

- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; with maximum flame-spread and smoke-developed indices of 10 and 10, respectively; passing ASTM E 136 for combustion characteristics.
1. Available Products:
    - a. CertainTeed Corporation.
    - b. Johns Manville Corporation.
    - c. Owens Corning.
- D. Acoustical Insulation: As specified in Division 7 Section "Building Insulation."

### PART 3 - EXECUTION

#### 3.1 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
  2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
    - a. Use deep-leg deflection track, unless noted otherwise.
    - b. Use proprietary firestop track at fire rated assemblies and where indicated.
- C. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

#### 3.2 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs 1/2 inch (13 mm) short of full height to provide perimeter relief.

2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
- D. Install steel studs and furring at the following spacings:
1. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
  2. Multilayer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
1. Install two 0.312 inch (0.79 mm) (20 gage) studs at each jamb, unless otherwise indicated.
  2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint.
  3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

### 3.3 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- F. Attach gypsum panels to framing provided at openings and cutouts.
- G. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  2. Fit gypsum panels around ducts, pipes, and conduits.
  3. Where partitions intersect open concrete coffer, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffer, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- H. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with LC-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- I. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
  - J. Fire-Resistance-Rated Gypsum Board Assemblies: Provide firestop system at the top of fire-resistance-rated gypsum board assemblies. Provide firestop system around any structural penetration of wall assembly.
  - K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
    1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

### 3.4 PANEL APPLICATION METHODS

- A. Single-Layer Application:
  1. On partitions/walls, apply gypsum panels [vertically (parallel to framing)] [horizontally (perpendicular to framing)], unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- B. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- C. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- D. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

### 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

### 3.6 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
  - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
  - 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where indicated.
  - 3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where indicated.
  - 4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, and for fire-resistance-rated and sound-rated assemblies, unless otherwise indicated.

END OF SECTION

## SECTION 09511

### ACOUSTICAL PANEL CEILINGS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

##### 1.2 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
  2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.
- C. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.

##### 1.3 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

##### 1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
  2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

#### PART 2 - PRODUCTS

##### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the following paragraphs of Part 2.

BARBER FOODS  
ADMIN/SECURITY VESTIBULE

ACOUSTICAL PANEL CEILINGS

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## 2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
1. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing ASTM E 1264 pattern designations and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range of products that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Water-Felted, Mineral-Base Acoustical Panels for Acoustical Panel Ceiling ACT-1: Where this designation is indicated, provide acoustical panels complying with the following:
1. Products: Provide one of the following:
    - a. Armstrong Cortega, No. 769.
    - b. Celotex Barouque, No. BET-197
    - c. USG Radar, No. 2310.
  2. Classification: Panels fitting ASTM E 1264 for Type III, mineral base with painted finish; Form 2, water felted.
  3. Pattern: Panels fitting ASTM E 1264 pattern designation (description) C (perforated, small holes); D (fissured).
  4. Color: White.
  5. Light Reflectance Coefficient: Not less than LR 0.80.
  6. Noise Reduction Coefficient: NRC 0.55.
  7. Ceiling Attenuation Class: Not less than CAC 35.
  8. Edge Detail: Square.
  9. Thickness: 5/8 inch (16 mm).
  10. Size: 24 by 48 inches (610 by 1220 mm).
- D. High-Density Ceramic-Base Acoustical Panels with Scrubbable Finish for Acoustical Panel Ceiling ACT-2: Where this designation is indicated, provide acoustical panels, treated with antimicrobial solution, and complying with the following:
1. Products: Available products include the following:
    - a. Armstrong Ceramaguard No. 602.
    - b. Celotex Vinyl Shield A.
    - c. USG Ceramic ClimaPlus No. 56645.
  2. Classification: Panels fitting ASTM E 1264 for Type XX, other types; described as high-density, ceramic-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
  3. Pattern: Panels fitting ASTM E 1264 pattern designation (description) CD (perforated, small holes and fissured). G (smooth).
  4. Color: White.
  5. Light Reflectance Coefficient: Not less than LR 0.80.
  6. Noise Reduction Coefficient: NRC 0.55.
  7. Ceiling Attenuation Class: Not less than CAC 40.
  8. Edge Detail: Square.

9. Thickness: 5/8 inch (16 mm).
10. Size: 24 by 48 inches (610 by 1220 mm).

### 2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, UL certified load compliance, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Suspension System for Acoustical Panel Ceilings: Where this designation is indicated, provide acoustical panel ceiling suspension system complying with the following:
  1. Products: Provide one of the following:
    - a. Prelude 15/16" Exposed Tee System; Armstrong World Industries, Inc.
    - b. S11 System; Celotex Corporation.
    - c. 1200 System; Chicago Metallic Corporation.
    - d. DX 24 System; USG Interiors, Inc.
  2. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G01 (Z001) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges; other characteristics as follows:
    - a. Structural Classification: Intermediate-duty system.
    - b. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
    - c. Face Design: Flush face.
    - d. Cap Material: Steel sheet.
    - e. Cap Finish: Painted white.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
  1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where ceilings in locker rooms are indicated.
- D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
  1. Postinstalled Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- F. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

- G. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- H. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- I. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
  - 1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
  - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
    - 1. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
  - 8. Do not attach hangers to steel deck tabs.
  - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.



10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.
  2. Do not use exposed fasteners, including pop rivets, on moldings and trim except where required for vertical framing.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  1. Arrange directionally patterned acoustical panels as follows:
    - a. Install panels with pattern running in one direction parallel to long axis of space.
  2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

### 3.2 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs acoustical panel ceilings, conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of acoustical panels until deficiencies have been corrected.
  1. Complete the following in areas to receive gypsum board ceilings:
    - a. Installation of 80 percent of lighting fixtures, powered for operation.
    - b. Installation, insulation, and leak and pressure testing of water piping systems.
    - c. Installation of air-duct systems.
    - d. Installation of air devices.
    - e. Installation of mechanical system control-air tubing.
    - f. Installation of through-penetration firestop systems.

### 3.3 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed exterior items and surfaces.
  - 2. Exposed interior items and surfaces.
  - 3. 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 the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect 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 work, and primed metal surfaces of mechanical and electrical equipment.
  
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1.2 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
  - 1. Material List: Provide 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.
  - 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  - 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
  
- B. Samples for Selection: Manufacturer's color chips showing the full range of colors available for each type of finish-coat material indicated.
  - 1. After color selection, the Architect will furnish color list of color selections for surfaces to be coated.
  
- 1.3 QUALITY ASSURANCE
  - A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the 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.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

#### 1.5 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

#### 1.6 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.
1. California Paint Co. (Cal).
  2. Benjamin Moore & Co. (Moore).
  3. ICI Dulux Paints (ICI)
  4. PPG Industries, Inc. (PPG).
  5. Sherwin-Williams Co. (S-W).
  6. Tnemec (Tne)

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and 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 professional paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide color selections made by the Architect. Allow for up to 5 different color selections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- 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.
1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

### 3.2 PREPARATION FOR NEW SURFACES

- A. **General:** 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 the 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.
- B. **Cleaning:** Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. **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:** Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. 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.
    - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
    - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
  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 backsides of wood, including cabinets, counters, cases, and paneling.
    - c. When transparent finish is required, backprime with spar varnish.
    - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
    - 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 the Steel Structures Painting Council's (SSPC) recommendations.
    - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
    - 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 the same primer as the shop coat.
- d. Piece Marks: Remove piece marks or numbers and characters that identify components for erection prior to field painting. Applying a primer to cover the marks will also be acceptable.
- 5. Galvanized Surfaces: Clean galvanized surfaces with a palm sander and 60 grit sandpaper so surface is free of surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- 6. New Stair Framing, Railings, Handrails, Hollow Metal Doors, Frames, and Borrowed Lites: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand primed surfaces exposed to view smooth and dust off.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

- 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.
- 3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.

- 1. Do not tint prime or base coat for multi-colored finishes.

### 3.3 PREPARATION FOR EXISTING SURFACES

A. General: 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 the 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.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

- 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. 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: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove 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.
  - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
  - b. Apply primer and one finish coat over new construction patched into existing construction.

- c. Apply one finish coat over existing walls scheduled to receive paint finish. Paint entire walls, corner to corner.
- 3. Gypsum Board: Prepare gypsum surfaces to be painted. Remove dust, dirt, grease, and oils. Touch-up drywall surface as required for smooth surface, removing dents, gouges, scratches, etc.
  - a. Apply primer and one finish coat over new construction patched into existing construction.
  - b. Apply one finish coat over existing surfaces scheduled to receive paint finish. Paint entire walls, corner to corner.
- 4. 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. Apply primer and one finish coat over new construction patched into existing construction.
  - b. Apply one finish coat over existing wood surfaces scheduled to receive paint finish.
- 5. 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 the Steel Structures Painting Council's (SSPC) recommendations.
  - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
  - 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 coat and one finish coat that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
  - d. Apply one finish coat over existing surfaces scheduled to receive paint finish.
- 6. Existing Hollow Metal Doors, Frames, and Borrowed Lites: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand primed surfaces exposed to view smooth and dust off.
  - a. Apply primer and one finish coat over touch-up areas.
  - b. Apply one finish coat over existing surfaces scheduled to receive paint finish.

### 3.4 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
  - 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  - 3. Provide finish coats that are compatible with primers used.
  - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  - 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
  10. Sand lightly between each succeeding enamel or varnish coat.
- B. 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. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer on metal surfaces that have been shop primed and touchup painted.
  3. 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. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. When using colors such as red, yellow or orange, an extra coat of finish may be necessary. Notify Architect when additional coats do not fix the problem.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the 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.
- H. 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.



- I. 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.
1. Provide satin finish for final coats.

- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### 3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.7 EXTERIOR PAINT SCHEDULE

- A. Ferrous and Zinc-Coated Metal: Provide the following finish systems over exterior ferrous and zinc-coated metals. Primer is not required on shop-primed items except as noted above.
1. Full-Gloss, Aliphatic Urethane Finish: 2 finish coats over a galvanized metal primer or compatible shop primer.
    - a. Touch-up for Primer: Metal primer applied at spreading rate of 2-3 mils DFT (Dry Film Thickness).
      - 1) Tne: Tnemec Series 27 Typoxy
    - b. First and Second Coats: Full-gloss, aliphatic urethane finish applied at spreading rate of 2-3 mils DFT.
      - 1) Tne: Tnemec Series 73 Endura-Shield III.

### 3.8 INTERIOR PAINT SCHEDULE

- A. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:
1. Low VOC, Eggshell, Acrylic-Enamel Finish: 2 finish coats over a block filler.
    - a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer.
      - 1) Moore: Super Craft Latex Block Filler #285.
      - 2) ICI: 3100-1200, Ultra-Hide Gripper Interior/Exterior Block Surfacer.

- 3) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
  - 4) S-W: PrepRite Block Filler B25W25 Series.
- b. First and Second Coats: Eggshell, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer.
- 1) Moore: Pristine Eco Spec Interior Latex Eggshell, No. 223
  - 2) ICI: LifeMaster 2000 Interior Eggshell, LM9300
  - 3) PPG: Pure Performance Eggshell Interior Latex, 9-411 Series.
  - 4) SW: Harmony® Interior Latex Eg-Shel, B9 Series.

B.

- Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
1. Low-Voc, Flat Acrylic Ceiling Finish: 2 finish coats over a primer.
    - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer.
      - 1) Moore: Pristine Eco Spec Interior Latex Primer Sealer, No. 231
      - 2) ICI: LifeMaster 2000 Interior Primer-Sealer, LM9116
      - 3) PPG: Pure Performance Interior Latex Primer, 9-2 Series.
      - 4) SW: Harmony® Interior Latex Primer, B11W900 Series.
    - b. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer.
      - 1) ICI: 1210-XXXX, Ultra-Hide Latex Flat Interior Wall Paint.
      - 2) Moore: Super Spec Latex Flat #275.
      - 3) PPG: Speedhide Interior Flat Latex, 6-70 Series.
      - 4) S-W: Harmony® Interior Latex Flat B5 Series.
  2. Low VOC, Eggshell, Acrylic-Enamel Finish: 2 finish coats over a primer.
    - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer.
      - 1) Moore: Pristine Eco Spec Interior Latex Primer Sealer, No. 231
      - 2) ICI: LifeMaster 2000 Interior Primer-Sealer, LM9116
      - 3) PPG: Pure Performance Interior Latex Primer, 9-2 Series.
      - 4) SW: Harmony® Interior Latex Primer, B11W900 Series.
    - b. First and Second Coats: Eggshell, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer.
      - 1) Moore: Pristine Eco Spec Interior Latex Eggshell, No. 223
      - 2) ICI: LifeMaster 2000 Interior Eggshell, LM9300
      - 3) PPG: Pure Performance Eggshell Interior Latex, 9-411 Series.
      - 4) SW: Harmony® Interior Latex Eg-Shel, B9 Series.

- C. Exposed Ferrous Metals (Metal doors and frames, railings): Provide the following finish systems over interior ferrous metals:
1. Gloss, Polyamide-Epoxy Finish: 2 finish coats over a primer.
    - a. Touch-up for Primer: Metal primer applied at spreading rate of 2.5-3 mils DFT (Dry Film Thickness).
      - 1) Tne: Themec Series 27 Typoxy
    - b. Intermediate Coat: Finish coat applied at spreading rate of 2 mils DFT (Dry Film Thickness).
      - 1) Tne: Themec Series 1080.
    - c. Finish Coat: Finish coat applied at spreading rate of 2 mils DFT (Dry Film Thickness).
      - 1) Tne: Themec Series 1080.

- D. Exposed Metal Deck and Steel Joists: Provide the following finish systems over ferrous metal:
  - 1. Modified Alkyd or Epoxy Finish: 1 finish coat over primed metal.
    - a. Finish Coat: Eggshell, modified alkyd or epoxy-based interior paint applied at spreading rate recommended by the manufacturer.
      - 1) Tnemec: Uni-Bond, Series 16.

END OF SECTION

SECTION 211313

AUTOMATIC FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Rework existing heads on renovated area. Design, install, test, and guarantee a completely automatic sprinkler system throughout the renovated area.

1.2 GENERAL REQUIREMENTS

- A. The provisions of Section 230500 "Supplemental Mechanical Requirements for the Design and Installation of the Mechanical Systems for Barber Foods Admin/Security Vestibule, Portland, Maine" are made a part of this section.
- B. Qualifications: The Contractor for the Fire Protection Work shall be a recognized, qualified Contractor primarily engaged in the design and installation of Fire Protection Systems.
- C. Substitutions: Your attention is directed to Section 230500 relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- D. Coordinate sprinkler layout with all trades and architect/engineer.

PART 2 FIRE PROTECTION SYSTEM DESIGN

2.1 SYSTEM DESIGN

- A. Design and document a full coverage dry pipe sprinkler system in accordance with NFPA-13, Chapter 7, Hydraulically Designed Sprinkler Systems, and NFPA-24, Fire Service Mains.

2.2 SPRINKLER COVERAGE

- A. Sprinkler Coverage shall be:
  - 1. Offices, lobbies, Toilets and similar areas: Light Hazard Occupancy 0.1 GPM/sq.ft. for most remote 1500 sq.ft.

PART 3 - PRODUCTS

3.1 PIPE AND FITTINGS

- A. Interior (Above Ground):
  - 1. Pipe shall be schedule 40 steel conforming to ASTM A120-63T (ANSI 836.20) or as otherwise allowed by NFPA standards subject to owner's insuring agent approval.

2. Pipe fittings may be cast, malleable or ductile iron. Screwed cast iron fittings shall conform to ANSI B16.4 with 175 PSI cold water rating. Screwed fittings shall have tapered pipe threads.

B. Exterior (Under Ground):

1. Pipe shall be Class 150 cement lined ductile iron pipe, per ANSI A21.6-1062, U.S. approved and as approved or acceptable to the local utility.
2. Bends, elbows, tees, and crosses shall conform to ANSI A21.10 for short body cast-iron fittings and shall be set plumb.
3. Joints shall be U.S. approved push-on, or mechanical joints. Standard mechanical joints made in accordance with ANSI A21.11 are approved if acceptable to the local utility.

3.2

VALVES

- A. Shall be U.L. approved gate, check, and detector check valve.
- B. Gate valves shall be O.S. and Y.
- C. O. S. & Y. valves shall be installed on each side of the check valve in the riser.
- D. Valves indicated above shall be chained and locked in the open position. Locks shall be fitted with breakable shanks.
- E. Valves: Provide as required by NFPA 24 for fire service. Gate valves shall conform to AWWA C500 or UL 262 with cast iron body and bronze trim, and shall open by counterclockwise rotation.
- F. Post Indicator Valves: Gate valves for uses with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Provide indicator post with one coat of primer and two coats of red enamel paint.
- G. Valve Boxes: Except where indicator posts are provided, provide each gate valve in buried piping with an adjustable cast-iron valve box of a size suitable for the valve on which it is to be used. Boxes outside of paved areas may be of Acrylonitrile-Butadiene-Styrene (ABS) plastic or of inorganic fiber reinforced black polyolefin plastic. The head shall be round and the lid shall have the word WATER cast on it. The least diameter of the shaft of the box shall be 5.25 inches. Provide each cast-iron box with a heavy coat of bituminous paint.

3.3

SPRINKLER HEADS

- A. Sprinklers shall be U.L. approved quick response commercial spray upright or pendent for 165° temperature classification.
- B. Pendent white heads and white escutcheons shall be provided in finished ceiling areas. Natural finish upright or pendent may be used in other areas.
- C. Sprinkler heads shall be located at the center of the ceiling tile for lay-in ceilings.

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- D. Sprinkler heads located 7'-6" or less from finished floor shall be provided with approved sprinkler head guards.
- E. Install deflector plates on heads which are located adjacent to electrical equipment, to direct water flow away from equipment.
- F. Adjacent to supervisory panel, provide a steel cabinet containing spare chrome plated pendent heads and spare natural finish upright heads and sprinkler wrenches, as required by NFPA 13. (Minimum 6 heads of each type furnished).

#### PART 4 - EXECUTION

##### 4.1 PIPING LAYOUT AND DESIGN

- A. Sprinkler piping shall be run concealed above ceilings where possible in occupied areas. Piping in other areas may be run exposed.
- B. In general, sprinkler piping shall be installed at maximum height throughout the building, except where piping must be run below air distribution duct. Piping installation shall be consistent with fire codes. Note: Before installing any piping, the contractor shall verify that there is sufficient clearance between the bottom of the ductwork and the top of the ceiling system to install his piping. If it is determined that insufficient clearance is available, the contractor shall notify the Architect.
- C. The piping system shall be installed in accordance with drawings and to avoid interference with structure, lights, ducts, diffusers, piping for other trades, storage areas, and bins. Sprinkler heads shall be located to provide a minimum of 6" clearance between ceiling diffusers, grilles, and lighting fixtures.

##### 4.2 PIPE ANCHORAGE

- A. Anchor underground mains, tees, ells, bends, valves, with concrete thrust blocks, bolted tie rods, and pipe clamps, or a combination of rods and thrust blocks, to resist the unbalanced thrust of water pressure of 200 PSI. Provide appropriate supporting and anchoring members for above ground piping so that the load imposed by the piping will not exceed the limitations of the structure.

##### 4.3 HANGERS

- A. Support sprinkler piping, valves and other components as specified in NFPA Pamphlet #13 for installing sprinkler equipment. Hangers shall be U.L. approved.
- B. U.S. approved expansion shields or explosion-driven fasteners shall be used for attaching to the building structure or to supplementary steel Members.
- C. Hangers suspended from bar joists shall be suspended at joist panel points. Hangers shall be supported concentrically from building structural members.

4.4

#### DRAINAGE

- A. Pipes shall be pitched to drain to the draw-off connection. Where it is impossible to avoid trapping any fire lines, trapped lines shall be pitched to auxiliary drains.

4.5

#### INSPECTOR'S TEST CONNECTION(S)

- A. Provide inspector test connection(s) as required. Extend drains from test connections to outdoors.

4.6

#### SIGNS

- A. Identification signs shall be provided for system and auxiliary drains, inspector's test connections, alarms, control valves, and as required by NFPA codes or local requirements.
- B. Furnish a 14"x18" colored, glass framed building plan drawing showing division lines of fire sprinkler system zones. Mount framed drawing on wall adjacent to sprinkler risers. The plan shall indicate fire zones, riser location, control valves, fire alarm location, and outside fire hydrant locations.

4.7

#### DISINFECTION

- A. Disinfect the new water piping in accordance with AWWA C601. Fill the piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine contents is not greater than 0.2 parts per million.

4.9

#### TESTING

##### A. Interior Piping Test:

1. Hydrostatic test shall be made on each system at 200 PSI for two (2) hours, and any additional tests as required by NFPA, ISO, and the owner's insuring agent.
2. Ceilings will not be installed until sprinkler piping has been installed and tested. Notify the Architect at least 24 hours before any scheduled test.
3. Defects made evident by the tests shall be properly repaired by the contractor. Leaks in piping shall be repaired only by means of tightening or replacing the fitting and not by any caulking method.
4. Certified test results to verify the actual water supply system properties at the base of the sprinkler risers, shall be submitted to the Architect. The results shall note the static pressure, and the water flow rate (G.P.M.) and the resultant residual pressure.
5. Perform tests to verify the adequacy of the water supply system, and the system design shall be based on these certified test results.

##### B. Underground Piping Test:

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1. Before backfilling trench, newly laid underground pipe shall be subjected to a hydrostatic test of 200 PSI for two (2) hours to determine that joints are tight and that there are no defective pipes or fittings.
  2. Defective joints or pipe shall be cut out and replaced. Remove and replace any cracked or defective pipes, fittings, valves or hydrants with new material.
- C. Alarm System and Control Test: Perform tests as required by NFPA, ISO, the owner's insuring agent, and the local fire marshal to certify the sequence of operation of alarms and controls.
- D. After the fire sprinkler system has been completely approved, secure a letter of final acceptance from the fire rating office having jurisdiction and deliver three copies of the letter to the Owner.

#### 4.10

#### WARRANTY

- A. Repair or replace any defective materials or workmanship supplied or performed for a period of one (1) year after completion of this installation at no expense to the Owner. Upon completion of the installation, the system shall be turned over to the Owner fully inspected and tested, and in operating condition.

#### 4.11

#### CERTIFICATE OF INSTALLATION

- A. Submit certificate upon completion of fire protection system work which indicates that work has been tested in accordance with NFPA 13 and also that system is operational, complete, and has no defects.

END OF SECTION



SECTION 230000

HVAC

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the Minimum Standards includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to design and install a complete and functional heating, ventilating and air conditioning system.

1.2 GENERAL REQUIREMENTS

- A. The provisions of Section 230500 "Supplemental Mechanical Requirements for the Design and Installation of the Mechanical Systems for BARBER FOODS Admin/Security Vestibule, Portland, Maine" are made a part of this section.
- B. Substitutions: Your attention is directed to Section 230500, relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of these Minimum Standards.
- C. Coordinate with all trades and Architect/Engineer.

PART 2 HEATING, VENTILATING AND AIR CONDITIONING SYSTEM DESIGN

2.1 DESIGN SCOPE

- A. Admin Offices: Existing ductwork and diffusers will be relocated and reworked from existing ceiling into new ceiling. Supply and return ductwork/grilles will be reworked into new ceiling layout. Thermostats in two rooms with walls being demolished shall be relocated as directed by Barbar Foods Facilities director. Refer to Drawings D101 and A101.
- B. Employee Entrance Area: Two (2) existing mini split indoor wall mounted units located in two offices will be relocated from partition wall to exterior wall. These two rooms will be combined into one space. Refrigeration piping will need to be modified and condensate piping will need to get reworked to new location. In new security desk area contractor shall add hydronic wall heater behind new desk and a new hydronic cabinet unit heater in new vestibule. Connect to hydronic piping located in old cafeteria. New t-stat shall be installed on wall behind desk to control wall heater behind security desk. Cooling for new area shall be provided from existing ducted rooftop unit. Add ductwork and diffuser near security desk. Move t-stat from cafeteria to behind security desk.
- C. Automatic Temperature Control – Rework existing controls and t-stats to suit new layout.

## PART 3 PRODUCTS

### 3.1 PIPING MATERIALS

- A. Hot Water Piping: Type L hard copper tubing with cast bronze or wrought copper solder fittings or Schedule 40 carbon steel pipe. Fittings for steel pipe are as indicated in paragraph "Fittings for Steel Pipe".

### 3.2 VALVES

#### A. Ball Valves:

1. 1/2" thru 2" copper, Apollo Model 70-203 thru 70-208.
2. 1/2" thru 2" IPS, Apollo Model 70-103 thru 70-108.
3. 1-1/2" thru 4" IPS, Victaulic style 721.

#### B. Gate Valves: Nibco.

1. 1/2" thru 2", copper, Model S-113.
2. 1/2" thru 2-1/2" IPS, Model T-113.

#### C. Check Valves:

1. 1/2" thru 2" copper, Nibco Model S-413.
2. 1/2" thru 2" IPS, Nibco Model T-413.
3. 2" thru 4" IPS, Victaulic series 712.

#### D. Butterfly Valves:

1. 1-1/2" thru 6", Victaulic style series 700 with standard handle.

2. 2-1/2" thru 6", 150 psi working pressure, Centerline or Norris. Lug type, iron body, 316SS disc and shaft, Buna-N seat.

#### E. Outside Screw and Yoke (OS&Y) Gate Valves: Nibco Class 250 Model F-667-0, iron body, flanged.

- F. Shut-off Valves for Fuel Oil Service: Apollo ball valves series 80-100 YRBX for flammable liquids. Valve shall be UL listed for this service.

### 3.3 FITTINGS FOR STEEL PIPE

#### A. Fittings in sizes 1/2" through 2": Steel or malleable iron with requirements as follows:

1. Steel fittings socket welding or screwed type conforming to ANSI B16.11.
2. Malleable iron fittings screwed type conforming to ANSI B16.3.
3. Victaulic rolled or cut grooves with rigid couplings and flexible couplings where required for expansion.

#### B. Fittings in sizes 2-1/2" and larger:

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1. Butt welding type conforming to ANSI B16.9.
  2. Flanged type conforming to ANSI B16.5.
  3. Victaulic rolled or cut grooves with rigid coupling and flexible couplings where required for expansion.
- C. Steel Flanges: Forged steel, welding type conforming to ANSI B16.5. Bolting and gaskets shall be as follows:
1. Bolting: Material used for bolts and studs shall conform to ASTM A 307, Grade B, and material for nuts shall conform to ASTM A 194, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ANSI B18.2.1 and ANSI B18.2.2 with threads conforming to ANSI B1.1 coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts.
  2. Gaskets: Gaskets shall be of a material that resists attack by the fluid or gas in the pipeline and shall be suitable for the pressure and temperature ranges encountered. Gaskets shall be as thin as the finish of surfaces will permit. Raised-face steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Gaskets shall have an inside diameter equal to or larger than the port openings.
- D. Butt Weld Joints: Shall conform to ANSI B31.1. The use of backing rings shall conform to ANSI B31.1. Ferrous rings shall be of weldable quality and shall not exceed 0.05 percent sulfur. Backing rings shall be of the continuous machined or split band type.

#### 3.4

##### HANGERS

- A. Adjustable Swivel Hanger: Carpenter and Paterson Fig. 800 or Clevis hanger Carpenter and Paterson Fig. 100.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 for steel pipe and Fig. 126 CT for copper tube.

#### 3.5

##### DUCT INSULATION AND ACOUSTIC LINING

- A. Duct Insulation: Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density, 0.29 but-in/hr-sf-°F conductivity, 0.05 permeance rating, fire hazard classification (flame/fuel/smoke) 25/50/50. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated.
- B. Acoustical Duct Lining: Acoustic lining and insulation: Knauf or Owens-Corning neoprene coated, duct liner board for 4000 FPM service (only), UL rated and NFPA-90A approved, thickness as indicated, 1.5 lb. density, 0.28 btu-in/hr-sf-EF conductivity, and fire safety rating of flame spread 25 and smoke developed 50.

#### 3.6

##### SHEETMETAL WORK AND MATERIALS

- A. Low Pressure Ductwork (Static Pressure  $\leq$  2" WG):

1. Rigid Ductwork: Galvanized steel conforming to ASTM A527, weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq. ft. of a sheet. Construction, metal gage, and reinforcements shall conform with SMACNA "Duct Construction Standards" and NFPA 90A for 1" W.G. pressure class for exhaust ductwork, return ductwork.
2. Low Pressure Flexible Ductwork: Wiremold Type "WG" with 1" thick thermal insulation. The duct shall be suitable for working pressures up to 10" WG.
3. Access Doors: Ruskin Model ADC2, 10"x10" size, 24 gauge galvanized steel, steel on both sides of door, foam gasket seals, 1" insulation, 4 cam locks, no hinge.
4. Turning Vanes: Solid, single blade, mounted with the long edge down stream.
5. Spin-in Fittings: General Environmental Corporation "Genflex" Model SM-2DE or Model SM-2DEL.
6. Manual Balancing Dampers: Ruskin Model MD-35 opposed blade with locking quadrant.

**B. Access Doors:**

1. Low Pressure Duct Systems: Ventlok 10" x 12" or as indicated with #99 Ventlok cam locking latches and no hinge.
2. Medium Pressure Duct Systems: Provide hinged, gasketed access doors with cam lock type fasteners rated for 6 inches WG pressure. Access doors shall be United Sheet Metal Type ARF-WD, designed as a pressure relief valve.

**C. Automatic Control Dampers:**

1. Automatic dampers not furnished as an integral part of an item of equipment shall conform to this paragraph. Automatic dampers shall be constructed and installed in accordance with the following Minimum Standards and shall be Arrow "Arrow-Foil" Model PBDAF-206, OBDAF-207 or Ruskin Model CD-50:
  - a. Damper Blades: Automatic dampers, including dampers for static pressure control, shall be of the balanced type, factory-fabricated, with fully gasketed extruded aluminum airfoil blades, mounted in welded frames. Damper blades shall be not more than 8 inches wide, shall have interlocking edges and be capable of operation against 4" static pressure differential.
  - b. Proportioning Dampers: Proportioning dampers shall be of the opposed blade type.
  - c. Damper Size and Bearings: Damper blades shall have steel trunnions mounted in oil-impregnated bearings. Dampers shall be not more than 48 inches in length between bearings.
  - d. Frames: Damper frames shall be of welded channel or angle-iron, with heavy steel corner gussets and braces or stiffened with steel tie-rods where necessary. Frames shall be painted with aluminum paint to prevent rusting.

- e. Dampers shall be guaranteed to close tight, and shall provide substantially the full area of the opening when open. Outdoor air intakes and exhaust ducts to outside and fresh air, return air and exhaust air dampers in systems shall have damper blades with inflatable seals or other devices to guarantee low leakage, not to exceed 6 CFM/SF at 1 in. WG pressure differential.
  - f. Damper Linkages: Damper-operating links shall be steel or brass rods, adjustable in length with ball and socket joints and of such proportions that they will withstand, without appreciable deflection, a load equal to not less than twice the maximum operating force of the damper motor. Linkages shall be concealed in the frame.
- D. Louvers: Ruskin ELF-6375D, box frame, for masonry walls, drainable blade, extruded aluminum construction. Provide 1/2" expanded metal bird screen on interior. Louver finish shall be Kynar, color selected by Architect. Coordinate sizes, shapes and locations with the architectural drawings. Pitch duct connecting to louver toward outside to facilitate draining. Seal duct water tight at connection point to louver. Refer to architectural drawings for further details.
  - E. Fire Dampers: Ruskin Model IBD2 curtain type with blades out of the airstream, 1-1/2 Hr. rated in accordance with UL and NFPA requirements in all horizontal and vertical penetrations.
  - F. Volume Extractors: Anemostat Model DTA, adjustable, with worm gear operator accessible thru the branch opening. Unit shall be suitable for tight shut-off.
  - G. Flexible Collars and Connectors: Ventifabrics, Inc. "Ventglass" neoprene coated glass fabric.
  - H. Joint Sealant: Hardcast, Inc., type DT5300 gypsum impregnated tape and Model FTA-20 activator/adhesive for indoor applications.

### 3.7

#### GRILLES, REGISTERS AND DIFFUSERS (Krueger or Metalaire)

- A. Ceiling Diffusers: Square neck louver faced with "lay-in" type frame (Model DL) for acoustic tile ceilings and or flanged frame (Model DF), for drywall ceilings pattern as required. Exposed ductwork areas shall have round diffusers.
- B. Return Grilles: Rectangular neck, 45° curved blade 1/2" blade spacing, for acoustic the ceilings (Model SAC35LD), or 3/4" blade spacing for acoustic ceilings (Model SAC3LD), 3/4" blade spacing with flanged frame for drywall ceilings (Model S3HD), and 1/2" blade spacing with flanged frame for plaster ceilings (Model S35HD). Straight blade, 3/4" spacing, flanged frame (Model S3HS).
- C. Exhaust Grilles: Square neck, 45° curved blade 1/2" spacing, aluminum construction.
- D. Transfer Grilles: Square neck, 45° curved blade 1/2" spacing with lay-in frame (Model SAC35LD) or flanged frame (Model S35HD).
- E. Supply Register: Rectangular neck, double deflection, front blades horizontal, steel construction with 1/2" blade spacing (Model S25HO) or 3/4" blade spacing (Model S2HO). Registers shall be provided with opposed blade balancing dampers.

F. Supply Grille: Square neck, double deflection, steel construction, front blades horizontal, 1/2" spacing (Model S25H), or 3/4" spacing (Model S2HO).

G. High Capacity Drum Diffusers: Extruded aluminum, adjustable with volume dampers.

3.8

HEATING, VENTILATING UNITS

A. Existing to remain and be re-used/reworked to suit new layout.

PART 4 EXECUTION

4.1 DESIGN AND INSTALLATION OF DUCTWORK AND AIR DEVICES

A. Provide and erect in accordance with the best practice of the trade ductwork required to complete the intended installation. Make offsets required to place ductwork in proper position to avoid conflicts with other work and to allow the application of insulation and finish painting to the satisfaction of the Owner. Ducts shall be arranged to adjust to "field conditions". The Sheet Metal trades shall coordinate his work with other trades. Work shall conform to ASHRAE duct construction recommendations, SMACNA "Duct Construction Standards," NFPA, and the requirements of BOCA code.

B. Construction for Low Pressure Round and Rectangular Ductwork:

1. Metal Gauge:

a. Thickness of metal for low pressure rectangular ducts, including elbows and other fittings, shall be as follows:

Longest Rectangular Dimension of Duct <u>Inches</u>	Galv. Steel & Stainless Steel <u>USS Gauge</u>
Up thru 12	26
13 thru 30	24
31 thru 54	22
55 thru 84	20
Over 85	18

b. Thickness of metal for low pressure round ducts, including elbows and other details, shall be as follows:

Duct Diameter <u>Inches</u>	Galv. Steel <u>USS Gauge</u>
Up thru 10	24
11 thru 20	22

2. Round Duct: The downstream end of each section of round duct shall be crimped and beaded. Assembly shall be made by inserting the crimped end into the upstream end of the adjoining section. The joints shall be fastened in place by three or more sheet metal screws spaced not over eight inches apart.

3. Longitudinal Seams: Longitudinal joints in ducts shall be Pittsburgh lockseams (ONLY). CAUTION: Button punch lock joints are not acceptable.
4. Transverse Joints and Bracing Angles: Transverse joints and bracing angles of rectangular duct shall be as follows:

Duct Size Long Side Inches	Transverse Joints	Bracing Angles Size - Inches	Flat Bar
18 or less	Hemmed S slip	None	None
19 thru 30	Hemmed S slip	1" x 1" x 1/8" @ 60"	1" x 3/16"
31 thru 42	1" Reinforced Bar Slip	1" x 1" x 1/8" @ 60"	1-1/4" x 1/4"
43 thru 60	1-1/2" Reinforced Bar Slip	1-1/2" x 1-1/2" x 1/8" @ 60"	1-1/2" x 1/4"
61 thru 96	1-1/2" Angle Re- inforced Pocket Lock	1-1/2" x 1-1/2" x 3/16" @ 30"	1-1/2" x 1/4"
Over 96	2" Angle Rein- Pocket Lock	2" x 2" x 1/4" @ 30"	2" x 5/16"

5. Transverse Joints: Drive slips shall be used on short sides of transverse duct joints if side is less than 24 inches. Metal and thickness of S slips and drive slips shall be same as duct. Ends of drive slips shall be bent over at least 1/2 inch at corners. Bar slips shall be fastened with sheet metal screws on 12 inch centers. Corners of bar slip joints shall be folded over and riveted. Pocket slips shall be riveted to duct on 6-inch centers, and corners shall be overlapped and riveted.
6. Stiffeners: Ducts over 18 inches wide shall be provided with stiffeners, which may be either transverse joints or angle bracing, as indicated above. The center-to-center spacing of stiffeners shall be not over four feet for ducts not exceeding 60 inches (long side) and shall be not over two feet for ducts not exceeding 8 feet in any case. Flat area of uninsulated ducts over 18 inches wide shall be stiffened by cross-breaking. Uninsulated exposed ducts shall have flat bar reinforcement and flush seams in lieu of bracing angles and projecting seams.
7. Bracing Angles: Bracing angles shall be of the same metal as the duct. Angles shall be riveted to the ducts on 6-inch centers, and shall be applied on four sides. On vertical ducts, set of bracing angles shall be located with heel down at the floor line wherever duct passes through floor. End of two opposite angles shall extend as required to catch floor construction.
8. Long Radius Elbows: Long radius elbows shall be constructed with a throat radius equal to not less than the dimensions of the duct width in the plane of the duct turn.

Where space does not permit the use of a long radius elbow, vaned mitered elbows shall be provided.

9. Mitered Elbows: Low pressure mitered (square) elbows shall be constructed with single wall turning vanes. A 12" x 12" access door shall be installed adjacent to each elbow with turning vanes.

D. Joint Sealing:

1. Low Pressure Ductwork: lateral duct joints and clinch connections shall be sealed to SMACNA seal Class B.

E. Duct Leak Testing:

1. The low pressure duct system shall be leak tested in accordance with SMACNA Duct Leakage Test Manual. Leakage for 1" WG pressure class ductwork shall be less than 12 CFM/100 SF at 1.0" WG test pressure. Test procedure as outlined in SMACNA will be followed and done in the presence of the Engineer.

2. The test procedure shall be as suggested by the SMACNA high pressure duct standards. This procedure is as follows:

a. Test Apparatus: The typical test apparatus consists of:

- 1) A source of high pressure air (3" -10" W.G. static) - a portable rotary blower.
- 2) The flow measuring device shall be an orifice assembly consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.
- 3) The test kit manufactured by United-McGill is an acceptable alternate.

b. Test Procedures:

- 1) Test for audible leaks as follows:
  - a) Close off and seal openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of high pressure flexible duct.
  - b) Start the blower with its control damper closed.
  - c) Gradually open the inlet damper until the duct pressure reaches 2" W.G. in excess of designed duct operating pressure (4 inches WG minimum). The test pressure is read on manometer indicated by the difference in level between the two legs of the manometer and not by the distance from zero to the reading on one leg only.



- d) Survey joints for audible leaks. Mark each leak and repair after shutting down blower. Apply a retest after sealants have set.
- 2) After audible leaks have been sealed, the remaining leakage shall be measured with the orifice section of the test apparatus as follows:
- a) Start blower and open damper until pressure in duct reaches 25% in excess of designed duct operating pressure.
  - b) Read the pressure differential across the orifice on manometer No. 2. The leakage rate in CFM is read directly from the calibration curve. If there is no leakage, the pressure differential will be zero.
  - c) Total allowable leakage shall not exceed 1/2 of one percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for sections shall not exceed the total allowable leakage.
  - d) Even though the system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which must be corrected.
- 3) At the conclusion of this testing procedure, a report shall be submitted to the Architect for review prior to system balancing.
3. Prior to the installation of the duct systems, a sample section of ductwork shall be installed that will be a minimum of 20 ft. long and incorporate a minimum of 6 field joints. This section of ductwork shall pass the required leakage test in the presence of the Owner before additional ductwork may be installed.
4. The duct system shall be tested in sections as required to allow ductwork to be concealed where applicable.
5. Pressure Taps: Provide near end of each duct run, between components of air handling systems and as required by the Air Balance Subcontractor, pressure taps of 1/4" copper tube, soldered to duct or plenum, and provided with neoprene cap to prevent air leakage. Where required, also provide taps for velocity traverse equipment.
- F. Turns shall be made with long radius elbows.
- G. Field Changes to Ductwork: Field changes of ducts such as those required to suit the sizes of factory-fabricated equipment actually furnished shall be designed to minimize expansion and contraction. Use 4:1 transitions in field changes as well as modifications to connecting ducts.
- H. Deflectors: Provide deflectors in duct-mounted supply outlets, take-off or extension collars to supply outlets, and tap-in branch-off connections. Adjust supply outlets to provide air volume and distribution as indicated.
- I. Fire Dampers: Install fire dampers for ducts penetrating fire walls or floors.

- J. Access Doors: Provide access doors for automatic dampers, counter balanced dampers, volume dampers, fire dampers, coils, thermostats, temperature controllers, valves, filters, and other concealed apparatus requiring service and inspection in the duct system.
- K. Duct Sleeves and Prepared Openings: Install duct sleeves and prepared openings for duct mains, duct branches, and ducts passing through walls, roofs, and ceilings. Ensure the proper size and location of sleeves and prepared openings. Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, expect at grilles, registers, and diffusers.
- L. Closure Collars: Provide closure collars of not less than 4 inches wide on each side of walls or floors where sleeves or prepared openings are installed. Fit collars snugly around ducts and insulation. Grind smooth edges of collar to preclude tearing or puncturing insulation covering or vapor barrier. Use nails with maximum 6-inch centers on collars.
- M. Duct Supports: Provide duct supports of not less than two one-inch by 1/16 inch galvanized strip-iron hangers spaced one on each side of ducts. Anchor risers in the center of the vertical run to allow ends of riser free vertical movements. Attach supports only to structural framing members and concrete slabs. Anchor supports to metal decking only if a means is provided for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable immediate metal framing. Where C clamps are used, use retainer clips.
- N. Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connections by zinc-coated steel clinch-type draw-band. For rectangular ducts, lock flexible connections to metal collars.
- O. Insulated Flexible Duct: The flex duct runout to each VAV box shall be a minimum of 3'-0" long and a maximum of 5"-0" long with no kinks or sags. Flexible ducts shall be connected using plastic or stainless steel strap type clamps and tape per the manufacturer's directions and in accordance with SMACNA Standards.
- P. Longitudinal joints shall be Pittsburgh Hammered Lockseam.
- Q. Transitions with a slope greater than 4 to 1 will be ordered removed from the system and replaced with a transition which meets this criteria.
- R. Installation of Air Devices:
1. Curved blade transfer grilles installed in vertical walls above the line of sight shall be installed with the blade opening facing the ceiling.
  2. Curved blade transfer and return grilles installed in ceilings shall be installed with the blade opening facing the nearest wall.
  3. Ductwork visible to the occupants thru the face of supply, return, transfer grilles or diffusers shall be painted with flat black paint.

#### 4.5 INSULATION OF DUCTWORK

- A. Insulate the supply air ductwork from the heating and ventilating units to the ceiling diffuser with 1-1/2" thick fiberglass duct wrap with a factory applied vapor barrier facing. Laps to be sealed and held in place with sealing tape adhesive and flared staples (sealing tape shall be SMACNA approved). On the bottom of the ducts 24" and wider, mechanical fasteners shall be provided approximately 12" on center.
- B. Acoustically line ductwork as required to meet the occupied space acoustic criteria scheduled. Lining shall be applied to the interior of the ductwork. Acoustic liner shall be applied to the flat sheet metal with adhesive and fabricated in the break. Provide stick clips on 12" centers for additional support in ducts over 12" wide.

#### 4.6 CLOSING IN UNINSPECTED WORK

- A. General: Cover up or enclose work after it has been properly and completely inspected and reviewed.
- B. If any of the work is covered or enclosed prior to required inspections and acceptance, uncover the work as required for the test and inspection. After inspection, tests and acceptance, repairs and replacements shall be made by the appropriate trades with such materials as necessary for the acceptance by the Engineer and at no additional cost to the Owner.

#### 4.7 TEST AND ADJUST

- A. Supply and return piping shall be tested with water to a pressure of 75 psi and held for a period of two hours. Any leaks shall be repaired and another test applied to the piping. Piping shall be tested before it is insulated.
- B. Before operating the system the piping shall be flushed out to remove oil and foreign materials.
- C. After the installation is complete and ready for operation, the system shall be tested under normal operating conditions in the presence of the Engineer and demonstrated that the system functions as designed.
- D. It shall be demonstrated that the piping systems have free and noiseless circulation of water and that parts including packing glands are tight.
- E. If any defects in operation develop during the test periods, correct them immediately and additional tests will then be conducted.

#### 4.8 CLEANING

- A. Prior to acceptance of the work, thoroughly clean exposed portions of the installation, removing labels and foreign substance.

4.9

#### INSTRUCTIONS

- A. On completion of the project, provide a competent technician to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not be less than eight(8) hours.

The time of instruction shall be arranged with the Owner. In addition to the prime HVAC Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

4.10

#### EQUIPMENT IDENTIFICATION

- A. Each pump, unit heater, fan, damper motor, water circulating pump switch and control device shall be identified with plastic laminated identification tags. "Dymo" type tags are prohibited. Set points shall be indicated on tag.

END OF SECTION

SECTION 230500

SUPPLEMENTAL MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

- A. Heating, ventilating, air conditioning, roof drain and fire protection system design and installation shall be performed by "design/build" Contractors, hereafter referred to as "Mechanical Contractor", for the entire building.
- B. Mechanical contractor is responsible for coordination with all trades and Architect/Engineer.

1.2 RELATED DOCUMENTS

- A. Architectural drawings and specifications.

1.3 WORKING DRAWINGS

- A. Provide working drawings indicating the location and arrangement of the increments of the systems of this section of work, coordinate mechanical systems with all trades. Material deviation from this arrangement, process or means of application, shall bear the architect/engineers favorable review stamp before the change is made on the job or materials are ordered. Changes made without favorable review shall be ordered removed and items installed as specified shall be provided at no additional expense to the Owner.
- B. The drawings shall show sufficient detail to allow coordination between trades, and to provide the architect/engineer with documents suitable for their quality assurance review.
- C. The design shall be in accordance with the current National Electrical Code, BOCA, SMACNA, ASHRAE, NFPA, the Maine State Plumbing Code, the Maine State Energy Code and other applicable codes.

1.4 MATERIALS AND LABOR

- A. Furnish materials and labor necessary to deliver to the Owner a complete and operable system installed in accordance with the contract documents.
- B. Materials shall be of the best quality. Workmanship shall be of highest grade and construction shall be done according to best practices of the trade.
- C. Where words "furnish", "provide", or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install", including materials complete with connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or scheduled information or in the technical sections of the Minimum Standards.

1.5

COOPERATION BETWEEN TRADES

- A. Provide information sufficiently in advance of this work, so that work by the other trades may be coordinated and installed without delays. Furnish and locate sleeves, supports, anchors and access panels.
- B. Where work is concealed, assure it does not project beyond finished lines of floors, ceilings, or walls.
- C. Equipment or piping requiring access found to be located above sheetrock ceilings shall be brought immediately to the attention of the Owner for resolution.

1.6

VISITING THE PREMISES.

- A. Visit the site and examine existing conditions before submitting bid.

1.7

ORDINANCES, AUTHORITIES, PERMITS, AND FEES

- A. Obtain necessary permits and licenses, give notices and comply with laws, ordinances, rules, regulations or orders affecting the work, and pay fees and charges in connection therewith.
- B. The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

1.8

PROTECTION OF WORK AND MATERIALS

- A. Protect and care for materials delivered and work performed until the completion of the work. Defective equipment or equipment damaged in the course of storage, installation or test shall be replaced or repaired to the satisfaction of the Owner at no additional cost to the Owner.

1.9

SAFETY REGULATIONS

- A. Work shall conform to the requirements of the Occupational Safety and Health Act (OSHA) of 1970 and Amendments thereto.
  - B. Equipment and materials in contact with potable water shall be lead free (ONLY).
- 1.10
- INSURANCE
- A. Purchase and maintain Workmen's Compensation Insurance, Public Liability and Property Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the General Conditions.

1.11

APPLICABLE CODES

A. Work and materials shall conform to the latest rules and regulations listed below and these rules and regulations hereby are made part of these Minimum Standards. They include, but are not necessarily limited to the following:

- American Gas Association (AGA)
- American Society for Testing and Materials (ASTM)
- Underwriters' Laboratories, Inc. (UL)
- Air Moving and Conditioning Assoc. (AMCA)
- American Society of Heating, Refrigerating, and Air Conditioning Owners (ASHRAE)
- American Society of Mechanical Owners (ASME)
- National Electrical Manufacturers Association (NEMA)
- Institute of Electrical and Electronics Owners (IEEE)
- American National Standards Institute (ANSI)
- National Fire Protection Association (NFPA)
- American Water Works Association (AWWA)
- Local Gray and State of Maine Fire Code
- The Board of Fire Underwriters
- Local and State Plumbing Codes
- American Welding Society
- Building Officials Code Administration (BOCA)
- Office of Safety and Health Administration (OSHA)

1.13

SHOP DRAWINGS

- A. Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, five (5) copies, to be submitted to the Owner for inclusion in operating and maintenance manual.
- B. Coordinate with all trades.
- C. Mechanical shop drawings are required for approval by state fire marshall's office to issue construction permit. Construction permit shall be obtained prior to installation of mechanical systems.

1.14

SUBSTITUTIONS

- A. Where the Minimum Standards allow the substitution of a product, still this product is subject to review by the architect/engineer in accordance with the paragraph entitled "Shop Drawings". Favorable review of a substitute item is an indication only that the substitute item is compatible with the specified item as a claim of the manufacturer. Insure dimensional propriety, performance, and quality of the substitute item.
- B. Reference in the Minimum Standards to any product, material, fixture, form or type of construction, by proprietary name, manufacturer, make or catalog number, establishes a standard of quality or design and is not meant to limit competition. Use any equivalent substitute provided favorable written review by the architect/engineer is first obtained. The (ONLY) notation in the Minimum Standards is an exception to this and leaves no option.

ADMIN/SECURITY VESTIBULE

BARBER FOODS

GENERAL MECHANICAL

- C. For materials or equipment which are supplied with integral or factory applied finish, color will be considered in evaluating substitutions.
- D. For the purpose of avoiding conflicts with other trades, contracts, and adjoining work where more than one (1) article, device, material, fixture, form or proprietary name, manufacturer, make or catalog number, the first named shall be used as the basis of design and details. The cost of any changes because of substituted item shall be borne by the Contractor requesting such change.

## PART II - EXECUTION

### 2.1 GRADES AND ELEVATIONS

- A. Establish and maintain grades and elevations in connection with this work.

### 2.2 EQUIPMENT SUPPORTS

- A. Furnish and install equipment supports for mechanical equipment as required. Supports shall be subject to review by the Owner.

### 2.3 SLEEVES AND PREPARED OPENINGS

- A. Coordinate cutting, patching and setting of sleeves, frames, framing and lintels for openings with other trades. Sleeves shall be furnished by the Contractor.
- B. Failure to give timely notice of and to locate openings and furnish sleeves shall cause no additional expense to the Owner.

### 2.4 CONNECTION TO EQUIPMENT

- A. Provide piping connections, supports, brackets, compensators or flexible connections to prevent application of excessive stresses to equipment.
- B. Equipment shall be installed with flanges or unions and shut-off valves in such a manner as to permit disconnecting for removal of tubes, coils, elements and other equipment for inspection, service and repairs.

### 2.5 ACCESS TO EQUIPMENT

- A. The installation of work performed shall provide reasonable accessibility for operation, inspection, and maintenance of equipment and accessories. The Engineer shall determine the adequacy of such accessibility.

### 2.6 ACCESS PANELS

- A. Access panels shall be provided where required for access to valves and other serviceable components.
- B. Access panels installed in fire-rated assemblies shall have the same fire rating as the assembly.



2.7

PAINTING OF EQUIPMENT

- A. Exposed ironwork, including steel supports and hangers in unfinished spaces, mechanical rooms, pits, and trenches shall be properly cleaned, prepared and painted with two (2) coats of black asphaltum varnish.
- B. Exposed spiral ductwork shall be painted by others in some areas.

2.8

GUARDS

- A. Exposed moving and rotating elements of mechanical equipment items shall be protected with suitable guards for personnel protection. Guards shall be of rigid construction, firmly positioned. Holes shall be provided in guards at shaft centers to facilitate tachometer readings. OSHA requirements shall govern.

2.9

LUBRICATION

- A. Furnish and install grease fittings for points requiring lubrication. Furnish extension type fittings as required to provide easy access for maintenance lubrication.
- B. Furnish initial charges of lubricants for equipment. Lubricants shall be in conformance with the manufacturer's requirements and recommendations.

2.10

ELECTRIC MOTORS AND MOTOR CONTROLS

- A. Motors, motor starters and other electrical accessories shall be selected with characteristics as follows:
  - 1/3 Horsepower and less - 120 volt, 1 phase 60 Hz.
  - 1/2 Horsepower and larger - 3 phase, 60 Hz.
- B. Motors shall be built in accordance with the latest applicable NEMA, IEEE and ANSI Standards. Motors shall be of the latest type and quality specified under individual items of equipment.
- C. Magnetic motor starters for mechanical items of equipment shall be delineated in the Minimum Standards for Electrical unless the starter is an integral part of a factory packaged item of equipment. Each starter furnished as an integral item of equipment shall be provided with overload heater elements. Starters shall be equipped with suitable step-down transformers to provide required control voltage.
- D. Motors 2 HP and larger shall be high efficiency type. Motors shall have a minimum continuous duty service factor of 1.15.

2.11

CLEANING OF SYSTEMS

- A. Piping systems shall be thoroughly cleaned and flushed prior to initial operation.
- B. Thoroughly clean exposed portions of the mechanical installation, removing labels and foreign substance.

- C. Furnish detergents, solvents, cleaning compounds, and tools required for cleaning operations.
- D. Keep the premises free from accumulation of waste material or rubbish and at the completion of the work, remove from the job site tools, scaffolding, surplus materials, and rubbish, leaving the work areas "vacuum" cleaned.

2.12

STARTING OF EQUIPMENT

- A. Testing or starting of equipment shall be done in collaboration with trades concerned to insure safe and proper operation of the equipment.
- B. Prior to starting equipment, provide lubrication at required points. Before starting any electrical or electric motor driven equipment, a check must be made to insure that proper heater coils are installed in the starters and that the equipment is rotating in the proper direction.

2.13

OPERATIONAL TESTING

- A. Operate systems until successful operation is demonstrated to the Owner. This initial operation shall be in addition to the testing of the system and shall be done after the system is cleaned and finished.

2.14

RECORD DRAWINGS

- A. During construction, keep an accurate record of deviations to the installation of the work as indicated on the drawings. Upon completion of the work, furnish a copy of this record to the Owner. **Submit record drawings before requesting final payment.**

2.15

MANUFACTURER'S REPRESENTATIVE

- A. As indicated in the Technical Sections of this design standard or as directed by the Owner, provide the services of a factory trained Engineer or Technician to inspect, adjust, and place in proper operating condition the equipment or item involved. No additional compensation will be allowed for such service.

2.16

MANUFACTURER'S INSTRUCTIONS, OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, maintenance, lubrication, cleaning, servicing, adjustment, and safety instructions.
- B. Manufacturer's data shall include performance data (curves are preferred where applicable) complete parts lists, recommended spare parts lists, piping, and wiring diagrams.
- C. Arrange data in complete sets, properly indexed and marked.
- D. Data shall include a complete set of shop drawings.

E. Material shall first be submitted in preliminary form for review by the Owner. After review, submit two (2) copies in bound volumes to the Owner.

2.17

GUARANTEES

- A. An item becomes "defective" when it ceases to conform to the Contract Documents. Guarantees begin on the date of issuance of a certificate authorizing final payment or certificate of substantial completion with the Owner taking occupancy or beneficial use thereafter.
- B. Upon completion of the work and before applying for final payment, furnish a written guarantee, stating that the work complies with the provisions of codes listed herein and the local enforcing authorities, and that it will be free from defects of material and workmanship for not less than one (1) year. Guarantee shall further state that the Contractor will, at his own expense, repair or replace any of his material and work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects.
- C. Where special guarantees, covering installation, operation or performance of any systems, or equipment furnished under are indicated, the full responsibility for the fulfillment of such guarantees must be assumed by the Contractor who shall obtain written guarantees in triplicate, two (2) copies of which shall be filed with the Owner before final acceptance.
- D. Repeated malfunctioning or failure in service of any item or work of the system is sufficient cause for the Owner to order the removal of the item, and its replacement with new item at the expense of the Contractor.

END OF SECTION

SECTION 230593

TESTING AND BALANCING

PART 1 - GENERAL

- 1.1 DESCRIPTION: The work covered by this section of the Minimum Standards includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required for testing and balancing the air and water systems.
- 1.2 GENERAL REQUIREMENTS: The provisions of Section 230500, "Supplemental Mechanical Requirements", apply to this section.
- 1.3 DEFINITIONS
- A. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment, (e.g., reduce fan speed, throttling).
  - B. Balance: To proportion flows within the distribution system (submains, branches and terminals) in accordance with specified design quantities.
  - C. Procedure: Standardize approach and execution of sequence of work operations to yield reproducible results.
  - D. Report Forms: Test data sheets arranged for collection of test data in logical order to submission and review. This data should also form the permanent record which shall be used as the basis for any future testing, adjusting, and balancing required.
  - E. Test: To determine quantitative performance of equipment.
- 1.4 SUBMITTALS: Submit the following:
- A. Standards Compliance:
    - Testing Agency
    - Testing Agency Personnel
    - Professional Engineers
    - Instrument Calibration
- 1.5 TESTING AND BALANCING AGENCY
- A. Air and Water Systems Testing and Balancing: Upon completion of the installation and field testing, performance test and adjust the supply, return, make-up, and exhaust air systems, and heating water systems to provide the air volume and water flow quantities designed. Accomplish work in accordance with the agenda and procedures specified and AABC 71679 and standards of the NEBB. Correct air and water system performance deficiencies disclosed by the test before balancing the systems.

B. Agency Qualifications: Obtain the services of a qualified testing organization to perform the testing and balancing work as herein specified. Prior to commencing work under this section of the Minimum Standards, the testing organization shall have been favorably reviewed by the Owner. The criteria for determining qualifications shall be membership in the AABC, or certification by the NEBB, or the testing organization shall have submitted proof to satisfy the Owner that the organization meets or exceeds the technical standards for membership of the AABC as published in the AABC 71679. The testing organization shall be independent of the installing contractors, designers and equipment suppliers for this project.

1.6

AGENDA

A. Preliminary Report: Review drawings and Minimum Standards prior to installation of any of the affected system. Submit a written report to the Owner indicating any deficiencies in the system that would preclude the proper adjusting, balancing, and testing of the systems.

1.7

PROCEDURES, GENERAL

A. Requirements: Adjust systems and components thereof that perform as required by drawings and Minimum Standards.

B. Test Duration: Operating tests of heating and cooling coils, fans and other equipment shall be of not less than 4 hours duration, after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measured during such tests.

C. Instrumentation: Method of application of instrumentation shall be in accordance with the manufacturer's instructions. Furnish personnel, instruments, and equipment for tests specified herein.

D. Accuracy of Instruments: Instruments used for measurements shall be accurate. Provide calibration histories for each instrument for examination. Calibrate each test instrument by an reviewed laboratory or by the manufacturer. The Owner has the right to request instrument recalibration, or the use of other instruments and test methodology, where accuracy of readings is questionable.

E. Accuracy of Thermometers: Plus or minus one graduation at the temperatures to be measured. Graduations shall conform with the following schedule:

Medium	Design Temperature Differential (°F)	Maximum Graduation (°F)
Air	10 or less	1/2
Air	over 10	1
Water	10 or less	1/10
Water	10-20	1/2
Water	over 20	1

## PART 2 - EXECUTION

### 2.1 AIR SYSTEM PROCEDURES

- A. Adjustments: Adjust air handling systems to provide the required design air quantity to, or through, each component. Conduct adjusting and balancing of systems during periods of the year approximating maximum seasonal operation.
- B. Balance: Use flow adjusting (volume control) devices to balance air quantities only; i.e., proportion flow between various terminals comprising system, and only to the extent that their adjustments do not create objectionable air motion or sound, i.e., in excess of specified limits.
- C. Balancing Between Runs (submains, branch mains, and branches): Use flow regulating devices at, or in, the divided - flow firing. Minimize restriction imposed by flow regulating devices in or at terminals.
- D. Final Measurements of Air Quantity: Make final measurements of air quantity, after the air terminal has been adjusted to provide the optimum air patterns of diffusion.
- E. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds, or axial-flow fan wheel blade pitch. For systems with direct-connected fans (without adjustable pitch blades), damper restrictions of a system's total flow or variable speed drives shall be adjusted as appropriate.
- F. Air Measurement:
  - 1. Pitot Tube: Except as specifically indicated herein, make pitot tube traverses of each duct to measure air flow therein. Pitot tubes, associated instruments, traverses, and techniques shall conform with the ASHRAE Handbook Fundamentals.
  - 2. Pitot Tube Traverse: Pitot-tube traverse may be omitted if the duct serves only a single room or space and its design volume is less than 2000 cfm. In lieu of Pitot-tube traverse, determine air flow in the duct by totalling volume of individual terminals served, measured as described herein.
  - 3. Measurements of Air Quantity: Where duct's design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.
- G. Air Terminal Balancing: Measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, shall be used only for balancing.

### 2.3 SOUND TEST PROCEDURES

- A. Sound Compliances Tests: Tests to demonstrate compliance with sound requirements shall be made as indicated.
- B. Timing: Take sound level measurements at times when the building is unoccupied, or when activity in surrounding areas and background noise levels in areas tested are at

minimum and free from sudden changes in noise levels. Take measurements with equipment secured, except that being tested. Measure sound levels at any point within a room not less than 6 feet from an air terminal or room unit, and not closer than 3 feet from any floor, wall, or ceiling surface.

C. Meters: Measure sound levels with a sound meter complying with the latest ANSI S1.4. Use the "A" scale to measure overall sound levels. To determine the specified octave band levels, the above sound level meter shall be supplemented by an Octave Band Analyzer complying with ANSI S1.11.

D. Equipment Components: Determine "equipment components" of room sound (noise) levels for each (of eight) octave bands as follows:

1. Measure room sound pressure level "LPb" with equipment to be tested shut off.
2. Measure room sound pressure level "LPt" with equipment to be tested turned on.
3. Calculate LPt-LPb; if this value is less than one, applicable test must be rerun with lower background level (LPb) unless LPt is within sound pressure level specified for equipment.
4. Determine "C" from table below:  

LPt-LPb (dB)	1	2	3	4-4-1/2	5-5-1/2	6-7-1/2	8-12	over 12
C (dB)	7	4	3	2	1-1/2	1	1/2	0
5. The "equipment component" of room sound level equals LPt-C.

2.4 CERTIFIED REPORTS

- A. Submittal: Submit four copies of the reports described herein, covering air and water system performance, air motion (fpm), to the Architect/engineer prior to final tests and inspection.
- B. Instrument Records: Include types, serial numbers, and dates calibration of instruments.
- C. Reports: Reports shall identify conspicuously items not conforming to contract requirements, or obvious maloperation and deficiencies.

2.5 AIR SYSTEM DATA

A. Report: The certified report shall include for each air-handling system the data listed below:

1. Equipment (fan or factory fabricated station unit):
  - a. Installation Data:
    - 1) Manufacturer and Model
    - 2) Size

- 3) Arrangement, Discharge, and Class
  - 4) Motor H.P., Voltage, Phase, Cycles, and Full Load Amps.
  - 5) Location and Local Identification Data
- b. Design Data: Data listed in schedules on drawings and Minimum Standards.
- c. Fan Recorded (Test) Data
- 1) C.F.M.
  - 2) Static Pressure
  - 3) R.P.M.
  - 4) Motor Operating Amps.
  - 5) Motor Operating B.H.P.
2. Duct Systems:
- a. Duct Air Quantities (Maximum and Minimum) - Main, Submains, Branches, Outdoor (Outside) Air, Total-Air, and Exhaust
    - 1) Duct size(s)
    - 2) Number of Pitot-tube (Pressure) Measurements
    - 3) Sum of Velocity Measurement, excluding pressure measurements
    - 4) Average Velocity
    - 5) Recorded (Test) C.F.M.
    - 6) Design C.F.M.
  - b. Individual Air Terminals:
    - 1) Terminal Identification (Supply or Exhaust, Location and Number Designation)
    - 2) Type Size, Manufacturer, and Catalog Identification
    - 3) Design and Recorded Quantities - C.F.M.
    - 4) Deflector Vane or Diffusion Cone Settings
    - 5) Applicable Factor for Application, Velocity, Area
    - 6) Design and Recorded Velocities - F.P.M. (State "core" "inlet," as applicable)

## 2.6

### SOUND LEVEL DATA

- A. Sound level tests shall be performed in each office area, stable, riding arena and multi-purpose room.
- B. Report: The certified report shall record data on sound levels, taken at each selected location, as follows:
  1. Source of sound and location
  2. Diagram or description of relationship of sound source to measuring instrument.



3. "A" scale readings:
  - a. Equipment being tested turned off (ambient) (2) Equipment being tested turned on (operating conditions)
4. Reading at each specified octave band frequency:
  - a. Equipment being tested turned off (ambient) (2) Equipment being tested turned on (operating condition)
5. "Equipment components" of sound (noise) levels with applicable calculations per "Sound Test Procedure."
6. Graph showing relationship between pressure levels specified and recorded readings.
- C. Retest: Subsequent to any correctional construction work, such as acoustic corrections, make measurements to verify that associated air and water quantities, as previously measured, have not been disrupted.
- D. Certified Report: Record sound data, and their locations, after final adjustments of air and water systems involved.

## 2.7

### FINAL TESTS, INSPECTION, AND ACCEPTANCE

- A. Capacity and Performance Tests: Make tests to demonstrate that capacities and general performance of air and water systems comply with contract requirements.
- B. Final Inspection: At the time of final inspection, recheck, in the presence of the Owner, random selections of data water and air quantities and air motion recorded in the certified report. In addition, conference rooms shall be rechecked.
- C. Points and Areas for Recheck: As selected by the architect/engineer or Owner.
- D. Measurement and Test Procedures: As reviewed for work forming basis of certified report.
- E. Selections for Recheck (specific plus random): In general, selections for recheck will not exceed 25 percent of the total number tabulated in the report.
- F. Retests: If random tests elicit a measured flow deviation of ten percent or more from, or a sound level of 2 Db or more greater than that recorded in the certified report listings, at ten percent or more of the rechecked selections, the report shall be automatically rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new certified reports submitted, and new inspection tests made.
- G. Marking of Settings: Following final acceptance of certified reports by the architect/engineer and Owner, the settings of valves, dampers, and other adjustment devices shall be permanently marked, so that adjustment can be restored if disturbed at any time. Mark devices after final review.

END OF SECTION

SECTION 260000

ELECTRICAL GENERAL

PART 1 GENERAL

1.1 SCOPE

- A. The electrical system design and installation shall be performed by a design-build contractor, hereinafter referred to as the electrical contractor.
- B. The electrical work shall include but not be limited to the following:
  - 1. Secondary power distribution system as needed in the renovated area.
  - 2. Lighting system interior - including exit and emergency lighting. See Architectural drawings for fixture layout. Rework wiring as needed where walls are being removed. Add new lighting in new employee entry including exterior.
  - 3. Provide circuits and connections for office furniture in Admin area. Provide receptacles at security desk two dedicated circuits. Provide general purpose receptacles throughout new vestibule area.
  - 4. Connections and disconnects as required for mechanical equipment.
  - 5. Fire Alarm system modifications in administrative area and new Security vestibule.
  - 6. Tel/data wiring by others including conduit and boxes.
  - 7. Relocate power for door opener in Equipment Storage- see drawings D101 and A101
- C. Incoming telephone service cables and interface shall be coordinated with the Telephone Company.

1.2 WORKING DRAWINGS

- A. Provide working drawings indicating the location and arrangement of the increments of the systems of this section of work.
- B. The drawings shall show sufficient detail to allow coordination between trades, and to provide the Architect/engineer with documents suitable for a quality assurance review. Include with the drawings, manufacturer's data of the electrical devices, fixtures, equipment and systems.
- D. The design shall be in accordance with the current National Electrical Code, BOCA, NEMA, ANSI, NFPA, and other applicable codes and standards.
- E. Provide drawings for State Fire Marshall and Portland Fire Department approval.

1.3 STANDARDS

- A. Materials, equipment and installation shall comply with the following:

- 1. National Electrical Code, latest approved edition.
- 2. Any Federal, State and/or local codes, applicable ordinances and regulations.
- 3. Latest approved standards of IEEE, ANSI, NEMA, NFPA, OSHA, ADA, UL.
- 4. Utility company requirements and telephone company requirements.

5. The Portland Fire Department.
6. The Portland Police Department.
7. The monitoring company selected by the Owner.

B. Electrical equipment shall be UL listed.

#### 1.4

##### MATERIALS AND LABOR

A. Furnish materials and labor necessary to deliver to the Owner a complete and operable system.

B. Materials shall be of the best quality. Workmanship shall be of the highest grade and construction shall be done according to the best practices of the trade.

#### 1.5

##### CODES, PERMITS, INSPECTIONS

A. The installation shall comply with laws and regulations applying to the electrical installation in effect at the site with regulations of any other governmental body of agency having jurisdiction, and with regulations of the National Electric Code (NEC).

B. Obtain and pay for permits required by the ordinances at the site. Arrange for all inspections by the local authorities. After completion of the work, furnish the Owner with a certificate of final inspection and approval from the Authority having jurisdiction.

#### 1.6

##### SHOP DRAWINGS

A. Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified. Five (5) copies shall be submitted to the Architect. Shop drawings will be returned "No Exceptions Taken", "Make Corrections Noted", "Revise and Resubmit", "Rejected", or "Submit as Specified", less two (2) copies. Work shall progress in accordance with "Reviewed" shop drawings (ONLY).

B. Groups of similar shop drawings shall be submitted as individual bound documents with covers and indexes.

C. Shop drawings must bear the Architect's review stamp. In the event that the Architect rejects shop drawings, the shop drawing must be revised and resubmitted for review.

D. Review will be for type and quality. Quantities and the ability to perform the function intended shall be the responsibility of the Contractor.

#### 1.7

##### SUBSTITUTIONS

A. Any substitution of a product is subject to review by the Architect. Review of a substitute item is an indication only that the substitute item is compatible with the specified item as a claim of the manufacturer. Insure dimensional propriety, performance, and quality of the substitute item.

B. Reference in the minimum standards to any product, material, fixture, form or type of construction, by proprietary name, manufacturer, make or catalog number, establishes a standard of quality or design and is not meant to limit competition. Use any equivalent substitute provided favorable written review by the Architect is first obtained.

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- C. Substituted items and systems must meet or exceed the standard of quality and performance inherent in the specified item or system.

1.8

INCIDENTAL WORK IN OTHER DIVISIONS AND BY OTHER CONTRACTORS

- A. Excavation, trenching, backfill, outdoor pole bases, transformer pad, cutting, patching and painting shall be as specified in the appropriate section of the specifications.

1.9

TEMPORARY POWER AND LIGHTING SYSTEM

- A. Temporary power for all trades will be provided under this section of the specification. The cost of the electrical power shall be as indicated in the General Conditions. Furnish at least a 200 amp single phase service, 120/240 volts with a 200 watt lamp holder for each room minimum. Furnish ground fault duplex outlets as required. Outlets shall be located so that 50' extension cords will reach any point in the building. Power to outlets shall be limited to 1/2 HP motors 120/240 volts. If additional power is required it shall be furnished by the trade requesting the service.

PART 2

EXECUTION

2.1

COORDINATION

- A. Coordinate work with the following to insure that the installation is in accordance with applicable requirements.
  - 1. Portland Fire Department
  - 3. Telephone company
  - 5. Data Wiring Contractor.
  - 6. All trades and Architect/engineer.

2.2

RECORD DRAWINGS

- A. Submit a neatly marked up set of Electrical Drawings to the Architect for a record of final installation as actually installed. Include an accurate layout of all in-slab, under-slab and buried conduits. This copy will be returned to the Owner after records are made.

2.3

INSTRUCTIONS, OPERATION AND MAINTENANCE DATA

- A. At the completion of the work, furnish one (1) set of operating and maintenance instructions of equipment and systems. Submit name and address of nearest available source of repair service and replacement equipment and parts to the Owner. Explain and demonstrate the operation of each system to the Owner representative. The Fire Alarm System and the Security Alarm System manufacturers' field technician shall be present at this demonstration.
- B. Data shall include a complete set of shop drawings.

2.4

GUARANTEE - WARRANTY

- A. The work executed under this section shall be guaranteed to be free from defects of materials, and workmanship for a period of one (1) year from the date of the final certificate of acceptance. Guarantee shall further state that repair or replacement of any material and

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work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects shall be executed at no additional expense to the Owner.

- B. Materials furnished shall be new and the work executed shall be in accordance with applicable laws, regulations and codes.

## 2.5

### TESTS

- A. After the interior wiring system installation is completed and at such time as the Owner may direct, conduct an operating test. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The tests shall be performed in the presence of the Owner or their authorized representative. Furnish instruments and personnel required for the tests.
- B. Upon completing the installation of the fire alarm system, conduct a complete test of the system in the presence of a representative of the fire alarm equipment manufacturer. During the course of the test, each manual station shall be activated, each smoke detector shall be smoke tested or an equivalent test performed, each rate-of-rise heat detector shall be activated by way of applying heat, each fixed temperature heat detector shall be activated by way of removing the fixed temperature heat fuse. The manufacturer shall supply a minimum of one year guarantee on fire alarm equipment.
- C. Each supervised circuit associated with the fire alarm system shall be opened at the most remote point in that circuit causing the trouble indication at the control panel to operate, thereby ascertaining that each circuit is supervised as required. At the completion of the test, submit a letter to the Owner, with a copy to the Engineer, stipulating that the fire alarm system was installed according to these specifications and complies with all applicable codes.
- D. The manufacturer shall furnish to the Owner, a one-year contract, effective from the date of acceptance, for maintenance and inspection services of the manufacturer's equipment with a minimum of two inspections during that contract year. Written evidence of such inspections shall be left with the appropriate authorities.
- E. Coordinate and comply with local fire department requirements and requirements of the alarm monitoring service.

END OF SECTION

## SECTION 261000

### SYSTEMS AND EQUIPMENT

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the electrical systems.
- B. Conductor material, installation and fittings shall meet NEC requirements. Conductors shall be listed for 600 volt AC unless otherwise noted.
- C. Minimum size power wiring shall be #12 AWG. Branch circuit conductors #8 and larger shall be stranded.
- D. Devices and switches shall be specification grade, grounding type with green ground screw.
- E. Provide circuits for office furniture cubicles. See architectural drawing for Quantity no more than 4 cubicles on one 20A circuit.
- F. The complete lighting system shall consist of indoor lighting, wall mounted exterior lighting, exit and emergency lighting including necessary caps, straps, clips, lamps, devices, etc. as required.
- G. All mechanical equipment feeders and connections.

##### 1.02 GENERAL REQUIREMENTS

- A. The provisions of Section 260000 "General Electrical" are made a part of this section.

#### PART 2 PRODUCTS

##### 2.01 RACEWAYS AND FITTINGS

- A. Rigid steel conduit, intermediate metal conduit, electric metallic tubing, (elbows, couplings and fittings) shall be hot dipped galvanized steel and shall conform to the latest ASA Standards.
- B. Flexible metal conduit shall be galvanized steel (NEC-350). Liquid tight flexible conduit shall be UL listed (NEC-351).
- C. Fittings for rigid steel conduit shall be cast or malleable iron bodies, cadmium or zinc plated, with taper threads and tapped holes for screw attached cover plates for installation in moist or wet locations, and shall have gaskets of an approved material.

- D. Conduit boxes, outlet, switch, junction, pull boxes, extension rings, adapters, and cover plates shall be sherardized galvanized or cadmium plated. Boxes for concealed work shall be stamped steel with stamped steel accessories. Boxes for exposed work shall be cast or malleable iron. UL listed PVC boxes and fittings may be used for concealed construction where permitted by the NEC.
- E. Rigid non-metallic conduit shall comply with NEC-347 and shall be schedule 40 or Schedule 80 if required. Approved PVC solvent shall be used for welding PVC conduit and fittings. Furnish listed PVC expansion joints for PVC conduit runs per manufacturer's recommendations.
- F. Surface metal raceways shall be Wiremold Series 2100 installed around counter areas in labs with grounded outlets 24" on center. Breakers serving these circuits shall be ground fault interrupting breakers.
- G. Cable trays for computer room shall be as hereinafter specified in Section 261000.2.13.

## 2.02

### CONDUCTORS

- A. Conductors shall be type THWN -75°C, copper. Type MC armored cable may be used above ceilings and concealed in walls where permitted by the NEC. Type NM cable shall not be used.
- B. Grounding conductors shall be copper with green insulation.
- C. Copper conductors #2 and larger may be aluminum providing the following items are adhered to:
  - 1. The ampere capacity, voltage drop and conduit fill is in accordance with the NEC and equal to copper conductors specified herein.
  - 2. Prior to making any connection the aluminum wire is to be brushed and an oxide inhibitor applied.
  - 3. Lugs and connectors are to be rated cu/al compression type.
  - 4. Termination of aluminum conductors at heat producing equipment such as motors or heaters is not acceptable.

## 2.03

### COLOR CODING OF CONDUCTORS

- A. The building power wiring shall be color coded, red, black and blue for insulated 120/208 volt conductors. The neutral shall be white or gray. Use green for grounding conductors.

## 2.04

### PANELBOARDS AND BOXES

- A. Panels, cabinets, and boxes shall be code gauge steel. Boxes shall comply with NEC requirements. Concealed outlet boxes shall be of code gauge galvanized or sherardized metal not less than #14 gauge. Junction boxes shall be of code gauge steel, cast, or PVC.
- B. Panelboards shall have mains as indicated and shall be furnished with active breakers, spare breakers and spaces as required. Panels shall have an equipment ground bus and when

indicated shall also have an insulated and isolated ground bus for computer circuits. Panels shall have main breaker or main lugs as indicated. Computer room panel shall be supplied with a 200% rated neutral, and a shunt trip for pushbutton disconnection as per N.E.C. Article 645-10. Panels shall be provided with 20% future growth capacity in mains and quantity of branch breakers.

1. Each subpanel shall have a hinged door with lock and typed directory.
2. Terminal connectors shall be UL listed al/cu type.
3. Flush and surface mounted panels shall have factory furnished trim. Panel boxes shall be galvanized steel, code gauge, primed and painted manufacturer's standard finish. Flush panels shall be furnished with 6-3/4" empty conduits stubbed up into hung ceiling space and capped for future use.
4. Panel breakers shall be UL listed quick make, quick break, thermal magnetic type. Breakers shall have interrupting ratings capable of interrupting the available short circuit fault current. HVAC refrigeration loads require HACR rated breakers. Connect panel breakers to insure proper load balance between phases.
- C. Fused and unfused switches shall be General Duty or as required. Fuses shall be furnished for fused disconnect switches. Fuses shall be dual-element of required or specified voltage and current rating. Furnish Owner with one set of spare fuses for each type installed.

## 2.05

### WIRING DEVICES

- A. Duplex receptacles shall be 20 amps, 125 volt, NEMA 5-20R, 3 wire, 2 pole, grounding type, white with matching plate. Spacing of receptacles shall be as noted in the National Electrical Code and additional receptacles shall be provided to result in an overall receptacle density of 10% in addition to the minimum quantity set forth in the N.E.C. Duplex floor outlets shall be furnished in a flush floor box with brass lift plates.
- B. Wall switches shall be grounding type rated at 120 volt, 20 ampere, white with matching plate. Rooms with 2 level lighting shall have 2 switches - one for inboard lamp(s) - one for outboard lamps. Typical for office, conference, reception.
- C. Ground fault receptacles shall be 20 amp, 125 volt, duplex, ivory, NEMA 5-20R.
- D. Surge suppressor receptacles shall be 20 amp, 125 volts, duplex, white, NEMA 5-20R- isolated ground. Quad Receptacles shall be provided for all computer work stations and at each data outlet location. Provide one duplex receptacle at each TV/monitor location mounting height shall be 6'-6" AFF. (See architectural plans and specifications for locations.)
- E. Device plates shall be white plastic.

## 2.06

### SUPPORTING DEVICES

- A. Conduit shall be supported on acceptable types of galvanized wall brackets, ceiling trapeze, strap hangers, or pipe straps, secured by means of toggle bolts, on hollow masonry units or expansion bolts in concrete or brick, machine screws on metal and wood surfaces. Wooden plugs inserted in masonry or concrete shall not be used as a base to fasten conduit supports.



- B. Where indicated, 3/4" painted plywood panels shall be provided to support electrical, telephone equipment and shall be painted black.

2.07

GROUNDING SYSTEMS

- A. Grounding conductors shall be copper and sized per N.E.C. Article 250 - Tables 250-66 and 250-122. Green grounding conductors shall be run in all raceways and cables shall include a green grounding conductor.
- B. Panelboards shall be furnished with equipment ground bus. Panelboards supplying computer receptacles shall also be furnished with insulated/isolated ground bus. Install an isolated grounding conductor back to main ground connection point.

2.10

LIGHTING FIXTURES

**ALL LIGHT FIXTURES SHALL BE SUBMITTED FOR APPROVAL BY THE ARCHITECT/ENGINEER PRIOR TO ORDERING.**

- A. Lighting in admin area shall be relocated and reworked to suit new open layout. Lighting in new security vestibule shall be new in recess into grid ceiling. Exterior lighting at security vestibule shall be two relocated wall packs, extend existing wiring to new locations. Exact location as determined by Barbar Foods Facility Department.
- B. Footcandle levels for all spaces shall conform to the recommendations of the Illuminating Engineering Society (IES).
- C. Emergency lighting shall be connected to the emergency generator. Emergency lighting shall comply with NFPA 101.
- E. Exit lighting fixtures shall be LED type, either 120V AC/12V DC or be self contained 120V AC, with integral battery and charger. Locate exit light fixtures as required to identify exit path.

2.11

TELEPHONE/DATA SYSTEM

- A. Empty conduit and boxes - infrastructure cabling by others

2.12

FIRE ALARM SYSTEM

- A. Modify as needed for complete operational system complying wit hall applicable codes.

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT CONNECTIONS

- A. Furnish and install disconnect switches as required.
- B. Power wire to motor equipment and special equipment, with flexible metallic conduit from disconnect or junction box to equipment (Use flexible liquid-tight conduit to outdoor equipment).

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SYSTEMS AND EQUIPMENT

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3.02

INSTALLATION OF RACEWAYS AND FITTINGS

- A. Conduit buried underground or encased in concrete shall be galvanized rigid steel, or schedule 40 PVC. Use schedule 40 PVC unless prohibited by code or required for structural strength.
- B. Use EMT or schedule 40 PVC for wiring in block walls. Exposed raceways shall be run in neat symmetrical lines parallel with the building lines. Do not use PVC where exposed to physical damage, in Mechanical Room or where prohibited by NEC.
- C. Support raceway and boxes in accordance with the NEC. Use double locknuts and bushings at boxes and equipment. Conduit or cables running parallel or crossing uninsulated hot water shall be separated by 12" if parallel or 7" of crossing. Where lines are insulated the wiring shall clear the insulated surfaces by 2". Do not run wiring directly under uninsulated cold water lines.
- D. Run flexible metallic conduit to equipment with motors or equipment requiring alignment or movement and to sound generating equipment. Use Liquidtight flexible metallic conduit in areas such as outdoor equipment or where subject to moisture.

3.03

INSTALLATION OF CONDUCTORS

- A. Splices for #6 and larger shall be by compression connectors.
- B. Direct burial cable (if used) shall be sleeved in schedule 40 conduit under paving and roadways and through walls and footings. Extend raceway 2' beyond paving.
- C. Furnish and install UL listed outlets and boxes and fire stopping for penetrations of fire rated walls, ceilings or penetrations.

3.04

INSTALLATION OF PANELBOARDS

- A. Set panelboards and boxes plumb with the building lines. Mount panelboards so that the top of the panel is not higher than 6'-6" AFF.
- B. Panelboards shall have engraved plastic nameplates fastened with screws.

3.05

INSTALLATION OF WIRING DEVICES

- A. Switches shall be mounted 48" AFF or as noted and on strike side of doors. Receptacles shall be mounted 24" AFF except as noted. Ground fault receptacles shall be mounted 48" AFF unless otherwise noted.

3.06

INSTALLATION OF SUPPORTING DEVICES

- A. Conduit shall be installed in such a manner as to insure against trouble from the collection or trapped condensation, and runs of conduit shall be arranged so as to be devoid of traps. Exercise the necessary precautions to prevent the accumulation of dirt, plaster or trash in conduit, fittings and boxes during the course of installation. A run of conduit which has become clogged shall be entirely freed of this accumulation, or shall be replaced.

- B. Type MC cable shall be supported every 4.5' with approved devices. When run above ceilings, do not lay cable on ceiling tiles. Use approved plastic grommets in metal studs with 360° protection!

3.07

INSTALLATION OF GROUNDING SYSTEMS

- A. Grounding shall be in strict compliance with the National Electrical Code, Article 250.
- B. Metallic conduit shall be grounded in accordance with NEC requirements; and equipment grounding conductors shall also be furnished and installed in all branch circuit and feeder raceways. Cables shall include a separate, insulated grounding conductor.
- C. Equipment grounding conductors shall be insulated copper with green jacket as covered by the NEC.
- D. The green grounding screw on all wiring devices shall be used for grounding connections.

3.08

INSTALLATION OF ELECTRIC SERVICE

- A. Determine the maximum available short circuit fault current from CMP and furnish the main panel accordingly.

3.09

INSTALLATION OF LIGHTING

- A. Furnish and install a lighting system ready for proper and satisfactory operation.
- B. In general, fixtures must be UL listed and labeled and be ETL certified and suited for the application. Each fixture shall be supplied with necessary caps, straps, supports, hangers, canopies, clips, or other misc. materials and devices to install them in a satisfactory manner conforming with the architectural treatment of the areas in which they are to be installed. Consult Architectural Plans to become familiar with the necessary details.
- C. Permanent lighting fixtures shall be lamped with lamps as specified, immediately prior to the inspection for Substantial Completion.
- D. Install battery units approximately 7' AFF with adequate clearance for maintenance and repair and inspection. Install heads approx. 7.5' AFF as indicated or required.
- E. DC wiring shall be sized for a maximum voltage drop of 5% from the most remote DC load to the unit. Minimum wire size shall be #12 AWG copper.

END OF SECTION

HSS 3 x 3 x 5/16 x 11.0 FT /ASTM A500-GR.B-46  
 Section Adequate By: 8.8%

Vertical Reactions:

Live:  
 Dead:  
 Total:  
 Vert-LL-Rxn= 8000 LB  
 Vert-DL-Rxn= 510 LB  
 Vert-TL-Rxn= 8510 LB

Horizontal Reactions:

TL-Rxn-Top= 227 LB  
 TL-Rxn-Bottom= 773 LB

Total Reaction at Top of Column (Lateral Loads Only):  
 Total Reaction at Bottom of Column (Lateral Loads Only):

Deflection due to lateral loads only:

Defl= 0.31 IN = L/426

Live Loads:

Dead Loads:  
 Column Self Weight:

Total Loads:  
 PL= 8000 LB

Eccentricity (X-X Axis):  
 PD= 400 LB

Eccentricity (Y-Y Axis):  
 CSW= 110 LB

Loads applied to:  
 PT= 8510 LB

Uniform Lateral Load:  
 ex= 1.50 IN

Point Load 1:  
 ey= 1.50 IN

Location from Top of Column:  
 (Wind/Seismic)

Column Data:  
 wL-lat= 0 PLF

Length:  
 P1-lat= 1000 LB

Maximum Unbraced Length (X-X Axis):  
 P1-loc= 8.5 FT

Maximum Unbraced Length (Y-Y Axis):  
 L= 11.0 FT

Column End Condition:  
 Lx= 11.0 FT

Column Bending Coefficient:  
 Ly= 11.0 FT

Properties for:HSS 3 x 3 x 5/16/A500-GR.B-46  
 K= 1.0

Steel Yield Strength:  
 Cm= 1.0

Modulus of Elasticity:  
 Fy= 46 KSI

Column Section: (X-X Axis):  
 E= 29000 KSI

Column Section: (Y-Y Axis):  
 dx= 3.00 IN

Area:  
 dy= 3.00 IN

Moment of Inertia (X-X Axis):  
 t= 0.291 IN

Moment of Inertia (Y-Y Axis):  
 A= 2.94 IN<sup>2</sup>

Section Modulus (X-X Axis):  
 Ix= 3.45 IN<sup>4</sup>

Section Modulus (Y-Y Axis):  
 Iy= 3.45 IN<sup>4</sup>

Radius of Gyration (X-X Axis):  
 Sx= 2.30 IN<sup>3</sup>

Radius of Gyration (Y-Y Axis):  
 Sy= 2.30 IN<sup>3</sup>

Column Compression Calculations:  
 rx= 1.08 IN

KL/r Ratio (X-X Axis):  
 ry= 1.08 IN

KL/r Ratio (Y-Y Axis):  
 KLx/rx= 122.2

Controlling Direction for Compression Calculations:  
 KLy/ry= 122.2

Column Slenderness Ratio:  
 (Y-Y Axis)

Allowable Compressive Stress:  
 Cc= 111.6

Compressive Stress:  
 Fa= 9997 PSI

Column Bending Calculations:  
 fa= 2214 PSI

Controlling Load Case: Axial Total Load and Lateral Loads (D + 0.75[L + W])

Eccentricity Moment (X-X Axis):  
 Mx-ex= 800

Eccentricity Moment (Y-Y Axis):  
 My-ev= 800

Lateral Load Moment Including Eccentricity (X-X Axis):  
 Mx-Lat= 2044

Lateral Load Moment Including Eccentricity (Y-Y Axis):  
 My-Lat= 800

Bending Stress (X-X Axis):  
 fbx= 10663 PSI

Bending Stress (Y-Y Axis):  
 fby= 4174 PSI

Flange Buckling Ratio:  
 FBR= 10.31

Allowable Flange Buckling Ratio:  
 AFBR= 28.01

Allowable Bending Stress:  
 Fbx=Fby= 28 KSI

Combined Stress Calculations:  
 Fex= 9997 PSI

Euler's Stress (X-X Axis):  
 Fey= 9997 PSI

Using AISC Formula H1-1:  
 CSF(1)= 0.91

Using AISC Formula H1-2:  
 CSF(2)= 0.62

Using AISC Formula H1-3:  
 CSF(3)= 0.76

Controlling Combined Stress Factor:  
 CSF(1) Controls : 0.91

Vertical Reactions:

Live: 8000 LB  
 Dead: 510 LB  
 Total: 8510 LB

Horizontal Reactions:

Vert-LL-Rxn= 8000 LB  
 Vert-DL-Rxn= 510 LB  
 Vert-TL-Rxn= 8510 LB

Total Reaction at Top of Column (Lateral Loads Only):  
 Total Reaction at Bottom of Column (Lateral Loads Only):

Horizontal Deflection:  
 Deflection due to lateral loads only:

TL-Rxn-Top= 227 LB  
 TL-Rxn-Bottom= 773 LB  
 Defl= 0.31 IN = L/426

Axial Loads:

IN = L/426

Live Loads:

8000 LB

Dead Loads:

400 LB

Column Self Weight:

110 LB

Total Loads:

8510 LB

Eccentricity (X-X Axis):

ex= 1.50 IN

Eccentricity (Y-Y Axis):

ey= 1.50 IN

Lateral Loads:

(Wind/Seismic)  
 (Dy Face)

wL-lat= 0 PLF  
 P1-lat= 1000 LB  
 P1-loc= 8.5 FT

L= 11.0 FT  
 LX= 11.0 FT  
 LY= 11.0 FT  
 K= 1.0  
 Cm= 1.0

Fy= 46 KSI  
 E= 29000 KSI  
 dx= 3.00 IN  
 dy= 3.00 IN  
 t= 0.291 IN  
 A= 2.94 IN2  
 Ix= 3.45 IN4  
 Iy= 3.45 IN4  
 Sx= 2.30 IN3  
 Sy= 2.30 IN3  
 rx= 1.08 IN  
 ry= 1.08 IN

KLx/rx= 122.2  
 KLy/ry= 122.2

Cc= (Y-Y Axis)  
 Fa= 111.6  
 fa= 2214

Mx-ex= 800 FT-LB  
 My-ey= 800 FT-LB  
 Mx-Lat= 2044 FT-LB  
 My-Lat= 800 FT-LB  
 fbx= 10663 PSI  
 fby= 4174 PSI  
 FBR= 10.31  
 AFBR= 28.01  
 Fbx=Fby= 28 KSI

Fex= 9997 PSI  
 Fey= 9997 PSI  
 CSF(1)= 0.91  
 CSF(2)= 0.62  
 CSF(3)= 0.76  
 CSF(1) Controls : 0.91

Properties for:HSS 3 x 3 x 5/16/A500-GR.B-46

Steel Yield Strength:

Modulus of Elasticity:

Column Section: (X-X Axis):

Column Section: (Y-Y Axis):

Column Wall Thickness:

Area:

Moment of Inertia (X-X Axis):

Moment of Inertia (Y-Y Axis):

Section Modulus (X-X Axis):

Section Modulus (Y-Y Axis):

Radius of Gyration (X-X Axis):

Radius of Gyration (Y-Y Axis):

Compression Calculations:

KL/r Ratio (X-X Axis):

KL/r Ratio (Y-Y Axis):

Controlling Direction for Compression Calculations:

Column Slenderness Ratio:

Allowable Compressive Stress:

Compressive Stress:

Bending Calculations:

Controlling Load Case: Axial Total Load and Lateral Loads (D + 0.75[L + W])

Eccentricity Moment (X-X Axis):

Eccentricity Moment (Y-Y Axis):

Lateral Load Moment Including Eccentricity (X-X Axis):

Lateral Load Moment Including Eccentricity (Y-Y Axis):

Bending Stress (X-X Axis):

Bending Stress (Y-Y Axis):

Flange Buckling Ratio:

Allowable Flange Buckling Ratio:

Allowable Bending Stress:

Combined Stress Calculations:

Euler's Stress (X-X Axis):

Euler's Stress (Y-Y Axis):

Using AISC Formula H1-1:

Using AISC Formula H1-2:

Using AISC Formula H1-3:

Controlling Combined Stress Factor: