

Pyrogel[®]
HPS

PYROGEL[®] HPS
**INSTALLATION
MANUAL**

Version 1.0



aspen | **aerogels[®]**

PIPE INSULATION Installation Manual

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Aspen Aerogels® recognizes that performance of our state-of-the-art aerogel insulation materials depends on the total thermal integrity of our system. Therefore, we have developed this installation manual with procedures refined in conjunction with our installation partners.

We are constantly striving to develop new application procedures and insulation systems to make our products stand above our competition with quicker delivery times, simpler logistics, and more reliable installation.

We are willing to work with you to develop application procedures to suit your project-specific execution plan.

For specialized training or recommendations regarding our application procedures, call 508-691-1111, or visit info.aerogel.com/contact.

NOTE

Pyrogel HPS is a highly effective barrier to heat flow in high temperature industrial applications. It is critical to properly engineer the system and correctly install the insulation to derive the full advantages of Pyrogel HPS. The technical guidance provided in this document is not exhaustive and is limited only to the scenarios described. Users must evaluate the guidance in light of the system design, applicable site safety guidelines and engineering judgement to adopt and/or revise the guidance as appropriate. When considering Pyrogel HPS in applications involving more than 80 mm insulation thickness or involving composite design with other insulation materials, please contact Aspen Technical Services team for further guidance. Our Technical Services team strives to help our customers derive the maximum value from our high-performance products.

PIPE INSULATION Installation Manual

Pyrogel®

The name Pyrogel® has become synonymous with superior performance, value, and durability across a range of applications. Around the globe, owners and operators repeatedly choose Pyrogel products to protect their people, processes and facilities. Key to Pyrogel's success is a common core of functionality that empowers Pyrogel products with class leading thermal performance, mechanical durability, resistance to water, versatility and resiliency. This unique feature set puts Pyrogel first in class for speed of application, reusability and space saving, particularly on large bore pipe and vessels.

PYROGEL® HPS

Pyrogel HPS shares all of Pyrogel XTE and XTF's core functionalities but advances thermal performance to a new level. Optimized for service temperatures up to 650°C (1200°F) it's extremely low thermal conductivity at high temperatures means that Pyrogel HPS is up to 75% thinner than competing insulation materials. This makes it ideal for installation in congested areas or near mechanical clashes, increasing both plant safety and efficiency. Reduced insulation thickness also supports even faster, application— helping to get your unit back on-stream, on-time.

Pyrogel HPS is tough and durable, delivering consistent performance without cracking, sagging, or settling. It can be re-used after maintenance or inspection, minimizing the time and expense required to stage replacement insulation. Pyrogel HPS is ideal for use in the fabrication of removable insulation pads. It maintains its shape and location after vibration or exposure to high temperatures.

Pyrogel HPS is designed to provide long-term performance for the ultimate in safety, process efficiency, and stability, in the power generation, refining, and chemical processing industries.

PYROGEL® PRODUCT FAMILY - PRODUCT USE AND SPECIFICATIONS

PRODUCT	PYROGEL XTE		PYROGEL HPS	PYROGEL XTF
MAX. USE TEMP.	650°C (1200°F)		650°C (1200°F)	650°C (1200°F)
OPTIMAL USE	Thermal Insulation Acoustics		Thermal Insulation Lower Thermal Conductivity in High Temperature Service	Thermal Insulation Passive Fire Protection Acoustics
APPLICATIONS	CUI Service District Energy Distillation		High Pressure Steam Gas and Steam Turbines Delayed Coking	Pool Fire and Jet Fire Protection Relief Systems Sizing (API 521)
COLOR	Maroon		Grey	Grey
DENSITY*	12.5 lb/ft ³ (0.20 g/cc)		12.5 lb/ft ³ (0.20 g/cc)	12.5 lb/ft ³ (0.20 g/cc)
THICKNESS*	5 mm (0.2 in)	10 mm (0.4 in)	10 mm (0.4 in)	10 mm (0.4 in)
ROLL SIZE*	1,500 sqft Bulk Rolls	850 sqft Bulk Rolls 80 sqft Pony Rolls**	850 sqft Bulk Rolls 80 sqft Pony Rolls**	850 sqft Bulk Rolls

*Nominal Values.

**Pony Rolls are cut from ASTM C1728 compliant material.

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Safety First

Pyrogel materials are engineered with safety and performance as our top priorities. Aspen has performed extensive EH&S testing and found our materials to be safe. Our Pyrogel insulation products are made of amorphous silica impregnated into a non-woven flexible fabric substrate. Amorphous silica is not considered to be a health hazard and, according to the U.S. EPA, "there should be no concerns for human health." The dust from our material is rated by the U.S. Occupational Safety and Health Administration (OSHA) as a "nuisance dust." The silica used in our products is produced synthetically, not mined, and as such contains no crystalline silica.

Handling of Pyrogel blankets will produce dust. Workplace exposure to all dusts should be controlled with standard industrial hygiene practices. Pyrogel dust exposure may produce a sensation of dryness to skin and irritation to eyes, skin, and respiratory track. For worker comfort when working with Pyrogel®, we recommend the use of dust masks, safety eyewear, and work gloves. Pyrogel dust can be washed from the skin and clothing using soap and water. Please follow the safety and handling guidelines outlined in our Best Practices Guide - Storage, Processing and Installation, which is available on request. For complete health and safety information, please see our Safety Data Sheets / Article Information Sheets.

Material Handling

Pyrogel HPS is available in two size - 850 square foot (79 m²) bulk rolls or 80 square foot (7.4 m²) pony rolls. Bulk rolls are typically 60 in (1.5 m) wide weighing up to 400 lb (180 kg) per roll. Bulk rolls can be moved by using a pallet jack or forklift. Bulk rolls should always be placed or stacked on their sides (parallel to width) and should never be positioned upright on their ends as this may damage the ends of the roll. The smaller pony roll size is 29 inches (73.5 cm) wide weighing approximately 45 lbs (20 kg) per roll. Pony rolls can be hand carried and are shipped on pallets with a minimum of 12 rolls per pallet.



Preparation and Storage

Pyrogel HPS should be stored in a clean, dry and protected environment. If material is stored in an outdoor setting, it should be placed on pallets and thoroughly covered with a waterproof tarp or plastic sheeting. Although the Pyrogel HPS insulation is hydrophobic, all necessary measures should be taken to protect it from the weather during storage.

To prepare for installation:

- Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.
- Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean and dry.
- Ensure that insulation is clean, dry, and in good mechanical condition. Wet, dirty, or damaged insulation should not be used for installation.
- Determine pipe size, pipe length, and number of layers of Pyrogel HPS required for the application.

NOTE: For specific questions, please contact Aspen Aerogels technical services team.

PIPE INSULATION Installation Manual

Optimal Work Setup

To achieve the most productive work environment for cutting and fabricating Pyrogel HPS we suggest the following setup. *

BULK CUTTING AREA

This area will be used for cutting Pyrogel HPS from full rolls into lengths required for the application, as well as cutting any preformed parts required to ease the installation process. This area should be setup in a covered and protected area. This area should contain several tables to accommodate the roll width and cutting length required for each component being worked. The roll of Pyrogel HPS should be located at the front of the table where it can be placed on a roller rack with a tube placed through the roll. Please refer to the Cutting Tools chart below for suggested tools for this application. Cut pieces of Pyrogel HPS should be placed on pallets and covered, bagged, or wrapped in plastic before bringing to work area.



WORK AREA

Ideally the insulation material should be placed and cut as close to the work area as possible. For sites with limited space, which cannot accommodate the table size required for cutting bulk rolls, we recommend the use of Pyrogel HPS pony rolls. The compact size of the pony rolls allows easier cutting in areas with space constraints and also offers the ability to cut closer to the installation location. Please refer to the cutting tools chart below for suggested tools for field applications.

Material	Cutting Tool (FIELD or SHOP)					
	Scissors	Box Cutter	Pizza Wheel/ Electric	Tin Snips	Slitter	Hand Shear
Pyrogel®	FIELD	FIELD	FIELD	FIELD	SHOP	SHOP

*Please consult with your local site safety guidelines before adopting these procedures.

PIPE INSULATION Installation Manual

First Layer Installation

1. Cut Pyrogel HPS to the length required for a complete wrap. The cut length may be determined by either wrapping a scrap piece around the pipe and marking the place where it overlaps, or consulting the cutting charts on pages 23-30. Either a butt joint or lap joint is acceptable for the longitudinal seam.



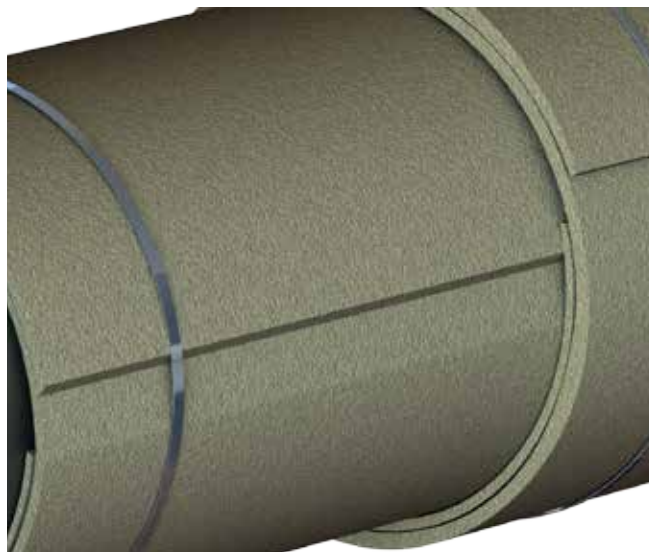
2. Place Pyrogel HPS on the pipe and wrap around the circumference of the pipe.



3. Once wrapped around the pipe, Pyrogel HPS may be held in place using wire or banding. Tighten seams to eliminate gaps.



4. When using a lap joint it is good practice to orient the overlap with a downward-facing watershed.



PIPE INSULATION Installation Manual

Single Piece Multi-Wrap Installation

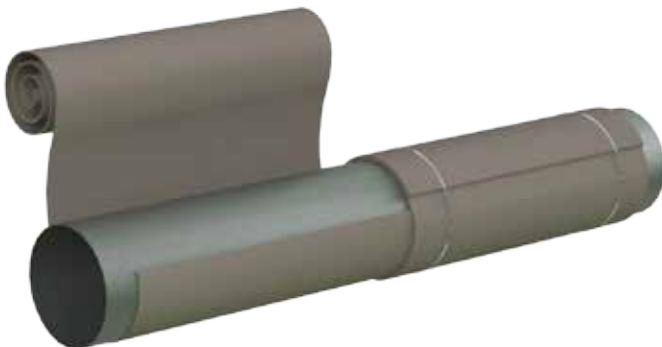
1. Multiple layers can be installed by using one continuous piece of Pyrogel HPS and overlapping it. First, cut the Pyrogel HPS blanket to the length required. The length may be determined by consulting the cutting charts on pages 23-30 and adding the lengths from the individual layers together. For ease of handling, we recommend that the maximum length of one piece of Pyrogel HPS be no longer than 3.3 m (10 ft).



2. Align the leading edge of the Pyrogel HPS with the long axis of the pipe and wrap around the pipe. The starting edge of Pyrogel HPS can be held in place by hand.



3. Overlap and continue around the circumference to achieve the double-layer application.



4. Once wrapped around the pipe, Pyrogel HPS may be held in place using wire or banding.



5. Install metal cladding in typical fashion and seal with owner-approved sealant.

Multi-Layer Wrap Pipe

1. For multi-layer applications follow the same steps as the double-layer application overlapping the circumferential and longitudinal joints until the final thickness is achieved.



2. Once wrapped around the pipe, Pyrogel HPS may be held in place using wire or banding.



3. Install metal cladding in typical fashion and seal with owner-approved sealant.



Small Bore Pipe - 15 to 100 mm (½ to 4 in) NPS

For piping smaller than 100 mm (4 in) NPS, we suggest the use of V-grooved, cut-to-length materials. Contact Aspen Aerogels at 508-691-1111 or info.aerogel.com/contact for details on local suppliers of pre-fabricated v-groove material.

V-GROOVE

- 1.** V-grooved pipe cover comes pre-cut to the particular pipe size and insulation thickness so that each layer comes to a perfect, butted closure.
- 2.** For multi-layer applications, align the grooves for better laydown, but stagger the longitudinal seams.



Pipe Fittings

PIPE ENDS

Install Pyrogel HPS past the pipe end to the same distance as required for the thickness of the insulation.

Cut plugs from Pyrogel HPS to the diameter of the opening and install to match the thickness.

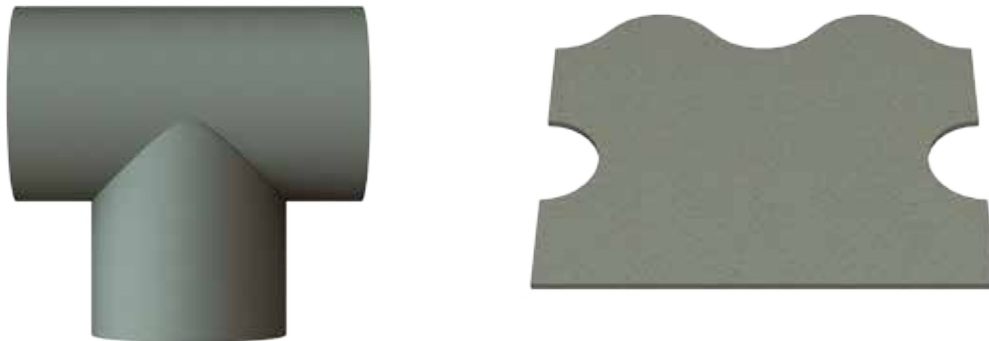
REDUCERS

Install Pyrogel HPS to the same thickness as would be required for the piping using the same layout pattern as would be required for the metal cladding less the required overlaps.

Install each layer in a staggered fashion.

TEES

Install Pyrogel HPS using the same techniques as would be used for installing the cladding. Contact Aspen Aerogels at 508-691-1111 or info.aerogel.com/contact for details on local suppliers of pre-cut tees.



PIPING SHOES

Install Pyrogel HPS around the pipe adjacent to the pipe shoe and make a slit the length of the shoe.

Slide Pyrogel HPS through the shoe area and continue wrapping the Pyrogel HPS on the other end of the shoe area.

For some shoe types that have a welded section through the center, it may be necessary to apply Pyrogel HPS from both ends.

Contact Aspen Aerogels at 508-691-1111 or info.aerogel.com/contact for details on local suppliers Pyrogel HPS insulated pipe shoes.

Valves and Flanges

This section gives the general techniques for insulating valves. Because of the variety in valves shapes and designs, some modifications to these instructions may be necessary.

1. Unless the finished Pyrogel HPS thickness could obstruct the bolt pattern on the flange, insulate the pipe all the way up to the weld line.



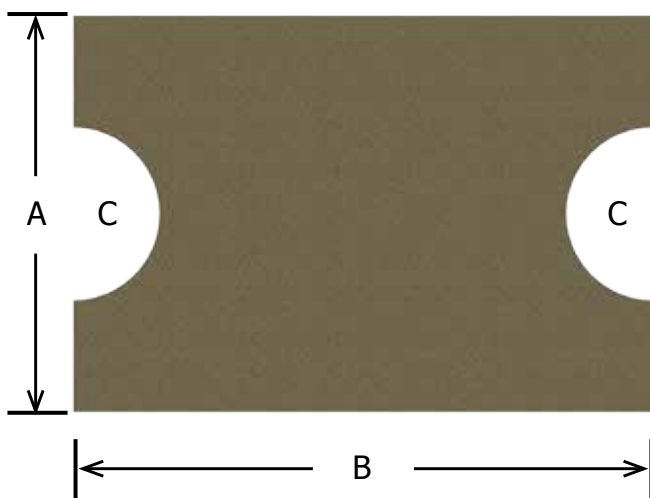
2. Wrap a strip of Pyrogel HPS over the insulated pipe portion to achieve the same diameter as the valve body.



PIPE INSULATION Installation Manual

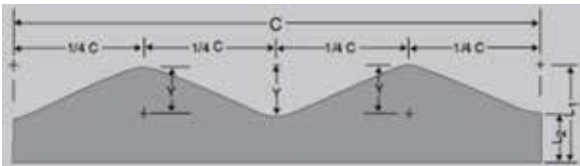
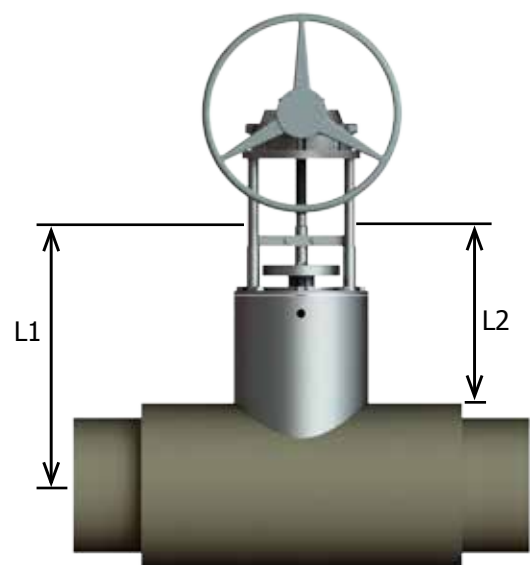
Valves and Flanges

3. Transfer length "A" and circumference "B" to Pyrogel HPS sheet and mark the cutouts for the bonnet neck "C". Move the cutout on each wrap of Pyrogel HPS to achieve stagger, and slide over handle section to achieve stagger. Note: for mechanical support, pack void spaces with Pyrogel HPS or high-density (96 kg/m³ or 6 lb/ft³) ceramic fiber.



Valves and Flanges

4. The bonnet insulation of Pyrogel HPS is cut to the size of C x L1, then marked in quarters. Next, the scalloped edge of the insulation is determined by swinging an arc from each point marked +. The radius of the arc is equal to Y. These areas are connected with straight lines to give a smooth scalloped edge.

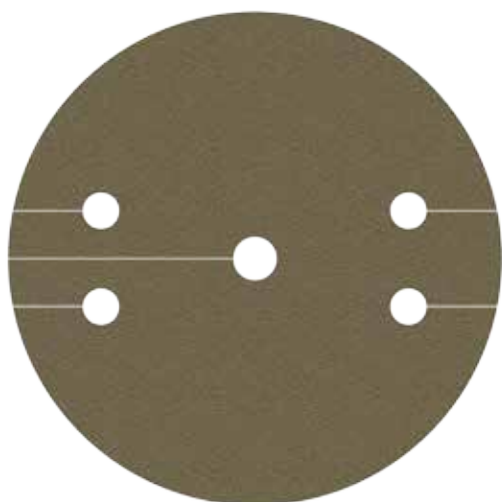


C	Overall length determined by wrapping a strip of Pyrogel HPS around the bonnet flange and marking where the ends meet
L1	Distance is from the outer surface of the Pyrogel HPS disc to the approximate middle of the valve body insulation
L2	Distance is from the outer surface of the Pyrogel HPS disc to the closest surface of the valve body insulation
Y	Difference between L1 and L2



Valves and Flanges

- 5.** Cut the disc to the same size as the bonnet end if insulation is required on the bonnet section.



- 6.** Wrap additional layers in the same manner with joints staggered.



Valves and Flanges

7. Apply jacketing/cladding.

8. Strap bands at the middle of the shoulder piece (step 2) location.



Valves and Flanges

10. Pyrogel®-lined removable metal or blanket covers may also be an option for valves and flanges.



45- and 90-Degree Elbows

Suggested Elbow Chart

Pipe Size (NPS)		Elbow Type		
mm	inches	Pre-Cut	Gored	Stove Pipe
15 - 40	$\frac{1}{2}$ - $1\frac{1}{2}$	✓		✓
50 - 150	2 - 6	✓	✓	
200 - 300	8 - 12	✓	✓	
350 - 600	14 - 24	✓	✓	
650 - 900	26 - 36	✓	✓	
950 - 1,200	38 - 48	✓	✓	

The instructions on the following pages cover three types of elbows available for use with Pyrogel HPS materials and installation suggestions.

Contact Aspen Aerogels at 508-691-1111 or info.aerogel.com/contact for details on local suppliers of pre-fabricated elbows and accessories.

45- and 90-Degree Elbows

FIRST LAYER ELBOW FITTINGS

Pre-fabricated elbows for piping NPS 200 mm (8 in) and smaller are based on a reverse gore-style pattern that gathers in the throat and is closed along the heel. Larger elbows are constructed of individual gores that get applied one at a time in the field, with the seam located in the throat.



1. Place the middle of the fitting along the inside (throat) of the pipe fitting.



45- and 90-Degree Elbows

2. Tightly wrap material around to the heel, aligning the seam with the centerline of the fitting.



3. It is important that the Pyrogel HPS material is tight to the elbow. Work excess material around the fitting towards the back side of the fitting until the butt joint is closed tightly. Apply wire, or outward-clenching staples to secure each finger.



4. Once all fingers have been secured, push material from both ends of the fitting cover to ensure all gore seams are tightly closed.

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45- and 90-Degree Elbows

5. Apply all subsequent layers in a similar fashion. Note that the seams in some layers are specifically engineered to not line up with the ones beneath it. Also note that in multi-layer fittings, the inner layers will often have an extended tangent to provide a ship-lap joint for the adjacent line insulation.



6. Install metal cladding and seal with owner-approved sealant.



45- and 90-Degree Elbows

GORED ELBOW FITTINGS

This style of elbow can be cut by the contractor using the same principles that are used to fabricate metal gored elbow, minus the overlaps.

Cut Pyrogel HPS to the required length and cut as per the gore pattern. Install each layer, staggering the seams where possible. This can be achieved by slitting one of the gored sections down the center to create half a gore. This half section will be used for the starter and finisher of the staggered layer. The gored elbow may also be achieved by separating the pre-cut elbows and installing one gore at a time.



STOVE PIPE

We recommend that this style of elbow only be used on small bore piping where the fabrication of the above elbow styles can not be done due to limited elbow throat space. In order to fabricate this elbow, we recommend that the pre-formed pipe covering be cut at a 45-degree angle with the sections adjoined in the elbow to form the 90-degree elbow.

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Pyrogel® HPS 10 mm Blanket Cut Chart (cm)

NPS (mm)	Material Stretchout (cm)							
	Includes 2.5 cm overlap							
	Number of Layers							
	1	2	3	4	5	6	7	8
15	15.8	35.7	62.2	95.3	135.0	181.3	234.2	293.7
20	17.5	39.1	67.3	102.0	143.4	191.4	245.9	307.1
25	19.6	43.3	73.6	110.5	154.0	204.0	260.7	324.0
32	22.4	48.8	81.9	121.5	167.7	220.6	280.0	346.0
40	24.3	52.7	87.6	129.2	177.3	232.1	293.4	361.3
50	28.1	60.2	99.0	144.3	196.3	254.8	319.9	391.7
65	32.1	68.2	110.9	160.3	216.2	278.7	347.9	423.6
80	37.1	78.2	125.9	180.2	241.1	308.7	382.8	463.5
90	41.1	86.2	137.9	196.2	261.1	332.6	410.7	495.4
100	45.0	94.1	149.8	212.1	281.0	356.5	438.6	527.3
115	49.0	102.1	161.8	228.1	301.0	380.5	466.6	559.2
125	53.5	111.1	175.3	246.1	323.5	407.4	498.0	595.2
150	62.0	128.1	200.7	280.0	365.8	458.3	557.3	663.0
200	78.0	160.0	248.6	343.8	445.6	554.0	669.0	790.6
250	94.9	193.9	299.5	411.6	530.4	655.8	787.7	926.3
300	110.9	225.8	347.3	475.5	610.2	751.5	899.4	1054.0
350	120.9	245.8	377.3	515.4	660.1	811.4	969.3	1133.8
400	136.8	277.7	425.1	579.2	739.9	907.1	1081.0	1261.4
450	152.8	309.6	473.0	643.0	819.7	1002.9	1192.7	1389.1
500	168.7	341.5	520.9	706.9	899.5	1098.6	1304.4	1516.8
550	184.7	373.4	568.8	770.7	979.3	1194.4	1416.1	1644.5
600	200.6	405.4	616.7	834.6	1059.1	1290.2	1527.8	1772.1
650	216.6	437.3	664.5	898.4	1138.9	1385.9	1639.6	1899.8
700	232.6	469.2	712.4	962.2	1218.7	1481.7	1751.3	2027.5
750	248.5	501.1	760.3	1026.1	1298.4	1577.4	1863.0	2155.2
800	264.5	533.0	808.2	1089.9	1378.2	1673.2	1974.7	2282.8
850	280.4	564.9	856.0	1153.7	1458.0	1768.9	2086.4	2410.5
900	296.4	596.9	903.9	1217.6	1537.8	1864.7	2198.1	2538.2
950	312.4	628.8	951.8	1281.4	1617.6	1960.4	2309.9	2665.9
1000	328.3	660.7	999.7	1345.3	1697.4	2056.2	2421.6	2793.5
1050	344.3	692.6	1047.6	1409.1	1777.2	2152.0	2533.3	2921.2
1100	360.2	724.5	1095.4	1472.9	1857.0	2247.7	2645.0	3048.9
1150	376.2	756.5	1143.3	1536.8	1936.8	2343.5	2756.7	3176.6

NOTES:

- All measurements should be verified with a test piece of insulation.
- Note that for best fit on pipes smaller than 100 mm (4 in) NPS, use 10 mm V-groove.
- Contact Aspen Aerogels for additional sizes.

PIPE INSULATION Installation Manual

Pyrogel® HPS 10 mm (0.4 in) Blanket Cut Chart (inches)

NPS (in.)	Material Stretchout (inches)							
	Number of Layers							
	1	2	3	4	5	6	7	8
0.5	6.2	14.1	24.5	37.5	53.2	71.4	92.2	115.6
0.75	6.9	15.4	26.5	40.2	56.5	75.3	96.8	120.9
1	7.7	17.1	29.0	43.5	60.6	80.3	102.6	127.6
1.25	8.8	19.2	32.2	47.8	66.0	86.8	110.2	136.2
1.5	9.6	20.7	34.5	50.8	69.8	91.4	115.5	142.3
2	11.1	23.7	39.0	56.8	77.3	100.3	126.0	154.2
2.5	12.6	26.9	43.7	63.1	85.1	109.7	137.0	166.8
3	14.6	30.8	49.6	71.0	94.9	121.5	150.7	182.5
3.5	16.2	33.9	54.3	77.2	102.8	130.9	161.7	195.0
4	17.7	37.1	59.0	83.5	110.6	140.4	172.7	207.6
4.5	19.3	40.2	63.7	89.8	118.5	149.8	183.7	220.2
5	21.1	43.7	69.0	96.9	127.3	160.4	196.1	234.3
6	24.4	50.4	79.0	110.2	144.0	180.4	219.4	261.0
8	30.7	63.0	97.9	135.4	175.4	218.1	263.4	311.3
10	37.4	76.3	117.9	162.1	208.8	258.2	310.1	364.7
12	43.7	88.9	136.8	187.2	240.2	295.9	354.1	414.9
14	47.6	96.8	148.5	202.9	259.9	319.4	381.6	446.4
16	53.9	109.3	167.4	228.0	291.3	357.1	425.6	496.6
18	60.1	121.9	186.2	253.2	322.7	394.8	469.6	546.9
20	66.4	134.5	205.1	278.3	354.1	432.5	513.5	597.2
22	72.7	147.0	223.9	303.4	385.5	470.2	557.5	647.4
24	79.0	159.6	242.8	328.6	417.0	507.9	601.5	697.7
26	85.3	172.2	261.6	353.7	448.4	545.6	645.5	748.0
28	91.6	184.7	280.5	378.8	479.8	583.3	689.5	798.2
30	97.8	197.3	299.3	404.0	511.2	621.0	733.5	848.5
32	104.1	209.9	318.2	429.1	542.6	658.7	777.4	898.8
34	110.4	222.4	337.0	454.2	574.0	696.4	821.4	949.0
36	116.7	235.0	355.9	479.4	605.4	734.1	865.4	999.3
38	123.0	247.6	374.7	504.5	636.9	771.8	909.4	1049.5
40	129.3	260.1	393.6	529.6	668.3	809.5	953.4	1099.8
42	135.5	272.7	412.4	554.8	699.7	847.2	997.4	1150.1
44	141.8	285.3	431.3	579.9	731.1	884.9	1041.3	1200.3
46	148.1	297.8	450.1	605.0	762.5	922.6	1085.3	1250.6

NOTES:

- All measurements should be verified with a test piece of insulation.
- Note that for best fit on pipes smaller than 100 mm (4 in) NPS, use 10 mm V-groove.
- Contact Aspen Aerogels for additional sizes.

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Pyrogel® Insulation Cladding Cut Chart (mm)

NPS (mm)	Pyrogel® Thickness (mm)							
	10 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm
	Cladding Cut Length (mm)							
15	180.7	243.5	306.3	369.2	432.0	494.8	557.7	620.5
20	197.4	260.3	323.1	385.9	448.7	511.6	574.4	637.2
25	218.6	281.4	344.2	407.1	469.9	532.7	595.6	658.4
32	246.1	308.9	371.8	434.6	497.4	560.3	623.1	685.9
40	265.2	328.1	390.9	453.7	516.6	579.4	642.2	705.1
50	303.1	366.0	428.8	491.6	554.5	617.3	680.1	743.0
65	343.0	405.9	468.7	531.5	594.4	657.2	720.0	782.9
80	392.9	455.8	518.6	581.4	644.2	707.1	769.9	832.7
90	432.8	495.7	558.5	621.3	684.1	747.0	809.8	872.6
100	472.7	535.5	598.4	661.2	724.0	786.9	849.7	912.5
115	512.6	575.4	638.3	701.1	763.9	826.8	889.6	952.4
125	557.5	620.4	683.2	746.0	808.9	871.7	934.5	997.4
150	642.3	705.1	767.9	830.8	893.6	956.4	1019.3	1082.1
200	801.9	864.7	927.5	990.4	1053.2	1116.0	1178.9	1241.7
250	971.4	1034.3	1097.1	1159.9	1222.8	1285.6	1348.4	1411.3
300	1131.0	1193.9	1256.7	1319.5	1382.4	1445.2	1508.0	1570.9
350	1230.8	1293.6	1356.4	1419.3	1482.1	1544.9	1607.8	1670.6
400	1390.4	1453.2	1516.0	1578.9	1641.7	1704.5	1767.4	1830.2
450	1550.0	1612.8	1675.6	1738.5	1801.3	1864.1	1927.0	1989.8
500	1709.6	1772.4	1835.2	1898.1	1960.9	2023.7	2086.6	2149.4
550	1869.2	1932.0	1994.8	2057.7	2120.5	2183.3	2246.1	2309.0
600	2028.8	2091.6	2154.4	2217.2	2280.1	2342.9	2405.7	2468.6
650	2188.3	2251.2	2314.0	2376.8	2439.7	2502.5	2565.3	2628.2

NOTES:

- Shaded areas indicate a finished diameter less than 75 mm. Depending on equipment, rolling metal to a finished diameter less than 75 mm may be problematic. Contact Aspen Aerogels for recommended solutions.
- All cut lengths are based on a 50 mm overlap and do not include for safety edge. Additional amounts required for larger overlap or safety edge should be added.
- All measurements should be verified with a test piece.
- Contact Aspen Aerogels for additional sizes.

PIPE INSULATION Installation Manual

Pyrogel® Insulation Cladding Cut Chart (inches)

NPS (in.)	Pyrogel® Thickness (inches)							
	0.4 in.	0.8 in.	1.2 in.	1.6 in.	2.0 in.	2.4 in.	2.8 in.	3.2 in.
	Cladding Cut Length (inches)							
0.5	7.1	9.6	12.1	14.5	17.0	19.5	22.0	24.4
0.75	7.8	10.2	12.7	15.2	17.7	20.1	22.6	25.1
1	8.6	11.1	13.6	16.0	18.5	21.0	23.4	25.9
1.25	9.7	12.2	14.6	17.1	19.6	22.1	24.5	27.0
1.5	10.4	12.9	15.4	17.9	20.3	22.8	25.3	27.8
2	11.9	14.4	16.9	19.4	21.8	24.3	26.8	29.3
2.5	13.5	16.0	18.5	20.9	23.4	25.9	28.3	30.8
3	15.5	17.9	20.4	22.9	25.4	27.8	30.3	32.8
3.5	17.0	19.5	22.0	24.5	26.9	29.4	31.9	34.4
4	18.6	21.1	23.6	26.0	28.5	31.0	33.5	35.9
4.5	20.2	22.7	25.1	27.6	30.1	32.6	35.0	37.5
5	22.0	24.4	26.9	29.4	31.8	34.3	36.8	39.3
6	25.3	27.8	30.2	32.7	35.2	37.7	40.1	42.6
8	31.6	34.0	36.5	39.0	41.5	43.9	46.4	48.9
10	38.2	40.7	43.2	45.7	48.1	50.6	53.1	55.6
12	44.5	47.0	49.5	52.0	54.4	56.9	59.4	61.8
14	48.5	50.9	53.4	55.9	58.4	60.8	63.3	65.8
16	54.7	57.2	59.7	62.2	64.6	67.1	69.6	72.1
18	61.0	63.5	66.0	68.4	70.9	73.4	75.9	78.3
20	67.3	69.8	72.3	74.7	77.2	79.7	82.1	84.6
22	73.6	76.1	78.5	81.0	83.5	86.0	88.4	90.9
24	79.9	82.3	84.8	87.3	89.8	92.2	94.7	97.2
26	86.2	88.6	91.1	93.6	96.0	98.5	101.0	103.5

NOTES:

- Shaded areas indicate a finished diameter less than 3". Depending on equipment, rolling metal to a finished diameter less than 3" may be problematic. Contact Aspen Aerogels for recommended solutions.
- All cut lengths are based on a 2" overlap and do not include for safety edge. Additional amounts required for larger overlap of safety should be added.
- All measurements should be verified with a test piece.
- Contact Aspen Aerogels for additional sizes.

PIPE INSULATION Installation Manual

Pyrogel® Miter Cut Chart (mm)

Pyrogel® Thickness												
NPS (mm)	10 mm			20 mm			30 mm			40 mm		
	Heel (mm)	Gores	Throat (mm)	Heel (mm)	Gores	Throat (mm)	Heel (mm)	Gores	Throat (mm)	Heel (mm)	Gores	Throat (mm)
100	86.2	4	33.5	90.1	4	29.6	94.1	4	25.6	98.0	4	21.7
125	106.5	4	43.1	110.4	4	39.2	114.3	4	35.3	118.3	4	31.4
150	84.5	6	35.2	87.1	6	32.6	89.7	6	30.0	92.3	6	27.3
200	111.1	6	48.5	113.7	6	45.9	116.3	6	43.3	118.9	6	40.6
250	103.6	8	46.0	105.5	8	44.1	107.5	8	42.1	109.5	8	40.1
300	123.5	8	56.0	125.5	8	54.1	127.5	8	52.1	129.4	8	50.1
350	113.3	10	54.3	114.9	10	52.7	116.4	10	51.1	118.0	10	49.6
400	129.2	10	62.3	130.8	10	60.7	132.4	10	59.1	134.0	10	57.6
450	121.0	12	58.5	122.3	12	57.2	123.6	12	55.9	124.9	12	54.6
500	134.3	12	65.2	135.6	12	63.9	136.9	12	62.6	138.2	12	61.3
550	126.5	14	61.6	127.6	14	60.5	128.8	14	59.3	129.9	14	58.2
600	137.9	14	67.3	139.0	14	66.2	140.2	14	65.0	141.3	14	63.9
650	149.3	14	73.0	150.4	14	71.9	151.6	14	70.7	152.7	14	69.6
700	140.6	16	68.8	141.6	16	67.9	142.6	16	66.9	143.6	16	65.9
750	150.6	16	73.8	151.6	16	72.8	152.6	16	71.9	153.5	16	70.9
800	142.7	18	70.1	143.6	18	69.2	144.5	18	68.3	145.4	18	67.4
850	151.6	18	74.5	152.5	18	73.6	153.3	18	72.7	154.2	18	71.9
900	144.4	20	71.0	145.2	20	70.2	146.0	20	69.5	146.8	20	68.7
950	152.4	20	75.0	153.2	20	74.2	154.0	20	73.5	154.8	20	72.7
1000	160.4	20	79.0	161.2	20	78.2	161.9	20	77.4	162.7	20	76.7
1050	168.4	20	83.0	169.1	20	82.2	169.9	20	81.4	170.7	20	80.6
1100	176.3	20	87.0	177.1	20	86.2	177.9	20	85.4	178.7	20	84.6
1150	184.3	20	91.0	185.1	20	90.2	185.9	20	89.4	186.7	20	88.6
1200	192.3	20	95.0	193.1	20	94.2	193.9	20	93.4	194.7	20	92.6

NOTES:

- All measurements above should be verified with a test piece of insulation.
- Contact Aspen Aerogels for additional sizes.

PIPE INSULATION Installation Manual

Pyrogel® Miter Cut Chart (mm) cont.

Pyrogel® Thickness												
NPS (mm)	50 mm			60 mm			70 mm			80 mm		
	Heel (mm)	Gores	Throat (mm)	Heel (mm)	Gores	Throat (mm)	Heel (mm)	Gores	Throat (mm)	Heel (mm)	Gores	Throat (mm)
100	101.9	4	17.8	86.2	4	13.8	109.8	4	9.9	113.7	4	6.0
125	122.2	4	27.4	126.1	4	23.5	130.0	4	19.6	134.0	4	15.6
150	95.0	6	24.7	97.6	6	22.1	100.2	6	19.5	102.8	6	16.9
200	121.6	6	38.0	124.2	6	35.4	126.8	6	32.8	129.4	6	30.2
250	111.4	8	38.2	113.4	8	36.2	115.4	8	34.3	117.3	8	32.3
300	131.4	8	48.2	133.3	8	46.2	135.3	8	44.2	137.3	8	42.3
350	119.6	10	48.0	121.1	10	46.4	122.7	10	44.9	124.3	10	43.3
400	135.5	10	56.0	137.1	10	54.4	138.7	10	52.8	140.2	10	51.3
450	126.2	12	53.3	127.5	12	52.0	128.9	12	50.7	130.2	12	49.4
500	139.5	12	60.0	140.8	12	58.6	142.2	12	57.3	143.5	12	56.0
550	131.0	14	57.1	132.1	14	56.0	133.2	14	54.8	134.4	14	53.7
600	142.4	14	62.8	143.5	14	61.7	144.6	14	60.5	145.8	14	59.4
650	153.8	14	68.5	154.9	14	67.4	156.0	14	66.2	157.2	14	65.1
700	144.6	16	64.9	145.5	16	63.9	146.5	16	62.9	147.5	16	62.0
750	154.5	16	69.9	155.5	16	68.9	156.5	16	67.9	157.5	16	67.0
800	146.2	18	66.6	147.1	18	65.7	148.0	18	64.8	148.8	18	63.9
850	155.1	18	71.0	156.0	18	70.1	156.8	18	69.3	157.7	18	68.4
900	147.6	20	67.9	148.3	20	67.1	149.1	20	66.3	149.9	20	65.5
950	155.5	20	71.9	156.3	20	71.1	157.1	20	70.3	157.9	20	69.5
1000	163.5	20	75.9	164.3	20	75.1	165.1	20	74.3	165.9	20	73.5
1050	171.5	20	79.9	172.3	20	79.1	173.1	20	78.3	173.9	20	77.5
1100	179.5	20	83.8	180.3	20	83.1	181.1	20	82.3	181.8	20	81.5
1150	187.5	20	87.8	188.2	20	87.1	189.0	20	86.3	189.8	20	85.5
1200	195.4	20	91.8	196.2	20	91.0	197.0	20	90.3	197.8	20	89.5

NOTES:

- All measurements above should be verified with a test piece of insulation.
- Contact Aspen Aerogels for additional sizes.

PIPE INSULATION Installation Manual

Pyrogel® Miter Cut Chart (inches)

NPS (in.)	Pyrogel® Thickness											
	0.4 in. (10 mm)			0.8 in. (20 mm)			1.2 in. (30 mm)			1.6 in. (40 mm)		
	Heel (in.)	Gores	Throat (in.)	Heel (in.)	Gores	Throat (in.)	Heel (in.)	Gores	Throat (in.)	Heel (in.)	Gores	Throat (in.)
4	3.4	4	1.3	3.5	4	1.2	3.7	4	1.0	3.9	4	0.9
5	4.2	4	1.7	4.3	4	1.5	4.5	4	1.4	4.7	4	1.2
6	3.3	6	1.4	3.4	6	1.3	3.5	6	1.2	3.6	6	1.1
8	4.4	6	1.9	4.5	6	1.8	4.6	6	1.7	4.7	6	1.6
10	4.1	8	1.8	4.2	8	1.7	4.2	8	1.7	4.3	8	1.6
12	4.9	8	2.2	4.9	8	2.1	5.0	8	2.1	5.1	8	2.0
14	4.5	10	2.1	4.5	10	2.1	4.6	10	2.0	4.6	10	2.0
16	5.1	10	2.5	5.2	10	2.4	5.2	10	2.3	5.3	10	2.3
18	4.8	12	2.3	4.8	12	2.3	4.9	12	2.2	4.9	12	2.2
20	5.3	12	2.6	5.3	12	2.5	5.4	12	2.5	5.4	12	2.4
22	5.0	14	2.4	5.0	14	2.4	5.1	14	2.3	5.1	14	2.3
24	5.4	14	2.6	5.5	14	2.6	5.5	14	2.6	5.6	14	2.5
26	5.9	14	2.9	5.9	14	2.8	6.0	14	2.8	6.0	14	2.7
28	5.5	16	2.7	5.6	16	2.7	5.6	16	2.6	5.7	16	2.6
30	5.9	16	2.9	6.0	16	2.9	6.0	16	2.8	6.0	16	2.8
32	5.6	18	2.8	5.7	18	2.7	5.7	18	2.7	5.7	18	2.7
34	6.0	18	2.9	6.0	18	2.9	6.0	18	2.9	6.1	18	2.8
36	5.7	20	2.8	5.7	20	2.8	5.7	20	2.7	5.8	20	2.7
38	6.0	20	3.0	6.0	20	2.9	6.1	20	2.9	6.1	20	2.9
40	6.3	20	3.1	6.3	20	3.1	6.4	20	3.0	6.4	20	3.0
42	6.6	20	3.3	6.7	20	3.2	6.7	20	3.2	6.7	20	3.2
44	6.9	20	3.4	7.0	20	3.4	7.0	20	3.4	7.0	20	3.3
46	7.3	20	3.6	7.3	20	3.6	7.3	20	3.5	7.3	20	3.5
48	7.6	20	3.7	7.6	20	3.7	7.6	20	3.7	7.7	20	3.6

NOTES:

- All measurements above should be verified with a test piece of insulation.
- Contact Aspen Aerogels for additional sizes.

PIPE INSULATION Installation Manual

Pyrogel® Miter Cut Chart (inches)

Pyrogel® Thickness												
NPS (in.)	2.0 in. (50 mm)			2.4 in. (60 mm)			2.8 in. (70 mm)			3.2 in. (80 mm)		
	Heel (in.)	Gores	Throat (in.)	Heel (in.)	Gores	Throat (in.)	Heel (in.)	Gores	Throat (in.)	Heel (in.)	Gores	Throat (in.)
4	4.0	4	0.7	3.4	4	0.5	4.3	4	0.4	4.5	4	0.2
5	4.8	4	1.1	5.0	4	0.9	5.1	4	0.8	5.3	4	0.6
6	3.7	6	1.0	3.8	6	0.9	3.9	6	0.8	4.0	6	0.7
8	4.8	6	1.5	4.9	6	1.4	5.0	6	1.3	5.1	6	1.2
10	4.4	8	1.5	4.5	8	1.4	4.5	8	1.3	4.6	8	1.3
12	5.2	8	1.9	5.2	8	1.8	5.3	8	1.7	5.4	8	1.7
14	4.7	10	1.9	4.8	10	1.8	4.8	10	1.8	4.9	10	1.7
16	5.3	10	2.2	5.4	10	2.1	5.5	10	2.1	5.5	10	2.0
18	5.0	12	2.1	5.0	12	2.0	5.1	12	2.0	5.1	12	1.9
20	5.5	12	2.4	5.5	12	2.3	5.6	12	2.3	5.6	12	2.2
22	5.2	14	2.2	5.2	14	2.2	5.2	14	2.2	5.3	14	2.1
24	5.6	14	2.5	5.7	14	2.4	5.7	14	2.4	5.7	14	2.3
26	6.1	14	2.7	6.1	14	2.7	6.1	14	2.6	6.2	14	2.6
28	5.7	16	2.6	5.7	16	2.5	5.8	16	2.5	5.8	16	2.4
30	6.1	16	2.8	6.1	16	2.7	6.2	16	2.7	6.2	16	2.6
32	5.8	18	2.6	5.8	18	2.6	5.8	18	2.6	5.9	18	2.5
34	6.1	18	2.8	6.1	18	2.8	6.2	18	2.7	6.2	18	2.7
36	5.8	20	2.7	5.8	20	2.6	5.9	20	2.6	5.9	20	2.6
38	6.1	20	2.8	6.2	20	2.8	6.2	20	2.8	6.2	20	2.7
40	6.4	20	3.0	6.5	20	3.0	6.5	20	2.9	6.5	20	2.9
42	6.8	20	3.1	6.8	20	3.1	6.8	20	3.1	6.8	20	3.1
44	7.1	20	3.3	7.1	20	3.3	7.1	20	3.2	7.2	20	3.2
46	7.4	20	3.5	7.4	20	3.4	7.4	20	3.4	7.5	20	3.4
48	7.7	20	3.6	7.7	20	3.6	7.8	20	3.6	7.8	20	3.5

NOTES:

- All measurements above should be verified with a test piece of insulation.
- Contact Aspen Aerogels for additional sizes.

PIPE INSULATION Installation Manual

For specialized training or recommendations regarding our application procedures, call 508-691-1111, visit info.aerogel.com/contact, or scan below with mobile device QR reader.

