



**Project:**

**Address:**

---

## **HVAC SUBMITAL**

---

**DATE:**

**ITEM:**

**SPECIFICATION:**

**SEQUENCE:**

ARCHITECT

ENGINEER

MECHANICAL  
CONTRACTOR



# PRODUCT DATA SUBMITTAL

# Rectangular Duct and Fittings Submittal

Submittal package provided based on the Project specifications and plans.

Prepared for the following:

**Project Name:** ]

All ductwork will be manufactured in accordance with the 2005 SMACNA HVAC Duct Construction Standards, Metal and Flexible, unless otherwise noted below:

**Materials:** Galvanized Steel Metal (ASTM A653 and A924)

**Pressure Class:** Positive  
1" W.G.  
2" W.G.  
3" W.G.

**Duct and Fitting Longitudinal Seam Construction:** Pittsburgh Locke

**Ducts to ship to the site with complete assembly of all fittings and straight duct**

**Duct Construction:** Single Bare Metal / Double Wall w/ Perforated Inner Wall 1" Insulation  
Kitchen Exhaust 18 Ga Stainless Steel 304 1/2" FL Out Joints Fully  
Welded

**Canvas Connections**

**Manual Volume Dampers** Included up to 12" depth – Up to 18" wide

**Slips & Drives**

**Ductmate Connections**

**TDC Connections**

**Conduit Reinforcements**

**Turning Vanes**

Included in all 90° Elbows – double wall type

**Production Identification**

Each product will be piece marked and tagged for easier installation with labels and piece marked drawing with a coordinated material list

# Galvanized Steel



All ductwork fabricated from galvanized steel is made with G-90 hot dipped galvanized metal. This cold rolled steel complies with ASTM A 527/A 653.

G90 steel is coated with a minimum .90 oz/ft<sup>2</sup> zinc to steel ratio.

Estimated to have zinc coating thickness of 1.53 mils (according to ASTM A 653/A 653M- 8.1.2.1).

Thermally treated galvanized steel suitable for immediate painting is available; known as “Galvaneal” and “Paintgrip”.

Available gauges: 16 ga to 26 ga  
Meets LEEDS standards for green construction.



## Meets LEEDS/GREEN standards

- ONLY RECYCLED DOMESTIC STEEL
- DUCT WIPED OUT
- WRAPPED ENDS PREVENT DEBRIS CONTAMINATION

2008 Recycled Steel Content (% by Total Weight)	
Product Group	Average Recycled Content
Nucor Bar Products	97.7%
Nucor Beam Products	76.2%
Nucor Plate Products	92.5%
Nucor Sheet Products	70.2%
<b>Total Nucor Steel Combined</b>	<b>89.7%</b>
Vulcraft Structural Products	97.7%
Vulcraft Decking	70.2%
Nucor Building Group	89.7%
NUCON Light Gauge Framing	70.2%
Nucor Fastener Products	97.7%
Nucor Wire Products	97.7%
Nucor Cold Finish	97.7%



February 19, 2013

**To: All Nucor Customers**

**Re: 2012 Recycled Content of Nucor Steel Products**

Nucor Corporation is the nation’s largest recycler, using over 19 million tons of scrap steel in 2012 to create new products. Nucor uses Electric Arc Furnace (EAF) technology at all of its steel recycling facilities. EAFs use post-consumer scrap steel material as the major feedstock, unlike blast furnace operations that use mined iron ore as the major feedstock. Nucor has prepared the following information to help calculate the recycled content for products being used in “Green Building” applications or for projects in the LEED® program. These percentages are approximate and are based on the total weight of the products. The calculations are based on 2012 scrap steel delivered and finished materials produced and are defined in accordance with ISO 14021:1999. More specific product information may be available from facility representatives.

**Recycled Content – LEED Version 2.2 Credits 4.1 & 4.2 and LEED V 3 Credit 4**

<b>2012 Recycled Steel Content of Nucor Products (% by Total Weight)</b>	
<b>Product Group</b>	<b>Average Recycled Content</b>
Nucor Bar Products	99.9%
Nucor Beam Products (and Nucor Castrip® Arkansas, LLC’s sheet products)	82.1%
Nucor Plate Products	84.8%
Nucor Sheet Products	75.7%
Nucor Castrip® Crawfordsville, IN	97.4%
<b>Total Nucor Steel Combined</b>	<b>91.4%</b>
Vulcraft Structural Products	99.9%
Vulcraft Decking	75.7%
Nucor Building Group	91.4%
Nucor Fastener Products	99.9%
Nucor Wire Products	99.9%
Nucor Cold Finish	99.9%

**Regional Materials – LEED Version 2.2 Credits 5.1 & 5.2 and LEED Version 3 Credit 5**

Nucor tracks the origin of scrap shipments to our mills. Nucor can approximate the amount of scrap extracted from any project site region. Nucor owns steel and steel products manufacturing facilities throughout the US that are often within 500 miles of the project site. Please refer to the LEED Contact List ([www.nucor.com/responsibility/environment/leed](http://www.nucor.com/responsibility/environment/leed), then click on “Nucor Regional Material Contacts”), and contact the specific Nucor representative at the facility directly.

**Bar Mill Group** – Darlington, SC; Norfolk, NE; Jewett, TX; Plymouth, UT; Auburn, NY; Birmingham, AL; Kankakee, IL; Jackson, MS; Seattle, WA; Marion, OH; Memphis, TN, Kingman, AZ

<b>2012 Approximate Recycled Steel Content Of All Nucor Bar Mill Group Products<sup>(*)</sup></b>				
Facility	Total Scrap Steel Used	Total Alloys and Other Iron Units	Total Post-consumer Recycled Content	Total Pre-consumer/ Post-industrial Recycled Content
All	<b>99.9%</b>	<b>0.1%</b>	<b>83%</b>	<b>17%</b>

The Nucor Bar Mill Group produces rebar, angles, flats, rounds and other miscellaneous shapes. The bar mill group uses recycled scrap steel for 99.9% of the feedstock.

**Sheet Mill Group** – Crawfordsville, IN; Hickman, AR; Huger, SC; Decatur, AL

<b>2012 Approximate Recycled Steel Content Of Nucor Sheet Mill Group Products<sup>(*)</sup></b>				
Facility	Total Scrap Steel Used	Total Alloys and Other Iron Units	Total Post Consumer Recycled Content	Total Pre-consumer/ Post-industrial Recycled Content
Crawfordsville, IN	<b>95.4%</b>	<b>4.6%</b>	<b>79.2%</b>	<b>16.2%</b>
Nucor Castrip® Crawfordsville, IN	<b>97.4%</b>	<b>2.6%</b>	<b>80.8%</b>	<b>16.6%</b>
Hickman, AR	<b>71.0%</b>	<b>29.0%</b>	<b>58.9%</b>	<b>12.1%</b>
Berkeley, SC	<b>64.1%</b>	<b>35.9%</b>	<b>53.2%</b>	<b>10.9%</b>
Decatur, AL	<b>72.5%</b>	<b>27.5%</b>	<b>60.2%</b>	<b>12.3%</b>

The Nucor Sheet Mill Group produces hot band, cold rolled, pickled and galvanized products. Nucor Sheet mills use varying amounts of recycled materials depending on metallurgical product demands and market conditions. The combined sheet mill total recycled content is approximately 75.7%.

**Beam Group** – Blytheville, AR; Huger, SC

<b>2012 Approximate Recycled Steel Content of Beam Mill Products<sup>(*)</sup></b>				
Facility	Total Scrap Steel Used	Total Alloys and Other Iron Units	Total Post Consumer Recycled Content	Total Pre-consumer/ Post-industrial Recycled Content
Nucor Yamato Steel, Blytheville, AR and Nucor Castrip Arkansas, LLC	<b>99.9%</b>	<b>0.1%</b>	<b>83.0%</b>	<b>17.0%</b>
Nucor Berkeley, Huger, SC	<b>64.2%</b>	<b>35.8%</b>	<b>53.3%</b>	<b>10.9%</b>

Nucor Beam mills produce narrow and wide flange structural beams. Nucor Yamato uses approximately 99.9% scrap steel for their feedstock. Nucor Castrip Arkansas, LLC uses steel melted at Nucor Yamato and products would be equivalent. Nucor Steel Berkeley uses a higher percentage of non-scrap iron due to metallurgical product demands for sheet steel produced using the same EAF's. The combined beam mill recycled content is approximately 82.1%.

**Plate Group** - Hertford County, NC; Tuscaloosa, AL

<b>2012 Approximate Recycled Steel Content of Plate Mill Products<sup>(*)</sup></b>				
Facility	Total Scrap Steel Used	Total Alloys and Other Iron Units	Total Post Consumer Recycled Content	Total Pre-consumer/ Post-industrial Recycled Content
Hertford County, NC	<b>89.6%</b>	<b>10.4%</b>	<b>74.4%</b>	<b>15.2%</b>
Tuscaloosa, AL	<b>79.9%</b>	<b>20.1%</b>	<b>66.3%</b>	<b>13.6%</b>

The Nucor Plate combined recycled content by weight is approximately 84.8%.

<sup>(\*)</sup> Studies show that the recycled steel used for Nucor products consists of approximately 83% post-consumer scrap. The remaining 17% typically consists of pre-consumer scrap generated by manufacturing processes.

**Vulcraft Group** – Florence, SC; Norfolk, NE; Brigham City, UT; Grapeland, TX; St. Joe, IN; Fort Payne, AL; Chemung, NY; **Verco Decking, Inc.** – Phoenix, AZ; Fontana, CA; Antioch, CA

**Joists** - The bar steel for Vulcraft joists is typically obtained from one of the eleven Nucor bar mills. That would mean that the average recycled content percentage for the Vulcraft group is 99.9%. The post consumer and pre consumer recycled content have been calculated to be approximately 83% and 17% respectively.

**Deck** – Steel for decking produced by Vulcraft facilities is typically obtained from one of the four Nucor sheet mills. That would mean that the Vulcraft deck products contain approximately 75.7% recycled steel. The post and pre consumer recycled content were calculated to be approximately 62.9% and 12.9% respectively. Verco Decking, Inc. may obtain steel from sources outside of Nucor that may contain lower amounts of recycled content; specific product information regarding Verco Decking, Inc. is available from facility representatives.

### **Products Group -**

- **Nucor Building Group** –
  - Swansea, SC; Waterloo, IN; Terrell, TX; Brigham City, UT;
  - **American Buildings Company** – Eufaula, AL; La Crosse, VA; Carson City, NV; El Paso, IL;
  - **Kirby Building Systems** – Portland, TN;
  - **Gulf States Manufacturer** – Starkville, MS;
  - **CBC Steel** – Lathrop, CA;
- **Nucor Fastener** – St. Joe IN
- **Nucor Wire Products Pennsylvania** – New Salem, PA; **Nucor Steel Connecticut** – Wallingford, CT; **LMP Steel** – Maryville, MO;
- **Nucor Cold Finish** – Milwaukee, WI; Darlington, SC; Brigham City, UT; Norfolk, NE
- **Nucor Steel Kingman, LLC**

**Nucor Building Group** (Including American Buildings Company, Kirby Building Systems, Gulf States Manufacturer, and CBC Steel) – Nucor Building Group products may contain steel from all of the Nucor steel mills or obtain steel from outside of Nucor Corporation for their sheet, plate, bar and beam steel needs. The Nucor Building Systems, when using Nucor steel, contains an average of 91.4% total recycled content. The post and pre consumer recycled content was 71.1% and 14.6% respectively.

**Nucor Fastener** – Steel for Nucor fasteners is typically obtained from Nucor bar mills that use scrap steel as their feedstock. Some fasteners may contain high percentages of alloys that may reduce the total recycled content of the products, but Nucor Fastener products typically contain 99.9% recycled materials. That would mean that the post and pre consumer recycled content would be approximately 83% and 17% respectively.

**Nucor Wire Products Pennsylvania, Nucor Connecticut, LMP Steel** – Steel for wire is typically obtained from a Nucor bar mill that uses scrap as the feedstock. Nucor wire products, when using Nucor bar steel, would contain an average 99.9% recycled steel. The post and pre consumer recycled content was calculated to be approximately 83% and 17% respectively.

**Nucor Cold Finish** – Steel processed at Nucor Cold Finish is typically obtained from Nucor bar mills. The Nucor Cold Finish, when using Nucor steel, would contain an average amount of 99.9% recycled steel. The post and pre consumer recycled content was calculated to be approximately 83% and 17% respectively.

**Nucor Steel Kingman, LLC** – Steel for Nucor Steel Kingman, LLC products is typically obtained from Nucor bar mills that use scrap steel as their feedstock. Nucor Steel Kingman, LLC products would then typically contain 99.9% recycled materials. That would mean that the post and pre consumer recycled content would be approximately 83% and 17% respectively.

Additional information regarding specific recycled content of Nucor Corporation products group for a customer's specific order is available from facility representatives.

Additional information is available online through the Steel Recycling Institute at <http://www.recycle-steel.org>.



# Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy- Coated (Galvannealed) by the Hot-Dip Process<sup>1</sup>

This standard is issued under the fixed designation A 653/A 653M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process in coils and cut lengths.

1.2 The product is produced in various zinc or zinc-iron alloy-coating weights [masses] or coating designations as shown in Table 1.

1.3 Product furnished under this specification shall conform to the applicable requirements of the latest issue of Specification A 924/A 924M, unless otherwise provided herein.

1.4 The product is produced in a number of designations, types, grades, and classes pertaining to chemical composition and typical mechanical properties of the steel sheet which are designed to be compatible with differing application requirements.

1.5 This specification is applicable to orders in either inch-pound units (as A 653) or SI units (as A 653M). Values in inch-pound and SI units are not necessarily equivalent. Within the text, SI units are shown in brackets. Each system shall be used independently of the other.

1.6 Unless the order specifies the “M” designation (SI units), the product shall be furnished to inch-pound units.

1.7 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of this specification.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

- A 90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings<sup>2</sup>
- A 568/A568M Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled,

### General Requirements for<sup>3</sup>

A 902 Terminology Relating to Metallic Coated Steel Products<sup>2</sup>

A 924/A924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process<sup>2</sup>

D 2092 Guide for Treatment of Zinc-Coated (Galvanized) Steel Surfaces for Painting<sup>4</sup>

E 517 Test Method for Plastic Strain Ratio  $r$  for Sheet Metal<sup>5</sup>

E 646 Test Method for Tensile Strain-Hardening Exponents ( $n$  values) of Metallic Sheet Materials<sup>5</sup>

### 2.2 ISO Standard:

ISO 3575 Continuous Hot-Dip Zinc-Coated Carbon Steel Sheet of Commercial, Lock-Forming, and Drawing Qualities<sup>6</sup>

## 3. Terminology

3.1 *Definitions*— See Terminology A 902 for definitions of general terminology relating to metallic-coated hot-dip products.

### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *differentially coated, n*—galvanized steel sheet having a specified “coating designation” on one surface and a significantly lighter specified “coating designation” on the other surface.

3.2.1.1 *Discussion*—The single side relationship of either specified “coating designation” is the same as shown in the note of Table 1 regarding uniformity of coating.

3.2.2 *high strength low alloy steel, Type A sheet, n*—steel sheet intended for applications where mechanical properties are specified and where improved formability is required compared to structural steel.

3.2.2.1 *Discussion*—Suppliers use one or a combination of microalloying elements as strengthening agents.

3.2.3 *high strength low alloy steel, Type B sheet, n*—steel sheet intended for applications where mechanical properties are specified and where improved formability is required compared to high strength low alloy steel, Type A.

3.2.3.1 *Discussion*—Suppliers use one or a combination of

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee A05 on Metallic-Coated Iron and Steel Products and is the direct responsibility of Subcommittee A05.11 on Sheet Specifications.

Current edition approved Oct. 10, 2000. Published November 2000. Originally published as A 653/A 653M – 94. Last previous edition A 653/A 653M – 99a.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.06.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.03.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 06.02.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 03.01.

<sup>6</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

**TABLE 1 Weight [Mass] of Coating Requirements<sup>A,B,C</sup>**

NOTE 1— Use the information provided in 8.1.2 to obtain the approximate coating thickness from the coating weight [mass].

		Minimum Requirement <sup>D</sup>			
		Triple-Spot Test		Single-Spot Test	
Inch-Pound Units					
Type	Coating Designation	Total Both Sides, oz/ft <sup>2</sup>	One Side	Total Both Sides, oz/ft <sup>2</sup>	
Zinc	G360	3.60	1.28	3.20	
	G300	3.00	1.04	2.60	
	G235	2.35	0.80	2.00	
	G210	2.10	0.72	1.80	
	G185	1.85	0.64	1.60	
	G165	1.65	0.56	1.40	
	G140	1.40	0.48	1.20	
	G115	1.15	0.40	1.00	
	G90	0.90	0.32	0.80	
	G60	0.60	0.20	0.50	
	G40	0.40	0.12	0.30	
	G30	0.30	0.10	0.25	
	G01	no minimum	no minimum	no minimum	
	Zinc-iron alloy	A60	0.60	0.20	0.50
A40		0.40	0.12	0.30	
A25		0.25	0.08	0.20	
A01		no minimum	no minimum	no minimum	
SI Units					
Type	Coating Designation	Total Both Sides, g/m <sup>2</sup>	One Side	Total Both Sides, g/m <sup>2</sup>	
Zinc	Z1100	1100	390	975	
	Z900	900	316	790	
	Z700	700	238	595	
	Z600	600	204	510	
	Z550	550	190	475	
	Z500	500	170	425	
	Z450	450	154	385	
	Z350	350	120	300	
	Z275	275	94	235	
	Z180	180	60	150	
	Z120	120	36	90	
	Z90	90	30	75	
	Z001	no minimum	no minimum	no minimum	
	Zinc-iron alloy	ZF180	180	60	150
		ZF120	120	36	90
		ZF75	75	24	60
		ZF001	no minimum	no minimum	no minimum

<sup>A</sup>The coating designation number is the term by which this product is specified. Because of the many variables and changing conditions that are characteristic of continuous hot-dip coating lines, the zinc or zinc-iron alloy coating is not always evenly divided between the two surfaces of a coated sheet; nor is it always evenly distributed from edge to edge. However, the minimum triple-spot average coating weight (mass) on any one side shall not be less than 40 % of the single-spot requirement.

<sup>B</sup>As it is an established fact that the atmospheric corrosion resistance of zinc or zinc-iron alloy-coated sheet products is a direct function of coating thickness (weight (mass)), the selection of thinner (lighter) coating designations will result in almost linearly reduced corrosion performance of the coating. For example, heavier galvanized coatings perform adequately in bold atmospheric exposure whereas the lighter coatings are often further coated with paint or a similar barrier coating for increased corrosion resistance. Because of this relationship, products carrying the statement "meets ASTM A 653/A 653M requirements" should also specify the particular coating designation.

<sup>C</sup>International Standard, ISO 3575, continuous hot-dip zinc-coated carbon steel sheet contains Z100 and Z200 designations and does not specify a ZF75 coating.

<sup>D</sup>No minimum means that there are no established minimum requirements for triple- and single-spot tests.

microalloying elements as strengthening agents and also treat the steel with additional small alloy additions to effect sulfide inclusion control.

3.2.4 *minimized spangle, n*—the finish produced on hot-dip zinc-coated steel sheet in which the grain pattern is visible to the unaided eye, and is typically smaller and less distinct than the pattern visible on regular spangle.

3.2.4.1 *Discussion*—This finish is produced by one of two methods: either (1) the zinc crystal growth has been started but arrested by special production practices during solidification of the zinc, or (2) the zinc crystal growth is inhibited by a combination of coating-bath chemistry plus cooling during solidification of the zinc. Minimized spangle is normally produced in coating designations G90 [Z275] and lighter.

3.2.5 *regular spangle, n*—the finish produced on hot-dip

zinc-coated steel sheet in which there is a visible multifaceted zinc crystal structure.

3.2.5.1 *Discussion*—Solidification of the zinc coating is typically uncontrolled, which produces the variable grain size associated with this finish.

3.2.6 *spangle-free, n*—the uniform finish produced on hot-dip zinc-coated steel sheet in which the visual spangle pattern, especially the surface irregularities created by spangle formation, is not visible to the unaided eye.

3.2.6.1 *Discussion*—This finish is produced when the zinc crystal growth is inhibited by a combination of coating-bath chemistry and/or cooling during solidification of the zinc.

3.2.7 *zinc-iron alloy, n*—a dull grey coating with no spangle pattern that is produced on hot-dip zinc-coated steel sheet.

3.2.7.1 *Discussion*—Zinc-iron alloy coating is composed

entirely of inter-metallic alloys. It is typically produced by subjecting the hot-dip zinc-coated steel sheet to a thermal treatment after it emerges from the molten zinc bath. This type of coating is suitable for immediate painting without further treatment except normal cleaning (refer to Guide D 2092). The lack of ductility of the alloy coating presents a potential for powdering, etc.

#### 4. Classification

4.1 The material is available in several designations as follows:

- 4.1.1 Commercial steel (CS Types A, B, and C),
- 4.1.2 Forming steel (FS Types A and B),
- 4.1.3 Deep drawing steel (DDS),
- 4.1.4 Extra deep drawing steel (EDDS),
- 4.1.5 Structural steel (SS),
- 4.1.6 High strength low alloy steel (HSLAS Type A), and
- 4.1.7 High strength low alloy steel (HSLAS Type B).

4.2 Structural steel and high strength low alloy steel are available in several grades based on mechanical properties. Structural Steel Grade 50 [340] is available in three classes based on tensile strength.

4.3 The material is available as either zinc-coated or zinc-iron alloy-coated in several coating weights [masses] or coating designations as shown in Table 1, and

4.3.1 The material is available with the same or different coating designations on each surface.

#### 5. Ordering Information

5.1 Zinc-coated or zinc-iron alloy-coated sheet in coils and cut lengths is produced to thickness requirements expressed to 0.001 in. [0.01 mm]. The thickness of the sheet includes both the base metal and the coating.

5.2 Orders for product to this specification shall include the following information, as necessary, to adequately describe the desired product:

5.2.1 Name of product (steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed)),

5.2.2 Designation of sheet [CS (Types A, B, and C), FS (Types A and B), DDS, EDDS, SS, or HSLAS (Types A and B)].

5.2.2.1 When a CS type is not specified, Type B will be furnished. When a FS type is not specified, FS Type B will be furnished.

5.2.3 When a SS or HSLAS designation is specified, state the type, grade, or class, or combination thereof.

5.2.4 ASTM designation number and year of issue, as A 653 for inch-pound units or A 653M for SI units.

5.2.5 Coating designation,

5.2.6 Chemically treated or not chemically treated,

5.2.7 Oiled or not oiled,

5.2.8 Minimized spangle (if required),

5.2.9 Extra smooth (if required),

5.2.10 Phosphatized (if required),

5.2.11 Dimensions (show thickness, minimum or nominal, width, flatness requirements, and length, if cut lengths). The purchaser shall specify the appropriate table of thickness tolerances in Specification A 924/A 924M that applies to the order, that is, the table of thickness tolerances for  $\frac{3}{8}$ -in.

[10-mm] edge distance, or the table of thickness tolerances for 1-in. [25-mm] edge distance.

5.2.12 Coil size requirements (specify maximum outside diameter (OD), acceptable inside diameter (ID), and maximum weight [mass]),

5.2.13 Packaging,

5.2.14 Certification, if required, heat analysis and mechanical property report,

5.2.15 Application (part identification and description), and

5.2.16 Special requirements (if any).

5.2.16.1 If required, the product may be ordered to a specified base metal thickness (see Supplementary Requirement S1.)

NOTE 1—Typical ordering descriptions are as follows: steel sheet, zinc-coated, commercial steel Type A, ASTM A 653, Coating Designation G 115, chemically treated, oiled, minimum 0.040 by 34 by 117 in., for stock tanks, or steel sheet, zinc-coated, high strength low alloy steel Type A Grade 340, ASTM A 653M, Coating Designation Z275, minimized spangle, not chemically treated, oiled, minimum 1.00 by 920 mm by coil, 1520-mm maximum OD, 600-mm ID, 10 000-kg maximum, for tractor inner fender.

NOTE 2—The purchaser should be aware that there are variations in manufacturing practices among the producers and therefore is advised to establish the producer's standard (or default) procedures for thickness tolerances.

#### 6. Chemical Composition

6.1 *Base Metal:*

6.1.1 The heat analysis of the base metal shall conform to the requirements shown in Table 2 for CS (Types A, B, and C), FS (Types A and B), DDS, and EDDS, and Table 3 for SS and HSLAS (Types A and B).

6.1.2 Each of the elements listed in Tables 2 and 3 shall be included in the report of heat analysis. When the amount of copper, nickel, chromium, or molybdenum is less than 0.02 %, report the analysis as either <0.02 % or the actual determined value. When the amount of vanadium, titanium, or columbium is less than 0.008 %, report the analysis as either <0.008 % or the actual determined value.

6.1.3 See Specification A 924/A 924M for chemical analysis procedures and product analysis tolerances.

6.2 *Zinc Bath Analysis*—The bath metal used in continuous hot-dip galvanizing shall contain not less than 99 % zinc.

NOTE 3—To control alloy formation and promote adhesion of the zinc coating with the steel base metal, the molten coating metal composition normally contains a percentage of aluminum usually in the range from 0.05 to 0.25. This aluminum is purposely supplied to the molten coating bath, either as a specified ingredient in the zinc spelter or by the addition of a master alloy containing aluminum.

#### 7. Mechanical Properties

7.1 Structural steel and high-strength low-alloy steel shall conform to the mechanical property requirements in Table 4 for the type, grade, or class, or all, specified.

7.2 The typical mechanical properties for CS (Types A, B, and C), FS (Types A and B), DDS, and EDDS sheet designations are listed in Table 5. These mechanical property values are nonmandatory. They are intended solely to provide the purchaser with as much information as possible to make an informed decision on the steel to be specified. Values outside of

**TABLE 2 Chemical Requirements**

Composition, %—Heat Analysis Element, max (unless otherwise shown)												
Designation	Carbon	Manganese	Phosphorus	Sulfur	Aluminum, min <sup>A</sup>	Cu <sup>B</sup>	Ni <sup>B</sup>	Cr <sup>B</sup>	Mo <sup>B</sup>	V <sup>C</sup>	Cb <sup>C</sup>	Ti
CS Type A <sup>D,E</sup>	0.10	0.60	0.030	0.035	...	0.20	0.20	0.15	0.06	0.008	0.008	0.30
CS Type B <sup>D,E,F</sup>	0.02 to 0.15	0.60	0.030	0.035	...	0.20	0.20	0.15	0.06	0.008	0.008	0.30
CS Type C <sup>D,E</sup>	0.08	0.60	0.100	0.035	...	0.20	0.20	0.15	0.06	0.008	0.008	0.30
FS Type A <sup>D,E,G</sup>	0.10	0.50	0.020	0.035	...	0.20	0.20	0.15	0.06	0.008	0.008	0.30
FS Type B <sup>D,E,G</sup>	0.02 to 0.10	0.50	0.020	0.030	...	0.20	0.20	0.15	0.06	0.008	0.008	0.30
DDS <sup>H</sup>	0.06	0.50	0.020	0.025	0.01	0.20	0.20	0.15	0.06	0.008	0.008	0.30
EDDS <sup>I</sup>	0.02	0.40	0.020	0.020	0.01	0.20	0.20	0.15	0.06	0.008	0.008	0.30

<sup>A</sup> Where an ellipsis ( . . . ) appears in this table, there is no requirement, but the analysis shall be reported.

<sup>B</sup> The sum of copper, nickel, chromium, and molybdenum shall not exceed 0.50 % on heat analysis. When one or more of these elements are specified, the sum does not apply; in which case, only the individual limits on the remaining elements shall apply.

<sup>C</sup> For steels having a carbon content of 0.02 % or less, the limit for columbium is 0.045 % maximum.

<sup>D</sup> For CS and FS, specify Type B to avoid carbon levels below 0.02 %.

<sup>E</sup> When a deoxidized steel is required for the application, the purchaser has the option to order CS to a minimum of 0.01 % total aluminum.

<sup>F</sup> CS Type B describes the typical Commercial Quality product previously included in this specification.

<sup>G</sup> Shall not be furnished as a stabilized steel.

<sup>H</sup> The producer has the option to furnish as a stabilized steel.

<sup>I</sup> Shall be furnished as a stabilized steel.

**TABLE 3 Chemical Requirements<sup>A</sup>**

Designation	Composition, %—Heat Analysis Element, max (unless otherwise shown)											
	Car- bon	Manga- nese	Phos- phorus	Sul- fur	Cu <sup>B</sup>	Ni <sup>B</sup>	Cr <sup>B</sup>	Mo <sup>B</sup>	V <sup>C</sup>	Cb <sup>C,D</sup>	Ti	
SS Grade												
33 [230]	0.20	...	0.04	0.04	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
37 [255]	0.20	...	0.10	0.04	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
40 [275]	0.25	...	0.10	0.04	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
50 [340] Class 1 and 2	0.40	...	0.20	0.04	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
50 [340] Class 3	0.50	...	0.04	0.04	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
80 [550]	0.20	...	0.04	0.04	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
HSLAS Type A <sup>E</sup>												
40 [275]	0.20	1.20	...	0.035	...	0.20	0.15	0.06	0.008	0.008	0.30	
50 [340]	0.20	1.20	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
60 [410]	0.20	1.35	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
70 [480]	0.20	1.65	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
80 [550]	0.20	1.65	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
HSLAS Type B <sup>E,F</sup>												
40 [275]	0.15	1.20	...	0.035	...	0.20	0.15	0.06	0.008	0.008	0.30	
50 [340]	0.15	1.20	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
60 [410]	0.15	1.20	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
70 [480]	0.15	1.65	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	
80 [550]	0.15	1.65	...	0.035	0.20	0.20	0.15	0.06	0.008	0.008	0.30	

<sup>A</sup> Where an ellipsis ( . . . ) appears in this table there is no requirement, but the analysis shall be reported.

<sup>B</sup> The sum of copper, nickel, chromium and molybdenum shall not exceed 0.50 % on heat analysis. When one or more of these elements are specified the sum does not apply; in which case, only the individual limits on the remaining elements shall apply.

<sup>C</sup> The limits do not apply when HSLAS is specified.

<sup>D</sup> For steels having a carbon content of 0.02 % or less, the limit for columbium is 0.045 % maximum.

<sup>E</sup> Steel conforming to this designation commonly contains the strengthening elements columbium, nitrogen, phosphorus, or vanadium added singly or in combination.

<sup>F</sup> The producer has the option to treat these steels by means of small alloy additions to effect sulfide inclusion control.

these ranges are to be expected.

7.3 When base metal mechanical properties are required, all tests shall be conducted in accordance with the methods specified in Specification A 924/A 924M.

7.4 *Bending Properties Minimum Cold Bending Radii*—Structural steel and high-strength low-alloy steel are commonly fabricated by cold bending. There are many interrelated factors that affect the ability of a steel to cold form over a given radius under shop conditions. These factors include thickness, strength level, degree of restraint, relationship to rolling direction, chemistry, and base metal microstructure. The table in Appendix X1 lists the suggested minimum inside radius for 90° cold bending for structural steel and high-strength low-alloy steel. They presuppose “hard way” bending (bend axis parallel to rolling direction) and reasonably good shop forming

practices. Where possible, the use of larger radii or “easy way” bends are recommended for improved performance.

## 8. Coating Properties

### 8.1 Coating Weight [Mass]:

8.1.1 Coating weight [mass] shall conform to the requirements as shown in Table 1 for the specific coating designation.

8.1.2 Use the following relationships to estimate the coating thickness from the coating weight [mass]:

8.1.2.1 1 oz/ft<sup>2</sup> coating weight = 1.7 mils coating thickness, and

8.1.2.2 7.14 g/m<sup>2</sup> coating mass = 1 μm coating thickness.

### 8.2 Coating Weight [Mass] Tests:

8.2.1 Coating weight [mass] tests shall be performed in

**TABLE 4 Mechanical Requirements, Base Metal (Longitudinal)**

Inch-Pound Units					
Designation	Type	Grade	Yield Strength, min, ksi	Tensile Strength, min, ksi <sup>A</sup>	Elongation in 2 in., min, % <sup>A</sup>
SS <sup>B</sup>	...	33	33	45	20
		37	37	52	18
		40	40	55	16
		50 Class 1	50	65	12
		50 Class 2	50	...	12
		50 Class 3	50	70	12
HSLAS	Type A	80 <sup>C</sup>	80 <sup>D</sup>	82	...
		40	40	50 <sup>E</sup>	22
		50	50	60 <sup>E</sup>	20
		60	60	70 <sup>E</sup>	16
		70	70	80 <sup>E</sup>	12
		80	80	90 <sup>E</sup>	10
HSLAS	Type B	40	40	50 <sup>E</sup>	24
		50	50	60 <sup>E</sup>	22
		60	60	70 <sup>E</sup>	18
		70	70	80 <sup>E</sup>	14
		80	80	90 <sup>E</sup>	12
		SI Units			
Designation	Type	Grade	Yield Strength, min, MPa	Tensile Strength, min, MPa <sup>A</sup>	Elongation in 50 mm, min, % <sup>A</sup>
SS <sup>B</sup>	...	230	230	310	20
		255	255	360	18
		275	275	380	16
		340 Class 1	340	450	12
		340 Class 2	340	...	12
		340 Class 3	340	480	12
HSLAS	Type A	550 <sup>C</sup>	550 <sup>D</sup>	570	...
		275	275	340 <sup>E</sup>	22
		340	340	410 <sup>E</sup>	20
		410	410	480 <sup>E</sup>	16
		480	480	550 <sup>E</sup>	12
		550	550	620 <sup>E</sup>	10
HSLAS	Type B	275	275	340 <sup>E</sup>	24
		340	340	410 <sup>E</sup>	22
		410	410	480 <sup>E</sup>	18
		480	480	550 <sup>E</sup>	14
		550	550	620 <sup>E</sup>	12

<sup>A</sup>Where an ellipsis (...) appears in this table there is no requirement.

<sup>B</sup>No type identification is applicable to the SS designation.

<sup>C</sup>For sheet thickness of 0.028 in. [0.71 mm] or thinner, no tension test is required if the hardness result in Rockwell B 85 or higher.

<sup>D</sup>As there is no discontinuous yield curve, the yield strength should be taken as the stress at 0.5 % elongation under load or 0.2 % offset.

<sup>E</sup>If a higher tensile strength is required, the user should consult the producer.

accordance with the requirements of Specification A 924/A 924M.

8.2.2 The referee method to be used shall be Test Method A 90/A 90M.

### 8.3 Coating Bend Test:

**TABLE 5 Typical Ranges of Mechanical Properties<sup>A,B</sup> (Nonmandatory)**

Designation	(Longitudinal Direction)			$r_m$ Value <sup>C</sup>	$n$ Value <sup>D</sup>
	Yield Strength		Elongation in 2 in. [50 mm], %		
	ksi	[MPa]			
CS Type A	25/55	[170/380]	≥20	<sup>E</sup>	<sup>E</sup>
CS Type B	30/55	[205/380]	≥20	<sup>E</sup>	<sup>E</sup>
CS Type C	25/60	[170/410]	≥15	<sup>E</sup>	<sup>E</sup>
FS Types A and B <sup>F</sup>	25/45	[170/310]	≥26	1.0/1.4	0.17/0.21
DDS <sup>G</sup>	20/35	[140/240]	≥32	1.4/1.8	0.19/0.24
EDDS <sup>H</sup>	15/25	[105/170]	≥40	1.6/2.1	0.22/0.27

<sup>A</sup>The typical mechanical property values presented here are nonmandatory. They are intended solely to provide the purchaser with as much information as possible to make an informed decision on the steel to be specified. Values outside of these ranges are to be expected. The purchaser may negotiate with the supplier if a specific range or a more restrictive range is required for the application.

<sup>B</sup>These typical mechanical properties apply to the full range of steel sheet thicknesses. The yield strength tends to increase and some of the formability values tend to decrease as the sheet thickness decreases.

<sup>C</sup> $r_m$  Value—Average plastic strain ratio as determined by Test Method E 517.

<sup>D</sup> $n$  Value—Strain-hardening exponent as determined by Test Method E 646.

<sup>E</sup>No typical mechanical properties have been established.

<sup>F</sup>The FS designation encompasses the properties of the previous DQ grade in Specification A 924/A 924M.

<sup>G</sup>The DDS designation encompasses the properties of the previous DQSK grade in Specification A 924/A 924M.

<sup>H</sup>EDDS Sheet will be free from changes in mechanical properties over time, that is, nonaging.

8.3.1 The bend test specimens of coated sheet designated by prefix “G” [“Z”] shall be capable of being bent through 180° in any direction without flaking of the coating on the outside of the bend only. The coating bend test inside diameter shall have a relation to the thickness of the specimen as shown in Table 6. Flaking of the coating within 0.25 in. [6 mm] of the edge of the bend specimen shall not be cause for rejection.

8.3.2 Because of the characteristics of zinc-iron alloy coatings designated by prefix “A” [“ZF”] as explained in 3.2.6, coating bend tests are not applicable.

## 9. Dimensions and Permissible Variations

9.1 All dimensions and permissible variations shall comply with the requirements of Specification A 924/A 924M, except for flatness of SS and HSLAS, which is specified in Table 7 and Table 8, respectively.

## 10. Keywords

10.1 alloyed coating; high strength low alloy; minimized spangle coating; sheet steel; spangle; steel; steel sheet; zinc; zinc coated (galvanized); zinc iron-alloy; zinc iron-alloy coated

**TABLE 6 Coating Bend Test Requirements**
**Inch-Pound Units**

Ratio of the Inside Bend Diameter to Thickness of the Specimen (Any Direction) CS, FS, DDS, EDDS									SS, Grade <sup>A</sup>		
Coating Designation <sup>B</sup>	Sheet Thickness			33	37	40					
	Through 0.039 in.	Over 0.039 through 0.079 in.	Over 0.079 in.								
G235	2	3	3	3	3	3					
G210	2	2	2	2	2	2		2½			
G185	2	2	2	2	2	2		2½			
G165	2	2	2	2	2	2		2½			
G140	1	1	2	2	2	2		2½			
G115	0	0	1	1½	2	2		2½			
G90	0	0	1	1½	2	2		2½			
G60	0	0	0	1½	2	2		2½			
G40	0	0	0	1½	2	2		2½			
G30	0	0	0	1½	2	2		2½			
G01	0	0	0	1½	2	2		2½			
HSLAS Type A <sup>A</sup>				HSLAS Type B							
	40	50	60	40	50	60	70	80			
G115	1½	1½	3	1	1	1	1½	1½			
G90	1½	1½	3	1	1	1	1½	1½			
G60	1½	1½	3	1	1	1	1½	1½			
G40	1½	1½	3	1	1	1	1½	1½			
G30	1½	1½	3	1	1	1	1½	1½			
G01	1½	1½	3	1	1	1	1½	1½			

**SI Units**

Ratio of the Inside Bend Diameter to Thickness of the Specimen (Any Direction) CS, FS, DDS, EDDS									SS, Grade <sup>C</sup>		
Coating Designation <sup>B</sup>	Sheet Thickness			230	255	275					
	Through 1.0 mm	Over 1.0 mm through 2.0 m	Over 2.0 mm								
Z700	2	3	3	3	3	3					
Z600	2	2	2	2	2	2		2½			
Z550	2	2	2	2	2	2		2½			
Z500	2	2	2	2	2	2		2½			
Z450	1	1	2	2	2	2		2½			
Z350	0	0	1	1½	2	2		2½			
Z275	0	0	1	1½	2	2		2½			
Z180	0	0	0	1½	2	2		2½			
Z120	0	0	0	1½	2	2		2½			
Z90	0	0	0	1½	2	2		2½			
Z001	0	0	0	1½	2	2		2½			
HSLAS Type A <sup>C</sup>				HSLAS Type B							
	275	340	410	275	340	410	480	550			
Z350	1½	1½	3	1	1	1	1½	1½			
Z275	1½	1½	3	1	1	1	1½	1½			
Z180	1½	1½	3	1	1	1	1½	1½			
Z120	1½	1½	3	1	1	1	1½	1½			
Z90	1½	1½	3	1	1	1	1½	1½			
Z001	1½	1½	3	1	1	1	1½	1½			

<sup>A</sup>SS Grades 50 and 80 and HSLAS Type A Grades 70 and 80 are not subject to bend test requirements.

<sup>B</sup>If other coatings are required, the user should consult the producer for availability and suitable bend test requirements.

<sup>C</sup>SS Grades 340 and 550 and HSLAS Type A Grades 480 and 550 are not subject to bend test requirements.

**TABLE 7 Structural Steel—Flatness Tolerances  
(Cut Lengths Only)**

NOTE 1—This table also applies to sheets cut to length from coils by the consumer when adequate flattening measures are performed.

NOTE 2— For Grade 50 [340] (Classes 1, 2, and 3) use 1½ times the values given in this table.

NOTE 3—For Grade 80 [550], there are no defined flatness standards.

Specified Thickness, in. [mm]	Specified Width, in. [mm]	Flatness Tolerance (Maximum Deviation from a Horizontal Flat Surface), in. [mm]
Over 0.060 [1.5]	to 60 [1500], inclusive	½ [12]
	over 60 [1500] to 72 [1800], inclusive	¾ [20]
0.060 [1.5] and thinner	to 36 [900], inclusive	½ [12]
	over 36 [900] to 60 [1500], inclusive over 60 [1500] to 72 [1800], inclusive	¾ [20] 1 [25]

**TABLE 8 High-Strength Low-Alloy Steel—Flatness Tolerances  
(Cut Lengths Only)**

NOTE 1—This table also applies to sheets cut to length from coils by the consumer when adequate flattening measures are performed.

		Inch-Pound Units				
Specified Thickness, in.	Specified Width, in.	Flatness Tolerances (Maximum Deviation from a Horizontal Flat Surface), in.				
		Grade				
		40	50	60	70	80
Over 0.060	to 60, inclusive	5/8	¾	7/8	1	1 1/8
	over 60	1	1 1/8	1 1/4	1 3/8	1 1/2
0.060 and thinner	to 36, inclusive	5/8	¾	7/8	1	1 1/8
	over 36 to 60, inclusive	1	1 1/8	1 1/4	1 3/8	1 1/2
	over 60	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8
		SI Units				
Specified Thickness, mm	Specified Width, mm	Flatness Tolerances (Maximum Deviation from a Horizontal Flat Surface), mm				
		Grade				
		275	340	410	480	550
Over 1.5	to 1500, inclusive	15	20	22	25	30
	over 1500	25	30	32	35	38
1.5 and thinner	to 900, inclusive	15	20	22	25	30
	over 900 to 1500, inclusive	25	30	32	35	33
	over 1500	35	38	40	45	48

### SUPPLEMENTARY REQUIREMENTS

The following standardized supplementary requirements are for use when desired by the purchaser. These additional requirements shall apply only when specified on the order.

#### S1. Base Metal Thickness

S1.1 The specified minimum thickness shall apply to the base metal only.

S1.2 The coating designation shown on the order indicates the coating to be applied to the specified minimum base metal thickness.

S1.3 The applicable tolerances for base metal thickness are shown in Tables 16 and Tables 17, Thickness Tolerance of Cold-Rolled Sheet (Carbon and High-Strength, Low-Alloy Steel), of Specification A 568/A 568M.

**APPENDIXES**
**(Nonmandatory Information)**
**X1. BENDING PROPERTIES**

X1.1 Table X1.1 lists suggested minimum inside radii for cold bending.

**TABLE X1.1 Suggested Minimum Inside Radii for Cold Bending<sup>A</sup>**

NOTE 1— (*t*) equals a radius equivalent to the steel thickness.

NOTE 2—The suggested radii should be used as minimums for 90° bends in actual shop practice.

Quality	Type	Grade	Minimum Inside Radius for Cold Bending <sup>B</sup>
SS		33 [230]	1½ <i>t</i>
		37 [255]	2 <i>t</i>
		40 [275]	2 <i>t</i>
		50 [340] Class 1	not applicable
		50 [340] Class 2	not applicable
		50 [340] Class 3	not applicable
HSLAS	Type A	80 [550]	not applicable
		40 [275]	2 <i>t</i>
		50 [340]	2½ <i>t</i>
		60 [410]	3 <i>t</i>
		70 [480]	4 <i>t</i>
		80 [550]	4½ <i>t</i>
HSLAS	Type B	40 [275]	1½ <i>t</i>
		50 [340]	2 <i>t</i>
		60 [410]	2 <i>t</i>
		70 [480]	3 <i>t</i>
		80 [550]	3 <i>t</i>

<sup>A</sup>Material that does not perform satisfactorily, when fabricated in accordance with the requirements in Table X1.1, may be subject to rejection pending negotiation with the steel supplier.

<sup>B</sup>Bending capability may be limited by coating designation.

**X2. RATIONALE FOR CHANGES IN PRODUCT DESIGNATIONS**

X2.1 Subcommittee A05.11 has revised the designations used to classify the various products available in each hot-dip coated specification. The previous “quality” designations have been replaced with designations and descriptions more closely related with product characteristics. Many of the former “quality” specifications described the steel only in terms of limited chemical composition, which in some cases was identical for two or more qualities. The former designations also did not reflect the availability of new steels which are the result of the use of new technologies such as vacuum degassing and steel ladle treatments.

X2.2 The former “quality” designators, defined in very broad qualitative terms, did not provide the user with all the information needed to select the appropriate steel for an application. The new designations are defined with technical information such as specific chemical composition limits and typical nonmandatory mechanical properties. These steel characteristics are important to users concerned with the weldability and formability of the coated steel products. The typical mechanical properties included in the new designation system are those indicated by the tension test. These properties are more predictive of steel formability than other tests such as the

hardness test which may not compensate adequately for product variables such as substrate thickness and coating weight.

X2.3 The new designations also provide the user with the flexibility to restrict the steels applied on any order. For example, a user can restrict the application of ultra low carbon steels on an application through the selection of an appropriate “type” designator.

X2.4 There is a limited relationship between the former and current systems of designation. Some of the reasons for this limited relationship are: addition of steels not previously described in ASTM specifications, restrictions placed on ranges of chemical composition, the addition of typical mechanical properties, and the enhanced capability of steel producers to combine chemical composition and processing methods to achieve properties tailored to specific applications.

X2.5 The changes in designation are significant which may create transition issues that will have to be resolved. Continued dialogue between users and producers will have to be maintained to assist with the transition to the new system of designations. A user with concerns about the appropriate

coated steel to order for a specific application should consult with a steel supplier or producer.

*The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or [service@astm.org](mailto:service@astm.org) (e-mail); or through the ASTM website ([www.astm.org](http://www.astm.org)).*



# SINGLE WALL RECTANGULAR DUCT & FITTINGS SUBMITTAL

# 1" STATIC PRESSURE

## (Positive & Negative)

with CONDU-LOCK rod reinforcement

### DUCT CONSTRUCTION STANDARDS FOR ±1" WG

GALVANIZED, 304 STAINLESS STEEL & 316 STAINLESS STEEL

DUCT SIZE (INCHES):	DUCT GAUGE:	FINISHED LENGTH: (INCHES)	CONNECTORS	
			LARGE SIDE:	SMALL SIDE:
0-18	26	59	FLAT SLIP T-6 24 GA	FLAT DRIVE T-1 24 GA
19-30	26	59	STANDING SLIP	
31-42	24	59		
43-54	22	59		
55-60	22	56	TDC T-25A	TDC T-25A
61-72	20	56	TDC W/CTR T-25A	
73-96	20	56	TDC W/CTR & JTR T-25A	TDC W/CTR & JTR T-25A
97 & UP	18	56		

**NOTES:**

*CDS uses 3/4" EMT RODS*

*CTR- CENTER TIE ROD*

*JTR- JOINT TIE ROD*

*MPTR- MID POINT TIE RODS (SPACING 2.5')*

# 2" STATIC PRESSURE

## (Positive & Negative)

with CONDU-LOCK rod reinforcement

### DUCT CONSTRUCTION STANDARDS FOR ±2" WG

GALVANIZED, 304 STAINLESS STEEL & 316 STAINLESS STEEL

DUCT SIZE (INCHES):	DUCT GAUGE:	FINISHED LENGTH: (INCHES)	CONNECTORS	
			LARGE SIDE:	SMALL SIDE:
0-14	26	59	FLAT SLIP T-6 24 GA	FLAT DRIVE T-1 24 GA
15-26	26	59	FLAT SLIP/ STANDING SLIP	
27-36	24	59	STANDING SLIP	
37-42	22	56		
43-48	22	56	TDC T-25A	TDC W/CTR T-25A
49-60	22	56	TDC W/CTR T-25A	TDC W/ CTR & JTR T-25A
61-84	22	56	TDC W/ CTR & JTR T-25A	
85-97	20	56		
98 & UP	18	56		

**NOTES:**

*CDS uses 3/4" EMT RODS*

*CTR- CENTER TIE ROD*

*JTR- JOINT TIE ROD*

*MPTR- MID POINT TIE RODS (SPACING 2.5')*

# 3" STATIC PRESSURE

## (Positive & Negative)

with CONDU-LOCK rod reinforcement

### DUCT CONSTRUCTION STANDARDS FOR ±3" WG

GALVANIZED, 304 STAINLESS STEEL & 316 STAINLESS STEEL

DUCT SIZE (INCHES):	DUCT GAUGE:	FINISHED LENGTH: (INCHES)	CONNECTORS	
			LARGE SIDE:	SMALL SIDE:
0-26	26	56 3/8	TDC T-25A	
27-36	24	56 3/8		
37-60	22	56 3/8	TDC T-25A CTR	TDC T-25A
61-72	20	56 3/8		
73-96	20	56 3/8	TDC T-25A CTR & JTR	
97 & UP	18	56 3/8	TDC T-25A CTR & JTR	

**NOTES:**

*CDS uses 3/4" EMT RODS*

*CTR- CENTER TIE ROD*

*JTR- JOINT TIE ROD*

*MPTR- MID POINT TIE RODS (SPACING 2.5')*

# 4" STATIC PRESSURE

## (Positive & Negative)

with CONDU-LOCK rod reinforcement

### DUCT CONSTRUCTION STANDARDS FOR ±4" WG

GALVANIZED, 304 STAINLESS STEEL & 316 STAINLESS STEEL

DUCT SIZE (INCHES):	DUCT GAUGE:	FINISHED LENGTH: (INCHES)	CONNECTORS	
			LARGE SIDE:	SMALL SIDE:
0-26	26	56 3/8	TDC T-25A	
27-30	24	56 3/8		
31-36	22	56 3/8		
37-42	20	56 3/8	TDC T-25A	TDC JTR T-25A
43-60	20	56 3/8	TDC CTR T-25A	
61-96	20	56 3/8	TDC CTR + JTR T-25A	
97 & UP	18	56 3/8		

**NOTES:**

*CDS uses 3/4" EMT RODS*

*CTR- CENTER TIE ROD*

*JTR- JOINT TIE ROD*

*MPTR- MID POINT TIE RODS (SPACING 2.5')*

# CANVAS DUCT NOTCH LOCK



## FABRIC DUCT- NOTCH LOCK BY ELGEN MANUFACTURING

### Features:

- prevents vibration and noise between fans and duct systems
- seals from air and water by connecting fabric to sheetmetal on both sides
- meets SMACNA standards
- G60/G90 Materials conform with ASTM A-635
- flame retardant coating
- meets NFPA-701 (old UL-214)
- meets NFPA-90A & 90B
- hermetic, waterproof seal

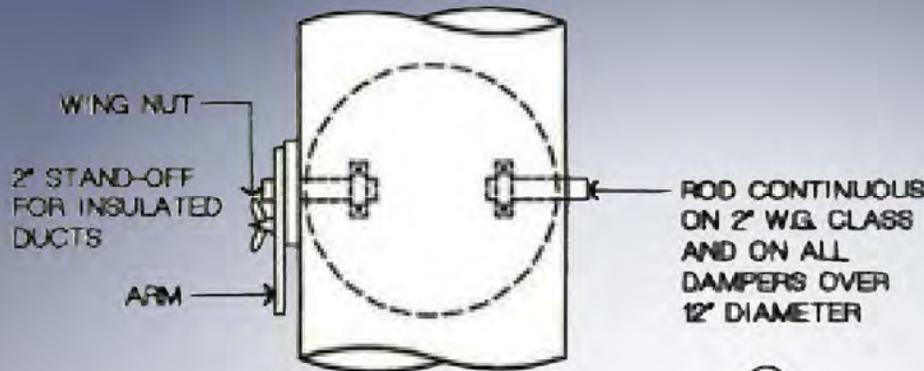
### Available Metals:

Galvanized	Alumium
Galvanneal (PaintGrip)	PVC Coated
Stainless Steel (#304 & #316)	AgION

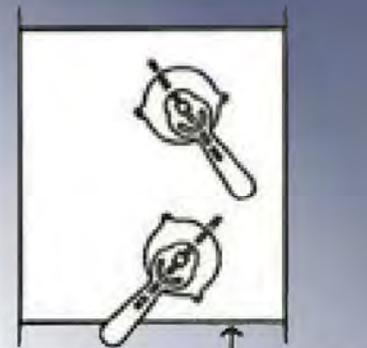
## Canvas Material Technical Data

	Temp Range	Tear Strength	Tensile Strength	Color	Weight SQ/YD	Features	Compliant
Vinlon	-40 F up to 265 F	100/100	300/300	BLACK	22	General Purpose, Airtight Resistance to Acids, Gasoline & Grease	UL-723, NFPA-701, LEEDs 30% Recycled
Neoprene	-40 F up to 200 F	25/25	500/500	BLACK	32	Excellent Acid, Weather, UV, Mildew & Ozone Resistance, High Abrasion, Resistant to Grease	LEEDs 30% Recycled
Hypalon	-50 F up to 300 F	20/20	350/250	WHITE	24	High Tear Strength, High Abrasion, Low Smoke, Extremely Flexible	
Silguard	-75 F up to 500 F	50/40	200/150	WHITE	18	High Temp. & Acid Resistant, Best Overall Fabric	
Teflon	-75 F up to 500 F	60/40	400/300	GRAY	18	High Temp., Very Low Smoke, Flame, Water, & Oil Resistant	
40 oz Neoprene	-40 F to 285 F	17/12	630/465	BLACK	40		
Super High Temp	-40 F to 1800 F	60/60	480/330	GRAY/WHITE	36		

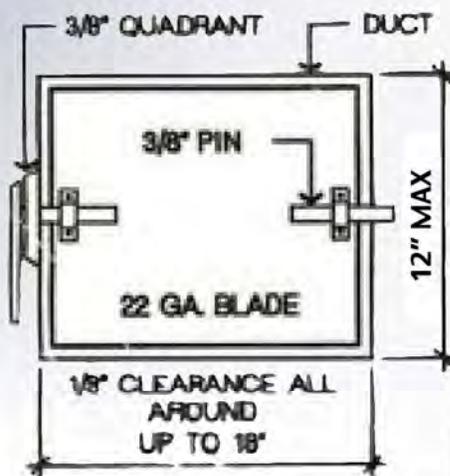
# VOLUME DAMPERS



**FIG. C**  
ROUND DAMPER

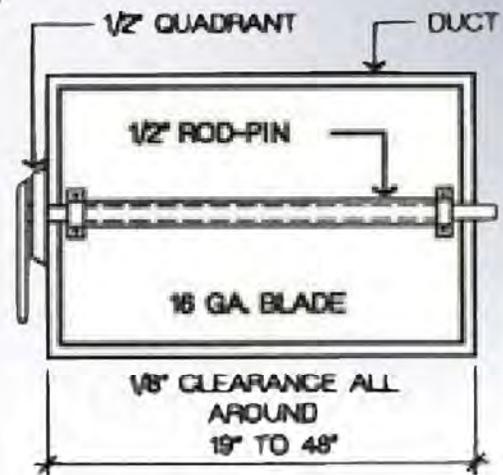


**FIG. D**  
ELEVATION  
TWO BLADE ARRANGEMENT



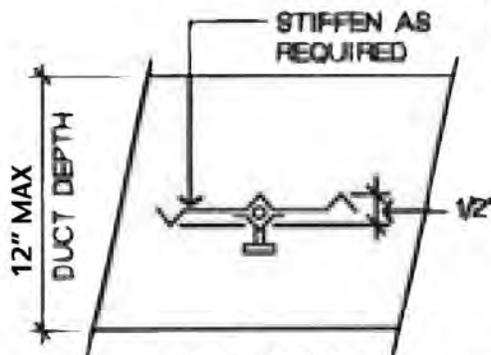
**FIG. A**

FOR SINGLE  
BLADE DAMPERS

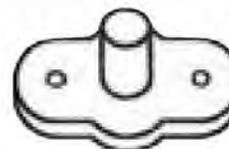


**FIG. B**

**NOTE:**  
OVER 18 X 12 USE  
MUTLIPLE BLADES

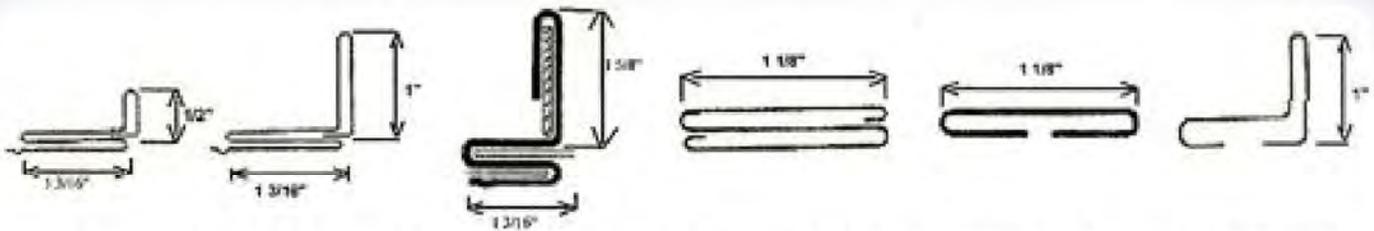


**FIG. A OR B**  
SIDE ELEVATION



REQUIRED ON 2" W.G.  
CLASS DUCT. OPTIONAL  
ON OTHERS.

# SLIPS AND DRIVES



1/2" & 1" STANDING S

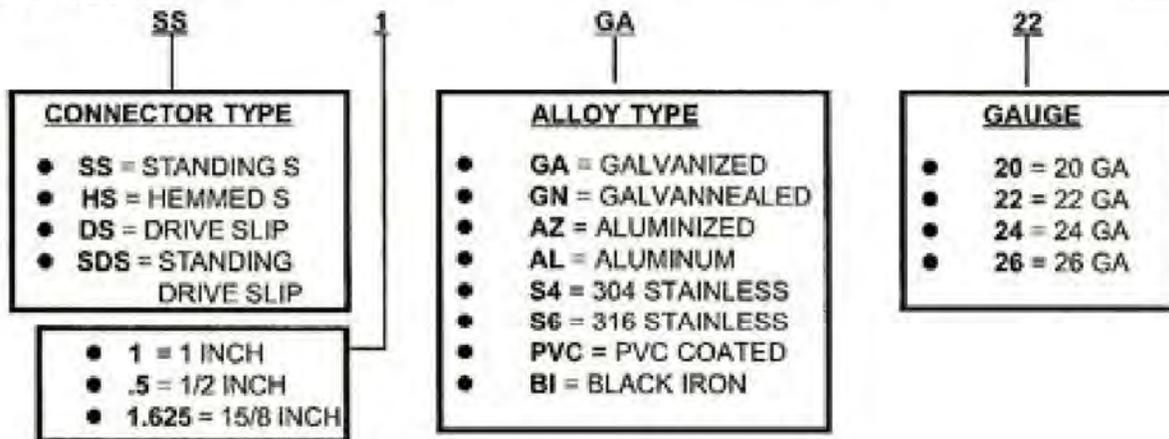
1 5/8" REINFORCED S

HEMMED S SLIP

DRIVE SLIP

1" STANDING DRIVE SLIP

EXAMPLE: SSGA22



**PACKAGING: 5', 8' OR 10' LENGTHS/100' BUNDLES**

## WEIGHTS LISTED IN LBS/FT

GAUGES	1/2" STANDING S	1" STANDING S	1 5/8" STANDING S	HEMMED S	DRIVE-SLIP	1" STANDING DRIVE SLIP	COLOR CODE
20 GA	N/A	0.78	0.79*	N/A	N/A	N/A	YELLOW
22 GA	N/A	0.58	0.60*	N/A	N/A	.46	GREEN
24 GA	0.41	0.55*	N/A	0.32*	0.19*	.40	ORANGE
26 GA	0.35*	0.44	N/A	0.25*	0.15*	.33	BLUE
28 GA	N/A	N/A	N/A	0.227	0.12	N/A	RED

\*MOST POPULAR GAUGE PER CONNECTOR

N/A DESIGNATES GAUGES NOT YET AVAILABLE

# TDC Connectors



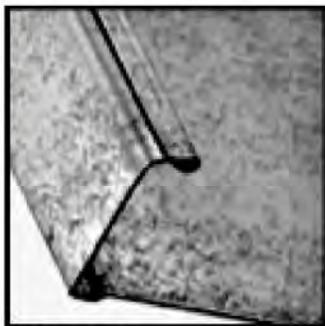
## Benefits:

- Lower installation costs, times, and leakage
- 3/8" carriage bolts at each corner lock the joint together.
- Flanges are roll formed from the duct wall metal, reinforcing the joints.
- Rigid connectors
- No additional sealing is required.

## TDC

Corner clips are available factory installed. Gasket and bolts are applied in the field. Optional clips are spaced down the length of the flanges sandwiching the gasket into a tight seal.

## Profile



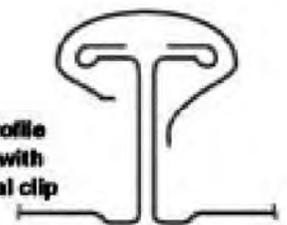
TDC® flange profile

TDC profile joined

Profile



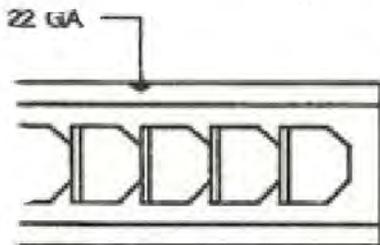
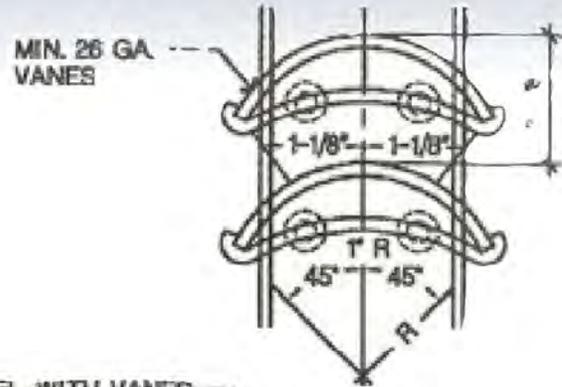
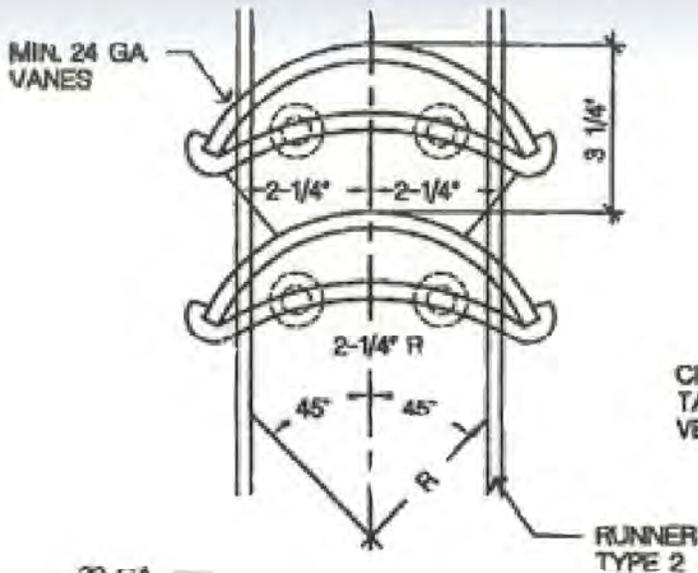
TDC profile joined with optional clip



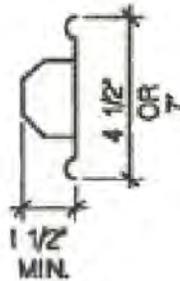
## Auxiliary Rolls

ROLLS AND OPTIONS	CAPACITY	STRIP WIDTH
TDC® Clip (minimum length 20")	22 gauge	2 1/8"
TDC® Clip Rolls with Lance	22 gauge	2 1/8"
TDC® Lance Kit Only	22 gauge	
Lockformer®/TDC® II Rolls (mounted inboard, available in 35, 30, 25 or 20 mm)	20 gauge	5 1/8"

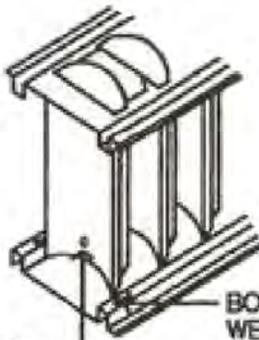
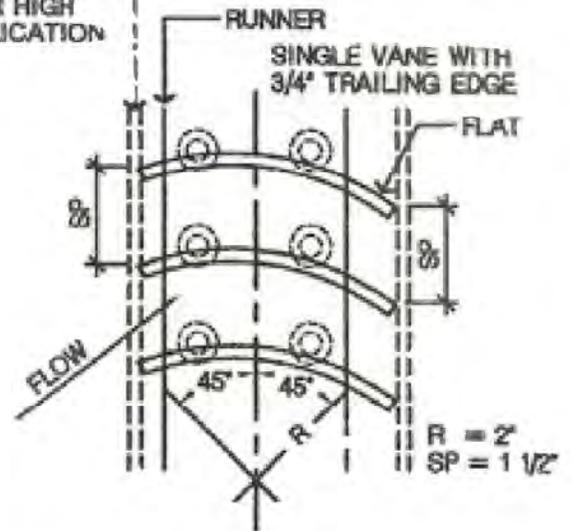
# TURNING VANES & VANE RUNNERS



RUNNER TYPE 1



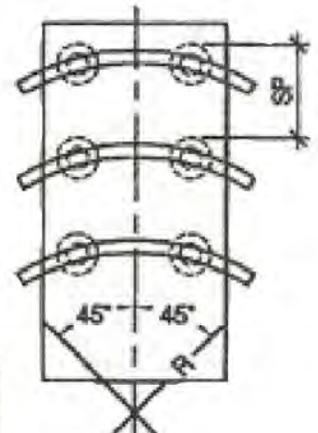
CHANNEL, WITH VANES TACKED IN FOR HIGH VELOCITY APPLICATION



SCREW EVERY 8TH VANE

BOLT, SCREW, OR WELD TO DUCT

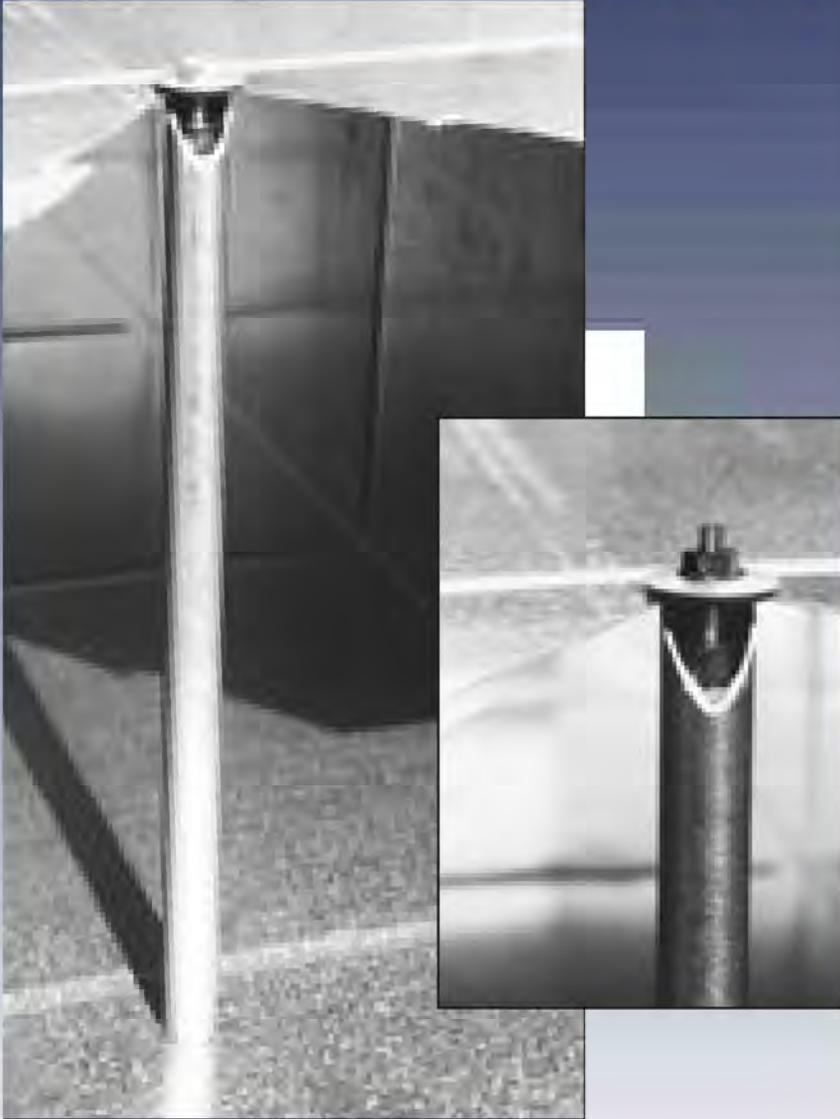
SINGLE VANE SCHEDULE			
SIZE	R	SP	GA.
SMALL	2"	1-1/2"	24
LARGE	4-1/2"	3-1/4"	22



**GENERAL NOTES:**

DOUBLE VANE FOR DUCTS GREATER THAN 18" x 18"  
SINGLE VANE FOR DUCTS UP TO 18" x 18"

# TIE ROD



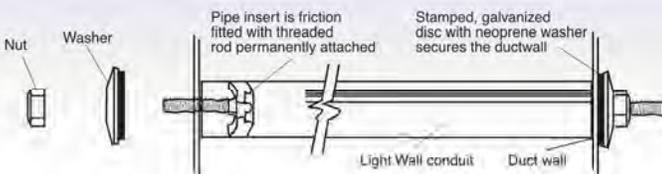
## EASYROD/EASYSTUD

### BY DUCTMATE INDUSTRIES

Easystud/Easyrod reinforces ductwork by inserting threaded studs in EMT conduit for consistent installation in positive or negative pressure applications. Ductmate Industries guarantees Easyrod/Easystud against defective material.

#### Installation Instructions:

- ❑ Drill a hole for 9/32" through both top and bottom walls of duct.
- ❑ Cut conduit to size of duct.
- ❑ Place Easyrod/Easystud insert on installation tool with prongs facing the tool.
- ❑ Drive one insert into each end of the conduit.
- ❑ Position the conduit with inserts protruding through holes in duct walls.
- ❑ Install the washer and nut to bolt and tighten till snug. (Do not overtighten.)

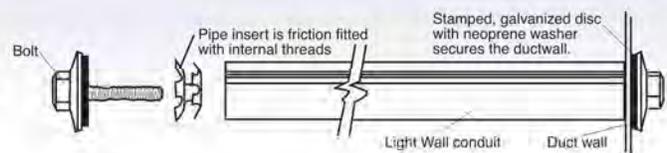


### EASYSTUD

PULL OUT RATED - 600 lbs

#### COMPONENTS:

- 1/2" Easystud insert
- 1/4" ID x 1" OD galvanized neoprene bonded washer
- 1/2" bolt



### EASYROD

PULL OUT RATED - 900 lbs

#### COMPONENTS:

- 1/2" or 3/4" Easyrod insert
- 1/4" ID x 1" OD galvanized neoprene bonded washer
- 1/4" x 1" N.C., Gr. 5, plated hex bolt

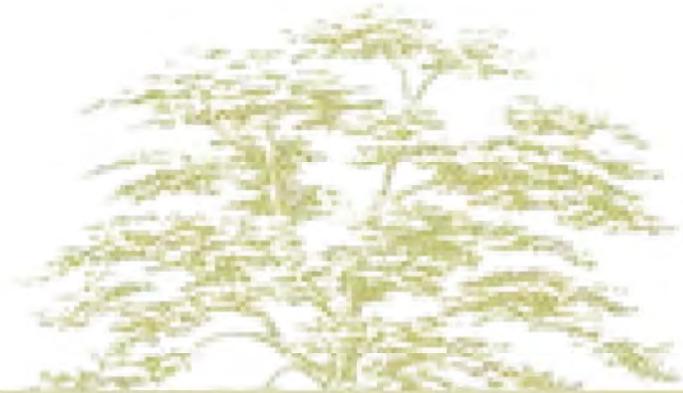
Maximum Half of Duct Perimeter	Pair at 10 ft Spacing		Pair at 8 ft Spacing		Pair at 5 ft Spacing		Pair at 4 ft Spacing	
	Strap	Wire/Rod	Strap	Wire/Rod	Strap	Wire/Rod	Strap	Wire/Rod
P/2 = 30"	1" × 22 ga	10 ga (.135")	1" × 22 ga	10 ga (.135")	1" × 22 ga	12 ga (.106")	1" × 22 ga	12 ga (.106")
P/2 = 72"	1" × 18 ga	3/8"	1" × 20 ga	1/4"	1" × 22 ga	1/4"	1" × 22 ga	1/4"
P/2 = 96"	1" × 16 ga	3/8"	1" × 18 ga	3/8"	1" × 20 ga	3/8"	1" × 22 ga	1/4"
P/2 = 120"	1 1/2" × 16 ga	1/2"	1" × 16 ga	3/8"	1" × 18 ga	3/8"	1" × 20 ga	1/4"
P/2 = 168"	1 1/2" × 16 ga	1/2"	1 1/2" × 16 ga	1/2"	1" × 16 ga	3/8"	1" × 18 ga	3/8"
P/2 = 192"	Not Given	1/2"	1 1/2" × 16 ga	1/2"	1" × 16 ga	3/8"	1" × 16 ga	3/8"
P/2 = 193" up	Special Analysis Required							
When Straps are Lap Joined Use These Minimum Fasteners:				Single Hanger Maximum Allowable Load				
				Strap			Wire or Rod (Dia.)	
1" × 18, 20, 22 ga -two #10 or one 1/4" bolt 1" × 16 ga -two 1/4" dia. 1 1/2" × 16 ga -two 3/8" dia. Place fasteners in series, not side by side.				1" × 22 ga - 260 lbs. 1" × 20 ga - 320 lbs. 1" × 18 ga - 420 lbs. 1" × 16 ga - 700 lbs. 1 1/2" × 16 ga - 1100 lbs.			0.106" - 80 lbs. 0.135" - 120 lbs. 0.162" - 160 lbs. 1/4" - 270 lbs. 3/8" - 680 lbs. 1/2" - 1250 lbs. 5/8" - 2000 lbs. 3/4" - 3000 lbs.	

**Table 5-1 Rectangular Duct Hangers Minimum Size**

**NOTES:**

- a. Dimensions other than gage are in inches.
- b. Tables allow for duct weight, 1 lb./sf insulation weight and normal reinforcement and trapeze weight, but no external loads!
- c. For custom design of hangers, designers may consult SMACNA's *Rectangular Industrial Duct Construction Standards*, the *AISI Cold Formed Steel Design Manual* and the *AISC Steel Construction Manual*.
- d. Straps are galvanized steel; other materials are uncoated steel.
- e. Allowable loads for P/2 assume that ducts are 16 ga maximum, except that when maximum duct dimension (w) is over 60 in. then P/2 maximum is 1.25 w.
- f. For upper attachments see Figs. 5-2, 5-3 and 5-4.
- g. For lower attachments see Fig. 5-5.
- h. For trapeze sizes see Table 5-3 and Fig. 5-6.
- i. 12, 10, or 8 ga wire is steel of black annealed, bright basic, or galvanized type.
- j. Cable hanging systems with adjustable mechanical device.





## MEETS LEED/GREEN STANDARDS

○ ONLY RECYCLED DOMESTIC STEEL

○ DUCT WIPED OUT

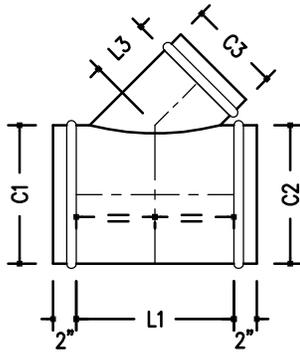
○ WRAPPED ENDS PREVENT DEBRIS CONTAMINATION

### 2008 Recycled Steel Content (% Total Weight)

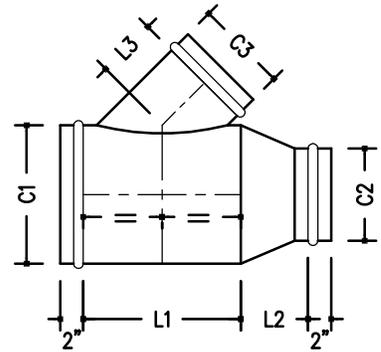
Product Group	Average Recycled Content
Nucor Bar Products	97.7%
Nucor Beam Products	76.2%
Nucor Plate Products	92.5%
Nucor Sheet Products	70.2%
<b>Total Nucor Steel Combined</b>	<b>89.7%</b>
Vulcraft Structural Products	97.7%
Vulcraft Decking	70.2%
Nucor Building Group	89.7%
NUCON Light Gauge Framing	70.2
Nucor Fastener Products	97.7%
Nucor Wire Products	97.7%
Nucor Cold Finish	97.7%

# TEES AND CROSSING TEES – LATERAL

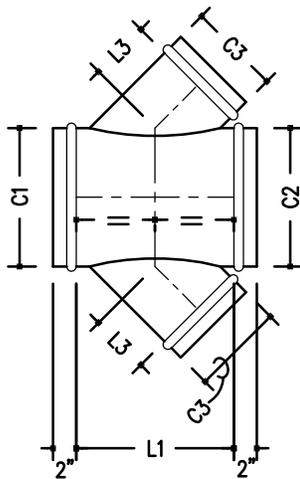
SINGLE WALL



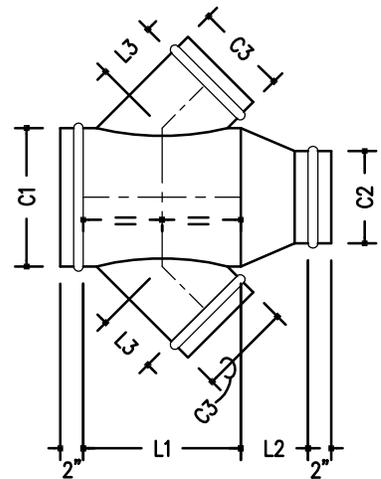
**TEL**  
**LATERAL TEE**  
(45° OR 30°)



**TEL**  
**REDUCING LATERAL TEE**  
(45° OR 30°, CAN ALSO BE  
TAPERED BODY)



**CRL**  
**LATERAL CROSS**



**CRLR**  
**REDUCING LATERAL CROSS**  
(CAN ALSO BE TAPERED BODY)

**NOMENCLATURE**

- TEL
- REDUCER (IF REQUIRED)
- TAP TYPE
- (S)TRAIGHT
- (C)ONICAL
- (L)ATERAL
- TYPE
- TE – TEE
- CR – CROSS
- WALL TYPE
- SINGLE WALL (BLANK)
- (D)OUBLE WALL

**CONNECTIONS**

- C1 1ST CONNECTION – ENTERING
- C2 2ND CONNECTION – LEAVING
- C3 1ST TAP
- C4 2ND TAP (IF REQUIRED)

**NOTES**

- $L1 = [(GREATER\ OF\ C3\ OR\ C4) \times 1.414] + 3"$
- $L2 = C1 - C2 + 3"$
- $L3 = (C1 \times 0.5) + 1"$
- C3 OR C4 CANNOT BE LARGER THAN C1
- CENTERLINES ARE THE SAME FOR C3 AND C4 ON CROSSES

**TEES &  
CROSSES –  
LATERAL**



# FLEXIBLE DUCT SUBMITTAL

# Commercial Flexible Duct



Made with



25' Insulated  
UL 181  
Class 1 Air Duct  
Available in R4.2, R6, & R8

## OmniAir 1200

All thermal performance (R-Values) are certified by the Air Diffusion Council (ADC) and classified by UL LLC in accordance with ADC Flexible Duct Performance and Installation Standard using ASTM C-518, at installed wall thickness, on flat insulation only.

### Construction

ATCO OmniAir 1200 is a UL 181, Class 1 Air Duct and is manufactured with a tri-directional fiberglass scrim reinforced, metallized polyester outer jacket. A triple lamination of metallized polyester, aluminum foil, and polyester, which encapsulates a steel wire helix, forms the air-tight inner core. The multi-layer core is wrapped in a thick blanket of fiberglass insulation. The OmniAir 1200 is designed for low-to-medium operating pressures.

## FEATURES & BENEFITS

- Air-tight Inner Core** – Energy efficient / No fiberglass erosion into air stream
- Encapsulated Wire Helix** – No unraveling when cut to length / Quick installation
- Smooth Inner Core** – Low friction loss / Low operating cost
- Highly Resistant to Mold Growth** – Tested and Listed to UL Environment's Standard UL 2824
- Certified for Low Chemical Emissions** – Tested and Certified to UL Environment's Standard UL 2818
- Certified Thermal Performance (R-values)** – UL Classified to Air Diffusion Council test program
- Tough Reinforced Metallized Polyester Jacket** – Tear and puncture resistant / Low maintenance
- Lightweight Compact Carton** – Reduces warehouse and jobsite handling cost
- Formaldehyde Free** – Made with Owens Corning EcoTouch Insulation

## APPLICATIONS & CODE COMPLIANCES

ATCO OmniAir 1200 is designed for indoor use as a supply and return air duct in commercial low-to-medium pressure heating and air conditioning systems. The OmniAir 1200 can be used as a complete air duct system and/or a branch duct connecting to mixing boxes, diffusers, light troffers, room inlets, or other terminal devices. UL 181, NFPA 90A & 90B, IMC, IRC, UMC (ICC ES REPORT NO. ESR-1268), HUD, Cities of Chicago, New York, San Francisco, County of Dade (Florida), California State Fire Marshal.\*

\*ATCO recommends that you check with the local code body having jurisdiction in your area to determine applicable codes.

# PRODUCT & PERFORMANCE DATA

## PRODUCT DATA

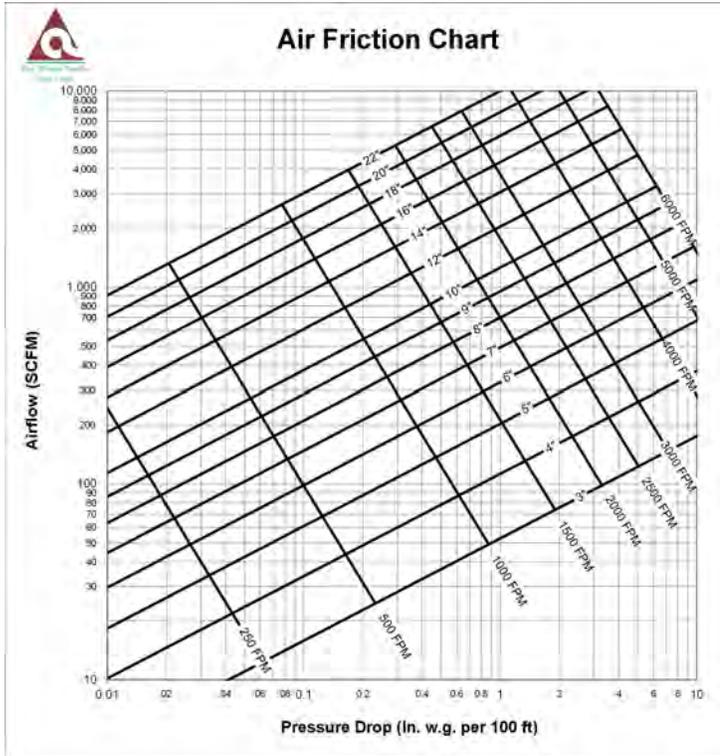
Length: 25'  
 Diameter: 3" – 10" all diameters, plus 12" – 20" even diameters  
 Vapor Barrier: Tri-directional, scrim reinforced metallized polyester  
 End Treatment: 25' – plain ends  
 Packaging: 1 piece per carton

## INSTALLATION

Air duct connections and joints shall be made per installation instructions outlined by ATCO Rubber Products, Inc. and as required by the UL 181 listing procedure.  
 (Installation instructions included with product packaging)

## STRAIGHT RUN

\*FD 72-R1 Test code of the Air Diffusion Council. Friction loss is reported in inches of water gauge per 100ft of duct. By using CFM or FPM values for a given duct dimension, the friction loss can be determined. Conversion of CFM to FPM also can be made.



# PERFORMANCE DATA

- Rated Positive Pressure: 15" w.g. 3" thru 16" dia. / 10" w.g. 18" thru 20" dia. per UL-181 (UL Listed pressure ratings are determined in straight lengths @ ambient temperatures.) (With factory installed metal collars, 2" w.g. – all diameters)
- Rated Negative Pressure: 2" w.g. 3" thru 20" dia.
- Rated Maximum Velocity: 5,000 FPM
- Recommended Operating Pressures: (Determined in a 90° bend at elevated temperatures in accordance with ADC FD 72-R1 Test Code.)
  - Maximum Positive: 6" w.g. – 3" thru 12" Dia.
  - 4" w.g. – 14" thru 20" Dia.
- Vapor Transmission: .05 perms
- Maximum Operating Temperatures:
  - 20°F to 140°F Continuous (@ maximum pressure)
  - 20°F to 180°F Continuous (@ 2" pos. w.g. max)
  - 20°F to 250°F Intermittent (@ ½" pos. w.g. max)
- Flame Spread: 25 max
- Smoke Developed: 50 max



**Warranty** – ATCO warrants that all flexible ducts will be free from defects in material and workmanship for a period of five years from the date of purchase only if the ducts are installed in accordance with ATCO's installation instructions and under conditions specified in ATCO's performance data. The buyer's exclusive remedies for any defect in the flexible ducts shall be replacement or refund of the purchase price, at ATCO's option. ATCO MAKES NO OTHER WARRANTIES, EXPRESS, IMPLIED, STATUTORY OR OTHERWISE. IN PARTICULAR, ATCO MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ATCO SHALL HAVE NO LIABILITY TO THE BUYER OR ANY THIRD PARTY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER, INCLUDING, BUT NOT LIMITED TO, PERSONAL INJURY, PROPERTY DAMAGE, LOST PROFITS OR OTHER ECONOMIC INJURY DUE TO ANY DEFECT IN THE FLEXIBLE DUCTS. MATERIALS AND SPECIFICATIONS FOR THE FLEXIBLE DUCTS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

## Manufacturing & Shipping Locations



Baltimore, MD • Cartersville, GA • Crawfordsville, IN  
 Fort Worth, TX • Houston, TX • Phoenix, AZ  
 Plainville, GA • Plant City, FL • Sacramento, CA  
 Springdale, AR • Vineland, NJ

## ATCO RUBBER PRODUCTS, INC.

CORPORATE HEADQUARTERS  
 7101 ATCO DRIVE  
 FORT WORTH, TEXAS 76118-7098  
 PHONE: (817) 595-2894  
 1-800-USS-DUCT (1-800-877-3828)  
 FAX: 1-800-366-3539 TELEX: 758-510

[www.atcoflex.com](http://www.atcoflex.com)



# CABLE TIES SUBMITTAL

# Catamount®

## Cable Ties

### MATERIALS FOR MOLDED ASSEMBLY HARDWARE

Property	ASTM Method	Test Condition	Units	Molded 6/6 Nylon	Heat Stabilized Nylon	Nylon
Tensile Strength	D638	+73°F; 50% RH	kpsi	11.2	11.2	9.0
Elongation at Break	D638	+73°F; 50% RH	%	≥300	≥300	200
Yield Strength	D638	+73°F; 50% RH	kpsi	8.5	8.5	9.0
Shear Strength	D732	Dry As Molded (DAM)	kpsi	9.6	9.6	10.5
Deformation Under Load	D621	2,000 psi +122°F; DAM	%	1.4	1.4	1.2
IZOD Impact	D256	+73°F; 50% RH	ft lb/in	2.1	2.1	2.0
Tensile Impact Strength	D1822	+73°F; Long Specimen; DAM	ft lb/in <sup>2</sup>	240	240	N.R.
Melting Point	D789	Fisher-Johns	°F	491	491	491
Thermal Linear Expansion	D696	DAM	in/in/°F	4 x 10 <sup>-5</sup>	4 x 10 <sup>-5</sup>	N.R.
Thermal Conductivity	—	DAM Conche-Fitch	BTU - in/ h · ft <sup>2</sup> · °F	1.7	1.7	1.7
Brittleness Temperature	D746	50% RH	°F	-85	-85	-62
Oxygen Index	D2863	DAM 50% RH	%O <sub>2</sub>	28 31	28 31	25 31
UL Flammability	UL 94	DAM 50% RH	— —	V-2 V-2	V-2 V-2	V-2 V-2

- Material data as provided by our suppliers.
- Tests conducted on 1/4" specimens.
- N.R. = Not Reported

### NBS SMOKE GENERATION FOR 6/6 NYLON

Sample Thickness	UL Flammability	Energy Source	Specific Optical Density	
			at Maximum Smoke Accumulation	at 2 Minutes
1/16"	94 V-2	Radiant (2.5 watts/sq cm)	13	0
1/8"	94 V-2	Radiant Plus Flaming Gas Jets	26	1

- Results as provided by National Bureau of Standards (NBS). Results may not be directly correlated with larger fires, such as burning buildings. Materials should be tested to your application.

### TEMPERATURE INDEX FOR MOLDED NYLONS

Material	Minimum Thickness (in)	Temperature Index		Hot Wire Ignition (sec)
		Electrical (°C)	Mechanical w/o Impact (°C)	
6/6 Nylon	.028	125	65	11.8
	.058	125	85	15.0
UV Black Nylon	.120	125	85	35.0
	.240	125	85	35.0
Heat Stabilized Nylon	.028	130	95	9.0
	.058	130	105	11.0
	.120	130	110	20.0

- Temperature Index is the temperature at which the specific property will decrease to one-half its original value after 60,000 hours exposure at that temperature.

### ABOUT NYLON...

Nylons possess an outstanding balance of properties combining strength, moderate stiffness, high service temperature and a high level of toughness. Nylon is particularly resistant to repeated impact, has a low co-efficient of friction and excellent abrasion resistance.

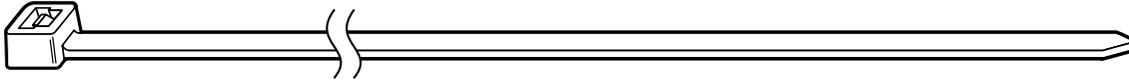
Nylon is resistant to fuels, lubricants and most chemicals, but is attacked by phenols, strong acids and oxidizing agents. Contact your Catamount Customer Service Representative or your Catamount Distributor for chemical data relative to your application.

Nylon is inherently susceptible to environmental conditions. Catamount Cable Ties are moisturized to optimum performance levels at machine-side and should be stored in cool dry areas out of direct sunlight. Cable Ties are packaged in plastic bags to contain moisture and should remain sealed until ready for use.

**Thomas & Betts**

# Catamount®

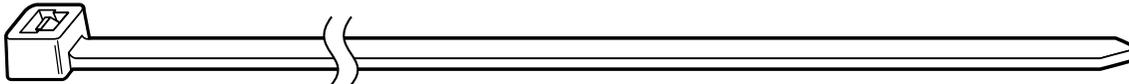
## Cable Ties



### HEAVY DUTY - SERIES 120

Per Bag	Item Number	Material	Color	Bundle Diameter		Length		Width		Minimum Loop Tensile	
				Inch	(mm)	Inch	(mm)	Inch	(mm)	LB	(kg)
100	L-8-120HS-0-C	Heat Stabilized Nylon	Black	3/16	2 (5 - 51)	8.0	(202)	.300	(8)	120	(54.4)
	L-8-120-0-C	UV Nylon									
	L-8-120-9-C	Nylon	Natural								
	L-11-120-0-C	UV Nylon	Black	3/16	3 (5 - 76)	11.1	(282)				
	L-11-120-9-C	Nylon									
	L-14-120HS-0-C	Heat Stabilized Nylon	Black	3/16	4 (5 - 102)	14.2	(363)				
	L-14-120-0-C	UV Nylon									
	L-14-120-9-C	Nylon	Natural								
	P-14-120-2-C	Nylon Colors	Red								
P-14-120-5-C	Green										
50	L-18-120HS-0-L	Heat Stabilized Nylon	Black	3/16	4 7/8 (5 - 124)	18.0	(457)	.300	(8)	120	(54.4)
	L-18-120-0-L	UV Nylon									
	L-18-120-9-L	Nylon	Natural								
	L-24-120HS-0-L	Heat Stabilized Nylon	Black	3/16	7 (5 - 178)	24.2	(616)				
	L-24-120-0-L	UV Nylon									
	L-24-120-9-L	Nylon	Natural								
	L-28-120-0-L	UV Nylon	Black	3/16	9 (5 - 230)	28.0	(816)				
L-28-120-9-L	Nylon	Natural									

• Use L-300 or ERG-297 Installation Tool



### EXTRA HEAVY DUTY - SERIES 175

Per Bag	Item Number	Material	Color	Bundle Diameter		Length		Width		Minimum Loop Tensile	
				Inch	(mm)	Inch	(mm)	Inch	(mm)	LB	(kg)
50	L-24-175-0-L	UV Nylon	Black	3/16	7.2 (5 - 184)	24.0	(612)	.345	(9)	175	(79.3)
	L-24-175-9-L	Nylon	Natural								
	L-34-175-9-L		3/16	10 (5 - 254)	34.0	(864)					
	L-36-175-0-L	UV Nylon	Black	2 3/4	10 3/4 (70 - 273)	36.0	(914)				
	L-36-175-9-L	Nylon	Natural								
	L-41-175-0-L	UV Nylon	Black	3/8	12 (5 - 305)	41.0	(1032)				
	L-41-175-8-L	Nylon	Gray								
	L-48-175-0-L	UV Nylon	Black	3/8	15 (5 - 375)	48.0	(1216)				
	L-48-175-8-L	Nylon	Gray								

• Use L-300 or ERG-297 Installation Tool



# SEALANT & GASKET SUBMITTAL

### PART NUMBERS

304142	1 Case w/ (25) 11 oz. Cartridges (White)
304146	1 Case w/ (25) 11 oz. Cartridges (Gray)
304144	1 Case w/ (4) 1-Gallon Pails (White)
304148	1 Case w/ (4) 1-Gallon Pails (Gray)
3C4143	1 - 2-Gallon Pail (White)
3C4147	1 - 2-Gallon Pail (Gray)
3C4145	1 - 5-Gallon Pail (White)

### TECHNICAL DATA

Color	White & Gray
Consistency	Heavy textured
Base	Synthetic latex
Solvent	Water
Weight per Gallon	11.6 lbs.
Solids Content	73.4%
Viscosity	Thixotropic
Coverage (UL 181 A-M)	Apply 18 mil, scrim, addt. 18 mil
Coverage (UL 181 B-M)	Approximately 214 to 320 lin. ft. per gal. at 20 to 30 mil wet film thickness at 3" width
Shore A Hardness	> 20
Flexibility	Passes ¼ inch mandrel bend
Time to Test	48 hours*
Service Temperature	-20°F to 200°F
Mildew Resistance	Mold & Mildew resistant
VOC	Exempt: 0 g/l Non Exempt: 38 g/l (less water)
Surface Burning	Flame Spread - 0, Smoke Developed - 0 (When tested in accordance with ASTM E84, UL 723)
Pressure Classes	SMACNA ½, 1, 2, 3, 4, 6 and 10 inches w.g.
Seal Class	Meets Seal Class A
Packaging	11 oz. cart.; 1, 2 & 5 gal. pails
Freeze/Thaw Stability	Passed 5 Cycles

\*May vary according to temperature and humidity

### SPECIFICATION/STANDARDS COMPLIANCE

Property	Method	Results
Freeze Thaw & Heat Cycling	ASTM C-731	Pass
Slump Test	ASTM D-2202	Pass
VOC Limitation	SCAQMD Rule 1168	Pass
	USDA	Pass
	FDA	Pass
	EPA	Pass
	City of Los Angeles Approval RR#8427	Pass

A versatile, all purpose duct sealant for use on all types of metal duct, fiberglass duct board, duct fabric and flex duct. CCWI- 181 incorporates a built-in polyester reinforcement for exceptional strength, with UV inhibitors for outdoor use. UL 181A-M listed / UL 181B-M listed.

### APPLICATION

Temperature	35°F to 110°F (1.7°C to 44°C)
Method	Brush, putty knife, caulk gun
Preparation	Surface must be dry, dirt, oil, and grease free.
Rate (UL 181 A-M)	Apply 18 mil, scrim and 18 mil over scrim.
Rate (UL 181 B-M)	Approx. 214 to 320 lin. ft. per gal. at 20 to 30 mil wet film thickness at 3" width.
Clean Up Wet	Soap and water
Clean Up Dry	UN-TACK™ or Solvent (Use safe handling practices.)
Painting	Only latex or epoxy paints
Ductboard	Scrim required for UL 181A-M

### STORAGE

Temperature	35°F to 110°F (1.7°C to 44°C) DO NOT FREEZE
Shelf Life	One year (unopened)
Flammability	Non-flammable

**Underwriters Laboratories Inc.®**  
 LISTED  
17NF  
UL 181A-M  
 FOR USE WITH U.L. LISTED RIGID FIBERGLASS AIR DUCTS OR CONNECTORS.  
UL 181B-M  
 FOR USE WITH U.L. LISTED FLEXIBLE AIR DUCTS OR CONNECTORS



### PRECAUTIONS

Surface must be clean and free of moisture, contamination and foreign matter. Do not allow this product to freeze. Apply when temperatures will not fall below freezing for at least 36–48 hours, depending on temperature and humidity. Do not apply this product where temperatures will exceed 200°F. Keep out of the reach of children. Review MSDS for complete safety information prior to use. DO NOT use where acidic or alkaline chemicals are present (ie., lab fume hood, vents, etc.)

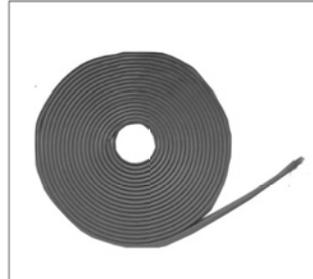
**For Industrial Professional Use Only.**

# Butyl Gasket - WBG

## Detail

Premium grade sealing tape for CL WARD four bolt connectors.

- Solids: 99.8%
- Color: Off-White (ASTM D1729-69)
- Specific Gravity: 1.60 ±.05 (ASTM D-71-72)
- 40% polymer content derived from butyl and proprietary co-polymers
- Fillers are inert and used as extenders and process aids
- Remaining compounds consists of antioxidants, fungicides, and organic processing aids
- Slump Resistance: 300°, 20 min, No slump
- Heat Resistance: 190°, 24 hours, No sag
- Density: 1.45 gm/cc+ .05
- Flash Point: 400°F-Penske Martens CC (ASTM E-134)
- Shelf and Service Life: 20 years minimum
- Life Expectancy: 20 years minimum
- Service Temperature: -65°F to 220°F
- Application Temperature: Above 40°F
- Water Resistance: Vacuum .75% max, Static 0%
- Oil Migration: None (applied to galvanized steel and subjected to a temperature of 158° for one week)
- Flexibility: No cracks when bent around a 1/4" mandrel after being subjected to 3 weeks at 158°F
- Adhesion: Excellent to most non-porous surfaces
- Specifications: MIL-C 0 18969 B, Type 2, Class B
- Elongation (%min): Over 300%
- UL 723 (ASTM E 84-84)
- Flame Spread: 5
- Smoke Developed: 5
- Military Specifications: M1 L-C- 18969B, Type II, Class B
- Federal Specification: TT-C- 1796A, Type II, Class B
- U.S.D.A. Acceptability: Product chemically acceptable to the U.S. Department of Agriculture for use in meat and poultry processing areas under Federal inspection
- F.D.A. Requirements: Meets Requirement 21CFR175.105
- No VOC's



## CONTACT

Office: 888.973.7600

1100 Ashwood Drive  
Suite 1102  
Canonsburg, PA 15317

[www.clward.com](http://www.clward.com)

## Profile

- 3/16" x 5/8"

## Packaging

Item Code	Item Description	Packaging	Weight
WBG	Butyl Gasket - 25' rolls	750 ft/case	57 lbs per case



# CERTIFICATE OF COMPLIANCE



## Hardcast, a Carlisle Company

CCWI-181 Gray Two Gallon Pail

113149-410

Certificate Number

04/30/2018 - 04/30/2023

Certificate Period

Certified

Status

UL 2818 - 2013 Standard for Chemical Emissions for Building Materials, Finishes and Furnishings

Building Construction Adhesives are determined compliant in accordance with an Office environment with an air change of  $0.68 \text{ hr}^{-1}$ .

Products tested in accordance with UL 2821 test method to show compliance to emission limits in UL 2818, Section 7.1.



*UL investigated representative samples of the identified Product(s) to the identified Standard(s) or other requirements in accordance with the agreements and any applicable program service terms in place between UL and the Certificate Holder (collectively "Agreement"). The Certificate Holder is authorized to use the UL Mark for the identified Product(s) manufactured at the production site(s) covered by the UL Test Report, in accordance with the terms of the Agreement. This Certificate is valid for the identified dates unless there is non-compliance with the Agreement.*

## GREENGUARD Certification Criteria for Building Products and Interior Finishes

Criteria	CAS Number	Maximum Allowable Predicted Concentration	Units
TVOC <sup>(A)</sup>	-	0.50	mg/m <sup>3</sup>
Formaldehyde	50-00-0	61.3 (50 ppb)	µg/m <sup>3</sup>
Total Aldehydes <sup>(B)</sup>	-	0.10	ppm
Particle Matter less than 10 µm <sup>(C)</sup>	-	50	µg/m <sup>3</sup>
4-Phenylcyclohexene	4994-16-5	6.5	µg/m <sup>3</sup>
Individual VOCs <sup>(D)</sup>	-	1/10th TLV	-

- (A) Defined to be the total response of measured VOCs falling within the C<sub>6</sub> – C<sub>16</sub> range, with responses calibrated to a toluene surrogate. Maximum allowable predicted TVOC concentrations for GREENGUARD (0.50 mg/m<sup>3</sup>) fall in the range of 0.5 mg/m<sup>3</sup> or less, as specified in CDPH Standard Method v1.2.
- (B) The sum of all measured normal aldehydes from formaldehyde through nonanal, plus benzaldehyde, individually calibrated to a compound specific standard. Heptanal through nonanal are measured via TD/GC/MS analysis and the remaining aldehydes are measured using HPLC/UV analysis.
- (C) Particle emission requirement only applicable to HVAC Duct Products with exposed surface area in air streams (a forced air test with specific test method) and for wood finishing (sanding) systems.
- (D) Allowable levels for chemicals not listed are derived from 1/10th of the Threshold Limit Value (TLV) industrial work place standard (Reference: American Conference of Government Industrial Hygienists, 6500 Glenway, Building D-7, and Cincinnati, OH 45211-4438).

