

ISSUED FOR				SPECIFICATION TITLE SHEET					
☐ IN-HOUSE REVIEW ☐ CLIENT APPROVAL ☐ QUOTATION ☐ PURCHASE ☐ CONSTRUCTION ☒ <u>INFORMATION</u>				THIS SHEET IS A RECORD OF EACH ISSUE OR REVISION TO THE SUBJECT SPECIFICATION. EACH TIME THE SPECIFICATION IS CHANGED ONLY THE NEW OR REVISED SHEETS NEED TO BE ISSUED. THE EXACT SHEETS CHANGED AND THE NATURE OF THE CHANGE SHOULD BE NOTED UNDER REMARKS. THESE REMARKS ARE NOT A PART OF THE SPECIFICATION. THE REVISED SHEETS BECOME PART OF THE ORIGINAL SPECIFICATION AND SHALL BE COMPLIED WITH IN THEIR ENTIRETY.				☒ ENTIRE SPECIFICATION ATTACHED ☐ REVISED SHEETS ONLY ATTACHED	
REV.	DATE	BY	CK	APPROVALS				REMARKS	
				SECTION	PROJECT		CLIENT		
0	8-31-79	RS	RS	SD	JK		Day	First issue	
PLAINTIFF'S EXHIBIT CHV-17									
PROJECT, CLIENT, LOCATION Sulfur Recovery Tail Gas Plant Chevron U.S.A. Inc. El Paso, Texas						SPECIFICATION TITLE Hot Insulation			
SPECIFICATION THE RALPH M. PARSONS COMPANY						SHEET A	OF 17	JOB NUMBER 5878-1	
SPECIFICATION NUMBER SPC-72-MA-4700-1						REV. 0			

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- 2.11 All insulation shall be protected from moisture and weather before and during application. If applied insulation should get wet before it is jacketed, it shall be thoroughly dried by heating the line or other suitable means before it is sealed by weatherproofing.
- 2.12 Piping and equipment insulation shall be applied with all joints fitted to eliminate voids.
- 2.13 Vessel insulation support rings will be furnished by the vessel fabricator to the extent shown on the vessel drawings.
- 2.14 Materials specified herein are set forth as standard acceptable materials for their group or trade classification. It is not intended to exclude any comparable material.
- 2.15 If insulation is called for on piping, any additional items relating to the lines (such as vents, drains, bypasses, etc.) that comprise a system shall be considered a part of the insulation work even though they are not identified by an individual line number. Vessel trim shall receive the same consideration, i.e., a level gage requiring insulation, the vent and drain nipples, swages, valves, etc., shall be insulated.
- 2.16 Stainless steel piping and equipment shall be insulated with low chloride materials meeting the requirements of Military Specification MIL-I-24244 for special corrosion and chloride requirements.
- 2.17 Aluminum jacketing shall be cut back in such a manner as to clear sufficiently all galvanized surfaces to eliminate any possibility for galvanic corrosion.
- 2.18 Equipment nameplates shall remain visible after the insulation application is completed.
- 2.19 Any welding required in connection with attachments shall conform to the applicable Piping and Vessel Codes. Prior approval shall be required from Parsons Resident Construction Manager.
- 2.20 All equipment stiffener rings shall be insulated and weatherproofed with specified material.
- 2.21 Unless specified otherwise, the following items are not to be insulated: miscellaneous drains to sewers, steam traps, unions, restriction orifices, and safety valve tail pipes.
- 2.22 All insulation materials shall be "asbestos free."

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3.5 Insulation Weatherproofing - Heads

Unprotected

- ☒ Metal
- ☐ Mastic/Glasfab/Mastic
- ☐ Wire Mesh & Mastic

Protected (Inside Skirts)

- ☐ Mastic
- ☒ Finishing Cement, Glasfab & Mastic
- ☐ Finishing Cement

3.6 Bottom Heads Inside Skirts

- ☒ Insulate, if specified
- ☐ Do Not Insulate

3.7 Manways

- ☐ Insulate
- ☒ Do Not Insulate
- ☐ Removable Covers
- ☐ Permanent Covers

3.8 Exchanger Channels

- ☒ Insulate
- ☐ Do Not Insulate
- ☐ Over 400°F
- ☐ When specified in Insulation Equipment List

3.9 Exchanger & Vessel Nozzles

- ☐ Insulate
- ☐ Do Not Insulate
- ☐ Over 400°F
- ☒ When Connected Pipe Is Insulated

3.10 Pumps

- ☐ Insulate
- ☒ Do Not Insulate
- ☐ Metal
- ☐ Glasfab & Mastic
- ☐ Removable Covers
- ☐ Permanent Covers

3.11 Flanges on Pumps & Turbines

- ☐ Insulate
- ☒ Do Not Insulate
- ☐ Metal
- ☐ Glasfab & Mastic
- ☐ Removable Covers
- ☐ Permanent Covers

3.12 Insulation Bevels

- ☐ Mastic Finish
- ☒ Metal



(2) Metal Finish on Horizontal Equipment

Horizontal vessel and equipment jacketing shall be installed in the same manner as specified for corrugated metal finish except that "S" clips shall not be used.

4.4 Insulation Weatherproofing - Heads and Irregular Surfaces(1) All Metal - Heads

Orange peel sections shall be applied to heads. Sections shall overlap to shed water and be secured with sheet metal screws on 4 inch centers. Orange peel sections shall overlap shell jacket approximately 4 inches on vertical vessels and shall be secured with a 3/4 inch x 0.020 inch Type 304 stainless steel band having an expansion spring. Each band shall have two band loops made of the same material to keep the band from slipping down. Loops shall be located 180° apart and secured with two sheet metal screws each. All laps shall be sealed. Horizontal vessel metal covers for heads shall be overlapped by the metal sidewall jacket.

(2) Mastic - Heads and Irregular Surfaces

Mastic and reinforcement shall be applied in the following manner:

- o Install galvanized wire mesh over the insulation and apply finishing cement 1/4 inch thick.
 - o Trowel on mastic to a thickness not to exceed 1/8 inch.
 - o Embed Glasfab into mastic, and work to a smooth finish. Laps shall be a minimum of 3 inches.
 - o When surface is dry, finish with an additional 1/8-inch thick coat of mastic. When wire mesh is used for reinforcement, it shall be installed over the block board and secured by wiring to insulation ties. All edges shall be laced together. A 1/4-inch wet coat of mastic shall be troweled over, and well into the wire mesh.
- (3) When mastic is specified for top vertical heads, a metal flashing shall be used. Flashing shall start 2 inches under the mastic and extend 3 inches down and over the sidewall jacket.
- (4) The mastic head weatherproofing shall feather edge out on the sidewall insulation on horizontal equipment, 3-inch minimum, and be overlapped by the sidewall metal jacket.

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5.0 INSULATION FOR HOT PIPING - CHECKLIST

5.1 Insulation Material - Pipe Covering

- ☐ Fiberglass
- ☒ Calcium Silicate

5.2 Insulation Securement - Pipe Covering

Bands (Only for outer layer of insulation)

<u>Material</u>	<u>Size</u>	<u>Spacing</u>
☐ Galvanized	☒ 1/2 x .015	☒ 9" on center
☒ Stainless Steel	☐ 1/2 x .020	☐ 12" on center
☐ Aluminum	☐ 3/4 x .020	☐ 18" on center

Wire (Only for inner layer of double layer insulation)

<u>Material</u>	<u>Size</u>	<u>Spacing</u>
☒ Galvanized	☐ 18 Ga.	☐ 6" on center
☐ Stainless Steel	☒ 16 Ga. for pipe O.D. 12" and under	☒ 9" on center
☐ Black	☒ 14 Ga. for pipe O.D. over 12"	☐ 12" on center

5.3 Insulation - Ells, Tees, Caps, Reducers, etc.

1-1/2" & Smaller

- ☐ Prefabricated
- ☒ Cement

2" & Larger

- ☒ Prefabricated
- ☐ Cement

5.4 Insulation - Flanges, Bonnet Flanges and Flanged Valves

(See para. 7.1.3(2) for alternate insulation method)

<u>Steam Services</u>	<u>Process</u>	<u>Jacketed, Electric & Stm. Traced</u>
☒ Yes ☐ Above _____°F	☐ Yes ☐ Above _____°F	☒ Yes
☐ No ☒ All	☒ No ☐ All	☐ No

Insulation - Weld & Screwed Valves & Bonnets

(See para. 7.1.3(2) for alternate insulation method)

☒ Yes ☐ Above _____°F	☐ Yes ☐ Above _____°F	☒ Yes
☐ No ☒ All	☒ No ☐ All	☐ No

5.5 Steam Tracer Loops Outside Insulation

- ☒ Yes
- ☐ No

Material

- ☒ Moldable Felt

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6.0 HOT PIPING APPLICATION METHODS

6.1 Straight Pipe Insulation

Insulation shall be applied using staggered joint construction, and shall be secured in place with specified securements on specified centers. Where wire is used, it shall be twisted tightly and ends embedded into pipe insulation.

Factory applied jacketing integral with insulation may be used in sizes provided by the manufacturer. Where factory applied insulation integral with jacketing is provided, insulation securement shall be omitted. Polykraft moisture barrier shall be integral with both factory and field applied jacketing.

6.2 Straight Pipe Finish (Metal Finish)

Where metal jacket finish is specified, metal shall be applied with circumferential and longitudinal seams lapped a minimum of 2 inches. Jacket shall be secured in place as specified. Longitudinal seams shall be placed on the bottom half of pipe below 45° position so as to shed water.

If insulation jacket is penetrated by nozzles, clips, supports, etc., all penetrations shall be sealed with flashing compound to prevent entrance of moisture and water.

On vertical pipe when band securement is specified, two "S" clips shall be used at circumferential laps of jacketing for piping 12 inches and under; for piping over 12 inches, install three "S" clips.

6.3 Fitting Insulation Including Valves, Flanges, etc.

- (1) Fittings 1-1/2 inches and smaller shall be insulated with an approved hydraulic setting insulating cement palmed on to a smooth finish equal in thickness to the adjacent pipe insulation.
- (2) Fittings larger than 1-1/2 inches shall be insulated with preformed, shop or field fabricated insulation covers, secured with a minimum of 3 tie wires (this method preferred). If field miters are used, they shall be secured with one tie wire for each miter and finished with a skim coat of specified cement.

When other than metal weatherproofing is specified, all fittings shall be given a skim coat of insulating cement to form a smooth finish.

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6.4 Metal Fitting Weatherproofing

Factory-fabricated or field-fabricated fitting covers shall be installed over all fitting insulation. Covers shall be secured with specified screws at 3-inch centers on all circumferential laps and seams. Overlaps of gores shall be secured in place with specified screws at 3 inches on centers.

On horizontal lines the pipe jacketing shall overlap fitting covers.

On vertical lines the laps of fitting covers and pipe jacketing shall be installed to shed water.

Specified bands shall be installed over all laps of fitting covers in addition to specified screws.

Where sizes for elbows are not available as a manufactured item, the metal ells shall be fabricated from gores using the same number of miters as the base insulation.

Metal fitting covers shall match metal jacketing for straight pipe, when manufactured as a standard item.

When metal fitting covers do not match metal jacketing for straight pipe, metal fitting covers shall be of standard manufacture, 0.020 inch thick.

All laps and seams of fitting covers and gores shall be sealed for outdoor installations.

6.5 Metal Bevel

The pipe covering shall be beveled to 45°. Metal bevel shall be fabricated to form a 45° angle onto pipe and may be made in one or two pieces. Edges shall fit under the adjacent pipe covering jacket. Metal thickness shall be a minimum of 0.020 inches. Covers shall be secured with specified screws on 3 inch centers at all circumferential laps and seams. Banding shall not be omitted.

6.6 Pipe - Expansion and Insulation Supports

- (1) Insulation extending more than 20 feet above a bottom elbow shall be supported by a pipe insulation support located directly above the elbow. Also a pipe insulation support shall be installed above each pair of flanges or flanged valve in vertical pipe. When pipe extends more than 15 feet above a pipe insulation support, additional supports shall be installed on approximate 15'-1" centers.

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- (2) Vertical and horizontal expansion shall be compensated for by leaving a 1-inch space below the insulation support for vertical pipe, and a 1-inch space for horizontal pipe operating above 600°F on 15-foot centers. The 1-inch space for expansion shall be packed with oil-free mineral wool or equal. (Not required when mineral wool or fiberglass pipe covering is specified.)

6.7 Clearance for Bolt Removal

Pipe covering shall be stopped short of bolts a sufficient distance to allow bolt removal without damage to adjacent pipe insulation when flanges and flanged valves are not insulated or when removable covers are provided.

6.8 Steam Traced Piping

- (1) Tracer shields shall be installed prior to insulation of pipe. The shields shall be fabricated from 28 ga. sheet metal strip. The strip width shall be in accordance with table shown in Fig. 1. The tracer and tracer shield shall be pulled into contact with pipe where possible. Tracer shields are not required within 2 feet of a flange or fitting.
- (2) All steam traced piping shall be insulated, secured and finished in the same manner as straight pipe using either larger O.D. pipe covering or extended leg.
- (3) Where steam tracer tubing jumps over valves, flanges, etc., the tracer shall be spirally wrapped with specified material, lapped a minimum of 1/4 inch. Laps shall be secured with 16-gage dead soft-annealed galvanized wire applied spirally. Spacing of spiral shall not exceed 3/8 inch on centers. Weatherproof with a 3/8 inch wet thickness of mastic smoothly palmed on.
- (4) When heat transfer cement (Thermon) is specified, it shall be furnished and installed in accordance with manufacturer's recommendations by the insulation subcontractor.

6.9 - Electric Traced Piping

Electric traced piping shall be insulated, secured and finished in the same manner as straight pipe using larger O.D. pipe covering when cable or channel is used, or nominal piping covering when tape is used.

6.10 Steam Jacketed Piping

Steam jacketed piping shall be insulated in the same manner as specified for normal piping.

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6.11 Expansion Springs for Weatherproofing

Provide expansion springs for piping 48 inches in diameter and over. Refer to Paragraph 5.5 for temperatures and number of springs.

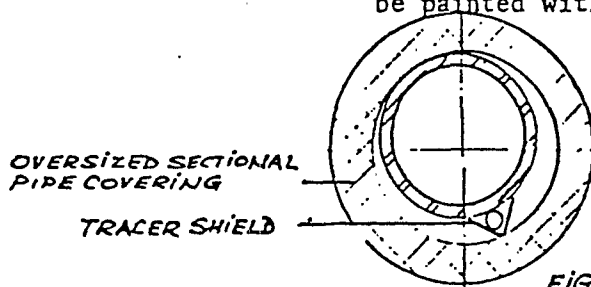
6.12 Insulation of Flanges and Valves

(1) Sheet Metal Covers

Flange and valve insulation shall be jacketed with removable, reusable sheet metal covers. The covers shall be multisectional for easy installation and removal. The overlaps of the cover sections shall be 1 inch minimum. The installed cover shall overlap the adjacent pipe insulation by the insulation thickness. The sheet metal cover shall leave the packing gland and other maintenance facilities accessible. The covers shall be installed by using quick release catches. Whenever possible the insulation material shall be permanently attached to the sheet metal cover sections so that the insulation can be reused.

(2) Insulation Pads (Alternative)

- (a) The insulation shall consist of pads fabricated from glass or asbestos fabric filled with loose mineral-wool. The thickness of the pads shall be in accordance with the insulation thickness table.
- (b) All seams of the pads shall be sewn with asbestos or glass yarn reinforced with a stainless steel wire. The stitch width shall be appropriate to prevent the loss of mineralwool during operation. The cushions shall be quilted to avoid sagging of the mineralwool and to maintain a uniform thickness.
- (c) The pads shall be manufactured in the required length and width to fit tightly to the surface to be insulated. All longitudinal installation seams shall be butt jointed and the joint shall be laced with galvanized wire using lacing hooks attached to the fabric. The hooks shall be spaced 4 inches on center. The cushions shall overlap the adjacent pipe insulation by the insulation thickness.
- (d) The fabric shall be water repellent or the cushion shall be painted with a heat resistant water repellent paint.



TRACER SHIELDS	
TRACER SIZE	STRIP WIDTH(in)
3/8" Nom. Copper	
5/8" " "	3 1/4
1/2" Steel Pipe	3 3/4
3/4" Steel Pipe	4 1/2
1" Steel Pipe	5

FIG 1 INSULATION OF STEAM TRACED PIPING

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7.0 INSULATION AND SECUREMENT MATERIAL LIST

7.1 Piping Insulation

Asbestos free molded calcium silicate sectional
 Pipe coverings (Item No. N14 - N18)
 Owens-Corning Fiberglas "Kaylo 10"
 Johns-Manville "Thermo 12"
 Pabco "Super Caltemp N.A.", or
 equal

7.2 Equipment Insulation

- (1) Mineralwool block insulation. Minimum size 24" x 36"
 Eagle Picher "Epitherm 1200 Block"
 Forty-Eight "N1200 Block", or equal
 (Item No. N42 - N46)

7.3 Insulating and Finishing Cement

- (1) Mineral fiber (asbestos free) insulating cement
 Johns-Manville No. 460, or equal (Item No. N102)
 (2) Hydraulic setting finishing cement.
 Johns-Manville No. 375, or equal (Item No. N103)

7.4 Reinforcements

Hexagonal wire mesh. Mesh size 1". Wire diameter 20 gage.
 Dip galvanized after weaving. (Item No. N130)

7.5 Weatherproofing Mastic

Chevron Asphalt Co. "Laykold" (Item No. N109)

7.6 Wire

Standard galvanized steel wire
 Thickness: 16 Gage (Item No. N131)
 Thickness: 14 Gage (Item No. N132)

7.7 Weather Jackets

- (1) Aluminum sheet metal, Alloy 3003, Hardness H14
 with polykraft moisture barrier.
 Thickness: 0.016", corrugated (Item No. N126)
 Thickness: 0.016", flat or corrugated (Item No. N127)
 Suppliers: Childers, Premetco or Pabco
 (2) Metal fitting covers for elbows, tees, end caps, terminus
 bevels, etc. shall be prefabricated (shop fabricated) from
 aluminum alloy specified under 8.7 (1) using epoxy vapor
 barrier, as supplied by Childers, or equal.

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7.8 Bands and Seals

Bands and seals shall be stainless steel Type 302.

The bands shall have following dimension:

3/4" wide by 0.020" thick (Item No. N134)

1/2" wide by 0.015" thick (Item No. N136)

Wing type seals for 3/4" wide bands (Item No. N135)

Wing type seals for 1/2" wide bands (Item No. N137)

Supplier: Garrad, or equal.

7.9 Expansion Springs

Flat spring expansion unit. Material: stainless steel

Supplier: Techalloy SR, or equal. (Item No. N141)

7.10 Floating Ring

Shall be fabricated from 3/8" diameter carbon steel rod
(Item No. 201)

7.11 Screws

Pan head or hex head slotted self tapping sheet metal
screws. Material: stainless steel.

7.12 "S" Clips

"S" clips shall be made from 3/4" x 0.040 Type 304
stainless steel with 1-1/2" legs at each end.

7.13 Fabric for Pad Type Insulation

The cloth shall be suitable for operating temperature
up to 1,000°F.

The fabric shall have a weight of 2.2 lb/sq.yd. for
asbestos cloth and 1.2 lb/sq.yd. for glass fabric.

Alpha-Maritex Style #1925/g 383 or equal.

7.14 Lacing Hooks

Fabricated from stainless steel.

Supplier: H. A. Jones, Dayton, Ohio; Eastern Refrac.,
Belmont, Mass., or equal.

7.15 Yarn for Pad Fabrication

Asbestos on glass sewing thread reinforced with stainless
steel wire.

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8.0 INSULATION THICKNESS - HEAT CONSERVATION

TABLE 1 - INSULATION CODES: IH; ST; ET

NOMINAL PIPE SIZE (INCHES)	OPERATING TEMPERATURE OF					
	141 TO 199	200 TO 299	300 TO 399	400 TO 499	500 TO 599	600 TO 649
1-1/2 & less	1	1	1-1/2	1-1/2	1-1/2	2
2	1-1/2	1-1/2	2	2-1/2	2-1/2	2-1/2
3	1-1/2	1-1/2	2	2-1/2	2-1/2	2-1/2
4	1-1/2	1-1/2	2	2-1/2	2-1/2	2-1/2
6	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
8	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
10	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
12	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
14	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
16	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
18	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
20	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
24 TO 42	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2
EQUIPMENT FLAT SURFACES	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	2-1/2

REFERENCE: W.O. 5128 INSULATION SELECTION CHART DATED 2/17/77.

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8.0 INSULATION THICKNESS - PERSONNEL PROTECTION (SAFETY INSULATION)

TABLE 2 - INSULATION CODE P

NOMINAL PIPE SIZE (INCHES)	OPERATING TEMPERATURE OF				
	161 TO 399	400 TO 499	500 TO 599	600 TO 649	
1-1/2 & less	1	1	1-1/2	1-1/2	
2	1	1	1-1/2	1-1/2	
3	1	1-1/2	1-1/2	1-1/2	
4	1	1-1/2	1-1/2	2	
6	1	1-1/2	2	2	
8	1-1/2	1-1/2	2	2	
10	1-1/2	1-1/2	2	2	
12	1-1/2	1-1/2	2	2-1/2	
14	1-1/2	1-1/2	2	2-1/2	
16	1-1/2	1-1/2	2	2-1/2	
18	1-1/2	1-1/2	2-1/2	2-1/2	
20	1-1/2	1-1/2	2-1/2	2-1/2	
24 TO 42	1-1/2	2	2-1/2	2-1/2	
EQUIPMENT FLAT SURFACES	1-1/2	2	2-1/2	3	

BASIS: AMBIENT AIR 80°F; AIR MOVEMENT 130 FT PER MIN; EMISSIVITY OF SURFACE: 0.2
 SURFACE TEMPERATURE 160°F
 THERMAL CONDUCTIVITY OF INSULATION MATERIAL:
 MEAN TEMP: (°F) 200 300 400 500 600
 K-FACTOR Btu in./sq.ft.hr. F 0.417 0.462 0.511 0.566 0.627



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