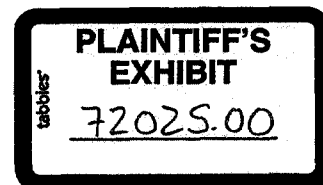


SPECIFICATIONS
FOR
THERMAL INSULATION

INSTITUTE PLANT

WORKS ENGINEERING DEPARTMENT
CARBIDE AND CARBON CHEMICALS COMPANY
A Division of
UNION CARBIDE AND CARBON CORPORATION
INSTITUTE, WEST VIRGINIA

MARCH, 1957



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1957

THERMAL INSULATION SPECIFICATIONS
MATERIALS AND APPLICATION SPECIFICATIONS
IN NUMERICAL ORDER

I - ALL MATERIALS AND APPLICATIONS:

General Specifications

II - CELLULAR GLASS:

- 10-H - Material and Application Specification for cellular glass thermal insulation for use on equipment and piping normally operating at temperatures above 70°F and up to 600°F and a cushioning blanket is required on all vessels. It is applicable to both indoor and outdoor service.
- 10-J - Material and Application Specification for cellular glass thermal insulation for use on equipment and piping normally operating at temperatures above 70°F and up to 500°F and a cushioning blanket is not required on any vessels. It is applicable to both indoor and outdoor service.
- 10-L - Material and Application Specification for cellular glass thermal insulation for use on equipment and piping normally operating at temperatures below 70°F and including cycle operation and thawout service up to 400°F. A cushioning blanket is required on all vessels. It is applicable to both indoor and outdoor service.

III - CALCIUM SILICATE:

- 20-H - Material and Application Specification for calcium silicate insulation for use on equipment and piping normally operating at temperatures from 70°F up to and including 750°F. It is applicable to both indoor and outdoor service.

IV - ASBESTOS FIBER:

- 21-H - Material and Application Specification for asbestos fiber thermal insulation for use on piping normally operating at temperatures from 70°F up to and including 750°F. It is applicable to both indoor and outdoor service.

Note - Specification 21-H covers piping only. For equipment requiring insulation use Specification 20-H.

V - HYDROUS CALCIUM SILICATE:

- 25-H - Material and Application Specification of "Kaylo 20" insulation for use on high temperature equipment and piping operating between 750°F up to and including 1200°F. It is applicable to both indoor and outdoor service.
- 32-H - Material and Application Specification of "Kaylo 20" insulation for use on high temperature equipment and piping to be protected from fire exposure. It is applicable to both indoor and outdoor service.

THERMAL INSULATION SPECIFICATIONS

MATERIALS DESCRIPTION, MANUFACTURERS AND TRADE NAMES

Insulation Spec. No.	Material	Description	Manufacturer	Trade Names	Temp.	Limits
					Min. (F°)	Max. (F°)
10-II 10-J 10-L	Cellular Glass (Block and Pipe Covering)	Inorganic, pure glass containing millions of separate hermetically sealed cells, each filled with air. Unusually high resistance to moisture, vapor and acid atoms. Incombustible and vermin proof. Combines light weight and high compressive strength.	Pittsburgh-Corning Corp.	Foamglas	-400	800
20-II	Calcium Silicate (Block and Pipe Covering)	Calcium silicate and asbestos fiber processed into rigid insulation. High compressive strength and relative hard surface. Does not disintegrate when wet.	Baldwin-Hill Johns-Manville Kearby-Mattison Mundet Owens-Corning Pabeo Ruberiod	Calcium Silicate Thermobestos Kaytherm Tri-Calite Kaylo Caltemp Calsilite	32 32 100 100 32 32 32	1200 1200 1500 1200 1200 1200 1250
21-II	Asbestos Fibers, Felted with Sodium Silicate Binder (Pipe Covering Only) Calcium Silicate (Block Covering Only)	Amosite asbestos fibers bonded with sodium silicate and processed into pipe insulation. Has considerable mechanical strength, and will resist vibration. Will "bridge" voids. Calcium Silicate same as Spec. 20-II above.	Armstrong Union Asbestos and Rubber See Spec. 20-II above.	Armobestos Unibestos #1200 See Spec. 20-II above.	32 32	1200 1200
25-II 32-II	Hydrous Calcium Silicate (Block and Pipe Covering)	Calcium silicate and asbestos fiber processed into rigid insulation. High compressive strength and relative hard surface. Does not disintegrate when wet. Low shrinkage.	Owens-Corning	Kaylo-20	100	2000

SERVICE: 10 PSI STEAM—25 PSI STEAM—LOW PRESSURE CONDENSATE (0-75 PSI)—
ALL BOILER WATER—HOT CITY WATER—CHEMICAL SERVICE UP TO 355 °F

INSULATION SPECIFICATION NO.: 26-H

MAXIMUM TEMP. FOR THIS SHEET: 355 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	VAL. FIT. & FLG. COVER	WIRE	SAND	REINF. MESH	WEATHER-COATING MAT'L.	WEATHER-COATING APPL.
1/4	CALCIUM SILICATE	1	1	FLO. FAB. OR INS. CEM.	18 USSWG. (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		1	1						
1		1	1						
1-1/4		1	1						
2		1	1						
2-1/4		1	1	SHOP PRE-FAB					
3		1	1						
3-1/4		1	1						
4		1	1		NONE	1/2" WIDE x .020" THICK x TYPE 304 SS			
6		1-1/4	1						
8		1-1/4	1						
10		1-1/4	1						
12		1-1/4	1						
14		1-1/4	1						
16		1-1/4	1						
18		1-1/4	1						
20		1-1/4	1						
22		1-1/4	1						
24		1-1/4	1						
26		1-1/4	1						
28		1-1/4	1						
30		1-1/4	1						
32		1-1/4	1						
34		1-1/4	1						
36		1-1/4	1						
EQUIPMENT (PLAT OR OVER 36")		1-1/4	1	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. /D-383301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- a) Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- b) Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- c) Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- d) Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- a) Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- b) Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- c) Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- d) Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- a) Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: 75 PSI STEAM—MEDIUM PRESSURE CONDENSATE (75-200 PSI) — CHEMICAL SERVICE UP TO 391 °F

INSULATION SPECIFICATION NO. 1 20-H

MAXIMUM TEMP. FOR THIS SHEET: 391 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	VAL. FIT. & FLG. COVER	WIRE	BAND	REINF. MESH	WEATHER-COATING MAT'L	WEATHER-COATING APPL.
1/4	CALCIUM SILICATE	1	1	FLD. FAB. OR INS. CEM.	18 USSWG. (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC 16 x 16 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
1/2		1	1						
1		1 1/4	1		SEE DWG. 7D-33300 (PAGE 40) FOR SPACING				
1 1/4		1	1						
2		1	1						
2 1/4		1	1	SHOP PRE-FAB					
3		1	1						
3 1/4		1	1						
4		1	1		NONE	1" WIDE x .020" THICK x TYPE 304 SS			
6		1 1/4	1						
8		1 1/4	1						
10		1 1/4	1						
12		1 1/4	1						
14		1 1/4	1						
16		1 1/4	1						
18		1 1/4	1						
20		1 1/4	1						
22		1 1/4	1						
24		1 1/4	1						
26		1 1/4	1						
28		2	1						
30		2	1						
32		2	1						
34		2	1						
36		2	1						
EQUIPMENT (FLAT OR OVER 36")		2	1	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. 7D-33301 (PAGE 41) AND GENERAL NOTE 4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/4" double gorged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: 200 PSI STEAM—HIGH PRESSURE CONDENSATE (200-400 PSI)

INSULATION SPECIFICATION NO.: 20-H

MAXIMUM TEMP. FOR THIS SHEET: 499 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	VA. FIT. & FLG. COVER	WIRE	BAND	REINF. MESH	WEATHER-COATING MAT'L.	WEATHER-COATING APPL.
1/2	CALCIUM SILICATE	1 1/2	1	FLD. FAB. OR INS. CEM.	18 USSWG. (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		1 1/2	1	↓	↓	↓			
1		1 1/2	1	SHOP PRE-FAB	↓	↓			
1 1/4		2	1		↓	↓			
2		2	1		NONE	1 1/2" WIDE x .020" THICK TYPE 304 S. S.			
2 1/2		2	1						
3		2	1						
3 1/2		2	1						
4		2	1						
6		2	1						↓
8		2	1						↑
10		2 1/2	1						
12		2 1/2	1						
14		2 1/2	1						
16		2 1/2	1						
18		2 1/2	1						
20		2 1/2	1						
22		2 1/2	1						
24		2 1/2	1						
26		2 1/2	1						
28		2 1/2	1						
30		2 1/2	1						
32		2 1/2	1						
34		2 1/2	1						
36		2 1/2	1						
EQUIPMENT (FLAT OR OVER 36")	↓	2 1/2	1	CUT FOR SIZE REQ'D. FAB. MAN.	SEE DWG. -D-383301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS	↓	↓	↓	↓

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1 1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #100, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: 400 PSI STEAM

INSULATION SPECIFICATION NO.: 20-H

MAXIMUM TEMP. FOR THIS SHEET: 643 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	LAYER DATA		VA. FIT. & FLG. COVER	WIRE (INNER LAYER)	BAND (OUTER LAYER)	REINF. MESH	WEATHER-COATING MAT'L	WEATHER-COATING APPL.
				INNER	OUTER						
1	CALCIUM SILICATE	2	1	NONE	1 1/2" IPS x 2"	FLD. FAB. OR INS. CEM.	18 USSWG (.0475") x TYPE 304 S.S. SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
2		2	1		1 1/2" IPS x 2"	↓	↓	↓			
1		2	1		1 1/2" IPS x 2"	SHOP PRE-FAB	↓	↓			
1-1/2		2-1/2	1		1-1/2" IPS x 2-1/2"		NONE	1 1/2" WIDE x .020" THICK x TYPE 304 S.S.			
2		2-1/2	1		2" IPS x 2-1/2"						
2-1/2		2-1/2	1		2-1/2" IPS x 2-1/2"						
3		2-1/2	1		3" IPS x 2-1/2"						
3-1/2		2-1/2	1	↓	3-1/2" IPS x 2-1/2"		↓				
4		3	2	4" IPS x 1-1/2"	7" IPS x 1-1/2"		18 USSWG (.0475") x TYPE 304 S.S. SOFT ANNEALED				↓
6		3	2	6" IPS x 1-1/2"	9" IPS x 1-1/2"						↑
8		3	2	8" IPS x 1-1/2"	11" IPS x 1-1/2"						
10		3	2	10" IPS x 1-1/2"	14" IPS x 1-1/2"						
12		3	2	12" IPS x 1-1/2"	16" IPS x 1-1/2"						
14		3	2	14" IPS x 1-1/2"	17" IPS x 1-1/2"						
16		3-1/2	2	16" IPS x 1-1/2"	19" IPS x 2"						
18		3-1/2	2	18" IPS x 1-1/2"	21" IPS x 2"						
20		3-1/2	2	20" IPS x 1-1/2"	23" IPS x 2"						
22		3-1/2	2	22" IPS x 1-1/2"	26" IPS x 2"						
24		3-1/2	2	24" IPS x 1-1/2"	27" IPS x 2"						
26		3-1/2	2	26" IPS x 1-1/2"	29" IPS x 2"						
28		3-1/2	2	28" IPS x 1-1/2"	31" IPS x 2"						
30		3-1/2	2	30" IPS x 1-1/2"	33" IPS x 2"						
32		3-1/2	2	32" IPS x 1-1/2"	35" IPS x 2"						
34		3-1/2	2	34" IPS x 1-1/2"	37" IPS x 2"						
36		3-1/2	2	36" IPS x 1-1/2"	39" IPS x 2"						
EQUIP. (FLAT OR OVER 36")	↓	3-1/2	2	1-1/2"	2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. -D-383381 (PAGE 41) AND GENERAL NOTE 14 FOR SPACING AND DETAILS	↓	↓	↓	↓

EQUIPMENT AND PIPING ACCESSORIES:

- a) Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- b) Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- c) Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- d) Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- a) Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- b) Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- c) Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- d) Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- a) Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: 100 PSI SUPERHEATED STEAM AT H2N (856)

INSULATION SPECIFICATION NO. 25-N

MAXIMUM TEMP. FOR THIS SHEET: 1200 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	LAYER DATA			VAL. FIT. & FLG. COVER	WIRE (INNER & MIDDLE LAY.)	BAND (OUTER LAYER)	REINF. MESH.	WEATHER-COATING MATL.	WEATHER-COATING APPL.
				INNER	MIDDLE	OUTER						
1/2	HYDROUS CALCIUM SILICATE	3-1/4	2	1-1/2" IPS x 1-1/4"	NONE	3-1/4" IPS x 2"	SHOP PRE-FAB	18 USSWG (.0478") x TYPE 304 SS SOFT ANNEAL	1-1/2" WIDE x .020" THICK x TYPE 304 SS	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		3-1/4	2	1-1/2" IPS x 1-1/4"		3-1/4" IPS x 2"						
1		4	2	1" IPS x 2"		5" IPS x 2"						
1-1/4		4	2	1-1/2" IPS x 2"		6" IPS x 2"						
2		4-1/4	2	2" IPS x 2"		6" IPS x 2-1/4"						↓
2-1/4		4-1/4	2	2-1/4" IPS x 2"		6" IPS x 2-1/4"						↑
3		4-1/4	2	3" IPS x 2"		7" IPS x 2-1/4"						
3-1/4		5	2	3-1/4" IPS x 2-1/4"		8" IPS x 2-1/4"						
4		5	2	4" IPS x 2-1/4"	↓	9" IPS x 2-1/4"						
6		5-1/4	3	6" IPS x 1-1/4"	5" IPS x 2"	14" IPS x 2"						
8		5-1/4	3	8" IPS x 1-1/4"	11" IPS x 2"	16" IPS x 2"						
10		6	3	10" IPS x 2"	15" IPS x 2"	19" IPS x 2"						
12		6	3	12" IPS x 2"	17" IPS x 2"	21" IPS x 2"						
14		6	3	14" IPS x 2"	18" IPS x 2"	22" IPS x 2"	SEE FABRICATION MANUAL	SEE DWG. 10-383300 (PAGE 40) FOR BRACING	SEE DWG. 10-383300 (PAGE 40) FOR BRACING		SEE GENERAL NOTE #6	
16		6	3	16" IPS x 2"	20" IPS x 2"	24" IPS x 2"						
18		6-1/4	3	18" IPS x 2"	22" IPS x 2"	26" IPS x 2-1/4"						
20		6-1/4	3	20" IPS x 2"	24" IPS x 2"	28" IPS x 2-1/4"						
22		6-1/4	3	22" IPS x 2"	26" IPS x 2"	30" IPS x 2-1/4"						
24		6-1/4	3	24" IPS x 2"	28" IPS x 2"	32" IPS x 2-1/4"	↑					
26		6-1/4	3	26" IPS x 2"	30" IPS x 2"	34" IPS x 2-1/4"						
28		6-1/4	3	28" IPS x 2"	32" IPS x 2"	36" IPS x 2-1/4"	↓					
30		7	3	30" IPS x 2"	34" IPS x 2"	38" IPS x 2-1/4"	SEE GENERAL NOTE #3					
32		7	3	32" IPS x 2"	36" IPS x 2-1/4"	41" IPS x 2-1/4"						
34		7	3	34" IPS x 2"	38" IPS x 2-1/4"	44" IPS x 2-1/4"						
36		7	3	36" IPS x 2"	40" IPS x 2-1/4"	47" IPS x 2-1/4"						
EQUIPMENT (FLAT OR OVER 36")	↓	8	3	2-1/4"	2-1/4"	3"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. 10-383301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS		↓	↓	↓

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1-1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", J. M. France Co. "Franset", or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—There is no heat resistant sealer available for this temperature. Use 24 MSG (.0239") steel sheet metal flashing instead.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: DOWTHERM

INSULATION SPECIFICATION NO.: 21-H

MAXIMUM TEMP. FOR THIS SHEET: 715 °

NOTE: The temperature at which the dowtherm line would be kept is over 100 °F if the procedure as shown below is followed and 75 PSI steam is used in the tracer. Dowtherm freezes at approximately 53 °F and this would keep it fluid over any extended shut-down period. Steam tracer details are per Engineering Standard P-84, page 46 of this book. Clamp and spacer details are per Engineering Standard P-84A, page 47 of this book. For information on other size of tracers see Engineering Standard P-84.

LINE SIZE (IPS)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	TRACER SIZE	LAYER DATA		VALVE, FITTING, & FLG. COVER	WIRE INNER	BAND (OUTER LAYER)	REINF. MESH	WEATHER-COATING MAT'L.	WEATHER COATING APPL.
					INNER LAYER	OUTER LAYER						
1/2	ASBESTOS FIBER	2-1/2	1	3/8" O.D.	NONE	2" IPS x 2-1/2"	FLD. FAB. OR INS. CEM.	18 USSWG (.0475") x TYPE 304 SS SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		2-1/2	1	3/8" O.D.		1-1/4" IPS x 2-1/2"	↓					
1		2-1/2	1	3/8" O.D.	↓	1-1/2" IPS x 2-1/2"	SHOP PRE-FAB					
1-1/4		3	2	3/8" O.D.	2-1/2" IPS x 1-1/2"	5" IPS x 1-1/2"						
2		3	2	3/8" O.D.	3" IPS x 1-1/2"	5" IPS x 1-1/2"						
2-1/2		3-1/2	2	3/8" O.D.	3-1/2" IPS x 1-1/2"	5" IPS x 2"						
3		3-1/2	2	3/8" O.D.	4" IPS x 1-1/2"	7" IPS x 2"						
4		3-1/2	2	5/8" O.D.	5" IPS x 1-1/2"	8" IPS x 2"						
6		4	2	5/8" O.D.	7" IPS x 2"	11" IPS x 2"						
8		4	2	5/8" O.D.	10" O.D. x 2"	15" IPS x 2"						
10		4	2	7/8" O.D.	12" O.D. x 2"	17" IPS x 2"						
12		4	2	7/8" O.D.	14" IPS x 2"	18" IPS x 2"						
EQUIP- MENT (PLAT OR OTHER)	CALCIUM SILICATE	5	2		2-1/2"	2-1/2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. 4D-383301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: TETRALIN

INSULATION SPECIFICATION NO.: 20-H

MAXIMUM TEMP. FOR THIS SHEET: 535°

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICK- NESS (IN.)	NO. LAY- ERS	LAYER DATA		VAL. FIT. & FLG. COVER	WIRE (INNER LAYER)	BAND (OUTER LAYER)	REINF. MESH	WEATHER- COATING MAT'L.	WEATHER- COATING APPL.
				INNER	OUTER						
1	CALCIUM SILICATE	2	1	NONE	1" IPS x 2"	FLD. FAB. OR INS. CEM.	18 USSWG (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN- FOSTER SEALFAS -C-	PALM
2		2	1		1" IPS x 2"	↓					
1		2	1		1" IPS x 2"	SHOP PRE-FAB					
1-1/2		2-1/2	1		1-1/2" IPS x 2"						
2		2	1		2" IPS x 2"						
2-1/2		2-1/2	1		2-1/2" IPS x 2-1/2"		NONE	1" WIDE x .020" THICK x TYPE 304 SS			
3		2-1/2	1		3" IPS x 2-1/2"						
3-1/2		2-1/2	1		3-1/2" IPS x 2-1/2"						
4		2-1/2	1		4" IPS x 2-1/2"						
6		2-1/2	1	↓	6" IPS x 2-1/2"						↓
8		3	2	8" IPS x 1-1/2"	11" IPS x 1-1/2"		18 USSWG (.0475") x TYPE 304 SS SOFT ANNEALED				↑
10		3	2	10" IPS x 1-1/2"	14" IPS x 1-1/2"						
12		3	2	12" IPS x 1-1/2"	16" IPS x 1-1/2"	SEE FABRICATION MANUAL					
14		3	2	14" IPS x 1-1/2"	17" IPS x 1-1/2"						
16		3	2	16" IPS x 1-1/2"	19" IPS x 1-1/2"						
18		3	2	18" IPS x 1-1/2"	21" IPS x 1-1/2"						
20		3	2	20" IPS x 1-1/2"	23" IPS x 1-1/2"						
22		3	2	22" IPS x 1-1/2"	25" IPS x 1-1/2"						
24		3	2	24" IPS x 1-1/2"	27" IPS x 1-1/2"	↓	SEE DWG. D-38300 (PAGE 40) FOR SPACING	SEE DWG. D-38300 (PAGE 40) FOR SPACING			
26		3	2	26" IPS x 1-1/2"	29" IPS x 1-1/2"	↑					
28		3	2	28" IPS x 1-1/2"	31" IPS x 1-1/2"						
30		3	2	30" IPS x 1-1/2"	33" IPS x 1-1/2"	SEE GENERAL NOTE #3					
32		3	2	32" IPS x 1-1/2"	35" IPS x 1-1/2"						
34		3	2	34" IPS x 1-1/2"	37" IPS x 1-1/2"						
36		3	2	36" IPS x 1-1/2"	39" IPS x 1-1/2"	↓					
EQUIP- MENT (FLAT OR OVER 36")		3-1/2	2	1-1/2"	2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. D-38300 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Fitting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: OIL AND PASTE LINES AT H2N (856)

INSULATION SPECIFICATION NO.: 20-H

MAXIMUM TEMP. FOR THIS SHEET: 750 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	LAYER DATA		VAL. FIT. & FLG. COVER	WIRE (INNER LAYER)	BAND (OUTER LAYER)	REINF. MESH	WEATHER-COATING MAT'L.	WEATHER-COATING APPL.
				INNER	OUTER						
1/2	CALCIUM SILICATE	2-1/4	1	NONE	1/2" IPS x 2-1/4"	SHOP PRE-FAB	18 GAGE (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC- 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		2-1/4	1		1/2" IPS x 2-1/4"						
1		2-1/4	1		1" IPS x 2-1/4"						
1-1/4		3	2	1-1/4" IPS x 1-1/4"	4-1/4" IPS x 1-1/4"			1" WIDE x .020" THICK x TYPE 304 SS			
2		3	2	2" IPS x 1-1/4"	6" IPS x 1-1/4"						
2-1/4		3	2	2-1/4" IPS x 1-1/4"	6" IPS x 1-1/4"						
3		3	2	3" IPS x 1-1/4"	6" IPS x 1-1/4"						
3-1/4		3	2	3-1/4" IPS x 1-1/4"	6" IPS x 1-1/4"						
4		3-1/4	2	4" IPS x 1-1/4"	7" IPS x 2"						
6		3-1/4	2	6" IPS x 1-1/4"	9" IPS x 2"						
8		3-1/4	2	8" IPS x 1-1/4"	11" IPS x 2"						
10		3-1/4	2	10" IPS x 1-1/4"	14" IPS x 2"						
12		4	2	12" IPS x 2"	17" IPS x 2"	SEE FABRICATION MANUAL				SEE GENERAL NOTE #5	
14		4	2	14" IPS x 2"	18" IPS x 2"		SEE DWG. #D-353300 (PAGE 40) FOR SPACING				
16		4	2	16" IPS x 2"	20" IPS x 2"			SEE DWG. #D-353300 (PAGE 40) FOR SPACING			
18		4	2	18" IPS x 2"	22" IPS x 2"						
20		4	2	20" IPS x 2"	24" IPS x 2"						
22		4	2	22" IPS x 2"	26" IPS x 2"						
24		4	2	24" IPS x 2"	28" IPS x 2"						
26		4	2	26" IPS x 2"	30" IPS x 2"						
28		4	2	28" IPS x 2"	32" IPS x 2"						
30		4	2	30" IPS x 2"	34" IPS x 2"	SEE GENERAL NOTE #3					
32		4-1/4	2	32" IPS x 2"	36" IPS x 2-1/4"						
34		4-1/4	2	34" IPS x 2"	38" IPS x 2-1/4"						
36		4-1/4	2	36" IPS x 2"	40" IPS x 2-1/4"						
EQUIP- MENT (FLAT OR OVER 36")		4-1/4	2	2"	2-1/4"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. #D-353301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #578, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: PASTE WITH HYDROGEN AT H2N (856)

INSULATION SPECIFICATION NO.: ZS-H

MAXIMUM TEMP. FOR THIS SHEET: 1003

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICK- NESS (IN.)	NO. LAY- ERS	LAYER DATA			VA. FIT. & FLG. COVER	WIRE (INNER & MIDDLE LAY.)	BAND (OUTER LAYER)	REINF. MESH.	WEATHER- COATING MAT'L.	WEATHE COATIN APPL.
				INNER	MIDDLE	OUTER						
1 1/2	HYDROUS CALCIUM SILICATE	3	2	1 1/2" IPS x 1-1/2"	NONE	3-1/2" IPS x 2"	SHOP PRE-FAB	18 USSWG (.0475") x TYPE 304 SS SOFT ANNEAL	1 1/2" WIDE x .020" THICK x TYPE 304 SS	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN- FOSTER SEALFAS "C"	PALM
1 1/4		3-1/2	2	2 1/4" IPS x 1-1/2"		3-1/2" IPS x 2"						
1 1/8		3-3/4	2	1" IPS x 1-1/2"		4" IPS x 2"						
1-1/2		4	2	1-1/2" IPS x 2"		6" IPS x 2"						
2		4	2	2" IPS x 2"		6" IPS x 2"						
2 1/2		4	2	2-1/2" IPS x 2"		6" IPS x 2"						
3		4-1/4	2	3" IPS x 2"		7" IPS x 2-1/2"						
3 1/2		4-1/2	2	3-1/2" IPS x 2"		7" IPS x 2-1/2"						
4		4-1/2	2	4" IPS x 2"		8" IPS x 2-1/2"						
6		6	2	6" IPS x 2-1/2"		11" IPS x 2-1/2"						
8		5	2	8" IPS x 2-1/2"		14" IPS x 2-1/2"						
10		5-1/2	3	10" IPS x 1-1/2"	14" IPS x 2"	18" IPS x 2"						
12		5-1/2	3	12" IPS x 1-1/2"	16" IPS x 2"	20" IPS x 2"						
14		6-1/2	3	14" IPS x 1-1/2"	17" IPS x 2"	21" IPS x 2"						
16		6	3	16" IPS x 2"	20" IPS x 2"	24" IPS x 2"	SEE FABRICATION MANUAL	SEE DWG. /D-383300 (PAGE 40) FOR SPACING	SEE DWG. /D-383300 (PAGE 40) FOR SPACING		SEE GENERAL NOTE #5	
18		6	3	18" IPS x 2"	22" IPS x 2"	26" IPS x 2"						
20		6	3	20" IPS x 2"	24" IPS x 2"	28" IPS x 2"						
22		6	3	22" IPS x 2"	26" IPS x 2"	30" IPS x 2"						
24		6	3	24" IPS x 2"	28" IPS x 2"	32" IPS x 2"						
26		6	3	26" IPS x 2"	30" IPS x 2"	34" IPS x 2"						
28		6-1/2	3	28" IPS x 2"	32" IPS x 2"	36" IPS x 2-1/2"	SEE GENERAL NOTE #2					
30		6-1/2	3	30" IPS x 2"	34" IPS x 2"	38" IPS x 2-1/2"						
32		6-1/2	3	32" IPS x 2"	36" IPS x 2"	40" IPS x 2-1/2"						
34		6-1/2	3	34" IPS x 2"	38" IPS x 2"	2-1/2"						
36		6-1/2	3	36" IPS x 2"	40" IPS x 2"	2-1/2"						
EQUIP- MENT (FLAT OR OVER 36")		7-1/2	3	2-1/2"	2-1/2"	2-1/2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. /D-383301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1 1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", J. H. France Co. "Franset" or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—There is no heat resistant sealer available for this temperature. Use 24 MSG (.0239") steel sheet metal flashing instead.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: ETHYLENE OXIDE (ABOVE 70 °F)

INSULATION SPECIFICATION NO.: 32-H

MAXIMUM TEMP. FOR THIS SHEET: PIPING: 535 °F EQUIPMENT: 427 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	LAYER DATA		VAL. FIT. & FLO. COVER	WIRE	GAND (BOTH LAYERS)	REINF. MESH	WEATHER-COATING MAT'L.	WEATHER-COATING APPL.
				INNER	OUTER						
1/2	HYDROUS CALCIUM SILICATE	2	2	1" IPS x 1"	2 1/2" IPS x 1"	SHOP PRE-FAB	NONE	1/2" WIDE x .020" THICK x TYPE 304 SS	GLASS FABRIC- 10 x 10 MESH STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		2	2	1 1/2" IPS x 1"	3" IPS x 1"						
1		2	2	2" IPS x 1"	4" IPS x 1"						
1-1/2		2	2	2 1/2" IPS x 1"	4 1/2" IPS x 1"						
2		2	2	3" IPS x 1"	5" IPS x 1"						
2-1/2		2	2	3 1/2" IPS x 1"	5 1/2" IPS x 1"						
3		2	2	4" IPS x 1"	6" IPS x 1"						
3-1/2		2	2	4 1/2" IPS x 1"	6 1/2" IPS x 1"						
4		2	2	5" IPS x 1"	7" IPS x 1"						
6		2-1/2	2	6" IPS x 1-1/2"	8" IPS x 1-1/2"						
8		3	2	8" IPS x 1-1/2"	11" IPS x 1-1/2"						
10		3	2	10" IPS x 1-1/2"	14" IPS x 1-1/2"						
12		3	2	12" IPS x 1-1/2"	16" IPS x 1-1/2"						
14		3	2	14" IPS x 1-1/2"	17" IPS x 1-1/2"						
16		3	2	16" IPS x 1-1/2"	19" IPS x 1-1/2"						
18		3	2	18" IPS x 1-1/2"	21" IPS x 1-1/2"						
20		3	2	20" IPS x 1-1/2"	23" IPS x 1-1/2"						
22		3	2	22" IPS x 1-1/2"	25" IPS x 1-1/2"						
24		3	2	24" IPS x 1-1/2"	27" IPS x 1-1/2"						
26		3	2	26" IPS x 1-1/2"	29" IPS x 1-1/2"						
28		3	2	28" IPS x 1-1/2"	31" IPS x 1-1/2"						
30		3	2	30" IPS x 1-1/2"	33" IPS x 1-1/2"						
32		3	2	32" IPS x 1-1/2"	35" IPS x 1-1/2"						
34		3	2	34" IPS x 1-1/2"	37" IPS x 1-1/2"						
36		3	2	36" IPS x 1-1/2"	39" IPS x 1-1/2"						
EQUIP- MENT (FLAT OR OVER 36")		2	2	1"	1"	CUT FOR SIZE REQ'D. (FAB. MAN.)		SEE DWG. #D-383301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING & DETAILS. WIRE IS NOT PERMITTED EXCEPT WHEN UNAVOIDABLE.			

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—J. H. France Co. "Frenset" or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.
- Wire—18 USSWG (.0475") Type 304 SS soft annealed.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

NOTE: The above are minimum thicknesses that may be applied to lines or equipment in Ethylene Oxide service for fire protection purposes.

SERVICE: CARBOWAX

INSULATION SPECIFICATION NO.: 10-J

MAXIMUM TEMP. FOR THIS SHEET: 355 °F

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	VA., FIT. & FLG. COVER	WIRE	BAND	REINF. MESH	WEATHER-COATING MAT'L	WEATHER-COATING APPL.
1/4	CELLULAR GLASS	1	1	SHOP PRE-FAB	18 USSWO. (.0475") 1 TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
1/2		1	1						
1		1	1						
1-1/4		1	1						
2		1	1						
2-1/4		1	1						
3		1	1						
3-1/4		1	1						
4		1	1		NONE	1/2" WIDE x .020" THICK x TYPE 304 SS			
6		1-1/4	1						
8		1-1/4	1						
10		1-1/4	1						
12		1-1/4	1						
14		1-1/4	1						
16		1-1/4	1						
18		1-1/4	1						
20		1-1/4	1						
22		1-1/4	1						
24		1-1/4	1						
26		1-1/4	1						
28		1-1/4	1						
30		1-1/4	1						
32		1-1/4	1						
34		1-1/4	1						
36		1-1/4	1						
EQUIPMENT (FLAT OR OVER 36")		1-1/4	1	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. #D-38300 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—Miracle Adhesive RT-1000 P up to 500 °F, HFR cement above 500 °F, or approved alternate.
- Anti-Abrasion Coating—Vinyl, Carlon 2500-H up to 400 °F, HFR cement above 400 °F, or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster 30-43 or approved alternate.
- Adhesive Cement—Miracle Adhesive Type H or approved alternate.
- Insulating Cement—Baldwin-Hill "Powerhouse", Eagle Picher, "one-coat" or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Die Cut Strap—3/4" wide x .023" thick x Type 304 SS, 2" fingers on 9" centers, A. J. Gerrard or approved alternate.
- Glass Wool Blanket—White Glass Wool, HEX netting one side, expanded metal lath on other side—Fiberglas "Metal Mesh Blanket" or approved alternate.

NOTE: All chemical lines and the 2"-200 PSI steam supply line to the neutralizer jet at the Carbowax unit to be insulated as shown above. However, the 2"-200 PSI steam supply line shall be insulated with one layer of two (2) inch thick cellular glass. This is good up to a temperature of 500 °F.

SERVICE: GENERAL SERVICE REQUIRING STEAM TRACING (75 PSI STEAM, OR UNDER, IN TRACER)

INSULATION SPECIFICATION NO.: 21-M

MAXIMUM TEMP. FOR THIS SHEET: 355 °F

NOTE: The temperature, as shown below, at which the process line will be kept is based on using 75 PSI steam in the tracer. For lower pressure steam the process line will be kept at a proportionately lower temperature. Steam tracer details are per Engineering Standard P-84, page 46 of this book. Clamps and spacer details are per Engineering Standard P-84A, page 47 of this book. For other sizes see Engineering Standard P-84.

LINE SIZE (IPS)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	INSULATION & TRACER DATA			VALVE FITTING & FLG. COVER	WIRE	BAND	REINF. MESH	WEATHER-COATING MAT'L.	WEATHER-COATING APPL.
				3/8" O.D. TRACER (PROCESS LINE TEMP.)	5/8" O.D. TRACER (PROCESS LINE TEMP.)	7/8" O.D. TRACER (PROCESS LINE TEMP.)						
1/2	ASBESTOS FIBER	1	1	2" IPS x 1" THK. (146°F)	2" IPS x 1" THK. (175°F)		SHOP PRE-FAB	18 USSWG (.0475") x TYPE 304 SS SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		1	1	1-1/4" IPS x 1" THK. (141°F)	1-1/2" IPS x 1" THK. (170°F)	2" IPS x 1" THK. (193°F)						
1		1	1	1-1/2" IPS x 1" THK. (136°F)	2" IPS x 1" THK. (166°F)	2-1/2" IPS x 1" THK. (188°F)						
1-1/4		1	1	2-1/2" IPS x 1" THK. (119°F)	3" O.D. x 1" THK. (164°F)	3" IPS x 1" THK. (166°F)						
2		1	1	3" IPS x 1" THK. (108°F)	3" IPS x 1" THK. (144°F)	3-1/2" IPS x 1" THK. (154°F)						
2-1/4		1	1	3-1/2" IPS x 1" THK. (99°F)	3-1/2" IPS x 1" THK. (133°F)	4" IPS x 1" THK. (144°F)						
3		1	1	4" IPS x 1" THK. (93°F)	4" IPS x 1" THK. (122°F)	5" O.D. x 1" THK. (133°F)						
4		1	1	5" IPS x 1" THK. (79°F)	5" IPS x 1" THK. (111°F)	6" O.D. x 1" THK. (122°F)						
6		1-1/2	1	7" IPS x 1-1/2" THK. (73°F)	7" IPS x 1-1/2" THK. (106°F)	8" O.D. x 1-1/2" THK. (122°F)						
8		1-1/2	1	9" IPS x 1-1/2" THK. (61°F)	10" O.D. x 1-1/2" THK. (92°F)	10" O.D. x 1-1/2" THK. (106°F)						
10		1-1/2	1	12" O.D. x 1-1/2" THK. (62°F)	12" O.D. x 1-1/2" THK. (82°F)	12" O.D. x 1-1/2" THK. (95°F)						
12		1-1/2	1	14" IPS x 1-1/2" THK. (46°F)	14" IPS x 1-1/2" THK. (73°F)	14" IPS x 1-1/2" THK. (82°F)						
EQUIP. MENT FLAT OR OTHER	CALCIUM SILICATE	2	1	2"	2"	2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. /D- 38381 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Fabricating Cement—A. P. Green Fire Brick Co. "Insulation Adhesive", or approved alternate.
- Insulating Cement—Hydraulic setting, Baldwin-Hill "Powerhouse", Eagle-Picher "One-Coat", or approved alternate.
- Heat Resistant Sealer—Benjamin-Foster #30-43 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting one side, expanded metal lath on the other side. (To be used on equipment expansion joints of the bellows type.)
- Mineral Wool Blanket—Black, spun rock wool, hexagonal wire netting on both sides. (To be used on very irregular shapes where metal lath type is not satisfactory.)
- Wire Netting—One inch, hexagonal mesh, #20 gage, Type 304 SS or approved alternate.
- Finishing Cement—Hard surface, Eagle-Picher #106, J. M. #678, or approved alternate.

PIPING ACCESSORIES ONLY:

- Finishing Cement—J. M. #352 or approved alternate. (For pipe patching)

SERVICE: ALL COLD TEMPERATURE SERVICE (EXCEPT ETHYLENE OXIDE)

INSULATION SPECIFICATION NO. 10-L

MINIMUM TEMP. FOR THIS SHEET: DOWN TO 32 °F (0 °C)

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	VA., FIT. & FLG. COVER	WIRE	BAND	REINF. MESH	WEATHER-COATING MAT'L	WEATHER-COATING APPL.
1/2	CELLULAR GLASS	1 1/2	1	SHOP PRE-FAB	18 USSWG. (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		1 1/4	1						
1		1 1/2	1						
1 1/4		2	1						
2		2	1		NONE	1 1/2" WIDE x .023" THICK x TYPE 304 SS			
2 1/4		2	1						
3		2	1						
3 1/4		2	1						
4		2	1						
6		2	1						
8		2	1						
10		2 1/4	1						
12		2 1/4	1						
14		2 1/4	1						
16		2 1/4	1						
18		2 1/4	1						
20		2 1/4	1						
22		2 1/4	1						
24		2 1/4	1						
26		2 1/4	1						
28		2 1/4	1						
30		2 1/4	1						
32		2 1/4	1						
34		2 1/4	1						
36		2 1/4	1						
EQUIPMENT (FLAT OR OVER 36")		2 1/4	1	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. (D-383301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Adhesive Cement—Miracle Adhesive Type H or approved alternate.
- Fabricating Cement—Hot (150 °F) Asphalt or approved alternate.
- Anti Abrasion Coating—Vinyl, Vimasco #49 or approved alternate.
- Joint Sealer—Vinyl asphalt, Vimasco #49 or approved alternate.
- Caulking Mastic—Vimasco Caulking Compound or approved alternate.
- Valve Sealer—Lion Oil Co. "Nokorode Low Temp" or approved alternate.
- Non-Setting Sealer—Benjamin Foster #30-73 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Cushioning Blanket—1 1/2 lb. density Aerowrap P-308, Fine Fiber Felt, Ultralite, Superfine or approved alternate.
- Die Cut Strap—1 1/4" wide x .023" thick x Type 304 SS, 2" fingers on 9" centers, A. J. Gerrard or approved alternate.
- Expansion Strap—1/4" wide x .023" thick x Type 304 SS, A. J. Gerrard "Expand-R-Strap" or approved alternate.

PIPING ACCESSORIES ONLY:

- Cushioning Blanket—1 1/2 lb. density Aerowrap P-308, Fine Fiber Felt, Ultralite, Superfine, or approved alternate. (To be used on piping only where excessive vibration is likely to occur.)

**SERVICE: ALL WATER, EXPOSED (TO PREVENT FREEZING)—
COLD TEMPERATURE SERVICE (EXCEPT ETHYLENE OXIDE)**

INSULATION SPECIFICATION NO.: 10-L

MINIMUM TEMP. FOR THIS SHEET — 4 °F (—20 °C)

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICK- NESS (IN.)	NO. LAY- ERS	LAYER DATA		VAL. FIT. & FLG. COVER	WIRE (INNER LAYER)	BAND (OUTER LAYER)	REINF. MESH	WEATHER- COATING MAT'L.	WEATHER- COATING APPL.
				INNER	OUTER						
1/2	CELLULAR GLASS	2	1	NONE	1" IPS x 2"	SHOP PRE-FAB	18 USSWG (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC- 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN- FOSTER SEALFAS "C"	PALM
3/4		2	1		1" IPS x 2"		↓	↓			
1		2-1/2	1		1" IPS x 2-1/2"		NONE	1" WIDE x .020" THICK x TYPE 304 SS			
1 1/2		2-1/2	1		1-1/2" IPS x 2-1/2"						
2		2-1/2	1		2" IPS x 2-1/2"						
2-1/2		2-1/2	1		2-1/2" IPS x 2-1/2"						
3		2-1/2	1		3" IPS x 2-1/2"		↓				
3-1/2		3	2	3-1/2" IPS x 1-1/2"	7" IPS x 1-1/2"		18 USSWG (.0475") x TYPE 304 SS SOFT ANNEALED				
4		3	2	4" IPS x 1-1/2"	7" IPS x 1-1/2"						
6		3	2	6" IPS x 1-1/2"	9" IPS x 1-1/2"						
8		3	2	8" IPS x 1-1/2"	11" IPS x 1-1/2"						
10		3	2	10" IPS x 1-1/2"	14" IPS x 1-1/2"						
12		3-1/2	2	12" IPS x 1-1/2"	16" IPS x 2"	SEE FABRICATION MANUAL				SEE GENERAL NOTE #5	
14		3-1/2	2	14" IPS x 1-1/2"	17" IPS x 2"		SEE DWG. ID-38300 (PAGE 10) FOR SPACING	SEE DWG. ID-38300 (PAGE 10) FOR SPACING			
16		3-1/2	2	16" IPS x 1-1/2"	19" IPS x 2"						
18		3-1/2	2	18" IPS x 1-1/2"	21" IPS x 2"						
20		3-1/2	2	20" IPS x 1-1/2"	23" IPS x 2"						
22		3-1/2	2	22" IPS x 1-1/2"	25" IPS x 2"						
24		3-1/2	2	24" IPS x 1-1/2"	27" IPS x 2"						
26		3-1/2	2	26" IPS x 1-1/2"	29" IPS x 2"						
28		3-1/2	2	28" IPS x 1-1/2"	31" IPS x 2"	SEE GENERAL NOTE #3					
30		3-1/2	2	30" IPS x 1-1/2"	33" IPS x 2"						
32		3-1/2	2	32" IPS x 1-1/2"	35" IPS x 2"						
34		3-1/2	2	34" IPS x 1-1/2"	37" IPS x 2"						
36		3-1/2	2	36" IPS x 1-1/2"	39" IPS x 2"						
EQUIP- MENT (FLAT OR OVER 36")		4	2	2"	2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. ID-38301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- a) Clips—1 1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- b) Adhesive Cement—Miracle Adhesive Type H or approved alternate.
- c) Lubricating Cement—Hot (180 °F) Asphalt or approved alternate.
- d) Anti-Abrasion Coating—Vinyl, Vimasco #49 or approved alternate.
- e) Joint Sealer—Vinyl asphalt, Vimasco #49 or approved alternate.
- f) Caulking Mastic—Vimasco Caulking Compound or approved alternate.
- g) Valve Sealer—Lion Oil Co. "Nokorode Low Temp" or approved alternate.
- h) Non-Setting Sealer—Benjamin Foster #30-73 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- a) Cushioning Blanket—1 1/2 lb. density Aerowrap P-308, Fine Fiber Felt, Ultralite, Superfine or approved alternate.
- b) Die Cut Strap—1" wide x .023" thick x Type 304 SS, 2" fingers on 9" centers, A. J. Gerrard or approved alternate.
- c) Expansion Strap—1 1/2" wide x .023" thick x Type 304 SS, A. J. Gerrard "Expand-R-Strap" or approved alternate.

PIPING ACCESSORIES ONLY:

- a) Cushioning Blanket—1 1/2 lb. density Aerowrap P-308, Fine Fiber Felt, Ultralite, Superfine, or approved alternate. (To be used on piping only when excessive vibration is likely to occur.)

SERVICE: ALL COLD TEMPERATURE SERVICE (EXCEPT ETHYLENE OXIDE)

INSULATION SPECIFICATION NO.: 10-L

MINIMUM TEMP. FOR THIS SHEET: DOWN TO -40 °F (-40 °C)

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	LAYER DATA		VA. FIT. & FLG. COVER	WIRE (INNER LAYER)	BAND (OUTER LAYER)	REINF. MESH	WEATHER-COATING MAT'L.	WEATHER-COATING APPL.
				INNER	OUTER						
1/2	CELLULAR GLASS	2-1/2	1	NONE	1" IPS x 2-1/2"	SHOP PRE-FAB	18 USSWG (.0475") x TYPE 304 S. S. SOFT ANNEALED	NONE	GLASS FABRIC- 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		2-1/2	1	↓	1" IPS x 2-1/2"			↓			
1		3	2	1" IPS x 1-1/2"	4" IPS x 1-1/2"			1" WIDE x .020" THICK x TYPE 304 SS			
1-1/2		3	2	1-1/2" IPS x 1-1/2"	4-1/2" IPS x 1-1/2"						
2		3	2	1-1/2" IPS x 1-1/2"	5" IPS x 1-1/2"						
2-1/2		3	2	2-1/2" IPS x 1-1/2"	5" IPS x 1-1/2"						
3		3-1/2	2	3" IPS x 1-1/2"	6" IPS x 2"						
3-1/2		3-1/2	2	3-1/2" IPS x 1-1/2"	7" IPS x 2"						
4		3-1/2	2	4" IPS x 1-1/2"	7" IPS x 2"						
6		4	2	6" IPS x 2"	10" IPS x 2"						↑
8		4	2	8" IPS x 2"	12" IPS x 2"						
10		4	2	10" IPS x 2"	16" IPS x 2"						
12		4	2	12" IPS x 2"	17" IPS x 2"						
14		4	2	14" IPS x 2"	18" IPS x 2"						
16		4	2	16" IPS x 2"	20" IPS x 2"						
18		4-1/2	2	18" IPS x 2"	22" IPS x 2-1/2"						
20		4-1/2	2	20" IPS x 2"	24" IPS x 2-1/2"						
22		4-1/2	2	22" IPS x 2"	26" IPS x 2-1/2"						
24		4-1/2	2	24" IPS x 2"	28" IPS x 2-1/2"						
25		4-1/2	2	26" IPS x 2"	30" IPS x 2-1/2"						
28		4-1/2	2	28" IPS x 2"	32" IPS x 2-1/2"						
30		4-1/2	2	30" IPS x 2"	34" IPS x 2-1/2"						
32		4-1/2	2	32" IPS x 2"	36" IPS x 2-1/2"						
34		4-1/2	2	34" IPS x 2"	38" IPS x 2-1/2"						
36		4-1/2	2	36" IPS x 2"	40" IPS x 2-1/2"						
EQUIP- MENT (FLAT OR OVER 36")		5	2	2-1/2"	2-1/2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. /D-383301 (PAGE 41) AND GENERAL NOTE 14 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- Adhesive Cement—Miracle Adhesive Type H or approved alternate.
- Fabricating Cement—Hot (180 °F) Asphalt or approved alternate.
- Anti-Abrasion Coating—Vinyl, Vimasco #49 or approved alternate.
- Joint Sealer—Vinyl asphalt, Vimasco #49 or approved alternate.
- Caulking Mastic—Vimasco Caulking Compound or approved alternate.
- Valve Sealer—Linn Oil Co. "Nokorod" Low Temp or approved alternate.
- Non-Setting Sealer—Benjamin Foster #30-73 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- Cushioning Blanket—1 1/2 lb. density Aerowrap P-309, Fine Fiber Felt, Ultralite, Superfine or approved alternate.
- Die Cut Strap—1/2" wide x .023" thick x Type 304 SS, 2" fingers on 9" centers, A. J. Gerrard or approved alternate.
- Expansion Strap—1/2" wide x .023" thick x Type 304 SS, A. J. Gerrard "Expand-R-Strap" or approved alternate.

PIPING ACCESSORIES ONLY:

- Cushioning Blanket—1 1/2 lb. density Aerowrap P-309, Fine Fiber Felt, Ultralite, Superfine, or approved alternate. (To be used on piping only where excessive vibration is likely to occur.)

SERVICE: ALL COLD TEMPERATURE SERVICE (EXCEPT ETHYLENE OXIDE)

INSULATION SPECIFICATION NO. 10-L

MINIMUM TEMP. FOR THIS SHEET: DOWN TO -112 OF (-80 °C)

LINE SIZE (IN.)	INSULATION MATERIAL	TOTAL THICKNESS (IN.)	NO. LAYERS	LAYER DATA			VAL. FIT. & FLG. COVER	WIRE (INNER & MIDDLE LAY.)	BAND (OUTER LAYER)	REINF. MESH.	WEATHER-COATING MAT'L.	WEATHER-COATING APPL.
				INNER	MIDDLE	OUTER						
1/2	CELLULAR GLASS	3-1/2	2	1-1/2" IPS x 1-1/2"	NONE	3-1/2" IPS x 2"	SHOP PRE-FAB	18 USSWG (.0475") x TYPE 304 SS SOFT ANNEAL	1/2" WIDE x .020" THICK x TYPE 304 SS	GLASS FABRIC 10 x 10 MESH / STARCH BINDER	VIMASCO WC-1 OR BENJAMIN-FOSTER SEALFAS "C"	PALM
3/4		3-1/2	2	1-1/2" IPS x 1-1/2"		3-1/2" IPS x 2"						
1		3-1/2	2	1" IPS x 1-1/2"		4" IPS x 2"						
1-1/4		4	2	1-1/2" IPS x 2"		5" IPS x 2"						
2		4	2	2" IPS x 2"		6" IPS x 2"						
2-1/4		4-1/2	2	2-1/2" IPS x 2"		6" IPS x 2-1/4"						
3		4-1/2	2	3" IPS x 2"		7" IPS x 2-1/2"						
3-1/4		4-1/2	2	3-1/2" IPS x 2"		8" IPS x 2-3/4"						
4		4-1/2	2	4" IPS x 2"		8" IPS x 2-3/4"						
6		6	2	6" IPS x 2-1/2"		10" IPS x 2-3/4"						
8		8-1/2	3	8" IPS x 1-1/2"	11" IPS x 2"	16" IPS x 2"						
10		8-1/2	3	10" IPS x 1-1/2"	14" IPS x 2"	18" IPS x 2"						
12		8-1/2	3	12" IPS x 1-1/2"	16" IPS x 2"	20" IPS x 2"						
14		8-1/2	3	14" IPS x 1-1/2"	17" IPS x 2"	21" IPS x 2"						
16		6	3	16" IPS x 2"	20" IPS x 2"	24" IPS x 2"	SEE FABRICATION MANUAL	SEE DWG. 10-38300 (PAGE 40) FOR SPACING	SEE DWG. 10-38300 (PAGE 40) FOR SPACING		SEE GENERAL NOTE #5	
18		6	3	18" IPS x 2"	22" IPS x 2"	26" IPS x 2"						
20		6	3	20" IPS x 2"	24" IPS x 2"	28" IPS x 2"						
22		6	3	22" IPS x 2"	26" IPS x 2"	30" IPS x 2"						
24		6	3	24" IPS x 2"	28" IPS x 2"	32" IPS x 2"						
26		6-1/2	3	26" IPS x 2"	30" IPS x 2"	34" IPS x 2-1/2"						
28		6-1/2	3	28" IPS x 2"	32" IPS x 2"	36" IPS x 2-1/2"						
30		6-1/2	3	30" IPS x 2"	34" IPS x 2"	2-1/2"	SEE GENERAL NOTE #3					
32		6-1/2	3	32" IPS x 2"	36" IPS x 2"	2-1/2"						
34		7	3	34" IPS x 2"	2-1/2"	2-1/2"						
36		7	3	36" IPS x 2"	2-1/2"	2-1/2"						
EQUIPMENT (FLAT OR OVER 36")		7-1/2	3	2-1/2"	2-1/2"	2-1/2"	CUT FOR SIZE REQ'D. (FAB. MAN.)	SEE DWG. 10-38301 (PAGE 41) AND GENERAL NOTE #4 FOR SPACING AND DETAILS				

EQUIPMENT AND PIPING ACCESSORIES:

- a) Clips—1/2" double pronged Type 304 SS, A. J. Gerrard or approved alternate.
- b) Adhesive Cement—Miracle Adhesive Type H or approved alternate.
- c) Fabricating Cement—Hot (180 °F) Asphalt or approved alternate.
- d) Anti-Abrasion Coating—Vinyl, Vimasco #49 or approved alternate.
- e) Joint Sealer—Vinyl asphalt, Vimasco #49 or approved alternate.
- f) Caulking Mastic—Vimasco Caulking Compound or approved alternate.
- g) Valve Sealer—Lion Oil Co. "Nokornde Low Temp" or approved alternate.
- h) Non-Setting Sealer—Benjamin Foster #30-73 or approved alternate.

EQUIPMENT ACCESSORIES ONLY:

- a) Cushioning Blanket—1 1/2 lb. density Acrowrap P-308, Fine Fyber Felt, Ultralite, Superfine or approved alternate.
- b) Die Cut Strap—1/2" wide x .023" thick x Type 304 SS, 2" fingers on 9" centers, A. J. Gerrard or approved alternate.
- c) Expansion Strap—1/2" wide x .023" thick x Type 304 SS, A. J. Gerrard "Expand-R-Strap" or approved alternate.

PIPING ACCESSORIES ONLY:

- a) Cushioning Blanket—1 1/2 lb. density Acrowrap P-308, Fine Fyber Felt, Ultralite, Superfine, or approved alternate. (To be used on piping only where excessive vibration is likely to occur.)