HWS - 7262

SPECIFICATIONS FOR
HIGH TEMPERATURE LATTICE TEST REACTOR
BUILDING 318

PROJECT CAH - 100

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SPECIFICATIONS FOR
HIGH TEMPERATURE LATTICE TEST REACTOR
BUILDING 318

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DIVISION I

EXCAVATING, BACKFILLING AND GRADING

GENERAL

1. SCOPE

This division of the specification covers all excavating, backfilling, stabilization, filling and grading for the High Temperature Lattice Test Reactor, Buildings 318, 318-A, 318-B, and 318-C except that required for the paved drive specified in Division XX and that required for the landscaping specified in Division XXI.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS (AASHO)

T180-57 Moisture-Density Relations of Soils Using a 10 Lb.
Rammer and 18" Drop

T147-54 Field Determination of Density of Soil in Place

MATERIALS AND WORKMANSHIP

3. EXCAVATING

3.1 FOOTINGS AND FOUNDATIONS

- a. Excavations will be made in predominantly sandy soil interspersed with strata of cemented gravel and small boulders up to approximately two feet in diameter.
- b. All excavations for footings and foundation slabs shall be made to proper depth and width with adequate allowances made for forms and bracing. Bottoms of such excavations shall be level and true and free from loose materials.
- c. Machine excavation for structures to bear on undisturbed earth shall be stopped 2 inches or more above the elevation of the bottom of the footing or base slab as shown on the drawings. The remaining excavation to the required elevation shall be done by manual means.
- d. If over-excavation occurs where footings or foundations are to be placed on undisturbed earth, it shall be corrected at the time of placing concrete by extending the concrete to undisturbed earth.

- e. Excavated or other materials shall not be stored closer than 4 feet from the edge of the excavation and shall be so stored and retained as to prevent them from falling or sliding into the excavation, and to prevent excessive pressure on the sides of the excavation.
- f. Sides and slopes of excavations shall be maintained in a safe condition by scaling, benching, or barricading. Excavations shall be maintained free from standing water at all times.
- g. All footings and foundations shall bear on undisturbed earth except for slabs on grade as defined in Section 4.4 below.

3.2 PIPE TRENCHES

- a. All excavations for piping shall be true to line and grade as shown on the drawings. They shall be of adequate width to permit handling of pipe and accessories and making necessary connections. They shall be of sufficient depth to permit the placement of a compacted sand cushion (4 inches minimum thickness) beneath pipe except where excavation is in undisturbed sand.
- b. Shoring will be required for all trench excavations more than 4 feet deep in which the sides are sloped steeper than one horizontal to one vertical. Shoring shall be installed as excavation progresses and shall be removed as backfilling is accomplished.
- c. Shoring and bracing shall be designed to withhold all material and surcharge pressures the full depth of the trench.
- d. Pipe trenches shall be maintained free from standing water while pipe laying is in progress.

4. BACKFILLING

4.1 GENERAL

- a. Only selected material shall be used for backfill. Frozen particles or lumps, vegetable matter or trash shall not be used in any backfill. Backfill shall not be placed on frozen ground.
- b. Backfilling by means of sluicing or flooding with water will not be permitted. This requirement shall not prohibit the saturation and vibration of the sand cushion beneath underground pipelines.

4.2 PIPE TRENCH BACKFILL

- a. Backfill material under the haunches of the pipe, around the sides, and up to a point one foot above the top of the pipe shall be sand, or excavated material containing no stones or gravel larger than 1/2 inch

in greatest dimension. Any over-excavation of pipe trenches shall be corrected by bringing the trench bottom up to proper profile with load-bearing backfill, prior to laying pipe. Trench backfill above a point one foot above the top of the pipe shall be non-load-bearing backfill, as specified in Section 4.3 below. Backfill beneath pipelines entering manholes, valve pits and foundation walls shall be load-bearing backfill.

- b. Backfill shall not be placed over joints in underground lines until pressure testing of the line has been completed.
- c. Heavy construction equipment shall not pass over underground lines until at least 3 feet of compacted backfill has been placed over the line.

4.3 NON-LOAD-BEARING BACKFILL

- a. Material for non-load-bearing backfill shall contain no rocks larger than 8 inches in any dimension.
- b. Non-load-bearing backfill shall be placed in layers not more than 12 inches thick, loose measurement. Each layer shall be compacted full width, by at least two passes of a vibratory type compactor.
- c. Backfill of excavations for structures shall be non-load-bearing backfill, except where load-bearing backfill is specified.

4.4 LOAD-BEARING BACKFILL

- a. All backfill beneath slabs-on-grade, such as building entry slabs, equipment slabs and concrete walks, shall be load-bearing backfill. Fill material, placed to raise the earth subgrades, within 5 feet of structures shall be compacted as specified below for load-bearing backfill. Materials for load-bearing backfill shall contain no rocks larger than three inches in any dimension.
- b. Load-bearing backfill shall be placed as follows:
 - (1) Materials shall be placed in layers not more than 8 inches thick, loose measurement. Each layer shall be uniformly spread, and compacted to the required density shown below.
 - (2) Load-bearing backfill shall be compacted with a vibratory type compactor until 95% of the "maximum density" is achieved.

The "maximum density" shall be determined by the method specified in AASHTO Designation: T180, Method D. The compacted backfill shall be tested by the method specified in AASHTO Designation: T147.

- c. The Contractor shall submit, in writing, a proposed method for compacting load-bearing backfill, for approval by the Commission. The Contractor will be required to demonstrate by physical test at the site

that the proposed method will provide the degree of compaction specified in paragraph b (2) above, at least five working days before starting backfill work.

- d. When a specific procedure has been approved by the Commission, it shall be followed in compacting all load-bearing backfill.

5. FINISH GRADING AND STABILIZATION

- a. The area surrounding the building shall be graded to the new contours shown on Drawing H-3-25006. Contour elevations include the gravel stabilization course and topsoil for landscaping. The subgrade shall be raked free of surface stones larger than 2 inches in greatest dimension, trash, scrap lumber, chips and other debris. Area designated for ground-cover planting shall be prepared for landscaping work covered in Division XXI.
- b. The extent of the stabilized area is shown on drawing H-3-25001. A three inch thick course of pit run gravel (maximum size two inches) shall be spread uniformly and compacted in place over the designated stabilized area. Passage of earth-moving equipment over the stabilizing course, during grading, is acceptable for compaction of the material.

DIVISION II
REINFORCED CONCRETE

GENERAL

1. SCOPE

This division covers concrete, other than high density and insulating concrete, for the High Temperature Lattice Test Reactor, Buildings 318, 318A, 318B, 318C and supporting facilities.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM C33-61T	Concrete Aggregates
ASTM C94-62	Ready-Mixed Concrete
ASTM C150-62	Portland Cement
ASTM C260-60T	Air-Entraining Admixtures for Concrete

2.2 HANFORD STANDARDS AND SPECIFICATIONS

HW-4798-S, Rev. 6	Placing Reinforced Concrete
HWS-6139-S, Rev. 1	Low Shrinkage Grout

2.3 AMERICAN CONCRETE INSTITUTE

ACI 315-57	Manual of Standard Practice for Detailing Reinforced Concrete Structures
ACI 318-63	Building Code Requirements for Reinforced Concrete

3. SUBMISSION OF DRAWINGS

Prior to fabrication, the Contractor shall submit complete reinforcing fabrication and placing drawings to the Commission for approval. Drawings shall be submitted in accordance with the requirements stated in the Special Conditions. Drawings shall conform to ACI-315.

MATERIALS

4. CONCRETE

a. Structural portland cement concrete shall conform to ASTM C94.

(1) Cement for structural concrete shall conform to ASTM C150, Type II.

- (2) Fine aggregate for structural concrete shall be washed natural sand conforming to ASTM C33.
- (3) Coarse aggregate for structural concrete shall be washed crushed stone or washed gravel conforming to the requirements of ASTM C33. Maximum size of coarse aggregate shall be 1-1/2 inches.
- b. Structural concrete shall have a minimum allowable compressive strength of 3000 psi at 28 days.
- c. An air entraining admixture shall be used in structural concrete. The admixture shall conform to the requirements of ASTM C260. The air content of the concrete shall be within the range 3 to 6 percent.
- d. Slump of concrete at the time of deposit in the forms shall be not less than two inches nor more than 4 inches, except that concrete in slabs and heavy wall sections (more than 24" thick) shall have a slump not greater than 2" at the time of placement in the forms.

5. GROUT

Low shrinkage grout shall conform to Hanford Standard Specification HWS-6139-S.

6. FORMS AND REINFORCING

Forms and reinforcing steel shall be as specified in Hanford Standard Specification HW-4798-S.

7. RETARDER

Concrete-set retarder to be applied to forms for exterior faces of Reactor Room walls shall be a type which will retard the set of the mortar on the face of the wall for a period of at least 5 days. Retarder shall be Sika Chemical Corp. "Rugasol F"; A. C. Horn Div. of Sun Chemical Corp. "Aggretex F"; or approved equal.

8. FOUNDATION WALL COATING

Coating for exteriors of exterior basement walls shall be a cold-applied asphalt specifically formulated for below-grade waterproofing. Foundation coating shall be A. C. Horn Div. of Sun Chemical Corp. "Dehydratine" No. 4, or approved equal.

9. ABRASIVE STAIR NOSINGS

Stair nosings shall be of the widths shown on the drawings and shall be extruded aluminum with abrasive filled ribs (top surface flat). Abrasive nosings shall be American Abrasive Metals Co. "Altred" No. 131A and 141 A; Wooster Products, Inc. "Super-Grit" No. 131 and 141; American Mason Safety Tread Co. Fig. 31 and 35, or approved equal.

WORKMANSHIP

10. PLACING CONCRETE

- a. All forming, reinforcing, placing, finishing (except finishing of exposed aggregate concrete), curing and repairing of structural concrete shall conform to the requirements specified in Hanford Standard Specification HW-4798-S, plus the following specific requirements:
- b. Concrete finishes shall be as follows:
 - (1) Formed surfaces to be exposed to earth backfill----- F-1.
 - (2) Interior formed surfaces of areaway, air inlet plenum, and filter pit----- F-2.
 - (3) Interior formed surfaces of building walls, generally- F-3.
 - (4) Formed surfaces in Reactor Room ----- F-4.
 - (5) Unformed surfaces of areaway slab and slabs for cooling tower, nitrogen tank, unit substations, sidewalks and roofs ----- U-2.
 - (6) Unformed surfaces of manhole base slabs and building floor slabs and stair treads ----- U-3.
 - (7) Exterior entry slabs at doors ----- U-5.
 - (8) Exposed aggregate finish for exterior of Reactor Room walls is specified in Section 12 below. ----- F
- c. All wall-to-wall corners (inside) shall be chamfered 3/4 inches.
- d. The shielding walls of the reactor room shall be placed as monolithic pours, in lifts not greater than 5 feet, with a differential level of not more than one foot around the walls during the pouring of each lift.
- e. "Pour slips" shall be prepared by the Contractor, at least one working day in advance of concrete placement, to show the specific portion of the structure to be placed, maximum size of coarse aggregate, compressive strength of concrete, and the required slump range. Commission approval will be required on each "pour slip" prior to ordering, delivery of, or mixing concrete. "Pour slip" forms will be furnished by the Commission.
- f. Waterstops, as specified in Hanford Standard Specification HW-4798-S, shall be used in all vertical construction joints in exterior walls of Building 318 below elevation 0'-0".

11. CONSTRUCTION JOINTS

- a. Joints not indicated on the plans shall be so made and located as to least impair the strength of the structure. Walls more than 2 feet thick shall not contain vertical construction joints.
- b. Beams and haunches shall be considered as part of the floor system and shall be placed integrally with the floor.
- c. Vertical construction joints in floors, where required, shall be located near the mid-point of the slab span. Floor and roof slabs for the Reactor Room shall not contain construction joints unless written permission is obtained from the Commission.

12. EXPOSED AGGREGATE FINISH

- a. Wall forms for the exterior face of Reactor Room shielding walls shall be coated with a retarder as listed in Section 7 above. The manufacturer's application instructions shall be followed in the application of the retarder.
- b. Following removal of forms, the surface laitance shall be removed to a depth of 1/8" to 1/4" to produce an exposed aggregate finish as called for on the drawings. Removal of surface mortar shall be done with a tampico-bristle brush and clean water. Care shall be exercised to prevent removal of more than 1/4" of the concrete surface.
- c. The concrete shall then be kept moist and cured for another 7 days.
- d. Care shall be exercised to prevent damage or misalignment to the sheet metal inserts on the exterior face of Reactor Room walls. Vertical inserts shall be supported, during placement of concrete, by wood blocking attached to the face of the form. The portions of metal inserts to be exposed to the atmosphere shall be primed with zinc-chromate, as specified in Division XIV, prior to erection.

13. BELOW-GRADE WATERPROOFING

- a. The exterior face of the exterior basement walls of Building 318 shall be given 2 coats of asphalt base, waterproofing of the type specified in Section 8 above. This requirement shall not apply to the walls of the areaway, air inlet plenum and the filter pit.
- b. The coating shall be applied in strict accordance with the printed instructions of the coating manufacturer. The coating shall not be applied until the concrete has been cured as specified in Hanford Standard Specification HW-4798-S.

DIVISION III

MASONRY

GENERAL

1. SCOPE

This division covers masonry for the High Temperature Lattice Test Reactor, Building 318.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM A82-61T	Cold Drawn Steel Wire for Concrete Reinforcement.
ASTM C90-59	Hollow Load-Bearing Concrete Masonry Units, Grade A.
ASTM C144-62T	Aggregate for Masonry Mortar
ASTM C207-49	Hydrated Lime for Masonry Purposes, Type N.

2.2 FEDERAL SPECIFICATIONS

SS-C-192d	Cements, Portland, Type II (low alkali cement)
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MATERIALS

3. CONCRETE

Concrete block for masonry walls shall conform to the requirements of ASTM C90, Grade A. Blocks shall be 8" x 8" x 16" or 4" x 8" x 16"

4. MASONRY MORTAR

Ingredients for mortar shall meet the following specifications:

- a. Portland cement shall conform to Federal Specification SS-C-192d, Type II, low alkali cement.
- b. Lime for mortar shall be normal hydrated lime conforming to ASTM C207, Type N.

- c. Aggregate for mortar shall be natural or manufactured sand conforming to ASTM C144.

5. MASONRY REINFORCING

- a. Masonry reinforcing shall be fabricated from steel wire conforming to the requirements of ASTM A82. Finish shall be bright basic.
- b. Reinforcement for concrete block shall have 2 No. 8 gauge or 3 No. 9 gauge longitudinal wires and shall be sized for normal 8" wall. Cross tie wires shall not be smaller than No. 12 gauge. Reinforcement shall be Durowal Produces "Durowal"; Carter-Waters Corp. "Blok-Mesh"; AA Wire Products Co. "Blok-Lok", or approved equal.

WORKMANSHIP

6. CONSTRUCTING MASONRY

6.1 MIXING MORTAR

- a. Mortar ingredients shall be mixed in the following proportions:

1 part (minimum) portland cement
1/4 part to 1/2 part hydrated lime

Dry loose aggregate shall be not less than 2-1/2 times nor more than 3 times the sum of the volumes of cement and lime used.

- b. Mortar materials shall be accurately measured by volume and thoroughly mixed in a batch mixer. Ingredients shall be thoroughly mixed while dry before adding water. Mixing shall continue for at least three minutes after all ingredients have been added. Mortar shall be mixed in quantities not greater than are required for use within one hour. Retempering of mortar will not be permitted. The use of salt or other anti-freeze admixtures will not be permitted.

6.2 LAYING BLOCKS

- a. Blocks shall be surface dry when laid. Blocks shall be laid in running bond pattern, and lintel blocks shall be used over doorway.
- b. Blocks shall be laid in shell mortar bedding. Mortar joints shall be struck off flush, and after the mortar has taken an initial set, the joint material shall be compacted with an oval faced grooving tool. Broken blocks shall not be used.

- c. Horizontal reinforcing shall be placed in every third course.
- d. Masonry walls shall be cleaned after mortar has set. Excess mortar and mortar stains shall be removed by scrubbing with a stiff tampico fiber brush and clean water. Where stains persist, muriatic acid shall be used to remove them.
- e. Block walls are to be fitted against concrete walls with a mortar joint and tied to concrete as shown on the drawings. Walls shall be fitted between flanges of structural steel columns and caulked with mortar as shown on the drawings.

7. CUTTING BLOCKS

Blocks requiring cutting shall be sawed with a masonry saw.

8. INSTALLING CINCH ANCHORS IN MASONRY

Masonry shall be drilled with a carbide bit, power drill for anchors. Star drills and manual operation will not be permitted.

DIVISION IV

STRUCTURAL STEEL AND MISCELLANEOUS METAL ITEMS

GENERAL

1. SCOPE

This division of the specification covers all structural steel framing and miscellaneous metal items for the High Temperature Lattice Test Reactor, Buildings No. 318, 318-A, 318-B, and 318-C.

2. SUBMISSION OF DRAWINGS

The Contractor shall submit complete shop drawings, erection diagrams and bills of material for all structural steel framing for approval by the Commission in accordance with the requirements stated in the Special Conditions.

3. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

3.1 AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC-1963	Specification for the Design, Fabrication and Erection of Structural Steel for Buildings
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3.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36-62T	Structural Steel
ASTM A283-58	Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality
ASTM A307-61T	Low Carbon Steel Externally and Internally Threaded Standard Fasteners
ASTM A325-61T	High Strength Steel Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers
ASTM A392-59T	Zinc Coated Steel Chain-Link Fence Fabric

3.3 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA B27.2-1958	Plain Washers
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3.4 FEDERAL SPECIFICATIONS

TT-P-86a	Paint, Red Lead, Ready-Mixed
RR-G-661a	Grating, Steel Floor
TT-P-645	Primer, Paint, Zinc Chromate

3.5 HANFORD STANDARD SPECIFICATIONS AND STANDARDS

AC-1-51	Rev. 0	Embedded Angles for Radiation Zones
AC-2-2	Rev. 2	Pipe Handrail - Platforms
HWS-4926-S	Rev. 5	Welding Carbon Steel
HWS-6139-S	Rev. 1	Low Shrinkage (Long Mix) Grout

MATERIALS

4. CARBON STEEL PLATES, SHAPES AND BARS AND CRANE RAILS

- a. Rolled structural steel plates, shapes and bars for building framing and miscellaneous steel items shall conform to the requirements of ASTM A36.
- b. Steel floor plates, including checkered plate, shall conform to the requirements of ASTM A283.
- c. Crane rails shall be ASCE 40 lb. sections and shall be mounted and attached as shown on the detail drawings.

5. BOLTS FOR ASSEMBLY AND ERECTION OF STRUCTURAL STEEL

Bolts, nuts and washers for all permanent connections in structural steel column and beam connections shall conform to the requirements of ASTM A325. Dimensions of washers shall conform to ASA B27.2. Bolts and nuts for miscellaneous connections such as stairs, handrails, etc., shall conform to the requirements of ASTM A307, Grade A. Anchor bolts shall be of ASTM A307, Grade A materials except as noted.

6. SHOP COAT PAINT FOR STRUCTURAL STEEL

Paint for shop-priming structural steel framing members, and prefabricated assemblies such as ledge angles, pipe sleeves, etc. shall be a product conforming to the requirements of one of the specifications listed below:

- a. Federal Specification TT-P-86a, Type II or III (red lead)
- b. Federal Specification TT-P-645

7. GRATINGS AND STAIR TREADS STRUCTURAL STEEL

Steel grating shall be pressure locked type conforming to Federal Specification RR-G-661a, Type 1. Grating and stair treads for exterior stairways shall be galvanized after fabrication. Openings more than 4 inches in diameter shall be banded.

8. FENCING

- a. Fabric for Areaway fence shall be 2" diamond mesh, 9 gauge wire, chain link type with top edge knuckle-finished and bottom selvage barbed and

twisted. Fence fabric shall be galvanized after fabrication and shall conform to ASTM A392, Class I.

- b. Fence posts, gate, hardware and fittings shall be of the types indicated on drawing H-3-25014 and shall be products of a firm normally engaged in the manufacture of chain link fence. All parts shall be galvanized after fabrication.

WORKMANSHIP

9. FABRICATION AND ERECTION OF STRUCTURAL STEEL

- a. Fabrication and erection of structural steel framing shall be in strict conformance with the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, 1963, and as noted herein and on the drawings.
- b. All beam connections shall be detailed in accordance with the provisions as specified in AISC Manual of Steel Construction, 6th edition, Part 4, Framed Beam Connections, Tables 1-A, with number of rows of fasteners as shown on the drawings.
- c. Friction type, high strength bolts, or equivalent welds shall be used for all permanent connections for steel column splices, beams and girders to columns, and beams to beams. Welding shall conform to the requirements of Division VI, Welding.
- d. Connections using high strength bolt fasteners shall conform to the requirements of the AISC Manual. Nuts may be tightened by the use of torque wrenches or by the "turn of the nut" method.
 - (1) When torque wrenches are used, tightening shall be done with properly calibrated wrenches to give a minimum bolt tension of 28,400 pounds for 3/4" bolts. Calibration of torque wrenches, once on each work shift, using instruments supplied by the Commission will be required. Hardened washers conforming to ASA B27.2 shall be used beneath either the nut or bolt head, whichever is turned in tightening.
 - (2) When the "turn of the nut" method is used, nuts shall be "free running" and the several parts of the joint shall be properly compacted by bringing at least one-half of the bolts to a snug tight condition, such as can be produced by a few blows of an impact wrench or by an ordinary spud wrench. Final tightening of the nuts shall consist of marking the position of the nut and giving it a 1/2 turn from the snug tight position, progressing from the most rigid part of the joint toward the free edges. One or more flat steel, circular washers conforming to ASA B27.2 are required beneath the nut.

10. SHOP PAINTING OF STRUCTURAL STEEL

- a. All structural steel shall be given a shop coat of paint in the fabricator's shop using one of the types of paint specified in Section 6 above.
- b. Structural steel shall be cleaned prior to receiving shop coat paint. Oil and grease shall be removed by solvent cleaning. Weld spatter shall be removed by chipping and grinding. Rust and loose mill scale shall be removed by wire brushing.
- c. The shop coat of paint shall not be applied when the steel is damp or when steel or the ambient temperature is below 40 F.
- d. Contact surfaces of friction type connections shall be left unpainted. This requirements is further covered in Division XIV, Painting.
- e. Steel surfaces to be embedded in concrete shall be cleaned and left unpainted.
- f. Sub-assemblies, formed from rolled structural shapes, shall be shop primed in the same manner as the building structure framing.

11. GROUTING-IN BASE PLATES AND BEARING PLATES

Column base plates, crane rail bases, and beam bearing plates shall be grouted-in with low shrinkage (long mix) grout, Hanford Standard Specification HWS-6139-S or with an epoxy-resin, non-shrink grout, approved by the Commission. Details covering preparation and placing of "long mix" grout are listed in Hanford Standard Specification HWS-6139-S.

DIVISION V

PLUMBING, PROCESS AND SERVICE PIPING

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DIVISION V

PLUMBING, PROCESS AND SERVICE PIPING

GENERAL

1. SCOPE

This division covers plumbing, process and service piping for the High Temperature Lattice Test Reactor, Building No. 318 and the Detector Building No 318-A other than that specified for the irrigation system in Division XXI.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The specifications and standards listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A53-61T	Welded and Seamless Steel Pipe
ASTM A72-59T	Welded Wrought-Iron Pipe
ASTM A106-61T	Seamless Carbon-Steel Pipe for High Temperature Service
ASTM A120-63T	Black and Hot Dipped Zinc Coated, Welded and Seamless, Steel Pipe for Ordinary Uses
ASTM A193-61T	Alloy Steel Bolting Materials for High Temperature Service
ASTM A194-59T	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A278-62T	Gray Iron Castings for Pressure-Containing Parts for Temperatures to 650 F.
ASTM A307-61T	Low Carbon Steel Externally and Internally Threaded Standard Fasteners
ASTM B75-62	Seamless Copper Tube
ASTM C39-61	Test for Compressive Strength of Molded Concrete Cylinders
ASTM C177-45	Thermal Conductivity of Materials (Guarded Hot Plate)
ASTM C296-59T	Methods of Test for Asbestos-Cement Pressure Pipe
ASTM C425-60T	Vitrified Clay Pipe Joints Using Materials Having Resilient Properties
ASTM C428-59T	Methods of Test for Asbestos-Cement Non-Pressure Sewer Pipe

2.2 AMERICAN STANDARDS ASSOCIATION (ASA) CODES AND STANDARDS

ASA A21.11-1953	Mechanical Joint for Cast Iron Pressure Pipe and Fittings
ASA A21.8-1962	Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds

ASA A40.1-1935	Cast Iron Soil Pipe and Fittings
ASA A40.8-1955	National Plumbing Code
ASA A116.1-1960	Polysulphide-Base Sealing Compounds for the Building Trade
ASA B16.3-1951	Malleable-Iron Screwed Fittings, 150 Lb.
ASA B16.4-1949	Cast Iron Screwed Fittings
ASA B16.5-1961	Steel Pipe Flanges and Flanged Fittings
ASA B16.9-1958	Steel Butt-Welding Fittings
ASA B16.11-1946	Steel Socket-Welding Fittings
ASA B16.12-1953	Cast Iron Screwed Drainage Fittings
ASA B31.1-1955	Code for Pressure Piping

2.3 AMERICAN WATER WORKS ASSOCIATIONS (AWWA) STANDARD

AWWA C203-62	Standard for Coal-Tar Enamel Protective Coatings for Steel Water Pipe
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2.4 FEDERAL SPECIFICATIONS

HH-I-523a (2)	Insulation; Block, Pipe Covering, and Cement, Thermal, Calcium Silicate
HH-I-552	Insulation; Pipe Covering, Thermal, Mineral Wool, Insulation, Blanket, Thermal Pipe Covering
HH-I-563	Insulation; Mineral Wool, Blanket, Felt and Industrial Batt
HH-P-117	Packing; Jute, Twisted
QQ-L-156 (1)	Lead; Caulking
WW-H-171 b	Hangers and Supports; Pipe
MIL-A-3316A	Adhesives, Fire Resistant, Thermal Insulation

2.5 HANFORD STANDARDS AND SPECIFICATIONS

HW-4926-S, Rev. 5	Welding Carbon Steels
HW-4966-S, Rev. 1	Disinfecting Sanitary Water Supply Systems
HW-5311-S, Rev. 1	Identification of Piping Systems
M-2-22, Rev. 1	Fire Hydrant

2.6 AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME Boiler Code, 1962, Section VIII, Code for Unfired Pressure Vessels

2.7 U.S. DEPT. COMMERCE - COMMERCIAL STANDARDS (CS)

CS 127-45	Self-Contained, Mechanically Refrigerated, Drinking Water Coolers
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MATERIALS

3. PIPE AND FITTINGS

a. Except for the substitution allowed by Section 3 b. below, pipe and

fittings shall be as specified in the Piping System Sheets of this specification and as detailed on the accompanying drawings and specifications for the particular service.

- b. For welded main lines 2" and larger, branches smaller than the main may be made with Weldolets, Sockoletts, or Thredolets, Bonney Forge & Tool Works, or approved equal, instead of the butt-welding tees specified in the Piping System Sheets included in this specification. When this substitution is chosen, Weldolets shall be used for branch **lines** specified to butt-welded, Sockoletts for socket-welded, and Thredolets for threaded. Material and weight shall correspond to that specified for the particular piping system.
- c. Close or butt nipples are not permitted.
- d. All steel piping to be exposed to earth backfill shall have an exterior protective coating of coal tar enamel with bonded asbestos felt wrap in accordance with AWWA C203.

4. VALVES AND STRAINERS

Valves and strainers identified in the Piping System Sheets by code number, are specified below. Brand names are shown only to illustrate the type and class of valve required. Valve packing shall be the manufacturer's standard for the service involved. Valves and strainers shall be as specified, or an approval equal.

4.1 GATE VALVES

<u>Valve Code No.</u>	<u>Specifications</u>
G 1.5 S 628	150 lb. bronze body & bonnet, ISRS, union or screwed bonnet, screwed ends, solid brass disc and stem. Crane No. 431 Lunkenheimer Fig. No. 2151 Ohio Injector Co. No. 96
G 1.2 F 302	125 lb. cast iron valve, OS & Y, flanged ends bolted bonnet, bronze stem and disc. Crane No. 465-1/2 Lunkenheimer Fig. No. 1430 Walworth No. 726 F
G 1.5 F 1	150 lb. cast steel valve, OS & Y, flanged ends, bolted bonnet; 12 Cr stem seat and disc. Crane No. 47 XR Pacific Fig. No. 150-3 Walworth No. 5202 F-AAA

G 6 T 276

600 lb. cast or forged steel, OS & Y, socket-welding ends, solid wedge
Crane No. 3605- XU
Hancock No. 950- W
Pacific No. 3652 - 3A

G 1.2 F 303

125 lb. cast iron, OS & Y, flanged ends, double disc, parallel seating
Crane No. 483
Jenkins No. 875
Walworth No. 820-F

4.2 GLOBE VALVES

GL 1.5 S 626

150 lb. bronze body & bonnet, ISRS, union or screwed bonnet, screwed ends, stainless steel disc.
Crane No. 7
Lunkenheimer No. 123
Jenkins Bros. 106-A

GL 1.2 F 304

125 lb. cast iron valve, OS & Y, flanged ends; bolted bonnet, bevel disc
Crane No. 351
Walworth No. 906-F

GL 1.5 F 3

150 lb. cast steel valve, OS & Y, flanged ends bolted bonnet, 12 Cr stem, disc & seat; plug type seat
Crane No. 143
Pacific Fig. No. 163-3
Walworth No. 5275-F

GL 6 T 277

600 lb. forged steel, OS & Y socket-welding ends, cone or plug disc
Crane No. 3652-W
Hancock No. 5520-W
Pacific No. 3662-3A

4.3 ANGLE VALVES

A 1.5 S 627

150 lb. bronze body & bonnet, ISRS, screwed bonnet, screwed ends, stainless disc
Crane No. 17
Jenkins Bros. Fig. No. 108-A
Walworth No. 96

A 1.2 F 305

125 lb. cast iron, OS & Y; bolted bonnet, bevel disc
Crane No. 353
Lunkenheimer No. 1124
Walworth No. 907 F

A 1.5 F 5

150 lb. cast steel valve; OS & Y, flanged ends,
bolted bonnet, plug type disc
Crane No. 45 XR
Pacific Fig. No. 170-3
Walworth No. 5278 F-AA

A 6 T 278

600 lb. cast or forged steel OS & Y, socket-
welding ends, cove or plug disc
Crane No. 3653 - W
Hancock No. 5530 - W
Ohio Injector No. 2127-HCH

4.4 CHECK VALVES

C 2 S 656

200 lb. bronze body swing check; screwed cap;
screwed ends
Crane No. 36
Lunkenheimer No. 554
Walworth No. 420

C 1.2 F 306

125 lb. cast iron body swing check flanged ends;
bolted cap
Crane No. 373
Lunkenheimer No. 1790
Walworth No. 928-F

C 1.5 F 7

150 lb. cast steel body swing check; flanged ends;
bolted cap, stainless steel seats and pivots
Crane No. 147-X
Pacific Fig. No. 180-1
Walworth No. 5341 F-AA

C 6 T 279

600 lb. cast or forged steel lift, bolted cap,
socket-welding ends; stainless steel seats
Crane No. 3682-X
Hancock No. 5540-W
Pacific No. 3682-1

4.5 STRAINERS

ST 1.5 S 1015

150 lb. bronze or steel body Type "Y" strainer;
screwed cap, screwed ends, stainless steel
strainer screen, 40 mesh or 1/64" perforations
Yarway Fig. No. 801
Fisher Gov Type No. 260
Kieley & Mueller Type No. 340

ST 1.5 F 1023

150 lb. steel or semi-steel body "Y" strainer, bolted cap, flanged ends, stainless steel strainer screen, 40 mesh or 1/64" perforations

5. GASKETS

Gaskets identified in the Piping System Sheets by code numbers shall be as specified below, or an approved equal.

<u>Hanford Code No.</u>	<u>Manufacturer's Identification</u>
G-1	White compressed asbestos 1/16" thick Garlock Style No. 7735 Johns-Manville No. 61
G-2	Dark compressed asbestos 1/16" thick Garlock Style No. 7021 Johns-Manville No. 60 without graphite
G-11	Medium hard neoprene, 60 $\pm$ 5 durometer Garlock Style No. 7986 Raybestos Manhattan No. RM-611

6. PIPE INSULATION

6.1 INSIDE BUILDING, IN PITS AND OUTSIDE ABOVE GROUND

- a. Insulation for all steam and condensate lines shall be molded, sectional, hydrous calcium silicate pipe covering conforming to Federal Specification HH-I-523a, Class 2. Thickness of insulation shall be as shown in the schedule below. The insulation shall be furnished with a factory-applied, 6 ounce, white canvas jacket, except that where the insulation is to be installed within 7 feet above a building floor or where exposed to the weather, the insulation shall have an aluminum jacket not less than 0.016" in thickness. Cement for forming insulation covering over fittings and valves shall conform to HH-I-523a, Class 3. Lagging adhesive shall be Benjamin Foster Co. No. 81-42 W, or approved equal.
- b. Anti-sweat pipe covering for condenser water, protected process water and cold sanitary water, where exposed to view, shall be a glass fiber material conforming to Federal Specification HH-I-552, Type 1, Class A, except that the density shall not be less than 7 lb. per cubic foot. Anti-sweat pipe covering shall be furnished with a factory-applied, laminated, kraft-paper-and-foil, vapor barrier jacket with white finish. Lap cement for this material shall be Owens-Corning "Vapor Barrier Cement", or approved equal.
- c. Anti-sweat pipe covering for hot and cold sanitary water inside partitions shall be a flexible, premolded, foamed plastic, Armstrong Co.

"Armaflex"; Johns-Manville Co. "Aerotube"; Owens-Corning "O-C Flexible Tubing Insulation", or approved equal. Cement for sealing joints in foamed plastic pipe covering shall be as recommended by the manufacturer of the covering.

- d. Insulation for hot sanitary water lines where exposed to view shall be a glass fiber material conforming to Federal Specification HH-I-552, Type 1, Class A, except that the material shall have a nominal density of not less than 3-1/2 Lb. per cubic foot. The insulation shall be furnished with a factory-applied, 6 ounce, white canvas jacket.
- e. Insulation for chilled-water supply and return lines shall be the same material with vapor barrier jacket as specified in Section 6.1 b above, except for thickness.
- f. Aluminum jacketing for insulation exposed to the weather shall be Type 3S-H14, plain or corrugated, not less than 0.016" in thickness, paper lined, and shall be furnished with aluminum or stainless steel bands for fastening in place. Jacketing designed for fastening with pop rivets or sheet metal screws is not acceptable. Jacketing shall be furnished in sections not less than 3 feet in length.
- g. Lagging cement for use with canvas insulation jackets shall be a white, fire resistive adhesive cement conforming to Mil-A-3316A. Benjamin Foster Co. No. 81-42 W, or approved equal, is an example of the type required.

INSULATION SCHEDULE

Service	Design Temp.	Type of Insulation	Nominal Pipe Size	Insulation Thickness
Steam-125 psig	360 F	Calcium Silicate	2" & less 2-1/2" to 4" 6" & 8"	2" 2-1/2" 3"
Steam- 30 psig	275 F	Calcium Silicate	2" & less 2-1/2" to 6"	1-1/2" 2"
Condensate	212 F	Calcium Silicate	All sizes	1"
Condenser Water	100 F	Fibrous Glass	All sizes	1/2" nom.
Protected Process Water	100 F			
Sanitary Water (cold)	70 F			
Sanitary Water (hot)	160 F	Fibrous Glass	All sizes	1/2" nom.
Chilled Water	45 F	Fibrous Glass	1-1/2" to 2-1/2" 3" & above	3-1/2" 4"

6.2 UNDERGROUND

- a. Insulation for steam and condensate lines where exposed to earth back-fill shall be a lightweight aggregate (vermiculite) concrete, enclosed in a plastic waterproof membrane of polyvinyl chloride at least 0.020 inches in thickness.
- b. The insulating concrete, after setting, shall have the following properties:
 - (1) A dry density of not more than 25 pcf.
 - (2) Compressive strength of not less than 75 psi at 28 days when tested in conformance with ASTM C39.
 - (3) A "k" factor of not more than 0.65 at 70 F mean temperature when tested in conformance with ASTM C177.
- c. The insulating concrete shall consist of expanded vermiculite aggregate (treated for underground use), portland cement, a liquid waterproofing admix and water.
- d. The concrete shall be prevented from bonding to the encased pipe. The parting medium shall be formed from 2 layers of kraft paper laminated with asphalt or foil. The parting medium shall be corrugated or embossed pattern.
- e. Continuous internal vents and drains not smaller than 1 inch in diameter shall be provided in the insulating concrete as shown on the drawings. Rubber tubing, expanded under pressure, water-filled polyethylene tubing, or similar means shall be used to form continuous vent passages through the insulating concrete between pits. Tubes shall be placed near the lower corners of the insulating conduit.

7. PIPE SLEEVES

- a. Pipe sleeves shall be fabricated from standard weight black steel pipe of the sizes indicated on the drawings.
- b. Packing for pipe sleeves carrying steam and condensate lines shall be calcium silicate insulation of the type specified in Section 6.1 above.
- c. Packing in sleeves for air, water and other unheated lines shall be tarred jute conforming to Federal Specification HH-P-117, Type II.
- d. Sealant for inner and outer ends of all sleeves shall be a polysulphide rubber conforming to ASA A116.1.

8. HANGERS AND SUPPORTS

- a. Pipe hangers specified below are intended to show general requirements for support at locations where special supports are not detailed on the drawings. Perforated straps shall not be used for supporting piping.
- b. Hangers for piping specified below shall conform to the requirements of Federal Specification WW-H-171 b.

<u>Piping</u>	<u>Hanger Type</u>
(1) Bare piping 4" & smaller, and insulated piping 1-1/4" and smaller	Type 6 adjustable swivel nut, split ring hanger
(2) Bare piping over 4"	Type 7 adjustable wrought clevis
(3) Insulated piping 1-1/2" and larger	Type 3 double-bolt clamp
(4) Clamps for suspending from the bottom flange of I-beams	Type 21 malleable I-beam clamp
(5) Wall brackets for horizontal piping	Type 33 medium weight welded steel bracket

- c. Clamps for suspending piping from structural steel members, other than those specified in paragraph b. (4) above, shall be the following Grinnell Co. products, or approved equal.
 - (1) Swinging top beam clamp - Grinnell Figure 270
 - (2) Universal channel clamp - Grinnell Figure 226
- d. Clamps for vertical offset piping shall be Blaw-Knox Figure 138, or approved equal.
- e. Where constant support hangers are specified on the drawings, such hangers shall be adjustable, spring-loaded type Grinnell Co. Fig. 82, or approved equal.
- f. Hanger rods shall be Grinnell Co. Figure 278 Welded-Eye Rods or Grinnell Co. Figure 140 Machine-Threaded Rods, or approved equal.
- g. Pipe covering protection saddles for lines inside the building, and outside the building above grade shall conform to the Federal Specification WW-H-171 b. and shall be of the following types:
 - (1) Type 40 A Steam, condensate and water lines
 - (2) Type 41 Chilled water lines

- h. Pipe supports formed from structural steel shapes shall conform to the materials and workmanship requirements stated in Division IV.

9. SUMP PUMPS EFN-318-P2 (A & B) & -P3 (A & B)

- a. The sump pumps for removal of waste water from the basement sumps in Building 318 shall be duplex units consisting of two, direct coupled, heavy duty, vertical sump pumps with suction strainers mounted on a common sump cover with sub plates for each pump (see drawing H-3-25258 for location).
- b. Each pump shall be designed to pump 40 gpm of waste water at a total dynamic head of 25 feet. Pump discharge pipes shall be 1-1/2" schedule 40 carbon steel.
- c. Pump motors shall be NEMA Splashproof for 3 phase, 60 cycle, 440 volt power supply.
- d. Sump pit dimensions are 32" x 32" x 4'-6" deep. Sump cover plate shall be 36" x 36".
- e. Pump controls shall consist of two, enclosed double pole float switches, each mounted on individual rigid support bolted to the sump cover. Float switches shall be actuated by adjustable copper floats, mounted on a brass rod.
- f. Sump pumps shall be Pacific Pumping Co. Type "SL" Duplex unit consisting of 2- Model 1-1/2" S05 pumps, or approved equal.

10. PLUMBING FIXTURES

10.1 WATER CLOSETS

- a. Water closets shall be wall mounted, vitreous china, siphon jet with elongated bowl, 1-1/2 inch top spud, exposed flush valve and white open front seat without cover. Water closets shall be American Standard "Glenco" No. F 2495-8, or approved equal, with white "Mol-Tex" 9500 seats.
- b. Flush valves for water closets shall be chromium plated with oscillating handle, screw driver stop, flush connection, and coupling for 1-1/2 inch top spud. Flush valves shall be Sloan Valve Company No. 112 YV "Royal", or approved equal, equipped with vacuum breaker, Sloan Valve Company No. V-100-A, or approved equal.
- c. Closets shall be mounted on Zurn Z-1205 or Z-1208 Series wall closet carriers and fittings, or approved equal.

10.2 DRINKING FOUNTAINS

Floor mounted drinking fountains shall be electric water cooler bubbler type, foot pedal operated, self-contained units with one piece stainless steel top, stainless steel reservoir, adjustable temperature control, and automatic stream regulator to provide uniform pressure at bubbler. Cooler shall have a capacity of 3 gph with 80 F inlet water and 50 F outlet water and shall conform to USBS Specification CS 127-45. Floor mounted drinking fountains shall be General Electric Co. Type PF 6 Cold, or approved equal.

10.3 SERVICE SINKS

Service sinks shall be vitreous enameled cast iron, 18 inches by 22 inches with 12 inch high back. Sinks shall be complete with adjustable floor mounted trap and double faucet with bucket hook, hose end spout, and vacuum breaker. Sinks shall be American Standard "Argo", No. P-7700-1 modified, or approved equal.

10.4 HOT SANITARY WATER HEATER

- a. Sanitary hot water heater shall be 80 gallon storage capacity, electrically heated. The tank shall be galvanized on the exterior and shall be glass-lined with 1" NPT connections. Tanks shall be insulated and jacketed. Pressure and temperature relief valve for the hot water tank is specified in drawing H-3-25277.
- b. The water heater shall be equipped with a minimum of two 240 volt, 60 cycle AC heating elements of the dry-well or strap-on type. Each element shall have individual thermostatic control. Upper element shall be 2000 watts and lower element 3000 watts.
- c. Hot water heater shall be Westinghouse Model TFH 80 P, or approved equal.

10.5 URINALS

- a. Each urinal shall be wall hung, vitreous china, siphon jet with 2 inch threaded outlet connection, integral trap, 1-1/4 inch top spud, and individual exposed flush valve. Urinals shall be American Standard "Alta", No. F-6240-1, or approved equal.
- b. Flush valves for urinals shall be chromium plated with oscillating handle, screw driver stop, flush connection for 1-1/4 inch top spud and vacuum breaker. Flush valves shall be Sloan Valve Company "Royal" 180 YV with vacuum breaker, or approved equal.
- c. Urinals shall be mounted on Zurn Z-1217 wall fixture carrier, or approved equal.

10.6 LAVATORIES

- a. Lavatories shall be vitreous china, 20 inches by 18 inches with 4-1/2 inch back, and concealed wall hanger. Lavatories shall be complete with combination supply fitting with aerator and pop-up drain. Adjustable 1-1/4 inch P trap, and 3/8 inch supply pipes with stops to wall shall be American Standard No. R-700-44 and R-2604 respectively, or approved equal.
- b. Lavatories shall be American Standard "Lucerne" No. F-350-40, or approved equal. Carriers for stud and plaster partitions shall be Zurn No. Z-1224 concealed hanger type carrier, or approved equal.

10.7 SHOWER CABINETS

Shower cabinets shall be a minimum 36 inches square by 82 inches high overall and shall have the following features:

- a. Walls of bonderized galvanized steel finished in baked-on enamel to match color of toilet compartments.
- b. Corners and joints shall be smooth with no projecting bolts or screws.
- c. Receptors shall be terrazzo with removable strainer plate. Receptors shall have non-skid surfacing and shall be attached to stall side wall in a manner which is leakproof.
- d. Fittings shall be chromium plated brass and shall consist of the following:
 - Hot and cold water valves
 - Shower head with ball joint
 - Soap dish
 - Curtain rod
- e. Curtains shall be heavy gauge translucent white plastic and shall extend to within 1 inch of bottom of receptor.
- f. Shower cabinets shall be Sanymetal Products Co., Inc. "Showermaster" shower cabinets, or approved equal, with non-skid surfacing covering 60% of standing area in the receptor, Minnesota Mining and Manufacturing "Safety-Wall", or approved equal.

11. AIR SYSTEM SPECIALTIES

Air system specialties are specified below and on the Data Sheets following.

11.1 INSTRUMENT AIR PRESSURE REDUCING VALVE - EPN-318-PRV-1

The PRV shall be a spring controlled pressure reducing valve to meet the

following specifications:

Fluid	Air
Pressure at inlet	90 psig
Pressure at outlet	40 psig
Temperature	80 F.
Flow	25 SCFM
End Connections	Screwed
Body Size	3/8"
Body Pattern	Single seated
Trim	Neoprene or composition seat

The PRV shall be Fisher Governor Type 95H to meet the above requirements, or approved equal.

11.2 INSTRUMENT AIR PRE-FILTER EPN-318-F-3

Pre-filter for removing oil and water from the instrument air supply shall have a capacity of 60 SCFM. The pre-filter shall be designed for entering air to be at 90 psig and at 70 F. Item shall be a Kemp Mfg. Co. Model PF-6 pre-filter charged with "Vaporsorb", or an approved equal.

11.3 INSTRUMENT AIR AFTER-FILTER EPN-318-F-4

- a. Air after-filter for removal of oil and water from the instrument air system shall have a capacity of 60 SCFM of dry oil-free air at 90 psig and 70 F. Connections shall be one inch screwed and filter shall have a swing bolt head.
- b. Filter shall be Kemp Mfg. Co. Model No. CPHS-IC, or an approved equal.

11.4 INSTRUMENT AIR RECEIVER - EPN-318-TK-2

- a. The vessel shall be a vertical, cylindrical, compressed-air receiver 2-1/2 feet diameter x 5 feet tall with nozzles located approximately as shown on drawing H-3-25274. Nozzles shall include inlet, outlet, drain, safety valve and inspection ports.
- b. Vessel shall be designed, fabricated, and stamped in accordance with Section VIII of the ASME Code.
- c. The safety valve shall meet ASME Code requirements and shall be provided pre-set at 100 psig for an expected working pressure of 90 psig.
- d. Forms U-1 and U-4 shall be completed as specified in the ASME Code for Unfired Pressure Vessels and shall be submitted to the Commission.
- e. Details of design are covered on the Pressure Vessel Data Sheet EPN-318-TK-2 following.

PRESSURE VESSEL DATA SHEET

Job No. CAH-100 Data Sheet No. EPN-318 - TK-2
Application Instrument Air Receiver
Location Bldg. 318
No. Required 1 Spares in Total 0 By LJ Chkd. ESF Appv'd _____ Date 6-18-64

Equipment Nos.	Rev.	Description	By	Appv'd	Date
EPN 318 - TK-2					

DESIGN DATA

Outside Dia. of Vessel 2-1/2 ft.
Length of Vessel, Tan. to Tan. 5 ft.
Working Press. psig 90 psig
Design Press. psig 125 psig
Working Temperature °F atmospheric
Design Metal Temperature °F same
Corrosion Allowance in none
Outside Dia. of Jacket ---
Jacket Working Press. psig ---
Jacket Design Press. psig ---
Jacket Working Temp. °F ---
Spec. Gravity of Contents (air)
Max. Oper. Level _____

MATERIAL DATA

Heads Carbon steel
Shell Carbon steel
Jacket Carbon steel
Jacket Bars Carbon steel
Internal Lugs, Clips, etc. Carbon steel
Skirt " "
Legs " "
Manhole Nozzles " "
Other Nozzles " "
Couplings " "
Flanges and Covers " "
Bolting, Pressure " "
Nuts - Pressure " "
Manhole Gaskets " "
Nozzle Gaskets " "
External Lugs, Clips, etc. " "
Tray Supports " "
Trays or Baffles " "
Internal Piping " "
Vessel Lining " "

CODE, TESTING, INSPECTION, ETC.

Code ASME Boiler & Pres. Ves. Code Sect. VIII
Stress Relieved _____
Radiographed _____
Stamped yes
Inspection By _____

RELATED SPECIFICATIONS

FABRICATION

Type of Head (top) flanged & dished
Type of Head (bottom) flanged & dished
Type of Supports base ring
Lifting Lugs _____
Manhole Flange Rating & Facing _____
Nozzle Flange Rating & Facing _____
Outside Paint Hand clean & apply 1 coat red lead.
Inside Paint _____
Cleanliness _____

REMARKS See Dwg. H-3-25274 for nozzle and coupling requirements.
A safety relief valve, set at 115 psig shall be supplied with the receiver. Relief valve shall be Kunkle Fig. 28-A, or approved equal.

11.5 ELECTRIC AIR DRYER - EPN-318-TK-3

Electric air dryer shall be C.M. Kemp Mfg. Co. "Oriad Dryer", fully automatic, Model 15 E or equivalent. Details shall conform to information listed on Data Sheet EPN-318-TK-3 following.

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EPN - 318-TK-3

INSTRUMENT DATA SHEET

Job No. CAH-100

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Data Sheet #

INSTRUMENT AIR DRYER No. EPN-318-TK3

Type: Electric reactivated dryer with dual adsorbing towers, complete with desiccant, to continuously dry instrument air per the following operation conditions:

Inlet Air: 60 SCFM @ 70 F & 90 psig saturated

Outlet Air: 60 SCFM @ 90 psig
Dew Point: 45 F

Operating Cycle: 8 hours minimum

Regeneration: Electric heat applied externally to dessicant bed
Length of cycle - 8 hour minimum

Dessicant: Quantity, type, depth, and surface area to be supplied by Seller.

Operation: Fully automatic, regenerative type with panel mounted instruments.

Orical: Power circuit - 440 volt, three phase, 60 cycle AC
Control circuit - 115 v, 1 phase, 60 cycle AC.

Dwg. Reference: H-3-25274

12. PROTECTED PROCESS WATER SYSTEM EQUIPMENT

The following Data Sheets specify the equipment and instrumentation required for the protected process water system. The instrumentation specified shall provide for maintenance of a constant liquid level in tank EPN 318-TK-4 and provide the necessary alarms and pump shutdown under abnormal operating conditions.

The equipment is as follows:

<u>Quantity</u>	<u>Item</u>	<u>Identification Number</u>
2	Process water feed pumps	EPN 318-P-4 & P-5
1	Underground water tank	EPN 318-TK-4
1	Purge rotameter	1 FI
1	Indicator-controller	1 LIC-57
2	Pressure switches	1 LS-57 & 2 LS-57
1	Flow control valve	1 FCV-57

CENTRIFUGAL PUMP DATA SHEET

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Job No. CAH-100 Data Sheet No. 318-P4, -P 5
 Application Protected Process Water System
 Location Bldg. 318
 No. Required 2 Spares in Total 0 By ESF Chk Appd Date

Equipment Nos.	Rev.	Description	By	Appd	Date
EPN 318 - P-4					
EPN 318 - P-5					

OPERATING CONDITIONS

Normal Capacity: gpm 275 Maximum Capacity: gpm 300
 Product Handled Water Total Dynamic Head (includes static head) 140 ft.
 Corrosion Due To --- Static Head
 Pumping Temp: °F 70 Vapor Press: PSIA 0.36 Suction Pressure 1.5 psig
 Sp. Gr. at Pumping Temp. 1 Differential Pressure
 Viscosity cps at °F NPSH Avail. 35 Ft. *NPSH Req'd ft
 Service continuous NPSH Includes 4 ft Static Head: Lift

Pump Shall Be
 Furnished in
 Accordance with

SPECIFICATIONS

Type horizontal frame mounted *Pump Eff. at Service Pt. %
 Over-all Size 60 in. max. length incl. driver Motor hp
 rpm 1750 No. Stages 1 Driver to be Furnished by Seller
 Rotation Pump Base pump and motor mounted on
 Suct. Size Driver Base common baseplate
 Disch. Size Coupling furnished by seller
 *Dia. of Impeller Furnished

MATERIALS AND DETAILS

Casing cast iron *Radial Bearings
 Bearing Enclosure Mfg. standard *Thrust Bearings
 Suct. & Discharge Conn. 125 lb. ASA flanges Packing or Seals
 Shaft carbon steel stuffing box
 Shaft Sleeves Mfg. Standard drawing reference: H-3-25273
 Impeller enclosed-cast iron Jacketing
 Wearing Rings Mfg. Standard Protective Coating

GENERAL INFORMATION

*Performance Curve No. Witness Tests Required:
 *General Assembly Drawing No. Hydrostatic Tests
 *Parts List Performance Tests
 *Dimension Print No. Inspection
 *Mfrs. Model No. Test Procedures & Calculations Per
 *Net Wt. of Pump & Base
 *Head, capacity, and horsepower curves shall be furnished with proposal

*Data to be furnished by vendor

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MOTOR DATA SHEET

Job No. CAH-100
Application Protected Process Water System
Location Bldg. 318
No. Required 2 Spares in Total 0

Data Sheet No. 318 - P4 - P5
Approved by Elect. Div. _____ Date _____
By ESF Chkd _____ Appd _____ Date _____

Equipment Nos.	Rev.	Description	By	Appd	Date
EPN 318 - P-4					
EPN 318 - P-5					

SPECIFICATION

Electrical Type Induction
Enclosure Type Splash Proof
Motor Rating: hp (**) _____ Duty Rating continuous
v 440 Phase 3 Frequency 60 Rated RPM 1750
Rated Temp. Rise: °C 95 Ambient Temp.: °C 20
Insulation Class B Ambient Atmosphere air
Bearings Ball or roller Lubrication _____
Starter Here Furnished, If Any by Buyer Altitude 400 ft.
Coupling Furnished By Seller
Base Furnished By Seller
Non-Standard Mount or Extensions _____
Approx. Load hp (under representative load) (*) _____

GENERAL INFORMATION
(to be furnished by vendor)

Manufacturer _____ NEMA Motor Code Letter _____
Outline Drawing No. _____ Starting Current: Amp _____
Frame No. _____ Full Load Current: Amp _____
Serial No. _____
Net Weight lb. _____

NOTES

Motor shall be furnished in accordance with NEMA Standards.
**Estimated horsepower _____; if vendor wishes to furnish a motor of larger horsepower
he must furnish reasons for this exception with his proposal.
Motor shall be furnished by equipment vendor assembled to equipment of same number.

REMARKS

TANK & DRUM DATA SHEET

Job No. CAH-100
Application Protected Process Water System
Location _____
No. Required 1 Spares in Total 0

Data Sheet No. EPN 318-TK-4
By ESF Chkd MOR Appd _____ Date 6-22-72

Equipment Nos.	Rev.	Description
EPN 318 TK-4		

PROCESS DATA

Process Fluid Water
Working Volume, gal. 800
Specific Gravity 1.0
Viscosity, cps. _____
Working Temperature, °F 70
Operating Pressure, psig atmospheric
Heat Transfer none
See Attached Exchanger Data Sheet
Agitation none
See Agitator Data Sheet No. _____
See Other _____

DESIGN DATA

Inside dia. of Vessel 5 ft. - 0 in.
Length of Vessel, Tan. to Tan. 10 ft. - 0 in.
* Vessel Volume, gal. _____
Design Pressure, psig _____
Hydrostatic Test Press., psig _____
Design Metal Temperature, °F 100
Corrosion Allowance, in. included in mat'l
Operating Level Range _____
Vessel Weight, lb. _____
* Max. Weight, Vessel & Controls, lb. _____
Insulation - Type none
Thickness, in. _____
Finish _____

CODE, TESTING, INSPECTION, ETC.

Code _____
Stress Relieved _____
Radiographed _____
Stamped _____
Inspection By _____

REMARKS:

Drawing Reference: H-3-25273

MATERIAL DATA

Heads carbon steel 3/16" min.
Shell carbon steel 3/16" min.
Internal Lugs, Clips, etc. carbon steel
Supports none
Manhole Nozzles carbon steel
Other Nozzles carbon steel
Couplings none
Flanges and Covers carbon steel
Bolting - Pressure, - Nonpressure
Bolts ASTM A193 - B 7
Nuts ASTM A194 - 2 H
Manhole Gaskets comp. asbestos
Nozzle Gaskets comp. asbestos
External Lugs, Clips, etc. carbon steel
Baffles carbon steel
Internal Piping carbon steel

FABRICATION

Type of Head (top) Optional
Type of Head (bottom) Optional
Type of Supports none
Lifting Lugs none
Manhole Flange Rating and Facing 75 lb. R.F.
Nozzle Flange Rating and Facing 150 lb. R.F.
Outside Finish coal tar enamel, AWWA C203
Inside Finish Fed. Spec TT-P-86c, Type IV

RELATED SPECIFICATIONS

STORAGE TANK DATA SHEET

Job No. CAH-100
Application Protected Process Water System
Location Bldg. 318
No. Required 1 Spares in Total 0

Data Sheet No. EPN - 318-TK-4
By DG Chkd ESF Appd Date 6-20-64

Equipment Nos.	Rev.	Description	By	Appd	Date

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PURGE ROTAMETER DATA SHEET

Job No. CAH-100 Data Sheet No. _____
Application Protected Process Water System _____
Location Building 318 _____
No. Required 1 Spares in Total 0 By _____ Chkd _____ Appd A.J.B. Date 6-18-61

Equipment Nos.	Rev.	Description	By	Appd	Date
1 FI					

TYPE: Variable area flow meter complete with differential pressure regulator

MOUNTING: Surface mounted

METERING TUBE: 65 millimeter glass tube

FLOAT: Glass bead

BODY: Manufacturer's standard for service

NEEDLE VALVE: Stainless steel needle valve adjustable from zero to full flow

CHECK VALVE: Nylon ball

PACKING & GASKETS: Manufacturer's standard for service

FLOWING MEDIUM: Air @ 70 F., 15 psig

RANGE: 0.25 - 2.5 SCFH

GRADUATIONS: Direct reading

CONNECTIONS: 1/4" NPT

INDICATOR CONTROLLER DATA SHEET

Job No. CAH-100 Data Sheet No. _____
Application Protected Process Water System
Location Building 318
No. Required 1 Spares in Total _____ By _____ Chkd _____ Appd A. J. H. Date 6-18-64

Equipment Nos.	Rev.	Description	By	Appd	Date
1 LIC-57					

TYPE: Direct connected pneumatic indicating pressure controller

MOUNTING: Surface

FINISH: Smooth, dull black

SCALE GRADUATIONS: 0 - 100 linear

ACCURACY: 3/4 % of full scale

RANGE: 0 - 60 inches water

PROPORTIONAL BAND: 0 - 200%, reversible

OUTPUT SIGNAL: 3 - 15 psig

AIR SUPPLY: 20 psig

ACCESSORIES: Manual-automatic transfer switch, manual loading station, air supply and output pressure gauges integral with case, and an air supply filter-regulator with built-in relief valve.

PRESSURE SWITCH DATA SHEET

Job No. CAH-100
Application Protected Process Water System
Location Building 318
No. Required 2 Spares in Total _____

Data Sheet No. _____
By _____ Chkd _____ Appd A.F.H. Date 6-18-66

Equipment Nos.	Rev.	Description	By	Appd	Date
1 LS 57 2 LS 57					

TYPE: Pressure actuated electric switch
CASE: General Purpose
MOUNTING: Surface
ELEMENT: Diaphragm
ACTUATING MEDIUM: Air
RANGE: 0 - 60 inches water
PROCESS CONNECTION: 1/4" NPT
ELECTRICAL CONNECTION: 1/2" NPT
CONTACT ACTION: Single pole double throw
CONTACT RATING: 115 volts, 60 cycles, 2 amperes minimum
ADJUSTMENT: Contacts shall be adjustable over full range
DIFFERENTIAL GAP: 6 inches water

CONTROL VALVE DATA SHEET

Job No. CAH-100

Data Sheet No. _____

Application Protected Process Water System

Location Building 318

No. Required 1 Spares in Total _____

By _____ Chkd _____ Appd A. J. K Date 6-18-64

Equipment Nos.	Rev.	Description	By	Appd	Date
1 FCV-57					

TYPE: Diaphragm operated control valve

APPLICATION: Double seated, throttling

GENERAL:

ACTION: Air to close. Valve to travel full stroke for an applied pressure of 3 to 15 psig.

RANGEABILITY: 40:1 minimum. (Defined as the maximum to minimum controllable flow at constant pressure differential across valve).

HYSTERESIS: 9" H₂O maximum without a positioner.

THREADS: Where stainless steel is mated tightly to stainless steel, materials shall be of different composition alloy and/or hardness to the degree necessary to prevent galling. Mated surfaces must be readily separable by ordinary maintenance methods.

FINISH: Manufacturer's standard

DIMENSIONS: Manufacturer's standard for service. Face to face dimension in accordance with ISA RP-4.1.

SUPERSTRUCTURE:

MATERIALS: Manufacturer's standard

ACTUATOR

HOUSING RATING: 35 psig minimum

AIR

CONNECTIONS: 1/4" NPT preferred

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INSTRUMENT DATA SHEET

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Job No. CAH-100

Data Sheet #

BEARING OR GUIDES: Non-lubricating type

VALVE STEM POSITION
INDICATOR: Required

BODY:

DESIGN: Globe type

MATERIAL: Carbon steel

PRESSURE RATING: 150 psig minimum

END CONNECTIONS: 3" - 150 lb. raised face flange

GASKETS: Manufacturer's standard for service

REMARKS: Flow direction arrow required on body

TRIM:

SIZE: See sizing information

PLUG AND STEM:

CHARACTERISTIC: Equal percentage

REMOVABILITY: Plug to be assembled to stem by threads and/or
pin in a manner to allow easy removal.

MATERIAL: 300 Series stainless steel

STEM PACKING: Teflon

FINISH: Manufacturer's standard

SEAT:

TYPE: Threaded and gasketed to body and notched for
easy removal.

MATERIAL: 300 Series stainless steel

FINISH: Manufacturer's standard

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INSTRUMENT DATA SHEET

Job No. CAH-100

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Data Sheet #

SIZING INFORMATION:

NOTE:	Manufacturer shall confirm sizing
FLOWING FLUID:	Water
TEMPERATURE:	70 F
FLOW RATE:	300 GPM
UPSTREAM PRESSURE:	85 psig
PRESSURE DIFFERENTIAL:	65 psi
REQUIRED C_v :	37 for maximum flow @ 75% valve travel
C_v OF VALVE:	Approximately 100

13. STEAM SPECIALTIES

13.1 STEAM PRESSURE REDUCING VALVE EPN-318-PRV-2

The PRV shall be a self-contained single-seated pressure reducing valve in accordance with the following specifications:

Fluid	Steam
Pressure at inlet	125 psig (saturated)
Pressure at outlet	30 psig
Capacity	4000 # 1 hr.
Body	Cast steel
End Connections	150 lb. standard flanged
Size	2-1/2"

The PRV shall be Spence Type ED, or approved equal.

13.2 EXPANSION JOINTS

- a. Expansion joints for steam and condensate lines shall be packless, bellows type joints, either single or double as shown on the drawings.
- b. Bellows shall be welded or hydro-formed. If hydro-formed type is furnished, bellows shall be fitted with external control rings. Joints shall have an internal flow liner. Both bellows and flow liner shall be fabricated from the same type of 300 series stainless steel. Joint ends shall be schedule 40 carbon steel pipe conforming to ASTM A53 or A106 and shall be beveled for welding.
- c. Expansion joints shall be furnished with an exterior carbon steel shroud or jacket to prevent the encasing, insulating concrete from interfering with bellows movement. Jacket shall be water-tight.
- d. Expansion joints shall be designed for:
 - (1) Installation at 50 F. and maximum operating temperature of 450 F.
 - (2) Normal operation at 340 F. and 115 psig.
 - (3) Hydrostatic test at 175 psig at 60 F.
 - (4) Steam test at 115 psig at 340 F.
 - (5) 10 year life with one complete cycle per month.
- e. Expansion joints shall be Adasco Division of Yuba Consolidated Industries, Inc. "Corruflex" joints; Flexicraft Industries "Flexicraft" joints; Cook Electric Co. "Magnetlastic" joints; or approved equal.

13.3 STEAM LINE TRAPS

- a. Steam traps, identified on the drawings by the Hanford Code No. T 4 S 1530, shall be thermodynamic-impulse type with screwed ends, renewable stainless

steel valve and seat in a steel or stainless steel body. Impulse traps shall be Yarnall-Waring Co. "Yarway" Series 60, or approved equal.

- b. Steam traps, to be used downstream of the pressure reducing valve, or identified on the drawings by Hanford Code No. T 0.3 S 1572, shall be float and thermostatic type, Sarco type FT-30 or type FTP, or approved equal.

13.4 RADIATOR ACCESSORIES

- a. Valves for base board convectors shall be brass body, angle union pattern, with replaceable seat and disc and non-conducting wheel handle. Valve shall have spring-loaded follower for stem packing and position indicator on the stem. Valve shall be Dunham-Bush No. 740, or approved equal.
- b. Traps for convectors shall be brass body, union connection type with liquid-filled thermostatic element incorporating the trap valve. Traps shall be suitable for a maximum operating pressure of 25 psig. Traps shall be Dunham-Bush No. 1 E, or approved equal.
- c. Air vents for baseboard convectors shall be hygroscopic type for use with steam. Vents shall provide a manually adjustable rate of venting and an off position. Vents shall be Hoffman Specialty Mfg. Corp. No. 500, or approved equal.

14. CHILLED WATER SYSTEM ACCESSORIES

14.1 VACUUM BREAKER

The vacuum breaker for the chilled water expansion tank shall be a 3/4" angle pattern, pressure type with bronze body and trim. The unit shall incorporate a check valve, spring-loaded air inlet, "Hycar" rubber air inlet seat, gate valve, angle valve and testing cocks. Vacuum breaker unit shall be Febco, Inc. No. 760, or approved equal.

14.2 AUTOMATIC MAKE-UP FEEDER

The unit shall be an automatic water feeder incorporating a level chamber, a float-operated water feed valve and a float-operated low water alarm switch. Valve stem shall operate through a sylphon bellows seal. Float chamber and float shall be suitable for operation at 75 psig. Water valve shall be 150 psig class. Feeder-alarm unit shall be McDonnell & Miller No. 53-2, or approved equal.

14.3 RELIEF VALVE

The relief valve shall be 1/2", outside spring type with screwed bonnet and ASME testing lever. All parts of the valve in contact with the fluid shall

be the equivalent of Type 316 stainless steel. The relief valve shall be set at 35 psig. The discharge capacity shall not be less than 0.25 gpm at 10% over-pressure. The relief valve shall be Crane Co. No. 18854, or approved equal.

14.4 VENT AND DRAIN VALVE

The combination vent and drain valve shall be a 1/2", 3-way valve with screwed ends and wheel handle. Valve shall be Bell & Gossett Co. "Air Charger & Tank Drainer" Valve, or approved equal.

14.5 GAUGE GLASS

The gauge glass for the expansion tank shall be the single unit, flat glass, reflex type, 7" visible length with 2 gauge cocks. Gauge cocks shall incorporate integral ball check valves. The unit shall be suitable for service at 250 psig and 400 F. The gauge glass assembly shall be Henry Vogt No. 18-R-5, or approved equal.

WORKMANSHIP

15. INSTALLATION OF PIPING

15.1 GENERAL

- a. All piping shall be fabricated and installed in accordance with ASA B31.1 and ASA A40.8, whichever is applicable, the Piping System Sheets, the drawings and these specifications.
- b. Welding on piping and field fabricated pipe supports shall conform to the requirements specified in Division VI.
- c. Valves, equipment and accessories shall be installed where and as shown on the drawings. Orifice plates for unions shown on drawing H-3-25257 will be furnished and installed by the Commission.
- d. Raised face flanges shall not be connected to flat face flanges.
- e. The ends of lines in open trenches shall be capped or plugged when erection is not in progress to prevent entry of water or blowing sand.

15.2 STEAM PIPING

- a. Steam piping shall be sloped 1 inch in 20 feet in the direction of flow or as shown on the drawings. Steam lines shall be free from low points or pockets, where condensate could collect, except at designated stations where traps are provided.
- b. Branches from the main shall be installed in the top 180 degrees of the main and shall slope up to valve stations and down to connected equipment.

- c. Condensate lines from the steam-using equipment shall enter the condensate return manifold in the top 180 degrees of the manifold. The condensate vent system shall slope down to the condensate return manifold.
- d. The inside of all pipes, valves, and fittings shall be smooth, clean and free from blisters, mill scale, sand, debris and dirt when erected. All lines shall be cleaned after installation and before placing in operation. Strainer screens shall be removed and cleaned after flushing.

15.3 CAST IRON AND ASBESTOS-CEMENT PIPING

- a. Cast iron and asbestos-cement pipe and fittings shall be handled with care at all times to avoid damage of any kind to the material or its coating. Damaged material shall not be included in the installation. Damage to pipe coating shall be repaired to the satisfaction of the Commission. Under no circumstances shall pipe or accessories be dropped or dumped.
- b. Cast iron and asbestos-cement water piping shall be laid on a bed of compacted or undisturbed sand not less than 4 inches thick under the bottom of the piping. Bell holes shall be prepared so that the pipe is supported along the full length of the barrel.
- c. Interior of pipe fittings and accessories shall be kept free from dirt or other foreign matter at all times.
- d. Before lowering pipe into the trench and while still suspended, each pipe section shall be inspected for defects and rung with a light hammer to detect cracks. Defective or damaged pipe shall not be used.
- e. Pipe shall be laid and maintained to the lines and grades shown on the drawings with fittings and valves at the required locations.
- f. Joints in mechanical joint cast iron piping shall be made in strict conformance with the pipe manufacturer's recommendations and "Notes on Methods of Installation" given in ASA A21.11.

15.4 VITRIFIED CLAY SEWER PIPING

- a. Pipe shall be protected during handling, against impact shocks and dropping. Immediately prior to laying, the pipe shall be inspected and any damaged sections shall be discarded.
- b. The laying of pipe in finished trenches shall be started at the lowest point of the run and progress upgrade with spigot ends pointed in the direction of flow. Trenches shall be free from standing water when jointing is in progress.

- c. All pipe joints shall be carefully centered so that, when the pipe is laid, a sewer with a uniform gradient will be formed. Bell holes shall be prepared so that the pipe is supported along the full length of the barrel.

16. INSTALLATION OF PIPE HANGERS AND SUPPORTS

- a. Vertical piping shall be supported at each floor level.
- b. Horizontal cast-iron soil piping shall be supported at intervals not to exceed 5 feet.
- c. Supports shall be in accordance with the suggested maximum spacing in ASA B31.1, Section 6, Table 21 A, with additional supports close to special concentrated loads such as heavy valves and specialties.

17. APPLICATION OF PIPE INSULATION

17.1 INSIDE BUILDINGS AND VALVE PITS AND OUTSIDE ABOVE GRADE

- a. After piping has been hydrostatically tested, the Commission will give notice that it is ready for insulation. The piping shall then be insulated, except that for steam lines, the flanges, fittings and valves shall be left uninsulated until the line has been tested at operating conditions. Approval of the Commission is required before insulating the flanges, fittings and valves.
- b. Pipe surface shall be free of water, oil, dirt, loose scale or other foreign material before the application of insulation.
- c. Insulation shall be of uniform thickness and shall fit snugly to the surface to which it is applied. Any insulation that is damaged or does not fit properly shall be replaced.
- d. Insulation shall be installed in a neat and uniform manner with joints tightly butted.
- e. Pipe insulation shall be terminated a sufficient distance from flanges to permit removal of bolts.
- f. Pipe insulation with small voids, such as broken corner, may be used, provided that the voids do not exceed one square inch in area and that they are filled with insulation material or silicate cement.
- g. Calcium silicate pipe insulation shall be covered with a troweled coat of silicate cement to present a smooth surface.
- h. Insulation for pipe bends shall be pipe covering mitered into lengths that fit neatly and smoothly with a troweled coat of silicate cement.

- i. Block insulation or pipe covering shall be applied over the body of flanged fittings and valves and shall be of sufficient thickness to make the OD of the insulation equal to the OD of the adjacent flanges. A sleeve type cover, consisting of pipe covering or block insulation equal in type and thickness to the adjacent pipe covering shall be applied over line flanges. Cover shall overlap the adjacent pipe covering not less than two inches or the pipe covering thickness, whichever is greater.
- j. Insulation shall be applied over valve bodies to the tops of the bonnets, covered with 6 oz. canvas and given a troweled coat of cement to present a smooth surface.
- k. On pipe sizes four inches and larger, welded fittings and valves bodies shall be insulated with block insulation or pipe covering and covered with calcium silicate cement the same as for flanged fittings and valves. On steam and condensate pipe sizes less than four inches, screwed and welded fittings and valve bodies shall be covered with ~~silicate~~ cement to a thickness equal to that of the adjacent pipe covering. The cement shall be applied in layers not exceeding 1/2 inch in thickness. Each layer shall be allowed to dry before applying the next layer and the final layer troweled to a smooth finish.
- l. On lines where glass fiber insulation is applied, valves and fittings shall be covered with mitered sections of line insulation. Where foamed plastic insulation is used, premolded fitting covers shall be installed.
- m. The vapor barrier on insulated condenser water, cold sanitary water and chilled water lines shall be sectionalized. The vapor barrier shall be terminated at flanged fittings and valves and sealed to the flange or returned to the pipe. All joints and laps in the vapor barrier jacket shall be sealed with vapor barrier cement.

17.2 INSTALLATION OF UNDERGROUND PIPE INSULATION

- a. Insulating concrete shall be placed on a structural concrete slab which in turn shall have been placed on undisturbed earth or compacted backfill and cured for at least 7 days.
- b. The plastic waterproofing membrane shall be laid directly on the concrete foundation slab and the pipe support blocks placed on top of the membrane. The height of the pipe support blocks shall be ~~adjusted~~ to preserve the gradient of steam and condensate lines as shown on the drawings.
- c. After the piping has been fabricated, the parting medium shall be placed around each pipe individually and fastened in place.
- d. Insulating concrete shall be placed around the pipes to the thickness shown on the drawings. After the concrete has set, the forms shall be removed and the devices used to form the vent and drain passages removed.

- e. As soon as forms have been removed the waterproofing membrane shall be completed. All laps in the waterproofing membrane shall be a minimum of 3 inches wide and shall be sealed with a rubber cement. Forms shall not be stripped from insulating concrete which cannot be covered with the waterproofing membrane on the same day. Where insulating concrete penetrates pit walls, a second layer of waterproofing membrane shall be adhered to the first layer and then flared out and cemented to the concrete of the pit wall.
- f. All punctures and tears in the waterproofing membrane shall be patched by cementing a piece of membrane in place over the damaged area.

18. CLEANING

- a. All pressure piping systems shall be flushed with water, immediately prior to pressure testing, until the effluent is clear and contains no visible particulate matter, but in no case less than 10 minutes.
- b. The flow for flushing pressure piping shall be sufficient to produce a velocity of at least 5 feet per second with pipe full.
- c. Pumps, coils and other equipment shall be protected by strainers during flushing.
- d. The method of disposal of flushing water shall be subject to approval by the Commission.
- e. All lines connecting directly to the sanitary water main shall be disinfected in accordance with Hanford Standard Specification HW-4966-S.

19. HYDROSTATIC TESTING

All piping shall be pressure-tested in accordance with the requirements stated in the Piping System Sheets and the following:

- a. All instruments, facilities and labor required to conduct the tests shall be furnished by the Contractor.
- b. Testing shall be performed under the direction of and to the satisfaction of the Commission.
- c. Testing shall be completed before pipe insulation is applied to above ground lines and before backfilling is completed over lines to be buried.
- d. Prior to testing, all chips, dirt and debris shall be flushed out of piping. Strainer screens shall be removed and cleaned after flushing.
- e. Air shall be expelled from lines prior to applying test pressure.
- f. Pressure in section of piping undergoing test shall be slowly raised to the specified test pressure.

- g. All piping, fittings and joints shall be carefully examined during testing, and valves shall be checked for proper operation. All visible leaks shall be repaired.
- h. All repaired piping shall be retested.
- i. Joints and connections of welded or screwed lines to be hydrostatically tested shall be painted with a blue powdered chalk and water mixture and allowed to dry before filling lines with water.
- j. Duration of test shall be at least 30 minutes with no visible leaks and without appreciable loss of pressure as determined by the Commission.

20. SEALING PIPE SLEEVES

Wherever pipe sleeves occur, the annular space between the sleeve and the pipe shall be packed with tarred jute or pipe insulation (see Section 7 above) to within 1/2 inch of the ends of the sleeve. The 1/2 inch deep space at the ends of the sleeve shall then be sealed with a polysulphide rubber type sealing compound of the type specified in Section 7 above.

21. CODE COMPLIANCE

The code compliance of compressed air (including instrument air), chilled water, steam and condensate lines shall be documented on a Pressure Piping Completion Record form. A copy of the form is included as Appendix "A" to this specification. One or more of the forms shall be used to described and record each of the systems. Each of the systems shall be described in enough detail and divided into enough piping reaches to readily identify the procedure number, filler material, welders' identification number, etc., used for any weld. These records shall be prepared and certified and signatures obtained by the Contractor prior to backfilling, insulating or otherwise covering any part of the piping system involved. Forms will be furnished by the Commission prior to acceptance of any of the piping systems named in this section.

22. IDENTIFICATION OF PIPING AND EQUIPMENT

- a. The details listed in Hanford Standard HW-5311-S shall be followed.
- b. A continuity check shall be made on lines shown in the drawings by passing compressed air or water through the line to verify that the correct line number has been used at both ends of the line.

23. PIPING SYSTEM SHEETS

All piping materials, fabrication, installation and testing shall be in conformance with the drawings, these specifications and the following Piping System Sheets:

PIPING SYSTEM H-9

<u>Service</u>	<u>Symbol</u>	<u>Max. Op. Press.</u>	<u>Max. Temp.</u>
a. Compressed Air	CA-90	90 psig	100 F
b. Instrument Air	IA-90	90 psig	100 F
	IA-40	40 psig	100 F

Size	Less than 1/2" OD	1/2" to 1-1/2" IPS	2" IPS and Larger
Pipe	Copper tubing, ASTM B 5. Annealed with flared fittings; light drawn or drawn with solder fittings.	Schedule 40 black steel, any ASTM A53 except Type F	
Fittings	Flared: Cast, wrought or bar stock brass, 45° SAE flared. Soldered: wrought copper	150 pound malleable iron, screwed, ASA B16.3	Schedule 40 wrought steel butt-welding, ASA B16.9
Unions	Flared Couplings	300 pound malleable iron, screwed, AAR M-404	Use flanges below
Flanges	None	None	150 pound forged welding-neck ASA B16.5. Use flat-face where mating to flat-face flanges.
Bolting	None	None	Carbon Steel, heavy hexagon or stud bolts and heavy hexagon nuts, ASTM A307 Grade B.
Gaskets	None	None	G-1 or G-2, use full-face gaskets with flat face flanges
Valves: Gate Globe Angle Check	IPS Sizes: G 1.5 S 628 GL 1.5 S 626 A 1.5 S 627 C 2 S 656		G 1.2 F 302 GL 1.2 F 304 A 1.2 F 305 C 1.2 F 306
Cleaning	See Section 18 herein.		
Testing	Hydrostatic test at 175 psig and dryout completely with oil-free air or nitrogen. See Section 19 herein for further details and requirements.		
Code Compliance	Per ASA B31.1, Section 2. Also see Section 21 herein.

PIPING SYSTEM H-11

<u>Service</u>	<u>Symbol</u>	<u>Maximum Op. Pressure</u>	<u>Max. Temp.</u>
Condensate	CNDS	125 psig	360 F

Sizes	1-1/2" and smaller	2" and larger
Pipe	Standard weight black wrought iron ASTM A72.	
Fittings	150 lb. malleable-iron screwed ASA B16.3	Butt-welding ASA B16.9, material and wall thickness to match pipe
Unions	300 lb. malleable-iron screwed brass-to-iron seat, AAR M-404	Use flanges below
Flanges	None	150 lb. forged steel welding neck ASA B16.5. Tube Turns Part No. 30 or approved equal. Use flat-face where mating to flat-face flanges.
Bolting	None	Carbon Steel, heavy hexagon or stud bolts and heavy hexa- gon nuts, ASTM A307, Grade B.
Gaskets	None	G-1 or G-2. Use full-face gaskets with flat-face flanges.
Valves		
Gate	G 1.5 S 628	G 1.2 F 302
Globe	GL 1.5 S 626	GL 1.2 F 304
Angle	A 1.5 S 627	A 1.2 F 305
Check	C 2 S 656	C 1.2 F 306
Cleaning	See Section 18 herein.	
Testing	Hydrostatic test at 175 psig and blow-out with air. See Section 19 of this division for further details and requirements.	
Code Compliance	Per ASA B31.1, Section 1; also see Section 21 herein.

PIPING SYSTEM H-14

<u>Service</u>	<u>Symbol</u>	<u>Maximum Op. Pressure</u>	<u>Max. Temperature</u>
a. Sanitary Water (Hot and Cold- Inside)	SW	115 psig	160 F

Sizes	3" and Smaller	4" and Larger
Pipe	Schedule 40 galvanized steel (any ASTM A53 (except Type F) or ASTM 120	Schedule 40 black steel, any ASTM A53 except Type F or A106
Fittings	150 pound galvanized malleable iron screwed, ASA B16.3	Schedule 40 wrought steel butt-welding, ASA B16.9
Unions	300 pound galvanized malleable iron screwed, brass-to-iron seat, AAR M-404	None
Flanges	None	150 pound forged steel welding neck or slip-on, ASA B16.5. Use flat-face where mating to flat-face flanges.
Bolting	None	Carbon Steel, heavy hexagon or stud bolts and heavy hexagon nuts, ASTM A307, Grade B
Gaskets	None	G-1 or G-2; use full-face gaskets with flat-face flanges
Valves Gate Globe Angle Check	GL 1.5 S 628 GL 1.5 S 626 A 1.5 S 627 C 2 S 656	G 1.2 F 302 C 1.2 F 306
Cleaning	See Section 18 herein.	
Testing	Hydrostatic Test at 175 psig. See Section 19 of this Division for further details and requirements.	
Disinfecting	Sanitary water piping shall be disinfected in accordance with Hanford Standard Specification HW-4966-S (see section B)	
Code Compliance	Per ASA B31.1, Section 1

PIPING SYSTEM H-15

<u>Service</u>	<u>Symbol</u>	<u>Max. Op. Pressure</u>	<u>Max. Temp.</u>
a. Protected Process Water	PPW	115 psig	100 F
b. Condenser Water	CDW	115 psig	100 F

Sizes	1-1/2" and Smaller	2 and Larger
Pipe	Black steel any ASTM A53 except Type F	
Fittings	150 lb. malleable-iron screwed ASA B16.3	Wrought steel butt-welding ASA B16.9. Wall thickness to match pipe.
Unions	300 lb. malleable-iron screwed brass-to-iron seat - AAR M-404	Use flanges below
Flanges	None	150 lb. forged steel welding neck ASA B16.5. Use flat- face where mating to flat- face flanges
Bolting	None	Carbon steel, heavy hexagon or stud bolts and heavy hexagon nuts, ASTM A307, Grade B
Gaskets	None	G-1 or G-2. Use full-face gaskets with flat-face flanges
Valves: Gate Globe Angle Check	G 1.5 S 628 GL 1.5 S 626 A 1.5 S 627 C 2 S 656	G 1.2 F 302 GL 1.2 F 304 A 1.2 F 305 C 1.2 F 306
Cleaning	See Section 18 herein.	
Testing	Hydrostatic test at 175 psig. Refer to Section 19 of this Division for further details and requirements.	
Code Compliance	Per ASA B31.1, Section 1.

PIPING SYSTEM H-16

<u>Service</u>	<u>Symbol</u>	<u>Maximum Op. Pressure</u>	<u>Max. Temp.</u>
a. Steam, Low Pressure	LPS	30 psig	275 F
b. Steam, Med. Pressure	MPS	175 psig	360 F

Sizes	1-1/2" and Smaller	2" and Larger
Pipe	Black Steel, any ASTM A53, except Type F	
Pipe Wall Thickness	Schedule 40	2" through 10"; Schedule 40 12" through 24"; 0.375" Wall
Fittings	105 lb. malleable-iron screwed ASA B16.3	Wrought steel, butt-welding per ASA B16.9. Wall thick- ness to match pipe.
Unions	300 lb. malleable-iron screwed brass-to-iron seat, AAR M404	Use flanges below
Flanges	None	150 lb. forged steel welding- neck ASA B16.5. Use flat- face flanges.
Bolting	None	Carbon steel, heavy hexagon or stud bolts and heavy hexagon nuts, ASTM A307, Grade B.
Gaskets	None	G-1 or G-2; use full-face gaskets with flat-face flanges.
Valves: Gate Globe Angle Check	G 1.5 S 628 GL 1.5 S 626 A 1.5 S 627 C 2 S 656	G 1.5 F 1 GL 1.5 F 3 A 1.5 F 5 C 1.5 F 7
Vacuum Breaker	150 lb. brass ball check valve Crane No. 27 or equal.	
Cleaning	See Section 18 herein.	
Testing	Hydrostatic test at 200 psig and steam test at operating press- ure. See Section 19 of this Division for further details and requirements.	
Code Compliance	Per ASA B31.1, Section 1 - Also see Section 21 herein.

PIPING SYSTEMS H-19A AND H-19B

<u>Service</u>	<u>Maximum Operating Pressure</u>	<u>Max. Temp.</u>
Fire and Sanitary Water (Underground)	115 psig	100 F

Sizes	2-1/2" and Smaller	3" through 24"
Pipe	Schedule 40 galvanized steel any ASTM A53 (except Type F) or ASTM 120	A. Class 150 centrifugally cast iron, ASA A21.6 or ASA A21.8 with mechanical joints per ASA A21.11.
		B. Class 150 asbestos-cement per ASTM C296 with Ring- Tite joints.
Fittings	150 lb. galvanized malleable iron screwed, ASA B16.3.	A. To match pipe.
		B. Ring-Tite joints, TIFCO RR fittings or approved equal, the Independent Fittings Company, Port- land, Oregon.
Valves	<u>1-1/2" and Smaller</u> G 1.5 S 628	A. For use with indicator post, G 1.2 M 504. Regular type G 1.2 M 503.
	<u>2" and 2-1/2"</u> G 1.2 S 502	B. For use with indicator post, G 1.2 R 506. Regular type G 1.2 R 505.
Valve Accessories	Extension Enclosure: Cast Iron service box, roadway box or valve box. Indicator post: IP 1.2 F 512	
Fire Hydrant	None	Fire Hydrant installation in conformance with Hanford Standard M-2-22.
Cleaning	See Section 18	
Testing	Hydrostatic Test at 175 psig. See Section 19 for further details and requirements.	
Disinfecting	Fire and sanitary water piping shall be disinfected in accordance with Hanford Standard Specification HW-4966-S.	
Code Compliance	See Section 21 herein.

PIPING SYSTEM H-20

<u>Service</u>	<u>Symbol</u>	<u>Maximum Operating Pressure</u>	<u>Max. Temp.</u>
a. Sanitary sewer, Waste and Vent - Inside	SNS	Gravity	160 F
b. Process Drains	PD	Gravity	160 F

Sizes	Above Ground: 2-1/2" and Smaller	Above Ground: 3" and Larger Under Ground: All Sizes
Pipe	Schedule 40 galvanized steel any ASTM A53 or ASTM A120	Extra-heavy cast-iron soil pipe ASA A40.1
Joints	Screwed	Firmly packed with tarred jute, filled with molten lead not less than 1" deep and caulked. Sufficient lead shall be used so that when caulking is completed, the lead shall not extend more than 1/8" below the rim of the hub.
Fittings	Waste Lines: Cast-iron screwed drainage, ASA B16.12. Vent lines 150 lb. galvanized malleable iron screwed, ASA B16.3; or 125 lb. cast-iron screwed, ASA B16.4.	Extra-heavy cast-iron soil fittings, ASA A40.1
Testing	Hydrostatic gravity test conforming to Paragraph 14.9.1 of the American Standard National Plumbing Code, ASA A40.8.	
Cleaning	Piping shall be flushed for 20 minutes prior to testing with a stream of water with a velocity of at least 5 feet per second.

PIPING SYSTEM H-21

Service

Maximum Operating Pressure

Max. Temp.

Process Sewer
(Underground)

Gravity

160 F

Sizes	4" through 24"
Pipe and Fittings	Extra Strength vitrified clay, ASTM C278 resilient jointing connection conforming to ASTM C425, such as Gladding, McBean & Company "Speed-Seal"
Testing	Hydrostatic gravity test subjecting each joint to not less than a 10' head of water

PIPING SYSTEM H-22A AND H-22B

Service

Maximum Operation Pressure

Max. Temperature

Sanitary Sewer
(Underground)

Gravity

160 F

Sizes	4" through 24"
Pipe and Fittings	A. Extra strength vitrified clay, ASTM C278, with resilient jointing connections conforming to ASTM C425, such as Gladding, McBean & Company "Speed-Seal".
	B. Nonpressure asbestos-cement conforming to ASTM C428 Class 2400 unless specified otherwise.
Testing	Hydrostatic gravity test subjecting each joint to not less than a 10' head of water.

PIPING SYSTEM H-32

Service	Maximum Operation Pressure	Max. Temperature
Chilled Water Supply (CWS)	115 psig	60 F
Chilled Water Return (CWR)	115 psig	60 F

Sizes	3/4" and Smaller	1" and Larger
Pipe	Schedule 40 black steel, any ASTM A53 (except Type F) or A106	
Fittings	Schedule 40 (2000 lb.) forged steel, socket welding, ASA B16.11	Schedule 40 wrought steel butt welding ASA B16.9
Unions	Schedule 40 (2000 lb.) forged steel socket-welding, steel-to-steel seat	Use flanges below
Flanges	150 lb. forged steel socket-welding ASA B16.5. Use flat-face where mating to flat-face flanges.	150 lb. forged steel welding neck ASA B16.5. Use flat-face where mating to flat-face flanges.
Bolting	Carbon steel, heavy hexagon or stud bolts and heavy hexagon nuts, ASTM A307, Grade B.	
Gaskets	G-1, G-2 or G-11; use full-face gaskets with flat-face flanges.	
Valves: Gate Globe Angle Check Plug Butterfly	<u>1-1/2" and Under</u> G 6 T 276 GL 6 T 277 A 6 T 278 C 6 T 279 125 lb. bronze spring-loaded plug cock, Walworth Company, Fig. #639, or approved equal.	<u>2" and Larger</u> G 1.2 F 303 GL 1.2 F 304 A 1.2 F 305 C 1.2 F 306 Non-lubricated plug valve, W-K-M, Div. of ACF Fig. #240, or equal. Plug facings shall be Hycar elastomer.
	None	150 lb. iron, for mounting between 150 lb. flanges, Henry Pratt Co., "Monoflange Mark II" or approved equal, with seat suitable for 34% ethylene-glycol solution.
Automatic Air Vents	Sarco No. 13-WH, or approved equal.	
Cleaning	See Section 18 of this Division.	
Testing	Hydrostatic test at 175 psig and blow-out with compressed air. See Section 19 herein for further details and requirements.	
Code Compliance	Per ASA B31.1, Section 1.

PIPING SYSTEM H-51

<u>Service</u>	<u>Symbol</u>	<u>Max. Op. Press.</u>	<u>Max. Temp.</u>
Low Pressure Condensate and Vent	CNDS-LP	Gravity	275 F

Sizes	1-1/2" and Smaller	2" and Larger
Pipe	Standard weight, black wrought iron per ASTM A72	
Fittings	125 lb. cast iron per ASA B16.4	Butt-welding per ASA B16.9, material and wall thickness to match pipe.
Unions	150 lb. malleable iron brass-to-iron seat	Use flanges
Flanges	None	150 lb. forged steel welding-neck per ASA B16.5. Use flat face where mating to flat-face flanges
Bolting	None	Carbon Steel, heavy hexagon series or stud bolts and heavy hexagon nuts per ASTM 307, Grade B, A307
Gaskets	None	G-1 or G-2. Use full-face gaskets with flat-face flanges.
Valves:		
Gate	G 1.5 S 628	G 1.2 F 302
Globe	GL 1.5 S 626	GL 1.2 F 304
Angle	A 1.5 S 627	A 1.2 F 305
Check	C 1.5 S 656	C 1.2 F 306
Cleaning	Flush with water. See Section 18 herein.	
Testing	Hydrostatic test at 50 psig. See Section 19.

PIPING SYSTEM H-55A

<u>Service</u>	<u>Symbol</u>	<u>Max. Operating Pressure</u>	<u>Max. Temp.</u>
Chemical Process Drains	CPD	Gravity	160 F

Sizes	All Sizes
Pipe	Bell and spigot type, extra heavy weight, high silicon iron alloy, Durco Duriron pipe, or approved equal
Joints	Firmly packed with impregnated asbestos rope packing (Durco No. 1900 rope packing, or approved equal), filled with molten lead not less than 1" deep and caulked; sufficient lead shall be used so that when caulking is completed the lead shall not extend more than 1/8" below the rim of the hub.
Fittings	Extra heavy Duriron fittings, or approved equal
Testing	Hydrostatic gravity test conforming to Paragraph 14.9.1. of the American Standard National Plumbing Code, ASA A40.8.
Cleaning	Piping shall be flushed for 20 minutes prior to testing with a stream of water with a velocity of at least 5' per second.

PRESSURE PIPING COMPLETION RECORD

AREA NO. VHFD	BUILDING OR FACILITY NO.	LOCATION	DATE
DESCRIPTION OF PIPING (IF NECESSARY USE ADDITIONAL SHEETS)			
MAX. ALLOWABLE WORKING PRESSURE _____ PSI TEMPERATURE _____ F		TEMPERATURE CORRECTION _____ % AND _____ PSI	APPLICABLE DRAWINGS OR SPECIFICATIONS
PIPE MATERIAL SPECIFICATIONS (ASTM, ETC.)			
ORIGINAL CONSTRUCTION	MODIFICATION	REPAIR	JOB ORDER (PROJECT NO., CONTRACT NO., OR W.O.NO.)
FABRICATOR (NAME OF PLANT FORCE FACILITY, COST PLUS FF CONTRACTOR, LUMP SUM CONTRACTOR)			
WELDING DONE IN ACCORDANCE WITH QUALIFIED WELDING PROCEDURE NOS.			
FILLER MATERIAL (ASTM AND TYPE)			
WELDERS OR WELDING OPERATORS WELD IDENTIFICATION NO. AND DATE LAST QUALIFIED			
TEST PERFORMED:			
SECTION	X-RAY ***	FLUID PENETRANT	OTHER **
HYDROSTATIC TEST PRESSURE _____ PSI AND TEMPERATURE _____ F MET TEST REQS. _____			
PIPE MATERIAL, FITTINGS, SIZES, SCHEDULES AND RATINGS CONFORMS TO DRAWINGS AND SPECIFICATIONS ? ☐ YES ☐ NO		PRESSURE RELIEF VALVES AND DEVICES INSTALLED IN ACCORDANCE WITH CODES ☐ YES ☐ NO	
PRESSURE RELIEF VALVES - (CROSS OUT INAPPLICABLE) - (BURSTING DISC) - (TESTED) (TAGGED) AT _____ PSI		INSTALLATION, WELDING AND TESTING DONE ACCORDING TO ASA B31.1 PLUS ADDITIONAL REQUIREMENTS IMPOSED BY APPLICABLE SPECS OR DWGS. ☐ YES ☐ NO	
REMARKS:			
* IF "NO" GIVE DETAILS IN "REMARKS" ** DESCRIBE IN "REMARKS" *** SPOT _____ % 100%		<u>CERTIFIED CORRECT:</u> FABRICATOR _____	
(CODE PIPING SYSTEMS ARE SUBJECT TO THIRD-PARTY INSPECTION; DATA BELOW IS REQUIRED FOR SUCH SURVEILLANCE.) <u>INFORMATION REQUIRED FOR THIRD-PARTY INSPECTION</u> ..		<u>TESTS WITNESSED BY:</u> INSPECTOR _____	
1. FULL SET OF DRAWINGS AND SPECIFICATIONS. 1 2. ALL APPLICABLE WELDING PROCEDURE QUALIFICATION SHEETS. 1 3. ALL OPERATOR PERFORMANCE QUALIFICATION SHEETS. 1 4. NON - DESTRUCTIVE TEST RESULTS SHEETS, INCLUDING RADIOGRAPHS. 1 5. CERTIFIED MILL TEST REPORTS ON ALL MATERIAL AND COMPONENTS USED. 1 6. ALL STAMPED JOINTS LEFT UNCOVERED BY PIPE COVERERS SO THAT THEY MAY BE INSPECTED. 1		<u>REVIEWED AND APPROVED BY:</u> ENGINEER _____

DIVISION VI

WELDING

GENERAL

1. SCOPE

This division covers all welding in connection with the construction of the High Temperature Lattice Test Reactor, Building No. 318, 318-B, and 318-C.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA B31.1-1955 Code for Pressure Piping

2.2 HANFORD STANDARD SPECIFICATIONS

HW-4900-S, Rev. 4 Specification for Qualifying Welders
HW-4926-S, Rev. 5 Welding Carbon Steels

3. QUALIFICATION OF WELDERS

All persons who perform welding covered by these specifications shall be qualified in accordance with the requirements specified below:

- a. Welds on structural steel building framing, sheet metal, and miscellaneous metal sub-assemblies shall be made only by welders who have been previously qualified by tests as prescribed in Hanford Standard Specification HW-4900-S.
- b. Welds on pressure piping shall be made only by welders who have been previously qualified by tests as prescribed in Section 6, Chapter 4 of ASA B31.1.
- c. It shall be the responsibility of the Contractor to insure that welders in his employ have been properly qualified as specified above prior to performing welding which will become a part of the work covered by these specifications. The results of the individual welder performance qualification tests shall be made available to the Commission.

4. WELDING PROCEDURES

- a. Commission-approved and qualified procedures governing the welding specified herein are on file in the office of the Commission. Copies

of these procedures will be made available for use by the Contractor upon request.

- b. If the Contractor elects to use his own procedures, qualification test results of such procedures shall be presented for approval by the Commission prior to welding on any items which will become a part of the work covered by these specifications. Procedures presented to the Commission for approval shall be in the form as recommended in Appendix A to Section 6, of ASA B31.1.

MATERIALS

5. FILLER METAL

Filler metal used in welding carbon steels shall conform to the requirements stated in Hanford Standard Specification HW-4926-S.

WORKMANSHIP

6. FABRICATION OF WELDED PIPING

- a. Welding of carbon steel piping shall be done in accordance with the American Standard Code for Pressure Piping, ASA B31.1, Section 6, Chapter 4.
- b. In addition to the above, welding on carbon steel piping shall meet the quality requirements specified in Hanford Standard Specification HW-4926-S.

7. WELDING OF CARBON STEEL PLATE, SHEET, AND MISCELLANEOUS SHAPES

Welding of all carbon steel plate, sheet, and miscellaneous structural shapes other than pressure piping, building framing and pressure vessels, shall be done in accordance with the requirements of Hanford Standard Specification HW-4926-S.

DIVISION VII
INSULATED METAL SIDING

GENERAL

1. SCOPE

This division covers insulated metal siding for the High Temperature Lattice Test Reactor, Building 318.

2. REFERENCED SPECIFICATIONS

The specifications and standards listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN STANDARDS ASSOCIATION

ASA A116.1-1960

Polysulphide-Base Sealing Compounds
for the Building Trade

2.2 FEDERAL SPECIFICATIONS

HH-I-521c

Insulation, Mineral Wool, Batts, Loose
Fill and Granular Fill

QQ-S-775c

Steel, Sheets, Carbon, Zinc-Coated

TT-C-598 (2)

Compound, Caulking, Plastic

MATERIALS

3. INSULATED METAL WALL PANELS

3.1 GENERAL

- a. Wall panels shall be formed from zinc-coated steel sheets conforming to Federal Specification QQ-S-775c, Type I, Class E. Face panels shall be bonderized or phosphate-treated and given a shop prime coat (baked on) at the manufacturer's plant.
- b. Wall panels shall be supplied in full-wall-height lengths so that intermediate horizontal joints will not be required.

- c. Panels shall be furnished complete with galvanized steel closure strips and flashing fabricated by the panel manufacturer from material conforming to Federal Specification QQ-S-775c, Type I, Class E. Closure strips shall be galvanized 18 gauge B & S, and shall conform to the requirements shown on the drawings. Cadmium plated steel or stainless steel self-tapping screws shall be furnished for fastening closures and flashings in place.
- d. Loose fill insulation for wall insulation at jambs and corners shall be mineral wool conforming to Federal Specification HH-I-521c, Type II.
- e. Insulation for panel sections shall be glass fiber, in batt or semi-rigid board form. Density of the insulation shall be not less than 2-1/2 lb. nor more than 6 lb. per cubic foot. Insulation shall conform to Federal Specification HH-I-521c, Type I, Class A.
- f. The Contractor shall submit test data developed by an independent laboratory showing that the panels, proposed for use under this specification, comply with the heat transmission requirements stated herein for the respective panels. Test data shall show the average rate of heat transmission for at least 3 test panels including a minimum of 2 side joints.

3.2 VENTILATION PENTHOUSE WALL PANELS

- a. The penthouse wall panels shall be factory-fabricated, 1 1/2" thick, 12" wide, flush, insulated panels, with both interior and exterior face sheets formed from 20 gauge (min.) steel sheets.
- b. The overall coefficient of heat transmission, of the assembled panel in still air shall be not greater than $U = 0.20 \text{ Btu/hr./sq. ft./degree F}$ temperature differential.
- c. Penthouse wall panels shall be fitted with interlocking male and female joint. Female section shall be factory-caulked, or male section shall have a sponge rubber gasket adhered, to form a weather-tight joint.
- d. Penthouse wall panels shall be furnished with mechanical fasteners for attachment to steel framing. Fasteners shall be of a type which will permit disassembly without damage to the panels.

3.3 MAIN BUILDING WALL PANELS

- a. Insulated metal wall panels for exterior siding of main building walls shall have a smooth interior face sheet and a fluted exterior sheet with 1-1/2 inch deep, modular flutes which are generally rectangular in section. Panels shall be 24 inches wide.
- b. Both interior and exterior face sheets shall be formed with male and female edges to provide a side joint which can be sealed air tight and can be made fast mechanically. The female edge of exterior and interior face sheets shall be factory-caulked.
- c. The panel assembly shall be capable of withstanding a wind load of 20 pounds per square foot with a deflection of not more than 1/180 of the span for a simple span of 12 feet, 6 inches.
- d. The overall coefficient of heat transmission of the assembled panel in still air, shall be not greater than $U=0.15$ Btu/hr/sq. ft./degree F temperature differential.
- e. Insulated metal wall panels shall be furnished with sub-girts for fastening exterior face sheet to the interior sheet to eliminate visible exterior fastenings. Sub-girts shall be insulated at fastening points to prevent direct metal to metal conduction of heat through the panel.

4. SEALING AND CAULKING COMPOUNDS

- a. Wherever caulked seams and joints are called for on the drawings the caulking material used shall conform to the requirements of Federal Specification TT-C-598, Grade 2 (knife grade).
- b. Wherever sealants or sealing compounds are specified on the drawings, the material used for this purpose shall conform to the requirements of ASA A116.1.

WORKMANSHIP

5. ERECTION OF INSULATED METAL WALL PANELS

5.1 VENTILATION PENTHOUSE

- a. Panel erection shall conform to the requirements shown on the erection drawings furnished by the manufacturer of the panels used and the contract drawings.

- b. Corner closures shall be packed with loose-fill insulation.
- c. Galvanized steel counter flashing, not lighter than 22 gauge, shall be installed around all wall openings (door and louver frames).
- d. Finish painting of penthouse wall panels shall be as specified in Division XIV.

5.2 MAIN BUILDING WALL PANELS

- a. Interior face sheets of insulated main building wall panels shall be attached to the building framing by plug welding or with sheet metal screws. Each sheet shall be fastened to each support in 3 places; one place near each edge and one as near the center as possible.
- b. Male edges of panels shall be press-fitted into factory-caulked female edges to provide air-tight sealed joints.
- c. Insulation and sub-girts shall then be installed and the exterior face sheets attached to the sub-girts in such a manner that fasteners are not visible on the exterior of the building.
- d. Insulation retainer strips and panel closure strips shall be fastened in place with cadimium plated or stainless steel, self-tapping, sheet metal screws.
- e. Molded neoprene or foam rubber closure strips shall be installed where shown on the drawings. Metal closure strips shall be installed as stops at top and bottom of inner face sheets. Flashings shall be provided as shown on the drawings to make the structure weather-tight.

DIVISION VIII

ROOF DECKS AND ROOFING

GENERAL

1. SCOPE

This division covers roof decking, insulating concrete and gravel surfaced built-up roofing for the High Temperature Lattice Reactor, Building No. 318.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM C332-56T	Light Weight Aggregates for Insulating Concrete
ASTM C150-62	Portland Cement

2.2 FEDERAL SPECIFICATIONS

QQ-S-775c	Galvanized Sheetmetal
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2.3 HANFORD STANDARDS AND SPECIFICATIONS

HWS-6143-S, Rev. 1	Applying Insulation to Steel Roof Decks
HWS-6148-S, Rev. 3	Built-Up Smooth and Gravel Surfaced Asphalt
HWS-6149-S, Rev. 3	Build-Up Smooth and Gravel Surfaced Asphalt Roofs on Insulated Decks
AC-8-1, Rev. 0	Flashing for Vent Pipes

MATERIALS

2.4 WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB #15 Grading and Dressing Rules

3. METAL DECKING

3.1 DECKING TO RECEIVE INSULATING CONCRETE

- a. Metal roof decking shall be corrugated (or fluted) zinc-coated steel, formed from structural quality sheets. Corrugations shall not be greater than 1-1/2 inches in depth. The decking shall be capable of supporting a combined live and dead load of 45 psf with a deflection of not more than 1/240 of the span.
- b. Decking panels shall be furnished in lengths to cover a minimum of two spans of roof support framing allowing a minimum of 2 inches bearing on end supports.
- c. Decking shall be furnished with vent clips or perforations to provide ventilation for the insulating concrete (minimum of 2 per span).
- d. Decking shall be furnished with 16 gauge anchor type, welding washers with a hole in the bearing surface to provide for plug welding the decking panels to the structural steel support framing.

3.2 DECKING FOR VENTILATION PENTHOUSE

- a. Penthouse decking shall be zinc-coated steel, panels formed from structural quality sheets. Panels shall be 2 feet wide, fluted section, 1-1/2 inches deep. Panels shall have male and female longitudinal joints with female section factory-caulked.
- b. Penthouse decking shall be capable of supporting a combined live and dead load of 35 psf with a deflection of not more than 1/240 of the span.
- c. Decking shall be furnished in single lengths to eliminate transverse joints. Also, 16 gauge welding washers, with a hole in the bearing surface to provide for welding the decking to the steel framing shall be furnished.

4. INSULATING CONCRETE

- a. Aggregates for insulating concrete roof decks shall be an expanded vermiculite conforming to ASTM C332, Group I. The unit weight of the aggregate shall be not less than 6 lb. or more than 10 lb. per cubic foot.

4. INSULATING CONCRETE (Continued)

Vermiculite aggregate shall be chemically treated to reduce capillarity in the concrete.

- b. Cement for insulating concrete shall conform to the requirements of ASTM C150, Type I or II.

5. ROOFING MATERIALS

- a. Roofing materials to be applied to concrete surfaces shall conform to the requirements of Hanford Standard Specification HWS-6148-S. References to reflective roof coatings, glass fiber roofing sheets and special heavy roofing sheets shall be disregarded.
- b. Roofing materials to be applied to the ventilation penthouse roof shall conform to the requirements of Hanford Standard Specification HWS-6149-S.
- c. Structural, board type insulation to be used on the penthouse roof shall conform to the requirements of Hanford Standard Specification HWS-6143-S.
- d. Flashing shall be galvanized sheet metal of 24 gauge or heavier conforming to Federal Specification QQ-S-775, Type I, Class D, unless otherwise noted on the drawings.
- e. Lumber for cants, nailers and stops shall be "Standard" Grade in accordance with paragraphs 122c or 123c of WCLIB #15.

WORKMANSHIP

6. INSTALLATION OF STEEL ROOF DECKS

- a. All steel roof decking shall be attached to the supporting structures by plug welding. Wing type anchor washers shall be used, at spacings as specified in the decking manufacturer's installation instructions.
- b. Decking shall be laid across the shorter spans of roof framing and shall span a minimum of 2 spans per length of deck panel.

6. INSTALLATION OF STEEL ROOF DECKS (Continued)

- c. Where decking is to be covered with insulating concrete, and decking is in solid sheets, vent clips shall be used at longitudinal laps, a minimum of 2 clips per span. If deck is punch or slit-vented, vent clips will not be required.
- d. Weld areas shall be cleaned, as soon as they have cooled, to remove weld spatter, slag and burned coatings. Weld areas then be touched up with zinc chromate primer of the type specified in Division XIV.

7. MIXING AND PLACING INSULATING CONCRETE

- a. Insulating concrete shall be mixed in a fixed-blade, rotating drum mixer with full drum agitator.
- b. Mix design for insulating concrete shall be based on 1 part portland cement per 6 parts expanded vermiculite aggregate. Water added shall be sufficient to provide a slump of 6 to 9 inches and an oven dry density of 28 to 30 lb. per cubic foot. The mix shall produce a uniform concrete with a compressive strength of 200 psi at 28 days.
- c. Mixing time shall be limited to that required to wet all the cement and aggregates and to form a uniform plastic mass. In no case shall the mixing time be more than 2 minutes. If transit mix equipment is used to deliver the concrete the mixer drum shall not be rotated while the equipment is in transit.
- d. Insulating concrete shall be placed immediately after mixing is complete. Screeds shall be set to provide the depth of concrete specified in the drawings. Insulating concrete shall be placed in alternate areas or panels defined by the screeds. When one panel has been screeded smooth the traffic in adjacent panels shall be restricted until the concrete in the completed panel has set 12 hours. Insulating concrete shall be screeded smooth but shall not be trowel finished.
- e. Insulating concrete shall not be placed on frosty surfaces or when the temperature is below 40 F. When it is anticipated that the air temperature will be near or below 40F after placing insulating concrete, the mixing water shall be heated to 75F to 100 F.

7. MIXING AND PLACING INSULATING CONCRETE (Continued)

- f. The Contractor shall take all precautions necessary to protect insulating concrete from freezing for a period of 7 days after placement. If damage should occur from freezing, all loose and scaling concrete shall be removed and replaced.
- g. The surface of the fresh insulating concrete shall be kept moist for a minimum of 3 days after placement, curing shall begin as soon as the concrete has taken an initial set. The insulating compound, which is compatible with roofing asphalt, shall be used. Compounds containing wax or ingredients which would prevent adhesion of roof insulation will not be acceptable.
- h. The insulating concrete shall be allowed to dry for a period of 21 days after curing is complete before application of roofing is started.

8. APPLICATION OF ROOFING

- a. Roofing on the concrete deck over the Reactor Room and on the insulating concrete deck over the service portion of Building 318 shall be 4-ply, built-up, gravel surfaced asphalt roofs in accordance with the requirements specified in Hanford Standard Specification HWS-6148-S. References to smooth surfaced roofs in the HWS-6148-S shall be disregarded.
- b. Roofing on the concrete deck over the Counting Room shall consist of 2 plies of 15 pound felt mopped solid over the primed deck and covered with a mopping of hot asphalt applied at the rate of 30 pounds per 100 square feet but not gravelled.
- c. The roof of the Ventilation Penthouse shall be covered with a plastic sheet vapor barrier and insulated as specified in Hanford Standard Specification HWS-6143-S. The roofing over the gravel surfaced asphalt roof as specified in Hanford Standard Specification HWS-6149-S.
- d. Metal flashing and asphalt plank walk ways shall conform to the details shown on the drawings and shall be applied as specified in the referenced specification for the portion of the roof involved.

DIVISION IX

PLASTER PARTITIONS AND CEILING

GENERAL

1. SCOPE

This division of the specification covers all plastered walls and ceilings for the High Temperature Lattice Test Reactor, Building 318.

2. SUBMISSION OF DRAWINGS

The Contractor shall prepare shop drawings to show methods of fastening plaster partitions to floors and ceilings and present them to the Commission for approval prior to purchase of materials. The drawings shall give complete information necessary for installation of all components, including weights and sizes of all parts and method of fastening partition framing to ceilings.

3. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

3.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C28-60	Gypsum Plasters
ASTM C35-62	Inorganic Aggregates for Use in Gypsum Plaster
ASTM C150-62	Portland Cement
ASTM C206-49	Special Finishing Hydrated Lime, Type S

3.2 FEDERAL SPECIFICATIONS

QQ-B-101c (1)	Bases, Metal (for) Plaster and Stucco Construction
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MATERIALS4. PARTITION FRAMING

- a. Framing for 2 inch and 2-1/2 inch solid metal lath and plaster partitions shall consist of the following:
- (1) Channel section studs, 3/4 inch cold rolled steel, shop coated weighing 300 pounds per 1000 linear feet (minimum)
 - (2) Metal lath, 1/8 inch flatrib, 2.75 pound per square yard, copper alloy steel, shop painted with rust inhibitive paint. Lath shall be expanded metal type, conforming to Federal Specification QQ-B-101c, Type FR. Lath shall be tagged with metal tags bearing manufacturer's name and weight of lath.
 - (3) Base assembly shall be 18 USS gage galvanized steel and shall consist of:
 - (a) Floor clip, for mounting 3/4 inch steel studs and bracket arms for 2-1/2" snap-on base.
 - (b) Snap-on base, 2-1/2", galvanized and prime painted, weighing 630 pounds per 1000 feet. Base splice plates shall be furnished.
 - (c) Cove base mould shall be 18 gage galvanized and prime coated steel, 1-3/16 inches high, with sheetmetal screws for attachment to metal base and wood screws for attachment to wood railing strip. Inland Steel Company "Milcor" No. 630 Cove Mould is an example of a product meeting these requirements.
 - (4) Ceiling runner shall be 20 gage galvanized steel channel section with integral clips for mounting 3/4 inch steel studs. Ceiling runner shall weigh not less than 200 pounds per 1000 lineal feet.
 - (5) Corner bead shall be 26 gage galvanized, short radius bead with 2-1/2 inch expanded metal wings and weighing not less than 215 pounds per 1000 lineal feet. Casing bead is described in Section 5d below.
 - (6) Bracing at doors and vent duct openings: 16 gage 3/4" steel channels.
 - (7) Tie wire for framing connections and splices shall be 16 gage galvanized annealed, iron wire. Lath tie wire shall be the same except 18 gage.

- b. Framing for 7-1/2 inch metal lath and plaster partitions shall consist of the following:
- (1) Channel section studs, 16 gauge galvanized steel, 6 inches wide.
 - (2) Floor runner (stud track), 6 inch channel section, 18 gauge galvanized steel, with stud shoes. Same construction at top and bottom of wall.
 - (3) Snap-on base, 2-1/2", shop coated (same as in 4a.(3)(b) above) Base clip shall be the type that clips on flange of stud and provides 3/4 inch plaster ground and bracket arms for snap-on base, Inland Steel Company "Milcor V-Clip" or approved equal.
 - (4) Lath, wire, cove mould and base shall be same as in a. above.

5. FRAMING FOR PLASTER CEILINGS

- a. Main channels for plaster ceilings shall be 2 inches x 19/32 x 16 ga. cold-rolled steel, either shop coated or galvanized and weighing not less than 490 lb. per 1000 lineal feet.
- b. Cross channels shall be the same as a. above except 3/4 inch x 1/2 inch weighing 300 lb. per 1000 lineal feet.
- c. Wire for framing connections and splices shall be 16 gauge, galvanized, annealed iron wire. Wire for lath ties shall be the same except 18 gauge.
- d. Casing bead for grounds and edging shall be 3/4 inch square nose bead with expansion flange formed from 24 gauge galvanized steel and weighing not less than 280 lb. per 1000 lineal feet.

6. PLASTER

- a. Gypsum cement plaster for base coats shall be gypsum neat plaster conforming to ASTM C28. The material when mixed with two parts by weight of Ottawa sand shall develop a compressive strength of not less than 750 psi in 7 days. US Gypsum "Redtop" cement plaster is an example of a material meeting these requirements.
- b. Finish plaster shall be a hard gauging gypsum-cement type that will set in 40 minutes and will develop a compressive strength of 1200 psi in 7 days. Finish plaster shall conform to ASTM C28. US Gypsum "Structo-Gauge" is an example of a material meeting these requirements.

7. LIME

Lime for preparation of lime putty to be used in plaster mixed shall be double-hydrated lime conforming to ASTM C206, Type S.

8. SAND

Sand for plaster and stucco shall be natural or manufactured sand conforming to the requirements of ASTM C35. Sand shall be washed and cleaned and shall be uniformly graded from coarse to fine within the following limits, by weight:

Retained on Sieve No.

4	None
8	0 to 5%
16	5 to 30%
30	30 to 65%
50	65 to 95%
100	90 to 100%

WORKMANSHIP

9. DELIVERY AND STORAGE OF MATERIALS

All materials for use in the work of this division shall be delivered to the job site in the manufacturer's original containers with labels intact and seals unbroken. All materials shall be stored in a dry, well ventilated space and as recommended by the manufacturer, until used.

10. ERECTION OF WIRE AND METAL LATH FOR PLASTER

- a. Framing for plaster partitions shall be securely attached to floors, ceilings and intersecting walls. Floor clips shall be used on concrete floors and ceiling runner used where partitions join metal roof deck, metal window mullions and structural steel. Sheet metal screws or welding may be used for connections to anchorage in concrete. Ceiling runner shall serve as a plaster ground.
- b. Metal corner beads shall be installed on all exterior corners where other trim is not shown on the drawings.
- c. A 3/4 inch channel shall be installed over all door openings and above and below duct openings and extended beyond the opening to connect to 2 studs on each side of the opening for reinforcement.

- d. Metal lath shall be wired to studs and reinforcing as recommended by the lath manufacturer. Laps between sheets shall be 1-1/2 inches. Inside corners shall be reinforced with pieces of lath extending a minimum of 3 inches each way from the corner. Lath shall be applied on ceilings before lath is applied on walls and ceiling lath shall be carried down 6 inches onto walls which are to receive lath. Lath on vertical surfaces shall be applied from the top down, with the top sheet lapping over the extended portion of the lath from the ceiling. In general, lath should be placed so that the lower sheet laps over the upper sheet.
- e. Ceiling furring channels shall be spaced 16 inches on centers and tied at joints with 2 strands of No. 16 wire. Metal lath shall be tied with No. 18 wire to all channels at 6 inch intervals.
- f. Lath shall be applied with long dimension of sheets across supports.

11. MIXING PLASTER

- a. Gypsum cement plaster for base coats shall be hand mixed while dry, in water-tight box and water added, or plaster shall be machine mixed.
- b. If plaster is machine mixed, wet mixing time shall not be less than 2 minutes and the mixer shall be thoroughly cleaned after each batch. Material that has partially set shall not be retempered or used.
- c. No more plaster shall be mixed than can be used within one hour.
- d. Gypsum cement plaster for scratch coat on metal lath shall be mixed in the following proportions by weight:

1 part plaster
2 parts sand

- e. Gypsum cement plaster for base coat on masonry shall be mixed in the following proportions, by weight:

1 part plaster
3 parts sand

- f. Finishing lime shall be prepared by mixing 5-1/2 to 6 gallons of water per bag of lime. Lime putty may be mixed by hand in a water-tight box or by machine. Care shall be taken to see that lime putty does not become crusty or dried out. Crusted material shall be discarded. Lime putty shall be screened through a No. 10 sieve immediately before use.

- g. Hard gauging-lime putty finish plaster shall be mixed in the following proportions, by weight:

100 lb. hard gauging plaster
200 lb. lime putty

12. METAL LATH AND PLASTER

- a. Plastering on metal lath shall be applied in 3 coats.
- b. On 2 inch and 2-1/2 inch solid partitions, the scratch coat shall be applied on lath side and allowed to set and partially dry. Back up coat shall then be applied in not less than two operations to give thickness sufficient to cover grounds. Brown coat shall then be applied in thickness to bring total thickness of partition to 1-3/4 or 2 inches as applicable.
- c. Finish coat plaster shall be applied 1/8 inch thick over brown coat on partitions. Finish coat shall be troweled to dense, smooth finish and checked with a 5' straightedge.
- d. Scratch and brown coats shall be screeded for leveling but shall be left rough to receive succeeding coat.

13. PLASTER CEILINGS

Ceiling plaster shall be 3/4" thick and shall be applied on one side only. Scratch coat shall be 3/8 inch thick, brown coat 1/4 inch thick and finish coat 1/8 inch thick.

14. VENTILATION

- a. Plaster shall not be applied when the ambient temperature is below 50 F. If the temperature outside the building is below 50 F when plastering is to be done, a source of heat shall be installed and window and door openings in outer walls covered.
- b. While plastering is in progress the air temperature within the spaces being plastered shall be maintained within the range of 50 F to 75 F. Temperature range shall be maintained for 48 hours after plastering is completed.
- c. If it becomes necessary to heat the spaces where plastering is in progress fans shall not be permitted to blow warm, dry air directly against a plastered surface which is less than 3 days old.

DIVISION X

STANDARD DOORS, WINDOWS AND HARDWARE

GENERAL

1. SCOPE

This division covers windows, standard sized pedestrian doors, and power operated rolling doors for the High Temperature Lattice Test Reactor, Building 318. Shielding doors are specified in Division XI. Doors for Building 318-A are specified in Division XIX.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 FEDERAL SPECIFICATIONS

DD-G-451a	Glass, Flat and Corrugated, for Mirrors and Other Uses
FF-H-106a (6)	Hardware, Builders; Locks and Door Trim
FF-H-00111b	Hardware, Builders; Shelf and Miscellaneous
FF-H-116c	Hinges, Hardware, Builders
FF-H-121c	Hardware, Builders; Door Closing Devices
HH-I-562	Insulation, Thermal, Mineral Wool, Block or Board

2.2 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA A115.1-1961	Door and Frame Preparation for Mortise Door Locks
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MATERIALS

3. HOLLOW METAL SWINGING DOORS

- a. Hollow metal doors shall be formed from minimum 18 gauge steel furniture stock. Steel shall be stretcher-leveled, fully pickled and annealed. All surface welds shall be ground smooth.
- b. Doors shall be constructed and braced inside with sufficient steel reinforcing to prevent sag or warp. Doors shall be reinforced at all sinkages and at all locations where hardware is to be attached in order that hardware can be attached with machine screws without altering doors in the field. Doors shall be fitted for template hardware.
- c. Hollow cores of doors shall be filled with a sound deadening material. Doors shall be of the types and sizes shown on Drawing H-3-25013.
- d. Hollow metal doors, type G, shall be filled with an incombustible material and shall be rated as 1-1/2 hour, Class B fire doors. Fire

doors shall bear the Underwriters Laboratories labels showing the name of the door manufacturer and UL classification stamp.

- e. Hollow metal swinging doors shall be furnished with a coat of baked-on metal-protective primer. Glazed doors shall be furnished with continuous glazing bead and metal moulding to hold glass in place.
- f. Louvers for doors shall have not less than 81.5% free area.
- g. Doors to be used in rolled structural channel frames shall be dapped for hinges to a depth sufficient to accept both leaves of the hinges.
- h. Cutouts for door lock sets shall conform to ASA A115.1.
- i. Doors shall be products of M. Reuter & Sons Metal Products Co., Ceco Steel Products Co., Overly Manufacturing Co., or approved equal.

4. FRAMES FOR HOLLOW METAL SWINGING DOORS

- a. Pressed steel frames for hollow metal swinging doors shall be formed from furniture stock steel not lighter than 16 gauge. Corners shall be mitered, electric welded and ground smooth to produce an invisible joint.
- b. Jambs of pressed steel frames shall have not less than 3 anchoring devices per jamb. Jambs shall be reinforced for attachment of template hinges. Head shall be reinforced for attachment of door closers.
- c. Pressed steel door frames shall be furnished with a shop coat of baked-on metal protective primer.
- d. Rolled structural steel shapes used for door frames shall conform to the same requirements for material and shop priming as specified for building framing in Division IV.
- e. Cutouts for lock strikes shall conform to the requirements of ASA A115.1.

5. WINDOW AND DOOR GLASS

- a. Wired glass for fire doors shall be 1/4 inch thick, polished plate glass containing welded wire mesh not smaller than 7/8 inches, formed from wire not smaller than 24 B & S gauge. Wired glass shall conform to the requirements of Federal Specification DD G-451a, Type IIIa. Mississippi Glass Co. "Misco" is a representative type.
- b. Glass for interior doors shall be flat drawn sheet, double strength, Grade B glass, conforming to Federal Specification DD-G-451a, Type II.
- c. Glass for windows shall be 3/16 inch thick, flat drawn, heavy sheet glass, Grade B conforming to Federal Specification DD-G-451a, Type II.

6. WINDOWS

- a. Windows shall be single light, fixed steel sash of the sizes and frame types shown on drawing H-3-25014.
- b. Frames shall be modified Z bars formed from hot rolled new billet steel. Corners of frames shall be coped or mitered and electrically welded. Joints and welds shall be ground smooth.
- c. Window sash shall be hot-dip galvanized, bonderized and shop primed with a baked-on coat of metal protective primer.
- d. All windows shall be designed for glazing clips and steel-window putty.
- e. Windows shall conform to the requirements of the Steel Window Institute specifications for 1-1/2 inch heavy intermediate steel windows and the requirements stated herein and on the drawings.

7. ROLLING DOORS

- a. Doors No. 1 and 102 shall be steel curtain, power operated, rolling doors of the sizes shown on the drawings. The doors shall be designed for mounting on the inside face of the exterior wall.
- b. Rolling doors shall be capable of withstanding a uniform loading of 20 psf without deflecting more than 1/240 of the span. Curtain slats shall be provided with end lugs to hold the curtain in the guides and shall be designed to provide for a minimum of leakage of air past the door.
- c. Slats, guides, bottom bar and roller housing (hood) shall be galvanized (not less than 1.25 oz. coating class) and phosphate coated, to receive finish paint in the field.
- d. The curtain roller shall be of sufficient strength and rigidity to hold the weight of the curtain and its attachment without deflecting more than .03 inches per foot of opening width. Rolling doors shall be counterbalanced and provided with counterbalance adjustment, outside the hood, so that the door can be adjusted for emergency manual operation.
- e. Doors shall be provided with a power operator and also a hand chain for manual operation in the event of loss of electric power. Motor shall be wound for operation with 440 volt, 3 phase, 60 cycle power supply. Control pushbutton stations shall be rated for 120 volts, single phase, 60 cycle AC. The doors shall be provided with limit switches to stop the power operator when the door curtain reaches fully open and fully closed positions. Doors shall be furnished with constant pressure push-button control stations requiring continuous pressure on the push-button to maintain door travel. Push-button stations shall be fitted for wall mounting inside the building. Power operator shall be capable of operating the door at a rate of approximately one foot per second.

- f. Rolling doors shall be equipped with latch bolts to hold doors in the closed position and prevent entry from the outside. The **bottom** edge of rolling doors shall be equipped with a safety device to stop the power operator if the door contacts an obstruction during travel.
- g. Rolling doors shall be Kinnear Manufacturing Co., Rolling Service Doors, or approved equal.

8. DOOR SILLS AND WEATHERSTRIPPING

- a. Door thresholds and weatherstripping shall be of the types shown on Drawing H-3-25013.
- b. Door threshold Type "S" shall be extruded brass with fluted top, approximately 4" wide and 1/2" high, Chamberlin No. 812, Sager No. 634, Zero No. 65, or approved equal.
- c. Automatic door bottoms, shown for "S" type sills, shall be fully mortised type, with sponge neoprene strip, operated by plunger contact with door jamb, Chamberlin No. 424-A, Zero No. 36-H, or approved equal.
- d. Weatherstripping for heads and jambs of swinging doors shall be sponge neoprene with aluminum housing Type "X" as shown on the drawing and shall be Zero No. 50 A, or approved equal.
- e. Weatherstripping at the bottom of the rolling doors, sill Type "T", shall be a loop type rubber or neoprene astragal that is attached to the bottom angles of the door. The astragal shall extend into each guide.

9. DOOR HARDWARE

- a. Door hinges for hollow metal pedestrian doors shall conform to the requirements of Federal Specification FF-H-116c (2) Type T2107 with U. S. 10 finish. Hinges shall be furnished in the sizes indicated in the Hardware Schedule. Hinges for doors with cylinder locks shall have non-removable pins.
- b. Locksets, for hollow metal swinging doors, shall conform to Federal Specification FF-H-106a (6) and shall be of the types shown in the Hardware Schedule. Latch bolts for Series 86 locks and latches shall be anti-friction type. Door knobs shall be Type 201G. Knobs and roses shall be plain design U. S. 10 finish.
- c. Door closers shall conform to the requirements of Federal Specification FF-H-121c, and shall be of the types shown in the Hardware Schedule, with bronze lacquer finish. Double doors No. 3, 100, and 120 require two closers, one for each leaf.
- d. Door stops and cremone bolts shall conform to the requirements of Federal Specification FF-H-0011b, and shall be of the type specified in the Hardware Schedule, with U. S. 10 finish.

- e. Exit devices shall have U.S. 10 finish and shall conform to the requirements of Federal Specification FF-H-106a. Locks for use with exit devices shall be mortise type with latch bolts having a $3/4$ " throw. Inactive door of pairs shall have a minimum $1/2$ " vertical rods with $5/8$ " hinged bolts having a $5/8$ " throw.
- f. Door pulls and pushplates shall conform to the requirements of Federal Specification FF-H-106a. The door pulls and pushplates shall be 14 " x $3-1/2$ ", wrought bronze, with U. S. 10 finish.
- g. All hardware for fire doors, Type "G", shall have been approved by Underwriters Laboratories for such use.
- h. Hardware for hollow metal doors shall be as shown in the Hardware Schedule on the next page. Hardware type numbers listed refer to the Federal Specifications referenced herein except where specifically noted otherwise.

CAH - 100 HARDWARE SCHEDULE

Door No.	Hinges	Lockset	Latchset	Exit Device	Closer	Stop	Push Plate	Pulls	Remarks
2, 101 & 103	4-1/2 x 4-1/2			820 H	3001-4P				
100	"			822 H	3001-4PH				
3	"	86 J-2*			3001-3H				* Active leaf only- cremone bolt 1028A for inactive leaf.
5, 109, 110, & 111	"	86 J-2			3001-3	1328-E			Doors 110 & 111 to have mortised elec. door opener. Graybar No. 9, or approved equal.
105	"	86 J-2			3001-3				
106, 107, 205, 206 & 208	"				3001-3	1328-E*	465	455	* No stop required for door # 106.
113	"	87 G-2			3001-3	1328-E			
200	"			820	3001-4P				
201, 202, 203 & 204	4 x 4	86 J-2							
209, 210, 211, & 212	4 x 4	86 J-2				1328-E			
207	4 x 4		86 N-2						
112, 113	4-1/2 x 4-1/2			*	3001-3	1328-E			* Corbin 127 without cyl. blank trim.
120	"	86 J-2*			3001-4PH				* Active leaf only. Cre- mone bolt # 1028A for inactive leaf.
300, 301, 302	"		86 N-2		3001-4P				

VITRO

10. LOCK CYLINDERS

a. Lock cylinders shall be 1-5/32 inch diameter (standard size) with five or more pin tumblers, masterkeyed as shown in the chart below.

b. Key System

	<u>Door No.</u>
Change Key No. 1	103
Change Key No. 2	2, 5, 100, 101, 113, 201, 202, 203, 204, 209, 210, 211, & 212
Change Key No. 3	3, 109, 110, & 111
Change Key No. 4	105
Change Key No. 5	120 (Detector Building)

- c. In addition Change Keys No. 2, 3, & 4 shall operate door with Change Key No. 1.
- d. Where a particular change key number covers more than one door number, cylinders for these doors shall be keyed alike. Cylinders in different change key numbers shall be keyed separately.
- e. All cylinders and keys shall be delivered direct from the manufacturer to the following address:

General Electric Company
Security Office
c/o L.D. Wright
705 Building
Richland, Washington

- f. The lock cylinders will be returned to the Contractor for installation.

WORKMANSHIP

11. INSTALLATION OF HOLLOW METAL DOORS

- a. Doors shall be hung plumb and true with proper clearances, and shall operate smoothly and easily without warp or bind.
- b. Hardware shall be attached to pedestrian doors with flathead machine screws finished to match the hardware.

- c. Doors and hardware shall be installed with care to prevent finger marks, scratches, or other blemishes on doors or hardware.
- d. Hardware shall be securely attached, carefully adjusted, and left in perfect working order.
- e. Rolled steel channel door frames shall be drilled and tapped for mounting hardware. Hinges on pedestrian doors shall not be welded to door frames.
- f. Glass in hollow metal doors shall be held in place by continuous glazing moldings, furnished by the door manufacturer.
- g. After completion of the work and inspection by the Commission, all glass shall be cleaned on both sides and manufacturers labels removed.
- h. Number of hinges installed per door shall be as follows:

4" x 4" - 3 per leaf

4-1/2" x 4-1/2" - 3 per leaf

12. INSTALLATION OF ROLLING DOORS

Rolling doors shall be installed in accordance with the manufacturer's erection instructions and the approved drawings.

13. TESTING

- a. Power-operated rolling doors shall be operated through 5 full cycles and travel time checked to assure that the requirements stated herein have been met. Limit switches and latching devices on power-operated doors shall be checked for proper operation.
- b. Closing devices and automatic door bottoms on hollow metal swinging doors shall be checked for proper operation.

DIVISION XI
SHIELDING DOORS
GENERAL

1. SCOPE

This division covers the fabrication, installation and testing of shielding doors for the High Temperature Lattice Test Reactor, Building 318.

2. PLANT AND EQUIPMENT FOR HIGH-DENSITY CONCRETE

The plant and equipment, proposed by the Contractor, for use in storage of aggregates and preparation and delivery of high-density shielding concrete and grout shall be subject to approval of the Commission. Such facilities shall be made available for inspection by the Commission during the period of preparation of high-density concrete.

3. REFERENCED STANDARDS AND SPECIFICATIONS

The specifications and standards listed below form a part of this specification to the extent indicated by subsequent references.

3.1 FEDERAL SPECIFICATIONS

TT-P-86c	Paint, Red-Lead Base, Ready Mixed
TT-P-645	Primer, Paint, Zinc Chromate, Alkyd Type

3.2 STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC-SP3-52T	Power Tool Cleaning
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3.3 U. S. MILITARY STANDARDS AND SPECIFICATIONS

MIL-C-16173A	Corrosion Preventive Compound, Solvent Cutback, Cold Application
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3.4 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A7-61T	Steel for Bridges and Buildings
ASTM A36-62T	Structural Steel
ASTM A320-62T	Alloy Steel Bolting Material for Low Temperature Service

ASTM C33-61T	Concrete Aggregates
ASTM C127-59	Specific Gravity and Absorption of Coarse Aggregate
ASTM C138-44	Weight per Cubic Foot, Yield and Air Content of Concrete
ASTM C143-58	Slump of Portland Cement Concrete
ASTM C150-61	Portland Cement

MATERIALS

4. STEEL AND BOLTING MATERIAL

- a. Rolled steel plates, shapes and bars, where not specified otherwise on the drawings, shall conform to the requirements of ASTM A7 or A36.
- b. Bolts for fastening door parts shall conform to the requirements of ASTM A320, except where specified otherwise on the drawings.

5. PRESSED WOOD

The pressed wood, specified on drawing H-3-25186 for fill in door No. 4, shall be tempered hardboard weighing not less than 88 lb. per cubic foot. The material used shall be Masonite Corporation "Masonite" Die Stock, or approved equal.

6. SHOP COAT

- a. Shop coat paint for exterior surfaces, other than bearing surfaces, shall be red lead per Federal Specification TT-P-86c, Type II or zinc chromate per Federal Specification TT-P-645.
- b. Rust preventive compound, for treating exterior surfaces of shielding doors not to be painted, shall conform to MIL-C-16173A, Grade 1, or approved equal. Grease shall not be used for this purpose.

7. INGREDIENTS FOR HIGH DENSITY CONCRETE

7.1 PORTLAND CEMENT

- a. Cement for high density concrete shall be low alkali, non-air-entraining, portland cement conforming to ASTM C150, Type II.
- b. The Contractor shall furnish mill test reports to the Commission, showing brand, date of manufacture and source of the cement furnished, prior to the placement of high-density concrete.

7.2 CONCRETE AGGREGATES

- a. Aggregates for high density concrete shall be a mixture of Magnetite and Ilmenite and shall conform to the requirements of ASTM Designation: C33 for soundness, impurities and methods of sampling and testing.
- b. Aggregates shall have properties which conform to the following requirements:

Minimum percent iron when dry at 100 C. 54

Minimum value of bulk specific gravity. 4.5

Maximum percent water absorption. 2.0

Specific gravity shall be the Bulk Specific Gravity (saturated, surface-dry basis) as defined in ASTM Designation: C127.

- c. Certifications of aggregates properties shall be furnished to the Commission prior to high density concrete placement.
- d. The fineness modulus of fine aggregate shall be within the range 2.3 to 3.1. Fine aggregate shall meet the following gradation requirements:

Amounts passing sieve size (percent by weight)

<u>Nominal Square Sieve Size</u>	<u>Percent</u>
1-3/4	100
1-1/2	95 to 100
1	60 to 85
3/4	35 to 70
1/2	20 to 50
3/8	10 to 30
No. 4	0 to 5
No. 8	0

7.3 WATER AND ADMIXTURES

- a. Water for high-density concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.
- b. Admixtures, de-air-entraining agents, or corrective additives, for any purpose, shall be used only with the written approval of the Commission.

WORKMANSHIP

8. FABRICATION AND INSTALLATION OF DOOR NO. 4

- a. Door No. 4 shall be fabricated in accordance with the design requirements shown on Drawing H-3-25186.
- b. Welding shall be done in accordance with the requirements stated in Division VI of this specification. All welds on the exterior surface shall be ground smooth.
- c. All exterior surfaces of the door, other than finished hardware, shall be given a shop coat of paint specified in Section 6 above. The minimum surface preparation prior to painting shall be in accordance with SSPC-SP3. All gouges in the exterior surfaces of the door shall be repaired by welding and grinding. Finish painting is specified in Division XIV.
- d. Each door leaf shall be fabricated in such a manner that the 18" thickness will consist of 13" of pressed wood and 5" of steel. Voids which would limit the radiation shielding effectiveness of the door are not acceptable. There shall be no more than one vertical or horizontal joint per layer of pressed wood fill. Joints shall be staggered in adjacent layers.
- e. Each leaf of Door No. 4 shall be fabricated and installed in such a manner that it can be moved through its full arc of travel with a force of not more than 40 pounds.

9. SHELL FABRICATION FOR DOOR NO. 104

- a. The steel shell of Door No. 104 shall be fabricated as shown on Drawings H-3-25185, Sheets 1 and 2.
- b. Welding shall conform to the requirements specified in Division VI of this specification. All external welds shall be ground smooth. All weld spatter shall be removed by grinding.
- c. Surface preparation and shop coating shall be the same as specified for Door No. 4 in Section 8c above.
- d. When the door shell fabrication has been completed it shall be placed upright on the floor at its "open" position. The door shall not be hung until all shielding concrete has been placed.

10. HIGH-DENSITY FILL

10.1 STORAGE OF MATERIALS

- a. Cement shall be stored in a continuously dry environment.

Broken sacks of cement or sacks containing partially solidified material shall not be used.

- b. All aggregates covered by this specification shall be handled and stored in a manner to prevent:
 - (1) loss of fine aggregate,
 - (2) contamination by foreign material,
 - (3) aggregate breakage,
 - (4) segregation.
- c. Aggregates shall be stored at the site of the batch plant in approved containers, bins, heavy sacks, or if obtained in bulk, it shall be stored in a manner to prevent inclusion of dirt and other foreign matter. Aggregates shall be covered with tarpaulins or plastic sheeting until used.
- c. Concrete placement equipment shall be thoroughly washed and cleaned before and after each concrete pour is made.

10.2 COMPOSITION OF HIGH-DENSITY CONCRETE

- a. High-density concrete shall be composed of portland cement, water, fine and coarse aggregate. High-density concrete shall have a compressive strength of at least 3000 lb. per sq. inch at 28 days and a density of not less than 225 lb. per cubic foot when dry.
- b. Following is a guide for determining mix constituents:

	<u>Lb/Cu/Ft</u>
Minimum wet density.	.238.0 (approx.)
Coarse Aggregate (Magnetite and Ilmenite). .	.110
Fine Aggregate (Magnetite and Ilmenite)... .	.95
Portland Cement.	.23
Mix Water.	.10

These mix data are based upon laboratory conditions and will require modification in the field to provide concrete of the required strength and density and placing and handling qualities. The Contractor shall submit a mix design to the Commission for approval, prior to mixing trial batch specified in Section 10.2e below.

- c. Ingredients used for batching concrete shall be mixed in proportions that will provide a workable consistency, minimum segregation during handling and as high a density as is obtainable with the specified heavy aggregates. The amount of mix water used shall be the absolute minimum consistent with job conditions. Slumps shall be within the range 1" to 3". Slump tests shall be made in accordance with ASTM Designation: C143.

- d. The wet density of the concrete shall be determined in accordance with ASTM Designation: C138 and shall not be less than the minimum value listed in Section 7.2b above. The air content of concrete shall not exceed 3 percent as determined by the method specified in ASTM C138. Tests shall be made at least every two hours by the Commission during all high-density concreting operations to determine air content and wet density.
- e. Prior to job mixing of concrete fill, a trial batch shall be made under field conditions by the Contractor in order to confirm the properties and adequacy of a particular mix and to prepare a set of six compression cylinders. The Contractor shall notify the Commission of scheduled dates for preparing trial batches at least 10 working days before preparation of trial batches and before placement of high density concrete is to begin.

10.3 BATCHING AND MIXING REQUIREMENTS

- a. Cement shall be measured by weight or by 94 lb. bags. When cement is weighed, it shall be done on a scale separate from that used for other materials. When cement is measured in bags, no fraction of a bag shall be used unless weighed.
- b. Aggregate shall be measured by weight. Batch weights shall be based on dry materials and shall be the required weights of dry materials plus the total weight of moisture (both absorbed and surface water) contained in the aggregate.
- c. Water shall be measured by volume or weight.

10.4 MIXING TIME

- a. The mixing time shall be determined at the time the trial batches are made. In general, the mixing time shall not be less than 1-1/4 minutes for each batch and shall be measured from the time that all solid materials are in the mixer drum, provided that all the mixing water shall be introduced before one-quarter of the mixing time has elapsed. Concrete consisting of aggregate inadequately mixed or lacking in mortar coating will be rejected by the Commission. Remixing or retempering will not be permitted.
- b. The mixing periods specified are predicated on control of the speed of rotation of the mixer and of the introduction of the materials, including water, into the mixer. The mixing time may be increased when, in the opinion of the Commission, the charging and mixing operation fails to result in the required uniformity of composition and consistency of the concrete or when test samples of concrete taken from three locations, such as front, center and back of the mixer, show a difference of more than 10 percent in the sand-cement or water-cement ratios.

- c. The mixer shall revolve at a uniform speed for a minimum of twelve revolutions after all materials have been placed in it. The mixer shall not be charged in excess of its safe capacity considering the density of the mix, nor shall it be operated at a speed in excess of that recommended by the manufacturer. Over-mixing, requiring additions of water to preserve the consistency, will not be permitted. Should the mixer produce concrete not in conformance with this specification, as determined by the Commission, additional concrete from that machine will not be accepted until the equipment has been put in correct operating condition.

10.5 COLD WEATHER PLACEMENT

- a. If the Commission permits concrete placement when the atmospheric temperature is below 40 F, either aggregates or water, or both, as may be necessary, shall be heated with steam coils or other means. Materials containing frozen lumps, ice or snow shall not be allowed to enter the mixer. When it is necessary to heat concrete ingredients, temperatures shall be controlled to not less than 50 F and not above 70 F.
- b. The use of salts, chemicals or other foreign materials in the mix to lower the freezing point of concrete is prohibited.
- c. Admixtures intended to accelerate the hardening of concrete or produce higher than normal strengths at early periods shall be permitted only upon written approval from the Commission and then only in approved percentages.

10.6 DELIVERY OF CONCRETE

- a. Concrete shall be delivered to the site of placement in a thoroughly mixed and uniform mass.
- b. The elapsed time from the time water is introduced into the mix until the concrete is discharged into the forms shall not exceed one hour. The maximum time concrete shall stand in non-agitating equipment shall be 30 minutes.
- c. Truck mixers or agitators shall provide slow agitation of the concrete during transit if the mixer is not located at the construction site. Bodies of non-agitating equipment shall be smooth, watertight, metal containers equipped with gates that will permit control of the discharge of concrete. Watertight covers shall be provided for protection against the weather when required. All wash water shall be removed from mixers or transportation equipment before concrete is placed in this equipment.
- d. Water shall not be added to the concrete after it leaves the mixer unless approved otherwise in writing by the Commission.

- e. The slump of high-density concrete shall be determined in accordance with the requirements of ASTM Designation: C143. Unless specified differently on the drawings, slump at the time of placement shall be from 1" to 3".
- f. When the ambient temperature is 85 F. or higher; or under conditions contributing to quick stiffening of the concrete; or when the temperature of the concrete is 85 F. or above, the time between the introduction of the cement to the aggregates and discharges into the forms shall not exceed 45 minutes.

10.7 PLACEMENT OF CONCRETE

- a. Segregation of mix ingredients shall be prevented during handling and placement procedures. There shall be no voids beneath embedded items, internal bracing or in remote corners of the shell. The composition of the concrete shall be uniform throughout the pour.
- b. High-density concrete shall be vibrated at the time of placement in the door shell in accordance with the requirements of Section 8.7 of HW-4798-S. Two workable vibrators shall be at the concrete pour before concrete placement in forms is started. One of the two vibrators shall be retained as a spare.
- c. "Pour slips" shall be prepared by the Contractor for high-density concrete and the same requirements as stated in Division II shall apply.
- d. Placement of high-density concrete in the door shell shall be made in three lifts. The first lift shall be 4 feet high and the remainder of the door height filled in two equal lifts. Each of the first two lifts shall be placed and allowed to cure for 7 days prior to placement of the succeeding lift.
- e. Rate of placement of high-density concrete in the door shell shall not be greater than 2 feet vertically per hour.
- f. At the completion of concrete placement, the concrete exposed to view shall be finished flush with the upper steel plate of the door shell using a steel trowel.

11. INSTALLATION OF DOOR NO. 104

- a. Door trolley track shall be aligned and shimmed to elevation within the tolerances shown on the drawings with wear strips welded in place.

- b. Trolleys shall be mounted on the track and beam spreaders attached.
- c. A minimum of ten days shall have passed after placement of the final lift of high-density concrete fill before the door may be raised to operating position using the lifting J-bolts.
- d. The faces of the completed door shall be checked with a 10-foot straight edge. Any dents or bulges which would limit the effectiveness of the air seal, or which cause a deviation of more than 1/4" from the straight edge shall be repaired.
- e. After the power operator has been installed, the door shall be operated through its full travel cycle two times to check for proper operation. The wiping seals shall be observed while the door is in the closed position to verify that the seals are in full contact with the door surface over the full length of the seals.
- f. Installation of power and control circuits for the power operator shall be in accordance with Division XV of this specification.

12. RADIATION SHIELDING INSPECTION

- a. The shielding doors will be subjected to a radiation shielding inspection by the Commission. The survey will be made using a radiation source on one side of the door and a counter on the opposite side.
- b. If it is determined that the shielding effectiveness of the door is reduced due to the presence of voids or other deficiencies, the Contractor will be so informed and repairs shall be made by the Contractor.

DIVISION XIISPRINKLER SYSTEM AND FIRE EXTINGUISHERSGENERAL1. SCOPE

This division covers the design, fabrication, installation and testing of an automatic wet pipe sprinkler system and associated appurtenances in the High Temperature Lattice Test Reactor Building, No. 318 and in the Detector Building, No. 318-A. The furnishing of certain hand fire extinguishers is also included.

2. SUBMISSION OF DRAWINGS AND INFORMATION

Drawing H-3-25271 indicates the desired general arrangement of the sprinkler system by protection zones. The system shall extend throughout the buildings, except that no sprinklers shall be installed in Rooms 1, 100 and 104 of Building 318. However, all piping shall be sized to provide for future extension of the sprinkler system into the areas not provided with sprinklers.

- a. The Contractor shall furnish complete, detailed, installation drawings, wiring diagrams, equipment drawings, and specifications, for approval, for all equipment to be furnished by the Contractor under this division of the specifications.
- b. Approval of the above drawings, diagrams and specifications shall in no way relieve the Contractor of responsibility for a complete job. Approval will be for design and general arrangement only and not for dimension or quantity. Commission approval is required before equipment is shipped to the construction site.
- c. Design drawings, approved by the State of Washington Surveying and Rating Bureau shall be submitted to the Commission for approval, prior to the start of any shop or field fabrication. Drawings and information shall be submitted in conformance with the requirements stated in the Special Conditions.
- d. The Contractor shall take such measurements in the field as may be required for proper fabrication and installation.
- e. Data for electrical alarm and annunciation system shall be furnished under Division XVI of this specification.

3. REFERENCED CODES AND STANDARDS

The codes and standards listed below form a part of this specification to the extent indicated by subsequent references.

3.1 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA No. 23-1931	Fire Department Hose Connections for Sprinkler Systems
NFPA No. 13-1961	Installation of Sprinkler Systems
NFPA No. 29A-1933	Valves

3.2 INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

Uniform Building Code (UBC), 1963 edition

3.3 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA B36.10-1959 Wrought Steel and Wrought Iron Pipe

4. DESIGN REQUIREMENTS

- a. The sprinkler system shall be the standard wet pipe type designed for ordinary hazard occupancy in accordance with the National Fire Protection Association Standards for the Installation of Sprinkler Systems, NFPA No. 13.
- b. The sprinkler system design shall be approved by the State of Washington Surveying and Rating Bureau.
- c. The sprinkler system shall include the following major equipment components:
 - (1) Alarm valve with three position (on, test, off) valve, true alarm contactor, and drain valve.
 - (2) Water gong.
 - (3) Standard upright spray heads, 165 F. rating.
 - (4) Excess pressure pump with automatic pressure control. Pump to be 120 volt, single phase, 60 cycle.
 - (5) Pressure contactor for initiating local low-pressure alarm to indicate pump failure.
 - (6) Pressure contactor to initiate true alarm when system operates with P.I.V. station closed.
 - (7) Fire department connection.
 - (8) Flow valves to initiate zone annunciation.
- d. In designing and installing the sprinkler system the following code exceptions shall apply:

- (1) Portions of the building are not to be supplied with sprinklers.
- (2) Water supply burial depth shall be as shown on the drawings.

5. GENERAL REQUIREMENTS

All recommended "advisory provisions" (See NFPA Code definition) such as spare head, wrenches, cabinet, identification signs, operating manuals, etc., shall be furnished and installed as a part of this contract.

MATERIALS

6. PIPE AND FITTINGS

- a. All pipe shall be standard weight, black steel or wrought iron pipe, conforming to the requirements of ASA B36.10.
- b. Pipe fittings shall be cast iron screwed fittings especially designed for sprinkler work and suitable for 175 lb. working pressure. Reducing fittings shall be used where changes in pipe sizes occur. Bushings are not acceptable.

7. HAND FIRE EXTINGUISHERS

The following fire extinguishers shall be furnished by the Contractor, for installation by the Commission.

- a. Six - 2-1/2 gal., hand operated, water pump cans, General Detroit Corp. Model A-704-C, or approved equal.
- b. One - 5 lb. and one - 10 lb. dry chemical fire extinguishers with wall brackets; Walter Kidde Co., Model "P", or approved equal.
- c. Seven - 5 lb. and three - 10 lb. CO₂ extinguishers; Walter Kidde Co., Model T-1, or approved equal.

WORKMANSHIP

8. INSTALLATION OF SPRINKLER SYSTEM

- a. Installation of system shall conform to NFPA 13. Sprinkler piping shall be exposed.
- b. Piping shall be run parallel to walls and arranged to pitch down to drain at main valves. Drains shall be run to outside and to building drains as shown on drawing H-3-25271.
- c. All piping shall be reamed free from all burrs and to the nominal size of the pipe.

- d. All piping shall be cleaned of all foreign matter before assembly. Ends of piping systems shall be kept capped when erection is not in progress. Lines shall be thoroughly flushed after erection.
- e. All screwed joints in steel pipe shall be made with approved thread lubricant or tetrafluoroethylene joint tape applied to the male threads only.
- f. All sprinkler system piping shall be disinfected by the same means as specified for sanitary water piping in Division V. All rubber valve seats shall be removed prior to disinfecting sprinkler system piping and replaced after lines have been disinfected.

9. TESTS AND FINAL ACCEPTANCE

- a. The sprinkler system shall be reverse-flushed after erection is completed, to remove foreign material.
- b. The sprinkler system shall be tested by operation of the Inspector's test valve. The operation of the alarm valve true alarm contactor shall be observed. (Note: When the electrical alarm system, as required in Division XVI is complete, both the sprinkler system and the electric alarm system shall be tested simultaneously).
- c. With the sprinkler system normal and the excess pressure pump shut off, the drain valve shall be ~~opened~~ slightly and the operation of the local low pressure alarm contactor observed.
- d. With the sprinkler system normal, the excess pressure pump shall be shut off and the PI valve closed. The drain valve shall be opened slightly and the operation of the contactor for initiating true alarms observed.
- e. The three-position valve shall be operated to test the mode of operation.
- f. The Contractor shall make all arrangements for the State of Washington Surveying and Rating Bureau to inspect the sprinkler installation and shall deliver a copy of the inspection report to the Commission.

DIVISION XIII

HEATING, VENTILATING AND AIR CONDITIONING

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DIVISION XIV

PAINTING, PROTECTIVE COATING AND FLOOR COVERING

GENERAL

1. SCOPE

This division covers painting, special protective coating and floor covering for the High Temperature Lattice Test Reactor, Buildings 318, 318-A, 318-B and 318-C except for standard products of approved manufacturers which are normally finished by painting in the manufacturer's plant.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 FEDERAL SPECIFICATIONS

TT-E-487	Enamel, Floor and Deck
TT-E-489c	Enamel, Alkyd, Gloss
TT-E-509a	Enamel, Odorless, Alkyd, Interior, Semigloss
TT-E-545a	Enamel Undercoat, Odorless, Alkyd, Interior
TT-P-86c	Paint, Red-Lead-Base, Ready-Mixed
TT-P-56b	Primer-Sealer, Pigmented for Plaster and Wallboard
TT-P-645	Primer Paint, Zinc Chromate, Alkyd Type
L-T-00345	Tile, Floor Vinyl-Asbestos
SS-T-308b	Tile, Ceramic, Floor, Wall and Trimmers

2.2 STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC-SF1-52T	Solvent Cleaning
SSPC-SP3-52T	Power Tool Cleaning
SSPC-SP5-52T	Blast Cleaning to "White Metal"

2.3 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA A108.5-1960	Installation of Ceramic Tile with Dry-Set Portland Cement Mortar
ASA A118.1-1959	Specification for Dry-Set Portland Cement Mortar

2.4 U. S. DEPARTMENT OF COMMERCE - COMMERCIAL STANDARDS (CS)

CS 181-1952	Water-Resistant Organic Adhesives for Installation of Clay Tile
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MATERIALS3. PAINT MATERIALS

- a. Sealer for concrete floor of Building 318-A shall be a clear, non-staining liquid for application shortly after steel troweling is completed. Floor sealer shall be A. C. Horn Div. of Sun Chemical Co. "Clear Seal", or approved equal.
- b. Primer for structural and miscellaneous carbon steel shall conform to Federal Specification TT-P-86c or TT-P-645, except where special protective coatings are specified.
- c. Primer for galvanized metal shall conform to TT-P-645.
- d. Primer-sealer for interior plaster, masonry and concrete shall conform to Federal Specification TT-P-56b.
- e. Enamel undercoat, for surfaces specified to be finished with enamel, shall conform to Federal Specification TT-E-545a.
- f. Whenever gloss enamel is specified in the Finish Schedules (Drawing H-3-25013) other than for floors the material used shall be an alkyd, gloss enamel conforming to Federal Specification TT-E-489c, Class A.
- g. Enamel for floors shall conform to the requirements of Federal Specification TT-E-487.
- h. Where semi-gloss enamel is specified in the Finish Schedule, the product used shall conform to Federal Specification TT-E-509a.
- i. Finish paint for exterior metal surfaces shall be an alkyd-base house paint, National Lead Company "Dutch Boy" No. 119, Deep Blending Base, or approved equal, either gloss or semi-gloss as specified on Drawing H-3-25013.

4. SPECIAL PROTECTIVE COATING

- a. If the Contractor proposes to use Special Protective Coatings other than those named herein he shall submit certified reports from independent laboratories showing the results of tests to determine conformance to the requirements stated herein. The certified laboratory reports shall be submitted to the Commission within 60 days after issuance of the Notice to Proceed in order to be considered for approval.
- b. The special protective coating (SPC) to be applied at the locations designated on Drawing H-3-25013 shall be a phenolic or epoxy resin base material formulated for air curing at room temperatures.

- c. To qualify for the service intended, the coating shall have withstood 10-day, room temperature, immersion tests in the following solutions without swelling, softening, becoming sticky, sloughing, blistering, disintegrating, dissolving, losing adhesion between coats or to the coupon, discoloring the solution or more than mildly discoloring the coupon:
- (1) 10% nitric acid
 - (2) 10% phosphoric acid
 - (3) 10% sulphuric acid
 - (4) 10% hydrochloric acid
 - (5) 10% caustic soda
 - (6) Xylene
 - (7) Methyl isobutyl ketone
 - (8) High purity water (500,000 ohms specific resistance)
- d. SPC shall resist abrasion to the extent that it will show not more than 0.160 grams weight loss per 2500 cycles in the Standard Taber Abraser test using a CS 17 wheel with a 1000 gram load. Loss of film thickness shall not be greater than 0.002 inches under the same conditions. Abrasion tests shall not be made on coating samples on which coating has been hardened by baking.
- e. SPC system shall have successfully withstood a radiation exposure of 1×10^9 roentgens without damage other than slight discoloration, such as changing white coating to cream color. Damage shall be interpreted to mean any of the defects mentioned in paragraph c. above.
- f. Coating for SPC service shall be Carboline Co. "Phenoline" 300 system or Amercoat Corporation "Amercoat" No. 66 system, or approved equal. Color samples of the coating system to be used shall be submitted to the Commission for approval. Samples will be used for comparison with the finished work.

5. FLOOR AND WALL TILE

5.1 VINYL ASBESTOS TILE

- a. Vinyl-asbestos floor tiles, where shown on the Finish Schedule on Drawing H-3-25013 shall be 3/32" gauge and shall conform to the requirements of Federal Specification L-T-00345.

- b. The following tile color and pattern number shown on the Finish Schedule shall be Armstrong Cork Company "Excelon", or approved equal.

No. 711 - Isleta Blue

- c. Cement for laying vinyl-asbestos tile shall be a waterproof type suitable for adhering tile to concrete on-grade. Armstrong's S-90 is an example of the type required.

5.2 CERAMIC TILE

- a. Ceramic tile, where specified in the Finish Schedule, Drawing H-3-25013, shall be unglazed, porcelain, ceramic tiles, 1" x 1" x 1/4" nominal size, conforming to Federal Specification SS-T-308b.
- b. Ceramic tile shall be United States Ceramic Tile Company, Dresden style, "Romany-Spartan" tiles, "Spice White" pattern No. 6002, or approved equal.
- c. Cement for installing ceramic tiles on floors shall be "Dry-Set Mortar" conforming to the requirements of ASA A118.1.
- d. Adhesive for installing ceramic tiles on walls shall be a waterproof tile adhesive conforming to CS-181.

WORKMANSHIP

6. HANDLING AND STORAGE OF PAINTS AND COATINGS

- a. All paint and coating materials shall be delivered to the jobsite in the manufacturer's original containers with labels intact and seals unbroken.
- b. Paint and coating materials shall be carefully handled and shall be stored, in accordance with the manufacturer's recommendations, in a well-ventilated place and not exposed to excessive heat, smoke, flame or direct rays of the sun.
- c. Paints and coating shall not be mixed within 25 feet of stored materials.
- d. The Contractor shall take all necessary precautions to prevent fires. Rags, waste, paper or other materials that have become spotted or soaked with paint, coatings, oil or solvents shall be placed in closed metal containers and disposed of each day. The Contractor shall furnish and maintain the closed metal containers at the work site.

7. SURFACE PREPARATION FOR PAINTING

Surfaces to be painted shall be prepared as specified below:

- a. The minimum surface preparation for carbon steel to be painted shall be in accordance with the requirements of SSPC-SP3.
- b. Galvanized and zinc-coated surfaces shall be prepared for painting by solvent cleaning in accordance with SSPC-SPL.
- c. All concrete and plaster surfaces to be painted shall be aged four weeks minimum prior to painting. All holes, cracks or other surface indentations in plaster and concrete surface shall be filled after priming and then spot primed after repairs are completed. Plaster surfaces which are too smooth for proper adherence of paint shall be roughened by sanding lightly with 2/0 sandpaper.
- d. Damage to shop coats shall be touched-up prior to application of succeeding coats.
- e. All surfaces to be painted shall be dry and free from dirt, grease, oil, weld spatter and other foreign materials prior to applying paint.
- f. Paint materials shall not be applied until surface preparation has been approved by the Commission.

8. PAINT MIXING

- a. Ready-mixed oil paints, in original containers, shall be vibrated in a power-driven vibrator-type paint mixer for a period of from three to ten minutes to remove all heavy sediment from the bottom of the can. The entire quantity shall then be "boxed" and strained through a fine wire screen or cheese-cloth before using.
- b. Ready-mixed enamels shall be thoroughly stirred in small quantities and "boxed" for uniformity.
- c. Paint shall not be mixed when the paint or surrounding air temperature is less than 50 F.

9. PAINTING

- a. Finished hardware, glass, stainless steel and floor tile surfaces shall not be painted. Aluminum surfaces such as vent ducts shall not be painted except where specified on the Finish Schedule.
- b. The Contractor shall take all necessary precautions to protect surfaces not to be painted.
- c. Paint shall be applied in conformance with the "Painting Schedule", of this division of the specifications.

- d. All paint materials shall be applied and spread with care to a uniform film thickness, showing no runs, sags, crawls, brush marks, overspray or other defects.
- e. Painting shall not be done when the ambient temperature of the surface temperature is below 50 F, without written permission from the Commission.
- f. Painting shall not be done when the atmospheric humidity is greater than 80%, or when dusting operations are in progress nearby, or when surfaces are damp to touch or frosty. Only thoroughly clean and dry surfaces shall be painted. A minimum of 24 hours shall elapse between coats of paint.
- g. All finished work shall be free from defective brushing or clogging of lines and angles. Edges of paint adjoining other colors or materials shall be clean and sharp without overlapping.
- h. "Wet Paint" signs shall be posted to protect newly finished surfaces from damage.
- i. Rags or other materials which have become spotted or soaked with paint materials shall not be permitted to accumulate anywhere inside of buildings except in closed metal containers during working hours and shall not be left within any building after working hours.
- j. All surfaces of structural steel, steel siding or underside of roof decking which are in contact with concrete and/or will be inaccessible for painting after erection (such as above suspended ceilings) shall receive two coats of paint primer, as specified in the Painting Schedule, before being erected. This requirement does not apply to surfaces to be embedded in concrete.
- k. Paint coats shall be applied with succeeding coats in contrasting colors and finished with the specified final color. Color contrast between coats shall meet the approval of the Commission.
- l. Metal wall panels, grills, registers, etc. which have been factory-primed, need not be reprimed in the field, if the specified finish is compatible with the primer previously applied.

10. PAINTING SCHEDULE

10.1 INTERIOR SURFACES

- a. Plaster, concrete and masonry to receive a pigmented finish shall be primed with one coat of primer-sealer per Federal Specification TT-P-56b.

- b. Interior surfaces to receive enamel finishes shall be given one coat of enamel undercoat (F. S. TT-E-545a) over the specified primer and finished with one coat of the enamel specified.
- c. Aluminum and galvanized surfaces to be painted shall be primed with one coat of zinc chromate, per Federal Specification TT-P-645.
- d. All ferrous metal items, received at the jobsite without a shop coat of paint, other than items to receive special protective coating or to be embedded in concrete, shall be primed with red-lead (F. S. TT-P-86c, Type II) or zinc-chromate (F. S. TT-P-645).

10.2 EXTERIOR SURFACES

- a. Exterior structural and miscellaneous steel items shall be primed with one coat of red lead per TT-P-86c or zinc chromate per TT-P-645.
- b. Aluminum and galvanized surfaces shall receive one prime coat of zinc chromate per Federal Specification TT-P-645, prior to finish painting if not factory-primed.
- c. Exterior metal surfaces shall receive two coats of alkyd base paint over the specified primer. Gloss of finish shall be as indicated by color numbers on Drawing H-3-25013.

11. SURFACE PREPARATION FOR SPECIAL PROTECTIVE COATINGS

11.1 METAL SURFACES

Metal surfaces to receive SPC shall be sandblasted to "white metal" in accordance with SSPC-SP5. This includes ledge angles and grating in the Reactor Room floor.

11.2 CONCRETE SURFACES

- a. Concrete surfaces to receive SPC shall have been given an U-3 finish (see HW -4798-S for definition of U-3) as specified in Division II. If the concrete finish has been marred, damaged in any way prior to coating, it shall be repaired with latex-cement surfacer specified in Division II.
- b. Concrete surfaces to be coated which are glazed or too smooth for proper adherence of the coating, as determined by the Commission, shall be etched with a solution of muriatic acid (1 part hydrochloric acid to 4 parts water). When solution stops bubbling, all traces of acid shall be removed by rinsing with clean water. The process shall be repeated if the surface does not show sufficient "tooth" or profile for proper adherence of the coating.
- c. If the coating manufacturer's specification recommends surface preparation other than that stated herein, it shall be done in addition to the requirements stated here.

- d. Coating materials shall not be applied until the surface preparation has been approved by the Commission.

12. APPLICATION OF SPECIAL PROTECTIVE COATINGS

- a. The Contractor shall take all necessary precautions to protect surfaces not to be coated.
- b. Coatings shall be applied in conformance with the "Coating Schedule" in this division of the specifications.
- c. Spraying and/or other application equipment for special protective coatings shall be as recommended by the coating manufacturer.
- d. Preparation of material, cleaning of surfaces and application of coatings shall be performed in strict accordance with the coating manufacturer's published recommendations. Coatings shall be applied to not less than the thickness required in the "Coating Schedule" included in this Division.
- e. Sandblasted surfaces of metal shall be primed as soon as possible after sandblasting. In all cases, surfaces shall be primed not later than 8 hours after being sandblasted. The first body coat shall be applied not later than 48 hours after surface has been primed.
- f. Coatings shall not be applied when the ambient temperature or the surface temperature is below 50 F.
- g. Solvent fumes in some of the coating solutions are hazardous for breathing and are also flammable. Forced air circulation shall be provided and personnel shall wear fresh air masks during application. Work shall not be done near a source of ignition. Matches, torches and smoking shall be prohibited in these locations. Air circulation must be maintained during application and curing.
- h. Surface cracks or openings not covered or filled with the first coating application shall be filled in accordance with manufacturer's recommendations prior to application of succeeding coats. Filled surfaces shall be coated same as remainder of surface.
- i. To insure complete coverage, successive coats shall be applied in alternate colors, finishing with the desired final color.
- j. Manufacturer's instructions on pot life of coating and cleaning of equipment shall be rigidly observed.
- k. Each coat of special protective coating shall be free of "orange peel" effect, overspray, embedded or partially embedded particles, craters, pinholes, "holidays" or other defects.

13. COATING SCHEDULE

- a. The floors of Rooms No. 1 and 100 shall be coated with special protective coating of the type specified in Section 4 of this division. The coating system used shall produce a dry film thickness of 20 mils (0.020 inches). Floor coating shall include interior surfaces of penetrations.
- b. The coating system used shall be as specified below or an approved equal.
 - (1) Carboline Company "Phenoline 300" system, applied as:
 - 1 Coat Phenoline 300 Orange Primer
 - 1 Coat Phenoline 302 Black
 - 1 Coat Phenoline 300 Floor Finish, White
 - (2) Amercoat Corporation "Amercoat 66" Radiation Resistant Coating System applied as:
 - 1 Coat Amercoat No. 66 Primer on concrete (No. 71 on steel)
 - 1 Coat Amercoat No. 66 Surfacer
 - 2 Coats (Minimum) Amercoat No. 66 Seal Gloss, finish color white
- c. Coating thickness specified above shall be verified by cutting 1" x 2" coupons from the finished work and measuring the thickness with a micrometer. Coupons shall be taken at the discretion of the Commission but not more than one per 500 square feet unless the coating thickness is found to be deficient. Deficiencies in coating thickness shall be corrected by applying one or more seal coats. Surfaces laid bare by the removal of coupons shall be repaired, at the Contractor's expense, in the same manner as application of the original coating.

14. INSTALLATION OF FLOOR COVERINGS

14.1 VINYL ASBESTOS TILE

- a. Vinyl asbestos tile shall be applied on the stairs and concrete floors of the rooms indicated in the Finish Schedule, Drawing H-3-25013.
- b. Vinyl asbestos tiles shall be cemented in place with an adhesive furnished by the manufacturer of the tile.

- c. Color and pattern shall be as specified in Section 5.1 above.
- d. Aluminum edge mouldings shall be installed where tile terminates at doorways which do not have thresholds.
- e. Tiles shall be applied prior to fastening metal cove strip in place at junctions with walls.
- f. Tile cement shall be applied only to clean, dry floor surfaces. Surfaces to be tiled shall be free from dust, dirt, grease and oil and shall be thoroughly dry. Concrete floors shall be cleaned by vacuuming immediately prior to applying tile cement.

14.2 CERAMIC TILES

- a. Ceramic tiles shall be set in dry-set mortar in floor recesses left in the concrete. Tiles shall be laid in accordance with ASA A108.5.
- b. Ceramic cove shall be installed where floor tile joins wainscot.
- c. Wall tile shall be set in a thin bed of water-resistant organic adhesive. Bull-nose tiles shall be placed at the top edge of wainscot panels and also at sides except where tile abuts other materials at right angles.

DIVISION XV

ELECTRICAL

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DIVISION XV

ELECTRICAL

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DIVISION XV

ELECTRICAL

GENERAL

1. SCOPE

This division covers electrical work for the High Temperature Latice Test Reactor Building No. 318 and associated facilities shown on the drawings.

2. SUBMISSION OF DRAWINGS AND INFORMATION

- a. The Contractor shall furnish to the Commission, dimensional outlines, complete wiring diagrams, installation instructions, maintenance instructions, performance data and operating procedures applicable for purchased items specified herein or on the drawings.

The drawings and information shall be furnished in two categories as follows:

- (1) Drawings and information submitted for approval and comment prior to the purchase and installation.
 - (2) Certified drawings and information submitted for the permanent files showing equipment as furnished and installed. (CVI).
- b. Data in the Section 2a (1) only, shall be required for panel boards, fabricated assemblies, relay panels, terminal boxes, welding outlets, lighting fixtures, automatic emergency lighting units, 600 V and 5 KV cable, underground ducts, wireways, cable trays and transformers 25 KVA and smaller.
- c. Data in both Sections 2a (1) and 2a (2) shall be required for the substations, motor control centers, voltage regulators, fire alarm and communications systems. Block diagrams and interconnection wiring diagrams shall be furnished for approval prior to shipment of equipment for fire alarm and communications specified in Division XVI.
- d. Drawings and specifications shall be submitted for approval, of all equipment and materials which are being furnished as an "approved equal" to the equipment and material called for on the drawings and in these specifications.
- e. Material or equipment purchased or installed without prior approval will be subject to rejection.

3. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

3.1 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA C57.12.00-1958	General Requirements for Transformers
ASA C57.12.20-1962	Overhead Type Distribution Transformers
ASA C57.12.90-1958	67,000 Volts and Below, 500 KVA and smaller
ASA C59.2-1960	Test Code (Including Supplement a.-1961)
	Testing Electrical Insulating Oils

3.2 FEDERAL SPECIFICATIONS

WW-C581d	Conduit, Electrical, Steel, Zinc-Coated
WW-C-566b	Conduit, Metal, Flexible
W-C-571 b	Conduit and Fittings, Non-Metal, Rigid
W-P-131a	Panel Boards (Equipped with Automatic Circuit Breakers)

3.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A475-62T	Zinc-Coated Steel Wire Strand
ASTM D20-56	Method of Test for Distillation of Tars and Tar Products
ASTM D88-56	Test for Saybolt Viscosity
ASTM D97-57	Test for Cloud and Pour Points
ASTM D287-55	Test for API Gravity of Petroleum Products

3.4 HANFORD STANDARD SPECIFICATIONS

HWS-8000-S, Rev. 5	Motor Control Centers, 600 Volt
HWS-8001-S, Rev. 2	Metal Enclosed Switchgear - 600 Volt
HWS-8002-S, Rev. 4	Thermoplastic Insulated Wire and Cable - 600 Volt
HWS-8003-S, Rev. 3	Synthetic Rubber Insulated Wire and Cable - 600 Volt
HWS-8004-S, Rev. 0	Thermoplastic Insulated, Jacketed Control Cable, 300 - 1000 Volt
HWS-8005-S, Rev. 3	5 KV Metal Enclosed Switch Gear
HWS-8006-S, Rev. 4	Butyl Rubber Insulated, Jacketed Cable, 5 and 15 KV
HWS-8200-S, Rev. 1	Industrial Fluorescent Lighting Units

3.5 HANFORD STANDARDS

D-20-10, Rev. 0	System and Equipment Grounding, Basic Requirements and Conductors
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D-20-10a, Rev. 1	System and Equipment Grounding, Basic Requirements and Conductors
D-20-10b, Rev. 0	System and Equipment Grounding, 120/240 and 120/208 Volt Systems
D-20-10c, Rev. 1	System and Equipment Grounding, 480 and 277/480 Volt Systems
D-20-10d, Rev. 0	System and Equipment Grounding, Ground Conductor Connections
D-20-20, Rev. 0	15 Amp-120 Volt Receptacle
D-20-21, Rev. 1	15 Amp-120 Volt Clock Outlet
D-20-23, Rev. 0	15 Amp-120 Volt, Twist-Lock Receptacle
D-20-24, Rev. 2	15 Amp-120 Volt Receptacles and Plugs for Instrumentation
D-20-35, Rev. 0	20 Amp-120 Volt Receptacle
D-20-50, Rev. 2	50 Amp-120/240 Volt Receptacle
D-20-110, Rev. 1	Lighting Switch Assemblies
D-20-120, Rev. 1	Fluorescent Fixture Hanger Assemblies
D-20-115, Rev. 1	Receptacle Assemblies

3.6 NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1-1959	Molded Case Circuit Breakers
NEMA TR 1-1962	Transformers, Regulators and Reactors

3.7 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA-70, 1962	National Electrical Code
NFPA-72, 1962	Proprietary Auxiliary and Local Protection Signaling Systems
NFPA-73, 1962	Municipal Fire Alarm Systems

3.8 NATIONAL BUREAU OF STANDARDS

National Electric Safety Code (NESC) 1959

3.9 WASHINGTON STATE DEPARTMENT OF LABOR AND INDUSTRIES

Rules for Installing Electric Wires and Equipment, 1954

MATERIALS

4. STANDARDS FOR MATERIALS

- a. Materials and equipment shall be new and as specified on the drawings and this specification, or approved equals. The listing of particular equipment or materials shall not be construed as all of the materials or equipment required to complete the job and place it in satisfactory operating condition.

- b. Materials and equipment shall conform to the National Electrical Manufacturers Association (NEMA) or NEC Standards if such standards have been established for the particular materials and equipment. NEMA standards for performance shall also apply.
- c. Materials for equipment that are not listed as being approved for the intended service by Underwriters Laboratories, Inc., shall not be accepted as substitutes for materials or equipment that are UL approved.

5. UNIT SUBSTATIONS

5.1 GENERAL

- a. The Building Power Substation (No. 1) shall be a 500 KVA, 3 phase, 60 cycle, 2400 - 480/277 volts, outdoor, metal-enclosed unit type substation for supplying power to equipment and/or circuits arranged for operation of a grounded Wye System rated 480/277 volts, three phase, four wire, 60 cycles.
- b. The Heater Power Substation (No. 2) shall be a 750 KVA, 3 phase, 60 cycle, 2400 - 480 volt, outdoor, metal-enclosed, unit type substation.
- c. Each unit substation shall include the following major components:
 - (1) Primary cubicle with load break fused disconnect switch.
 - (2) "Askerel" insulated, self-cooled transformer.
 - (3) Low voltage switchgear with drawout circuit breakers.

In addition, Substation No. 2 shall include saturable reactors as shown on the drawings.

5.2 TRANSFORMERS

- a. The transformer for the Building Power Substation (No. 1) shall be rated 500 KVA, 3 phase, 60 cycles, self-cooled, askerel insulated, 2400 volts delta primary, 480/277 volts secondary with two 2-1/2% taps below normal and two 2-1/2% taps above normal.
- b. The transformer for the Heater Power Substation (No. 2) shall be rated 750 KVA, 3 phase, 60 cycles, self-cooled, askerel insulated, 2400 volt delta primary with two 2-1/2% taps above normal and two 2-1/2% taps below normal and 480 volts delta secondary.

- c. Transformer construction shall be in accordance with ASA C57.12.20, Section 7.
- d. The tolerances for transformer ratio and regulation shall be as specified in ASA C57.12.00, Section 12-04.
- e. The limits of temperature rise shall be as specified in NEMA publication No. TR-1, Part 0 and Part 2 for 65 C rise oil-immersed transformers.
- f. Transformer insulation levels and dielectric test levels shall be in accordance with ASA C57.12.20, Section 2.
- g. Factory tests for transformer shall be in accordance with ASA C57.12.00, Section 12-06, Routine Tests. Test procedures and methods shall conform to ASA C57.12.90.
- h. At the option of the Commission, transformer may be tested at Hanford for acceptance as follows:
 - (1) Visual inspection for workmanship
 - (2) Turns ratio and polarity check
 - (3) Dielectric strength and power factor test of the oil shall be in accordance with ASA C59.2.
- i. Standard accessory equipment shall be furnished in accordance with ASA C57.12.20, Section 7.600.

5.3 SWITCHGEAR

- a. Switchgear for the unit substations shall conform to the requirements of Hanford Standard Specification HWS-8001-S. Switchgear shall be arranged as shown on Drawing H-3-25081.
- b. Switchgear for Unit Substation No. 1 shall have manually-operated circuit breakers and instruments as indicated on the one-line diagram, Drawing H-3-25051, Sheet No. 1, in weatherproof structures.
- c. Switchgear for Unit Substation No. 2 shall consist of weatherproof housings containing circuit breakers and saturable reactors as indicated on one-line diagram, Drawing H-3-25051, Sheet 2. Current transformers and overload relays shall be furnished on the load side of the feeder circuit breakers. The feeder circuit breakers only shall be remote, electrically-operated and shall have shunt trip coils and provision for remote red and green indicating lights and control switch.

- d. The four saturable core reactors for Unit Substation No. 2 shall be air-insulated, 60 cycles, 80 C rise, single phase, connected in series with the load. The line voltage will be 480 volts. Output voltage shall be guaranteed at least 90% of the input voltage. Reactor shall be enclosed within the 30" wide weatherproof cubicle. Guaranteed load current control shall be from a minimum of 10% to a maximum of 100% for the given design. Saturable reactors shall provide control power from 1-100%. Load shall be unity power factor. The control and the power circuits shall be insulated from each other. Direct current control power supply shall be furnished with the saturable reactors. Provision for remote control shall be as indicated on Drawing H-3-25051.

5.4 ELECTRICAL INSULATING OIL

- a. This specification covers the minimum requirements for an acceptable quality insulating oil to be used in the substation transformers. The insulating oil shall be non-flammable type, askerels such as Pyranol, Inerteen, etc. The transformer oil shall meet the following requirements on delivery at Hanford Works.
- b. Composition of the oil shall conform to the following:
- (1) 45% by weight hexachlorobiphenyl
 - (2) 40% by weight trichlorobenzene
 - (3) 15% by weight tetrachlorobenzene
 - (4) 0.125% by weight diepoxide
- c. Insulating oil shall exhibit the properties as listed below:

<u>Properties</u>	<u>Typical</u>
Viscosity: at 37.8 C (ASTM D88)	41 - 45 Se. Saybolt Univ.
Specific Gravity: at 15.5/15.5 C (ASTM D287)	1.560 - 1.571
Color: APHA	150
Condition:	Clear
Acidity: mgKOH/g	0.014 maximum
Pour Point: ° C, (ASTM D97)	-44C, or lower

Inorganic chlorides: PPM	0.10 maximum
Refractive Index: at 25 C	1.6075 - 1.6085
Distillation Range: (ASTM D20)	
Corrected for Steam	
Barometric Pressure	
First Drop	210 C Minimum
35%	240 - 256 C
55%	290 - 330 C
65%	385 - 400 C
95%	395 - 415 C
Corrosion:	After heating with aluminum for 6 hours at 200 - 220 C the aluminum must not be corroded either on visual or weight inspection and the insulating oil should meet the following specifications:
	Color APHA 200 Max.
	Acidity, mg KOH/g 0.014 Max.
	Inorg. chlorides, ppm 5 Max.
	Clear
Water Content: ppm	30 Max.
Resistivity: 100 C., 500 V, 0.1" gap	100 x 10 ⁹ Ohm-cm, min.
Dielectric Strength: 25 C	35 KV, min.

6. MOTOR CONTROL CENTERS - 600 VOLTS

Motor Control Centers shall consist of standardized prefabricated metal sections completely enclosing the control equipment and assembled to provide a dead front unit. Incoming lines shall enter from the bottom. Overload devices for the motor starters shall be sized for the motors to be furnished with the equipment. Control Centers shall conform to Hanford Standard Specification HWS-8000-S and the applicable drawings. The wiring of magnetic starters shall be as shown on the elementary diagrams. Terminal points shall be marked with the wire numbers as shown on the drawings. All 3 phase motor starters shall have two normally open and two normally closed auxiliary contacts.

7. MOTOR CONTROLLERS - 600 VOLTS

Motor starters shall be the combination type with NEMA Type 1 enclosure and two overload protection elements. For motors rated 3 hp and smaller, a 30 ampere fused disconnect shall be furnished

with the starter. For motors rated 5 hp and larger a circuit breaker, rated according to the National Electrical Code shall be furnished with the starter. All 3 phase motor starters shall have two normally open and two normally closed auxiliary contacts.

8. PANELS, BRANCH CIRCUIT

Branch circuit panels for 120/208 volt system shall be heavy duty circuit breaker type. The panels shall comply with U. S. Federal Specification W-P-131a, Class C. Bolted-in circuit breakers shall be 100 ampere frame and thermal magnetic type. The number and rating of circuit breakers for each panel shall be as shown on the Panel Schedule. The breakers shall comply with NEMA Publication No. AB-1. Circuit breakers marked "Spare" shall be furnished in the size marked. Blank covers shall be provided for circuit breakers marked "Future". The main busses shall be rated for 225 amperes with solderless lug terminals. Cabinet shall be flush or surface-mounted as indicated on the drawings. Cabinet shall have hinged doors with lock-type latches and keys.

9. GENERAL PURPOSE TRANSFORMERS, DRY TYPE

General purpose, dry type transformers shall be three phase, 60-cycle, 480 volts primary with two 2-1/2% taps above and two 2-1/2% taps below normal - 120/208 volts secondary unless indicated otherwise on the drawings. The transformers shall meet all ASA, NEMA, and AIEEE Standards for transformers and specialty transformers. The transformers shall be suitable for floor or wall mounting. The ambient temperature rating shall be 40 C.

10. RACEWAYS, FITTINGS AND BOXES

- a. Rigid steel conduit shall be hot-dipped galvanized, zinc metallized or Shephardized and shall meet the requirements of Federal Specification WW-C-581d. An anti-friction finish shall be applied to the internal surfaces. Unless otherwise shown on the drawings, minimum size conduit shall be 3/4" I.P.S.
- b. Electrical metallic tubing (EMT) shall not be used in the work.
- c. Flexible conduit and fittings shall be liquid-tight type UA. The liquid-tight flexible conduit in Rooms 1 and 100 shall be jacketed with radiation-resistant compounds such as Hypalon 40, Neoprene, Polyethylene, Scotch #27 Tape, or approved equal.
- d. All steel conduit fittings shall be galvanized. Threadless fittings shall not be used. Galvanized steel flexible conduit shall conform to Federal Specification WW-C-566b. Fittings for flexible steel conduit shall be galvanized. Liquid-tight flexible conduit shall be the type with a built-in grounding conductor. Fittings for liquid-tight flexible conduit shall be Appleton Electric Company, Type St, or approved equal. Conduit bushings shall be insulated type, O.Z. Electric Mfg. Co., Inc., "OZ", or approved equal.

10. RACEWAYS, FITTINGS AND BOXES (Continued)

- e. Wireways or ducts and fittings shall be flangeless, of the size specified on the drawings, fitted with hinged covers and shall be Square D Company (lay-in-duct), Keystone (lay-in-wireway), General Electric (hinged cover wireway), or approved equal.
- f. Auxiliary gutters shall be constructed of galvanized steel. Removable covers shall be held in place by winged-head captive fasteners not smaller than $1/4$ " diameter. Maximum length of any one cover shall be 4'. Maximum spacing of cover fasteners shall be 12". Cover fasteners, coupling and fittings shall not extend into the duct and shall not have sharp edges or points. Struts, spaced not more than 4' apart, shall be fixed across the open side in order to maintain rigidity.
- g. Wireways, gutters, cable trays, or banks of conduit and equipment shall be supported on hangers, factory made for the purpose, or on built-up metal framing such as "Uni-Strut", "Kindorf", or approved equal.
- h. Cable trays and fittings shall be of the size specified on the drawings and shall be ladder type with rungs slotted and spaced 6" on center unless specified otherwise. The sides of the ladder shall be a nominal 3" in height formed in channel or "Zee" with $3/4$ " legs. The rungs shall be not less than 0.081" thick, high strength aluminum alloy. Channel connectors shall be 0.125" thick aluminum. Ladder and fittings shall have all sharp edges and projections removed. All bolts and nuts used for support and assembly shall be non-corrosive type and shall not project into the cable space, except for large radius, $3/4$ " minimum bolt heads.
- i. Boxes used with galvanized rigid conduit in dry locations shall be galvanized sheet steel without gaskets. Boxes used in Rooms No. 1 and 100 shall be water-tight, galvanized boxes with threaded hubs and gasketed covers. Water-tight boxes shall conform to the Joint Industry Conference Electrical Standards for Industrial Equipment Specifications for Sealed Tight Fittings. One-hole clamps used for supporting conduit shall be equipped with clamp backs. Deep type concrete outlet boxes shall be used where conduits enter the sides in order to avoid interference with reinforcing steel. Unless specified otherwise on the drawings, outlet boxes for lighting fixtures where conduit is concealed shall be not smaller than 4" octagon boxes. Boxes for switches and receptacles shall be one-piece pressed steel, 4" square x $1-1/2$ " deep minimum for one or two devices. For flush mounting, $1-1/4$ " raised covers with rectangular openings for devices shall be used. Outlet boxes for switches and plug receptacles on unfinished walls where boxes cannot be concealed shall be set exposed with $1/2$ " raised surface covers

to fit the device. Assemblies shall be in accordance with Hanford Standards D-20-110 and D-20-115. Outlet boxes for telephone, signal, communications, push-button or buzzer outlets shall have plaster covers with a rectangular opening in the center. Each outlet shall have a plate appropriately bushed in the center for the device.

- j. Asbestos-cement conduit shall be equal to that manufactured by Johns-Manville and shall meet the requirements of Federal Specification W-C-571b.

11. CONDUCTORS

11.1 GENERAL

- a. Wire and cable shall be a type specified herein. Size and number of conductors shall be as shown on the drawings and as specified herein. All wire and cable shall be accompanied by manufacturer's certification as to compliance with the applicable specification as listed under Section 11.2 below and as to date of manufacture.
- b. All single conductor insulated wire shall be rejected for installation unless readily identified by continuous, permanent marking to indicate the type, voltage, wire size and manufacturer.

11.2 WIRE AND CABLE - 600 VOLT

- a. Synthetic rubber insulated cable with polychloroprene or polyvinyl chloride thermoplastic jacket, Type RHW, shall be used in sized #1/0 AWG and larger and shall conform to the Hanford Standard Specification HWS-8003-S.
- b. Wire according to Hanford Standard Specification HWS-8002-S, conductor temperature of 60 C shall be used for branch circuits from lighting panels, fire alarm system circuits and annunciator circuits. All other wire and cable shall be rated at 75 C for conductor temperature. The minimum wire size for lighting and power circuits shall be #12 AWG. Unless otherwise specified, wire sizes #8 and larger shall be stranded and #10 and smaller shall be solid, except that all control wiring and equipment grounding conductors shall be stranded. All conductors shall be copper unless otherwise shown on the drawings. Multiple conductor cables shall be as specified in Hanford Standard Specification HWS-8004-S.
- c. Wire and cable for Room #100 only shall be insulated with either chlorosulfonated polyethylene, such as Dupont Company's "Hypalon" 40 or cross-linked polyethylene such as General Electric Company "Vulkene" or Sequoia Wire Company "Hyrad", or approved equal. This type of insulation is needed for the particular environment surrounding a nuclear reactor and shall be used for power, control, communication systems, detection circuits, lighting and auxiliary circuits in Room #100.

11.3 WIRE MARKERS

Identification marking of individual conductors shall be imprinted tubular plastic markers as manufactured by the E. C. P. Corporation, 4726 Superior Avenue, Cleveland 3, Ohio; Floytag of Seattle, Washington, or approved equal. Glued, cemented or wrap-around types of markers are not acceptable.

11.4 CABLE - 5 KV

The 5 KV cable shall be unshielded and shall conform to Hanford Standard Specification HWS-8006-S. Cable shall be sized in accordance with the drawings.

11.5 GALVANIZED GROUNDING CONDUCTOR

All grounding conductors, buried in the earth or encased in concrete, shall be steel strand wire, common grade, with Class B Zinc coating in accordance with ASTM A475. Size of the grounding conductor shall be as shown on the drawings.

12. SOLDERLESS CONNECTORS AND TERMINALS - 600 VOLTS AND LESS

Pressure type, solderless connectors and terminal lugs shall be used in wiring not exceeding 600 volts between conductors. Connectors with insulating caps or covers shall be UL approved for the voltage of the system in which they are used. Connectors shall be as specified below or approved equal.

a. For conductors #8 AWG and smaller:

- (1) Ideal Industries, Inc. - Ideal set screw type
- (2) Burndy Engineering Company, HYDENT
- (3) Minnesota Mining and Manufacturing Company - Scotchlock
- (4) Thomas and Betts Company - Sta-Kon.

b. For conductors #6 AWG and larger:

- (1) Burndy Engineering Company, Screw Pressure Connectors or Hypress
- (2) Thomas and Betts Company - Lok-Tite Connectors
- (3) General Electric Company, Pressure Connectors
- (4) Erico Products, Inc. - CADWELD Connections

13. RECEPTACLES AND PLUGS

Details of, and connections to, the receptacles and plugs shall be as shown on Hanford Standards and as follows:

a. For 120 volt, single phase service.

- (1) Convenience outlets - polarized, 3 pole, 15 ampere, Standard D-20-20.
- (2) Clock outlets - polarized, 3 pole, 15 ampere, Standard D-20-21.
- (3) Outlets where cord is in tension - polarized, 3 pole, twist-lock, 15 ampere, Standard D-20-23.
- (4) Instrumentation receptacles - polarized, 3 pole, 15 ampere, Russell and Stoll "Midget-Ever-Lok" series. Standard D-20-24. Only products of other manufacturers which are directly interchangeable with the "Midget-Ever-Lok" will be permitted.
- (5) Medium duty-polarized, 3 pole, 20 ampere, Standard D-20-35.

b. For 240 volt, single phase service.

- (1) Range receptacle, 50 ampere, 240 volts with external grounding clips, Standard D-20-50.

14. LIGHTING FIXTURES

Lighting fixtures shall be of the type, size and quality specified on the drawings and in this specification. Each fixture shall meet or exceed the specified standards including photometric data and components construction, and shall be furnished complete with lamps. Lamps shall be rated at 120 volts AC. All exposed lamps shall be inside frosted unless shown otherwise on the drawings.

15. LIGHTING SWITCH ASSEMBLIES

Lighting switches, boxes, covers and plates shall be as shown on Hanford Standard D-20-110.

16. INSTRUMENTATION LINE VOLTAGE REGULATORS

a. Nine instrumentation line voltage regulators shall be furnished and installed. The regulators shall be the magnetic amplifier type with the following characteristics:

Rating:	5 KVA
AC Input:	95 - 135 volts, 1 phase, 60 cycle
Regulation:	$\pm 0.5\%$ for any combination of line voltage variation from 95 to 135 volt and load variation from 10% to 100% load

Harmonic Content:	3% Maximum
Response Time:	0.1 second or less (for 63% recovery from maximum deviated value)
Ambient Temperature Range:	Up to 55 C

- b. The regulators shall be enclosed in NEMA Type 1 enclosures.

WORKMANSHIP

17. GENERAL

- a. All equipment, materials, conduits and boxes shall be installed as indicated on the drawings and as specified herein.
- b. The work shall conform to the requirements on the following listed codes except where specified otherwise on the drawings, or on the Hanford Standards or in this specification.

- (1) National Fire Protection Association (NFPA 70, 72 and 73)
- (2) National Electrical Safety Code (NESC)
- (3) Washington State Rules for Installation of Electrical Lines, 1954 and supplements thereto.

Recommended methods and materials for installation of work described in the above codes, shall be mandatory unless specified otherwise herein, on the drawings or on the referenced Hanford Standards.

- c. All equipment, boxes and conduits shall be securely bolted or fastened to the structural members of the building or to the metal supports attached to the structure. Fastening to metal wall or to ceiling panels is not permitted. Supports attached to structural steel shall be clamped or welded. Drilling of holes in structural steel will not be permitted, except with specific written approval. Cone type expansion anchors, shall be used with bolts which fasten equipment to concrete.
- d. All equipment, boxes and conduit shall be located as per the dimensions on the drawings. When location dimensions are not shown, the equipment, boxes and conduit shall be located approximately where shown in relation to equipment served. Conduit raceways and boxes shall not be installed in positions that interfere with other services such as piping, ventilation, etc.

18. INSTALLING BUILDING GROUNDING SYSTEMS

18.1 UNDERGROUND ELECTRODES AND CONNECTIONS

- a. Grounding shall be by means of a ground grid supplemented by driven ground electrodes in accordance with the drawings.

- b. All grounding conductors installed in earth or concrete shall be galvanized, stranded steel. Grounding conductors exposed to the atmosphere shall be copper cable as shown on the drawings.
- c. Buried ground conductors shall be protected against all mechanical damage before and during backfill. Backfill material within one foot of the cable shall not contain rocks larger than 2" in diameter.
- d. Splices and taps in galvanized steel grounding conductors that are to be buried in the earth or concrete shall be made with cast copper joints, "Cadweld process", or approved equal. The joint shall be completely covered with asphalt paint and cotton tape for at least 6" each way from the joint.
- e. Where it is necessary to join a copper conductor to a galvanized steel conductor or to any steel, the joint shall be made above the ground in a dry location.
- f. The resistance of a ground conductor with joints or taps shall not be greater than the resistance of an equal length of continuous conductor without joints or taps.

18.2 SYSTEM AND EQUIPMENT GROUNDING

- a. The neutral conductor of single phase and three phase, wye-connected distribution systems shall be grounded at the transformer bank only, unless otherwise specified and indicated on the drawings.
- b. Grounding methods shall be in accordance with Hanford Standards D-20-10, D-20-10a, D-20-10b, D-20-10c and D-20-10d.
- c. In this specification and on the drawings the term "equipment" shall be understood to mean all exposed metal parts of a wiring system including conduit, raceways, metal armor of cables, cabinets, switch boxes, outlet boxes, motor controllers, panelboards, lighting fixtures, etc.
- d. All metallic conduits, wiring channels and the armor of armored cable shall be connected at each end, with a good electrical contact to a properly grounded connection box. Ground connections must be made to the grounding conductor at each box.
- e. Portable electrical equipment shall be grounded by means of a separate green colored grounding conductor in the cord or cable equal in current-carrying capacity to the largest line conductor. The ground shall be completed to a separate grounding pole in the plug and receptacle.

18.3 STATIC GROUNDING

- a. The steel columns of the building shall be thoroughly grounded to the ground grid as shown on the drawings.
- b. The installation of ground conductor risers, embedded in concrete, shall be in a manner to form an ever-rising path from the ground grid to the highest termination. Also, bends of less than 8" radius are not acceptable.

19. RACEWAY AND TRAY INSTALLATION

19.1 INSTALLING STEEL CONDUITS

- a. Concealed conduits shall be run as directly and with as long bend radii as possible. Exposed conduit shall be run parallel to or at right angles with the lines of the building. Exposed horizontal runs of conduit shall be run not less than 9' above the floor level unless shown otherwise on the drawings. All bends shall be made with standard conduit ell's, field bends or screw jointed conduit fittings.
- b. All conduit field bends shall be made with approved bending devices and shall have an inner edge radius not less than specified in the National Electrical Code. All bends shall be free of dents or flattening.
- c. All conduit shall be cut square, reamed, have burrs removed and shall be cleaned before the introduction of wires or cables. Immediately after installation, all conduit ends shall be plugged or capped with standard conduit accessories until wires are pulled.
- d. Conduit joints shall be set up tight. Hangers and fastenings shall be secure and of a type appropriate in design and dimensions for the particular application. Maximum distance between supports shall be 7' for 3/4" conduit or smaller, and 10' for 1" conduit and larger. Runs shall be straight and plumb and parallel or perpendicular to walls and ceilings. Elbows, offsets and bends shall be uniform and symmetrical.
- e. Couplings, connectors and fittings shall be approved types and shall be installed to provide a rigid mechanical assembly and positive electrical conductivity. Conduit and fittings shall be deburred.
- f. Galvanized steel lock nuts and bushings shall be used for attachment to enclosures unless threaded hub is specified. In addition, ground wedges or bushings shall be installed as required by the grounding standards referred to in Section 18. Threadless fittings are not permitted for rigid conduit unless specifically indicated on the drawings. Erickson type couplings shall be used where required. Running threads are not permitted.

- g. One hole malleable-iron pipe straps equipped with clamp-backs shall be used for fastening conduit to plane surfaces.
- h. Conduits shall be run without moisture traps where possible. When traps are unavoidable, a pull box or conduit with drilled hole shall be placed at each low point to provide a means of escape for moisture except where low point is embedded in concrete. Burrs shall be removed from drilling holes.
- i. Flexible conduit in sections 2' long or less shall be used to make connections to motors and other equipment subject to vibration. Flexible conduit may also be used for other equipment where the use of rigid conduit is impractical. Liquid tight flexible conduit and fittings shall be used in Rooms 1 and 100.
- j. Conduit runs to outside walls and runs between ventilation zones where an air pressure differential exists shall be sealed at both ends to prevent the flow of air through the conduit and consequent condensation of moisture on the inside surface of the conduit. Duct sealing compound such as "Volseal", "Kerite" putty, or approved equal, shall be used for this purpose.
- k. All conduit penetrations through walls, floors or ceilings of Rooms 1 and 100 shall be installed at the elevations and locations shown on the drawings. Unless dimensioned otherwise, conduits through a wall, floor or ceiling of Rooms 1 and 100 shall be offset a minimum of six times the conduit diameter. Each conduit end shall terminate perpendicular to the wall and shall have a straight length of $1/3$ the wall thickness.
- l. Conduit shall not be installed within 6" of piping operating at more than 140 F unless high temperature wire is to be used within the conduit.
- m. Conduit runs shall be all steel.
- n. Rigid steel conduit shall be used where embedded in masonry or concrete building construction. Under-slab runs of conduit shall be encased in concrete of 3" minimum thickness on all sides of the conduit.
- o. All underground conduit shall be encased concrete. The minimum depth below grade of underground ducts shall be 30". The slope of the conduit shall be continuously toward a manhole or moisture trap.
- p. Asbestos-cement conduit shall be used where specified on the drawings and shall be encased in concrete.
- q. All spare conduit runs shall have a #12 AWG bare, galvanized steel or a #12R AWG copper pull wire installed.
- r. Penetrations of conduit through walls shall conform to the details shown on the drawings.

19.2 INSTALLING METAL RACEWAY OTHER THAN CONDUIT

- a. Cable trays, wireways and metal ducts shall be installed complete with the necessary fittings, connectors and parts according to the recommendations of manufacturer.
- b. All parts of cable trays, wireways and metal ducts shall be assembled accurately and supported firmly. Supports shall be spaced not less than 5' apart, unless specifically shown otherwise on the drawings. Manufactured sections and fittings shall be used wherever possible. Field cuts or alterations shall be made in the manner prescribed by the manufacturer.
- c. Cable trays, wireways and metal ducts shall have all obstructions, burrs and sharp edges removed and shall present a smooth surface for introduction of cable and wire.
- d. Penetrations through walls or floors by cable tray, wireways or metal ducts shall be sealed with a room-temperature-vulcanizing rubber compound. The wall or floor penetration shall be sized to give a close fit to the raceway in order to keep the amount of sealing compound to a minimum. Excess compound shall be trimmed off flush with the surface. Penetrations through walls shall be framed with closure strips.

19.3 IDENTIFICATION OF CABLE TRAYS AND CONDUIT

- a. All cable trays shall be identified with the tray number as shown on the drawings. The identification shall be black letters and numbers not less than 1-1/2" in height painted at intervals not exceeding 20' on a clearly visible side of the tray.
- b. All embedded conduits shall be identified with the assigned conduit (P) number or sleeve (SL) number by black characters not less than 1/2" in height painted on the walls where the conduit enters and emerges. Where conduits enter the back, sides or tops of flush boxes, the conduit number shall be painted inside the box as close to the particular conduit as possible and visible upon inspection of the box. All surface conduit runs shall be identified at each end with 1/2" high black painted letters and numbers on the conduits.

20. INSTALLING BOXES, ENCLOSURES AND WIRING DEVICES

- a. Junction and pull boxes shall be sized and installed in accordance with the National Electrical Code, unless larger sizes are shown on the drawings. Type enclosure is as specified herein.
- b. Pipe plugs and knock-out seals shall be installed in all unused openings of the enclosures.

- c. Outlet boxes for lighting fixtures shall be as shown in typical mounting diagrams.
- d. All boxes shall be firmly secured in position and plumb.
- e. Outlet boxes, panels or other electrical equipment must be located at least 10' laterally from safety showers unless such equipment is located 8' or more above the floor.
- f. Unless specified otherwise on the drawings, switches shall be mounted at 4' above the floor elevation; junction boxes shall not be lower than 9' above the floor or 6" below the ceiling line.
- g. All junction and pull boxes shall be identified by the proper number as shown on the drawings. The identification shall be painted black letters and numbers not less than 1" in height on the box cover and on one side of the box of surface-mounted boxes. For flush-mounted boxes the cover shall be identified with one-inch-high black painted letters. The flush-mounted boxes shall be identified with painted black letters not less than 1/2" in height inside ~~and on~~ an unobstructed side or back portion of the box after the wiring installation is complete.

21. INSTALLING CONDUCTORS

- a. All conduit runs shall be cleaned, dried and blown free of all debris before any wire is pulled.
- b. Wire smaller than number 12 AWG shall not be installed unless specifically indicated on the drawings or in the specifications.
- c. Cables installed in the trays shall not be bent, either during installation or in their permanent locations, to radii less than the cable manufacturers corresponding minimum bending radii. Single conductor wires, when installed in trays, shall be tied together with a cord to form feeder and control cables according to the wire run list. Ties shall be a maximum of 18" apart. Placing of cables in trays shall be in a manner to form straight parallel lines and to avoid crossing cables over each other.
- d. All wires and cables carried in cable tray shall be tied to the tray at 8' intervals or less with waxed linen cord or nylon tape. In all vertical cable tray runs, cables shall be tied to the trays at intervals of 4' maximum.
- e. Circuit conductor color coding shall be:

Three Phase System

A Phase - Red

B Phase - Yellow

Single Phase System

Ungrounded - Black

Neutral - White

C Phase - Blue

Ground - Green or Bare

Neutral - White

Ground - Green or Bare

Paint or pressure-sensitive tape may be used to identify the conductors in lieu of colored insulation on #2 AWG and larger wire only. Phase color coding shall be maintained for all main circuits, feeders and subfeeders up to and including equipment connections. Neutral and equipment ground conductors, where required, shall be clearly identified throughout the system.

- f. At each terminal point, or terminal box junction, each individual conductor shall be identified according to the drawings by imprinted tubular plastic wire markers. All splices, terminations and connections to devices shall be identified. The sized, tubular, plastic wire marker in such a manner that the identifying number will remain within 2 inches (maximum) of the wire termination. Markers shall be placed so that the identification is visible without moving the wire or the marker.
- g. Only the cable manufacturer's recommended lubricant shall be used to decrease friction when pulling wire and cable through conduit.

22. SPICES, TAPS AND CABLE TERMINATIONS

- a. Splices and taps in building wire shall be made with the solderless connectors as previously described. Taps in receptacle or switch boxes shall be made with connectors and pigtail wires to the device. Terminals on the device shall not be used as a wire tap.
- b. Solderless connectors shall be used according to the manufacturer's instructions. For connector types which require installation tools, the proper tool, made especially for the connector, shall be used. Connectors without insulating covers shall be taped.
- c. Plastic insulating tape, made especially for electrical work, shall be used for all splices and taps on circuits up to 600 volts. Scotch No. 27 tape, or approved equal, shall be used in Rooms 1 and 100. The insulating tape shall be applied to a thickness at least equal to that of conductor insulation. Where a bolted splice or connection presents an irregular surface, an insulating putty, Minnesota Mining and Manufacturing Company "Scotch-Fill", General Electric Company No. 8380, or approved equal, shall be applied to the joints before taping.
- d. Manufacturer's instructions and directions shall be strictly adhered to for all splices, stress cones and terminations in cables operating at over 600 volts to ground.

23. INSTALLING LIGHTING FIXTURES

- a. Lighting fixtures shall be installed (according to the fixture schedule) complete with lamps. The height of mounting shall be as specified on the drawings.
- b. Fixtures shall be securely mounted by one of the fastening methods illustrated in Hanford Standard D-20-120. A fixture stud shall be used for fixtures weighing more than 16 pounds or where fluorescent fixtures are hung from an outlet box. The box cover fastening screws shall not be used to support these fixtures.

24. INSTALLING DISTRIBUTION AND BRANCH CIRCUIT PANELS

- a. Panels shall be installed where shown on the drawings.
- b. Circuits shall be connected to the disconnecting devices as shown on the drawings.
- c. A typed panel directory shall be provided to identify the equipment served by each circuit.

25. INSTALLING MOTOR CONTROL CENTERS

- a. Installation of motor control centers shall be according to the equipment manufacturer's instructions and as specified herein. Metal Nameplates shall be attached with sheetmetal screws.
- b. Motor control centers shall be plug welded to the angle sills, both front and back, a minimum of two places in each vertical section. Control centers shall be assembled and wired at shipping section breaks in accordance with the manufacturer's instructions and all connections shall be checked and tightened. All covers and enclosures, which have been removed for shipment or installation, shall be replaced and bolted into place.
- c. All wiring between adjacent control centers routed (as shown on the drawings) through the opening, either top or bottom, between the centers, shall be installed and connected to the proper terminals as called for on the motor control center manufacturer's drawings.
- d. Phase rotation shall be checked prior to making cable connections and shall be in accordance with the face arrangement of the motor control center drawings. Cable and bus conductors shall be connected with phase sequence as follows when observed from the front.

A Phase - Front	Left	Top
B Phase - Center	Center	Center
C Phase - Rear	Right	Bottom

26. INSTALLING MOTOR-OPERATED DOORS

Wiring to motor-operated doors shall be in accordance with the drawings, this specification and the door manufacturer's instructions. All wiring to the limit switches and other devices may not appear on the construction drawings but shall be included in the installation as indicated on the manufacturer's drawings.

27. INSPECTION AND TESTING

27.1 GENERAL

- a. All electrical equipment and wiring installed under these specifications shall be inspected and tested by the Contractor before any attempt is made to operate the equipment. Resistance, current and voltage measurements may be made as the work progresses. The Contractor shall maintain a systematic record by using the schedule or chart of all tests and measurements. Space shall be provided to record readings, dates and witnesses. All tests shall be witnessed by the Commission. The Contractor shall correct all items found during inspection and testing to be at variance with the drawings and these specifications.
- b. All instruments, labor and equipment required to conduct the inspection and testing specified herein shall be supplied by the Contractor.
- c. Accuracy of the instruments used for testing shall be attested by a calibration stamp satisfactory to the Commission.

27.2 MOTORS AND GENERATORS

- a. All safety hazards to men and machinery shall be corrected.
- b. Frames of motors and generators shall be checked for proper grounding.
- c. Voltage, frequency and number of phases of power supply shall correspond with those required for the machine.
- d. The electrical connection shall be checked for tightness and proper insulation.
- e. Leads to motors and generators and power wiring shall be checked for proper numberings in accordance with drawings and specifications.
- f. Bearings shall be inspected for proper lubrication.
- g. The shaft end play and freedom of rotation shall be checked by hand where practical.

- h. Belts shall be checked for the correct tension.
- i. The voltage, current and speed under normal operating loads shall be measured and recorded.
- j. Supply and exhaust fans of the ventilation system shall be operated under the normal load for a six-hour heat run. The fan bearing temperatures and the motor bearing and winding temperatures shall be checked for excessive temperature rise. Temperature rise shall not exceed the temperature rise of the motor. Equipment shall be checked for any unusual noises or vibrations.

27.3 WIRING SYSTEMS

- a. All conduits and devices shall be checked for secure mounting and proper attachment.
- b. Condulets, junction boxes and raceways shall be checked for loose or missing covers.
- c. Conduit connections shall be checked for tightness.
- d. Panels shall be checked for tightness of connections, filling of all open knock out holes, security of mounting, mechanical damage, identification of panel and circuits therein, cleanliness and fuse size or overload protection device settings.
- e. Circuit numbers shall be checked for conformance with the drawings.
- f. All wiring connections shall be checked for proper installation.
- g. The proper color coding for all wire and cable shall be verified.
- h. Receptacles shall be checked to assure proper functioning of the devices, correct wiring and correct polarity of plugs and receptacles.
- i. All wiring and cable, rated 600 volts or less, and used for services, power feeders and branch circuits, shall be tested phase-to-phase and phase-to-ground with a 500 volt megger. The instrument manufacturer's instruction pamphlet, accompanying the instrument, will provide the detailed instructions for methods of conducting the tests. Any device not capable of withstanding voltage and current of a megger test (such as microphones, recording and indicating instruments, relays and lamps) shall be disconnected or bypassed before the test is made. To prevent damage to the wiring under test and to the electrical devices left in place during the test, the maximum output of the megger to be used with each class of insulation shall be as follows:

<u>VOLTAGE OUTPUT OF MEGGER</u>	<u>VOLTAGE RATING OF EQUIPMENT AND WIRING TO BE TESTED</u>
100 and 250 volts	Up to 100 volts
400 volts	Telephone Cable
500 volts	100-600 volts

- j. It is permissible to test the entire system or any part of a system including feeder cables, etc., provided the observed minimum insulation resistance is equal to or greater than the value specified in Section 110-19 of the National Electrical Code for the smallest size of wire included in the system or part under test. If such readings are low, the system must be separated until the part causing the low reading is determined and corrected.

27.4 LIGHTING SYSTEMS

- a. An inspection shall be made to determine that panel interiors are clean, wiring has been properly supported, breakers are of correct rating as shown on the drawings and that circuit directories have been satisfactorily filled out.
- b. An inspection shall be made to insure that all lighting fixtures are properly mounted, equipped with correct size of lamps or tubes, are clean and in satisfactory operating condition.
- c. All fixtures, receptacles and appliances shall be checked for correct circuiting and switching as per the drawings.

27.5 MOTOR CONTROL CENTERS AND STARTERS

- a. Each compartment shall be checked for proper nameplate identification.
- b. Equipment and devices in control center cubicle shall be checked with the drawings and schedules to assure that they are correctly mounted and wired and installed in the correct compartment. The size and rating of breakers, fuses and overload heaters shall be verified.
- c. Wire tag numbers, terminal strip markings and wiring shall be checked with the drawings. Wiring shall be checked for standard color coding of phases.
- d. Installation of arc-confining baffles or barriers between compartments and devices, where provided in control center, shall be checked.

- e. All vertical and horizontal bus supports and insulator bolts shall be checked for tightness. All connections, bus-to-bus, bus-to-lugs, and bus-to-stabs shall be inspected to determine that they are silvered, tight and corrosion free. Busses shall be checked for proper bus phase arrangement as called for in the specifications.
- f. Each unit assembly in the control center shall be removed and checked for horizontal and vertical alignment of units and guides, and alignment of stabs with busses. There shall be no tendency to twist or turn out of position or fit loosely. The unit stabs shall make contact automatically with insertion of unit and disconnect automatically with removal of unit.
- g. Compartment door fit and door handle interlocking features shall be checked to assure that door cannot be opened when unit it houses is energized. Operating handle linkages shall have a minimum of slack or play. Handle shall be lockable in either the "ON" or "OFF" position. The switch or breaker position marker shall be checked for correct indication, i.e., breaker or switch in "OPEN" or "CLOSED" or breaker is "TRIPPED" as marker indicates.
- h. All breaker, switch and starter mechanisms shall be checked to see that nuts and bolts are in place and tight, and no pins or keys have worked out of place and all cotter pins have sufficient spread. Mechanism rods and moving parts shall not bind and shall be in proper working order.
- i. Motor starters shall be operated several times to check for binding, free operation of moving parts, proper contact area and pressure of main and auxiliary contacts and correct operating coil voltage.
- j. Control transformers shall be checked for proper voltage ratio. Fuses for the transformers shall be removed and checked for correct size and condition. Check shall be made for ground on one side of transformer secondary. All connections and mounting bolts shall be tight.
- k. Pilot light shall be checked to assure proper indication of motor operation. Pushbuttons shall be checked for connections and operability.
- l. Insulation tests shall be made before energizing the control center by meggering all busses, internal cabling, breakers and starters, phase-to-phase and phase-to-ground.

27.6 TRANSFORMERS

- a. The condition of high and low voltage bushings shall be checked for freedom from damage and cleanliness.

- b. The condition of high voltage stress cone connections and low voltage bus connections shall be checked.
- c. Oil gauges and thermometers shall be checked for damage, tightness and proper indication.
- d. The oil level shall be checked and corrected for temperature of oil.
- e. The case and fittings shall be inspected for oil leaks.
- f. The breather shall be checked for obstructions.
- g. The relief diaphragm shall be checked for operation.
- h. The tank ground shall be checked for continuity and tightness of connections.

27.7 SWITCHGEAR

- a. The switchgear, auxiliaries and conduits shall be checked for workmanship and general appearance. Any external factors such as moisture, chemicals, dust and oil that are detrimental to the switchgear shall be noted and corrected.
- b. All breakers and compartments shall be checked for proper identification according to the drawings.
- c. Switchgear shall be checked for missing covers, loose or missing parts, dirt on relays, feeders or other devices. Doors and locks shall be checked for proper fit.
- d. The overcurrent tripping devices and the trip latches shall be inspected for freedom of movement.
- e. The operating voltage shall be adequate for correct operation of all breakers.
- f. All breakers shall be "racked out" from the enclosures and checked for proper functioning of the mechanisms. All readily accessible parts shall be checked for proper insulation from live parts of the breaker. Mechanical interlocks shall be checked for correct operation.
- g. The door shall be checked to insure that it cannot be opened when the breaker is closed without tripping the breaker as specified. Provisions for locking the breaker in the trip position and locking of the lift mechanism for door shall be checked.
- h. All busses, incoming lines, feeders and tie connections shall be checked for phase sequence, identification and proper color coding.

- i. Each control switch shall be checked for operation and for provision for locking in the trip position. Operation of red and green lights shall be checked for correct operation in their respective positions of breakers.
- j. Insulation tests shall be made before energizing the switchgear by meggering all busses, internal cabling and breakers, phase-to-phase and phase-to-ground.
- k. All overcurrent, undervoltage and timing relays shall be:
 - (1) Tested and adjusted according to the manufacturer's instructions by the Commission. The Contractor shall remove, replace and protect the relays in the Switchgear for these tests.
 - (2) The Contractor shall notify the Commission three working days prior to the time the relays are to be tested. Completion of the tests and adjustment of relays will not constitute acceptance of the switchgear.
- l. All electrically-operated circuit breakers shall be:
 - (1) Closed and opened at least three times using the respective control switch.
 - (2) Tripped three times by simulating overcurrent conditions.
- m. All manually-operated breakers shall be closed and opened three times. The overcurrent trip elements shall be checked for the correct ratings and settings.
- n. Voltmeters and ammeters shall be checked for proper indication on each phase by operating the transfer switch.
- o. Key interlock breakers and primary disconnects shall be checked for operation of the lock system. The number of keys specified for each interlock system shall be checked.
- p. Painted surfaces shall be checked for scratches.

DIVISION XVI

COMMUNICATIONS AND ALARM SYSTEMS

GENERAL

1. SCOPE

This division covers telephone and inter-communications systems, audible alarm systems and the fire alarm system as shown on the drawings for the High Temperature Lattice Test Reactor, Building No. 318 and 318-A.

2. SUBMISSION OF DRAWINGS AND INFORMATION

The Contractor shall furnish to the Commission, dimensional outlines, complete wiring diagrams, installation instructions, maintenance instructions, performance data and specifications for the equipment specified herein in accordance with the requirements stated in the Special Conditions.

The drawings and information shall be furnished as follows:

- a. Data shall be submitted to the Commission for approval and comment prior to purchase and installation.
- b. Certified data showing equipment as furnished and installed shall be submitted to the Commission for the permanent files.

MATERIALS

3. AUDIBLE ALARMS EQUIPMENT

The horns, sirens and gongs for the audible alarms systems are specified on drawings H-3-25075 and H-3-25077. Audible alarm devices shall have a sound level which is adjustable within the range 80 to 100 decibels when measured within 5 feet of the device.

4. TELEPHONE EQUIPMENT

- a. Telephone instruments will be furnished and installed by the Commission.
- b. Telephone cable for connecting the building telephone terminal cabinet to the existing 300 Area telephone system is specified on Drawing H-3-25096.
- c. The main telephone terminal cabinet shall be furnished by the Contractor and shall be a Western Electric Catalog No. 31D, or approved equal.
- d. Conduit, raceways, pull boxes and accessory fittings shall be as specified in Division XV.

5. INTER-COMMUNICATIONS SYSTEM EQUIPMENT

The features, operation and details of the inter-communications system shall be as follows:

- a. Each station shall be capable of independent communication with any other station. Location of each station shall be as shown on the drawings.
- b. All stations shall originate calls to any other station by depressing the appropriate selector button for the station to be called.
- c. Each station shall receive calls from any other station without operating any buttons, controls or switches.
- d. It shall be possible to hold as many simultaneous independent conversations as there are pairs of stations in the system.
- e. Voice circuits shall be electronic to provide maximum audibility with a minimum of distortion.
- f. Power supply for all stations will be 115-120 V AC, 60 cycle. All stations shall be capable of operation with minimum distortion through a voltage range of $\pm 10\%$ from nominal values. Battery-operated equipment will not be acceptable.
- g. The inter-communication system wiring shall consist of an adequate number of twisted, independently shielded pairs, to serve the system requirements, and to provide for future addition of a minimum of four stations. Pair shielding shall be adequate to prevent interference or crosstalk. All conductors shall be covered and protected by an outer jacket of polyvinylchloride.
- h. All stations shall be provided with plug-in type connections to the wiring system via a 6 foot minimum length cord.
- i. All stations shall be provided with hand-sets. Lifting the hand-set shall automatically cut out the loudspeaker at that station.

WORKMANSHIP

6. INSTALLATION OF COMMUNICATIONS AND ALARM SYSTEMS

6.1 GENERAL

- a. Conduit, raceways, pull boxes and accessory fittings shall be as specified in Division XV.
- b. All splices in the alarm system wiring shall be made mechanically strong and soldered. Single conductors in interior alarm systems shall be not smaller than number 14 AWG stranded.

- c. Fire alarm loop detector circuits shall be color coded and the same colors shall be maintained throughout the circuit.
- d. The panelboard breaker supplying 120 volts AC to the fire alarm supervisory panel, communications system and evacuation alarm system shall be fitted with a suitable guard requiring the removal of a screw to open the breaker. The supply breaker handle shall be painted with red enamel.
- e. The auxiliary fire alarm terminal boxes shall be painted with red enamel with "F. A." in 1 inch high letters painted in white in a prominent place.
- f. All fire alarm junction and pull boxes shall be painted with red enamel.

6.2 FIRE ALARM SYSTEM

- a. The fire alarm control and supervisory panel shall be supplied with battery power for emergency operations as shown on the drawings.
- b. The building fire sprinkler system covered in Division XII shall be connected to the supervisory panel to register an alarm, when the wet pipe pressure detector is triggered, through flow switches as shown on the drawings.

6.3 AUDIBLE ALARM SYSTEMS FUNCTIONING

- a. The alarm systems shall provide for distribution of building alarm sounds for high radiation level (howler), fire (bell), civil defense (siren), safety circuit made up (pulsator siren) and reactor start-up (horn).
- b. The alarm sounders shall be located as shown on the drawings. The fire alarm signal shall be relayed from the fire alarm supervisory panel. The civil defense alarm will be activated by a signal originating in the 300 Area CD headquarters and transmitted to the building via a telephone pair. The high radiation level alarm will be activated by a signal from any one of the radiation detection instruments to be located in the building. The radiation detection instruments will be furnished and installed by the Commission.

6.4 TELEPHONE SYSTEM

- a. The completed telephone system will be connected to a private dial exchange. The Contractor shall install all conduit, raceways, ducts, pull boxes, and the main telephone terminal cabinet.
- b. The telephone instruments will be installed by the Commission at a later date.
- c. The Contractor shall install a pull wire in each telephone conduit from the hand-set locations shown on the drawings to the main telephone terminal cabinet.

7. INSPECTION AND TESTING

7.1 INTERCOM SYSTEM

- a. A voice signal shall be provided at normal speaking volume into each hand-set. Each station shall be checked for direct voice communication with each other station.
- b. Each call button shall be checked for call signal to each other station.

7.2 AUDIBLE ALARM SYSTEMS

- a. The fire alarm signal shall be generated by operating a pull box.
- b. The civil defense signal shall be generated with a 1-1/2 volt battery.
- c. The other audible alarm sounders shall be tested individually by energizing with 120 V AC prior to mounting.

7.3 FIRE ALARM SYSTEM TESTS

- a. The fire alarm system shall be tested only after:
 - (1) All wiring has been tested for continuity of circuits and for grounds and breaks in insulation as specified in Division XV.
 - (2) All sprinkler piping has been pressure tested and the requirements in Division XII have been satisfied.
- b. When the alarm system is energized, the low pressure alarm shall be tested by closing the main supply valve and opening a test drain. The following shall be checked for response to alarm signal:
 - (1) Local panel
 - (2) Alarm gongs
 - (3) Annunciator
 - (4) Ventilation supply fan shutdown
 - (5) 300 Area fire station
- c. Each sprinkler zone flow switch shall be checked by causing water to flow from the zone test valve connection. The following shall be checked for response:

- (1) Alarm gongs
- (2) Annunciator
- (3) Ventilation supply fan shutdown
- (4) 300 Area Fire Station

(Note: For the following tests the circuit to the 300 Area Fire Station may be disconnected and operation of the master box checked by observing the relay in the main panel)

- d. The rate-of-rise detectors shall be checked by applying a heat source such as a heat lamp, to each detector. The following shall be checked for response:

- (1) Master box alarm relay
- (2) Alarm gongs
- (3) Annunciator
- (4) Ventilation supply fan shutdown.

(Note: The alarm gongs may be silenced after the first detector in each zone is tested)

- e. The system "trouble" alarm and transfer to battery power shall be checked by opening the breaker in the normal AC supply circuit. (Breaker handle should be painted red).

- f. The handles of each auxiliary box shall be pulled in turn and the following checked for response:

- (1) Master box alarm relay
- (2) Alarm gongs
- (3) Annunciator
- (4) Ventilation supply fan shutdown

- g. A voltage divider shall be used to simulate low battery voltage to verify that the alarm system will be actuated below 85% of normal voltage.

DIVISION XVII

SPECIAL EQUIPMENT AND FURNISHINGS

GENERAL

1. SCOPE

This division covers laboratory, lunch room, rest and change room furnishings, storage bins, and shelving for the High Temperature Lattice Test Reactor, Building 318.

2. SUBMISSION OF DRAWINGS AND INFORMATION

If the Contractor proposes to supply furnishings other than those specified in this division, he shall submit 5 copies of complete descriptive information and specifications for such items to the Commission for approval prior to purchase. The information submitted shall identify by description and room number, the item for which the alternate is proposed, the manufacturer's name and catalog identification number of the proposed item. Commission approval of alternate items is required prior to purchase.

MATERIALS

3. WORK BENCHES

- a. Work benches shall be steel framed benches with 1-3/4" laminated maple wood tops. Steel cabinets, doors and drawers shall be formed from stretcher-leveled steel furniture stock. All metal surfaces shall be finished in baked-on, light gray enamel. Wood tops shall be filled and sealed in a natural finish to resist grease and oil stains.
- b. Work benches for the Radiation Monitoring Laboratory, Room 102, shall be Lyon Metal Products, Inc., No. 2902; Columbia-Hallowell Division of Standard Pressed Steel Co., Model 640; Equipto 255 Series or approved equal.

4. STORAGE CABINETS AND BINS

- a. Storage cabinets shall be standard steel floor-standing cabinets with four (4) adjustable shelves and double doors with **3-point latch and handle**. Storage cabinets for Room 102 shall be 3'-0" x 7'-0" x 1'-6" deep and shall be Republic Steel Corp. No. 8020, or approved equal.
- b. Storage bins shall be standard steel shelving with 3-1/2" high x 2" deep toe space under the front of the bottom shelf. Shelving shall be bond-erized steel with baked-on light gray enamel finish. Clean clothes issue storage bin units shall be 3'-0" x 7'-0" x 1'-6" deep with wire fronts where shown on drawing H-3-25018. Shelving shall be Lyon closed section shelving units, or approved equal.

5. KITCHEN EQUIPMENT

- a. The kitchen range shall be 27" white porcelain enamel range suitable for "building-in" with metal base cabinets. Range shall have 4 calrod type surface units and 21" oven with front controls. Range shall be 220 volt, General Electric Company No. JM-61-W, or approved equal. Range shall be furnished complete with chrome plated trim moulding.
- b. The range hood-fan unit shall be 30" wide, copper-finished, with aluminum mesh grease filter. Unit shall be Nutone Inc. No. 5013, or approved equal.
- c. The refrigerator shall be an upright, single door model with 11.5 to 12.0 cubic foot capacity and freezer compartment. Refrigerator shall have white baked-on enamel finish and shall be General Electric Company Model TB-313Y; Hotpoint Model SSD.312E; Westinghouse Model RVE21; or approved equal.
- d. The food warmer shall be a built-in type approximately 12" x 15" x 8" to 10" high for operation wet or dry. Warmer shall be capable of heating foods within the range 100F to 250F. Warmer shall be 230 volt, 600 watt, with signal light and front control panel. Food warmer shall be McGraw-Edison Company "Toastmaster" Model 15A4, or approved equal.
- e. The kitchen sink shall be seamless drawn, 18 gage stainless steel with all corners coved. Ledges shall be No. 4 finish. Back rim shall have 2 cutouts, 8" O.C., straddling center line. Sink shall be 24" x 21" x 7" deep with 1-1/2" drain. Sink shall be Lyons-Stainless Products "Lyoncraft", or approved equal.
- f. Base cabinets shall be formed from stretcher-leveled, steel furniture stock and finished in white, baked-on enamel. Cabinets shall be arranged as shown on Drawing H-3-25014 and shall be sized as follows:
 - (1) 18" wide, 25" deep with one drawer over shelved cabinet space with a single swing door and interior catch; Geneva Kitchens Division of Acme Steel Company, No. 18CL or approved equal.
 - (2) 27" wide for range, Geneva No. X-YRP, or approved equal.
 - (3) 30" wide, 25" deep, with drawer space over shelved cabinet space, with double swing door and interior catches. Drawer front panel to be modified to receive food warmer; Geneva No. 30C, or approved equal.
 - (4) 30" wide, 25" deep, with one drawer over shelved cabinet space with double swing door and interior catches; Geneva No. 30C, or approved equal.

- (5) 42" sink front with ventilated panel over double swing door and interior catches; Geneva 42 SF-FF, or approved equal.
 - (6) 5" end filler for base cabinets; Geneva No. 8 SF, or approved equal.
 - g. Wall cabinets shall be arranged as shown on Drawing H-3-25014. Wall cabinets shall be 30" wide, 18" high and 13" deep, wall mounted, white baked-on enamel finish, double swinging doors and interior catches; Geneva No. 3018 W, or approved equal.
6. LUNCH ROOM FURNITURE AND COUNTER TOPS
- a. The lunch room tables, chairs and chalkboard, shown on the drawings, will be furnished and installed by the Commission.
 - b. The lunch room countertop and 6" splashback shall be plywood with melamine plastic surfacing, and shall be 3/4" thick, reinforced to 1-1/2" thick at the edges and self-edged with plastic surfacing material. Melamine plastic shall be a minimum of 1/16" in thickness. Stainless steel edge moulding shall be provided around the splashback with 1/2" stainless steel cove moulding at the joint between counter top and splashback. Plastic surfacing shall be General Electric Company "Textolite", or approved equal, crackle pattern white.
 - c. Can opener for the lunch room shall be white enamel or chrome finished, manually operated, slide-out or swing-out model with magnetic lid holder and bracket for attaching to the underside of metal wall cabinet.

7. CHANGE ROOM FURNISHINGS

- a. Lockers for change room shown on Drawing H-3-25008, shall be 15" x 18" x 72" equipped with hat shelf, 3 coat hooks and padlock hasp but without legs (for curb mounting). Lockers shall have flat tops, louvered doors and shall be finished in light gray, baked-on enamel. Lockers shall be single row, single tier, and shall be Republic Steel Corporation Type SS, No. 50 gray; Lyon Metal Products, Inc. No. 5032; Penco Division Alan Wood Steel Company Series 6100, No. 704 warm gray; or approved equal

- b. Cigarette urn for the change room shall be floor standing, cylindrical, steel sand urn with steel or aluminum tray in the top. Urn shall be 10" diameter by approximately 19" high.

8. TOILET COMPARTMENTS AND BAFFLE SCREENS

- a. Toilet compartments and baffle screens shall be galvanized, bonderized steel with baked enamel finish and chrome plate hardware. Baffle screens shall have full depth flange for mounting on plaster wall. Toilet compartments shall be flush top with floor support pilasters. All panels shall be not less than 1" thick with 1-1/4" thick pilasters and shall be filled with sound deadening core material. Compartments shall have roll paper holder on wall and coat hook on door.
- b. Toilet compartments shall be: Sanymetal Products Co., Inc. "Normandie" Style, No. 25 blue; Robart Partitions Inc. Type A, No. 11564 blue; Milwaukee Stamping Co. "Ferrometal" Type 2, dark blue; or approved equal.
- c. Baffle screens shall be 24" x 42" and shall be: Sanymetal Products Co., Inc. Type A, No. 25 blue; Robart Partitions Inc. Type FS, No. 11564 blue; Milwaukee Stamping Co. "Ferrometal" Type 2, dark blue; or approved equal.

9. TOWEL DISPENSERS

The paper towel dispensers shall be steel cabinet type for folded towels. Dispensers shall be West Disinfecting Co. "Westowel" Cabinets, or approved equal. Color: white.

10. SANITARY NAPKIN DISPENSER

A sanitary napkin dispenser shall be provided in the women's rest room. Dispenser shall be West Disinfecting Co. napkin dispenser, or approved equal. Color: white.

11. MIRRORS

Mirrors shall be the size shown on the drawings and shall be polished plate glass with silver applied to one side. Silver film shall be protected by electrolytically plating copper in a solid film over silver. Copper plating shall be protected with a coat of hard paint. Mirror frames shall be of stainless steel or chrome plated steel with a 5" x 16" stainless steel shelf attached at the bottom. Mirrors shall be Charles Parker Co. No. 53020, or approved equal.

12. WASTE RECEPTACLES

- a. Waste receptacle in the men's room shall have swing top and gray, baked-on enamel finish on the exterior. Inner container shall be galvanized steel

of approximately 27 gallon capacity. Receptacle shall be approximately 16" x 16" x 36" high. Receptacle shall be West Disinfecting Co. No. 130, or approved equal.

- b. A metal wastebasket shall be provided in the women's rest room. Size: approximately 12" x 12" x 15". Color: gray.
- c. Waste receptacle for the lunch room shall be approximately 15" diameter and 36" high. Receptacle shall have white baked-on enamel finish, with chrome plated push-open top and trim. The inner container shall be galvanized steel of approximately 15 gallons capacity. Receptacle shall be West Disinfecting Co. "Round Top Receptacle" Style No. 1536, or approved equal.
- d. One waste receptacle shall be provided in the women's rest room for soiled sanitary napkins. Receptacle shall be approximately 11" high, by 7-5/8" wide, by 3-3/4" deep and shall be U. S. Sanitary Specialties Corp. No. 198 "Useptican", or approved equal.

13. ROOM IDENTIFICATION SIGNS AND NUMBERS

Room identification signs and numbers shall be Spencer Industries, Philadelphia, Pa., Bakelite Signs, or approved equal, black face with white gothic style letters and numerals, minimum size of sign 2" x 6". Lettering and numerals shall be as specified in this division.

WORKMANSHIP

14. INSTALLATION OF CABINETS AND FURNISHINGS

- a. Cabinets, shelving, and storage bins shall be located as shown on the drawings. Items not specifically located on the drawings shall be located as directed by the Commission.
- b. Metal closure strips shall be attached to adjacent cabinets with sheet metal screws and shall be painted to match cabinets.
- c. Metal furnishings shall have burrs, sharp points and rough edges removed.
- d. Lockers and locker bench shall be anchored to the floor with bolt anchors. Chalkboard, mirrors and other wall-mounted furnishings shall be rigidly secured to mounting surfaces with mechanical fasteners.
- e. Can opener shall be mounted on the underside of wall cabinet.
- f. A paper towel dispenser shall be mounted on the wall adjacent to each lavatory (one in women's rest room, two in men's change room) and one on the underside of wall cabinet adjacent to the lunch room sink.

- g. A mirror, as described in Section 11 above, shall be mounted over each of the lavatories.

15. INSTALLATION OF ROOM IDENTIFICATION SIGNS

- a. Room identification and room number signs shall be mounted to the right of the respective doors 5'-6" above the floor. Signs on concrete and concrete block walls shall be attached with flat head screws in plastic screw-anchors set in drilled holes. Signs on plaster walls shall be attached with pan head, self-tapping screws, 1/2" long minimum.
- b. The legends listed below shall be mounted beside the respective doors shown.

<u>LEGEND</u>	<u>DOOR NO.</u>	<u>ROOM NO.</u>
Men's Change Room	106	101
Control Room	110	Corridor No. 1
Heating & Ventilating Room	3	3
Counting Room	5	3
Janitor	207	Corridor No. 2
Women	205	Corridor No. 2
Lunch Room	208	Corridor No. 2

- c. With the exception of exterior doors, doors No. 4 and 104 and doors to rooms listed in paragraph b. above, all doors shall be identified with room number signs.

DIVISION XVIII
OVERHEAD BRIDGE CRANE
GENERAL

1. SCOPE

This division covers the design, fabrication, erection and testing of an electric-motor-driven bridge crane for the High Temperature Lattice Test Reactor Building No. 318.

2. SUBMISSION OF DRAWINGS AND INFORMATION

- a. The Contractor shall submit copies of the following to the Commission for comment and approval prior to fabrication of the crane.
- (1) Dimensioned shop drawings of crane and hoist.
 - (2) Wiring Diagrams including control and safety circuits.
 - (3) Specifications for materials.
 - (4) Exact hoisting and travel speeds
- b. Final copies of the information outlined in paragraph (a) above together with lubrication, maintenance and operating instructions shall be submitted to the Commission in accordance with the requirements stated in the Special Conditions.

3. REFERENCED STANDARDS AND SPECIFICATIONS

The specifications and standards listed below form a part of this specification to the extent indicated by subsequent references.

3.1 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA Z55.1-1950	Gray Finishes for Industrial Apparatus and Equipment
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3.2 FEDERAL STANDARDS

No. 595-1956	Colors
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3.3 ELECTRIC OVERHEAD CRANE INSTITUTE (EOCI)

EOCI No. 61	Electric Overhead Traveling Cranes
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3.4 HOIST MANUFACTURERS ASSOCIATION

Specifications for Electric Wire Rope Hoists

3.5 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70-1962

National Electrical Code (NEC)

3.6 HANFORD STANDARDS

D-20-10, Rev. 0

System and Equipment Grounding - Basic
Requirements and Conductors

4. DESIGN REQUIREMENTS

4.1 GENERAL

- a. The 5-ton electric-motor-driven crane specified herein shall be furnished complete and in place, tested and operable.
- b. The crane rails and limiting dimensions shall be as shown on drawing H-3-25031 and the sketch included in this division of the specifications.
- c. The crane shall be capable of handling a load of 125% of rated capacity. The crane shall conform to EOCI-61, Class B (light service).
- d. Stops, attached to the runway rails, shall be provided at the extremities of bridge travel.
- e. Anti-friction bearings shall be used for all journals. All gear cases shall be enclosed and lubrication shall be oil bath or grease. Cranes shall be constructed so as to prevent the dropping of oil, grease or hydraulic fluid on the crane or below.
- f. The hoist motor shall be dual wound and equipped with a gear reduction unit to provide hoisting speeds in the range 2 to 6 feet per minute for low speed and in the range 8 to 15 fpm at high speed for all loads up to crane capacity.
- g. The bridge and trolley shall have 5 step, variable speed in both forward and reverse. The three lower speeds shall be within the following ranges:

First - 3 to 7 fpm

Second - 7 to 10 fpm

Third - 10 to 15 fpm

The maximum speed shall be 25 fpm. The fourth and fifth steps shall have a standard time delay relay to delay the start of these speeds to guard against accidental contact. The crane shall have full load capacity in all speed ranges.

- h. Hoist drum shall be double-grooved (right and left hand) to permit the load hook to travel vertically. The hoist shall conform to the standard specifications for Electric Wire Rope Hoists published by the Hoist Manufacturers' Association, Inc. except as specified otherwise herein.

4.2 ELECTRICAL

- a. All crane and hoist motors shall be totally enclosed with Class B insulation and rated for service on 480 volt, 3 phase, 60 cycle power supply.
- b. All runway and bridge contact conductors shall be enclosed or insulated except for a slot by means of which the collector contact shoe may engage in sliding contact with the conductor. The collector shall be so insulated that it may be withdrawn from contact with the conductor by hand without danger of accidental contact with electrically energized parts. The collector shall be constructed to allow removal from the conductor at any point in the run. "Insul-8-bar" manufactured by Insul-8-Corporation will meet these specifications. The crane bridge and trolley shall be grounded in accordance with Hanford Standard D-20-10 utilizing a separate crane contact conductor for the equipment ground. The runway contact conductors shall be supported from the building structure adjacent to the side of the runway.
- c. Insulated wire and cable shall be insulated with either chlorosulfonated polyethylene, such as Dupont Company's "Hypalon" 40 or cross-linked polyethylene such as General Electric Company "Vulkene" or Sequoia Wire Company "Hyrad", or approved equal. This type of insulation is needed for the particular environment surrounding a nuclear reactor and shall be used for power and control for the crane.
- d. Limit switches shall be provided to limit the travel of the bridge, trolley and hoist. A load limit switch shall be provided and adjusted to 125% of the rated crane capacity.
- e. All electrical work shall conform to the requirements of the NEC. Boxes and enclosures shall be NEMA Type 12.

4.3 BRAKES

- a. The crane hoist shall be equipped with two independent braking means as follows:
 - (1) A mechanical load brake which will automatically control the load during lowering to prevent undue acceleration. The load brake shall be rated at 125% of the hoist capacity.

- (2) A solenoid operated hoist motor brake interlocked with the motor control to quickly stop the hoist drum when power to the motor is interrupted.

- b. The bridge and trolley drives shall have solenoid brakes rated at not less than 50% of the full load, drive motor torque.

4.4 CONTROLS

- a. Crane controls shall be rated for operation on 120 volt, single phase, 60 cycle power supply.
- b. The crane shall be operated by a pendant pushbutton station suspended from the trolley. The pendant control enclosure shall be grounded through a separate conductor within the suspending cable. Each pushbutton shall have an individual metal nameplate for identification.
- c. The pushbuttons shall be stepped to provide speeds in the ranges specified in Section 4.1 above. The pushbutton station shall be equipped with "Stop" and "Start" buttons and a safety suspension chain.

5. PAINTING

- a. Crane shall have the trolley, lower sheave block and lifting hook finished in "focal orange", color No. 12246 per Federal Standard 595.
- b. The crane bridge, trucks, rails and other parts not mentioned in Section 5a above shall be finished in medium light gray, No. 49 per ASA 255.1.
- c. Sliding or rolling contact surfaces shall not be painted.

6. TESTING

The crane shall be tested after complete installation to demonstrate conformance to the following requirements:

- a. The crane shall be loaded with a 10,000 pound load and operated through the full range of hoisting speeds and bridge and trolley travel speeds in both forward and reverse.
- b. The crane shall lift, without damage to the crane or rails, a load equal to 125 percent of rated capacity when such load is placed at midspan of the bridge.
- c. The load limit switch shall be adjusted to prevent hoisting of load in excess of 125 percent rated capacity and a slight overload

added to test the operation of the switch.

- d. The hook-to-wall minimum distances, maximum hook height, and clearances shall be verified as complying with the specifications.

Length of Runway = 54'-0"

Vendor to Verify Dimensions Marked *.

Pendant Attached to Trolley (Wound on Reel)
With 10'-0" Extra Reach

DIVISION XIX

PREFABRICATED STEEL BUILDING

GENERAL

1. SCOPE

This division of the specification covers furnishing and erecting a prefabricated steel building of the type shown on drawing H-3-23017, for the Detector Building 318 A.

2. SHOP DRAWINGS

The contractor shall submit shop working drawings, erection drawings and bills of material for the prefabricated steel building to the Commission for approval, prior to shipment to the jobsite. Drawings shall show the location, and size of anchor bolts required for the building foundation. Drawings and bills of material shall be submitted in the form and number of copies as stated in the Special Conditions.

3. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

3.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A307 - 61T	Low Carbon Steel, Externally and Internally Threaded Standard Fasteners
ASTM A374 - 58T	High Strength Low Alloy Cold-Rolled Steel Sheets and Strips

3.2 FEDERAL SPECIFICATIONS

FF-H-106a (1)	Hardware, Builders, Locks and Door Trim
FF-H-00111b	Hardware, Builders, Shelf and Miscellaneous
FF-H-116c (4)	Hinges, Hardware, Builders
FF-H-121c	Hardware, Builders, Door Closing Devices
HH-I-521c	Insulation, Mineral Wool, Batts, Loose Fill and Granular Fill

MATERIALS

4. PREFABRICATED STEEL BUILDINGS

- a. The prefabricated steel building shall be Armco Drainage and Metal Products Company "Steelox" building, type S-2 conforming to the requirements shown on drawing H-3-25017 and as specified below, or an approved equal.
- b. Building shall be a gable roof type to give wall-to-wall space unobstructed by columns. Roof slope shall be approximately 2 on 12.
- c. The design loads for the buildings shall be as follows:
 - (1) Wind design load, for vertical projection of buildings, of not less than 15 pounds per square foot.
 - (2) Roof design live load, for horizontal projection of buildings, of not less than 20 pounds per square foot.
- d. Building shall be designed to be installed on concrete floor slab. Door headers and frames shall be designed accordingly.
- e. Side wall, end wall and roof panels shall consist of interlocking panels formed from galvanized, steel, sheet-metal panels. Roof and wall panels shall be of gage necessary to satisfy the structural requirements outlined herein. Insulation requirements are shown on the plans.
- f. Side wall and end wall panels shall be supplied in full side wall heights with no horizontal joints except over door openings and at gables. Roof panels shall be supplied in one length from eave to ridge without joints or splices. All major fastenings of panels shall be made with galvanized or cadmium plated bolts.
- g. Prefabricated galvanized steel panels for roof and siding shall be made of cold-rolled steel sheets conforming to ASTM A374.
- h. Attachment bolts, sheet metal screws and panel connector parts shall be galvanized or cadmium plated.
- i. Anchor bolts shall conform to manufacturer's recommendations for size and spacing and shall be of ASTM A307 steel.

5. SWINGING DOORS

- a. Swinging doors shall be exterior flush, hollow metal doors, with all necessary jambs, lintels, threshold and sill weatherstripped (see drawing H-3-25013 for door style and glazing).
- b. Hardware for swinging doors shall have US-10 finish and shall be as follows, or approved equal

Door butts (U.S. 10 finish) 1-1/2 pairs per door,
Federal Specification FF-H-116c, Type
T2105 - 4-1/2" x 4-1/2".

Lock Set: Active door, Federal Specification
FF-H-106a Series 86 D-2 (see Division
X for keying) with Type 201G knobs.

Cremone bolt: Federal specification FF-H-00111b, Type
1028A for inactive leaf.

Closer: Federal specification FF-H-121c, Style
3004PH - size IV for each leaf.

- c. Doors shall be shop coated with manufacturer's standard baked-on rust inhibitive primer.

6. INSULATION

- a. Mineral wool insulation batts conforming to Federal Specification HH-I-521c shall be used in ceiling construction.
- b. Insulation for wall panels shall have a "k" factor not greater than 0.20 and shall be a foamed type adhered to the steel liner panels or other rigid type in sheets the full height of the wall.

WORKMANSHIP

7. BUILDING ERECTION

- a. The buildings shall be erected in accordance with the approved erection drawings and the manufacturer's erection instructions.

- b. All joints and connections shall be properly fitted, flashed and caulked where necessary to provide weather-proof construction. Insulation shall be placed in accordance with the manufacturer's instructions.
- c. Doors shall be hung plumb and true with proper clearances, and shall operate smoothly and easily without binding.
- d. Door hardware shall be installed with flat head screws finished to match hardware and working parts shall be graphite lubricated.
- e. Flight tube openings shall conform to details shown on the drawings.

DIVISION XX

PAVED DRIVE

GENERAL

1. SCOPE

This division covers the grading and surfacing of vehicle driveway for the High Temperature Lattice Test Reactor, Building 318.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 HANFORD STANDARD SPECIFICATIONS

HWS 6131-S, Rev. 1
HWS 6134-S, Rev. 0
AC-6-2, Rev. 1

Hot Laid Asphaltic Concrete Pavement
Grading and Drainage for Roads
Intra-Area Roadway Cross-Sections

MATERIALS

3. ASPHALTIC CONCRETE PAVEMENT

Materials for base course, leveling course and asphaltic concrete for roadway shall conform to the requirements specified in Hanford Standard Specification HWS-6131-S. Prime coat of "cutback" asphalt will not be required for the work covered by this division.

WORKMANSHIP

4. GRADING

Earth grading for roadway shall be done in accordance with the requirements as stated in Hanford Standard Specification HWS-6134-S.

5. ASPHALTIC CONCRETE PAVING

- a. The base course and leveling course shall be constructed on the earth subgrade prepared as specified in Section 4 above.
- b. The roadway cross-section shall conform to Hanford Standard Specification AC-6-2, Type A, except that the paved surface shall be 12' wide.
- c. The asphaltic concrete shall be constructed as specified in Hanford Standard Specification HWS-6131-S. Prime coat under asphaltic concrete will not be required.

DIVISION XXI

LANDSCAPING AND IRRIGATION SPRINKLERS

GENERAL

1. SCOPE

This division covers landscaping with ground cover and installing irrigation sprinklers in a portion of the site around the High Temperature Lattice Test Reactor, Building No. 318.

2. REFERENCED STANDARDS AND SPECIFICATIONS

The standards and specifications listed below form a part of this specification to the extent indicated by subsequent references.

2.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A53-61T Specifications for Welded and Seamless Steel Pipe

ASTM A120-61T Specifications for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses

2.2 U. S. DEPARTMENT OF COMMERCE - COMMERCIAL STANDARDS (CS)

CS-197-60 Flexible Polyethylene Plastic Pipe

2.3 AMERICAN STANDARDS ASSOCIATION (ASA)

ASA B16.3-1951 Malleable-Iron Screwed Fittings, 150 Pounds

2.4 ASSOCIATION OF AMERICAN RAILROADS (AAR)

AAR M 404 Malleable-Iron Unions, Screwed, 300 Pounds

MATERIALS

3. PLANTS - "VINCA MINOR"

The ground cover to be planted is "Vinca Minor" or common periwinkle. This vine type plant shall be two years of age and of a Grade 2 quality or better. Plants shall be delivered to the job site in 3-inch pot containers. The individual plants shall each have a minimum of 8 to 12 runners which shall be 4 to 6 inches in length. The quality of the plants shall be as described above, or approved equal.

4. PIPE AND FITTINGS

- a. Pipe, valves, fittings and accessories for the irrigation sprinkling system, from the supply main to and including the sectionalizing valves shall conform to the requirements of Piping System Sheet UGS-1, included in this division of the specifications.
- b. Water distribution piping for the irrigation sprinkler system shall conform to the requirements shown on Piping System Sheet UGS-2. Pipe shall be flexible, black polyethylene conforming to CS197, Type II, Series 2. Polyethylene pipe shall be National Tube, Division of U. S. Steel Company, "National", 75 pound pressure rated Polyethylene Pipe, NSF Grade; Washington Turf and Irrigation Company, "Turfco Ful-Flo 75"; Western Plastics Corporation "Panther" No. 325 Duraflex; or approved equal.
- c. Pipe fittings, such as tees, elbows, nipples, plugs, etc. for use with plastic irrigation pipe shall be 150 pound galvanized, screwed fittings in accordance with ASA B16.3.
- e. Adaptors for connecting threaded fittings to flexible plastic pipe shall be threaded brass male insert fittings to be used with stainless steel, band type clamps with screw take-up. Adaptors shall be Western Plastic Corporation "Panther" Adaptors, or approved equal.

5. REMOTE CONTROL VALVE

- a. The remote control valve shall be a 3", globe pattern, screw end, solenoid-operated, diaphragm valve, spring loaded, normally closed. Valve shall be designed for manual operation in case of power failure.
- b. Solenoid shall be rated for operation on 120 volt, single phase, 60 cycle, power supply.
- c. Remote control valve shall be Turfco Class 150, Model 457, Electric Automatic Diaphragm Valve, or approved equal.

6. AUTOMATIC CONTROL UNIT

- a. The automatic control unit shall be a single unit capable of operating a minimum of three remote control valves independently or in selected combinations, both manually and automatically. Controller shall have a weather-proof enclosure with front access door and flat key lock.

6. AUTOMATIC CONTROL UNIT (Continued)

- b. The controller shall be designed for operation on 110-120 volt, single phase, 60 cycle, power supply. The timing unit shall be sealed in a moisture-proof housing, from which it can be removed for maintenance. With the timer removed, the controller shall be capable of manual operation.
- c. The controller shall be so designed that the operating times of the control valves may be set from a minimum of 5 minutes to a maximum of one hour.
- d. The control unit shall be designed for exterior wall mounting and shall be Turfco No. C6-WO, or approved equal.

7. SPRINKLER HEADS

- a. Sprinkler heads shall be adjustable for part circle or full circle coverage. Heads shall be brass with 1/2" male connection. Sprinklers shall have a 40' radius coverage with supply water at 45 psig and shall discharge approximately 4.5 gpm.
- b. Sprinkler heads shall be Rainbird No. 25 with 5/32" nozzle, or approved equal.

8. FERTILIZER AND HUMUS

- a. Fertilizer shall be a commercial mix of 7% available nitrogen (maximum), 10% phosphate and 10% potash, by volume.
- b. Humus shall be bulk peat moss, commercial grade, with not less than 80% organic content.

WORKMANSHIP

9. UNDERGROUND PIPING

- a. Plastic irrigation piping shall be laid in trenches at the locations shown on Drawing H-3-25003.
- b. Piping shall be laid to drain at the points shown on the drawing. Slope of irrigation piping shall be 1/16" per foot.
- c. Piping shall be installed with the fittings described in Section 4 of this division.
- d. Plastic irrigation piping shall be given a hydrostatic test at 75 psig, with all joints uncovered. Test shall be made when the ambient temperature is not higher than 70 F. Test pressure shall be maintained for a period of 30 minutes without visible leaks.
- e. Sprinkler heads shall not be installed until all grading operations are completed in the area to be planted.

10. SITE GRADING AND SOIL PREPARATION

- a. The area to be planted in ground cover shall be leveled approximately 10 inches below the finish grades shown on Drawing H-3-25006. The finish grade shall be established with soil brought from southeast of Building 318.
- b. The top 10 inches of soil in the area to be planted shall not contain rocks larger than 2 inches in greatest dimension.
- c. Any grading done with heavy earthmoving equipment shall be accomplished before piping is laid. Equipment heavier than a pneumatic-tired farm tractor shall not pass over buried plastic piping.
- d. The finish grade shall be left approximately one inch above the contour grades shown on the drawings. Peat humus shall be spread over the area to be planted to a depth of 2 inches. Fertilizer shall be distributed at the rate of 10 pounds per 1000 square feet. The entire area shall then be tilled with a rototiller or dull farm disk to work the mixture into the top 10 inches of soil. The area shall then be kept saturated with water for 24 hours before planting is started.

11. INSTALLATION OF SPRINKLERS

- a. Sprinkler heads of the size and type specified herein shall be installed at the locations shown on Drawing H-3-25003. Part-circle sprinklers shall have the arc of coverage adjusted for the area in which installed. Nozzle broaching screw shall be adjusted and tightened in place to give a uniform curtain of water when the sprinkler is in operation.
- b. Riser length shall be such that when the sprinkler head is installed, the tip of the nozzle is 9" to 10" above the finished grade.

12. PLANTING

- a. Planting holes for the Vinca Minor plants shall be dug on 12" centers in both directions. All rocks and trash excavated during preparation of the planting holes shall be collected and disposed of. Excavation of planting holes shall be done while the soil below grade is damp.
- b. Planting holes shall be of such a depth that when the plant is placed in the hole with roots spread in a natural position, the bole of the plant from which the runners emanate will be 3 inches below the finished grade.

- c. A cone of earth shall be formed in the bottom of the planting hole. The plants shall be tapped from the nursery pots and the plant roots spread to a natural position over the earth cone. Soil from the planting hole shall then be compacted by hand around the plant roots. Since the plants are to be placed below finished grade, a bowl-shaped hole shall then be formed around each plant.
- d. Water shall be placed in the planting hold as soon as the plant is set. Soil around the roots of plants shall be kept wet until all planting is completed and regular irrigation can be started.

13. MAINTENANCE OF PLANTINGS

- a. Plants shall be established in growing conditions and maintained until the contract is completed. Maintenance shall include watering, cultivation and weeding necessary to establish all plants in a healthy and growing condition.
- b. Plants which are damaged from any cause or are obviously dying during the maintenance period, or at any time prior to acceptance of the work by the Commission shall be replaced and established in growing condition.

14. INSTALLATION OF THE IRRIGATION CONTROLLER

- a. The automatic irrigation controller shall be installed on the inside of the windbreak panel at the building front entry.
- b. Electrical work for controller installation and connection to the remote control valve shall conform to the requirements stated in Division XV and Drawing H-3-25096.

PIPING SYSTEM SHEET UGS-1

<u>Service</u>	<u>Maximum Operation Pressure</u>	<u>Maximum Temperature</u>
Irrigation Water	115 psig	100 F.
Sizes	3" and smaller	
Pipe	Schedule 40 galvanized steel ASTM A120 or any ASTM A53 (except Type F).	
Fittings	150 pound galvanized malleable-iron screwed, ASA B16.3.	
Unions	300 pound galvanized malleable-iron screwed, brass-to-iron seat, AAR M-404	
Valves:		
Shutoff and Sectionalizing Valves	150 pound bronze gate with rising stem, solid wedge and screw ends, Crane Company No. 431; Walworth No. 11; Jenkins Brothers, Figure 49-U, or approved equal.	
Pressure Regulating	3", screwed ends, with spring chamber not exposed to water, for water service at 75 to 100 psig. Reduced pressure range 20 to 60 psig. Charles M. Bailey No. 30; Fisher Governor Type 75; or approved equal.	
Cleaning	Flush with water	
Testing	Hydrostatic test at 125 psig

PIPING SYSTEM SHEET UGS-2

<u>Service</u>	<u>Operating Pressure</u>	<u>Operating Temperature</u>
Underground Sprinkler System	60 psi	70 F.

Pipe Size	All Sizes
Pipe	Black, flexible polyethylene, per CS197-60, Type II, Series 2.
Fittings	Galvanized, malleable iron, 150 pound per ASA B16.3 with brass or galvanized threaded insert adaptors and stainless steel clamps for attaching flexible plastic pipe.
Unions	None
Valves	Drain cock. 125 pound bronze cock with screw ends, square head, Crane Company No. 250; Walworth No. 554; William Powell Figure 948; or approved equal.
Cleaning	The entire pipe system must be thoroughly flushed, one outlet at a time, before installing screens and sprinklers on risers.
Testing	Hydrostatic test at 75 psig

SPECIFICATIONS FOR
HIGH TEMPERATURE LATTICE TEST REACTOR
BUILDING 318

Prepared By:

VITRO ENGINEERING COMPANY

Specifications Section

7-29-64

Date

Project Coordinator

7-29-64

Date

Supplement No. 1

HWS-7262

SPECIFICATIONS FOR
HIGH TEMPERATURE LATTICE TEST REACTOR
BUILDING 318
PROJECT CAH-100

Prepared By:

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2/23/66

Date

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Date

Approved for Public Release;

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J. D. Aardal 12/09/2010

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HWS-7262

SPECIFICATIONS FOR
HIGH TEMPERATURE LATTICE TEST REACTOR

BUILDING 318

PROJECT CAH-100

LIST OF DATA SHEET FORMS

<u>Title</u>	<u>Form No.</u>
System-Static Pressure.	1
Equipment - Butterfly Valves.	2
Equipment - Heating Coils	3
Equipment - Cooling Coils	4
Equipment - Humidifiers	5
Equipment - Condensate Return Unit.	6
Air Distribution Test Data - Supply Registers	7
Air Distribution Test Data - Jet Diffusers.	8
Air Distribution Test Data - Circular Diffusers	9
Air Distribution Test Data - Exhaust Registers.	10
Equipment - Unit Heater	11
Equipment - Evaporative Cooler.	12
Equipment - Refrigeration Unit.	13
Equipment - Cooling Tower	14
Equipment - Fans	15
Equipment - Air Filters	16
Equipment - Automatic Air Filters	17

HEATING, VENTILATING AND AIR CONDITIONING

TEST DATA

BUILDING 318

1.0 PURPOSE

This supplement has been prepared to provide for recording of data accumulated in testing and balancing the heating, ventilating and air conditioning system.

2.0 TESTING AND BALANCING

Refer to Division XIII, Section 23, Page 152, of HWS-7262 for instructions. Test data shall be recorded on field copies and transcribed to the masters of the Data Sheets for final reproduction. Prior to the start of testing on any system or component, the HVAC contractor shall submit to the Commission a test schedule listing all items of equipment to be tested. To ensure proper coordination, such schedule shall be approved by the Commission before testing is started.

3.0 SYSTEMS DEFINITIONS

- a. In order to clarify the overall systems to be checked, the following design drawings are referenced:

H-3-25281, Air Flow and Control Diagram, Sheet 1, System K-1.

H-3-25282, Air Flow and Control Diagram, Sheet 2, System K-2.

H-3-25283, Air Flow and Control Diagram, Sheet 3, System K-3.

H-3-25284, Detector Building.

H-3-25285, Refrigeration and Heating Flow and Control Diagram, Systems K-5 and K-6.

- b. Note that details of instrumentation are the responsibility of the HVAC Contractor, but that the "Sequence of Operations" given on the design drawings is the basis for approving the control systems.
- c. The flow sheet required by Division XIII of HWS-7262 for each portion of the system being tested shall be sketched on a copy of Form 1 of this Supplement (System-Static Pressure) so that a description of the extent of each test is recorded. This will provide a cover sheet for each set of back-up data sheets (Forms 2 through 17) selected to record the applicable test data and list all equipment tested in accordance with the requirements of Division XIII of HWS-7262.

4.0 POWER FAILURE TESTING

System K-3 feeding the Reactor Room and Reactor Basement shall be checked for operation under power failure conditions.

4.1 PROCEDURE

- a. At Motor Control Center #2, shut off power to the following equipment:
- (1) Supply Fan Reactor Room 5 Mot 89,
 - (2) Exhaust Fan Reactor Room and Basement 6 Mot 89,
 - (3) Humidifier Reactor Room 4 Mot 89.
- b. Check that following operations occur:
- (1) Emergency Damper FDR 3-4 opens _____
 - (2) Exhaust System Valve FVK 3-2 opens _____
- c. Start emergency engine and check that exhaust fan operates _____
- d. Turn on power at Motor Control Center #2, shut off emergency engine and restart ventilation system according to the normal procedure.

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Initiating Engineer

2/23/66

Date

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Specifications Coordinator

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Date

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