

SECTION 01521 – CONSTRUCTION SAFETY AND OCCUPATIONAL HEALTH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Other general provisions of the Contract, including FAR clauses by reference or as amended in Contract Sections B through J, and other Division 1 sections of these Contract Specifications apply to requirements of this Section; this Section in turn applies to the Contract Drawings and to Specification Divisions 2 through 16 to be developed by the Contractor.
- B. Refer to Section 01501, *Temporary Facilities and Controls*, for information on materials, equipment, and electrical power related to temporary facilities.
- C. Regulations and Standards. Governing regulations and specific technical safety and health requirements for work performed at Project Site and incorporated into this construction safety and occupational health program include the following:
  - 1. Latest edition of U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual, EM 385-1-1; this document is available at U.S. Government Printing Office, Washington D.C.
  - 2. DOS Foreign Affairs Manual (FAM), Vol. 6, Subchapter 610 "Safety Health and Environmental Management Program" shall apply when and where construction activity impacts on U.S. diplomatic missions and the public.
  - 3. NFPA Code 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
  - 4. ANSI A10 series standards for Safety Requirements for Construction and Demolition.
  - 5. NFPA Code 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.
  - 6. NFPA 10, Standard for Portable Fire Extinguishers.
  - 7. Rigging, by James Headley, Crane Institute of America Publishing Company, Maitland Florida, 2001.
  - 8. 2001 Food Code, Food and Drug Administration, National Technical Information Service Publication PD2002-100819, or latest edition.

1.2 SUMMARY

- A. The purpose of this Section is to indicate the nature and scope of Contractor responsibilities for:
  - 1. Construction safety and occupational health for all persons and property at the Project Site.
  - 2. Developing a Construction Accident Prevention Plan (CAPP) for management procedures, operations, training, inspections, assessments and reporting of safety and health matters on site.

### 1.3 DEFINITIONS

Refer to Contract Glossary for definitions of all safety-related terms, and specifically, Designated Authority, Hazard, Activity Hazard Analysis, Job Hazard Analysis, Qualified Person, and Confined Space.

### 1.4 SUBMITTALS

#### A. Construction Accident Prevention Plan (CAPP).

1. See Attachment "A", *Guidelines for Preparation of the Construction Accident Prevention Plan*. The Construction Accident Prevention Plan (CAPP) is a safety and health policy and program management document. The CAPP shall be job-specific, and shall address unusual or unique aspects of the Project. The CAPP is based upon USACE EM 385-1-1, where it is referred to as "Accident Prevention Plan (APP)".
2. Before beginning work at the Project Site, submit to Project Director/COR for acceptance, a detailed CAPP indicating means which will be provided to ensure: safe access to work areas, protection/safety/health of persons authorized to be at Project Site, and protection of property on and adjacent to Project Site during all phases of construction. Include in the text of CAPP a certified statement executed by Contractor's representative having broad corporate authority indicating full commitment to accepted CAPP, and level of authority in assignment of responsibilities for implementation at the Project Site. Include specific details for meetings, inspections, and training/instruction of Contractor, subcontractor, and separate contractor employees.

#### B. Activity and Job Hazard Analysis. Prior to proceeding with performance of work involving unusual construction operations, work practices, or work involving hazardous materials, prepare and submit written analysis to Project Director/COR. Do not proceed with work that has been identified as being potentially hazardous until Project Director/COR has expressed and recorded "no objection" to proposed methods and procedures.

#### C. Hazardous Materials. Contractor shall bring to immediate attention of Project Director/COR any material suspected of being hazardous which is encountered in demolition or excavation or used during execution of the work. A determination will be made by Project Director/COR as to whether to have tests performed to ascertain whether the material is hazardous; do not proceed with that part of the work until directed by Project Director/COR.

#### D. Hazardous Work Permits. Contractors and subcontractors shall submit written requests to Project Director/COR for all Hazardous Work Permits. Permits are required whenever construction operations include the following:

1. Hot Work. Includes all work that results in open flame such as welding, cutting, brazing, and burning. The Contractor shall provide effective fire protection and prevention at all times during such operations.
2. Confined Space Entry. As defined above, includes work in enclosed areas such as storage tanks, bins, sewers, in-ground vaults, boilers, vessels, tunnels, manholes, pits, etc.
3. Internal Combustion Engines. The use of trucks, forklifts, pumps, or generators

- powered by petroleum-based fuel when used inside a building, structure, or confined space.
4. Explosive Actuated Tools. These include powder charged tools manufactured by Hilti, Remington, Ram Set, and others used for fastening purposes.
  5. Explosives. Follow all applicable US and local government regulations. In all cases close coordination with controlling officials shall be effected.
- E. Material Safety Data Sheets (MSDS). Refer to the requirements USACE EM 385-1-1.
- F. Minutes of Meetings. Record and submit to Project Director/COR minutes of safety related meetings, including weekly tool box safety meetings and meetings of the Joint Safety and Health Committee as described below.
- G. Records of Inspection. All records of inspection shall be made available to the Project Director/COR. Records of inspection shall include documentation of safety, health, and housekeeping inspections and corrective actions and timetables associated with any deficiencies encountered. Documentation shall also be made available for verification that corrective actions were implemented.
- H. Accident Investigation and Reporting. Investigate and submit separate accident report on each accident resulting in lost time, disabling/fatal injuries, or damage to vehicles, property, materials, supplies, or to furniture, fixtures, and equipment.
1. Prepare reports on forms supplied by and in accordance with instructions of Project Director/COR. Include in each report Contractor's recommendations and statement of actions taken to prevent recurrence of accident. Submit report of each accident with 24 hours of accident or mishap, except as otherwise indicated by requirements or governing regulations.
  2. Except as may be otherwise requested by Project Director/COR during time of contract, report major accidents and mishaps on Form (3-92) DS-1663, related instruction sheet available from the Project Director/COR.

## 1.5 PROJECT CONDITIONS

- A. General. Continue management and implementation of safety and health program through time of construction. Comply with conditions existing and developing at Project Site, and with requests of Project Director/COR. Acceptance by Project Director/COR will not relieve the Contractor of overall responsibility for compliance with the strict interpretation of all safety and health requirements of the Contract.
- B. The Project Director/COR reserves the right to suspend work when and where the Contractor's safety and health program is considered to be operating in an inadequate manner, has severe shortcomings, or is not in compliance. This shall include failures to complete required submittals within the time periods specified.
- C.

## PART 2 – PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and workmanship for temporary facilities described in this Section shall be provided and performed in accordance with requirements in Section 01501, *Temporary Facilities and Controls*.

### PART 3 - EXECUTION

#### 3.1 IMPLEMENTATION OF CONSTRUCTION ACCIDENT PREVENTION PLAN

- A. Management and Corporate Commitment. Implementation and management of accepted CAPP shall have full cooperation and support of management at the broad, corporate level. Full cooperation and support shall be expressed by written statement executed by a senior officer of the construction contracting firm/corporation, included with the CAPP as described in this Section.
- B. Safety and Health Rules. The Contractor shall establish and enforce clearly written, definitive rules to be followed by employees of Contractor, subcontractors, and separate contractors at Project Site, applicable for performance of each unit of work. Prominently post notices in English, the host national language, and third country languages, if appropriate, stating that failure to comply with safety and health rules may cause immediate termination of employment. Post safety and health rules at the Project Site and provide a copy to each subcontractor prior to the commencement of work.
- C. Emergency Resources. The Contractor shall establish, jointly with OBO, a listing of telephone numbers and location of ambulance, physician, hospital, fire, police, and other sources of emergency assistance. This information shall be conspicuously posted in several locations on Project Site.
- D. Emergency Communication. Wireless telephone service shall be the preferred method of emergency communications. Emergency communication access shall be available to site medical personnel and nearby medical clinic or hospital.
- E. Emergency Plans. The Contractor shall establish, jointly with the Project Director/COR and OBO Site Security Manager, plans to ensure safety of all persons at Project Site in the event of fire or other emergency, and review with all effected employees. Emergency plans shall be tested quarterly using drills to ascertain and ensure their effectiveness. Testing of emergency plans shall be conducted jointly by USG and Contractor staff.
  - 1. Plans shall include: Escape procedures and routes, method of accounting for employees following emergency evacuation, identification of source and location for rescue and medical assistance, means of reporting emergencies, and persons to be contacted for information or clarification.
  - 2. Planning for Project shall include total system response capabilities to minimize consequences of accidents, natural disasters, or other emergencies.
  - 3. On-site emergency planning shall be integrated with off-site emergency support.
  - 4. The number of persons permitted in any location shall be limited to rescue and escape capability, as determined by Contractor and in concurrence with Project Director/COR.
- F. Emergency alert systems shall be identified, selected, installed, and tested to alert all persons likely to be affected by existing or imminent disaster conditions, and to alert and summon personnel and equipment comprising emergency response capability.
- G. General Orientation. Contractor to provide orientation for new employees regarding safety and health policies, and work rules.
- H. Specific Training.
  - 1. Provide specific training to supervisory personnel and all craft workers of the

- Contractor and subcontractors in proper use and care of specific personal protective gear, equipment, and clothing.
2. Contractor and subcontractor employees shall be trained and supervised by qualified persons to perform, safely and confidently, recognized hazardous work operations and work performed with hazardous conditions to which they have been assigned.
- I. Safety and Health Program Manager (SHPM).
1. Assign to the Project Site a full-time SHPM whose duties shall be the effective implementation, coordination, and enforcement of the CAPP. Provide support to the SHPM for the duration of the Contract. Notices posted at Project Site shall name the SHPM and describe the authority held by the position.
  2. Qualification. The SHPM shall be a qualified, experienced construction industry professional having ability and authority to manage CAPP. The SHPM shall be qualified to anticipate, identify, evaluate, and implement corrective action in relation to potential safety and health hazards and dangerous exposures.
- J. Joint Safety and Health Committee. Establish for the project, a functioning Joint Safety and Health Committee. Membership to include management or supervisory personnel of the Contractor and subcontractors and OBO representatives as may be needed. The Joint Safety and Health Committee, chaired by the SHPM, shall meet at regularly scheduled times and at other times as determined by the Project Director/COR. The committee shall:
1. Coordinate the management of safety and health activities and actions for effective protection.
  2. Determine implementation of new safety and health measures related to forthcoming construction activities.
  3. Anticipate and analyze potentially hazardous conditions, and implement safe and healthy solutions.
  4. Perform Activity and Job Hazard Analysis for work activities involving unusual construction operations, work practices, or work involving hazardous materials. Develop methods and procedures to reduce identified hazards to greatest extent possible.
- K. Inspections.
1. Frequent safety, health, and housekeeping inspections shall be conducted by qualified persons of temporary structures, fabrication shops, material, machinery and equipment at the Project Site. All inspections shall be documented by qualified persons. Documentation shall include any deficiencies encountered along with details and timetable for corrective actions.
  2. The SHPM shall be responsible to identify and coordinate all safety, health, and housekeeping inspections.
  3. The SHPM shall be responsible to verify, document, and ensure that all corrective actions have been implemented.
- L. Tool Box Meetings. Contractor shall hold "tool box" safety meetings once each week. Require attendance by all tradespersons, laborers, foremen, and supervisors at Project Site; include those of separate contractors. Discuss current construction operations, analyze hazards, and communicate solutions.

### 3.2 TOOLS, EQUIPMENT, AND MACHINERY

- A. Quality. Hand tools, power tools, equipment, machinery, materials, and personal protective apparatus shall be of manufacturer listed by U.S. or internationally recognized testing laboratory for specific application for which they are to be used. They shall be quality products recognized for professional construction use, applications, and work practices.
- B. Safe Clearance Procedure. Prior to initial use, and periodically thereafter at times of continued use, provide inspections of construction tools, equipment, and machinery. Do not permit continued use of tools, equipment, and machinery that are not in satisfactory working condition. Immediately upon identification of damage or malfunction, tag and remove from Project Site. Do not allow return of items until repaired or reprocessed in compliance with industry practice. Engage qualified persons to make such inspections and repair. Prepare written records, including recommendations for corrections of defects and misapplication.
- C. Machinery and Mechanized Equipment.
  - 1. Prior to being placed in use, all machinery and mechanized equipment shall be inspected and tested by qualified personnel and certified to be in safe operating condition. Records of tests and inspections shall be maintained at the site by the Contractor and shall become part of the official project file.
  - 2. Tower cranes, crawler cranes, truck and wheel mounted cranes and material hoists shall be erected, tested, maintained, and repaired in accordance with the manufacturer's recommendations. All actions shall be documented.
    - a) Tower cranes shall be inspected quarterly for operation and structural integrity in accordance with manufacturer's recommendations.
  - 3. Hoisting Equipment. Provide general-use manufactured apparatus for hoisting and material handling equipment, suitable for Project configuration, that is, for the number of stories and similar considerations and for the suitable handling of materials, fabrications, tools, equipment, work platforms, and, where applicable, for the transportation of craftspersons between grade and floor levels.
- D. Walking and Working Surfaces.
  - 1. Scaffolding shall be a standard, medium- to heavy-duty welded tubular frame or a project-designed steel tube and clamp system. All components shall be manufactured and tested according to international standards. All types of manufactured scaffolding systems shall include the scaffold manufacturer's integrated access stairway sections, handrails, and walking platforms.
  - 2. For all cast-in-place concrete installations of walls, columns, beams and slabs, provide manufacturer's standard access scaffolding and work platforms which are an integral part of a pre-engineered, reusable, factory built concrete forming/shoring system consisting of pre-fabricated modular metal framed plywood or all metal panels.
  - 3. Protect openings in floor slabs of more than 0.03 square meters (46 square inches) in area. Provide guardrails at floor slab edges that are not yet permanently walled off, where located more than 1.25 meters (4 feet) above grade or adjoining floor/deck surface.
- E. Access to Construction Operations. Provide ramps, stairs, ladders, and similar devices for craftsperson, inspector, authorized visitor, and USG personnel access and egress.

- F. Noise Reduction. Minimize the generation of noises through the efficient and shielded use of materials, tools, processes and procedures. Restrict the use of noise or impact-producing tools to necessary prosecution of the work. These actions shall seek to minimize complaints from nearby occupancies, and comply with requests of local authorities.

### 3.3 SITE MAINTENANCE, PROTECTION, AND SANITATION

- A. General. Provide indirect, work-related, temporary support facilities and services as described below in conjunction with performance of work at Project Site.
  - 1. Comply with Host Country governing regulations as enforced by authorities; including building codes, requirements of utility companies, health/safety regulations by police/rescue/fire departments, environmental protection regulations, and similar applicable regulations.
  - 2. Inspections. Arrange for required inspections, certifications, and permits, for installation and use of each temporary facility, prior to use; as may be required by governing authorities and franchised service vendors.
  - 3. Maintain temporary facilities in clean, sanitary, and safe operating conditions; and do not allow conditions of use to become inefficient, overloaded, hazardous, or otherwise deleterious to the USG's interests; comply with the Project Director's/COR's requests.
- B. Fire Protection. Except as otherwise indicated, and in every instance, expedite/complete and place into service permanent fire protection system and equipment. Prior to the time permanent facilities are placed into service, provide temporary fire protection facilities, as will be adequate for conditions at the Project Site. Where possible, arrange jointly with Project Director/COR and local fire department to respond to calls for assistance and service in cases of fire emergency. Provide temporary portable fire extinguishers, complying with applicable provisions of NFPA 10, Standard for Portable Fire Extinguishers, and UL rated; multi-purpose dry chemical type, 5.0 kg size, UL-rated "4-A:60-B:C." Maintain unobstructed access to fire extinguishers and locate at each prime point of access to each story of construction, and at each principal office, lunch room, fabrication shop, storage enclosure, gate/guard house, and similar temporary facility at Project Site. Prohibit smoking, except in designated areas of relatively low fire hazard. During welding, cutting, and burning, comply with NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, in fire-hazardous areas of exposure, provide stand-by fire-protection personnel and adequate supervision of operations.
- C. First Aid. At project sites on which more than 99 and less than 300 persons are employed (greatest number being the total number of employees on a shift), establish and equip, as directed by a licensed physician, a first aid station staffed full time with a professional nurse trained in emergency response. If medical clinics or hospitals are accessible within five minutes of the project site, the facilities may be approved by a licensed physician for use, in lieu of a first aid station.
- D. Barricades, Closures, and Traffic Control. Provide substantial barricade-type closures and rails at locations where encroachment of a physically hazardous condition in construction is possible, for equipment, tradespersons, and others at or adjoining the Project Site. Provide sidewalk bridge type protective structure where traffic, vehicular and pedestrian, cannot be excluded from hazardous areas under and nearby overhead

work in progress. Provide appropriate warning signs, flashing-type warning lights, and adequate general lighting at principal barricades which are not intended to be crash-proof. Maintain barricades through periods of exposure to hazardous conditions.

- E. Roadways and Walkways. Establish safe roadways and walkways in and around Project Site, and connecting with adjoining public thoroughfares. Provide signage and other markings; including traffic control signage and signals, as may be necessary and useful in controlling traffic and in restricting traffic from passing through other areas. Cooperate with local officials in the establishment and/or adjustment of street entrance/exiting signals and signs. Do not allow established traffic ways to become encumbered or obstructed with work activities, materials, parked vehicles, equipment, and similar elements. In particular, keep established entrance-and-exit passages clear for medical emergencies, escape, fire fighting, and other emergency access and egress.
- F. Environmental Protection. Provide facilities and services as may be required by governing authorities to protect the environment; as it may be affected by performance of the work at the Project Site, and elsewhere, wherever work is in progress. Minimize the generation of wastes and avoid the pollution of every element of the environment. Prohibit the discharging and accidental loss of substances from the construction process that could possibly contaminate the atmosphere, surface or ground water, soil or subsoil.
- G. Excavation and Demolition.
  - 1. The Contractor, before commencement of any part of excavation or demolition, shall give any notices required to be given to adjoining landowners or other parties. Contractor shall initiate all necessary protective provisions prior to excavation or demolition of any site improvement.
  - 2. Before excavation or demolition of any site improvement, Contractor shall examine structural condition of all adjacent structures or infrastructure, whether on site or on adjoining property. Based on examination, where there is reason to believe planned excavation or demolition will cause damage or unsafe conditions to adjacent structures or infrastructure, excavation or demolition operations shall not be performed until means have been provided to insure stability and prevent collapse of adjacent structures or infrastructure. Such means shall consist of sheet piling, shoring, bracing, underpinning, or equivalent.
  - 3. Other protective provisions shall include, at a minimum, temporary protective coverings or enclosures of adjoining work, warning signs, and similar provisions.
- H. Dust Control. Where and when applicable, implement a suitable program for dust control in and around the Project Site, designed to reduce dust generation/ distribution to reasonable level. Coordinate with environmental protection program.
- I. Rodent, Pest, and Vermin Control. Employ specialized services to eliminate or minimize the threat of deleterious effects from insects, animals, and other vermin at Project Site. Up to and at the time of substantial completion, the Project and Project Site will be relatively free of entrenched and harbored pests of every description. Employ only environmentally safe methods and products in the control of rodents, pests and other vermin.
- J. Potable Water. Where reasonably possible, provide potable water for entire water requirement of construction period. Where and when that is not possible, provide potable water for drinking and other uses where specified; clearly marked with signage in multiple languages as appropriate for site location; with source as Contractor's option:

City-controlled piped water, well on site, commercially bottled water, or other reliable source. Demonstrate on a monthly basis to the Project Director/COR that the potable water from all selected sources is safe for human consumption. Sterilize piping of temporary potable water systems prior to use.

K. Construction Site Sanitation and Health Facilities.

1. Toilets Facilities and Restrooms.

- a) Toilet facilities are defined as enclosures containing one or more toilet fixtures or commodes for the purpose of defecation or urination or both. A urinal is a toilet fixture maintained within a toilet room for the sole purpose of urination. A toilet facility or restroom may be a temporary structure, portable units, or a permanent facility.
- b) The Project Site shall be provided with adequate toilet facilities. Separate facilities shall be provided for each sex and properly labeled in English and the commonly understood local language. Pictograms shall be used. The sewage disposal method shall comply with the requirements of the authority having jurisdiction. Toilet facilities shall be provided so as to be readily accessible to all employees. As far as is practicable, toilet facilities shall be located within sixty-one (61) meters (200 feet) of all locations where workers are regularly performing the work. The number of toilet fixtures shall be based on the anticipated maximum number of workers at Project Site. An adequate supply of toilet paper shall be maintained at all times. A hand-washing lavatory shall be provided in close proximity to all toilet facilities.
- c) The construction and installation of toilet facilities shall be accepted by the Project Director/COR and shall be in compliance with, if appropriate, all-applicable local jurisdictional codes. The floors, walls, partition, and doors of all toilet facilities shall be of a hard, impervious finish that can be easily cleaned. Floors shall be concrete. Walls and partitions shall be constructed of concrete masonry units, and doors shall be of metal or solid wood. All surface finishes shall be chosen to facilitate cleaning and the maintenance of the highest standards of sanitation.
- d) Each toilet or commode shall occupy a separate compartment or stall which shall be equipped with a door and latch. Partitions and doors shall be of nonabsorbent materials. The walls of compartments, stalls, or partitions between the toilets or commodes may be less than the height of room walls, but the top shall not be less than one hundred seventy-three (173) centimeters (5 feet, 8 inches) from the floor and the bottom not more than thirty (30) centimeters (1 foot) above the floor.
- e) In all newly constructed toilet rooms, the floors and exterior walls to a height of fifteen (15) centimeters (6 inches) above the floor shall be of watertight construction to facilitate cleaning and sanitation.
- f) Every toilet fixture, commode, or urinal shall be so installed that the space around and behind the fixture can be easily cleaned.
- g) Where non-sewer waste disposal systems are permitted, these shall be of a type accepted by the local health authorities having jurisdiction. These systems shall be maintained in a sanitary condition.

2. Lavatories and Personal Washing Facilities.
  - a) A lavatory is a basin or similar vessel for washing hands, arms, face and head. Adequate facilities for maintaining personal cleanliness shall be provided at the Project Site. Facilities shall be convenient for employee access and shall be maintained in a sanitary condition.
  - b) Lavatories shall be provided at or adjacent to all toilet facilities. Lavatories with adequate hot (43°-60°C or 110°-140°F) and cold water shall be provided. Mixing or combination supply fixtures are preferable. Sixty (60) centimeter diameter (24 inch) basin rims shall be considered as equal to one lavatory. In all instances, a dispenser containing a suitable skin cleaning agent shall be provided at each lavatory.
  
3. Drinking Fountains and Dispensers.
  - a) Provide an adequate number of drinking water fountains or dispensers, distributed for convenience and efficiency, around the Project Site and service support areas. Maintain an adequate supply of sanitary disposable paper cups and waste receptacles at each water dispenser.
  - b) Provide bottled drinking water where piped potable water service is not available.
  
4. Shower Facilities.
  - a) Where employees are exposed to skin contamination with poisonous, infectious, or irritating material (cement, lime, solvents, etc.), or where unsanitary or unhealthful working conditions require bathing before leaving the Project Site, the Contractor shall provide shower facilities in the ratio of one per each fifteen persons so exposed. Showers shall be supplied with ample hot (43°-60°C or 110°-140°F) and cold water.
  - b) A dispenser containing a suitable skin-cleaning agent shall be provided at each shower. Individual hand towels of cloth or paper shall be provided. Proper receptacles or other sanitary means shall be provided for the disposal of used towels. The provision of a loop towel rack for general or common use shall be prohibited as unsanitary.
  
5. Laundry Facilities.
  - a) Provide laundering of work clothing and coveralls that have become contaminated with poisonous, irritating or infectious material (cement, lime, solvents, etc.). The Contractor shall provide clean sets of laundered clothing or coveralls as part of the protective clothing requirement.
  - b) Should the process in which the worker is engaged be such that the individual's work clothing becomes wet or has to be washed between shifts, the Contractor shall make such provision to dry such clothing before reuse.
  
6. Changing Rooms.
  - a) Changing or dressing rooms shall be provided whenever it is the local practice or a requirement to change from street clothing to work clothing.

- b) Street and work clothing shall not be stored in contact with each other in changing rooms.
7. Lunch Rooms, Mess Halls, Dining Facilities, and Food Service Operations.
- a) An enclosed facility shall be provided and set aside specifically for employees to eat lunch at the Project Site. The minimum area per person shall be specified as 1.0 square meter or 11 square feet. The Contractor shall provide such enclosed facilities to accommodate at one time 50% of the maximum number of non-office-occupant personnel anticipated and as authorized to be at Project Site.
  - b) These facilities shall be equipped with tables and chairs or benches to seat the number of persons anticipated. The Contractor shall specify suitable floor, wall, and ceiling finishes, doors and windows, screening, and suitable fixtures and accessories. The Contractor shall provide general lighting, HVAC system, and drinking fountains or dispensers.
  - c) These dining facilities shall be physically separated from toilets at a minimum distance of sixty-one (61) meters (200 feet). Dining facilities shall be physically separated from all locations where there is the threat of exposure to toxic or infectious materials.
  - d) Perishable home-prepared lunches are a potential source of food-borne illness when stored at room temperature. Accordingly, the Contractor shall provide refrigeration facilities capable of maintaining a temperature of 7°C or 45°F or lower for the storage of lunches prior to consumption. Should local law require that meals be provided, the Contractor shall accommodate those requirements.
  - e) The Contractor shall provide space, utilities, and support services for the installation of vending machines for drinks and incidental foods. The Contractor shall establish, administer, and supervise service contracts with local vending firms. These contracts and the plan for their execution in practice must be cleared by the Project Director/COR and the Site Security Manager.
  - f) If the Contractor provides prepared or pre-prepared catered meals at the Project Site, all employee food service facilities and operations shall meet and comply with relevant requirements of the FDA 2001 Food Code or latest edition.
- L. Waste Handling and Janitorial Services.
- 1. General. Provide proper and adequate segregated waste containers for the collection and removal of waste materials in different categories. These include, but are not limited to: hazardous wastes, flammable wastes, sanitary and health-care wastes, garbage, wastes for recycling as required by local authorities, inert and dry wastes, and incidental debris from the construction process. Dispose of general non-organic wastes at seven (7) day intervals. Dispose of organic, garbage, and similar temperature-sensitive wastes at three (3) day intervals when the average outdoors-daily maximum temperature can be expected to be above 18°C. Clean waste containers regularly and adequately. Dispose of wastes in a lawful manner.

- a) Contractor may develop and implement a waste management plan that quantifies material diversion goals and methods of salvage and recycling in order to earn LEED points as described in Contract Section C.
2. On a daily basis the Contractor shall keep the Project and Construction Site clean and clear of accumulated wastes, including surplus materials, trimmings, incidental demolished work, and construction debris. Clean completed elements and portions of work, and maintain in "broom clean" condition, except as otherwise indicated by the Project Director/COR.
3. On a daily basis, provide janitorial services, including the restocking of disposable products, for the maintenance of temporary offices, security spaces, toilets, first-aid rooms, lunchrooms, shower/locker rooms, and similar facilities. Scrub toilet and first-aid room fixtures and floors daily, and scrub floors and walls of shower rooms daily. Provide weekly cleaning, damp mopping, or vacuuming, as may be appropriate, for other floors. Provide monthly washing of windows and cleaning of other walls, ceilings, light fixtures, and similar facility surfaces. Comply with the Project Director's/COR's specific requests to maintain facilities in a reasonably clean and sanitary condition at all times. Extend janitorial services to include permanent facilities as may be authorized for use as temporary facilities.

END OF SECTION 01521









**UNITED STATES DEPARTMENT OF STATE  
OVERSEAS BUILDINGS OPERATIONS  
NEW EMBASSY COMPOUND, BAGHDAD, IRAQ**

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**01523 CONFINED SPACE ENTRY PROCEDURE**

**PART 1. GENERAL**

**1.1 PROGRAM OBJECTIVE**

- A. The purpose of this procedure is to protect workers against the hazards involved in confined spaces. This procedure establishes the controls and responsibilities for entering, working in, and exiting confined spaces.

**1.2 SCOPE**

- A. This program covers all employees required to enter confined spaces such as manholes, ducts, tanks, etc., which may potentially contain hazardous atmospheres or conditions.

**1.3 DEFINITIONS**

- A. Attendant - a Qualified Employee stationed outside of the Permit-Required Confined Space who monitors the authorized entrant(s).
- B. Confined Space - a space which:
  - 1. Is large enough and so configured that an employee can enter and perform assigned work and
  - 2. Has limited or restricted means for entry or exit (some examples are tanks, boilers, manholes)
  - 3. Is not designed for continuous employee occupancy.
- C. Entrant or Authorized Entrant - a Qualified Employee or contractor who will enter the Confined Space. The entrant is trained on the procedures of the Confined Space and is authorized by Penn to enter.
- D. Entry - the action by which a person passes through an opening into a Permit-Required Confined Space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.
- E. Entry Permit - a written authorization to enter a Permit-Required Confined Space. It defines the conditions under which the permit space may be entered. It states the reasons for entering, identifies all hazards and identifies the Entry Supervisor.
- F. Entry Supervisor - a Qualified Employee who is responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, authorizes entry, oversees entry operations, and terminates entry when required.
- G. Hazardous Atmosphere: An atmosphere that may expose employees to the risk of death, incapacitation, interfere with an individual's ability to escape unaided from a space, or cause acute illness from one or more of the following causes:
  - 1. Flammable gas, vapors, or mists in excess of five percent (5%) of its Lower Explosion Limit (LEL).
  - 2. Atmospheric oxygen concentrations below 19.5% or above 23.5%.

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3. Atmospheric concentrations of any substance that could meet or exceed the permissible exposure limit as prescribed by OSHA standards. Review the MSDS sheets of all known substances contained within a space.
  4. Any other atmospheric condition that is immediately dangerous to life or health (IDLH).
- H. Isolation - the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout/tagout of all sources of energy; or blocking or disconnecting all mechanical linkage.
- I. Non-Permit Confined Space - a Confined Space which does not contain or have the potential to contain a "Hazardous Atmosphere" or any hazard capable of causing death or serious physical harm.
- J. Permit Required Confined Space (PRCS):
- K. A Confined Space that has one or more of the following characteristics:
1. Contains or has the potential to contain a "Hazardous Atmosphere"
  2. Contains a material with the potential for engulfment of an entrant,
  3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section; or
  4. Contains any other recognized serious safety or health hazard.
  5. Any space meeting the above definition will be entered by permit only.
  6. See Attachment A for a list of PRCS's and their associated hazards.
- L. Qualified Employee - an employee that has been trained on confined space entry procedures and the use of confined space equipment, air-monitoring equipment, and ventilation equipment.
- M. Stratified Atmosphere - an atmosphere where the contents have become "layered".
- (i) Atmospheric testing may indicate different percentages of oxygen, explosive gasses, and
  - (ii) hazardous contaminants at different levels.

#### **1.4 RESPONSIBILITIES**

- A. Management
1. Shall ensure that personnel under their direction maintain compliance with this program.
  2. Shall ensure that only trained employees assume roles and perform work in confined spaces in accordance with this program.
  3. Ensures that a periodic review of the overall effectiveness of the Confined Space Program/Procedures is completed.
- B. Supervision
1. Is responsible for initiating and controlling this procedure on shift.
  2. Ensures that the proper procedures for isolating all energy sources have been controlled.
  3. Ensures Entry Supervisors are inspecting work in spaces to ensure adherence to procedures.
- C. Entry Supervisors

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1. Be aware of hazards of the space to be entered, and signs, symptoms, and consequences of exposure, and specific space control procedures.
  2. Execute all requirements of this instruction before work begins within a confined space.
  3. Authorizes entry into a confined space when acceptable entry conditions have been met.
  4. Ensures that all personnel entering and leaving the confined space are accounted for.
  5. Terminate entry and cancel the permit if conditions warrant.
  6. Verify that rescue services have been identified and that means for summoning them are operable.
  7. Remove unauthorized individuals who enter or who attempt to enter the permit space during entry operations.
- D. Entrants
1. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.
  2. Use all equipment as required by this instruction and the specific permit space entry procedures.
  3. Communicate with the attendant as necessary to enable the attendant to alert entrants of the need to evacuate the space as required by this instruction and for attendant to be able to monitor status of entrants.
  4. Alert the attendant whenever:
    - a. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or
    - b. The entrant detects a prohibited condition.
  5. Exit from the confined space as quickly as possible whenever:
    - a. Order to evacuate is given by the attendant or the entry supervisor.
    - b. The entrant recognizes any warning sign or system of exposure to a dangerous situation, or the entrant detects a prohibited condition or an evacuation alarm is activated.
- E. Attendants
1. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.
  2. Be aware of the possible behavioral effects of hazard exposure in authorized entrants.
  3. Continuously maintain an accurate count of authorized entrants in the permit space and ensure that the means used to identify authorized entrants in the permit under this procedure accurately identifies who is in the permit space.
  4. Remain outside the permit space during entry operations until relieved by another attendant.
  5. Communicate with authorized entrants as necessary to monitor entrant status and to alert entrant of the need to evacuate the space if conditions warrant.
  6. Initiate onsite rescue procedures and if necessary, summon additional rescue and other emergency rescue services when self-rescue is not possible.
  7. Perform no duties that might interfere with his/her ability to monitor and protect the authorized entrants.
  8. Monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space.

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9. Warn unauthorized persons to stay away and advise those who may have entered the permit space that they must leave.
10. Inform authorized entrants and Entry Supervisor of unauthorized persons.

**1.5 GENERAL INFORMATION**

**A. General Rules**

1. When practical, all confined spaces shall be permanently marked. A sign shall be installed at each opening of the Confined Space. Signs should contain the following text or similar language:

**DANGER**

**PERMIT REQUIRED CONFINED SPACE DO NOT ENTER**

2. Spaces not permanently marked (ex. manholes) shall be posted with a portable sign when access to the spaces is required.
3. All confined spaces where there is an opening that can easily be walked into (floor openings, manhole openings, etc.) shall have a physical barrier (guardrail, gate, etc).
4. When required, isolating energy sources to the confined space shall be performed in accordance with Penn's Lockout/Tagout Program.
5. If "hot work" conditions exist, precautions shall be taken in accordance with Penn's Welding, Cutting, Hot Work Program. Cylinders of compressed gases are never permitted in a confined space.
6. No smoking is permitted in a Confined Space or near the entrance/exit area.
7. Air monitoring is required before entering any PRCS.
8. Portable electrical equipment used in Confined Spaces, which have wet surfaces, shall be supplied power through a ground fault interrupter or be battery powered.

- B. Confined Space Personnel -** The following individuals are required when entry into a PRCS is necessary. Employees shall receive the appropriate level of training before entry into the Confined Space is permitted. Note: An attendant can also act as an entry supervisor if properly trained.

1. Entry Supervisor
2. Attendant
3. Entrant(s)

**1.6 PROCEDURE**

**A. Confined Space Entry Permit**

1. Before entry is authorized, the entry supervisor shall document the safety measures taken in order to enter the Confined Space by preparing a Confined Space Entry Permit (See Attached).
2. Before entry begins, the entry supervisor identified on the permit shall complete and sign the entry permit to authorize entry. Acceptable entry conditions must be met in order for entry to be authorized.
3. The completed permit shall be made available at the time of entry to all authorized entrants, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

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4. The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit.
  5. The entry supervisor shall terminate entry and cancel the entry permit when:
    - a. The entry operations covered by the entry permit have been completed or
    - b. A condition that is not allowed under the entry permit arises in or near the permit space.
  6. Canceled entry permits shall be retained for at least one year to facilitate the review of the PRCS program. Any problems encountered during an entry operation shall be noted on the pertinent permit so that appropriate revisions to the program can be made.
- B. Air Testing**
1. The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiencies exist. Direct reading instruments, detector tubes, alarm only gas monitors and explosion meters are examples of monitoring equipment that may be used to test confined space atmospheres. Employees who have successfully completed air-monitoring training for the type of monitor they will use shall perform the air testing. Air testing equipment shall be calibrated (bump tested using span gas) and certified according to the manufacturer's recommendations. Calibration records shall be kept.
  2. The minimum parameters to be monitored are oxygen deficiency, LEL and, if applicable, contaminants that may be present which are over OSHA's PEL's. When testing for atmospheric hazards, first test for oxygen content, then for flammable gases or vapors and lastly for toxic gases or vapors. The initial air readings shall be recorded on the Permit and kept at the work site for the duration of the job. The employees shall be able to review the testing results.
- C. Air Testing Procedures. Prior to atmospheric testing, check air readings outside of the Confined Space to ensure proper operation of the instrument and that air readings are within normal ranges. Record Air test readings on the Permit.**
1. Air testing for Confined Spaces having a top entrance (manholes, tanks, etc.):
    - a. From each entrance, drop the sampling probe of the Meter to the bottom of the space. Additionally, use other available openings, which would facilitate air testing for that confined space.
    - b. Slowly raise the sampling probe, stopping at intervals of two feet to ensure that the atmosphere is not stratified. The rate of sampling shall be slowed to accommodate detector response due to the length of the sampling line and probe.
    - c. Record air testing data on the confined space permit.
  2. Air testing for Confined Spaces having a side or bottom manway (ducts, tanks, etc.):
    - a. From each entrance, move the sampling probe of the Meter to the opposite side of the space. Use rods, poles or other means to extend the probe to the opposite side of the space.
    - b. Slowly test all areas inside the Confined Space. The rate of sampling shall be slowed to accommodate detector response due to the length of the sampling line and probe.
    - c. Record air testing data on the confined space permit.

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3. Upon initial entry, all areas that could not be tested from the manway shall be tested. Slowly test the areas with the sampling probe out in front of you, checking all areas that were missed.
4. If there are no non-atmospheric hazards present and if the pre-entry tests show there are no dangerous air contamination and/or oxygen deficiency within the space, entry into and work within the space may proceed.
5. The atmosphere within the space shall be periodically tested as necessary to ensure no accumulation of a hazardous atmosphere. If conditions exist that could change the atmosphere of the Confined Space, it will be necessary to monitor the atmosphere continuously during occupancy. Air monitoring shall be performed at the actual work location in the confined space. The results of this monitoring shall be documented on the confined space permit, at a frequency established by the Entry Supervisor.
6. The workers will immediately leave the permit space and notify Environmental Health and Radiation Safety (EHRS) when any of the gas monitor's alarm set points are reached as defined. After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated and EHRS approves.

**1.7 Entry Procedures**

- A. Each PRCS to be entered shall have specific procedures developed to ensure the safety of all affected personnel, including, but not limited to, the following:
- B. Specifying acceptable entry conditions,
  1. Isolating the permit space,
  2. Purging, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards,
  3. Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards and
  4. Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.
  5. Retrieval and rescue equipment is required for entry into permit required confined spaces. The use of a harness is not required if it will create a greater hazard to the wearer.
  6. Reference Appendix A and Attachment A for specific confined space entry procedures.

**1.8 Alternative Procedures**

- A. Alternative entry procedures may be used in the following circumstances:
  1. The only hazard posed by the permit space is an actual or potential hazardous atmosphere.
  2. The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry. Air levels must be below 50% of established permissible exposure levels.
  3. The employer develops monitoring and inspection data that supports the demonstration that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry.

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- B. The atmosphere within the space shall be continuously monitored to ensure that forced air ventilation is preventing the accumulation of a hazardous atmosphere.
- C. Training shall be provided to the employees who enter permit spaces under the alternative procedures and to the employer's representatives who verify that permit spaces are safe for entry under the alternative procedures.
- D. The Attendant and Entry Supervisor are not required by the Alternative Procedures as well as retrieval and rescue equipment.
- E. The Entry Supervisor is responsible for documenting the basis for determining that all atmospheric hazards in the permit space have been eliminated or controlled through a certification that contains the date, the location of the space, any air sampling data to support this and the signature of the Entry Supervisor making the determination. This certification shall be made available to all employees involved.
- F. See Appendix B for alternate entry procedures

**1.9 Reclassifying a Permit Required Confined Space**

- A. A space classified as a PRCS may be reclassified as a non-permit confined space under the following procedures.
- B. If the PRCS poses no actual or potential atmospheric hazards or if all hazards within the space are eliminated without entry into the space and without the use of forced ventilation, the permit space may be reclassified as a Non-Permit Confined Space for as long as the non-atmospheric hazards remain eliminated.
- C. If it is necessary to enter a PRCS to eliminate a hazard or to test for atmospheric hazards, such entry shall be completed under a confined space permit.
- D. Once the space is reclassified, it may be treated as a Non-Permit Confined Space for the duration of the work being performed. The permit is no longer required as well as an attendant, supervisor, retrieval and rescue equipment. Air monitoring should be conducted each day before entering the non-permitted space. Once a job is complete, the space reverts to a PRCS.
- E. The Entry Supervisor is responsible for documenting the basis for determining that all hazards in the permit space have been eliminated through a certification that contains the date, the location of the space, any air sampling data to support this and the signature of the Entry Supervisor making the determination (the use of a confined space entry permit will meet this requirement). The Supervisor will sign on the permit that the space has been reclassified, as non-permit required. This certification shall be made available to all employees involved.

**1.10 Contractors**

- A. At a minimum, Contractors must follow the requirements of Penn's Confined Space Program.
- B. Government will provide Contractors: information on all PRCS('s) to be entered, hazards associated with the Confined Space(s) and a copy of this Confined Space Program.
- C. Contractor employees must be trained in confined space entry. Contractors that are required to enter a Confined Space must show certification that their employees have been trained in accordance with 29 CFR 1910.146.
- D. Additionally, the Contractor employees will be trained on Penn's Confined Space Program. Penn's Contractor Representative will communicate to the Contractor the

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requirements of this program and potential hazards they may encounter inside the confined space and the surrounding area. Contractor Training should be documented.

**1.11 CONFINED SPACE RESCUE**

- A. In the event of an emergency of any type in the confined space, entrants in the space shall evacuate as quickly as possible. Injured employees are encouraged to use self-rescue when applicable.
- B. If rescue from within the confined space is required, the attendant should immediately call RSO. Inform the RSO that rescue is needed from a confined space. Give the emergency service the location, the type of confined space, and the hazards associated with the space.

**1.12 TRAINING**

- A. All personnel involved with confined space activities shall receive training consistent with their duties. Employees will receive training in order to acquire the understanding, knowledge and skills necessary for the safe performance of the duties assigned under this program.
- B. Training shall be provided to each affected employee that may be designated as a supervisor, entrant or attendant:
  - 1. Before the employee is first assigned duties,
  - 2. Before there is a change in assigned duties,
  - 3. Whenever there is a change in confined space operations which presents a hazard to an employee who has not been previously trained and
  - 4. Whenever the employer has reason to believe that there are deviations from the confined space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.
  - 5. The training shall establish employee proficiency in the duties required and shall introduce new or revised procedures, as necessary, for compliance.
- C. Training content shall include:
  - 1. Duties of Entry Supervisor, Entrant and Attendants,
  - 2. Confined Space Program and other procedures relating to Confined Space Entry (Lockout/Tagout, Hot Work, etc.),
  - 3. Hazards of Confined Spaces,
  - 4. Use of Air Monitoring Equipment,
  - 5. Use of ventilation equipment,
  - 6. Emergency Action & Rescue Procedures,
  - 7. Confined Space Entry Equipment, including Personal Protective Equipment and
  - 8. Requirements of 29 CFR 1910.146 Permit Required Confined Spaces.

**1.13 DOCUMENTATION**

- A. Department Managers shall retain each canceled entry permit for at least one year to facilitate the review of the PRCS program. The Department Manager or designee will conduct and document this review.
- B. Training documentation shall be kept for all affected employees. Training rosters shall indicate the employee's name, date, level of training (supervisor, entrant, and/or attendant) and the instructor who performed the training. The Department Managers

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shall maintain all training rosters. The most current training record shall be kept for each affected employee.

- C. Calibration and/or certification of air monitoring instruments shall be conducted in accordance with the manufacturer's recommendations. The Department Manager shall maintain records. The Department Manager shall periodically inspect the calibration records to ensure completion.

**1.14 REFERENCES**

- A. 29 CFR 1910.146 Permit Required Confined Spaces
- B. Lockout/Tagout Procedure
- C. Hot Work Procedure

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**Appendix A - CONFINED SPACE ENTRY PROCEDURE**

**JOB PLANNING MEETING**

- 1) Prior to entry into a confined space, personnel involved with the job will discuss the procedures that will be followed, so that the confined space work will be completed safely. The required equipment will be assembled; instructions will be conveyed to those involved in the entry; procedures will be discussed; and hazards, which may be encountered, will be explained. The attendant should ensure that any ignition source taken into the confined space is limited to ones required to perform the necessary work. Each location may have different hazards.
- 2) All necessary equipment to be used for entry will be assembled by the attendant, including communication devices (radios, if required) to be used to quickly summon Rescue Personnel

**ENTRY PROCEDURE**

- 1) Follow Penn's Lockout/Tagout procedures to isolate any potential hazardous sources, which will adversely affect those working in confined space.
- 2) Open sufficient manhole covers, doors, vents, or other openings in the confined space.
- 3) Where necessary, use ventilators to change the air in the confined space.
- 4) A Qualified Employee will test the air for oxygen content, flammable and toxic gases (See Section 6.2). Initial air monitoring data will be recorded on the confined space permit. (See Attached Confined Space Permit)
  - a) Oxygen must be between 19.5% and 23.5%
  - b) Flammable/Explosive gases must be below 5% Lower Explosive Limit (LEL)
  - c) Toxic gases/vapors must be below OSHA's Permissible Exposure Limits
- 5) The Entry Supervisor will assign a trained Attendant to control entry into the confined space.
- 6) The Attendant will ensure that all Entrants are authorized; keep an accurate count of all who enter; continually communicate with those within the confined space; watch out for the well-being and safety of all entrants; and stay until relieved. Attendants will verify that all Entrants sign the Permit prior to entry.
- 7) If all is clear in step 6, the Entry Supervisor will authorize entry. Continuous forced ventilation should be used when required. Continuous air monitoring shall be conducted and recorded periodically on the back of the permit when required.
- 8) If work is stopped for any reason, the air tests shall be re-taken if deemed necessary by the Entry Supervisor, prior to re-entry.
- 9) When the job has been completed, the Attendant will account for all Entrants before they leave the job site.
- 10) The Entry Supervisor will check to ensure that all personnel are out, all equipment is clear, and when he is satisfied with the site conditions, he/she can close out the confined space entry permit, prior to allowing the Confined Space to be sealed.

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**Appendix B - ALTERNATIVE ENTRY PROCEDURES**

This checklist is to be used when confined space is entered using the Alternative Procedures. The signature of the employer's representative verifies that the space is safe for entry. This certification shall be made before entry and shall be available to each employee entering the space.

Alternative entry procedures may be used in the following circumstances. The only hazard posed by the permit space is an actual or potential hazardous atmosphere. The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry, and the employer develops monitoring and inspection data that supports the demonstration that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry.

Permit Space Location: \_\_\_\_\_ Date: \_\_\_\_\_

1. Eliminate any conditions making it unsafe to remove an entrance cover. List the hazards and precautions:
2. When the entrance covers are removed, promptly guard the entrance to prevent accidental falls through the opening and to protect the entrants from foreign objects. Describe the guards to be erected:
3. Before an employee enters the space, test the internal atmosphere for the following conditions, in the order given, and record below. List the acceptable range for the potential toxic air contaminants.

Oxygen Content: _____	Range Acceptable 19.5% to 23.5%
Flammable Gas and Vapors: _____	0% to 5%
LEL Toxic Air Contaminants (____): _____	0 to

4. Provide continuous forced air ventilation as follows:
  - Worker may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere.
  - Forced ventilation is so directed as to ventilate the immediate areas where the worker is or will be present within the space and shall continue until all workers have left the space. The air supply for the forced air ventilation is from a clean source and does not increase the hazards in the space.
5. Continuous monitoring will be conducted. Employees must evacuate the space if the oxygen content drops below 19.5%, the flammable gas or vapor concentration is at or above 5% of the LEL, and the toxic gases or vapor concentration exceeds 50% of the PEL.
6. If a hazardous atmosphere is detected during entry, each employee shall leave the space immediately; the space shall be evaluated to determine how the hazardous atmosphere developed; and measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

I, \_\_\_\_\_, certify that these procedures have been followed and that the confined space is safe for entry.

Entry Supervisor:

Signature

Date

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**Attachment A  
Confined Space Inventory**

<b>CONFINED SPACE LOCATION</b>	<b>DESCRIPTION</b>	<b>HAZARDS</b>	<b>SPACE LABELED</b>	<b>SAFETY REQUIRMENTS / PPE</b>
Electrical Manholes	Pits containing electrical lines	Atmospheric Electrical Heat Stress	Caution Confined Space Permit	Follow Confined Space Entry Permit Procedure
Air Handling Units	Without Energy recovery units	Mechanical	No	Lockout/Tagout
Air Handling Units	With Energy Recovery Units (BRB2/3, Johnson, CRB, Stellar Chance, Rosenthal)	Chemical/ Radiological Mechanical	Danger Do Not Enter Follow Service Procedure	Follow specific unit's entry procedure
Sump Pit		Atmospheric		Lockout Tagout Follow Confined Space Entry Permit Procedure

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**CONFINED SPACE ENTRY PERMIT**

(Complete Prior to Entry)

Confined Space Location /Number: \_\_\_\_\_ Purpose of Entry: \_\_\_\_\_

Date Permit Issued \_\_\_\_\_ Time of Entry: (in) \_\_\_\_\_ (out) \_\_\_\_\_

Permit Expires \_\_\_\_\_

**II. ENTRY TEAM MEMBERS**

Name (list below)	Time In	Time out
Attendant:		
Entrant:		

**III. ATMOSPHERIC TESTING**

Has unit been calibrated within last month		Yes/No		Battery checked? Yes/No	
Location in space	% O <sub>2</sub>	% LEL	CO ppm	Other	Initials of Tester
Prior to Entry*					
<u>At Opening</u>					
<u>Middle</u>					
<u>Bottom</u>					
Acceptable Limits*	19.5-23.5%	Below 5%	Below 25 ppm		

\*Continuous monitoring may be required. Site-specific conditions may require entrant to wear a monitor.

\*\*Contact COR if any reading exceeds acceptable limit. Do not proceed until given written authorization

**IV. SAFETY CHECKLIST (check each item when completed)**

- \_\_\_ 1. Establish communication from worksite with approved Supervisor
- \_\_\_ 2. Barricades in position
- \_\_\_ 3. Establish continuous ventilation/monitoring if required.
- \_\_\_ 4. Communication checked between entrants and attendant (List how)
- \_\_\_ 5. Escape harness, tripod and winch available
- \_\_\_ 6. Lockout/tag out completed (if needed)
- \_\_\_ 7. Appropriate PPE worn: \_\_\_ Harness \_\_\_ Hardhat \_\_\_ Gloves \_\_\_ Hearing Protection \_\_\_ Foot Personal Monitor \_\_\_ Eye Protection
- \_\_\_ 8. Lighting, Heat conditions assessed
- \_\_\_ 9. Others (list)

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**V. AUTHORIZATION FOR ENTRY**

Entry Supervisor (print) \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

OR: Entry into this confined space can be completed using *Alternative Method Procedures*:

Entry Supervisor (print) \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

OR: The above confined space has been reclassified to *Non Permit Required*:

Entry Supervisor (print) \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

**MANAGER MUST RETAIN THIS FORM FOR ONE (1) YEAR FROM DATE OF ISSUE**

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Shelf angles.
2. Metal angle corner guards for columns, walls and bading deck edge subject to vehicular impact.
3. Metal edgings.
4. Pipe bollards.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 67 deg C, ambient; 100 deg C, material surfaces.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Metal nosings and treads.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

- D. Welding certificates.
- E. Qualification Data: For professional engineer.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

### PART 2 - PRODUCTS

#### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

#### 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
- E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- F. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- G. Galvanized Pipe and Sleeves: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, with Z275 coating; 2.8-mm nominal thickness.
- H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

### 2.3 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563M; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.7M.
- E. Lag Bolts: ASME B18.2.3.8M.
- F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- G. Plain Washers: Round, carbon steel, ASME B18.22M.
- H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.2M.
- I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
  1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 738M and nuts complying with ASTM F 836M.
- J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

### 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Shop Primers: Provide primers that comply with Division 9 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
  - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
  - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 20 MPa , unless otherwise indicated.

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1 mm, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 67 deg C, ambient; 100 deg C, material surfaces.
- I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- J. Remove sharp or rough areas on exposed traffic surfaces.
- K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports indicated and as necessary to complete the Work.
- B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Fabricate units from slotted channel framing where indicated.
  2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 32 mm wide by 6 mm thick by 200 mm long at 600 mm o.c., unless otherwise indicated.
  3. Furnish inserts if units must be installed after concrete is placed.
- C. Fabricate supports for operable partitions as follows:

1. Beams: Continuous steel shapes of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

## 2.7 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 150 mm from each end, 150 mm from corners, and 600 mm o.c., unless otherwise indicated.
- C. Galvanize miscellaneous steel trim in the following locations:
  1. Exterior.
  2. Interior, where indicated.

## 2.8 STEEL PIPE BOLLARDS

- A. Type: Standard schedule 40 steel pipe.
  1. Fill with standard weight concrete; set in concrete foundations.
  2. Continuously weld steel plate to top; grind smooth.
- B. Finish: Paint.

## 2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  1. ASTM A 123, for galvanizing steel and iron products.
  2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

#### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 0.05-mm dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05515 - METAL LADDERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Steel ladders and ships ladders.
- B. Related Sections: Division 9 for Painting

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Fabricator is responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
  - 1. Employ registered professional engineer to engineer each component of ladder system.
- B. Structural Requirements: In addition to requirements shown and specified, comply with ANSI A14.3 for design, materials, fabrication, and installation of component parts.

1.3 QUALITY ASSURANCE

- A. Welder Qualifications: AWS certified within past 12 months for each type of weld required.
- B. Certifications:
  - 1. Engineering Certifications.
  - 2. Certification that code required design loadings have been complied with in design and fabrication of work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Section: ASTM A36/A36M.
- B. Steel Tubing: 32 mm NPS ASTM A53, Grade B, Schedule 40, or as required for design loading.
- C. Cold-Rolled Structural Steel Sheet: ASTM A611, grade as required for design loading.
- D. Hot-Rolled Structural Steel Sheet: ASTM A570/A570M, grade as required for design loading.

- E. Galvanized, Structural Steel Sheet: A653/A653M, Quality SQ, Coating Designation Z275 , Grade as required for design loading.
- F. Steel Bar Grating Treads: ASTM A36/A36M.
- G. Fasteners:
  - 1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for type, grade and class required.
  - 2. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.
  - 3. Lag Bolts: Square head type, FS FF-B-561.
  - 4. Machine Screws: Cadmium plated steel, FS FF-S-92.
  - 5. Wood Screws: Flat head carbon steel, FS FF-S-111.
  - 6. Plain Washers: Round, carbon steel, FS FF-W-92.
  - 7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.
  - 8. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.
  - 9. Lock Washers: Helical spring type carbon steel, FS FF-W-84.
- H. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47M , or cast steel, ASTM A27/A27M. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.

## 2.2 VERTICAL LADDERS

- A. Type: Vertical steel ladders consisting of following components:
  - 1. Side Rails : 10 mm by 63 mm flat steel bars with eased edges spaced as detailed on Drawings or not less than 450 mm between.
  - 2. Rungs : 19 mm minimum round steel bars spaced 300 mm maximum OC, punched through stringers and plug welded.
  - 3. Provide non-slip surface on top of each rung, either by coating rung with aluminum oxide granules set in epoxy resin adhesive, or by using type of manufactured rung, which is filled with aluminum oxide grout.
  - 4. Angle Supports : Support ladders by steel angles bolted to walls and floors to provide minimum of 180 mm from face of wall to centerline of rungs. Locate at 1500 mm OC and within 400 mm of top and bottom.
  - 5. Safety Handrails : Extend rails 1100 mm above top rung and anchor to structure, if adjacent structure does not extend above top rung, gooseneck extended rails back to structure.
  - 6. Vertical Ladder Cages: Provide steel bar cages enclosing ladders where required by code. Fabricate from structural steel flat bars, assembled by welding or riveting. Unless otherwise indicated, provide 8 mm by 100 mm top and bottom hoops and intermediate hoops spaced not more than 6100 mm on center; 8 mm by 50 mm hoops at 1200 mm on center between 100 mm wide hoops; and 8 mm by 50 mm vertical bars, secured to each hoop. Space vertical bars approximately 230 mm OC. Fasten assembled safety cage to ladder rails and adjacent construction.
- B. Safety Post:

1. Provide telescoping tubular safety post fabricated from hot dipped galvanized steel for ladders to roof hatches.
  - a. Acceptable product: Bilco LadderUp Safety Post Model LU-2.

### 2.3 FABRICATION PROCEDURES

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
  1. Verify measurements in field for work fabricated to fit job conditions. Before starting work, examine adjoining work on which work of this section is in any way dependent for workmanship and fit.
  2. Fabricate finish surfaces smooth, unless otherwise specified.
  3. Cut, punch, drill, and tap for attachment of work coming in contact with ladder where indicated or where directions for same are given prior to or with approval of shop drawings.
- B. Make joints as strong and rigid as adjoining sections. Make exposed joints close fitting and where jointing is least conspicuous. Unless otherwise indicated or specified, full weld joints and seams and dress smooth where exposed. Meet design loads for weights of connections and accessories.

### 2.4 SURFACE PREPARATION AND APPLICATION

- A. Steel Surfaces to be Primed: Dry and free of dirt, oils, rust, salt and other contaminants.
  1. Blast-clean steel to "commercial grade" SSPC SP-6 for general use.
- B. Apply primers in accordance with manufacturer's instructions.

### 2.5 UNIVERSAL PRIMER

- A. Manufacturer's standard, lead and chromate free primer, capable of providing sound foundation for field applied top coats despite prolonged exposure.
  1. Maximum Allowable Dry Time: Four hours to touch; 24 hours to re-coat.
  2. Compatible with finish paint system specified in 09910.
- B. Acceptable Products:
  1. Valspar 13-Y-5, Valspar, Baltimore, MD.
  2. Tnemec, Chem Prime 37H-77, Tnemec, Kansas City, MO.
  3. Carboline Multi-Bond 150, Carboline Company, St. Louis, MO.

2.6 GALVANIZING

- A. Provide hot-dip galvanized coating in accordance with:
  - 1. ASTM A153 - Iron and Steel Hardware.
  - 2. ASTM A123 - Rolled, pressed, forged steel shapes, plates, bars, strips 1/8 inch thick and heavier.
- B. Galvanizing Repair Paint: MIL-P-21035 or SSPC-Paint-20.
  - 1. Acceptable Products:
    - a. Valspar M-2-2 (13-F-2), Valspar, Baltimore, MD.
    - b. Tnemec 90-93, Tnemec Co., Kansas, MO.
    - c. Carboline Galvanox, Carboline Company, St. Louis, MO.

2.7 FINISHES

- A. Interior: Universal primer, exterior (subject to exterior atmosphere): Galvanized.
- B. Final Painting: Refer to Division 9 for Painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and proceed only after determining conditions are properly prepared for installation.

3.2 INSTALLATION AND PROTECTION

- A. Set items in position, align and brace securely until permanent anchorage is made.
  - 1. Provide suitable anchors and install supporting members, fastenings, framing, hangers, bracing brackets, straps, bolts and angles required to set and connect work to structure.
- B. Upon completion of installations, re-examine work and provide additional shims, washers, anchors and corrective work to ensure that installation is firm, tight, anchored, in alignment with neat fits, without distortion, unsightly fastenings, raw edges or protrusions.
- C. Protect finished installation.

END OF SECTION 05515

## SECTION 09912 - PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, COR will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
    - a. Architectural woodwork.
    - b. Acoustical wall panels.
    - c. Metal lockers.
    - d. Elevator equipment.
    - e. Finished mechanical and electrical equipment.
    - f. Light fixtures.
  2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
    - a. Foundation spaces.
    - b. Furred areas.
    - c. Ceiling plenums.
    - d. Utility tunnels.
    - e. Pipe spaces.
    - f. Duct shafts.
    - g. Elevator shafts.

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3. Finished metal surfaces include the following:
    - a. Anodized aluminum.
    - b. Stainless steel.
    - c. Chromium plate.
    - d. Copper and copper alloys.
    - e. Bronze and brass.
  
  4. Operating parts include moving parts of operating equipment and the following:
    - a. Valve and damper operators.
    - b. Linkages.
    - c. Sensing devices.
    - d. Motor and fan shafts.
  
  5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

## 1.2 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
  1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
  2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
  3. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
  4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
  1. Include manufacturers' product data for paints, including printed statement of VOC content and chemical components.
  2. Include manufacturers' MSDS information for each product.
  3. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

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4. **Manufacturer's Information:** Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. **Samples for Initial Selection:** For each type of topcoat product indicated.
  - C. **Samples for Verification:** For each type of paint system and in each color and gloss of topcoat indicated.
    1. Submit Samples on rigid backing, 200 mm square.
    2. Step coats on Samples to show each coat required for system.
    3. Label each coat of each Sample.
    4. Label each Sample for location and application area.
  - D. **Product List:** For each product indicated, include the following:
    1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
    2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

#### 1.4 QUALITY ASSURANCE

- A. **Applicator Qualifications:** A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.
- B. **Source Limitations:** Obtain block fillers, primers, and undercoat for each coating system from the same manufacturer as the finish coats.
- C. **Environmental Regulations:** Comply with Government, regulations limiting volatile organic compound (VOC) content in coating materials, related to coating materials and application methods, as current at time of performance of the work.
  1. Paints and coatings listed in Schedules do not necessarily comply with environmental regulations in force at the project site. In such cases, subject to acceptance by Government, provide manufacturer's equivalent or replacement product, as verified by compliance with submittal requirements specified above.
- D. **Pre-installation Conference:** Before beginning preparation of samples, meet with Government and appropriate consultants, and other concerned entities.
  1. Review requirements for shop-priming, compatibility of each coating material with substrates and other coatings, and the suitability of each specified paint system for the substrates and other field conditions indicated.

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2. Record discussions of conference, including decisions and agreements or disagreements reached, and furnish a copy for each attendee. If substantial disagreements exist at the conclusion of the conference, determine how disagreements will be resolved and set a date for reconvening the conference.
- E. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
    - a. Wall Surfaces: Provide samples on at least
    - b. Small Areas and Items: Architect will designate items or areas required.
  2. Apply benchmark samples, according to requirements for the completed work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
  3. Final approval of colors will be from benchmark samples.

#### 1.5 PROJECT CONDITIONS

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
1. Product name or title of material.
  2. Product description (generic classification or binder type).
  3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.
  6. Application instructions.
  7. Color name and number.
  8. VOC content.

#### 1.6 Keep storage area neat and orderly. Remove oily rags and waste daily.

- A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 7 deg C. Maintain storage containers in a clean condition, free of foreign materials and residue.
- B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 10 and 32 deg C.
- C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 7 and 35 deg C.

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- D. Do not apply paint in rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 3 deg C above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Provide paint products by one of the following manufacturers:

1. Benjamin Moore
2. PPG Industries
3. Sherwin-Williams

- B. Special Coatings:

1. Carboline Company (Carboline)
2. Du Pont Company High Performance Coatings (Du Pont)
3. Tnemec Company (Tnemec)

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

### 2.3 PREPARATORY COATS

- A. Concrete Unit Masonry Block Filler: High-performance latex block filler of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
- B. Exterior Primer: Exterior alkyd or latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal and Aluminum Substrates: Rust-inhibitive metal primer.

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2. Zinc-Coated Metal Substrates: Galvanized metal primer.
  3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.
- C. Interior Primer: Interior latex-based or alkyd primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal Substrates: Quick drying, rust-inhibitive metal primer.
  2. Zinc-Coated Metal Substrates: Galvanized metal primer.
  3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

## 2.4 EXTERIOR FINISH COATS

- A. Exterior Flat Acrylic Paint.
- B. Exterior Semigloss Acrylic Enamel.
- C. Exterior Full-Gloss Acrylic Enamel for Concrete, and Masonry.
- D. Exterior Full-Gloss Acrylic Enamel for Ferrous and Other Metals.
- E. Exterior Full-Gloss Alkyd Enamel.

## 2.5 INTERIOR FINISH COATS

- A. Interior Flat Acrylic Paint.
- B. Interior Flat Latex-Emulsion Size.
- C. Interior Semigloss Acrylic Enamel.
- D. Interior Full-Gloss Acrylic Enamel.
- E. Interior Full-Gloss Alkyd Enamel for Gypsum Board.
- F. Interior Full-Gloss Alkyd Enamel for Wood and Metal Surfaces.

## 2.6 INTERIOR WOOD STAINS AND VARNISHES

- A. Open-Grain Wood Filler.
- B. Interior Wood Stain: Alkyd based.
- C. Interior Alkyd- or Polyurethane-Based Clear Satin Varnish.

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- D. Interior Waterborne Clear Satin Varnish: Acrylic-based polyurethane.
  - E. Interior Waterborne Clear Gloss Varnish: Acrylic-based polyurethane.
  - F. Paste Wax: As recommended by manufacturer.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with procedures specified in PDCA P4 for inspection and acceptance of surfaces to be painted.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime.
  - 2. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
  - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
    - c. If transparent finish is required, backprime with spar varnish.

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- d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
  - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
    - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3, SSPC-SP 10/NACE No. 2.
    - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
  5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- E. Material Preparation:
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- F. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  5. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
- G. Sand lightly between each succeeding enamel or varnish coat.

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- H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
    - 1. Omit primer over metal surfaces that have been shop primed and touchup painted.
    - 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
  - I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
  - J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
  - K. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
  - L. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
  - M. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
  - N. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
  - O. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
  - P. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

### 3.2 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

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- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by COR.
  - C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
    - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.3 PAINT SCHEDULES

- A. Wherever more than one coat of paint is called for, paint with completely separate coats with the manufacturer's minimum drying time between coats.
  - 1. Application of separate coats, with manufacturers dry time between, is imperative and absolute. Drying time between coats is mandatory and not to be waived or modified.
  - 2. Under no circumstances is the number of coats to be combined into a lesser number with an, "equivalent" thickness to attempt to equal separate coats, applied individually.
  - 3. Applications called, "Equivalent", with fewer than the specified number of coats, but equal to the total thickness, are not acceptable.
  - 4. To assure performance, keep a record of application of each coat, each location, with dates of application, substrate, type of paint, names of applicators, and ambient conditions. Submit the record to the Government for review and acceptance in authorizing payment for the work.

### 3.4 EXTERIOR PAINT SCHEDULE

#### A. SYSTEM NO. 1.

- 1. High Performance Coating Over Exposed To View Shop Primed or Galvanized Steel Surfaces:
  - a. Structural components, equipment supports, bollards, etc.
- 2. Certify compatibility with shop applied primers requirements specified in Part I
- 3. Observe paint manufacturer's limitations on elapsed time between coats.
- 4. Provide two coats over primer (first coat) as follows.

- a. Intermediate Coat: High performance epoxy coating formulated for use over exterior primed or galvanized steel, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of 2.0 and 3.0 mils.
  - 1) Tnemec 27FC Typoxy
- b. Finish Coat: Aliphatic acrylic polyurethane enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness range of 2.0 to 3.0 mils.
  - 1) Tnemec Series 73 (semi gloss) Enduro Shield III

B. SYSTEM NO. 2

1. Premium, Full Gloss. Alkyd Enamel Finish: Apply at the following surfaces:
  - a. Exposed surfaces (exterior and interior) of exterior shop primed hollow metal door and frame assemblies.
  - b. Exposed surfaces (exterior and interior) of shop primed overhead coiling door curtains and other exposed overhead coiling door components.
2. Touch-up shop applied primer before applying finish coats. Provide two finish coats over a shop applied primer
  - a. First and Second Finish Coats: Premium quality, full gloss, exterior, alkyd enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.
    - 1) MooreIronClad Quick-Dry Industrial Enamel #071
    - 2) Tnemec Series 23, Enduratone

3.5 INTERIOR PAINT SCHEDULE General: Provide the following paint systems for the various substrates, as indicated. Apply additional coats when undercoats, previous coatings or other conditions show through the final coat, until the cured film is of uniform coating finish, color and appearance.

A. SYSTEM NO. 3

1. Semi-Gloss, two component Polyester - Epoxy Coating over Concrete.
  - a. Apply over concrete wall and column surfaces where sanitary conditions must be maintained, where subject to water, and as scheduled
2. Provide two coats over a primer as follows:
  - a. Primer: Acrylic primer spread at rate recommended by manufacturer.
    - 1) Moore: Regal first coat interior latex primer & underbody #216
  - b. Second Coat: Epoxy enamel base and polyester-resin hardener, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.
    - 1) Moore: Iron Clad Tile Like Catalyzed Coating #371

- c. Finish Coat: Semigloss, clear epoxy glaze and polyester resin hardener, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.9 mils.
  - 1) MooreIron Clad Tile-Like Clear Glaze Semi-Gloss

B. SYSTEM NO. 4

- 1. Semi-Gloss, Acrylic Enamel over Concrete.
  - a. Apply over concrete wall and column surfaces scheduled to receive paint other than system 3 and generally at the following locations:
    - 1) Stairs, service corridors and service areas on each floor.
    - 2) Locker rooms, athletic areas, workrooms.
- 2. Provide two coats over a primer as follows:
  - a. Primer: Alkali-resistant, acrylic latex interior primer spread at rate recommended by manufacturer to achieve a total dry film thickness of not less than 1.0 mil.
    - 1) Moore: Regal first coat interior latex primer & underbody #216
    - 2) PPG: 6-2 Speedhide Interior Quick Drying Latex Sealer
  - b. First and Second Coats: Semigloss acrylic-latex interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
    - 1) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333
    - 2) 88-110 Satinhide Interior Enamel Wall & Trim LO-Lustre Semi-Gloss Latex.

C. SYSTEM NO. 5

- 1. Flat Acrylic over Concrete.
  - a. Apply over concrete wall and column surfaces scheduled to receive paint not included in Systems No. 3 or 4
- 2. Provide one finish coat over a primer as follows:
  - a. Primer: Alkali-resistant, acrylic latex interior primer spread at rate recommended by manufacturer to achieve a total dry film thickness of not less than 1.0 mil.
    - 1) Moore: Regal first coat interior latex primer & underbody #216
    - 2) PPG: 6-2 Speedhide Interior Quick Drying Latex Sealer
  - b. Finish Coat: Flat, latex based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
    - 1) Moore: Moore's Regal Wall Satin #215
    - 2) PPG: 80 Line Wallhide Interior Wall flat latex paint.

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D. SYSTEM NO. 6

1. Flat Acrylic over Concrete with leveling coat.
  - a. Apply at concrete ceiling surfaces scheduled to receive leveling coat.
2. Provide vinyl-base leveling coat with primer and one finish coat, as follows:
  - a. Primer: Alkali-resistant, acrylic-latex interior primer spread at rate recommended by manufacturer to achieve a total dry film thickness of not less than 1.4 mils.
    - 1) Moore: Regal First Coat Interior Latex Primer & Underbody #216
    - 2) PPG: 6-2 Speedhide Interior Quick Drying Latex Sealer.
  - b. Finish Coat: Flat, acrylic-latex, interior paint spread at rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
    - 1) Moore: Regal Wall Satin #215
    - 2) PPG: 80 Line Wallhide Interior Wall Flat Latex Paint

E. SYSTEM NO. 7

1. Semi-Gloss, Two Component, Polyester-Epoxy Coating over Concrete Masonry Units.
  - a. Apply over concrete masonry units subject to water and elsewhere where scheduled.
2. Provide two finish coats over a block filler as follows:
  - a. Block Filler: High performance, latex based, block filler applied rate recommended by manufacturer to achieve a total dry film thickness of not less than 5.0 mils.
    - 1) Moore: Moorcraft Interior & Exterior Block Filler #
  - b. Second Coat: Epoxy enamel base and polyester resin hardener, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.
    - 1) Moore: IronClad Tile-Like Catalyzed Coating #371
  - c. Finish Coat: Semigloss, clear epoxy glaze and polyester resin hardener, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.9 mils.
    - 1) MooreIron Clad Tile-Like Clear Glaze Semi-Gloss 370-02

F. SYSTEM NO. 8

1. Semi-Gloss, Acrylic-Enamel over Concrete Masonry Units.
  - a. Apply over concrete masonry units, where scheduled, generally at the following locations:

- 1) Stairs, service corridors.
  - 2) Locker rooms, athletic spaces and toilet areas.
2. Provide two finish coats over a block filler as follows:
    - a. Block Filler: High performance, latex based, block filler applied rate recommended by manufacturer to achieve a total dry film thickness of not less than 5.0 mils.
      - 1) Moore: Moorcraft Interior & Exterior Block Filler #173
      - 2) PPG: 6-7 Speedhide Interior/Exterior Masonry Block Filler
    - b. First and Second Coats: Semigloss, acrylic-latex, interior applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
      - 1) Moore: Moore's Regal AquaGlo Vinyl-Acrylic latex Enamel #333
      - 2) PPG: 88-110 Satinhide Interior Enamel Wall & Trim Lo-Lustre Semi-Gloss Latex.

G. SYSTEM NO. 9

1. Flat, Acrylic-Enamel over Concrete Masonry Units.
  - a. Apply over concrete masonry units, where scheduled, but not included in Systems 7 and 8.
2. Provide two finish coats over a block filler as follows:
  - a. Block Filler: High performance, latex based, block filler applied rate recommended by manufacturer to achieve a total dry film thickness of not less than 5.0 mils.
    - 1) Moore: Moorcraft Interior & Exterior Block Filler #173
    - 2) PPG: 6-7 Speedhide Interior/Exterior Masonry Block Filler
  - b. First and Finish Coats: Flat, latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils.
    - 1) Moore: Regal Wall satin #215
    - 2) PPG: 80 Line Wallhide Interior Wall Flat Latex Paint.

H. SYSTEM NO. 10

1. Semi-gloss, Acrylic-Enamel over Gypsum Board.
  - a. Apply at exposed gypsum board wall surfaces scheduled to receive paint at the following locations:
    - 1) Stairs and service corridors
    - 2) Locker rooms, athletic spaces, toilets.
2. Provide two finish coats over a primer as follows:
  - a. Primer: Latex based interior applied rate recommended by manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

- 1) Moore: Regal First Coat Interior Latex Primer & Underbody #216
- 2) PPG: 17-10 Quick-Drying Interior Latex Primer Sealer.

b. First and Second Coats: Semi-gloss, acrylic-latex- interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.

- 1) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex enamel #333
- 2) PPG: 89-10 Satinhide Interior enamel wall& Trim Lo-Lustre semi-Gloss Latex.

I. SYSTEM NO. 11

1. Low- Lustre, Acrylic-Enamel over Gypsum Board.

a. Apply at exposed gypsum board wall surfaces scheduled to receive low luster, or satin finish paint.

2. Provide two finish coats over a primer as follows:

a. Primer: Latex based interior applied rate recommended by manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

- 1) Moore: Regal First Coat Interior Latex Primer & Underbody #216
- 2) PPG: 17-10 Quick-Drying Interior Latex Primer Sealer.

b. First and Second Coats: Low-Lustre (eggshell or satin), acrylic-latex- interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

- 1) Moore: Moore's Regal AquaVelvet #319
- 2) PPG: 89-Line Manor Hall Eggshell Latex Wall and Trim Enamel

J. SYSTEM NO. 12

1. Flat, Acrylic-Enamel over Gypsum Board.

a. Apply at exposed gypsum board wall surfaces scheduled to receive paint but not included in Systems 10 and 11.

2. Provide one finish coat over a primer as follows:

a. Primer: Latex based interior applied rate recommended by manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

- 1) Moore: Regal First Coat Interior Latex Primer & Underbody #216
- 2) PPG: 17-10 Quick-Drying Interior Latex Primer Sealer.

b. Finish Coat: Flat, acrylic-latex- interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

- 1) Moore: Regal Wall Satin #215AquaGlo Vinyl-Acrylic Latex enamel #333
- 2) PPG: 80 Line Wallhide Interior Wall Flat Latex

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K. SYSTEM NO. 13

1. Low-Lustre, Acrylic Enamel over Steel Surfaces:
  - a. Apply to steel doors and frames, metal trim and other miscellaneous metal items except surfaces included in System 14.
2. Provide two finish coats over primer.
  - a. Primer: Quick drying rust inhibiting alkyd based or epoxy metal primer, as recommended by the manufacturer for this substrate, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 1.5 mils.
    - 1) Moore: IronClad Retardo Rust inhibitive paint #163
    - 2) PPG: 6-208 Speedhide Interior/Exterior rust inhibitive steel primer.
  - b. First and Second Coats: Low luster (eggshell or satin) acrylic-latex, interior enamel applied at spread rate recommended by the manufacturer to achieve a dry film thickness of not less than 2.8 mils.
    - 1) Moore: Moore's Regal AquaVelvet #319
    - 2) PPG: 89-Line Manor Hall Eggshell Latex Wall and Trim Enamel

L. SYSTEM NO. 14

1. Semi-gloss alkyd enamel over steel surfaces:
  - a. Apply to steel surfaces scheduled to be painted, at the following locations:
    - 1) Steel doors and frames not included in Systems 12 or 13.
    - 2) Steel stair components, ladders, railings, and handrails.
    - 3) Metal trim and other miscellaneous items including mechanical and electrical.
2. Provide one finish coat over an undercoat and an alkyd or latex primer. Except for touch up, primer is not required over shop-primed items.
  - a. Alkyd Primer: Quick drying, rust inhibitive, alkyd based or epoxy metal primer, as recommended by the manufacturer for this substrate, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 1.5 mils.
    - 1) Moore: IronClad Retardo Rust inhibitive paint #163
    - 2) PPG: 6-208 Speedhide Interior/Exterior rust inhibitive steel primer.
    - 3) S-W: Kem Kromik Metal Primer B50N2/B50W1
  - b. Latex Primer: Alkyd-modified, acrylic, rust inhibitive latex primer, as recommended by the manufacturer for this substrate, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 1.5 mils.
    - 1) Moore: Retard-X do Rust inhibitive Latex primer #162
    - 2) PPG: 6-208 Red inhibitive metal primer.

- c. Undercoat: Alkyd interior enamel undercoat or semi-gloss interior alkyd enamel finish coat, Alkyd Primer: Quick drying, rust inhibitive, alkyd based or epoxy metal primer, as recommended by the manufacturer for this substrate, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 1.2 mils.
  - 1) Moore: Moore's alkyd Enamel Underbody #217
  - 2) PPG: 6-6 Speedhide Interior Quick Drying Enamel Undercoater
  - 3) S-W: Pro-Mar 200 Interior Alkyd Semi-Gloss Enamel B34W200
  
- d. Finish Coat: Low –odor, semi-gloss, alkyd interior enamel applied at, a spreading rate as recommended by the manufacturer for this substrate, to achieve a dry film thickness of not less than 1.4 mils.
  - 1) Moore: Alkyd Dulamel #207
  - 2) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil
  - 3) S-S: Classic 99 Interior/Exterior Semi-gloss Alkyd Enamel A-40 Series.

M. SYSTEM NO. 15

1. Waterborne Satin –Varnish Finish:
  - a. Apply at hardwood surfaces to receive transparent finish, but not scheduled to receive shop-applied finish by casework fabricator.
  
2. Provide two finish coats of a waterborne, clear satin varnish over sealer coat and a waterborne, interior wood stain. Wipe wood filler before applying stain, if recommended by the manufacturer for wood species indicated.
  - a. Stain Coat: Waterborne, interior wood stain applied at spreading rate recommended by the manufacturer.
    - 1) Moore: Benwood Penetrating Stain #234
    - 2) PPG: 77-302 Rez Interior Semi-transparent Stain.
  
  - b. Sealer Coat: Clear sanding sealer applied at spreading rate recommended by the manufacturer.
    - 1) Moore: (None recommended)
    - 2) PPG: 77-Rez Interior Quick Drying Sealer and Finish.
  
  - c. First and Second Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by manufacturer.
    - 1) Moore: Stays Clear Acrylic Polyurethane #423, Satin
    - 2) PPG: Rez Satin Acrylic Clear Polyurethane

N. SYSTEM NO.16

1. Low-Luster, Acrylic-Enamel over Wood.

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- a. Apply at exposed wood and construction panel surfaces not scheduled to receive transparent, natural, finish.
  2. Provide two finish coats over a primer.
    - a. Primer: Alkyd, or acrylic-latex based, interior wood primer, as recommended by the manufacturer for this substrate, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 1.4 mils.
      - 1) Moore: Moore's Alkyd enamel underbody #217
      - 2) PPG: 17-225 Quick Drying Enamel Undecoat
    - b. First and Second Coats: Low-luster (eggshell or satin) acrylic latex interior enamel, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 2.8 mils.
      - 1) Moore: Moore's Regal Aqua Velvet #319
      - 2) PPG: 89 Line Manor Hall Interior Eggshell Latex Wall and Trim Enamel

O. SYSTEM NO.17

1. Semi-gloss, Alkyd Enamel over other Wood Surfaces.
  - a. Apply at exposed wood and construction panel surfaces not scheduled to receive transparent, natural, finish, and not included in System No. 16.
2. Provide two finish coats over a primer.
  - a. Primer: Alkyd, or -latex based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 1.2 mils.
    - 1) Moore: Moore's Alkyd enamel underbody #217
    - 2) PPG: 17-225 Quick Drying Enamel Undecoat
    - 3) S-W: Pro Mar 200 Alkyd Enamel Undercoater B49W200
  - b. First and Second Coats: Odorless, semigloss, interior enamel, applied at a rate recommended by the manufacturer to achieve a dry film thickness of not less than 2.4 mils.
    - 1) Moore: Alkyd Dulamel #207
    - 2) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil
    - 3) S-W: Classic 99 Interior/Exterior Semi-gloss Alkyd Enamel A-40 Series.

P. SYSTEM NO. 18

1. Two Component Epoxy Coating System for Concrete Floors

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- a. Apply at exposed concrete floors in spaces requiring special high performance coating as scheduled.
  2. Provide two finished coats. Prior to applying coating, condition floor according to coating manufacturer's instructions and recommendations.
    - a. First and Second Coats: High gloss polyamide epoxy coating system applied at spreading rate as recommended by manufacturer to achieve a total dry film thickness of not less than 2.5 mils per coat. Thin first coat per manufacturer's recommendations.
      - 1) Moore: Iron Clad Chemical and Water Resistant Epoxy Enamel #182
      - 2) PPG: 97-1 Series Aquapon Polyamide- Epoxy Ready Mixed Colors
      - 3) Tnemec: Series 67 Tneme-Tread.

Q. SYSTEM NO. 19

1. Concrete Sealer (chemical type).
  - a. Apply at concrete floor surfaces as follows:
    - 1) Indicated to receive glue down carpet installation.
    - 2) Surfaces indicated to be sealed
2. Provide transparent, colorless, penetrating liquid hardener and sealer of proven compatibility with carpet adhesive.
  - a. Prepare surfaces and apply not less than two coats complying strictly with the manufacturer's instructions and recommendations.
    - 1) "Armotrop", by Anti-Hydro Co.
    - 2) "Sikafuard 70", by Sika Corp.
    - 3) "Thoro Penetrating Sealer", by Thoro System Products

END OF SECTION 09912

**SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Escutcheons.
4. Equipment installation requirements common to equipment sections.
5. Painting and finishing.
6. Concrete bases.
7. Supports and anchorages.

**1.2 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.

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1.3 PREVENTION OF CORROSION

- A. For all outdoor applications and all indoor applications in a harsh environment refer to Section 09960, "High Performance Coatings."

1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. All Division 15 work shall comply with the most recent version of the International Mechanical Code, The International Plumbing Code, and the International Fuel Gas Code.
- E. Commissioning of all Division 15 work shall be performed in accordance with ASHRAE Guideline 1 – "The HVAC Commissioning Process."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

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- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

**PART 2 - PRODUCTS**

**2.1 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

**2.2 JOINING MATERIALS**

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 3.2-mm maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 3.2 mm thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

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2.3 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Underground Piping DN 40 and Smaller: Manufactured fitting or coupling.
  - 2. Underground Piping DN 50 and Larger: AWWA C219, metal sleeve-type coupling.
  - 3. Aboveground Pressure Piping: Pipe fitting.
- B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With spring clips and chrome-plated finish.
- F. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.5 PAINTING

- A. For all outdoor applications and all indoor applications in a harsh environment refer to Section 09960, "High Performance Coatings."

**PART 3 - EXECUTION**

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.

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- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
- f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
- h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

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- i. ceilings and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- M. Verify final equipment locations for roughing-in.
- N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- O. No installation shall be permitted which blocks or otherwise impedes access to any existing machine or system. Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations. All indicators, to include gauges, meters, and alarms shall be mounted in order to be easily visible by people in the area.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping DN 50 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping DN 65 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

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3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section "Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 100 mm larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 450-mm centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 20.7-MPa, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- B. Equipment bases and foundations, when constructed of concrete or grout, shall cure a minimum of 28 or 14 days as specified before being loaded.

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3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

**END OF SECTION 15050**

## **SECTION 15110 - VALVES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following general-duty valves:
1. Copper-alloy ball valves.
  2. Ferrous-alloy ball valves.
  3. Ferrous-alloy butterfly valves.
  4. Bronze check valves.
  5. Ferrous-alloy wafer check valves.
  6. Spring-loaded, lift-disc check valves.
  7. Chainwheel actuators.
- B. Related Sections include the following:
1. Division 2 piping Sections for general-duty and specialty valves for site construction piping.
  2. Division 15 Section "Mechanical Identification" for valve tags and charts.
  3. Division 15 Section "HVAC Instrumentation and Controls" for control valves and actuators.
  4. Division 15 piping Sections for specialty valves applicable to those Sections only.

#### **1.2 DEFINITIONS**

- A. The following are standard abbreviations for valves:
1. CWP: Cold working pressure.
  2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  3. PTFE: Polytetrafluoroethylene plastic.

#### **1.3 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

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- C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.4 QUALITY CONTROL

- A. Install devices in accordance with manufacturer's recommendations.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.
- B. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
  - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- C. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- D. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.
- E. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 4. Set butterfly valves closed or slightly open.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

**PART 2 - PRODUCTS**

2.1 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: DN 50 and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: DN 65 and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
  - 1. Gear Drive: For quarter-turn valves DN 200 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Lever Handle: For quarter-turn valves DN 150 and smaller, except plug valves.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

2.2 FERROUS-ALLOY WAFER CHECK VALVES

- A. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.
- B. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.

**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, butterfly, or plug valves.
  - 2. Throttling Service: Ball, butterfly, plug, or valves.
  - 3. Pump Discharge: Spring-loaded, lift-disc check valves.
- B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
  - 1. Ball Valves, DN 50 and Smaller: Two-piece, 2760-kPa CWP rating, copper alloy.

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2. Ball Valves, DN 65 and Larger: Class 150, ferrous alloy.
3. Butterfly Valves, DN 65 and Larger: Flangeless, 1035-kPa CWP rating, ferrous alloy, with EPDM liner.
4. Swing Check Valves, DN 50 and Smaller: Type 4, Class 125, bronze.
5. Swing Check Valves, DN 65 and Larger: Type II, Class 125, gray iron.
6. Wafer Check Valves, DN 65 and Larger: Single-plate, wafer, Class 125 or 150, ferrous alloy.

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7. Spring-Loaded, Lift-Disc Check Valves, DN 50 and Smaller: Type IV, Class 125 minimum.
8. Spring-Loaded, Lift-Disc Check Valves, DN 65 and Larger: Type I, Class 125, cast iron.

**3.3 VALVE INSTALLATION**

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
  1. Swing Check Valves: In horizontal position with hinge pin level.
  2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  3. Lift Check Valves: With stem upright and plumb.

**3.4 JOINT CONSTRUCTION**

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

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3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

**END OF SECTION 15110**

## SECTION 15140 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes domestic (potable) water piping from locations indicated to fixtures and equipment inside the building.
- B. Related Sections include the following:
  - 1. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
  - 2. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

#### 1.2 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Domestic Water Service Piping: 1100 kPa.
  - 2. Domestic Water Distribution Piping: 1035 kPa.

#### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with ASME B31.9, "Building Services Piping," for materials, products and installation.
- C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.
- D. The distribution system shall be designed in accordance with the requirements of the International Plumbing Code.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Underground Domestic Water Service Piping: Protect piping from exterior corrosion in accordance with AWWA Manual 27. Use the following piping materials for each size range:
  - 1. DN 50 and Smaller: Soft copper tube, Type A; copper pressure fittings; and soldered joints. Underground installation of soft copper tubing is to be installed in building interior only.
  - 2. DN 65 to DN 90: Soft copper tube, Type A; copper pressure fittings. Underground installation of soft copper tubing is to be installed in building interior only.
  - 3. DN 100 to DN 200: Mechanical- or push-on-joint, ductile-iron pipe; mechanical- or push-on-joint, ductile-iron fittings; and restrained, gasketed joints.
  - 4. DN 250 and DN 300: Mechanical- or push-on-joint, ductile-iron pipe; mechanical- or push-on-joint, ductile-iron fittings; and restrained, gasketed joints.
- D. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
  - 1. DN 40 and Smaller: Hard copper tube, Type B; copper pressure fittings; and soldered joints.
  - 2. DN 50: Hard copper tube, Type B; copper pressure fittings; and soldered joints.
  - 3. DN 65 to DN 90: Hard copper tube, Type B; copper pressure fittings; and soldered joints.

### 2.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use bronze ball valves for piping DN 50 and smaller. Use cast-iron butterfly valves with flanged ends for piping DN 65 and larger.
  - 2. Throttling Duty: Use bronze ball or globe valves for piping DN 50 and smaller. Use cast-iron butterfly valves with flanged ends for piping DN 65 and larger.
  - 3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
  - 4. Drain Duty: Hose-end drain valves.

## 2.4 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 15 Section "Meters and Gages," and drain valves and strainers are specified in Division 15 Section "Plumbing Specialties."
- F. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 15 Section "Plumbing Specialties."
- G. Install domestic water piping level and plumb.
- H. If water treatment is to be done within the building or if no water treatment is required, extend domestic water service piping to exterior water distribution piping in sizes and locations indicated. If water treatment is to be done remotely on-site outside the building, extend domestic water service piping to exterior water distribution piping connecting building domestic water service with remote water treatment in sizes and locations indicated.
- I. Extend domestic water service to all plumbing fixtures supplying water for drinking, culinary use, or processing food.
- J. Extend domestic water service to domestic hot water. Domestic hot water shall be supplied to all plumbing fixtures and equipment used for building maintenance, food preparation, and dishwashing.

- K. Install underground ductile-iron piping according to AWWA C600 and AWWA M41. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- L. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- M. Perform the following steps before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
  - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.
- N. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- O. Check plumbing specialties and verify proper settings, adjustments, and operation.
  - 1. Water-Pressure Regulators: Set outlet pressure at 550 kPa maximum, unless otherwise indicated.

## 2.5 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

## 2.6 VALVE INSTALLATION

- A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping DN 50 and smaller. Use butterfly valves for piping DN 65 and larger.
- B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping DN 50 and smaller. Use butterfly valves for piping DN 65 and larger.
- C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

## 2.7 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 30 m and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 30 m: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 30 m, if indicated: MSS Type 49, spring cushion rolls.
  3. Multiple, Straight, Horizontal Piping Runs 30 m or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 10 mm.
- E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. DN 100 and DN 125: 3.7 m with 16-mm rod.
  2. DN 150: 3.7 m with 19-mm rod.
  3. DN 200 to DN 300: 3.7 m with 22-mm rod.
- F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. DN 20 and Smaller: 1500 mm with 10-mm rod.
  2. DN 25 and DN 32: 1800 mm with 10-mm rod.
  3. DN 40 and DN 50: 2400 mm with 10-mm rod.
  4. DN 65: 2700 mm with 13-mm rod.
  5. DN 80 to DN 90: 3 m with 13-mm rod.
- G. Install supports for vertical copper tubing every 3 m.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

## 2.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
  - 1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
  - 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for DN 65 and larger.

## 2.9 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested. Tests are to be witnessed by the government.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Cap and subject piping to static water pressure of 150 percent of operating pressure, without exceeding pressure rating of piping system materials. This test pressure is to be maintained for a period of at least 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

2.10 ADJUSTING

- A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - 1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  - 2. Adjust calibrated balancing valves to flows indicated.

2.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 mg/L of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 mg/L of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140