12. Lead-Based Paint
 - Lead-Based Paint Clearance Sampling Results – See Section 3.01(D)(10)
 - Lead Waste TCLP Sampling Results – See Section 3.01(D)(10)
13. Spill Prevention and Response
 - Spill Notification (if applicable) - See Section 3.01(D)(11)
 - Contaminated Soil Stockpile Request (if applicable) – See Section 3.01(D)(11)
14. Green Procurement – NONE REQUIRED

C. SUBMITTALS REQUIRED AFTER COMPLETION OF SITE WORK:

1. Air emissions & Ozone Depleting Substances – NONE REQUIRED
2. Water resources – NONE REQUIRED
3. Hazardous Materials – NONE REQUIRED
4. Hazardous Waste - Hazardous Waste Records – See Section 3.01(D)(4)
5. Solid Waste – NONE REQUIRED
6. Fuel Storage Tanks - Not Applicable
7. Historical and Cultural Resources – NONE REQUIRED
8. Natural Resources – NONE REQUIRED
9. Polychlorinated Biphenyls (PCBs) – NONE REQUIRED
10. Asbestos - Asbestos Disposal Manifests – See Section 3.01(D)(9)
11. Radon – Not Applicable
12. Lead-Based Paint – NONE REQUIRED

REPAIR MILITARY FAMILY HOUSING, KINSER HEIGHTS (97UN)
Camp Kinser, Okinawa, Japan

13. Spill Prevention and Response – NONE REQUIRED

14. Green Procurement – NONE REQUIRED.

-- End of Section --

SECTION 02 41 00

DEMOLITION

05/10

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.
- A. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations
 - B. U.S. ARMY CORPS OF ENGINEERS (USACE)
EM 385-1-1 (2014) Safety and Health Requirements
 - C. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
40 CFR 61-SUBPART M National Emission Standard for Asbestos
- 1.2 GENERAL REQUIREMENTS: Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.
- 1.3 REGULATORY AND SAFETY REQUIREMENTS: Comply with base and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform to ASSE/SAFE A10.6.
- 1.4 DUST AND DEBRIS CONTROL: Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to flooding, or pollution. Vacuum and dust the work area daily.
- 1.5 PROTECTION
- A. Existing Work: Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer.

- B. Facilities: Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.
 - C. Protection of Personnel: During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
- 1.6 BURNING: The use of burning at the project site for the disposal of refuse and debris will not be permitted.
- 1.7 USE OF EXPLOSIVES: Use of explosives will not be permitted.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

- A. Concrete: Saw concrete along straight lines to a depth of a minimum 50 mm. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.
- B. Patching: Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish.
- C. Air Conditioning Equipment: Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)." Turn in salvaged

Class I ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment."

- D. Mechanical Equipment and Fixtures: Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Mechanical equipment and fixtures must be disconnected at fittings. Do not remove equipment until approved.
- E. Utilities and Related Equipment: Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that is not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.
- F. Electrical Equipment and Fixtures: Salvage motors, motor controllers, and operating and control equipment that are attached to the driven equipment. Salvage wiring systems and components. Box loose items and tag for identification. Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.
 - 1. Fixtures: Remove and salvage electrical fixtures. Salvage unprotected glassware from the fixture and salvage separately. Salvage incandescent, mercury-vapor, and fluorescent lamps and fluorescent ballasts manufactured prior to 1978, boxed and tagged for identification, and protected from breakage.
 - 2. Electrical Devices: Remove and salvage switches, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.
 - 3. Conduit and Miscellaneous Items: Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed

3.2 DISPOSITION OF MATERIAL:

- A. Title to Materials: Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government-controlled property at the Contractor's responsibility and expense before the completion and final acceptance of the work. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such

property after contract award. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

- B. Unsalvageable Material: Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed outside Base property daily or as directed by the Contracting Officer.
 - C. Disposal of Ozone Depleting Substance (ODS): Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be turned over to the Contracting Officer and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.
- 3.3 CLEANUP: Debris and rubbish shall be removed from excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.
- A. Debris and Rubbish: Debris shall be removed and transported in a manner that prevents spillage on streets and adjacent areas. Local regulations regarding hauling and disposal shall apply.

-- End of Section --

SECTION 05 52 00

METAL RAILINGS

08/15

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.

A. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION
OFFICIALS (AASHTO)

AASHTO M 314 (1990; R 2013) Standard Specification for Steel
Anchor Bolts

B. AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural
Welding Code - Steel

C. ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip
Galvanized) Coatings on Iron and Steel Products

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black
and Hot-Dipped, Zinc-Coated, Welded and
Seamless

ASTM E488/E488M (2015) Standard Test Methods for Strength of
Anchors in Concrete and Masonry Elements

D. JAPANESE ARCHITECTURAL STANDARD SPECIFICATION (JASS)

JASS 6 (1993) Structural Steel Work

E. JAPANESE INDUSTRIAL STANDARD (JIS)

JIS B 1220 (2015) Set of Anchor Bolt with Rolled Threads for
Structures

JIS G 3302 (2005) Hot-Dip Zinc-Coated Steel Sheets and Coils

JIS H 8641 (2007) Hot Dip Galvanized Coating

F. NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS
(NAAMM)

NAAMM AMP 521

(2001) Pipe Railing Manual

1.2 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only.

- A. Shop Drawings
 - 1. Fabrication Drawings
- B. Product Data
 - 1. Steel Handrails

PART 2 PRODUCTS

2.1 FABRICATION

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes, including zinc coatings.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ensure all exposed edges are eased to a radius of approximately 0.8 millimeter. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

- A. Steel Handrails: Fabricate joint posts, rail, and corners by one of the following methods:

1. Flush-type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 10 mm hexagonal-recessed-head setscrews.
 2. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight fitting interior sleeve not less than 150 mm long.
- B. Protective Coating: Provide hot dipped galvanized steelwork as indicated in accordance with JIS H 8641 or ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.2 COMPONENTS

- A. Steel Pipe: Provide pipe conforming to ASTM A53/A53M or JIS G 3302, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).
- B. Masonry Anchorage Devices: Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M or JIS B 1220 as follows:

Provide lead expansion shields for machine screws and bolts larger than 6 millimeter in size; head-out embedded nut type, multiple unit class, Group I, Type 1, Class 2.

Provide bolt anchor expansion shields for bolts; closed-end bottom bearing class, Group II, Type 2, Class 1.

PART 3 EXECUTION

- 3.1 PREPARATION: Adjust stair handrails prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length.

Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 75 millimeter projection from the finish wall surface to the center of the pipe drilled to receive one M10 bolt. Locate brackets not more than 1525 millimeter on center. Provide wall return fittings of cast iron castings, flush-type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

- a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.
- b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.

3.2 INSTALLATION

- A. Steel Handrail: Install in masonry with expansion shields and bolts or toggle bolts. Secure rail ends by steel pipe flanges anchored by expansion shields and bolts.
- B. Touchup Painting: Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 0.051 millimeter.

3.3 FIELD QUALITY CONTROL

- A. Field Welding: Ensure procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M or JASS 6.

-- End of Section --

SECTION 06 61 16

SOLID SURFACING FABRICATIONS

08/10

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.

A. ASTM INTERNATIONAL (ASTM)

ASTM D2583	(2013a) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D5116	(2010) Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G21	(2015) Determining Resistance of Synthetic Polymeric Materials to Fungi

B. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates
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1.2 SYSTEM DESCRIPTION

- A. Work under this section includes vanity countertops with integral bowl and as described in this specification.
- B. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus 3 mm.

1.3 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Shop Drawings
 - 1. Detail Drawings
- B. Product Data
 - 1. Solid Polymer Material
- C. Samples
 - 1. Material
- D. Certificates
 - 1. Fabrications
 - 2. Qualifications
- E. Operation and Maintenance Data
 - 1. Clean-up

1.4 QUALITY ASSURANCE

- A. Qualifications: Fabricators shall have a minimum of 5 years of experience working with solid polymer materials. Submit solid polymer manufacturer's certification attesting to fabricator qualification approval.

1.5 DELIVERY, STORAGE, AND HANDLING: Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

PART 2 PRODUCTS

2.1 MATERIAL: Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting CSA B45.5-11/IAPMO Z124 or equivalent requirements. Material shall have minimum physical and performance properties specified. Submit a minimum 100 by 100 mm sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation.

- A. Cast, 100 Percent Acrylic Polymer Solid Surfacing Material: Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	291 kg/cm ² 4(max.)	ASTM D638
Hardness	55-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.0000386cm/cm/degC (max.)	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
6.4 mm sheet	910 mm, 227 g	1/2 lb ball, no failure
12.7 mm sheet	3550 mm, 227 g	1/2 lb ball, no failure
19 mm sheet	5070 mm, 227 g	1/2 lb ball, no failure
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.1 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	30 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51

- B. Acrylic-modified Polymer Solid Surfacing Material: Cast, solid polymer material shall be composed of a formulation containing acrylic and polyester polymers, mineral fillers, and pigments. Acrylic polymer content shall be not less than 5 percent and not more than 10 percent in order to meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min or max)	TEST PROCEDURE
Tensile Strength	288 kg/cm ² 4000 psi (max.)	ASTM D638
Hardness	50-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.0000386cm/cm/deg C	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
6.4 mm sheet	910 mm, 227 g	1/2 lb ball, no failure
12.7 mm sheet	3550 mm, 227 g	1/2 lb ball, no failure
19 mm sheet	5070 mm, 227 g	1/2 lb ball, no failure
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.6 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	100 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51

C. Material Patterns and Colors: Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

D. Surface Finish: Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be as indicated on the drawings.

2.2 ACCESSORY PRODUCTS: Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

A. Seam Adhesive: Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

- B. Silicone Sealant: Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer.
- C. Mounting Hardware: Provide mounting hardware, including bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

2.3 FABRICATIONS: Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

- A. Joints and Seams: Form joints and seams between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.
- B. Edge Finishing: Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.
- C. Counter and Vanity Top Splashes: Fabricate backsplashes and end splashes from 13 mm thick solid surfacing material to be 100 mm high. Backsplashes and end splashes shall be provided at locations indicated on the drawings. Backsplashes shall be shop fabricated and be permanently attached.
 - 1. Permanently Attached Backsplash: Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition or with seam adhesive and to form a radiused coved transition from countertop to backsplash.
 - 2. End Splashes: End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

- D. Counter and Vanity Tops: Fabricate all solid surfacing and vanity top components from 13 mm thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 100 mm high permanently attached, 90 degree transition permanently attached with coved transition backsplash and loose endsplashes where indicated on the drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings.
- E. Solid Polymer Vanity Bowls: Solid polymer vanity bowls shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer vanity tops. Bowls shall be of the same polymer composition as the adjoining counter top.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Components: Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.
- B. Silicone Sealant: Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.
- C. Plumbing: Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

- 3.2 CLEAN-UP: Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Submit a minimum of four copies of maintenance data indicating manufacturer's care, repair and cleaning instructions.

-- End of Section --

SECTION 08 11 16

ALUMINUM DOORS AND FRAMES

08/08

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 in the text by the basic designation only.

A. JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1516	(1998) Windows and Doorsets – Air Permeability Test
JIS A 1517	(1996) Windows and Doorsets - Watertightness Under Dynamic Pressure
JIS A 4702	(2015) Doorsets
JIS H 4000	(1988) Aluminum and Aluminum Alloy Sheets and Plates, Strip and Plates
JIS H 4100	(2015) Aluminum and Aluminum Alloy Extruded Shapes

B. JAPANESE ARCHITECTURAL STANDARD SPECIFICATION (JASS)

JASS 16	Doors, Windows, and Shutter Work
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1.2 PERFORMANCE REQUIREMENTS

- A. Structural: Frame deflections shall not exceed L/160 of the unsupported member lengths. Shapes and thicknesses of framing members shall be sufficient to withstand the design wind load of not less than 95 pounds per square foot with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide moldings, and trim of not less than 1.25 mm nominal thickness.
- B. Air Infiltration: When tested in accordance with JIS A 1516, air infiltration shall not exceed 0.06 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).
- C. Water Penetration: When tested in accordance with JIS A 1517, there shall be no water penetration at a pressure of 8 pounds per square foot of fixed area.

- 1.3 DELIVERY, STORAGE AND HANDLING: Inspect materials delivered to the site for damage. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on

non-absorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings.

1.4 SUBMITTALS: Submit the following in accordance with Section 01 11 00 GENERAL REQUIREMENTS:

A. Shop Drawings

1. Doors and frames

Show elevations of each door type, size of doors and frames, metal gages, details of door and frame construction, methods of anchorage, details, weatherstripping, provisions for and location of hardware, and details of installation.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES: Aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members, trim, and accessories.

2.2 MATERIALS

A. Aluminum Alloy for Doors and Frames: JIS H 4100 for extrusions. JIS H 4000, alloy and temper best suited for aluminum sheets and strips.

B. Fasteners: Hard aluminum or stainless steel.

C. Anchors: Stainless steel or steel with hot-dipped galvanized finish.

D. Weatherstripping: Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.3 FABRICATION

A. Aluminum Frames: Extruded aluminum shapes with contours approximately as indicated. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 300 mm o.c. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

B. Aluminum Door:

1. Flush Doors: JIS A 4702. Of type, size, and design indicated and not less than 45 mm (1-3/4 inch) thick. Use facing sheets with a plain smooth surface.

- C. Weatherstripping: Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively.
- D. Anchors: Provide anchors of the sizes and shapes as indicated. Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation. Place anchors near top and bottom of each jamb and at intermediate points not more than 635 mm apart.
- E. Provisions for Hardware: Hardware is specified in Section 08 71 00, "Door Hardware."
- F. Finishes: Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF-45. Finish shall be clear (natural), designation AA-M10-C22-A31.

PART 3 EXECUTION

- 3.1 INSTALLATION: In accordance with JASS 16 and each manufacturer's instruction. Plumb, square, level, and align frames and framing members to receive doors. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions. Anchor bottom of each frame to rough floor construction with 2.4 mm thick stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. After erection, adjust doors and hardware to operate properly.
- 3.2 PROTECTION FROM DISSIMILAR MATERIALS: Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.
- 3.3 CLEANING: Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.
- 3.4 PROTECTION: Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

SECTION 08 14 00

WOOD DOORS

08/16

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 in the text by the basic designation only.
- A. JAPANESE ARCHITECTURAL STANDARD SPECIFICATION (JASS)
JASS 16 (1988) Doors and Windows
 - B. JAPANESE INDUSTRIAL STANDARD (JIS)
JIS A 5703 (1994) Plastic Laminated or Printed Boards for Inside Use
- 1.2 SUBMITTALS: Submit the following in accordance with Section 01 11 00 GENERAL REQUIREMENTS.
- A. Shop Drawings
 - 1. Doors

Submit drawings or catalog data showing each type of door unit. Drawings and data shall indicate door type and construction, sizes, thickness, and methods of assembly.
 - B. Product Data
 - 1. Doors
- 1.3 DELIVERY, STORAGE, AND HANDLING: Deliver doors to the site in an undamaged condition and protect against damage and dampness. Replace defective or damaged doors with new ones.
- 1.4 WARRANTY: Warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

PART 2 PRODUCTS

- 2.1 BI-FOLD CLOSET DOOR: [Provide paneled louvered doors, premium grade, heavy duty conforming to WDMA I.S. or equal.](#) Equip doors with manufacturer's standard hardware, including tracks, hinges, guides and pull.

- 2.2 FINISH: Factory applied, JIS A5703 or equal, general purpose type, 1.25 mm minimum thickness. Glue laminated plastic for hollow core doors to wood veneer, plywood, or hardboard backing to form door panel. Provide a combined thickness of laminate sheet and backing of 2.5 mm minimum.

PART 3 EXECUTION

- 3.1 INSTALLATION: Fit, trim, and hang doors with a 2 mm minimum, 3 mm maximum clearance at sides and top, and a 5 mm minimum, 6 mm maximum clearance over thresholds.

-- End of Section --

SECTION 08 51 13

ALUMINUM WINDOWS

05/11

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.
- A. ALUMINUM ASSOCIATION (AA)
AA DAF-45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes
 - B. JAPANESE ARCHITECTURAL STANDARDS SPECIFICATION(JASS)
JASS 16 Doors, Windows, and Shutter Work
 - C. JAPANESE INDUSTRIAL STANDARDS (JIS):
 - JIS A 1516 (1998) Window and Doorsets - Air Permeability Test
 - JIS A 1517 (1996) Windows and Doorsets - Watertightness Test Under Dynamic Pressure
 - JIS A 4706 (2015) Windows
 - JIS H 4100 (2015) Aluminum and Aluminum Alloy Extruded Profiles
 - JIS H 8602 (2010) Combined Coatings of Anodic Oxide and Organic Coatings on Aluminum and Aluminum Alloys
 - JIS R 3205 (2005) Laminated Glass
 - D. U.S. DEPARTMENT OF DEFENSE (DOD)
UFC 4-010-01 (2007) DoD Minimum Antiterrorism Standards for Buildings
- 1.2 PROTECTION: Protect finished surfaces during shipping and handling using the manufacturer's standard method.
- 1.3 SUBMITTAL: Submit the following in accordance with REQUIREMENTS:
- A. Shop Drawing:
 - 1. Window

B. Product Data:

1. Aluminum Window and Frames

1.4 WARRANTY: Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

1.5 WINDOW PERFORMANCE: Design window components, including hardware and anchors, to withstand a wind speed of 212 mph. Air and water filtration when tested in accordance with JIS A 1516 and JIS A 1517.

PART 2 PRODUCTS

2.1 WINDOW AND FRAME: JIS A 4706. Fixed and Sliding Type Window. Aluminum frame shall conform to JIS H 4100. Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be clear natural finish.

2.2 ACCESSORIES

A. Hardware: Provide hardware and controls for manually operation where indicated and complete with brackets, bolts, clips, anchors, and fittings as required for a complete and operable installation.

B. Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside of the building and to permit easy access to operating hardware.

PART 3 EXECUTION

3.1. WORK PROCEDURE: In accordance with JASS 16 and manufacturer's instruction.

3.2. INSTALLATION

A. Method of Installation: Install in accordance with the window manufacturer's printed instructions and details. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment.

B. Dissimilar Materials: Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials. Do not coat surfaces in contact with sealants after installation with any type of protective material.

- C. Anchors and Fastenings: Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 11 mm.
- 3.3 CLEANING: Clean aluminum window finish and glass on exterior and interior sides in accordance with window manufacturer's recommendations.

-- End of Section --

SECTION 08 71 00

DOOR HARDWARE

02/16

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 in the text by the basic designation only.

A. BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	(2013) Butts and Hinges
BHMA A156.13	(2012) Mortise Locks & Latches Series 1000
BHMA A156.16	(2013) Auxiliary Hardware
BHMA A156.2	(2011) Bored and Preamsembled Locks and Latches
BHMA A156.4	(2013) Door Controls - Closers

B. JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1510-2	(2001) Test Method for Door Fittings of Buildings Part 2: Fittings for Door
JIS A 1510-3	(2001) Test Method for Door Fittings of Buildings Part 3: Floor Concealed Door Closer, Door Closers and Hinge Closers
JIS A 1541-1	(2016) Building Hardware—Locks and Latches—Part1: Test Methods for Lock and Latches

- 1.2 SUBMITTALS: Submit the following in accordance with Section 01 11 00 GENERAL REQUIREMENTS:

A. Product Data
Hardware items

- 1.3 HARDWARE SCHEDULE: Prepare and submit hardware schedule in the following form:

Hard- ware Item	Quan- tity	Size	Reference Publication Type No.	Finish	Mfr and Catalog No.	Name	Key Control Symbol	UL Mark (If fire Rated and Listed)	ANSI/BHMA Finish Designation
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- 1.4 DELIVERY, STORAGE, AND HANDLING: Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Deliver permanent keys to the Contracting Officer, either directly. Deliver construction master keys with the locks.

PART 2 PRODUCTS

- 2.1 TEMPLATE HARDWARE: Provide hardware to be applied to metal manufactured to template. Coordinate hardware items to prevent interference with other hardware.
- 2.2 HARDWARE ITEMS: Hinges, locks, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.
- A. Hinges: JIS A 1510-2/BHMA A156.1 or equal.
 - B. Bored Locks and Latches: JIS A 1541-1/BHMA A156.2, Series 4000 or equal.
 - C. Mortise Locks and Latches: JIS A 1541-1/BHMA A156.13, Series 1000, Grade 1 or equal.
 - D. Keys: Furnish one file key, one duplicate key, and one working key for each key change and for each master keying system. Master key shall be compatible with the existing lockset in the building. Furnish one additional working key for each lock of each keyed-alike group. Do not place room number on keys.
 - E. Closers: JIS A 1510-3/BHMA A156.4 or equal. Provide with brackets, arms, mounting devices, fasteners, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers.
 - F. Door Stop and Silencer: BHMA A156.16, Type L01381 for interior door or equal. Provide stops to prevent doors from hitting wall. Provide three silencers for each single door, two for each pair.
- 2.4 FASTENERS: Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.
- 2.5 FINISHES: Hardware shall have satin stainless steel finish, unless specified otherwise.

PART 3 EXECUTION

- 3.1 INSTALLATION: Install hardware in accordance with manufacturers' printed instructions.
- A. Weather Stripping Installation: Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding.
 - B. Threshold Installation: Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, stainless steel screws.
- 3.2 FIELD QUALITY CONTROL: After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.
- 3.3 HARDWARE SETS: Deliver Hardware templates and hardware for use in fabricating the doors and frames.

-- End of Section --

SECTION 08 81 00

GLAZING

08/11

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.
- A. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
ANSI Z97.1 (2009, Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
 - B. JAPANESE INDUSTRIAL STANDARDS (JIS)
 - JIS A 5756 (2006) Building gaskets and Building Structural Gaskets-Materials in Preformed Solid Vulcanizates Used for Sealing Glazing and Panels
 - JIS R 3203 (2009) Patterned Glass
 - JIS R 3205 (2005) Laminated Glass
 - JIS R 3209 (1998) Sealed Insulating Glass
- 1.2 SUBMITTALS: The following shall be submitted in accordance with Section 01 11 00 GENERAL REQUIREMENTS:
- A. Shop Drawings
 - 1. Installation

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.
 - B. Manufacturer's Instructions
 - 1. Setting and sealing materials
 - 2. Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.
- 1.3 SYSTEM DESCRIPTION: Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work.

- 1.4 DELIVERY, STORAGE, AND HANDLING: Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.
- 1.5 ENVIRONMENTAL REQUIREMENTS: Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

PART 2 PRODUCTS

2.1 GLASS:

- A. Laminated Glass: JIS R 3205. Color shall be clear.
- B. Insulating Glass: JIS R 3209. Two panes of glass separated by a dehydrated 13 mm airspace, filled with argon and hermetically sealed.
- C. Patterned Glass: JIS R 3203, 6mm thk, Type II, Class 1 (translucent), Form 3 (patterned).

2.2 SETTING AND SEALING MATERIALS: Provide as specified and manufacturer's recommendations, unless specified otherwise herein. Materials exposed to view and unpainted shall be gray or neutral color.

- A. Putty and Glazing Compound: Glazing compound shall conform to ASTM C 669 or JIS A 5756 for face-glazing metal sash. Putty and glazing compounds shall not be used with laminated glass.
- B. Sealants: Provide elastomeric sealants conforming to JIS A 5758. Use for channel or stop metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes. Color of sealant shall be white.
- C. Joint Backer: Joint backer shall have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.
- D. Preformed Channels: Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.
- E. Accessories: Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide non-corroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

PART 3 EXECUTION

- 3.1 PREPARATION: Preparation, unless otherwise specified or approved, shall conform to manufacturer's recommendations. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.
- 3.2 GLASS SETTING: Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to manufacturer's recommendations. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.
- A. Laminated Glass: Sashes which are to receive laminated glass shall be weeped to the outside to allow water drainage into the channel.
- B. Patterned Glass: Place the patterned surface in same direction in all openings.
- 3.3 CLEANING: Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted.
- 3.4 PROTECTION: Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Upon removal, separate protective materials for reuse or recycling. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.
- 3.5 SCHEDULE: Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

PRODUCTS	INCH-POUND	METRIC
Glass	1/8 inch	3 mm
	7/32 inch	6 mm
	1/4 inch	6 mm

REPAIR MILITARY FAMILY HOUSING, KINSER HEIGHTS (97UN)
Camp Kinser, Okinawa, Japan

Interlayer	0.015 inch	0.38 mm
Glazing Channel	1/4 inch	6 mm

-- End of Section --

SECTION 09 30 10

CERAMIC TILE, QUARRY AND GLASS TILING

11/13

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.
- A. JAPANESE INDUSTRIAL STANDARDS (JIS)
 - JIS A 5209 (1994) Ceramic Tiles
 - JIS R 5210 (2003) Portland Cement
 - B. JAPANESE ARCHITECTURAL SPECIFICATION STANDARDS (JASS)
 - JASS 19 Ceramic Tile Work
- 1.2 SUBMITTALS: Submit the following in accordance with Section 01 11 00 GENERAL REQUIREMENTS:
- A. Samples
 - 1. Wall Tiles
 - 2. Floor Tiles
- 1.3 DELIVERY AND STORAGE: Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and stored under cover in accordance with manufacturer's printed instructions.
- 1.4 ENVIRONMENTAL REQUIREMENTS:
- A. Close space in which tile is being set to traffic and other work. Keep closed until tile is firmly set. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal Portland cement mortar installations for at least 72 hours.
 - B. Do not perform ceramic tile work unless the substrate and ambient temperature is at least 10 degrees C (50 degrees F) and rising. Maintain temperature above 10 degrees C (50 degrees F) while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tile work.

- 1.5 WARRANTY: Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.
- 1.6 EXTRA STOCK: Supply an extra two percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 Tiles:

- A. Ceramic Wall Tile: JIS A 5209, glazed porcelain tile, 100x100x5mm.
- B. Ceramic Floor Tiles: JIS A 5209, unglazed porcelain or natural with cushioned edges. Size shall be 100x100x9mm. The body of the tile shall be slip resistant.

- 2.2 Cement Mortar: Consist of Portland cement (JIS R 5210, normal), aggregate, water, and admixture, in accordance with JASS 15.

- 2.3 WATER: Provide potable water.

- 2.4 ADHESIVE: In accordance with the tile manufacturer.

- 2.5 SCRATCH COAT: Apply scratch coat and allow to dry slowly for not less than 24 hours before tile is to be set. Apply in the thickness indicated or as necessary to bring the face of the tile to the required plane.

PART 3 EXECUTION

- 3.1 PREPARATORY WORK AND WORKMANSHIP: Ceramic installation shall be done in accordance with manufacturer's instruction.
- 3.2 GENERAL INSTALLATION REQUIREMENTS: JASS 19. Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar.
- 3.3 CLEANING AND PROTECTING: Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Replace damaged or defective tiles.

-- End of Section --

SECTION 09 65 00

RESILIENT FLOORING

08/10

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.

A. ASTM INTERNATIONAL (ASTM)

ASTM E 648

(2014c) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

ASTM F 1344

(2015) Rubber Floor Tile

B. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 253

(2011) Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

C. JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5705

(2016) Polyvinyl Chloride Floorcoverings

1.2 SYSTEM DESCRIPTION:

- A. Fire Resistance Requirements: Provide a minimum average critical radiant flux of 0.22 watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E 648 or local equivalent.

1.3 SUBMITTALS: Submit the following in accordance with Section 01 11 00 GENERAL REQUIREMENTS:

A. Product Data

1. Resilient flooring and Accessories
2. Wall Base
3. Sheet Vinyl Flooring

Manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

- 1.4 DELIVERY, STORAGE, AND HANDLING: Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature maintained above 20 degrees C and below 30 degrees C, stacked according to manufacturer's recommendations. Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.
- 1.5 ENVIRONMENTAL REQUIREMENTS: Maintain areas to receive resilient flooring at a temperature above 20 degrees C and below 30 degrees C for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 13 degrees C thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.
- 1.6 SCHEDULING: Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.
- 1.7 WARRANTY: Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.
- 1.8 EXTRA MATERIALS: Provide extra flooring material of each color and pattern at the rate of 1 tile for each 50 tiles installed. Provide extra wall base material composed of 6 m of each type, color and pattern. Package all extra materials in original properly marked containers bearing the manufacturer's name, brand name, pattern color name and number, production run, and handling instructions. Provide extra materials from the same lot as those installed. Leave extra stock at the site in location assigned by Contracting Officer.

PART 2 PRODUCTS

- 2.1 RESILIENT FLOORING: Vinyl composition tile shall conform to JIS A 5705, asbestos-free, and shall be 300 mm square, 3.0 mm thick. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile.
- 2.2 SHEET VINYL FLOORING: 2 mm thick conforming to JIS A 5705. Extend color and pattern through the total thickness of the material.
- 2.3 VINYL COVE BASE: JIS A 5705, Type CT, asbestos-free type. Base shall be 100 mm high and a minimum 2.0 mm thick.

- 2.4 ADHESIVES: Provide adhesives for flooring, base and accessories as recommended by the manufacturer and comply with local indoor air quality standards.
- 2.5 CAULKING AND SEALANTS: Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.
- 2.6 POLISH/FINISH: Furnish polish as recommended by the manufacturer.
- 2.7 MANUFACTURER'S COLOR, PATTERN AND TEXTURE: Color, pattern and texture for resilient flooring and accessories shall be selected from manufacturer's standard colors.

PART 3 EXECUTION

- 3.1 EXAMINATION: Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation. Do not take any corrective action without written permission from the Government. Work will proceed only when conditions have been corrected and accepted by the installer.
- 3.2 SURFACE PREPARATION: Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor shall be flat to within 4.75 in 3048 mm. Before any work under this section is begun, correct all defects such as uneven surfaces and warps. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.
- 3.3 PLACING VINYL-COMPOSITION TILES: Install tile flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, but no edge tile with less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.
- 3.4 PLACING WALL BASE: Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.
- 3.5 CLEANING: Immediately upon completion of installation of flooring in a room or an area, dry/clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean

flooring as recommended in accordance with manufacturer's printed maintenance instructions. No sooner than 5 days after installation, wash flooring with a nonalkaline cleaning solution, rinse thoroughly with clear cold water, and, except for rubber flooring and stair treads, risers and stringers, vinyl and other flooring not requiring polish finish by manufacturer, apply the number of coats of polish in accordance with manufacturer's written instructions. Clean and maintain all other flooring as recommended by the manufacturer.

- 3.6 PROTECTION: From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

SECTION 09 68 00

CARPETING

08/16

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.
- A. AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
 - AATCC TM 107 (2013) Colorfastness to Water
 - AATCC TM 16 (2004,E2010) Colorfastness to Light
 - AATCC TM 165 (2013) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method
 - AATCC TM 174 (2011) Antimicrobial Activity Assessment of Carpets
 - B. ASTM INTERNATIONAL (ASTM)
 - ASTM E 648 (2014c) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - C. CARPET AND RUG INSTITUTE (CRI)
 - CRI CIS (2011) Carpet Installation Standard
 - D. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
 - 16 CFR 1630 Standard for the Surface Flammability of Carpets and Rugs (FF 1-70)
 - E. JAPANESE INDUSTRIAL STANDARDS
 - JIS A 5536 (2015) Adhesive for Resilient, Textile and Laminate Floor Covering
 - JIS L 1021-6 (2007) Textile Floor Coverings-Part 6: Determination of Thickness Loss Under-Static Loading
 - JIS L 1021-9 (2007)Textile Floor Coverings-Part 9: Determination of Delamination Strength
 - JIS L 4405 (2000) Tufted Pile Carpet
 - F. FEDERAL SPECIFICATIONS (FS)
 - FS DDD-C-0095A Carpets and Rugs, Wool, Nylon, Acrylic, Modacrylic, Polyester, Polypropylene

1.2 SYSTEM DESCRIPTION

- A. Environmental Data: Submit documentation indicating type of biobased material in product and biobased content. Indicate relative dollar value of biobased content products to total dollar value of products included in project.
- B. Scheduling: Install carpet systems after the installation and ventilation period of materials or finishes which have high short-term emissions of VOCs, formaldehyde, particulates, or other air-borne compounds which may be adsorbed by or settle on the carpet tiles.

1.3 SUBMITTALS: Submit the following in accordance with Section 01 11 00 GENERAL REQUIREMENTS:

A. Product Data

- 1. Carpet

B. Samples

- 1. Carpet
- 2. Moldings

Submit two (2) samples of carpet 500 by 500 mm of carpet proposed for use, showing quality, pattern, and color specified and two (2) pieces of aluminum Moldings at least 300 mm long.

C. Test Reports

- 1. Flammability Test
- 2. Static Propensity Test

D. Certificates

- 1. Carpet

E. Operation and Maintenance Data

- 1. Carpet
- 2. Cleaning and Protection

1.4 DELIVERY, STORAGE, AND HANDLING: Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Carpet shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store carpet near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

- 1.5 AMBIENT CONDITIONS: Maintain areas in which carpeting is to be installed at a temperature above 16 degrees C and below 32 degrees C for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 13 degrees C thereafter for the duration of the contract. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet.
- 1.6 WARRANTY: Provide manufacturer's standard performance guarantees or warranties including minimum one (1) year material and workmanship.

PART 2 PRODUCTS

- 2.1 CARPET: Furnish first quality carpet; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably non-allergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance.

- A. Physical Characteristics: JIS L 4406. Provide carpet of tufted, woven, fusion-bonded, first quality and free from visual blemishes, streaks, poorly dyed areas, and other physical and manufacturing defects. Use nontoxic carpet materials and treatments reasonably non-allergenic, and free of other recognized health hazards. Conform to the following:

2.2 PERFORMANCE REQUIREMENTS

- A. Shrinkage: FS DDD-C-0095. Except that maximum shrinkage of length and width shall be 3 percent.
- B. Colorfastness to Light: Comply colorfastness to light with AATCC TM 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.
- C. Colorfastness to Crocking: Comply dry and wet crocking with AATCC TM 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.
- D. Pile Coverage: Sufficient to conceal backing.
- E. Tuft Bind: Provide tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 40 N average force for loop pile.
- F. Flammability and Critical Radiant Flux Requirements: Comply carpet with 16 CFR 1630. Provide carpet in corridors and exits with a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648. If attached

cushion is specified, test carpet and cushion together as they will be installed. If separate underlay is specified, test carpet over the actual cushion used, as they will be installed.

- G. Static Control: Provide static control to permanently regulate static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 21 degrees C in accordance with JIS L 1021-6.
 - H. Colorfastness to Water: Comply colorfastness to water with AATCC TM 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.
 - I. Delamination Strength: Provide delamination strength for tufted carpet with a secondary back of minimum 440 N/m in accordance with JIS L 1021-9.
 - J. Antimicrobial: Nontoxic antimicrobial treatment in accordance with AATCC TM 174 Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.
- 2.3 ADHESIVE: JIS A 5536, Waterproof, nonflammable, carpet adhesive as furnished or recommended by the carpet manufacturer. Use waterproof, nonflammable, non-staining seal adhesive as furnished or recommended by the carpet manufacturer.
- 2.5 TAPE: Provide tape for seams as recommended by the carpet manufacturer for the type of seam used in installation. Any seam sealant shall have a maximum VOC content of 50 grams/liter. Do not use sealants that contain 1,1,1-trichloroethane or toluene.

PART 3 EXECUTION

- 3.1 SURFACE PREPARATION: Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Submit four copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.
- 3.2 INSTALLATION: Install in accordance with the carpet's manufacturer's printed instruction. Carpet must be smooth, uniform and secure with minimum of seams. Fit cutouts such as door jambs, columns and ducts. Locate carpet seams to doorways parallel to and centered directly under doors. Do not seam at doorways perpendicular to door or at pivot points. Follow the wall line parallel to the carpet direction for seams at corridor changes of direction.
- 3.3 CLEANING AND PROTECTION: Submit four copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

- A. Cleaning: After installation, remove all debris, moldings, scraps, and other foreign matters. Remove any soiled spots or adhesive from the face of the carpet with appropriate spot remover recommended by the carpet manufacturer. Clip any protruding face yarn with sharp scissor. Vacuum the carpet until clean.
- B. Protection: Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover. Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATING

05/11

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 in the text by the basic designation only.

A. JAPANESE ARCHITECTURAL STANDARD SPECIFICATION(JASS)

JASS 18	Paint Work
JASS 23	Spray Work

B. JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 6909	(2014) Coating Materials for Textured Finishes of Buildings
JIS K 5516	(2003) Ready Mixed Paints (Synthetic Resin Type)
JIS K 5660	(2008) Synthetic Resin Emulsion Paint
JIS K 5670	(2003) Non Aqueous Dispersion Acrylic Paint

C. STEEL STRUCTURES PAINTING COUNCIL (SSPC) SPECIFICATIONS

SSPC PA Guide 3	(1982; E 1995) A Guide to Safety in Paint Application
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D. JAPAN PAINT MANUFACTURER'S ASSOCIATION (JPMA) PUBLICATION

JPMA 2009 E	Paint Color Samples
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E. CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000	Air Contaminants
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- 1.2 SUBMITTALS: Submit the following in accordance with Section 01 11 00 GENERAL REQUIREMENTS.

A. Manufacturer's Instructions

1. Manufacturer's material safety data sheets (MSDS)

1.3 REGULATORY REQUIREMENTS

- A. Lead Content: Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

- B. Chromate Content: Do not use coatings containing zinc-chromate or strontium-chromate.
 - C. Asbestos Content: Materials shall not contain asbestos.
 - D. Mercury Content: Materials shall not contain mercury or mercury compounds.
 - E. Silica: Abrasive blast media shall not contain free crystalline silica.
- 1.4 PACKAGING, LABELING, AND STORAGE: Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer.
- 1.5 SAFETY AND HEALTH: Apply coating materials using safety methods and equipment in accordance with the following:
- A. Safety Methods Used During Coating Application Comply with the requirements of SSPC PA Guide 3.
 - B. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
 - 1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
 - 2. 29 CFR 1910.1000.
 - 3. The Japanese Labor, Safety, and Sanitation Law.
 - 4. Japanese Regulation of Organic Solvent Toxication Prevention
- 1.6 ENVIRONMENTAL CONDITIONS: Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation.
- A. Coatings: Do not apply coating when air or substrate conditions are:
 - 1. Less than 3 degrees C (5 degrees F) above dew point;
 - 2. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
 - B. Post-Application: Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

1. Supply 100 percent outside air 24 hours a day.
 2. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F (13 degrees C) and 85 degrees F (29 degrees C) and humidity is between 30 percent and 60 percent.
 3. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.
- 1.7 SCHEDULING: Allow paint to cure prior to the installation of materials that adsorb VOCs.
- 1.8 COLOR AND TEXTURE SELECTION: Color and texture of finish coats shall be as indicated or specified. Where not indicated or specified, colors, type of paint (such as gloss, semi-gloss, etc.), and texture shall be selected by the Contracting Officer from samples of JPMA.
- 1.9 LOCATION AND SURFACE TYPE TO BE PAINTED
- A. Painting Included: Where a space or surface is indicated to be painted, include the following unless indicated otherwise.
 1. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
 2. Existing coated surfaces that are damaged during performance of the work.
 3. Exposed piping, conduit, and ductwork;
 - B. Painting Excluded: Do not paint the following unless indicated otherwise.
 1. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
 2. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
 3. Steel to be embedded in concrete.
 4. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
 5. Hardware, fittings, and other factory finished items.

PART 2 PRODUCTS

- 2.1 PAINT AND COATING MATERIALS: Paints shall use low (no) VOC paints to preclude no negative impacts to indoor air quality.
- A. Concrete and CMU Wall:
 1. Interior: Top coat of JIS K 5670.
 2. Exterior: Top coat of JIS A 6909, multi-layer coating, Type E.

- B. Gypsum Wall Board Surface: Topcoat shall be JIS K 5660.
- C. Waterproof Gypsum Board Surface: Top coat of JIS K 5660.
- D. Steel surfaces: Top coat shall be JIS K 5516.

PART 3 EXECUTION

- 3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED: Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.
- 3.2 SURFACE PREPARATION: Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.
 - A. Concrete: Concrete surfaces shall be allowed to cure at least 30 days before painting. Remove the following deleterious substances
 - 1. Dirt, grease, and oil: Wash new coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.
 - 2. Fungus and Mold: Wash new coated surfaces with a solution composed of 0.2 liter trisodium phosphate, 0.1 liter household detergent, 1.6 liters 5 percent sodium hypochlorite solution and 4.8 liters of warm water. Rinse thoroughly with fresh water.
 - 3. Paint and Loose Particles: Remove by wire brushing.
 - Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendation and prior to painting application.
 - B. Gypsum Board and Waterproof Gypsum Board: Clean surface and repair minor defects in accordance with JASS 18, Para 4.3, and JASS 23, Para. 3.4, "Surface Preparation".

C. Steel Surface:

1. New Steel Surface: Solvent clean in accordance with SSPC-SP 1 to remove oil and grease.
 2. Existing Steel: Remove existing loose and deteriorated paint with hand tool in accordance with SSPC SP-2 and solvent clean in accordance with SSPC-SP 1 to remove oil and grease.
- 3.3 APPLICATION: Apply coating materials in accordance with JASS 18 and JASS 23, the each paint and coating manufacturer's instruction, and specified hereinafter.
- A. Exterior Concrete Surface: Apply sealer and primer in accordance with the top coat manufacturer and two top coats, JIS A 6909, multi-layer coating system, Type E in the rate of 1.6 kg per sq.m. in accordance with JASS 18.
 - B. Interior Concrete Surface: Apply sealer in accordance with the top coat manufacturer, and two top coats, in the rate of 0.10 kg/m² per one coat, in accordance with JIS K 5670.
 - C. WR Gypsum Board Surface: Apply one coat of sealer for absorption control in accordance with the top coating manufacturer, and two top coats of non aqueous acrylic paint, conforming to JIS K 5660, in the rate of 0.08 kg/m² per one coat, in accordance with JASS 18.
 - D. Gypsum Board Surface: Apply sealer in accordance with the top coat manufacturer, and two top coats, synthetic resin emulsion paint, JIS K 5660 Type A in the rate of 0.10 kg/m² per one coat, in accordance with JASS 18, Para 4.17, "Synthetic Resin Emulsion Paint".
 - E. Steel Surface: Apply anticorrosive paint in accordance with the top coat manufacturer, and two top coats, synthetic resin type ready mixed paint, JIS K 5516, in the rate of 0.09 kg/m² per one coat, in accordance with JASS 18
- 3.4 INSPECTION AND ACCEPTANCE: In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

-- End of Section --

SECTION 10 28 13

TOILET ACCESSORIES

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.

- A. ASTM INTERNATIONAL (ASTM)
ASTM C 1036 (2006) Standard Specification for Flat Glass

- 1.2 SUBMITTALS: Submit the following in accordance with Section 01 11 00 SUBMITTAL PROCEDURES:

- A. Product Data
1. Medicine Cabinet

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

- 1.3 DELIVERY, STORAGE, AND HANDLING: Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

- 1.4 WARRANTY: Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

- 2.1 MEDICINE CABINET: Construct medicine cabinet with cold-rolled carbon steel of 20 gauge with white heat cured acrylic paint finish. Mirrors shall have full surround of stainless steel frame with full closure. Cabinet shall have hinge, built-in door stop and magnetic door catch of manufacturer's standard. Cabinets shall include three adjustable glass shelves. Cabinet shall be reversible for left and right hand installation. Cabinet door assembly shall include lighting fixture. Provide surface mount assembly.

- A. Finishes: Except where noted otherwise, provide the following finishes on metal:

<u>Metal</u>	<u>Finish</u>
Stainless steel	No. 4 satin finish

PART 3 EXECUTION

- 3.1 INSTALLATION: Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.
- A. Surface Mounted Accessories: Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.
- 3.2 CLEANING: Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

-- End of Section --

SECTION 10 56 13

STEEL SHELVING

04/06

PART 1 GENERAL

- 1.1 **SUBMITTALS:** Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with SUBMITTAL PROCEDURES:
 - A. **Product Data**
 1. Shelving Units
 2. Installation instructions
- 1.2 **DELIVERY, STORAGE, AND HANDLING:** Deliver materials in original packages, containers or bundles bearing the brand name and identification of the manufacturer. Store inside under cover. Protect surfaces from damage.

PART 2 PRODUCTS

- 2.1 **MANUFACTURED UNITS:** Provide shelving units indicated. Provide shelving units designed for full dead and live load, designated medium duty. Provide wall anchorages for shelving units. Provide door and drawer earthquake stops.
- 2.2 **FINISH:** Provide the shelving units in the manufacturer's standard colors as chosen by the Contracting Officer. Clean metal by multiple stage phosphatizing and sealing process, for rust resistance and paint adhesion. Provide electrostatically applied enamel finish coats, baked hard for a minimum of 30 minutes at 149 degrees C.

PART 3 EXECUTION

- 3.1 **EXAMINATION:** Before installation, examine shelving units for dents and scratches. Replace damaged shelving.
- 3.2 **INSTALLATION:** Install shelving according to manufacturer's installation instructions.
- 3.3 **PROTECTION:** Cover and protect shelving from damage during the completion of construction. Remove prior to acceptance of project.

-- End of Section --

SECTION 12 21 00

WINDOW BLINDS

08/10

PART 1 GENERAL

- 1.1 **SUBMITTALS:** Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with SUBMITTAL PROCEDURES
 - A. Product Data
 1. Window Blinds
 2. Installation
 - B. Samples
 1. Window Blinds
- 1.2 **DELIVERY, STORAGE, AND HANDLING:** Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above 10 degrees C. Do not open containers until needed for installation unless verification inspection is required.
- 1.3 **WARRANTY:** Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

- 1.1 **WINDOW BLINDS:** Provide each blind, including hardware, accessory items, mounting brackets and fastenings, as a complete unit produced by one manufacturer. All parts shall be one color, unless otherwise indicated, to match the color of the blind slat. Treat steel features for corrosion resistance. Submit samples of each type and color of window treatment. Provide aluminum horizontal blind slats.
 - A. Horizontal Blinds: Provide horizontal blinds with 25 mm slats. Blind units shall be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds shall be inside mount. Provide tapes for 50 mm slats with longitudinal reinforced vinyl plastic in 1-piece turn ladder construction. Tapes for 25 mm slats shall be braided polyester or nylon.

1. Head Channel and Slats: Provide head channel made of steel or aluminum with corrosion-resistant finish nominal 0.46 mm for 50 mm slats. Provide slats of aluminum, not less than 0.203 mm thick, and of sufficient strength to prevent sag or bow in the finished blind. Provide a sufficient amount of slats to assure proper control, uniform spacing, and adequate overlap. Enclose all hardware in the headrail.
 2. Controls: The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. Provide a tilter control of enclosed construction. Provide moving parts and mechanical drive made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. Include a mechanism to prevent over tightening. Provide a wand of sufficient length to reach to within 1500 mm of the floor.
 3. Intermediate Brackets: Provide intermediate brackets for installation, as recommended by the manufacturer, of blinds over 1200 mm wide.
 4. Bottom Rail: Provide bottom rail made of corrosion-resistant steel with factory applied finish. Provide closed oval shaped bottom rail with double-lock seam for maximum strength. Bottom rail and end caps to match slats in color.
 5. Braided Ladders: Provide braided ladders of 100 percent polyester yarn, color to match the slat color. Space ladders 15.2 slats per 300 mm of drop in order to provide a uniform overlap of the slats in a closed position.
- B. Vertical Blinds: Provide vertical blind units capable of nominal 180 degree partial tilting operation and full stackback. The blinds shall be listed by the manufacturer as designed for heavy duty strength applications including heavy duty hardware. Provide ceiling mounted vertical blinds with inside brackets. Blinds shall be floor length. Outside mount type installation shall provide adequate overlap to control light and privacy.
1. Louvers: Provide louvers which are fire resistant solid vinyl, UV stable, and impact resistant or which are flame retardant fabric having straight, flat, unfrayed edges and flat, without noticeable twists. Provide a weight at the bottom of the louver without the insert discoloring the fabric. Fabric inserts shall be flame retardant and colorfast. Louvers that are 90 mm shall overlap not less than 10 mm shall overlap not less than 6 mm and be dimensionally stable.
 2. Carriers: Provide carriers to support each louver made of molded plastic to transverse on self-fabricated wheels for smooth, easy operation. The hook of the carrier shall have an automatic latch to permit easy installation and removal of the louver, and to securely lock the louver for tilting and traversing.

3. Headrail System: Provide headrail system not less than 1.19 mm thick and made of anodized aluminum alloy or 0.635 mm thick phosphate treated steel with a baked on ivory gloss enamel paint finish. The headrail shall extend the full width of the blind and be closed with an end cap at each end. One cap shall contain the traversing and tilting controls. The opposite cap will house the pulley for the traversing cord.
 4. Valance: Attach the manufacturer's standard valance to the headrail by metal or plastic holders which grip the top and bottom edge of the valance and accept an insert of the same material as the slats. Provide sufficient clearance behind the valance to permit the louvers to tilt without interference. Extend the headrail cover the full width of the blind.
 5. Controls: Provide tilting and traversing controls that hang compactly at the side of the blinds and reach within 1500 mm of the floor. The tilt/traverse control shall tilt all vanes simultaneously to any desired angle and hold them at that angle. Provide louvers that traverse one way to the right. The traversing control cord shall be minimum 1.78 mm in diameter with a minimum breaking strength of 556 N. Anchor the cord to a lead carrier linked to all adjacent carriers. Sliding glass doors shall have a one way draw with stackback occurring opposite door openings.
 6. Connectors and Spacers: The connector shall be flexible, smooth and flat to slide unhindered when carriers move independently of each other, and to nest compactly when carriers are stacking. Relate the length of the links to the louver width in order to equally space the traversing louvers, to maintain uniform and adequate overlap of louvers, and to fully cover the width of the opening.
 7. Intermediate Brackets: Provide intermediate installation brackets for blinds over 1575 mm wide.
- C. COLOR: Provide color, pattern and texture selected from manufacturer's standard colors.

PART 3 EXECUTION

- 3.1 EXAMINATION: After becoming familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.
- 3.2 INSTALLATION:
 - A. Horizontal Blinds: Perform installation of Horizontal Blinds in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Provide and install supplementary or miscellaneous items in total, including clips, brackets, or

anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

- B. Vertical Blinds and Valance: Perform installation of Vertical Blinds and Valance in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Provide and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

- 3.3 CLEAN-UP: Upon completion of the installation, free window treatments from soiling, damage or blemishes; and adjust them for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Contracting Officer. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, shall be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 20 mm or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

-- End of Section --

SECTION 12 32 00

MANUFACTURED WOOD CASEWORK

11/16

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.

A. ASME INTERNATIONAL (ASME)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

B. ASTM INTERNATIONAL (ASTM)

ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 325M (2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)

ASTM C1036 (2010; E 2012) Standard Specification for Flat Glass

ASTM D4690 (2012) Standard Specification for Urea Formaldehyde Resin Adhesives

ASTM F 836M (2016) Standard Specification for Style 1 Stainless Steel Metric Nuts

C. BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9 (2015) Cabinet Hardware

D. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3.1 (2005) Performance, Application, Fabrication and Installation of High-Pressure Decorative Laminate

E. U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588 (Rev E, Notice 1) Bolt, Toggle: and Expansion Sleeve, Screw

FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

FS MM-L-736 (Rev D) Lumber; Hardwood

FS TT-V-121 (Rev H) Varnish, Spar, Water-Resisting

1.2 SUBMITTALS: Submit the following in accordance with Section 01 11 00 General Requirements:

- A. Shop Drawings
 - 1. Wall and base cabinets
 - 2. Vanity cabinets

Furnish for approval, shop drawings, catalog cuts and descriptive material showing type of cabinet and related items included in this contract. Indicate clearly the complete layout of cabinets, accessories and pertinent details of construction fabrication and attachments.

- B. Product Data
 - 1. Wall and base cabinets
 - 2. Countertops
 - 3. Vanity Cabinets

- C. Samples
 - 1. Colors

Submit one sample of each color of cabinet finish for verification that products match the colors indicated.

1.3 DELIVERY, STORAGE, AND HANDLING: Deliver materials in manufacturer's original unopened containers or packaging with labels intact and legible. Deliver, handle, and store cabinets in a manner that prevents damage or deformity. Replace defective or damaged materials.

PART 2 PRODUCTS

2.1 FABRICATION: Laminate Cabinet Fabrication: Construct cabinets with frame fronts and solid ends throughout. Frame members will be 20 by 40 millimeter kiln-dried hardwood, using mortise and tenon, dovetailed or doweled, and glued together. Brace top and bottom corners with hardwood blocks that are glued with water-resistant glue and nailed in place. Provide base cabinets with an integral toe space at least 65 millimeter deep and 100 millimeter high. Mount drawers on metal guides. Provide fixed and adjustable shelving, as indicated on drawings.

2.2 MATERIALS: Minimum thicknesses of materials for cabinet construction is as follows:

- a. End, Backs and bottoms of base cabinets and tops of wall cabinets: **10mm hardwood/plywood with plastic laminate covering.** Brace bottoms with wood members glued in place.

- b. Doors and Drawer Fronts: 19 millimeter plywood or medium density fiberboard cores with solid edge bands
- c. Interior partitions or dividers: 19 millimeter plywood or medium density fiberboard cores with solid edge bands
- d. Shelves: Supported on ends and 600 millimeter on centers
- e. Adjustable shelves: 19mm hardwood/plywood with plastic laminate covering.
- f. Base cabinet shelves: 19mm hardwood/plywood with plastic laminate covering.
- g. Wall cabinet shelves: 19mm hardwood/plywood with plastic laminate covering.

2.4 ACCESSORIES AND HARDWARE: Provide corrosion-resisting hardware. Exposed hardware shall have bronze finish. Paint semi-concealed hinges to match cabinets on cabinets where paint finish is specified. Equip doors and drawers and shelves with hardware indicated. Locks shall be provided on closets, drawers and cabinets as shown on drawing.

- a. Provide corrosion-resistant steel conforming to ASTM A167, Type 304 Finish 4.
- b. Provide adhesives for application of plastic laminate consisting of a thermosetting urea-resin Type II conforming to ASTM D4690 as recommended by the manufacturer of the laminate. Provide adhesive for wood members conforming to ASTM D4689.
- c. Provide filler material conforming to FS TT-F-336.
- d. Provide hardwood plywood conforming to HPVA HP-1.
- e. Provide plastic laminate conforming to ANSI/NEMA LD 3.

Provide accessories and hardware conforming to the following requirements, as applicable:

- a. Extension drawer slides: ANSI/BHMA A156.9, Type B85071
- b. Semiconcealed hinges: ANSI/BHMA A156.9, Type B81201, 1-1/2 inches
- c. Catches: Magnetic, 22 newton pull

Provide fasteners conforming to the following:

- a. Screws: ASME B18.6.1, Group, Type and Class as applicable

- b. Anchoring Devices: FS FF-S-325, Group, Type, and Class as applicable
- c. Toggle bolts: FS FF-B-588, Type I, Class A, Style 2
- d. Nuts: ASTM F594, corrosion-resistant steel
- e. Bolts: ASTM A325, heavy, hexagon head bolts corrosion-resistant steel

PART 3 EXECUTION

- 3.1 **INSTALLATION:** Install casework plumb with countertops level to within 1 millimeter in 3000 millimeter. Level base cabinets by adjusting leveling screws. Scribe and fit scribe strips to irregularities of adjacent surfaces. Gap opening is not to exceed 0.63 millimeter.

Secure cases permanently to floor and wall construction using 6 millimeter diameter masonry anchors, spaced 760 millimeter maximum on center, minimum of two for each case.

Support wall cases on continuous 1.3 millimeter galvanized steel hanging brackets. Secure wall cases in position with screws to blocking. Bolt adjoining cases together. Width of joints not exceed 0.79 millimeter. Provide closer strips, filler strips, and finish moldings as required. Align doors, adjust hardware, clean and wax surfaces.

Submit Installation Drawings for wood cabinets. Include in drawings location of cabinets, details of cabinets related and dimensional positions, and locations for roughing in plumbing, including sinks, faucets, strainers and cocks.

- 3.2 **CLEANING:** On completion of cabinet installation, touch up marred or abraded finished surfaces. Remove crating and packing materials from premises. Wipe down surfaces to remove fingerprints and markings and leave in clean condition.
- 3.3 **INSPECTION:** Examine casework grounds and supports for adequate anchorage, foreign material, moisture, and unevenness that could prevent quality casework installation. Ensure that electrical and plumbing rough-ins for casework are complete. Do not proceed with installation until defects are corrected.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

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.

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

ASHRAE 189.1	(2011) Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - IP	(2010) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - SI	(2010) Energy Standard for Buildings Except Low-Rise Residential Buildings

B. AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2005) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C606	(2015) Grooved and Shouldered Joints
AWWA C651	(2014) Standard for Disinfecting Water Mains
AWWA C652	(2011) Disinfection of Water-Storage Facilities

C. AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2011; Amendment 2012) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.2/B2.2M	(2010) Specification for Brazing Procedure and Performance Qualification

D. ASME INTERNATIONAL (ASME)

ASME A112.19.1/CSA B45.2	(2013) Enameled Cast Iron and Enameled Steel Plumbing Fixtures
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ASME A112.19.2/CSA B45.1	(2013) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
ASME A112.19.3/CSA B45.4	(2008; R 2013) Stainless Steel Plumbing Fixtures
ASME A112.6.1M	(1997; R 2012) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
	(2016) Standard for Floor and Trench Drains
	(2013) Pipe Threads, General Purpose (Inch)
ASME B16.15	(2013) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2011) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2012) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.50	(2013) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME B31.1	(2016) Power Piping
ASME B31.5	(2016) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications

E. ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings
ASTM A518/A518M	(1999; R 2012) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM A733	(2013) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A74	(2016) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B152/B152M	(2013) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B306	(2013) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM B370	(2012) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B42	(2015a) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B43	(2014) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B584	(2014) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B813	(2016) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B828	(2016) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B88	(2014) Standard Specification for Seamless Copper Water Tube

ASTM B88M	(2013) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C564	(2014) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D1785	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2235	(2004; R 2011) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2012) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2665	(2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2672	(2014) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D2846/D2846M	(2014) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2855	(2015) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3138	(2004; R 2011) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components

ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3311	(2011; R 2016) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM F1760	(2016) Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F2389	(2010) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
ASTM F437	(2015) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	(2015) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439	(2013) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441/F441M	(2013; E 2013) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F442/F442M	(2013; E 2013) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F493	(2014) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F877	(2011a) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F891	(2016) Standard Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core
G. CAST IRON SOIL PIPE INSTITUTE (CISPI)	
CISPI 310	(2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for

Sanitary and Storm Drain, Waste, and Vent
Piping Applications

- H. COPPER DEVELOPMENT ASSOCIATION (CDA)
CDA A4015 (2010) Copper Tube Handbook
- I. CSA GROUP (CSA)
CSA B45.5-11/IAPMO Z124 (2011; Update 1 2012) Plastic Plumbing Fixtures
- First Edition
- J. INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
(IAPMO)
IAPMO PS 117 (2005b) Press Type Or Plain End Rub Gasketed
W/ Nail CU & CU Alloy Fittings 4 Install On CU
Tubing
- K. INTERNATIONAL CODE COUNCIL (ICC)
ICC IPC (2015) International Plumbing Code
- L. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND
FITTINGS INDUSTRY (MSS)
MSS SP-58 (1993; Reaffirmed 2010) Pipe Hangers and
Supports - Materials, Design and Manufacture,
Selection, Application, and Installation
MSS SP-80 (2013) Bronze Gate, Globe, Angle and Check
Valves
MSS SP-83 (2014) Class 3000 Steel Pipe Unions Socket
Welding and Threaded
MSS SP-85 (2011) Gray Iron Globe & Angle Valves Flanged
and Threaded Ends
- M. NSF INTERNATIONAL (NSF)
NSF/ANSI 61 (2016) Drinking Water System Components -
Health Effects
- N. PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)
PPFA Fire Man (2010) Firestopping: Plastic Pipe in Fire
Resistive Construction
- O. PLUMBING AND DRAINAGE INSTITUTE (PDI)
PDI WH 201 (2010) Water Hammer Arresters Standard

- P. SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)
SAE J1508 (2009) Hose Clamp Specifications
- Q. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
40 CFR 141.80 National Primary Drinking Water Regulations;
Control of Lead and Copper; General
Requirements
PL 109-58 Energy Policy Act of 2005 (EPAct05)
- R. UNDERWRITERS LABORATORIES (UL)
UL 430 (2009; Reprint Dec 2014) Standard for Waste
Disposers

1.2 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Air Force Form 66:

A. Product Data

1. Fixtures

- a. List of installed fixtures with manufacturer, model, and flow rate.
- b. Flush Tank Water Closets
- c. Countertop Lavatories
- d. Kitchen Sinks
- e. Shower Faucets

B. Test Reports

1. Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.3 STANDARD PRODUCTS: Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the

commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

A. Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

B. Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

C. Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

D. Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1. Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

2. Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

- 1.4 DELIVERY, STORAGE, AND HANDLING: Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

A. Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX or JIS equivalent. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1 or JIS equivalent. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable.

- 1.6 REGULATORY REQUIREMENTS: Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - SI ASHRAE 90.1 – IP.
- 1.7 PROJECT/SITE CONDITIONS: The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

A. Water-Efficient Products

1. Fixtures
2. Flush tank water closets
3. Countertop lavatories
4. Kitchen sinks
5. Showerheads

2.2 Materials: Materials for various services shall be in accordance with TABLES I and II.

A. Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used underground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

1. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310
2. Coupling for Steel Pipe: AWWA C606.
3. Couplings for Grooved Pipe: Malleable Iron ASTM A47/A47M, Grade 32510.
4. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21 or JIS equivalent. Gaskets shall be flat, 1.6 mm 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
5. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5 or JIS equivalent.
6. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have contain potassium borides; and contain fluorides.
7. Solder Material: Solder metal shall conform to ASTM B32 or JIS equivalent.
8. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813 or JIS equivalent, Standard Test 1.
9. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

10. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.
11. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F477 or JIS equivalent.
12. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138 or JIS equivalent.
13. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D2235 or JIS equivalent.
14. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855 or JIS equivalent.
15. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F493 or JIS equivalent.
16. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22 or JIS equivalent and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing element shall be selected based on manufacturer's approved application guidelines.
17. Copper tubing shall conform to ASTM B88M ASTM B88 or JIS equivalent Type K, L or M.

B. Miscellaneous Materials

Miscellaneous materials shall conform to the following:

1. Water Hammer Arrestor: PDI WH 201.
2. Hose Clamps: SAE J1508 or JIS equivalent.
3. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
4. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
5. Hypochlorites: AWWA B300.

6. Liquid Chlorine: AWWA B301.

C. Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.3 PIPE HANGERS, INSERTS, AND SUPPORTS: Pipe hangers, inserts, and supports shall conform to MSS SP-58 or JIS equivalent.

2.4 VALVES: Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80 or JIS equivalent
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34 or JIS equivalent
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85 or JIS equivalent

A. Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 20 mm 3/4 inch male inlet threads, hexagon shoulder, and 20 mm 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.5 FIXTURES: Fixtures shall be water conservation type, in accordance with ASHRAE 189.1 Section 6.3.2.1 (Plumbing fixtures and Fittings).

A. Flush Tank Water Closets

ASME A112.19.2/CSA B45.1, white vitreous china, siphon jet, round bowl, pressure assisted, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 356 to 381 mm 14 to 15 inches, except 432 to 483 mm 17 to 19 inches for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Water

flushing volume of the water closet shall not exceed 1.6 gallons per flush. Provide white solid plastic round closed-front seat with cover.

B. Countertop Lavatories

ASME A112.19.2/CSA B45.1, white vitreous china, self-rimming, minimum dimensions of 483 mm 19 inches wide by 432 mm 17 inches front to rear, with supply openings for use with top mounted centerset faucets. Furnish template and mounting kit by lavatory manufacturer. Water flow rate shall not exceed 1.9 L per minute when measured at a flowing water pressure of 414 kPa. Mount counter with the top surface 864 mm 34 inches above floor and with 737 mm 29 inches minimum clearance from bottom of the counter face to floor.

C. Kitchen Sinks

ASME A112.19.3/CSA B45.4, 20 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of 838 mm 33 inches wide by 533 mm 21 inches front to rear, two compartments, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 89 mm 3.5 inch drain outlet. Water flow rate shall not exceed 8.3 L per minute when measured at a flowing water pressure of 414 kPa. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 38 mm 1.5 inch P-trap and drain piping to vertical vent piping from each compartment. Provide UL 430 waste disposer in right compartment.

D. Bathtubs, Cast Iron

ASME A112.19.1/CSA B45.2, white enameled cast iron, recessed type, minimum dimensions of 1524 mm 60 inches wide by 762 mm 30 inches front to rear by 406 mm 16 inches high with drain outlet for above-the-floor drain installation. Provide left or right drain outlet bathtub as indicated.

2.6 DRAINS

A. Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be

adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3.

B. Bathtub and Shower Faucets and Drain Fittings

Provide single control pressure equalizing bathtub and shower faucets with body mounted from behind the wall with threaded connections. Provide ball joint self-cleaning shower heads. Provide shower heads which deliver a maximum of 2.5 GPM.

- 2.7 TRAPS: Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.813 mm 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm 2 inches. The interior diameter shall be not more than 3.2 mm 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.8 MISCELLANEOUS PIPING ITEMS

A. Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

B. Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors.

Sleeves are not required where [supply] drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

1. Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2. Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

C. Pipe Hangers (Supports)

Provide MSS SP-58 Type 1 or JIS equivalent with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS: Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 m 5 feet outside the building, unless otherwise indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 150 mm 6 inches above the floor from point of entry. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown.

A. Water Pipe, Fittings, and Connections

1. Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

2. Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3. Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

4. Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 12 mm 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100

mm 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

B. Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

1. Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

2. Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3. Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm 2-1/2 inches and smaller; flanges shall be used on pipe sizes 80 mm 3 inches and larger.

4. Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

5. Copper Tube and Pipe

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 50 mm 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.
- c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.
- d. Press connection. Copper press connections shall be made in strict accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s)

approved by the manufacturer of that joint. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

6. Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

7. Other Joint Methods

C. Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

D. Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

1. Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links

shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm 4 inches above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed with sealants. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

2. Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 40 mm 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 40 mm 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe.

3. Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

E. Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified.

F. Supports

1. General

Hangers used to support piping 50 mm 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

2. Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d.. Type 19 and 23 C-clamps shall be torqued per MSS SP-58 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 100 mm 4 inches and larger when the temperature of the medium is 15 degrees C 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
 - 1. Be used on insulated pipe less than 100 mm 4 inches.
 - 2. Be used on insulated pipe 100 mm 4 inches and larger when the temperature of the medium is 15 degrees C 60 degrees F or less.
 - 3. Have a high density insert for all pipe sizes. High density inserts shall have a density of 128 kg per cubic meter 8 pcf or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-58 and a support shall be installed not over 300 mm 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m 5 feet apart at valves.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m 15 feet nor more than 2 m 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:
 - 1. On pipe 100 mm 4 inches and larger when the temperature of the medium is 15 degrees C 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

2. On pipe less than 100 mm 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
 3. On pipe 100 mm 4 inches and larger carrying medium less than 15 degrees C 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
 - k. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
 - l. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm 4 inches or by an amount adequate for the insulation, whichever is greater.
 - m. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.
3. Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

4. Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has

been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

- 3.3 **FIXTURES AND FIXTURE TRIMMINGS:** Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

A. Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

B. Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 775 mm 31 inches above finished floor.

C. Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

D. Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the

desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

1. Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

2. Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

E. Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.4 IDENTIFICATION SYSTEMS

A. Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 35 mm 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.5 ESCUTCHEONS: Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.6 PAINTING: Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09 90 00 PAINTS AND COATINGS.

A. Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

1. Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 3 mm 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C 120 degrees F, the factory painting system shall be designed for the temperature service.

B. Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 50 degrees C 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

1. Temperatures Less Than 50 Degrees C 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 50 degrees C 120

degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm 0.3 mil, one coat of primer applied to a minimum dry film thickness of 0.0255 mm one mil; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm one mil per coat.

2. Temperatures Between 50 and 205 Degrees C 120 and 400 Degrees F: Metal surfaces subject to temperatures between 50 and 205 degrees C 120 and 400 degrees F shall receive two coats of 205 degrees C 400 degrees F heat-resisting enamel applied to a total minimum thickness of 0.05 mm 2 mils.
3. Temperatures Greater Than 205 Degrees C 400 Degrees F: Metal surfaces subject to temperatures greater than 205 degrees C 400 degrees F shall receive two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm 2 mils.

3.7 TESTS, FLUSHING AND DISINFECTION

A. Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure and reasons for choosing this option in lieu of the smoke test to the Contracting Officer for approval.

1. Drainage and Vent Systems Test. The final test shall include a smoke test.
2. Building Sewers Tests.
3. Water Supply Systems Tests.

B. System Flushing

1. During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second 4 fps through all portions of the piping system. In the event that this is

impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 1 L 0.25 gallons per 24 hour period, ten times over a 14 day period.

2. After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - SI ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

C. Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

1. Time, date, and duration of test.
2. Operation of each fixture and fixture trim.
3. Operation of each valve, and faucet.

4. Temperature of each domestic hot-water supply.
5. Operation of each floor and roof drain by flooding with water.

D. Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator and booster pump until the entire system is completely filled.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take additional samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.8 TABLES

TABLE I							
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS							
Item #	Pipe and Fitting Materials	<u>SERVICE A</u>	<u>SERVICE B</u>	<u>SERVICE C</u>	<u>SERVICE D</u>	<u>SERVICE E</u>	<u>SERVICE F</u>
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X	
2	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 4				X	X	
3	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 4				X	X	
4	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S, Grade B	X			X	X	
5	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F891, (Sch 40) ASTM F1760	X	X	X	X	X	X
SERVICE: A - Underground Building Soil, Waste and Storm Drain B - Aboveground Soil, Waste, Drain In Buildings C - Underground Vent D - Aboveground Vent E - Interior Rainwater Conductors Aboveground F - Corrosive Waste And Vent Above And Belowground * - Hard Temper							

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	<u>SERVICE A</u>	<u>SERVICE B</u>	<u>SERVICE C</u>	<u>SERVICE D</u>
1	Seamless copper pipe, ASTM B42	X	X		X

REPAIR MILITARY FAMILY HOUSING, KINSER HEIGHTS
Camp Kinser, Okinawa, Japan

2	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
3	Cast bronze threaded fittings, ASME B16.15 for use with Item 1	X	X		X
4	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Item 1	X	X	X	X
5	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 2	X	X	X	X
<p>SERVICE:</p> <p>A - Cold Water Service Aboveground</p> <p>B - Hot and Cold Water Distribution 82 degrees C 180 degrees F Maximum Aboveground</p> <p>C - Compressed Air Lubricated</p> <p>D - Cold Water Service Belowground</p> <p>Indicated types are minimum wall thicknesses.</p> <p>** - Type L - Hard</p> <p>*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors</p> <p>**** - In or under slab floors only brazed joints</p>					

-- End of Section --

SECTION 23 00 00
AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS
08/10

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.

- A. AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
AMCA 500-D (2012) Laboratory Methods of Testing Dampers for Rating

- B. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
ASHRAE 90.1 - IP (2010) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - SI (2010) Energy Standard for Buildings Except Low-Rise Residential Buildings

- C. ASTM INTERNATIONAL (ASTM)
ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A924/A924M (2016a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B280 (2016) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B766 (1986; R 2015) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C553 (2013) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM D3359 (2009; E 2010; R 2010) Measuring Adhesion by Tape Test
ASTM D520 (2000; R 2011) Zinc Dust Pigment

ASTM E2016 (2015) Standard Specification for Industrial Woven Wire Cloth

D. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2016) Motors and Generators

NEMA MG 10 (2013) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors

NEMA MG 11 (1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

E. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2015) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

NFPA 90A (2015) Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 96 (2014) Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

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

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

G. U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

H. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82 Protection of Stratospheric Ozone

PL 109-58 Energy Policy Act of 2005 (EPAct05)

I. UL ENVIRONMENT (ULE)

ULE Greenguard UL Greenguard Certification Program

J. UNDERWRITERS LABORATORIES (UL)

UL 181 (2013) Factory-Made Air Ducts and Air Connectors

UL Bld Mat Dir (2012) Building Materials Directory

1.2 SYSTEM DESCRIPTION: Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

- A. Mechanical Equipment Identification: The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms.
- B. Service Labeling: Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation. Labels shall be in accordance with the typical examples below:

SERVICE	LABEL AND TAG DESIGNATION
Air handling unit Number	AHU - []
Exhaust Fan Number	EF - []

Identify similar services with different temperatures or pressures. Where pressures could exceed 860 kilopascal 125 pounds per square inch, gage, include the maximum system pressure in the label. Label and arrow piping in accordance with the following:

- Each point of entry and exit of pipe passing through walls.
- Each change in direction, i.e., elbows, tees.
- In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.
- In long straight runs, locate labels at distances within eyesight of each other not to exceed 22 meter 75 feet. All labels shall be visible and legible from the primary service and operating area.

For Bare or Insulated Pipes	
for Outside Diameters of	Lettering
13 thru [] mm 1/2 thru 1-3/8 inch	13 mm 1/2 inch
40 thru [] mm 1-1/2 thru 2-3/8 inch	[] mm 3/4 inch
65 mm and larger 2-1/2 inch and larger	[] mm 1-1/4 inch

- 1.3 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Form 66:

A. Product Data

1. Duct Connectors
2. Manual Balancing Dampers
3. Registers and Grilles
4. Louvers
5. Ceiling Exhaust Fans
6. Residential Range Hood
7. Dehumidifier Unit
8. Test Procedures
9. Diagrams

B. Test Reports

1. Performance Tests

C. Manufacturer's Instructions

1. Manufacturer's Installation Instructions
2. Operation and Maintenance Training

D. Operation and Maintenance Data

1. Operation and Maintenance Manuals
2. Manual Balancing Dampers
3. Ceiling Exhaust Fans;
4. Residential Range Hood
5. Dehumidifier Unit

- 1.4 QUALITY ASSURANCE: Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

- a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

- b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.
 - c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.
- A. Prevention of Corrosion: Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations.
- B. Asbestos Prohibition: Do not use asbestos and asbestos-containing products.
- C. Ozone Depleting Substances Used as Refrigerants: Minimize releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F. Any person conducting repair, maintenance, servicing or disposal of equipment containing refrigerants must comply with the following:
- 1. Do not knowingly vent or otherwise release into the environment, Class I or Class II substances used as a refrigerant.
 - 2. Do not open appliances without meeting the requirements of 40 CFR 82 Part 82.156 Subpart F, regarding required practices for evacuation and collection of refrigerant, and 40 CFR 82 Part 82.158 Subpart F, regarding standards of recycling and recovery equipment.
 - 3. Only persons who comply with 40 CFR 82 Part 82.161 Subpart F, regarding technician certification, can conduct work on appliances containing refrigerant.

In addition, provide copies of all applicable certifications to the Contracting Officer at least 14 calendar days prior to initiating maintenance, repair, servicing, dismantling or disposal of appliances, including:

- 1. Proof of Technician Certification

2. Proof of Equipment Certification for recovery or recycling equipment.
 3. Proof of availability of certified recovery or recycling equipment.
- D. Use of Ozone Depleting Substances, Other than Refrigerants: The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:
1. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon
 2. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays.
 3. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial cabling.
 4. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.
- Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.
- E. Detail Drawings: Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

- 1.5 DELIVERY, STORAGE, AND HANDLING: Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS: Provide components and equipment that are "standard products" of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. "Standard products" is defined as being in satisfactory commercial or industrial use for 2 years before bid opening, including applications of components and equipment under similar circumstances and of similar size, satisfactorily completed by a product that is sold on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record are acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Provide equipment items that are supported by a service organization.

- 2.2 IDENTIFICATION PLATES: In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background.

Letters shall be upper case. Identification plates 40 mm 1-1/2-inches high and smaller shall be 1.6 mm 1/16-inch thick, with engraved lettering 3 mm 1/8-inch high; identification plates larger than 40 mm 1-1/2-inches high shall be 3 mm 1/8-inch thick, with engraved lettering of suitable height. Identification plates 40 mm 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

- 2.3 EQUIPMENT GUARDS AND ACCESS: Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

2.4 ELECTRICAL WORK

- a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide

manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

- b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.
 - c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system, and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.
 - d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.
- 2.5 ANCHOR BOLTS: Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.
- 2.6 PAINTING: Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.
- 2.7 INDOOR AIR QUALITY: Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.
- 2.8 DUCT SYSTEMS

A. Metal Ductwork: Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification .

1. Ductwork shall be constructed meeting the requirements for the duct system static pressure specified in APPENDIX D of Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

Provide radius type elbows with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes are allowed.

Provide sealants that conform to fire hazard classification specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.

Make spiral lock seam duct, and flat oval with duct sealant and lock with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA 1966. Apply the sealant to the exposed male part of the fitting collar so that the sealer is on the inside of the joint and fully protected by the metal of the duct fitting. Apply one brush coat of the sealant over the outside of the joint to at least 50 mm 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar are not acceptable. Fabricate outdoor air intake ducts and plenums with watertight soldered or brazed joints and seams.

- a. Insulated Nonmetallic Flexible Duct Runouts: Use flexible duct runouts only where indicated. Runout length is indicated on the drawings, and is not to exceed 1.5 m 5 feet. Provide runouts that are preinsulated, factory fabricated, and that comply with NFPA 90A and UL 181. Provide either field or factory applied vapor barrier. Provide not less than 0.60 L 20 ounce glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts. Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

- b. General Service Duct Connectors: Provide a flexible duct connector approximately 150 mm 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector system that complies with NFPA 701 and is classified as "flame-retardent fabrics" in UL Bld Mat Dir.
 - c. High Temperature Service Duct Connections: Provide material that is approximately 2.38 mm 3/32 inch thick, 1.2 to 1.36 kg per square meter 35 to 40-ounce per square yard weight, plain weave fibrous glass cloth with, nickel/chrome wire reinforcement for service in excess of 650 degrees C 1200 degrees F.
 - d. Corrosion Resisting (Stainless) Steel Sheets: ASTM A167 or JIS Equivalent
- B. Manual Balancing Dampers: Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators. Install dampers that are 2 gauges heavier than the duct in which installed. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 300 mm 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.
- C. Air Supply And Exhaust Air Dampers: Where outdoor air supply and exhaust air dampers are required they shall have a maximum leakage rate when tested in accordance with AMCA 500-D as required by ASHRAE 90.1 - SI ASHRAE 90.1 – IP including maximum Damper Leakage for:
- 1. Climate Zones 1,2,6,7,8 the maximum damper leakage at 250 Pa 1.0 inch w.g. for motorized dampers is 20 L/s per square m 4 cfm per square foot of damper area and non-motorized dampers are not allowed.

2. All other Climate Zones the maximum damper leakage at 250 Pa 1.0 inch w.g. is 50 L/s per square m 10 cfm per square foot and for non-motorized dampers is 100 L/s per square m 20 cfm per square foot of damper area.

Dampers smaller than 600 mm 24 inches in either direction may have leakage of 200 L/s per square m 40 cfm per square foot.

- D. Air Deflectors and Branch Connections: Provide air deflectors at all duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections are allowed in lieu of deflectors for branch connections. Furnish all air deflectors, except those installed in 90 degree elbows, with an approved means of adjustment. Provide easily accessible means for adjustment inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, provide external adjustments with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Provide factory-fabricated air deflectors consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Provide factory or field assembled air deflectors. Make adjustment from the face of the diffuser or by position adjustment and lock external to the duct. Provide stand-off brackets on insulated ducts as described herein. Provide fixed air deflectors, also called turning vanes, in 90 degree elbows.
- E. Louvers: Provide louvers for installation in exterior walls that are associated with the air supply and distribution system as indicated.
- F. Bird Screens and Frames: Provide bird screens that conform to ASTM E2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.9 AIR SYSTEMS EQUIPMENT

A. FANS

1. Ceiling Exhaust Fans: Provide centrifugal type, direct driven suspended cabinet-type ceiling exhaust fans. Provide fans with acoustically insulated housing. Provide chatter-proof backdraft damper. Provide egg-crate design or

louver design integral face grille. Mount fan motors on vibration isolators. Furnish unit with mounting flange for hanging unit from above. Provide U.L. listed fans.

2. Residential Range Hood: Provide manufacturer standard unit as indicated in drawing M-6. Installation shall be as per manufacturer's recommendation.
3. Dehumidifier Unit: Provide as indicated in drawing M-6. Installation shall be as per manufacturer's recommendation.

- 2.10 FACTORY PAINTING: Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A123/A123M or ASTM A924/A924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B117, ASTM D1654, and ASTM D3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 3 mm 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D520 Type I.

Factory painting that has been damaged prior to acceptance by the Contracting Officer shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.11 SUPPLEMENTAL COMPONENTS/SERVICES

- A. Condensate Drain Lines: Provide and install condensate drainage for each item of equipment that generates condensate as indicated.
- B. Insulation: The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

PART 3 EXECUTION

3.1 INSTALLATION

- a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation

so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

- b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices).
 - c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.
- A. Condensate Drain Lines: Provide water seals in the condensate drain from all units as indicated. Provide a depth of each seal of 50 mm 2 inches plus 0.1 mm for each Pa the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.
- B. Equipment and Installation: Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 150 mm 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS.
- C. Access Panels: Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced. Provide access panels as indicated.

- D. Flexible Duct: Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.
- E. Metal Ductwork: Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.
- F. Kitchen Exhaust Ductwork
 - 1. Ducts Conveying Smoke and Grease Laden Vapors: Provide ducts conveying smoke and grease laden vapors that conform to requirements of NFPA 96. Make seams, joints, penetrations, and duct-to-hood collar connections with a liquid tight continuous external weld. Provide duct material that is a minimum 1.3 mm 18 gauge, Type 304L or 316L, stainless steel.
 - 2. Exposed Ductwork: Provide exposed ductwork that is fabricated from minimum 1.3 mm 18 gauge, Type 304L or 316L, stainless steel with continuously welded joints and seams. Pitch ducts to drain at hoods and low points indicated. Match surface finish to hoods.
 - 3. Concealed Ducts Conveying Moisture Laden Air: Fabricate concealed ducts conveying moisture laden air from minimum 1.6 mm 16 gauge, galvanized steel. Continuously weld, braze, or solder joints to be liquid tight. Pitch ducts to drain at points indicated. Make transitions to other metals liquid tight, companion angle bolted and gasketed.
- G. Dust Control: To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

- H. Insulation: Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit or up to the point where the outdoor air mixes with the return air stream.
 - I. Duct Test Holes: Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.
 - J. Power Transmission Components Adjustment: Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.
- 3.2 EQUIPMENT PADS: Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 75 mm 3-inch margin around the equipment and supports.
- 3.3 CUTTING AND PATCHING: Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.
- 3.4 CLEANING: Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks. Incorporate housekeeping for field construction work which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean.
- 3.5 PENETRATIONS: Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 380 mm 15 inches and smaller. Build framed, prepared openings for round duct larger than 380 mm 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the

openings. Provide 25 mm one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

- A. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 1 mm 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 20.
 - B. Framed Prepared Openings: Fabricate framed prepared openings from 1 mm 20 gauge galvanized steel, unless otherwise indicated.
 - C. Insulation: Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 16 degrees C 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.
 - D. Closure Collars: Provide closure collars of a minimum 100 mm 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 380 mm 15 inches in diameter or less from 1 mm 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 380 mm 15 inches from 1.40 mm 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 380 mm 15 inches or less from 1 mm 20 gauge galvanized steel. Install collars with fasteners a maximum of 150 mm 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 300 mm 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 500 mm 20 inches in diameter or less.
 - E. Firestopping: Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials.
- 3.6 FIELD PAINTING OF MECHANICAL EQUIPMENT: Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 50 degrees C 120 degrees F. Where more than one coat of paint is specified, apply the second coat

after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

- A. Temperatures less than 50 degrees C 120 degrees F: Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm 0.3 mil, one coat of primer applied to a minimum dry film thickness of 0.0255 mm one mil; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm one mil per coat to metal surfaces subject to temperatures less than 50 degrees C 120 degrees F.
 - B. Temperatures between 50 and 205 degrees C 120 and 400 degrees F : Apply two coats of 205 degrees C 400 degrees F heat-resisting enamel applied to a total minimum thickness of 0.05 mm two mils to metal surfaces subject to temperatures between 50 and 205 degrees C 120 and 400 degrees F.
 - C. Temperatures greater than 205 degrees C 400 degrees F: Apply two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm two mils to metal surfaces subject to temperatures greater than 205 degrees C 400 degrees F.
- 3.7 IDENTIFICATION SYSTEMS: Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 35 mm 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 2 mm 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.
- 3.8 DUCTWORK LEAK TEST: Perform ductwork leak test for new air distribution and exhaust system. Provide test procedure, apparatus, and report that conform to SMACNA 1972 CD.
- 3.9 TESTING, ADJUSTING, AND BALANCING: The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.
- 3.10 PERFORMANCE TESTS: After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and

adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general operating tests by an experienced engineer. Provide tests that cover a period of not less than 2 days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

Submit test reports for the performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.16 OPERATION AND MAINTENANCE

- A. Operation and Maintenance Manuals: Submit manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS

08/10

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.

A. ASTM INTERNATIONAL (ASTM)

ASTM B117 (2016) Standard Practice for Operating Salt Spray (Fog) Apparatus

B. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2017) National Electrical Safety Code

C. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) NEMA MG 1 (2016) Motors and Generators

NEMA MG 10 (2013) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors

NEMA MG 11 (1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

D. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) National Electrical Code

1.2 RELATED REQUIREMENTS: This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

1.3 QUALITY ASSURANCE

A. Material and Equipment Qualifications: Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the

commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

- B. Alternative Qualifications: Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.
 - C. Service Support: The equipment items must be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations must be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
 - D. Manufacturer's Nameplate: For each item of equipment, provide a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.
 - E. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.
- 1. Definitions: For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions must be considered mandatory, the word "should" is interpreted as "must." Reference to the "code official" must be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" must be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" must be interpreted to mean the "lessor." References to the "permit holder" must be interpreted to mean the "Contractor."
 - 2. Administrative Interpretations: For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, must be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.
- 1.4 DELIVERY, STORAGE, AND HANDLING: Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

- 1.5 ELECTRICAL INSTALLATION REQUIREMENTS: Electrical installations must conform to IEEE C2, NFPA 70, and requirements specified herein.
- A. New Work: Provide electrical components of mechanical equipment, such as motors, motor starters [(except starters/controllers which are indicated as part of a motor control center)], control or push-button stations, float or pressure switches, solenoid valves, integral disconnects, and other devices functioning to control mechanical equipment, as well as control wiring and conduit for circuits rated 100 volts or less, to conform with the requirements of the section covering the mechanical equipment. Extended voltage range motors are not to be permitted. The interconnecting power wiring and conduit, control wiring rated 120 volts (nominal) and conduit, [the motor control equipment forming a part of motor control centers,] and the electrical power circuits must be provided under Division 26, except internal wiring for components of package equipment must be provided as an integral part of the equipment. When motors and equipment furnished are larger than sizes indicated, provide any required changes to the electrical service as may be necessary and related work as a part of the work for the section specifying that motor or equipment.
 - B. Modifications to Existing Systems: Where existing mechanical systems and motor-operated equipment require modifications, provide electrical components under Division 26.
 - C. High Efficiency Motors
 - 1. High Efficiency Single-Phase Motors: Unless otherwise specified, single-phase fractional-horsepower alternating-current motors must be high efficiency types corresponding to the applications listed in NEMA MG 11.
 - 2. High Efficiency Polyphase Motors: Unless otherwise specified, polyphase motors must be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings must meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.
 - D. Three-Phase Motor Protection: Provide controllers for motors rated one 1.34 kilowatts 1 horsepower and larger with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.
- 1.6 ACCESSIBILITY: Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA (Not Applicable)

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT: New equipment painting must be factory applied or shop applied, and must be as specified herein, and provided under each individual section.

- A. Factory Painting Systems: Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors must withstand 500 hours in a salt-spray fog test. Salt-spray fog test must be in accordance with ASTM B117, and for that test the acceptance criteria must be as follows: immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen must show no signs of rust creepage beyond 3 mm 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment must not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C 120 degrees F, the factory painting system must be designed for the temperature service.

- B. Shop Painting Systems for Metal Surfaces: Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 50 degrees C 120 degrees F must be cleaned to bare metal. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat must be aluminum or light gray.

1. Temperatures Less Than 50 Degrees C 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 50 degrees C 120 degrees F must receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm 0.3 mil, one coat of primer applied to a minimum dry film thickness of 0.0255 mm 1 mil; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm 1 mil per coat.
2. Temperatures Between 50 and 205 Degrees C 120 and 400 Degrees F: Metal surfaces subject to temperatures between 50 and 205 degrees C 120 and 400

degrees F must receive two coats of 205 degrees C 400 degrees F heat-resisting enamel applied to a total minimum thickness of 0.05 mm 2 mils.

3. Temperatures Greater Than 205 Degrees C 400 Degrees F: Metal surfaces subject to temperatures greater than 205 degrees C 400 degrees F must receive two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm 2 mils.

-- End of Section --

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.
- A. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
 - ASHRAE 62.1 (2010) Ventilation for Acceptable Indoor Air Quality
 - B. ASSOCIATED AIR BALANCE COUNCIL (AABC)
 - AABC MN-1 (2002; 6th ed) National Standards for Total System Balance
 - C. NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)
 - NEBB MASV (2006) Procedural Standards for Measurements and Assessment of Sound and Vibration
 - NEBB PROCEDURAL STANDARDS (2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems
 - D. 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 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 "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by SMACNA Leak Test Manual for an indicated duct construction and sealant class." "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING." 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. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).
- i. TAB: Testing, adjusting, and balancing (of HVAC systems)
- j. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed
- k. TAB Agency: TAB Firm
- l. TAB team field leader: TAB team field leader
- m. TAB team supervisor: TAB team engineer
- n. TAB team technicians: TAB team assistants
- o. TAB team field leader: TAB team field leader
- p. TAB team supervisor: TAB team engineer
- q. TAB team technicians: TAB team assistants

r. TABB: Testing Adjusting and Balancing Bureau

A. 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.

SIMILAR TERMS			
Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems	International Standards for Environmental Systems Balance
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures	Field Readiness Check & Prelim. Field Procedures

- 1.3 WORK DESCRIPTION: The work includes duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of new and existing heating, ventilating, and cooling (HVAC) air distribution systems including equipment and performance data, ducts, and piping which are located within, on, under, between, and adjacent to buildings, including records of existing conditions.

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.

A. 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.

B. TAB SCHEMATIC DRAWINGS

Show the following information on TAB Schematic Drawings:

1. A unique number or mark for each piece of equipment or terminal.
2. Air quantities at air terminals.
3. Air quantities and temperatures in air handling unit schedules.
4. 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 file for Graphics for Unified Facilities Guide Specifications:
<http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf>

The Testing, Adjusting, and Balancing (TAB) Specialist must review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the effective and accurate TAB of the system, including records of existing conditions, and systems readiness check. The TAB Specialist must provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation. The Testing, Adjusting, and Balancing (TAB) Specialist must review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the effective and accurate TAB of the system, including records of existing conditions, and systems readiness check. The TAB Specialist must provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

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.

C. Related Requirements

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

- 1.4 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following:

A. Preconstruction Submittals

1. Records of Existing Conditions;

B. Shop Drawings

1. TAB Schematic Drawings and Report Forms;

C. Product Data

1. Equipment and Performance Data;
2. TAB Related HVAC Submittals;
3. TAB Procedures;
 - a. Proposed procedures for TAB, submitted with the TAB Schematic
 - b. Drawings and Report Forms.

D. Test Reports

1. Completed Pre-Final DALT Report;
2. Certified Final DALT Report;
3. Certified Final TAB Report;

1.5 QUALITY ASSURANCE

A. TAB and Personnel Qualifications

Shall have extensive experience in performing TAB works of similar or larger magnitude of work that can be verified on records, and shall be familiar with AABC MN-1, NEBB Procedural Standards, or SMACNA 1780 (TABB). TAB personnel can be an employee of the main contractor or mechanical subcontractor.

1. TAB Standard

Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard are considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practical, to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations.

All quality assurance provisions of the TAB Standard such as performance guarantees are part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures must be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are considered mandatory, including the latest requirements of ASHRAE 62.1.

2. Qualifications

a. TAB Specialist Responsibilities

TAB Specialist responsibilities include all TAB work specified herein and in related sections under his direct guidance. The TAB specialist is required to be onsite on a daily basis to direct TAB efforts. The TAB Specialist must participate in the commissioning process.

3. TAB Related HVAC Submittals

The TAB Specialist must prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. Accompany the submittals identified on this list with a letter of approval signed and dated by the TAB Specialist when submitted to the Government. Ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

B. Responsibilities

The Contractor is responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate TAB execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule listed in the paragraph TAB SUBMITTAL AND WORK SCHEDULE.

1. Contractor

- a. TAB personnel: Ensure that the DALT work and the TAB work is accomplished by a group meeting the requirements specified in the paragraph TAB PERSONNEL QUALIFICATION REQUIREMENTS.
- b. Pre-DALT/TAB meeting: Attend the meeting with the TAB Supervisor, and ensure that a representative is present for the sheet metal contractor, mechanical contractor, electrical contractor, and automatic temperature controls contractor.
- c. HVAC documentation: Furnish one complete set of the following HVAC-related documentation to the TAB agency:
 - 1. Contract drawings and specifications
 - 2. Approved submittal data for equipment
 - 3. Construction work schedule
 - 4. Up-to-date revisions and change orders for the previously listed items
- d. Submittal and work schedules: Ensure that the schedule for submittals and work required by this section and specified in the paragraph TAB SUBMITTAL AND WORK SCHEDULE is met.
- e. Coordination of supporting personnel:

Provide the technical personnel, such as factory representatives or HVAC controls installer required by the TAB field team to support the DALT and the TAB field measurement work.

Provide equipment mechanics to operate HVAC equipment and ductwork mechanics to provide the field designated test ports to enable TAB field team to accomplish the DALT and the TAB field measurement work.

Ensure these support personnel are present at the times required by the TAB team, and cause no delay in the DALT and the TAB field work.

Conversely, ensure that the HVAC controls installer has required support from the TAB team field leader to complete the controls check out.

- f. Deficiencies: Ensure that the TAB Specialist submits all Design/Construction deficiency notifications directly to the Contracting officer within 3 days after the deficiency is encountered. Further, ensure that all such notification submittals are complete with explanation, including documentation, detailing deficiencies.
- g. Prerequisite HVAC work: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as prerequisite work items, the deficiencies pointed out by the TAB team supervisor in the design review report.
- h. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. Do not allow the TAB team to commence TAB field work until all of the following are completed.
 - 1. HVAC system installations are fully complete.
 - 2. HVAC prerequisite checkout work lists specified in the paragraph PRE-FIELD TAB ENGINEERING REPORT are completed, submitted, and approved. Ensure that the TAB Agency gets a copy of the approved prerequisite HVAC work checklist.
 - 3. DALT field checks for all systems are completed.
 - 4. HVAC system filters are clean for both Season 1 and Season 2 TAB field work.
- i. Advance notice: Furnish to the Contracting Officer with advance written notice for the commencement of the DALT field work and for the commencement of the TAB field work.

- j. Insulation work: For required DALT work , ensure that insulation is not installed on ducts to be DALT'd until DALT work on the subject ducts is complete. Later, ensure that openings in duct and machinery insulation coverings for TAB test ports are marked, closed and sealed.

2. TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Pre-DALT/TAB meeting: Attend meeting with Contractor.
- c. Design review report: Review project specifications and accompanying drawings to verify that the air systems and water systems are designed in such a way that the TAB engineer can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
- d. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the pre-field engineering report, the during the DALT or TAB field work.
- e. Pre-field DALT preliminary notification: Monitor the completion of the duct installation of each system and provide the necessary written notification to the Contracting Officer.
- f. Pre-field engineering report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.
- g. Prerequisite HVAC work checklist: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.

- h. Technical assistance for DALT work.
 - 1. Technical assistance: Provide immediate technical assistance to TAB field team.
 - 2. DALT field visit: Near the end of the DALT field work effort, visit the contract site to inspect the HVAC installation and the progress of the DALT field work. Conduct a site visit to the extent necessary to verify correct procedures are being implemented and to confirm the accuracy of the Pre-final DALT Report data which has been reported. Also, perform sufficient evaluation to allow the TAB supervisor to issue certification of the final report. Conduct the site visit full-time for a minimum of 8 hour workday duration.
- i. Final DALT report: Certify the DALT report. This certification includes the following work:
 - 1. Review: Review the Pre-final DALT report data. From these field reports, prepare the Certified Final DALT report.
 - 2. TAB Verification: Verify adherence, by the TAB field team, to the procedures specified in this section.
- j. Technical Assistance for TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.
- k. Design/Construction deficiencies: Within 3 working days after the TAB Specialist has encountered any design or construction deficiencies, the TAB Supervisor must submit written notification directly to the Contracting Officer, with a separate copy to the Contractor, of all such deficiencies. Provide in this submittal a complete explanation, including supporting documentation, detailing deficiencies. Where deficiencies are encountered that are believed to adversely impact successful completion of TAB, the TAB Specialist must issue notice and request direction in the notification submittal.
- l. TAB Field Check: The TAB team supervisor must attend and supervise TAB field check.

C. Project/Site Conditions

- 1. DALT and TAB Services to Obtain Existing Conditions

Conduct DALT and TAB of the indicated existing systems and equipment and submit the specified DALT and TAB reports for approval. Conduct this DALT and TAB work in accordance with the requirements of this section.

D. Pre-Field DALT Preliminary Notification

Notification: On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing within 7 calendar days after completion.

E. TAB Pre-Field Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

1. Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.
2. Air System Diagrams: Use the contract drawings and duct fabrication drawings if available to provide air system diagrams in the report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagrams which identifies each outlet contained in the outlet airflow report sheets. Show intended locations of all traverses and static pressure readings.
3. Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or SMACNA 1780 data report forms with the following pre-field information filled in:

1. Design data obtained from system drawings, specifications, and approved submittals.
2. Notations detailing additional data to be obtained from the contract site by the TAB field team.

3. Designate the actual data to be measured in the TAB field work.
 4. Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. Place the instrument key number in the blank space where the measured data would be entered.
- c. Prerequisite HVAC work checkout list: Provide a list of inspections and work items which are to be completed by the Contractor. This list must be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.

At a minimum, a list of the applicable inspections and work items listed in the NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" must be provided for each separate system to be TAB'd.

F. Instrument Calibration Certificates

It is the responsibility of the TAB Specialist to provide instrumentation that meets the minimum requirements of the standard under which are approved for use on a project. Instrumentation must be in proper operating condition and must be applied in accordance with the instrumentation's manufacturer recommendations. All instrumentation must bear a valid NIST traceable calibration certificate during field work and during government acceptance testing. All instrumentation must be calibrated within no later than one year of the date of TAB work or government acceptance testing field work.

G. TAB Standard

Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard are considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practical, to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and

Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations.

All quality assurance provisions of the TAB Standard such as performance guarantees are part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures must be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are considered mandatory, including the latest requirements of ASHRAE 62.1.

H. Test Reports

1. Data from DALT Field Work

Report the data for the Pre-final DALT Report and Certified Final DALT Report in compliance the following requirements:

- a. Report format: Submit report data on Air Duct Leakage Test Summary Report Forms as shown on Page 6-2 of SMACNA 1972 CD. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Include node numbers in the completed report forms to identify each duct section. The TAB supervisor must review and certify the report.
- b. The TAB supervisor must include a copy of all calculations prepared in determining the duct surface area of each duct test section. In addition, provide the ductwork air leak testing (DALT) reports with a copy(s) of the calibration curve for each of the DALT test orifices used for testing.
- c. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date. Instruments must have been calibrated within one year of the date of use in the field. Instrument calibration must be traceable to the measuring standards of the National Institute of Standards and Technology.
- d. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

2. Certified TAB Reports

Submit: TAB Report in the following manner:

- a. Report format: Submit the completed pre-field data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed and certified by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data must be typewritten. Handwritten report forms or report data are not acceptable.
- b. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:
 1. Measure and compile data on a continuous basis for the period in which TAB work affecting those rooms is being done.
 2. Measure and record data only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode.
 3. Data may be compiled using direct digital controls trend logging where available. Otherwise, temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls must be fully operational a minimum of 24 hours in advance of commencing data compilation. Include the specified data in the TAB Report.
- c. System Diagrams: Provide updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations. Use a key numbering system on the diagram which identifies each outlet contained in the outlet airflow report sheets.
- d. Static Pressure Profiles: Report static pressure profiles for air duct systems including: Report static pressure data for all supply, return, relief, exhaust and outside air ducts for the systems listed. Include the following in the static pressure report data, in addition to AABC/NEBB/TABB required data:

1. Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.
2. Report static pressure drop across DX coils and heat reclaim devices installed in unit cabinetry or the system ductwork.
3. Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.
4. Report static pressure drop across air filters, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

5. Report static pressure drop across outside air and relief/exhaust air louvers.
6. Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.

- 1.6 WARRANTY: Furnish workmanship and performance warranty for the DALT and TAB system work performed for a period not less than 1 year from the date of Government acceptance of the work; issued directly to the Government. Include provisions that if within the warranty period the system shows evidence of major performance deterioration, or is significantly out of tolerance, resulting from defective TAB or DALT workmanship, the corrective repair or replacement of the defective materials and correction of the defective workmanship is the responsibility of the TAB Specialist. Perform corrective action that becomes necessary because of defective materials and workmanship while system TAB and DALT is under warranty 7 days after notification, unless additional time 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 as specified in Appendix A WORK DESCRIPTIONS OF PARTICIPANTS.

3.2 PRE-DALT/TAB MEETING: Meet with the Contracting Officer's technical representative (COTR) and the designing engineer of the HVAC systems] 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

A. 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.

B. Advance Notice of Pre-Final DALT Field Work

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.

C. 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 Specialist. 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.

D. Completed Pre-Final DALT Report

After completion of the DALT work, prepare a Pre-final DALT Report meeting the additional requirements specified in Appendix B REPORTS - DALT and TAB. Data

required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the Pre-final DALT report shall provide the basis for the Final DALT Report.

TAB supervisor shall review, approve and sign the Pre-Final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COTR that the field check of the Pre-Final DALT Report data can commence. After completion of the DALT work, prepare a Pre-final DALT Report using the reporting forms specified. TAB team to furnish data required by those data report forms. Prepare the report neatly and legibly; the Pre-final DALT report is the basis for the Final DALT Report. TAB supervisor must review and certify the Pre-final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COTR that the field check of the Pre-final DALT Report data can commence.

E. 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.

F. 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.

G. Certified Final DALT Report

On successful completion of all field checks of the Pre-final DALT Report data for all systems, the TAB Supervisor is to assemble, review, certify and submit the Final DALT Report to the Contracting Officer for approval. On successful completion of all field checks of the Pre-Final DALT Report data for all systems, the TAB Supervisor shall assemble, review, approve, sign and submit the Final DALT Report in

compliance with Appendix B REPORTS - DALT and TAB to the Contracting Officer for approval.

H. 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

A. 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.

B. 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.

C. TAB Air Distribution Systems

1. Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, and air distribution devices for supply air, return air, and outside air.

2. Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

D. TAB Work on Performance Tests Without Seasonal Limitations

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 heating systems and cooling systems.

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. 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.

4. Refrigeration Units

For refrigeration compressors/condensers/condensing units, report data as required by NEBB Form TAB 15-83, NEBB PROCEDURAL STANDARDS, including refrigeration operational data.

5. Coils

Report heating and cooling performance capacity tests for DX for the purpose of verifying that the coils meet the indicated design capacity.

E. TAB Reports

Additional requirements for TAB Reports are specified in Appendix B REPORTS - DALT and TAB

- 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 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.

3.7 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS

Appendix B REPORTS - DALT and TAB

Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE

Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

Appendix A

WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

1. Contractor

- a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.
- b. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Pre-DALT and TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.
- d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.
- e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph CONSTRUCTION DEFICIENCIES. Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.
- f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating

malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.

- g. Give Notice of Testing: Submit advance notice of TAB field work accompanied by completed prerequisite HVAC Work List
- h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Submittals: Provide the submittals specified herein.
- d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.
- e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

- f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the DALT or TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

- g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.
- h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.
- i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph CONSTRUCTION DEFICIENCIES. Resolve each deficiency as soon as practical and submit revised schedules and other required documentation.
- j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.

3. TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, EXECUTION.
- b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the

Contractor to be working as designed, reaches the office of the TAB Specialist.

Appendix B

REPORTS - DALT and TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. DALT and TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. Include the following:

- a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.
- b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.
- c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.
- d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.
- e. A list of DALT and TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.

- f. A thorough checklist of the work items and inspections that need to be accomplished before DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.
- g. A thorough checklist of the work items and inspections that need to be accomplished before the TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-TAB Work Checklist before the TAB field work can be accomplished.

3. Design Review Report

Submit report containing the following information:

- a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
- b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.

4. Completed Pre-Final DALT Work Checklist

Report the data for the Pre-Final DALT Report meeting the following requirements:

- a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1972 CD. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.

- c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.
- d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date. Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.
- e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

5. Final DALT Report

On successful completion of all COTR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

6. TAB Reports: Submit TAB Report in the following manner:

- a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
- c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:

- (1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.
 - (2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.
 - (3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation.
- d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.
- e. Air Static Pressure Profiles: Report static pressure profiles for air duct systems including: AHU-1 Report static pressure data for all supply, return, relief, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB or TABB required data, the following:
- (1) Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.
 - (2) Report static pressure drop across chilled water coils, DX coils, hot water coils, steam coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.
 - (3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.
 - (4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding,

wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

- (5) Report static pressure drop across outside air and relief/exhaust air louvers.
 - (6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.
- f. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.
 - g. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.
 - j. Data From TAB Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph WORKMANSHIP.

Appendix C

DALT AND TAB SUBMITTAL AND WORK SCHEDULE

Perform the following items of work in the order listed adhering to the dates schedule specified below.

Ductwork Selected for DALT: Within 14 calendar days after receiving an acceptable completed Pre-Final DALT Work Checklist, the Contracting Officer's technical representative (COTR) will select the project ductwork sections to be DALT'd.

DALT Field Work: Within 48 hours of COTR's selection, complete DALT field work on selected project ductwork.

Submit Pre-Final DALT Report: Within two working days after completion of DALT field work, submit Pre-final DALT Report. Separate Pre-final DALT reports may be submitted to allow phased testing from system to system.

Quality Assurance - COTR DALT Field Checks: Upon approval of the Pre-final DALT Report, the COTR's DALT field check work shall be scheduled with the Contracting Officer.

Submit Final DALT Report: Within 14 calendar days after completion of successful DALT Work Field Check, submit TAB report.

Advance Notice of TAB Field Work: At a minimum of 14 calendar days prior to TAB Field Work, submit advance notice of TAB field work accompanied by completed Pre-TAB Work Checklist.

Submit TAB Report: Within 14 calendar days after completion of TAB field work, submit initial TAB report.

Quality Assurance - COTR TAB Field Check: 30 calendar days after initial TAB report is approved by the Contracting Officer, conduct field check.

Complete TAB Work: Prior to CCD, complete all TAB work and submit final.

Receive the approved TAB report: Within 21 calendar days, receive the report from Contracting Officer approved TAB report.

Appendix D			
REQUIREMENTS FOR DUCT AIR LEAK TESTING			
		SYSTEMS	
		AHU	Exhaust Systems
Duct System Static Pressure, in millimeters W.C.	for Supply	50	n/a
	for Return	25	n/a
	for Exhaust	13	25
	for Outside Air	25	n/a
System Oval/Round Duct and Rectangular Duct SMACNA Seal Class	for Supply	A	A
	for Return	A	A
	for Exhaust	A	A
	for Outside Air	A	A
System Oval/Round Duct SMACNA Leak Class	for Supply	6	n/a
	for Return	12	n/a
	for Exhaust	12	12
	for Outside Air	12	n/a

-- End of Section --

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

02/13

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. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

A. ASTM INTERNATIONAL (ASTM)

ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A580/A580M	(2016) Standard Specification for Stainless Steel Wire
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C1136	(2012) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1710	(2011) Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form
ASTM C195	(2007; R 2013) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C534/C534M	(2014) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C547	(2015) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C552	(2016a) Standard Specification for Cellular Glass Thermal Insulation
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants

ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D2863	(2013) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM E2231	(2015) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials (2016) Standard Test Methods for Water Vapor Transmission of Materials

B. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
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C. MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards
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D. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2015) Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 96	(2014) Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. UNDERWRITERS LABORATORIES (UL)

UL 723	(2008; Reprint Aug 2013) Test for Surface Burning Characteristics of Building Materials
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1.2 SYSTEM DESCRIPTION

A. General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

- 1.3 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following :

A. Product Data

1. Pipe Insulation Systems;
2. Duct Insulation Systems;

B. Manufacturer's Instructions

1. Pipe Insulation Systems;
2. Duct Insulation Systems;

1.4 QUALITY ASSURANCE

A. Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

- 1.5 DELIVERY, STORAGE, AND HANDLING: Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material, date codes, and approximate shelf life (if applicable). Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS: Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation

instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation.

A. Insulation System

Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems that are located within, on, under, and adjacent to buildings; and for plumbing systems. Provide CFC and HCFC free insulation.

B. Surface Burning Characteristics

Unless otherwise specified, insulation must have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Test insulation in the same density and installed thickness as the material to be used in the actual construction. Prepare and mount test specimens according to ASTM E2231.

- 2.3 MATERIALS: Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials shall be asbestos free.

A. Adhesives

1. Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C195.

B. Caulking

ASTM C920, Type S, Grade NS, Class 25, Use A.

C. Corner Angles

Nominal 0.406 mm 0.016 inch aluminum 25 by 25 mm 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209M ASTM B209, Alloy 3003, 3105, or 5005.

D. Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems in accordance with ASTM C1710. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor). For satisfactory performance, properly installed protective vapor retarder/barriers and vapor stops shall be used on high relative humidity and below ambient temperature applications to reduce movement of moisture through or around the insulation to the colder interior surface.

E. Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 100 mm 4 inch wide rolls. Class 3 tape shall be 0.15 kg/square m 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

F. Staples

Outward clinching type ASTM A167, Type 304 or 316 stainless steel.

G. Jackets

1. Stainless Steel Jackets

Stainless Steel jackets shall be JIS Compliance.

H. Vapor Retarder Required

1. White Vapor Retarder All Service Jacket (ASJ)

ASJ is for use on hot/cold pipes, ducts, or equipment indoors or outdoors if covered by a suitable protective jacket. The product shall meet all physical property and performance requirements of ASTM C1136, Type I, except the burst

strength shall be a minimum of 585 kPa 85 psi. ASTM D2863 Limited Oxygen Index (LOI) shall be a minimum of 31.

In addition, neither the outer exposed surface nor the inner-most surface contacting the insulation shall be paper or other moisture-sensitive material. The outer exposed surface shall be white and have an emittance of not less than 0.80. The outer exposed surface shall be paintable.

b. Vapor Barrier/Weather Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance Vapor barrier shall meet UL 723 or ASTM E84 25 flame and 50 smoke requirements; and UV resistant.

I. Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

J. Wire

Soft annealed ASTM A580/A580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

K. Insulation Bands

Insulation bands shall be 13 mm 1/2 inch wide; 26 gauge stainless steel.

L. Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum permeance of 0.02 perms based on Procedure B for ASTM E96/E96M, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.4 PIPE INSULATION SYSTEMS: Conform insulation materials to Table 1 and minimum insulation thickness as listed in Table 2.

A. Aboveground Cold Pipeline (-34 to 16 deg. C -30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

1. Flexible Elastomeric Cellular Insulation

Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive, complying with ASTM C534/C534M, Grade 1, Type I or II. Type I, Grade 1 for tubular materials. Type II, Grade 1, for sheet materials. Type I and II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation, and require an additional exterior vapor retarder covering for high relative humidity and below ambient temperature applications.

2. Mineral Fiber Insulation with Integral Wicking Material (MFIWM)

ASTM C547 or JIS A9504. Install in accordance with manufacturer's instructions.

B. Aboveground Hot Pipeline (Above 16 deg. C 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

1. Mineral Fiber

ASTM C547 or JIS A9504, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

2.5 DUCT INSULATION SYSTEMS

A. Mineral Fiber Insulation

JIS A9504. 50mm minimum thickness.

B. Kitchen Exhaust Ductwork Insulation

Insulation thickness shall be a minimum of 50 mm mineral fiber conforming to JIS A9504.

C. Duct Insulation Jackets

1. All-Purpose Jacket

Provide insulation with insulation manufacturer's standard reinforced fire-retardant jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jacket with a white surface suitable for field painting.

PART 3 EXECUTION

3.1 APPLICATION – GENERAL: Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

A. Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces.

B. Firestopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials. The protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by UL, FM, or a NRTL.

C. Painting and Finishing

Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

D. Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

E. Pipes/Ducts/Equipment That Require Insulation

Insulation is required on all pipes and ducts, except for omitted items as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

A. Pipe Insulation

1. General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Pipe used solely for fire protection.
- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Air chambers.
- e. Adjacent insulation.
- f. ASME stamps.
- g. Access plates of fan housings.
- h. Cleanouts or handholes.

2. Pipes Passing Through Walls, Roofs, and Floors

Pipe insulation shall be continuous through the sleeve.

Provide a stainless steel jacket or vapor barrier/weatherproofing self adhesive jacket (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed), greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder over the insulation wherever penetrations require sealing.

a. Penetrate Interior Walls

The stainless steel jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed), greater than 3 plies standard grade, silver, white, black and embossed shall extend 50 mm 2 inches beyond either side of the wall and shall be secured on each end with a band.

b. Penetrating Exterior Walls

Continue the aluminum jacket required for pipe exposed to weather through the sleeve to a point 50 mm 2 inches beyond the interior surface of the wall.

c. Hot Water Pipes Supplying Lavatories or Other Similar Heated Service

Terminate the insulation on the backside of the finished wall. Protect the insulation termination with two coats of vapor barrier coating with a minimum total thickness of 2.0 mm 1/16 inch applied with glass tape embedded between coats (if applicable). Extend the coating out onto the insulation 50 mm 2 inches and seal the end of the insulation. Overlap glass tape seams 25 mm 1 inch. Caulk the annular space between the pipe and wall penetration with approved fire stop material. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 10 mm 3/8 inches.

d. Domestic Cold Water Pipes Supplying Lavatories or Other Similar Cooling Service

Terminate the insulation on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). Protect the insulation with two coats of weather barrier mastic (breather emulsion type weatherproof mastic impermeable to water and permeable to air) with a minimum total thickness of 2 mm 1/16 inch. Extend the mastic out onto the insulation 50 mm 2 inches and shall seal the end of the insulation. The annular space between the outer

surface of the pipe insulation and caulk the wall penetration with an approved fire stop material having vapor retarder properties. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 10 mm 3/8 inches.

3. Pipes Passing Through Hangers

Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 50 mm 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-58. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 50 mm 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

a. Horizontal Pipes Larger Than 50 mm 2 Inches at 16 Degrees C 60 Degrees F and Above

Supported on hangers in accordance with MSS SP-58, and Section 22 00 00 PLUMBING, GENERAL PURPOSE.

b. Horizontal Pipes Larger Than 50 mm 2 Inches and Below 16 Degrees C 60 Degrees F

Supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-58. An insulation insert of cellular glass, prefabricated insulation pipe hangers, or perlite above 27 degrees C 80 degrees F shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 25 mm 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

c. Vertical Pipes

Supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-58 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 25 mm 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 9 m 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

d. Inserts

Covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, overlap the adjoining pipe jacket 38 mm 1-1/2 inches, and seal as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

4. Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 150 mm 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 150 mm 6 inches shall not be stretched around the pipe. On pipes larger than 300 mm 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation. Type II requires an additional exterior vapor retarder/barrier covering for high relative humidity and below ambient temperature applications.

5. Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed) vapor barrier/weatherproofing jacket, (greater than 3 ply, standard grade, silver, white, black and embossed) jackets shall be utilized. Pipe insulation to the 2 m 6 foot level shall be protected.

6. Pipe Insulation Material and Thickness

Pipe insulation materials must be as listed in Table 1.

TABLE 1					
Insulation Material for Piping					
Service					
	Material	Specification	Type	Class	VR/VB Req'd
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping					
	Mineral Fiber	JIS A9504			No
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)					
	Mineral Fiber	ASTM C547 or JIS A9504			No
Refrigerant Suction Piping (1.67 degrees C35 degrees F nominal)					
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
Condensate Drain Located Inside Building					
	Mineral Fiber	JIS A9504			No
NOTE: VR/VB = Vapor Retarder/Vapor Barrier					

TABLE 2	
<p>Piping Insulation Thickness (mm/inch)</p> <p>For flexible cellular foam the thickness should be 13mm instead of 15mm. Economic thickness or prevention of condensation is the basis of these tables. If prevention of condensation is the criterion, the ambient temperature and relative humidity must be stated. Do not use integral wicking material in Chilled water applications exposed to outdoor ambient conditions in climatic zones 1 through 4.</p>	
Service	
	Material
	Tube And Pipe Size (mm) (inch)

		<25<1	25-<40 1-<1.5	40-<100 1.5-<4	100-<200 4-<8	> or = 200>8
Cold Domestic Water Piping						
	Mineral Fiber	251	251	251	N/A	N/A
Hot Domestic Water Supply & Recirculating Piping (Max 93 C 200 F)						
	Mineral Fiber	251	251	251	401.5	401.5
Refrigerant Suction Piping (1.67 degrees C 35 degrees F nominal)						
	Flexible Elastomeric Cellular	251	251	251	N/A	N/A
Condensate Drain Located Inside Building						
	Mineral Fiber	251	251	251	401.5	401.5

B. Aboveground Cold Pipelines

The following cold pipelines for minus 34 to plus 16 degrees C minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

- i. Horizontal and vertical portions of interior roof drains.
- ii. Refrigerant suction lines.
- iii. Air conditioner condensate drains.
- iv. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

1. Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

2. Factory or Field applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or field applied seal welded PVC jacket or greater than 3 ply laminated self-adhesive (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed) vapor barrier/weatherproofing, standard grade, silver, white, black and embossed for use with Mineral Fiber Insulated Pipe.

3. Installing Insulation for Straight Runs Hot and Cold Pipe

Apply insulation to the pipe with tight butt joints. Seal all butted joints and ends with joint sealant and seal with a vapor retarder coating, greater than 3 ply laminate jacket adhesive tape or PVDC adhesive tape.

a. Longitudinal Laps of the Jacket Material

Overlap not less than 38 mm 1-1/2 inches. Provide butt strips 75 mm 3 inches wide for circumferential joints.

b. Laps and Butt Strips

Secure with adhesive and staple on 100 mm 4 inch centers if not factory self-sealing. If staples are used, seal in accordance with paragraph STAPLES below. Note that staples are not required with cellular glass systems.

c. Factory Self-Sealing Lap Systems

May be used when the ambient temperature is between 4 and 50 degrees C 40 and 120 degrees F during installation. Install the lap system in accordance with manufacturer's recommendations. Use a stapler only if specifically recommended by the manufacturer. Where gaps occur, replace the section or repair the gap by applying adhesive under the lap and then stapling.

d. Staples

Coat all staples, including those used to repair factory self-seal lap systems, with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. Coat all seams, except those on factory self-seal systems, with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

e. Breaks and Punctures in the Jacket Material

Patch by wrapping a strip of jacket material around the pipe and secure it with adhesive, staple, and coat with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket adhesive tape. Extend the patch not less than 38 mm 1-1/2 inches past the break.

f. Flexible Elastomeric Cellular Pipe Insulation

Install by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. Secure all seams and butt joints and seal with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Push insulation on the pipe, never pulled. Stretching of insulation may result in open seams and joints. Clean cut all edges. Rough or jagged edges of the insulation are not be permitted. Use proper tools such as sharp knives. Do not stretch Grade 1, Type II sheet insulation around the pipe when used on pipe larger than 150 mm 6 inches. On pipes larger than 300 mm 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

4. Insulation for Fittings and Accessories

- a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket.
- b. Precut or preformed insulation shall be placed around all fittings and accessories as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used.
- c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 2 mm 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 25 mm 1 inch. The coating shall extend out onto the adjoining pipe insulation 50 mm 2 inches.
- d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 150 mm 6 inches from the insulation surface.

- e. Insulation shall be marked showing the location of unions, strainers, and check valves.

5. Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

C. Aboveground Hot Pipelines

1. General Requirements

All hot pipe lines above 16 degrees C 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

- a. Domestic hot water supply & re-circulating system.
- b. Steam.
- c. Condensate & compressed air discharge.
- d. Hot water heating.
- e. Heated oil.
- f. Water defrost lines in refrigerated rooms.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

2. Insulation for Fittings and Accessories

Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

a. Precut or Preformed

Place precut or preformed insulation around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

b. Rigid Preformed

Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 50 mm 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

D. Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed) vapor barrier/weatherproofing jacket (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

1. Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 50 mm 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 300 mm 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 16 degrees C 60 degrees F and below shall be sealed with metal jacketing/flashings sealant while overlapping to prevent moisture penetration.

Where jacketing on piping 16 degrees C 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 16 degrees C 60 degrees F shall be sealed with a moisture retarder.

2. Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 25 mm 1 inch and the adjoining aluminum jacket not less than 50 mm 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed) vapor barrier/weatherproofing jacket, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant).

3.3 DUCT INSULATION SYSTEMS INSTALLATION: Install duct insulation systems in accordance with manufacturer's published installation instructions. Duct insulation minimum thickness and shall be 50 mm.

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

A. Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

- i. Supply ducts.
- ii. Return air ducts.
- iii. Relief ducts.

- iv. Flexible run-outs (field-insulated).
- v. Plenums.
- vi. Coil headers and return bends.
- vii. Coil casings.
- viii. Fresh air intake ducts.
- ix. Filter boxes.
- x. Mixing boxes (field-insulated).
- xi. Ducts exposed to weather.

Insulation for rectangular ducts shall be flexible type minimum density 12 kg/cubic m 3/4 pcf, Insulation for both concealed or exposed round/oval ducts shall be flexible type, minimum density 12 kg/cubic m 3/4 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered. Insulation for all exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a field applied vapor retarder/vapor barrier jacket coating finish as specified, the total field applied dry film thickness shall be approximately 2 mm 1/16 inch. Insulation on all concealed duct shall be provided with a factory-applied Type I or II vapor retarder/vapor barrier jacket. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder/vapor barrier shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder/vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

1. Installation on Concealed Duct

- a. For rectangular, oval or round ducts, flexible insulation shall be attached by applying adhesive around the entire perimeter of the duct in 150 mm 6 inch wide strips on 300 mm 12 inch centers.

- b. For rectangular and oval ducts, 600 mm 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 400 mm 16 inch centers and not more than 400 mm 16 inches from duct corners.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 400 mm 16 inch centers and not more than 400 mm 16 inches from duct corners.
- d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder/vapor barrier jacket joints overlap 50 mm 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.
- e. Where mechanical fasteners are used, self-locking washers shall be installed and the pin trimmed and bent over.
- f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 0.05 mm 2 mils adhesive, 0.075 3 mils embossed) adhesive tape.
- g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 50 mm 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed) adhesive tape.
- h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape greater than 3 ply laminate (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed) adhesive tape.
- i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating. The coating shall overlap the adjoining insulation and

un-insulated surface 50 mm 2 inches. Pin puncture coatings shall extend 50 mm 2 inches from the puncture in all directions.

- j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

2. Installation on Exposed Duct Work

- a. For rectangular ducts, insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 300 mm 12 inches apart and not more than 75 mm 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm 12 inches and larger. One row shall be provided for each side of duct less than 300 mm 12 inches. Mechanical fasteners shall be as corrosion resistant as G60 coated galvanized steel, and shall indefinitely sustain a 22.7 kg 50 lb tensile dead load test perpendicular to the duct wall.
- b. Form duct insulation with minimum jacket seams. Fasten each piece of rigid insulation to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder/barrier jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors.
- c. Impale insulation on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.
- e. Seal joints in the insulation jacket with a 100 mm 4 inch wide strip of tape. Seal taped seams with a brush coat of vapor retarder coating.
- f. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm 2 inches beyond the break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.
- g. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a flashing sealant.

- h. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated surface 50 mm 2 inches. Pin puncture coatings shall extend 50 mm 2 inches from the puncture in all directions.
- i. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 12 kg per cubic meter 3/4 pcf.

B. Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 16 degrees C 60 degrees F, ducts shall be insulated as specified for cold air duct.

C. Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

D. Duct Exposed to Weather

1. Installation

Ducts exposed to weather shall be insulated and finished as specified for the applicable service for exposed duct inside the building. After the above is accomplished, the insulation shall then be further finished as detailed in the following subparagraphs.

2. Round Duct

Laminated self-adhesive (minimum 0.05 mm 2 mils adhesive, 0.075 mm 3 mils embossed) vapor barrier/weatherproofing jacket, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply, heavy duty, white and natural) membrane shall be applied overlapping material by 75 mm 3 inches no bands or caulking needed - see manufacturer's recommended installation instructions. Aluminum jacket with factory applied moisture retarder shall be applied with the joints lapped not less than 75 mm 3 inches and secured with bands located at circumferential laps and at not more than 300 mm 12 inch intervals throughout. Horizontal joints shall lap down to shed water and located at 4 or 8 o'clock position. Joints shall be sealed with metal jacketing sealant to prevent moisture penetration. Where jacketing abuts an un-insulated surface, joints shall be sealed with metal jacketing sealant.

3. Fittings

Fittings and other irregular shapes shall be finished as specified for rectangular ducts.

4. Rectangular Ducts

Two coats of weather barrier mastic reinforced with fabric or mesh for outdoor application shall be applied to the entire surface. Each coat of weatherproof mastic shall be 2 mm 1/16 inch minimum thickness. The exterior shall be a metal jacketing applied for mechanical abuse and weather protection, and secured with screws or vapor barrier/weatherproofing jacket less than 0.0000 permeability greater than 3 ply, standard grade, silver, white, black, and embossed or greater than 8 ply, heavy duty white and natural. Membrane shall be applied overlapping material by 75 mm 3 inches. No bands or caulking needed-see manufacturing recommend installation instructions.

5. Kitchen Exhaust Duct Insulation

NFPA 96. Provide insulation with 19 mm 3/4 inch wide, minimum 4 mm 0.15 inch thick galvanized steel bands spaced not over 305 mm 12 inches o.c.; or 16 gauge galvanized steel wire with corner clips under the wire; or with heavy welded pins spaced not over 305 mm 12 inches apart each way. Do not use adhesives.

-- End of Section --

SECTION 23 81 00.00 20

UNITARY AIR CONDITIONING EQUIPMENT

11/09

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.
- A. AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
AHRI DCUP (Online) Directory of Certified Unitary Products
 - B. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
 - ANSI/ASHRAE 15 & 34 (2013; Addenda A 2014; ERTA 1 2014; Addenda A-T AND SUPP 2015; ERTA 2 2015; INT 1 2015; ERTA 3 2015; ERTA 4 2016; INT 2-3 2016) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
 - ASHRAE 52.2 (2012; Errata 1 2013; INT 1 2014; ADD A, B, AND D SUPP 2015; INT 3 2015; Errata 2 2015; ADD C 2015; ADD E, F 2016) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
 - ASHRAE 55 (2010) Thermal Environmental Conditions for Human Occupancy
 - ASHRAE 62.1 (2010) Ventilation for Acceptable Indoor Air Quality
 - C. AMERICAN WELDING SOCIETY (AWS)
 - AWS A5.8/A5.8M (2011; Amendment 2012) Specification for Filler Metals for Brazing and Braze Welding
 - D. ASME INTERNATIONAL (ASME)
 - ASME B16.22 (2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - ASME B31.5 (2016) Refrigeration Piping and Heat Transfer Components

E. ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M	(2015; E 2016) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B280	(2016) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B88	(2014) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2013) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C534/C534M	(2014) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM D1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials

F. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

G. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA MG 1	(2016) Motors and Generators

H. U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50502

(Basic) Air Conditioners, (Unitary Heat Pump),
Air to Air (3,000 to 300,000 BTU)

I. UNDERWRITERS LABORATORIES (UL)

UL 109

(1997; Reprint Aug 2013) Tube Fittings for
Flammable and Combustible Fluids,
Refrigeration Service, and Marine Use

UL 900

(2015) Standard for Air Filter Units

1.2 RELATED REQUIREMENTS: Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS: Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Air Force Form 66:

A. Shop Drawings

1. Field-Assembled Refrigerant Piping
2. Control System Wiring Diagram

B. Product Data

1. Heat Pumps, air to air
2. Filters
3. Thermostats
4. Refrigerant: Provide MSDS sheets for all refrigerants
5. Refrigerant Piping and Accessories

C. Test Reports

1. Salt-Spray Tests
2. Start-Up and Initial Operational Tests

D. Manufacturer's Instructions

1. Heat Pumps, air to air
2. Filters
3. Thermostats
4. Refrigerant Piping and Accessories

- E. Operation and Maintenance Data
 - 1. Heat Pumps, air to air, Data Package 3
 - 2. Filters, Data Package 2
 - 3. Thermostats, Data Package 2

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

- F. Closeout Submittals
 - 1. Posted Operating Instructions

1.4 QUALITY ASSURANCE

- A. Modification of References

Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Contracting Officer.

- B. Detail Drawing

For refrigerant piping, submit piping, including pipe sizes. Submit control system wiring diagrams.

- C. Safety

Design, manufacture, and installation of unitary air conditioning equipment shall conform to ANSI/ASHRAE 15 & 34.

- D. Posted Operating Instructions

Submit posted operating instructions for each packaged air conditioning unit.

- E. Sizing

Size equipment based on Design Manual CS from the Air Conditioning Contractors of America; do not oversize.

- 1.5 REFRIGERANTS: Refrigerants shall have an Ozone Depletion Potential (ODP) of 0.0. The ODP shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Programme. CFCs and Halons shall not be permitted. Refrigerant shall be an approved alternative refrigerant per EPA's Significant New Alternative Policy (SNAP) listing.
- 1.6 ENVIRONMENTAL REQUIREMENTS: For proper Indoor Environmental Quality, maintain positive pressure within the building. Ventilation shall meet or exceed ASHRAE 62.1 and all published addenda. Meet or exceed filter media efficiency as tested in accordance with ASHRAE 52.2. Thermal comfort shall meet or exceed ASHRAE 55.

PART 2 PRODUCTS

- 2.1 PRODUCT SUSTAINABILITY CRITERIA: For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

A. Energy Efficient Equipment for Unitary Air Conditioning Equipment

Provide unitary air conditioning equipment meeting the efficiency requirements as stated within this section

B. Ozone Depleting Substances

Unitary air conditioning equipment must not use CFC-based refrigerants, and must have an Ozone Depletion Potential (ODP) no greater than 0.0, with exception to R-123, in conformance with this section.

- 2.2 HEAT PUMPS, AIR TO AIR: CID A-A-50502, shall be split type with floor mounted indoor (Air Handling) unit as indicated. List units with capacities smaller than 39,555 watt 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the AHRI Directory, a letter of certification from AHRI that the units have been certified and will be listed in the next Directory will be acceptable. Provide factory assembled units complete with accessories, wiring, piping, and controls. Air filters as specified in the paragraph FILTERS.

A. Energy Performance

Energy performance shall be in accordance with CID A-A-50502. Heat pumps shall have energy efficiency ratio (EER) of 11.3 and a minimum COP of 3.35.

B. Air Coils

Extended-surface fin and tube type with seamless copper or aluminum tubes with copper or aluminum fins securely bonded to the tubes. On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified.

C. Compressors

For compressors above 70 kW 20 tons, compressor speed shall not exceed 3450 rpm. For equipment over 35 kW 10 tons, provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have a means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shutdown by safety controls. Provide reciprocating compressors with crankcase heaters, and vibration isolators.

D. Mounting Provisions

Provide units that permit mounting as indicated.

E. Temperature Controls

Provide controls as specified in CID A-A-50502 and as modified herein.

F. Accessories

In addition to accessories specified in CID A-A-50502, provide the following accessories for heat pump units.

1. Protective grille around outside unit coils

2.6 FILTERS: Provide filters to filter outside air and return air and locate inside combination air filter mixing box. Provide cleanable, reusable type. Filters shall conform to UL 900, Class 1 or Class 2. Polyurethane filters shall not be used on units with multiframe filters.

A. Cleanable Type Filters

Provide sufficient oil to coat filters six times based on one pint of oil per each 0.93 square meter 10 square feet of filter area. Provide washing and charging tanks for cleaning and coating filters. Filters shall have a MERV of 6-8 when tested in accordance with ASHRAE 52.2.

- 2.7 COATINGS FOR FINNED TUBE COILS: Where stipulated in equipment specifications of this section, coat finned tube coils of the affected equipment as specified below. Apply coating at the premises of a company specializing in such work. Degrease and prepare for coating in accordance with the coating applicator's procedures for the type of metals involved. Completed coating shall show no evidence of softening, blistering, cracking, crazing, flaking, loss of adhesion, or "bridging" between the fins.

A. Phenolic Coating

Provide a resin base thermosetting phenolic coating. Apply coating by immersion dipping of the entire coil. Provide a minimum of two coats. Bake or heat dry coils following immersions. After final immersion and prior to final baking, spray entire coil with particular emphasis given to building up coating on sheared edges. Total dry film thickness shall be 0.064 to 0.076 mm 2.5 to 3.0 mils.

- 2.8 MOTORS AND STARTERS: NEMA MG 1, NEMA ICS 1, and NEMA ICS 2. Motors less than 3/4 kW 1 hp shall meet NEMA High Efficiency requirements. Motors 3/4 kW 1 hp and larger shall meet NEMA Premium Efficiency requirements. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide watertight type starter enclosures in accordance with NEMA ICS 6.

- 2.9 REFRIGERANT PIPING AND ACCESSORIES: Provide accessories as specified in CID A-A-50502 and this section. Provide suction line accumulators as recommended by equipment manufacturer's installation instructions.

A. Factory Charged Tubing

Provide extra soft, deoxidized, bright annealed copper tubing conforming to ASTM B280, factory dehydrated and furnished with a balanced charge of refrigerant recommended by manufacturer of equipment being connected. Factory insulate suction line tubing with 9.52 mm 3/8 inch minimum thickness of closed cell, foamed plastic conforming to ASTM C534/C534M with a permeance rating not to exceed 1.0. Provide quick-connectors with caps or plugs to protect couplings. Include couplings for suction and liquid line connections of the indoor and outdoor sections.

B. Field-Assembled Refrigerant Piping

Material and dimensional requirements for field-assembled refrigerant piping, valves, fittings, and accessories shall conform to ANSI/ASHRAE 15 & 34 and ASME B31.5, except as herein specified. Factory clean, dehydrate, and seal piping before delivery to the project location. Provide seamless copper tubing, hard drawn, Type K or L, conforming to ASTM B88M ASTM B88 or JIS Equivalent, except that tubing with outside diameters of 6.35 mm 1/4 inch and 9.52 mm 3/8 inch shall have nominal wall thickness of not less than 7.62 mm 0.030 inch and 0.81 mm 0.032 inch, respectively. Soft annealed copper tubing conforming to ASTM B280 or JIS Equivalent may be used where flare connections to equipment are required only in nominal sizes less than one inch outside diameter.

C. Fittings

ASME B16.22 or JIS Equivalent for solder-joint fittings. UL 109 for flared tube fittings.

D. Brazing Filler Material

AWS A5.8/A5.8M or JIS Equivalent.

E. Pipe Hangers and Supports

MSS SP-69 and MSS SP-58 or JIS Equivalent.

F. Pipe Sleeves

Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 6.35 mm 0.25 inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs

Provide Schedule 40 or Standard Weight zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 80 mm 3 inches above finished floor.

2. Sleeves in Partitions and Non-Masonry Structures

Provide zinc-coated steel sheet sleeves having a nominal weight of not less than 4.39 kg per square meter 0.90 pound per square foot, in partitions and other than masonry and concrete walls, floors, and roofs.

2.10 FINISHES: Provide steel surfaces of equipment including packaged terminal units, heat pumps, and air conditioners, that do not have a zinc coating conforming to ASTM A653/A653M, or a duplex coating of zinc and paint, with a factory applied coating or paint system. Provide a coating or paint system on actual equipment identical to that on salt-spray test specimens with respect to materials, conditions of application, and dry-film thickness.

2.11 SOURCE QUALITY CONTROL

A. Salt-Spray Tests

Salt-spray test the factory-applied coating or paint system of equipment including packaged terminal units, heat pumps, and air conditioners in accordance with ASTM B117. Conduct test for 500 hours for equipment installed outdoors, or 125 hours for equipment installed indoors. Test specimens shall have a standard scribe mark as defined in ASTM D1654. Upon completion of exposure, evaluate and rate the coating or paint system in accordance with procedures A and B of ASTM D1654. Rating of failure at the scribe mark shall not be less than six, average creepage not greater than 3.18 mm 1/8 inch. Rating of the unscribed area shall not be less than 10, no failure.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION: Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using

templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar.

Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

A. Unitary Air Conditioning System

Install as indicated, in accordance with requirements of ANSI/ASHRAE 15 & 34, and the manufacturer's installation and operational instructions.

3.2 PIPING: Brazing, bending, forming and assembly of refrigerant piping shall conform to ASME B31.5 or JIS Equivalent.

A. Pipe Hangers and Supports

Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58 or JIS Equivalent. Installation of hanger types and supports for bare and covered pipes shall conform to MSS SP-69 for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58.

B. Refrigerant Piping

Cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to provide for expansion and contraction due to temperature fluctuation. Where pipe passes through building structure pipe joints shall not be concealed, but shall be located where they may be readily inspected. Install piping to be insulated with sufficient clearance to permit application of insulation. Install piping as indicated and detailed, to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Trapping of lines will not be permitted except where indicated. Provide sleeves of suitable size for lines passing through building structure. Braze refrigerant piping with silver solder complying with AWS A5.8/A5.8M or JIS Equivalent. Inside of tubing and fittings shall be free of flux. Clean parts to be jointed with emery cloth and keep hot until solder has penetrated full depth of fitting and extra flux has been expelled. Cool joints in air and

remove flame marks and traces of flux. During brazing operation, prevent oxide film from forming on inside of tubing by slowly flowing dry nitrogen through tubing to expel air. Make provisions to automatically return oil on halocarbon systems. Installation of piping shall comply with ASME B31.5.

C. Returning Oil From Refrigerant System

Install refrigerant lines so that gas velocity in the evaporator suction line is sufficient to move oil along with gas to the compressor. Where equipment location requires vertical risers, line shall be sized to maintain sufficient velocity to lift oil at minimum system loading and corresponding reduction of gas volume. Install a double riser when excess velocity and pressure drop would result from full system loading. Larger riser shall have a trap, of minimum volume, obtained by use of 90- and 45-degree ells. Arrange small riser with inlet close to bottom of horizontal line, and connect to top of upper horizontal line. Do not install valves in risers.

D. Refrigerant Driers, Sight Glass Indicators, and Strainers

Provide refrigerant driers, sight glass liquid indicators, and strainers in refrigerant piping in accordance with CID A-A-50502 and this section when not furnished by the manufacturer as part of the equipment. Install driers in liquid line with service valves and valved bypass line the same size as liquid line in which dryer is installed. Size of driers shall be determined by piping and installation of the unit on location. Install dryers of 820 mL 50 cubic inches and larger vertically with the cover for removing cartridge at the bottom. Install moisture indicators in the liquid line downstream of the drier. Indicator connections shall be the same size as the liquid line in which it is installed.

E. Strainer Locations and Installation

Locate strainers close to equipment they are to protect. Provide a strainer in common refrigerant liquid supply to two or more thermal valves in parallel when each thermal valve has a built-in strainer. Install strainers with screen down and in direction of flow as indicated on strainer's body.

F. Solenoid Valve Installation

Install solenoid valves in horizontal lines with stem vertical and with flow in direction indicated on valve. If not incorporated as integral part of the valve, provide a strainer upstream of the solenoid valve. Provide service valves upstream of the solenoid valve, upstream of the strainer, and downstream of the solenoid valve. Remove the internal parts of the solenoid valve when brazing the valve.

- 3.3 AUXILIARY DRAIN PANS, DRAIN CONNECTIONS, AND DRAIN LINES: Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment where condensate overflow will cause damage to ceilings, piping, and equipment below. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section 22 00 00 PLUMBING, GENERAL PURPOSE.
- 3.4 ACCESS PANELS: Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.
- 3.5 AIR FILTERS: Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air.
- 3.6 FLASHING AND PITCH POCKETS: Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls.
- 3.7 IDENTIFICATION TAGS AND PLATES: Provide equipment, gages, thermometers, valves, and controllers with tags numbered and stamped for their use. Provide plates and tags of brass or suitable nonferrous material, securely mounted or attached. Provide minimum letter and numeral size of 3.18 mm 1/8 inch high.
- 3.8 FIELD QUALITY CONTROL

A. Leak Testing

Upon completion of installation of air conditioning equipment, test factory- and field-installed refrigerant piping with an electronic-type leak detector. Use same type of refrigerant to be provided in the system for leak testing. When nitrogen is used to boost system pressure for testing, ensure that it is eliminated from the system before charging. Minimum refrigerant leak field test pressure shall be as specified in ANSI/ASHRAE 15 & 34, except that test pressure shall not exceed 1034 kPa (gage) 150 psig on hermetic compressors unless otherwise specified as a low side test pressure on the equipment nameplate. If leaks are detected at time of installation or during warranty period, remove the entire refrigerant charge from the system, correct leaks, and retest system.

B. Evacuation, Dehydration, and Charging

After field charged refrigerant system is found to be without leaks or after leaks have been repaired on field-charged and factory-charged systems, evacuate the system using a reliable gage and a vacuum pump capable of pulling a vacuum of at least 133 Pa one mm Hg absolute. Evacuate system in accordance with the triple-evacuation and blotter method or in accordance with equipment manufacturer's printed instructions and recharge system.

C. Start-Up and Initial Operational Tests

Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

D. Performance Tests

Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, test the systems to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, record readings hourly. At the end of the test period, average the readings, and the average shall be considered to be the system performance.

-- End of Section --

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

07/06

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 in the text by the basic designation only.

A. ASTM INTERNATIONAL (ASTM)

ASTM D 709 (2001; R 2007) Laminated Thermosetting
Materials

B. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2007; Errata 2006 & 2007; INT 44-56 2007; INT
47, 49, 50, 52-56 2008; INT 57, 58 51, 48, 59
2009) National Electrical Safety Code
IEEE Std 100 (2000) The Authoritative Dictionary of IEEE
Standards Terms

C. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment
(1000 Volts Maximum)

D. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014) National Electrical Code

1.2 RELATED REQUIREMENTS: This section applies to all sections of Division 26 of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

B. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

C. The technical paragraphs referred to herein are those paragraphs in PART 2 -

PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

- 1.4 ELECTRICAL CHARACTERISTICS: Electrical characteristics for this project shall be 208Y/120V, three phase, four wire. Final connections to the power distribution system at the existing panelboard shall be made by the Contractor as directed by the Contracting Officer.

- 1.5 ADDITIONAL SUBMITTALS INFORMATION: Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

A. Product Data

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

- B. Standard Products: 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. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1. Alternative Qualifications: Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

2. Material and Equipment Manufacturing Date: Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.
- 1.7 WARRANTY: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- 1.8 MANUFACTURER'S NAMEPLATE: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.
- 1.9 FIELD FABRICATED NAMEPLATES: ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm (0.125 inch) thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm (one by 2.5 inches). Lettering shall be a minimum of 6.35 mm (0.25 inch) high normal block style.
- 1.10 ELECTRICAL REQUIREMENTS: Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.
- 1.12 INSTRUCTION TO GOVERNMENT PERSONNEL: Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

PART 2 PRODUCTS

- 2.1 FACTORY APPLIED FINISH: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements specified in the technical sections.

PART 3 EXECUTION

- 3.1 FIELD APPLIED PAINTING: Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.
- 3.2 FIELD FABRICATED NAMEPLATE MOUNTING: Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

-- End of Section --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

02/14

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 in the text by the basic designation only.

A. ASTM INTERNATIONAL (ASTM)

ASTM B 1 (2013) Standard Specification for Hard-Drawn Copper Wire

ASTM B 8 (2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM D 709 (2016) Laminated Thermosetting Materials

B. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2007; Errata 2006 & 2007; INT 44-56 2007; INT 47, 49, 50, 52-56 2008; INT 57, 58 51, 48, 59 2016)

IEEE Std 100 National Electrical Safety Code
(2000) The Authoritative Dictionary of IEEE Standards Terms

IEEE Std 81 (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) Normal Measurements

C. JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 0920 (2003) Degrees of protection provided by Enclosures

JIS C 2805 (1991) Crimp-Type Terminal Lugs for Copper Conductors

JIS C 2806 (2003) Non-Insulated Crimp-Type Connecting Sleeves for Copper Conductors

JIS C 2810 (1995) General Rules on Non-Separable Wire Connectors for Interior Wiring

JIS C 3102 (1984) Annealed Copper Wires for Electrical Purpose

JIS C 3307 (2000) 600 V Grade Polyvinyl Chloride Insulated Wires

JIS C 3317 (2000) 600 V Grade Heat-Resistant Polyvinyl Chloride Insulated Wires

- | | |
|------------|---|
| JIS C 4520 | (1991) General Rules for Control Switches |
| JIS C 8303 | (2007) Plugs and Receptacles for Domestic and Similar General Use |
| JIS C 8304 | (2009) Small Switches for Indoor Use |
| JIS C 8305 | (1999) Rigid Steel Conduits |
| JIS C 8309 | (1999) Flexible Metal Conduit |
| JIS C 8325 | (1984) Plastic Surface Raceway for Interior Wiring |
| JIS C 8330 | (1999) Fittings for Rigid Metal Conduits |
| JIS C 8359 | (1991) Fittings for Metal Conduits and Under-Floor Ducts |
| JIS C 8430 | (1999) Unplasticized Polyvinyl Chloride (PVC-U) |
| JIS C 8431 | (1993) General Rules For Fittings of Unplasticized Polyvinyl Chloride (UPVC) Conduits |
- D. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
- | | |
|------------|---|
| NEMA C80.1 | (2005) Standard for Electrical Rigid Steel Conduit (ERSC) |
| NEMA ICS 1 | (2000; R 2005; R 2008) Standard for Industrial Control and Systems General Requirements |
| NEMA KS 1 | (2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum) |
| NEMA MG 1 | (2014) Standard for Motors and Generators |
| NEMA WD 1 | (205) General Color Requirements for Wiring Devices |
- E. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- | | |
|---------|---------------------------------|
| NFPA 70 | (2014) National Electrical Code |
|---------|---------------------------------|
- F. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
- | | |
|-----------------|--|
| 29 CFR 1910.147 | Control of Hazardous Energy (Lock Out/Tag Out) |
|-----------------|--|
- G. UNDERWRITERS LABORATORIES (UL)
- | | |
|--------------|--|
| UL 1010 | (2006) Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations |
| UL 360 | (2013) Liquid-Tight Flexible Steel Conduit |
| UL 486A-486B | (2013) Standard for Wire Connectors |
| UL 498 | (2012) Safety Attachment Plugs and Receptacles |
| UL 50 | (2007) Standard for Enclosures for Electrical Equipment |
| UL 510 | (2005; Rev thru Jul 2013) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape |
| UL 514A | (2013) Standard for Metallic Outlet Boxes |
| UL 514B | (2012) Standard for Conduit, Tubing and Cable Fittings |

UL 514C	(2014) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007) Standard for Electrical Rigid Metal Conduit-Steel
UL 83	(2008) Standard for Thermoplastic-Insulated Wires and Cables

1.2 DEFINITIONS: Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

1.3 SUBMITTALS: The following shall be submitted in accordance with Section 01 11 00 GENERAL REQUIREMENTS:

- A. Product Data
 - 1. Conduit;G
 - 2. Wire;G
 - 3. Switch;G
 - 4. Receptacle;G
- B. Test Reports
 - 1. 600-volt wiring test; G
 - 2. Grounding system test; G

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.
- B. Standard Products: 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. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be 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. Alternative Qualifications: Products having less than a 2-year field service record will

be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

2. Material and Equipment Manufacturing Date: Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 MAINTENANCE

- A. Electrical Systems: Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. This shall include:

1. Single line diagram of the "as-built" building electrical system.
2. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).
3. Manufacturers' operating and maintenance manuals on active electrical equipment.

- 1.6 WARRANTY: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT: Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

- 2.2 CONDUIT AND FITTINGS: Shall conform to the following:

- A. Rigid Metallic Conduit

1. Rigid, Threaded Zinc-Coated Steel Conduit: NEMA C80.1, UL 6, or JIS C 8305, thick wall conduit.

- B. Flexible Metal Conduit

1. Liquid-Tight Flexible Metal Conduit, Steel: UL 360 or JIS C 8309, Class 2.

- C. Fittings for Metal Conduit, EMT, and Flexible Metal Conduit: UL 514B or JIS C 8330 and JIS C 8359. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B. Fittings for Rigid Metal Conduit and IMC shall be threaded-type and split couplings unacceptable.

- 2.3 OUTLET BOXES AND COVERS: UL 514A or JIS equivalent, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.
- 2.4 JUNCTION BOXES AND PULL BOXES: Volume greater than 1640 mL, UL 50 or JIS equivalent, hot-dip, zinc-coated, if sheet steel.
- 2.5 WIRES AND CABLES: Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.
 - A. Conductors: Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.
 - 1. Minimum Conductor Sizes: Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.
 - B. Color Coding: Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:
 - 1. 208/120 volt, three-phase
 - a. Phase A - black
 - b. Phase B - red
 - c. Phase C - blue
 - C. Insulation: Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83 or JIS C 3317 Type HIV, except that grounding wire may be type TW conforming to UL 83 or JIS C 3307, Type IV; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83 or JIS C 3307, Type IV.
 - D. Bonding Conductors: ASTM B 1 or JIS C 3102, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8 or JCS 226, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

- 2.6 SPLICES AND TERMINATION COMPONENTS: UL 486A-486B or JIS C 2810, JIS C 2806, and JIS C 2805 for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or JIS C 2810, JIS C 2806, and JIS C 2805 (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.
- 2.7 SWITCHES:
- A. Toggle (Tumbler) Switches: UL 20 or JIS C 8304, totally enclosed with bodies of thermosetting plastic and mounting strap. Handles shall be brown or ivory. Wiring terminals shall be screw-type, side-wired. Switches shall be rated quiet-type ac only, with current rating and number of poles indicated.
 - B. Electromagnetic Switches: JIS C 8325. Features shall be as indicated. Thermal protective devices shall be provided except as noted.
 - C. Control Switches: JIS C 4520 or NEMA KS 1, suitable capacity and type for the intended purpose.
- 2.8 RECEPTACLES: JIS C 8303 or UL 498 and NEMA WD 1, grounding type. Ratings and configurations shall be as indicated. Bodies shall be of ivory thermosetting plastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap.
- 2.9 DEVICE PLATES: One-piece device plates for outlets and fittings to suit the devices installed. Plates on finished walls shall be nonmetallic material or satin finish chromium plated brass. The use of sectional type devices will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations." Screws shall be machine type with countersunk heads in a color to match the finish of the plate.
- 2.10 LOCKOUT REQUIREMENTS: Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147.
- 2.11 MANUFACTURER'S NAMEPLATE: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.
- 2.12 FIELD FABRICATED NAMEPLATES: ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and,

when applicable, the position. Nameplates shall be melamine plastic, 3 mm (0.125 inch) thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm (one by 2.5 inches). Lettering shall be a minimum of 6.35 mm (0.25 inch) high normal block style.

2.13 SINGLE STATION SMOKE ALARM SYSTEM:

The smoke alarm shall at a minimum meet the requirements of UL217. It shall be powered by a 120VAC, 60Hz, source along with a 9V battery backup. The unit shall have a nominal alarm sensitivity of 0.72-3.45%/ft. The temperature operating range shall be between 40°F and 100°F (4°C and 38°C) and the humidity operating range shall be up to 85% relative humidity. The smoke alarm can be installed on any standard single gang electrical box. The electrical connection (to the alarm) shall be made with a plug-in connector. The unit shall provide optional tamper resistance that deters removal of the unit from the ceiling. The alarm shall include a test button that will electronically simulate the presence of smoke and cause the unit to go into alarm. The unit shall include a piezoelectric horn that is rated at 85 decibels at 10 feet. In a smoke incident, the horn will sound in the repetitive manner – three (3) beeps, a pause, three (3) beeps, a pause. The unit shall include the button feature that silences the unit. By pressing the button, it will desensitize the unit for approximately 10 minutes if a nuisance condition occurs. The red LED will flash every 10 seconds during this time and will automatically reset after approximately 10 minutes and sound the alarm if particles of combustion are still present. The unit shall also include a low battery warning utilizing a brief alarm chirp every 30-40 seconds for a minimum of seven (7) days.

PART 3 EXECUTION

3.1 INSTALLATION: Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

A. Wiring Methods: Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 16 mm (1/2 inch) in diameter for low voltage lighting and power circuits.

B. Conduit Installation

1. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are

placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations.

2. Directional Changes in Conduit Runs: Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.
 3. Locknuts and Bushings: Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.
 4. Flexible Connections: Provide flexible steel conduit between 915 and 1830 mm (3 and 6 feet) in length for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 16 mm (1/2 inch) diameter. Provide liquid-tight flexible conduit in wet and damp locations and for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.
- C. Boxes, Outlets, and Supports: Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when surface mounted on interior walls exposed up to 2135 mm above floors and walkways, or when installed in hazardous areas and when specifically indicated. Boxes in other locations shall be sheet steel. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 100 mm (4 inches) square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway

with approved-type fastener maximum 610 mm from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

1. Boxes for use with raceway systems shall be minimum 40 mm (1 1/2 inches) deep, except where shallower boxes required by structural conditions are approved.
 2. Pull Boxes: Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.
 3. Extension Rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.
- D. Mounting Heights: Mount disconnecting switches so height of operating handle at its highest position is maximum 1980 mm above floor.
- E. Conductor Identification: Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.
1. Marking Strips: White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.
- F. Splices: Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with

insulation material equivalent to conductor insulation.

- G. Covers and Device Plates: Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 0.58 mm (1/16 inch). Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.
 - H. Grounding and Bonding: Provide In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways.
 - I. Equipment Connections: Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.
 - J. Repair of Existing Work: Repair of existing work, demolition, and modification of existing electrical distribution systems shall be performed as follows:
 - 1. Workmanship: Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.
 - 2. Existing Concealed Wiring to be Removed: Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.
 - 3. Continuation of Service: Maintain continuity of existing circuits of equipment to remain. Existing circuits of equipment shall remain energized. Circuits which are to remain but were disturbed during demolition shall have circuits wiring and power restored back to original condition.
- 3.2 FIELD FABRICATED NAMEPLATE MOUNTING: Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.
- 3.3 FIELD APPLIED PAINTING: Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

- 3.4 FIELD QUALITY CONTROL: Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.
- A. Devices Subject to Manual Operation: Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.
 - B. 600-Volt Wiring Test: Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.
- 3.5 SMOKE ALARM SYSTEM INSTALLATION: The smoke alarm should be installed to comply with Article 760 of the National Electric Code, and NFPA 72. Make certain all alarms are wired to a single, continuous (non-switched) power line, which is not protected by a ground fault interrupter. Use standard UL listed 12AWG wire. The alarm will utilize a red LED that shall flash once every 30-40 seconds to indicate the alarm is receiving power.

-- End of Section --

SECTION 26 51 00

INTERIOR LIGHTING

05/16

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 in the text by the basic designation only.

ILLUMINATING ENGINEERING SOCIETY (IES)

IES LM-79	(2008) Electrical and Photometric Measurements of Solid-State Lighting Products
IES LM-80	(2015) Measuring Lumen Maintenance of LED Light Sources
IES RP-16	(2010; Addendum A 2008; Addenda B 2009; Addendum C 2016) Nomenclature and Definitions for Illuminating Engineering

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012; Errata 1 2012; INT 1-4 2012; Errata 2 2013; INT 5-7 2013; INT 8-10 2014; INT 11 2015) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C78.389	(2004; R 2009) American National Standard for Electric Lamps - High Intensity Discharge (HID) - Methods of Measuring Characteristics
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NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C78.LL 3	(2003; R 2015) Electric Lamps - Procedures for High Intensity Discharge Lamp Sample Preparation and the Toxicity Characteristic Leaching Procedure
NEMA SSL 1	(2010) Electronic Drivers for Led Devices, Arrays, or Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2015; ERTA 2015) Life Safety Code
NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 8750	(2009; Reprint May 2014) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products
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1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires or luminaire accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, must be as defined in IEEE 100.
- b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in IES LM-80.
- c. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is gathered from LM-79 data for the

luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing together.

- d. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

A. Product Data

Luminaires; G

1.5 QUALITY CONTROL

1.5.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70, unless more stringent requirements are specified or indicated.

1.5.2 Standard Products

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. Products must have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two-year period. Where two or more items of the same class of equipment are required, these items must be 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.

1.5.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.2.2 Material and Equipment Manufacturing Date

Products manufactured more than six months prior to date of delivery to site must not be used, unless specified otherwise.

1.5.2.3 Energy Efficiency

Submit data indicating lumens per watt efficacy and color rendering index of light source.

1.6 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.1 LED Luminaire Warranty

- a. Provide a written 10 year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.

- (1) Include finish warranty to include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

- (2) Material warranty must include:

- (a) All drivers.

- (b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.

- b. Warranty period must begin on date of beneficial occupancy. Provide the Contracting Officer with signed warranty certificates prior to final payment.

PART 2 PRODUCTS

2.1 LUMINAIRES

Provide luminaires as indicated in luminaire schedule. Provide luminaires complete with light sources of quantity, type, and wattage indicated. Provide all luminaires of the same type by the same manufacturer. Luminaires must be specifically designed for use with the driver, provided.

2.1.1 LED Luminaires

Provide luminaires complete with power supplies (drivers) and light sources. Provide design information including lumen output and design life in luminaire schedule on project plans for LED luminaires.

LED luminaires must also meet the following minimum requirements:

- a. Luminaires must have a minimum 10 year manufacturer's warranty.
- b. Luminaire drive current value must be identical to that provided by test data for luminaire in question.
- c. Luminaires must be tested to IES LM-79 and IES LM-80 standards.

2.2 DRIVERS

2.2.1 LED Drivers

NEMA SSL 1, UL 8750. LED drivers must be electronic, UL Class 1 or Class 2, constant-current type and comply with the following requirements:

- a. Output power (watts) and luminous flux (lumens) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.
- b. Current draw Total Harmonic Distortion (THD) of less than 20 percent.
- c. Class A sound rating.
- d. Operable at input voltage of 120-277 volts at 60 hertz.
- e. Minimum 10 year manufacturer's warranty.
- f. Integral thermal protection that reduces or eliminates the output power if case temperature exceeds a value detrimental to the driver.

- g. UL listed for dry or damp locations typical of interior installations.

2.4 LIGHTING CONTROLS

2.4.1 Toggle Switches

Provide line-voltage toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.6 EQUIPMENT IDENTIFICATION

2.6.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.6.2 Labels

Provide labeled luminaires indicating the type, lamps, drivers/ballasts and color temperature.

2.7 FACTORY APPLIED FINISH

Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum, meets requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations must conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Luminaires

Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires and secure in accordance with manufacturers' directions and approved drawings. Installation must meet requirements of NFPA 70. Mounting heights specified or indicated must be to the bottom of the luminaire for ceiling-mounted luminaires and to center of luminaire for wall-mounted luminaires.

3.1.2 Power Supplies

Typically, provide power supplies (drivers) integral to luminaire as constructed by the manufacturer.

-- End of Section --

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		C O P I E S	D O C U M E N T S	S E T T I N G	S E A L I N G	S E A L I N G	S E A L I N G	S E A L I N G	S E A L I N G	S E A L I N G	S E A L I N G	S E A L I N G	S E A L I N G						S E A L I N G	APPROVED			
11	Doors and Frames 08 11 16 1.4.A		4											30 Calendar Days Prior to Installation									
12	Doors 08 14 00 1.2.A.1		4											30 Calendar Days Prior to Installation									
13	Doors 08 14 00 1.2.B.1						4							30 Calendar Days									
14	Window 08 51 13 1.3.A.1		4											30 Calendar Days Prior to Installation									
15	Aluminum Window and Frame: 08 51 13 1.3.B.1						4							30 Calendar Days									
16	Hardware Item: 08 71 00 1.2.A.1						4							30 Calendar Days									
17	Installation 08 81 00 1.2.A.1		4											30 Calendar Days Prior to Installation									
18	Setting and Sealing Materials 08 81 00 1.2.B.1							4						30 Calendar Days									
19	Glass Setting 08 81 00 1.2.B.2							4						30 Calendar Days									
20	Wall Tiles 09 30 13 1.2.A.1			4										30 Calendar Days Prior to Installation									

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21	Floor Tiles 09 30 13 1.2.A.2			4										30 Calendar Days Prior to Installation									
22	Resilient Flooring and Accessories 09 65 00 1.3.A.1						4							30 Calendar Days									
23	Wall Base 09 65 00 1.3.A.2						4							30 Calendar Days									
24	Resilient Flooring and Accessories 09 65 00 1.3.A.3						4							30 Calendar Days									
25	Carpet 09 68 00 1.3.A.1						4							30 Calendar Days									
26	Carpet 09 68 00 1.3.B.1			4										30 Calendar Days Prior to Installation									
27	Molding 09 68 00 1.3.B.2			4										30 Calendar Days Prior to Installation									
28	Flammability Test 09 68 00 1.3.C.1								4					30 Calendar Days									
29	Static Propensity Test 09 68 00 1.3.C.2								4					30 Calendar Days									
30	Carpet 09 68 00 1.3.D.1					4								30 Calendar Days									

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31	Carpet 09 68 00 1.3.E.1											4	30 Calendar Days After Installation									
32	Carpet 09 68 00 1.3.E.2											4	30 Calendar Days After Installation									
33	MSDS 09 90 00 1.2.A.1							4					30 Calendar Days									
34	Medicine Cabinet 10 28 13 1.2.A.1						4						30 Calendar Days									
35	Shelving Units 10 56 13 1.1.A.1						4						30 Calendar Days									
36	Installation Instructions 10 56 13 1.1.A.2						4						30 Calendar Days									
37	Window Blinds 12 21 00 1.1.A.1						4						30 Calendar Days									
38	Installation 12 21 00 1.1.A.2						4						30 Calendar Days									
39	Window Blinds 12 21 00 1.1.B.1			4									30 Calendar Days Prior to Installation									
40	Window Blinds 12 21 00 1.1.C.1							4					14 Calendar Days After Test									

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41	Wall and Base Cabinet 12 32 00 1.2.A.1		4											30 Calendar Days Prior to Installation									
42	Vanity Cabinets 12 32 00 1.2.A.2		4											30 Calendar Days Prior to Installation									
43	Wall and Base Cabinet 12 32 00 1.2.B.1						4							30 Calendar Days									
44	Countertops 12 32 00 1.2.B.2						4							30 Calendar Days									
45	Vanity Cabinets 12 32 00 1.2.B.3						4							30 Calendar Days									
46	Colors 12 32 00 1.2.C.1			4										30 Calendar Days Prior to Installation									
47	Flush Tank Water Closets 22 00 00 1.2.A.a.2						4							30 Calendar Days									
48	Countertop Lavatories 22 00 00 1.2.A.a.3						4							30 Calendar Days									
49	Kitchen Sinks 22 00 00 1.2.A.a.4						4							30 Calendar Days									
50	Shower Faucets 22 00 00 1.2.A.a.5						4							30 Calendar Days									

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51	Tests, Flushing, and Disinfection 22 00 00 1.2.A.a.5										4										
52	Ceiling Exhaust Fans 23 00 00 1.3.A.5							4													
53	Residential Range Hood 23 00 00 1.3.A.7							4													
54	Dehumidifier Unit 23 00 00 1.3.A.8							4													
55	Ceiling Exhaust Fans 23 00 00 1.3.D.2										4										
56	Completed Pre-Final DALT Report 23 05 93 1.3.C.1										4										
57	Certified Final DALT Report 23 05 93 1.3.C.2										4										
58	Certified Final TAB Report 23 05 93 1.3.C.2										4										
59	Pipe Insulation Systems 23 07 00 1.3.A.1							4													
60	Duct Insulation Systems 23 07 00 1.3.A.2							4													

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61	Pipe Insulation Systems 23 07 00 1.3.B.1						4					30 Calendar Days									
62	Duct Insulation Systems 23 07 00 1.3.B.2						4					30 Calendar Days									
63	Field Assembled Refrigerant Piping 23 81 00.00 20 1.3.A.1		4									30 Calendar Days Prior to Installation									
64	Control System Wiring Diagram 23 81 00.00 20 1.3.A.2		4									30 Calendar Days Prior to Installation									
65	Heat Pumps, Air to Air 23 81 00.00 20 1.3.B.1						4					30 Calendar Days									
66	Thermostats 23 81 00.00 20 1.3.B.3						4					30 Calendar Days									
67	Thermostats 23 81 00.00 20 1.3.D.3						4					30 Calendar Days									
68	Filters 23 81 00.00 20 1.3.E.2						4					14 Calendar Days After Installation									
69	Posted Operating Instructions 23 81 00.00 20 1.3.F.1									4		30 Calendar Days After Installation									
70	Conduit 26 20 00 1.3.A.1						4					30 Calendar Days									

SCHEDULE OF MATERIAL SUBMITTALS													PROJECT NUMBER	PROJECT TITLE NYJS 16-4540 REPAIR MFH Kinser Heights (97UN		SOLICITATION/CONTRACT NO.						
TO BE COMPLETED BY PROJECT ENGINEER													TO BE COMPLETED BY CONTRACT ADMINISTRATOR									
L I N E N U M B E R		NO. OF COPIES REQUIRED										REQUIRED SUBMISSION DATE (CALENDAR DAYS AFTER NTP)	DATE RECEIVED IN CON- TRACTING	DATE TO CIVIL ENGINEER- ING	RETURN SUSPENSE DATE	FOLLOW-UP	DATE CONTRACTOR NOTIFIED		CONTRACTOR RE- SUBMITTAL	FINAL APPROVAL	REMARKS	
		C O P I E S	D R A W I N G S	S A M P L E S	S H E E T S	S T A T E M E N T S	D I S C U S S I O N S	R E F E R E N C E S	R E Q U I R E D	C O P Y S	S E C U R E						S E C U R E	APPROVED				DIS- APPROVED
71	Wire 26 20 00 1.3.A.2						4						30 Calendar Days									
72	Switch 26 20 00 1.3.A.3						4						30 Calendar Days									
73	Receptacle 26 20 00 1.3.A.4						4						30 Calendar Days									
74	600-volt wiring Test 26 20 00 1.3.B.1								4				14 Calendar Days After Test									
75	Grounding System Tes 26 20 00 1.3.B.2								4				14 Calendar Days After Test									
76	Luminaires 26 51 00 1.4.A.1						4						30 Calendar Days									

ATTACHMENT 3 LIST OF DRAWINGS

<u>DRAWING NO.</u>	<u>SEQUENCE NUMBER</u>	<u>SHEET NUMBER</u>	<u>DESCRIPTION</u>	<u>DATE OF DWG.</u>
	1 of 62	T-1	Index of Drawings, Target Designations, Location & Vicinity Maps and Abbreviations	Feb. 14, 2017
	2 of 62	A-1	Removal 1 st & 2 nd Floor Plan (Type JB4-90)	Feb. 14, 2017
	3 of 62	A-2	Modified 1 st & 2 nd Floor Plan (Type JB4-90)	Feb. 14, 2017
	4 of 62	A-3	Removal 1st & 2nd Floor Reflected Ceiling Plan (Type JB4-90)	Feb. 14, 2017
	5 of 62	A-4	Modified 1st & 2nd Floor Reflected Ceiling Plan (Type JB4-90)	Feb. 14, 2017
	6 of 62	A-5	Removal 1st & 2nd Floor Plan (Type JC3-90)	Feb. 14, 2017
	7 of 62	A-6	Modified 1st & 2nd Floor Plan (Type JC3-90)	Feb. 14, 2017
	8 of 62	A-7	Removal 1st & 2nd Floor Reflected Ceiling Plan (Type JC3-90)	Feb. 14, 2017
	9 of 62	A-8	Modified 1st & 2nd Floor Reflected Ceiling Plan (Type JC3-90)	Feb. 14, 2017
	10 of 62	A-9	Interior Finish Schedule (Type JB4-90 & JC3-90)	Feb. 14, 2017
	11 of 62	A-10	Removal 1st & 2nd Floor Plan (Type Sqk4-95)	Feb. 14, 2017
	12 of 62	A-11	Modified 1st & 2nd Floor Plan (Type SQK4-95)	Feb. 14, 2017
	13 of 62	A-12	Modified 1st & 2nd Floor Plan (Type SQK4-95)	Feb. 14, 2017
	14 of 62	A-13	Interior Finish Schedule (Type SQK4-95)	Feb. 14, 2017
	15 of 62	A-14	Modified Kitchen Plan and Interior Elevations (Type JB4-90)	Feb. 14, 2017
	16 of 62	A-15	Modified Kitchen Plan and Interior Elevations (Type JC3-90)	Feb. 14, 2017
	17 of 62	A-16	Modified Kitchen Plan and Interior Elevations (Type SQK4-95)	Feb. 14, 2017
	18 of 62	A-17	Elevations & Sections (Type SQK4-95)	Feb. 14, 2017

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19 of 62	A-18	Enlarged 2nd Floor Shower and Bathroom Modified Plan and Interior Elevations (Type JB4-90)	Feb. 14, 2017
20 of 62	A-19	Enlarged 2nd Floor Shower and Bathroom Modified Plan, Interior Elevations and Miscellaneous Details (Type JC3-90)	Feb. 14, 2017
21 of 62	A-20	Enlarged 1st Floor Toilet Modified Plan and Interior Elevations and Miscellaneous Details (Type SQK4-95)	Feb. 14, 2017
22 of 62	A-21	Enlarged 2nd Floor Bathroom 1 & 2 Modified Plan and Interior Elevations (Type Sqk4-95)	Feb. 14, 2017
23 of 62	A-22	Metal Handrail Details (Type SQK4-95)	Feb. 14, 2017
24 of 62	A-23	Typical Floor Transition Details and Breakfast Nook Detail (Type SQK4-95)	Feb. 14, 2017
25 of 62	A-24	Doors and Windows Schedule (Type SQK4-95)	Feb. 14, 2017
26 of 62	A-25	Door Details (Type SQK4-95)	Feb. 14, 2017
27 of 62	A-26	Window Details (Type SQK4-95)	Feb. 14, 2017
28 of 62	A-27	Kitchen Cabinet Details 1 (Type JB4-90 & Type JC3-90)	Feb. 14, 2017
29 of 62	A-28	Kitchen Cabinet Details 2 (Type JB4-90)	Feb. 14, 2017
30 of 62	A-29	Kitchen Cabinet Details 3 (Type JC3-90)	Feb. 14, 2017
31 of 62	A-30	Kitchen Cabinet Details 4 (Type SQK4-95)	Feb. 14, 2017
32 of 62	M-1	Exst/Removal HVAC Plan (Type "JB4-90"), Scope of Works, General Notes, Legend and Abbreviations	Feb. 14, 2017
33 of 62	M-2	Exst/Removal HVAC Plan (Type "JC3-90"), Scope of Works, General Notes, Legend and Abbreviations	Feb. 14, 2017
34 of 62	M-3	Exst/Removal HVAC Plan (Type "SQK4-95"), Scope of Works, General Notes, Legend and Abbreviations	Feb. 14, 2017
35 of 62	M-4	Modified HVAC Plan (Type	Feb. 14, 2017

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		"JB4-90")	
36 of 62	M-5	Modified HVAC Plan (Type "JC3-90")	Feb. 14, 2017
37 of 62	M-6	Modified HVAC Plan (Type "SQK4-95")	Feb. 14, 2017
38 of 62	M-7	Mechanical Room Enlarged HVAC Plan, Section and Elevation	Feb. 14, 2017
39 of 62	M-8	HVAC Miscellaneous Details	Feb. 14, 2017
40 of 62	P-1	Exst/Removal Plumbing Plan (Type "JB4-90"), Scope of Works, General Notes, Legend and Abbreviations	Feb. 14, 2017
41 of 62	P-2	Exst/Removal Plumbing Plan (Type "JC3-90"), Scope of Works, General Notes, Legend and Abbreviations	Feb. 14, 2017
42 of 62	P-3	Exst/Removal Plumbing Plan (Type "SQK4-95"), Scope of Works, General Notes, Legend and Abbreviations	Feb. 14, 2017
43 of 62	P-4	Modified Plumbing Plan (Type "JB4-90")	Feb. 14, 2017
44 of 62	P-5	Modified Plumbing Plan (Type "JC3-90")	Feb. 14, 2017
45 of 62	P-6	Modified Plumbing Plan (Type "SQK4-95")	Feb. 14, 2017
46 of 62	P-7	Plumbing Miscellaneous Details	Feb. 14, 2017
47 of 62	E-1	Electrical Scope of Work, General Notes, Legend & Symbol	Feb. 14, 2017
48 of 62	E-2	1st & 2nd Floor Lighting Removal Plan (Type JB4-90)	Feb. 14, 2017
49 of 62	E-3	1st & 2nd Floor Power Removal Plan (Type JB4-90)	Feb. 14, 2017
50 of 62	E-4	1st & 2nd Floor Modified Lighting Plan (Type JB4-90)	Feb. 14, 2017
51 of 62	E-5	1st & 2nd Floor Modified Power Plan (Type JB4-90)	Feb. 14, 2017
52 of 62	E-6	1st & 2nd Floor Lighting Removal Plan (Type JC3-90)	Feb. 14, 2017
53 of 62	E-7	Power Removal 1st & 2nd Floor Plan (Type JC3-90)	Feb. 14, 2017
54 of 62	E-8	Lighting Modified 1st & 2nd Floor Plan (Type JC3-90)	Feb. 14, 2017
55 of 62	E-9	Power Modified 1st & 2nd Floor	Feb. 14, 2017

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		Plan (Type JC3-90)	
56 of 62	E-10	Lighting Removal 1st & 2nd Floor Plan (Type SQK4-95)	Feb. 14, 2017
57 of 62	E-11	Power Removal 1st & 2nd Floor Plan (Type SQK4-95)	Feb. 14, 2017
58 of 62	E-12	Lighting Modified 1st & 2nd Floor Plan (Type SQK4-95)	Feb. 14, 2017
59 of 62	E-13	Power Removal 1st & 2nd Floor Plan (Type SQK4-95)	Feb. 14, 2017
60 of 62	E-14	Modified Panel Load Schedule and Single Line Diagram	Feb. 14, 2017
61 of 62	E-15	Lighting Fixture Detail and Schedule I	Feb. 14, 2017
62 of 62	E-16	Lighting Fixture Detail and Schedule II	Feb. 14, 2017

-- End of List of Drawings--