

ADDENDUM NO. 4

August 5, 2002

Notice to All Bidders:

The attention of Bidders submitting proposals for the 103rd Air Control Squadron project indicated above is called to the following Addendum to the Plans and Specifications. The revisions set forth herein, whether of omission, addition or substitution, are to be included in and form a part of the Proposal submitted.

The number of this Addendum must be entered in the space provided on the Bid Form.

Changes to the Specifications:

Table of Contents

- A. Insert in sequence Section 01210, Allowances.
- B. Delete Section 01300, Submittals.
- C. Insert in sequence Section 16482, Motor Control Centers.

Section 01210 – Allowances

- A. Insert attached Section 01210.

Section 01270 – Schedule of Values

- A. In Paragraph 1.02B.4.c, change “Additive Bid Items” to “Alternates” at both occurrences.

Section 01300 – Submittals

- A. Delete Section 01300 in its entirety; refer to Section 01330, Submittal Procedures.

Section 01400 – Quality Control

- A. In Paragraph 1.01C, after the words “as required,” delete the words “testing, Contracting Officer, and other specified services.”

Section 01500 – Temporary Facilities and Controls

- A. In Paragraph 1.02A1, insert the word “other” before “temporary facilities” and insert the following at the beginning of Item 1:

The Government will allow the use of water sewer and electric utilities on-site without payment of use charges, subject to the restrictions below.

- B. In Paragraph 1.02B.1.a, last word, change “Government” to “Contractor.”
- C. In Paragraph 1.02B.5, delete Item a.

Section 01560 – Environmental Protection

- A. In Paragraph 3.07A, insert the following before the first sentence:

The only known contaminated soils on site will be removed by the Government under a separate contract.

Section 01770 – Closeout Procedures

- A. In Paragraph 1.04A, add Item 4 as follows:

4. Government will furnish CAD files of contract drawings and specifications at no cost.

Section 02051 – Building Demolition

- A. In Paragraph 1.02B.6, replace “Housing Authority” with “Owner.”
- B. In Paragraph 1.02C, delete Items 2, 3, 4 and 6.
- C. Delete Paragraphs 1.05G and H.
- D. In Paragraph 1.06E, replace “Project Management and Coordination” with “Project Meetings.”

Section 02230 – Site Clearing

- A. In Paragraph 1.02B, delete Item 1 in its entirety.

Section 02273 – Erosion Control

- A. In Paragraph 3.03A, delete reference to “RI Standard 9.1.”

Section 02300 – Earthwork

- A. In Paragraph 1.02B, delete Items 3 and 4.

Section 02510 – Water Distribution

- A. Delete Paragraph 3.04A.
- B. Delete Paragraph 3.10B.

Section 02530 – Sanitary Sewerage

- A. Delete Paragraph 3.05B.
- B. Delete Paragraph 3.06F.
- C. Delete Paragraph 2.04C and replace with the following:
 - C. Structure Channels and Benches. Refer to Drawing C-14 for requirements.

Section 02630 – Storm Drainage

- A. Delete Paragraph 3.05B.

Section 03300 – Cast-in-Place Concrete

- A. After Paragraph 2.01E, insert the following:
 - F. Floor Hardener: Floor hardener shall be a dry-shake, non-metallic type applied at the rate of 2 lbs/sq. ft. in two passes. After placement, the surface shall be bull-floated to embed the aggregate, then floated and troweled.

Section 05120 – Structural Steel

- A. In Paragraph 3.02A, delete Item 2.
- B. In Paragraph 2.02D.2, replace Item c with the following:
 - c. Clean steel according to SSPC-SP 6 “Commercial Blast Cleaning.”

Section 05500 – Metal Fabrications

- A. In Paragraph 2.02L, insert Item 4:
 - 4. Manufacturer: Wright Hoists, or approved equal.

Section 06200 – Finish Carpentry

- A. Add the following to the end of Paragraph 1.02A.2:
 - d. Standing and running trim (window sills and window trim) for field-applied interior opaque wood finish.
- B. In Paragraph 2.01A, add the following to the end of Item 7:

Exterior millwork, panels and trim shall be “Smartsystem” components manufactured by Louisiana-Pacific Corporation, or approved equal, in configurations shown on the Drawings.
- C. Change the designations of Paragraphs 2.02C, D and E to D, E and F, respectively, and insert the following as Paragraph 2.02C:
 - C. Standing and Running Trim – Interior Work:
 - 1. Quality Standard – Interior Work:
 - a. Field-Applied Interior Opaque Wood Finish:
ASI 300, Custom Grade.
 - 2. Wood Species and Cut – Interior Work:
 - a. Field-Applied Interior Opaque Wood Finish:
Poplar, plain-sawn; no finger-jointed lumber.
 - 3. Backs: Backout or groove backs of flat trim members, kerf backs of other wide flat members, except for members with ends exposed in finished work.
 - 4. Casings:
 - a. Assemble in plant, except where limitation of access to place of installation requires field assembly.
 - b. Miter corners and assemble joints with waterproof adhesive and biscuits.

Section 07530 – Single-Ply Membrane Roof

- A. Delete Paragraph 1.02B in its entirety.

Section 07901 – Joint Sealants

- A. In Paragraph 1.02B, delete Item 1.

Section 08300 – Overhead Doors and Grilles

- A. Replace Section 08300, dated June 7, 2002, with updated version dated August 5, 2002, attached.

Section 09650 – Resilient Flooring

- A. In Paragraph 1.02A, insert the following after Item 5:
 - 6. Sports Flooring.
- B. After Paragraph 2.01C, insert the following:
 - D. Sports Flooring: Titan as manufactured by Tuflex Rubber Flooring Inc. or approved equal.
- C. After Paragraph 2.02E, insert the following:
 - F. Sports Flooring
 - 1. Size: 27" x 27"
 - 2. Gauge: 3/8"
 - 3. Composition: 100% recycled elastomers

Section 09680 – Carpet

- A. In Paragraph 2.01A.1, add “Blue Ridge Commercial Carpet” after “Madison Square.”

Section 10100 – Visual Display Boards

- A. In Paragraph 2.02B.1, add new Items c, d and e as follows:
 - c. Size: 4' x 8'.
 - d. Quantity: 5.
 - e. Location: Job Control, Room 204.

Section 10615 – Demountable Partition System

- A. In Paragraph 1.01B.1, delete “16100” and insert “Division 16” in its place.
- B. Add the following to Paragraph 2.02 after Item 12:
 - 13. Sound Transmission Class: STC 39

Section 10651 – Operable Panel Partitions

- A. In Paragraph 1.02B, add at the end a new item as follows:
 - 3. 05500, Metal Fabrications; for steel supports.

Section 10950 – Miscellaneous Specialties

- A. In Paragraph 1.02A, delete Items 4, 5 and 6.
- B. In Paragraph 2.01E, in Item 9, change “as indicated” to “12' by 6' 6”.”

Section 11140 – Vehicle Service Equipment

- A. In Paragraph 1.02B2, change “15400” to “15051.”
- B. In Paragraph 1.02B3, change “16100” to “16010.”

Section 11400 – Food Service Equipment

- A. In Paragraph 1.03B, change “15400” to “15051.”
- B. In Paragraph 1.03C, change “15500” to “15051.”
- C. In Paragraph 1.03D, change “16100” to “16010.”
- D. In Paragraph 2.01B, insert Item 5:
 - 5. Manufacturer: JBI Spray Booths, or approved equal.

Section 13046 – Portable Steel Gate House

- A. In Paragraph 1.02B.5, change “15400” to “15051.”
- B. In Paragraph 1.02B.6, change “16100” to “16010.”

Section 15071 – Mechanical Vibration and Seismic Controls

- A. In Paragraph 1.06B, delete the sentence, “These items are specified in Division 7 ‘Roof Accessories’.”
- B. In Paragraph 2.02D, delete the words, “Insert Drawing Designation.”

Section 15083 – Pipe Insulation

- A. Delete section 15083 in its entirety and replace with new Section 15083 Pipe Insulation, attached hereto.

Section 15183 – Refrigerant Piping

- A. Add the following to Paragraph 1.02B:
 - 6. Division 15 Section “Pipe Insulation” for insulation of refrigerant piping.

Section 15550 – Breechings, Chimneys, and Stacks

- A. In Paragraph 1.05A, delete the sentence, “These items are specified in Division 7 Section Roof Accessories.”

Section 15626 – Rotary-Screw Water Chillers

- A. Delete Paragraph 1.02B.

Section 15820 – Duct Accessories

- A. In Paragraph 1.02B, delete Item 1.

Section 15856 – Intake and Relief Ventilators

- A. In Paragraph 1.06A, delete the sentence, “These items are specified in Division 7 Section ‘Roof Accessories’.”
- B. In Paragraph 3.01B, delete the sentence, “Refer to Division 7 Section ‘Roof Accessories’ for installation of roof curbs.”

Section 15900 – HVAC Instrumentation and Controls

- A. Delete Paragraph 1.4C.

- B. Delete Paragraph 1.8B and replace with the following:
 - B. Coordinate equipment with Division 16 Section “Fire Alarm System” to assure full compatibility with equipment that interfaces with that system.
- C. In Paragraph 1.8D, delete the word “Panelboards” and replace with “Basic Electrical Materials and Methods”

Section 16482 – Motor Control Centers

- A. Insert attached Section 16482.

Section 16740 – Telecommunications Wiring System

- A. Delete Paragraph 1.01C.
- B. Delete Paragraph 1.02C.
- C. Delete Paragraph 1.03.
- D. Delete Paragraph 1.04C.
- E. In Paragraph 1.05A, replace “Building 806” with “Main Building.”
- F. In Paragraph 1.05A, delete all text after the first sentence referencing base bid and alternates for telephone, data and cable TV.

Section 16800 – Security Systems

- A. In Paragraph 1.04B, change “bidder” to “Contractor” and delete the second sentence.
- B. In Paragraph 1.04E, delete the words “as part of the bid package.”
- C. In Paragraph 1.04F, delete the last sentence.

Changes to the Drawings:

Drawing G003 – Code Summary and General Notes

- A. In Demolition Note 5, after the word “filled,” insert “full length.”

Drawing CS-1 – Construction Sequencing Plan

- B. In the notes under Phase IV, add “8” to list of buildings to be demolished shown after the eighth “bullet.”
- C. Add the following General Note:

Phasing is required to allow the Air Control Squadron to remain in operation throughout construction. The Contractor shall propose specific durations for each phase within the overall 540-day contract duration for approval by the Contracting Officer.

Drawing C-3 –Demolition Plan

- A. For Buildings 6 and 7 add note “Remove and dispose of building and foundation” and a leader to the designated building footprints.
- B. Insert the following as Note 8:
 - 8. The underground fuel tank removal required as part of this project is located within an IRP site. The Contractor is responsible only for removal and disposal of the tank and its contents. Removal of contaminated soil and backfilling to grade will be performed by others and coordinated through the Contracting Officer.
- C. At Site Preparation Legend, add the following to the “RDH” symbol:

For removal and demolition of heating fuel in above-ground fuel tanks.

Drawing C-4 – Site Layout Plan

- A. In ABI descriptions, change Section 01030 to Section 01230.
- B. Note that the helicopter landing area is a 12" wide painted yellow line on pavement.
- C. Insert the following table summarizing concrete stair requirements:

Location	No. of Risers	Bottom Elev.	Middle Landing	Top Elev.
110'W of Sta. 15+40	14	233.88	NA	242.00
240'W of Sta. 17+10	12	229.82	236.20	243.16
40'W of Sta. 27+40	11	213.60	220.56	226.94
30'E of Sta. 30+75	4	183.00	NA	185.32
Building Entrance	Refer to Drawing C-8			

Note: All risers shall be 7".

- D. Note that the exterior area to the northwest of the new building measuring approximately 46' by 70' is to be bituminous pavement, except for the equipment pads.
- E. At the south end of Parking Lot A, delete the words "concrete stairs."
- F. In the description of ABI No. 2, delete the word "swing" and replace with "all."

Drawing C-5 – Grading Plan

- A. Note that the water service to the building shall be 6" C.L.D.I. pipe and the fire service shall be 8" C.L.D.I. pipe.

Drawing C-6 – Utility Plan

- A. At CB-30, delete the note and information shown to the left; the data to the right are correct.

Drawing C-8 – Plan View Details

- A. At the Entrance detail, note that the vertical steel beam shown in the island is not part of any ABI. Revise its footing size to 2' x 2' x 5'.
- B. At the Fuel Island detail, delete note at the upper left-hand corner in its entirety and insert the following:

Provide dual 5,000/1,000 gallon, above-grade fuel tank with 7-gallon overflow containment and 20-year warranty by Convault, or approved equal. Tank shall have interior steel primary containment, 30-mil high-density polyethylene secondary containment, and concrete exterior encasement as specified below. Approximate tank dimensions are 17'-7" x 8'-0". It shall be set on a 12" thick reinforced slab 17'-7" x 8'-0" reinforced as follows:

1. Top mat shall have #5 longitudinal bars @ 6" oc.
2. Top mat shall have #4 transverse bars @ 12" oc.
3. Bottom mat shall have #5 longitudinal bars @ 4 ½" oc.
4. Bottom mat shall have #4 transverse bars @ 12" oc.

Steel Tank

1. Steel tank shall be manufactured in accordance with UL 142.
2. Steel tank shall be rectangular in shape and have continuous welds on all sides conforming with the American Welding Society Standard for continuous weld.
3. Steel tank shall be pressure tested at 5 psi for 24 hours.
4. Steel tank shall have emergency vent as required by NFPA 30.
5. Steel tank openings shall be threaded, including detector tube.
6. Outer surface of steel tank shall be covered by minimum ¼ inch thick insulating spacer panels of polystyrene which melts on contact with leaking petroleum products.
7. Secondary containment shall consist of a 30-mil non-permeable high-density polyethylene liner enclosing the polystyrene spacer panels.
8. Steel tank shall be pressurized to 5 psi until concrete sets to provide expansion space between concrete and steel tank during use.
9. Steel tank shall be supported by internal bracing.
10. No steel or insulating spacer panels in unit shall come in direct contact with concrete or any other corrosive material with the exception of tank top openings which must be Schedule 40 steel pipe.

Concrete Encasement

1. Steel tank and secondary containment shall be encased in homogenous layer of a minimum 5,000 psi factory poured reinforced concrete 6 inches thick with no penetrating metal elements except at the top.
2. Vault shall be of a continuous and visually verifiable monolithic (seamless) pour on top, bottom and sides of steel tank and contain no cold joints or heat sinks (heat transfer points) on bottom and sides.
3. Vault shall have capability of physical monitoring between primary and secondary containment.
4. Vaulted tank shall be tested in accordance with UL Standard 1709 and shown to have a two-hour fire wall, as mandated by the Uniform Fire Code.
5. Complete tank and vault assembly including secondary containment UL 2085 for insulated and protected tanks.

Installation, Compliance and Other Specifications

1. Unit shall have concrete exterior finished with protective coating or architectural finish.
2. Unit shall have permanent exterior warning signs to meet applicable code requirements.
3. Vaults shall have concrete support legs of unitized monolithic construction.
4. Tanks shall have seven gallon overfill system, UL listed, with internal reservoir or optional exterior overfill and normally closed UL listed drain port where required.
5. Vaulted tank design shall have been in manufacturing production and commercial use for a minimum of ten years.
6. Tank and concrete vault shall be finished as one unit at factory and required no assembly, construction or completion at installation site.

Accessories

1. Provide two vent packages per tank manufacturer's recommendations.
2. Provide fill limiters per tank manufacturer's recommendations.
3. Provide one set galvanized stairs and concrete slab for stair foundation and landing per tank manufacturer's recommendations. Location to be determined by tank manufacturer.
4. Provide two Gasboy Astra pump systems Model No. 9823A (21 gpm capacity), or approved equal. Pumps shall be $\frac{3}{4}$ -horsepower continuous-duty rated, housed in a cabinet. Pumps shall be heavy-duty, belt-driven gear type with air eliminator built in, power requirement per manufacturer's recommendations. Discharge hose shall be $\frac{3}{4}$ " with maximum working pressure of 50 psi. Total pump enclosure to have overall dimensions approximately 29"W x 23.5"H x 21.5"D.
5. Provide Gasboy Series 1000 fuel management system or approved equal, as recommended by pump manufacturer. Supplier to provide 50 keys, commissioning and startup services and O&M training.
6. Provide Morrison clock quotes, or approved equal, based on tank manufacturer's recommendations.
7. Fuel tank and fuel dispensing unit manufacturers shall provide all necessary safety and operational signage.

Drawing C-9 – Landscape Plan

- A. In ABI description, change Section 01030 to Section 01230.

Drawing C-12 – Site Details

- A. On Fence Detail shown at the lower right hand corner, change 1'-1 7/16" footing depth to 3'-0".

Drawing C-13 – Site Details

- A. Add the following note to Detail I:

Railings at ramps not required to have handicapped-accessible railings shown on Detail H/C-13 shall be similar to this stair railing, except that height to the centerline of the top rail shall be 34".

Drawing A101 – Lower Level Plan – Room Finish Schedule

- A. In the Room Finish Schedule, delete all references to painting concrete floors and add the following note at the bottom of the Schedule:

All concrete slabs not scheduled to receive a wearing surface shall be sealed with a penetrating liquid floor treatment.

- B. In the General Notes, Note 4 reference to Drawing "A704" should read "A705."

- C. At Room Finish Schedule for Room 262 Wash Bay, change the following:

1. "CMU" to "Brick."
2. "Paint" under Wall Finish to "None."
3. "GWB" to "Linear metal ceiling."
4. "Paint" to "Factory finish."
5. "Sloped" to "Flat."

- D. At Lower Level Plan, the following rooms shall have a 1-hour rating:

Stair A, Electric Room 105, Security Telephone 106, Mail Room 117.

- E. At Lower Level Plan, the following rooms shall have a 2-hour rating:

Electrical 127, Mechanical Room 128.

Drawing A102 – Upper, Level Plan – Wall Types

- A. Add the following to ABI #6 note at column line E:

Refer to Section 11140 for lift size and capacity.
- B. At the upper level plan, the following rooms shall have a 1-hour rating:

Stair A, Telephone 217, Electrical 219, Laundry 233, Electric Room 241,
Telephone 244, and Air Conditioning Repairs 259.

Drawing A103 – Mezzanine/Attic Plan

- A. Add the following note to Detail A:

Refer to Section 05500 for monorail/chain hoist requirements.

Drawing A301 – Building Sections

- A. At Building Section 5, delete the note “Cement board ceiling with cementitious coating” and insert in its place:

Linear metal ceiling as manufactured by Atas International or approved equal.

Drawing A302 – Wall Sections

- A. Detail at Roof Rake E:
 - 1. Extend plywood roof sheathing and roofing and provide 11/16" x 4 5/8" synthetic wood crown molding at top of fascia. Crown molding shall have similar profile to Brosco Model No. WM57-8005.

Drawing A305 – Wall Sections

- A. At Wall Section 2, at ceiling, delete “Ext. gyp. board on suspended metal framing” and insert the following in its place:

Linear metal ceiling by Atas International or approved equal with 0.040 gauge aluminum carriers, 8" wide 0.020 gauge aluminum ceiling panels, and recessed filler strips.

Drawing A701 – Enlarged Toilet Plans, Elevations and Details

- A. On Elevation 36 Kitchen Lav, the reference “TA-4” should read “TA-3.”

Drawing A802 – Gatehouse/Covered Canopy Plans, Sections and Details

- A. In Note 12 for the Gatehouse, delete “Anchor bolts not included.”
- B. On the Gatehouse plan, in Toilet Room G02, delete the item designated as “8.”
- C. On the Gatehouse plan, in Guard House G01, the outlet designated as “1” should read “6.”

Drawing A803 – Elevated Radar Pad, Plan, Sections and Details

- A. In elevated radar pad front Elevation A:
 - 1. Delete “with rubbed” from the note “Smooth form concrete with rubbed finish UON.”
 - 2. Insert at the end of note “Textured concrete finish” the phrase, “lightly sandblasted to expose concrete aggregate.”
- B. On Roof Hatch Detail D, delete “See Specifications” and insert “Bilco Type NB, galvanized hatch with ladder-up safety post.”
- C. On typical Landing 2 Plan, after “Concrete filled metal fan stair assembly,” add, “Refer to Section 05500 for non-slip aggregate finish.”
- D. At the First Level Plan, add the following notes:
 - 1. Steel stair may be supported by the tube steel posts, the concrete walls, and the concrete landings in accordance with the fabricator's approved design and details.
 - 2. All attachments of stair components to concrete shall be made with post-installed anchors.

Drawing A901 – Door and Window Types

- A. Add Note 4 as follows:
 - 4. All ornamental security grilles shall be primed and painted in accordance with Section 09900.
- B. At Interior Observation Windows, add “Hollow metal frame” at Window Type OW1.

Drawing A905 – Miscellaneous Details

- A. At Detail 14, Section at Mailboxes, add the following note:

Rear-loading mailboxes shall be Guardian Series manufactured by American Postal Manufacturing or approved equal.
- B. At Detail 15, Details at Letter Drop, add the following note:

Vertical recessed letter drop shall be Model 491 manufactured by Bommer Postal Specialties, or approved equal.

Drawing A906 – Miscellaneous Interior Details

- A. On Detail 20, Building Identification – Room Signage, change “Dtl 16 on A-2” to “Dtl 21 on A906.”

Drawing S001 – General Notes and Typical Details

- A. In Structural Steel Notes, change Note VI.8 to read:
 - 8. Structural steel surfaces abutting masonry shall be coated with bituminous mastic coating.
- B. In Structural Steel Notes, add Note VI.10 as follows:
 - 10. All exterior lintel angles and combined plate-and-tube lintels shall be hot-dip galvanized. The supporting columns need not be galvanized, unless noted otherwise. Any welds made to galvanized members shall be cleaned and coated with cold galvanizing repair compound.

Drawing S201 – Upper Level framing Plan & Foundation Plan

- A. Add the following note to the vestibule area located immediately northeast of grid point G-7:

Depressed slab (see Arch. drawings for size and location).

Drawing P102 – Plumbing – Upper Level Plan

- A. Add the following notes to the plan:
1. The piping and fittings for the transmission fluid, grease and oil piping systems shall be Type “L” had copper, with wrought copper soldered pressure fittings, conforming to ASTM B 88. The system requirements shall correspond to those listed in Section 15440.
 2. The piping and fitting requirements for the grease waste and vent piping system correspond to those for the sanitary waste and vent piping system, as listed in Section 15450.

Drawing E006 – Electrical Site Details

- A. Add Note 3 as follows:
3. Provide concrete encasement for conduit crossing all roadway and parking areas.

Changes to Addendum No. 1:

- A. In Item F, under Section 16800 – Security Systems, change “4.01B” to “5.01A and B.”
- B. In Section 08710 – Finish Hardware:
1. Delete Paragraph 1.01A and insert the following in its place:
 - A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
 2. In Paragraph 1.02B, change “Section 6” to “Division 6,” “Section 8” to “Division 8,” and “Section 16” to “Division 16.”
 3. In Paragraph 1.02D.1, change “Section 6 Interior Architectural Woodwork” to “Division 6 Section, Finish Carpentry.”
 4. In Paragraph 1.02D.2, change “Section 16” to “Division 16 Section.”
 5. At the bottom right-hand corner of all pages, change “07810” to “08710.”

6. In Paragraph 1.05A, delete the last two sentences and insert the following in their place:

Door hardware listed herein is specified as the “basis of design” to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that will be used to evaluate comparable products of other named manufacturers, subject to the limitations below.

END OF ADDENDUM NO. 4

SECTION 01210

ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - 1. Contingency allowances for utility company charges.
- C. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.3 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices to show actual quantities of materials delivered to the site and costs incurred for use in fulfillment of each allowance.

1.4 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Contracting Officer for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products, equipment and services ordered by Owner under the contingency allowance are not included in the allowance and are part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- C. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

August 5, 2002

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.2 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Include \$25,000 for gas company service installation charges associated with work indicated on Drawing C-6, Note 3.
- B. Allowance No. 2: Include \$50,000 for electric company primary service installation charges indicated in Section 16010, Paragraph 1.06.

END OF SECTION 01210

SECTION 08300

OVERHEAD DOORS AND GRILLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes: Work of this Section consists of installing all materials furnished under this Section, including all equipment, labor, services, and incidental items required to complete work as shown on Drawings and specified in this Section.
 - 1. Overhead coiling grilles, including curtains, guides, counterbalance mechanisms, hardware, operators, and installation accessories.
 - 2. Insulated steel, prefinished overhead manually-operated coiling doors, including insulated slats, guides, counterbalance mechanisms, hardware, operators, and installation accessories.
 - 3. Insulated steel, prefinished overhead sectional door with personnel hinged door and glazing, including guides, counterbalance mechanism, hardware, and installation accessories.
- B. Related Sections:
 - 1. 09900, Painting; ; for field-applied exterior opaque metal finish.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Product data, roughing-in diagrams and installation instructions for each type and size of overhead assembly.
 - 2. Include operating instructions and maintenance data.

- B. Shop Drawings: Submit for special components and installations are not fully dimensioned or detailed in manufacturer's product data.

1.04 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Provide each overhead assembly as complete unit furnished by one manufacturer, including hardware, accessories, mounting, and installation components.
 - 2. Furnish overhead assembly units by one manufacturer for entire Project.
 - 3. Insert and Anchorages:
 - a. Furnish inserts and anchoring devices that must be set in concrete or built into masonry for installation of units.
 - b. Provide setting drawings, templates, instructions, and directions for installing anchorage devices.
 - c. Coordinate delivery with other work to avoid delay.
 - d. Refer to Concrete and Masonry Sections for installation of inserts and anchorage devices.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Coiling Grille: Apton Rolling Doors A Gichner Systems Group Inc., Atlas Roll-Lite Overhead Doors/Div. MASCO, Ceco/Windsor-Div. Ceco Corp., The

Cookson Co., Cornell Iron Works Inc., Dynamic Closures Corp., Mahon Door Corp., Overhead Door Corp., Pacific Rolling Door Co., Raynor Garage Doors, Southwestern Steel Rolling Door Co., J.G. Wilson Corp.

- B. Sectional Overhead Door: McKee Door Co., Overhead Door Co., Raynor Manufacturing Co., Ceco Corp.

2.02 MATERIAL

- A. Grille Curtain - Overhead Coiling Grille:
 - 1. General: Fabricate grille curtain consisting of network of min. 5/16 in. dia. horizontal rods spaced approximately 2 in. o.c. and rotating on rods.
 - 2. Aluminum Grilles: ASTM B221, with clear satin anodized finish.
 - 3. Bottom Bar:
 - a. Manufacturer's standard extruded shape or two angles, finished to match grille.
 - b. Provide replaceable flexible vinyl or neoprene continuous floor bumper at underside of bar.
 - 4. End Locks: Continuous end links or other devices at ends of rods, locking and retaining grille curtain in guides against excessive pressures, maintaining curtain alignment and preventing lateral movement.
 - 5. Guides:
 - a. Manufacturer's standard extruded aluminum shape having curtain groove with return lips or bars to retain curtain.
 - b. Furnish pile strips, rigid vinyl liner, or other nonmetallic inserts to prevent metal-to-metal contact and minimize travel noise.
 - c. Furnish removable stops on guides to prevent curtain overtravel.
- B. Door Curtain - Overhead Coiling Door:
 - 1. Fabricate overhead coiling door curtain of interlocking slats designed to withstand required

- wind loading, of continuous length for width of door without splices.
2. Provide slats of material gage recommended by door manufacturer for size and type of door required, and as follows.
 3. Steel Door Curtain Slats: Structural quality, cold-rolled, galvanized steel sheets complying with ASTM A446, Grade A, with G90 zinc coating, complying with ASTM A525, and phosphate treated before fabrication.
 4. Insulation: Fill slat with manufacturer's standard foam insulation and enclose insulation completely within metal slat faces with inside curtain slat face to match outside metal curtain slot.
 5. Design: Standard flat-face slats.
 6. Endlocks:
 - a. Malleable iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets.
 - b. Provide locks on alternate curtain slats for curtain alignment and resistance against lateral movement.
 7. Windlocks:
 - a. Malleable iron castings secured to curtain slats with galvanized rivets.
 - b. Unless otherwise recommended by door manufacturer, provide windlocks on doors exceeding 16 ft. width.
 - c. Space windlocks approximately 24 in. o.c. on both edges of curtain.
 8. Bottom Bar:
 - a. Consisting of two angles, each min. 1 in. x 1 in. x 1/8 in. thick, either galvanized or stainless steel or aluminum extrusions to suit type of curtain slats.
 - b. Provide replaceable gasket of flexible vinyl or neoprene between angles as weather seal and cushion bumper for manually operated doors, unless shown as overlapping joint.

9. Curtain Jamb Guides:
 - a. Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading.
 - b. Build-up units with min. 3/16 in. thick steel sections, galvanized after fabrication.
 - c. Slot bolt holes for track adjustment.
 - d. Secure continuous wall angle to wall framing by min. 3/8 in. bolts, max. 30 in. o.c., unless closer spacing is recommended by door manufacturer.
 - e. Extend wall angles above door opening head to support coil brackets, unless otherwise indicated.
 - f. Place anchor bolts on exterior wall guides so they are concealed when door is in closed position.
 - g. Provide removable stops on guides to prevent overtravel of curtain, and continuous bar for holding windlocks.
10. Weather Seals:
 - a. Provide vinyl or neoprene weatherstripping for exterior exposed doors, except where otherwise indicated.
 - b. Door Heads: Use 1/8 in. thick continuous sheet secured to inside of curtain coil hood.
 - c. Door Jambs: Use 1/8 in. thick continuous strip secured to exterior side of jamb guide.

C. Steel Sections - Sectional Door:

1. General: Construct door sections from galvanized structural quality carbon steel sheets complying with ASTM A446, Grade A, or ASTM A526, min. 33,000 psi yield strength and minimum G90 zinc coating complying with ASTM A525.
2. Steel Sheet Thickness: 0.016 in.
3. Exterior Section Face: Ribbed textured.
4. Fabrication:
 - a. Fabricate sections from single sheet to provide units max. 24 in. high, and nominal 2 in. deep.

- b. Roll horizontal meeting edges to continuous shiplap, rabbeted, or keyed weather seal, with reinforcing flange return.
 - c. Enclose open section with 16 gage galvanized steel channel end stiles welded in place.
 - d. Provide intermediate stiles, cut to door section profile, max. 48 in. o.c. and welded in place.
 - e. Reinforce bottom section with continuous channel or angle conforming to bottom section profile.
 - f. Reinforce sections with continuous horizontal and diagonal reinforcing, as required by door width and design wind loading.
 - g. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth, and bolted or welded in place.
5. Insulation:
- a. Insulate inner core of steel sections with manufacturer's standard glass fiber or polyurethane foam-type insulation.
 - b. Enclose insulation with manufacturer's standard steel sheet secured to door panel.
6. Vision Panels:
- a. Except as otherwise indicated, furnish clear float glass vision panels in arrangement shown.
 - b. Set glass in rubber or neoprene channel glazing strips for metal framed doors and elastic glazing compound for wood doors, as required.
 - c. Provide removable stops of same material as door section frames.
7. Pass Doors:
- a. Provide pass doors in sectional doors where indicated, complete with glazing, operating hardware, and mortise lock.
 - b. Construct pass doors of same materials and design as overhead door unit.
 - c. Where door unit is power operated, provide safety interlock switch to disengage power supply when pass door is open.

- d. Lock cylinder is specified in Section 08710.
- 8. Finish:
 - a. Pretreat zinc-coated steel with zinc phosphate conversion coating after cleaning.
 - b. Apply manufacturer's standard prime and finish coats, applied to interior and exterior door faces.
- D. Counterbalancing Mechanism - Coiling Grille and Door:
 - 1. General:
 - a. Counterbalance grille with steel helical torsion spring mounted around steel shaft and contained in spring barrel connected to curtain.
 - b. Use grease-sealed ballbearings or self-lubricating graphite bearings for rotating members.
 - 2. Counterbalance:
 - a. Hot-formed, structural-quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion and limit barrel deflection to max. 0.03 in. per ft. of span under full load.
 - b. Furnish spring balance of one or more oil-tempered, heat-treated steel helical torsion springs.
 - c. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel.
 - d. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.
 - e. Fabricate torsion rod for counterbalance shaft of case-hardened steel, sized to hold fixed spring ends and carry torsional load.
 - 3. Brackets: Manufacturer's standard design, either cast iron or cold-rolled steel plate.
 - 4. Hood - General:
 - a. Form to entirely enclose coiled curtain and operating mechanism at opening head.
 - b. Contour to suit end brackets to which hood is attached.

- c. Roll and reinforce top and bottom edges for stiffness.
 - d. Provide closed ends for surface-mounted hoods, and any portion of between-jamb mounting projecting beyond wall face.
 - e. Provide intermediate support brackets as required to prevent sag.
5. Aluminum Hoods: Fabricate hoods for aluminum grilles of alloy 3003 aluminum sheet, min. 0.032 in. thick, finished to match curtain.
6. Tubular Steel Columns: Provide for large grille curtains, as detailed.
- E. Tracks, Supports and Accessories - Sectional Door:
- 1. Tracks:
 - a. Provide manufacturer's standard galvanized steel track system, sized for door size and weight, and designed for clearances shown.
 - b. Provide complete track assembly including brackets, bracing and reinforcing for rigid support of ball bearing roller guides, for required door type and size.
 - c. Slot vertical sections of track 2 in. o.c. for door drop safety device.
 - d. Slope tracks at proper angle from vertical, or otherwise design to ensure tight closure at jambs when door unit is closed.
 - e. Weld or bolt to track supports.
 - 2. Track Reinforcement and Supports:
 - a. Provide galvanized steel track reinforcement and support members.
 - b. Secure, reinforce and support tracks as required for size and weight of door to provide strength and rigidity, and to ensure against sag, sway, and detrimental vibration during opening and closing of doors.
 - c. Support and attach tracks at opening jambs with continuous angle welded to tracks and attached to wall.
 - d. Support horizontal ceiling tracks with continuous angle welded to track and supported by laterally-braced attachments to

- overhead structural members at curve and end of tracks.
3. Weather Seals:
 - a. Provide continuous, rubber, neoprene, or flexible vinyl adjustable weatherstrip gasket at tops and compressible astragal on bottoms of each overhead door.
 - b. Provide continuous flexible seals at door jamb edges for fully weathertight installation.
- F. Hardware - Sectional Door:
1. General: Provide heavy-duty, rust-resistant hardware, with galvanized or cadmium-plated or stainless steel fasteners, to suit type of door.
 2. Hinges:
 - a. Provide heavy steel hinges at each end stile and at each intermediate stile, per manufacturer's recommendations for size of door.
 - b. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts.
 - c. Use rivets or self-tapping fasteners where access to nuts is not possible.
 - d. Provide double-end hinges, where required, for doors exceeding 16 ft. -0 in. in width, unless otherwise recommended by door manufacturer.
 3. Rollers:
 - a. Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track.
 - b. Extend roller shaft through both hinges where double hinges are required.
 - c. Provide roller tires to suit size of track 3 in. dia. for 3 in. track; 2 in. dia. for 2 in. track.
 - d. Case-hardened steel tires, for normal installations.

- G. Counterbalancing Mechanisms - Sectional Door:
1. Extension Spring:
 - a. Hang door assembly for operation by extension spring counterbalance mechanism with aircraft-type steel cable over ball-bearing sheaves.
 - b. Provide oil tempered wired springs with internal safety rods.
 - c. Combine operation with spring bumper in each horizontal track to cushion door at end of opening operation.
 2. Torsion Spring:
 - a. Hang door assembly for operation by torsion spring counterbalance mechanism, consisting of adjustable tension tempered steel torsion springs mounted on case-hardened steel shaft, and connected to door with galvanized aircraft-type lift cable.
 - b. Provide cast aluminum or grey iron casting cable drums, grooved to receive cable.
 - c. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft with 1 additional midpoint bracket for shafts up to 16 ft. long and 2 additional brackets at 1/3-points to support shafts over 16 ft. long, unless closer spacing recommended by door manufacturer.
 - d. Include spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side, designed to stop door automatically if either cable breaks.
 - e. Provide either compression spring or leaf spring bumper installed at end of each horizontal track to cushion door at end of opening operation.
- H. Manual Operation:
1. Grille and Door:
 - a. Furnish manual chain hoist operator consisting of endless steel hand chain, chain

- pocket wheel and guard, and geared reduction unit with max.
 - b. 35 lb. pull for door operation.
 - c. Furnish alloy steel hand chain with chain holder secured to operator guide.
2. Sectional:
- a. Provide direct-drive chain hoist, side-mounted unit, consisting of endless steel hand chain, cast iron pocket pulley and chain guard, mounted on counterbalance shaft as shown, and operating with max. 35 lbs. pull.
 - b. Connect to door through secondary drive roller chain and sprocket and operate at max. 35 lbs. pull.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install assembly and operating equipment, complete with necessary hardware in accordance with final shop drawings, manufacturer's instructions, and as specified.
- B. After completing installation, including work by other trades, lubricate, test, and adjust assembly to operate easily, free from warp, twist, or distortion.

END OF SECTION

SECTION 15083

PIPE INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 15 Section "Duct Insulation" for insulation for ducts and plenums.
 - 3. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.03 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
 - 2. Insulation application at pipe expansion joints for each type of insulation.
 - 3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 4. Removable insulation at piping specialties and equipment connections.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

August 5, 2002

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.06 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for insulation application.

1.07 SCHEDULING

- A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.

August 5, 2002

2. Flexible Elastomeric Thermal Insulation:

- a. Armstrong World Industries, Inc.
- b. Rubatex Corp.

2.02 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

2.03 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Jacket Color: White or gray.

C. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-(0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

2.04 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
 2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
 3. Aluminum: 0.007 inch (0.18 mm) thick.
 4. Brass: 0.010 inch (0.25 mm) thick.
 5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.
- C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

2.05 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.03 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

August 5, 2002

- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:

August 5, 2002

1. Pull jacket tight and smooth.
 2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
1. Seal penetrations with vapor-retarder mastic.
 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 4. Seal metal jacket to roof flashing with vapor-retarder mastic.
- Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."
- T. Floor Penetrations: Apply insulation continuously through floor assembly.
1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.
- 3.04 MINERAL-FIBER INSULATION APPLICATION
- A. Apply insulation to straight pipes and tubes as follows:
1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.

August 5, 2002

2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.05 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

- B. Apply insulation to flanges as follows:
 - 1. Apply pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

- C. Apply insulation to fittings and elbows as follows:
 - 1. Apply mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

- D. Apply insulation to valves and specialties as follows:
 - 1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
 - 2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
 - 3. Apply insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.06 FIELD-APPLIED JACKET APPLICATION

- A. Apply PVC jacket where indicated, with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

3.07 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Flexible connectors.
 - 2. Vibration-control devices.
 - 3. Fire-suppression piping.
 - 4. Drainage piping located in crawl spaces, unless otherwise indicated.
 - 5. Below-grade piping, unless otherwise indicated.
 - 6. Chrome-plated pipes and fittings, unless potential for personnel injury.
 - 7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

August 5, 2002

3.08 FIELD QUALITY CONTROL

- A. Inspection: Government will engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
- B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.09 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.10 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic hot and recirculated hot water.
 - 1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper and PVC Pipe, All Pipe Sizes: 1" thick
 - 4. Field-Applied Jacket: None.
 - 5. Vapor Retarder Required: No.
 - 6. Finish: None.
- B. Service: Rainwater conductors.
 - 1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper and PVC Pipe, All Pipe Sizes: 1" thick
 - 4. Field-Applied Jacket: None.
 - 5. Vapor Retarder Required: No.
 - 6. Finish: None.

- C. Service: Roof drain bodies.
 - 1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: 1" thick.
 - 4. Field-Applied Jacket: None.
 - 5. Vapor Retarder Required: No.
 - 6. Finish: None.

- D. Service: Condensate drain piping.
 - 1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
 - 2. Insulation Material: Flexible elastomeric.
 - 3. Insulation Thickness: 1" thick.
 - 4. Field-Applied Jacket: None.
 - 5. Vapor Retarder Required: Yes.
 - 6. Finish: None.

- E. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.
 - 1. Operating Temperature: 35 to 120 deg F (2 to 49 deg C).
 - 2. Insulation Material: Flexible elastomeric.
 - 3. Insulation Thickness: ½" thick.
 - 4. Field-Applied Jacket: PVC P-trap and supply covers.
 - 5. Vapor Retarder Required: No.
 - 6. Finish: None.

- F. Service: Chilled-water supply and return.
 - 1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Steel Pipe, All Pipe Sizes: 1" thick.
 - b. Copper Pipe, All Pipe Sizes: 1" thick.
 - 4. Field-Applied Jacket: None.
 - 5. Vapor Retarder Required: No.
 - 6. Finish: None.

- G. Service: Refrigerant suction and hot-gas piping.
 - 1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
 - 2. Insulation Material: Flexible elastomeric.
 - 3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe, All Pipe Sizes: ¾" thick.

August 5, 2002

4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: None.

H. Service: Heating hot-water supply and return.

1. Operating Temperature: 100 to 200 deg F (38 to 93 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Steel or Copper Pipe, Through 1": 1 ½" thick.
 - b. Steel or Copper Pipe, 1 ¼" through 6": 2" thick.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

3.11 EXTERIOR INSULATION APPLICATION SCHEDULE

A. This application schedule is for aboveground insulation outside the building. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.

B. Service: Refrigerant suction.

1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe, All Pipe Sizes: ¾" thick.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: Painted.

END OF SECTION 15083

SECTION 16482

MOTOR CONTROL CENTERS

PART 1 - GENERAL

- 1.01 RELATED DOCUMENTS: Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.
- 1.02 DESCRIPTION OF THE WORK:
- 1.02.1 Provide all labor, materials, equipment, accessories, services and tests to provide a complete and functional installation of motor control centers (MCCs) in accordance with the Drawings and Specifications.
- 1.02.2 Quantity of motor starters, motor circuit protectors, circuit breakers, auxiliary equipment, spares and fully equipped spaces shall be as shown on the design drawings.
- 1.03 QUALITY CONTROL:
- 1.03.1 MCCs shall be manufactured by:
- Square D - Model 5
 - Allen Bradley – Centerline
 - Engineer approved substitute
- 1.03.2 Motor control equipment shall bear the Underwriters' Laboratories (UL) Label.
- 1.04 SUBMITTALS:
- 1.04.1 In addition to submittals specified elsewhere the Contractor shall submit the following product literature detailing the electrical and physical characteristics of the equipment.
- A. Shop Drawings. Include front and side views of enclosures with overall dimensions shown, conduit entrance locations and requirements, nameplate legends, size and number of bus bars per phase, neutral and ground, electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time/current curves of all equipment and components.
 - B. Manufacturer's installation and maintenance manuals.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Shipping preparation shall be in accordance with supplier's standards unless noted otherwise. Supplier shall provide all shipping preparations necessary to ensure that the equipment arrives at site in excellent working condition when handled by commercial carrier.
- B. Each shipping section of stationary structures shall be furnished with removable lifting angles and/or plates suitable for crane hooks or slings. Each shipping section shall also be furnished with removable steel channel base plates, which will permit using pipe rollers or dollies without damaging the frame steel of the equipment.
- C. Each shipping section of stationary structures shall be provided with a readily visible identification tag bearing the equipment number of the assembly of which it is a part.
- D. Where MCC sections must be separated for shipment, all information, materials and equipment necessary for re-assembly and reconnection of interconnection bus work and wiring in the field shall be furnished.

1.06 SPARE PARTS AND SPECIAL TOOLS

- A. A minimum of six (6) spare fuses of each size and type used in the motor control center shall be furnished.
- B. Furnish one set of all special tools required for the erection, operation, calibration and maintenance of all equipment furnished and installed under this Section.
- C. Furnish one pint each of primer and touch-up paint, of each color.

PART 2 - PRODUCTS

2.01 GENERAL:

2.01.1 Motor Control Centers:

- A. All MCCs shall be in compliance with UL845.
- B. MCCs shall be of dead front construction with horizontal and vertical power and ground buses, plus neutral bus if indicated on drawings.

- C. MCCs shall have a minimum integrated short circuit current rating of 42,000 AIC at 480 volts.
- D. MCCs shall be of NEMA 12 Dust tight and drip tight construction.
- E. MCC wiring shall be Class I, type B.
- F. MCC shall be UL listed and approved for installation in Seismic Zone-2.

2.02 SECTIONS:

2.02.1 General:

- A. Sections shall be totally enclosed, dead front, freestanding assemblies, and capable of being bolted together to form a single assembly.
- B. The overall height of the MCC shall not exceed 90", not including base channel. Base channels shall be removable. The total width and depth of one section shall be 20".
- C. Each 20" wide standard section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units. Manual bus shutters shall cover vertical bus openings.
- D. Each section shall include a top plate, which shall be removable for ease in cutting conduit entry openings.
- E. Requirements for incoming line shall be as indicated on schedules.

2.02.2 Wireways:

- A. Structures shall contain a minimum 6" high horizontal wireway at the top and bottom of each section. These wireways shall run the full length of the MCC to allow room for power and control cable to connect between units in different sections.
- B. A vertical wireway shall be provided in each MCC section which shall connect with both the top and bottom horizontal wireway and be isolated from unit interiors by a full height barrier. The vertical wireway shall be 4" wide (minimum) with a separate hinged door. Access to the wireways shall not require opening control unit doors.

August 5, 2002

2.02.3 Materials and Finishes:

- A. Each MCC shall consist of one or more vertical section of heavy gauge steel bolted together to form a rigid freestanding assembly. A removable steel lifting angle shall be mounted for the full width of the lineup at the top. Removable 7 gauge bottom channel sills shall be mounted underneath front and rear of the vertical sections extending the full width of the lineup. Vertical sections shall be made of welded side-frame assembly formed from 12-gauge steel (minimum). Internal reinforcement structural parts shall be of 11-gauge steel to provide a strong rigid assembly. The entire assembly shall be constructed and packaged to withstand all stresses included in transit and during installation.
- B. All steel parts shall be provided with UL listed acrylic/alkyd baked enamel paint finish except plated parts used for ground connections. All painted parts shall undergo a multi-stage treatment process followed by the finishing paint coat.

2.03 BUSSING:

2.03.1 All bussing and connectors shall be as follows:

- A. All bussing and connectors shall be tin plated or silver-plated copper.
- B. The main horizontal bus shall extend the full length of the MCC. Bus ratings shall be based on 65 °C maximum temperature rise in a 40 °C ambient. Provisions shall be provided for splicing additional sections onto either end of the MCC.
- C. The horizontal bus splice bars shall be preassembled into a captive bus stack and installed into the end of the MCC power buss to allow the installation of additional sections. The main bus splice shall utilize four bolts; two on each side of the bus split for each phase. Additional bolts must not be required when splicing higher amperage bus. The splice bolts shall secure to self-clenching nuts installed in the bus assembly.
- D. Each section shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of the same material and plating as the main bus and shall be rated at 300A or 600A, continuous. The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors.
- E. A tin-plated copper ground bus shall be provided that runs the entire length of the MCC. The ground bus shall be a minimum of 0.25" x 1.0", with a minimum continuous rating of 300 amps. The ground bus shall be provided with six (6) 0.38-inch holes for each vertical section to accept customer-supplied ground lugs for any loads requiring a ground conductor.
- F. Each vertical section shall have a copper vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.

August 5, 2002

- G. When indicated on drawings, a tin or silver plated copper neutral bus with a rating equal to main horizontal bus shall be provided that extends the full length of the MCC. Connection of the neutral shall be made through connection plates in each section. A neutral termination plate shall also be available for neutral terminations at the MCC.
- H. All power bussing and splice connections shall be isolated from the unit compartments and the wireways. The horizontal bus shall be mounted onto a glass filled polyester support assembly that braces the bus against the forces generated during a short circuit. The horizontal bus shall be isolated from the top horizontal wireway by a two-piece grounded steel barrier. This barrier shall be removable to allow access to the bus and connections for maintenance.
- I. The vertical bus shall be housed in a molded glass filled polyester support that provides bus insulation and braces the bus against the forces generated during a short circuit. These supports shall have openings every 3 inches for unit stab-on connections. Each opening shall be provided with a manual shutter to close off the stab opening. These shutters shall be attached to the structure so that when they are removed to allow a stab connection, they are retained in the structure and are readily accessible for use, should a plug-in unit be removed from the MCC.
- J. Barriers shall be provided in the vertical structure and unit designs to prevent the contact of any energized bus or terminal by a fish tape inserted through the conduit or wireway areas.

2.04 PLUG-IN UNITS:

2.04.1 Construction:

- A. Units with circuit breaker disconnects through 250A frame, and fusible switch disconnects through 200A, shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus. Stabs on all plug-in units shall be solidly bussed to the unit disconnect. Cabled stab assemblies are not permitted.
- B. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.
- C. Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All plug-on units shall use a twin handle camming lever located at the top of the bucket to rack the plug-in unit in and out. The cam lever shall work in conjunction with the hanger brackets to ensure positive stab alignment.
- D. A cast metal handle operator must be provided on each disconnect. With the unit stabs engaged into the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit disconnect, with clear indication of the disconnect status. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.

August 5, 2002

- E. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. There shall be included, a means for authorized personnel to defeat these interlocks for testing and maintenance.
- F. A non-defeatable interlock shall be provided between the handle operator and the cam lever to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.
- G. The plug-in unit shall have a grounded stab-on connector, which engages the vertical ground bus prior to, and releases it after, the power bus stab-on connectors.
- H. Provisions shall be provided for locking all disconnects in the OFF position.

2.04.2 Components:

- A. Disconnects for starter units shall be either motor circuit protector type circuit breakers or fusible switches as indicated on schedules.
- B. Starters:
 - 1. Magnetic starters shall be furnished in all combination starter units. All starters shall utilize NEMA rated contactors. Unless otherwise indicated, starters shall be provided with 120V coil, and on pilot light.
 - 2. Unless otherwise indicated, oversized control circuit transformers shall be provided, including properly sized fuses and fuse blocks. The transformer shall be sized to accommodate the contactor and all connected control circuit loads. The transformer rating shall be fully visible from the front when the unit door is opened.
 - 3. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.
 - 4. Type of starting shall be as shown on the design drawings. Each starter shall have the following:
 - 5. Starter sizes 1 through 3: Three (3) phase, manual operated, bimetallic, overload relay. Heater elements shall be furnished (loose) by vendor and installed by others.
 - 6. Starter sizes 4 through 6: Three (3) phase, manual operated solid state overload relay, D.I.P. switch selectable for the specific motor full load amps. Overloads to monitor all three phase currents, to provide motor overload running protection, phase loss and phase unbalance protection.

7. Motors over 50 HP shall be provided with solid state reduced voltage starters.
 8. Furnished with two (2) normally open, two (2) normally closed auxiliary contacts on each contactor (in addition to the holding contact). Contacts shall be wired to terminal boards.
 9. Starter sizes and types shall be as shown on schedules.
- C. Terminal Blocks:
1. All starter units shall be provided with unit control terminal blocks for user control terminations.
 2. Terminal blocks shall be pull-apart type, 600 volt and rated at 25 amps. All current carrying parts shall be tin plated. Terminals shall be accessible from inside the unit when the unit door is opened. Terminal blocks shall be mounted with the stationary portion of the block secured to the unit bottom plate. The stationary portion shall be used for factory connections and shall remain attached to the unit when unit is removed. The terminals used for field connections shall face forward so they can be wired without removing the unit or any of its components.
- D. Solid State Reduced Voltage Starters:
1. Where indicated on the drawings, provide solid state reduced voltage motor starters.
 2. Solid state reduced voltage starters shall consist of an SCR based power section, a logic board and a paralleling bypass contactor.
 3. The logic board shall incorporate electronic motor overload and over-temperature protection, field selectable for Class 10 or Class 20 operation. Control logic shall be phase sensitive to inhibit starting on improper phase rotation, and to protect on phase loss or imbalance greater than 35%.
 4. The control logic shall also include field adjustable:
 - ramp up and selectable ramp down timers,
 - 100-200 % adjustable starting torque
 - 75-500% adjustable starting current limit
 - Energize bypass contactor once the motor accelerates to full speed.
 5. The bypass contactor shall be fully rated for the motor starting current, and shall be capable of across the line starting if so desired.
- E. Feeder Units:
1. Where indicated on schedules, circuit breaker or fusible switch feeder units shall be provided.

2. Circuit breaker feeder units shall have thermal magnetic breakers unless otherwise indicated. Circuit breakers up to 100A shall be available as dual mounted units.
3. Fusible switch feeder units shall use fuse types as scheduled. Switches up to 60A shall be available as dual mounted units.

2.05 VARIABLE FREQUENCY DRIVES:

2.05.1 Variable frequency drives shall be defined as adjustable frequency motor controls consisting of a pulse width modulated (PWM) inverter for use on a standard NEMA Design B induction motor VFDs shall be rated for full load motor amperes plus service factor.

2.05.2 The adjustable frequency system shall be for continuous duty, and shall be suitable for use on motors that are either direct connected or connected by power transmission components to the fans.

2.05.3 ADJUSTABLE FREQUENCY INVERTER:

- A. Provide a NEMA 1 enclosure with deadsides for individual wall installation.
- B. Free standing enclosures shall be suitable for mounting on a concrete housekeeping pad.
- C. Fused input shall utilize standard I²T type fuses.
- D. Provide solid state power and logic unit. The unit shall transform 3 phase 60 Hertz input power into frequency and voltage controlled 3 phase output power suitable to provide positive speed and torque control to standard induction motors.
- E. The speed control shall be stepless throughout the speed range under variable torque load on a continuous basis. The adjustable frequency control shall be of a pulse width modulated type utilizing a minimum 12-pulse, full wave diode bridge rectifier and shall have a power factor of .95 or better throughout the whole range of frequencies and 95% efficiency minimum. Insulated gate bipolar transistors (IGBT) shall be employed for high reliability in the output power switching circuit.

2.05.4 HARMONIC DISTORTION:

- A. VFDs shall be sinusoidal input type which provide clean power operation to the connected power source. Individual or simultaneous operation of the VFDs shall not add more than 3% total harmonic voltage distortion and no more than 5% total harmonic current distortion (per IEEE 519 1992) as measured at the point of common coupling which is the input terminals of each VFD.
- B. A harmonic analysis shall be performed assuming a power system short circuit ratio of 10 with all VFDs operating at maximum speed and maximum load. Compliance shall be verified by the VFD manufacturer with field measurements of harmonic distortion differences at point

August 5, 2002

of common coupling with and without VFDs operating. Short circuit current (ISC) utilized for harmonic analysis calculations shall be defined as:

$$ISC = 10 * (\text{Sum of total full load amps of all VFDs})$$

- C. If the analysis indicates that the harmonic distortion limits specified in "A" above are exceeded, the contractor shall provide filters, or a different VSD design as recommended by the VFD manufacturer to reduce harmonic distortion levels.

2.05.5 BASIC FEATURES:

- A. The door of each unit shall include a "Power On" light, a VFD fault light, a VFD run light, stop pushbutton, start pushbutton, a fault reset pushbutton, a "Hand-Off-Automatic" selector switch, and a manual speed control potentiometer.
- B. Input disconnect switch or circuit breaker interlocked with the enclosure door, with through-the-door handle to provide positive disconnect of incoming AC power. The circuit breaker shall be rated for 35,000 AIC.
- C. Drive is to be provided with isolated 4-20mA DC output signals, proportional to speed and current, for remote monitoring of the VFD.
- D. The VFD shall be software programmable to provide automatic restart after any individual trip condition resulting from either overcurrent, overvoltage, undervoltage, or overtemperature. For safety, the drive shall shut down and require manual reset and restart if the automatic reset/restart function is not successful within a maximum of three attempts.
- E. A speed reduction feature shall be included which reduces the speed of the drive on transient overloads. The drive is to return to set speed after transient is removed. If the acceleration or deceleration rates are too rapid for the moment of inertia of the load, the drive is to automatically compensate to prevent drive trip.
- F. Automatic restart after drive trip or utility failure; software selectable if not desired.
- G. Individual adjustable settings for start, stop, entry, slope, and minimum and maximum speed points.
- H. Process signal inverter, software selectable to allow speed of drive to vary inversely with input signal.
- I. A critical speed avoidance circuit will be included for selection of two critical speeds, with a rejection band centered on that speed. The drive will ignore any speed signals requiring drive operation within the rejection band.
- J. Proportional and integral setpoint process controller with menu driven selection and programming via door mounted keypad.

- K. The VFD shall be able to determine the motor speed and resume control of a motor which is spinning in either direction without tripping.
- L. A door mounted membrane keypad with integral LCD display, capable of controlling the VFD and setting drive parameters, and shall including the following features:
 - 1. A digital display that presents all diagnostic messages and parameter values in English engineering units when accessed, without the use of codes.
 - 2. A keypad module containing a self-test software program that can be activated to verify proper keypad operations.
 - 3. A digital keypad that allows the operator to enter exact numerical settings in English engineering units, and shall include plain English user menu software as a guide to parameter setting.
 - 4. Drive parameters shall be factory set in EEPROM and resettable in the field through the keypad. Six (6) levels of password security shall be available to protect drive parameters from unauthorized personnel. The EEPROM stored drive variables must be able to be transferred to new boards to re-program spare boards.
 - 5. At a minimum, the display shall be capable of displaying output frequency, output current, output voltage, percent speed demand, control mode, and indication of all faults.
- M. The VFD shall be designed and built to operate as specified, within the following conditions:
 - 1. Elevation to 3300 feet above sea level.
 - 2. Ambient temperature range from 32 °F to 104 °F.
 - 3. Non-condensing relative humidity up to 95%.
- N. Input: 3-phase, 60 Hz (±5%), 480 VAC (±10%).
- O. The VFD shall be designed to operate without a motor or any other equipment connected to the output.
- P. A 115 VAC control power transformer shall be provided.
- Q. The controller may be started or stopped by any of the following methods:
 - 1. Hand-Off-Auto selector switch.
 - 2. A momentary or maintained contact closure.
 - 3. External control input signal.

August 5, 2002

- 4. Three-wire start/stop with built-in holding circuit.
 - 5. Application and removal of 115 VAC (on/off signal).
 - R. A single pole, double throw contact shall be provided which shall change state when any trip condition has occurred (summary alarm contact).
 - S. The VFD shall have programmable 4-20mA, 0-10V analog, and 24 VDC digital inputs.
 - T. An RS232/RS422 serial interface shall be provided.
- 2.05.6 PROTECTIVE FEATURES:
- A. Single phase fault or 3-phase short circuit protection on VFD output terminals without damage to any power component.
 - B. Static instantaneous overcurrent and overvoltage trip with inverse overcurrent protection.
 - C. Static overspeed (overfrequency) protection.
 - D. Phase or fuse loss and undervoltage protection. Undervoltage trip will activate when line voltage drops 15% below rated input voltage.
 - E. Power unit overtemperature protection.
 - F. Electronic motor overload protection.
 - G. Isolated operator controls.
 - H. Input line fuses.
 - I. Insensitivity to incoming power phase sequence.
 - J. DC buss discharge circuit for protection of operator and service personnel with an indicator lamp.
 - K. Input line noise suppression with line reactor.
 - L. Individual transistor overcurrent protection.
- 2.07 INCOMING CABLE COMPARTMENT:
- 2.07.1 Provide main lugs only incoming compartment, which shall consist of a blank compartment containing horizontal bus and crimp (compression) type lugs for the main incoming cables.
- 2.08 WIRING METHODS:
- 2.08.1 Power wiring shall be stranded copper, 600 V, supplier's standard type.

- 2.08.2 Control wiring shall be flexible, stranded copper, 600 V, supplier's standard type. Minimum wire size shall be #14 AWG.
- 2.08.3 Power terminal boards shall be provided on all Size 2 and smaller starters. On Size 3 and larger starters, "T" leads from motor shall be terminated at appropriate starter terminals; therefore, power terminal boards are not required.
- 2.08.4 Unit terminal boards for control wiring shall be barrier, pull-apart type. Terminals shall be mounted up front in the unit, not in the vertical wireway.
- 2.08.5 The starters shall be wired for an external 3-wire control. Additionally, the hot and the neutral legs of the control transformer shall be wired to terminal blocks. Provide spare terminals as indicated on data sheets.
- 2.09 NAMEPLATES:
 - 2.09.1 Engraved nameplates of laminated 1/16" thick white phenolic material with black letters (3/16" high minimum) shall be furnished for each individual controller or feeder circuit breaker. Each motor control center having front-of board construction shall be furnished with one (1) main nameplate with 1" high (minimum) letters. All spare units shall be furnished with blank nameplates. All nameplates shall be engraved in strict accordance with the nameplate engraving information on the design drawings.
 - 2.09.2 Motor control center shall have a permanently installed, readily accessible data plate showing the manufacturer's name, type of service, ampacity, frequency, maximum withstandable fault current level and material number.
 - 2.09.3 All nameplates shall be secured using self-tapping sheet metal screws.
 - 2.09.4 All nameplate text shall be submitted to Engineer for approval.

PART 3 - EXECUTION

3.01 INSTALLATION:

- 3.01.1 Provide concrete housekeeping pads for MCCs.
- 3.01.2 Install MCCs in accordance with manufacturer's instructions and requirements for installation in Seismic Zone-2.
- 3.01.3 Tighten accessible bus connections and mechanical fasteners after placing motor control center.
- 3.01.4 Install fuses in fusible switches. Install and adjust as required thermal motor overloads to suit the installed motor requirements.
- 3.01.5 Provide engraved plastic nameplates under the provisions of Section 16195.

- 3.01.6 Motor Data: Provide neatly typed label inside each motor starter door, identifying motor served, nameplate horsepower, full load amperes, code letter, and service factor.
- 3.01.7 Insure that working clearances and dedicated spaces comply with Articles 110-16 and 384-4 of the NEC.
- 3.01.8 Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit terminations are not stressed.
- 3.01.9 Vacuum clean all interior equipment.
- 3.02 TESTING:
 - 3.02.1 All starter units shall be tested to insure that unit controls function as required. Any units not functioning properly shall have wiring corrected or faulty components replaced. Re-test after corrections have been made.

END OF SECTION 16482