

SECTION 11052

RIGGING, CURTAINS, AND TRACKS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Stage Curtains and Tracks
 - 2. Stage Rigging
- B. Preparation and submission of complete shop drawings and samples for review prior to fabrication.
- C. Verification of dimensions and conditions at the job site.
- D. Shipment of equipment to job site and the secured storage of all non-fixed equipment.
- E. Installation and completion, in accordance with these Specifications, related Drawings, the Equipment Manufacturer's recommendations, established trade criteria, and all applicable code requirements.
- F. The inspection, demonstration, and necessary adjustment of the completed installation by the Contractor's engineering personnel.
- G. Preparation and submission of complete record drawings and operational and maintenance data and certificates.

1.02 QUALIFICATIONS

- A. All equipment and installation shall be the responsibility of a single contractor who shall own and operate a full-time, staffed shop for the fabrication and assembly of stage equipment. This Contractor shall assume complete responsibility for the engineering, fabrication, transportation, and installation of the work in this Section, and shall hold the Owner, Architect, Theatre Consultant, and all their Employees and Consultants harmless for any costs for errors or omissions associated with the work of this Section and any action arising therefrom.
- B. Approved contractors may, at their option, arrange for sub-contract field and special shop work to be done by others. Bid submissions must identify such subcontractors and indicate the work they are to do.
- C. The Contractor shall have at least ten (10) years' experience in the installation of similar equipment and systems for theatres. If requested, the Contractor shall submit a representative list of theatre installations of similar scope during the above period.
- D. Subject to the above requirements, work performed under this Section may be by one of the following listed contractors:
 - 1. Chicago Spotlight, Chicago, Illinois 312-455-1171
 - 2. Chicago Flyhouse, Chicago, Illinois 773-728-8455
 - 3. SECOA, Champlin, Minnesota 763-506-8800
 - 4. Tiffin Scenic Studio, Tiffin, Ohio, 800-445-1546
 - 5. *Grand Stage, Chicago Illinois 312-332-5611*
 - 6. *Texas Scenic, San Antonio, Texas 800 292-7490*
 - 7. *Mainstage Theatrical Milwaukee, WI 800 236-0878*
- E. Contractors not having a qualified and experienced sewing room as an integral part of their operation shall employ the services of a qualified and experienced Sewing Subcontractor for the fabrication of stage curtains. Sewing Sub-contractor shall have at least ten (10) years' experience in the fabrication of curtains for professional theatres.

1. If requested, the Rigging Contractor shall submit a representative list of professional theatre projects performed by the Sewing Sub-contractor during the above period. Subject to the above requirements, work performed under this Section may be by one of the following Sewing Sub-contractors:
 - a. Rose Brand, New York, New York
 - b. Stage Decoration and Supplies, Greensboro, North Carolina
 - c. Stagecraft Industries, Portland, Oregon
 - d. Syracuse Scenery and Stage Lighting, Liverpool, New York
 - e. Tiffin Scenic Co., Tiffin, Ohio
 - f. I. Weiss & Sons, Long Island City, New York
- F. Other contractors or sewing rooms may be considered with the prior review of the Theatre Consultant. Contractors seeking review must contact the Theatre Consultant not later than fourteen (14) days prior to bid date.
- G. *A qualified and experienced supervisor for the Stage Rigging Contractor and employed full time by the Stage Rigging Contractor for not less than 3 years shall be at the site during the entire installation period and shall actively direct and supervise the work. The supervisor shall be an ETCP Certified Rigger - Theatre.*

1.03 SUBMITTALS

- A. With bid.
 1. Proof that the firm has been continuously engaged in the fabrication and installation of stage rigging and drapery for theatres during the past ten (10) consecutive years.
 2. A list of at least three (3) theatre stage rigging and drapery installations by the bidder comparable to this project in scope.
 3. A list of any proposed deviations or exceptions from the Specifications. Any deviations or exceptions from the Specification proposed after bid shall not be accepted.
 4. A schedule for the anticipated completion of the following:
 - a. Shop drawings
 - b. Delivery of all equipment
 - c. Installation of all systems
- B. Shop drawings. Within sixty (60) days of contract award, the Contractor shall submit at least one set of reproducible drawings to the Architect for review prior to fabrication:
 1. Floor plan, gridiron plan, and section of stage in scale equal to 1/4" = 1'-0".
 2. Elevation of each rigging set type, showing stage floor, batten support and arrangement, and cable management.
 3. Curtain schedule indicating fabric, finished size, fullness, and top finish.
 4. Complete, fully dimensioned shop drawings of all major components.
 5. Requisite plans, sections, schematics, and details indicating assembly and installation of components.
 6. Load ratings of all bearings, blocks, trim chains, lift lines, and purchase lines within the system.
 7. Complete descriptions, including the manufacturer's catalog data sheets, of all bearings, motors, and transmissions.
 8. Certification that all steel cable and rope is of domestic manufacture, or certification that all steel cable meets the noted U.S. Military Standards.
 9. Details of all supplementary structural support to be supplied and installed as part of the work of this Section.
 10. Quantities of each component and sub-assembly.
 11. Indication by boxed caption of any and all variations from the contract Drawings and Specifications, whether or not these variations have been formally or informally accepted by the Theatre Consultant.

12. Prepare all shop drawings under the supervision of professional electrical and structural engineers so licensed by the State of Illinois. All shop drawings shall be stamped and certified by those engineers. Structural Engineer's review shall include, but not be limited to, all elements related to overhead lifting, structural support of elements provided by the Rigging Contractor (such as platform floors), and all overhead suspended elements.
- C. Samples. Within sixty (60) days of contract award, the Contractor shall submit to the Architect for review prior to fabrication:
1. Color lines for all curtain fabrics, for color selection by Architect.
 2. Sewn sample of main curtain, demonstrating fabrication of top, bottom, and side hems. Finished size shall be 5'-0" wide and 5'-0" high. Fabric shall be identical to that specified, but fabric may be any color.
 3. 30-inch square sewn sample of the cyclorama, showing construction of all hems and grommets.
 4. 30-inch square sample of the projection screen material.
 5. 36-inch long sample of each type of curtain track, complete with (if applicable) live end pulley, dead end pulley, operating line, one single carrier, and one master carrier.
 6. Samples of any equipment component requested by the Theatre Consultant. Samples shall not be considered part of specified quantities but shall be returned.
- D. Final submittal. Within thirty (30) days of final tests, and as a condition for final review, the Contractor shall submit to the Architect:
1. Receipts for delivery of all non-installed items, i.e., all items designated, "deliver to Owner."
 2. Three (3) bound sets to the Architect and one (1) bound set to the Theatre Consultant:
 - a. "As built and approved" drawings and wiring diagrams showing all systems and components as installed, including all field modifications.
 - b. Operation and service manuals, schematics, and parts lists for each unit of equipment installed or provided.
 - c. Flameproofing certificates.
 - d. Certificates of warranty, as set forth below.

1.04 TESTING AND INSTRUCTION

- A. Upon completion of all installation work, the Contractor shall certify in writing to the Architect that the work is complete and ready for final inspection. Final inspection shall be scheduled by the Owner, the Architect, and the Theatre Consultant within fourteen (14) days following the Contractor's notice of completion.
- B. Final inspection shall be conducted by a knowledgeable representative of the Contractor, in the presence of the Owner, the Architect, and the Theatre Consultant, and shall include the following:
1. Operation of all components.
 2. Visual examination of all components.
 3. Sightline check of masking curtains.
 4. Necessary adjustments or modifications shall be made as required.
- C. Contractor's representative shall instruct Owner's designated staff or representatives in the safe operation and maintenance of all items, including the storage and cleaning of all fabrics. This instruction session shall be scheduled to last a minimum of four (4) hours. While it may be possible to schedule this instruction session to coincide with the system checkout, such coincidence shall not be assumed.

1.05 GENERAL REQUIREMENTS

- A. General Conditions of the project contract, work schedules, and site regulations apply to this work.
- B. This work shall comply with local codes and applicable NEC and UL standards, and all electrical

components shall carry pertinent UL labels.

- C. All equipment shall be fully insured against loss or damage during shipment, job site storage, installation, and testing. The Contractor shall have and assume full responsibility for the safety of every unit of equipment, components, wiring, and plans during delivery, installation, and testing. Certification of such coverage shall be furnished to the Architect within 30 days of award of contract.
- D. Warranty
 - 1. The Contractor shall unconditionally warrant all equipment and systems provided under this Section to be free from defects in materials and workmanship for a period of at least twelve (12) months from the date of final acceptance of all work of this Section.
 - 2. All repairs and service during the warranty period shall be performed at the job site; labor, materials, and transportation of replacement material and parts and service personnel to and from the job site shall be included hereunder at the Contractor's expense.
 - 3. Appropriate additional equipment or draperies to replace equipment, devices, or draperies removed for repair, service, or cleaning shall be provided at the job site at no expense to the Owner to replace any and all equipment which must be removed for repair or service.
 - 4. Warranty service shall be performed by personnel in the employ of the Contractor and shall not be sub-contracted or assigned to another company, service, or individual unless the Owner has approved such assignment in writing, in which event the Contractor shall nevertheless be responsible to the Owner for such work.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All components shall be new and of first quality.
- B. Machinery and component parts shall comply with applicable trade practice, industry standards, and code requirements and bear appropriate labels of conformity and acceptability.
- C. All flameproofed components shall bear pertinent flameproofing certificates and UL labels. All components shall bear labels identifying the manufacturer, model number, and serial number. All such labels and certificates shall be permanently attached in a conspicuous location.
- D. Operating parts of all equipment shall be machine finished, and tolerances, finishes, fit, etc., where not specified, shall conform to good trade practices.
- E. All items necessary for a complete, operational, and safe system shall be provided, including bolts, nuts, washers, fittings, anchors, supports, hinges, and all other items required for completeness and operational safety. Where not specified elsewhere in this Section, all bolts shall be Grade 5 or better.
- F. Where not specifically called out in this Section, rope and wire rope shall be selected using a minimum safety factor of 8 to 1. All chain, shackles, and other hardware shall be selected using a minimum safety factor of 3 to 1. These safety factors apply to dynamic loading conditions.
- G. Where specification allows for "approved equal," substitutions shall be proposed to the Theatre Consultant at least ten (10) days prior to bid date.
- H. Equipment and hardware are specified on the basis of performance and minimum acceptable quality. Materials manufactured by any of the following companies which equals or surpasses the performance and quality specified will be acceptable:
 - 1. Automatic Devices Company, Allentown, Pennsylvania
 - 2. J. R. Clancy, Syracuse, New York
 - 3. H & H Specialties, South El Monte, California
 - 4. SECOA, Champlin, Minnesota
 - 5. Tiffin Scenic Co., Tiffin, Ohio

2.02 DESIGN RESPONSIBILITY

- A. The design of all equipment, devices, machinery, and systems shall encompass the following criteria:
 - 1. Safety to personnel during operation, use, and maintenance.
 - 2. Adequate strength.
 - 3. Proper coordination of all systems and elements, including electrical insulation levels, interrupting capacities, protective relays, impact strength, breaking strength, emergency stopping distances, acceleration and deceleration rates, and normal working stress capabilities of equipment and all components.
 - 4. Reliability, with consideration for special or unusual requirements of the unit or installation.
 - 5. Ease of maintenance.
 - 6. System operating sequences, including designing for simultaneous as well as sequential operation of systems and sub-systems.
 - 7. Coordination with associated and/or adjacent systems provided by others, including system and sub-system status information, if required.
 - 8. Quiet operation.
- B. Provide all supplementary structural support necessary for safe and proper static and dynamic conditions of all systems and components required for the work of the Specification. Supplementary structural support required for access, support, enclosure, and service to all motors and motor control cabinets shall be supplied and installed as part of the work of this Section. All attachments, anchorages, connections, and miscellaneous steel additions to accommodate pulleys, blocks, etc., shall be designed, supplied, and installed by the Contractor and reviewed by the Architect. All methods of connection and imposed loads resulting from the Contractor's work shall be submitted to the Architect prior to fabrication.
- C. Provide all guards and other protective devices required to ensure protection of individuals associated with the operation of, or who may be near or adjacent to, equipment and devices provided as part of the work of this Section.
- D. Loading capacities of systems, where specified in the Drawings or the Specifications, refer to the net working capacities exclusive of the dead loads-pipe battens, truss battens, sandbags, hooks, etc. exactly as indicated on the Drawings and Specifications. Should the Contractor choose to suggest alternate methods that require heavier dead loads, the Contractor shall be responsible for increasing the capacities of the individual components, including the arbor capacities, accordingly. Any alternate methods must be approved specifically by the Theatre Consultant.

2.03 EQUIPMENT COMPONENTS

- A. Single and Multiple Line Sheaves:
 - 1. Supporting, load bearing, and idler sheaves shall be of materials indicated. Size and capacity shall be as required for safe and reliable operation under design loads, but in no instance shall bearing pressure of the wire rope on a sheave groove exceed:
 - a. 100 pounds/sq. in. for nylon
 - b. 250 pounds/sq.in. for Nylatron
 - c. 250 pounds/sq. in. for cast iron
 - d. 500 pounds/sq. in. for high tensile cast iron
 - e. 750 pounds/sq. in. for cast steel
 - f. 2,000 pounds/sq. in. for turned steel sheaves.
 - 2. Tread diameter of wire rope sheaves shall be at least 30 times the diameter of the wire rope employed, except minimum diameter of idler sheaves and mule blocks that divert the cable direction by less than 45° may be 20 times cable diameter. Tread diameter of textile rope sheaves shall be at least 15 times the diameter of the textile rope employed.

3. All castings shall be designed and detailed for required loads and cable diameters with safety factors of at least three.
4. Provide rigid and accurate shaft and bearing mounting. Shafts shall be seized to prevent rotation. Each bearing in a single block shall be selected to support at least 1.5 times the intended sheave load at 500 rpm, or as otherwise indicated. Each bearing in a multiple line block shall be selected to support at least three (3) times the intended sheave load at 500 rpm, or as otherwise indicated. Bearings shall be of the tapered roller type.
5. Cable grooves shall be lathe turned and machined to the proper size for cable used, with groove diameter clearances to fit cable closely and prevent cable from assuming oval or elliptical shape under load. Groove diameter clearance shall be 8% of cable diameter. Groove depth shall be equal to the cable diameter. Cast grooves are not acceptable. All grooves on the same casting or billet shall have the same pitch diameter. All groove sides shall be beveled for required fleet angle to eliminate rubbing. Fleet angles shall not exceed ± 2 degrees.
6. Fleeting, muling, idler, and spacer blocks shall be provided as necessary to guide, turn, support, and separate lift-lines. Load bearing sheaves shall be of at least the same components and sizes as required for other sheaves in the set and provided with suitable swivel bases, slip-shafts, mounting brackets, platforms, and accessories to satisfy job requirements.
7. Spacers shall be located so as to both retain the cable in the sheave groove and to retain the sheave within the block in the event of shaft failure. Clearance between the spacer and the rope shall be not more than 40% of the rope diameter nor less than 20% of the rope diameter.

B. Bearings

1. Unless otherwise noted, all bearings shall be of the tapered roller type. Precision sealed ball bearings and oil impregnated bronze bushings, or similar, shall not be used except in specific applications identified in this Specification, and where guidance or diverting of wire rope self-weight are the only loads carried. In all cases, such bearings and bushings may be used only when specifically approved in advance by the Architect and Theatre Consultant on Shop Drawings.
2. Selection of bearings or bushings shall meet the following performance criteria:
 - a. Silent operation at expected RPM
 - b. Low maintenance and lubrication
 - c. Ability to withstand long periods of static disuse under full design load without affecting performance
3. All bearings shall be pre-lubricated and sealed for life. For bearing types that cannot be sealed for life, easy means shall be provided for periodic lubrications via standard and common fittings. Such lubrication shall not require the disassembly of blocks or other *extraordinary means*.

- C. *Components shall bear labels identifying the manufacturer, model number, and serial number. Permanently attach labels and certificates in a conspicuous location.*

2.04 STRUCTURAL AND MISCELLANEOUS METAL WORK

- A. Additional structural steel and other fittings required for installation, support, bracing, and/or operation of theatrical rigging in all areas of the Project are the responsibility of this Contractor and shall be in accordance with related Divisions of the Project Specifications.
- B. Patented channel type shall be capable of supporting a live load of at least 75 lbs./lin.ft. Channels shall equal Unistrut Series 1000.
- C. Flame Cutting: Flame cutting is not an acceptable procedure for this Project, except for fabrication of counterweight iron.
- D. Miscellaneous steel shall be of suitable types and sizes. All straps, rods, anchors, clip anchors,

clip angles and other hardware necessary for the attachment shall be supplied.

2.05 ELECTRICAL CABLE SUPPORT

- A. Contractor is responsible for the rigging of all cords and cables supplying electricity or control signal to any equipment supported by equipment furnished under this Section.
- B. Electrical cables shall be rigged in such a manner that the entire length of all cables is in a plane parallel to the associated set and so that, except for the terminal, no portion of the cable ever rests on or hangs below the electrical device supplied. Provide support, muling, and turning blocks as required for proper support and movement of the electrical cables and cords.
- C. Construction of cable management units must employ non-ferrous materials to prevent the creation of inductive fields that could cause cable heating and breakdown of the insulation.

2.06 ISOLATION OF NOISE GENERATING EQUIPMENT

- A. Electrically-operated and other rotating equipment and associated controls which produce noise during operation, including motors, gear boxes, and drums, shall be mounted on vibration isolators as required to minimize levels of structure-borne noise. Equipment shall be mounted on double-deflection neoprene mountings with a static deflection of less than 3/8". Electrical connections shall include a 360 degree loop of super-flex flexible conduit.

2.07 STEEL CABLE

- A. All rope shall be impregnated with a dry lubricant. All cable shall meet the requirements of the US Military Standard MIL-DTL-83420, Wire Rope, Flexible, for Aircraft Control. Certification shall be provided from an independent testing laboratory.
- B. Counterweight set lift lines. 7 x 19 preformed galvanized aircraft cable of right regular lay. Minimum breaking strength shall be not less than indicated below: Cables larger than 3/8" diameter are permitted to be of 6x37 XIPS construction. Contractor shall submit certification that cable is of domestic manufacture with bid.
 - 1. 3/16" = 4,200 lbs.
 - 2. 1/4" = 7,000 lbs.
 - 3. 5/16" = 9,800 lbs.
 - 4. 3/8" = 14,400 lbs.
 - 5. 7/16" = 17,600 lbs.
 - 6. 1/2" = 22,800 lbs.
- C. Curtain guide lines. 3/16" 6 x 7 preformed improved plow steel cable of right regular lay.
- D. All wire rope connections shall employ thimbles of the proper size and compressed oval sleeve fittings as manufactured by National Telephone ("Nicopress"). All fittings shall be malleable copper. Aluminum fittings shall not be acceptable. All connections shall be selected and installed to develop the full tensile strength of the cable. Free ends shall extend above the fittings to an amount equal to the rope diameter. Rope ends shall be seized with a high-strength epoxy sealant. Contractor shall maintain and inspect all swaging equipment on a daily basis to ensure the integrity of swaged fittings.
- E. Drop-forged steel cable clips may be used only in specific locations as directed by this Specification, or in locations approved in advance by the Theatre Consultant or Using Agency. Clips shall meet or exceed Federal Specification FF-C-450 and shall produce a termination equal to at least 80% of the breaking strength of the wire rope. The saddles of the clips shall be in contact with the load end of the rope. One clip shall be tight against the thimble to retain the cable in the thimble. Rope ends shall be seized with a high-strength epoxy sealant and secured to the standing line with nylon tension ties. Quantity and separation of the clips shall be according to the following:

CABLE DIAMETER	QUANTITY OF CLIPS	INCHES OF CABLE TO TURN BACK
3/16"	2	3-3/4"

1/4"	2	4-3/4"
5/16"	2	5-1/4"
3/8"	2	6-1/2"
7/16"	2	7"
1/2"	2	11-1/2"

Sizes and connections per Drawings and Schedules.

2.08 TRIM CHAINS

- A. Trim chains shall be grade 43 proof steel chain, proof tested to not less than 3,900 lbs.
- B. Trim chains shall be sized and terminated per the drawings. Trim adjustment shall be with a screw-pin type drop forged shackle, proof tested to not less than 2,000 lbs. Screw pins shall be wired shut after installation.
- C. Quantities and attachment per Drawings.

2.09 PIPE BATTENS

- A. Pipe battens shall be nominal 1-1/2" I.D. black steel pipe, ASTM A53/A Strong (Schedule 40), stripped and painted with at least one coat of black primer and one coat of flat black paint.
- B. Splices shall be close-fitting internal steel sleeves with a wall thickness of not less than 0.1875 inch, and min. 24 inches long. One side of the splice shall be held in place with a minimum of two (2) plug welds. Other side shall be held with a minimum of two (2) 5/16" bolts and lock nuts; bolts shall be placed at right angles. For removable pipe sections, see Drawings for location of welded and bolted splice sides.
- C. Both ends of every batten, including electric sets and track strong backs, shall be threaded and contain a threaded coupling.
- D. Six (6) inches of both ends of every batten, including the threaded coupling, shall be painted "safety yellow" as well as a 1-inch wide strip at the center of every batten.
- E. A 1-inch wide white strip shall be painted at the attachment point of each lift line, to indicate the plumb attachment of each lift line.
- F. Lengths and quantities as per Drawings and Schedules.

2.07 STAGE LIGHTING PROTECTIVE CAGE

- A. *Cage shall be of size and form indicated on the drawings and shall be of a design and of sufficient size to permit use of lighting equipment specified elsewhere.*
- B. *Cage shall be primed and painted to match ceiling beams or as directed by architect.*
- C. *Cage shall be "Spotlight Cage" by SSRC, SECOA, or Chicago Spotlight or approved equal.*

2.10 BOX TRACK

- A. Tracks shall be of the heavy duty channel type, approximately 3" x 3" 14 ga. galvanized steel, entirely enclosed except for slot in bottom. Automatic Devices -Company 2800, or approved equal.
- B. Every track and each half of every bi-parting curtain track shall be one continuous piece, except where splicing clamps are required. Splicing clamps shall provide a flush, positive alignment of track sections.
- C. Tracks shall be supported at both the live and dead ends, at the center of the overlap, where applicable, and no more than 7'-0" O.C. in between, using hanging clamp ADC 2808, or approved equal. Attach to pipe battens using clamp for 1-1/2" I.D. pipe, ADC 2815, or approved equal.

- D. Carriers shall be constructed of steel or nylon bodies with a "hollow center" design to contain operating line, with nylon tired ball bearing wheels and 6" trim chains on plated swivels. H&H 416 (single) and H&H 417 (master) or ADC 2851 (single) and 2852 (master), or approved equal.
- E. All curtains shall be hung at center of trim chain length, to permit trim adjustment.
- F. All tracks shall be provided with rear fold devices to stack curtain only at offstage track ends. Rubber washers shall be placed on both sides of each rear fold tab.
- G. Operating line shall be 1/2" braided cotton with a fiberglass center.
- H. Live and dead end pulleys shall contain 8-inch diameter cast iron sheaves on ball bearings. ADC 2863-A (live) and 2864-A (dead), or approved equal. For travellers mounted in rigging systems using lineset spacing of 9 inches or less, mount 8-inch dead-end pullies at a 45° angle, rather than parallel to the floor.
- I. Floor pulleys shall contain 8-inch diameter cast iron sheaves on ball bearings. Side plates shall be slotted to allow a min. 8 inch vertical adjustment. ADC 2866-A, or approved equal.
- J. All pulleys shall provide for positive retention of the operating line.
- K. Paint track channel, hangers, pulleys, and all fittings flat black.
- L. Quantities, sizes, and locations as per Drawings and Schedules.

2.10 BEAM TRACK

- A. *Track shall be extruded 7 gauge aluminum open "I" beam track with two intermediate flanges, approximately 3-1/4" high by 1-5/8" wide, for walk-along operation, finished anodized matte black.*
- B. *End-stop by bolt through tracks with rubber or neoprene bumper sleeves each side of track. Furnish and install fittings and clamps for attachment to pipe batten spaced not more than 5 feet 0 inches on center.*
- C. *Provide special lateral bracing for curved track sections to prevent sway when moving curtains.*
- D. *Verify and indicate in shop drawings the stacking space requirements and weights of all curtains.*
- E. *Carriers shall be U-shaped steel carrier; two nylon wheels with ball bearings; rubber bumpers.*
- F. *Plated swivel for curtain snap-hooks.*
- G. *Provide sufficient carriers for curtains on sets plus 5 percent spares. All carriers finished black except wearing surfaces on wheels and axles.*

2.11 CURTAINS

- A. Fabrics
 - 1. All fabrics not inherently flameproof shall be fully mill flameproofed by the immersion process to meet or exceed the minimum requirements set forth by NFPA 701: *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2004 Edition. Small-Scale 701.* ~~The Contractor shall submit certificates so stating.~~
 - a. *Certification label shall be sewn on back of each curtain at bottom of stage hem, off stage or, for side masking, upstage.*
 - b. *Provide certificates as required under submittals.*
 - 2. All fabrics shall be produced from one dye lot per color. Color quality shall be consistent throughout, with no visible streaking, striping, or spotting.
 - 3. All curtain color selections shall be submitted to the Theatre Consultant following selection by Architect. Final color approval by the Theatre Consultant is required prior to ordering

- fabric.
4. *Attach by sewing at webbing to rear of each piece sufficient material samples for a minimum of four tests per 2004 NFPA 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.*
 5. *Velour-Main Curtain and Teaser. 100% combed cotton velour, 54 inches wide, weighing ~~25 oz. per linear yard~~ weight per schedules after flameproofing. "Majestic" as manufactured by KM Fabrics, Inc., Greenville, South Carolina, or approved equal, ~~by J. L. DeBall Fabrics or J. B. Martin Fabrics.~~*
 - a. ~~44 backing ends per inch~~
 - b. ~~44 pile ends per inch~~
 - c. ~~44 picks per inch~~
 - d. ~~968 pile tufts per square inch~~
 - e. ~~Pile height: approximately .094 inch~~
 6. *Velour-Masking Curtains. 100% carded cotton velour, 54 inches wide, weighing ~~25~~ weight per schedules oz. per linear yard after flameproofing. "Memorable" as manufactured by KM Fabrics, Inc., Greenville, South Carolina, or approved equal, ~~by J. L. DeBall Fabrics or J. B. Martin Fabrics.~~*
 - a. ~~40 backing ends per inch~~
 - b. ~~40 pile ends per inch~~
 - c. ~~32 picks per inch~~
 - d. ~~640 pile tufts per square inch~~
 - e. ~~Pile height: approximately .135 inch~~
 7. *Lining. 100% cotton, 54 inches wide. Dazian Lining Denim, or approved equal. Flameproofed. Color as selected by the Architect.*
 8. *Furnish and install skydrops per schedule. Material shall be Procyc Opera by Gerriets or Twin White by Rosco. All seams shall be ultrasonically welded flat, without wrinkles or stress lines for a seamless appearance. Top finish shall be 2-½" wide webbing with grommets ultrasonically welded on 12" centers. Side finish shall be reinforced with 2-½" webbing welded to screen surface with grommets ultrasonically welded on 12" centers. Bottom finish shall accommodate a 1" steel pipe batten with a 9" skirt welded onto face of drop. Provide pipe in pocket. Provide batten with sleeved joints. Drop must appear seamless, uniform in color, and free of wrinkles or seam lines. ~~Cyclorama canvas. 100% cotton duck, weighing 12 oz. per square yard, 72 inches wide. Rose Brand 12 oz. Canvas, or approved equal. Flameproofed. Color: natural (unbleached).~~*
 9. *Heat resistant border. 100% glass yarn, coated both sides with a fiber-containing coating. Non-asbestos. Weight: 32 oz. per square yard. Continuous service temperature: 1100° F. Color: black. Newtex Zetex 800 or Canvas Specialty Co. CSC-G2P or W. E. Palmer Co. "Heatstop".*

B. Fabrication

1. General
 - a. Unless otherwise noted, all pile fabrics shall have pile running up.
 - b. All seams shall be vertical, unless otherwise specifically indicated. All fabric widths shall run full height, with no vertical piecing.
 - c. Thread colors shall match face fabric.
 - d. The center of every curtain shall be indicated by a 1/2"-wide fabric strip sewn to the back of the webbing.
 - e. All grommets shall be black in finish.
 - f. Every curtain shall contain a permanent label sewn to the off-stage end of the curtain. Borders shall have labels located at the top webbing. Full-height curtains shall have labels located 48" above the bottom hem, and stitches shall not penetrate the front face fabric of the curtain. This label shall indicate fabric, color, finished size, and method and date of flameproofing.
 - g. Sizes and quantities per Drawings and Schedules.
2. Main curtain.

- a. Fabric pile shall run *up*.
 - b. Top hem shall be single turned and reinforced with continuous 3-1/2" heavy jute webbing. Fullness shall be sewn into the curtain by means of box pleats 12 inches O.C. Two No. 3 brass grommets shall be provided at each top corner of each finished panel and one grommet shall be provided at the center of each box pleat along the top hem. One heavy duty 1-1/2" Shook shall be provided for each grommet for attachment to track.
 - c. Bottom hem shall be 6 inch double turned and contain a continuous No. 6 plated jack chain held in a separate muslin pocket 4 inches above bottom of curtain and tacked at each vertical seam to prevent bunching. A dust ruffle of the face fabric shall be sewn at the back of the bottom hem and shall be exposed 2 inches below the bottom hem. The dust ruffle shall be a single turn of face fabric on both sides, for the full height of the dust ruffle. The dust ruffle shall be inside of the vertical hems.
 - d. All vertical hems shall be faced back with one-half width of face fabric.
 - e. Lining shall be applied with the same fullness as the face fabric. The lining shall be sewn to the face fabric only along the top and bottom hems. An inverted tuck of at the bottom shall be sewn into the lining to allow for shrinkage difference between face fabric and lining. The side hems of the lining shall be 2 inch single turned and shall be attached to the inside edge of the face fabric vertical hems by means of continuous twill tape laced through tape loops attached to both curtains 18 inches O.C. and evenly staggered between the two panels.
 - f. Front curtain height shall be determined by field measurement, to ensure that top of curtain is not visible from any seat in auditorium. Finished height shall be this field measurement or dimension stated in curtain schedule, whichever is greater.
3. Teaser.
- a. Fabric pile shall run *up*. Top hem shall be single turned and reinforced with continuous 3-1/2" heavy jute webbing. Fullness, if called for in schedule, shall be sewn into the curtain by means of box pleats 12 inches O.C. One No. 3 brass grommet shall be provided at each top corner of each finished panel and one grommet shall be provided at the center of each box pleat along the top hem. One tie line shall be provided for each grommet. Tie lines shall be braided cotton, black in color, and 36 inches long.
 - b. Bottom hem shall be 6 inch double turned. Teasers with fullness shall contain a continuous No. 6 plated jack chain held in a separate muslin pocket 4 inches above bottom of curtain and tacked at each vertical seam to prevent bunching.
 - c. Vertical hems shall be 4 inch double turned.
 - d. Lining shall be applied with the same fullness as the face fabric, and an inverted tuck of 4 inches at the bottom shall be provided to allow for shrinkage difference between face fabric and lining.
4. Leg Curtains
- a. Top hem shall be single turned and reinforced with continuous 3-1/2" heavy jute webbing. One No. 3 brass grommet shall be provided at each top corner of each finished panel and 6 inches O.C. along the top hem. One tie line shall be provided for each grommet. Tie lines shall be braided cotton, black in color, and 36 inches long.
 - b. Bottom hem shall be 6 inch double turned and contain a continuous No. 6 plated jack chain held in a separate muslin pocket 4 inches above bottom of curtain and tacked at each vertical seam to prevent bunching.
 - c. All vertical hems shall be faced back with 12 inches of face fabric.
5. Travelers
- a. Top hem shall be single turned and reinforced with continuous 3-1/2" heavy jute webbing. One No. 3 brass grommet shall be provided at each top corner of each finished panel and 12 inches O.C. along the top hem. One heavy duty 1-1/2" S-hook shall be provided for each grommet for attachment to track.
 - b. Bottom hem shall be 6 inch double turned and contain a continuous No. 6 plated jack chain held in a separate muslin pocket 4 inches above bottom of curtain and tacked at

- c. each vertical seam to prevent bunching.
 - d. All vertical hems shall be faced back with one-half width of face fabric. 6. Borders.
 - e. Top hem shall be single turned and reinforced with continuous 3-1/2" heavy jute webbing. One No. 3 brass grommet shall be provided at each top corner of each finished panel and 12 inches O.C. along the top hem. One tie line shall be provided for each grommet. Tie lines shall be braided cotton, black in color, and 36 inches long.
 - f. Bottom hem shall be 6 inch double turned and contain a separate non-flameproof 8 oz. cotton duck pipe pocket that shall hold the pipe within the bottom of the curtain. Openings shall be provided every 1 0'-0" along the back of the bottom hem and pipe pocket to facilitate the coupling of pipe sections. Provide 3/4" I.D. schedule 40 galvanized steel pipe in 10'-0" and 6'-0" sections with internal sleeve couplings; lengths as necessary to run full length of support batten.
 - g. Vertical hems shall be 4 inch double turned.
- ~~6. Cyclorama: All seams shall be vertical. Top hem canvas shall be double turned and reinforced with continuous 3-1/2" heavy jute webbing. One No. 3 brass grommet shall be provided at each top corner of each finished panel and 12 inches O.C. along the top hem.~~
- ~~a. Bottom hem shall be 6 inch double turned. A separate non-flameproof 8 oz. cotton duck pipe pocket shall be applied to the rear of the bottom hem. Pipe pocket shall hold the pipe 2 inches above the bottom of the curtain. Openings shall be provided every 1 0'-0" along the back of the pipe pocket to facilitate the coupling of pipe sections. Provide 3/4" I.D. schedule 40 black steel pipe in 10'-0" and 6'-0" sections with internal sleeve couplings; lengths as necessary to run full width of curtain.~~
 - ~~b. Vertical hems shall be double turned and reinforced with 2" jute webbing. No. 2 brass grommets shall be provided 12 inches O.C. vertically along both side hems.~~
 - ~~c. One tie line shall be provided for each grommet, top and sides. Tie lines shall be braided cotton, white in color, and 36 inches long.~~

C. Fabricate and install as shown in the Drawings and Schedules.

PART 3 - EXECUTION

3.01 FABRICATION

- A. This Contractor is responsible for becoming familiar with and verifying all pertinent dimensions and conditions, both in the Drawings and in the field, before proceeding with any work.
- B. Coordinate the design, planning, and scheduling of the work of this Section with the work of all other trades. Notify the Architect of any difficulties in coordinating work with other contractors. Failure to do so shall constitute acceptance of construction as suitable in all ways to receive the work of this Section.
- C. All electrical components shall be fully assembled and internally wired, with terminals of the proper rating and clearly labeled, provided for external feeder and control wiring.
- D. All metal fabricated items shall be given at least one coat of primer and one coat of finish paint. Color: flat black.
- E. Where not specifically called out in the Drawings and Specifications, tracks and fittings shall be painted or anodized black.
- F. Verify curtain height dimensions after track installation is complete, prior to fabricating curtains.
- G. All curtain color selections shall be submitted to the Theatre Consultant following selection by Architect. Final color approval by the Theatre Consultant is required prior to ordering fabric.
- H. All equipment shall be fabricated and installed to facilitate maintenance and future replacement.

3.02 INSTALLATION

- A. Contractor shall employ only experienced stage riggers for the installation of work of this

Section. A competent supervisor shall be maintained on this Project during the entire installation. A change of supervisor shall not be acceptable unless by written authorization of the Architect.

- B. Coordinate installation with all other trades doing adjoining work.
- C. Examine all existing conditions at the jobsite prior to beginning installation.
- D. Provide protection for all stage flooring, regardless of whether flooring has been stained or sealed. Flooring shall be protected from both structural damage and cosmetic damage.
- E. Provide and install all supplementary structural support as required for the installation and safe operation of equipment and materials supplied under this Section.
- F. Support all pipe grids with hangers minimum 8'-0" O.C. in each major direction.
- G. Do all required cutting, drilling, tapping, and welding necessary for proper installation. Cut no structural members unless specifically shown in the Drawings or indicated in the Contractor's shop drawings, or unless written approval is obtained from the Architect.
- H. Install all items in conformity with standard trade practices and manufacturers' recommendations. Position all items accurately and true to plumb line and level. Maintain maximum headroom and clearances at all locations.
- I. Ropes and cables shall enter rigging blocks at a fleet angle not exceeding ± 2 degrees. Ropes and cables shall enter drums at a fleet angle not exceeding + 1.5 degrees.
- J. All turnbuckles and screw-pin shackles shall be wired shut after adjustment.
- K. Install all traveller tracks with 3'-0" overlap at center.
- L. Install all curtain tracks with the turnbuckles at the mid-point of travel, to allow future adjustment in either direction. Install all curtains on tracks at the mid-point of the carrier trim chain, to allow future adjustment in either direction.
- M. No curtains shall be installed until construction and painting are complete and the building has been cleaned. Any curtains delivered to the job site prior to their installation shall be stored in a clean area in dustproof bags.

3.03 CLEAN UP

- A. *The Stage Rigging Contractor shall be responsible for clean up, including removal of packing materials etc. and the protection of surfaces or equipment provided by other contractors.*

3.04 INSPECTION AND TESTING

- A. *During the installation of equipment the Stage Rigging Contractor shall arrange for access as necessary for inspection of equipment by the Architect or their consultants.*
- B. *On completion of installation and testing the Stage Rigging Contractor shall conduct a complete pre-test of the system to ensure it is working properly and in conformance with this specification. This shall include a complete test of all electrical systems and components. All tests shall be conducted as if the Architect or Consultant were present and appropriate corrections made before the final inspection.*
- C. *If specifications, the Architect's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Stage Rigging Contractor shall give the Architect timely notice of its readiness for inspection, and of dates of inspections to be made by other authorities.*
- D. *Any equipment, which is not in conformance with the plans and specifications, shall be repaired or replaced with suitable equipment. Should deficiencies due to faulty equipment or installation require a second review; such second review will be scheduled under the same conditions as*

previously specified. All additional expenses resulting from a second review, including time and travel of the Architect and their consultants shall be the paid by the Stage Rigging Contractor.

- E. Upon completion of all installation work, the Stage Rigging Contractor shall notify the Architect that the work is complete and ready for final review.*
- 1. Final inspection shall be conducted by the Stage Rigging Contractor's ETCP Certified Rigger, in the presence of the Architect or their consultant and shall include the following:*
 - a. At the time of the review, the Stage Rigging Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Architect or their consultant.*
 - b. The Stage Rigging Contractor's ETCP Certified Rigger shall be present for this review. At the time of these inspections, no other work shall be performed in the auditorium and stage areas.*
 - c. Remove temporary bracing, scaffolding, etc. to permit full operation of, and access to, all equipment.*
 - d. Final acceptance will be withheld until all systems have been thoroughly tested and found to be in first class operating condition in every particular.*

3.05 DEMONSTRATION AND SAFETY CLASS

- A. Stage Rigging Contractor's representative shall provide a rigging operation and safety class to instruct Owner's designated staff or representatives in the safe operation, and maintenance of all items, including the storage and cleaning of all fabrics, and recommended practice for the rigging logs. Class shall be of sufficient time to adequately cover the work. While it may be possible to schedule the class to coincide with the system checkout, such coincidence should not be assumed.*

END OF SECTION 11052

SECTION 15195 - NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include all sections in Divisions 15 and 16 as well as the following:
 - 1. Division 1 Section "Submittal Procedures."
 - 2. Division 1 Section "Quality Requirements."
 - 3. Division 1 Section "Execution Requirements."
 - 4. Division 2 Section "Earthwork."
 - 5. Division 3 Section "Cast-in-Place Concrete."
 - 6. Division 3 Section "Cast-in-Place Concrete (Limited Applications)."
 - 7. Division 7 Section "Through-Penetration Firestop Systems."
 - 8. Division 8 Section "Access Doors and Frames."
 - 9. Division 9 Section "Painting Interior and Exterior Natural-Gas Piping".
 - 10. Division 15 Section "Meters and Gages."
 - 11. Division 15 Section "Hangers and Supports."
 - 12. Division 15 Section "Mechanical Identification."

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.
 - 6. Service meters.
 - 7. Mechanical sleeve seals.
 - 8. Grout.
 - 9. Concrete bases.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - 5. Dielectric fittings.
 - 6. Mechanical sleeve seals.
 - 7. Escutcheons.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Shop Drawing Scale: 1/4 inch per foot (1:50).
- C. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- D. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- E. Welding certificates.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For motorized gas valves pressure regulators and service meters to include in emergency, operation, and maintenance manuals.
- H. Provide and install safety cut-off solenoid valves as may be required by Code and CPS requirements.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.7 WARRANTY

- A. Provide manufacturer's standard 1-year warranty for materials and labor, commencing on date of substantial completion.

1.8 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa).
 - 4. Natural-Gas System Pressure within Buildings: 2 psig (13.8 kPa) or less.

1.9 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Owner no fewer than seven] days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Corrugated, Stainless-Steel Tubing:
 - a. OmegaFlex, Inc.
 - b. Parker Hannifin Corporation; Parflex Division.
 - c. Titeflex.
 - d. Tru-Flex Metal Hose Corp.
 - 2. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. Lyall, R. W. & Company, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Perfection Corporation; a subsidiary of American Meter Company.
 - 3. Bronze Plug Valves:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
 - 4. Cast-Iron, Nonlubricated Plug Valves:
 - a. McDonald, A. Y. Mfg. Co.
 - b. Mueller Co.; Gas Products Div.
 - c. Xomox Corporation; a Crane company.
 - 5. Cast-Iron, Lubricated Plug Valves:
 - a. Flowserve.
 - b. McDonald, A. Y. Mfg. Co.
 - c. Mueller Co.; Gas Products Div.
 - d. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
 - 6. Automatic Gas Valves:
 - a. ASCO Power Technologies, LP; Division of Emerson.

- b. Eaton Corporation; Controls Div.
 - c. Eclipse Combustion, Inc.
 - d. Honeywell International Inc.
 - e. Johnson Controls.
7. Electrically Operated Valves:
- a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Eclipse Combustion, Inc.
 - c. Goyen Valve Corp.; Tyco Environmental Systems.
 - d. Magnatrol Valve Corporation.
 - e. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
 - f. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
8. Line Pressure Regulators:
- a. Eclipse Combustion, Inc.
 - b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - c. Invensys.
 - d. Maxitrol Company.
 - e. Richards Industries; Jordan Valve Div.
9. Appliance Pressure Regulators:
- a. Eaton Corporation; Controls Div.
 - b. Harper Wyman Co.
 - c. Maxitrol Company.
 - d. SCP, Inc.
10. Dielectric Unions:
- a. Capitol Manufacturing Company.
 - b. Hart Industries International, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
11. Dielectric Flanges:
- a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
12. Mechanical Sleeves:
- a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.

2.2 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
1. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 2. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.
 3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 4. Striker Plates: Steel, designed to protect tubing from penetrations.
 5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 6. Operating-Pressure Rating: 5 psig (34.5 kPa).
- C. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A).
1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

- a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.
3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch (0.56 mm) thick.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches (1830 mm).

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

C. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

D. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig (5170 kPa).

- E. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig (862 kPa) .
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
 - 6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: 125 psig (862 kPa) .
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze BBody: Bronze, complying with ASTM B 584.
 - 1. Ball: Chrome-plated bronze.
 - 2. Stem: Bronze; blowout proof.
 - 3. Seats: Reinforced TFE; blowout proof.

4. Packing: Threaded-body packnut design with adjustable-stem packing.
5. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. CWP Rating: 600 psig (4140 kPa).
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig (862 kPa).
6. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig (862 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig (862 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Body: Brass or aluminum.
2. Seats and Disc: Nitrile rubber.
3. Springs and Valve Trim: Stainless steel.
4. Normally closed.
5. Visual position indicator.
6. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Pilot operated.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
6. NEMA ICS 6, Type 4, coil enclosure.
7. Normally closed.
8. Visual position indicator.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 2 psig (13.8 kPa).

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 2 psig (13.8 kPa).

2.8 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Minimum Operating-Pressure Rating: 150 psig (1034 kPa) .
2. Combination fitting of copper alloy and ferrous materials.
3. Insulating materials suitable for natural gas.
4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Minimum Operating-Pressure Rating: 150 psig (1034 kPa).
2. Combination fitting of copper alloy and ferrous materials.
3. Insulating materials suitable for natural gas.
4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.9 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

2.10 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.11 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Stamped-Steel Escutcheons: With set screw and chrome-plated finish.
- D. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw, and chrome-plated finish.
- E. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.12 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.
- D. Comply with local and state fire marshals' offices as may be required.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Division 2 Section "Earthwork" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.
- C. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
- D. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- E. Install fittings for changes in direction and branch connections.
- F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
- G. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- H. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- I. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 15 Section "Meters and Gages."

3.4 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install escutcheons at penetrations of interior walls, ceilings, and floors.
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - c. Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - d. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw.
 - e. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
 - f. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."
- L. Verify final equipment locations for roughing-in.

- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- Q. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 5. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
 - c. Do not install natural-gas piping underground below building slabs.
- R. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- S. Connect branch piping from top or side of horizontal piping.

- T. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- U. Do not use natural-gas piping as grounding electrode.
- V. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- W. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 15 Section "Meters and Gages."

3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector. Provide unions or flanges to remove valves or PRV's for replacement or maintenance.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 2. Cut threads full and clean using sharp dies.
 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 2. Bevel plain ends of steel pipe.

3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 15 Section "Hangers and Supports;" refer to Section 15060, 1.4 for support and hanger requirements.
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
 4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
 5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).
- C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
 2. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
 3. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
 4. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).

2. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

3.8 CONNECTIONS

- A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 15 Section "Mechanical Identification" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 PAINTING

- A. Comply with requirements in Division 9 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating. This applies to piping and components installed by the utility as well as the contractor.
 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Topcoat: Exterior alkyd enamel flat.
 - c. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating. This applies to piping and components installed by the utility as well as the contractor.
 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.

- b. Topcoat: Interior latex flat.
 - c. Color: Gray .
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base.
1. Construct concrete bases of dimensions indicated or required by contractor or utility furnished equipment, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.13 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.14 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be the following:
1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

2. Steel pipe with wrought-steel fittings and welded joints.
 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- 3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)
- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be[one of] the following:
1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 2. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
 3. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
 3. Underground, below building, piping shall not be allowed.
- C. See gas flow diagram drawing for gas pressures.
- 3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 kPa) AND LESS THAN 5 PSIG (34.5 kPa)
- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
- C. See gas flow diagram drawing for gas pressures.
- 3.17 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be[one of] the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.

- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be[one of] the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be[one of] the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be[one of] the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- E. Valves in branch piping for single appliance shall be[one of] the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.

3.18 CLEANING AND ADJUSTING

NOT APPLICABLE

3.19 CONTRACTOR STARTUP AND REPORTING

NOT APPLICABLE

3.20 DEMONSTRATION AND COMMISSIONING

NOT APPLICABLE

END OF SECTION 15195

SECTION 16720
INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All sections of Division 16 and 17 apply to this section.

1.2 SUMMARY

- A. Section includes: Material, labor, and services for the installation of an Intrusion Detection System including but not limited to:
 - 1. Security Control Panel
 - 2. Remote Security Keypads
 - 3. Motion Detectors
 - 4. Status Contacts
 - 5. Addressable Interfaces
 - 6. Loop Extender
 - 7. Phone Line
 - 8. Programming
 - 9. Wiring and Connections
 - 10. Final Adjustments and System Check Out
- B. An integrated intrusion detection system providing building security functions.
- C. An addressable system in which every device is an individual zone.

1.3 DEFINITIONS – NOT APPLICABLE

1.4 SUBMITTALS

- A. Product Data: For each component.
- B. Shop Drawings: Detail installed features and devices. Include the following:

1. Riser and connection drawing.
 2. Wiring diagrams showing wire, and cable requirements for each piece of equipment. Include wire types and sizes.
 3. Conduit layout plan.
 4. Programming documentation using manufacturer's programming form and system layout work sheets. Contact City of Chicago Schools Emergency Control Department at (773) 553-3335 for general programming requirements.
 5. Battery back-up calculations using manufactures battery calculations form.
 6. Template for door and frame preparation for door contacts.
- C. Furnish three (3) copies of an operation and maintenance manual consisting of a 3 ring binder with equipment specifications, programming instructions, programming disk, maintenance instructions and 8 1/2" x 11" copies of as built drawings. Include names and phone numbers to contact for assistance, maintenance, and warranty service. Deliver to The Board at time of demonstration and training required in Part 3.
- D. Furnish six copies and one reproducible set D size "as built" drawings.

1.5 QUALITY ASSURANCE

- A. Installer qualifications: The work of this section shall be performed by a qualified Intrusion Detection System Subcontractor (IDSS) under the direct supervision of the Electrical Subcontractor. Minimum requirements for the IDSS are:
1. Factory trained and authorized installer of the products specified.
 2. Carries replacement parts in stock and have personnel trained in service and trouble shooting of the products specified.
 3. Experienced in installing and servicing low voltage, micro processor based systems.
 4. Installation shall be performed under the supervision of a technician trained and approved by the manufacturer of the security control panel system. Technician shall make final adjustments, check operation of the systems, certify that the final installation is in accordance with the manufacturer, and instruct the Board on the programming, use, and operation of the systems.
 5. The IDSS shall have a minimum of (3) three service personnel on call at the same time and provide service response within 24 hours.
 6. Licensed by the State of Illinois as a Private Alarm Contractor under the Private Detective, Private Alarm and Private Security Act of 1993.
 7. Licensed by City of Chicago in Accordance with Section 14-12-170 of the City of Chicago Electrical Code.
- B. Pre-Installation Meeting:
1. Arrange for a meeting of trades involved in the installation. Coordinate the work to assure a complete operational system.
 2. Arrange a training session for trades involved in the installation.

- C. Comply with City of Chicago Building Code.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in City of Chicago Electrical Code, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing and shipping:
 - 1. Deliver items in manufacturer's original packaging.
 - 2. Package with bolts, screws, and fastenings for installation.
 - 3. Pack keys separately. Identify with The Board's name, factory order number, and contract number.
- B. Acceptance at site:
 - 1. Deliver keys direct to the Board via registered mail or personal delivery.
- C. Storage:
 - 1. Store materials above grade in a dry, well ventilated area.
- D. Do not install electronic components until major construction work in the area is complete. Do not install in areas where dust or moisture can contaminate the working parts or where finish can be marred by construction work.

1.7 MAINTENANCE

- A. Extra materials: Furnish the following maintenance stock to The Board at the time of substantial completion:
 - 1. (2) Each type of Motion Detector
 - 2. (1) Each type Door Contact
 - 3. (1) Each type of Addressable Interface

1.8 WARRANTY

- A. The Contractor shall unconditionally warrant all equipment and systems provided under this section to be free from defects in materials and workmanship for a period of at least twelve months from the date of final acceptance of all work of this section.

PART 2 - PRODUCTS

2.1 SECURITY CONTROL PANEL

A. Includes:

1. Central Processor
2. Enclosures
3. Power Supplies

B. Central Processor:

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Ademco, part no. Vista 50PUL, for schools with up to 87 zones.
 - b. Ademco, part no. Vista 128BP, for schools with 88 to 128 zones.
 - c. Ademco, part no. Vista 250BP, for schools with 129 to 250 zones.
2. Listed for (UL1023) Burglary, (UL1610) Grades A, AA Central Station and (UL365) Grades A, AA Police Connect.
3. Microprocessor based, programmable, 8 partition system with EEPROM technology for user defined programming.
4. Either expandable to a minimum of 87 zones including hardwired and addressable zones, 128 zones or 250 zones as required per school layout and design.
5. Utilize a 2-wire polling loop as a multiplex system..
6. Zones shall report to City of Chicago Schools Emergency Control Department.
7. Programming Capability:
 - a. Downloading locally from a personal computer (PC).
 - b. Remote downloading from the central receiving station.
 - c. Programming from security keypad.
 - d. 128 user codes with 99 in a given partition.
 - e. Alpha descriptors for zones and partitions.
 - f. 20 custom words can be added to built-in vocabulary.

C. Enclosures:

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Hoffman, a Pentair company
2. For mounting the central processors, power supplies and batteries: NEMA 1
 - a. Size to allow for 2" open area around interior for conduit penetrations and wiring.
 - b. Provide door with hasp to accept a padlock, provided by The Board.
 - c. Provide a tamper switch wired to local hardwired alarm zone.
 - d. Plug all knock-outs with disc plugs and carriage bolts.
 - e. Mount a shock sensor to back box wired to local hardwired zone different from the tamper switch.
 - f. Enclosure shall be resistant to attack and shall meet the requirements of UL grade

- A mercantile premises listing.
 - g. Provide red acrylic label on door with 2 inch white lettering. Label shall read "Security Control Panel, Panel Will Alarm When Opened, Call Emergency Control Department at (773) 553-3335 Before Opening".
 - 3. For storage of spare parts and operation & maintenance manuals: NEMA 1
 - a. Size to allow for spare parts and 3 sets of operation and maintenance manuals.
 - b. Provide door with hasp to accept a padlock, provided by The Board.
 - c. Provide a tamper switch wired to local hardwired alarm zone.
 - d. Plug all knock-outs with disc plugs and carriage bolts.
 - e. Provide red acrylic label on door with 2 inch white lettering. Label shall read "Security System Spare Parts, Panel Will Alarm When Opened, Call Emergency Control Department at (773) 553-33305 Before Opening".
 - 4. Transformer Enclosure:
 - a. Size to allow for mounting of transformer.
- D. Power Supplies:
 - 1. Central processor transformer:
 - a. UL listed class 2 hardwired sized to handle maximum current draw of system plus 25%.
 - b. Mount in a separate enclosure.
 - 2. Battery Backup:
 - a. Size to operate system for a minimum of 4 hours upon power failure.

2.2 REMOTE SECURITY KEYPAD

- A. Keypad:
 - 1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Ademco, part no. 6139
 - 2. 32 character 2 x 16 Alpha/Numeric Display.
 - 3. Backlit display and keys.
 - 4. Display of user information and instructions.
 - 5. Supply back box with tamper switch electrical contractor.
- B. Keypad security enclosure:
 - 1. Louvered hard plastic transparent cover.
 - 2. No lock required.

2.3 MOTION DETECTORS

A. Quad PIR (passive infrared) Motion Detector:

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Ademco, part no. 4278EX, for dip switch addressing
 - b. Ademco, part no. 4278EXSN, for serial number addressing
 - c. Ademco, part no. 1877SM, for swivel mount kit
2. Mirror to accommodate 40 foot by 50 foot wide angle.
3. Two wire multiplex power and communications.
4. Provide with swivel mount kit.
5. Provide additional loop for connection to dry contact devices.
6. Provide dip switch addressing for user programmable address to accommodate up to 64 zones.
7. Provide serial number addressing for greater than 64 zones.

B. PIR (passive infrared) Motion Detector – Ceiling Mount Applications:

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Intellisense, part no. CK-IS280CM
2. Mirror to accommodate 50 foot, 360 degree pattern.
3. Two wire multiplex power and communications.

C. Microwave/PIR (passive infrared) Motion Detector:

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Ademco, part no. Quest 2260SN, for serial number addressing
 - b. Ademco, part no. V-Plex Interface Module 4208U, for addressable interface module
 - c. Ademco, part no. 998SB, for swivel mount bracket
2. 60' x 75' area coverage.
3. Use detector in rooms that have significant temperature swings such as the kitchen, pool, dock, boiler room, greenhouse, etc.
4. Passive infrared shall have 38 zones and one look down zone.
5. Provide serial number addressing.
6. Include addressable interface module.
7. Provide with swivel mount bracket.

D. Microwave/PIR (passive infrared) Motion Detector (Large Coverage Patterns):

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Intellisense, part no. Dual TEC DT-900, for 90' x 70' coverage
 - b. Intellisense, part no. Dual TEC DT-600 for 60' x 60' coverage
2. Use detector in rooms that require large coverage patterns such as gymnasiums.
3. Passive infrared shall have 38 zones and one look down zone.
4. Includes ratcheted swivel base.
5. Provide serial number addressing.

2.4 STATUS CONTACTS

A. Door Contact:

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Detex, part no. MS-2049F
2. Flush mount magnetic switch.
3. Designed to work with addressable interface module.
4. Provide with Torx security screws.
5. Potted component reed switch rated at one million operations under resistive load.
6. ANSI sized cut out 4 7/8 inches by 1 1/4 inches.
7. Designed for use in steel, aluminum, or wood doors.

B. Overhead Door Contact:

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Ademco, part no. 959 XTP
2. Rail mount 12" above finished floor with 2" gap.
3. Rail mount kit required.
4. Designed to work with addressable interface module.

C. Door Contact (Renovation Projects Only):

1. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - a. Sentrol, part no. 2200AU
2. Mini surface mount contact with minimum of 3" gap.
3. Rugged construction fed with stainless steel armored cable.

2.5 ADDRESSABLE INTERFACE MODULE

- A. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - 1. Ademco, part no. 4190WH
- B. Remote two point module:
 - 1. Two addressable dry contact loops.
 - 2. 2 wire polling loop.

2.6 LOOP EXPANDER

- A. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - 1. Ademco, part no. 4197
- B. Polling Loop Extender:
 - 1. Powered from central processor.
 - 2. Capable of extending 2 wire polling loop from 2000 ft to 3200 ft.

2.7 SHOCK SENSOR:

- A. Manufacturer: Subject to compliance with requirements, provide products by the following manufacturer:
 - 1. Sentrol, part no. 5402
- B. Description:
 - 1. Powered from central processor.
 - 2. Alarm status LED.
 - 3. Adjustable sensitivity.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not install electronic components until major construction work is complete, HVAC systems working, and there is no chance of contamination of the electronics by moisture and construction dust.

3.2 INSTALLATION

A. General:

- 1. Install in accordance with the recommendations of the manufacturer and the shop drawings.
- 2. Install Intrusion Detection system wiring in a separate, dedicated raceway system. Conceal raceway except in unfinished spaces.
 - a. Comply with requirements of Division 16 Section "Raceways and Boxes" for conduit and boxes.

B. Wiring:

- 1. Use stranded wire only.
- 2. Use color-coded wires. Maintain color-coding throughout system.
- 3. Wiring shall be neat and field dressed in bundles. Allow sufficient extra cable in devices for easy removal of electronic module for service and adjustment.
- 4. Minimum Wire sizes: Unless a specific wire size is required by the device manufacturer, use the following minimum sizes.
 - a. #18 AWG wire for low voltage power.
 - b. #18 AWG twisted-pair for polling loop.
 - c. #18 AWG wire for keypad loop.
 - d. #24 AWG 4-conductor for phone line.
 - e. #12 AWG from breaker to security control panel.
 - f. Use heavier wire when recommended by manufacturer or required by code.
- 5. Minimize splices.
- 6. Tin ends of wire before connecting to terminals.
- 7. Maximum length of wire runs, combined, for polling loop shall be 2000 feet. One loop extender can be used to extend length by 1200 feet for a total of 3200 feet. Further than 3200 feet, additional central processor(s) are required.
- 8. Maximum length of remote keypad loop is 1000 feet divided by the number of keypad on the loop.

C. Mounting:

- 1. Remote Security Keypad:
 - a. Mount 68 inches above finished floor.

2. Motion Detectors, Vertically Wall Mounted:
 - a. Mount 9 feet 6 inches above finished floor. Do not mount within 6" of a ceiling. Contact City of Chicago Emergency Control Department at (773) 553-3335 if required to be mounted below 9 feet from finished floor and request written waiver from the security group prior to installation.

D. Grounding:

1. Ground system to metal cold water pipe with copper strap or to AC third wire ground.
2. Unless otherwise specified by manufacturer, terminate shields at the security control station and insulate at the field device to provide a floating ground.

E. Protective covers:

1. Install protective keypad enclosure when the keypad is installed in a public area.

F. Phone connection:

1. Provide a direct connect cord with plug for each central processor and connect to incoming phone line via phone jack in security control panel enclosure.
2. Contact Department of Telecommunications for the City of Chicago Schools at (773) 553-3333 to arrange for installation of phone line.
3. Contact Telecommunications within 30 days of award of contract and coordinate installation and location of phone line.

G. Electrical Power:

1. Provide 3 wire power including hot, neutral, and separate ground.
2. Power shall come from a breaker dedicated only to the security control panel.
3. Install wire, conduit and boxes in accordance with the general provisions stated in Division 16 and the City of Chicago Electrical Code.

3.3 LABELING

- A. Labeling: Clearly, logically, and permanently label cable terminations with Brady or equivalent labels.
- B. Cables and Cable Terminations Labeling: Clearly, logically, and permanently label cable and termination's with Brady or equivalent labels.
- C. Motion Detector Labeling: Clearly, logically, and permanently label each motion detector as well as its operable zone identification number with Brady or equivalent labels.
- D. Door Contact Labeling: Clearly, logically, and permanently label each door contact as well as its operable zone identification number with Brady or equivalent labels.

- E. Comply with requirements of Division 16 Section "Electrical Identification" for equipment labels.

3.4 CLEANING

- A. On completion of installation inspect exposed finishes. Remove burrs, dirt, paint spots, and construction debris. Repair damaged finish(es), including chips, scratches, and abrasions.
- B. All equipment, hardware and finishes shall be cleaned prior to final acceptance. Unless otherwise indicated, clean shall mean free of dust, dirt, mud, debris, oil, grease, residues, and contamination.
- C. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion. Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps. Cover fixtures, materials, equipment and devices furnished or installed under this section or otherwise protect against damage, both before and after installation. Hardware, materials, equipment, or devices damaged prior to final acceptance of the work shall be restored to their original condition or replaced.
- D. During the course of installation work, provide for on-going proper disposal of all debris, including but not limited to: equipment packaging and shipping materials, shipping pallets, empty cable reels/boxes, cable cuttings, etc. The Contractor shall, at all times, keep the site free from accumulations of waste material or rubbish caused by its employees or work. Remove all crates, cartons, and other waste materials or trash from the working areas at the end of each working day. Flammable waste material must be removed from the working areas at the time of generation. All rubbish and debris, combustible or not, shall be discarded in covered metal containers daily and removed from the premises at least weekly and legally disposed of.

3.5 CONTRACTOR STARTUP AND REPORTING

- A. Adjusting:
 - 1. Make adjustments or corrections for operation of the system.
 - 2. Follow the manufacturer's instructions to program the system in accordance with the Board's requirements and provide The Board with copy of programming on 3 1/2 inch floppy disk in format suitable for downloading.
 - 3. Re-adjust or replace system devices when false alarms occur. Adjustment is not completed until no false alarms occur for a period of 30 consecutive days.
- B. Demonstration:
 - 1. Provide a minimum of two, four hour training sessions for designated Board's representatives. Training shall include system programming, operation and maintenance procedures, and delivery of manuals required under Part 1.

CPS Control Rev: 1_02/28/06
Project Rev: A_04/16/09

2. Contact City of Chicago Emergency Control Department at (773) 553-3335 for scheduling training.
- C. Provide point to point, as built, wiring diagrams.

3.6 COMMISSIONING AND DEMONSTRATION – NOT APPLICABLE

END OF SECTION 16720

SECTION 16750
ASSISTED LISTENING DEVICE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. All sections of Division 16 apply to this section.

1.2 SUMMARY

- A. This section includes requirements for furnishing and installing a complete and operating Assisted Listening Systems.

1.3 DEFINITIONS - NOT APPLICABLE

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.
- B. Product data for each type of product specified.
- C. Wiring diagrams, detailing wiring for power, signal, and control, differentiating clearly between manufacturer-installed wiring and field-installed wiring. Identify terminals to facilitate installation, operation and maintenance.
- D. Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual specified in Division 1. Provide complete manual material concurrently with system submittal and provide updated final version of manuals one month before completion of construction and final system turnover.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who is a factory-authorized service representative to perform the work of this Section.
- B. Electrical Component Standard: Provide work complying with applicable requirements of City of Chicago Electrical Code.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.7 FUNCTION

- A. The transmitter/emitter panel shall receive an output signal from an existing public address system.
- B. The system shall transmit via infrared frequencies to the receiver units.
- C. The system shall be capable of connecting to a new public address system.

1.8 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to replace equipment and devices that fail in materials or workmanship within specified manufacturer's standard period or one (1) year, whichever is greater.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Alpha Communications.
 - 2. Bogen Communications International, Inc.
 - 3. Dukane Corporation; Communications Systems Div.
 - 4. Rauland-Borg Corporation.
 - 5. Whelen Engineering Company, Inc.

2.2 TRANSMITTER/EMITTER PANELS

- A. The system shall be a two channel system. The system shall operate on frequencies 2.3 and 2.8 MHz. The infrared emitters must be on 11 x 12 light emitting diode array with open field coverage of 5000 square feet. The transmitter must be integrated into a transmitter/emitter panel with capability to drive any number of daisy-chained slave emitter panels. The master transmitter panels must have two balanced audio inputs employing Phoenix 6 pin terminal block with Combicon plug. The inputs and outputs for interconnecting master slave panels must employ coax connectors. The power input connectors for master and slave must employ Phoenix 2 pin terminal block with Combicon plug. The system must offer optional remote slave to master switching for multi-zone reconfiguration capability. Provide 120 volt power and low voltage transformer.

2.3 RECEIVERS

- A. The receiver shall have a selection of optional listening devices, including earbuds, headphones and inductive loops.

PART 3 - EXECUTION

3.1 WIRING

- A. Provide interconnection to new sound system and proper wiring.
- B. Provide power and wiring for all devices. Wiring shall be installed in raceways. Raceways installed in public areas shall be wiremold surface raceway.
- C. Reference Division 16 section "Conductors and Cables" for additional wiring requirements.

3.2 INSTALLATION

- A. Locate emitters in room for proper coverage. Quantity of emitters shall be provided for proper coverage.

3.3 SYSTEM INTERCONNECTION

- A. Provide system electronic components in existing sound system for system interconnection.

3.4 CLEANING

- A. The contractor shall remove all paint spatters and other spots, dirt and debris from the equipment. Clean equipment and devices internally and externally using methods and materials recommended by the manufacturer. Replace stained or improperly painted wall plates or devices.

3.5 CONTRACTOR STARTUP AND REPORTING

- A. Contractor shall submit a complete set of record drawings, operation and maintenance data, and certificates as outlined in this section.

3.6 COMMISSIONING AND DEMONSTRATION – NOT APPLICABLE

END OF SECTION 16750