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RECIP.NAME RECIPIENT AFFILIATION
VARGA,S.A. Operating Reactors Branch 1

SUBJECT: Responds to NRC 801031 request for info re containment sumps & insulation. Applicable portions of design drawings G-190267 & 190371 detailing RHR recirculation sump arrangement & associated piping encl.

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Carolina Power & Light Company

February 24, 1981

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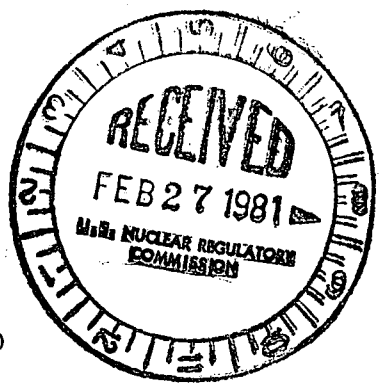

Office of Nuclear Reactor Regulation
ATTENTION: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
United States Nuclear Regulatory Commission
Washington, D. C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
REQUEST FOR INFORMATION - CONTAINMENT SUMPS AND INSULATION FOR OPERATING REACTORS, TAP-43

Dear Mr. Varga:

This letter is in response to your request for information concerning containment sumps and insulation for operating reactors dated October 31, 1980. The reasons for our delayed schedule in submitting this information were discussed with your staff on February 6, 1981.

Enclosed for your use are the applicable portions of design drawing Nos. G-190267 and G-190371 detailing the residual heat removal (RHR) recirculation sump arrangement and associated piping. The basic insulation material used in containment during the construction phase was Unibestos block and pipe covering, manufactured by Pittsburgh Corning Corporation at the Port Alleghaney, Pennsylvania plant. The density range of this material is 15-18 pounds per cubic foot. You will also find enclosed for your use the construction specification governing insulation material and its installation. A review of the piping and insulation list for parts of systems inside containment has determined Unibestos insulation was installed on piping in the following systems:

Chemical and Volume Control
Reactor Coolant
Safety Injection
Component Cooling Water
Service Water
Feedwater
Steam Generator Blowdown
Main Steam
Residual Heat Removal
Sampling System

P

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Unibestos insulated major components inside containment are as follows:

Steam Generators (3)
Pressurizer
Regenerative Heat Exchanger
Reactor Coolant Pumps (3)
Excess Letdown Heat Exchanger

CP&L has estimated that approximately 6400 cubic feet of Unibestos was used in the initial insulation of piping and components within containment. Approximately 75 percent is in the area within the missile barrier in the reactor coolant pump bays. These are gross estimates due to the fact that detailed construction records concerning the installation of insulation are not available. The present standard for new and replacement insulation for Q-List piping/components is Thermon-12 as manufactured by Johns-Manville Company or equivalent, having a density of 13 pounds per cubic foot. Approximately 15 percent of the originally installed insulation has been replaced with Thermon-12.

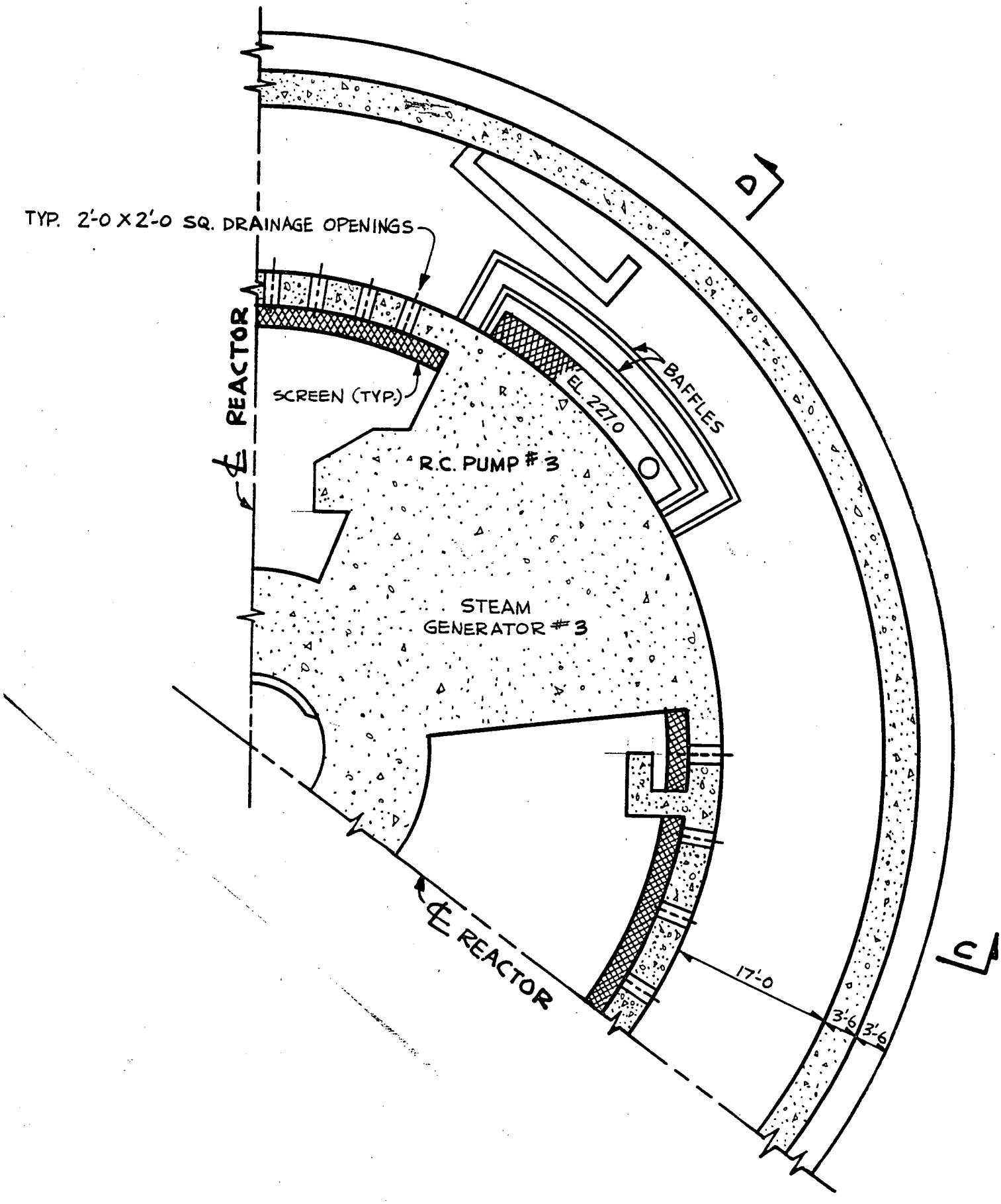
If you require additional information, please contact my staff.

Yours very truly,

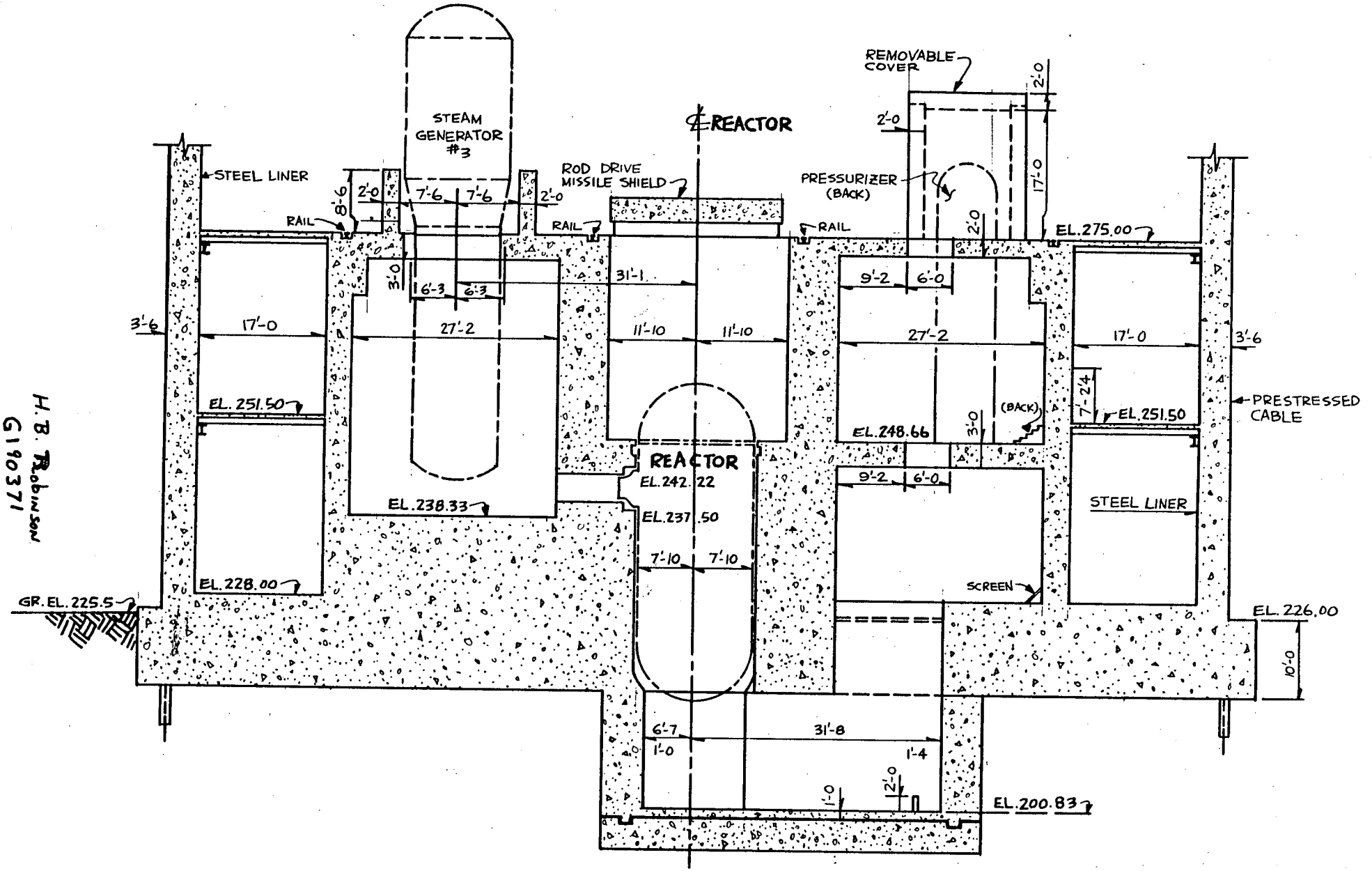
E. E. Utley
Executive Vice President
Power Supply and
Engineering & Construction

SWF/CSB/jc (2792)
Enclosures

cc: Mr. J. D. Neighbors



H. B. Robinson
G190371



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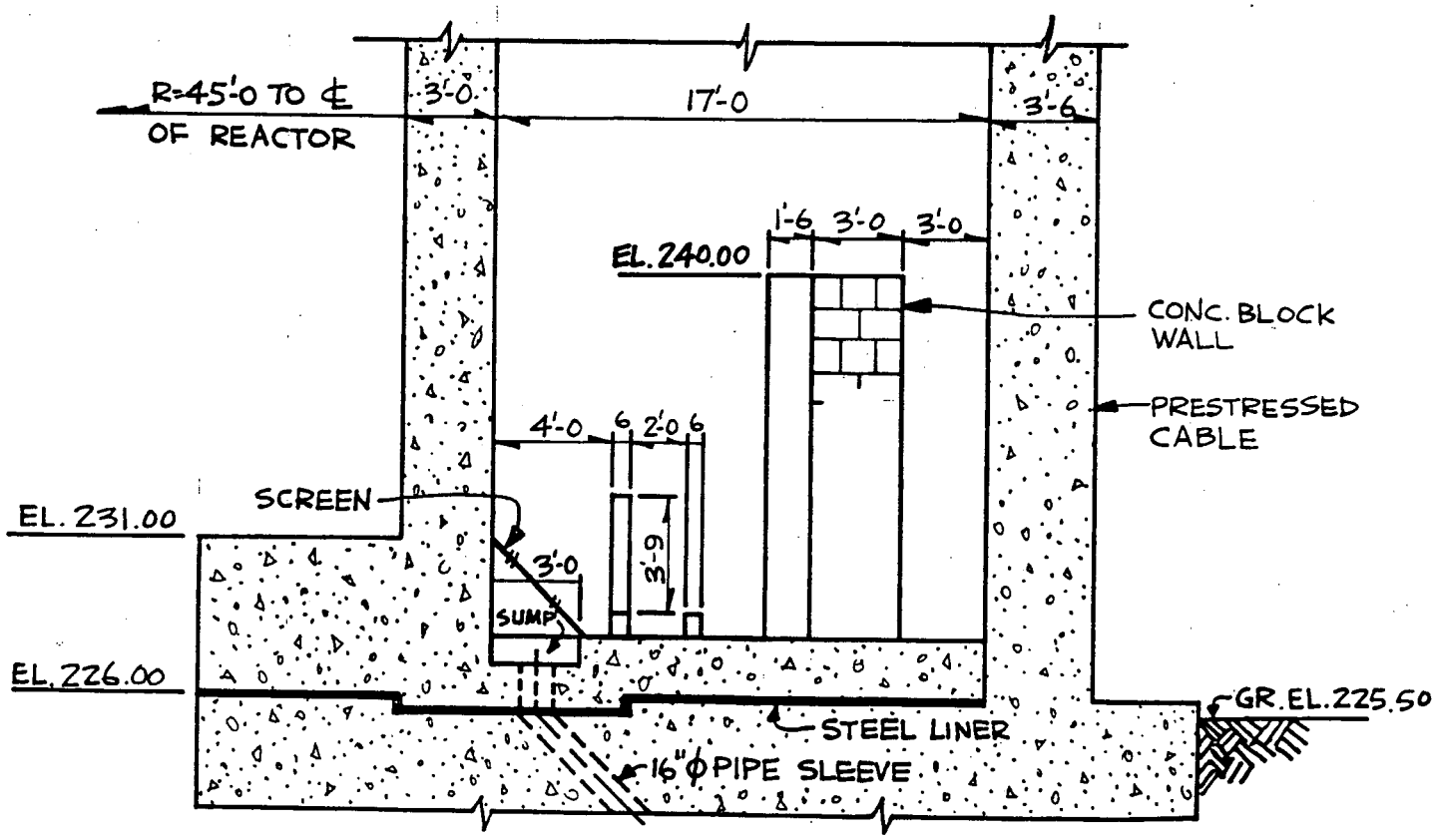
H. B. Robinson
G190371



SECTION D-D

H. B. Robinson
G 190371

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PART I - HEAT INSULATION

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PART II - FREEZE PROTECTION

1. Purchaser - Ebasco Services Incorporated

Station - H B Robinson Plant - Unit No. 2

Location - Hartsville, South Carolina

Elevation - 225 feet above sea level

2. The purpose of this specification is to designate the service requirements and essential particulars of all station heat insulation, non-sweat and freeze protection with the exception of the turbine generator and those items specifically excluded. GENERAL

3. All heat insulation material shall comply with applicable codes (latest revision) of American Standards Association, American Society for Testing Materials and American Society of Mechanical Engineers. Also, construction shall comply with the state laws of South Carolina and with local ordinance. STANDARDS

4. Seller shall furnish, deliver and apply in first class condition throughout, all heat insulating material, non-sweat pipe insulation, anti-freeze pipe insulation and its protective covering for power plant piping nuclear steam supply system and equipment, including all valves and fittings as shown on Ebasco and/or Manufacturer's equipment drawings listed in Paragraphs 4.5 and 8 and as outlined in the following parts of this specification. EXTENT OF WORK

.1 Seller shall furnish all labor, transportation, apparatus and tools required for the proper execution of the work described in this specification.

.2 Seller shall unload and truck to job site and place all materials in storage and shall assume full responsibility for damage due to improper handling and by the weather elements.

Storage facilities adequately weatherproofed shall be provided by the seller.

4.3 Metal rods, clips or insulation supports attached to the surfaces to be insulated where required shall be furnished and installed by Purchaser. EXTENT OF WORK (Cont'd)

.4 In general, all piping and equipment operating at temperatures above 120° F shall be completely insulated and weather-protected except where the Purchaser specifically indicates that insulation shall be omitted or is to be furnished by others.

.5 The following drawings marked up by the Seller indicate the extent of heat insulation, non-sweat and freeze protection and shall form a part of the order.

EBASCO DRAWINGS

Drawing Number	Rev No.	Title
B-190174		Piping and Insulation Standard
B-190175		Valve and Specialty List
G-190181		Gen Arrangement - Turbine Bldg Ground Floor Plan
G-190182		Gen Arrangement - Turbine Bldg Mezzanine - Floor Plan
G-190183		Gen Arrangement - Turbine Bldg Operating Floor Plan
G-190184		Gen Arrangement - Turbine Bldg - Sections AA & BB
G-190186		Gen Arrangement - Reactor Bldg Plans - Sh 1
G-190187		Gen Arrangement - Reactor Bldg Plans - Sh 2
G-190188		Gen Arrangement - Reactor Bldg Sections
G-190190		Gen Arrangement - Reactor Aux Bldg Plans
G-190191		Gen Arrangement - Reactor Aux Bldg Sections
G-190192		Gen Arrangement - Fuel Handling Bldg & Machine Shop - Plans
G-190193		Gen Arrangement - Fuel Handling Bldg & Machine Shop - Sections
G-190196		Flow Diagram - Main, Extraction and Aux Steam Systems
G-190197		Flow Diagram - Feedwater Condensate & Air Evacuation Systems
G-190198		Flow Diagram - Heater Drain & Vent Systems
G-190199		Flow Diagram - Service & Cooling Water Systems
G-190200		Flow Diagram - Plant & Instr Air Systems
G-190202		Flow Diagram Fire & Make-up Water Systems
G-190203		Flow Diagram Miscellaneous Systems - Sh 1
G-190204		Flow Diagram Miscellaneous Systems - Sh 2

4.5 Ebasco Drawings (Cont'd)

EXTENT OF WORK (Cont'd)

Drawing Number	Rev No.	Title
G-190206		Main Steam & Feedwater Piping Plan - Sheet 1
G-190207		Main Steam & Feedwater Piping Plan - Sheet 2
G-190208		Main Steam & Feedwater Piping - Sections
G-190210		Turbine and Extraction Steam Piping Plan
G-190211		Turbine and Extraction Steam Piping Plan - Sections
G-190213		Condensate Piping Plan
G-190214		Condensate Piping Sections
G-190217		Heating Steam & Condensate Return Piping
G-190220		Heater Drain and Vent Piping Plan
G-190221		Heater Drain and Vent Piping Sections
G-190223		Air Evacuation Piping
G-190225		Reactor & Reactor Aux Bldgs Service & Cooling Water Piping - Plan
G-190226		Reactor & Reactor Aux Bldgs Service & Cooling Water Piping Sections
G-190227		Turbine Bldg - Service & Cooling Water Piping - Plan
G-190228		Turbine Bldg - Service & Cooling Water Piping - Sections
G-190229		Fire Water Piping
G-190233		Service & Instrument Air Piping - Plans
G-190236		Fuel Oil & Diesel Oil Piping Plans & Sections
G-190237		Lube Oil, Vapor Extractor & Misc Piping
G-190238		Fuel Handling Bldg - Floor & Equip Drainage and Embedded Piping
G-190232		Service & Instrument Air Piping
684-J-721-	G-190244	Flow Diagram Waste Disposal System
684-J-917-	G-190245	Flow Diagram Waste Disposal System
541-F-056-	G-190247	Flow Diagram Sampling System
685-J-433	-G-190248	Flow Diagram Reactor Coolant System (Primary)
541-F-058	-G-190246	Flow Diagram Reactor Aux Coolant Sys - Resid. Heat Removal
684-J-731	-G-190249	Flow Diagram Reactor Aux Coolant System -Component Cool.
541-F-059	-G-190250	Flow Diagram Reactor Aux Coolant System - Spent Fuel Pit Cool
684-J-753	-G-190251	Flow Diagram Chemical & Vol Cont Sys Sh 1
684-J-925	-G-190252	Flow Diagram Chemical & Vol Cont Sys Sh 2
541-F-55	-G-190253	Flow Diagram Chemical & Vol Cont Sys Sh 3
684-J-878	-G-190254	Flow Diagram - Safety Injection System
G-190255		Waste Disposal Piping - Sh 1
G-190256		Waste Disposal Piping - Sh 2
G-190257		Waste Disposal Piping - Sh 3
G-190258		Waste Disposal Piping - Sh 4

4.5 Ebasco Drawings (Cont'd)

EXTENT OF WORK (Cont'd)

Drawing Number	Rev No.	Title
G-190260		Primary & Demineralizer Water Piping
G-190261		Penetration Pressurization System Piping
G-190262		Isolation Valve Seal Water System Piping
G-190264		Nuclear Sampling System Piping
G-190267		Residual Heat Removal System Piping
G-190269		Primary Coolant Loop System Piping
G-190270		Reactor Coolant System Piping
G-190271		Reactor Component Coolant Sys Piping
G-190272		Reactor Component Coolant Sys Piping - Plan
G-190273		Reactor Component Coolant Sys Piping - Sections
G-190274		Spent Fuel Pit Coolant System Piping
G-190276		Chemical & Volume Control Sys Piping - Plan - Sheet 1
G-190277		Chemical & Volume Control Sys Piping - Plan - Sheet 2
G-190278		Chemical & Volume Control Sys Piping - Sections
G-190279		Demineralizer Piping - Plan
G-190280		Demineralizer Piping - Sections
G-190281		Safety Injection System - Plan - Sh 1
G-190282		Safety Injection System - Plan - Sh 2
G-190283		Safety Injection System - Sections

5. Insulation class and thickness shall be as specified in Ebasco Piping and Insulation Standard, Drawing No. B-190174 - R3 dated October 1, 1968. MATERIAL

All piping and equipment shall be insulated with a layer of Unibestos, or equal.

The stainless steel piping and equipment insulation shall meet the following requirements:

5.01 Only low leachable chloride insulation, silicate inhibited against chloride stress corrosion of austenitic stainless steel shall be used.

5.02 Seller shall submit for Ebasco approval the type of insulation material and shall include the following:

a - Trade name of product

b - Name of Supplier

5.02 (Cont'd)

MATERIAL (Cont'd)

c - The form of the insulating material - pipe, block, board, blanket, cloth, felt, tape, adhesive or cement.

d - Applicable specifications to which materials conform.

e - Corrosion test data which confirms that the insulation product will not cause stress corrosion cracking when wetted.

5.03 All insulation materials shall meet the requirements of the following stress corrosion test:

Knolls Atomic Power Test (H F Karnes, "The Corrosive Potential of Wetted Thermal Insulation" presented at the AICHE 57th National Meeting, September 25-29, 1965; Conf 650905-2; NSA 19:49949)

5.04 A Manufacturer's test report certifying that each lot or batch of insulating materials will meet the stress corrosion test requirements in Paragraph 3, shall be submitted to Ebasco prior to installation of material.

Piping and equipment shall also be weatherproofed with a corrugated aluminum jacket of minimum thickness 0.016 in. with an integral moisture barrier, except in reactor containment building where white duck shall be used. VIMASCO WC-1 Mastic can be used on irregular surfaces where aluminum jacketing is not practical.

.1 The insulating material and its protective covering supplied and installed under this specification shall be of high quality and shall conform to the following:

a - Insulation Blocks

Unibestos insulation blocks of same material as piping insulation as manufactured by Pittsburgh Corning Corporation.

5.1 MATERIAL (Cont'd)

b - Insulating Cement

Insulating cement shall have the same material composition as that of the insulating block to which it is applied. It shall also be capable of withstanding the same temperature.

c - Rosin Sized Paper

Material shall weigh 40 lb minimum per standard roll of 500 sq ft.

d - Asbestos Paper

Material shall be of good commercial grade weighing approximately 12 lb per 100 sq ft.

e - Finishing Cement

Finishing cement shall be made of asbestos fibers and binding materials for use with temperatures up to 100 F. It shall set to a hard finish.

f - Weatherproof Materials

A corrugated aluminum jacket minimum 0.016" thick with Integral Vapor Barrier shall be fastened with aluminum bands.

g - Wire Bands

Wire bands for securing block and sectional or segmental pipe insulation shall be No. 16 gage annealed iron wire using not less than 3 loops of wire per section.

h - Canvas

Material shall be best quality white duck weighing 8 oz per sq yd.

6. TYPE AND THICKNESSES

Minimum thicknesses of insulation and conditions of temperature are shown on Purchaser's Piping and Insulation Standard Drawing B-190174 for power plant piping systems involved. In all cases, the insulation thicknesses given do not include finishing and/or weatherproofing coats. The insulation thickness specified indicate the minimum value acceptable for covering the pipe, valves, fittings and equipment to meet the service requirements. The Seller shall supply materials of regular commercial dimensions having thicknesses

6. (Cont'd) TYPE AND THICKNESSES (Cont'd)

in closest accord; but not less than the specified minimum. The Seller shall provide sufficient total thickness of heat insulation so that the paper, canvas, or other surfacing or finishing material employed will not be subjected to temperatures high enough to cause injury to these materials or to discolor the lead and oil paint which may be used thereon.

7. The power plant piping systems which include a complete outdoor installation subject to inclement weather and prevailing winds, shall be adequately protected with suitable waterproof and weather protected covering over insulation. A 1/2-inch thickness of added insulation beyond the minimum specified in Purchaser's Piping and Insulation Standard Dwg. No. B-190174, for retention of heat is required for all outdoor piping systems and equipment. SCOPE OF PIPING

.1 Insulation for personnel protection shall not be included in the proposal but shall be furnished as directed later by Purchaser's Construction Superintendent.

.2 All lines 2 inches and smaller shall be priced on a unit cost basis and furnished as directed later by Purchaser's Construction Superintendent.

.3 All instrumentation, vent and drain lines shall be insulated in the same manner as the connecting pipe, and up to and including the first root valve.

8. Equipment indicated on Manufacturer's drawings tabulated below shall be insulated with block type insulation, or freeze protected listed in table below: * SCOPE OF EQUIPMENT

* An additional 1/2 inch heat insulation shall be added to the minimum thickness listed below if equipment is located outdoors.

EBASCO SPECIFICATION
HEAT INSULATION - PART I

Purchaser's Identification:

Spec No. CPL-R2-MI-1
Issue Date: July 20, 1968
R1: September 10, 1968

Ebasco File No.	Rev	Mfg Dwg No.	Title	Qty	Operating Temp. °F	Thickness In.
HEAT INSULATION						
5379-36	R3	4432D98	HP Heater 6A & 6B	2	442	2
5379-37	R2	4441D31	LP Heater 5A & 5B	2	370	1-1/2
5379-44	R3	4445D23	LP Heater 4A & 4B	2	310	1-1/2
5379-45	R3	4445D15	LP Heater 3A & 3B	2	258	1-1/2
5379-46	R4	4441D59	LP Heater 2A & 2B	2	205 (1)	1-1/2
5379-53	R4	4441D58	LP Heater 1A & 1B	2	171 (1)	1-1/2
5379-34	R4	4432D17	Moisture Separator Reheater	4	510	2
5379-787	R2	FC-44096	Steam Driven Aux Feedwater Pump	1	510	2
5379-881	R1	W-25-8A PICD86X2	Heater Drain Pump	2	370	1-1/2
5379-588	R3	FC-43570	Feedwater Pump	2	442	2
5379-1	R4	679J440/Sh1	Steam Generator	3	600	4-1/2
5379-244	R2	J618J742	Reactor Coolant Pumps	3	550	4
5379-1060	R0	A04195-A01	Regenerative Heat Exch	1	550	4-1/2
5379-1057	R0	V-8X20W86X1	Residual Heat Removal Pumps	2	350	2
5379-2	R3	4417D30	Pressurizer	1	650	5
		Sketch	Boron Injection Tank	1	170	1
5379-65	R0	MC-1603	Boric Acid Blender	1	170	1
5379-785	R0	DY-16352	Boric Acid Filter	1	170	1
5379-414	R1	685J083	Boric Acid Tanks	1	170	1
5379-137	R2	684J838	Batching Tank	1	170	1
5379-224	R0	A61673	Boric Acid Transfer Pumps	2	170 (2)	1
5379-411	R0	D-1503	Non-Regenerative Heat Exch	1	350 (3)	2
5379-412	R1	D-1519	Excess Letdown Heat Exch	1	550 (3)	2
5379-223	R0	A-61670	Concentrates Holding Tank Pumps	2	170 (2)	1
5379-816	R0	51035	Concentrates Filter	1	170	1
5379-413	R1	D-1520	Residual Heat Exchangers	1	350 (3)	2
5379-136	R3	684J836	Concentrates Holding Tank	1	170	1

(1) Only portion exposed outside condenser neck
(2) Heated enclosures
(3) Bonnet only

Ebasco File No.	Rev	Mfg Dwg No.	Title	Qty	Operating Temp. °F	Thickness In.
ANTI-FREEZE						
5379-58	R1	D140907	Condenser Vacuum Pump	2	110 (4)	1

SCOPE OF NON-SWEAT INSULATING

9. Seller shall furnish, deliver and apply in first class condition throughout, non-sweat material, Foster's 60-24 cork filled mastic (or equal), a minimum coat 1/4 inch thick to be applied by brush or trowel to pipe, valve, fitting or equipment.

WORKMANSHIP AND APPLICATION - PIPING INSULATION

10. Before insulating material is applied, all surfaces shall be thoroughly cleaned of all foreign material such as scale, dirt and rust by use of steel wire brushes, steel scrapers or hammers where necessary. No pipe shall be painted by the Seller before application of insulating material, except as hereinafter noted under Freeze Protection, paragraphs 29.1 and 29.6.

.1 All pipes up to and including 12 inches nominal diameter shall be covered with molded form sectional pipe insulation made up in 36-inch sections having not more than two longitudinal joints. All sectional insulation shall be carefully fitted to the pipes with side and end joints butted tightly and securely wired in place with No. 16 gage annealed iron wire using not less than 3 loops of wire per section. Where canvas jackets are specified for covering, all irregularities in the insulation shall first be smoothed out with an application of hard finish cement, sufficient only to provide a uniform, even surface but not intended as a hard cement finish coat. In applying double layer insulation, the inner layer shall be securely wired in place with 16 gage annealed iron wire. The ends of all wire loops shall be firmly twisted together with pliers, bent over and carefully pressed into the surface of the insulation.

(4) Heat Exchanger, tank (up to water level), and circulating pump only.

10.2 Insulating material for piping over 12-inch nominal size, and all bends, shall be made of sectional (2 piece) blocks moulded to fit the circumference of the pipe. All segmental blocks shall be tightly butted together and wired in place with No. 16 gage annealed iron wire in the manner described above for double layer insulation. After being wired in place, the joints between the segments shall be carefully tapped and rubbed close with a smooth tool. Where two or more layers of insulating material are applied, successive layers shall be laid to stagger both butt and longitudinal joints with next adjoining layer. All sectional or segmental block insulation having a total thickness, exclusive of specified finish, greater than 2 inches shall be applied in two or more layers.

WORKMANSHIP AND APPLICATION - PIPING INSULATION (Cont'd)

11. Heat insulation applied to main steam piping system shall be covered with asbestos paper followed by a weatherproof corrugated aluminum jacket minimum 0.016 inches thick with vapor barrier except for piping runs located within reactor containment building.

WORKMANSHIP AND APPLICATION - PIPE COVERING

.1 All insulation applied to piping located outside of the reactor containment building other than main steam piping shall be protected with rosin-sized sheathing paper and corrugated aluminum jacket minimum 0.016 inches with integral vapor barrier.

.2 Muslin furnished on sectional insulation shall be securely and neatly pasted in place in all cases before rosin-sized sheathing paper is applied.

12. Heat insulation material applied to all piping except for bends and fittings, located outdoors shall be weather protected by a corrugated aluminum jacket, minimum 0.016 inches thick, with integral vapor barrier. WORKMANSHIP AND APPLICATION PIPING WEATHERPROOFING

.1 The aluminum jacket shall have lapped longitudinal joints and shall be fastened with aluminum bands. Lapped joints for aluminum jackets for pipe sizes up to 2 inches shall have an overlap of 1-1/2 inches, 2 inches overlap for pipe sizes up to 6 inches, 3-inch overlap for pipe sizes up to 10 inches and 4-inch overlap for pipe sizes over 10 inches. End joints of jackets shall also be lapped type, sealed with a cold setting cement such as VIMASCO WC-1, product of the Vimasco Corporation, or equal, one end of section of jacket projecting over or under adjoining section of jacket, 2 inches for pipe sizes up to 2 inches, 3 inches for pipe sizes up to 6 inches, 4 inches for pipe sizes over 6 inches. Longitudinal joints on horizontal runs of pipe shall be arranged so upper sheet overlap lower sheet. End joints in vertical runs of pipes shall be arranged so upper section of jacket overlaps lower section. Use of screws to fasten aluminum jacket is prohibited and shall not be used unless authorized by Purchaser.

.2 The weatherproof jacket used to cover the pipe insulation as outlined above shall not develop cracks or check marks in service when subject to alternate periods of rain and sun, nor tend to disintegrate or lose mechanical strength under the climatic conditions generally prevailing in the locality of its installation.

13. All valves, bends and fittings shall be covered with molded block and plastic insulation of the thickness and type of material as used on adjacent pipes. On valves, bends and fittings 3 inches and smaller, an all cement insulation may be used. Blocks shall be securely wired in place with No. 16 gage annealed iron wire and all joints filled with plastic insulating cement of the same material as the blocks. Insulation sections formed of plastic material shall be thoroughly reinforced with galvanized wire mesh. Vimasco WC-1, WORKMANSHIP APPLICATION VALVES, BENDS & FITTINGS INSULATION & COVERING

13. (Cont'd)

WORKMANSHIP APPLICATION VALVES, BENDS & FITTINGS INSULATION & COVERING (Cont'd)

or equal, shall be applied on all valves and fittings (with exception of bends and ells) in two or more layers and each layer of Vimasco WC-1, or equal, shall be permitted to dry before the next is applied. A glass fabric embedded in the second coat of Vimasco WC-1 shall be followed by a third coat of Vimasco WC-1, or equal. The outer surface shall be troweled smooth. All valve bonnets shall be insulated up to the stuffing boxes. The ells shall be fitted with aluminum sheet metal jackets. The bends shall be also fitted with aluminum sheet metal jacket(mitered sections where type for ells are not available). The points at which the ell and bend jackets meet, the aluminum pipe jackets and the seams in the jackets shall be finished in a manner similar to that as described in Paragraph 12.1, Part I.

.1 Flange fitting insulation shall be solid built-up block type securely wired in place with No. 16 gage annealed iron wire and covered with plastic cement of the same material as the blocks. Flange insulating material shall be applied after protecting covering has been applied to adjacent pipe. Flange, including valve bonnet flange, insulating blocks shall be constructed so that they may be removed readily and replaced without damage to the blocks, adjacent insulating material or its protective covering. At flanged joints, the pipe insulation shall be tapered off at an angle of approximately 45 degrees on both sides of the joint for a length sufficient to permit removing flange bolts without damage to the covering.

14. Block type insulating material shall be wired securely in place with No. 16 gage annealed iron wire or iron band and all cracks or joints shall be filled solidly with plastic cement of same material as insulation. One and one-half (1-1/2) inch mesh galvanized wire netting shall be stretched over insulating material and two coats of hard asbestos cement applied, each coat being 1/4 inch thick.

WORKMANSHIP AND APPLICATI EQUIPMENT INSULATION COVERING AND WEATHERPROOF

14. (Cont'd)

WORKMANSHIP AND APPLICATIO EQUIPMENT INSULATION COVERING AND WEATHERPROOFI (Cont'd)

First coat shall be applied with a rough surface and allowed to dry before second coat is applied. Second coat shall consist of two parts by weight of hard finish, asbestos cement and one part of Portland Cement and shall be troweled to smooth, uniform surface and be finished neatly around all openings, heads, covers, plates, etc. Rosin-sized paper can be substituted as an alternate for the two coats of hard asbestos cement finish over the block type insulation. Equipment (outdoor) insulation shall be provided with corrugated aluminum jackets minimum 0.016 inches thick, with integral vapor barrier.

.1 Aluminum jacket joints shall be lapped and fastened together with aluminum sheet metal bands. Inner surfaces of lapped joints shall be coated with Vimasco WC-1, or equal, to provide a sealed joint before fastening with bands.

.2 Insulation applied to bolted or screwed cover plates or head of equipment and to manhole necks and flanged ends shall be tapered-off toward the bolted flanges and stopped short so that bolts, screws, heads, covers or plates may be removed without damage to the insulation or covering.

.3 Rain shields over pipe penetrating concrete decks shall be furnished later as directed by Purchaser's Construction Superintendent and shall be priced on a unit cost basis.

15. Seller shall furnish anti-freeze protection in accordance with Purchaser's Specification CPL-R2-MI-1, Part II.

ANTI-FREEZE PROTECTION

16. Seller shall furnish full size samples of material upon Purchaser's request.

SAMPLES

17. In addition to guarantees given by Seller, as required by Purchaser's General Conditions attached hereto, the Seller shall guarantee the following:

GUARANTEES

.1 Heat losses and efficiencies shall be within 10 percent of those specified by "85% Magnesia Insulation Manual" latest edition.

17.2 In the event that Seller's material does not meet the heat transfer loss guarantee, liability under such a guarantee shall include, among other items, application by Seller free of all cost to the Purchaser of sufficient insulating material over original insulation to reduce heat loss to guaranteed amount. In this latter case, Seller shall remove the insulating material already applied and reinsulate the piping or equipment with insulation that will meet the guarantee. GUARANTEES (Cont'd)

.3 Seller shall also guarantee the entire job as to the quality of material and workmanship for a period of two years from date of application.

18. Equipment nameplates shall be removed and reinstalled by Seller on outside of covered insulated surface in a secure manner satisfactory to the Purchaser. NAMEPLATES

19. Suitable and adequate means, acceptable to the Purchaser, shall be provided as required in all insulation for effects of changes in temperature of the insulated surface and of any metal used in supporting the insulation. Insulation, on surfaces where appreciable thermal movement may be expected, shall be applied in a manner which will avoid the occurrence of breaking or telescoping of insulating material due to alternate periods of expansion and contraction. Expansion joints in the insulation of high temperature pipe systems shall not be spaced less than 15 feet apart. The proposed methods for accommodating thermal expansion on vertical risers as well as horizontal runs shall be submitted to the Purchaser for approval. THERMAL MOVEMENT

20. Tests to determine heat conductivity shall be made by the "Electrical Method" as described in detail in ASME Transactions Vol. No. 37 or by such other methods as mutually agreed upon between Purchaser and Seller. Before performance of such tests, Purchaser and Seller shall agree upon: TESTS

20. (Cont'd) TESTS (Cont'd)

a - General procedure for carrying out tests.

b - Number of tests to be performed.

c - Method of averaging such tests.

d - Necessity of check tests and their bearing on normal tests.

21. This specification, together with Purchaser's and equipment Manufacturer's drawings herein enumerated are to be taken together, and any work specified or indicated and any such work as can reasonably be inferred therefrom as necessary to complete the application of insulating material and protective covering to each and any of the various piping systems and equipment specified is included unless specifically stated to the contrary, and shall be performed by Seller in satisfactory fulfillment of this specification. GENERAL UNDERSTANDING AND AGREEMENT

22. In general, the Seller shall follow methods and technical data, as outlined in this specification. However, the Seller may, upon approval of the Purchaser, deviate from type of material, thicknesses or procedure set herein if Seller can show such action will better either the efficiency of insulation, workmanship or economy of insulation without the improvement of one being seriously detrimental to the other. DEVIATION FROM STANDARDS

23. Seller shall furnish a competent superintendent experienced in this class of work who shall oversee the work and keep a running inventory of materials available and required to complete the work in order that, at all times, sufficient material will be available. All unused material and loose scaffolding will be removed and the premises left in a condition satisfactory to Purchaser's Superintendent before leaving the site each day; when not done, Purchaser's Superintendent will provide clean-up service against Contractor's account. After the work covered by this specification has been completed, all rubbish and debris resulting from such work shall be removed and the premises left in a condition satisfactory to the Purchaser. SUPERINTENDENC AND MISCELLANEOUS REQUIREMENTS

INSPECTION

24. The Purchaser's Inspector shall have the right to examine all work and material at the factory or the site, and any material found to be defective, or which does not meet the requirements of this specification, shall be replaced by the Seller at his own expense. Such inspection, however, shall not relieve the Seller from full responsibility for the quality and correctness of his materials and work.

25. The purpose of this specification is to provide for a satisfactory installation for protection of certain piping, equipment, controls and accessories against possible freezing when exposed to outdoor winter weather conditions. It is contemplated that the feedwater and condensate piping and including lines through which flow can be maintained at all times or which can be drained, will not be protected beyond the regular heat insulation except at specific locations. GENERAL

26. Seller shall furnish, deliver and apply in first class condition throughout, anti-freeze pipe insulation and its protective covering on all exposed cooling and service water piping. All exposed and accessible piping at circulating water pump intake structure, sample and equipment bearing cooling water supply and return shall be protected with anti-freeze materials in accordance with Piping & Insulation Standard Drawing No. B-190174, and Paragraph 31 - Freeze Protection by Electric Heating. EXTENT OF WORK

27. The anti-freeze material for the station is divided into two piping systems: SYSTEM CLASSIFICATIO

a - Cold pipe system.

b - Hot and/or Cold Insulated Pipe System.

.1 The cold pipe system such as: (a) Cold Water Piping, (b) Compressed Air Piping and all operating pipe lines which never exceed 120 F; all pipe systems designated as "cold pipes" are to be freeze protected as hereinafter specified.

.2 The hot and/or cold insulated pipe designation applies to all lines requiring protection which may be either hot or cold for normal operation and under this classification, all of the piping is to receive the regular heat insulation materials as specified in the Piping and Insulation Standard Drawing B-190174 and, in addition, heating cable for freeze protection.

28. The freeze protection circuits for those piping systems and tanks subject to freezing temperature during normal operation will be protected automatically by energizing Purchaser's thermostats arranged in parallel electrical circuits. The piping systems and tanks subject to freezing during plant shut-down only will be protected by a manual switch located at a winterizing control panel. CONTROL SYSTEM

Location of thermostats will be as follows:

Thermostat No.	Location of Thermostat
A	On Col (later) at approx El (later) ft
B	On Col (later) at approx El (later) ft

29. Heating cable application for both "Cold Pipe" and "Hot and/or Cold Insulated Pipe" lines shall be in accordance with the following schedule: APPLICATION OF CABLE AND INSULATION

a - Type MI Heating Cable	Furnished & Applied by Purchaser
b - Type MI Feeder Cable	Furnished & Applied by Purchaser
c - Flexible Mineral Felt, or equal	Furnished & Applied by Seller
d - Sheet Aluminum minimum 0.016" thickness with integral Vapor Barrier	Furnished & Applied by Seller
e - Paper Masking Tape - 1" width	Furnished & Applied by Purchaser
f - Vimasco WC-1, or equal	Furnished & Applied by Seller
g - Aluminum Foil 0.004" thick	Furnished & Applied by Seller
h - Zinc rich paint on pipe surfaces	Furnished & Applied by Purchaser

The above materials to be applied as follows:

APPLICATION OF CABLE AND INSULATION (Cont'd)

29.1 Cold Pipe System

One (1) coat of Debanode or Galvanox zinc-rich paint, or equal, shall be applied by Purchaser to all bare cold water lines in accordance with Ebasco Coating Guide CP-21, Rev 1, prior to the application of heating cable and/or insulation.

.2 Heating cables shall be selected by Purchaser. When tubing is also run in bundle with one or more pipes, the over-all diameter of the bundle shall determine the quantity of heating cable and insulating materials to be applied using nearest outside diameter for pipe size.

.3 Fiberglas with vapor barrier, 1 inch thick insulation with notch provided for heating cable*, shall be applied and fastened in place with monel wire for pipe sizes up to 6 inches. For 8 inch pipe size and over, 1-1/2 inch thick fiberglas with vapor barrier insulation having notch provided for heating cable*, shall be furnished,

.4 Corrugated aluminum covering with integral vapor barrier shall be wrapped over the fiberglas insulation with the longitudinal seam or joint made by overlapping 4 inches or less as described in Part I, Par. 12.

.5 The aluminum jacket shall be installed as outlined in Part I, Par. 12.

For all hot and/or cold insulated pipes which are continuously and intermittently hot and/or cold during normal plant operation.

This section deals with application of heating cable to 6 inches and smaller piping operating at less than 500 F.

* Notch shall be provided in all anti-freeze insulation for heating cable where applicable. Oversize insulation is acceptable only on instrumentation piping and tubing. The cost of notching the insulation or the use of oversize insulation shall be included in the quoted price.

APPLICATION OF CABLE AND INSULATION (Cont'd)

29.13 To prevent progressive deterioration of the heating cable copper sheath, one layer of thermal insulation must be applied to the piping before the heating cable is applied. Since the area protected is that area which is at the radius on which the heating cable is located, the outside diameter of the insulation beneath the heating cable determines the area of the protected surface for the purpose of determining heating requirements.

.14 The heating cable shall be attached with one inch paper masking tape to hold it firmly in place until remainder of insulation and jacketing is complete.

.15 For all pipes and/or tanks with thermal insulation under the heating cable, one wrap of 0.004 in. embossed aluminum foil is required over the heating cable. The aluminum foil shall be applied in 3 ft sections held in place with a tinsmith's "lock" which can be made by hand without tools. This foil is available in rolls three feet wide containing approximately 360 linear feet. Joints between sections should be wired or taped unless remainder of thermal insulation is to be applied the same day.

.16 Thermal insulation for piping over 500 F shall be applied as specified in Part I except that the outer layer of thermal insulation used on the inner layer of thermal insulation as required by Part II, paragraph 29.13, shall be Fiberglas with vapor barrier insulation with the thickness being based on the outer diameter of the high temperature thermal insulation.

.17 General Instruction On Accessories

Fiberglas with vapor barrier insulation 1 inch thick shall be used for bare pipe sizes up to and including 6 in. pipe size and 1-1/2 inch thick fiberglas with vapor barrier insulation for 8-inch pipe size and larger. Where Fiberglas with vapor barrier insulation is used for the outer layer of normally insulated pipe as specified in Paragraph 29.13, the thickness of fiberglas insulation shall be selected to agree with Part I.

APPLICATION OF CABLE AND INSULATION (Cont'd)

29.6 Exterior surfaces of bare black iron pipe which will be intermittently hot during normal operation shall be painted with one coat of zinc-rich paint as in Paragraph 29.1 above. In addition, since galvanic action with the copper sheath will occur in the presence of moisture, it will be necessary to minimize this action. Glass impregnated cloth tape (Scotch Electrical Tape Number 27, or equivalent) shall be applied to the heating cable used for all pipe, hot or cold. One inch wide tape applied to cable half lapped at factory will protect the cable satisfactorily.

.7 The heating cable shall be attached to the outer pipe or tank surface with 1-inch paper masking tape to hold it firmly in place until thermal insulation and jacketing is complete.

.8 Heating cable shall be applied and run straight along the pipe line. No weather resistant paint shall be applied to the bare pipe (except for cold pipes).

.9 Fiberglas insulation shall be applied in accordance with Part II, Paragraph 29.3.

.10 Aluminum covering with integral vaporseal barrier shall be applied over the insulation material.

This section deals with application of heating cable to 8 inch and larger piping operated at less than 500 F. For piping 8 inch nominal size and larger, multiple straight runs of heating cable are required equally spaced over circumference of protected area.

.11 Application of heating cable shall be the same as described in Part II, Paragraph 29.6 and 29.7, above.

.12 Thermal insulation shall be applied as described in Part II, Paragraphs 29.3 and 29.4.

This section deals with application of heating cable to piping which regularly exceeds 500 F.

APPLICATION OF CABLE AND INSULATION (Cont'd)

29.18 Monel wire shall be used to hold the insulation firmly in place. Two wires per section up to 6 inch pipe size and three wires per section above 6 inch pipe size.

.19 The longitudinal flap of the Fiberglas with vapor barrier insulation shall be attached to the pipe insulation by applying a thin brush coat of Vimasco WC-1, or equal. At the butt joints, a two-inch wide brush coat of Vimasco WC-1, or equal, will be applied around the circumference of the pipe insulation overlapping the joint 1 inch on adjoining sections embedding the fiberglas with vapor barrier insulation over the butt joint.

.20 Valves, fittings and other accessories installed in the pipe line shall be insulated as follows for freeze protection:

.21 Valves, fittings and other accessories installed in Cold and Hot and/or Cold Insulated Piping.

Heating cable shall be applied to bare valves, fittings and other accessories in a quantity equal to the equivalent run of pipe as specified by Ebasco Specification S 52-1 - Freeze Protection by Electric Heating. The cable shall be held on or attached by 1 inch paper masking tape.

.22 Over the cable, Fiberglas with vapor barrier insulation shall be wired on to a thickness equal to that furnished for adjacent pipe. Weather protection shall be by aluminum sheet metal jackets; or Vimasco VC-1, or equal, with gray pigment mixed into the mastic, where aluminum jackets are not acceptable or practical, and as specified in Paragraph 13.

.23 Insulation shall be applied as specified in Part I for the valves and fittings without weather resistant paint. Heating cable shall be applied around the pipe or fittings in a quantity equal to the equivalent run of pipe and the cable held in place as specified in 29.21.

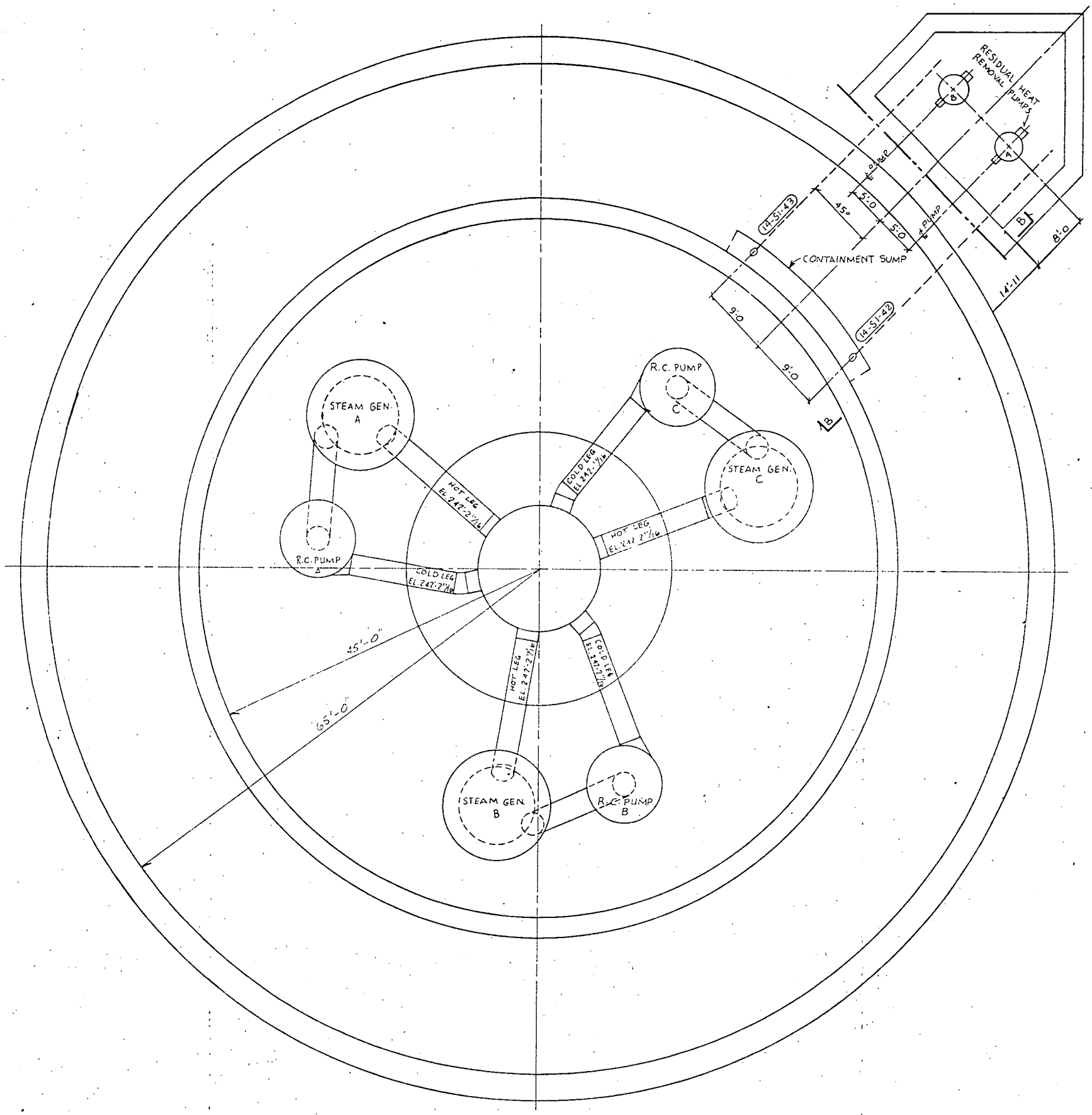
MISCELLANEOUS PIPING TO BE PROTECTED

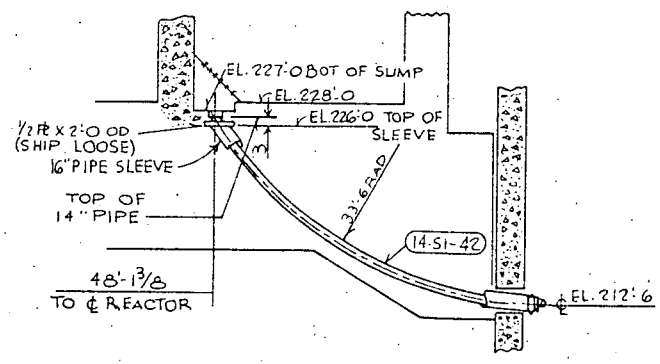
30.1 Water supply to circulating water pumps and motor bearings at intake structure will require heating cable protection. Exposed water supply piping shall be coated with Foster's 60-24 cork filled mastic, or equal, 1/4 inch thick for non-sweat protection, except where freeze protected per tabulation in freeze protection summary.

.2 Instrument piping and tubing to be field run - Instrument control lines containing steam, water or moist air shall be freeze protected in accordance with Paragraph 29.6 and 29.13.

PRELIMINARY GUIDE FREEZE PROTECTION BY ELECTRIC HEATING

31. Freeze protection by Electric Heating shall be in accordance with Ebasco Guide S52-1 dated March 1958, entitled, "Freeze Protection by Electric Heating" using Type MI heating and feeder cables.





SECTION B-B

H.B. Robinson Unit No. 2

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