

UNION CARBIDE CORPORATION
Chemicals and Plastics
Engineering Department

May 13, 1968

CONSTRUCTION SPECIFICATIONS
for
Gas Mixing and Storage Building
Building No. 748

Technical Center
South Charleston, West Virginia

UCC Job No. 68003

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This specification outline conforms
to the Uniform System of the
Construction Specification Institute

TECHNICAL CENTER
SOUTH CHARLESTON, WEST VIRGINIA



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1. SCOPE

- A. These specifications, and the drawings, provide for the construction of a Gas Mixing and Storage Building at the Owner's Technical Center.
- B. All permanent portions of the building, site work, and the attached fixtures and equipment shall be included in the work.
- C. Structural steel, exterior siding, and laboratory furniture furnished by the Owner shall be installed under this contract.

2. DEFINITIONS

- A. Wherever the words defined in this section or pronouns used in their stead occur in these specifications, they shall have the meanings here given. Wherever in these specifications words are used in the singular form, they shall have plural meanings where applicable.
 - (1) The word "Owner" refers to Union Carbide Corporation.
 - (2) The word "Engineer" refers to the Owner's Construction Superintendent.
 - (3) The word "Contractor" shall mean and apply equally to the Contractor whose signature appears on the Contract Documents and/or his subcontractors.
 - (4) The word "Work" shall be held to include labor or material, or both.
 - (5) The words "Approved" or "Approval" as used in these specifications signify that the Engineer must be consulted as to the source from which the material or equipment is to be purchased as well as its general quality, construction and durability, but such approval shall not be held to mean the acceptance of the material furnished if same should prove to be defective.
 - (6) The word "Provide" shall mean that the Contractor shall furnish, install, and connect in operative condition all materials, equipment, apparatus, and required appurtenances of the particular item to which it has reference.
 - (7) The word "Directed" shall mean in accordance with written instructions or directions given by the Engineer.
 - (8) The word "Drawings" shall mean those drawings listed in the Contract Documents, or in any addendum or any detailed drawings pertaining or supplemental thereto.

2. DEFINITIONS (contd)

A. (contd)

- (9) The words "Equal", "Necessary", "Required", "Satisfactory", or "Proper", shall mean equal, necessary, required, satisfactory, or proper in the opinion of the Engineer when applicable to work called for or indicated in the Contract Documents.
- (10) The words "Complete", or "Completion", shall indicate full and exact compliance and conformity with the provisions and requirements expressed or implied in the Contract Documents.

3. CONTROLLING CONDITIONS

- A. The Contractor shall confine his and his subcontractors' workmen and employees or trucks to the limits indicated by the Engineer and shall not trespass or use any other portion of the Owner's property or walkways, roads, or buildings; and he shall be held strictly responsible and accountable for any damage due to his lack of observance of this provision.
- B. The Contractor shall confine his apparatus, the storage of materials, and the operation of his workmen to the limits indicated by the Engineer.
- C. The Contractor may use only such roadways as the Engineer may direct.
- D. Upon the completion and before acceptance of the Work under this Contract, the Contractor shall repair and clean adjacent property damaged due to his operations, all as directed by the Engineer.

4. LINES AND GRADES

- A. A grade benchmark and starting coordinate will be given by the Owner. All subsequent engineering, such as establishing contour lines, necessary for the work shall be the responsibility of the Contractor.
- B. The marks as established shall be carefully preserved by the Contractor, and he shall be held responsible for any ensuing incorrect work due to his failure to observe this provision.

5. CONTRACT DRAWINGS AND SPECIFICATIONSA. Scope of Drawings

The drawings and Specifications shall be considered as fixing the extent of the Work.

5. CONTRACT DRAWINGS AND SPECIFICATIONS (contd)

B. Dimensions

Where dimensions or other information are lacking on the drawings, or conflictions occur, the Contractor shall not scale the drawings or proceed with the work affected, but shall first apply to the Engineer who will furnish the necessary information.

C. Copies of Drawings Furnished

The Engineer will furnish all drawings showing the general and various parts of the work. Eight copies of drawings, together with eight sets of specifications, will be furnished to the Contractor by the Engineer.

D. Voided Drawings

The Contractor shall be required to receipt for copies of revised drawings, and shall thereafter be responsible for errors made in using superseded drawings.

E. Ownership of Drawings

All drawings, psecifications, and copies thereof furnished to the Contractor are to be considered as the property of the Owner and shall be returned to the Owner at his request upon the completion of the Contract.

F. Contractor's Claim

If, in the execution of the work, the Contractor believes that the drawings he received subsequent to the signing of the Contract require more work than contemplated in the drawings upon which he based his contract, he must make all claims for additional allowance thereon within five days after receiving the drawings, or before the execution of the Work, whichever is first, or lose all right to make such claims at any subsequent time.

6. PROGRESS SCHEDULE

- A. Promptly after award of Contract, the Contractor shall prepare a schedule of the Work. If requested by the Contractor, the Engineer will advise him in Critical Path techniques and make available the Owner's computer facilities to make a Critical Path analysis of the Work.
- B. The Contractor shall thereafter so coordinate his and his subcontractors' work to conform with the approved construction schedule.

7. OWNER'S OPERATION IN ADJACENT AREAS

- A. The Owner will occupy the parking lot and areas adjacent to the building. The Contractor must make every effort to limit interference with the Owner's operations in these areas. Adequate room for unloading and storage will be provided.

8. TEMPORARY FACILITIES

- A. The Contractor shall supply his own temporary field office and storage facilities.
- B. The location of these facilities shall be as directed by the Engineer.
- C. (1) Contractor shall furnish temporary toilet facilities for his and his subcontractors' personnel.
(2) The toilet facilities shall be chemical-type of design and capacity to satisfy minimum requirements of municipal and state governing agencies.
(3) The Contractor shall maintain the toilet facilities in sanitary condition.
- D. Temporary facilities shall be removed and the area left clean at the completion of the Work and as directed by the Engineer.
- E. The Contractor shall furnish all temporary shoring and anchoring that the nature of the Work may require in order to insure the stability and security of the Work.
- F. The Owner will furnish electric power, steam, and city water at available voltages and pressures for the Contractor's use in the performance of the Work. These utilities will terminate at a point, on the job site, that will be pointed out to the Contractor when he visits the site. If any extensions of the utilities beyond their termination are necessary, the Contractor shall make them at his own expense.
- G. The Contractor shall furnish all compressed air required.

9. DRAWINGS TO BE FURNISHED BY THE CONTRACTOR

A. Shop Drawings

- (1) Before proceeding with the fabrication of materials or equipment requiring shop drawings, the Contractor shall submit complete assembly, setting, and detail drawings, giving all information necessary for installation of such equipment and material and for demonstrating that it complies with the specifications.

9. DRAWINGS TO BE FURNISHED BY THE CONTRACTOR (contd)

A. Shop Drawings (contd)

- (2) Shop drawings shall be made in a manner to give clear, permanent reproductions, in either blue or black line prints on white paper. Drawings shall be identified by serial numbers and descriptive titles indicating their application to the Contract, and shall be signed by a responsible representative of the Contractor.
- (3) Drawings shall be drawn to the following or a larger scale:
 - a. Plans and Sections 1/4 inch scale
 - b. Details 3/4 inch scale
- (4) Prints of each drawing shall be submitted in quadruplicate to the Engineer for approval and in such sequence that the Engineer will have all information necessary for checking. Obtain approval of drawings prior to fabricating any material or proceeding with the work. Six copies of approved and corrected drawings shall be submitted to the Engineer for the Owner's records.

10. ITEMS OF SPECIAL MAKE

- A. Wherever an item is specified by manufacturer, name, trademark, or catalog number, such reference shall establish a standard for the article required. Equal product of other make may be substituted upon the written approval of the Engineer in advance. Articles other than those specified, brought to the project without such written approval, will not be accepted.

11. SUBSTITUTIONS

- A. The Engineer reserves the right to substitute items similar to those specified or of different cost. The Contractor shall thereupon submit to the Engineer his proposal covering the amount to be added or deducted and, if satisfactory to the Owner, a written order to cover it will be issued.

12. PROPRIETARY ITEMS

The Contractor shall use products manufactured by Union Carbide Corporation when such products are needed or specified. The following is a list of products manufactured by Union Carbide Corporation:

- A. Polyethylene film - Zendel
- B. Concrete Admixtures

12. PROPRIETARY ITEMS (contd)

B. Concrete Admixtures (contd)

- (1) For strength and workability - Placewel
- (2) For Air Entrainment - Aircon
- (3) To retard set - Retardwel

C. Pipe support slide plate - National Graphite Slide Plates

13. PROTECTION OF FINISHED SURFACES

- A. The Contractor is especially cautioned that care shall be taken by mechanics and other workmen doing any work in or around locations where the finishes have been applied, so they will not mark, soil, or deface the finished surfaces in any manner. The Contractor shall have signs painted and placed in conspicuous locations warning mechanics and other workmen not to impair finished Work installed on his contract.
- B. In event any finished surfaces become marked, soiled, or defaced in any way, the Contractor shall clean or otherwise restore such damaged surfaces to their original clean condition, or where necessary, replace same at his own expense.
- C. In the event any finished surfaces outside this Contract become marked, soiled, or defaced in any way by the Contractor's workmen or mechanics, the Contractor shall pay necessary costs for restoring such damaged surfaces to their original condition or for replacing same.

14. PROTECTIVE BARRIERS AND LIGHTS

- A. The Contractor shall furnish, install, and maintain, from the beginning to the completion of the Work, all protective barriers, lights, and warning signs necessary and required by law, and shall take all necessary precautions, required by any political division or subdivision and any other law or requirement, to avoid injury or damage to any and all persons and property.

15. TIE-INS TO EXISTING LINES, EQUIPMENT, AND STRUCTURES

- A. Before tying into existing above ground or underground pipelines, and electrical circuits, and before removing any existing supporting structures, such as kick blocks for underground pipelines, the Contractor shall review the work with the Engineer. The Engineer will schedule all shutdowns for connections to existing service.

16. CLEAN-UP

- A. Any and all work soiled or damaged in the execution of the Work shall be thoroughly cleaned and repaired, as directed by the Engineer. The Contractor shall remove all waste material and debris from the job site daily as directed by the Engineer.

17. WORKMANSHIP

- A. The Work shall be installed by workmen skilled in the trades in which they are employed, and competent supervision shall be provided. The installation shall be rigid, secure, straight, and plumb with the various components tightly interlocked and properly connected.

18. COMPLIANCE WITH STANDARD AND INDUSTRY SPECIFICATIONS

- A. Any material or operation specified by reference to the published specification of a manufacturer, the American Society for Testing Materials (ASTM), or other published standards, shall comply with the requirements of the current specification or standard listed. In case of conflicts between the referenced specification or standard, the one having the more stringent requirement shall govern. The Contractor, if requested, shall furnish an affidavit from the manufacturer certifying that the material or product delivered to the job meets the requirements specified.

19. SAFETY AND SECURITY REGULATIONS

- A. Hard Hats. Metal or fiber hard hats of accepted construction quality shall be worn by all employees of the Contractor. The Contractor shall furnish all hard hats.
- B. Cameras. Cameras and other photographic equipment are prohibited on the Owner's property.
- C. Badges. Identification badges, furnished by the Owner, shall be worn in plain sight by the Contractor and all his employees.

20. FINAL JOB CLEANING BEFORE OCCUPANCY

- A. The Contractor shall be responsible for leaving the finished buildings clean and ready for occupancy.
- B. While the various divisions of the specifications call for a protection of finished work and special cleaning, the following is a list of items that must be completed before final acceptance:
1. Thoroughly clean all vinyl asbestos floors and leave ready for waxing. Owner will furnish and apply wax.

20. FINAL JOB CLEANING BEFORE OCCUPANCY (contd)

2. Manufacturer's label shall be removed from all glass, mirrors, partitions, plumbing fixtures, etc.
3. Paint splatters or droplets on floors, walls, piping, ductwork, etc., shall be removed.
4. All concrete floors shall be broom clean.
5. All partitions shall be cleaned of finger prints and smudge marks.
6. Windows shall be cleaned to the satisfaction of the Engineer.
7. All plumbing fixtures and trim shall be thoroughly cleaned.
8. Light fixtures and receptacle covers shall be left dirt-free.

1. SCOPE OF WORK

A. Extent

The work required under this section consists of providing all temporary construction and facilities necessary to complete the work as indicated on drawings and described in specifications.

2. TEMPORARY SCAFFOLDS, STAGING, AND SAFETY DEVICES

- A. Provide, erect, maintain and remove when directed, all scaffolding, staging, platforms, temporary runways, temporary flooring, guards, railings, stairs, etc., as required by local and state codes, or laws, for the protection of workmen and the public. The construction, inspection and maintenance of the above items shall comply with all safety codes and regulations as applicable to the project.

3. COLD WEATHER PROTECTION AND TEMPORARY HEAT

A. Extent

The Contractor shall provide at his own expense all cold weather protection, temporary heat and fuel as necessary to carry on the work expeditiously during inclement weather, to protect all work and materials against injury from dampness and cold, to dry out the building and to provide suitable working conditions for the installation and curing of materials until final acceptance by the Owner. Refer to requirements in detail specifications for temperatures to be provided and maintained for installation and curing of work under the various trades. The Owner will furnish all steam and electric power required for temporary heat.

B. Methods

The methods of heating and the type of fuel and equipment used shall be subject to approval by Engineer. After building is completely enclosed, the permanent heating system may be used to dry out the building and to provide suitable working conditions in all or various parts thereof as soon as practicable.

C. Preparation of Heating System

If permanent electrical service is not yet available, the Contractor shall install temporary service of the proper characteristics for the operation of the heating plant. Temporary connections, controls and other arrangements shall be installed to permit the most effective use of

3. COLD WEATHER PROTECTION AND TEMPORARY HEAT (CONTD)

C. Preparation of Heating System (contd)

the heating system, or parts thereof. The Contractor shall be responsible for the use of the permanent heating system. Such use shall not relieve the Contractor of his responsibility to turn over the system to the Owner in perfect condition on completion of the project, nor shall it shorten the stipulated guarantee period.

4. LIFTING DEVICES AND HOISTING FACILITIES

- A. Contractor shall provide cranes, hoists, towers, and other lifting devices necessary for the proper and efficient movement of materials; provide operating personnel for equipment as required. Equipment shall be provided with proper guys, bracing and other safety devices as required by local or state codes. Remove towers and hoisting equipment when they are no longer needed, or as directed by Engineer.

1. SCOPE OF WORK

A. Extent

The work required under this section consists of all excavating, filling, grading, paving and related items necessary to complete the work indicated on drawings and described in specifications.

- (1) In general the items of work to be performed under this section shall include but are not limited to: clearing and removal of asphalt pavement, excavation for building, removal of underground obstructions when indicated or specified, backfilling, filling, fill compaction, and grading of entire site within the contract limit lines as indicated on drawings. In addition, provide concrete and bituminous paving for walks, ramps and patching where indicated on drawings.
- (2) Excavated material that is suitable shall be used for fills and backfills indicated or required. All unsuitable material, and all surplus excavated material not required for site grading or backfill, shall be removed from the site. The location of dump and length of haul shall be the Contractor's responsibility.
- (3) Provide and place any additional fill material from off the site as may be necessary to produce the grades required. Fill obtained from off site shall be of kind and quality as specified for fills herein, and the source approved by Engineer.
- (4) Where adjacent lawn or surface areas within the project site, but outside the contract limits for grading, are disturbed as a result of building operations or storage of materials under this contract, they shall be cleaned of all debris and restored to original grades and condition, including seeding or sodding.

B. Related Work Specified under Other Sections

- (1) Excavation and backfilling for utility lines.
- (2) Porous fill under concrete floor slabs on ground.

2. EXCAVATION FOR BUILDING

A. Dimensions

Excavate to elevations and dimensions indicated; allow additional space as required for construction operations and inspecting foundations.

2. EXCAVATION FOR BUILDING (CONTD)

B. Obstructions

Completely remove all existing paving and other construction from under new foundations.

C. Suitable Bearings for Foundations

If suitable bearing is not encountered at the depth indicated on drawings for foundations, the contractor shall immediately notify the Engineer; he shall not proceed further until instructions are given and necessary measurements made for purpose of establishing additional volume of excavation. The Contract Price will be adjusted if additional excavation is required.

D. Drainage

Contractor shall control the grading around buildings so that ground is pitched to prevent water from running into the excavated areas. Maintain all pits and trenches where footings are to be placed, free of water at all times. Provide all pumping required to keep excavated spaces clear of water during construction. Should any springs or running water be encountered in the excavation, the Engineer shall be notified and the Contractor shall provide free discharge of it by trenches and drain to an appropriate point of disposal as directed.

E. Footing Trenches

Where soil conditions will permit, footing trenches may be excavated to the exact dimensions of the concrete, and side forms omitted. Place footings and foundations upon undisturbed and firm bottoms, fill with concrete any excess cut under footings and foundations. Fill excess cut under slabs with gravel and thoroughly compact.

F. Frost Protection

Do not place footings or slabs on frozen ground. When freezing temperatures may be expected, do not excavate to the full depth indicated, unless the footings or slabs can be placed immediately after the excavation has been completed. Protect the bottoms so excavated from frost if placing of concrete is delayed.

3. DISPOSITION OF UTILITIES

- A. Rules and regulations governing the respective utilities shall be observed in executing all work under this section.

3. DISPOSITION OF UTILITIES (CONTD)

- B. Active utilities shown on the drawings shall be adequately protected from damage and removed or relocated only as indicated or specified. Where active utilities are encountered but are not shown on the drawings, the Engineer shall be advised; the work shall be adequately protected, supported, or relocated as directed by Engineer; the contract price will be adjusted for such additional work.

4. FILL UNDER FLOOR SLABS ON GRADE

- A. Where fill is required to raise the sub-grade for concrete floor slab to the elevations indicated on drawings, such fill shall be of earth or bank-run gravel, placed and compacted as specified. The type and quality of material for fills shall be approved by Engineer; cinders or other similar material that will corrode piping or other metal shall not be used for fill. The placing and compaction of fill under slabs after foundation walls are in place shall be coordinated with the backfilling against the outside of the walls, or walls shall be adequately braced to prevent damage.

5. SITE GRADING

A. Grades

Do all cutting, filling, compacting of fills and grading required to bring the entire project area, outside of buildings, to grades as indicated on drawings.

6. PAVED AREAS

- A. Patching of bituminous pavement shall be made with a 5-inch compacted base course, prime coat, a 1-1/2-inch compacted intermediate course, a 1-inch compacted hot mixed bituminous concrete wearing course. All thickness specified shall be thickness after compaction.

Where new paving meets existing work, the junction shall be flush with no abrupt changes in grade or elevation, except as shown on drawings. Bituminous ramp shall be shaped as indicated on drawings and blended into existing pavement.

- B. Concrete walk shall be as indicated on drawings. See Section 3-A for concrete specifications.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all concrete walks on grade, concrete floor slab on grade, porous fill under slab, and related items necessary to complete the work indicated on drawings and described in specifications.

B. Related Work Specified Under Other Sections

- (1) Excavation for foundations and slab.
- (2) Floor drains, inserts, and pipe sleeves for mechanical and electrical work.

2. MATERIALS AND ACCESSORIES

A. Portland Cement

ASTM C150-⁶⁷~~68~~ or ASTM C175⁶⁷ for Air-Entraining Portland Cement.

B. Sand

Clean hard natural sand, or manufactured sand, or a combination of both and conforming to ASTM C33-~~53~~⁶⁶

C. Coarse Aggregate

Except as otherwise specified, aggregate shall be hard, durable, uncoated crushed stone, air cooled blast-furnace slag, or gravel conforming to ASTM C33-~~62~~⁶⁶.

- (1) Maximum size aggregate allowed is 1/5 of narrowest dimension between forms of the concrete member or 3/4 of minimum clear spacing between reinforcing bars, or as recommended in ACI Standard No. 613-54.
- (2) For concrete having an exterior surface exposed, 95 to 100 percent shall pass a 1-1/2 inch sieve; 35 to 70 percent shall pass a 3/4 inch sieve; 10 to 30 percent shall pass a 3/8 inch sieve and not over 5 percent shall pass a No. 4 sieve. Percentages are by weight.

D. Mixing Water

Clean and free from oil, acid and injurious amounts of vegetable matter, alkalies and other impurities.

2. MATERIALS AND ACCESSORIES (contd)E. Metal Reinforcement

Reinforcing steel shall meet the following specifications:

- (1) Reinforcing Bars - Bars shall be deformed in accordance with ASTM A408-~~50T~~⁶⁴ and formed of intermediate grade billet steel ASTM A 15-~~50T~~⁶⁶, regular grade rail steel ASTM A 16-~~50T~~⁶⁸, or intermediate or hard grade axle steel ASTM A 160-~~50T~~⁶⁶. Reinforcement shall be clean and free from loose rust, scale or other coatings that will reduce bond.
- (2) Welded Wire Fabric Reinforcing - ASTM A 185-~~60T~~⁶⁴ steel wire spot welded at intersections and of size indicated. Where size is not noted it shall be 6 x 6 inch mesh, No. 6 gauge.

F. Metal Accessories

Include all spacers, chairs, bolsters, ties, and other devices necessary for properly placing, spacing, supporting, and fastening reinforcement in place. Accessories shall conform to requirements of CRSI "Manual of Standard Practice for Reinforced Concrete Construction".

G. Insulation Joint Fillers

Asphalt impregnated fiberboard conforming to ASTM D 1751-~~60T~~⁶⁵. Joint fillers shall extend full depth of slab or joint and be of thickness and lengths indicated on drawings.

H. Control Joint Filler

Filler for sawed control joints shall be Gardox as manufactured by W. R. Meadows, Inc. Contractor may first insert a Plastistrip joint filler before pouring Gardox.

I. Admixtures

- (1) Placewel - Use "Placewel" as manufactured by Union Carbide Corporation in all concrete. Mix in accordance with manufacturer's directions.
- (2) Airecon - Use "Airecon" as manufactured by Union Carbide Corporation in all concrete for walks and paving. Mix in accordance with manufacturer's directions.

3. WORKMANSHIPA. Subgrade

The existing subgrade shall be cleared of all large stones, sod, wood, mud, and other debris. All holes and other irregularities shall be filled and compacted before the main fill is placed.

The fill material shall consist of granular material such as bank-run sand, foundry sand, gravel, crushed stone or other granular material approved by the engineer. Cinders, clay, or silt are not acceptable.

The fill shall be placed in layers not exceeding 6 in. in depth approximately parallel to the plane of the floor. Fill material shall be thoroughly compacted to 95 per cent maximum density at optimum moisture content plus or minus 2 per cent, as determined by ASTM D 698 by rolling, vibrating, tamping, or by a combination of these methods.

The subgrade shall be in a moist condition at the time of concreting. If necessary it shall be dampened with water in advance of concreting. There shall be no free standing water on the subgrade nor shall there be muddy or soft spots when concrete is cast.

B. Type of Forms and Exposed Finishes(1) Rough Finish

Rough concrete finish shall be used for all vertical surfaces of concrete. Obtain by using clean plywood or metal forms. Concrete having a rough finish shall have honeycombing and minor defects patched.

C. Construction of Forms

- (1) Construct forms to slopes, lines, and dimensions shown, plumb and straight and sufficiently tight to prevent leakage; securely brace and shore forms to prevent displacement and to safely support construction loads. Do not coat forms with material that will stain or cause injury to exposed concrete surfaces. Keep wood forms wet as necessary to prevent shrinkage.

D. Placing Reinforcement

- (1) Place reinforcement in position shown, securely fasten and support to prevent displacement before or during pouring. Cleaning, bending, placing, and splicing of reinforcement in slabs shall be done in accordance with CRSI "Manual of Standard Practice". Mesh reinforcement in slabs shall have sides and ends lapped not less than one mesh.

3. WORKMANSHIP (contd)E. Inserts and Fastening Devices for Other Work

- (1) Assure installation of inserts, conduit, pipe, pipe sleeves, drains, hangers, metal ties, anchors, bolts, dowels, blocking, grounds and other fastening devices required for attachment of other work. Properly locate in cooperation with other trades and secure in position before concrete is poured.
- (2) Sufficient time between erection of forms and placing of concrete shall be given to the various trades to permit the proper installation of their work. See drawings and other sections of the specifications for extent, location, and details of items to be embedded or placed in concrete.
- (3) All sleeves, chasers, inserts, hangers, etc., which are provided and placed in the forms by the various trades shall be maintained in position and protected until the concreting is completed.

F. Strength, Proportions, and Consistency of Concrete

- (1) Ready-mixed concrete shall conform to ASTM Specification C 94-⁶¹~~63~~, Alternate No. 2 with the following values: minimum allowable compressive strength, 3,000 psi at 28 days; maximum slump, 4 in.; air content for concrete with 1-1/2 in. maximum size aggregate, 5 per cent plus or minus 1 per cent - or air content for concrete with 3/4 in. maximum size aggregate, 6 per cent plus or minus 1 per cent.

G. Mixing Concrete(1) Ready-Mixed Concrete

Ready-mixed concrete shall be mixed and delivered to the project in accordance with ASTM Specification C94-⁶¹~~63~~, using Alternate No. 2 for the responsibility of the mix design. In addition, the ready-mixed concrete producer shall furnish duplicate delivery tickets with each load of concrete delivered to the project.

- a. The delivery tickets shall indicate the delivery date and time dispatched; name and location of project; name of contractor; name of ready-mixed concrete producer; truck number; number of cu. yds. of concrete in load; class of concrete; the cement content in bags per cu. yd. of concrete; admixtures in concrete; maximum size of aggregate and the amount of water added at job, if any.

3. WORKMANSHIP (contd)H. Control Tests for Concrete(1) Testing Laboratory

The Owner will take samples and retain the services of a testing laboratory and pay all costs to make tests and submit reports of test to the Engineer. The Contractor shall cooperate by furnishing materials for testing and space for storage when necessary. Any additional testing required because of failure of concrete to meet specification requirements shall be paid for by the Contractor.

(2) Extent of Tests

The Owner will take samples at his option and make tests as herein-after listed. All concrete will be subject to compression, strength, slump and air-entrainment tests.

- a. Compression and Strength Tests - Each test shall consist of four standard 6-inch by 12-inch cylinders; two cylinders to be tested at the age of 7 days and two cylinders at the age of 28 days. Samples from which compression test specimens are molded shall be secured in accordance with ASTM C172-54. Specimens made to check the adequacy of the design for strength of concrete, or as a basis for acceptance of concrete, shall be made and laboratory-cured in accordance with ASTM C31-~~59~~ 66. Additional tests of specimens cured entirely under field conditions may be utilized to check the adequacy of curing and protection of the concrete as directed. Strength tests shall be made in accordance with ASTM C39-61. ?
- b. Slump Tests - Tests for slump shall be made at the place of deposit and in accordance with ASTM C143-~~58~~ 66. Tests shall be made periodically, and as often in the opinion of the Engineer when a change in consistency of the concrete mix is noted.
- c. Air-Entrainment Tests - At least two tests may be made at the place of deposit for each day's placing and as often in the opinion of the Engineer when a change in the consistency of the concrete mix is noted. The tests shall be made in accordance with ASTM C138-~~44~~ ⁶³ or C173-58.

(3) Enforcement of Strength Requirements

When the ultimate compressive strength of any cylinder falls below the specified strength for the class of concrete specified, the design mix and water content shall be adjusted to produce the specified

3. WORKMANSHIP (contd)H. Control Tests for Concrete (contd)(3) Enforcement of Strength Requirements (contd)

strength for concrete that is subsequently placed. In addition, the Engineer may order additional curing for that portion of the structure where the questionable concrete has been placed.

- a. In the event that such additional curing does not give the strength required, as determined by load tests made in accordance with ACI 318-63, or cored cylinder tests, and if such tests indicate the necessity, the defective parts shall be removed and replaced, or shall be reinforced as directed by the Engineer, at the Contractor's expense, including the expense of the tests. If such tests indicate that the structure adequately meets the requirements of the specifications, the test result of the defective cylinders will be waived and the cost of these tests will be paid by the Owner.

I. Placing and Compacting

- (1) After suitable bulkheads, screeds, and jointing materials have been positioned, the concrete shall be placed continuously between construction joints, beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall be distributed by shovels and consolidated by vibration or other suitable means. The concrete shall then be brought to correct level with a straightedge and struck off. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.

(2) Floating

After the concrete has been properly placed, struck off, and darbied or bullfloated, it shall not be worked until ready for floating. The lapse of time between darbying and power floating may vary from 2 to 8 hours or more depending on the weather conditions, concrete temperature, and the concrete mixture. Floating shall begin when the water sheen has disappeared, and/or the mix has stiffened sufficiently that the weight of a man standing on it leaves only a slight imprint on the surface. If two power floating operations are necessary to bring the surface to the desired state, the concrete shall be allowed to stiffen or become harder before beginning the second floating operation.

3. WORKMANSHIP (contd)I. Placing and Compacting (contd)(3) Troweling

Both power and hand troweling shall be required. Power troweling shall begin as soon as little or no cement paste clings to the blades. Troweling shall be continued until the surface is dense, smooth, and free of all minor blemishes, such as trowel marks. Final hand troweling shall be required to remove slight imperfections left by troweling machines to bring the surface to a dense, smooth, polished finish. Final hand troweling shall be continued until a ringing sound is heard as the trowel passes over the surface.

The maximum variation in surface tolerance shall be 1/8 in. in 10 ft. If variations greater than this exist, the engineer may direct the contractor to grind the floor to bring the surface within the requirements. Patching of low spots shall not be permitted. Grinding shall be done as soon as possible, preferably within 3 days, but not until the concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

Sprinkling of dry cement or a mixture of dry cement and sand on the surface of the fresh concrete to absorb water or to stiffen the mix shall not be permitted during any stage of floor construction.

(4) Broom Finish

Walks shall be lightly broomed after steel troweling.

J. Curing and Protection

All freshly cast concrete shall be protected from damaging effects of the elements - freezing, rapid drop in temperature, and loss of moisture - and from future construction operations. When necessary, the contractor shall provide and use insulation and tarpaulins to maintain the concrete temperature above 50°F for the first week.

The concrete shall not be permitted to dry during the curing period. If the floor is left uncovered during the curing period, a film of water shall be clearly visible at all times on the entire surface of the slab. If the film of water cannot be maintained, the slab shall be covered with curing paper meeting the requirements of Specification for Waterproof Paper for Curing Concrete (ASTM C171), or other curing material as approved by the engineer, and shall be left on the slab for the entire curing period.

3. WORKMANSHIP (contd)J. Curing and Protection (contd)

If at any time during the progress of work the temperature is, or in the opinion of the engineer will drop, below 40°F, the contractor shall make suitable provisions to protect the concrete. This protection shall consist of the use of insulating materials such as blankets, mats, etc., and equipment for providing artificial heat. Unvented salamanders or other heaters which produce carbon dioxide as a by-product shall not be permitted in the building during the casting operations or for the following 36 hours. Salamanders or other heaters shall be placed in the building prior to concreting to maintain the temperature above 50°F and to remove any frost from the subgrade.

A thermometer accurate to plus or minus 2°F shall be placed at the interface of the slab under the curing blanket to record the temperature. If the temperature at this position falls below 50°F, additional insulating material shall be supplied to maintain the temperature above 50°F. If heaters are used, precautions shall be taken to prevent drying of the slab. Water jackets or other suitable devices shall be provided on all heaters to maintain the relative humidity of the atmosphere as high as possible.

After the curing period, the temperature of the exposed surface shall not be permitted to drop faster than 30°F in 24 hours.

In hot weather suitable precautions shall be taken to avoid drying of the slab prior to the finishing operation. Windbreaks and/or sunshades shall be provided as directed by the Engineer. During extremes in weather, floors shall not be cast unless the slab is protected by a roof and other suitable protective measures can be taken.

After curing has been completed, the floor shall be exposed to the air for at least 48 hours prior to allowing traffic on the floor.

K. Joints

Construction, control, and isolation joints shall be installed as called for by the plans.

Construction joints shall be formed and located as shown on drawings.

Control joints shall be formed by sawing. Sawing shall be done as soon as the concrete hardens sufficiently to prevent raveling of the concrete at the edges. Sawing shall not be done while the concrete temperature is falling.

3. WORKMANSHIP (contd)

K. Joints (contd)

~~The~~ Contractor shall have at least one spare saw available during the sawing operation.

Control joints shall be cleaned and filled with Gardox joint sealing compound.

Isolation joints shall be installed in the manner shown on the plans around all columns, footings, walls, etc. They shall be truly vertical and shall completely isolate the floor slab from the building and appurtenances.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all concrete block partitions, brick work, and related items necessary to complete the work indicated on drawings and described in specifications.

2. MASONRY MATERIALS

A. Building Brick

Brick shall be made from clay or shale and conform to ASTM Specification C62-~~58~~. Brick shall be in modular sizes. Use brick for scale base.

B. Concrete Masonry Units

Units shall conform to the applicable ASTM Specifications with additional requirements as specified: C145-~~59~~ for solid load-bearing units and C90-~~59~~ for hollow load-bearing units. Use load-bearing type units for interior partitions, and where so indicated, to be constructed of concrete masonry units.

- (1) Units shall be in modular sizes. Corner units shall have square external corners. Provide jamb units at doors. Units shall not contain iron spots or other substances that will stain paint.

C. Precast Concrete Lintels

Precast concrete lintels shall be provided for all openings in block wall. They shall have a uniform texture on exposed surfaces and be free of cracks, chipped or broken edges. Top of lintels shall be marked. Lintels shall be properly cured before setting in place.

D. Joint Reinforcement

Steel reinforcement for use in horizontal bed joints of concrete masonry units, and other locations as hereinafter specified, shall be prefabricated type formed of zinc-coated cold drawn steel wire conforming to ASTM Specification A82-~~58~~. Reinforcing shall be of proper widths for the partition thicknesses shown. Reinforcing shall be similar to "Keywall" as manufactured by Keystone Steel Company.

2. MASONRY MATERIALS (CONTD)

E. Reinforcing Rods

Steel rods for lintels and other reinforcement not specified otherwise shall conform to ASTM Specification A15-~~50T~~ or A16-~~50T~~⁶⁷. Bars of No. 3 size and larger shall be deformed in accordance with ASTM Specification A305-~~50T~~⁶⁵.

F. Masonry Cement

Cement shall conform to ASTM Specification C91-~~60~~⁶⁷, Type II.

G. Sand

Sand shall conform to ASTM Specification C144-~~50T~~^{66T}, except that sand for mortar in 1/4-inch wide joints shall pass a No. 16 sieve.

H. Mixing Water

Water shall be clean and potable.

I. Storage of Materials

Store materials under cover in a dry place and in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store concrete masonry units under covers that will permit circulation of air and prevent excessive moisture absorption. Store air-setting mortars in water-tight sheds with elevated floors. Protect reinforcement from the elements; immediately before placing, reinforcement shall be free from loose rust, ice or other foreign coatings that will destroy or reduce the bond. Concrete masonry units shall be protected against wetting prior to use.

3. WORKMANSHIP

A. Mixing Mortar

(1) Mortar for All Masonry

Mortar shall be mixed in the proportions of 1 part masonry cement and 2-1/4 to 3 parts of sand by volume.

- (2) Mix all cementitious materials and sand in a mechanical batch mixer for a minimum of 5 minutes. Adjust the consistency of the mortar to the satisfaction of the mason, but add only as much water as is compatible with convenience in using the mortar. If the mortar begins to stiffen from evaporation or from absorption

3. WORKMANSHIP (CONTD)A. Mixing Mortar (contd)

of a part of the mixing water, retemper the mortar immediately by adding water, and remix the mortar. All mortar shall be used within 2-1/2 hours of the initial mixing. It shall not be used after it has begun to set.

B. Precautions and General Requirements

- (1) Do not lay masonry when the temperature of the air is below 40 degrees F. unless suitable means as approved by the Engineer are provided to heat materials, protect work from cold and frost and insure that mortar will harden without freezing. No anti-freeze ingredient shall be used in the mortar.
- (2) Brick having absorption rates more than 0.025 oz. per square inch per minute shall be wetted sufficiently so that the rate of absorption when laid does not exceed this amount. All units shall be free from water adhering to their surfaces when they are laid in the wall. Do not wet concrete masonry units.
- (3) Consult other trades and make provisions that will permit the installation of their work in a manner to avoid cutting and patching. Build in work specified under other Sections, as necessary, and as the work progresses.

C. Laying Brick

- (1) Lay brick plumb, level and true to line in full beds of mortar. Except where other pattern is indicated or specified, lay brick in running bond.
- (2) Make joints in brickwork uniform and not more than 3/8-inch wide. After becoming "thumb-print" hard, joints shall be tooled concave with a round or other suitable jointer that is slightly larger than the width of the mortar joint. Close all cracks and crevices.

D. Laying Concrete Masonry(1) Requirements

Set units plumb and true to line. All units shall be laid with level horizontal joints. Except where specified or shown otherwise, units shall be laid in "running bond".

3. WORKMANSHIP (CONTD)

D. Laying Concrete Masonry (contd)

- a. Where electric conduit, outlet, and switch boxes occur grind and cut units before building in services. Coordinate work with Electrical Subcontractor. Cutting of all units exposed in finished work shall be done with an approved type of power saw.
- b. Continuous wire mesh shall be laid in each second horizontal joint of interior concrete masonry unit partitions.
- c. Bond each course at corners in a masonry bond and at intersections with metal ties, anchors, or joint reinforcement spaced vertically not exceeding 16 inches. Filling in with brick will only be permitted where brick and units will not be exposed in finish work.
- d. Joints of concrete masonry units that will be exposed or painted shall be cut flush and tooled when thumb-print hard to form a concave joint.
- e. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Make joints uniform, approximately 3/8-inch thick unless indicated otherwise.

E. Pointing and Cleaning Masonry

- (1) Point all holes in exposed masonry. Cut out defective joints and repoint them with mortar.
- (2) Concrete masonry units shall have all loose mortar cleaned off and all stains removed.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of erecting all structural steel furnished by the Owner and furnishing all related items of construction such as erection equipment, scaffolding, welding machines and welding rods, all in accordance with drawings and specifications.

B. List of Items Furnished by Owner

- (1) Structural steel frame including columns, girders, knee braces, bolts, and all angles and connections attached thereto.

C. Related Work Specified in Other Sections

The following items of related work are specified and included in other sections of these specifications:

- (1) Steel joists.
- (2) Steel roof decks.

2. ERECTION OF STEEL

A. Applicable Standards

Except as otherwise indicated on drawings or specified, the erection of structural steel shall be in accordance with the American Institute of Steel Construction's "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" adopted April 17, 1963, "Code of Standard Practice for Steel Buildings and Bridges" revised February 20, 1963, and with modifications and other specific requirements described herein.

B. Methods for Erection

Prior to starting work the contractor shall submit to the Engineer a description of the methods, sequence of erection, and type of equipment he proposes to use for erecting the structural steel work. This submission or approval shall not relieve the contractor of his responsibility for providing the proper methods, equipment, or workmanship, or safety precautions.

2. ERECTION OF STEEL (CONTD)D. Welding

Where structural joints are made by welding, the details of all joints, the technique of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, and the "Code for Arc and Gas Welding in Building Construction" of the American Welding Society. In addition, welds shall be made only by operators who have been previously qualified by tests, as prescribed in the "Standard Qualification Procedure" of the American Welding Society to perform the type of work required.

E. Cutting Holes

The use of a gas-cutting torch in the field for correcting fabrication errors will be permitted on structural framing members provided that approval of the Engineer is first obtained for each specific condition.

F. Setting Plates

Column base plates and leveling plates shall be set level to correct elevations and temporarily supported on steel wedges or shims until the supported members have been plumbed and grouted. The entire bearing area under plates shall be grouted solid with equal parts of Portland cement and sand.

G. Templates

Templates shall be furnished as indicated on drawings. The Contractor shall furnish instructions for the setting of anchors and bearing plates and shall ascertain that the items are properly set during the progress of the work.

H. Framing

The framing shall be carried up true and plumb and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. It shall finally be removed by the Contractor as part of his equipment. As erection progresses the work shall be securely connected to take care of all dead load, wind and erection stresses.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all open web steel joists, accessories and related items necessary to complete the work indicated on drawings and described in specifications.

- (1) All joists shall have top chord pitched one way, 1/8 inch per foot; joists at columns shall have square ends; all others, underslung.

B. Related Work Specified in Other Sections

- (1) Structural beams, columns and other supports for joists.
- (2) Metal decking over steel joists.
- (3) Field painting on steel joists, except touch-up.

C. Shop Drawings

- (1) Submit shop drawings and erection diagrams of steel joists to Engineer for approval in accordance with requirements described in Section 1-A. Shop drawings shall indicate joist type, number, sizes, spacings, bridging, connections, headers, anchoring, and all other details of erection.

2. MATERIALS

A. Open Web Joist-J-Series

Open web J-Series steel joists shall be provided for roof. The joist shall be designed, fabricated and erected in accordance with the Standard Specifications and Load Tables for Open Web Steel Joist, J-Series as adopted by the Steel Joist Institute, February 1965, and with modifications as indicated on drawings and specified herein.

3. WORKMANSHIP

A. Painting

Joists, bridging, anchors and other accessories shall be cleaned of all rust and scale and given one shop coat of rust inhibitive paint of type standard with the manufacturer, except as follows:

- (1) After erection, the field connections and all abraded places of shop paint shall be painted with same kind of paint as the shop coat.

3. WORKMANSHIP (CONTD)

B. Extended Ends

Provide extended ends for top chords of joists where indicated.

C. Erection

Set joists spaced shown with minimum bearings of 2-1/2 inches on steel.

- (1) Each joist resting on steel supports shall be welded to each support with two welds, each one-inch long.
- (2) Bridge J-Series joist with horizontal bridging. Space bridging at intervals indicated and in accordance with the Steel Joist Institute.
- (3) The joists shall be permanently fastened to supports and all bridging and anchors completely installed before any construction loads are placed on the joists.
- (4) Welding shall be executed in accordance with the "Code for Arc and Gas Welding in Building Construction" of the American Welding Society as amended to date, and only by welding operators who have been previously qualified to perform the type of work required.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of steel roof deck and related items necessary to complete the work indicated on drawings and described in specifications.

- (1) The cutting, drilling, or punching of openings in the deck for passage of pipes, ducts, and the attachment of other items shall be performed in the field by the respective trades requiring the openings or attachments.
- (2) Provide closures for underside of deck at outside walls and center partitions.

B. Related Work Specified in Other Sections

- (1) Structural framing for support of decks.
- (2) Rigid board or insulation on top of decks.
- (3) Field painting of exposed deck surfaces, except touch-up.
- (4) Metal flashings, gutters and downspouts.

C. Substitutions

- (1) The materials or products specified herein and indicated on drawings by trade name, manufacturer's name or catalogue number shall be provided as specified. Substitutions will not be permitted, except as described in Section 1-A, Special Conditions.

D. Shop Drawings

- (1) Submit shop drawings for steel roof decks to Engineer for approval in accordance with requirements described in Section 1-A.
- (2) Shop drawings shall indicate size and location of roof framing supports and the location, lengths and markings of deck units to correspond with the sequence of installation. Drawings shall indicate fastening methods for deck units, accessories, closure pieces, fittings, and the type and sequence of welded connections. Indicate welds by standard welding symbols adopted by the American Welding Society.

2. MATERIALS

A. Type

Decking shall be prefabricated, interlocking steel units, Type "A", as manufactured by Bowman Building Products or Republic Steel Corporation and have a factory primed paint finish. Deck units shall be rolled-formed from steel sheets not lighter than 20 U.S. Standard Gauge. The basic steel for deck units having a primed finish shall be cold-rolled sheets conforming to ASTM Specification A245 or hot-rolled sheets conforming to ASTM Specification A303.

B. Design

Deck units shall be designed and manufactured in accordance with the current "Basic Design Specifications for Steel Roof Deck Construction" as adopted by MRDTI, and with modifications as indicated on drawings and specified herein.

- (1) The section design properties shall be computed in accordance with the applicable requirements of the 1962 edition of American Iron and Steel Institute's "Specifications for the Design of Light Gage Cold-Formed Steel Structural Members". The deck units shall conform to the manufacturer's published load tables.
- (2) Decking shall safely support a uniformly distributed live load of 35 pounds per square foot plus dead loads of the construction indicated. Deflection shall not exceed $1/240$ of the maximum span shown for the live loads specified. The unit design strength shall not exceed the minimum yield strength of steel divided by 1.65. The maximum working stress shall not exceed 20,000 psi.

C. Fabrication

Fabricate deck units to sizes and details indicated or specified. Deck units shall be cut to required lengths so that end joints will occur on supporting members and be lapped a minimum of 2 inches. Typical lengths shall extend over 2 or more spans with end joints staggered.

- (1) Ends of lapped sections shall be swaged or otherwise formed so that matching ends at laps will fit tight and prevent the roofing bitumen from dripping through the joint.
- (2) Closure fittings of metal, composition, neoprene, or rubber to fit the underside of steel deck shall be provided to seal the ribs or corrugations in decking that will be left exposed at outside walls and over center interior partition.

2. MATERIALS (CONTD)

D. Accessories

- (1) Furnish with decking all necessary accessories such as ridge plates, closure pieces, and other items as indicated or required. Accessories shall be of same material and finish as deck units and of manufacturer's standard design and recommended gauges.

E. Protective Coating

- (1) Steel deck units shall be cleaned of scale, rust, grease, oil, or other foreign matter and given a phosphate treatment and a shop prime coat of rust inhibitive paint. The type of phosphate treatment, the type of paint, and the time and temperature for drying shall conform to manufacturer's recommended standard practice.
- (2) After erection, all scarred areas on both top and bottom sides of the decking, including cuts, drill holes, rust spots, welds and weld scars, shall be touched up with an air drying paint similar to that used in the shop coat.

3. INSTALLATION

- A. Place steel deck units on supporting frame work and adjust to final position with proper bearings, end and side laps before being permanently secured. Decking shall be installed in accordance with approved shop drawings and the manufacturer's specifications and erection layouts. Secure deck units to supports by welding. In all cases, deck units shall be anchored to the supporting frame work in a manner to resist the gross uplift forces specified in the Basic Design Specifications of the MRDTI.
- B. Welded connections to steel supports shall be fusion type performed by competent welders who have qualified by tests as prescribed by the American Welding Society to perform the type of work required. The sizes, spacings and welding sequence shall be as recommended by the deck manufacturer and indicated on approved erection layouts, or shop drawings. Side joints shall be interlocked and mechanically fastened, or welded; the type and spacing of fastenings shall be determined by the span and the gauge of decking as recommended by the manufacturer. Fasten accessories to deck by welding or by self-tapping sheet metal screws.

1. GENERAL REQUIREMENTS

A. Extent

The work under this section covers all labor, materials and equipment necessary or required to provide and fully complete all Miscellaneous Metal Work and related items as shown on the drawings and as herein specified, unless otherwise noted.

B. Items of Work

For the convenience of the Contractor, the major items of work are listed as follows: Items not listed, but called for by the plans and/or specifications, are not hereby eliminated by reason of such omission and shall be provided by the Contractor.

- (1) Furnish and install all anchor bolts for equipment shown on drawings.
- (2) Furnish and install ladder.
- (3) Furnish all steel for supporting equipment on roof.
- (4) Furnish and install all Unistrut supports for laboratory piping.
- (5) Furnish and install all support framing for hanging toilet stall partitions.
- (6) All other labor and materials customarily needed to make the work under this section complete.

C. Related Work Specified in Other Sections

- (1) Metal walls.
- (2) Structural steel.
- (3) Hollow metal door frames and doors.
- (4) Metal suspension system for ceilings.
- (5) Steel joists.
- (6) Metal roof decks.
- (7) Metal toilet partitions.
- (8) Movable metal partitions.

1. GENERAL REQUIREMENTS (CONTD)C. Related Work Specified in Other Sections (contd)

- (9) Metal thresholds.
- (10) Metal windows.
- (11) Roof hatch.

2. MATERIALS

- A. All materials for the work to be performed under this specification shall be new and of the best quality obtainable. Secondhand or used material will not be permitted or accepted.
- B. The ferrous materials required for this work shall be of new steel members, assembled from well finished bars, plates, and cold-rolled shapes, straight, clean and free from mill scale, flake rust, rust pittings, and with square-edge fillets.
- C. Pipe rails and railings shall be standard wrought iron or milled steel seamless drawn pipe, as shown, free from scale, rust or rust pittings.
- D. All structural steel shall conform to the requirements of the American Society for Testing Materials for Steel for Bridge and Buildings, Designation A-36, current edition.
- E. Steel members shall be standard, well finished structural shapes and bars.
- F. Gauges specified or shown for metal work shall be U.S. Standard and are the minimum acceptable under the contract.
- G. Bolts for fastening nonferrous metals to ferrous metals shall be hot-dipped galvanized of sizes required.

3. WORKMANSHIP

- A. The Contractor shall take field measurements and verify all dimensions at the building as may be necessary or required to fit his work to actual conditions.
- B. The Contractor shall be responsible for the accuracy of field dimensions and for fitting and proper attachment of his work.

3. WORKMANSHIP (CONTD)

- C. Anchors and other connecting members which occur in concrete or masonry shall be built in as the work progresses, so as to avoid unnecessary cutting and drilling.
- D. All supplementary miscellaneous items not shown or specified, but implied or required, shall be furnished in order to complete the work.
- E. All joints shall be made in a careful and workmanlike manner, filed, milled, machined, or welded as required to secure and maintain close and perfect connections such as will not be readily detected by the eye.
- F. All welds in exposed work shall be ground smooth.
- G. All ferrous metal in contact with nonferrous metal shall be insulated one from the other by coating the ferrous metal with a heavy coating of bituminous paint.

4. LADDER

- A. Ladders shall have 2-1/2" X 3/8" side rails with 3/4" diameter rungs welded to side rails.
 - (1) Ladder shall be fastened as shown.
 - (2) Side rails shall be bent to radius at roof as shown.

5. SUPPORTS FOR LABORATORY PIPING

- A. Supports shall be "Unistrut" channels as manufactured by Unistrut Products Company, or equal as approved.
- B. Supports shall be of the type as indicated on the drawings.
- C. Supports shall have "Greenamel" finish.

6. ERECTION

- A. All work shall be erected true to lines, contours and levels in strict accordance with the contract drawings and with the structural requirements of the building.
- B. All work shall be set plumb and true, properly aligned and securely anchored.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all carpentry and related items necessary to complete the work indicated on drawings and described in the specifications.

B. List of Items Included

Without restricting the volume or generality of the above "Extent", the work to be performed under this section shall include, but is not limited to, the following:

- (1) Treated wood blocking for gravel stop.
- (2) Walkway on roof.

C. Related Work Specified in Other Sections

- (1) Thermal insulation.
- (2) Temporary offices and sheds.
- (3) Concrete form work.

2. MATERIALS

A. Grades and Species of Wood

- (1) Grades and species of lumber and plywood shall be as follows, except that grades and species hereinafter specified under specific items shall govern:

- a. Lumber and plywood shall be identified by the official grade mark.

- (2) Framing and Rough:

- a. Members shall be construction grade, Douglas fir or Southern pine.

B. Miscellaneous Materials

- (1) Rough hardware, except as specified otherwise herein, shall be as required for the proper execution of the work of this division.

3. WORKMANSHIP

A. General

- (1) Framing members shall be S4S unless indicated otherwise.
- (2) Nail or spike members in accordance with NLMA's "Manual for House Framing".

B. Anchors

- (1) Anchor carpentry work to steel as required.

C. Pressure Treatment

- (1) Treat all wood in contact with concrete or masonry and blocking for gravel stop.
- (2) Pressure impregnate with any of the following: coal tar creosote - pentachlorophenol - zinc chloride - zinc-meta-arsenite - wolman salts with arsenic content.
 - a. Retained percentage and method of treatment shall be in accordance with the Standard Specifications of the American Wood Preservers Association for the specific wood species involved.
 - b. Brush-coat surfaces of lumber sawed or cut after treatment with same preservative used at plant.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all roofing, sheet metal, roof insulation, and related items necessary to complete the work indicated on drawings and described in specifications.

B. List of Items Included

Without restricting the volume or generality of the above "Extent", the work to be performed under this section shall include, but is not limited to, the following:

- (1) Provide all roofing and insulation.
- (2) Provide all metal flashing and pitch boxes.
- (3) Provide all stainless steel gravel stops, gutters and downspouts.
- (4) Provide prefabricated roof curbs.
- (5) Provide flashing caps for pipe and duct projecting through roof.
- (6) Provide roof hatch.
- (7) Asphalt treads walkway surface.

C. Related Work Specified under Other Sections

- (1) Wood blocking and nailers for securing sheet metal flashings and gravel stops.
- (2) Sheet metal required for the heating and ventilating installation.

D. Shop Drawings

- (1) Submit shop drawings for roof hatch, gravel stop, gutters, downspouts and prefabricated roof curbs to Engineer for approval in accordance with Section 1-A. Shop drawings shall indicate thickness and dimensions of all parts, fastening and anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction.

1. GENERAL REQUIREMENTS (CONTD)

E. Proper Surfaces

Surfaces to which roofing and sheet metal are to be applied shall be even, smooth, sound, thoroughly clean and dry, and free from all defects that might affect the application. Report any unsatisfactory surfaces to the Engineer.

F. Materials To Be Built In

Materials furnished under this division which are to be built in by other trades shall be delivered to the site in time to avoid delays to construction progress.

G. Accessories

All accessories or other items essential to the completeness of the sheet metal installation, though not specifically shown or specified, shall be provided. All such items, unless otherwise shown on the drawings or specified, shall be of the same kind of materials as the item to which applied. Nails, screws, and bolts shall be of the types best suited for the purpose intended, and shall be of a composition that is compatible with the metal to which it will contact.

H. Dissimilar Materials

Where sheet metal abuts or members into adjacent dissimilar materials, the juncture shall be executed in a manner that will prevent electrolysis between the two materials.

I. Workmanship

Except as otherwise shown on drawings or specified, the workmanship of sheet metal work, method of forming joints, anchoring, cleating, provisions for expansion, etc., shall conform with the standard details and recommendations of the Copper and Brass Research Association in effect on the date of this specification.

2. MATERIALS

A. General

The type and locations of the various kinds, gauges, thickness and finish of sheet metal to be used is specified hereinafter under the individual items.

2. MATERIALS (CONTD)B. Zinc-Coated (Galvanized) Steel

Material not specified otherwise shall be flat type and conform to Federal Specification QQ-S-775a, Class 4 coating.

C. Stainless Steel

Stainless steel sheets shall conform to ASTM Specification A167-58, Grade 2, Type 302. Stainless steel for bars, bolts, and fastenings shall be of types as recommended by the manufacturer. Except as specified otherwise, the finish for the sheet material shall be No. 2D, dull.

D. Aluminum Alloy

Aluminum alloy flat sheet shall be Alloy 3003, conforming to Federal Specification QQ-A359d, and not less than 0.032-inch thick.

E. Solder

Solder shall conform to ASTM B32-60T. Composition shall contain 50 percent tin and 50 percent lead except as specified otherwise. Solder for aluminum and monel shall be of composition as recommended by the metal manufacturer.

F. Insulation under Built-Up Roofs

1/2" Fesco Board or equal

- (1) Cellular Glass Insulation. Cellular glass insulation shall be 1-inch thick in board size of 24 by 48 inches, and with corners full and square. Material shall be "Celramic-Board" as manufactured by Pittsburgh Corning Corporation. It shall have compressive strength of 30-35 lbs per square inch and a density of 11 lbs per cubic foot.

G. Built-Up Roofing

Built-up roofing shall be equal to Philip Carey Specification No. 300, double-coated organic felt and asphalt with gravel surface.

H. Asphalt Tread Walkway

Asphalt tread walkways shall be equal to Philip Carey's Carey-Tread, 36" wide and 1/2" thick.

I. Roof Hatch

Roof hatch shall be equal to Belco, Type "S", size 2'6" X 3'0".

2. MATERIALS (CONTD)J. Prefabricated Roof Curbs

Prefabricated roof curbs shall be equal to Uni-Curb Type "SA" size to suit mechanical work and/or equipment.

3. WORKMANSHIPA. Application of Insulation

- (1) The deck shall be smooth, dry and clean. Insulation shall be kept dry before and during installation. Insulation shall be laid with all joints tightly butted, in parallel courses and with all joints between installation staggered. Insulation shall be firmly adhered to prepared deck by laying immediately in a hot mopping of steep asphalt. The long dimension of the insulation shall be laid at right angles to the deck ridges and the edges of the board shall be on the ridges of the deck.
- (2) The insulation shall not be left exposed to the weather. No more insulation shall be applied than can be completely covered with the finished built-up roofing on the same day.

B. Built-Up Roofing

All roof surfaces shall be covered with a built-up roofing installed in accordance with the roofing manufacturer's current recommended specifications for the type of deck specified and with modifications described herein. Roofing shall consist of a 43 lb Colcap base sheet and two-plys of No. 30 double-coated organic felts. Solid-mop with 30 lbs steep asphalt per 100 sq ft for base sheet and 40 lbs steep asphalt between plys. Flood coat shall be 55 lbs Hydro-Gard asphalt with 400 lbs of gravel.

C. Roof Surfacing

Apply surfacing material uniformly over top layer of roofing felts and embed in a hot pouring of asphalt. Surfacing material shall be hard clean gravel, applied at a rate of 400 lbs per 100 sq ft. Surfacing materials shall be graded from 1/4 inch to 5/8 inch in size. Apply surfacing as soon as possible after felts are installed.

- (1) Provide walkways for light foot traffic on built-up roofing at locations indicated on roof plan. Walkways shall be Carey-Tred. Omit roof surfacing material on these portions of built-up roofing. Embed Carey-Tred in a continuous bed of asphalt applied at the rate of 55 lbs per 100 sq ft.

3. WORKMANSHIP (CONTD)D. Protection

Provide a protective plywood covering of finish roof in areas where other crafts are working. Leave protection in place until all work of roof is complete.

E. Metal Gravel Stops and Gutters

- (1) Provide metal gravel stops and gutters at exposed edges of built-up roof except at rake. Fabricate gravel stops from 28 U.S. Std. gauge stainless steel Type 302 with dull finish.
- (2) Form gravel stops and gutters to sizes and details indicated. Extend flanges of gravel stops out 3-1/2 inches on top of built-up roofing felts. Prime the flanges with bituminous paint and embed them in bituminous plastic cement. Cover flanges of gravel stops with two strips of bituminous-saturated roofing felt, mopped on. Metal in contact with roofing shall be painted one coat of bituminous paint before placing. Bottom layers of roofing felt at eaves shall be turned up and back over the top of the upper plies, and cemented down, to prevent bituminous drippage.
- (3) Form gravel stop in 8 or 10 foot straight sections with end joints, lapped 4 inches and set in plastic cement.

F. Downspouts

- (1) Provide metal downspouts on outside walls from all gutters, as indicated. Fabricate downspouts from 28 U.S. Std. gauge stainless steel. Form downspouts to sizes and shapes indicated in 8 lengths. Telescope end joints 1-1/2 inches and lock longitudinal joints. Fasten downspouts to walls with stainless steel straps, 3 inches wide, spaced not more than 8 feet apart. Fit downspouts into cast iron boots or drain pipes where indicated; caulk and cement joints neatly.

G. Metal Cap Flashing

- (1) Provide metal cap flashing for all pipe, conduit and duct projecting through roof indicated on drawings. Fabricate cap flashings from 26 U.S. Standard gauge zinc-coated sheet steel.
- (2) Form flashing as required; lap end joints 3 inches. Make flashing continuous at angles. Cap flashing shall overlap base flashing a minimum of 3 inches.

3. WORKMANSHIP (CONTD)

H. Roof Hatch

- (1) Roof hatch shall be furnished complete with curbs, flashings, cover compensating spring hinges, lifting handles, automatic lock bar, spring latch and padlock lug, 1-inch fiberglass insulation on cover and on curbs, Neoprene draft stops and other appurtenances as required for a complete installation.

I. Prefabricated Roof Curbs

- (1) Curbs shall be sized to suit mechanical work and/or equipment. Cooperate with other contractors for size and location of curbs.
- (2) Curbs shall be welded to metal deck before deck is cut. After curb is securely welded, cut opening in deck and install closure as indicated on drawings.

J. Guarantee

- (1) The Contractor shall furnish to the Owner a written guarantee to keep the roofing and flashing in watertight condition, at no cost to the Owner, for a period of 10 years after acceptance by the Engineer. A bond will not be required.
- (2) The Contractor's guarantee shall cover only the labor and materials that he furnishes. Damage caused by the activities of other contractors, or of the Owner, after acceptance of the work is excluded from the guarantee.

1. GENERAL REQUIREMENTS

- A. The work required under this section consists of erecting all exterior preformed siding panels furnished by Owner in accordance with manufacturer's directions and as indicated on drawings.
- B. Erection drawings will be furnished by the manufacturer. Panels will be shipped and unloaded at the building site by the manufacturer.

2. MATERIALS

- A. Exterior siding panels furnished by the Owner will be Butler F-103 panels.
- B. All required fasteners, closure strips, caulking, and flashing will be furnished by the Owner. The Contractor shall furnish all equipment and labor for erection.
- C. The window shown on drawings will be furnished by Owner and installed by Contractor.

3. WORKMANSHIP

A. F-103 Panels

- (1) All side laps shall be one full corrugation.
- (2) End laps, where they occur on building endwall, shall be at least 6" and fastened together over and to the structural members.
- (3) Fastening of panel-to-panel and panel-to-structural connections shall be with positive-type self-clinching fasteners.
- (4) Fastener spacing shall not exceed 6" at end laps.
- (5) There shall be a minimum of 4 fasteners per lineal foot at end laps.
- (6) All panel-to-panel and panel-to-structural connections shall be made with Low Profile Lock-Rivets set by a special Lock-Rivet tool.
- (7) Color caps of matching colors shall be applied on the exposed heads of all wall panel side lap Lock-Rivets.
- (8) Lock-Rivet locations shall be as shown on erection drawings as furnished by Butler Manufacturing Company.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all caulking as shown on drawings and hereinafter specified.

- (1) Clean out and caulk joints around metal door frames in masonry walls.
- (2) Set metal door sills in caulking bed.
- (3) Caulking of all exposed structural steel, pipe and duct work through walls and roof.
- (4) Fill joints with oakum where called for on plan or where necessary.
- (5) Caulk sides and top of partition marked vapor proof on plans.

B. Related Work Specified Under Other Sections

- (1) Window glazing
- (2) Caulking of construction joints in concrete slabs.

2. MATERIALS

One-Part Butyl Rubber Sealant: Sealant shall be a one-component ready to use type, similar to "Duribbon" as manufactured by Pittsburgh Plate Glass Company or "Butakouk" as manufactured by Sonneborn Building Products. The sealant shall be a flexible type, of gun or knife grade as required, and shall comply with the published specifications of the manufacturer. In addition, the performance properties of the sealant after installation for a minimum of 3 days shall comply with the requirements of ASA Specification A 116.1. Color shall be light gray.

3. WORKMANSHIP

- A. No caulking shall be done when temperature is below 35°F. Before caulking, brush joints clean.

B. Joints Pointed with Caulking and Sealing Compounds

- (1) Joint surface shall be clean, dry and free of dust, oil, grease or frost. Follow compound manufacturer's recommendations for joint preparation.

3. WORKMANSHIP (contd)

B. Joints Pointed with Caulking and Sealing Compounds (contd).

- (2) Backup material as indicated on drawings and as necessary shall be inserted in the joints to the proper depth as detailed to allow the correct balance of joint and sealant dimension.
- (3) Prior to application of compound, all joint surfaces shall be primed in accordance with the manufacturer's recommendation.
- (4) Apply the compound with a gun having a nozzle of proper size and shape for the joint.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of providing all hollow metal doors, door louvers, frames, and related items necessary to complete the work indicated on drawings and described in specifications.

B. Related Work Specified Under Other Sections

- (1) Finishing hardware.
- (2) Doors and frames in movable metal partitions.
- (3) Glass and glazing in doors.
- (4) Field painting of doors and frames.
- (5) Caulking of doors frames.
- (6) Weatherstripping doors.
- (7) Toilet compartment doors.

C. Acceptable Manufacturers

Except as otherwise specified herein, or approved by the Engineer, all hollow metal doors and frames shall be products of Steelcraft Manufacturing Company, or Truscon Steel Company, subject however, to compliance with specification requirements.

D. Shop Drawings

Submit shop drawings of all items specified herein to Engineering for approval in accordance with Section 1-A. Shop drawings shall indicate: elevations of each door type; details of each frame type; location in the building for each item; conditions at openings with various wall thicknesses and materials; typical and special details of construction; methods of assembling sections; location and installation requirements for hardware; size, shape, and thickness of materials; joints and connections.

2. MATERIALS

A. Metal Frames

All metal frames for doors shall be formed of steel to size and shaped indicated. Frames may be knock-down, field-assembled type construction.

2. MATERIALS (contd)

B. Metal Doors

- (1) Metal for doors shall be cold-rolled, pickled and oiled, stretcher leveled steel sheets with clean smooth surfaces. The gauges of metal shall be as hereinafter specified under the various door types. Metal shall be phosphate treated prior to painting for items as hereinafter specified.
- (2) Doors indicated on drawings as hollow metal shall be Steelcraft K18 or approved equal.

3. WORKMANSHIP

A. Frames

(1) Workmanship and Design

The finished work shall be strong and rigid, neat in appearance and free from defects. Fabricate molded members straight and true with corner joints well formed, in true alignment and fastenings concealed where practicable.

(2) Provisions for Hardware

Frames shall be prepared at the factory for the installation of hardware. Welding of hinges to frames will not be permitted. Frames shall be mortised, reinforced, drilled and tapped to templates to receive all mortised hardware; frames to receive surface-applied hardware shall be provided with reinforcing plates only. Provide cover boxes in back of all hardware cut-outs. Door frames shall be punched to receive rubber or vinyl door silencers; provide three silencers on lock side of single doors, and furnish the required number and type of silencers with the frames. Lock strikes shall be set out and adjusted to provide clearance for silencers.

(3) Wall Anchors

Furnish three 10-inch-long corrugated or other deformed type adjustable anchors at each jamb in masonry walls. Furnish 3 wood stud anchors for each jamb in drywall construction.

(4) Floor Anchors

Provide floor clips of not less than 16-gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be adjustable and drilled for 3/8 inch diameter anchor bolts.

3. WORKMANSHIP (contd)A. Frames (contd)(5) Shipment

For welded type frames, provide temporary steel spreaders fastened across bottom of frames; remove spreaders after frames are set and anchored. In place of spreaders, frames may be strapped together in pairs with head inverted for bracing during shipment. Ship knock-down type frames in bundles securely strapped, or in packages. Before shipping, label each frame with metal or plastic tags to show their location, size, door swing, and other pertinent information.

(6) Installation

Set frames in position, plumb, align and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts, or with power fasteners. Build wall anchors into walls, or secure to adjoining construction as indicated or specified.

B. Doors(1) Workmanship

The finished work shall be rigid, neat in appearance and free from defects. Form molded members straight and true, with joints coped or mitered, well formed, and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so they are invisible after finishing.

(2) Door Sizes and Clearances

Doors shall be of type, sizes, and design indicated; 1-3/4 inches thick. The clearances for doors shall be 1/8-inch at the jambs and heads, and 3/4-inch at bottom unless indicated or specified otherwise.

(3) Weather Seal for Exterior Doors

The top and bottom edges of all hollow metal exterior doors shall be closed to provide a weather seal. This seal may be provided as part of the door construction or by the addition of inverted steel channels or other suitable shapes welded to the face sheets.

(4) Provisions for Hardware

Mortise, reinforce, drill and tap doors at factory to receive all mortise type hardware. Provide reinforcing only for doors to receive surface applied hardware, except push plates; drilling and tapping for surface applied hardware will be done in the field. Provide metal reinforcing plates for locks and all

3. WORKMANSHIP (contd)

B. Doors (contd)

(4) Provisions for Hardware (contd)

mortised hardware; provide reinforcing plates for surface applied hardware as required. The gauges of metal for reinforcing plates shall comply with manufacturer's recommendations for the type of hardware used and the size and thickness of doors, provided that the gauges used are not lighter than those required by Commercial Standard CS 242-62.

(5) Location of Hardware

The location of hardware shall be as indicated in manufacturer's published literature.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all finishing hardware and related items necessary to complete the work indicated on drawings and described in the specifications.

B. Related Work Specified in Other Sections

- (1) Metal toilet compartments and hardware.
- (2) Weatherstripping.

C. Substitutions

The materials or products specified herein and indicated on drawings by trade name, manufacturer's name, or catalogue number shall be provided as specified. Substitutions will not be permitted unless approved in writing by the Engineer, except that hardware for doors in movable metal partitions may be the manufacturer's standard subject to approval by the Engineer.

D. Schedule

Submit complete schedule of finish hardware in accordance with requirements of "Shop Drawings" in Section 1-A. Schedule each item of hardware required for each door or item of equipment. List hardware item number, manufacturer, manufacturer's number or symbol, and finish.

2. MATERIALS

A. General

- (1) Include all fastenings with exposed surfaces matching finish of adjacent metal parts of hardware.
- (2) Furnish hardware to template and with proper fastenings for use with metal frames, and metal covered or hollow metal doors.

B. Finishes

- (1) Lock sets - latch sets - cylinders, shall have US10 finish.
- (2) Hinges for interior painted finish doors shall have US10 finish.
- (3) Overhead exposed closers shall have US10 finish.
- (4) Metal kick and push plates shall have US10 finish.

2. MATERIALS (CONTD)

C. Lock and Latch Sets

Shall be manufactured by Sargent.

- (1) Furnish Series 8 for all doors.
- (2) Design shall be MC.
- (3) Backset shall be 2-3/4".

D. Hinges

Shall be manufactured by Henry Soss.

- (1) Hinges shall have flat button tip, removable non-rising pins.
- (2) Hinges shall have ball bearings unless otherwise noted.

E. Closers

Shall be manufactured by Sargent.

- (1) Surface closers shall be Series 50.

F. Thresholds

Shall be 4" Alumogrit as manufactured by Wooster.

G. Push Plates

Shall be as manufactured by Sargent.

- (1) Plates shall be 16" by 4" wrought bronze.

H. Pulls

Shall be as manufactured by Sargent.

- (1) Pulls shall be wrought bronze and match push plates.

I. Kick Plates

Shall be as manufactured by Sargent.

- (1) Kick plates shall be 8" high by 1-1/2" less in length than door width.
- (2) Kick plates shall be wrought bronze.

2. MATERIALS (CONTD)

I. Kick Plates (contd)

- (3) Bevel all edges.

J. Door Stops

Shall be as manufactured by Sargent.

- (1) Include fastening device appropriate for receiving surface.

K. Door Silencers

Shall be as manufactured by Sargent.

- (1) Style 3446 for hollow metal frames.
- (2) Provide 3 silencers for each single door, and 2 for each pair of double doors.

L. Foot and Chain Bolts

Shall be as manufactured by Stanley.

3. KEYING

- A. Provide 2 keys each for all locks.
- B. Locks shall be master keyed to the Technical Center system.

4. PACKAGING AND IDENTIFICATION

- A. Package each item of hardware separately in individual containers, complete with screws, keys, special wrenches, instructions, and installation templates necessary for accurately locating, setting, adjusting, and attaching hardware.
- B. Mark each container with number of door to which hardware item is to be applied, and with item number corresponding with hardware item number listed in contractor's hardware schedule.
- C. At the completion of the project, the Contractor shall turn over to the Engineer all installation instructions, templates, and adjusting tools.

5. RECEIVING AND STORAGE

- A. Provide adequately locked storage space with necessary open shelves, bins, and counters for hardware.
- B. Properly tag, index, and file all keys and turn over to Engineer.

6. INSTALLATION

- A. Install hardware accurately fitted, securely applied, and carefully adjusted. Install in accordance with manufacturer's instructions. Use care not to injure other work when installing.
- B. Remove all visible hardware before painting is begun and replace afterwards, prior to completion of building.
- C. All thresholds shall be caulked (See Section 7-C).

7. SCHEDULE OF HARDWARESet No. 1

3 pr. hinges 4-1/2 X 4-1/2	X500-4T AMS
1 Lockset	8G37 MC
1 Chain Bolt 6" Long	1055
1 Foot Bolt	1057
2 Door Stops	3375
1 Threshold	Type 110

Set No. 2

1-1/2 pr. hinges 4-1/2 X 4-1/2	X450 TBB AMS
1 Lockset	8G37 MC
1 Closer	554 U
1 Threshold	Type 110
1 Door Stop	3378

Set No. 3

1-1/2 pr. hinges 4-1/2 X 4-1/2	X500-4T AMS
1 Lockset	8G37 MC
1 Door Stop	3375
1 Threshold	Type 110

Set No. 4

1-1/2 pr. hinges 4-1/2 X 4-1/2	450 T AMS
1 Lockset	8U15 MC
1 Stop	3381
1 Threshold, 4" Alumogrit	Type 110

7. SCHEDULE OF HARDWARE (CONTD)

Set No. 5

1-1/2 pr. hinges 4-1/2 X 4-1/2
1 Push Plate
1 Pull
1 Closer
1 Stop
1 Kick Plate

450 TBB AMS
3015 PLE
3135 PLE
552
3381
3716

Set No. 6

1-1/2 pr. hinges 4-1/2 X 4-1/2
1 Lockset
1 Stop

450 T AMS
8U15 MC
3381

Set No. 7

1-1/2 pr. hinges 4-1/2 X 4-1/2
1 Lockset
1 Closer
1 Door Stop

450T BB AMS
8U15 MC
553
3381

Set No. 8

By Owner.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of providing weatherstripping for doors numbered 2, 3, 4, 6, 8, and 12.

B. List of Items Included

Without restricting the volume or generality of the above "Extent", the work to be performed under this section shall include head, jamb, and sill weatherstripping, all as shown on drawings and indicated in specifications.

C. Related Work Included in Other Sections

- (1) Caulking
- (2) Thresholds

2. MATERIAL

- A. Head and jamb weatherstripping shall be Zero #50A with sponge neoprene in aluminum housing. Weatherstripping shall be applied to metal stops of head and jamb with self-tapping metal screws.
- B. Meeting stiles of double doors shall be weatherstripped with Zero #155-M Surface Astragal with wool pile. Weatherstripping shall be made of extruded aluminum and fastened to metal doors with self-tapping metal screws.
- C. Sill weatherstripping shall be Zero #36-S surface mounted aluminum housing.

3. FINISH

All weatherstripping shall have finish US 28, anodized.

1. GENERAL REQUIREMENTSA. Extent

The work required under this section consists of all glass, glazing and related items necessary to complete the work indicated on drawings and described in specifications.

B. List of Items Included

Without restricting the volume or generality of the above "Extent", the work to be performed under this section shall include, but is not limited to, the following:

- (1) Glazing of windows.
- (2) Glazing of doors.
- (3) All mirrors as indicated on drawings and specified.

C. Related Work Specified in Other Sections

- (1) Glass in fire equipment cabinets.
- (2) Glass for lighting fixtures.

2. MATERIALSA. General Requirements for All Glass

Except as hereinafter specified under specific glass types, all glass shall comply with requirements of Federal Specifications DD-G-451a, as applicable to the type specified.

B. Clear Wire Glass

1/2-inch thick, with diamond mesh. Polished Miscovas wired glass manufactured by Mississippi Glass Company.

C. Mirror Glass

Clear, 1/4-inch thick mirror glazing quality polished plate glass with backs silvered two coats, heavily electroplated with copper and given a prime coat of mirror backing paint. Mirrors shall be guaranteed against silver spoilage for a period of 5 years from date of installation. Metal framed mirrors shall have a 1/2-inch wide frame of 18 gauge stain finish stainless steel and a 20 gauge galvanized steel back arranged for concealed mounting. Mirrors shall have theft proof mounting. Provide one 16 X 20 inch metal framed mirror at lavatory in men's toilet.

2. MATERIALS (CONTD)

D. Elastic Glazing Compound

Similar to "DAP No. 1012", as manufactured by DAP, Inc. Compound used for glazing in aluminum frames shall be colored to harmonize with the frames and also be of type and composition that will not require any paint or other coating to protect it. Use elastic glazing compound for glazing in metal sash and frames as hereinafter specified.

3. WORKMANSHIP

A. Sizes, Delivery, and Storage

- (1) The sizes of glass indicated on drawings are approximate only; determine the actual sizes required by measuring frames to receive the glass at the project site, or from guaranteed dimensions provided by the frame supplier. Dimensions for glass and glass holding surrounds shall be coordinated to provide the following minimum clearances:
 - a. At perimeter edge of glass on all four sides provide clearance equal to glass thickness.
- (2) Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material as directed in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage.

B. Installation of Glass

(1) General Requirements

Apply glazing compound uniformly with accurately formed corners and bevels. Remove excess compound from glass and sash. Use only recommended thinners, cleaners and solvents. Do not cut or dilute glazing compounds without approval from Engineer. Make good contact with glass and frame when glazing and facing off. Do not apply any compound at temperature lower than 40 degrees F or on a damp, dirty, or dusty surface. After glazing, doors shall be fixed so they cannot be operated until compound has set. All putty and compounds shall be removed from patterned glass and other glass having a rough finish before it hardens. Remove any excess sealants from glass and adjoining surfaces during the working time of the material; within 2 to 3 hours.

3. WORKMANSHIP (CONTD)

B. Installation of Glass (contd)

(2) Preparation of Glass and Rabbets

Clean the sealing surfaces at perimeter of glass and the sealing surfaces of rabbets and stop heads before applying any glazing compound. Use only the approved solvents and cleaning agents recommended by the compound manufacturer.

(3) Positioning Glass

Center in glazing rabbet to maintain specified clearances at perimeter on all four sides. Maintain centered position of glass in rabbet and provide the required sealer thickness on both sides of glass.

C. Replacements and Cleaning

At completion of work, all glass shall be free from cracks and other defects not allowed by the specifications. Any defective glass that may appear before acceptance, or within the 1-year warranty period that is a direct result of manufacturing, transporting, or the performance of the Contractor, shall be removed and replaced with new glass without cost to the Owner. Remove from site all boxes, crates, containers, and other debris used for glazing operations.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all drywall interior finish construction and related items necessary to complete the work indicated on drawings and described in specifications.

B. List of Items Included

- (1) Metal suspension system for ceilings in rooms 103, 104, and 107.
- (2) Drywall ceilings.

C. Related Work Included in Other Sections

- (1) Movable metal partitions.
- (2) Field painting.

2. MATERIALS

A. Gypsum Wallboard

- (1) Wallboard shall comply with requirements of ASTM C36-62.
- (2) Fire-rated gypsum wallboard shall be 1/2" thick, 4' wide. Long edges shall be square.

B. Nails

- (1) For nailable metal members: 1-1/4" Fetter Annular Ring Nail.

C. Screws

- (1) For securing single-layer wallboard to metal furring and framing:
1" long, Phillips head self-drilling, black oxidized.

D. Metal Accessories

- (1) Corner bead shall be electro-galvanized steel.
- (2) Casing bead and trim shall be electro-galvanized steel.

2. MATERIALS (CONTD)E. Metal Framing and Furring

(1)

(2) Ceiling runners shall be Channel.

(3) Carrying channels shall be 1-1/2" cold rolled channels weighing not less than 1.4 lbs per yard black asphaltum finish.

(4) Hanger wire shall be #8 gage galvanized annealed.

(5) Tie wire shall be 18 galvanized annealed.

3. GENERAL REQUIREMENTS FOR INSTALLATION

- A. Examine and inspect all surfaces and supports to which gypsum wall-board is to be applied. Remedy all conditions which will jeopardize satisfactory finish wall prior to installation of dry wall. Commencement of work under this section constitutes acceptance of responsibility for correction of any defects in the finish work due to faulty sub-surface conditions.
- B. Minimum temperature in space shall be 50° F. Preferable minimum is 70° F.
- C. Provide ventilation and heat as required to remove excess moisture.
- D. Stock pile wallboard at project flat on floor in piles. Leave in original wrappings or containers until ready for actual use.
- E. Protect wallboard from wetting.
- F. All wallboard joints shall be butted loosely together. Butt-ends shall not be placed against a tapered edge. Maximum allowable gap at end joints shall be 1/4 inch.
- G. Install in maximum practical lengths to span ceiling and walls without end (butt) joints. If butt joints do occur, stagger joints and locate as far as possible from center of ceilings or walls.
- H. Install metal trim at edges, doors securely, according to manufacturer's instructions.
- I. Openings cut in wallboard to fit electrical outlets, plumbing, piping, etc., shall fit snugly and shall be small enough to be covered by plates and escutcheons. Both face and back paper shall be cut for all cut-outs which are not made by use of a saw.

3. GENERAL REQUIREMENTS FOR INSTALLATION (CONTD)

J. Mix all adhesive and joint finishing compounds in strict accordance with manufacturer's directions. Mix only enough at one time to be used up during recommended pot life of compound.

K. Fasteners

- (1) Install fasteners no closer than 3/8" to end or edge.
- (2) Space fasteners opposite each other on adjacent ends or edges.
- (3) Begin fastening from center of wallboard and proceed toward outer end or edges.
- (4) Apply pressure on wallboard adjacent to fasteners being driven to insure that wallboard will be secured tightly to framing member. Check for looseness at fasteners.
- (5) Drive fastener with shank reasonably perpendicular to face of board.

L. Nailing

- (1) For finish layer, use crown-head hammer. Seat nail so that head is in slight, uniform dimple formed by last blow of hammer. Do not break paper with blow of hammer.

M. Screwing

- (1) Drive screws with a power driver as recommended by wallboard manufacturer.
- (2) Surface of head shall be below surface of paper without cutting paper.

4. SINGLE PLY APPLICATION TO METAL FRAMINGA. General Notes

- (1) Apply ceiling wallboard first.
- (2) Apply wallboard on walls horizontally.

B. Simple Nailing(1) Ceilings

- a. Space nails at 7" on centers.
- b. Space screws at 12" on centers.

4. SINGLE PLY APPLICATION TO METAL FRAMING (CONTD)B. Simple Nailing (contd)(2) Walls

- a. Space nails at 8" on centers.
- b. Space screws at 12" on centers.

5. JOINT TREATMENT

- A. Apply bedding compound to edge and end joints, and to nail heads. Shear off surplus, leaving a tapered groove for embedding tape. Leave no material on high edges. Allow 12 hours for drying before taping.
- B. Apply a uniformly thin layer of bedding compound over the joint approximately 4 inches wide. Center tape over joint and embed into compound.
- C. Allow compound to dry thoroughly. For normal conditions this will be approximately 24 hours. Cover tape with a coat of finishing and spread out 3 inches on each side of tape. Feather out at edge.
- D. After preceding coat is thoroughly dry, apply another coat with slight, uniform crown over joint. This coat must be smooth and with edges feathered out 3 inches beyond preceding coat.
- E. Reinforce ceiling and wall angles and inside corner angles with tape folded to angle and embedded in compound. Apply at least one additional coat and feather out edges.
- F. All nail heads and dimples shall receive at least 3 coats of compound. Apply as each coat is applied to joints, allowing at least 24 hours between each coat.
- G. Flanges of corner bead and trim shall be concealed by at least 2 coats of compound. First layer shall be bedding compound. Apply along with respective coats of compound on joints. Feather out compound approximately 9 inches from metal bead.
- H. Sand coats of compound when thoroughly dry, if sanding is needed. Avoid roughing surface of wallboard.
- I. Leave wallboard and treated areas smooth and uniform, and ready for decoration.

6. PATCHING

- A. After trim has been applied, and prior to decoration, correct all surface damage and defects as required to leave work smooth and without observable blemishes which will show through decoration.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all resilient floor coverings and related items necessary to complete the work indicated on drawings and described in the specifications.

B. Samples

Submit samples in duplicate of the following materials or assemblies to Engineer for approval.

- (1) Vinyl asbestos floor tile.

2. MATERIALS

A. General Requirements

- (1) Flooring shall be 1/8" and uniform in thickness and size.
- (2) Tile shall be cut accurately with square, true edges.
- (3) Plain colors shall be uniform throughout in color.
- (4) Variations from piece to piece with variegated colors shall not be so wide as to mar the decorative value of the floor.

- B. Vinyl asbestos floor tile shall consist of a thoroughly blended composition of a thermoplastic binder, fillers, pigments, and stabilizers. The thermoplastic binder of vinyl-asbestos floor tile shall consist of Bakelite copolymer vinyl resin VYFS, a primary plasticizer manufactured by Union Carbide Corporation, Chemicals and Plastics Operations Division, such as "Flexol 426" or "Flexol DOP", and minor amounts not exceeding fifteen percent of the total plasticizer content of an approved secondary plasticizer and/or tackifying resin, if required.

C. Base

- (1) Vinyl base set on cove, ribbed back, 1/8".
 - a. Moulded internal and external corners which match base.

D. Edging

Vinyl 1/8", 1" wide.

2. MATERIALS (CONTD)

E. Adhesive

Type and brand as recommended by manufacturer of resilient flooring and related materials.

F. Crack Filler

Type and brand as recommended by manufacturer of resilient flooring.

G. Cleaner

As recommended by manufacturer.

3. WORKMANSHIP

A. Delivery

Deliver materials to project site in manufacturer's original unopened containers with manufacturer's brand name, color, and pattern number clearly marked thereon.

B. Storage

Store materials carefully in conformity with manufacturer's recommendations.

C. Store materials in original containers at not less than 70° F for at least 24 hours before installation.

D. Inspection

Surfaces to receive resilient flooring shall be examined, and work shall not be started until defects have been corrected.

- (1) The Contractor shall notify the Engineer in writing of any and all conditions which, in his opinion, will affect the satisfactory execution of his work or endanger its permanence.
- (2) Starting of application of resilient flooring shall constitute acceptance by the Contractor that the surface is in proper condition.
- (3) After such acceptance, Contractor shall be liable for correcting all work and materials which produce an unsatisfactory installation of the resilient flooring.

3. WORKMANSHIP (CONTD)

- E. Do not start work until all materials of other trades have been installed which will penetrate resilient flooring.
- F. Do not start work until painting has been substantially completed.

G. Tolerances

Surfaces receiving resilient flooring shall not vary more than 1/8" in any 6-foot distance, nor more than 1/16" within any one-foot distance.

- (1) Any deviation from this tolerance of the surface receiving flooring shall be filled with underlayment material approved for use under adhesive and resilient flooring specified herein.

H. Preparation of Surfaces

Surfaces receiving resilient flooring shall be broom clean, and free of paint, grease, wax, oil, dirt, and any material which will inhibit adhesive bond.

- (1) After surface is dry, fill minor remaining cracks and depressions with crack filler.

I. Installation

In spaces where resilient flooring is stored and is to be installed, maintain temperature at not less than 70° F for 24 hours before installing and at least 48 hours after installing. Thereafter, maintain a temperature of 55° F or above.

J. Adhesive

- (1) Adhesive shall be mixed and installed in accordance with instructions of manufacturer.
- (2) Cover area evenly and only to the extent which can be covered with resilient material in the recommended working time of the adhesive. Remove any adhesive which dries or films over.
- (3) Apply with trowel notched according to recommendations of manufacturer. Clean and rework trowel notches as necessary to insure proper application of adhesive.
- (4) Observe caution to prevent soiling walls, bases, and adjacent areas with adhesives.

3. WORKMANSHIP (CONTD)

K. Flooring

- (1) Resilient floor shall be placed so that fields or patterns run continuously throughout the floor level.
- (2) Except as required in irregularly shaped rooms, no tile shall be less than one-half the width of field tile.
- (3) Lay tile to pattern selected, square with room axis, with grain reversed in alternate tile.
- (4) Between rooms with different colors, lay strip 1" wide of black tile.
- (5) Fit flooring neatly into breaks and recesses around pipes, under saddles or thresholds.
- (6) Fit flooring with tight, aligned joints.
- (7) Remove excess adhesive in accordance with manufacturer's instructions.

L. Base

(1) Set-on Cove

- a. Firmly cement to wall. Press down so that bottom cove edge follows floor.
- b. Form internal corners by use of premoulded corners.
- c. Form external corners by using premoulded corners.
- d. Scribe base accurately to abutting materials.

1. GENERAL REQUIREMENTS

- A. The work under this section includes the painting of all interior building surfaces, except factory-finished surfaces, exterior ferrous metal, interior ferrous metal, equipment, piping, and fixtures which normally require painting, unless otherwise specified.
- B. Paint all surfaces which are shop or factory-primed for field painting.

2. MATERIALS

- A. Materials specified establish the quality, type, and color of paint desired. The Contractor shall submit with his proposal, for Owner's approval, a list indicating the paint manufacturer, quality, type, and color he proposes to use for the various surfaces. The paint shall be of the same quality, type, and color as that specified.
- B. Materials shall be delivered to the site in manufacturer's sealed containers, each labeled by the manufacturer. Labels shall give manufacturer's name, brand, type of paint, color of paint, and instructions for thinning.
- C. Mixing, thinning, tinting, and handling of materials shall be in strict accordance with the manufacturer's instructions.

3. WORKMANSHIP

A. General

- (1) The Contractor shall inspect the surfaces to be painted and determine that surfaces and areas are in proper condition to paint. Starting work will constitute acceptance of preceding work and conditions under which paint will be applied, and the assuming by the Contractor of responsibility for results to be obtained.
- (2) Before painting, Contractor shall remove hardware, accessories, plates, and similar items or provide ample protection of such items. Upon completion of each space, above items shall be replaced. Only skilled mechanics shall be used for removing and replacing above items.
- (3) The Contractor shall protect adjacent surfaces of his work and the work of other trades against damage or injury by materials or tools used. Work soiled or damaged by the Contractor in the execution of the work covered by these specifications shall be cleaned, repaired, or replaced by the Contractor at his own expense to the satisfaction of the Engineer.

3. WORKMANSHIP (contd)A. General (contd)

- (4) Access panels, registers, radiators, exposed piping, conduit, ductwork and hangers generally shall be painted a color to match adjacent walls or ceilings. Where adjacent surfaces do not require painting, use color as directed by the Engineer.

B. Preparation of Surfaces

- (1) Steel and Iron: Clean to remove rust, scale, grease, oil, dirt, mud, or other foreign matter so as to provide a clean, dry surface to receive the paint. Steel received with primer previously applied shall be inspected and cleaned to remove any loose scale, rust, or loose paint. Any such damaged, chipped, or abraded places shall be touched up.
- (2) Galvanized Metal: Clean to remove dirt, oil, and grease, and prepare so as to obtain adhesion of the primer.
- (3) Wood: Sand to smooth, even surface and dust clean. After first coat has been applied, all nail holes, cracks, or other defects shall be filled. Interior woodwork shall be sanded between coats.
- (4) Concrete and Masonry: Clean to remove all dirt, dust, oil, and grease stains, and efflorescence. The method of surface preparation will be left to the discretion of the Contractor, providing the results are satisfactory to the Engineer.
- (5) Drywall: Cracks, holes, or imperfections in drywall shall be filled with suitable material and smoothed off to match adjoining surfaces. Surface salts deposits shall be removed by dry brushing with a stiff brush.
- (6) Aluminum: Clean to remove dirt, oil and grease, and prepare so as to obtain adhesion of the primer, by treating with Sherwin-Williams Alumiprep, or approval equal.

C. Application

- (1) All materials shall be applied in a workmanlike manner to provide a uniform film and a smooth even appearance, free of runs, sags, skips, objectionable brush marks, or other defects. Workmanship and application shall be in accordance with best practices applying to the type and kinds of materials specified. Edges of paint adjoining other material or colors shall be made sharp and clean without overlapping.

3. WORKMANSHIP (contd)C. Application

- (2) No paint or other finish shall be applied to damp or frosted surfaces, or when the temperature is below 50°F.
- (3) The total dry film thickness for the protection of steel surfaces shall be five mils minimum.
- (4) Materials may be applied by brush or spray as required. Each coat of paint shall be applied smoothly, worked out evenly, and allowed to dry thoroughly before the subsequent coat is applied.

D. Storage of Materials

All materials and equipment shall be stored in a place designated by the Engineer. All oily rags, waste, and combustible materials, including unused paint, shall be removed from the work area at the completion of each work day and returned to the storage place, or disposed of as directed by the Engineer. Necessary precautions shall be taken to prevent fire.

4. COLOR SELECTION

AC-40	SW Quali-Craft Alkyd Eg-Shel Enamel
AG-6	SW Quali-Craft Alkyd Eg-Shel Enamel
DB-5	SW Quali-Craft Alkyd Eg-Shel Enamel
G-1	SW Quali-Craft Alkyd Eg-Shel Enamel
AC-59	SW Kem Lustral Enamel
AC-14	SW Kem Lustral Enamel
AC-72	SW Kem Lustral Enamel
AC-77	SW Loxon Interior Masonry Paint
M-DB-1	SW Hi Hide Alkyd Semi Gloss
AC-86	SW Kem Lustral Enamel

A. Scale Room & Conditioning Room (Space 103 & 104)(1) Walls

Masonry G-6
Movable Metal Partitions AC-40

(2) Ceilings

Drywall G-1

4. COLOR SELECTION (contd)

A. Scale Room & Conditioning Room (Space 103 & 104) (contd)

(3) Floor

Vinyl Asbestos Tile - Heron White

(4) Trim

Vinyl Base - Black
Door Frames - Wall Color

(5) Doors

No. 6, 7, and 8 AC-59
No. 13 AC-40

(6) Exposed Piping and Duct Work

Match background

B. Men's Toilet (Space 107)

(1) Walls

Masonry DB-5
Metal Walls - Desert Beige (factory applied)

(2) Ceiling

Drywall - G-1

(3) Floor

Vinyl Asbestos Tile - Heron White

(4) Trim

Vinyl Base - Black
Door Frame - Wall Color

(5) Toilet Stalls

Selected from manufacturer's standard colors.

4. COLOR SELECTION (contd)B. Men's Toilet (Space 107) (contd)(6) Door

AC-59

C. Gas Mixing Laboratory (Space 101)(1) WallsOutside Metal Panel - Manufacturer's Standard Finish "Desert Beige"
Shop Applied.

Masonry Block - G-6

Movable Metal Partitions - AC-40

(2) Ceiling (Including joists)

M-DB-1

(3) Floor

Vinyl Asbestos Tile - Heron White

(4) Trim

Vinyl Base - Black

Door Frames - Interior - Wall Color

Exterior - AC-72

(5) Doors

6, 8, 9, and 11 AC-59

2, 3 AC-14

13 AC-40

(6) Ductwork

M-DB-1

(7) Laboratory Piping (where exposed)

Paint into background.

(8) Structural Steel

Columns and Beams AC-72

4. COLOR SELECTION (contd)

D. Manifold Room (Space 145)

(1) Walls

Outside Metal Panel - Desert Beige (Shop Applied)
Masonry Block Partitions - G-6

(2) Ceilings (Including Joists)

M-DB-1

(3) Floor

Concrete - Natural Color

(4) Trim

Base - Paint Black
Interior Door Frames - Wall Color
Exterior Door Frames - AC-72

(5) Doors

Nos. 9 and 10 - AC-59
No. 4 - AC-14

(6) Ductwork

M-DB-1

(7) Laboratory Piping (where exposed)

Paint into background

(8) Structural Steel

Columns and Beams - AC-72

E. Pump Room (Room 106)

(1) Walls

Masonry Block Partitions - AC-77
Outside Metal Walls - Manufacturer's Standard Finish
"Desert Beige" Shop Applied

4. COLOR SELECTION (contd)

E. Pump Room (Room 106) (contd)

(2) Ceiling (Including Joists)

M-DB-1

(3) Floor

Concrete - Natural Color

(4) Trim

Base - Paint Black

Door Frames - Wall Color

(5) Doors

AC-59

(6) Piping (where exposed)

Paint into background

F. Store Room (Room 108)

(1) Walls

North, South, and West Walls - Manufacturer's Standard Finish
"Desert Beige", Shop Applied
East Wall - Painted Masonry Block AC-77

(2) Ceiling (Including Joists)

M-DB-1

(3) Floor

Concrete - Natural color

(4) Trim

Base - Paint Black

Door Frames - AC-72

(5) Doors

AC-14

4. COLOR SELECTION (contd)

F. Store Room (Room 108) (contd)

(6) Ductwork

M-DB-1

(7) Laboratory Piping (where exposed)

Paint into background

(8) Structural Steel

Columns and Beams AC-72

G. Exterior of Building

(1) Equipment mounted on roof - AC-86

(2) Roof Ventilators, Vents, etc. - Light Gray
(Note: Do not paint plastic ventilators)

(3) Doors

AC-14

(4) Door Frames

AC-72

(5) Ladder

AC-72

5. COATING SCHEDULE

A. Building Exterior

(1) Structural Steel on roof and ladder

(a) Shop primer or 1 coat of rust inhibitive primer,
Sherwin-Williams Kromik Metal Primer.

(b) 2 coats S-W Kem Lustrol Enamel

(2) Prefinished Metal Siding

No paint required

(3) Gravel Stops, Louvers, and Wall Grill System - Aluminum - Stainless Ste.

No paint required

5. COATING SCHEDULE (contd)

A. Building Exterior (contd)

(4) Doors and Door Frames - Metal

(a) Shop primer.

(b) 2 coats Sherwin-Williams Kem Lustral Enamel.

(5) Equipment on Roof

Equipment

(a) Shop coat or 1 coat of Sherwin-Williams Kromik Metal Primer.

(b) 2 coats Sherwin-Williams Kem Lustral Enamel.

Ducts - Aluminum, Insulated

No paint - pigmented insulation weather coating mastic, supplied by insulator.

Ventilators (Glass finish - Alkyd base)

(a) Shop coat or 1 coat Sherwin-Williams Kem Kromik.

(b) 2 coats Sherwin-Williams Kem Lustral Enamel.

Note: Do not paint plastic ventilators. Prime galvanized surfaces with Sherwin-Williams Galvanized Iron Primer No. B50A1.

B. Building Interior

(1) Primed Roof Deck and Exposed Structural Steel

(a) Shop primed.

(b) 2 coats Sherwin-Williams Hi Hide Alkyd Semi Gloss.

(2) Walls - Siding, Prefinished

No paint required.

(3) Drywall

(a) 1 coat Sherwin-Williams Latex Wall Primer.

(b) 1 coat Sherwin-Williams Quali-Craft Alkyd Eg-Shel.
Color as shown on color schedule.

5. COATING SCHEDULE (contd)B. Building Interior (contd)(4) Sash-Aluminum

No paint required.

(5) Floor - Concrete and Tile

None required.

(6) Metal Doors and Frames

(a) Shop primer.

(b) 2 coats Sherwin-Williams Kem Lustral Enamel. Color as shown on color schedule.

(7) Conduit - Galvanized

(a) 1 coat Sherwin-Williams galvanized iron primer.

(b) 2 coats finish to match background.

(8) Exposed Piping

(a) Uninsulated - 1 coat Sherwin-Williams Kromik Metal Primer.
2 coats finish to match background.

(b) Insulated - 1 coat finish to match background.

(9) Metal Supports for Equipment

(a) Shop primer or Sherwin-Williams Kromik Metal Primer.

(b) 2 coats Sherwin-Williams Kem Lustral.

(10) Walls, Concrete Block (Center N-S Block partition shall receive 2 coats each)

(a) 1 coat Sherwin-Williams Block-Tex #B42W1 brush applied
(Mix 1 quart latex paint per gal. Block-Tex)

(b) 1 coat Sherwin-Williams Quali-Craft Alkyd Eg-Shel Enamel.

Note: Provide a black enamel mop strip approximately 4 inches high where vinyl base is not required.

5. COATING SCHEDULE (contd)

B. Building Interior (contd)

(11) Structural Steel (see color selection schedule)

- (a) 2 coats Sherwin-Williams Kem Lustral Enamel. Color as shown on color schedule.

(12) Ducts - Aluminum

- (a) 2 coats Sherwin-Williams Quali-Craft Eg-Shel Enamel.

(13) Miscellaneous Iron and Steel Items

- (a) Shop primer or 1 coat of Sherwin-Williams Kromik Metal Primer.
- (b) 2 coats Sherwin-Williams Semi-Lustre Enamel. Color as shown on color schedule.

1. GENERAL REQUIREMENTS

A. Extent

The work under this section includes all labor, materials, and equipment necessary or required to provide and fully complete all Metal Partition Work and related items as shown on the drawings and as herein specified.

B. Work Included

Interior steel partitions as designated on the plans, including:

- (1) Door frames
- (2) Doors
- (3) Hardware
- (4) Baked enamel prime coat
- (5) Electrical cutouts
- (6) Partition accessory items

C. Related Work Specified in Other Sections

- (1) Finish coat of paint on partitions, doors, and frames
- (2) Resilient base on partitions
- (3) Electrical fittings, wiring, and device plates
- (4) Mechanical elements, grilles
- (5) Glazing of doors

D. Partitions shall be double-wall as manufactured by E. F. Hauserman Company, Cleveland, Ohio, or equal as approved.

2. MATERIALS

A. Partition

- (1) Partition shall be not less than 3" thick and shall provide a minimum of 1-1/2" of clear internal space to accommodate utilities vertically and horizontally.

2. MATERIALS (CONTD)

A. Partition (contd)

- (2) Design must permit extension in two, three or four way conditions without removing existing units.
- (3) The system shall provide a 2-1/4" adjustment in overall height to accommodate floor and ceiling irregularities.
- (4) Panels shall be balanced sandwich construction of two sheets of steel bonded to an incombustible core.
- (5) Posts or studs shall provide continuous engagement with panel edges and be of adequate strength to meet specified structural performance.
- (6) Vertical and horizontal channels shall be continuous in each partition run flanged not less than one nor more than two inches over partition faces. Channels shall be designed to include resilient sound and light seals.
- (7) All unexposed steel components shall be formed of zinc coated material. All exposed steel components shall receive a coat of baked on prime.
- (8) Panels shall be capable of horizontal cut down to accommodate lower elevations as required. Panels also shall be capable of vertical cut down at two-way, three-way, four-way intersections, and conditions and at door frames to permit re-use of material in runs of different length.

B. Doors and Frames

Both doors and frames shall be of reversible design so that flush doors become non-handed and interchangeable regardless of swing.

- (1) Doors shall be manufacturer's standard steel full flush or half glass. Clearance shall be not more than 1/8" at jambs, 1/16" at head, and 3/4" at bottom of openings. Cutout and reinforce to receive specified hardware.
- (2) Frames shall be formed steel completely free of exposed bolts or other fasteners. Provide a continuous resilient seal at jambs and head. Frames shall be adjustable to floor irregularities and mortised and reinforced for specified hardware.

2. MATERIALS (CONTD)C. Hardware

Hardware shall be furnished and installed by the Partition Contractor as called for in the hardware schedule.

D. Uniform Load

Partitions shall be calculated or tested to prove they will resist 10#/sq ft in bending and that the deflection will not exceed $\frac{L}{120}$ with a 5#/sq ft load.

E. Acoustical Performance

Partitions shall be tested under laboratory conditions that are designed for full size components including panels, posts, and end fillers installed in accordance with normal installation procedures, in a test opening that has normal variation in floor, ceiling and end walls. The partition shall have a minimum sound transmission loss of STC 40 when tested in such an opening under ASTM E-90-61T test procedures.

F. Electrical and Mechanical Access

- (1) Panel faces shall be removable from either side for access without disturbing the opposite face.
- (2) By utilizing the basic components of the standard wall, it shall be possible to increase the thickness to accommodate services.
- (3) Base mould shall be readily removable from either face for wiring access.
- (4) Partitions of a standard thickness shall provide a minimum inside clearance of 2" between panels and 1-1/2" through posts for passage of services. It shall be possible to pass these lines vertically and horizontally continuously inside the wall at any point.
- (5) The partition shall accommodate industry standard wiring devices and boxes.
- (6) Contractor shall furnish cutouts for switches and receptacles.

3. WORKMANSHIP

- A. Partition shall be installed over finish flooring.

3. WORKMANSHIP (CONTD)

- B. Partition shall be scribed and neatly fitted to existing building conditions, erected in a rigid and substantial manner, straight and plumb, with horizontal lines level, and vertical lines plumb.
- C. After installation, partitions shall be free of exposed screws or other fasteners and all finished surfaces shall be free of tool marks.
- D. Clean-up

All cartons and rubbish shall be removed and the partition and work area left broom clean.

1. GENERAL REQUIREMENTS

A. Extent

The work required under this section consists of all metal toilet compartments, accessories, and related items to complete the work indicated on drawings and described in the specifications.

B. Related Work Included in Other Specifications

- (1) Toilet room accessories except as specified herein.
- (2) Structural steel supporting ceiling-hung compartment.

C. Acceptable Manufacturers

All metal toilet compartments shall be the products of Sanymetal or approval equal, subject to compliance with specification requirements. Type shall be Century, ceiling-hung.

D. Shop Drawings

Submit shop drawings of metal toilet compartments and related items to Engineer for approval. Submit drawings in accordance with requirements described in Section 1-A.

Shop drawings shall indicate plans, elevations, details of construction, sizes of openings and parts, anchoring details, leveling details, brand name of steel to be used, metal thickness, protective coatings, finishes, colors, hardware and accessories, fittings and fastenings, field work required to install, and necessary coordination with work of other trades.

2. MATERIALS

A. Sheets for Acrylic Finish

- (1) For Face Plates: Cold rolled copper-bearing steel, stretcher leveled, galvanized, and bonderized.
- (2) Strip for Edge Binding: Cold-rolled copper bearing steel, galvanized and bonderized.
- (3) Minimum thickness of zinc coating shall conform to ASTM A-164-55, Type RS, applied by electrolytic process.

B. Cores

Pads of honeycombed paper expanded to one inch maximum cell size.

2. MATERIALS (contd)

C. Finishes

(1) Acrylic enamel:

- (a) Primer: One coat of rust inhibiting paint sprayed on and baked.
- (b) Finish coats: 2 coats acrylic enamel.
- (c) Colors shall be selected from manufacturer's color chart, and a maximum of 2 colors will be used for the project.

D. Stainless Steel Pilaster Shoe

AISI 302

E. Brackets for Connecting to Wall, Panel, and Pilaster

Extruded aluminum alloy, polished finish.

F. Plated Parts of Hardware

Chromium plated non-ferrous cast alloy, polished finish.

G. Concealed latch for toilet compartment.

H. Accessories

- (1) Combined coat hook and bumper: No. 6810, polished finish.
- (2) Paper holder: No. 331, polished finish.

I. Steel for Concealed Reinforcement: Hot rolled.

J. Fastenings: Bolts shall be chrome plated brass.

K. Gages:

- (1) Minimum thickness of sheet and strip steel is listed in U. S. Standard gage prior to application of protective coating, and before fabrication and finishing.
- (2) Face plates of doors and partitions 58 inches and less in greatest dimension: 22 gage.
- (3) Face plates of ceiling hung pilasters 16 gage.
- (4) Reinforcement for tapping, 14 gage.

3. WORKMANSHIP

A. Panels and Doors

- (1) Panels and doors shall be 1 inch thick.
- (2) Make up panels with two face plates with formed edges.
- (3) Cement faces under pressure to core.
- (4) Tack weld face panels at contacting edges at 8 inches on centers.
- (5) Install formed drive-in edge moulding on all edges.
- (6) Corners shall be welded and ground smooth.

B. Pilasters

- (1) Pilasters shall be 1-1/4 inches thick.
- (2) Make up pilasters with two face plates.
- (3) Cement faces under pressure to core.
- (4) Tack weld face panels at contacting edges at 8 inches on centers.
- (5) Install formed drive-in edge moulding on all exposed edges not involved in anchoring or carrying head-rail.
- (6) Corners shall be welded and ground smooth.
- (7) Pilasters for all compartments shall be ceiling hung type.
 - (a) Pilasters shall be suspended from structural steel member above ceiling.
 - (b) Anchoring device shall consist of steel channel and a horizontal steel bolting member not less than 1/2 by 7/8 inches, welded to face plates of pilaster. Two 3/8 inch minimum diameter cadmium plated threaded rods shall be bolted to bolting member and to structural support.
 - ¹ Leveling and securing to structural support shall be accomplished by double-nutting to prevent subsequent movement.
 - ² Anchoring device shall be designed to transmit the strain of lateral thrust and pull to structural supporting members without strain on finished ceiling.

3. WORKMANSHIP (contd)

B. Pilasters (contd)

- (7) (c) Anchoring device shall be concealed by a stainless steel pilaster cap 3 inches high, and secured by concealed clips.
- (d) Bottom of doors shall be level with bottom of pilaster when doors are closed.

C. Urinal Screens

- (1) Screens shall be wall hung, wing Type "F".
 - (a) Panel construction shall be similar as for toilet compartments.
 - (b) Integral flange shall be formed to provide means of attachment.

D. Hardware

(1) Hinges:

- (a) Hinges shall be double-acting gravity type, adjusted to hold door ajar 30 degrees when unlatched.
- (b) Hinges shall have opposing (nylon) telescoping cams, aligned over a pintle and actuated by spring tension. All operating parts shall be concealed within the door.
- (c) Top pivots shall be mounted approximately 2 inches below top of door in the vertical back edge. The stainless steel pivot pin shall be anchored to the door structure above and below the point of bearing. Compensation for any vertical movement of the door shall be concealed by a movable encasing member.
- (d) All moving parts of hinges and pivots shall operate in nylon.

1. GENERAL REQUIREMENTS

- A. The work required under this section consists of installing laboratory bench, sink and hood furnished by the Owner in accordance with plans and specifications.
- B. Manufacturer's drawings will be furnished and equipment will be delivered and unloaded at the building site by the manufacturer.

2. INSTALLATION

- A. All work shall be installed or erected in a rigid and substantial manner.
 - (1) The work shall be located as shown on the drawings, straight and plumb with horizontal surfaces level.

3. PROTECTION

- A. Adequate precautions shall be taken during installation to prevent any damage to the work or finish.
- B. Any part of the work that has been damaged will be rejected and shall be replaced with approved material, without cost to the Owner.
- C. Upon completion, all work shall be carefully cleaned.

1. SCOPE OF WORK

The work under this section consists of providing venetian blinds for window in exterior wall of building.

2. MATERIALS

Venetian blinds shall be Flexalum - Twi-Nighter, or approved equal. Blinds shall have .2" wide aluminum alloy, spring tempered slots, 1-1/2" wide vinyl plastic tape, steel head and bottom rail, drum type lubricated tilters and No. 4 nylon braided cord. Color to be selected by Owner.

3. WORKMANSHIP

Venetian blinds shall be installed level and plumb in a workmanlike manner.

1. GENERAL CONDITIONS

A. Scope of Work

- (1) These specifications and accompanying drawings describe and call for plumbing, drainage, and fire protection systems including the connections and services thereof in the Owner's new Building No. 748. Contractor shall furnish all labor, materials, equipment, apparatus, tools, transportation, storage, permits, certificates, shop drawings, temporary work, and all other items of work necessary or required to be substantial, safe, and ready for regular operation and use by the Owner.
- (2) The following is a listing of work included, which shall also be as further described hereinafter in these specifications and/or indicated on Drawings, as required for a complete operating installation in full conformity with requirements of all authorities having jurisdiction. Items not listed herein, but called for by the plans are not hereby eliminated by reason of such omission and shall be provided by this Contractor.
 - a. Provide water fountain, service sink, safety shower and toilet fixtures and services thereto.
 - b. Provide all service and drain lines to laboratory bench, sinks, and floor drains. Provide Unistrut supports for services. Laboratory bench will be furnished by Owner and installed under this section, including the connection of all services and drain lines thereto.
 - c. Provide hot water heating equipment.
 - d. Provide vacuum system. Vacuum pump furnished and installed by Owner.
 - e. Provide fire protection system as hereinafter specified.
 - f. Provide sleeves for all pipe penetrating masonry walls.

B. Shop Drawings

- (1) Submit shop drawings and equipment data for items covered in this section in accordance with Section 1-A. Obtain approval prior to fabrication or shipment.
- (2) Shop drawings shall be complete for fire protection and shop fabricated lines such as Ricwil pipe. Furnish complete manufacturer's data for all items of equipment including fixtures and fittings.

2. MATERIAL

A. General

- (1) Contractor shall provide all plumbing fixtures, trim and accessories, laboratory traps, wastes, cocks, and valves as shown on drawings and hereinafter specified.
- (2) Contractor shall provide all required nuts, bolts, screws, anchor posts, supports, hangers, toggle bolts, brackets, expansion shields, fittings, nipples, and other accessories required for complete installation of all the above-mentioned items.
- (3) Fixtures shall be free from cracks, dents, crazes, chips, twists, discolorations, and other defects, and shall be in strictly first class condition. Surfaces coming in contact with walls or floors shall be ground flat. Fixtures shall have manufacturer's guarantee label or trademark indicating quality.
- (4) Fittings shall be properly protected, and shall be in perfect condition when turned over to the Owner; any fixture not in perfect condition at that time shall be replaced by the Contractor at no additional cost to the Owner.

B. Equipment Specifications

- PL-1 Water Closet - Crane Company, Walton Model 3-450 W/3-981CC black plastic seat
- PL-2 Urinal - Crane Company, Santo Model 7-111 W/Sloan Royal Flush Valve No. 186
- PL-3 Lavatory - Crane Company, Norwitch Model 1-165-S, 20" by 18" W/No. 8-2070-A trim
- PL-4 Service Sink UCC Standard P-137
- PL-5 Hot Water Heater - W. L. Johnson Manufacturing Company Model No. GU-3-D
- PL-6 Eye Bath and Safety Shower - W. H. Curtis & Company, Model 876-760
- PL-7 Drinking Fountain - Ebco Manufacturing Company, Oasis Model No. ODP 3 RH
- PL-8 Laboratory Bench with Sink and Hood - Furnished by Owner - Installed by Contractor
- PL-9 Vacuum Pump - Furnished and installed by Owner.

2. MATERIAL (CONTD)

C. Pipe and Fittings

- (1) All sanitary drainage and vent piping above ground inside of building shall be copper per UCC Specification 110.
- (2) Water piping inside building shall be Type "L" copper tubing, ASTM B-88, hard temper throughout, except that with approval from Engineer, soft temper tubing may be used for local connections to accommodate tight space conditions. Fittings shall be cast bronze or wrought copper, solder joint type, Crane Company, or approved equal.
- (3) Shut-off valves 2-inches and smaller on Type "L" copper tubing shall be all-bronze rising stem double wedge disc gate valves with solder joint ends and malleable iron non-heat wheel handle, 200 psi water working pressure class, Lunkenheimer No. 2131, or approved equal.

3. WORKMANSHIP AND INSTALLATION

A. Piping

- (1) Drawings are generally diagrammatic and indicative of work to be installed. Run and arrangement of piping shall be approximately as indicated on drawings, subject to such modifications as required to suit conditions at the building, to avoid interference with work of other trades, or for proper, convenient, and accessible location of all parts of piping systems. Contractor shall arrange his work accordingly, furnishing all offsets, fittings, valves, traps, drains, etc., as required to meet such conditions.
- (2) Piping shall be installed promptly after cutting so that openings may be closed up as quickly as possible. No piping shall, however, be permanently closed up, furred in, or covered before examination and test before all authorities having jurisdiction, and Engineer's representative.
- (3) Piping shall be run as straight and direct as possible, in general forming right angles with or parallel with walls or other piping, and shall be neatly spaced. Risers shall be erected plumb and true. Piping shall be so installed that there is a clearance of at least an inch between finished coverings of such piping and between finished coverings and adjoining work. Piping at ceiling shall be hung from construction above and as close as possible to bottom of beams or other members, maintaining maximum headroom at all times. Run pipe through open web joists if possible.
- (4) Control valves shall be located to give complete accessibility.

3. WORKMANSHIP AND INSTALLATION (CONTD)A. Piping (contd)

- (5) Reducing fittings shall be used wherever a change in pipe size occurs. No bushings shall be used except drainage fittings cast in sand.
- (6) Extra heavy pipe shall be used for nipples where unthreaded portion is less than 1-1/2 inches long. Close nipples will not be permitted except with special permission; only shoulder nipples shall be used.
- (7) Unions or flanges shall be provided in connections to risers, bypasses, pumps, tanks, heaters, and other equipment.

B. Expansion Swings

- (1) Expansion allowance shall be made throughout for proper expansion and contraction of piping. At point of connection of branches to cold and hot water supply and hot water mains and risers, and at connections to hot water heaters, tanks, pumps, and other equipment, sufficient number of elbow swings shall be provided to allow for proper expansion and contraction of mains and risers.

C. Joints

- (1) Joints in screwed piping shall be made up with a compound of best quality pure red or white lead and oil; all carefully and smoothly placed on threads of pipes and not on fittings. Lamp wick shall not be used in making up screw joints. Graphite shall be used on clean-out plugs. Thread shall be perfect and clean cut, and of exactly proper length. Threaded piping shall be properly reamed after cutting and threading, and screwed up tight into fittings.
- (2) Joints in cast iron hub and spigot drainage piping shall be caulked with oakum packing and molten new soft pig lead. Joint shall be made in one continuous pouring and shall be poured full so that when caulking is completed, joint will finish flush and smooth with face of hub.
- (3) Joints between cast iron hub and spigot pipe and threaded piping shall be caulked as specified above. Ends of threaded pipe shall be provided with a ring or half coupling screwed on to form a spigot end. Tucker hub may be used on soil pipe connections.
- (4) Solder joints for copper tubing shall be made with a noncorrosive paste flux (#50) and solid string or wire solder (#50). Installation shall be in accordance with manufacturer's instructions and

3. WORKMANSHIP AND INSTALLATION (CONTD)

C. Joints (contd)

by thoroughly competent workmen. Tubing shall be carefully cut square and burrs removed. Tubing ends and fitting sockets shall be thoroughly cleaned to a bright finish and shall be properly fluxed before assembly.

D. Hangers and Supports

- (1) Approved type hangers and supports shall be used to properly support piping in order to secure piping in place, to maintain required pitch of lines, to prevent vibration, and so arranged as to provide for expansion and contraction. Hangers and supports shall be of ample size and weight to carry pipe, its contents, and its covering. Chain, strap, perforated bar, or wire hangers will not be permitted.
- (2) Hangers and supports for piping including rods, inserts, etc., shall be dipped in zinc chromate primer before installation.

E. Tests

- (1) Before being covered up, or built in, all systems forming a part of plumbing work shall be properly tested in the presence of the Engineer, as hereinafter specified. Contractor shall furnish and pay for all materials, supplies, labor, and power required in connection with his tests. Proper notice shall be given before tests are made. Piping shall be retested as often as necessary to prove such work tight at pressures and for periods specified. Defects disclosed by tests shall be replaced with new work without extra cost to the Owner.
- (2) The Contractor shall be responsible for work of other trades that may be disturbed or damaged by his tests or repair and replacement of his work, and shall cause work so disturbed or damaged to be restored to its original condition at his own expense.
- (3) Entire systems of leaders, soils, wastes, vents, and horizontal drains, including branches, shall be tested either in their entirety or in sections. If tested in their entirety, systems shall be filled with water to overflowing at roof, and if tested in sections, each section shall be filled with water to overflowing 10 feet above the section (so that all of each section, except topmost, is tested with a head of at least 10 feet) at which condition they shall show no leaks.

3. WORKMANSHIP AND INSTALLATION (CONTD)E. Tests (contd)

- (4) Domestic and sprinkler water piping shall be tested with water under a pressure of 150 psi at base of system for two hours, at which condition it shall show no leaks.
- (5) Compressed air and nitrogen piping shall be tested with air at a pressure of 200 psi for two hours, at which condition it shall show no leaks.
- (6) Vacuum system shall be tested with air at a pressure of 100 psi for two hours, at which condition it shall show no leaks.
- (7) After drainage connections have been made to all fixtures and other equipment requiring same, drainage system shall be proved tight by a smoke test. Traps shall be filled with water and thick penetrating smoke produced by a smoke machine (chemical mixtures will not be allowed) forced into the entire system at base. As smoke appears at roof openings, they shall be closed tight and a pressure equivalent to 1-inch of water shall be applied, at which condition system shall show no leaks.

F. Cleaning and Adjusting

- (1) As directed, Contractor shall finally and thoroughly clean all fixtures, equipment, piping, and other exposed work. Traps, wastes, and supplies shall be shown to be free and unobstructed. Plated, polished, bronzed, or painted work shall be bright and clean. Flush valves, faucets, laboratory cocks, and all automatic control devices shall be carefully adjusted for proper and quiet operation. Hot water system shall be adjusted for proper temperature.

G. Drainage System

- (1) Contractor shall provide complete sanitary and clean sewer systems for the buildings where shown on Drawings.
- (2) Contractor shall provide drainage connections to all sinks, fixtures, drains, outlets, hoods, and all other equipment requiring same, as indicated on drawings, or hereinafter specified.
- (3) Contractor shall provide all required traps for fixtures, equipment, and drains.
- (4) All plumbing work shall be done in accordance with local plumbing codes and in a manner approved by all authorities having jurisdiction.

3. WORKMANSHIP AND INSTALLATION (CONTD)G. Drainage System (contd)

- (5) Drains shall be run at a uniform grade of 1/8-inch per foot. Changes in direction of drainage piping shall be made by appropriate use of 45 degree wyes, long turn tee wyes, long sweep quarter, sixth, eighth, or sixteenth bends, except that where space conditions require it, short turn sanitary tees may be used on vertical lines. Slip joints will be permitted only on fixture trap inlets or elbows connecting to fixture tail-pieces. Unions will not be permitted on sewer side of traps; Tucker or hub end fittings shall be used for these connections.

H. Domestic Water Supply System

- (1) Contractor shall provide domestic water supply systems, heating equipment, and all required cold and hot water connections to plumbing fixtures, mechanical equipment, sinks and all other equipment requiring same, as shown on Drawings or herein specified.
- (2) Contractor shall provide stop valves on all fixtures and equipment.
- (3) Water piping shall be run so as to be free of traps wherever possible. It shall be graded and valved to provide for complete control and drainage of system with drain cocks at all low points.
- (4) Unless otherwise indicated or specified, individual water branches to fixtures and equipment shall be provided with air chambers 12-inches long and of same diameter as branch.
- (5) Water branches to laboratory benches shall be provided with 2'-0" air chambers of same diameter as branch and shall be located in the service strip behind the benches.
- (6) Water supply connections to plumbing fixtures and other equipment shall be made in a manner to prevent contamination of water supply.
- (7) Wherever possible, water supplies to plumbing fixtures and other equipment shall be over-rim supplies. Necessary below-rim connections, water powered apparatus, water closet flush valves, and hose bibbs and hose connections shall be provided with approved type vacuum breakers and/or check valves.
- (8) Connections to plumbing fixtures and outlets shall be made with adapters and threaded fittings.
- (9) Connections to equipment and outlets shall be made with flanges or unions. Threaded adapters shall be used for all swing connections.

3. WORKMANSHIP AND INSTALLATION (CONTD)I. Plant Air Systems

- (1) Contractor shall provide an air system within the building, furnishing and installing pressure regulator, and all required outlets and connections as indicated on the drawings, or hereinafter specified. Air system shall be extended from Plant air header indicated on drawings.
- (2) Compressed air piping shall be run free of traps and shall be graded to low points provided with drain petcocks.
- (3) 1/2-inch brass petcock drains shall be installed in all low points in compressed air piping; all similar and approved equal to Crane Company's No. 700.

4. FIRE PROTECTION

- A. Provide extra hazard sprinkler protection in laboratory area.
- B. Provide ordinary hazard sprinkler protection in the storage area.
- C. Sprinkler systems shall be provided in accordance with MFPA Pamphlet No. 13 and UCC Specification B-280, except that all heads shall be 212 degree F temperature rated. Sprinkler heads projecting through ceiling shall be chrome plated.
- D. Provide hose cabinet as indicated on the drawings.
 - (1) Elkhart Series 1300, sized to house one 2-1/2-gallon water extinguisher and 100 LF of 1-1/2-inch fire hose.
 - a. The cabinet shall not contain a hose rack.
 - b. Fire hose and extinguisher will be provided by the Owner.
 - (2) The cabinet shall be equipped with the following:
 - a. Duo-panel door
 - b. Elkhart No. U-25 angle valve, 1-1/2-inch F.P.T. inlet, 1-1/2-inch N.S.T. male, fire hose threaded outlet, Higbee cut, brass rough body

1. SCOPE OF WORK

- A. These specifications describe the design conditions, materials, and equipment required to furnish, install, and connect in operative condition all materials, equipment, and apparatus, and required appurtenances necessary to provide the heating, ventilating, and air conditioning systems in the Owner's Building 748.
- B. For convenience of Contractor, major items of work are listed hereinafter. Items not listed, but called for or inferred by the drawings are not hereby eliminated by reason of such omission and shall be provided by the Contractor.
 - (1) Provide complete steam, steam condensate, and air services within the building from points indicated on the Owner's drawings. This includes, but is not limited to, mains, headers, risers, steam reducing stations, condensate trapping stations and all items of work customarily required to make said systems complete, operable, safe and reliable.
 - (2) Provide underground steam supply system to the building.
 - (3) Provide complete heating, ventilating, and air conditioning systems including ductwork, controls, steam and condensate piping, hangers, registers, diffusers, and all items of work customarily required to make said systems complete, operable, safe, and reliable.
 - (4) Provide complete air exhaust systems including connection to hoods, ductwork, grilles, hangers, and all items of work customarily required to make said systems complete, operable, safe, and reliable.
 - (5) Furnish to the plaster contractor all access doors required for access to dampers, valves, and equipment above plastered ceiling.
 - (6) Provide inserts and pipe sleeves for mechanical work in floor slabs, roof deck, partitions, and exterior walls as indicated on the drawings.
- C. The following items of related work are included in other Sections of these specifications:
 - (1) Plumbing, Drainage, and Fire Protection
 - (2) Thermal Insulation
 - (3) Power, Control, and Ground Wiring.

2. DESIGN CONDITIONS

	<u>Summer</u>	<u>Winter</u>	<u>Ventilation</u>
Outdoor Air	95FDB 75FWB	0°F	
Gas Mixing Lab.	78FDB 50% R.H.	75°F	3000 CFM
Manifold Room	Outdoor Air Ambient	75°F	750 CFM
Cylinder Room	78FDB 50% R.H.	75°F	500 CFM *

* Circulated air from the Gas Mixing Laboratory.

3. DESCRIPTION OF SYSTEMS

- A. The Gas Mixing Laboratory is air conditioned utilizing a water-cooled unit which handles 6000 CFM air (3000 CFM outside and 3000 CFM recirculated). Air supplied to this space is exhausted through the bench and reach-in hoods by a roof-mounted exhauster which is electrically interlocked with the supply fans. Cooling water is supplied from a roof-mounted cooling tower.
- B. The Scale Room and Cylinder Conditioning Room are air conditioned by circulating 500 CFM filtered air from the Gas Mixing Laboratory through these rooms. The air supply unit is controlled by a switch within the Scale Room to permit the cessation of all air movement during weighing operation. A roof-mounted exhaust fan controlled from within the Scale Room is capable of exhausting 477 CFM from the Scale Room in the event of a gas escape.
- C. The Manifold Room is continuously supplied with 750 CFM outside air through a roof-mounted heating and ventilating unit. Air supplied is ambient temperature in summer and heated in winter. Air is exhausted through a duct system interconnected with the exhauster serving the Gas Mixing Laboratory.
- D. The Storage Area is heated by a ceiling suspended unit heater to maintain above freezing conditions only.
- E. A wall-mounted exhaust fan will remove continuously 120 CFM from the toilet.

4. LIMITATION OF WORK

- A. The Contractor shall perform all the work necessary or required for the installation of the heating, ventilating, and air conditioning systems that are shown or called for on the drawings, including all piping, controls, ductwork, hangers, and all other items of work necessary to make these installations complete in every respect and guaranteed to be substantial, safe, and ready for regular operation and use by the Owner.

5. RESPONSIBILITY FOR LABOR, MATERIALS, TOOLS, AND EQUIPMENT

- A. The Contractor shall furnish all labor, equipment, materials, tools, transportation, permits, and temporary work necessary for and incidental to, the complete installation of all heating, ventilating, and air conditioning systems as shown or called for on the Owner's drawings.
- B. A list of heating, ventilating, and air conditioning equipment and accessories is included in these specifications.

6. MATERIALS AND EQUIPMENT

- A. All materials and equipment furnished by the Contractor shall be new and the latest standard products of manufacturers regularly engaged in the production of such materials and equipment.
- B. Capacities of all equipment and sizes of all accessories and services shown or called for on the drawings are the minimum that may be installed.

7. CONTRACTOR'S ENGINEER

- A. The Contractor shall furnish the services of a competent engineer who shall place the systems in operation, balance the air quantities, and adjust all controls. The Contractor's engineer shall also instruct the Owner's personnel in the proper operation and maintenance of the systems.

8. ASHRAE GUIDE

- A. All work, where not otherwise specified, shall be in accordance with the latest edition of the Heating, Ventilating, and Air Conditioning Guide, published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers.

9. DRAWINGS

- A. The Owner's drawings are intended to be used as construction drawings and every care has been taken in their preparation. It is possible, however, that due to field and other conditions, interferences may occur. Should such an interference occur, the Contractor shall work out a reasonable solution to the satisfaction of the Owner's Engineer.
 - (1) The Owner's drawings are based upon the requirements dictated by the equipment described in these specifications. In event the Contractor elects to substitute approved equal equipment for that specified, he shall prepare shop drawings for the installation of the substituted equipment, all in accordance with the General Requirements Division I, Section 1-A.

10. DUCTWORK

- A. All supply and exhaust ductwork shall be constructed of aluminum sheet (gages and fabrication as recommended by the ASHRAE Guide). All ducts shall conform accurately to the dimensions shown on the drawings, and shall be straight and smooth on the inside, with joints neatly finished. Horizontal ducts shall be securely anchored to the building by means of suitable strap hangers for ducts up to 14-inch size, and by angles or channels and vertical steel hanger rods for ducts of larger size. The hangers shall be installed so that the ducts are completely free from vibration under all conditions of operation. Vertical ducts shall be supported by clamps or collars.
- B. The centerline radius of curved elbows without splitters shall be equal to 1-1/2 times the width of the duct. Curved elbows having a centerline radius less than 1-1/2 times the width of the duct, shall be equipped with splitters. All square elbows shall be equipped with turning vanes. Splitters shall consist of curved metal blades. Turning vanes shall be of the formed (double thickness) type. Splitters and turning vanes shall be so arranged as to permit the air to make abrupt turns without excessive turbulence, and shall be free from vibration and noise when the system is in operation.
- C. Adjustable splitter dampers shall be installed at all branch ducts. The splitter shall be of a length equal to the width of the branch duct, and shall be constructed of 18-gage aluminum. Each damper shall be equipped with an accessible locking device that clearly indicates the damper position and holds the damper firmly in place.
- D. Ducts shall be reinforced and braced in accordance with ASHRAE recommendations. The internal ends of all slip joints shall be installed in the direction of flow. All uninsulated panels shall be cross-broken for added rigidity.

11. FLEXIBLE CONNECTIONS

- A. Flexible connections, constructed of material as approved by the Engineer, shall be provided between all items of air-moving equipment and the ducts to which they are connected, and in other locations shown or called for on the drawings.

12. PIPE SLEEVES

- A. Pipes passing through roof and masonry partitions shall be fitted with steel pipe sleeves. Each pipe sleeve shall extend through the respective roof or wall. Sleeves through walls shall be cut flush with each surface. Sleeves through roof shall extend six inches above roof. Sleeves shall be securely cemented in place and shall be two nominal pipe sizes larger in diameter than the passing pipes. Pipes passing through walls shall have approved escutcheons installed on both sides of walls.

13. VIBRATION-ABSORBING ISOLATORS

- A. All units of mechanical equipment, such as fans, fan-coil units, and pumps, shall be properly isolated from the building structure by means of vibration-absorbing isolators such as Korfund pads.

14. ELECTRICAL GROUNDING

- A. All items of mechanical equipment, such as fans, fan coil units, ductwork, and pumps, shall be electrically grounded to the building ground systems. Ground wiring is provided in Division 16, Section 16-A.

15. PIPE HANGERS

- A. Horizontal pipe shall be supported by adjustable hangers at all turns and at intermediate points not exceeding a spacing of ten feet apart. Vertical pipe shall be supported by clamps or collars, spaced not over 20 feet apart. All pipe supports shall be of a type approved by the Engineer.

16. CONTROL SYSTEMS

- A. The Contractor shall install a complete adjustable automatic control system for each heating, ventilating, and air conditioning system as shown or called for on the drawings. Final connections and adjustments of all automatic control equipment shall be made by the manufacturer's representative, or under his supervision.
- B. Before starting work, the Contractor shall furnish to the Engineer for approval four prints of a shop drawing for each automatic control system to be installed. Upon completion of the work, the Contractor shall furnish to the Engineer five certified prints of a diagrammatic layout for each automatic control system that has been installed. Layouts shall show all control equipment, and the function of each item shall be indicated for the different seasons.

17. PIPE FABRICATION AND INSTALLATION

- A. Service piping shall be fabricated and installed by the Contractor as follows:
- (1) No pipe shall be bent unless called for on the drawings or approved by the Engineer.
 - (2) The ends of all field-fabricated pipes, either screwed or welded, shall be carefully reamed to inside diameter of pipe and shall be free from burrs, slivers, damaged threads, dirt, or other foreign matter that would disturb fluid flow or prevent the making of a tight joint.

17. PIPE FABRICATION AND INSTALLATION (contd)

- (3) All field-assembled screwed pipe connections shall be made with thread dope or ribbon tape specified in appropriate Valve and Piping Specifications. Thread dope or ribbon tape shall be applied to male threads only.
- (4) The interior surfaces of all pipe shall be cleaned immediately before erection, and shall be maintained in a clean condition during erection. The cleaning procedure to be used shall depend on the type and degree of contamination of the surfaces, and shall be approved by the Engineer.

B. Instrument piping shall be fabricated and installed by the Contractor as follows:

- (1) All lines shall be located in the field, and shall be so located and arranged as to conform to the installation requirements specified on the drawings, and shall present the neatest possible appearance. Instrument piping shall not be installed around any structural member in a manner that would prevent painting, inspection for corrosion, or removal of the member. If possible, instrument piping shall not be supported from process and service piping or process equipment, except where single lines or single pairs of lines may be most economically installed by supporting them from the piping or equipment.
- (2) All bends in lines shall be made with approved bending tools, and shall be free from kinks or flats.
- (3) All lines shall be blown free of any dirt or cutting burrs, and shall be thoroughly cleaned before being installed. Where tube is cut in the field, ends shall be carefully reamed to the inside diameter of the tube. Thread dope shall be used sparingly on male pipe threads only. No dope shall be used on tube or tube fittings. Thread dope shall be white lead, and gasket dope graphite and oil.

18. TESTING

- A. After completion of each system, all steam, steam condensate and air piping shall be pressure tested for leaks. Steam and steam condensate piping shall be tested with the service medium at service pressure. Instrument air lines shall be tested with 30 psig, clean, dry air. These lines shall be proved tight by spraying all connections and joints with soapless lather. All pipe undergoing testing will be considered satisfactory if no leaks appear within one hour after the start of the test. All leaks detected by the first test shall be stopped in a manner satisfactory to the Engineer. If necessary, the tests shall be repeated, and all further leaks stopped, until satisfactory results are obtained. All repairing of leaks shall be done at no expense to the Owner.

18. TESTING (contd)

- B. A direct-reading velocity instrument (furnished by the Contractor) which has been recently tested and calibrated, shall be used to adjust the air flow in the various ducts so that they will deliver the required volume of air at each air supply and return opening, respectively.
- C. After the above tests have been completed, general operating tests shall be conducted in the presence of the Engineer. The general operating tests shall cover a period of not less than 72 hours under normal operating conditions for each system, and shall demonstrate that all equipment is functioning properly and to the entire satisfaction of the Engineer.

19. INSPECTION BY OWNER

- A. The work shall be subject to the surveillance of the Engineer at all times.
- B. If the Engineer finds any deviations in the work from the drawings or specifications, and if he considers it necessary, he will stop the work. Before the Contractor may continue the work, the Engineer will submit, in writing, his decision concerning such deviations. The Engineer's decision shall be binding on the Contractor and the Owner.
- C. The work performed by the Engineer shall not relieve the Contractor of any of the terms of the contract, or other responsibilities connected with the satisfactory completion of the work.
- D. Before acceptance by the Owner, the entire system, or systems, including all equipment, piping, ductwork, controls, and electrical work, shall be subject to inspection and approval by a representative of the Owner's Plant Fire Protection Division.

20. MINOR EQUIPMENT SPECIFICATIONS

- A. Float-thermostatic traps (with strainers) shall be installed on all steam coils and at all other points shown or called for on the Owner's drawings. Units shall be equal in every respect to Sarco FT-15 Series.
- B. Supply registers shall be double deflection (both sets of louvers adjustable) with opposed blade damper, clear lacquer finish. Units shall be equal in every respect to Connor Engineering Corporation Kno-Draft Style SAHVO, sizes as indicated on the Owner's drawings.
- C. Return air grilles shall have horizontal fins set at 0° deflection and shall be equipped with opposed blade damper. Units shall be equal in every respect to Connor Engineering Corporation Type RFH.
- D. Volume extractors shall be installed at all duct outlet registers. Units shall be individually adjustable and shall be equal to Connor Engineering Corporation Windtrol.

21. CONTROL SPECIFICATIONSItem No. 748 AC-101-A

Type: Dry bulb and relative humidity recorder.
Make: Johnson Service Company 12R 24-hr., or approved equal,
chart with 7-day wind mechanical drive.
Range: 0 to 100, 500 charts, similar for both pens.
Misc.: Thermal system Class 1-A Code 4442 with Model 27107
dewcell and box type pens.
Use: To record temperature and relative humidity leaving
Units 201 and 202 supplying air to AC Units 205 and 206.

Item No. 748 AC-101-B

Type: Reverse acting relay.
Make: Johnson Service Company C-208, or approved equal.
Action: A rise in pilot pressure causes a fall in branch pressure.
Use: To reverse the room humidostat signal to operate the stages
of refrigeration.

Item No. 748 AC-101-C

Type: High pressure selector.
Make: Johnson Service Company C-122, or approved equal.
Use: To select the branch pressure from either the room
thermostat or the room humidostat, whichever is calling
for the greatest amount of cooling, and operate the two (2)
stages of refrigeration.

Item No. 748 AC-101-D

Type: Pressure electric switch.
Make: Johnson Service Company G-271, or approved equal.
Action: Close on rise in pressure.
Use: To bring on the first stage of refrigeration whenever either
the room thermostat or room humidostat requires it.

Item No. 748 AC-101-E

Type: Pressure electric switch
Make: Johnson Service Company G-271, or approved equal.
Action: Close on rise in pressure.
Use: Series with second stage of refrigeration to energize this
refrigeration whenever the room thermostat or room humidostat
requires it.

21. CONTROL SPECIFICATIONS (contd)Item No. 748 AC-101-F

Type: Solenoid air valve.
Make: Johnson Service Company V-24, or approved equal.
Action: Two-position
Voltage: 208
Use: To close humidifier valve on fan failure.

Item No. 748 AC-101-G

Type: Submaster thermostat.
Make: Johnson Service Company T-901, or approved equal.
Action: Direct acting reverse readjustment.
Use: To maintain the desired steam coil discharge temperature by modulating the normally open steam valve, and to have this temperature reset from the room thermostat.

Item No. 748 AC-101-H

Type: Normally closed steam humidifier valve.
Make: Johnson Service Company V-3970, or approved equal.
Size: 1/2" I.P.S.
Operator: Rubber diaphragm spring range 5 to 9 pounds.
Action: Normally closed - air to open.
Capacity: 135# per hour
Steam Supply: 15 psi
Use: Steam control to the grid humidifier.

Item No. 748 AC-101-J

Type: Steam grid humidifier.
Make: Johnson Service Company H-201, or approved equal.
Misc.: Entire construction of copper with inlet and drain connections.
Use: To add steam to the air when the room humidostat calls for an increase in space humidity.

Item No. 748 AC-101-K

Type: Steam heating coil valve.
Make: Johnson Service Company V-3752, or approved equal.
Size: 1" I.P.S.
Operator: Rubber diaphragm spring range 5 to 9 pounds.
Action: Normally open - air to close.
Capacity: 320# per hour.
Steam Supply: 15 psig
Use: Steam control to the heating coil.

21. CONTROL SPECIFICATIONS (contd)Item No. 748 AC-101-L

Type: Room thermostat.
Make: Johnson Service Company T-4002, or approved equal.
Action: Proportional direct acting, air on branch on a rise in temperature.
Range: 55 - 85°F.
Sensitivity: Adjustable 1 - 8 PSI/F°.
Misc.: Furnish necessary mounting equipment and cover.
Use: To maintain the space temperature by modulating the steam heating coil and sequencing the stages of refrigeration.

Item No. 748 AC-101-M

Type: Room humidostat.
Make: Johnson Service Company H-4100, or approved equal.
Action: Proportional reverse acting, air on branch on a fall in humidity.
Range: 10%-95% RH.
Sensitivity: Adjustable 1 - 8 PSI/1% RH.
Misc.: Furnish necessary mounting equipment and cover.
Use: To maintain a desired space humidity condition, by modulating the grid humidifier valve, and sequencing the stages of refrigeration.

Item No. 748 AC-101-N

Type: High-limit insertion humidostat.
Make: Johnson Service Company H-159, or approved equal.
Action: Reverse acting, rise in humidity causes a fall in branch pressure.
Range: 10%-95% RH.
Sensitivity: Adjustable 1 - 10 PSI/1% RH.
Misc.: Furnish necessary mounting equipment.
Use: To prevent the humidity of the discharge air from rising too high and causing condensation.

Item No. 748 AC-101-P

Type: Pressure reducing valve.
Make: Johnson Service Company R130, or approved equal.
Use: To reduce plant air supply to 20#.

Item No. 748 AC-101-R

Type: Instrument air filter.
Make: Johnson Service Company A400, or approved equal.
Use: To filter the air supply for control use.

21. CONTROL SPECIFICATIONS (contd)Item No. 748 AC-102-A

Type: Single temperature room thermostat.
Make: Johnson Service Company, or approved equal.
Action: Proportional direct acting, air in branch on rising temperature.
Range: 55 - 85°
Sensitivity: Adjustable 1 to 8 PSI/F°.
Misc.: Furnish necessary mounting equipment and cover.
Use: To modulate heat coil valves and face and by-pass dampers to maintain desired space dry bulb conditions.

Item No. 748 AC-102-B

Type: By-pass damper operator.
Make: Johnson Service Company D-251, or approved equal.
Size: #4 - 3 5/8" stroke.
Spring Range: 5 - 10#.
Misc.: Furnish moulded rubber diaphragm, mounting bracket, linkage and crank arm for properly connecting to preheat coil by-pass damper.
Use: To modulate preheat coil face and by-pass damper in accordance with load demand.

Item No. 748 AC-102-C

Type: Freeze protection thermostat.
Make: Johnson Service Company T-751, or approved equal.
Action: Normally open (close on temperature rise).
Range: 15 - 55°F.
Differential: 5°F.
Misc.: Furnish manual reset feature, SPST, line voltage contact block and 20' sensing element.
Use: To stop unit fan should preheat coil discharge temperature fall below a predetermined setting.

Item No. 748 AC-102-D

Type: Preheat coil steam valve.
Make: Johnson Service Company V-3752, or approved equal.
Size: 1/2" IPS
Action: Proportional, normally open (air to close).
Size: 39#/Hr. 15 psig steam.
Body: Cast Brass, 150 PSI rating, Scr'd., seat against supply pressure.
Spring Range: 9 - 13#
Top: V-3000, exposed, rubber diaphragm, field changeable.
Use: To vary steam flow to heat coil in accordance with load demand.

21. CONTROL SPECIFICATIONS (contd)Item No. 748 AC-102-E

Type: Three-way air valve.
Make: Johnson Service Company V-6133, or approved equal.
Action: Two-position.
Size: 1/8" IPS, Scrd. openings.
Use: To open steam valve in accordance with outside air temperature.

Item No. 748 AC-110-A

Type: Room thermostat.
Make: Johnson Service Company T-4002, or approved equal.
Action: Proportioned direct acting, air on branch on a rise in temperature.
Range: 55 to 85
Sensitivity: Adjustable 1 - 8 psi/F°.
Misc.: Furnish necessary mounting equipment and cover.
Use.: To maintain the space temperature by modulating the steam heating coil.

Item No. 748 AC-110-B

Type: Steam heating coil valve.
Make: Johnson Service Company V-3752, or approved equal.
Size: 1/2" I.P.S.
Operator: Rubber diaphragm spring range 5 to 9 pounds.
Action: Normally open-air to close.
Capacity: 60#/hr
Steam Supply: 15 psig
Use: Steam control to heating coil.

Item No. 748 AC-111-B

Type: 3-way heating coil valve - piped bypass.
Make: Johnson Service Company V-4322.
Body: Cast brass, 150 psi rating, screwed, 2 inlets, 1 outlet.
Capacity: 45 GPM, 2# drop.
Spring Range: 5 to 9 psi.
Top: V-3000 exposed, rubber diaphragm, field changeable.
Use: To vary amounts of condenser water flowing through tower to maintain discharge temperature.

21. CONTROL SPECIFICATIONS (contd)Item No. 748 AC-111-C

Type: Pressure electric switch.
Make: Johnson Service Company G-271.
Action: Normally open (close on increased pressure).
Range: 3-35# (field adjustable).
Misc.: Furnish necessary mounting bracket, fittings, and pilot pressure air gauge and line voltage contacts.
Use: To cycle tower fan in accordance with load demands.

Item No. 748 AC-111-D

Type: Capillary insertion thermostat.
Make: Johnson Service Company T-800.
Action: Proportional, reverse acting (air in branch on falling temperature).
Range: -30 to 300°F.
Sensitivity: Adjustable, 1/8 to 5 psi/°F.
Misc.: Furnish supply and branch air gauges and fittings, liquid filled stainless steel compensated capillary with "B" bulb and well.
Use: To modulate 3-way valve on tower water to maintain constant condenser water temperature.

Item No. 748 AC-111-E

Type: Reheat coil valve.
Make: Johnson Service Company V-3020.
Size: 3/4"
Body: Cast brass, 150 psi, screwed.
Spring Range: 5-9#.
Top: V-3000, exposed rubber diaphragm, field changeable.
Use: To vary steam supply to heating coil in tower basin.

Item No. 748 AC-111-F

Type: Capillary insertion thermostat.
Make: Johnson Service Company T-800.
Action: Proportional, reverse acting (air in branch on falling temperature).
Range: -30 to 300°F.
Sensitivity: Adjustable, 1/8 to 5 psi/°F.
Misc.: Furnish supply and branch air gauges and fittings, liquid filled stainless steel compensated capillary with "B" bulb and well.
Use: To modulate steam valve on tower basin in accordance with load demands.

21. CONTROL SPECIFICATIONS (contd.)Item No. 748 AC-112 - Underground Steam Supply System

- A. Contractor shall furnish and install underground, insulated steam piping as shown on the drawings. ~~Multiple pipes~~ to be installed within a single prefabricated steel conduit casing, as indicated on the plans. Underground insulated piping shall be Ric-Wil Prefabricated Insulated Pipe Units as manufactured by Ric-Wil, Incorporated, Barberton, Ohio (or approved equal). Conduit shall be 16-gauge galvanized corrugated steel conduit "Galva-Flex" having full-welded lock seam, or 10 gauge galvanized smoothwall conduit "Galva-Gard" multiple machine coated with high melting point asphalt with an interposed layer of fiberglass cloth and one (1) final outer wrap of asphalt impregnated fiberglass reinforced asbestos pipe line felt applied spirally under tension. Minimum coating thickness will be 3/16 inches.
- B. The unloading, handling, and installation of the underground insulated piping system to be in strict accordance with the manufacturer's recommendations. A qualified, factory-trained representative of the conduit manufacturer shall be present during all critical periods of the installation and tests of the pipe and conduit, and shall furnish a certificate upon completion of the installation indicating that the system was installed in accordance with the manufacturer's recommendations.
- C. Steam piping shall be 2" @ 200 psi A-53, Gr B, seamless Sch. 40 with welded joints. ~~Condensate return piping shall be 1-1/4" A-53, Gr B, seamless Sch. 80 with welded joints.~~ All piping shall be hydrostatically tested in the field under a pressure of 400 psig, and all piping joints shall be hammer tested.
- D. Piping shall be insulated with Calcium Silicate Insulation, 1-1/2" thick for Steam Line, ~~1" thick for Condensate Return Line.~~
- E. Conduit Connectors shall be minimum 10 gauge and of the welded type. Conduit shall be air tested in the field at 15 psig and all joints shall be soap tested. Air pressure shall be kept in conduit while backfilling is being conducted and until system is completed and turned over to the Owner. After conduit field joints have been soap tested, this Contractor shall apply Rip-Coat Mastic Blanket protective coating over the conduit connectors.
- F. Conduit ends shall be provided with end seals or gland seals as required where conduit enters buildings. Conduit seals to have drain and vent openings. Conduit to be vented to atmosphere. The terminal ends of conduits in walls at buildings shall be equipped with leakplates.

21. CONTROL SPECIFICATIONS (contd)

Item No. 748 AC-112 - Underground Steam Supply System (contd)

- G. Contractor shall furnish and install concrete anchor block to be poured around each steel anchor plate and conduit in accordance with the manufacturer's recommendations.
- H. Base of trench shall be of clean earth, sand, or limestone screenings to provide a 4" bed and properly hand tamped. Backfill to be of clean earth, sand, or limestone screenings completely enveloping conduit on both sides and top to a minimum thickness of 6". All backfill shall be carefully hand tamped in 6" layers until 18" has been deposited over top of the conduit.
- I. No underground conduit system (or manufacturer) will be acceptable that has not been manufactured and field tested under actual conditions for a period of five (5) years or more.

Item No. 748 AC-113 - Ceiling Diffuser

One Cornor Engineering Company, or approved equal, 12" neck size, Style KPDG ceiling diffuser with standard finish.

22. MAJOR EQUIPMENT SPECIFICATIONS

Item No. 748 AC-101 - Air Conditioning Unit

One (1) Trane or approved equal, Model SUW 150, 15 ton vertical floor-mounted self-contained water cooled air conditioning unit. Unit shall be equipped with two (2) 7-1/2 ton compressors, factory charged with R-22 refrigerant, hot gas bypass to be field installed on lead compressor. Unit shall be capable of operating on 440 - 3 - 60 current. Steam heating coils shall be steam distributing type, capable of heating 6000 CFM air from 35°F to 80°F with 15 psig steam. Filters shall be throw-away type. Front return air panel not required. Water regulating valves not required.

Fans shall deliver 6000 CFM air at 3/4 in. external S.P. and 2.7 BHP. Fan motor is a 3 H.P. 440-3-60 open motor with adjustable sheave. Full load amperage is 3.8 amps for the fan motor and 24.8 amps for each compressor.

Cooling capacity shall be 191,000 BTU/HR handling 6000 CFM at EAT = 86° FDB and 71° FWB. Condensing temperature shall be 105°F with 30 GPM of 85°F cooling water.

22. MAJOR EQUIPMENT SPECIFICATIONS (contd)Item No. 748 AC-102 - Heating and Ventilating Unit

Unit is Model H1016LPHVFYA American Air Filter, or approved equal, horizontal deck mounted heating and ventilating unit. Unit is for roof top mounting and is completely weatherproofed including gasketed access door, caulked panels, totally enclosed belt guard and motor enclosure. Unit is to discharge 750 CFM of air at 1.30 in. T.S.P. of which .50 in. is external. Unit has an outlet velocity of 1420 FPM with a 1 row, 10 FPI. American Air Filter Type DT steam distributing coil. Coil has 1 in. O.D. condensing tubes and 5/8 in. O.D. distributing tubes, and a capacity to raise the air temperature from 0°F to 100°F based upon 15 PSIG of steam and a coil face velocity of 475 FPM. The fan wheel is forward curved and 8-1/8 in. diameter and is to be driven at 1194 RPM and 0.29 BHP through an adjustable V-belt drive by a 1 HP, 1750 RPM, 230/460 volt, 60 cycle, 3 phase, T.E.F.C. Motor. Fan discharge position is No. 1 with the motor located in position No. 2A. Unit has an angle bank filter section with one (1) American Air Filter No. 5700, size 16 x 25 throw-away cell, filter area is 5.65 sq. ft. velocity through the filter is 135 FPM with a Swartwout Model 4-W 4 in. deep fixed galvanized louver to be mounted on the inlet. Louver size is 15 in. x 25 in. with 2 mesh galvanized bird screen. Complete with rubber-in-shear vibration isolators set No. AA-1. External face and bypass section, dampers and bypass duct.

Item No. 748 AC-103 - Roof Exhauster

Unit is a size 33 Type MS upblast discharge, clockwise rotation, Clarage, or approved equal, belt driven ready unit, to exhaust a capacity of 3250 CFM at 1.0 in. S.P. The Type MS wheel is belt driven at 1469 RPM and 1.05 BHP through an adjustable V-belt drive by a 1-1/2 H.P., 1750 RPM, one speed 230/460-3-60 TEFC motor. Unit is complete with outdoor cover which covers both motor and drive. Type "B" non-spark construction and vibration pads.

Item No. 748 AC-104 - Roof Exhauster

Unit is a size 12 DLS upblast discharge, clockwise rotation, Clarage, or approved equal, direct drive ready unit. Capacity 477 CFM at 3/8 in. S.P. Direct driven by a 1/6 HP, 1725 RPM 230/460-3-60 TEFC motor. The fan is of AMCA Type "B" non-sparking construction. Complete with outdoor cover and vibration pads.

Item No. 748 AC-105 - Lavatory Vent Fan

Unit is Model 16FCW Swartwout, or approved equal, direct drive wall FiberAire exhaust fan. 120 CFM capacity at 1/4 in. S.P. Has a non-sparking aluminum wheel and is direct driven by a 1/25 HP, 1550 RPM, open motor, 115/60/1.

22. MAJOR EQUIPMENT SPECIFICATIONS (contd)Item No. 748 AC-106 - Automatic Discharge Louver

Unit is size 20 in. x 16 in. Swartwout, or approved equal, Model 29T counter balanced relief dampers for wall mounting.

Item No. 748 AC-107 - Filtered Air Supply Unit

Unit is Size 50 American Air Filter, or approved equal, make-up air supply unit with bag type dri-pak filter. 500 CFM capacity less inlet plenum. Complete with fan and 3/4 HP 230/460-3-60 explosion proof motor. Arrangement No. A.

omit
Item No. 748 AC-108 - Condensate Pump

Unit is Weinman, or approved equal, Model 20C-6A-FV30F Simplex condensate return unit. 1000 sq. ft. of direct radiation discharging against a pressure of 40 PSI. Unit consists of a vertical ~~unipump~~ close coupled to a 3 HP, 1750 RPM 230/460-3-60 open motor. Also complete with a 20 gallon cast iron receiver with low return inlet, glass gauge, and float switch.

Item No. 748 AC-109 - Steam Reducing Valve

Furnish and install unit with capacity to reduce 1000 lb./hr. steam from 200 psig to 15 psig. Unit shall be equal in every respect to Sarco Company Type 25P, size 1/2 in. pilot actuated, diaphragm-operated, with ductile nodular iron body. Unit shall be installed in strict accordance with manufacturer's recommendations.

Item No. 748 AC-109-A - Steam Trap

Size 3/4 in. I.P.S., Sarco Company, or approved equal, Type FT0, float thermostatic steam trap suitable for 200 psig steam.

Item No. 748 AC-110 - Unit Heater

American Air Filter, or approved equal, Model SB HU 1033, horizontal unit heater, capacity 56,300 BTH with 15 psig steam, 60°F entering air and 140°F leaving air, 1/4 HP, 1750 RPM 230/460-3-60 totally enclosed one speed motor complete with fan guard and vertical deflectors. Fan to supply 578 CFM at 70°F.

Item No. 748 AC-111 - Roof Mounted Water Cooling Tower

Unit is Marley Company Permatower No. 5815 complete with float valve and 0.7 HP motor suitable for 220/440 volt, 3 phase, 60 cycle current with a full load capacity of 1.2 amps on 440 volts.

22. MAJOR EQUIPMENT SPECIFICATIONS (contd)

Item No. 748 AC-111-A - Cooling Water Circulating Pump

Unit is Weinman single stage end suction bronze fitted General Service Model 1-1/2 K - 1-1/2 - 4 complete with non-overloading totally enclosed, weatherproof motor, 2 H.P., 1750 RPM, 220/440 3-60 current capable of delivering 45.5 GPM of 85°F cooling water at a TDH of 60 feet. Unit has 2 in. I.P.S. suction and 1-1/2 in. IPS discharge FPT connections. Pump shall have Crane type mechanical seals. Pump shall be electrically interlocked with the compressors of Item No. 748 AC-101 such that the pump will operate only when the compressors are in operation.

1. SCOPE OF WORK

- A. The work under this Section includes the furnishing of all supervision, labor, materials, tools, and equipment necessary for, and incidental to, application of all thermal insulation as shown or called for on the drawings, and specified in the Owner's Insulation Specifications.
- B. The following items of related work are included in other divisions of these specifications:
 - (1) Roof insulation, Section 7A.

2. MATERIALS

- A. Insulation material shall be in accordance with Owner's Specifications 14J, 15H, 18 FX, and 23H, which are included and made a part of these specifications.

3. APPLICATION

- A. Insulation shall be applied in accordance with instructions and details given in the numbered Insulation Specifications and the General Insulation Specifications which are included and made a part of these specifications.
- B. Type and thickness of insulation shall be as shown or called for on the drawings.
- C. Insulation shall not be installed until after respective piping systems have been tested and approved. Where Contractor does otherwise, it shall be his responsibility to remove and replace the insulation at his own expense.

1. GENERAL CONDITIONS

- A. These specifications describe the work required to furnish, install, and connect in operative condition all materials, equipment, apparatus, and required appurtenances necessary to provide the electrical systems specified herein and indicated on the drawings.
- B. Items of Work
- (1) Provide all safety switches, motor starters, lighting fixtures, bus ducts, and any other electrical equipment and material specified herein or indicated on the drawings and which is not specifically designated as being provided by others.
 - (2) Provide all breaker panels, power and control wiring for heating, ventilating, and air conditioning equipment unless otherwise specified to be furnished by others.
 - (3) Provide grounding of structural steel and equipment as indicated on drawings and hereinafter specified.
 - (4) Provide testing of electrical work.
 - (5) Provide Fire Alarm System as indicated on drawings.
- C. Codes
- (1) The electrical installation shall comply with all local and state laws and ordinances, and with the latest revision of the National Electrical Code.
 - (2) Laws, ordinances, and codes shall take precedence over specifications and drawings, in the event of conflict. The Contractor shall obtain written approval from the Engineer before changes are made because of conflict.
- D. Conflicts with Other Classes of Work
- All conflicts with other classes of work that cause deviations from location or conduits as shown on the drawings shall be settled in a manner satisfactory to the Engineer before proceeding with the work.

2. MATERIALS

A. Proprietary Products

- (1) Manufacturer's products specified are descriptive of type and quality required. Products of other reputable manufacturers of this same type and quality may be substituted.

2. MATERIALS (contd)A. Proprietary Products (contd)

- (2) Materials and equipment shall be standard products of manufacturers regularly engaged in the production of such materials or equipment and shall be the Manufacturer's latest designs.

B. Conduit

- (1) Aluminum conduit and fittings shall meet all requirements of the American Standard for Rigid Aluminum Conduit, ASA C80-5, latest revision.
- (2) Electrical metallic tubing and fittings shall meet all requirements of the American Standard for EMT conduit, latest revision.
- (3) Flexible Metallic Conduit may be used at indoor dry locations: Where limited flexibility is required, such as at motor terminals, flexible metallic conduit shall be "Sealtite" Type UA as manufactured by American Brass Company.

C. Boxes - Outlet and Switch, Pull and Junction(1) General

Boxes and covers shall be of steel, sizes proportioned to conduit or conductors serviced, protectively coated inside and outside with a metallic conductive material such as tin, cadmium or zinc.

D. Wiring Devices

- (1) Local light switches shall be low voltage as indicated on drawings.
- (2) Convenience outlets for 110 volt general purpose use to be duplex, 15 ampere, 125 volt, 3 wire grounding type, Hubbell No. 5262.
- (3) All switch and convenience outlet plates in general purpose areas to be Hubbell .040 stainless steel chrome-x plates and to suit outlets installed.

E. Conductors(1) Power and Lighting

- a. All wire size 12 and larger shall be stranded.
- b. Wires and cables 600 volt and below shall be Type "TW" with 3/64" minimum thermoplastic insulation unless otherwise noted on drawings.

2. MATERIALS (contd)F. Grounding Material(1) Grounding Conductors

Soft drawn or medium hard drawn copper wire, strap, or as called for on drawings. Sizes No. 4 and smaller - solid; No. 2 and larger - stranded. Sizes smaller than No. 6 shall not be used for buried grounding conductors.

(2) Driven Rod Electrodes

Copper, copper-clad steel or copper alloy, pointed on one end to facilitate driving. Each rod shall bear figures to show the size in inches and the length in feet. Cross-section shall not be less than the area of a $3/4$ " diameter circle and the length shall be not less than 10'.

3. WORKMANSHIPA. Conduit

- (1) Locating and sizing of conduits or ducts in or passing through floors, walls, etc., shall be the responsibility of the Contractor.
- (2) In no case shall any duct be formed, or any conduit be bent, or any fabricated elbow be applied to less than the allowable bending radius of the conductor to be installed.
- (3) Conduits Overhead
 - a. Separation of not less than 6" shall be maintained between all conduits and the insulation of hot water, steam lines or any other work liberating heat in excess of conductor rating. When this separation cannot be maintained, a pipe covering shall be used, applied on the conduit and subject to the approval of the Engineer.
 - b. The exact locations and routing of conduit, when not shown in detail on drawings, shall be determined by the Contractor subject to approval by the Engineer.
 - c. When necessary to make field bends, they shall be made with tools designed for conduit bending. Heating of conduit to facilitate bending will not be permitted.
 - d. End of conduit runs shall be protected immediately after installation by steel bushings and flat non-corroding metallic discs. Discs shall not be removed until necessary in order to pull wire. Con-

3. WORKMANSHIP (contd)A. Conduit (contd)(3) Conduits Overhead (contd)

- d. tractor shall be responsible for the entrance of foreign matter into the conduit system and shall make repairs or replacements if necessary at no extra expense to the Owner.
- e. Motors mounted on slide rails shall be connected to conduit system as shown on the drawings with a flexible metallic conduit or coupling to allow for a minimum motor movement of 1-1/2" in either direction. The length of flexible conduit must be a minimum consistent with Manufacturer's standard lengths and recommended bending radii.
- f. Motors on vibration mounts shall be connected to rigid conduit system as shown on the drawings with flexible metallic conduit to permit maximum expected movement.
- g. Location of supports for conduit

<u>Conduit Size</u> <u>Inches</u>	<u>Location</u>	<u>Max. Spacing</u> <u>of Supports</u> <u>Feet</u>
	<u>Horizontal Runs</u>	
1/2 & 3/4	Any Location	6
1" & Larger	Any Location	8
	<u>Vertical Runs</u>	
1/2 & 3/4	Exposed	7
1 & 1-1/4	Exposed	8
1-1/2 & Larger	Exposed	10
Up to 2	Shaftways	14
2-1/2 & Larger	Shaftways	28
Any	Concealed	10

- h. Pull boxes shall be installed to sectionalize runs of conduit where the number of 90 degree bends exceeds the following:

<u>Max. Length of Run</u> <u>Feet</u>	<u>Max. No. of 90 Deg. Bends</u>
0-49	4
50-99	3
100-149	2
150-199	1

3. WORKMANSHIP (contd)A. Conduit (contd)(3) Conduits Overhead (contd)

- i. Exposed conduit shall be run at right angles to or parallel to building structural members wherever possible and shall be adequately supported by brackets, clamps, or braces wherever required. Diagonal runs shall not be made except in special cases or in concealed work, and must be approved by the Engineer.
- j. Conduits shall be rigidly supported with one hole malleable iron conduit clamps, Unistrut Corporation supports or C. C. Korn Company's clamps, depending on the type of construction or as indicated. Where a group of conduits run together, support on hangers fabricated from light steel framing, Unistrut or as indicated. Size all such hangers to accommodate at least 25 percent more conduit than is to be installed.
- k. Perforated flat steel strap shall not be used for supporting conduit.
- l. Conduit shall be installed in such manner that wires may be removed and replaced at a later date.
- m. Conduit shall be continuous from outlet to outlet and from outlet to cabinets, junction or pull boxes, and shall enter and be secured in such a manner that each system shall be electrically continuous from a point of service to all outlets.
- n. When local interferences require changes in the location of outlets from those shown on drawings, such changes may be made only if approved by the Engineer.

B. Conductors - Insulated

- (1) Bending radius of any insulated cable or conductor, either permanently or temporarily, shall not be less than minimum recommended by Manufacturer
- (2) To facilitate pulling of cables in ducts, Electro-Compound Company, "Yer-Ease", Ivory Soap Flakes or powdered soap stone only may be used.
- (3) Attachments for pulling cable shall be patented cable grips, or other devices subject to the Engineer's approval. In using woven basket grips on lead-covered cable, care shall be taken to avoid damage to cable-end seal, which shall be maintained during cable installation.
- (4) Maximum pull tension for any conductor or cable shall not exceed Manufacturer's recommended value when measured by tension dynamometer.

3. WORKMANSHIP (contd)B. Conductors - Insulated (contd)

- (5) After being pulled in, each cable or conductor shall be identified at both terminations and in junction boxes and pull boxes by attachment of suitable plastic or non-ferrous metal discs or markers, stamped with the circuit designation shown on drawings.
- (6) In terminal boxes, panelboards, switch boards, or any termination in close proximity to energized parts, identifying discs or markers shall be plastic or fiber attached to cable with strong twine.
- (7) Connections to insulated leads, current transformers or busses shall be covered and taped in a manner appropriate to the class of insulation originally on conductor. Irregular connectors and surfaces shall be plastered smooth with Johns-Manville Dux-Seal or equal before taping. All terminal taping shall be painted with General Electric Company Glyptol No. 1201.
- (8) Where conductors emerge from a lead sheath they shall be protected from moisture and mechanical injury by suitable and approved terminators or potheads designed for the voltage and conductor capacity used.
- (9) Non-leaded shielded conductors or cables shall be terminated in approved potheads. The shield shall be treated as a live conductor and shall be properly grounded. It shall be the Electrical Sub-contractor's responsibility to obtain from pothead manufacturers particular instructions and recommendations for terminating each class of shielded cable.
- (10) Connection of conductors No. 6 AWG and larger, to panels and apparatus shall be by means of approved lugs or connectors. Cast copper lugs shall be used on all feeder cables.

C. Communications - Fire-Alarm, Private Telephone, Electronics

- (1) Cables or conductors shall be provided in continuous length. Where discontinuous lengths are unavoidable, approved terminal boxes with suitable terminals shall be provided as junction points.

D. Lighting Systems

- (1) Rows of fixtures shall be installed accurately as to line and level. Fastenings and supports shall be firmly set so that fixtures will not be distorted by handling incident to normal maintenance.
- (2) Fixture wire shall not be less than No. 16 AWG.

3. WORKMANSHIP (contd)D. Lighting Systems (contd)

- (3) Local switches shall be mounted 4'6" from floor. When located near doors, they shall be close to trim on lock side.
- (4) Convenience outlets shall be mounted at 1'6" from floor, unless noted otherwise on drawings. Outdoor outlets shall be weather-proof and mounted 4'6" above grade.
- (5) At time of final inspection all fixtures and equipment must be complete with the required glassware and/or reflectors which must be clean and free of defects. Any glassware or reflectors broken prior to the time of final acceptance must be replaced.
- (6) Lighting panelboard shall be installed at a height not exceeding 6' to the centerline of the topmost breaker.
- (7) Lamps shall be furnished and installed by the Electrical Sub-contractor for 115-volt operation.
- (8) A durable and legible directory shall be inserted in the lighting panelboard identifying the number of breaker or switch and the associated area or room to be lighted. This directory is to be typewritten.
- (9) Ballast for all fluorescent fixtures shall be Class "P"..

E. Power System

- (1) The Contractor shall check the overload relay heaters furnished with motor starters, with the full load current as shown on each motor nameplate and with the overload relay heater selection tables in the catalog of the manufacturer of each starter supplied.
- (2) If any overload relay heater as supplied with a starter is rated incorrectly, the Electrical Subcontractor shall replace it with one of the size and make as required by the manufacturer of the starter

F. Grounding(1) General

- a. All conduits, cabinets, motors, panels, secondary neutrals and other exposed non-current carrying metal parts of electrical equipment shall be grounded.
- b. All contact surfaces shall be thoroughly clean and bright, before connections are made, to insure making good electrical contact.

3. WORKMANSHIP (contd)F. Grounding (contd)(1) General (contd)

- c. All grounding connections shall be made by the "Cadweld" process or mechanical type connectors; bolts and nuts shall be of silicon bronze material and shall be secured by lock washer or equivalent.
- c. All clamped joints shall be made up firmly, and where located underground shall be completely covered with a suitable heavy coal tar coating such as "Bitumastic No. 50", as made by Koppers Company, or equivalent, after the connection is made.

G. Cathodic Protection

(See Section 16B.)

H. Structural Supports

- (1) Steel supports, rod supports, hangers, etc., for transformers, panelboards and other control equipment shall be furnished and installed by Contractor. If supports for these have not been designed by Owner, they shall be designed and fabricated by Contractor subject to approval by the Engineer.

I. Telephone Installation shall comply with the regulations of the local telephone company.J. Equipment Identification

- A. Feeder switches and breakers, motor starters, power and lighting panelboards, unit substations, disconnecting switches and other similar equipment having important functions in process or safety requirements, shall be identified in a clear, legible, and durable manner. Stenciling or skilled free-hand painting may be employed. Color of the imprint shall be suitable contrast to the applied field.

K. Tests

- (1) All tests shall be performed in the presence of the Engineer. The Contractor shall furnish all instruments and personnel required for the tests. The Owner will furnish necessary electrical power.

3. WORKMANSHIP (contd)K. Tests (contd)

- (2) Insulation Resistance Test shall be made in accordance with the applicable provisions of NEC, after all wiring and connections are completed.
- (3) Operation Test

Equipment shall be energized and full load shall be carried for a minimum of 2 hours, unless otherwise required by the Engineer. Equipment shall be checked at this time for proper starting, rotation, heating, undue vibration, noises, etc.
- (4) Grounding Tests for the grounding system shall be made in accordance with one of the following methods and the combined resistance of the grounding conductor and the connection with ground shall not exceed 3 ohms for water pipe connections or 25 ohms for artificial (buried or driven) grounds.
 - a. Three Point Method, using an ammeter and voltmeter with alternating current or direct current power supply.
 - b. Commercial Instrument Method, using "Megger" ground tester as manufactured by James G. Biddle Company, Philadelphia, Pa., or "Vibraground" tester manufactured by Associated Research, Inc., Chicago, Illinois.

L. Responsibility(1) Coordination of Work

It shall be the responsibility of the Contractor to determine to his satisfaction the quantities of material, equipment and labor involved. He shall cooperate with other trades, whether specifically mentioned in specification or implied, to adjust all conflicts to the mutual satisfaction of all concerned.

(2) Inspection

All work will be subject to field inspection by the Engineer. After completion of the work the Contractor shall furnish the Owner a certificate of final inspection and approval from the electrical inspection agency having jurisdiction.

(3) Permits

The Contractor shall obtain permits local or otherwise, required for the performance of this work.

3. WORKMANSHIP (contd)

L. Responsibility (contd)

(4) Guarantee

When a part of the electrical system is placed in service by the Owner prior to the date of final approval, the particular system or equipment shall then commence its one year period of guarantee. This guarantee shall expire one year after such system or equipment is placed in service without regard to the date when the final certificate of approval covering the entire system is granted.

1. GENERAL REQUIREMENTSA. Scope

The Contractor shall furnish all labor, materials, tools, and equipment necessary for the installation of cathodic protection systems, as shown or called for on the Drawings, and as specified in these specifications.

Materials and equipment to be furnished by the Contractor shall include the following:

- (1) All anodes.
- (2) All wire, cable, and splicing kits for wire and cable.
- (3) All materials and equipment for Thermit welding.
- (4) All coating materials.

2. MATERIALSA. Electrical Conductors

- (1) Sacrificial Anode System - Electrical conductors for the sacrificial anode system are tabulated as follows:

<u>Designation of Conductor</u>	<u>Where Used</u>	<u>Description of Conductor</u>	<u>Color Code</u>
Anode lead	From single anode to pipe	No. 12 AWG TW solid copper wire	Black

B. Anodes

- (1) Magnesium Anodes. All magnesium anodes shall be the 17-lb packaged backfill type, such as "Galvomag", manufactured by the Dow Chemical Company, Midland, Michigan, or approved equal.

C. Cable Splicing Kits

All kits for splicing cable shall be Scotchcast No. 90-B1, manufactured by Minnesota Mining and Manufacturing Company, St. Paul, Minnesota, or approved equal.

D. Thermit Welding Materials and Equipment

Thermit welding materials and equipment shall be Cadweld, manufactured by Erico Products, Inc., Cleveland, Ohio; Thermoweld, manufactured by Continental Industries, Inc., Tulsa, Oklahoma; or Thermoweld, manufactured by the Burndy Corporation, Norwalk, Connecticut, or approved equal.

2. MATERIALS (contd)E. Compression-Type Connectors

Compression-type electrical connectors shall be "Crimpfit", manufactured by the Burndy Corporation, or approved equal.

F. Coating Material

Coating material shall be Roskote 612XM (summer or winter grade, as required), manufactured by Royston Laboratories, Inc., Pittsburgh, Pennsylvania.

3. WORKMANSHIPA. Installation of Magnesium or Zinc Anodes

- (1) General. The number, size, type, and spacing of magnesium anodes shall be as shown or called for on the Drawings.
- (2) Placing of Anodes
 - a. The distance between pipe and anodes shall be at least 3 feet.
 - b. If possible, anodes shall be installed in auger holes, directly beneath the pipe. Horizontal installations shall be made only when vertical installations are not feasible.
 - c. Anodes shall not be placed on rocks or other solid non-conductive material. Excavations for anodes shall be backfilled with clean, rock-free earth, placed and tamped in 4-inch layers. If water is available, packaged anodes shall be wetted before backfilling.
- (3) Connection of Anodes to Pipe
 - a. Anodes shall be connected to the pipe in accordance with Owner's Standard EL-76. Brazing the lead wire to the pipe will not be permitted.
 - b. After the wires have been connected to the pipe, the entire area and weld shall be thoroughly cleaned and coated with one heavy coat of Roskote 612XM. The coating shall be allowed to dry 20 to 30 minutes before any backfill is placed. A piece of heavy paper from the anode wrapper shall be placed over the freshly coated surface to act as a rock shield.
 - c. Location of Thermit Welds. Thermit welds shall not be made at locations of known major stresses, such as bends or welds.

3. WORKMANSHIP (contd)

B. Insulation

- (1) Insulated bushings shall be Dedrin Pipe Bushings or equal as manufactured by Cathodic Protection Services, Houston, Texas.

C. Inspection by Owner

- (1) The Work shall be subject to the surveillance of the Engineer at all times.
- (2) If the Engineer finds any deviations in the Work from the Drawings or Specifications, and he considers it necessary, he shall stop the Work. Before the Contractor may continue the Work, the Engineer shall submit, in writing, his decision concerning such deviations. The Engineer's decision shall be binding on the Contractor and the Owner.
- (3) The work performed by the Engineer shall not relieve the Contractor of any of the terms of the contract or other responsibilities connected with the satisfactory completion of the Work.

STANDARD SPECIFICATIONS



CHEMICALS, OLEFINS, PLASTICS,
SILICONES DIVISIONS AND
UNION CARBIDE CANADA

14-J
INSULATION
JULY 1966

THERMAL INSULATION APPLICATION SPECIFICATIONS

PREFORMED FLEXIBLE PLASTIC FOAM

SCOPE

This specification describes the essential requirements for application of preformed flexible plastic foam insulation for use on equipment, piping, and ductwork normally operating at temperatures from 32 F up to and including 180 F. It is applicable to both indoor and outdoor service.

SECTION A - MATERIALS

1. INSULATION MATERIAL

Insulation shall be as specified in MATERIAL SPECIFICATION 14.

2. ACCESSORY MATERIALS

Accessory materials shall be as specified in the MATERIAL SPECIFICATIONS, article numbers as noted.

Contact Adhesive (standard)	VII.A.65
Contact Adhesive (high temperature)	VII.A.66
Vinyl Finish	VII.A.67
Flexible Sealer	VII.A.68
PVA Finish Coating (color as specified)	VII.A.69
Tape	VII.A.89
Weather-Barrier Mastic (color as specified)	VII.B.1.a

SECTION B - APPLICATION

1. SURFACE PREPARATION

- a. Outer surfaces of carbon steel equipment and ductwork shall be sandblasted and coated with zinc silicate inorganic coating, in accordance with the Union Carbide Corporation Design and Construction Coatings Manual, prior to application of insulation.
- b. Outer surfaces of aluminum, copper, or galvanized steel equipment and ductwork shall be cleaned of all dirt, grease, oil, and other contaminants prior to application of insulation.

2. TEMPERATURE LIMITATIONS

- a. Insulation shall be applied at ambient temperatures above 32 F.
- b. Temperature limitations of contact adhesives are as follows
 - (1) Standard, 160 F
 - (2) High Temperature, 180 F

3. APPLICATION PROCEDURES

- a. Size of Sheets. Sheets of preformed flexible plastic foam insulation for vessels and ductwork shall be cut slightly oversize so that they must be compressed to fit at all butt joints.
- b. Contact Adhesives. Standard or high temperature contact adhesive, as required, shall be applied over the entire surface to be insulated, and to the inner surface (out cell side) of insulation, sufficiently in advance of installation of sheet to allow the adhesive to dry to a non-tacky state. At temperatures from 32 F to 40 F the drying time is much longer than at temperatures above 40 F.
- c. Equipment
 - (1) Place each insulation sheet so that it overlaps the edges of the previously installed sheet, or sheets, by 1/8 inch. While holding the sheet in position, spot adhere it at the center to the surface of the vessel; then work outward to avoid trapping air between the insulation and the surface. Compress the butt edges into place to achieve a tight joint, then spread the joint and, by means of a small brush, apply sufficient adhesive in the joint to obtain a firm bond. Press sheets and joints firmly into place with a small hand roller.
 - (2) When a double layer of insulation is required, the outer surface of the inner layer and the inner surface of the outer layer shall be coated with standard contact adhesive and the adhesive allowed to dry as specified in Subsection b. above. The outer layer shall then be applied in the manner specified in Paragraph (1) above, in staggered joint construction.
 - (3) Voids and lines of insulation termination shall be caulked with flexible sealer.

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STANDARD SPECIFICATIONS

UNION CARBIDE
CHEMICALS, OLEFINS, PLASTICS,
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INSULATION
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SECTION B - APPLICATION - contd

3. APPLICATION PROCEDURES - contd

e. Piping - contd

(5) Supports and Hangers

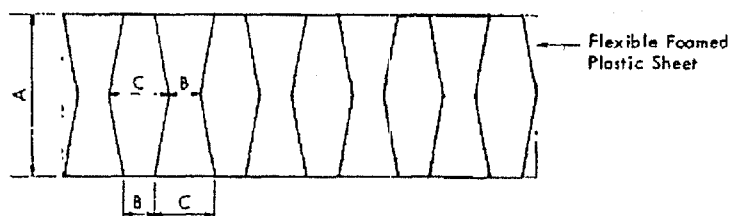
(a) Where horizontal piping is supported on the surface of the insulation, by means of cradles as shown on Owner's Standard P-82, rigid plastic foam closed cell insulation shall be installed between the cradle and the pipe. This insulation shall be of sufficient length to extend beyond both ends of the cradle. Seams shall be adhered with standard contact adhesive as specified in Paragraph (2).(b) of this subsection, except that two coats of adhesive shall be applied to the seam surfaces. The first coat shall be allowed to dry to touch before the second coat is applied.

(b) Where hangers are attached directly to the pipe, the rods projecting through the insulation shall be insulated for a distance of six inches.

(6) Fitting, Flange, and Valve Covers

(a) Fitting, flange, and valve covers which can be produced from pipe insulation shall be prefabricated in accordance with ASTM Recommended Practice C 450, latest revision, using contact adhesive for fabricating cement.

(b) Fitting, flange, and valve covers for piping larger than 5-inch NPS shall be formed from sheet insulation cut and formed to fit, and adhered to the fittings with contact adhesive. Dimensions for cutting sheet insulation for 90-degree long and short radius elbows are given in Figure 14-J-2.



Dimension "A" is a job-site measure of the elbow circumference.

TABLE FOR DIMENSIONS B AND C					
Nominal Pipe Size	Number of Segments	Long Radius 90° ELL		Short Radius 90° ELL	
		"B", In.	"C", In.	"B", In.	"C", In.
5	3	2-5/32	5-21/32	29/32	4-9/16
	4	1-19/32	4-1/4	1/2	3-5/16
6	3	2-21/32	6-27/32	1-5/32	5-13/32
	4	2	5-5/32	13/16	3-27/32
	6	1-5/16	3-7/16	9/16	2-19/32
	8	15/16	2-5/16	13/32	1-31/32
8	6	1-13/16	4-1/2	13/16	3-13/32
	8	15/16	2-5/16	19/32	2-19/32
10	6	2-11/32	5-19/32	1-1/16	4-1/4
	8	1-3/4	4-3/32	13/16	3-3/16
12	8	2-27/32	6-19/32	1-5/16	5-1/16
	10	2-3/32	4-31/32	1	3-13/16
16	8	3	6-13/32	1-29/32	6-1/2
	10	2-13/32	5-5/32	1-13/32	4-27/32
18	8	3-13/32	7-3/16	2-5/32	7-1/4
	10	2-11/16	5-13/16	1-19/32	5-7/16
20	8	3-3/4	8	2-13/32	8-1/16
	10	3	6-13/32	1-13/16	6-1/16
24	8	4-9/16	9-21/32	2-31/32	9-21/32
	10	3-21/32	7-11/16	2-3/16	7-1/4

Dimensions for Cutting Flexible Sheet Insulation

Figure 14-J-2

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STANDARD SPECIFICATIONS



CHEMICALS, OLEFINS, PLASTICS,
SILICONES DIVISIONS AND
UNION CARBIDE CANADA

15-H
INSULATION
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JULY 1966

THERMAL INSULATION APPLICATION SPECIFICATIONS

PREFORMED FIBROUS GLASS

High Density (Over 10 lb per cu ft)

SCOPE

This specification describes the essential requirements for application of preformed fibrous glass insulation for use on equipment and piping normally operating at temperatures from 70 F up to and including 750 F. It is applicable to both indoor and outdoor service.

Procedures described in the GENERAL SPECIFICATIONS are applicable to and constitute an integral part of this specification.

SECTION A - MATERIALS

1. INSULATION MATERIAL

Insulation shall be as specified in MATERIAL SPECIFICATION 15

2. ACCESSORY MATERIALS

Accessory materials shall be as specified in the MATERIAL SPECIFICATIONS, article numbers as noted.

Glass Wool Blanket	VII.A. 1	Pin Clips	VII.A. 23
Insulating Cement	VII.A. 6	Heat-Resistant Sealer	VII.A. 42
Pipe Insulation Support	VII.A. 9	Mastic	VII.A. 45
Expansion Sleeve	VII.A. 10	Glass Cloth Jacket	VII.A. 90
Equipment Insulation Strap	VII.A. 11	High Temperature Fabricating Cement	VII.A. 91
Clips for Equipment Strap	VII.A. 12	Bonding Adhesive	VII.A. 9
Pipe Insulation Strap	VII.A. 13	Glass Wool Metal Mesh Blanket	VII.A. 9
Clips for Pipe Strap	VII.A. 14	PVA Finish Coating and Lagging Adhesive	VII.A. 95
Stainless Steel Wire	VII.A. 17	Weather-Barrier Mastic (color as specified)	VII.B.1.a
Welding Pins	VII.A. 19	Reinforcing Cloth	VII.B.1.b
Stainless Steel Pins	VII.A. 20	Stainless Steel Weather Barrier (Designation M)	VII.B.2
Stainless Steel Skewers	VII.A. 21	Treated Steel Weather Barrier (Designation MT)	VII.B.3
Welding Pin Insulation Fasteners	VII.A. 22		

SECTION B - APPLICATION

1. EQUIPMENT

a. Insulation Supports. Equipment shall be provided with insulation supports as specified in Part II of the GENERAL SPECIFICATIONS.

b. Thickness Schedule. Unless otherwise specified, insulation in excess of three inches total thickness shall be applied in multiple layers as specified in Article III.B of the MATERIAL SPECIFICATIONS.

c. Curved Surfaces

(1) On cylindrical equipment larger than 30 inches in diameter, preformed fibrous glass block insulation shall be shop fabricated in curved segments to fit vessel surface, and applied to vessel sides in staggered position.

(2) On cylindrical equipment 30 inches and smaller in diameter, preformed fibrous glass pipe insulation, of the size required to fit the vessel surface, shall be used. See Part 2, Piping, of this section.

(3) Preformed fibrous glass block insulation for vessel heads shall be shop fabricated to fit the contour of the head.

(4) Block insulation shall be applied with all joints tightly butted. Multiple layers shall be applied so that the butt joints of one layer do not coincide with those of any other layer.

d. Flat Surfaces

(1) Block insulation shall be applied to flat surfaces in staggered position with all joints tightly butted. Multiple layers shall be applied so that the butt joints of one layer do not coincide with those of any other layer.

(2) Voids and fastener depressions in insulation shall be pointed up with insulation cement troweled flush with the surface.

e. Flanges. Manhole flanges, blind flanges, and vessel flanges shall be insulated unless otherwise specified.

f. Securement

(1) Curved Surfaces

(a) Where contour of vessel permits firm and effective attachment, all layers of preformed fibrous glass insulation shall be secured in place with stainless steel insulation strap. Where required, insulation strap shall be attached to strap anchor angles in accordance with Owner's

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STANDARD SPECIFICATIONS

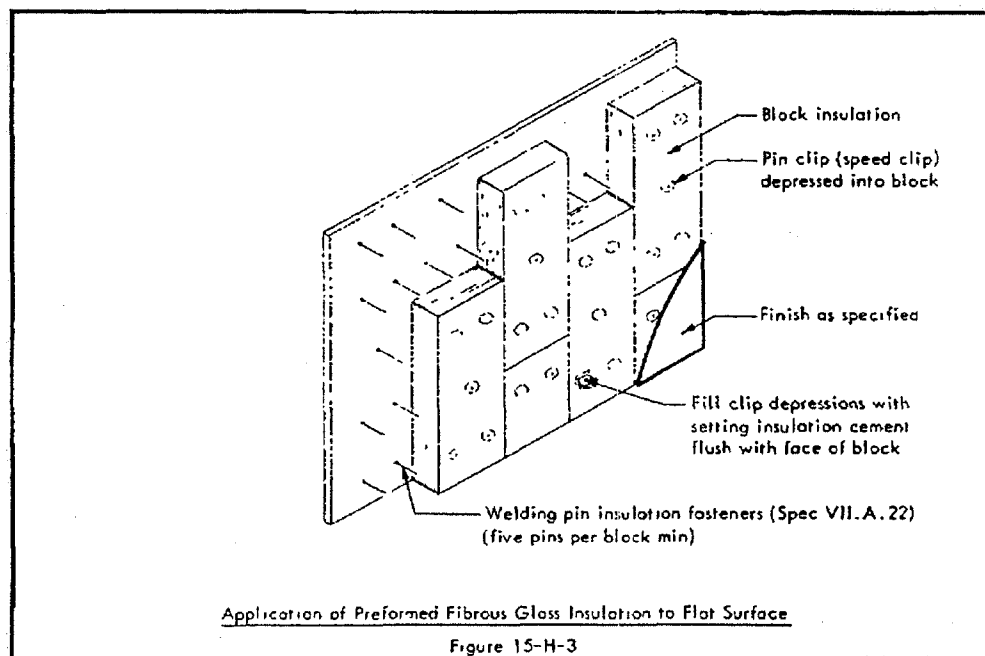
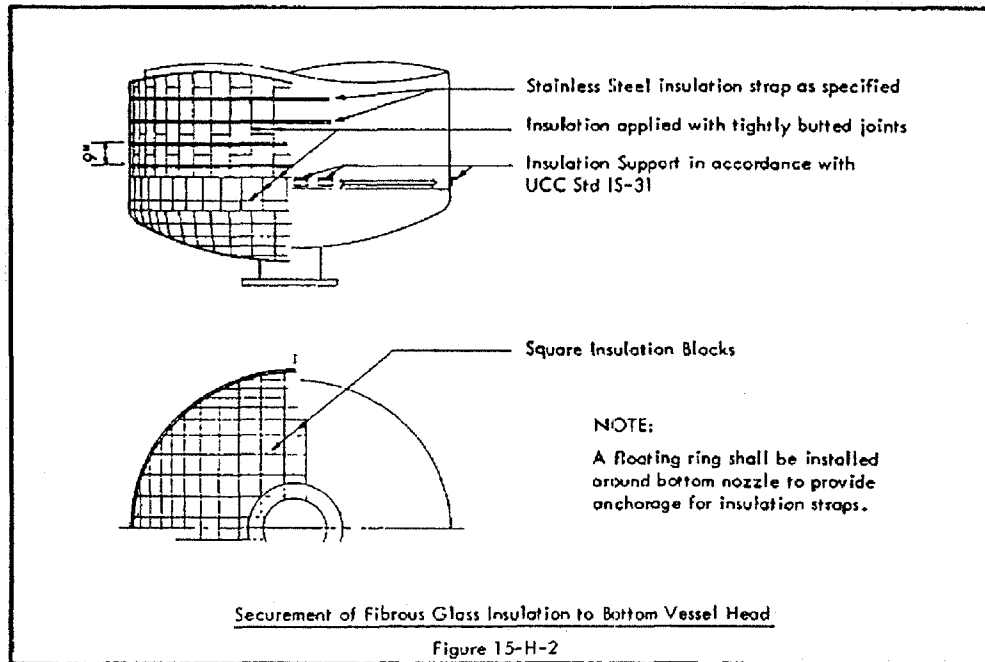


CHEMICALS, OLEFINS, PLASTICS,
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SECTION B - APPLICATION - contd

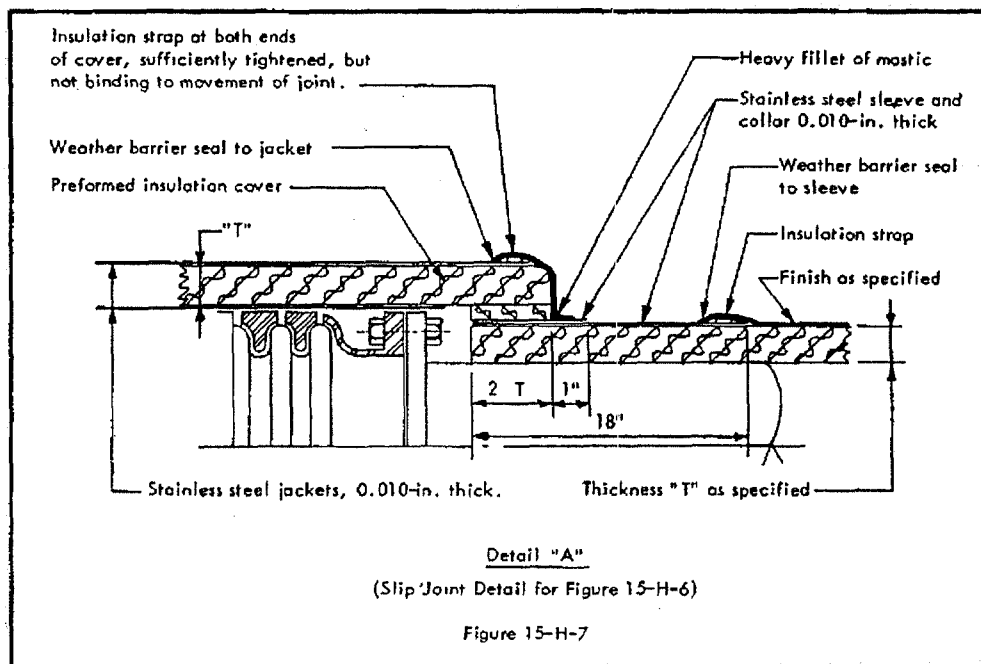
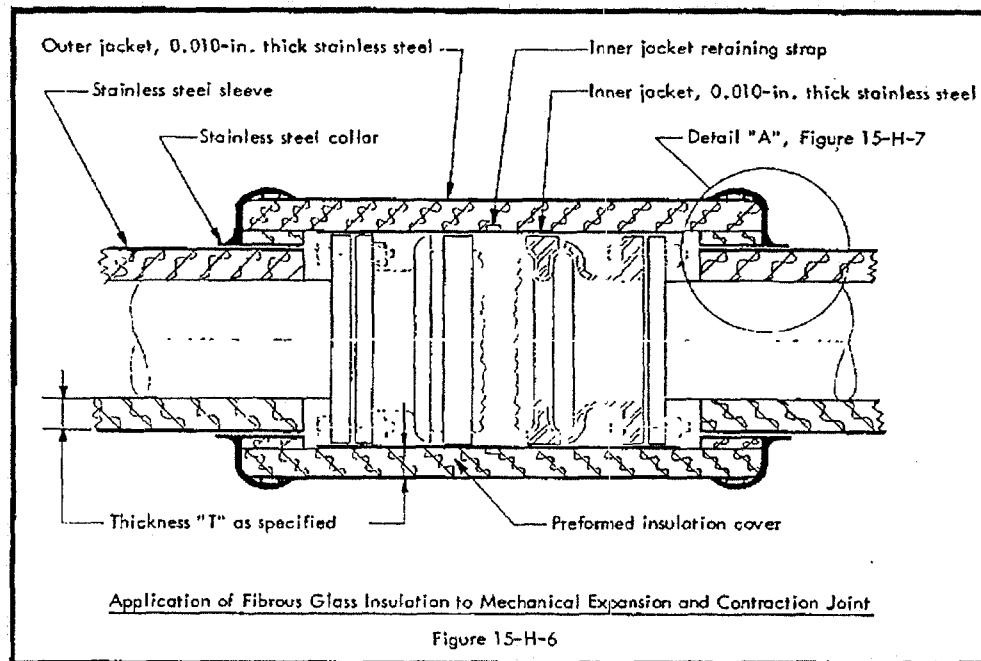
1. EQUIPMENT - contd



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SECTION B - APPLICATION - contd

1. EQUIPMENT - contd



STANDARD SPECIFICATIONS

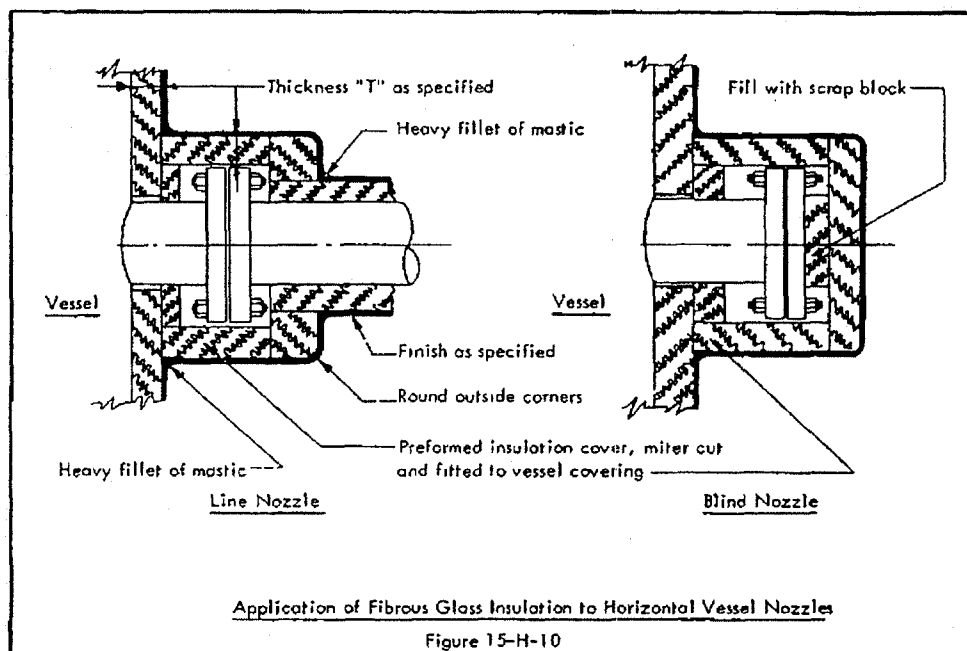
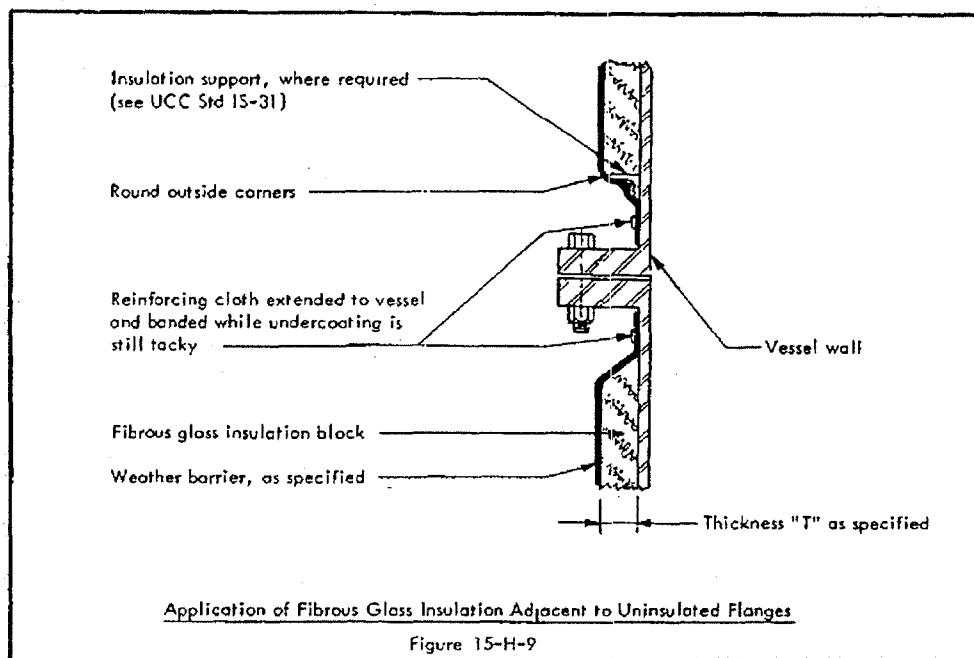


CHEMICALS, OLEFINS, PLASTICS,
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SECTION B - APPLICATION - contd

1. EQUIPMENT - contd



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STANDARD SPECIFICATIONS

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SECTION B - APPLICATION - contd

1. EQUIPMENT - contd

a. Weather Barrier and Jacketing

(1) Outdoor Equipment

(a) Cylindrical Equipment. Weather-barrier coating or jacket shall be applied as specified in Articles XIV.8 and XV.8, respectively, of the GENERAL SPECIFICATIONS.

(b) Flat Surfaces and Heads of Equipment. Weather-barrier coating shall be applied as specified in Article XIV.8 of the GENERAL SPECIFICATIONS.

(2) Indoor Equipment. The specified glass cloth jacket shall be adhered with uniform tautness to the surface of the insulation with bonding adhesive. All joints shall be overlapped a minimum of two inches. After adhesive has dried, the entire surface shall be coated with PVA finish coating (color as specified) to present a uniform color and surface texture.

2. PIPING

a. Pipe Insulation

(1) Pipe insulation shall be supported and secured as specified in Part III of the GENERAL SPECIFICATIONS.

(2) Insulation in excess of 3 inches total thickness shall be applied in multiple layers as specified in Article III.E of the MATERIAL SPECIFICATIONS.

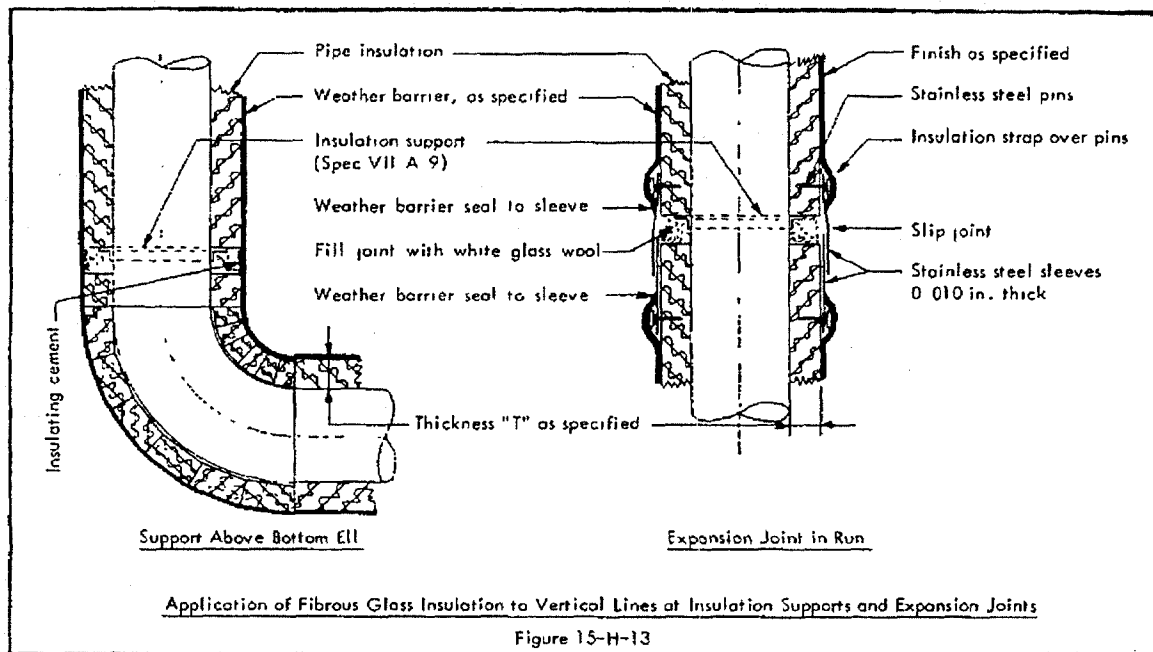
(3) Pipe insulation shall be applied to piping in staggered position in accordance with Figures GA-1 and GA-2 of the GENERAL SPECIFICATIONS.

(4) Insulation shall be applied with all joints tightly butted and fitted to eliminate voids. Large voids shall not be filled with weather-barrier mastic, but eliminated by either refitting or replacing insulation. Any rounded corners on the insulation surfaces to be butted shall be trued before application.

b. Vertical Pipe

(1) Insulation on 4-inch NPS and larger pipe extending more than 15 feet above bottom elbow shall be supported by a pipe insulation support located directly above the elbow. Typical installation is shown in Figure 15-H-13. A pipe insulation support shall also be installed above each pair of flanges or flanged valve in vertical pipe.

(2) When pipe extends more than 15 feet above pipe insulation supports located directly above elbows, flanges or flanged valves, additional supports shall be installed on approximately 15-foot centers to provide for installation of an expansion joint as shown in Figure 15-H-13.



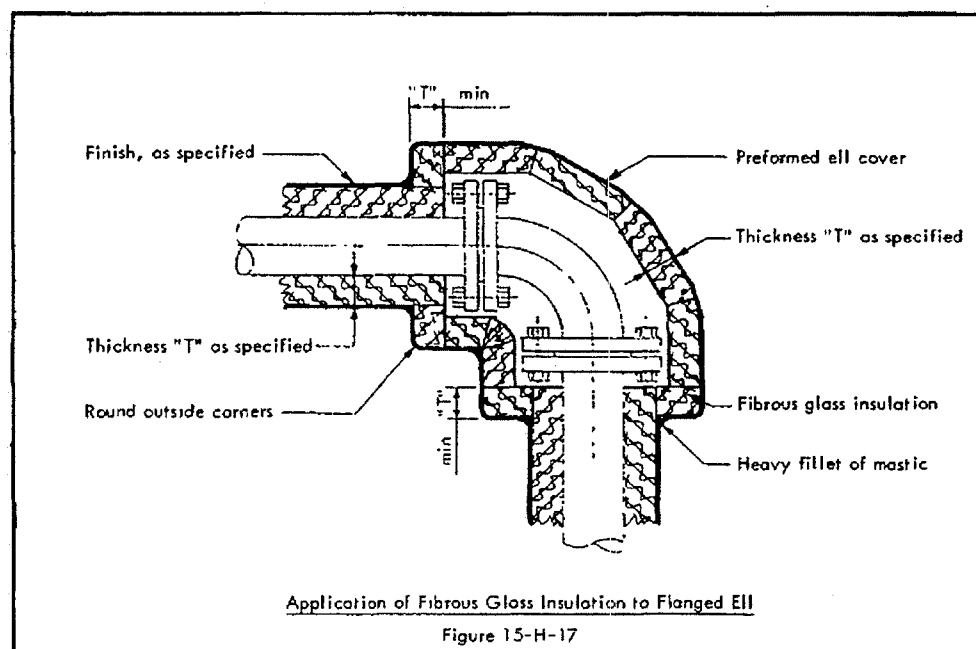
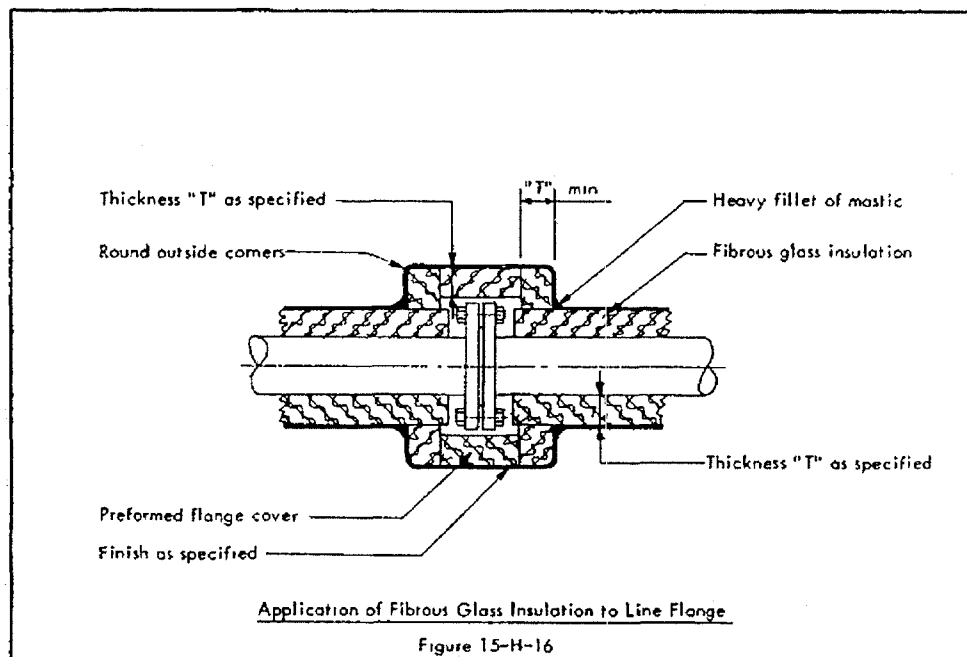
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SECTION 8 - APPLICATION - contd

2. PIPING - contd

c. Fitting, Flange, and Valve Covers - contd

- (4) Screwed and welded fitting covers for three-inch NPS and smaller piping may be field fabricated.
- (5) All valves shall be packed and filled around valve stem and packing gland assembly with heat-resistant sealer to eliminate water pockets.
- (6) Cementing of shop assemblies shall be done with fabricating cement. In all cases the joints shall be as thin as possible with just sufficient cement to obtain good adhesion and complete closure. In no case will wide cement joints, or voids and holes plugged with cement, be permitted

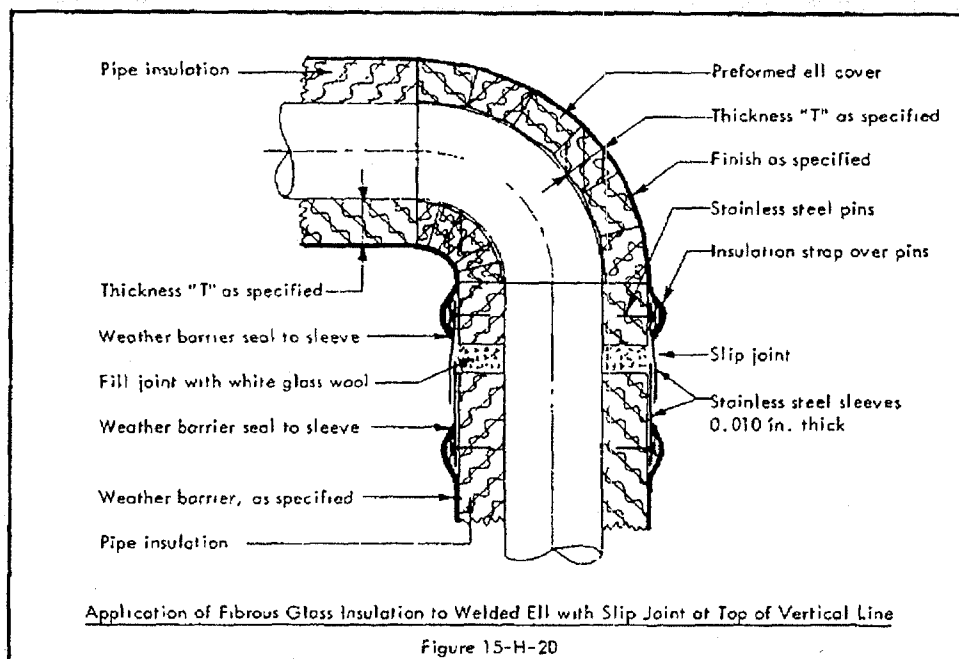


SECTION B - APPLICATION - contd

2. PIPING - contd

d. Expansion and Contraction Joints - contd

- (2) If an expansion or contraction crack occurs after a line has been put in service, the crack shall be filled with white glass wool, and an expansion and contraction joint shall be installed at that location.
- (3) Expansion slip joints shall be installed at the insulation support in vertical piping as shown in Figure 15-H-13.
- (4) Expansion slip joints shall also be provided at the junction of fitting covers and pipe insulation located at the tops of risers where riser exceeds 15 feet in height and pipe is 4-inch NPS and larger. Typical installation is shown in Figure 15-H-20.



e. Traced Installations. Tracing and insulation on traced lines shall be installed as specified in Article XIII of the GENERAL SPECIFICATIONS.

f. Surface Finish. When insulation of the specified thickness has been applied, all small cracks and depressions shall be filled with insulating cement and troweled flush with the surface.

g. Weather Barrier and Jacketing

(1) Outdoor Piping. Weather-barrier coating or jacket, whichever is called for, shall be applied as specified in Articles XIV.B and XV.8, respectively, of the GENERAL SPECIFICATIONS. Mastic weather barrier shall be used unless metal jacket is called for as follows:

(a) Weather barrier consisting of stainless steel jacketing, where required, shall be called for by the addition of the letter M to the specification designation, thus 15-HM.

(b) Weather barrier consisting of treated steel jacketing, where required, shall be called for by the addition of the letters MT to the specification designation, thus 15-HMT.

(2) Indoor Piping

(a) The specified glass cloth jacket shall be adhered with uniform tautness to the surface of the insulation with bonding adhesive. After the adhesive has dried, the entire surface shall be coated with PVA finish coating (color as specified) to present a uniform color and surface texture.

(b) Fitting, flange, and valve covers shall be coated with weather-barrier coating as specified in Article XIV.B of the GENERAL SPECIFICATIONS.

THERMAL INSULATION APPLICATION SPECIFICATIONS

FIBROUS GLASS FLEXIBLE DUCT INSULATION

Faced With Fire-Retardant Vapor Barrier

SCOPE

This specification describes the essential requirements for application of fibrous glass flexible duct insulation faced with fire-retardant vapor barrier for use on the exterior surfaces of heating, ventilating, and air conditioning ducts that are in concealed indoor spaces.

SECTION A - MATERIALS

1. INSULATION MATERIAL

Insulation shall be as specified in MATERIAL SPECIFICATION 18-FX.

2. ACCESSORY MATERIALS

Accessory materials shall be as specified in the MATERIAL SPECIFICATIONS, article numbers as noted.

Fire-Resistant Adhesive VII.A.100

Joint Tape VII.A.104

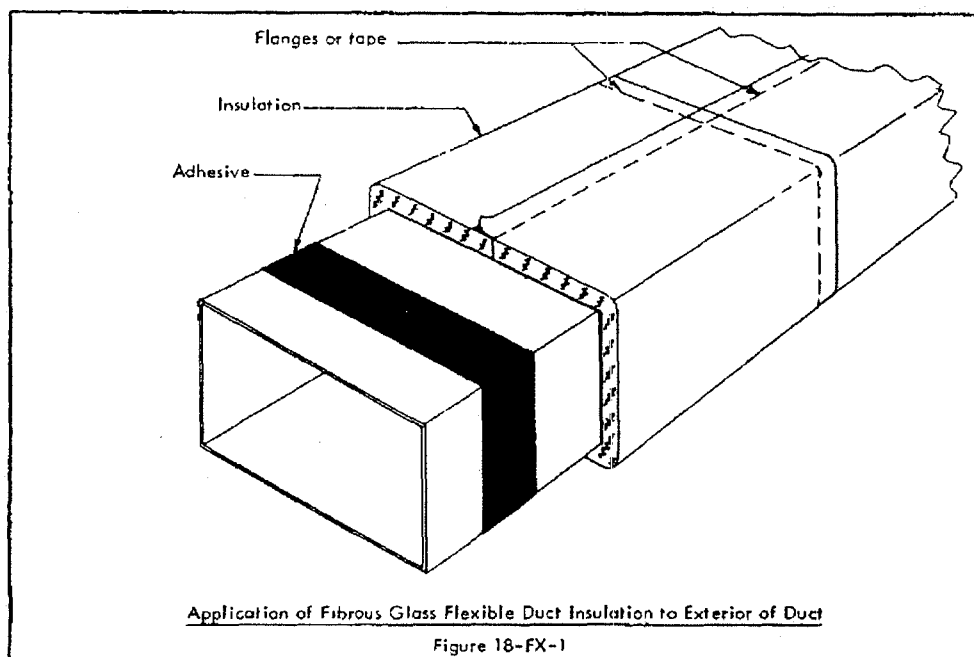
SECTION B - APPLICATION

1. THICKNESS OF INSULATION

Thickness of insulation shall be as scheduled.

2. DUCTS

Insulation shall be adhered to ducts with fire-resistant adhesive. All joints shall be tightly butted and sealed with joint tape or with 2-inch wide flanges of factory-applied vapor-barrier facing adhered to the insulation with fire-resistant adhesive. Typical installation is shown in Figure 18-FX-1.



UNION CARBIDE CORPORATION



CHEMICALS, OLEFINS, PLASTICS
AND SILICONES DIVISIONS

SERVICE SINK - CONCEALED PIPING

ENGINEERING
STANDARD NO.
P-137

CLASSIFICATION

DETAIL

SPONSOR

DEPT 936

REVIEWED BY

S.H. Smith, Jr.

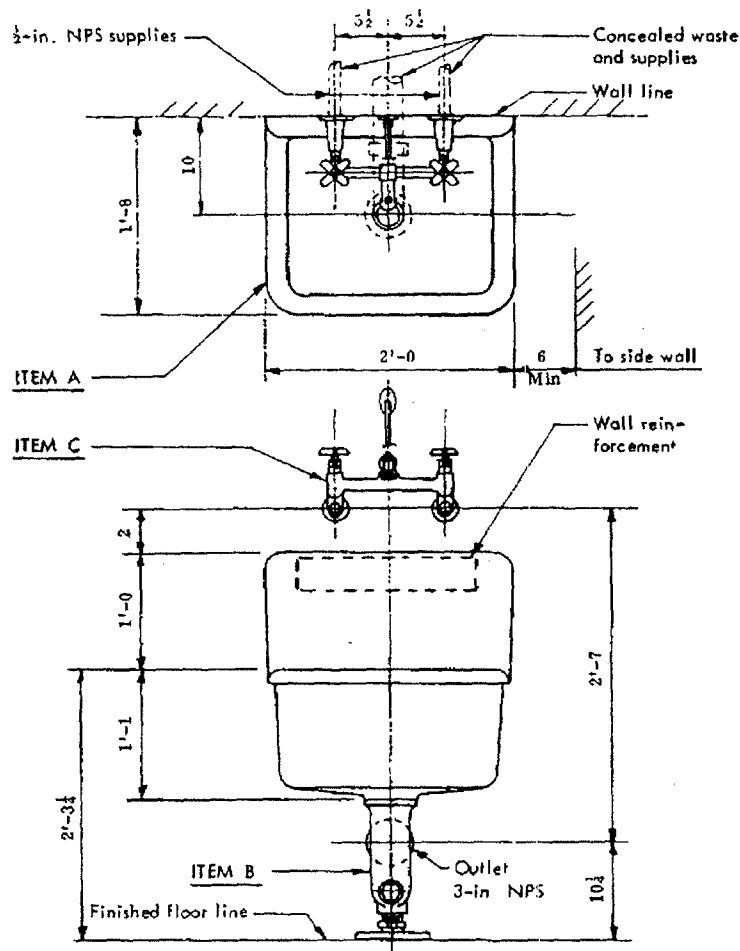
APPROVED BY

R.S. Sullivan

ISSUED

5-20-65

REVISED



BILLING:

ITEM A, As Required,

Service Sinks, each consisting of the following:

- 1 - 24-in. x 20-in. Cast Iron Service Sink, porcelain enameled inside, painted outside, rolled rim, concealed hanger, 12-in. high back.
Crane No. 7-566 or approved equal.

ITEM B, Bill one for each ITEM A.

- 1 - 3-in. adjustable P-Trop Standard, cast iron, porcelain enameled inside, painted outside, 3-in. female NPS outlet, with chromium-plated brass waste strainer, rough brass cleanout plug, gaskets.
Crane No. 7-620 or approved equal.

ITEM C, Bill one for each hot and cold water sink

- 1 - Exposed 1/2-in. NPS Double Service Sink Faucet with Indexed Dial-Ese cross-handle controls; rigid threaded spout for hose, bucket hook, wall brace and integral stops with adjustable screw flanges.

ITEM F, Apply to all Bills of Material for ITEMS A through E.

Roughing-in Prints in QUINTUPLICATE to be sent to the purchaser at _____

NOTE:

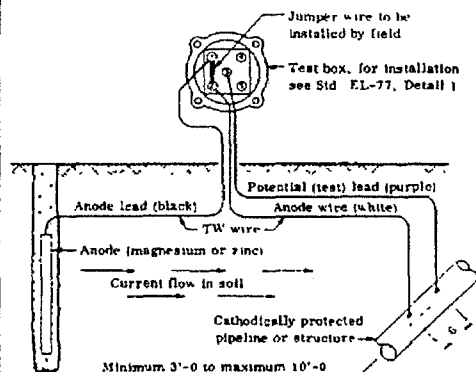
Drawings shall show location of service sink, and refer to this Standard for roughing-in details and complete billing specifications.

Dimensions shown on this Standard apply only to Crane No. 7-566 Service Sinks. For dimensions of other makes of service sinks, see roughing-in prints furnished by Manufacturer.

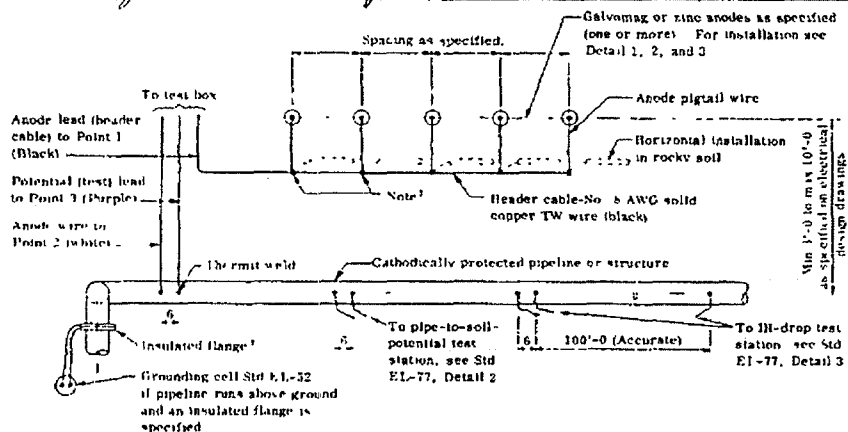
Service sinks in metal buildings shall be mounted on partition walls only.

UNLESS OTHERWISE INDICATED, ALL DIMENSIONS GIVEN IN INCHES.

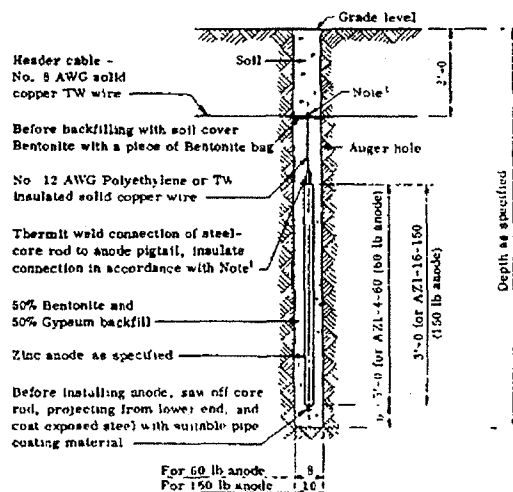
CLASSIFICATION	SPONSOR	REVIEWED BY	APPROVED BY	ISSUED	REVISED
DETAIL	DEPT 936	<i>S.H. Smith, Jr.</i>	<i>H. Comerford</i>	6-1-62	



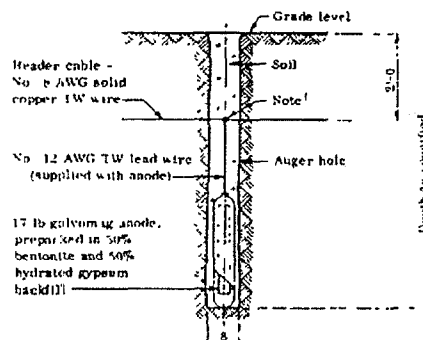
Typical Diagram of a Sacrificial Anode Installation



Typical Anchor Bed Layout Plan



Detail 1, Zinc Anode Installation (Vertical)



Detail 2, Magnesium Anode Installation

4411

All conductors shall be solid copper with 70 insulation, the header cable shall be No. 8 AWG and the test leads shall be No. 12 AWG.

If mechanical protection of conductors is required, plastic conduit or fiber conduit shall be used.

All test leads and anode wires shall be color coded as indicated in the typical anode bed layout plan. If wires are not color coded, they shall be identified by permanently stamped tags or other dependable means. Test leads shall not be spliced, if possible.

All underground wiring shall be installed 24 inches below grade, and sufficient slack shall be provided to allow for any pipe or soil movement.

Thermit Weld equipment and material shall be as manufactured by the Durnidy Corporation (Thermoweld), the Eric Products, Inc. (Cadweld), or Continental Industries (Thermoweld)¹, or approved equal. Thermit Welds shall not be located at places on pipe lines of known major stresses, such as on bends or welds. All Thermit Weld connections shall be coated with "Rovokote" as manufactured by the Royston Laboratories, Inc., Blawnox, Pennsylvania, or approved equal.

All wire connections (anode pigtail to header cables) shall be made with Crimpit³ compression type connectors and four half-lap layers of self vulcanizing rubber tape (as manufactured by Monolithic Cable Company or approved equal), two half lap layers of No. 11 Scotch Tape⁴ and a coat of Scotch-Kote Sealer⁴.

² As manufactured by Krato Plastic Pipe Company, Santa Ana, California, or approved equal.

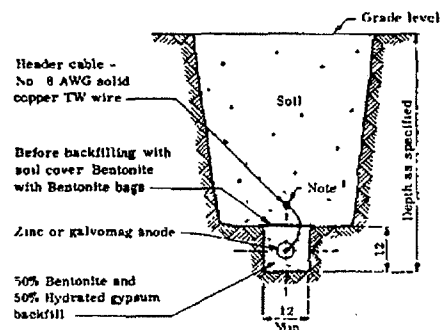
¹ As manufactured by Barnard Corporation, Norwalk, Connecticut, or approved equal.

¹ As manufactured by Minnesota Mining and Manufacturing Company, Saint Paul 6, Minnesota, or approved equal.

³ As manufactured by Erico Products, Inc., Cleveland, Ohio, or approved equal.

^c As manufactured by Continental Industries, Tulsa, Oklahoma, or approved equal.

* Insulated flanges shall be coated with white paint. A permanent tag (plastic or lead, stamped) shall be attached to each insulated flange, containing the following instruction: "Before disassembly or assembly of this insulated flange, notify the plant corrosion engineer."



Detail 3. Anode Installation (Horizontal)

Unless otherwise indicated, all dimensions given in inches

(OVER)

UCASB00217690

ENGINEERING STANDARD NO. EL-76

NOTE:

Underground piping systems are generally provided with cathodic protection systems where soils have a soil resistivity of 10,000 ohm-centimeters or less. Soil resistivity surveys shall be used as guides. A corrosion engineer should be consulted when cathodic protection systems are to be designed.

The sacrificial anode cathodic protection system is employed where it is desirable or sufficient to apply small protective currents.

All cathodic protection systems shall be shown on electrical design drawings, referring to this Standard for the various installation details. Piping drawings shall show the points for the connection of cathodic protection wiring (Thermit-weld or lugs), the locations of any insulated flanges, and if desirable, the location of the anodes. Piping drawings shall also refer to the electrical design drawings showing the cathodic protection system.

The types of anodes used with the sacrificial anode cathodic protection system are magnesium or zinc anodes, or as otherwise specified by the corrosion engineer. If necessary, due to soil conditions, the anodes may be installed horizontally, instead of in the preferred vertical position.

All types of test stations shall be installed in accordance with Standard EL-77 or as otherwise specified by the corrosion engineer. Locations of test stations shall be specified by the corrosion engineer.

Cast iron test boxes with terminal blocks, as are available from C. P. Test Services, Inc, Kearney, New Jersey, may be used where a flush-with-grade installation is specified.

Insulated flanges shall not be detailed on electrical design drawings. The components to convert standard flanges to the insulated type consist of gaskets, bolt sleeves and washers made of Micarta material and are available in kit form from F. H. Maloney Company, Houston 1, Texas. If Micarta is incompatible with the fluid carried by the protected pipeline, suitable gasket material shall be specified.

In order to assure optimum efficiency for a cathodic protection system, scheduled testing shall be specified.

All materials shall be billed from electrical design drawings.

REFERENCES:

Ground Rod Installation - Zinc Anode	Std EL-51
Zinc Anode Grounding Cell	Std EL-52
Test Stations for Cathodic Protection Systems	Std EL-77
Standard Specifications, Cathodic Protection of Underground Steel Pipelines	B260

THERMAL INSULATION APPLICATION SPECIFICATIONS

INHIBITED CALCIUM SILICATE

SCOPE

This specification describes the essential requirements for application of preformed inhibited calcium silicate insulation for use on equipment and piping, including stainless steel, normally operating at temperatures from 70 F up to and including 750 F.

Procedures described in the GENERAL SPECIFICATIONS are applicable to and constitute an integral part of this specification.

SECTION A - MATERIALS

1. INSULATION MATERIAL

Insulation material shall be as specified in MATERIAL SPECIFICATION 23.

2. ACCESSORY MATERIALS

Accessory materials shall be as specified in the MATERIAL SPECIFICATIONS, article numbers as noted.

Cushioning Blanket	VII A 1	Stainless Steel Skewers	VII A 21
Mineral Wool Blanket (wire netting on both sides)	VII A 5	Welding Pin Insulation Fasteners	VII A 22
Insulating Cement	VII A 7	Pin Clips	VII A 23
Pipe Insulation Support	VII A 9	Fabricating Cement	VII A 38
Equipment Insulation Strap	VII A 11	Heat-Resistant Sealer	VII A 42
Clips for Equipment Strap	VII A 12	Mastic	VII A 45
Pipe Insulation Strap	VII A 13	Mineral Wool Blanket (wire netting on one side, expanded metal lath on the other side)	VII A 106
Clips for Pipe Strap	VII A 14	Weather-Barrier Mastic (color as specified)	VII B 1 a
Stainless Steel Wire	VII A 17	Reinforcing Cloth	VII B 1, b
Wire Netting	VII A 18	Stainless Steel Weather-Barrier Jacket (Designation M)	VII B 2
Welding Pins	VII A 19	Treated Steel Weather-Barrier Jacket (Designation MT)	VII B 3
Stainless Steel Pins	VII A 20		

SECTION B - APPLICATION

1. EQUIPMENT

a. Insulation Supports. Equipment shall be provided with insulation supports as specified in Article II of the GENERAL SPECIFICATIONS.

b. Thickness Schedule. Unless otherwise specified, insulation in excess of three inches total thickness shall be applied in multiple layer construction as specified in Article III.B of the MATERIAL SPECIFICATIONS.

c. Cushioning Blanket. On all equipment operating above 500 F and 12 feet and larger in diameter, a one-inch thick white glass wool cushioning blanket shall be applied over the entire surface before application of the calcium silicate insulation. The blanket shall not be compressed and shall be secured in place with a minimum amount of stainless steel wire. Cushioning blanket shall not be considered as part of the specified insulation thickness.

d. Curved Surfaces. On all equipment insulation block shall be properly cut in curved sectors and rectangular blocks, as required, to fit vessel surfaces with a one-inch space allowed for cushioning blanket where used and applied to vessel sides and heads in staggered position with all joints tightly butted. Multiple layers shall be applied so that the butt joints of one layer do not coincide with those of any other layer. Typical installation is shown in Figure 23-HSS-1.

e. Flat Surfaces

(1) Block insulation shall be applied to flat surfaces in staggered position with all joints tightly butted. It shall be secured with wire attached to welding pins as shown in Owner's Standard IS-40, or other approved securement. On rectangular equipment, the welding pins, or other approved securements, shall be placed on 12-inch centers, diamond pattern, for bottom surfaces, and on 24-inch centers, diamond pattern, for side surfaces and on 24-inch centers, diamond pattern, for top surfaces. Where specified in the Insulation Design Schedule, block may be applied to flat surfaces with an approved adhesive.

(2) When specified thickness of insulation has been applied, wire netting shall be stretched tightly over block and secured with tie wires or other approved securement. Entire surface shall be given a 1/2-inch thick, smooth and uniformly applied trowel coat of setting insulating cement. Typical installation is shown in Figure 23-HSS-2.

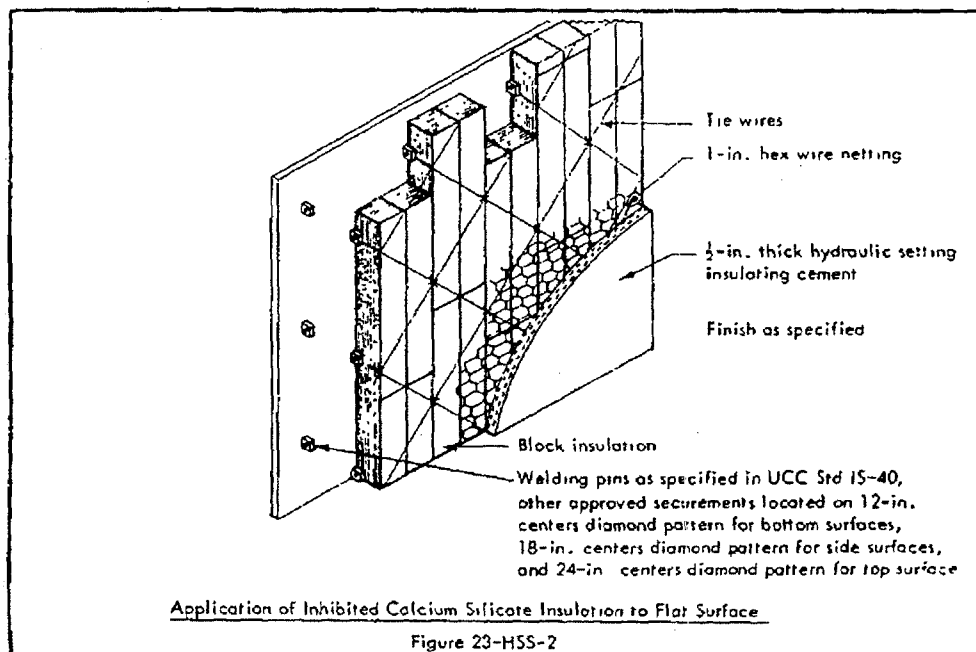
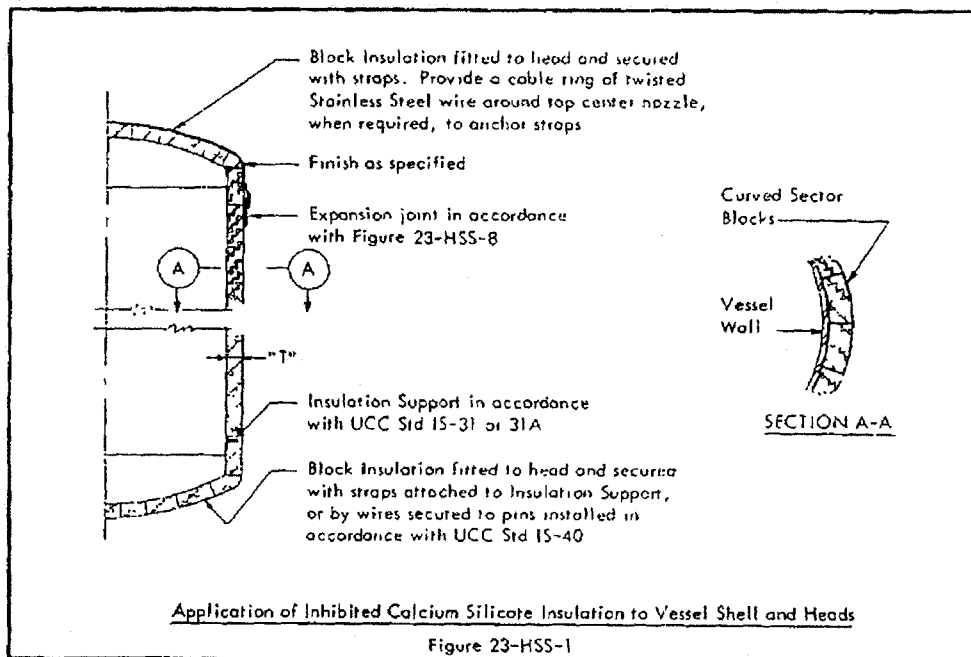
f. Securement

(1) All layers of insulation shall be secured with insulation strap where contour of vessel permits firm and effective attachment. Where required, insulation strap shall be attached to strap anchor angles as shown in Owner's Standard IS-31A. Insulation applied to irregular surfaces, where use of strap is impracticable, shall be secured with wire fastened to welding pins, drawn taut, ends twisted and embedded in insulation.

(2) All layers of insulation on bottom heads of vertical equipment and heads of horizontal equipment shall be secured in place with wire attached to welding pins or with insulation strap attached to insulation support as shown in Owner's Standards IS-31 and IS-40, and in Figure 23-HSS-3.

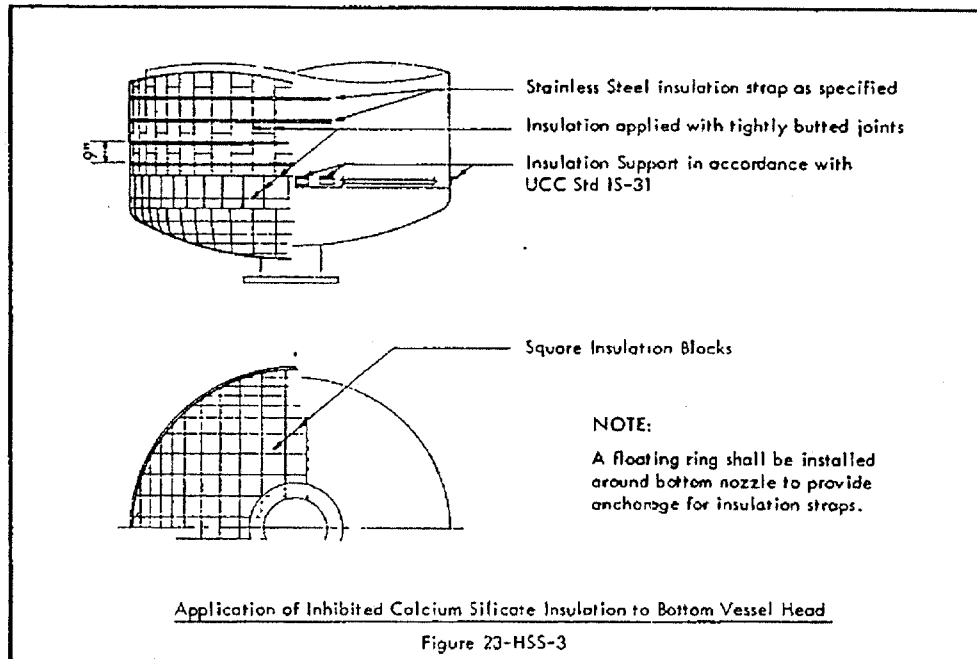
SECTION B - APPLICATION - contd

1. EQUIPMENT - contd



SECTION B - APPLICATION - contd

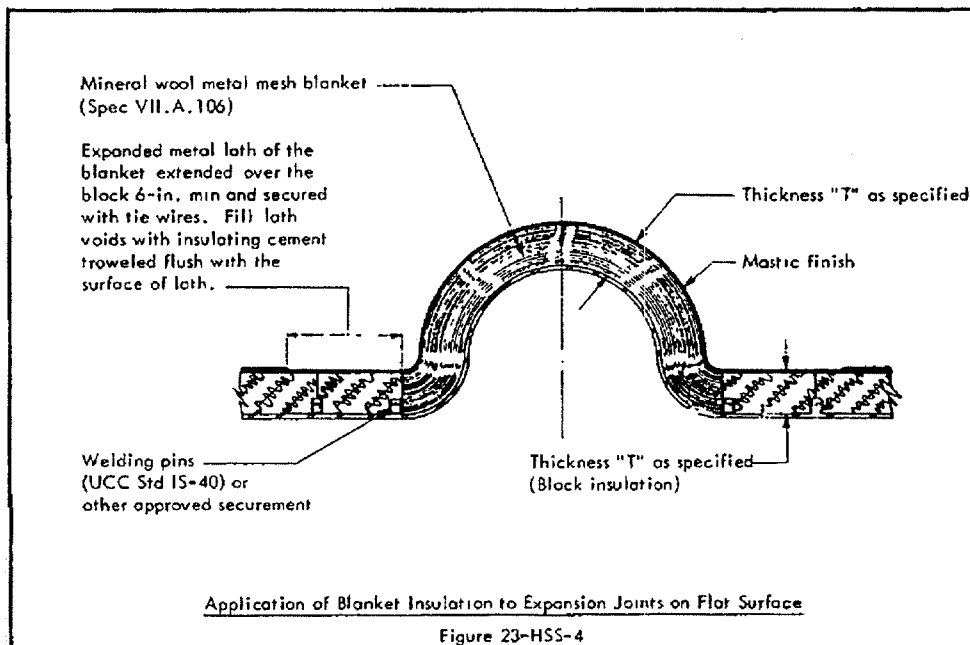
1. EQUIPMENT - contd



g. Flanges. Manhole flanges, blind flanges, and vessel flanges shall be insulated unless otherwise specified.

h. Expansion Joints

(1) Expansion joints in flat surfaces or cylindrical vessels shall be insulated with flexible blanket insulation. Typical installation is shown in Figure 23-HSS-4.



SECTION B - APPLICATION - contd

I EQUIPMENT - contd

h Expansion Joints - contd

(2) Corrugated mechanical expansion joints in piping (usually listed as equipment items) shall be insulated as shown in Figures 23-HSS-5 and 23-HSS-5A. A slip joint shall be provided by applying an 18-inch long sleeve of 0.010 inch thick stainless steel over the pipe insulation at each end of the expansion joint, placed flush with the butt end of the pipe covering. The sleeve shall be secured with strap at one end only, that farthest from the expansion joint cover. A collar band of 0.010-inch thick stainless steel of sufficient length to project one inch beyond the expansion joint insulation cover shall be applied over the sleeve and held in place by the expansion joint cover which is then secured with insulation strap. The longitudinal laps of the stainless steel bands shall be a minimum of two inches and shall be placed so as to shed water. Weather-barrier mastic shall be applied to the ends of the expansion joint cover and carried down and sealed to the collar band. Weather-barrier mastic shall overlap the stainless steel weather jacket on the expansion joint cover.

Where expansion joints are installed vertically in piping, the slip joint at the top shall be omitted and the expansion joint cover securely fastened to the pipe covering.

i. Insulated Vessel Flanges. Vessel flanges shall be insulated with preformed insulation assembly and weather protected by stainless steel jacket. An insulation support shall be provided immediately above vessel flange. Assembly shall be installed so as to provide slip joints which allow movement of insulation and weather-barrier jacket. Typical installation is shown in Figure 23-HSS-6.

j. Uninsulated Vessel Flanges. Where vessel flanges are uninsulated, the reinforcing cloth of the weather barrier on the adjacent vessel insulation shall be extended to metal vessel body, coated with weather-barrier coating, and banded while coating is still tacky. A second application of weather-barrier coating shall then be applied over the reinforcing cloth and securement. Typical installation is shown in Figure 23-HSS-7.

k. Insulation Support. A slip joint shall be provided at each insulation support except the bottom support on vertical vessels, and at each insulation support without exception on horizontal vessels. Typical installation is shown in Figure 23-HSS-8.

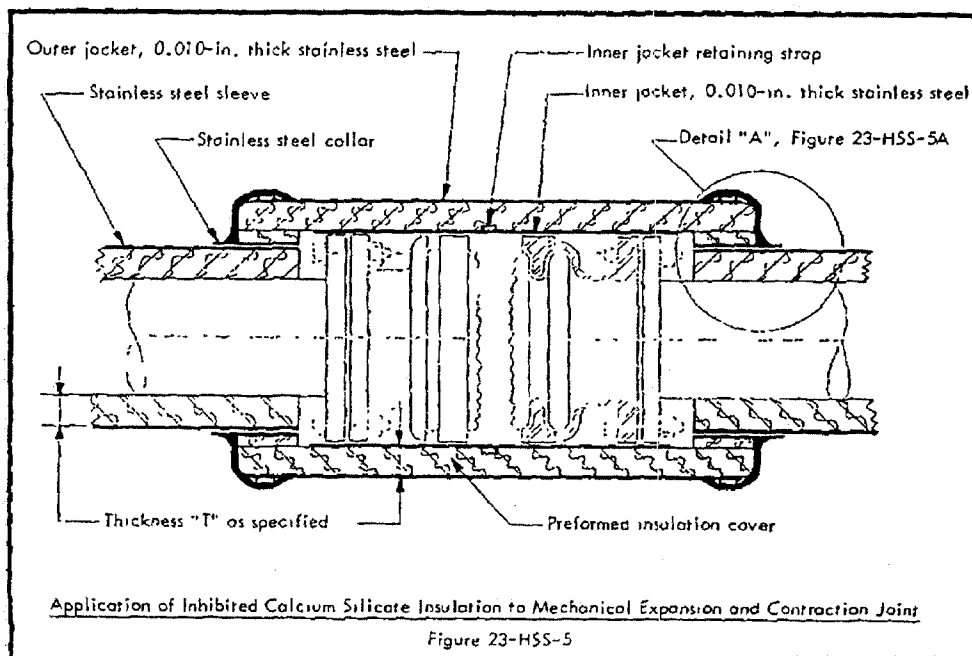
l. Vessel Nozzles. Vessel nozzles shall be insulated as shown in Figure 23-HSS-9 and 23-HSS-10.

m. Vessel Legs

(1) Concrete-filled structural tubing legs shall be insulated as specified in Article V.C of the GENERAL SPECIFICATIONS.

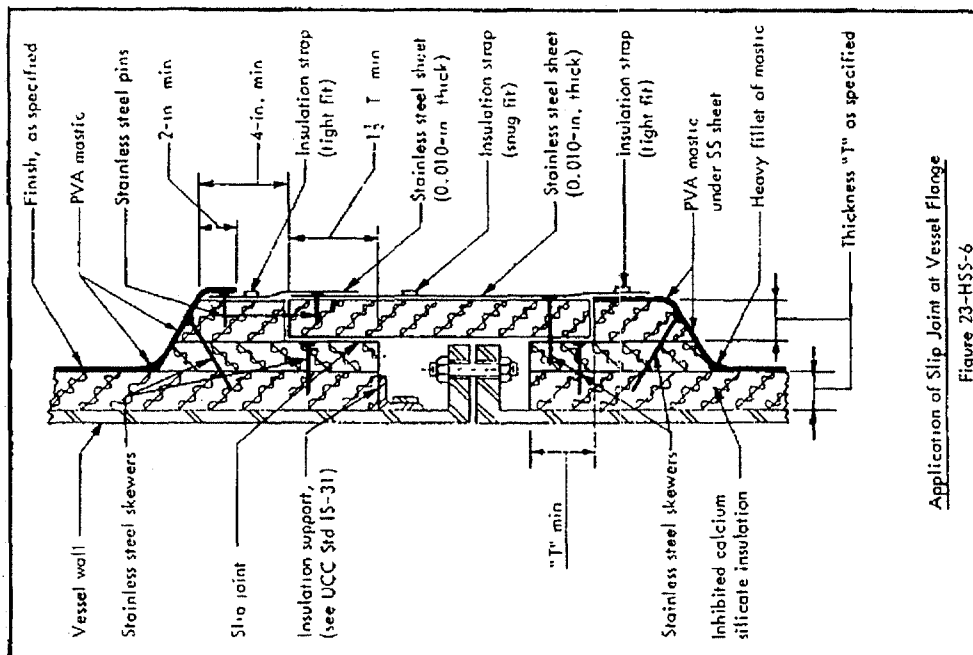
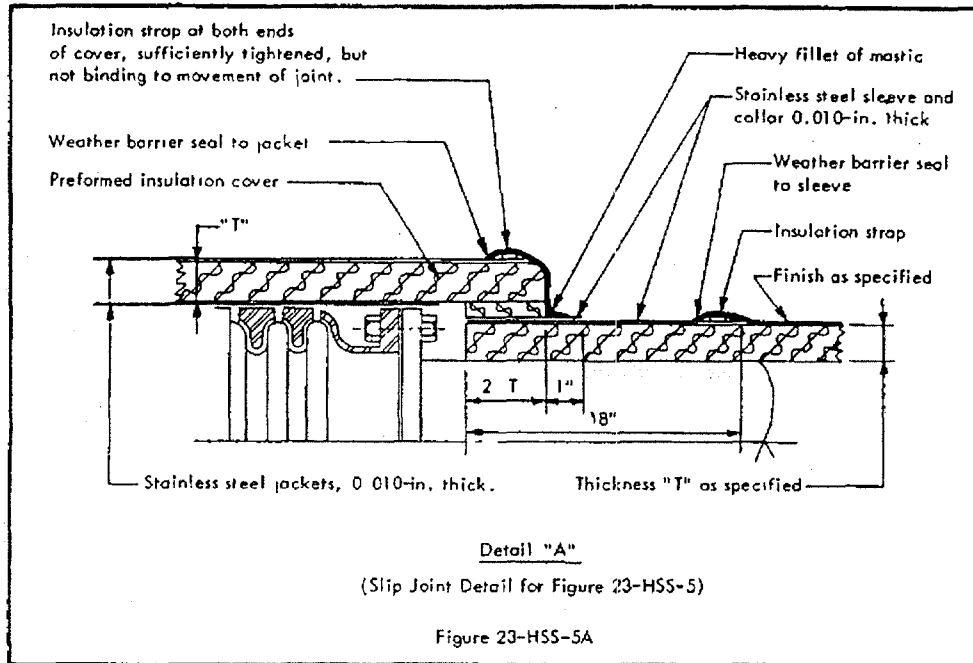
(2) Channel legs shall be insulated with block which shall extend over channel flanges and down channel legs to fireproofing. Thickness shall be a minimum of one-half that specified for body of vessel.

(3) Vessel insulation shall be butted firmly against tank leg flange. Reentrant space between channel flanges and over channel flanges between body insulation shall be filled with block. Installation shall be as shown in Figure 23-HSS-11.



SECTION B - APPLICATION - contd

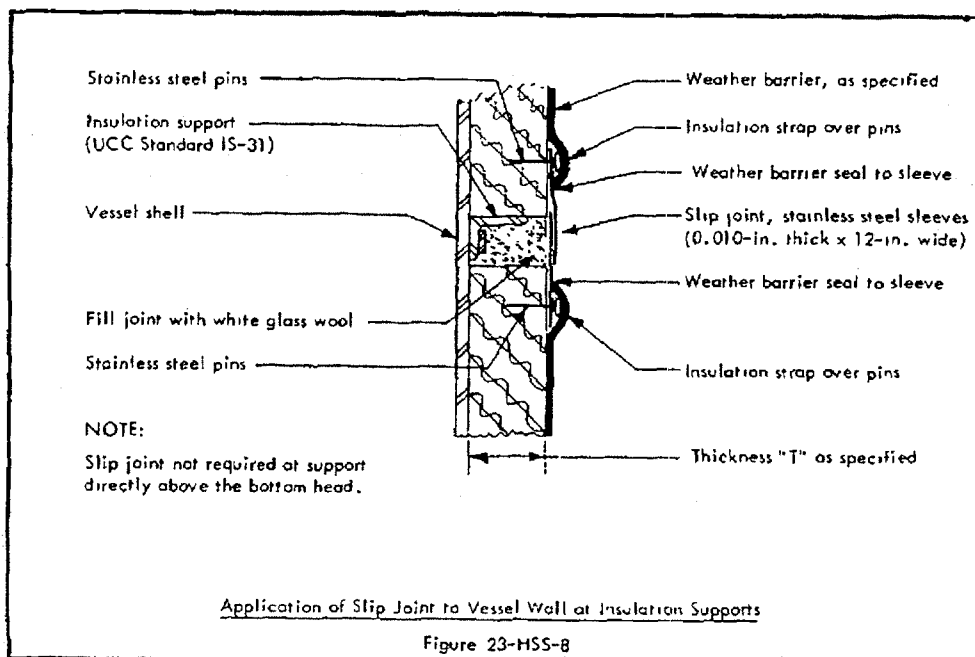
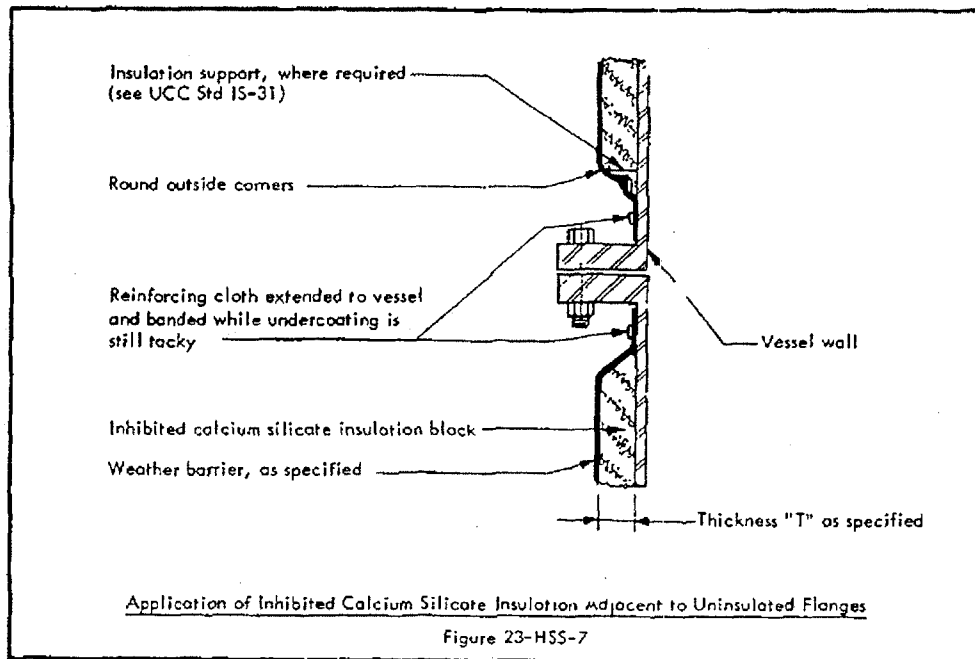
1. EQUIPMENT - contd





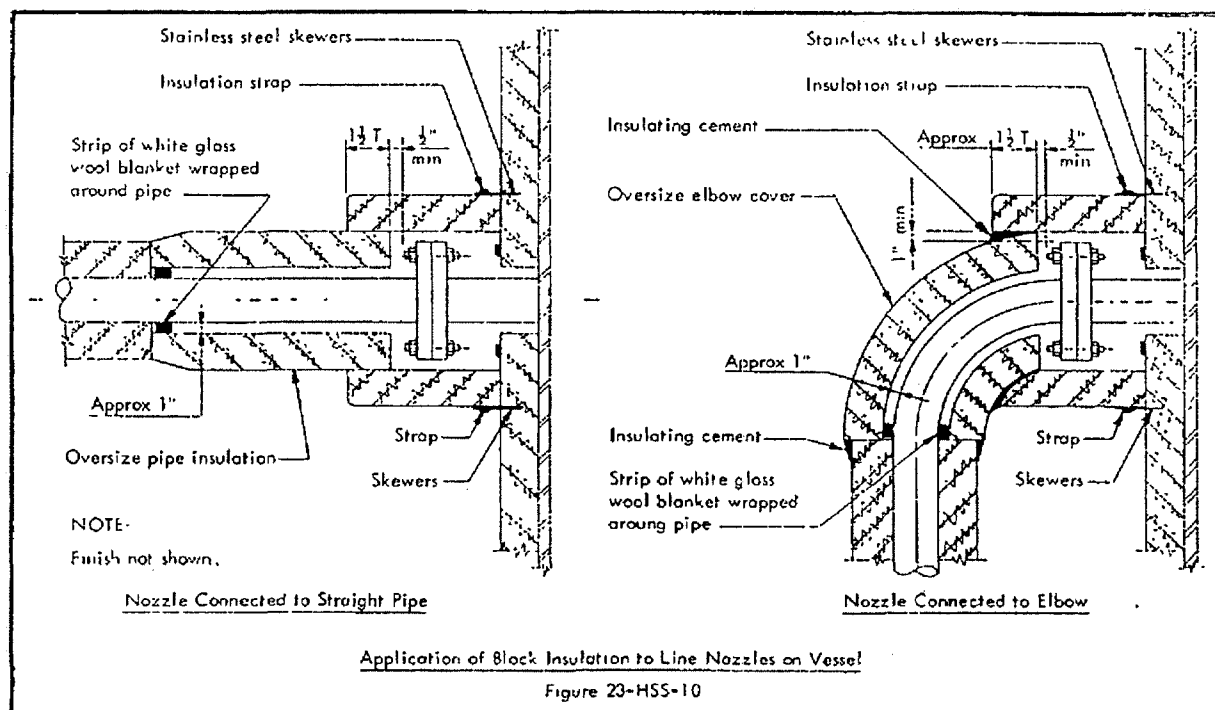
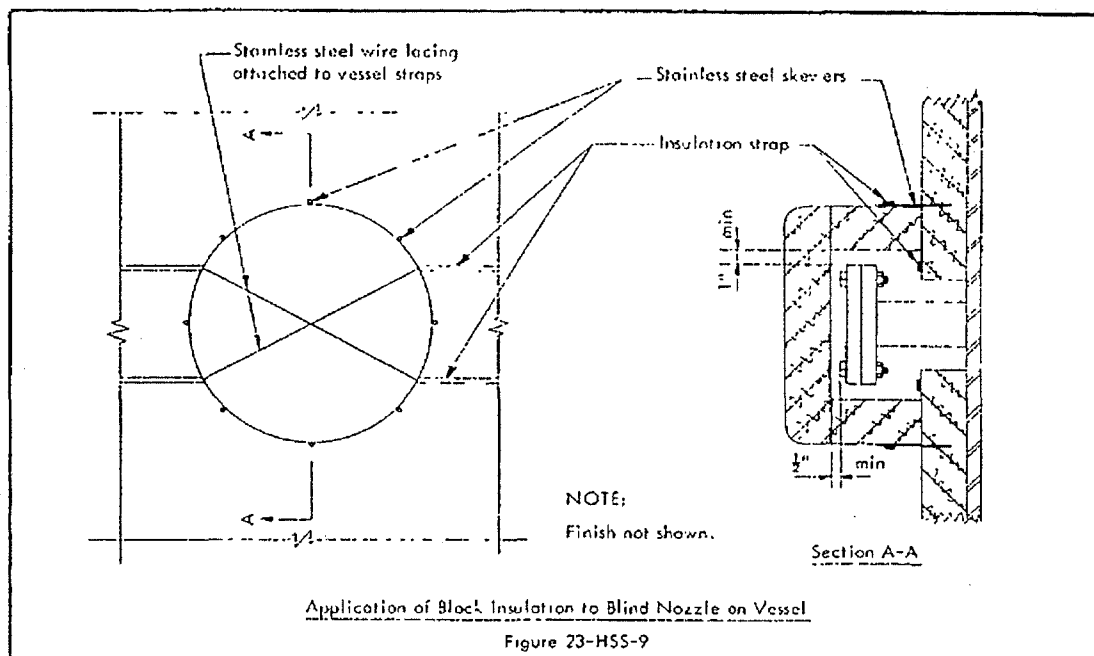
SECTION B - APPLICATION - contd

1. EQUIPMENT - contd



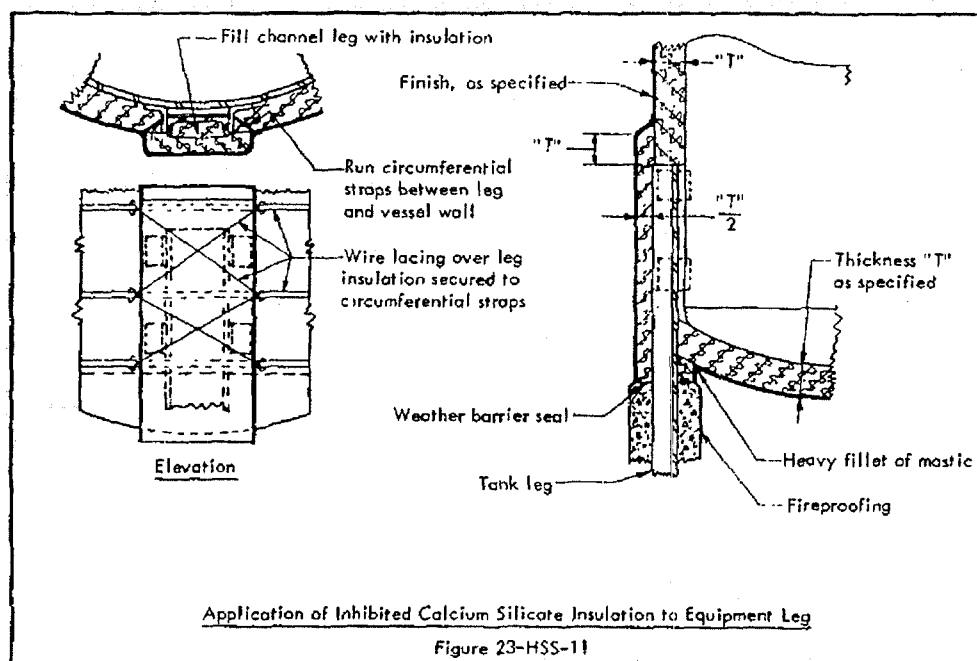
SECTION B - APPLICATION - contd

1 EQUIPMENT - contd

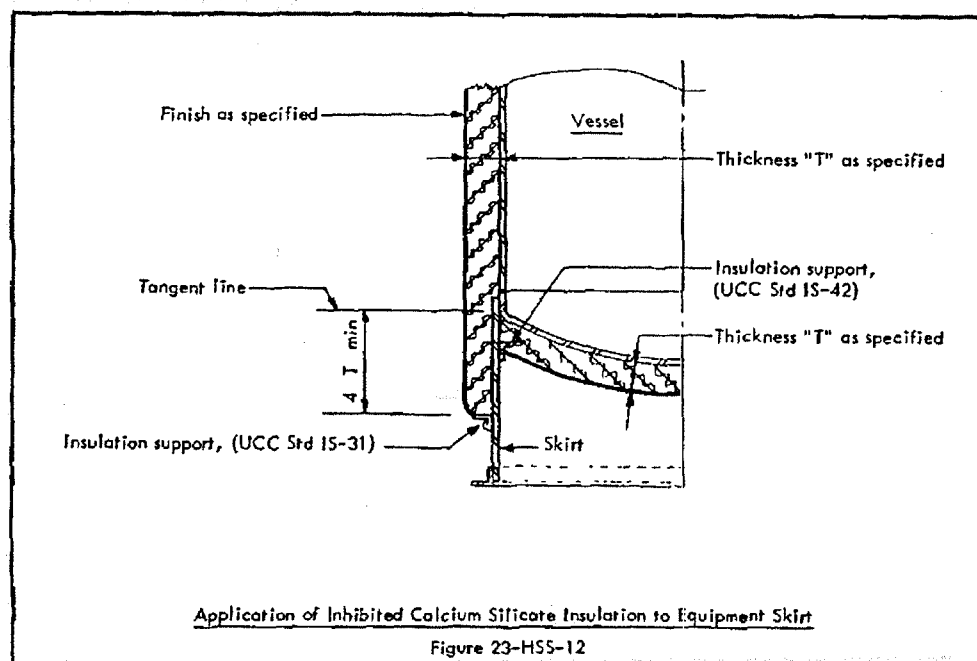


SECTION B - APPLICATION - contd

1. EQUIPMENT - contd



n. Vessel Skirts. Skirts supporting vertical equipment shall have their outer surfaces insulated. Unless otherwise specified, insulation shall extend downward from junction of skirt with bottom head a minimum of four times the specified thickness but not less than 12 inches, or to bottom of skirt if that distance is less than 12 inches. Thickness shall be as specified for body of vessel. The bottom head insulation shall be supported in accordance with Owner's Standard IS-40 or IS-42. Installation shall be as shown in Figure 23-HSS-12.



SECTION B - APPLICATION - contd

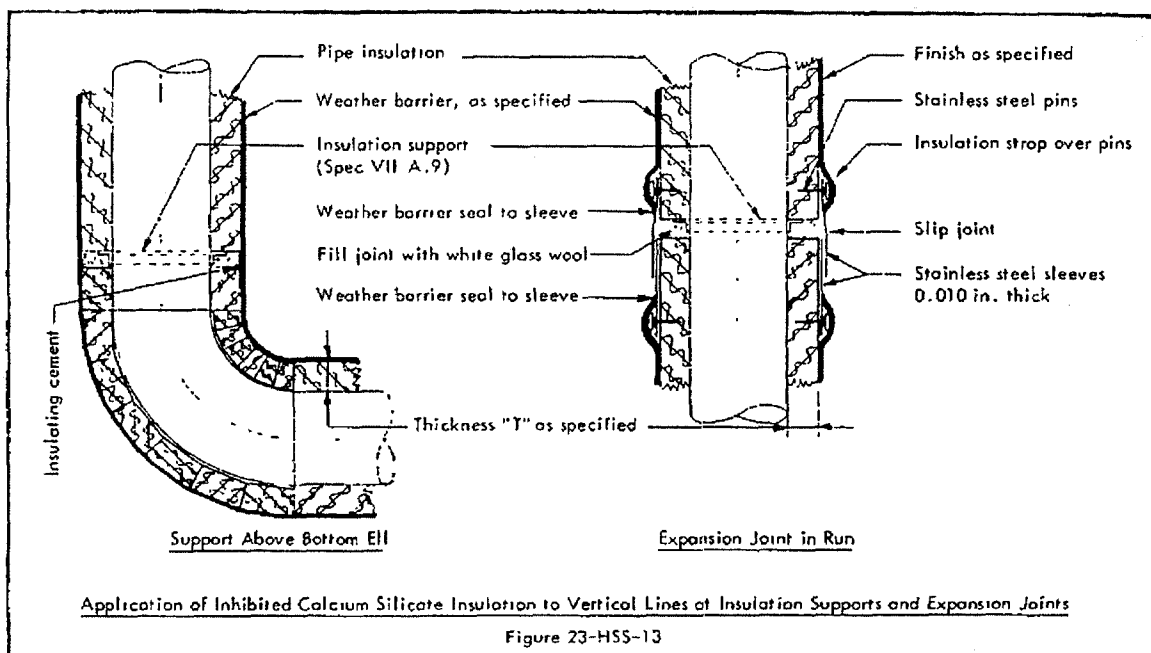
1. EQUIPMENT - contd

- o. Traced Installations. Tracing and insulation on traced equipment shall be installed as specified in Article XIII of the GENERAL SPECIFICATIONS.
- p. Surface Finish. When specified thickness of insulation has been applied, any small cracks or depressions shall be pointed up with insulation cement and troweled flush with surface of insulation.
- q. Weather Barrier. Weather-barrier coating or jacket, whichever is called for, shall be applied as specified in Articles XIV.B and XV.B, respectively, of the GENERAL SPECIFICATIONS. Mastic weather barrier shall be used unless metal jacket is called for as follows:
 - (1) Weather barrier consisting of stainless steel jacketing, where required, shall be called for by the addition of the letter M to specification designation, thus 23-HM or 23-HSSM.
 - (2) Weather barrier consisting of treated steel jacketing, where required, shall be called for by the addition of the letters MT to the specification designation, thus 23-HMT or 23-HSSMT.

2. PIPING

a. Pipe Insulation

- (1) Insulation Supports. Pipe insulation shall be supported and secured as specified in Article III of the GENERAL SPECIFICATIONS.
- (2) Thickness Schedule. Unless otherwise specified, insulation in excess of three inches total thickness shall be applied in multiple layer construction as specified in Article III.B of the MATERIAL SPECIFICATIONS.
- (3) Vertical Pipe
 - (a) Insulation on 4-inch NPS pipe and larger extending more than 15 feet above the bottom elbow shall be supported by a pipe insulation support located directly above the elbow. Typical installation is shown in Figure 23-HSS-13. A pipe insulation support shall also be installed above each pair of flanges or flanged valve in vertical pipe.
 - (b) When pipe extends more than 15 feet above pipe insulation supports located directly above elbows, flanges or flanged valves, additional supports shall be installed on approximately 15-foot centers to provide for installation of expansion joint as shown in Figure 23-HSS-13.



STANDARD SPECIFICATIONS



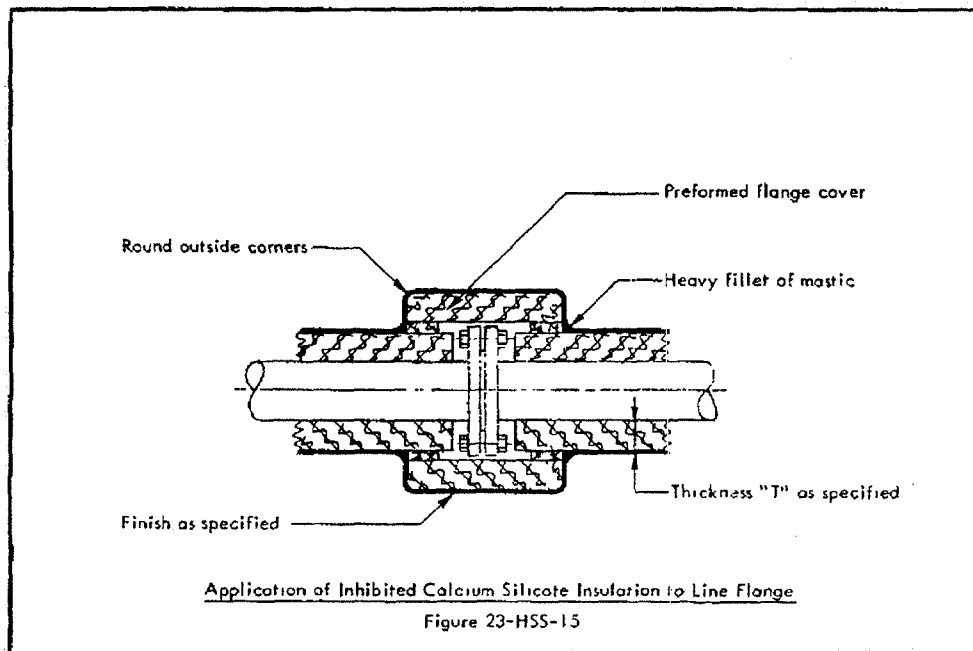
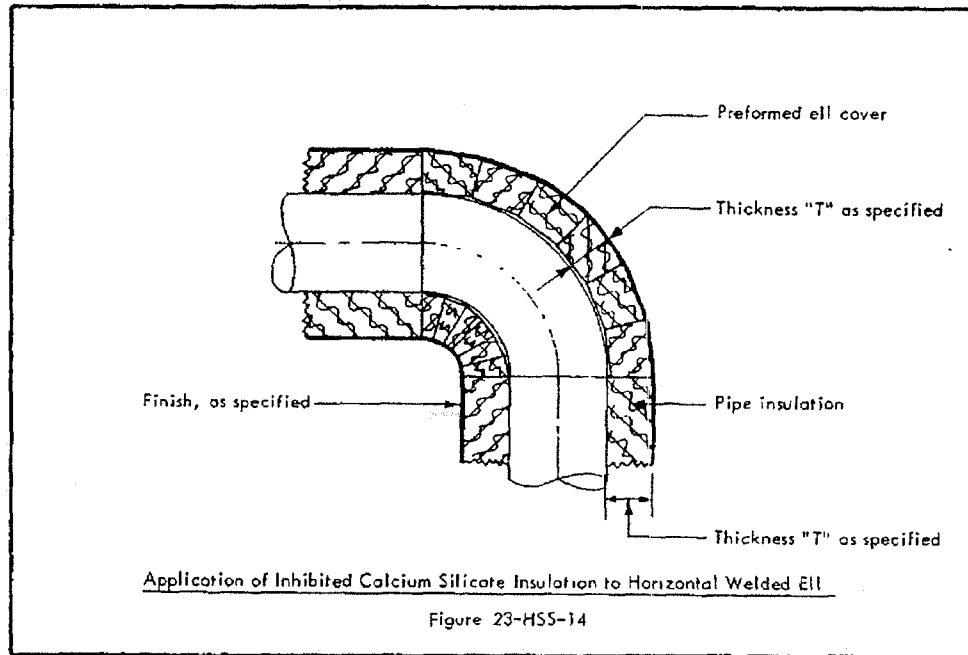
CHEMICALS, OLEFINS, PLASTICS,
SILICONES DIVISIONS AND
UNION CARBIDE CANADA

SECTION B - APPLICATION - contd

2. PIPING - contd

b. Fitting, Flange, and Valve Covers

- (1) With exception of ball and plug valves, all fittings, flanges, and valves over three-inch NPS shall be insulated with covers prefabricated in accordance with ASTM Recommended Practice C 450, latest revision.
- (2) Ball and plug valve covers shall be field fabricated of proper sized pipe covering.
- (3) Screwed and welded fitting covers for three-inch NPS and smaller piping may be field fabricated.



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STANDARD SPECIFICATIONS



CHEMICALS, OLEFINS, PLASTICS,
SILICONES DIVISIONS AND
UNION CARBIDE CANADA

23-H, 23-HSS
INSULATION

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JULY 1966

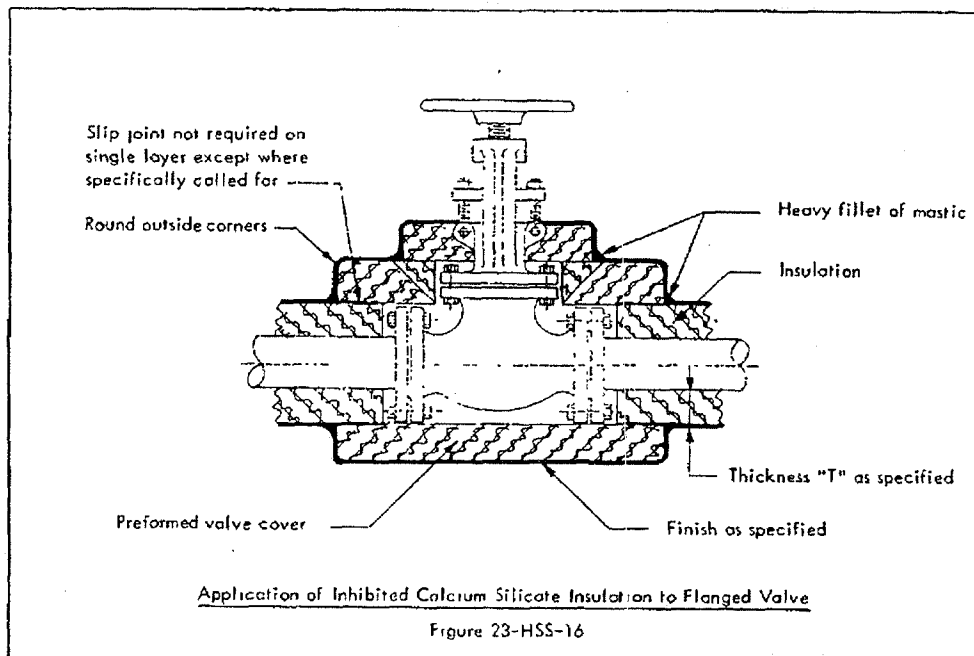
SECTION B - APPLICATION - contd

2. PIPING - contd

b. Fitting, Flange, and Valve Covers - contd

(4) Fitting insulation shall be secured with wire or strap as required.

(5) Insulation for all fittings shall be fitted and assembled with tight joints. Cementing of prefabricated assemblies shall be done with fabricating cement. In all cases the joints shall be as thin as possible with just sufficient cement to obtain good adhesion and complete closure. In no case will wide cement joints, or voids and holes plugged with cement, be permitted. Typical covers are shown in Figures 23-HSS-14, 23-HSS-15, and 23-HSS-16



c. Expansion Joints

(1) Expansion slip joints shall be provided in the insulation for horizontal piping 4-inch NPS and larger. An expansion joint shall be installed in each 21 feet of straight piping not interrupted by flanges, valves, or fittings, and insulated with multiple layer insulation, and each 42 feet insulated with single layer insulation. Typical installation is shown in Figure 23-HSS-17. If an expansion crack occurs after the line has been put in service, the crack shall be filled with white glass wool and an expansion joint shall be provided at that location.

(2) The expansion slip joints shall be installed at the insulation support in vertical piping as shown in Figure 23-HSS-13.

(3) Expansion slip joints shall be provided at junction of fitting covers and pipe insulation located at the tops of risers where riser exceeds 15 feet in height and pipe is 4-inch NPS or larger, for multiple layer applications. Typical installation is shown in Figure 23-HSS-18.

(4) Where flanged fittings or valves occur within these intervals, expansion shall be provided for in the flange cover, and expansion joints in the insulation will not be required.

d. Traced Installations. Tracing and insulation on traced lines shall be installed as specified in Article XIII of the GENERAL SPECIFICATIONS.

e. Surface Finish. Where present, small cracks and depressions shall be filled and smoothed with insulating cement before application of weather barrier.

f. Weather Barrier. Weather barrier coating and jackets, whichever is called for, shall be applied as specified in Articles XIV, B and XV, B, respectively, of the GENERAL SPECIFICATIONS. Mastic weather barrier shall be used unless metal jacket is called for as follows:

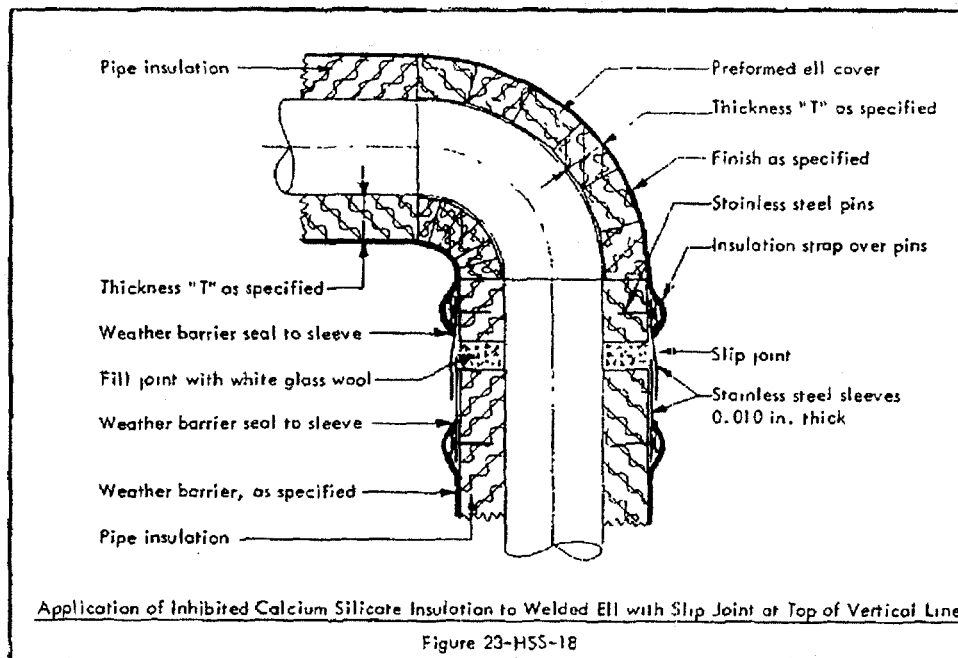
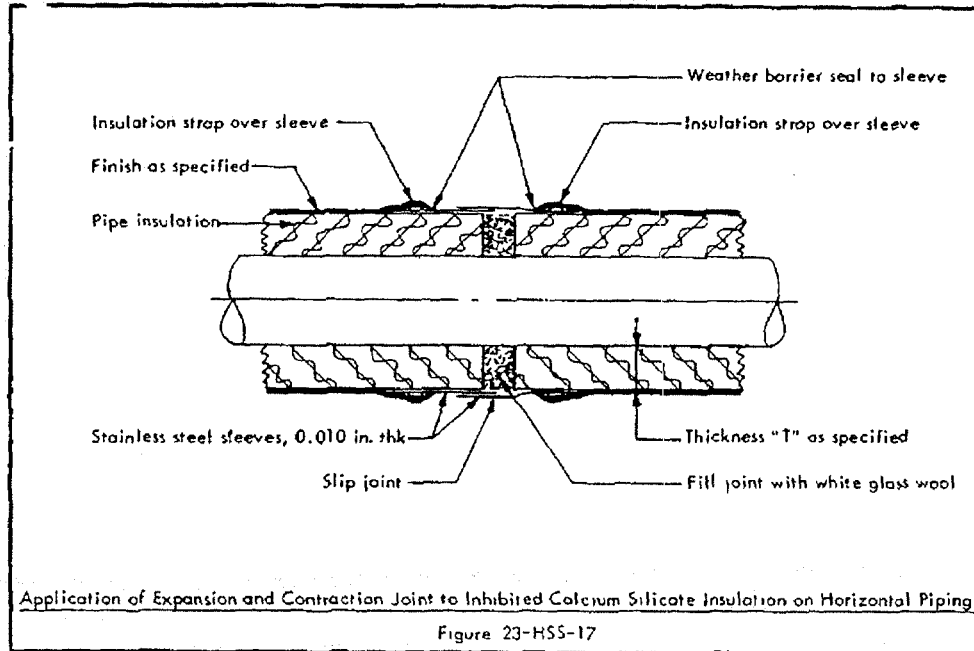
(1) Weather barrier consisting of stainless steel jacketing, where required, shall be called for by the addition of the letter M to the specification designation, thus 23-HM or 23-HSSM.

(2) Weather barrier consisting of treated steel jacketing, where required, shall be called for by the addition of the letters MT to the specification designation, thus 23-HMT or 23-HSSMT.

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SECTION B - APPLICATION - contd

2. PIPING - contd





STANDARD

CHEMICALS AND PLASTICS OPERATIONS DIVISION
AND UNION CARBIDE CANADA LIMITED

B280
Fire Protection
1 of 3
Dec 66

SPECIFICATIONS FOR SPRINKLER SYSTEMS

SECTION A — GENERAL CONDITIONS

1. SCOPE

These specifications cover the design, installation, and testing of sprinkler systems of all types, as described in NFPA Standard No. 13, Latest Revision. The type and number of sprinkler systems required is stated in an addendum to these specifications.

2. DEFINITIONS

As applied in these specifications

- a. "Contractor" designates the contractor who shall design, fabricate, and install the sprinkler system, or systems.
- b. "Purchaser's Drawings" designates the Purchaser's construction drawings.
- c. "Sketches" designates the Purchaser's sprinkler system layout sketches, which are included in an addendum to these specifications.
- d. "Fire Protection Group" designates the fire protection engineers of the Owner's Engineering Department.
- e. "Approved" designates materials, apparatus, and methods of installing the materials and apparatus, that meet all requirements of NFPA Standard No. 13, Latest Revision, and any addendums to these specifications.
- f. "HAD" designates a rate-of-rise heat-actuated device.
- g. "NFPA" designates the National Fire Protection Association.
- h. "Approved Equal" designates a material, raw, semi-finished, or finished, or a product, either as a unit component or a complete unit assembly, of a make (brand name, trade name, or other proprietary designation) other than that specified, and of a size, composition, grade, or quality equal to the specified material or product, that, subject to the written approval of the Purchaser, may be substituted for the specified material or product.
- i. "Latest Revision", as applied to reference standards, specifications, and codes, designates the official issues in effect on the date of the Vendor's Quotation or the Contractor's Proposal. Use of subsequent revisions, if any, shall be subject to negotiation between the Purchaser and the Vendor or Contractor.

3. WORK NOT INCLUDED

These specifications do not include painting, the installation of underground supply piping, electrical work, and cutting and patching of holes for pipes passing through walls and floors, unless otherwise stated.

4. STARTING POINTS OF CONTRACTOR'S WORK

The Contractor's work shall start at one of the following points, depending upon the type of installation

- a. New Systems. Work shall start at the terminus of the underground fire water supply line, or at another point, as shown on the Purchaser's Drawings.
- b. Extensions of Existing Systems. Work shall start at the points shown on the Sketches.

5. LIMITATION OF WORK

The Contractor shall do all work required to design, fabricate, and install the type of sprinkler system that is specified in an addendum to these specifications, and/or as shown on the Sketches, unless stipulated otherwise. The Contractor shall disregard all information and requirements in these specifications that pertain to sprinkler systems of a type other than that specified and shown, and any indicated fire protection facilities other than the specified sprinkler protection unless otherwise stated.

6. RESPONSIBILITY FOR LABOR, MATERIALS, APPARATUS, TOOLS, AND EQUIPMENT

- a. The Purchaser will furnish and install all supervisory devices, when specified, except trouble switches, which shall be furnished and installed by the contractor.
- b. Unless otherwise specified in an addendum to these specifications, the Contractor shall furnish all labor, materials, apparatus (except that furnished by the Purchaser), tools, and construction equipment necessary to design, fabricate, and install a sprinkler system, or systems, of the specified type.
- c. Unless otherwise specified in an addendum to these specifications, materials and apparatus furnished by the Contractor shall include all pipe, pipe fittings, valves, flanges, bolts and nuts, gaskets, gasket dope, and thread dope; all sprinkler heads and sprinkler guards, all hangers and supports for pipe and conduit, all conduit, conduit fittings, and air tubes, all deluge valves, alarm check and dry pipe valves, accelerators, regulators, water-motor alarms, strainers, HADs, and trouble switches, and, if a pneumatic actuating system requiring plant air is specified, all air supply connections, pressure regulators, receivers, drying traps, and filters.

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CHEMICALS AND PLASTICS OPERATIONS DIVISION
AND UNION CARBIDE CANADA LIMITED

SECTION A — GENERAL CONDITIONS - contd

7. REVIEW OF PURCHASER'S DRAWINGS

The Contractor may review the Purchaser's Drawings and model, if available, covering process piping at the office of the Design and Construction Department, UCC Technical Center, South Charleston, West Virginia, or at the Purchaser's field office at the job site or at a location designated by the Purchaser. Drawings covering architectural and structural work will be furnished to the Contractor for use in preparing his bid.

8. INTERFERENCES

The Contractor shall be responsible for avoiding interferences with all other facilities, at no extra expense to the Purchaser.

9. APPROVAL OF CONTRACTOR'S DRAWINGS

a. Before ordering or fabricating materials, the Contractor shall furnish to the Purchaser four prints and one set of each working drawing for approval. After the drawings, including all necessary revisions, are given final approval, the Contractor shall furnish to the Purchaser nine complete sets of the approved drawings for file and field use.

b. Unless otherwise specified in an addendum to these specifications, the Contractor shall not obtain approvals of his working drawings from insurance underwriters, inspection bureaus, or other regulatory agencies. All such approvals that are required shall be obtained only by the Owner's Fire Protection Group.

c. Any major changes during construction shall be subject to the approval of the Owner. If requested by the Purchaser, the Contractor shall revise his working drawings to indicate and identify all approved changes.

SECTION B — MATERIALS AND APPARATUS

1. PIPE, PIPE FITTINGS, AND VALVES

All piping shall be designed in accordance with NFPA Standard No. 13 (Latest Revision) rules for light, ordinary, extra hazard occupancy, or as otherwise specified in an addendum to these specifications. Pipe, pipe fittings, and valves shall conform to NFPA Standard No. 13. Pipe shall be sized to include futures where these are indicated.

2. SPRINKLER HEADS

a. Approved sprinkler heads shall be used throughout the system, or systems. All closed sprinkler heads shall have a temperature rating of 160F to 165F, except those heads located near heating outlets, steam lines, or other hot pipes, or as noted on the Sketches. Locations of higher temperature rated sprinkler heads shall be noted on the drawings for record. Orifice sizes shall be $\frac{1}{2}$ -inch unless otherwise specified in an addendum to these specifications.

b. Unless otherwise specified in an addendum to these specifications or indicated on the Sketches, all sprinkler heads shall be coated with a corrosion-resisting compound such as "Corroproofing", or Approved Equal.

3. HANGERS AND SUPPORTS FOR PIPE AND CONDUIT

a. All hangers and supports for pipe and conduit shall be of Approved types as shown in Figure 531 of NFPA Standard No. 13, Latest Revision. All hangers and supports shall also be subject to the approval of the Purchaser.

b. The Contractor's approval drawings shall show the locations of all hangers and supports and all special non-standard hangers shall be shown in detail.

4. APPARATUS

All apparatus for sprinkler systems, such as alarm check valves, dry pipe valves, deluge valves, water motor alarms, strainers, and HADs, shall be new, and of Approved types. All HADs of the brass chamber type shall be cadmium plated. Dry pipe valves, deluge valves, and alarm check valves shall be complete with standard trim and accessories, including regulators and accelerators when required. Deluge valves shall also operate on loss of pressure if normally actuated by increase in pressure.

5. AIR TUBES AND CONDUIT

a. Air tubes between HADs and deluge valves may be of hard-drawn or soft copper, and shall be cadmium plated or lead coated. Fittings for hard-drawn copper tubes shall be of the compression type, with ferrule. SAE 37 $\frac{1}{2}$ degree fittings shall be used for soft copper tubes.

b. Conduit for encasing air tubes shall be steel, and shall meet all requirements of the American Standard for Rigid Steel Conduit, ASA C80.1, Latest Revision, except that it shall be zinc coated inside and outside. All tubes and conduits to go underground shall be suitably protected against corrosion.

6. ELECTRICAL DEVICES

All electrical switching devices shall be single-pole double-throw switches, with one contact normally open and one normally closed, and shall be approved for Class I, Group D, Division 2 locations, as defined by the National Electrical Code, Latest Revision.

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CHEMICALS AND PLASTICS OPERATIONS DIVISION
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SECTION C — INSTALLATION, TESTING, AND INSPECTION

1. GENERAL INSTALLATION NOTES

- a. All sprinkler heads shall be located in accordance with NFPA Standard No. 13, Latest Revision. Generally, the heads shall be located as shown on the Sketches. Some deviation may be necessary to avoid interferences.
- b. Sprinkler heads that are subject to mechanical injury shall be protected by approved guards.
- c. All sprinkler piping shall be supported and hung in an Approved manner with hangers and supports as specified in Article B.3.a.
- d. Flushing connections, consisting of capped nipples 4 inches long, shall be installed at the ends of all feed and crossmains to facilitate flushing.
- e. A standard inspector's test connection shall be installed in each system at the points shown on the Sketches.
- f. Approved drains shall be installed at all low points or trapped sections in the sprinkler distribution system, or systems.
- g. OS & Y gate valves of the required sizes shall be installed, if specified, in each new water supply pipe upstream from the alarm check valve, dry pipe valve, or deluge valve.
- h. HADs of the rate-of-rise type shall be installed in all preaction and deluge sprinkler systems, and shall be located and spaced as shown on the Sketches.
- i. To facilitate transmission of "trouble" supervisory signals in deluge sprinkler systems, an electrical switching device of the type specified in Article B.6.a shall be installed for each deluge valve.
- j. If a pneumatic actuating system requiring plant air is installed, the Contractor shall make the connection to the plant air header (see tie-in point indicated on Sketches), install the piping, receiver, drying trap, air filter, and pressure reducer.
- k. The Owner's plant fire department shall post signs identifying the manual releases.

2. OPERATING REQUIREMENTS

Complete operation (full capacity discharge from the most remote sprinkler head) of any deluge sprinkler system shall be effected in not more than 45 seconds from the instant that heat (160-165 °F) is applied to any one HAD or a remote manual release is actuated.

3. TESTING

- a. After a sprinkler system is completed, it shall be subjected to a hydrostatic test at a pressure of 200 psig for a period of 2 hours. All leaks shall be repaired, and repairs retested until satisfactory results are obtained. Following the hydrostatic test, an operating test (except water flow) shall be conducted to ensure that the system performs as specified.
- b. All tests shall be witnessed by representatives of the Owner's Fire Protection Group, and the Insurance Inspection Authority, if any, having jurisdiction. The tests and their results shall be satisfactory to and approved by said representatives.

4. REPAIRING LEAKS

- a. If welded pipe is used, weld leaks shall be repaired by chipping out and rewelding. Leaks in flanged joints shall be repaired by dismantling the joint and reassembling it, tightening the bolts in the correct order. Leaks in screwed joints shall be repaired by dismantling the joint and reassembling it.
- b. Attempting to repair weld leaks by caulking or peening, and leaks in flanged and screwed joints by overtightening the bolts, or fittings, will not be permitted.

5. INSPECTION

Before acceptance by the Purchaser, all sprinkler systems shall be subject to inspection and approval by representatives of the Owner's Fire Protection Group, and the Insurance Inspection Authority, if any, having jurisdiction.

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STANDARD
CHEMICALS AND PLASTICS OPERATIONS DIVISION
AND UNION CARBIDE CANADA LIMITED

VALVE AND PIPING SPECIFICATION **IBI**

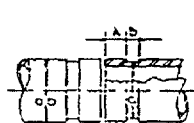
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DATE 7-1-67

SERVICE RANGE									HYDRO TEST					SERVICE			
125 psi at 32°F to 200°F (0°C to 93°C)									250 psi					Air Nitrogen Water above ground			
ADJUSTED PRESSURE-TEMPERATURE RATINGS									CORROSION ALLOWANCE								
None									0.030"								
COMPONENTS	NOTES	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8	10	12			
PIPE	1	Galv Steel-40-W							120 Serr. 40-W	Steel 40 Smls	Steel-20-Smls						
FITTINGS	NIPPLES	Galv Steel-40-W															
	COUPLINGS	1, 2	DI-300-Scrd							Victaulic Style 75			Victaulic Style 77				
	UNIONS		MI-150-Scrd														
	BUSHINGS		Steel														
	PLUGS		Steel														
	ELBOWS	3	CI-125-Scrd							MI-Std-Victaulic							
	CAPS		MI-150-Scrd							MI-Std-Victaulic			Steel 219" BW	Steel 250" BW			
REDUCERS		CI-125-Scrd							MI-Std-Victaulic			Steel 219" BW	Steel 250" BW				
BRANCHES	FULL SIZE	4	CI-125-Scrd							Fabricate from pipe							
	REDUCING	4, 6	CI-125-Scrd														
FLANGES	STRAIGHT	2, 5, 7							CI-125-Scrd-FF			FS-150-SO-RF					
	REDUCING	2, 5							CI-125-Scrd-FF			FS-150-SO-RF					
	BLIND		CI-125-FF										FS-150-RF				
VALVES	SHUTOFF	7	BR-125-Scrd BA-1173A				BR-125 Scrd GA-1		Std-125-Wafer BF-1170								
			BR-150-Scrd BA-1184A						CI-125-Flg GA-5								
	CONTROL	7	BR-125-Scrd GL-101						Std-125-Wafer BF-1170								
	CHECK		BR-125-Scrd CK-201						CI-125-Flg CK-204								
	4-WAY		CI-200-Scrd CO-444						CI-125-Flg CO-1312								
		1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8	10	12			
BOLTING		ASTM A307, Gr B square head bolts, heavy hex nuts															
GASKETS:		Couplings Victaulic Grade H Flanges Compressed asbestos															
		DOPE GASKET - Flange Graphite & oil THREAD - Coupling Cupgrease Teflon tape															

NOTES

(1) For Victaulic joints the pipe end is to be cut or roll ground in accordance with the following detail



Maintain "C" concentric
with pipe OD

*Victaulic Company recommendations for rigid
joint where flexibility is desired, use "A"
dimension shown in Victaulic catalog

Pipe Size	A-B 015	B-C 031	C
2	.022	.012	1.344 ± 0.0018
4	.018	.015	4.344 ± 0.0010
6	.016	.013	9.455 ± 0.0022
8	.028	.017	4.448 ± 0.0025
10	.028	.020	10.562 ± 0.0027
12	.028	.020	12.531 ± 0.0030

Note Gustin Bacon GBL "Gruvajoint" and GBR "Gruvagrip"
couplings are equivalent to Victaulic Style 75 and 77
respectively

- (2) Victaulic construction is preferred over flanged construction
- (3) Steel standard weight butt-welding elbows may be substituted in sizes 3" to 12" where minimum layout is desired
- (4) Reinforcement of 90° branch connections fabricated from pipe is not required
- (5) Where mating flanged equipment or existing lines under 1" use cast iron 125 lb screwed flat face flanges
- (6) Screwed connections shall be fabricated into run pipe by welding in a forged steel 1000 lb screwed pipe coupling, "Thredolet," or "Elbolet." Maximum screwed connection size shall be 2 1/2"
- (7) When using butterfly valves, BF-1170, stem and pin shall be installed with the pin end flush with flange face to provide proper pin operation.

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STANDARD

CHEMICALS AND PLASTICS OPERATIONS DIVISION
AND UNION CARBIDE CANADA LIMITED

VALVE AND PIPING SPECIFICATION **1B2**

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DATE: 7-1-67

SERVICE RANGE									HYDRO TEST						SERVICE					
Thru 12" 125 psi at 32°F to 353°F(0°C to 179°C) 14" thru 24" 100 psi at 32°F to 188°F(0°C to 170°C) 30" 50 psi at 32°F to 298°F(0°C to 148°C)									250 psi 200 psi 100 psi						Air Chemicals (Non-hazardous) Nitrogen Steam Distribution Water Above Ground					
ADJUSTED PRESSURE-TEMPERATURE RATINGS									CORROSION ALLOWANCE											
1/2" thru 12" 175 psi at 150°F (non-hazardous gas)									0.030"											
COMPONENTS	NOTES	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8	10	12	14	16	18	20 thru 30		
PIPE	5, 9, 10	120 Steel-40-W					Steel 40 Sm/a		Steel 156" ERW		Steel 188" ERW		Steel 203" ERW	Steel 20 Sm/a	Steel-10-BW					
FITTINGS	NIPPLES	Steel-80-Sm/a				Steel-40-Sm/a														
	COUPLINGS	DI-300-Scrd																		
	UNIONS	MI-150-Scrd																		
	BUSHINGS	Steel																		
	PLUGS	Steel																		
	ELBOWS	9	CI-125-Scrd							Steel Std BW	Steel 188" BW	Steel- 219"-BW			Steel 250" BW	Steel-10-BW				
	CAPS	9	MI-150-Scrd							Steel Std BW	Steel 188" BW	Steel- 219"-BW			Steel 250" BW	Steel-10-BW				
REDUCERS	9	CI-125-Scrd							Steel Std BW	Steel 188" BW	Steel- 219"-BW			Steel 250" BW	Steel-10-BW					
BRANCHES	FULL SIZE	1, 9	CI-125-Scrd							Fabricate from pipe										
	REDUCING	1, 2, 4	CI-125-Scrd																	
FLANGES	STRAIGHT	3, 5							FS-150-SO-RF											
	REDUCING	3							FS-150-SO-RF											
	BLIND		CI-125-FF							FS-150-RF										
VALVES	SHUTOFF	4	BR-125-Scrd BA-1173A					BR-125 Scrd GA-1	CI-125-Flg GA-5					CI-125-Flg GA-5A						
		4, 6, 8							Std-125-Wafer BF-1170											
	CONTROL	4	BR-125-Scrd GL-101						CI-125-Flg GL-102											
		4, 6, 8								Std-125-Wafer BF-1170										
	CHECK	7	BR-125-Scrd CK-201						CI-125-Flg CK-204											
			1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8	10	12	14	16	18	20 thru 30	
BOLTING		ASTM A307, Gr B square head bolts, heavy hex nuts										DOPE		GASKET - Graphite and oil THREAD - Teflon tape						
GASKETS		Compressed asbestos																		

- NOTES**
- (1) Reinforcement of 90° branch connections fabricated from pipe is not required.
 - (2) Screwed connections shall be fabricated into run pipe by welding in a forged steel 3000 lb screwed pipe coupling, "Thredolet", or "Elbolot". Maximum screwed connection size shall be 2-1/2".
 - (3) Where mating flanged equipment or existing lines under 3" size use cast iron 125 lb screwed flat face flanges.
 - (4) Use the appropriate valve from specification 1G1 when piping is to be connected below the normal liquid level on all storage tanks.
 - (5) 3" - 4" sizes may be fabricated by cold flaring laps on the Leonard flanging machine. Use FS-150-LAP flanges and steel "Flareweld" Schedule 40 ERW pipe.
 - (6) When mating butterfly valves BF-1170, slip-on flanges shall be installed with pipe end flush with flange face to provide proper clamping action for valve liner.
 - (7) Consideration may be given to use of wafer-type check valves in sizes 3" and larger. Consult manufacturer's data, such as Mission or Keystone, or Standards Engineering Group for information.
 - (8) Valve BF-1170 has rubber seat which limits maximum operating temperature to approximately 200°F. Consult manufacturer's data or Standards Engineering Group for application to specific conditions.
 - (9) Piping 3" and larger installed in water service shall be externally lined and bituminous coated.
 - (10) 120 Steel-40-W pipe may be substituted in 3" and 4" sizes when economically advantageous.

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STANDARD

CHEMICALS AND PLASTICS OPERATIONS DIVISION
AND UNION CARBIDE CANADA LIMITED

VALVE AND PIPING SPECIFICATION

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DATE 1-1-67

SERVICE RANGE									HYDRO TEST					SERVICE									
Thru 20" 150 psi at 32°F to 500°F(0°C to 260°C) 24" 150 psi at 32°F to 500°F(0°C to 260°C)									425 psi 240 psi					Chemicals Vacuum (IC1a)									
ADJUSTED PRESSURE-TEMPERATURE RATINGS									CORROSION ALLOWANCE														
See Table - Page 2									0.030"														
COMPONENTS	NOTES	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8	10	12	14	16	18	20	24				
PIPE	5	Steel-40-W					Steel-40-Smla	Steel-156"ERW	Steel-188"ERW	Steel-203"ERW	Steel-20-Smla	Steel-10-Smla											
FITTINGS	NIPPLES	Steel-80-Smla			Steel-40-Smla																		
	COUPLINGS	5	DI-300-Scrd																				
	UNIONS	5	DI-300-Scrd																				
	BUSHINGS		Steel																				
	PLUGS		Steel																				
	ELBOWS	5	DI-300-Scrd					Steel-Std-BW	Steel-188"BW	Steel-219"-BW	Steel-250"BW	Steel-10-BW											
	CAPS	5	DI-300-Scrd					Steel-Std-BW	Steel-188"BW	Steel-219"-BW	Steel-250"BW	Steel-10-BW											
	REDUCERS	5	DI-300-Scrd					Steel-Std-BW	Steel-188"BW	Steel-219"-BW	Steel-250"BW	Steel-10-BW											
BRANCHES	FULL SIZE	1, 5	DI-300-Scrd					Fabricate from pipe															
	REDUCING	1, 2, 5	DI-300-Scrd																				
FLANGES	STRAIGHT	3, 6							FS-150-SO-RF														
	REDUCING	3							FS-150-SO-RF														
	BLIND		FS-150-RF																				
VALVES	SHUTOFF	4	Steel-800-Scrd GA-1117					Steel-150-Flg GA-59	Steel-150-Flg GA-1174	Steel-150-Flg GA-59													
									Steel-150-BW GA-1202	Steel-150-BW GA-1202H	Steel-150-BW GA-1202G												
	CONTROL		Steel-800-Scrd CL-1132						Steel-150-Flg CL-1143														
									Steel-150-BW CL-1203	Steel-150-BW CL-1203H													
	CHECK		Steel-800-Scrd CK-1197						Steel-150-Flg CK-203														
									Steel-150-BW CK-1205	Steel-150-BW CL-1205H	Steel-150-BW CK-1205G												
		1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8	10	12	14	16	18	20	24				

BOLTING

ICI ASTM A307, Gr B square head bolts, heavy hex nuts

DOPE

GASKET - Graphite and oil

GASKETS

ICla ASTM A193, Gr B7 or B16 alloy steel stud bolts ASTM A194, Gr 2 or 2H heavy hex nuts
Compressed asbestos

THREAD - Teflon tape

NOTES

- (1) Reinforcement of 90° branch connections fabricated from pipe is not required.
- (2) Screwed connections shall be fabricated into run pipe by welding in a forged steel 3000 lb screwed pipe coupling, "Thredolet", or "Elbolet". Maximum screwed connection size shall be 2".
- (3) Where mating flanged equipment or existing lines under 2-1/2" size, use forged steel 150 lb screwed raised face flanges.
- (4) GA-1174 is a reduced-port valve. Do not use under a safety valve in vapor relief service or where port reduction is of significance, instead use GA-59.
- (5) Seal welding screwed connections is prohibited.
- (6) 2-1/2" - 4" sizes may be fabricated by cold flaring laps on the Leonard flanging machine. Use FS-150-LAP flanges and steel "Flareweld" Schedule 40 ERW pipe.

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DATE 1-1-87

PRESSURE-TEMPERATURE RATINGS
(Maximum pressure - psi)

Maximum temp, °F	32 to 100	150	200	250	300	350	400	450	500	Hydro
Maximum temp, °C	0 to 38	66	93	121	149	177	204	232	260	Test
Thru 14"	275	255	240	225	210	195	180	165	150	425
16"	250	245	235	225	210	195	180	165	150	375
18"	220	215	210	205	200	195	180	165	150	330
20"	195	190	185	180	175	175	170	165	150	290
24"	160	160	155	150	145	145	140	135	130	240

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STANDARD

CHEMICALS AND PLASTICS OPERATIONS DIVISION
AND UNION CARBIDE CANADA LIMITED

VALVE AND PIPING SPECIFICATION

3681

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DATE 6-5-67

SERVICE RANGE		HYDRO TEST		SERVICE																			
1/2" thru 2" 125 psi at 32°F to 130°F (0°C to 54°C) 1" thru 14" 150 psi at 32°F to 130°F (0°C to 54°C) 16" thru 20" 100 psi at 32°F to 130°F (0°C to 54°C) 24" thru 48" 75 psi at 32°F to 130°F (0°C to 54°C)		1/2" thru 14" 150 psi 16" thru 20" 100 psi 24" thru 48" 75 psi		Water - underground (City Lake River Wells)																			
ADJUSTED PRESSURE-TEMPERATURE RATINGS			CORROSION ALLOWANCE																				
None			None																				
COMPONENTS	NOTES	1 to 2	3 to 12	14 to 20	24 to 48																		
PIPE	UNRESTRAINED	1, 2, 3	Centrifugally cast iron - Class 22 thickness with push-on type joints (Type II) cement-lined and bituminous coated Fed Spec WW-P-421 b		Pre-stressed reinforced concrete cylinder pipe for 75 psi design pressure AWWA Spec C-301																		
	RESTRAINED	1, 2, 3, 4, 6	Centrifugally cast iron with integrally locked push-on type joints (Type III) cement-lined and bituminous coated Fed Spec WW-P-421 b Thickness 7 thru 11" - Class 22; 6" - Class 23, 10" and 12" - Class 24																				
FITTINGS (Elbows, Bends, Tees, Reducers)	4	Copper - Solder	Cast iron, 150 lb class, all ball for push-on type joints (Type II) cement-lined and bituminous coated Fed Spec WW-P-421 b	Cast iron, 150 lb class, mechanical joint (Type III) cement-lined and bituminous coated Fed Spec WW-P-421 b	Pre-stressed reinforced concrete cylinder pipe fittings for 75 psi design pressure AWWA Spec C-301																		
FITTINGS (Above ground connections)			125 lb USA cast iron flanged fittings USA B16.1 with cement-lining Fed Spec WW-P-421 b																				
ADAPTERS	PIPE JOINT TO FLANGE	4, 8	Cast iron, 250 lb class, grooved spigot (Type II) flange USA 125 lb cement-lined and bituminous coated Fed Spec WW-P-421 b	Cast iron, 150 lb class, mechanical joint (Type III) flange USA 125 lb, cement-lined and bituminous coated Fed Spec WW-P-421 b																			
	PUSH JOINT TO MECHANICAL JOINT	4, 8	Cast iron, 250 lb class, grooved spigot (Type III) integral mechanical joint gland cement-lined Fed Spec WW-P-421 b																				
JOINT RESTRAINT	4, 8		Integral with joint	"ULOK" as per Engineering Standards P-111, 111A, 111B, 111C																			
FLANGES (BLIND)			CI-125-PF																				
VALVES	SHUTOFF AT HEADER	5	BR-100-NPT by Flared CO-415																				
	SHUTOFF	6, 7	BR-125-Scrd GA-1 (Extension UCC Std P-126)	CI-125-Water BF-1170A	Specify as item of equipment																		
	CHECK		CI-125-Fig CK-204 (Install in concrete pit)																				
		1 to 2	3 to 12	14 to 20	24 to 48																		
BOLTING Mechanical Joints - Tee head alloy steel bolts, heavy hex nuts Fed Spec WW-P-421 b Flanges - ASTM A107, Gr B square head bolts heavy hex nuts SOLDER Silver Gr B Cu P-5																							
GASKETS Pipe joints - Unrestrained - molded rubber Fed Spec WW-P-421 b Restrained - molded rubber with integral steel struts Fed Spec WW-P-421 b Flanges - Compressed asbestos DOPE Threads - Teflon tape Gaskets - None																							
GENERAL A In size 10 in. to 20 in. concrete cylinder pipe may be used as an alternative for cast iron pipe. Selection is to be based upon price and availability. If concrete cylinder pipe is selected the pipe and all fittings shall be pre-stressed reinforced concrete cylinder pipe AWWA Spec C-301 or pre-tensioned concrete cylinder pipe, Federal Specification SS-P-381 for the commensurate design pressure. Size 10" only is furnished to a manufacturer's modification of Federal Specification SS-P-381. B Whitewashing of the outside of bituminous coated pipe and fittings may be required to protect the pipe from the heat of the sun if shipped in summer, or if it is to be stored for long periods of time. C After testing and flushing have been completed and before being placed in service, all Underground Water Piping that handles city water shall be disinfected by introducing chlorine or a solution of a chlorine-containing compound in sufficient quantity to produce a minimum initial residual of 50 ppm and a minimum residual of 25 ppm after a 24-hour contact with the pipe as determined by testing in accordance with the AWWA Standard Methods for the Examination of Water and Sewage - latest Revision. Following the contact period, the piping shall again be flushed, and water run through it until the water leaving the piping, as determined by testing, is comparable in bacteriological quality to the water entering the piping. All bacteriological tests of city water shall be made by state (or provincial) or municipal health departments. NOTES (1) Soft tubing may be substituted for hard where warranted by scope of work. (2) Thickness of cast iron pipe is based on listed design pressure, 5 ft. of cover and laying conditions "B" as tabulated in USA A21.6 Table 6.4. (3) Thickness of concrete pipe is based upon listed design pressure, 6 ft. of cover and ordinary trench conditions. (4) Method of joint restraint indicated is preferred, where not applicable mechanical joint and fittings with either "ULOK" joint restraint per Engineering Standards P-111, 111A, 111B, 111C or clamps and rods may be used upon specific approval of the Engineering Department. (5) Maximum size tap in Class 22 cast iron pipe: <table><tr><td>Pipe size, inches</td><td>1</td><td>2</td><td>3</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12 and larger</td></tr><tr><td>Tap size, inches</td><td>1/2</td><td>3/4</td><td>1</td><td>1 1/4</td><td>1 1/2</td><td>2</td><td>2 1/2</td><td>3</td></tr></table> (6) Refer to manufacturer's catalog for pressure and temperature ratings of butterfly valves. (7) Check dimensions of particular butterfly valve to be used. In some instances manufacturer's standard spacers or adapters will be required to assure free disc movement. (8) Indicated construction, sizes 2" to 12" is provided by LOK-TYTON joint furnished by United States Pipe and Foundry Company.						Pipe size, inches	1	2	3	4	6	8	10	12 and larger	Tap size, inches	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Pipe size, inches	1	2	3	4	6	8	10	12 and larger															
Tap size, inches	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3															

UCASB00217711



STANDARD

CHEMICALS AND PLASTICS OPERATIONS DIVISION
AND UNION CARBIDE CANADA LIMITED

VALVE AND PIPING SPECIFICATION

36B2

PAGE 1 of 2

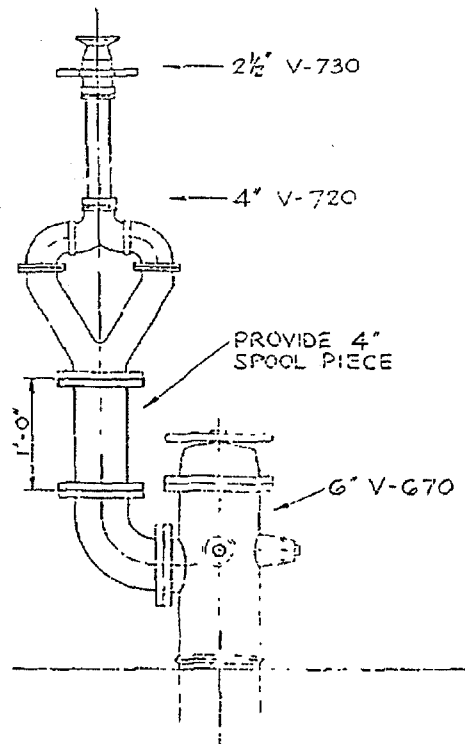
DATE: 8-1-67

SERVICE RANGE		150 psi at 32°F to 130°F (0°C to 54°C)				HYDRO TEST		200 psi for two hours and all leaks repaired before backfill				SERVICE		Fire Water - underground			
ADJUSTED PRESSURE-TEMPERATURE RATINGS		None				CORROSION ALLOWANCE		None									
COMPONENTS		NOTES	3	4	6	8	10	12	14	16	18	20					
PIPE	UNRESTRAINED	1, 2	Centrifugally cast iron, Class 22 thickness with push-on type joint (Type II), cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b														
	RESTRAINED	1, 2, 3, 5	Centrifugally cast iron, with integrally located push-on type joints (Type II), cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b Thickness: Thru 6" - Class 22, 8" - Class 23, 10" and 12" - Class 24										Centrifugally cast iron, mechanical joint (Type III), cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b Thickness: Class 22 with rod and clamp joint restraint, Class 23 for "ULOK" joint restraint				
FITTINGS (Elbows, Tees, Bends, Reducers)		3	Cast iron, 250 lb class, all ball for push-on type joints (Type II), cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b										Cast iron, 150 lb class, mechanical joint (Type III), cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b				
FITTINGS (Above ground connections)			125 lb USA cast iron flanged fittings, USA B1b, 1 with cement lining. Fed. Spec. WW-P-421 b														
ADAPTERS	PIPE JOINT TO FLANGE	3, 5	Cast iron, 250 lb class, grooved spigot (Type II) flange, USA 125 lb, cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b										Cast iron, 150 lb class, mechanical joint (Type III), flange, USA 125 lb, cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b				
	PUSH JOINT TO MECHANICAL JOINT	3, 5	Cast iron, 250 lb class, grooved spigot (Type II) integral mechanical joint (Type III) gland, cement-lined and bituminous-coated. Fed. Spec. WW-P-421 b														
JOINT RESTRAINT		3	Integral with joint										"ULOK" per Engineering Standards P-111, 111A, 111B, 111C or rod and clamp as specified by Engineering Department				
FLANGES (BLIND)			CI-125-FF														
VALVES	SHUTOFF		CI-125-Flg GA-5 (Above ground or in concrete pit)														
			175 lb CI mechanical joint gate valve, bronze trim, Garlock 150 packing, with manufacturer's standard indicator post, centerline of valve ___ ft below grade. Mueller-Columbian A-2072-20 with Fig. A-20800 post or approved equal (GA-1103) (underground only)														
	HYDRANTS AND HOSE VALVES	New Construction 4 Maintenance 4	As specified by Fire Protection Engineering Group (See table, page 2)														
BOLTING		Mechanical Joints - Tee head alloy steel bolts, heavy hex nuts. Fed. Spec. WW-P-421 b Flanges - ASTM A307, Gr. B square head bolts, heavy hex nuts										GASKETS Pipe joints - Unrestrained - molded rubber. Fed. Spec. WW-P-421 b Restrained - molded rubber with integral steel struts. Fed. Spec. WW-P-421 b (5) Flanges - Compressed asbestos or rubber					
GENERAL		A. All lines shall be flushed in accordance with the following flow rates: 4" - 500 gpm 10" - 4000 gpm 6" - 1500 gpm 12" and larger - 6000 gpm 8" - 2500 gpm B. Concrete cylinder or other Underwriters' approved pipe may be used as alternative for cast iron pipe. Selection is to be based on price and availability. If concrete cylinder pipe is selected the pipe and all fittings shall be pre-stressed reinforced concrete cylinder pipe AWWA Spec. C-301 or pre-tensioned concrete cylinder pipe, Federal Specification SS-P-381 for the commensurate design pressure. Size 10" only is furnished to a manufacturer's modification of Federal Specification SS-P-381. C. Whitewashing of the outside of bituminous-coated pipe and fittings may be required to protect the pipe from the heat of the sun if shipped in summer, or if it is to be stored for long periods of time.															
NOTES		(1) Thickness of cast iron pipe is based on listed design pressure, 5 ft of cover and laying conditions "B" as tabulated in USA A21.6 Table 6.4 (2) Thickness of concrete pipe is based upon listed design pressure, 6 ft of cover and ordinary trench conditions (3) Method of joint restraint indicated is preferred, where not applicable, mechanical joint pipe and fittings with either "ULOK" joint restraint per Engineering Standards P-111, 111A, 111B, 111C or clamps and rods may be used upon specific approval of the Engineering Department (4) Set hydrants on undisturbed soil or a backfill of two shovels full of concrete. Provide a 2 ft depth of gravel, broken stone, or other approved material around each hydrant drain. (5) Indicated construction, sizes 2" to 12" is provided by LOK-TYTON joint furnished by United States Pipe and Foundry Company															

UCASB00217712

Plant	Hydrant		Hose Valve		
	Type	UCC V-No.	Qty	UCC V-No.	
ALL	Monitor	670	1	700	Include one each V-720 mon. or nozzle, V-730 nozzle & p. and spool piece per Monitor Installation Detail below
Bound Brook	2-way	652	1	701	
Brownsville	2-way	650	1	700	
Institute	2-way	650	1	710	
Marietta	2-way	650B	1	700	
Montreal	3-way (steamer)	661	1	702	
Ottawa	2-way	650B	1	700	
Squadrift	2-way	650	1	701	
South Charleston	2-way	650	1	701	
Taft	2-way	650A	1	700	
Texas City	2-way	650	1	701	
Torrance	2-way (hose)	670	-	-	
	2-way (steamer)	661	-	-	
	3-way (steamer)	662	-	-	
Whiting	2-way	651	1	701	

MONITOR INSTALLATION DETAIL



GROUND ROD INSTALLATION - COPPERWELD ROD

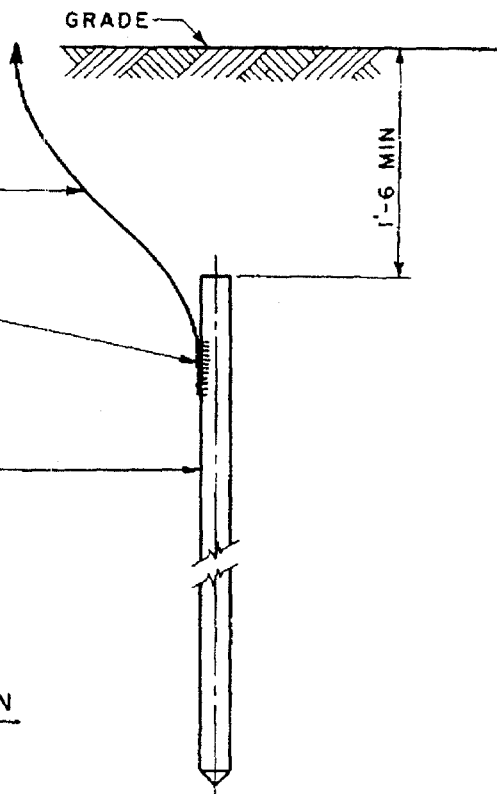
BARE¹, STRANDED COPPER CABLE, NO. 2/0
MAXIMUM, TO GROUND CONNECTION ON BUILD-
ING COLUMN, EQUIPMENT, OR STRUCTURE
USE GROUND CONDUCTOR AS SPECIFIED ON
ELECTRICAL GROUNDING DRAWING, OR ON
APPLICABLE GROUNDING STANDARDS.

WELD OR BRAZE GROUND CABLE TO GROUND
ROD AS SHOWN.²

1-IN COPPERWELD GROUND ROD LENGTH
SHALL BE AS SPECIFIED ON ELECTRICAL
GROUNDING PLANS.

DRIVE GROUND ROD INTO GROUND, WELD OR
BRAZE GROUND CABLE TO ROD² AND COVER
WITH SOIL.

TYPICAL GROUND ROD INSTALLATION



NOTE.

GROUND RODS SHALL BE DRIVEN BELOW PERMANENT MOISTURE LEVEL WITH A MINI-
MUM DRIVING DEPTH OF 8'-0, AND SHALL HAVE A MAXIMUM RESISTANCE TO GROUND OF
5 OHMS.

¹WHERE AVAILABLE ON JOB SITE, SURPLUS INSULATED WIRE MAY BE USED.

²IN AREAS WHERE BRAZING OR WELDING IS PROHIBITED, THE GROUND CONDUCTOR SHALL
BE BRAZED OR WELDED TO THE GROUND ROD IN THE SHOP.

GROUND ROD INSTALLATION - COPPERWELD ROD

NOTE:

All copperweld ground rods shall be specified and located on electrical grounding plans, referring to this Standard for installation details.

All materials shall be billed from electrical grounding plans.

The following shall be grounded in accordance with this Standard:

- (A) The neutral of lighting transformers.
- (B) Motor frames of motors with a voltage of 600 volts and over. (These motor frames shall have a separate ground lead, color coded green, running from the motor frame through the conduit to a ground bus in the switch room or substation.)

Motor frames of motors with voltages under 600 volts, motor control cases, and lighting cabinets. (These items do not require separate ground leads where they are continuously connected to ground through rigid conduit or structural steel frames.)

- (C) Switchgear frames and enclosures, transformer cases and enclosures, switchracks, and all non-current-carrying parts of electrical equipment.
- (D) Transformer pad fences and guards.
- (E) Instrument cases (see Std EL-68).

As recommended by the NEC, ground resistance measurements for ground rods should be made regularly (every one to two years) to verify that any impairment such as corrosion, mechanical injury, or breaking, does not increase ground rod resistance to ground above the acceptable maximum of five ohms. Ground test procedures, using the "Megger Ground Tester" and instructions, as furnished by the J. G. Biddle Company, Philadelphia 7, Pennsylvania, are recommended.

In order to detect ground rods easily at buildings and structures, they should be located on column centerlines as shown on Std EL-61.

REFERENCES:

- Grounding Methods for Steel Structures Std EL -61
- Typical Grounding Connections for Instruments Std EL -68

STANDARD

UNION
CARRIOT

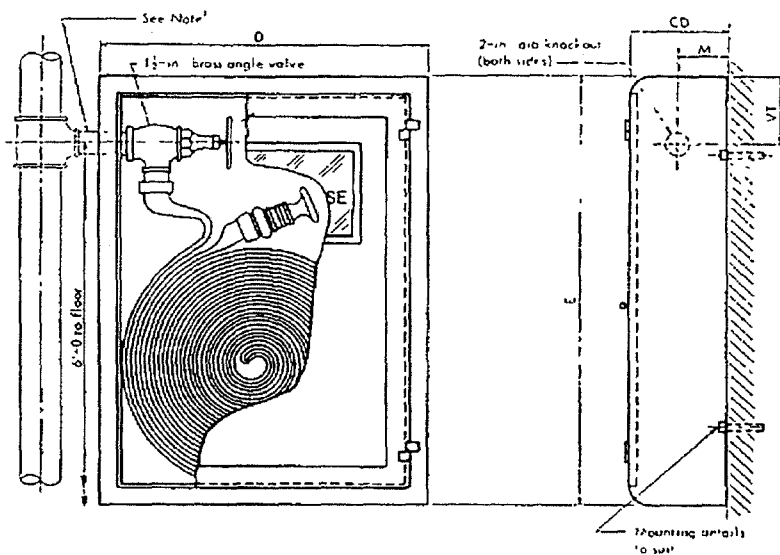
CHEMICALS, OLEFINS, PLASTICS,
SILICONES DIVISIONS AND
UNION CARBIDE CANADA

FP-72

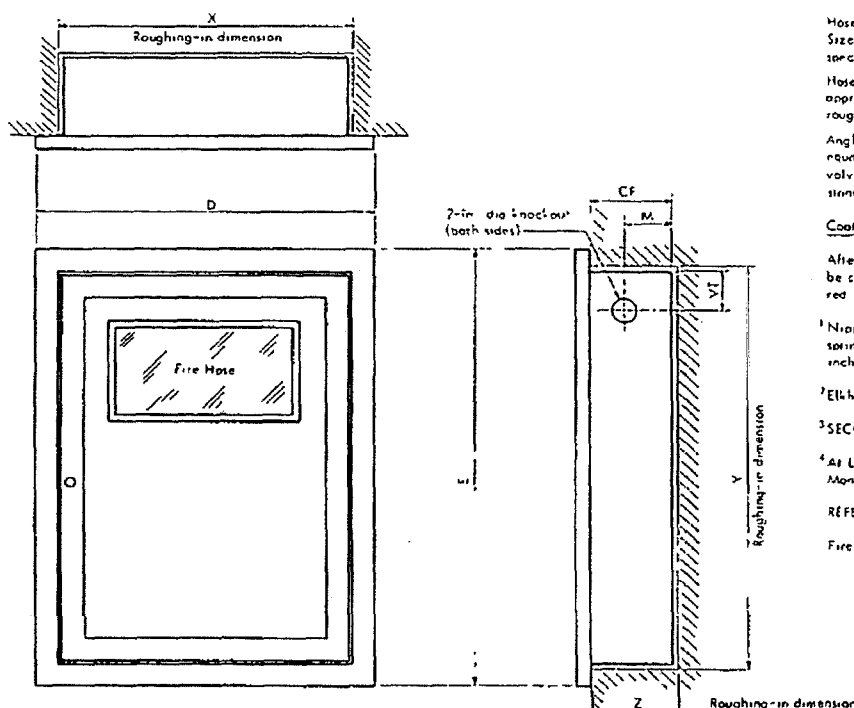
FIRE PROTECTION- DATA

11-4-66

INSIDE FIRE HOSE CABINET AND EQUIPMENT



INDOOR SURFACE-TYPE CABINET
(Outdoor Cabinets Similar)



INDOOR RECESSED-TYPE CABINET
Details not Shown are Same as for Surface-Type Cabinet

NOTE

This Standard describes two types, and two sizes of each type, of fire hose cabinets for indoor use. It also describes fire hose cabinets for outdoor use.

Types and sizes of hose cabinets for indoor use are as follows:

- Surface-mounted, containing hose only
- Surface-mounted, containing hose and fire extinguisher
- Recessed, containing hose and fire extinguisher

SPECIFICATIONS

Fire Hose Cabinets

All fire hose cabinets shall be steel, with white baked enamel interior finish and prime coat exterior finish. Cabinets shall be fitted with two-panel doors having cam action latch, and hinges on right or left hand side, as specified by purchaser, and shall have 2-inch knockouts on both sides near top. The words "Fire Hose", in manufacturer's standard characters, shall be lettered or otherwise placed, facing outward, on the interior surface of the door glass.

Fire hose cabinets for outdoor use shall be fitted with weather-resistant seals on doors and other openings.

Indoor surface-mounted fire hose cabinets shall be "Elkhart"² Catalog No. ST-1101-S, for hose only, or ST-1104-S, for hose and fire extinguisher, or approved equal. Indoor recessed cabinets shall be "Elkhart"² Catalog No. ST-1101-R, for hose only, or ST-1104-R, for hose and fire extinguisher, or approved equal. Purchaser shall specify the types and sizes of the cabinets.

Outdoor fire hose cabinets shall be "SECO"³ No. W-10-CD, surface mounted, or approved equal.

Equipment

Hose shall conform to Owner's Standard Specification A 304. Size shall be 1 1/2-inch and one length of 50, 75, or 100 ft., as specified by purchaser.

Hose nozzles shall be "Elkhart"² Catalog No. L-205-B, or approved equal, 1 1/2-inch size, national standard hose thread, rough brass combination nozzle.

Angle valve shall be "Elkhart"² Catalog No. 25, or approved equal, standard weight, standard finish, 1 1/2-inch brass angle valve with 1 1/2-inch NPS female inlet and 1 1/2-inch male national standard hose thread⁴ outlet.

Coating

After installation, outside surfaces of fire hose cabinets shall be coated by purchaser with two coats of No. B9 or VB9 signal red.

¹ Nipples shall be 1 1/2-inch NPS except for connections to sprinkler systems, which require 1-inch NPS nipples with 1 1/2-inch by 1-inch bushings or angle valves.

² Elkhart Brass Manufacturing Company, Inc., Elkhart, Indiana.

³ SECO Manufacturing, Inc., Detroit, Michigan.

⁴ At Location S17, Chicago Standard Thread. At Location 033, Montreal Standard Thread.

REFERENCE

Fire Hose

Standard Specification A 304

Type	Make and Catalog Number	Roughing-In Dimensions							
		CD	CF	D	E	M	VT	X	Y
Outdoor, Surface-Mounted	SECO ³ W-10-CD	7 1/2	24 1/2	34 1/2	1				
Indoor, Surface-Mounted	Elkhart ² ST-1101-S	6 1/2	27 1/2	37 1/2	3	1 1/2			
	Elkhart ² ST-1104-S	8 1/2	29 1/2	39 1/2	4	1 1/2			
Indoor, Recessed	Elkhart ² ST-1101-R	6 1/2	27 1/2	37 1/2	3	3	24	35 1/2	16 1/2
	Elkhart ² ST-1104-R	8 1/2	29 1/2	39 1/2	4	4	26 1/2	37 1/2	18 1/2

Unless otherwise indicated, all dimensions given in inches

UNION CARBIDE CORPORATION

 CHEMICALS, OLEFINS, PLASTICS
AND SILICONES DIVISIONS

SERVICE SINK - CONCEALED PIPING
**ENGINEERING
STANDARD NO.
P-137**

CLASSIFICATION

DETAIL

SPONSOR

DEPT 936

REVIEWED BY

J.H. Smith, Jr.

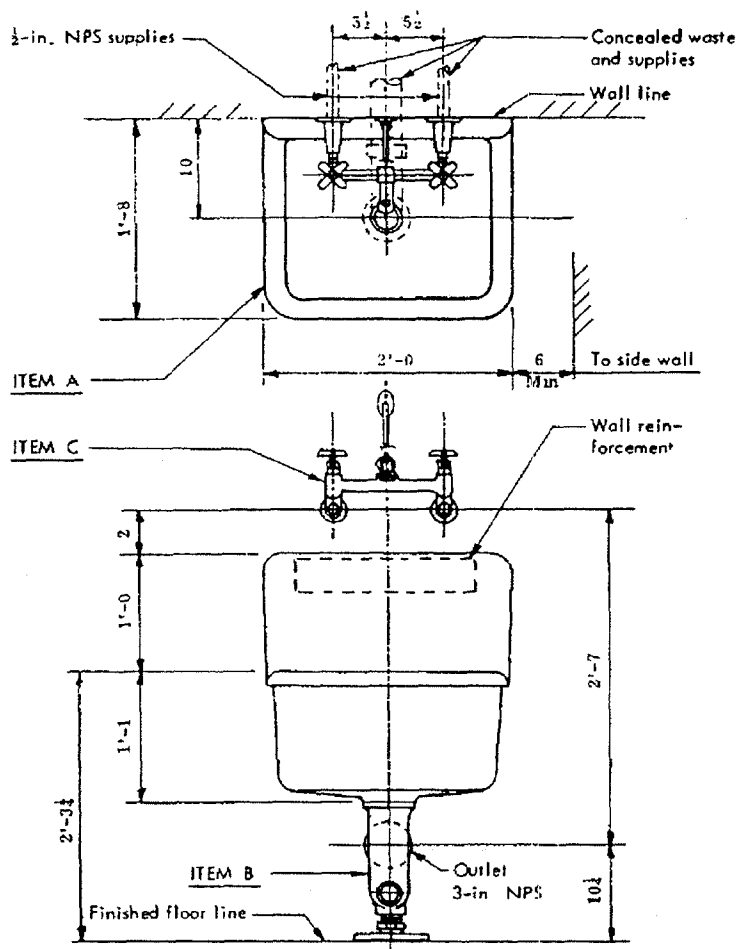
APPROVED BY

R.S. Sullivan

ISSUED

5-20-65

REVISED


BILLING:
ITEM A, As Required.

Service Sinks, each consisting of the following

- 1 - 24-in. x 20-in. Cast Iron Service Sink, porcelain enameled inside, painted outside, rolled rim, concealed hanger, 12-in. high back. Crane No. 7-566 or approved equal.

ITEM B, Bill one for each ITEM A.

- 1 - 3-in. adjustable P-Trap Standard, cast iron, porcelain enameled inside, painted outside, 3-in. female NPS outlet, with chromium-plated brass waste strainer, rough brass cleanout plug, gaskets. Crane No. 7-620 or approved equal.

ITEM C, Bill one for each hot and cold water sink

- 1 - Exposed 1/2-in. NPS Double Service Sink Faucet with indexed Dial-Ese cross-handle controls, rigid threaded spout for hose, bucket hook, wall brace and integral stops with adjustable screw flanges.

ITEM F, Apply to all Bills of Material for ITEMS A through E.

Roughing-in Prints in QUINTUPLICATE to be sent to the purchaser at _____

NOTE

Drawings shall show location of service sink, and refer to this Standard for roughing-in details and complete billing specifications.

Dimensions shown on this Standard apply only to Crane No. 7-566 Service Sinks. For dimensions of other makes of service sinks, see roughing-in prints furnished by Manufacturer.

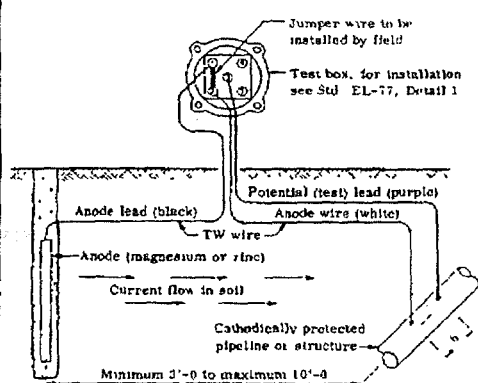
Service sinks in metal buildings shall be mounted on partition walls only.

UNLESS OTHERWISE INDICATED, ALL DIMENSIONS GIVEN IN INCHES.

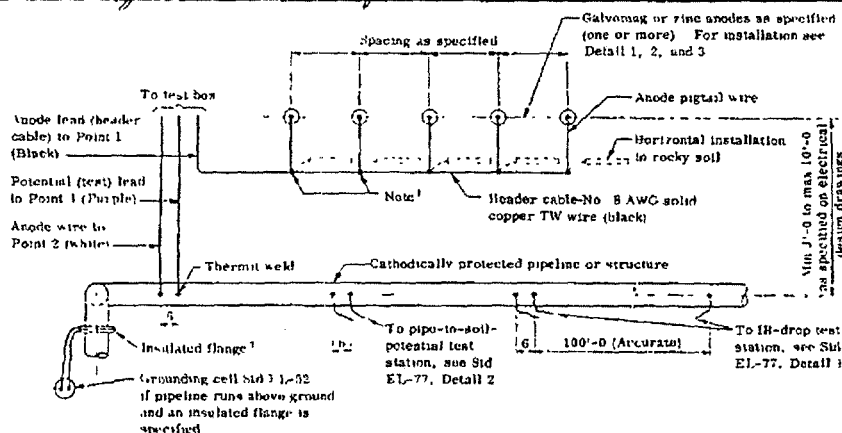
D-137

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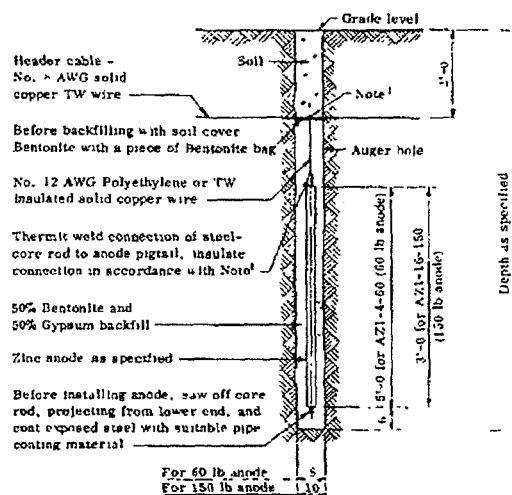
CLASSIFICATION	SPONSOR	REVIEWED BY	APPROVED BY	ISSUED	REVISED
DETAIL	DEPT 936	<i>S.H. Smith, Jr.</i>	<i>H. H. H. H. H.</i>	6-1-62	



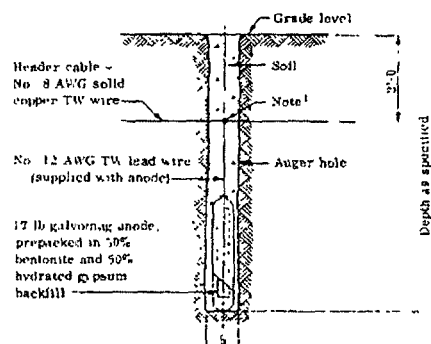
Typical Diagram of a Sacrificial Anode Installation



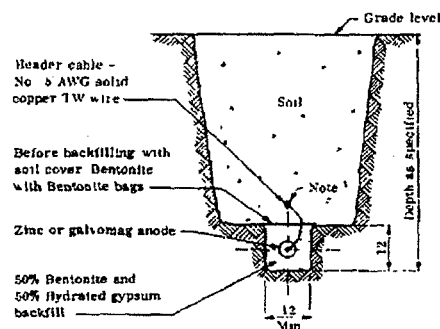
Typical Anode Bed Layout Plan



Detail 1, Zinc Anode Installation (Vertical)



Detail 2, Magnesium Anode Installation



Detail 3, Anode Installation (Horizontal)

NOTE

All conductors shall be solid copper with TW insulation, the header cable shall be No. 8 AWC and the test leads shall be No. 12 AWC.

If mechanical protection of conductors is required, plastic conduit or fiber conduit shall be used.

All test leads and anode wires shall be color coded as indicated in the typical anode bed layout plan. If wires are not color coded, they shall be identified by permanently stamped tags or other dependable means. Test leads shall not be spliced, if possible.

All underground wiring shall be installed 24 inches below grade, and sufficient slack shall be provided to allow for any pipe or soil movement.

Thermit Weld equipment and material shall be as manufactured by the Burndy Corporation (Thermoweld), the Frisco Products, Inc. (Cordweld), or Continental Industries (Thermoweld), or approved equal. Thermit Welds shall not be located at places on pipe lines of known major stresses, such as on bends or welds. All Thermit Weld connections shall be coated with "Rokote" as manufactured by the Royston Laboratories, Inc., Blawnox, Pennsylvania, or approved equal.

¹ All wire connections (anode pigtail to header cables) shall be made with Crimpit² compression type connectors and four half-lap layers of self vulcanizing rubber tape (as manufactured by Okonite Cable Company or approved equal), two half lap layers of No. 33 Scotch Tape³ and a coat of Scotch-Kote Sealer⁴.

² As manufactured by Kraloy Plastic Pipe Company, Santa Ana, California, or approved equal.

³ As manufactured by Burndy Corporation, Norwalk, Connecticut, or approved equal.

⁴ As manufactured by Minnesota Mining and Manufacturing Company, Saint Paul 6, Minnesota, or approved equal.

⁵ As manufactured by Erico Products, Inc., Cleveland, Ohio, or approved equal.

⁶ As manufactured by Continental Industries, Tulsa, Oklahoma, or approved equal.

⁷ Insulated flanges shall be coated with white paint. A permanent tag (plastic or lead, stamped) shall be attached to each insulated flange, containing the following instruction: "Before disassembly or assembly of this insulated flange, notify the plant corrosion engineer."

Unless otherwise indicated, all dimensions given in inches.

(OVER)

UCASB00217718

ENGINEERING STANDARD NO. EL-76

NOTE:

Underground piping systems are generally provided with cathodic protection systems where soils have a soil resistivity of 10,000 ohm-centimeters or less. Soil resistivity surveys shall be used as guides. A corrosion engineer should be consulted when cathodic protection systems are to be designed.

The sacrificial anode cathodic protection system is employed where it is desirable or sufficient to apply small protective currents.

All cathodic protection systems shall be shown on electrical design drawings, referring to this Standard for the various installation details. Piping drawings shall show the points for the connection of cathodic protection wiring (Thermit-weld or lugs), the locations of any insulated flanges, and if desirable, the location of the anodes. Piping drawings shall also refer to the electrical design drawings showing the cathodic protection system.

The types of anodes used with the sacrificial anode cathodic protection system are magnesium or zinc anodes, or as otherwise specified by the corrosion engineer. If necessary, due to soil conditions, the anodes may be installed horizontally, instead of in the preferred vertical position.

All types of test stations shall be installed in accordance with Standard EL-77 or as otherwise specified by the corrosion engineer. Locations of test stations shall be specified by the corrosion engineer.

Cast iron test boxes with terminal blocks, as are available from C P Test Services, Inc., Kearney, New Jersey, may be used where a flush-with-grade installation is specified.

Insulated flanges shall not be detailed on electrical design drawings. The components to convert standard flanges to the insulated type consist of gaskets, bolt sleeves and washers made of Micarta material and are available in kit form from F H Maloney Company, Houston 1, Texas. If Micarta is incompatible with the fluid carried by the protected pipeline, suitable gasket material shall be specified.

In order to assure optimum efficiency for a cathodic protection system, scheduled testing shall be specified.

All materials shall be billed from electrical design drawings.

REFERENCES:

Ground Rod Installation - Zinc Anode	Std EL-51
Zinc Anode Grounding Cell	Std EL-52
Test Stations for Cathodic Protection Systems	Std EL-77
Standard Specifications, Cathodic Protection of Underground Steel Pipelines	B260