State of Alaska
Department of Environmental Conservation
Village Safe Water Program
555 Cordova Street
Anchorage, AK 99501
April.akers@alaska.gov

August 1, 2022

To: Vendor List

Re: Amendment 2
ITB 22-VSW-UNK-044
Unalakleet Water Source Project
ITB Due Date: August 11, 2022 @ 2:00 PM AST

The following are vendor questions and the department's response:

1. Vendor: Section 33 - 90 -10 - 1.1 A calls for contractor to purchase pipe and fittings please confirm that this is just in addition to what is called out as supplied an other sections of the specifications. Also please confirm that submittals will be supplied on what was purchased and not be required to be submitted again.

   Department: The submittals for the owner provided material will not be required to be submitted again by the contactor and are attached titled Arctic Pipe and Utilities, Pipe End Views and Thermacor Process, Inc., Piping Submittal Data, 10X10 Well Enclosure Unalakleet, Alaska. Please see section 01 64 00 for an itemized list / quantity breakdown of owner supplied pipe and below question and answer # 7.

2. Vendor: Please confirm that Water from the new wells or raw water from the existing water supply source will be available in sufficient quantity and volume to use for flushing the new line. Please indicate if there is a fee for this water.

   Department: The maximum allowable pumping rates from each well are:

- Well 1: 17 gpm,
- Well 3: 41 gpm,
- Well 4: 16 gpm,
- Well 6: 17 gpm,
- Well 8: 24 gpm.

The contractor may utilize the wells for construction purposes as long as the well heads are protected from damage and contamination, all products used within the wells are National Sanitation Foundation (NSF) approved for potable water, and the pumping rates for individual wells do not exceed those listed above. If additional flow / volume is necessary the contractor will need to make other arrangements. There is no fee for water use.

3. Vendor: Please confirm that there will be potable water available to flush the new water mains with after chlorination is complete so that there will be no issue with contaminated water introduced into the line for water quality testing. Please indicate if there is a cost for this.

   Department: Water from the wells will be available as noted above. The City of Unalakleet (City) also has a 1-million gallon potable water storage tank. Any use of water from the storage tank must be coordinated with the City. Charges may apply to water from the tank.

4. Vendor: Water testing calls for samples to be drawn every 1200 feet of new water main. The main does not have access points indicated in the installation drawings. Please advise if these will need to be added for this requirement. If not, what samples will be required to be collected and sent out for testing?

   Department: The department will allow for samples to be collected at the termination of the water line (at the water treatment plant). The line will be drained at a slow rate and samples will be taken from the drain stream at periodic intervals that mimic sampling water at 1,200 lf intervals.

5. Vendor: Please confirm if the commissioning agent will be supplied by owner or by engineering team and will run all meetings and provide all forms required for contractor use.

   Department: The commissioning agent will be provided by the department's engineering firm and all necessary commissioning forms will be provided by the department. Commissioning agent will observe the contractor performing the necessary functional checklist items.

6. Vendor: Please confirm that no insulated fittings or joint kits have been purchased at this point or there are no plans to have the owner supply them.

   Department: No insulated fittings, joint kits, or accessories are being provided. The owner (department) is only providing the pipe itself.

7. Vendor: Specifications Section 01 64 00, Receipt of Owner Furnished Materials: Can the items being purchased in this list provided by owner show what the lengths of pipe are coming in? Re: 20 ft./40 ft. / coils?

   Department: All insulated pipe (items 2-5) was made in 40' lengths. The bare 2' HDPE pipe (item 6) was made in 40' lengths. The bare 1-1/4" HDPE pipe (item 7) was made in 20' lengths.

8. Vendor: Are there any pipe fittings, joint kits and accessories being pre-purchased by owner or are these all contractor provided?

Department: See above question and answer # 6.

9. Vendor: The owner furnished materials include items expected to be delivered into Unalakleet this fall. Its understood the owner furnished materials would need to be handed over to the successful contractor upon award. At this time, I would suspect the materials arriving this fall would deliver before a contractor is awarded a contract. Please confirm the expected handover process post award and if the materials will already be secured/staged for winter storage this fall pre award.

   Department: All materials that arrive this fall will be unloaded and staged at the barge landing area by the city of Unalakleet. Contractor is responsible for inspecting and accepting the materials in Unalakleet prior to winter.

10. Vendor: The specification for the fiberglass shelters include a variety of information on design, material properties, etc. Please confirm the warranty requirement (5 year) is being handled directly between Village Safe Water and vendor during purchase and not to be handled by the contractor on this project.

    Department: Shelter manufacturer is responsible for warranty of any defects in the construction of the shelters. Contractor is responsible for warranty of any damage that the structures incur due to construction activities after the Contractor takes possession. Contractor warranty period duration shall be as specified in the contract documents.

11. Vendor: Please confirm items included in the shelter purchase (lifting eyes, roof access hatch, etc) or other information to clarify what exactly is included.

    Department: The department provided shelters include all items shown on the attached approved shop drawings titled 10x10 Well Enclosure Unalakleet, Alaska.

12. Vendor: The trenching in asphalt paved roads has the requirement to pave a 12' panel and match existing thickness and a minimum of 2". Please confirm the expected asphalt thickness.

    Department: Contractor shall assume that asphalt thicknesses of up to 5-inches will be encountered.

13. Vendor: The bid schedule appears to be a single line and listed as "basic bid" (page 19 of the RFP package). There is also included in the documents (on page 120 of the entire RFP package for reference) which has a more broken down list of work and also called bid schedule with more detailed quantities. Please confirm the bid schedule is to be provided as a single lump sum.

    Department: Bid schedule to be provided is lump sum. Disregard the bid schedule shown immediately after technical specification index page. Bidders shall only use the bid schedule form 00312 on page 19 of the Invitation to Bid (ITB) package.

14. Vendor: The specification section 01 22 00 "Unit Prices" implies items are paid on a unit price basis. Please confirm the bid schedule for the project is a single lump sum.

    Department: Please see above response.

15. Vendor: There is reference to the geotechnical report as being included, but it does not appear to be contained in the RFP package. Please provide the Geotech report for review.

Department: Bidders must contact the procurement officer for a copy of the geotechnical report dated 5/20/2020. This file will be sent via ZendTo.

16. Vendor: In the scope of work, contractors are required to abide by all permit stipulations, which according to the Summary specifications include the Fire Marshall Permit and ADEC approval to construct permit. Please provide for review. Also please confirm there is no wetland fill permit required for the access road construction.

    Department: Bidders must contact the procurement officer for copies of the permits. Files will be sent via ZendTo. Permit POA-2022-00715 confirms the wellfield does not contain waters of the US and is classified dryland.

17. Vendor: Drawing C105 indicates that the WS (Water Service?) type piping runs from Well House #1 to 30+00 connection. Please confirm that this is the correct type of carrier pipe and piping type as the fittings are called out as Raw Water.

    Department: The piping shown on sheet C105 (STA 30+44 to STA 33+07) and sheet C106 (STA 40+19 to STA 42+42) running down the center of the access roads will be "raw water arctic pipe" (Detail 1/C502). The shorter runs of pipe between the raw water arctic pipe and the well house will be "well service line arctic pipe" (detail 2/C502). The transition between the two pipe types will be in accordance with the details on sheet C509. The error will be corrected on the conformed drawings.

18. Vendor: Drawing C106 indicates that the WS (Water Service?) type piping runs from Well House #4 to 40+00 connection. Please confirm that this is the correct type of carrier pipe and piping type as the fittings are called out as Raw Water.

    Department: See response above. The general configuration shown on sheets C103 and C104 apply to all the well house connections (raw water arctic pipe along the access road, well service line arctic pipe for the 40 ft +/- run to each well house).

19. Vendor: If the two lines above are in fact Well Service Lines There is no detail for well service lines that are hdpe jacket to be buried. Would it be the same as C502 detail 2 with hdpe – 1 ¼" or 1 ½" Heat trace.

    Department: See above responses. Details 1/C502 and 2/C502 are correct and cover all arctic pipe requirements for the job.

Evan Patterson

Evan Patterson

Procurement Specialist

Attachments:

1. Arctic Pipe and Utilities, Pipe End Views,
2. Thermacor Process, Inc., Piping Submittal Data,
3. 10X10 Well Enclosure Unalakleet, Alaska,
4. Geotechnical report dated 5/20/2020 (sent via ZendTo),
5. Permits (sent via ZendTo):
    - United States Department of Agriculture, Rural Development, Revised Notice of Availability of an Environmental Assessment,
    - State of Alaska (SOA), Department of Environmental Conservation, Drinking Water Program, Separation Distance Waiver and Conditional Construction Approval,

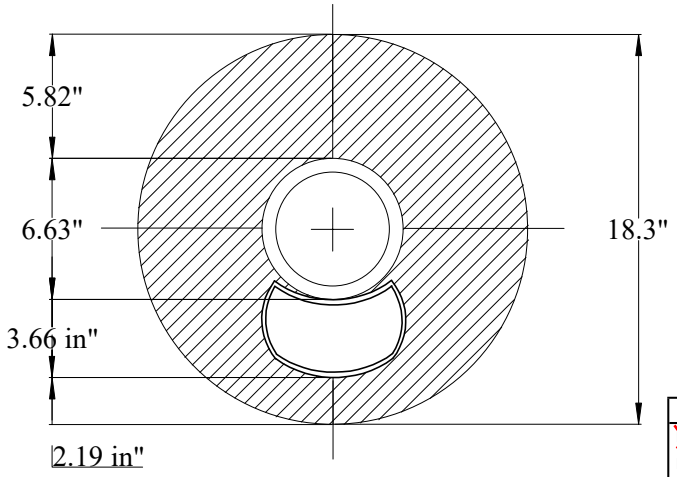
- SOA, Department of Transportation & Public Facilities, Permit No.: 2-166851-22-023,
- SOA, Department of Public Safety, Division of Fire and Life Safety, Water Treatment Plant – Renovation / Remodel,
- Department of Defense, Department of the Army, POA, No.: POA-2022-00175.

Arctic Pipe and Utilities

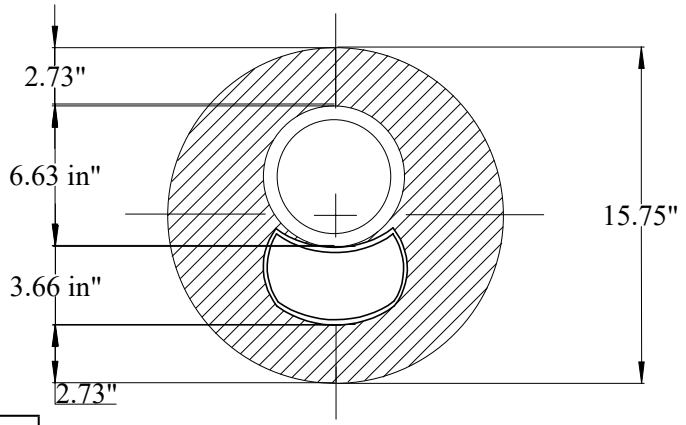
6320 MacKay Street Anchorage, AK 99518

Title

Pipe End Views



6" HDPE SDR-11 X 18.3" HDPE Jacket with 3" x 7" Kidney Bean Glycol Channel



6" HDPE SDR-11 X 15.75" Aluminum Sipr-o-lok Jacket with 3" x 7" Kidney Bean Glycol Channel

SHOP DRAWING / SUBMITTAL REVIEW

- [X] Approved
- [ ] Approved as Noted
- [ ] Partial Approval, Resubmit as Noted
- [ ] Revise and Resubmit

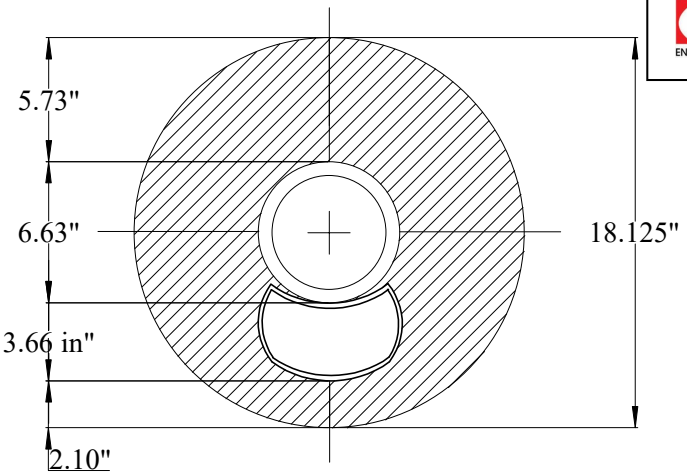
NOTE: CORRECTIONS OR COMMENTS MADE ON CONTRACTOR'S SUBMITTAL/SHOP DRAWINGS DURING THIS REVIEW DO NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH THE CONTRACT DRAWINGS OR SPECIFICATIONS. THIS SUBMITTAL HAS BEEN REVIEWED FOR CONFORMANCE WITH THE CONTRACT DOCUMENTS ONLY. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRECTING ALL QUANTITIES AND DIMENSIONS, FABRICATION PROCESSES AND TECHNIQUES, COORDINATING WORK WITH OTHER TRADES, AND SATISFACTORY AND SAFE PERFORMANCE OF THE WORK.

By: Karl Hulse Date: 5-13-22

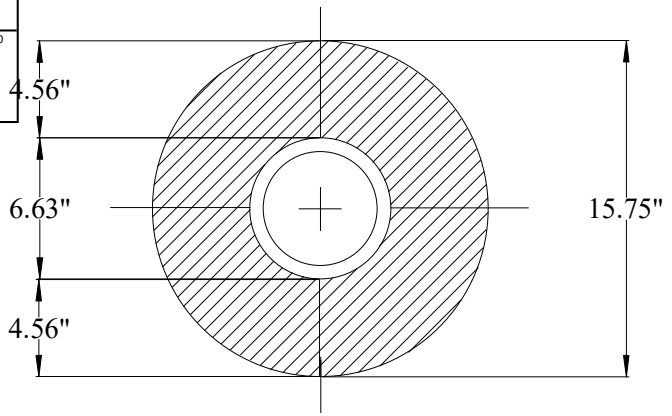
CRW ENGINEERING GROUP LLC
www.crweng.com

Anchorage: 3940 Arctic Blvd. Suite 300, Anchorage, AK 99503, Phone: (907) 562-3252

Palmer: 808 S. Bailey St. Suite 104, Palmer, AK 99645, Phone: (907) 707-1352



6" HDPE SDR-11 X 18" Aluminum Spir-o-lok Jacket with 3" x 7" Kidney Bean Glycol Channel



6" HDPE SDR-17 X 15.75" Aluminum Sipr-o-lok Jacket

APU REP:_____DATE:_____

APPROVED BY:_____DATE:_____

Thermacor Process Inc.

Piping Submittal Data

P.O. Box 79670, Fort Worth, Texas 76179
Phone: 817-847-7300 Fax: 817-847-7222

Created: 3/28/2022: By Shannon Walker
Modified: 3/28/2022: By Shannon Walker

Project Name:	UNALAKLEET WATER SOURCE
Project Number:	NO-0044142-N902 QUOTE N11406A-902 REV 1
Project Location:	ALASKA
Representative:	ARCTIC PIPE & UTILITIES
Salesperson:	WIL BARKER
Contractor:	
Other Contact:	
Submittal Revision:	

Project Summary

Primary Tag	Model Series	Model Descriptions
6" x 18" INSULATED PIPE	05-POLYCOR	BONDED FOAM SYSTEM WITH SDR-11 HDPE CARRIER PIPE AND HDPE JACKET WITH A 3" x 7" KIDNEY BEAN GLYCOL CHANNEL
6" x 15" INSULATED PIPE	06-SPIRAL-THERM	BONDED FOAM SYSTEM WITH SDR-17 HDPE CARRIER PIPE AND ALUMINUM JACKET
6" x 15" INSULATED PIPE	06-SPIRAL-THERM	BONDED FOAM SYSTEM WITH SDR-11 HDPE CARRIER PIPE AND ALUMINUM JACKET WITH A 3" x 7" KIDNEY BEAN GLYCOL CHANNEL
6" x 18" INSULATED PIPE	06-SPIRAL-THERM	BONDED FOAM SYSTEM WITH SDR-11 HDPE CARRIER PIPE AND ALUMINUM JACKET WITH A 3" x 7" KIDNEY BEAN GLYCOL CHANNEL

- [x] Released as Submitted, No Changes
- [ ] Released with Changes as Noted
- [ ] Revise and Resubmit as Noted
- [ ] Submittal Approval Only - Hold For Release

Approved By: Karl Hulse, P.E.
Title: Engineer
Date: 4/20/2022

Note: This submittal is based on equipment and options listed on the attachment(s) and represents our interpretation of your requirements. It is the contractor's responsibility to review this submittal and verify that it meets the job specifications.

POLYCOR:
BONDED FOAM SYSTEM WITH SDR-11 HDPE CARRIER PIPE AND HDPE JACKET WITH A 3" x 7" KIDNEY BEAN GLYCOL CHANNEL 6" x 18" INSULATED PIPE

1.02 - Carrier Pipe Specification: PE4710 High Density Polyethylene-IPS. To be centered in jacket

1.03 - Carrier Pipe Origin: 100% Domestic in Origin

1.04 - Carrier Pipe Weight: SDR 11

1.05 - Pipe Length: 40' Lengths

1.06 - Foam Specification: Polyurethane, 90% minimum corrected closed cell content, 2.0 to 4.0 pcf, K=.15@75°F and a compressive strength of not less than 35 psi. Operating temperature not to exceed 250°F. Insulation thickness is per attached chart with a tolerance of +/- 1/8" on ends, +/-1/4" in middle.

1.07 - Jacket Specification: Extruded black PE4710 high-density polyethylene (HDPE) with a minimum cell classification of PE445574C in accordance with ASTM D-3350, Minimum thickness 125 mils for jacket sizes less than or equal to 12", 150 mils for jacket sizes larger than 12" to 24", and 175 mils for jacket sizes greater than 24".

1.08 - End Seal Type: End seals shall be factory applied mastic completely sealing the exposed end of the insulation.

1.09 - System Type: System is Sticks & Kits: Straight Pipe Sections provided. System Design by Others.

1.10 - Fitting Type: By Others

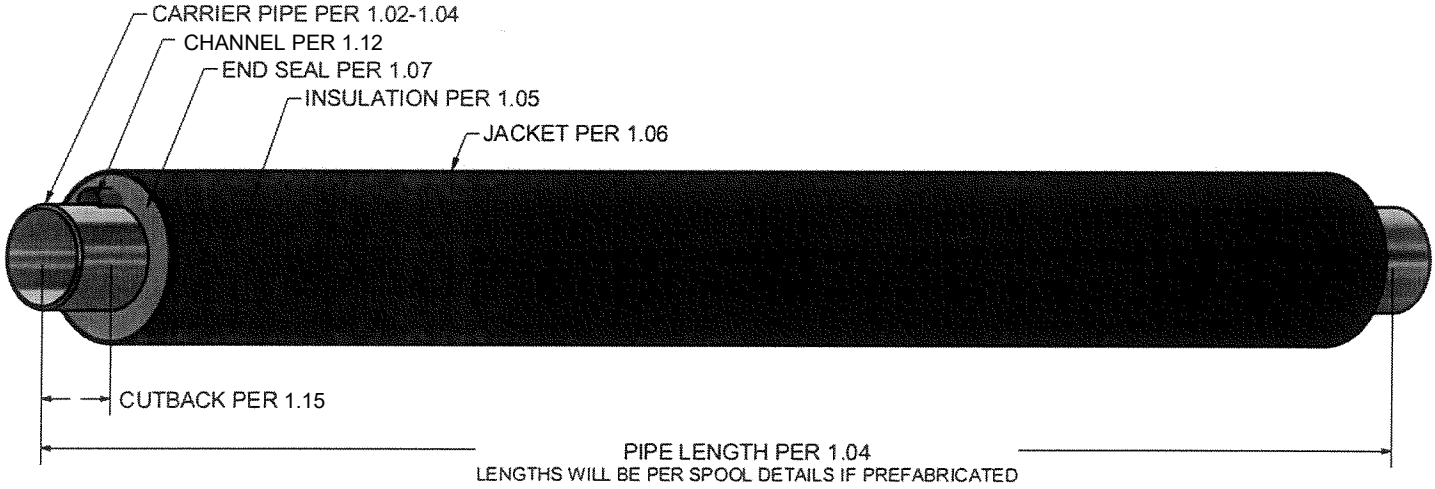
1.11 - Joint Kit & Fitting Kit Types: By Others

1.12 – Channel: System will have a 3" X 7" Kidney Bean Glycol Channel. Channel shall stick out of insulation 1-2".

1.15 - Cutback: 12" +/- ½" Cutbacks

POLYCOR

6" x 18" INSULATED PIPE



Nominal Pipe Size	Jacket Size (OD)	Insulation Thickness
6"	18.3"	5.57"

SPIRAL-THERM:
BONDED FOAM SYSTEM WITH HDPE CARRIER PIPE AND ALUMINUM JACKET
6" x 15" INSULATED PIPE

1.02 - Carrier Pipe Specification: PE4710 High Density Polyethylene-IPS

1.03 - Carrier Pipe Origin: 100% Domestic in Origin

1.04 - Carrier Pipe Weight: SDR **11**

1.05 - Carrier Pipe Length: 40' Lengths,

1.06 - Foam Specification: Polyurethane, 90% minimum corrected closed cell content, 2.0 to 4.0 pcf, K=.15@75°F and a compressive strength of not less than 35 psi. Operating temperature not to exceed 250°F. Insulation thickness is per attached chart with a tolerance of +/- 1/8" on ends, +/-1/4" in middle.

1.07 - Jacket Specification: .063", 5052 Aluminum Spiral Lock-seam jacket.

1.08 - End Seal Type: End seals shall be factory applied mastic completely sealing the exposed end of the insulation.

1.09 - System Type: System is Sticks & Kits: Straight Pipe Sections provided. System Design by Others.

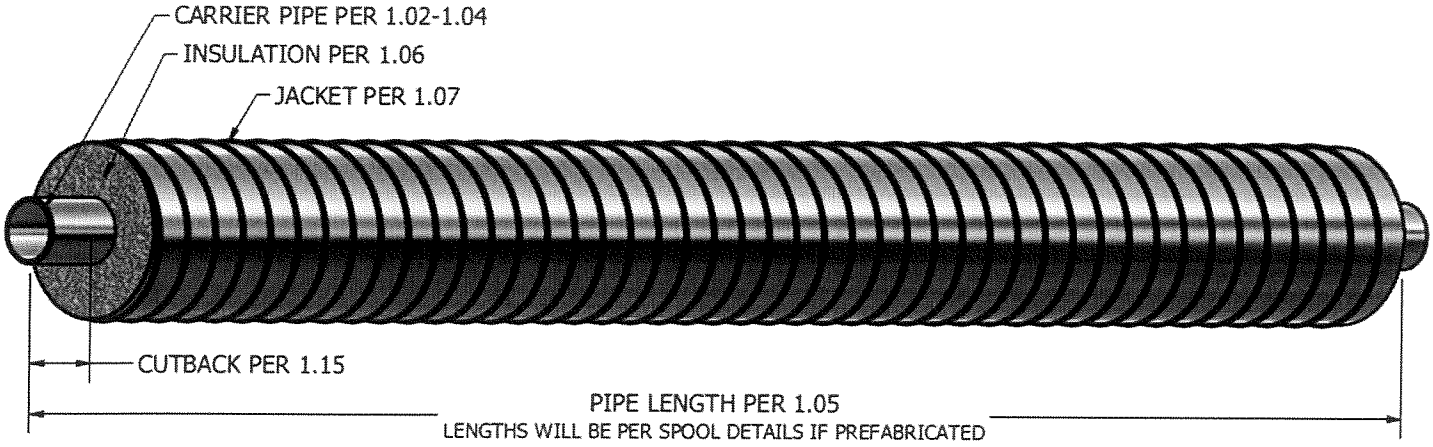
1.10 - Fitting Type: Fittings By Others

1.11 - Joint Kit & Fitting Kit Types: By Others

1.15 - Cutback: 12" +/- ½" Cutback on each end.

Spiral-Therm:

6" x 15" INSULATED PIPE



Nominal Pipe Size	Jacket Size (OD)	Insulation Thickness
6"	15.75"	4.68"

SPIRAL-THERM:
BONDED FOAM SYSTEM WITH SDR-11 HDPE CARRIER PIPE AND ALUMINUM JACKET WITH A 3" x 7" KIDNEY BEAN GLYCOL CHANNEL
6" x 15" INSULATED PIPE
6" x 18" INSULATED PIPE

1.02 - Carrier Pipe Specification: PE4710 High Density Polyethylene-IPS. To be centered in jacket.

1.03 - Carrier Pipe Origin: 100% Domestic in Origin

1.04 - Carrier Pipe Weight: SDR 11

1.05 - Pipe Length: 40' Lengths

1.06 - Foam Specification: Polyurethane, 90% minimum corrected closed cell content, 2.0 to 4.0 pcf, K=.15@75°F and a compressive strength of not less than 35 psi. Operating temperature not to exceed 250°F. Insulation thickness is per attached chart with a tolerance of +/- 1/8" on ends, +/-1/4" in middle.

1.07 - Jacket Specification: .063", 5052 Aluminum Spiral Lock-seam jacket.

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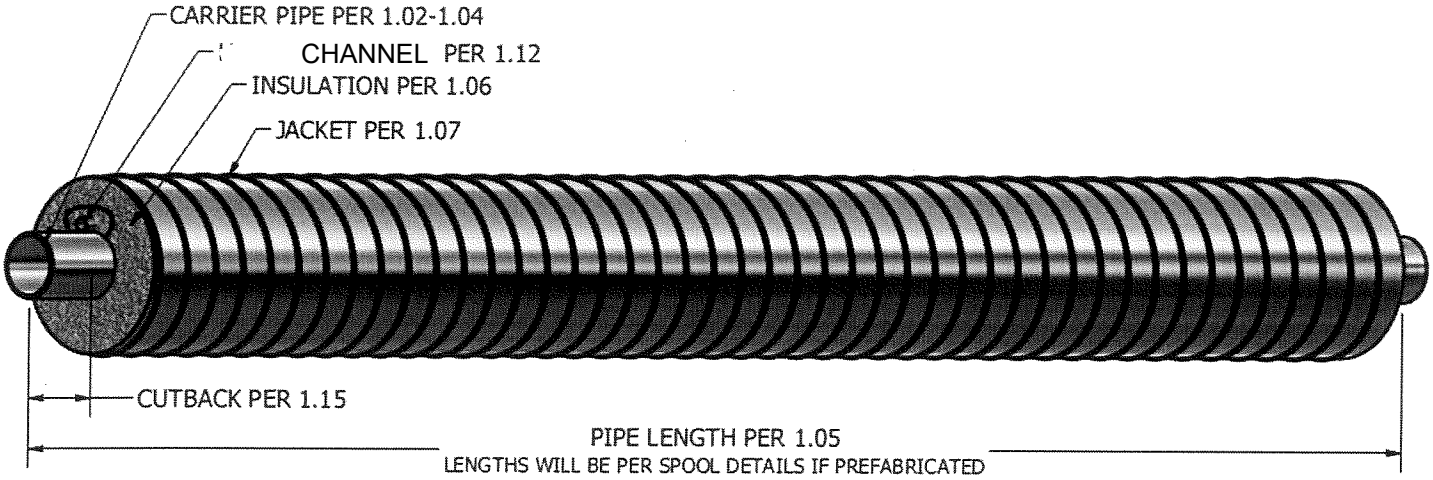
1.11 - Joint Kit & Fitting Kit Types: By Others

1.12 - Channel: System will have a 3" X 7" Kidney Bean Glycol Channel. Channel shall stick out of insulation 1-2"

1.15 - Cutback: 12" +/- ½" Cutbacks

Spiral-Therm

6" x 15" INSULATED PIPE, 6" x 18" INSULATED PIPE WITH A 3" x 7" KIDNEY BEAN GLYCOL CHANNEL



Nominal Pipe Size	Jacket Size (OD)	Insulation Thickness
6"	15.75"	4.68"
6"	18.125"	5.68"

CARRIER PIPE SPECIFICATIONS 1.02, 1.03 1.04

HDPE Water/Sewer | IPS

PRESSURE-RATED HDPE PIPE

6" SDR-17 & SDR-11 HDPE CARRIER PIPE

JM Eagle™

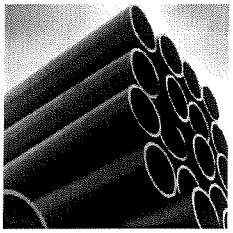
DELIVERING GOOD WATER TO YOU

ANSI/AWWA C906, ASTM F714, ASTM D3035
ASTM D3350 Cell Class 445574C/E, PPI (TR-4) PE 4710
ANSI/NSF 61/14

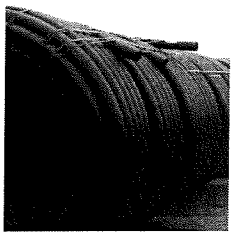
MARKETS

Potable | Reclaim | Sewer | Drainage | Irrigation | Rehabilitation

DESCRIPTION



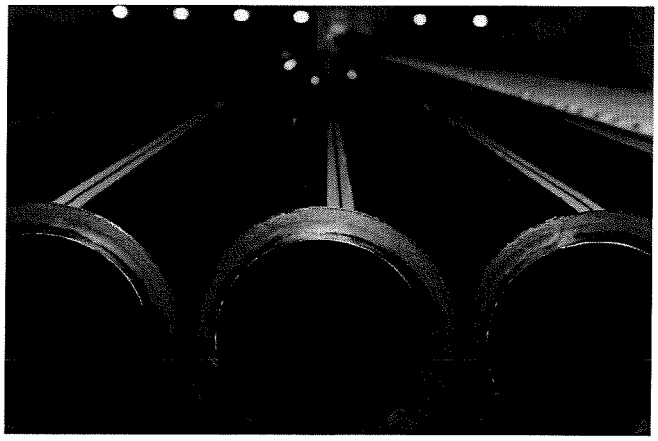
Standard HDPE



Coiled HDPE

IPS	PIPE SIZES:	ADDITIONAL OPTIONS:
Nominal Laying Length: 40/50 feet *(Laying length tolerances are in accordance with AWWA and ASTM standards)*	4", 5", 6", 7", 8", 10", 12", 14", 16", 18" 20", 22", 24", 26" 28", 30", 32", 34", 36" 42", 48", 54", 63"	Perforated*: 4", 5", 6, 7", 8"
		Coil*: 4", 5", 6"
PIPE COLORS:	**BLACK W/COLOR STRIPES:**	**ADDITIONAL COLOR OPTIONS:**
Black	Blue Green Purple	Grey*

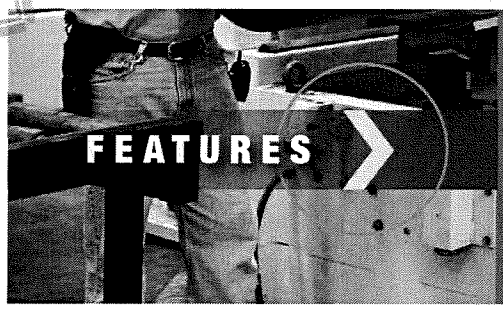
AWWA C906	
DR 7	335 psi
DR 9	250 psi
DR 11	200 psi
DR 13.5	160 psi
DR 17	125 psi
DR 19	112 psi
DR 21	100 psi
DR 26	80 psi
DR 32.5	63 psi



BENEFITS

Lightweight, with long laying length, great for easy transportation and installation.

Pipe applicable for open-trench and slip-lining installation.



Extremely durable, corrosive, gouging and abrasion resistant.

Features 100 years design life per Florida DOT.

Great flexibility, and highly suitable for earth-quake-prone areas.

Highest PE pressure rating, resistance to slow crack growth and rapid crack propagation.

Made in America

JM Eagle 50 YEAR WARRANTY* ON PLASTIC PIPE

*Please call regarding availability.

HDPE Water/Sewer | IPS

PRESSURE-RATED HDPE PIPE

6" SDR-17 & SDR-11 HDPE CARRIER PIPE

JM Eagle™

DELIVERING GOOD WATER TO YOU

SUBMITTAL AND DATA SHEET

HDPE IRON PIPE SIZE (IPS) PRESSURE PIPE

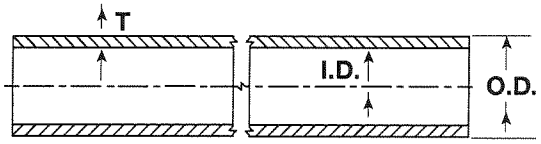
PIPE SIZE (IN)	AVG.O.D. (IN)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)
		DR 7 (335 psi)			DR 9 (250 psi)			DR 11 (200 psi)		
4	4.500	0.643	3.137	3.40	0.500	3.440	2.75	0.409	3.633	2.30
5	5.375	0.795	3.747	4.85	0.618	4.109	3.92	0.506	4.338	3.29
6	6.625	0.946	4.619	7.36	0.736	5.065	5.96	0.602	5.349	4.99
7	7.125	1.018	5.056	8.52	0.792	5.446	6.89	0.648	5.751	5.78
8	8.625	1.232	6.013	12.48	0.958	6.594	10.09	0.784	6.963	8.46
10	10.750	1.536	7.494	19.40	1.194	8.219	15.68	0.977	8.679	13.14
12	12.750	1.821	8.889	27.28	1.417	9.746	22.07	1.159	10.293	18.49
14	14.000	2.000	9.760	32.90	1.556	10.107	26.61	1.273	11.301	22.30
16	16.000	2.286	11.154	42.97	1.778	12.231	34.75	1.455	12.915	29.12
18	18.000	2.571	12.549	54.37	2.000	13.760	43.97	1.636	14.532	36.84
20	20.000	2.857	13.943	67.13	2.222	15.289	54.28	1.818	16.146	45.49
22	22.000	3.143	15.337	81.23	2.444	16.819	65.68	2.000	17.760	55.05
24	24.000	3.429	16.732	96.67	2.667	18.346	78.18	2.182	19.374	65.52
26	26.000	N/A	N/A	N/A	2.889	19.875	91.75	2.364	20.988	76.90
28	28.000	N/A	N/A	N/A	3.111	21.405	106.40	2.545	22.605	89.15
30	30.000	N/A	N/A	N/A	3.333	22.934	122.13	2.727	24.219	102.35
32	32.000	N/A	N/A	N/A	N/A	N/A	N/A	2.909	25.833	116.46
34	34.000	N/A	N/A	N/A	N/A	N/A	N/A	3.091	27.447	131.48
36	36.000	N/A	N/A	N/A	N/A	N/A	N/A	3.273	29.061	147.41

Product Standard:
ANSI/AWWA C906
ASTM F714
ASTM D3035
Pipe Compound:
PPI TR-4 PE 4710, ASTM D3350
Cell Class 445574 C/E
Certification: ANSI/NSF 61, ANSI/NSF 14*
Additional Option:
Perforated (4" - 8")*

Nominal Laying Length: 40/50 feet (Laying length tolerances are in accordance with AWWA and ASTM standards)
Coil option available upon request for size 6" and below.
Installation: JM Eagle™ HDPE Water/Sewer Installation Guide

Manning Coefficient (n) = 0.009
Hazen-Williams Coefficient (c) = 150

*Supply may vary based on plant location. Please call regarding availability.



T: (Wall Thickness) **I.D.:** (Inside Diameter) **O.D.:** (Outside Diameter)

PIPE SIZE (IN)	AVG.O.D. (IN)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)
		DR 13.5 (160 psi)			DR 17 (125 psi)			DR 19 (111 psi)		
4	4.500	0.333	3.794	1.91	0.265	3.938	1.55	0.237	3.998	1.39
5	5.375	0.412	4.531	2.73	0.327	4.705	2.21	0.283	4.775	1.99
6	6.625	0.491	5.584	4.15	0.390	5.798	3.35	0.349	5.885	3.02
7	7.125	0.528	6.006	4.80	0.420	6.237	3.88	0.375	6.330	3.49
8	8.625	0.639	7.270	7.03	0.507	7.550	5.68	0.454	7.663	5.12
10	10.750	0.796	9.062	10.92	0.632	9.410	8.82	0.566	9.550	7.95
12	12.750	0.944	10.749	15.36	0.750	11.160	12.41	0.671	11.327	11.19
14	14.000	1.037	11.802	18.52	0.824	12.253	14.98	0.737	12.438	13.49
16	16.000	1.185	13.488	24.19	0.941	14.005	19.55	0.842	14.215	17.61
18	18.000	1.333	15.174	30.61	1.059	15.755	24.75	0.947	15.992	22.29
20	20.000	1.481	16.860	37.79	1.176	17.507	30.53	1.053	17.768	27.52
22	22.000	1.630	18.544	45.75	1.294	19.257	36.86	1.158	19.545	33.30
24	24.000	1.778	20.231	54.44	1.412	21.007	43.99	1.263	21.322	39.63
26	26.000	1.926	21.917	63.89	1.529	22.759	51.61	1.368	23.100	46.51
28	28.000	2.074	23.603	74.09	1.647	24.508	59.87	1.474	24.875	53.94
30	30.000	2.222	25.289	85.04	1.765	26.258	68.74	1.579	26.653	61.92
32	32.000	2.370	26.967	96.76	1.882	28.010	78.18	1.684	28.430	70.45
34	34.000	2.519	28.660	109.26	2.000	29.760	88.28	1.790	30.205	79.54
36	36.000	2.667	30.346	122.49	2.118	31.510	98.98	1.895	31.983	89.17
42	42.000	3.111	35.404	166.70	2.471	36.761	134.72	2.211	37.314	121.37
48	48.000	3.556	40.462	217.76	2.824	42.013	175.97	2.526	42.644	158.52
54	54.000	N/A	N/A	N/A	3.177	47.265	222.67	2.842	47.975	200.63

PIPE SIZE (IN)	AVG.O.D. (IN)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)
		DR 21 (100 psi)			DR 26 (80 psi)			DR 32.5 (63 psi)		
4	4.500	0.214	4.046	1.27	0.173	4.133	1.03	0.138	4.207	0.83
5	5.375	0.265	4.832	1.81	0.214	4.936	1.48	0.171	5.025	1.19
6	6.625	0.315	5.957	2.74	0.255	6.084	2.24	0.204	6.193	1.81
7	7.125	0.340	6.406	3.18	0.274	6.544	2.59	0.219	6.661	2.09
8	8.625	0.411	7.754	4.66	0.332	7.921	3.80	0.265	8.063	3.06
10	10.750	0.512	9.665	7.24	0.413	9.874	5.90	0.331	10.048	4.77
12	12.750	0.607	11.463	10.17	0.490	11.711	8.30	0.392	11.919	6.69
14	14.000	0.667	12.586	12.28	0.538	12.895	10.00	0.431	13.086	8.08
16	16.000	0.762	14.385	16.03	0.615	14.696	13.07	0.492	14.957	10.54
18	18.000	0.857	16.183	20.28	0.692	16.533	16.54	0.554	16.826	13.36
20	20.000	0.952	17.982	25.03	0.769	18.370	20.43	0.615	18.696	16.48
22	22.000	1.048	19.778	30.31	0.846	20.206	24.72	0.677	20.565	19.95
24	24.000	1.143	21.577	36.06	0.923	22.043	29.42	0.738	22.435	23.72
26	26.000	1.238	23.375	42.32	1.000	23.880	34.53	0.800	24.304	27.86
28	28.000	1.333	25.174	49.07	1.077	25.717	40.05	0.862	26.173	32.33
30	30.000	1.429	26.971	56.36	1.154	27.554	45.98	0.923	28.043	37.09
32	32.000	1.542	28.730	64.11	1.231	29.390	52.31	0.985	29.912	42.22
34	34.000	1.619	30.568	72.36	1.308	31.227	59.06	1.046	31.782	47.63
36	36.000	1.714	32.366	81.12	1.385	33.064	66.22	1.108	33.651	53.42
42	42.000	2.000	37.760	110.43	1.615	38.576	90.08	1.292	39.261	72.68
48	48.000	2.286	43.154	144.25	1.846	44.086	117.68	1.477	44.869	94.95
54	54.000	2.571	48.549	182.51	2.077	49.597	148.95	1.662	50.477	120.20
63	63.000	3.000	56.640	248.46	2.423	57.863	202.73	1.938	58.891	163.53

1.07 - JACKET SPECIFICATION 18.3" HDPE JACKET

6" x 18" POLYCOR

STANDARD CASING PIPE 8" and Larger

Nominal Size		Outside Diameter			Wall Thickness			ID	
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Lbs/Ft
5.563	Inches	5.563	5.538	5.588	0.184	0.175	0.193	5.195	1.300
0.175 Wall	MM	141.300	140.665	141.935	4.674	4.445	4.902	131.953	
6.625 Casing	Inches	6.625	6.595	6.655	0.193	0.180	0.206	6.239	1.600
0.180 Wall	MM	168.275	167.513	169.037	4.902	4.572	5.232	158.471	
8.625 Casing	Inches	8.625	8.586	8.664	0.191	0.180	0.201	8.244	2.100
0.180 Wall	MM	219.075	218.084	220.066	4.839	4.572	5.105	209.398	
10.80 Casing	Inches	10.800	10.724	10.876	0.210	0.200	0.220	10.380	2.950
0.200 Wall	MM	274.320	272.390	276.250	5.334	5.080	5.588	263.652	
12.80 Casing	Inches	12.800	12.724	12.876	0.210	0.200	0.220	12.380	3.500
0.200 Wall	MM	325.120	323.190	327.050	5.334	5.080	5.588	314.452	
15.65 Casing	Inches	15.650	15.619	15.681	0.276	0.250	0.301	15.099	5.350
0.250 Wall	MM	397.510	396.723	398.297	6.998	6.350	7.645	383.515	
18.30 Casing	Inches	18.300	18.218	18.382	0.276	0.250	0.301	17.749	6.250
0.250 Wall	MM	464.820	462.737	466.903	6.998	6.350	7.645	450.825	
20.30 Casing	Inches	20.300	20.209	20.391	0.325	0.300	0.350	19.650	8.300
0.300 Wall	MM	515.620	513.309	517.931	8.255	7.620	8.890	499.110	
22.80 Casing	Inches	22.800	22.697	22.903	0.325	0.300	0.350	22.150	9.300
0.300 Wall	MM	579.120	576.504	581.736	8.255	7.620	8.890	562.610	
24.50 Casing	Inches	24.500	24.390	24.610	0.325	0.300	0.350	23.850	10.000
0.300 Wall	MM	622.300	619.506	625.094	8.255	7.620	8.890	605.790	

.063 ALUMINUM JACKET

THERMACOR - NORTHWEST

500 Metcalf St. Bldg. A-3 Sedro Woolley, WA. 98284 Ph. (360) 855 - -9829 – Fax (360) 855 – 1680

INTERNAL LOCK SEAM ALUMINUM JACKET

Thermacor Northwest Inc. manufactures aluminum jacketing from16 gauge (.063"), 5052 H-32 aluminum material.

The jacketing has an internal locking seam with inside corrugations. Sizes available are 4" thru 22" in even numbers above 20".

The jacketing has passed the five-foot water test. The internal lock seam is air and watertight.

Thermacor Northwest may also exercise the option to purchase aluminum jacketing from SpiralTec, Inc.

See attached letter from SpiralTec.

.063 ALUMINUM JACKET

SPIRALTEC INC.
3951 HAMMER DR
BELLINGHAM WASH
PH 360-734-7831

We have been contacted by Thermacor Northwest Inc. to provide aluminum jacket.

All products manufactured by SPIRALTEC meet or exceed SMACNA 1995 Duct construction standards.

Our Spiral Jacket has a high quality 4-ply lockseam that is air and watertight, that wind's around the exterior of the pipe to give it added strenght and rigidity as compared to conventional longitudinal seam jacket.

We have met the five foot water test on our jacket with a sealer in the seam. We have also gone from the 3000 series aluminum to the 5000 series aluminum, for availability of material and to get more quility in our product.

Aluminum Jacket MFG: .063 (16 G.A.) 5052 H-32 Inside seam Inside corrugations. Sizes available: 4" Diam to 60" Diam with or without corrugations.

SPIRALTEC
MANUFACTURER OF COMMERCIAL GRADE
SPIRAL DUCT SYSTEMS

DAVE MELLOTT

3970 HAMMER DR
BELLINGHAM, WA 98226

PH. (360) 734-7831
FAX (360) 738-7838

Thank You
Dave Mellott
Owner

ELASTOPOR® P 15953R SYSTEM
TECHNICAL DATA SHEET

DESCRIPTION

Elastopor® P 15953R Resin/Elastopor® P 1001U Isocyanate is a two-component polymeric MDI based system utilizing a low global warming potential blowing agent. This system is designed for use in pipe insulation applications. The desired foam performance and suitability of use at any service temperature must be tested and qualified by the end user.

ELASTOPOR® P 15953R RESIN COMPONENT

Appearance	Amber liquid
Odor	Slight amine
Specific Gravity @ 73°F	1.04 ± 0.02
Resin Viscosity @ 73°F	730 ± 100 cps
Flash Point, ASTM 3278-89	> 93°C

ELASTOPOR® P 1001U ISOCYANATE COMPONENT

Appearance	Dark brown liquid
Odor	Slight aromatic
Viscosity @ 77°F	200 ± 30 cps
Flash Point	> 400°F
Vapor Pressure at 20°C	0.00016 mm Hg

STORAGE RECOMMENDATIONS

Resin - Shelf Life	180 days
- Temperature	16 - 27 °C (60 - 80 °F)
Isocyanate - Shelf Life	365 days
- Temperature	10 - 25 °C (50 - 77 °F)

For more information on this product, please contact the BASF Tech Desk at **800.527.8324** or techquestions.na@basf.com

ELASTOPOR® P 15953R SYSTEM
TECHNICAL DATA SHEET

ELASTOPOR® P 15953R RESIN COMPONENT

Parts by Weight	85 Resin / 100 Isocyanate
Parts by Volume	1:1

HANDMIX REACTIVITY

Resin/Isocyanate Temperature	53°F / 73°F
Mix Time Jiffy Mixer @ 1720 rpm	8 seconds
Cream Time	40 - 55 seconds
Gel Time	240 - 280 seconds
Tack Free Time	500 - 540 seconds
Free Rise Density #10 Cup	2.7 - 2.9 pcf

DIMENSIONAL STABILITY*

%Volume Change, D2126 ASTM	
158°F 28 days	-0.02%
158°F / 97% RH 28 days,	0.41%
-4°C, 28 days	0.27%

**Physical property values were measured on a specimen taken from a moulded 2' x 2' x 4" laboratory sample.*

For more information on this product, please contact the BASF Tech Desk at **800.527.8324** or techquestions.na@basf.com

ELASTOPOR® P 15953R System

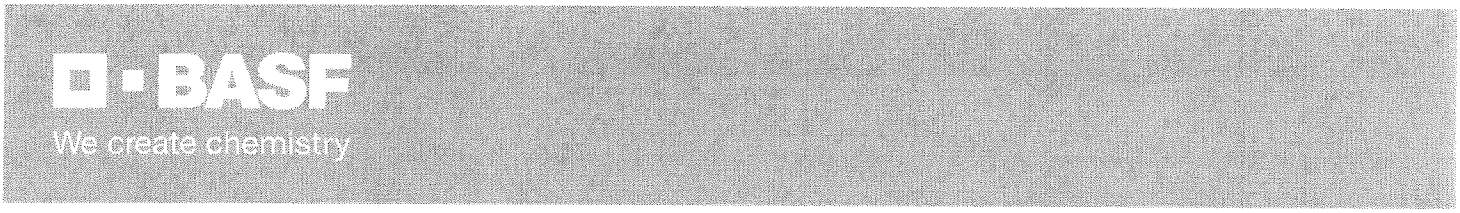
TECHNICAL DATA SHEET

TYPICAL PHYSICAL PROPERTIES**

Molded, ASTM D 1622	4.2 pcf
Core Density, ASTM D 1622	3.6 pcf
Compressive Strength @10% deflection, perpendicular, ASTM D 1621	49 psi
Compressive Modulus, ASTM D 1621	970 psi
Compressive Strength @10% deflection, parallel, ASTM D 1623	51 psi
Compressive Modulus, ASTM D 1621	1,236 psi
Water Absorption, ASTM D 2842	
Surface Area	0.07 lb/ft²
Volume	2.53 lb/ft³
% by volume	4.06%
Closed Cells, ASTM D 6226	92% (uncorrected)
k Factor, ASTM C518	
Initial	0.161 BTU-IN/HR-FT²-°F
Aged, 30 days	0.201 BTU-IN/HR-FT²-°F

***Physical property values were measured on a specimen taken from a moulded 2' x 2' x 4" laboratory sample.*

For more information on this product, please contact the BASF Tech Desk at **800.527.8324** or techquestions.na@basf.com



Mastic End Seal

1.08-End Seal Type

ErgonArmor
TECHNICAL COATING SOLUTIONS ™

- Weathercoat and vapor seal over insulation in normal or corrosive atmospheres
- Corrosion protection
- Waterproofing

BLACKHAWK Seal Kote

Meets ASTM D 4479 Type II

Functions, Typical Uses

Vapor Seal and Weather Barrier in normal or corrosive atmospheres

- Over insulation on low temperature storage tanks, process vessels
- Over foamed-in-place polyurethane on machinery, roofs, etc.
- As a vapor barrier under polyurethane foam
- Over insulation on underground chilled water lines
- Over insulated ells, tees, etc. on piping

Corrosive Prevention

- Over metal buildings, roofs, structural steel, barges, piping, kilns, etc.
- Over cement concrete structures in plant process, or corrosive chemical areas
- On totally or intermittently water immersed bridge structures, waterfront construction

Applications

Surface Preparation

All surfaces to be coated should be dry and free of dust or loosely bonded insulation. With proper equipment to warm the Seal Kote, applications can be made with surface temperatures below freezing provided the surfaces are frost free.

Priming is desirable on porous, dusty or fibrous insulation types. Such surfaces may be primed with BH SP Asphalt by brush or spray, with coverage at 150 to 250 sq. ft. per gallon, depending on surface roughness and degree of absorptivity of the insulation. Where unusual insulation movement might be expected due to thermal differentials, or undue mechanical stress, a glass fabric may be imbedded as reinforcement. A tack coat of about 2 gallons per 100 sq. ft. of Seal Kote should be applied, the fabric pressed in smoothly and a second coat of Seal Kote applied to the desired thickness.

It is also recommended that the coating be reinforced with strips of imbedded glass fabric at edges, angles and protrusions.

In areas where corrosive conditions are severe, and especially where sharp corners or edges are to be coated, added protection against under film corrosion creep at edges and unavoidable coating holidays is recommended in the form of primer systems. Commercial vinyl wash or chromate primers have been successful under Seal Kotes in severe corrosive conditions.

Application Methods

Brush Grade is usually applied by a soft bristle brush. Two coats are recommended, the second applied with brush strokes running at right angles to those of first application.

Spray Grade is of the correct consistency for spray application through industrial type mastic spray equipment. Either airless or air atomizing type equipment may be used (refer to Spray Recommendations data sheet). Large areas may be coated quickly and efficiently by this method of application. By this method, a one-coat thickness of up to 1/8" wet film may be applied.

Trowel Grade is applied by troweling or palming with coating films up to 3/16" thickness. In troweling, wetting the trowel with mineral spirits will ease the pull required. The trowel grade is also well suited for caulking purposes and can be extruded rapidly through a hand or pressure caulking gun.

Corrosive Conditions - As in all coating applications, metal surface preparation is extremely important to insure good coating bond and lasting corrosion protection. The "Surface Preparation Specifications" approved by the Steel Structures Painting Council serve as excellent guidelines for coating application. In severely corrosive environments specification SSPC-SP6-63, "Commercial Blast Cleaning," or SSPC-SP8-63, "Pickling," should be used. In mildly corrosive atmospheres SSPC-SP2-63, "Hand Tool Cleaning," SSPC-SP3-63, "Power Tool Cleaning," or SSPC-SP7-63, "Brush-Off Blast Cleaning," may be used.

Military or Federal Specification
Mil-C-82052 (Dock)
SS-A-00694C; Brush, Spray
SS-A-00694d; Brush only

ErgonArmor
A Division of Ergon Asphalt & Emulsions
450 Fumston Road
Kansas City, KS 66115
1-800-456-8556
Fax 913-481-3419

Mastic End Seal

Typical Properties & Performance

Grade	Light	Medium	Heavy
Application By	Brush	Spray	Trowel
Application Temperature (Material), °F.	50-120	50-120 Brush 80-120	50-100 (can be sprayed above 90)
Flash Point, Pensky Martens Closed Cup, °F., Min.	100	100	100
Solids, weight %, Min.	63	63	68
Corrosion to steel, copper aluminum	None	None	None
Decrease in film thickness on curing, %	37	41	37
Flow of cured film at 325°F.	None	None	None
Approximate weight, lbs./gal. At 60°F.	8.5	8.53	8.55
Dry to touch, 3/32" film, hrs., max.	2.0	2.0	2.0
Dry to firm, 3/32" film, hrs., max.	24	24	24
Salt fog resistance, 1/16" cured film, complete protection of steel panel, hrs., min.	500	500	500
Resistance to abrasion by sandblast	Excellent	Excellent	Excellent
Cracking or disbonding of 1/16" cured film on steel panel, rapid temp change from 140°F. to -60°F.	None	None	None
Outdoor weather performance	Excellent	Excellent	Excellent
Water Vapor Permeability-Test Method ASTM E-96, Method E, Perm-Inch	0.0021	0.0030	0.0025
Fire Retardant Properties: Uncured Film	Poor	Poor	Poor
Cured Film (Flame Spread Index-U.L.)	150	150	150
Thermal Conductivity, Estimated of Cured Film	1.7 BTU/hr. - sq. ft. - °F. - inch		
Resistance to solutions of acid, 60 day immersion of steel panels coated with 3/32" film.	No appreciable attack, blistering or hardening of coating or corrosion of panels by 10% HCl, 10% H_2SO_4 and 10%, 30% and 85% solutions of phosphoric acids. Not recommended for concentrated nitric acid exposure.		
Resistance to solutions of alkalies and salts, 60 day immersion of steel panels coated with 3/32" film.	No appreciable attack, blistering or hardening of coating or corrosion of panels by solutions of 10% and 30% NaOH, 45% ammonium nitrate, and saturated solution of ammonium sulfate.		
Resistance to oils, greases, solvents	Poor. Not recommended for application in locations where exposed to solvents of asphalt.		
Service Temperature Range Cured Film, °F.	-60 to 325	-60 to 325	-60 to 325

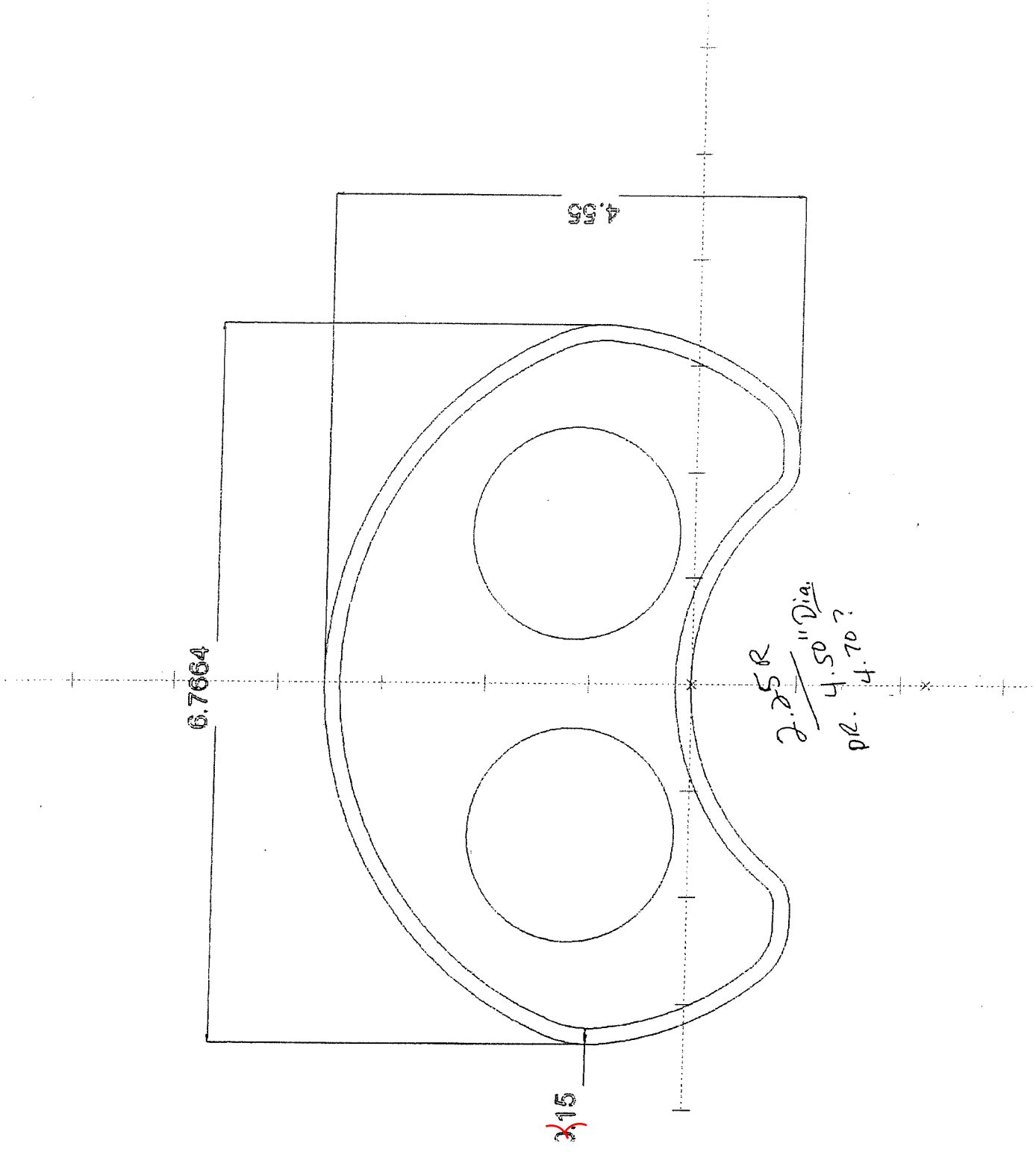
Coverages

Dry Film Coverage Equivalents for Thickness BH Seal Kote

Dry Film Thickness Inches	Wet Film Thickness Required to Nearest 1/64"	Coverage Sq. Ft./ Gallon	Required Gallons/100 Sq. Ft.
1/32"	3/64"	34.3	2.9
1/16"	7/64"	14.7	6.8
3/32"	5/32"	10.3	9.7
1/8"	13/64"	7.9	12.7
3/16"	19/64"	5.4	18.5
1/4"	13/32"	4.0	25.0

Limitations: Neither can be used with foamed styrene insulation, or when exposed to oils and solvents, or when exposed to concentrated nitric acid.

1.12 -1 CHANNEL SPECIFICATION
3" x 7" KIDNEY BEAN GLYCOL CHANNEL



Reiff Manufacturing

www.reiffman.com

670 B Street, Walla Walla, WA 99362 (800) 835-1081

10x10 STATE of ALASKA SHELTER

ALL OUR SHELTERS ARE DESIGNED THE SAME AS THIS SHELTER.

FLOOR LOAD 200 PSF+
ROOF 90 PSF
WIND 250 MPH
SEISMIC ZONE 4

ANY SPECIFIC ITEMS UPON YOUR REQUEST FOR PROPOSAL WILL BE ADHERED TO.
NOTE: ELECTRICAL COMPONENTS INCLUDING CONDUIT, JUNCTION BOXES, MAIN PANELS, EXHAUST FANS, LIGHTING, SURGE PROTECTORS, AIR CONDITIONERS, ETC., CAN BE PLACED ON ANY WALL OF THE SHELTER. THE 'LAYOUT' OF THESE ITEMS ARE NOT RESTRICTED. ALSO THE DOOR CAN BE PLACED IN ANY WALL. " WE'LL PUT IT WHERE YOU WANT IT."

SHEET AND DRAWING INDEX

SHOP DRAWING / SUBMITTAL REVIEW

☒ Approved ☐ Approved as Noted

☐ Partial Approval, Resubmit as Noted ☐ Revise and Resubmit

NOTE: CORRECTIONS OR COMMENTS MADE ON CONTRACTOR'S SUBMITTAL/SHOP DRAWINGS DURING THIS REVIEW DO NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH THE CONTRACT DRAWINGS OR SPECIFICATIONS. THIS SUBMITTAL HAS BEEN REVIEWED FOR CONFORMANCE WITH THE CONTRACT DOCUMENTS ONLY. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRECTING ALL QUANTITIES AND DIMENSIONS, FABRICATION PROCESSES AND TECHNIQUES, COORDINATING WORK WITH OTHER TRADES, AND SATISFACTORY AND SAFE PERFORMANCE OF THE WORK.

By: Karl Hulse Date: 6-13-22

CRW ENGINEERING GROUP, LLC
www.crweng.com

Anchorage: 3940 Arctic Blvd. Suite 300, Anchorage, AK 99503, Phone: (907) 562-3252

Palmer: 808 S. Bailey St. Suite 104, Palmer, AK 99645, Phone: (907) 707-1352

SUBMITTAL APPROVAL
Signature or Initial: Date:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/8"
ANGULAR: MACH ± 1°
BEND ± 1°
TWO PLACE DECIMAL **± 0.1**

ACCURACY TOLERANCE
(Job Specific): 1/4" U.N.O.

DRAWN	DMR	06/05/22
CHECKED	XXX	00/00/20

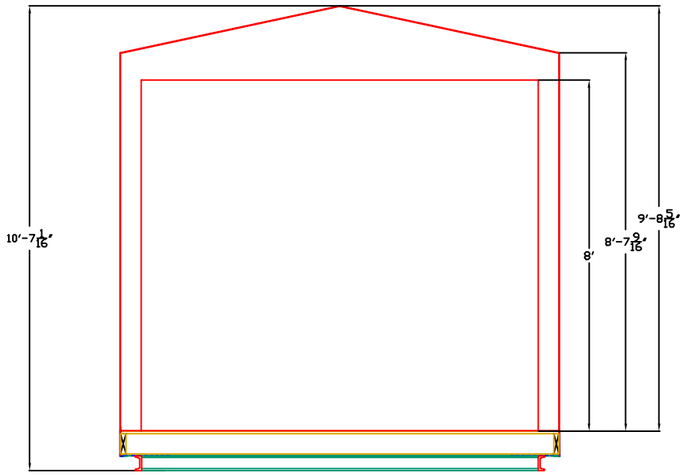
Reiff Manufacturing
www.reiffman.com
670 B Street, Walla Walla, WA 99362 (800) 835-1081

TITLE: **10x10 Well Enclosure**
Unalakleek, Alaska

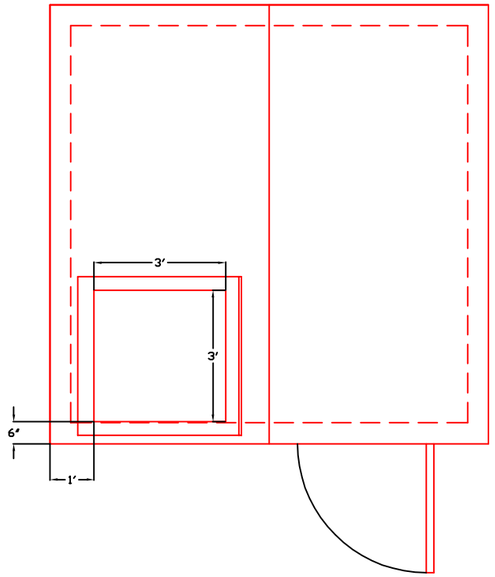
FOR: State of Alaska

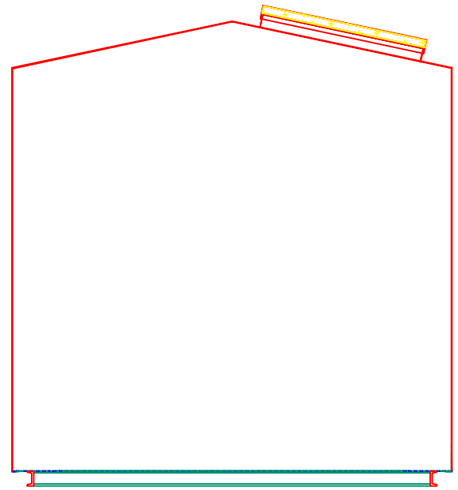
REIFF#: Job 5100

REVISION: 1 **SHEET:** 1 / 7



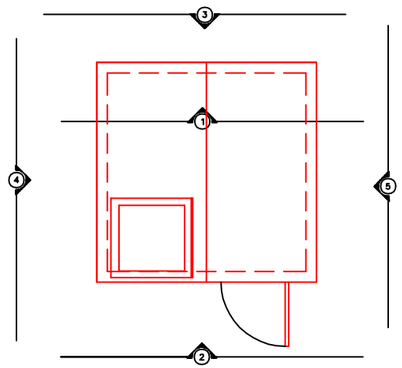
1 TYPICAL CROSS SECTION
NTS

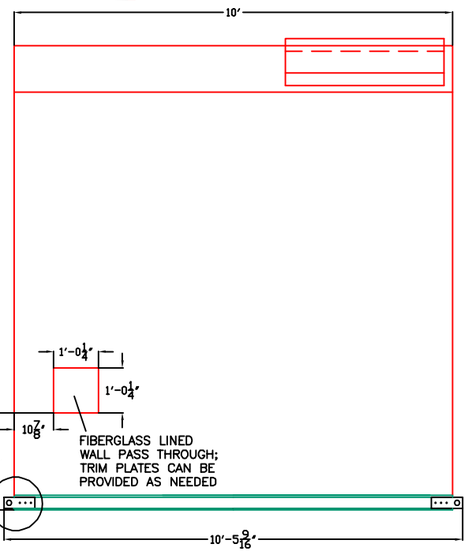




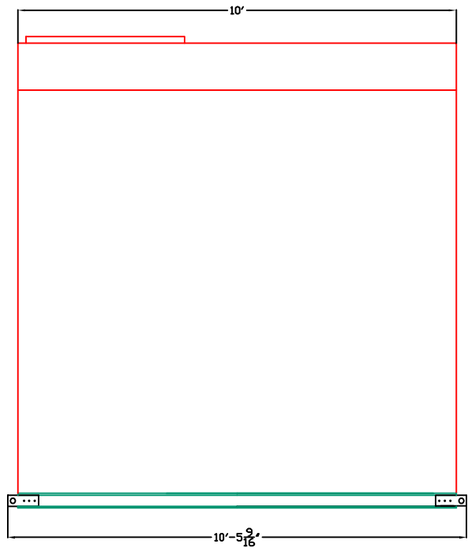
3 REAR VIEW
NTS

2 FRONT VIEW
NTS

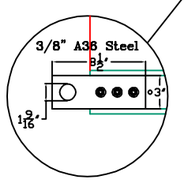




4 SIDE VIEW
NTS



5 SIDE VIEW
NTS



LIFTING EYE
TYP. 4 PLACES

SUBMITTAL APPROVAL
Signature or Initial: Date:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/8"
ANGULAR: MACH ± 1°
BEND ± 1°
TWO PLACE DECIMAL ± 0.1

ACCURACY TOLERANCE
(Job Specific): 1/4" U.N.O.

DRAWN	DMR	05/25/22
CHECKED	xxx	00/00/20

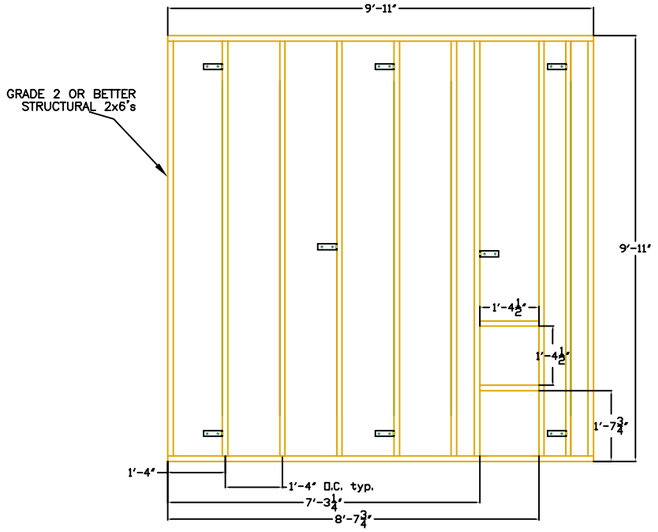
Reiff Manufacturing
www.reiffman.com
670 B Street, Walla Walla, WA 99362 (800) 835-1081

TITLE: **10x10 Well Enclosure**
Unalakleek, Alaska

FOR: State of Alaska

REIFF#: Job 5100

REVISION: 1 **SHEET:** 2 / 7



FLOOR DESIGN

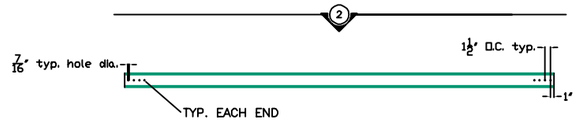
3 PLAN VIEW, NTS

FLOOR JOISTS ARE GRADE 2 OR BETTER STRUCTURAL GRADE DOUGLAS FIR 2X6 ON 16" CENTERS

NOTE: THE WAY OUR FLOOR IS DESIGNED, WE CAN INCREASE THE DESIGN LOAD ON THE FLOOR SIMPLY BY ADDING FLOOR JOISTS. THE FLOOR AS DRAWN IS A 200 PSF FLOOR. THIS CAN BE INCREASED TO AS MUCH AS 600 PSF QUITE EASILY.

ATTACH SUBFLOOR TO 2x6's WITH 2-3/8" RING SHANK ON 12" MIN. CENTERS AND GLUE.

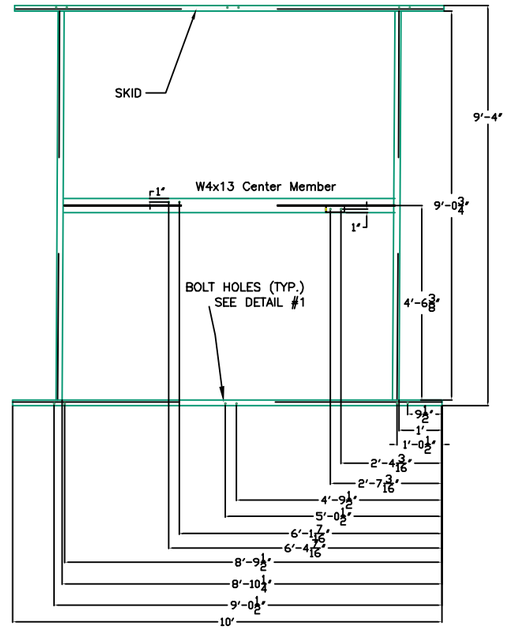
ALL WELDS ARE GAS METAL ARC WELDING (GMAW), 1/4" FILLET WELD



NOTE: THE ABOVE HOLES ARE FOR GROUNDING LUGS. OTHER THAN BEING AT LEAST 7" FROM THE END, LOCATION IS OPTIONAL.

SIDE VIEW OF SKID

1 NTS

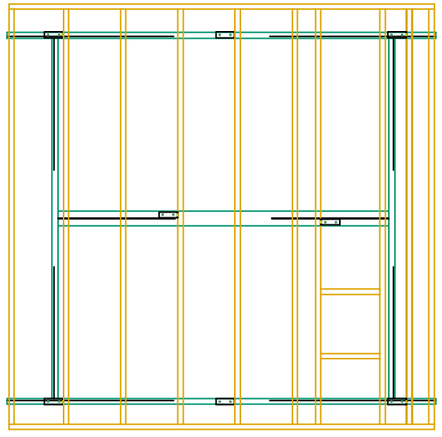


SKID DESIGN 10x12

2 NTS

FLOOR W/SKID

4 PLAN VIEW + SKID, NTS



SKID MATERIAL IS 4"x6.25 LB/FT CHANNEL PERIMETER, CENTER MEMBER IS W4X13 WIDE FLANGE BEAM ASSEMBLY IS HOT DIPPED GALVANIZED

Confidential and Proprietary: To be used with Reiff Manufacturing ONLY

SUBMITTAL APPROVAL
Signature or Initial: Date:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/8"
ANGULAR: MACH ± 1°
BEND ± 1°
TWO PLACE DECIMAL ± 0.1
ACCURACY TOLERANCE (Job Specific): 1/4" U.N.O.

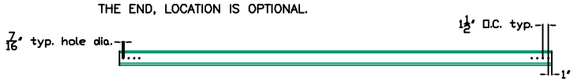
DRAWN	DMR	05/25/22
CHECKED	XXX	00/00/20

Reiff Manufacturing
www.reiffman.com
670 B Street, Walla Walla, WA 99362 (800) 835-1051

TITLE: **10x10 Well Enclosure**
Unalakleek, Alaska
FOR: State of Alaska
REIFF#: Job 5100
REVISION: 1 **SHEET:** 3 / 7

TYP. EACH END

NOTE: THE ABOVE HOLES ARE FOR GROUNDING LUGS. OTHER THAN BEING AT LEAST 7" FROM THE END, LOCATION IS OPTIONAL.

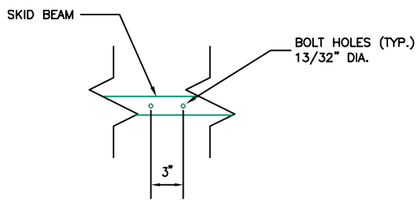


4 SIDE VIEW OF SKID

NTS

1 LIFTING EYE VIEW

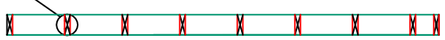
NTS, TYP. 4 PLACES



5 SPACING BOLT HOLES

NTS

3" x .131" ROUND NAILS, GLUE COATED TO ATTACH FLOOR JOISTS TO RIM JOISTS. 3 TYP EACH SIDE FOR EACH FLOOR JOIST TO RIM JOIST



6 SIDE VIEW FLOOR DESIGN

NTS

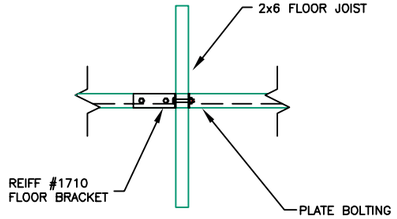
7 END VIEW FLOOR DESIGN

NTS

ALL WELDS ARE GAS METAL ARC WELDING (GMAW), 1/4" FILLET WELD

SKID MATERIAL IS 4"x6.25 LB/FT CHANNEL ASSEMBLY IS HOT DIPPED GALVANIZED AFTER FABRICATION.

NOTE: SKIDS HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A123

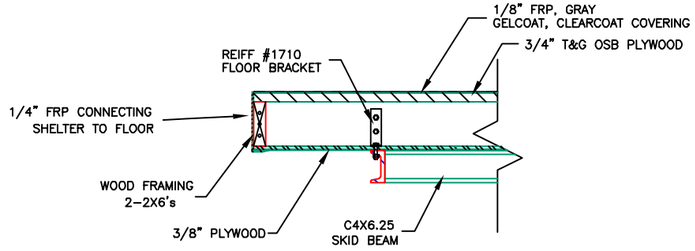


1 TOP VIEW FLOOR MOUNTING

NTS

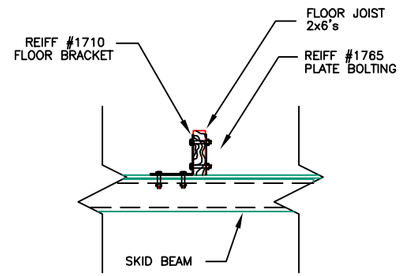
NOTE: THE WAY OUR FLOOR IS DESIGNED, WE CAN INCREASE THE DESIGN LOAD ON THE FLOOR SIMPLY BY ADDING FLOOR JOISTS.

ATTACH SUBFLOOR TO 2x6's WITH 2" X .112" RING SHANK NAILS ON 6" CENTERS AND GLUE.



2 END VIEW FLOOR MOUNTING

NTS



3 FRONT VIEW FLOOR MOUNTING

NTS

SUBMITTAL APPROVAL
Signature or Initial: Date:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/8"
ANGULAR: MACH ± 1°
BEND ± 1°
TWO PLACE DECIMAL ± 0.1

ACCURACY TOLERANCE
(Job Specific): 1/4" U.N.O.

DRAWN	DMR	05/25/22
CHECKED	XXX	00/00/20

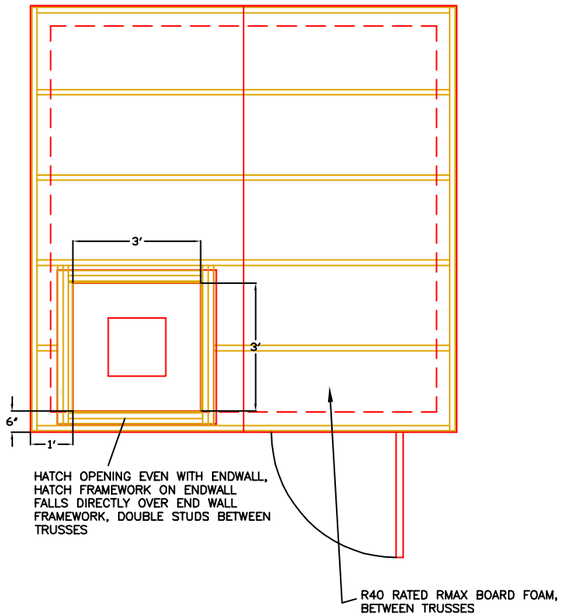
Reiff Manufacturing
www.reiffman.com
670 B Street, Walla Walla, WA 99362 (800) 836-1061

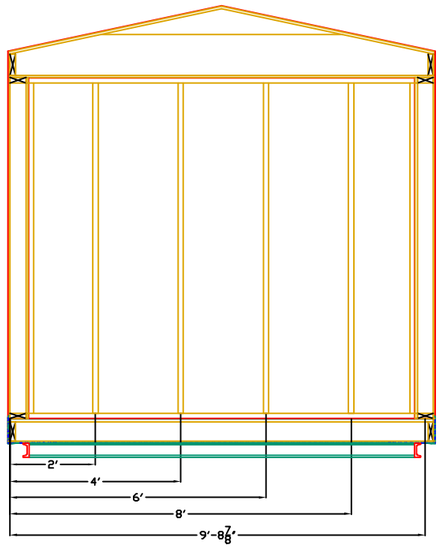
TITLE: **10x10 Well Enclosure**
Unalakleek, Alaska

FOR: State of Alaska

REIFF#: Job 5100

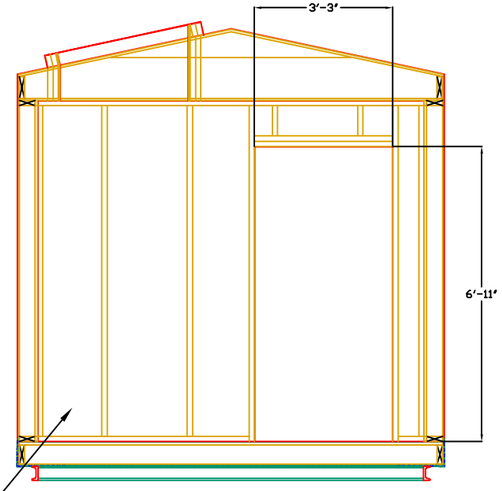
REVISION: 1 **SHEET:** 4 / 7





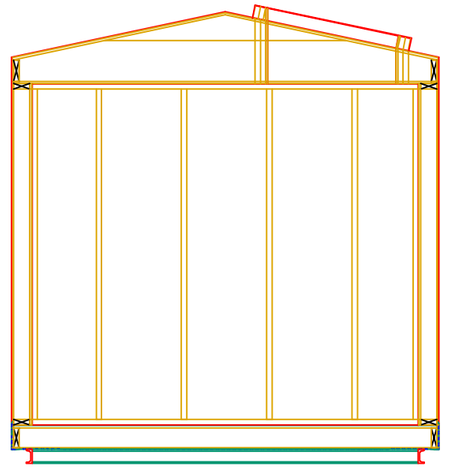
2 TYPICAL WALL CROSS SECTION

NTS



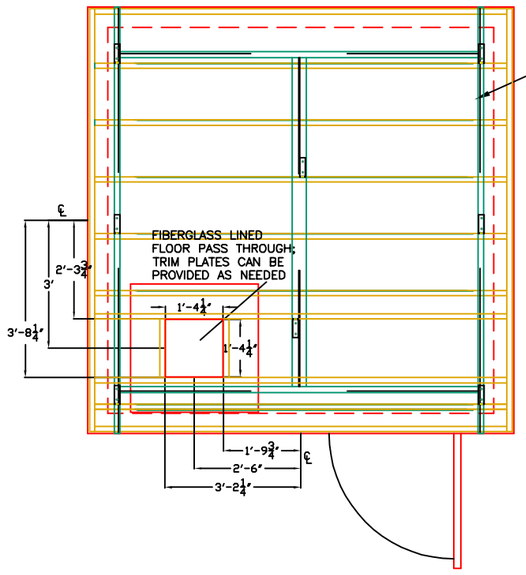
1 FRONT ELEVATION

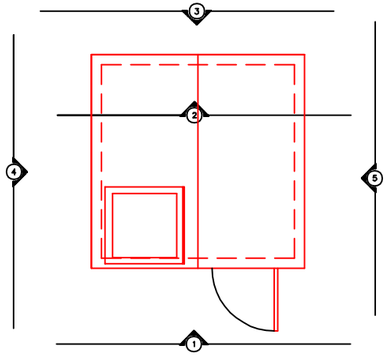
NTS

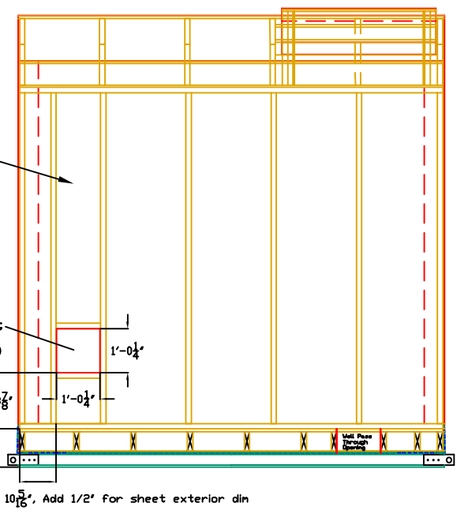


3 REAR ELEVATION

NTS

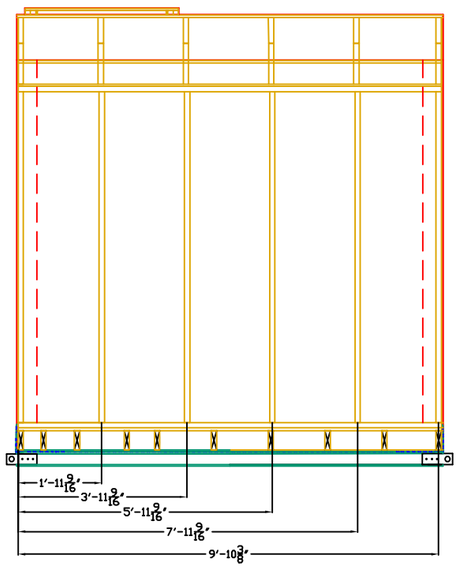






4 SIDE ELEVATION

NTS



5 SIDE ELEVATION

NTS

SUBMITTAL APPROVAL

Signature or Initial: Date:

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/8"
ANGULAR: MACH ± 1°
BEND ± 1°
TWO PLACE DECIMAL ± 0.1

ACCURACY TOLERANCE
(Job Specific): 1/4" U.N.O.

DRAWN	DMR	05/25/22
CHECKED	XXX	00/00/20

Reiff Manufacturing
www.reiffman.com
870 B Street, Walla Walla, WA 99362 (800) 635-1081

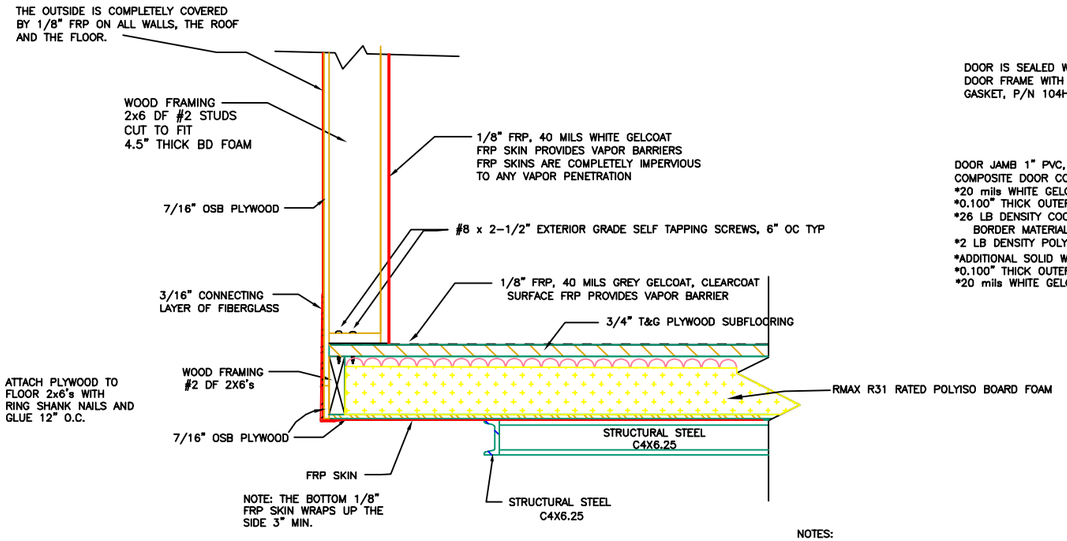
TITLE: **10x10 Well Enclosure**
Unalakleek, Alaska

FOR: State of Alaska

REIFF#: Job 5100

REVISION: 1

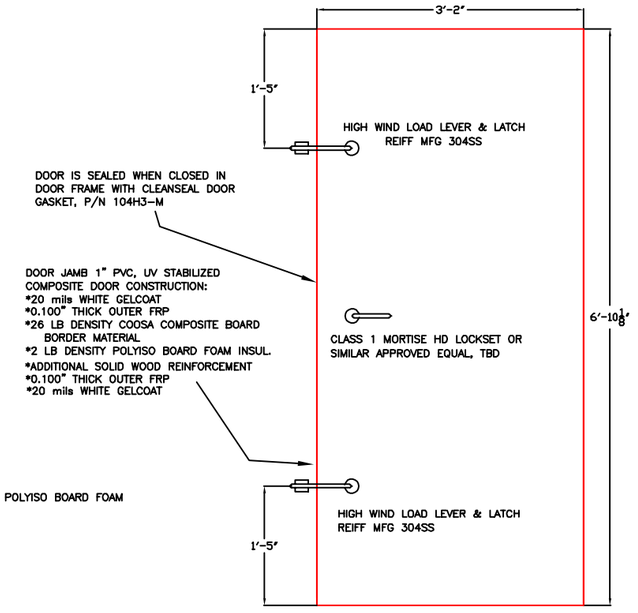
SHEET: 5 / 7



DETAILED FLOOR CONNECTION

1 NTS

FRP COVERS ENTIRE SHELTER INTERIOR
FRP SKIN PROVIDES VAPOR BARRIERS
FRP SKINS ARE COMPLETELY IMPERVIOUS TO ANY VAPOR PENETRATION



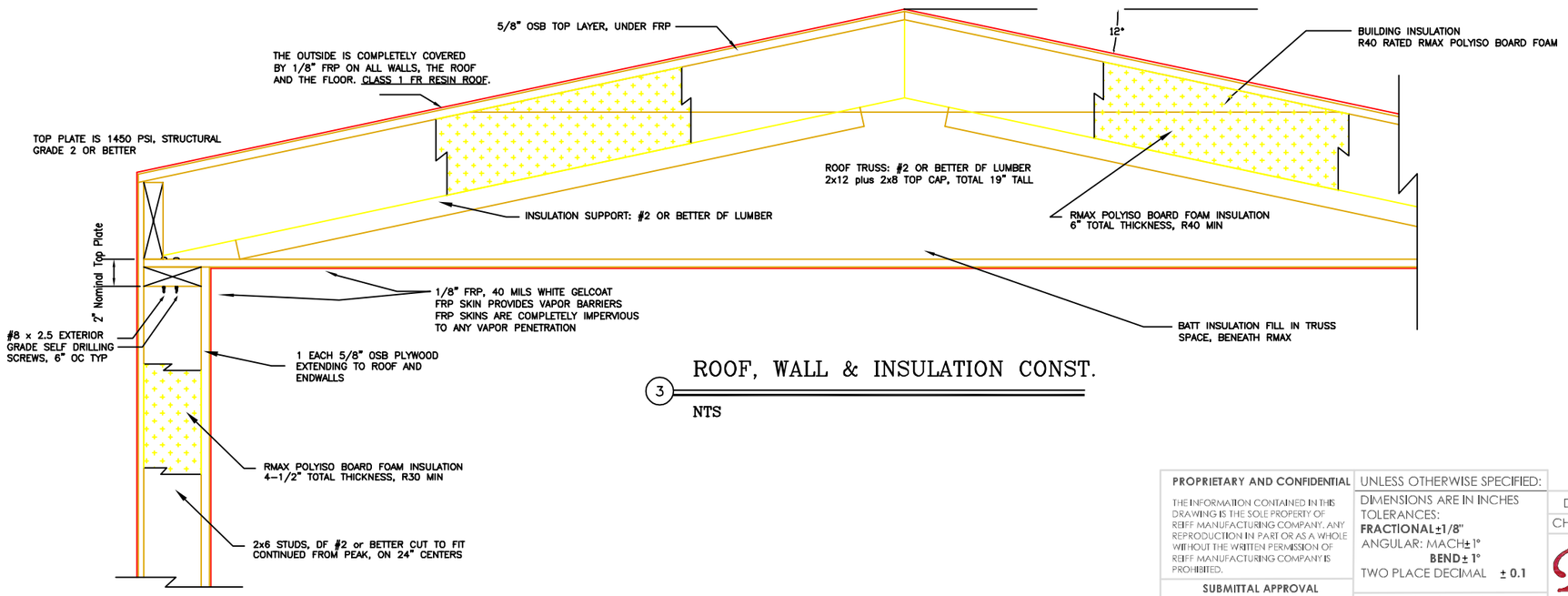
FIBERGLASS DOOR

2 NTS

NOTES:

1. ALL FOAM THAT IS ATTACHED TO FRP MUST BE APPLIED TO A WET LAMINATE AND BE APPLIED IN SUCH A MANNER TO ACHIEVE A FULL BOND (DOORS & HATCH).
2. ALL FOAM THAT IS INSTALLED IN STUD GAPS TO BE SNUG, GAP FREE
3. ROOF TRUSSES ARE TO BE ATTACHED TO TOP PLATE BY #8 x 2-1/2" SELF TAPPING SCREWS 6" O.C.
4. THE WALLS HAVE 2X4'S CUT TO FIT AND INSTALLED IN THE SAME MANNER AS THE ROOF PEAK AND ROOF EDGES BRACES.
5. ALL WALL STUDS HAVE 24" SPACING UNO.
6. INSULATION IS 4.5" RMAX POLYISOCYANURATE BOARD FOAM INSULATION OR EQUAL.

ROOF ASSEMBLY COMPLIANT WITH ASTM E108 class C, FLAME SPREAD <13'



ROOF, WALL & INSULATION CONST.

3 NTS

SUBMITTAL APPROVAL
Signature or Initial: Date:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/8"
ANGULAR: MACH ± 1°
BEND ± 1°
TWO PLACE DECIMAL ± 0.1

ACCURACY TOLERANCE (Job Specific): 1/4" U.N.O.

DRAWN	DMR	05/25/22
CHECKED	XXX	00/00/20

Reiff Manufacturing
www.reiffmfg.com
670 B Street, Walla Walla, WA 99362 (800) 635-1081

TITLE: **10x10 Well Enclosure**
Unalakleek, Alaska

FOR: State of Alaska

REIFF#: Job 5100

REVISION: 1

SHEET: 6 / 7

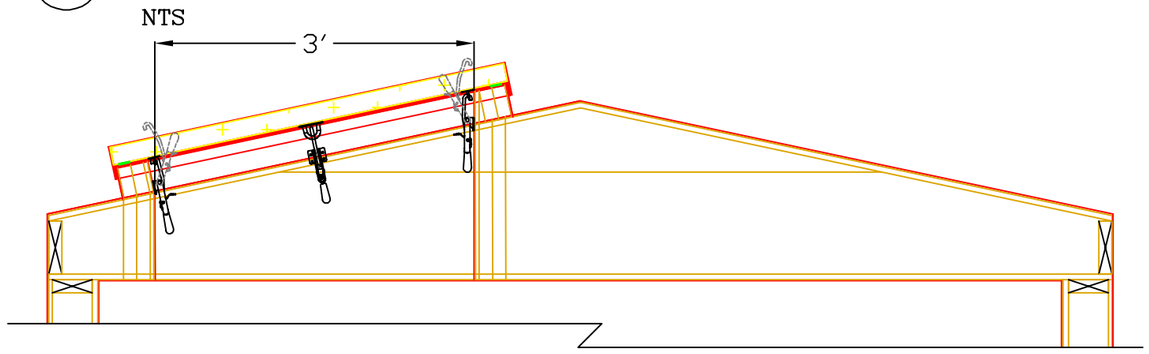
HATCH & PASS THROUGH:

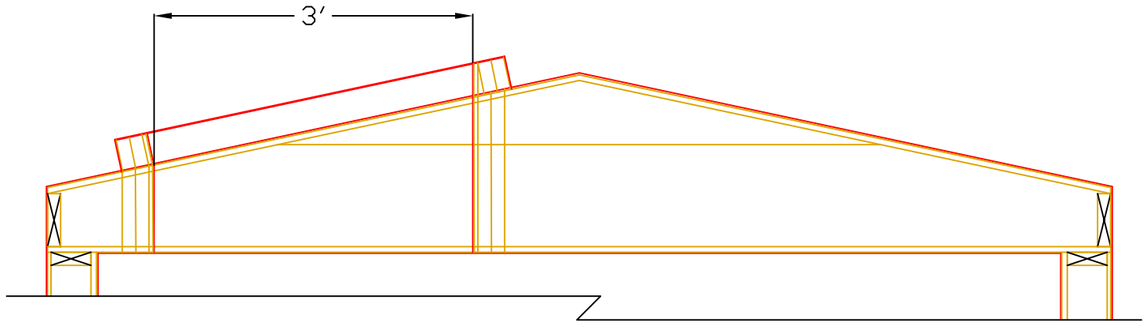
1. HATCH $\frac{1}{4}$" TOTAL FRP BUILDUP, 2" BOARD FOAM INS.
2. STAINLESS DRAW LATCH, 4 PER HATCH
   *1 PER SIDE
   *SOLID BACKING IN LID FOR ATTACHMENT
3. P–SEAL ON HATCH SIDE, MCMASTER p/n 93085K91
3. PASS THROUGH CONSTRUCTION:
   *DOUBLE 2 by FRAMEWORK,
   *$\frac{7}{16}$" INNER SHEETING
   *$\frac{1}{8}$" FIBERGLASS COVERING, SEAMLESS

ROOF with HATCH

2

NTS

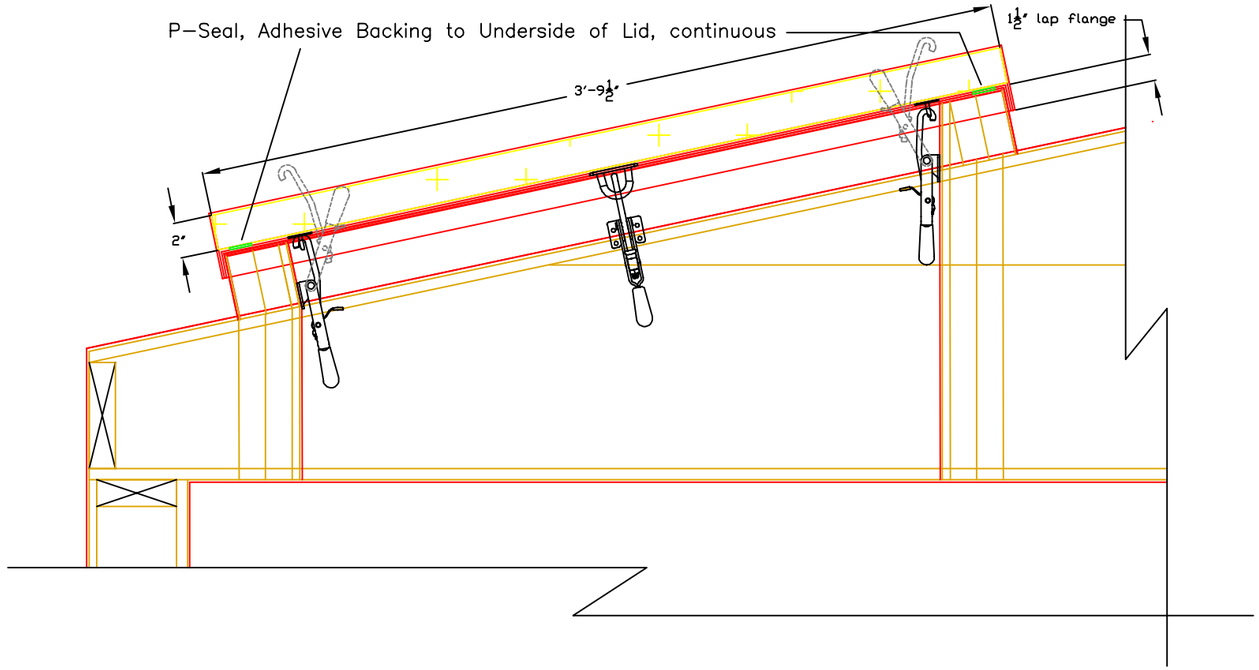




ROOF with OPENING

2

NTS



HATCH SECTION

2

NTS

Toggle clamps located on inside of opening. Clamps could also be mounted on lid with catches mounted on sidewalls. A 90 degree drawing toggle clamp is available for this application. If you prefer this you can approve as noted and require us to change to 90 degree style and mount draw clamps to hatch lid. (Grey toggle clamp is extended position, FYI).

SUBMITTAL APPROVAL
Signature or Initial: Date:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/8"
ANGULAR: MACH ± 1°
BEND ± 1°
TWO PLACE DECIMAL ± 0.1
ACCURACY TOLERANCE
(Job Specific): 1/4" U.N.O.

DRAWN	DMR	05/25/22
CHECKED	XXX	00/00/20

Reiff Manufacturing
www.reiffman.com
670 B Street, Walla Walla, WA 99362 (800) 835-1051

TITLE: **10x10 Well Enclosure**
Unalakleek, Alaska

FOR: State of Alaska

REIFF#: Job 5100

REVISION: 1 **SHEET:** 7 / 7

THERMASHEATH®

INSULATION FOR THE BUILDING ENVELOPE

PRODUCT DESCRIPTION

Rmax Thermasheath® is an energy-efficient thermal insulation board composed of a closed-cell polyisocyanurate (polyiso) foam core bonded to reinforced aluminum foil facers with clear coating for limited protection against oxidation on each side.

COMPLIANCES

- ASTM C1289 Type I, Class 1 and 2
- International Building Code (IBC) Section 2603, Foam Plastic
- ASHRAE 90.1
- DrJ TER 1309-03
- ESR-1864, ICC Evaluation Service
- International Energy Conservation Code (IECC)
- Miami-Dade County Product Control Approved
- RR 25322, City of Los Angeles Research Report
- California Code of Regulations, Title 24 (BHFTI License T1523)
- Tested per NFPA 285 to comply with IBC Section 2603.5.5
- Tested per NFPA 286 (ICC-ES AC12 Appendix B)
- Water-Resistive Barrier (WRB) per ICC-ES AC71 (ASTM E331, AATCC Test Method 127)
- Class A Flame Spread and Smoke Developed Indices per IBC Chapter 8, Interior Finishes (1" min.)
- 1, 2, 3 or 4 hour Fire Rated Assemblies as shown in the UL Fire Resistance Directory.

NOTE: For details, requirements and/or limitations, refer to Third-Party Evaluation Reports

APPLICATIONS

Exterior walls (Type I-IV): Masonry, steel stud, FRTW stud; wood stud (Type V); concrete foundation; exterior ducting; limited roofing applications

THERMAL PROPERTIES / PRODUCT DATA

"R" means resistance to heat flow. The higher the R-value, the greater the insulating power.

NOMINAL THICKNESS	THERMAL R-VALUE[1]
Inches	°F•ft²•hr/Btu
0.50	3.2
0.75	5.0
1.00	6.0
1.10	6.7
1.25	7.8
1.50	9.6
1.55	10.0
1.75	11.4
2.00	13.1
2.10	13.9
2.30	15.3
2.50	16.7
2.90	19.6
3.00	20.3
3.50	23.9
3.70	25.3
4.00	27.4
4.50	31.0

[1]Thermal values are determined by using ASTM C518 test method at 75°F mean temperature on material conditioned according to PIMA Technical Bulletin No. 101.

Thermasheath® is shipped in bundles that are approximately 48" high and wrapped in plastic for easy handling. Visit www.rmax.com for a complete list of thicknesses and packaging information.

TYPICAL PHYSICAL PROPERTIES

Physical properties shown are based on data obtained under controlled conditions and are subject to normal manufacturing tolerances.

PROPERTY	TEST METHOD	RESULTS
Density, Overall, Nominal	ASTM D1622	2.0 pcf
Compressive Strength	ASTM D1621	20 psi[1]
Flexural Strength	ASTM C203	60 psi
Flame Spread, Core[2]	ASTM E84	≥ 1" 25 or Less < 1" 75 or Less
Smoke Developed, Core[2]	ASTM E84	< 450
Air Permeance	ASTM E2178	< 0.02 L/(s·m²)
Water Vapor Permeance	ASTM E96	< 0.03 perm
Water Absorption	ASTM C209 ASTM C272	< 0.2% Vol. 0.3% max
Dimensional Stability, Length and Width	ASTM D2126	< 1% Linear Change
Mold Resistance	ASTM D3273	10, no defacement
Service Temperatures		250°F max

[1]Also available in 25 psi upon request. Less than 1" is standard at 16 psi.
[2]Flame spread and smoke numbers are shown for comparison purposes only and are not intended to represent the performance of Thermasheath® and related components under actual fire conditions.

APPLICATION / INSTALLATION

NOTE: For use as a code prescribed Water-Resistive Barrier over wood or steel studs, refer to the Water-Resistive Barrier section for specific installation and securement details.

General – Thermasheath® shall be installed vertically or horizontally with all edges tightly butted. Vertical joints must be backed by framing or structural sheathing. Taping the joints is acceptable, although not required. Rmax recommends using a pressure sensitive tape such as R-SEAL Construction Tape, R-SEAL 3000, or equivalent.

Securement – Rmax recommends a minimum of eight fasteners per 4'x8' board. Additional fasteners may be required in locations expected to experience additional loading (heavy wind drafts/gusts, accelerated wear and tear, etc.). The appropriate number of fasteners also depends on the type of fastener and its capacity; consult fastener manufacturer.

Fasten to wood framing using cap nails, washers with roofing nails, or washers with bugle head screws. When used in conjunction with Thermasheath®-SI, staples at 12" o.c. pattern may be used to fasten Thermasheath®. With staples, Rmax recommends taping the joints as soon as possible. All fasteners shall be long enough to penetrate wood framing a minimum of 1". Fasten to metal framing using self-taping screws and plastic washers. The fasteners shall be long enough to penetrate metal framing a minimum of four threads. Secure to concrete surfaces using plastic masonry fasteners with washer or a quality grade construction adhesive. TRUFAST Walls fasteners, sold by Rmax, are a great option for fastening Thermasheath® to wood, steel and concrete substrates. Refer to the Rmax/TRUFAST Walls Fastener List and Installation Guide for more details.

Water-Resistive Barrier – When Thermasheath® is installed over wood or steel studs with the joints sealed, it serves as a code prescribed Water-Resistive Barrier (WRB). For use as a WRB, Thermasheath® shall be installed with vertical board joints placed directly over wood framing spaced a maximum of 24" o.c. Use a minimum 3/4" cap nail spaced 12:16 o.c. or 1 3/8" staples spaced 12" o.c. at all vertical framing. All insulation board joints must be covered by R-SEAL Construction Tape or R-SEAL 3000. All transitions and throughwall penetrations must be flashed to comply with applicable code.

LIMITATIONS

Thermasheath® is not recommended, nor warranted, for use as a commercial roof insulation. Consult Rmax Sales for suitable commercial roof insulation products.
Thermasheath® is not a structural panel; stud walls insulated with Thermasheath® must be properly braced for lateral loads according to the requirements of local Building Codes.

WARNING

Polyiso is an organic material which will burn when exposed to an ignition source of sufficient heat and intensity and may contribute to flames spreading.
Installations utilizing Thermasheath® must be fully protected on the inhabited side of the building by a thermal barrier such as a minimum of 1/2" gypsum wallboard. Consult local building codes and insurance authorities regarding special applications or details required when using Thermasheath® as an exposed product in uninhabited spaces.

Per the IBC, a WRB is required behind the exterior wall veneer. The code also has provisions regarding vapor retarders, type and location, based on the assembly, climate zone and the amount of continuous insulation. It is up to the design professional to specify an assembly that will perform adequately and meet these requirements.

WARRANTY

See Rmax "Sales Policy" for terms and conditions. Rmax does not assume any responsibility or liability for the performance of any products other than those manufactured by Rmax. **NOTE: All Rmax products must be tarped, placed on skids and kept dry before and throughout construction.**

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Sika

Technical Datasheet

Ashland Performance Materials

HETRON®

HETRON® FR 650 Series Flame Retardant Resins

HETRON FR 650 Series resins are flame retardant[1] polyester resins. Composites made with HETRON FR 650 Series resins have been tested and have achieved a Class 1 Flame Spread per ASTM E-84 without addition of synergists such as antimony trioxide.

HETRON FR 650 Series resins may be classified as a high strength resin per the definition in section § 63.5935 of the US RCP MACT (Title 40 CFR Part 63 Subpart WWWW).

HETRON FR 650 T-20 resin is a low viscosity, promoted, thixotropic, version. It exhibits excellent wet-out properties and low drainage when applied to vertical surfaces. This resin is formulated to contain 35% styrene.

HETRON FR 650 INF-20 resin is a low viscosity promoted resin optimized for the infusion process. This grade may also be used for resin transfer molding. It exhibits excellent glass wet out properties.

APPLICATIONS AND USE

HETRON FR 650 Series resins, depending on the grade selected, can be used in hand lay-up, spray-up, filament winding and infused flame retardant applications. Markets include architectural, mass transit, passenger rail, electrical and mine ducting.

MODAR 814 A resin may be considered where low smoke properties are desired. HETRON FR 992 resin resin may be considered when improved corrosion resistance is desired. Recommendations for specific services and environments can be provided by contacting us at hetron@ashland.com.

TYPICAL LIQUID RESIN PROPERTIES

Property[2] at 25°C (77°F)	Value	Value	Unit
	Thix (T) Version	Infusion (INF) Version	
Viscosity, Brookfield, #2 spindle @ 30 rpm	450	180	MPa·s (cps)
Thixotropic Index	2.8	n/a	
Specific Gravity	1.16	1.16	gm/cc
%Solids	60	60	%

TYPICAL CURING CHARACTERISTICS

Gel time at 25°C (77°F)	Value	Unit
Gel Time, 1.25 gm Norox[3] 925/100 gm resin	25	minutes

Technical Datasheet

Ashland Performance Materials

HETRON®

HETRON® FR 650 Series Flame Retardant Resins

(1) HETRON resin will burn if provided with a sufficient amount of heat and oxygen. The degree of flame retardancy of the cured polyester resin is characterized by the ASTM E-84 tunnel test. This test is performed under strictly controlled conditions where a flame spread rating is assigned according to comparisons with test set-point materials. The behavior of the cured composite under these controlled conditions can vary from an actual fire situation.
(2) Properties are typical values based on material tested in our laboratories or third party laboratories. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.
(3) Registered trademark of Syrgis.

TYPICAL MECHANICAL PROPERTIES

Property(2) of cured casting(4) at 25°C (77°F)	Value (SI)	Value (US)	Method
Tensile Strength	77 MPa	11,200 psi	ASTM D638
Tensile Modulus	3.5 GPa	5.1×10^5 psi	ASTM D638
Tensile Elongation	2.7%	2.7%	ASTM D638
Flexural Strength	120 MPa	17,800 psi	ASTM D790
Flexural Modulus	3.5 GPa	5.1×10^5 psi	ASTM D790
Heat Distortion Temperature	68°C	156°F	ASTM D648

Property(2) of 36% glass laminate(5) at 25°C (77°F)	Value (SI)	Value (US)	Method
Tensile Strength	112 MPa	16,200 psi	ASTM D638
Tensile Modulus	7.4 GPa	1.1×10^6 psi	ASTM D638
Flexural Strength	179 MPa	25,900 psi	ASTM D790
Flexural Modulus	6.5 GPa	9.5×10^5 psi	ASTM D790

Resistance to UV radiation may be improved by adding up to 1.0% CYASORB(6) UV-9 ultraviolet screener to the resin for the exterior exposed surface.

For all surfaces that will be exposed to air during fabrication (top-coating, patching, exterior surfaces, etc.), the addition of 0.4% paraffin wax to the final resin layer is recommended. A waxed surface might affect secondary bonding and flame retardance.

TYPICAL FLAME RETARDANT

Technical Datasheet

Ashland Performance Materials

HETRON®

HETRON® FR 650 Series Flame Retardant Resins

PROPERTIES

Flame retardant testing was performed on HETRON FR 650 T-20 laminates without antimony trioxide.

Test	Value[2]	Method
E-84 Tunnel Test (flame spread index (FSI))	Class 1	ASTM E-84
E 162 Radiant Heat Source Surface Flammability (FSI)[7]	20	ASTM E-162
E-662 Optical Smoke Density - Flaming Exposure[7]	0.22 @ 1.5 minutes	ASTM E-662
	41 @ 4 minutes	
	Maximum - 600	
E-662 Optical Smoke Density - Non-Flaming Exposure[7]	0.14 @ 1.5 minutes	ASTM E-662
	8.3 @ 4 minutes	
	Maximum - 290	
Toxic Gas Gas Generation - Flaming Exposure[7][8]		SMP 800-C
CO (ppm) Max/Avg	443 / 363	
CO_2 (ppm) Max/Avg	4105 / 3272	
SO_2 (ppm) Max/Avg	4 / 3	
Toxic Gas Gas Generation - Non-Flaming Exposure[7][8]		SMP 800-C
CO (ppm) Max/Avg	30 / 20	
CO_2 (ppm) Max/Avg	194 / 182	
SO_2 (ppm) Max/Avg	6 / 5	

(4) Neat resin casting prepared by curing with 1.25 phr MEKP 925H and 0.125 phr TBPB for 18 hours followed by post-curing as follows: 60°C (140°F) for 24 hrs for Tensile and Flex specimens. 150°C (300°F) for 2 hrs for HDT.
(5) Chop / spray manufactured. Ambient cure, no post cure.
(6) Registered trademark of Cytec Industries.
(7) 100 parts resin, 75 parts alumina trihydrate, 44 parts (20%) chopped glass fibers
(8) Bombardier SMP 800-C Toxic Gas Generation. HBr, HCl, HCN, HF and NO_x were not detected in this test.

CERTIFICATES AND APPROVALS

The manufacturing, quality control and distribution of products, by Ashland Performance Materials, comply with one or more of the following programs or standards: Responsible Care, ISO 9001, ISO 14001 and OHSAS 18001.

Responsible Care*

ASHLAND
With good chemistry great things happen.™

Technical Datasheet

Ashland Performance Materials

HETRON® FR 650 Series Flame Retardant Resins

STANDARD PACKAGE	Non-Returnable Drum with Net Weight of 230 Kgs (507 Lbs) DOT Label Requirement: Flammable Liquid
COMMERCIAL WARRANTY	Three months from date of shipment, when stored in accordance with the conditions stated below.
STORAGE	Drums - Store at temperatures below 25°C (77°F). Storage life decreases with increasing storage temperature. Avoid exposure to heat sources such as direct sunlight or steam pipes. To avoid contamination of product with water, do not store outdoors. Keep containers sealed to prevent moisture pick-up and monomer loss. Mild mixing is recommended after prolonged storage. Rotate stock. Bulk - See Ashland's Bulk Storage and Handling Manual for Polyesters and Vinyl Esters. A copy of this may be obtained from Ashland Performance Materials at +1.614.790.3333 or 800.523.6963. All other conditions being equal, higher storage temperatures will reduce product stability and lower storage temperatures will extend product stability.
Notice	All information presented herein is believed to be accurate and reliable, and is solely for the user's consideration, investigation and verification. The information is not to be taken as an express or implied representation or warranty for which Ashland assumes legal responsibility. Any warranties, including warranties of merchantability or non-infringement of intellectual property rights of third parties, are herewith expressly excluded. Since the user's product formulations, specific use applications and conditions of use are beyond the control of Ashland, Ashland makes no warranty or representation regarding the results which may be obtained by the user. It shall be the responsibility of the user to determine the suitability of any of the products mentioned for the user's specific application. Ashland requests that the user reads, understands and complies with the information contained herein and the current Material Safety Data Sheet.

Responsible Care*

Protocols of Mechanical Testing for Composite Materials

Objectives for testing

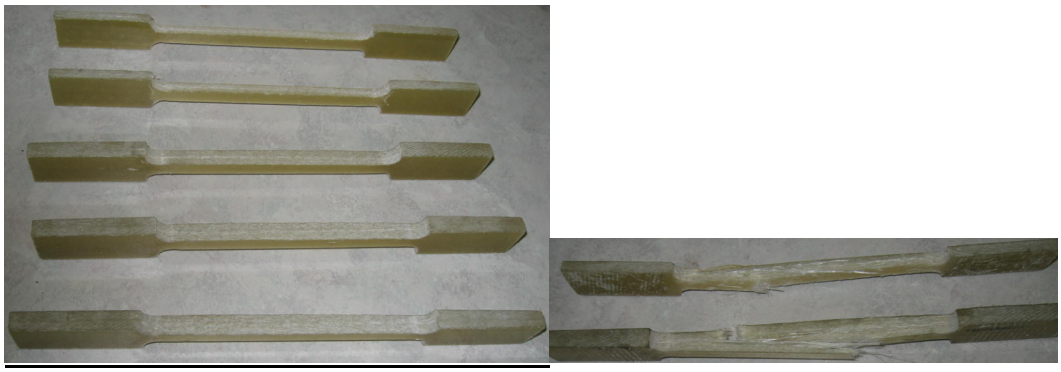
- Present goals
  - Test samples in urgent need
  - Develop protocols of composite materials testing techniques
    - Testing techniques for fiber composites
    - Testing techniques for laminates (fiber-resin-reinforced composites and wood composite structures)
- Long-term goals
  - Establish property database specific for Reiff Manufacturing
  - Develop industry-specific standards for testing protocols of composite materials
  - If possible, develop grant proposal for advanced composite testing facilities through collaboration with Reiff Manufacturing

Objectives for composite simulations

- Develop general simulation protocols of composite materials
- Develop simulation models of composite structures with various application background

Tensile Strength Test

A few samples were tested for the specimens received a few years ago by Kirk Betz [1]. The dog-bone specimens as shown in Figure 1 were pulled using the Instron Hydraulic Universal Tester at WWU. The failure follows a typical pattern of similar fiber composites, breakage accompanying with fiber pullouts from resin. The specimen gauge dimension is about 3/8" x 2/8", with clear finish from a milling machine. One of the samples failed at 2340 lbs, resulted in an ultimate strength of roughly 25 ksi. A very limited numbers of samples were tested and a more careful study was suggested in order to obtain useful results.



(a) Dog-bone specimens **(b) Failed under tension**

Figure 1 tensile specimens prepared for the Instron Hydraulic Universal Testing Machine

As one of the most fundamental experiments, tensile tests of fiber-resin reinforced composites can be done using the Instron Tester at WWU. For more useful work to be accomplished, a design of experiment may be developed to make a systematic study of certain fiber resin composites that are current used in the factory.

Flexural Strength and Elastic Modulus using a Three-Point Bending Fixture

In our engineering materials lab, we have an existing 3-point bending fixture. This fixture may be further improved in design if the test protocol using a 3-point bending test works well. Figure 2 shows how the specimen may be tested using the Olsen Universal Testing Machine in our materials lab.

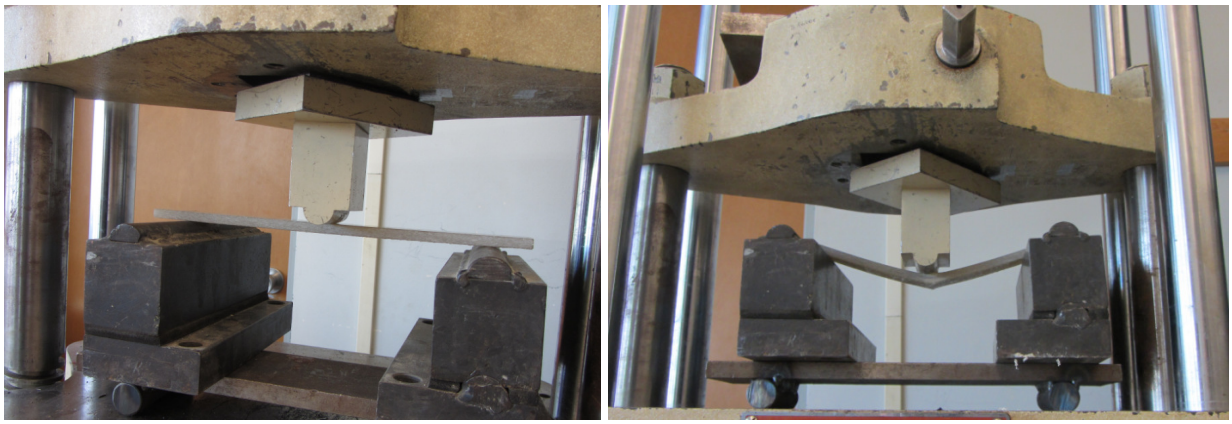


Figure 2: A 3-point bending test using the Olsen Universal Testing Machine

The basic principle using a 3-point bending test is readily available in literature. The basics of this type of test may be illustrated in Figure 3. When the load F is applied at the middle of the specimen, deformation occurs and stress develops in the specimen. At certain load, the specimen fails and the indicator on the machine dial points to the maximum load. Any continuous loading will not cause a rise of the load on the dial. We may denote this load as F_f. Based on the principle of strength of materials, the flexural strength, which is the maximum bending stress across the middle cross-section geometry of the sample, can be expressed as:

$$\sigma_{fs} = \frac{3F_f L}{2bh^2}$$

Where
F_f = failure load [lb]
σ_{fs} = flexural strength [psi]
L = sample span length between the two simple supports [in]
b, h = sample cross-section dimensions [in]

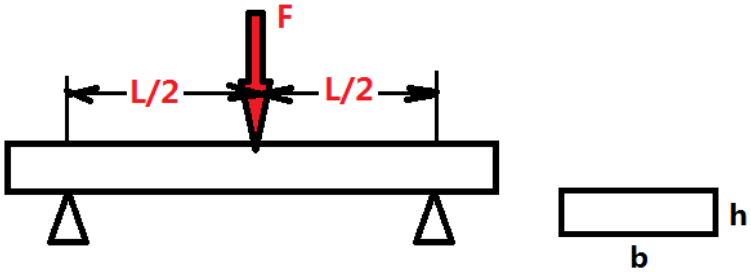


Figure 3: the principle of 3-point bending test for flexural strength and modulus of elasticity

If the vertical displacement along the neutral axis at the middle section of the sample can be monitored during the test, then the modulus of elasticity can be determined using the following formula.

$$F = E\left(\frac{4bh^3}{L^3}\delta\right)$$

Where
F = applied load [lb]
δ = displacement of the neutral surface at the middle section of the sample [in]

I tested two of the samples using our Olsen machine and summarized the test data in Table 1. The results show that the flexural strength of the sample is approximately 33ksi and its modulus of elasticity from the bending test is approximately 1400 ksi, which seems a bit lower than some literature.

Table 1 three-point bending test of the fiber composite samples

Fiber Information: Type of fiber _____
Resin Information: name of the resin _____
Fiber/Resin ratio: 36 vol% of fiber???
Sample Observations: there is a thin mat (one layer?) lined up in the middle of the specimen; chopped fibers mixed bonded by resin on both sides of the mat; one side is rough with fiber clearly seen and the other smooth with gel coat (?)

Sample 1: b = 0.995 in. h = 0.271 in. L = 8 in.

Test #	F (lb)	δ (in.)	$(4bh^3/L^3)\,\delta = 1.5471(10^{-4})\,\delta$	E (ksi)	Notes
1	40	0.17	2.63007E-05	1521	
2	60	0.23	3.55833E-05	1686	
3	80	0.329	5.08996E-05	1572	
4	110	0.461	7.13213E-05	1542	
5	140	0.591	9.14336E-05	1531	
6	160	0.721	0.000111546	1434	
7	180	0.841	0.000130111	1383	
8	200	0.961	0.000148676	1345	
average				**1502**	

Failure load F_f = 200 (lb); Flexural Strength: $\sigma_{fs} = \left(\frac{3L}{2bh^2}\right)F_f$ = 164.2 F_f = **32.84 ksi**

Sample 2: b = 0.996 in. h = 0.393 in. L = 8 in.

Test #	F (lb)	δ (in.)	$(4bh^3/L^3)\,\delta = 4.7231(10^{-4})\,\delta$	E(ksi)	Notes
1	160	0.198	9.35174E-05	1711	
2	200	0.320	0.000151139	1323	
3	240	0.393	0.000185618	1293	
4	280	0.473	0.000223403	1253	
5	320	0.553	0.000261187	1225	
6	360	0.647	0.000305585	1178	
7	400	0.715	0.000337702	1184	
8	420	0.768	0.000362734	1158	
average				**1291**	

Failure load F_f = 420 (lb); Flexural Strength: $\sigma_{fs} = \left(\frac{3L}{2bh^2}\right)F_f$ = 78.01 F_f = **32.76 ksi**

Remarks:

- Load dial may need calibration for accuracy, especially for low load range dial.
- Displacement measurement needs to be improved.

Fig. 4 Failed samples under the 3-point bending tests

Integrated Testing Techniques

- Shear strength test in general
- Fiber composite and wood laminates

A discussion is on-going with Andrew about how the shear strength of fiber-resin-wood composites can be tested in our lab. The grip part might be too short to be applicable using either of the tensile machines.

Fig. 5 Andrew's samples for shear tests

References

[1] Kirk Betz, "Fiber Glass Tank Redesign", senior project report, October 6, 2009

[2] Qin Ma, "Analysis of Design Strength of A Hatchery Round Tank Including Wind Load, Snow Load and Seismic Load", Report, March 3, 2009.

LT-451SS STAINLESS STEEL LATCH TYPE TOGGLE CLAMP (CROSS REFERENCED: 351-SS)

Toggle-style draw clamp for roof hatch (proposed)

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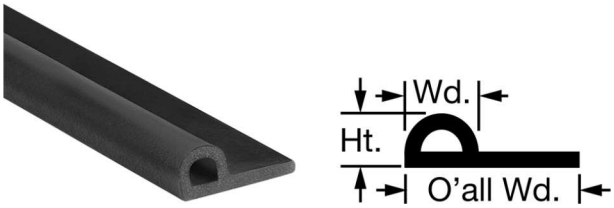

Hatch seal, affix to lid (proposed)

Overall Width	1 1/4"
Width	1/2"
Height	1/2"
Material	EPDM Foam
Cell Type	Closed
Seal	
Edge Style	Bulb
Construction	Hollow
Mount Type	Adhesive Back
Backing Type	Adhesive
Temperature Range	0° to 140° F
Adhesive Temperature Range	0° to 140° F
For Use Outdoors	Yes
For Use With	Water
Color	Black
Length	10 ft., 20 ft., 50 ft., 100 ft., Other
RoHS	RoHS 3 (2015/863/EU) Compliant
REACH	REACH (EC 1907/2006) (01/19/2021, 211 SVHC) Compliant
DFARS	Specialty Metals COTS-Exempt
Country of Origin	United States
USMCA Qualifying	Yes
Schedule B	401610.0000
ECCN	EAR99

Softer and more flexible than EPDM rubber seals, these EPDM foam rubber seals will effortlessly conform to uneven surfaces. They resist water, sunlight, and ozone. They have hollow construction for compressibility and a flange that can be positioned along a door's edge to cover gaps and block dust, noise, and vibration. The foam has closed-cell construction, which resists absorption.