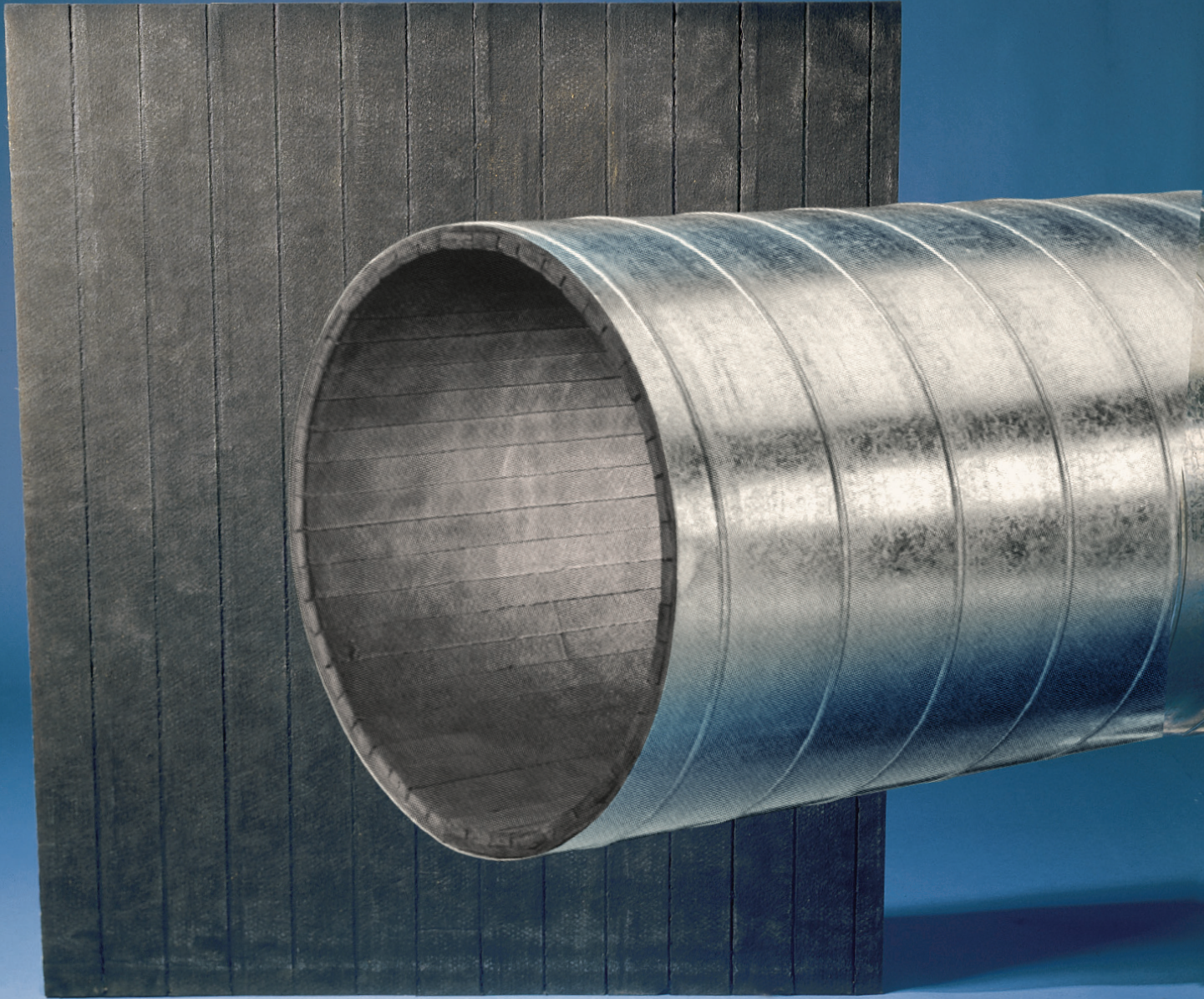


CertainTeed

ToughGard™ Ultra*Round

Spiral Duct Liner Installation Manual



CertainTeed
SAINT-GOBAIN

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General Information

Introduction

CertainTeed ToughGard® Ultra*Round™ Duct Liner is a high quality acoustical and thermal insulation. It is composed of glass fibers bonded together with thermosetting resin into a semi-rigid board-type insulation. The board is grooved to provide the flexibility required to line the inside of spiral and round HVAC sheet metal ducts. The air stream surface is extremely tough and durable material that adds strength to the product during fabrication, installation, system operation and maintenance. The surface includes an EPA registered antimicrobial agent in order to reduce the potential of microbial growth that may affect this product; the antimicrobial properties are intended to only protect this product.

ToughGard Ultra*Round Duct Liner is used primarily to reduce heat loss or gain, but also as an acoustical liner in HVAC ducts to absorb unwanted crosstalk, equipment and air rush noise. It performs in most HVAC spiral and round sheet metal ducts operating at air velocities up to 6,000 fpm, temperatures up to 250°F and duct diameters of at least 12".

This manual is intended to be used as a general guideline for the use and installation of ToughGuard Ultra*Round Duct Liner in spiral and round HVAC sheet metal ducts. It does not purport to address all aspects of installation nor does it limit other alternative methods.

ToughGard Ultra*Round is a duct liner insulation and its application, installation and use should comply with the applicable requirements of the NAIMA Fibrous Glass Duct Liner Standard or the SMACNA HVAC Duct Construction Standards. Where the unique physical properties of ToughGard Ultra*Round may allow deviation from these standards, it is the contractor's responsibility to obtain appropriate prior approvals.

Inasmuch as CertainTeed has no control over installation design, installation workmanship, accessories, materials or conditions of application, CertainTeed does not warrant the performance or results of any installation containing ToughGard Ultra*Round Duct Liner. This warranty disclaimer includes all implied warranties, including the warranties of merchantability and fitness for a particular use.

The technical data presented for ToughGard Ultra*Round Duct Liner represents typical average values obtained in accordance with accepted test methods and is subject to normal manufacturing variations. This data is supplied as a technical service and is subject to change without notice.

General Information

Benefits

CertainTeed ToughGard Ultra*Round Duct Liner provides many benefits to both the contractor and building owner:

- Eliminates the cost of perforated metal lining of double wall construction.
- Simplifies fabrication and installation in the shop and on the job.
- Reduced weight compared to double wall construction.
- May eliminate the need for pins and adhesives in most straight duct sections.
- Improves acoustical performance over double wall systems.
- Lower installed costs.
- Tough, durable and cleanable air stream surface that contains an EPA registered antimicrobial agent.

Selection Table by Duct Diameter

CertainTeed ToughGard Ultra*Round Duct Liner is available in three thicknesses (1", 1½" and 2") and two types (SD and LD). Type SD is for installation in smaller diameter ducts while LD is intended for installation in larger diameter ducts. The standard available sizes and their intended uses are shown below.

Thickness: 1" (25mm)					
Product Type	Metal Unfinished Duct ID		Finished ID		
	in	mm	in	mm	Sq. Ft./Pallet
SD (Small Diameter)	12 to 26	305 to 660	10 to 24	254 to 610	1800 / (167.2m²)
LD (Large Diameter)	28 and up	711 and up	26 and up	660 and up	
Thickness: 1-1/2" (38mm)					
Product Type	Metal Unfinished Duct ID		Finished ID		
	in	mm	in	mm	Sq. Ft./Pallet
SD (Small Diameter)	20 to 38	508 to 965	17 to 35	432 to 889	1200 / (111.5m²)
LD (Large Diameter)	40 and up	1016 and up	37 and up	940 and up	
Thickness: 2" (51mm)					
Product Type	Metal Unfinished Duct ID		Finished ID		
	in	mm	in	mm	Sq. Ft./Pallet
SD (Small Diameter)	28 and up	711 and up	24 and up	610 and up	880 / (81.8m²)

Physical Properties

Properties	Performance	Test Methods
Operating Limits: Temperature	Maximum: 250°F (121°C)	ASTM C411
Air Velocity	6,000 fpm (30.5 m/s)	UL 181, ASTM C1071
Surface Burning Characteristics (Fire Hazard Classification)	Maximum: Flame Spread Index 25 Smoke Developed Index 50	ASTM E84 UL 723
Limited Combustibility	Pass (<3,500 Btu/lb)	NFPA 255
Water Vapor Sorption	<3% by weight	ASTM C1104
Corrosiveness	Pass	ASTM C665
Fungi Resistance	Pass, no growth	ASTM C1338 & G21
Bacteria Resistance	Pass, no growth	ASTM G22

General Information

Thermal Performance

Product		K-Value		C-Value		R-Value	
Thickness		Btu•in. h•ft ² •°F	W m ² •°C	Btu h•ft ² •°F	W m ² •°C	h•ft ² •°F Btu	m ² •°C W
in.	mm						
1	25	0.23	0.033	0.23	1.31	4.3	0.76
1 1/2	38			0.15	0.87	6.5	1.15
2	50			0.12	0.65	8.7	1.53

Thermal conductance (C) and resistance (R) values are derived from the material thermal conductivity (k) value. Tested in accordance with ASTM C518 and/or ASTM C177 at 75°F (24°C) mean temperature.

Acoustical Performance

Product		Absorption Coefficients @ Octave Band Frequencies (Hz)						
Thickness		125	250	500	1000	2000	4000	NRC
in.	mm							
1	25	0.07	0.21	0.74	0.98	1.05	1.04	0.75
1 1/2	38	0.12	0.49	1.02	1.10	1.06	1.07	0.90
2	50	0.17	0.76	1.05	1.02	0.95	0.96	0.95

Sound absorption tested in accordance with ASTM C423 using Type A mounting per ASTM E795.

Use and Limitations

CertainTeed ToughGard Ultra*Round Duct Liner is intended for use in spiral and round HVAC ducts operating at temperatures up to 250°F and air velocities not exceeding 6,000 fpm.

CertainTeed ToughGard Ultra*Round Duct Liner can be used to replace double wall construction. However, the contractor should obtain appropriate approvals prior to bidding and installing ToughGard Ultra*Round Duct Liner as a substitute to specified double wall construction in the project specifications.

Limitations: ToughGard Ultra*Round Duct Liner is not to be used under poured concrete slabs or to convey exhaust fumes, solids or corrosive gases. Ducts exposed to the weather must be weather protected and reinforced per industry standards. They must not be used adjacent to high temperature heating coils. Insulation should be kept clean and dry during shipping, storage, installation and system operation. Please see your CertainTeed representative if you have questions.

Installation Procedures

General

Straight sections of duct are lined by forming the ToughGard Ultra*Round Duct Liner into a tube that is the same diameter as the inside of the duct. This tube is then compressed and slipped into the duct until it is flush with one end of the duct section. The Ultra*Round Duct Liner expands against the duct wall, holding itself in place without the need for adhesive or pins. Additional tubes of Ultra*Round Duct Liner are then inserted from the opposite end of the duct until the duct is fully lined.

When deemed necessary by the installer or project specifications, Ultra*Round should additionally be secured, as required, to the sheet metal ductwork using mechanical fasteners (impact-driven or weld-secured). These fasteners vary in type and length. Fastener length should be such that the Ultra*Round thickness is compressed no more than 10% of its design thickness. Maximum fastener spacing shall be in accordance with NAIMA or SMACNA guidelines.

Installation Steps

1. Determine the Type of ToughGard Ultra*Round Duct Liner Required.

See the chart on page 5 to determine which type of duct liner to select.

2. Determine the Ultra*Round Duct Liner Stretch-Out Dimension.

Stretch-out is the length of the duct liner that is required to form a tube that has an outside diameter equal to the inside diameter of the duct being lined. The only accurate way to determine the stretch-out for a given duct is to measure the inside circumference of the duct with a flexible tape and then test fit a duct section. It is often necessary to reduce the actual circumferential measurement by $\frac{1}{8}$ " to $\frac{1}{2}$ " in order to obtain a proper fit. As a starting point, the nominal stretch-out dimension for standard duct sizes can be found in the table below or calculated from the following formula:

$$SO = D \times 3.14159$$

SO is the stretch-out length in inches. D is the duct inside diameter in inches.

Ultra*Round Stretch-out Dimensions

Duct Diameter I.D. Unlined (in)	Nominal Stretch-out (in)	Duct Diameter I.D. Unlined (in)	Nominal Stretch-out (in)
14	44	32	106½
16	50¼	34	106¾
17	53⅝	36	113⅝
18	56½	38	119⅝
20	62¾	40	125⅝
22	69⅝	42	131⅝
24	75⅝	44	138¼
26	81⅝	46	144½
28	87⅞	48	150¾
30	94¼	50	157⅞

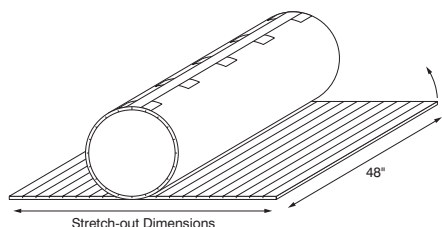


Figure 1 — Tube Forming

3. Forming the Tube

Measure the stretch-out dimension along the length of the Ultra*Round Duct Liner and make a cut parallel to the width of the liner. The length dimension of the duct liner is perpendicular to the direction in which grooves are cut into the duct liner air stream surface.

With the Ultra*Round Duct Liner lying flat and the air stream surface facing up, raise the two width edges in a circular motion until they meet and form a butt joint that causes the duct liner to take the shape of a tube. Hold the butt joint in place by using tape cross tabs (a minimum of 8" long on 12" centers) along the width of the formed tube and then applying a length of tape centered along the entire butt joint seam (Figure 1). Tape tabs and the tape itself must meet the requirements for UL 181 A closures.

Ducts with diameters of 38" and larger will have stretch-out dimensions that exceed the 120" length of the duct liner. When this occurs it will be necessary to join multiple pieces of Ultra*Round Duct Liner together to obtain the required stretch-out dimension. This can be accomplished by placing two or more pieces of Ultra*Round Duct Liner on a flat surface with their air stream surface down and butting them together along their widths. The butt joints are then attached using tape and cross tabs as described above.

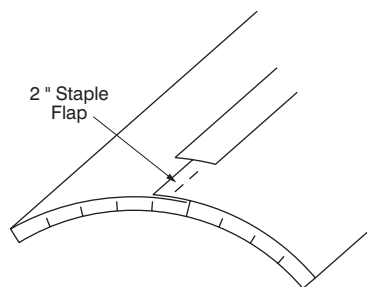


Figure 2 — Optional Staple Flap Joint

Butt joints can also be made by forming a staple flap using the duct liner FSK facing, ½" outward clinching staples and tape. The staple flap is formed by measuring back 2" from one of the width edges, cutting through the insulation down to the FSK facing (but not through the facing) and stripping away the insulation to form a 2" wide tab. The joint is then formed by pulling the tab across the edge of the adjacent section and stapling it in place using outward clinching staples on 4" to 5" centers. Tape is centered along the full length of the tab edge and rubbed firmly in place (Figure 2).

Note: When using staple flap joints, you must add 2" to the stretch-out dimension to replace the amount of insulation that was lost when forming the staple flap.

4. Test Fitting the Duct

Most spiral and round sheet metal ducts are supplied in standard sizes. However, these are nominal sizes and actual dimensions can vary between suppliers. For this reason it is recommended that a test fitting be made on each duct size in order to confirm that the stretch-out dimension is correct for that specific duct.

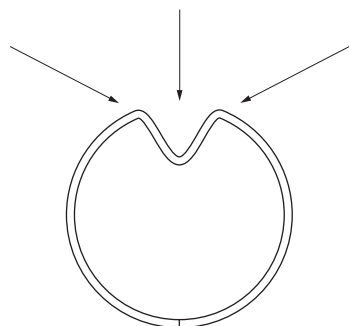


Figure 3

With the trial duct liner tube lying on the floor and with the joint on the bottom of the tube, push down on the top of the tube to form a heart shape (Figure 3). This heart shape reduces the diameter of the insulation tube so that it can be inserted into the duct until the end edge of the tube is flush and square with the front edge of the duct section. Push the folded portion outward until it fits tightly inside the duct with no ripples or overlapping sections. At this point, the compressive strength of the insulation will cause the tube walls to expand out and firmly hold the insulation in place. Check for snugness of fit and make adjustments to the stretch-out dimension as required. There should be no gap between the insulation and the duct wall.

Installation Procedures

Installation Steps (cont'd)

5. Completing the Duct

With the first section in place, insert additional sections of duct liner into the opposite end of the sheet metal duct using the method described above until the entire duct is lined. As you insert the additional sections, make sure that the sections are tightly butted and square with the duct. A mastic or duct adhesive, meeting the requirements of ASTM C916, can be applied to the edges to ensure fibers disturbed during fabrication are sealed.

The ToughGard Ultra*Round Duct Liner sections are 48" long so it will often be necessary to install a partial section in order to completely line the duct. The partial section can be prefabricated or full sections can be inserted into the duct and trimmed to fit. In either case the cut edges must be coated with a mastic or duct liner adhesive that meets the requirements of ASTM C916 as required by the NAIMA and SMACNA standards (Figure 4).

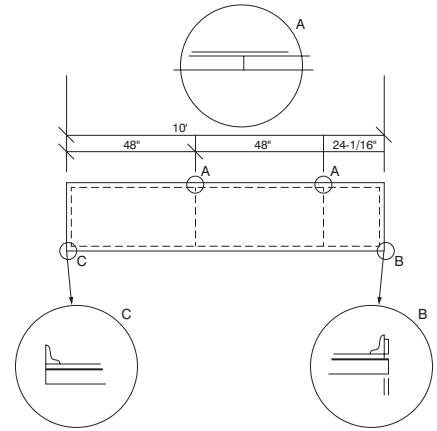


Figure 4

6. Transverse Joint Connections

There are several types of connections used to join sections of spiral and round sheet metal ducts, and their installation details can impact the installation of Ultra*Round Duct Liner (Figure 5).

For connectors that reduce the inside diameter of the duct, it may be necessary to remove a strip of FSK facing (the width of the collar seat) from the outside of the Ultra*Round Duct Liner tube to allow the collar to slip into place properly. If the inside diameter of the duct is reduced by more than 1/4", a strip of insulation with the FSK facing removed may be required to compensate for this duct ID reduction.

For connectors that are screwed in place, it may be necessary to remove the screws in order to allow the insulation to be slipped into place.

For connectors that have beads or use gaskets it may be necessary to adjust the location of the Ultra*Round Duct Liner tube so that when the sections of duct are joined there are no gaps in the insulation.

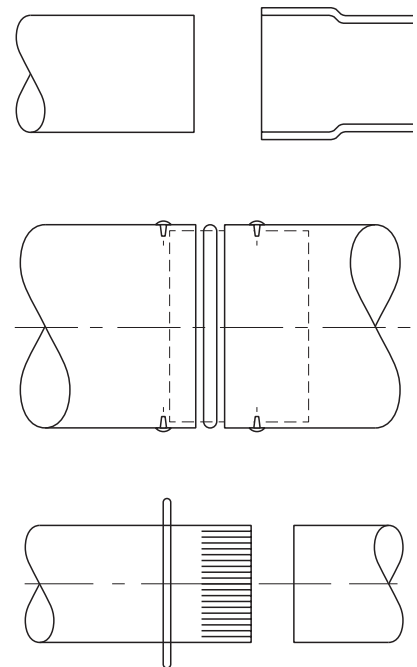


Figure 5

Installation of Fittings

General Information

ToughGard Ultra*Round may be used for fittings, but CertainTeed recommends the use of CertainTeed ToughGard Duct Liner for this approach. This rotary duct liner has the unique characteristics of strength, durability and flexibility that allow it to be formed into various shapes while maintaining its integrity, and it has the same smooth air stream surface as Ultra*Round as well as virtually the same thermal and acoustic performance characteristics. In addition, fabrication using ToughGard Duct Liner saves considerable labor and reduces waste compared to other methods of lining fittings.

Due to the large variety of fittings possible in a round duct system, only the most common types will be covered in this manual. The principles that apply to the fittings shown may be adapted to other types of fittings. Spiral or round duct systems are normally fabricated conforming to the standards set forth by the Sheet Metal and Air Conditioning Contractors' Association of North America (SMACNA) or the Spiral Duct Manufacturers Association (SPIDA). Thus, many fittings will be typical to all manufacturers. However, due to the inconsistencies of both man and machine, it is still very important to verify dimensions of all fittings.

Attachment of the duct liner to the sheet metal should follow the requirements found in the NAIMA Fibrous Glass Duct Liner Standard or the SMACNA Duct Construction Standards. While the information in these standards is for rectangular ducts, the gluing, pinning and edge treatment requirements are applicable to round ducts. Additionally, all adhesives and mastics used should meet the requirements of ASTM C916. One of the main requirements of ASTM C916 is that the adhesive or mastic have a flame spread index not greater than 25 and a smoke developed index of not greater than 50 when tested in accordance with ASTM E84.

Installation of Fittings

Common Reducers

The most common form of reducer is the concentric reducer. The concentric reducer consists of three parts: an inlet collar, a center section that transitions from one size to another, and an outlet collar. The collars are provided “fitting size,” meaning the outer diameters of the collars are just small enough to slip inside the duct on either end of the fitting. A flat pattern or the fitting itself prior to forming can be used to cut the liner to shape. The collar sections are cut to the length and stretch-out dimension of the collars. Adhesive is applied to the inside of the fitting and the cut pieces of duct liner are then installed. Weld pins or impact applied pins are then installed in accordance to location and spacing requirements, and all cut edges of the duct liner are buttered with an adhesive or mastic. Since the liner is installed from “end to end” of the reducer, the connecting section of straight duct will require the duct liner to be cut back the amount that the collar slips into the duct. Adhesive or mastic should be applied to the edges of the Ultra*Round installed in the straight duct sections and to the edges of the liner installed in the reducer. If fittings are purchased and patterns are not available, a simple layout method, the apex method, can be used for centerline tapers (Figure 6).

Draw a side view of the reducer. The height should equal that of the fitting being lined. The inlet and outlet dimensions should equal those of the fitting being lined. Extend the sloping lines of the reducer upward until they meet to form a triangle. At the point of intersection, the apex, sweep an arc through the point where the outlet collar intersects the body of the fitting. This arc should be large enough to contain the circumference of the outlet end of the taper. Next, sweep an arc through the point where the inlet collar intersects the body of the fitting. It should be large enough to contain the circumference of the inlet end of the taper. From the apex, draw a straight line to the bottom arc (inlet end). Measure the circumference of the inlet end along the arc from the point of intersection of this line. Make a mark on the arc to define the measurement of the circumference. From this point, draw a line to the apex. The intersection of the arc through the inlet ID and the two lines just drawn will locate the top end of the pattern and will be equal to the circumference of the outlet end. Cut along the arcs and along the two straight lines. The resulting pattern can be laid on the liner for marking and cutting.

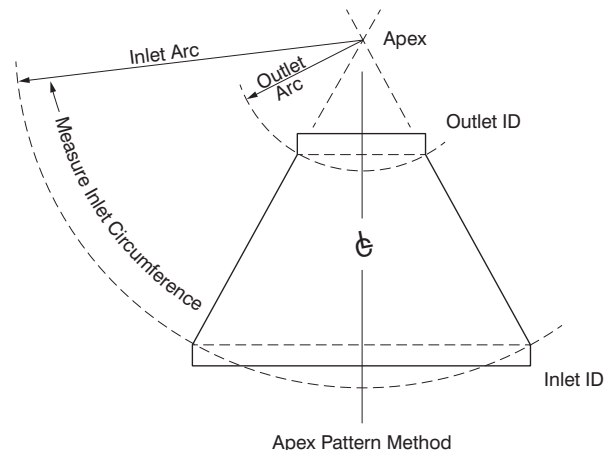


Figure 6

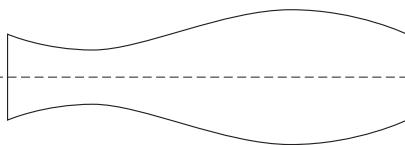
Other Reducers

Other reducers (eccentric, offset, etc.) can also be lined using flat patterns to cut the duct liner to the required shape. If patterns are not available, lay out the insulation with the same method used for sheet metal. Remember that many sheet metal patterns are laid out with additional metal added for seams. The insulation should be cut to the finished dimensions of the fittings after they are assembled.

Multiple Gore Elbows



End Gore Pattern



Center Gore Pattern

Figure 7

Duct liner should be used to line elbows as well as reducers. Use an end-gore pattern for the two end gores and a center-gore pattern for the two center gores (Figure 7). Since most patterns have an allowance for seams, either subtract the seam allowance when marking on the duct liner or use patterns for butt-welded elbows. Adhesive should be applied to the interior surface of the elbows and the liner installed working from one end to the other. At the junction of the two pieces of insulation use either a duct adhesive or mastic to butter the seams. Weld pins or impact pins are then installed in accordance with the location and spacing requirements. The minimum pinning requirements are one row of pins per gore on 16" centers around the circumference. Some larger elbows may require two or more rows of pins for each gore. Since elbows are also made "fitting size," duct liner should be installed from end to end. Cut back the duct liner on adjacent straight sections the amount required for the collar of the elbow to fit into the straight section. Use adhesive or mastic where the duct liner in the elbow and the duct liner board in the straight section mate.

Estimating Material Requirements

Estimating the ToughGard Ultra*Round Duct Liner material needed for a job is easy and straightforward. The process involves determining the stretch-out dimension for each duct diameter, multiplying it by the lineal feet of that duct size and then adding an allowance for scrap. This is done for each duct size and the results are added together to get the total job requirements. Note that product type and thickness do not affect the job's total square feet requirements, but you will need to keep track of them so that the right materials are priced and ordered for the job.

Caution: When estimating material requirements from plan drawings, be sure to confirm that the duct diameters indicated include an allowance for the thickness of the liner. Unless specifically indicated on the drawing, duct cross sectional dimensions are normally considered to be for the net free area indicated and the actual size of the duct must be increased to allow for the thickness of the liner. For 1" thick liner, add 2" to the duct diameter. For 1½" thick liner, add 3" to the duct diameter. For 2" thick liner, add 4" to the duct diameter.

The stretch-out dimension in feet can be calculated from the following formula or looked up in the table on the next page.

Duct I.D. (Inner Dimensions) is measured in inches.
SO (Stretch-out)

$$\text{SO} = \frac{\text{duct I.D.} \times 3.14159}{12} = .262 \times \text{Duct I.D.}$$

The scrap factor should be based upon the contractor's experience, work practices and job conditions. As a rule of thumb, use 10% for shop installations and 15% for field installations.

The material requirements for a given duct size are calculated using the following equation:

$$\begin{aligned} \text{Material required} &= (\text{SO} \times \text{lineal feet of duct}) + (\text{SO} \times \text{lineal feet of duct} \times \frac{\% \text{ scrap}}{100}) \\ &= (1 + \frac{\% \text{ scrap}}{100}) \times (\text{SO} \times \text{lineal feet of duct}) \end{aligned}$$

Example: 40 feet of 24" spiral duct lined with 1" SD ToughGard Ultra*Duct Liner, fabricated in the shop.

A. Using the table: For a 24" duct, the stretch-out is 75.4" and the material usage is 6.91 square feet of Ultra*Round per lineal foot of duct, including a 10% scrap factor:

$$6.91 \times 40 = 276.40 \text{ ft}^2$$

B. Using the equation:

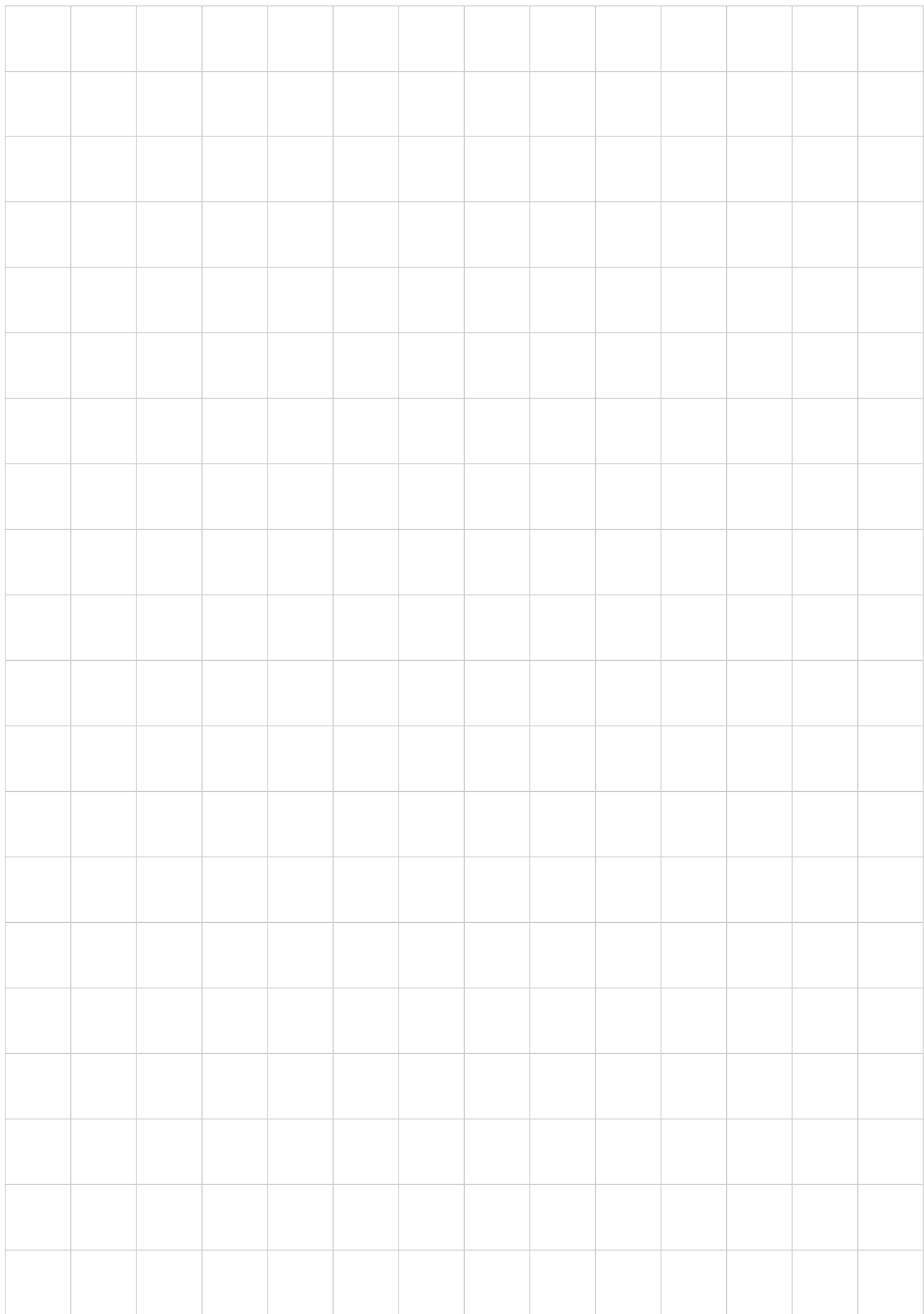
$$\begin{aligned} \text{Material required} &= (1 + \frac{10}{100}) \times (.262 \times 24) \times (40) \\ &= (1.1) \times (.262 \times 24) \times (40) \\ &= 276.67 \text{ ft}^2 \end{aligned}$$

Stretch-out Chart

CertainTeed ToughGard Ultra*Round Stretch-out Chart and Material Estimating Table

Duct Diameter I.D. Unlined (in)	Nominal Stretch-out (in)	Material Usage Including Scrap Factor (ft² per lineal feet of duct)				
		0% Scrap	5% Scrap	10% Scrap	15% Scrap	20% Scrap
14	44	3.7	3.9	4.0	4.2	4.4
16	50¼	4.2	4.4	4.6	4.8	5.0
17	53⅜	4.5	4.7	4.9	5.1	5.3
18	56½	4.7	4.9	5.2	5.4	5.7
20	62¾	5.2	5.5	5.8	6.0	6.3
22	69⅞	5.8	6.0	6.3	6.6	6.9
24	75⅞	6.3	6.6	6.9	7.2	7.5
26	81⅝	6.8	7.1	7.5	7.8	8.2
28	87⅞	7.3	7.7	8.1	8.4	8.8
30	94¼	7.9	8.2	8.6	9.0	9.4
32	100½	8.4	8.8	9.2	9.6	10.1
34	106¾	8.9	9.3	9.8	10.2	10.7
36	113⅝	9.4	9.9	10.4	10.8	11.3
38	119⅞	9.9	10.4	10.9	11.4	11.9
40	125⅝	10.5	11.0	11.5	12.0	12.6
42	131⅞	11.0	11.5	12.1	12.6	13.2
44	138¼	11.5	12.1	12.7	13.2	13.8
46	144½	12.0	12.6	13.2	13.8	14.5
48	150¾	12.6	13.2	13.8	14.5	15.1
50	157	13.1	13.7	14.4	15.1	15.7
52	163⅜	13.6	14.3	15.0	15.7	16.3
54	169⅝	14.1	14.8	15.6	16.3	17.0
56	175⅞	14.7	15.4	16.1	16.9	17.6
58	182⅞	15.2	15.9	16.7	17.5	18.2
60	188½	15.7	16.5	17.3	18.1	18.8
62	194¾	16.2	17.0	17.9	18.7	19.5
64	201	16.8	17.6	18.4	19.3	20.1
66	207⅜	17.3	18.1	19.0	19.9	20.7
68	213⅝	17.8	18.7	19.6	20.5	21.4
70	219⅞	18.3	19.2	20.2	21.1	22.0
72	226⅞	18.8	19.8	20.7	21.7	22.6

Note: Stretch-out dimension based on butt joints. For staple flap joints, add 2" per joint. For ducts greater than 38", add-on sections are required. Minimum add-on section is 12".



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