THIS FORM MUST BE PRINTED TO A STATIC PDF FOR DISTRIBUTION

Yellow highlighted text will not appear in the printed document.

SUBMITTAL REVIEW

CLIENT NAME: Vails Gate Fire Department

PROJECT TITLE: Vails Gate FD - New Firehouse

SUBMITTAL No.: 233113-1 **H2M PROJECT No.:** VGFD2001

SUBMITTAL NAME: Sheet Metal Work PD

SUBMITTAL REVIEW

**REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS.
NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS
OF DIMENSIONS OR DETAILS**

- [x] NO EXCEPTIONS TAKEN
- [ ] SUBMIT SPECIFIED ITEM
- [ ] MAKE CORRECTIONS NOTED (RESUBMISSION NOT REQUIRED)
- [ ] NO ACTION TAKEN (REVIEW IS THE RESPONSIBILITY OF ANOTHER PARTY)
- [ ] REVISE & RESUBMIT
- [ ] NO ACTION TAKEN (THIS SUBMITTAL IS NOT REQUIRED BY THE CONTRACT)
- [ ] REJECTED - SEE REMARKS
- [ ] RECEIVED FOR RECORD

Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating their work with that of all other trades; and performing the work in a safe and satisfactory manner.

H2M architects + engineers

Date: 03/09/2023 By: MJV

Rev.: 2020-05-20

Comments:

h2m.com

CONTRACTOR'S COMPANY NAME
ADDRESS

SUBMISSION TRANSMITTAL FORM
CLIENT NAME: Vails Gate Fire District
PROJECT TITLE: VGFD2001-New Firehouse

H2M PROJECT NO.: VGFD2001

Product, Item, or System Submitted:	Sheet Metal Work Product Data		
Submission Date:	2/13/2023	Submission Log No.:	233113-1
Specification Section:	233113	Paragraph Reference:	1.05/B
Contract Drawing Reference(s):			
Manufacturer's Name:			
Manufacturer's Mailing Address:			
Manufacturer's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
Supplier's Name:	Joe Lombardo Plumbing & Heating		
Supplier's Mailing Address:			
Supplier's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
This item is a substitution for the specified item:		☑ No	☐ Yes

KEY CONSTRUCTION SERVICES, LLC

Project No: VGFD2001

Reviewed for General Acceptance Only. This review does not relieve the Subcontractors or Suppliers of responsibility for making the work conform to the requirements of the contract. The Subcontractor and Suppliers are responsible for all dimensions, correct fabrication and accurate fit with the work of other trades.

SUBJECT TO ARCHITECT AND OR ENGINEER APPROVAL

Signed *Joseph Manfredi* (PM) **Date: 2/13/2023**

Contractor's Approval Stamp with Signature & Date

Contractor's Brief Comments or Remarks (attach separate letter as needed):

By making this submission, we represent that we have determined and verified all field measurements and dimensions, field construction criteria, site and building constraints in terms of limitations in moving the item into the enclosed space, materials, catalog and model numbers and similar data and that we have checked and coordinated this submission with other work at or adjacent to the installed location in accordance with the requirements contained in the Contract Documents.

END OF SECTION 013300

Joe Lombardo

Plumbing & Heating of Rockland, Inc.

321 Spook Rock Road
Suffern, NY 10901
Ph. 845-357-6537 Fx 845-357-8529
E: info@josephlombardo.com
Website: www.josephlombardo.com

Rockland Cty. Plumbing #1000 *Rockland Cty. Cooling # 1468*
Westchester Cty. Plumbing #460 *New Jersey State Plumbing #12702*

LETTER OF TRANSMITTAL

DATE: 02/09/23	JOB NO.
ATTENTION: Joe Manfredi	
RE: Vails Gate Firehouse	

TO: Key Construction
4246 Albany Post Rd. Suite 1
Hyde Park, NY 12538

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	02/09/23	233113	SHEETMETAL WORK

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ No Exceptions Taken ☐ Resubmit _____ copies for review
☐ For your use ☐ Make Corrections Noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Rejected ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 20___ ☐ PRINTS RETURNED AFTER LOAN TO US

COPY TO: CHRIS GERMANO

SIGNED: Ronald J. Lombardo

DUCT CONSTRUCTION STANDARDS

PROJECT: **VAILS GATE FIRE DISTRICT**

NEW STORAGE BUILDING (PHASE I) &
NEW FIRE STATION (PHASE II)

872 BLOOMING GROVE TNPK
NEW WINDSOR, NY 12553

ENGINEER: **H2M ARCHITECTS + ENGINEERS**

DATE: **2/3/2023**

15 ANACONDA DRIVE~LAKE KATRINE ~ NY 12449 ~ PHONE (845) 382-2010 ~ FAX (845) 382-2019

SHEET METAL INC.
Commercial And Industrial Ductwork

DUCTWORK SYSTEM SCHEDULE

Project: Vails Gate Fire Dept.

SYSTEM		SUB – SYSTEM	PRESS CLASS	SEAL CLASS	MAT' L	LINING	REMARKS
ALL SUPPLY	SA	FROM AHU TO	2"	A	GALV	NOTE 1	
		TO DISCHARGE					
ALL RETURN	RA	FROM REGISTER TO UNIT	-2"	A	NOTE 2	NOTE 1	
ALL OUTSIDE AIR	OA	FROM LOUVER TO UNIT	2"	A	GALV	NONE	
DRYER EXHAUST	EA	FROM DRYER TO DISCHARGE	-2"	A	ALUM	NONE	
SHOWER EXHAUST	EA	FROM SHOWER TO DISCHARGE		A	ALUM	NONE	
KITCHEN EXHAUST	EA	FROM HOOD TO UNIT	NOTE 3	NOTE 3	NOTE 3	NOTE 3	NOTE 3
ALL OTHER EXHAUST	EA	FROM REGISTER TO UNIT	-2"	A	GALV	NONE	
ALL TRANSFER DUCTS			2"	A	GALV	NONE	
***NO DUCT LESS THAN 22 ga.**							

COMMENTS:

NOTE 1- 20 ft. upstream and downstream of AHUs and fans shall be 1" lined.

NOTE 2- Galvanized is assumed as no return material noted within material schedule.

NOTE 3- Grease duct is Captive Air Double-Wall factory welded grease duct system as specified on sheet M2-618.00 or equal.

HVAC DUCT CONSTRUCTION STANDARDS

METAL AND FLEXIBLE

THIRD EDITION – 2005

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.
4201 Lafayette Center Drive
Chantilly, VA 20151-1209
www.smacna.org

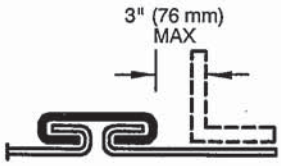
HVAC
DUCT CONSTRUCTION STANDARDS
METAL AND FLEXIBLE

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

4201 Lafayette Center Drive
Chantilly, VA 20151-1209

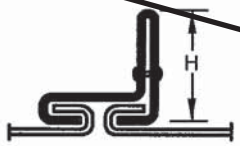
Printed in the U.S.A.

FIRST EDITION - 1985
SECOND EDITION - 1995
THIRD EDITION - 2005
SECOND PRINTING - 2006
THIRD PRINTING - 2008
FOURTH PRINTING - 2009



T-1 – DRIVE SLIP
T-3 – REINFORCED

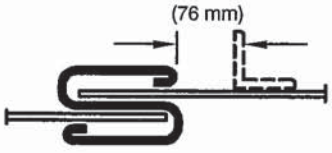
- Gage no less than two gages less than duct gage
- 24 ga minimum
- Qualification as reinforcement per Table 2-48
- T-3 – Slip Gage as per T-1
  - Any length at 2 in. wg
  - 36 in. maximum length at 3 in. wg
  - 30 in. maximum length at 4 in. wg
  - Not allowed above 4 in. wg



STANDING DRIVE SLIP
T–2

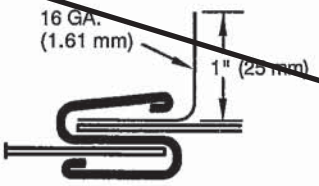
- Fasten standing portions within 2 in. of each end and elsewhere at 8 in. spacing or less
- Any length at 2 in. wg
- 36 in. maximum length at 3 in. wg
- 30 in. maximum length at 4 in. wg
- Not allowed above 4 in. wg

PLAIN "S" SLIP
T–5



T–6 HEMMED "S" SLIP
(T–6a REINFORCED)

- Not less than two gages less than duct gage
- 24 ga minimum
- When used on all 4 sides, fasten within 2 in. of the corners and at 12 in. maximum intervals
- 2 in. wg maximum pressure



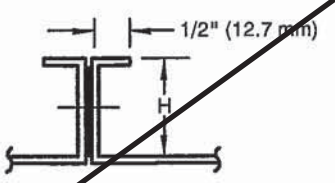
REINFORCED "S" SLIP
T–7

- Use slips conforming to T-6
- Use 16 ga angle of 1 in. height into slip pocket
- Fasten with screws at ends
- Angle used only for A, B, or C rigidity class
- 2 in. wg maximum pressure

FIGURE 2–1 RECTANGULAR DUCT/TRANSVERSE JOINTS

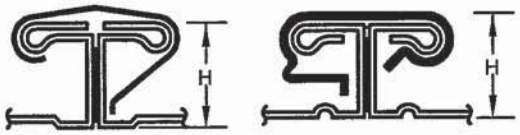
FLANGED
(WITH GASKET)
T–24

- Assemble per Figure 2-16
- Close corners with minimum 16 ga corner pieces and ⅜ in. bolts min.
- Lock flanges together with 6 in. long clips located within 6 in. of each corner
- Clips spaced at 16 in. maximum for 3 in. wg pressure class or lower
- Clips spaced at 12 in. maximum for 4, 6 and 10 in. wg
- Gasket to be located to form an effective seal



FLANGED
(WITH GASKET)
T–24A

- Bolt, rivet 1 in. maximum from ends and at 6 in. maximum intervals
- Limited to 2 in. wg pressure class
- *See* Figure 2-16
- Gasket to be located to form an effective seal



FLANGED
(WITH GASKET)
T–25a

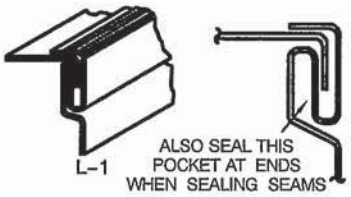
FLANGED
(WITH GASKET)
T–25b

- Assemble per Figure 2-17
- Ratings may be adjusted with EI-rated bar stock or members from Tables 2-29 and 2-30
- Supplemental members may be attached to the duct wall on both sides of the joint
- Single members may be used if they are fastened through both mating flanges
- Gasket to be located to form an effective seal

SLIP–ON
FLANGE

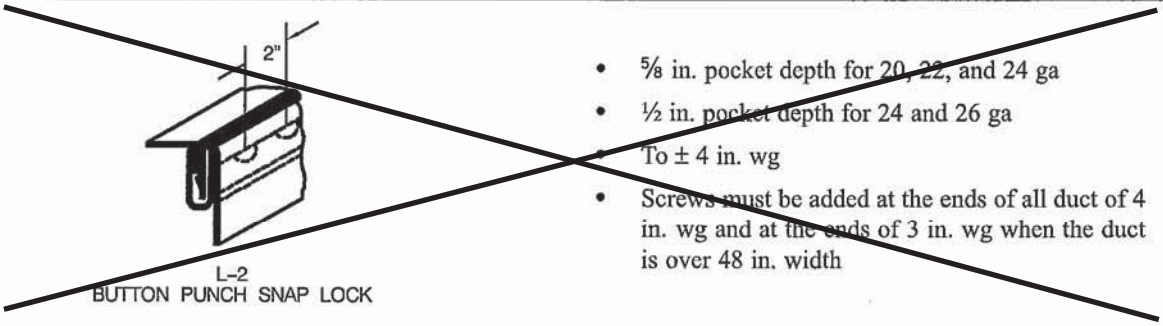
- Consult manufacturers for ratings established by performance documented to functional criteria in Chapter 11.

FIGURE 2–1 RECTANGULAR DUCT/TRANSVERSE JOINTS (CONTINUED)



PITTSBURGH LOCK

- Pocket depth from ¼ in. to ⅝ in.
- Use on straight duct and fittings
- To ± 10 in. wg



L–2
BUTTON PUNCH SNAP LOCK

- ⅝ in. pocket depth for 20, 22, and 24 ga
- ½ in. pocket depth for 24 and 26 ga
- To ± 4 in. wg
- Screws must be added at the ends of all duct of 4 in. wg and at the ends of 3 in. wg when the duct is over 48 in. width

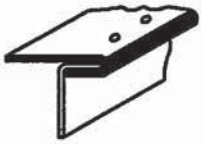
L–3
GROOVED SEAM
ALSO CALLED FLAT LOCK AND PIPE LOCK

- To ± 10 in. wg

SEE FIG. 2–7 ALSO

L–4 STANDING SEAM

- To ± 10 in. wg
- 1 in. seam up to duct width of 42 in.
- 1 ½ in. seam for larger ducts
- May be used on duct interiors
- Fasten at 2 in. maximum from ends and at 8 in. maximum intervals



L–5 SINGLE CORNER SEAM

- To ± 10 in. wg
- Fasten as per L-4

FLANGED
(WITH GASKET)
T–25a

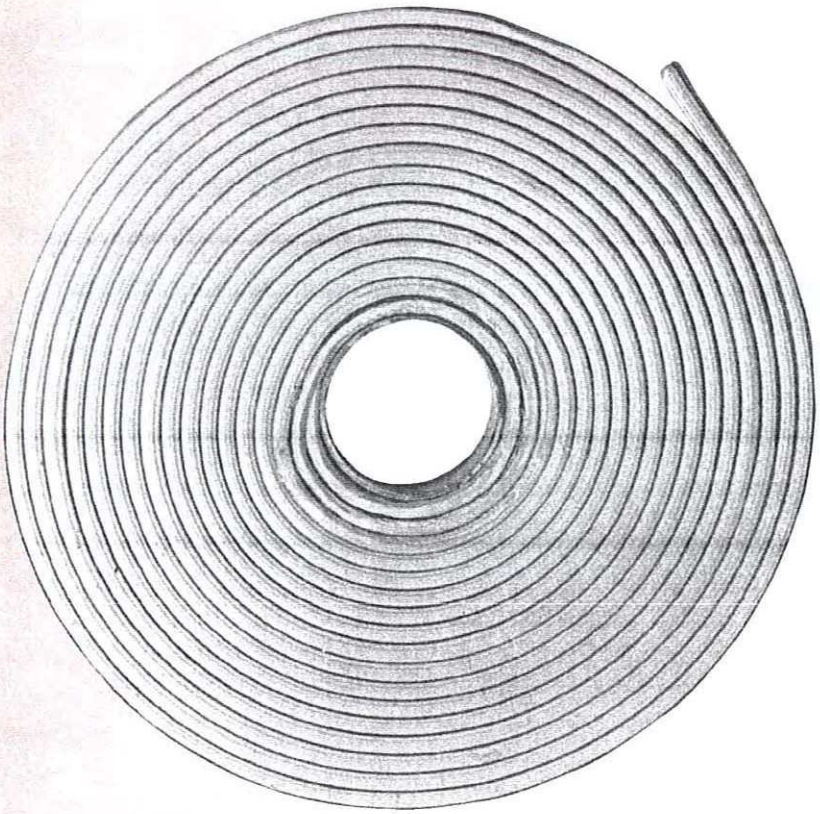
FLANGED
(WITH GASKET)
T–25b

- Assemble per Figure 2-17
- Ratings may be adjusted with EI-rated bar stock or members from Tables 2-29 and 2-30
- Supplemental members may be attached to the duct wall on both sides of the joint
- Single members may be used if they are fastened through both mating flanges
- Gasket to be located to form an effective seal

FIGURE 2–2 RECTANGULAR DUCT/LONGITUDINAL SEAMS

D U C T M A T E

DM 440™ Gasket Tape



High Quality Butyl Sealing Tape

Ideal for Rectangular Connections

- Wide range of application temperatures
- Works under extreme conditions
- Non-hardening
- Good adhesion to galvanized, aluminized, stainless steel and other metal surfaces.

GASKETS, SEALANTS, ADHESIVES

DUCTMATE® Industries, Inc.

DM 440™ Gasket Tape

High Quality Sealing Tape

DESCRIPTION

This product is a high quality sealing tape developed for use with Ductmate' s 4 bolt duct connection systems. Ductmate 440 tape has the widest range of application temperatures (see Hardness and Force to Compress) of any material on the market ensuring a positive seal and ease of application under extreme conditions. It is non-hardening and has extremely good adhesion to galvanized, Galvalume™, aluminized metal, stainless steel and other metal surfaces.

BASIC USE

High quality sealing tape for use with Ductmate's 4 bolt duct connection systems. Also suitable for use with other rectangular flange systems which require gasket.

SPECIAL CHARACTERISTICS

This compound has a 40% polymer content that is derived from butyl and a proprietary co-polymer. The plasticizers are of the Polyisobutylene and Polybutene type and permit no oxidation or migration. The fillers are inert and are used mainly as extenders and process aids and to a lesser extent as reinforcing pigments. The remaining compound consists of antioxidants, fungicides and organic processing aids.

3/16" x 5/8" x 25' per roll. Other sizes available upon request

Mineral Spirits will readily facilitate the cleaning of tools and equipment.

PACKAGING INFORMATION

Standard product is packaged 500 ft. per carton (20 rolls x 25 ft. per roll). This product is extruded on silicone backed release paper. All rolls are separated by chipboard pads and protected by upright stacking cores. Standard shipping cartons are constructed of 200 lb Kraft material. Pallets are heavy duty and have 4-way entry. All pallets are stretchwrapped for shipment.

LIMITED PRODUCT WARRANTY

Manufacturer is not liable for consequential, incidental or special damages. There are no statutory or implied warranties including the warranties of fitness for a particular purpose and merchantability. There are no warranties other than as set forth below and factory neither assumes nor authorizes any person to assume any liability or other obligation in connection with 440 Gasket Tape.

440 Gasket Tape is warranted to be free from any and all defects in material and workmanship only at the time of shipment from our factory. If material is shown to be defective at the time of shipment from our factory, manufacturer will at its sole option, replace or issue credit for the original purchase price.

To determine the suitability of 440 Gasket Tape for each specific purpose the user must conduct his own test. Manufacturer does not guarantee the results from the use of 440 Gasket Tape because of the extreme differences in surface texture and porosity of available materials as well as the possibility of structural movement or externally caused damages.

CLASSIFIED UL

GENERAL USE TAPES
SURFACE BURNING CHARACTERISTICS
70M1

TECHNICAL INFORMATION

% SOLIDS:	99.8% (ASTM C771-74)
COLOR:	Off-White (ASTM D1729-69)
SPECIFIC GRAVITY:	1.60 ± .05 (ASTM D-71-72)
FLASH POINT:	400°F Pensky-Martens CC (ASTM E-134)
SHELF & SERVICE LIFE:	20 years minimum
HARDNESS:	Test Method (ASTM D217-94) (300 gr total wt.) 0°F - 4.5mm (min) 77°F - 9.5mm - 12.0mm (max) 120°F - 14.0mm (max) 190°F - 20.0 mm (max)
SLUMP RESISTANCE:	DM-1100 (300°F, 20 min) No slump
HEAT RESISTANCE:	DM-1190 (190°F, 24 hours) No sag
SOFTENING POINT:	>350°F (ASTM E28)
PLASTICIZER MIGRATION:	No bleed/contact stain (ASTM C772-74)
STAINING:	No bleed/contact stain (ASTM D925-73)
FLEXIBILITY:	Cold temperature passes (ASTM C765-73)
WATER RESISTANCE:	Static 0% (ASTM D1056)
TENSILE STRENGTH:	30 psi min. (ASTM C907-90)
PEEL STRENGTH:	No Pressure Applied @ 77°F 90 oz min. 500 Grams Pressure Applied @ 77°F
AGING CHARACTERISTICS:	(Weather-O-Meter, 1,000 hrs.) 10% reduction in most physicals QUV Cabinet 10% reduction in most physicals (ASTM D750-88)
SERVICE TEMPERATURE:	-65°F to +220°F
APPLICATION TEMPERATURE:	Above 40°F
MANUFACTURING TOLERANCES:	Tape Width - +1/32 Inch Tape Height - +1/32 Inch

SPECIFICATION COMPLIANCE:

MILITARY SPECIFICATIONS:	Ml L-C- 18969B. Type II, Class B
FEDERAL SPECIFICATIONS:	TT-C- 1796A, Type II, Class B (Supersedes MILC- 18909B)
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

Ductmate 440 Gasket Tape applied to inorganic reinforced cement board.

Flame Spread 10 Smoke Developed 10

Tested as applied in two 6/8" wide longitudinal stripes spaced 8 in. O.C. (Tape coverage: 7% of the exposed test sample area)

DUCTMATE Industries, Inc.

Charleroi, PA
210 Fifth Street
Charleroi, PA 15022
800-245-3188
724-258-0500
FAX: 724-258-5494

Lodi, CA
810 S. Cluff Avenue
Lodi, CA 95240-9141
800-344-3270
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FAX: 209-333-4678

www.ductmate.com

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Ductmate is a proud member of the following organizations:

SMACNA SPIDA

HARDCAST
DUCT SEALANTS & INSULATION ADHESIVES

Contributes to LEED® Credit Requirements

Sure-Grip™ 404

Solvent-Based Duct Sealant

PART NUMBERS

302014	1 Case w/ (25) 11-oz. Cartridges
302009	1 Case w/ (4) 1-Gallon Pails
302020	(1) 5-Gallon Pail

TECHNICAL DATA

Color	Gray
Consistency	Heavy Brush On
Base	Synthetic Rubber Resin
Solvent	Toluene and Heptane
Weight per Gallon	8.8 lbs.
Solids Content	65%
Viscosity	150K - 200K cps
Coverage (per gal.)	Up to 320 lin. ft. at 3" width, 20-mil thickness
Shore A Hardness	> 60
Flexibility	Excellent
Time to Test	24 hours
Service Temperature	-20°F to 200°F
Water Resistance	Excellent
Mildew Resistance	Mold & mildew resistant
VOC	395 g/l
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- & 5-gal. pails
Freeze/Thaw Stability	Passed 5 Cycles

SPECIFICATION/STANDARDS COMPLIANCE

Property	Method	Results
VOC Limitation	ASTM D-2202 11-oz. Cartridges: LEED Compliant	Pass

Sure-Grip 404 is a fiber-free, solvent based, synthetic rubber duct sealant. Its exceptional strength, fast drying time and unmatched flexibility make it ideal for those applications requiring a solvent-based sealant. Sure-Grip's low-viscosity, no-drip, no-string formulation allows fast application for labor savings and extended coverage for lower installed cost.

APPLICATION

Temperature	25°F to 100°F (-3.8°C to 38°C) Keep material at room temp prior to use
Method	Brush, putty knife, caulk gun and trowel
Preparation	Surface must be dry and free of dirt, oil and grease.
Rate	Apply at joints and fasteners 20-mil-thick wet film
Clean Up	UN-TACK™ or Solvent (Use safe handling practices.)
Painting	Allow 72 hours, Use only latex or epoxy paints

STORAGE

Temperature	Below 90°F (32°C)
Shelf Life	One year (unopened)
Flammability	Flammable. Store according to local code.

PRECAUTIONS

FLAMMABLE liquid and vapor. Keep away from open flame. May cause flash fire. Contains heptane and toluene solvents. Harmful if swallowed or inhaled. May cause eye irritation. Do not apply this product in areas where intense overexposure is anticipated, or where temperatures will exceed 200°F. Keep out of the reach of children. Review Material Safety Data Sheet 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.

CLASSIFIED C UL US

ADHESIVE
Surface Burning Characteristics
294U
*Applied to inorganic reinforced cement board

FLAME SPREAD.....10
SMOKE DEVELOPED.....5

*Tested as applied in two 3/8 inch wide strips 8 inches on center at a coverage of 80 sq. ft. per gallon. Flash point of finished adhesive, closed cup: less than minus 14°C.

UL LISTED

17NF
UL 181B-M
Mastic closure systems for use with flexible duct systems or connectors.

CARLISLE HVAC PRODUCTS

USA: 900 Hensley Lane, Wylie, TX 75098 • (877) 495-4822
Canada: 2100 Remembrance Road, Lachine, QC H8S 1X3 • (800) 544-5535
www.carlislehvac.com

HARDCAST
DUCT SEALANTS & INSULATION ADHESIVES

Contributes to LEED® Credit Requirements

Versa-Grip™ 181

Premium Indoor/Outdoor Water Based Duct Sealant

PART NUMBERS

304141	1 Case w/ (25) 11 oz. Cartridges (White)
305056	1 Case w/ (25) 11 oz. Cartridges (Gray)
304138	1 Case w/ (4) 1-Gallon Pails (White)
305057	1 Case w/ (4) 1-Gallon Pails (Gray)
304139	1 - 2-Gallon Pail (White)
305058	1 - 2-Gallon Pail (Gray)

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. Approximately 130 lin. ft. per 11-fluid-oz tube, ⅛" bead (40 m per 325 L tube, 3.2 mm bead)
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 (-28.8°C to 93.3°C)
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 gal. pails
Freeze/Thaw Stability	Passed 5 Cycles

*May vary according to temperature and humidity

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.

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

Versa-Grip 181 is a premium grade, versatile, all purpose duct sealant for use on all types of metal duct, fiberglass duct board, duct fabric, and flex duct. Versa-Grip incorporates a built-in fiber 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

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
Extractant Testing	NSF	Pass
Compounds for use in Construction of Federally Inspected Meat & Poultry Plants	FSIS	Pass
Acceptable Indoor Air Concentrations	Michigan Department of Quality Criteria (Part 201/213)	Pass
	US EPA	Pass
	NSF/AWSI Standard 61	Pass
	USDA	Pass
	FDA	Pass
	City of Los Angeles Approval RR#8427	Pass

USDA, EPA & FDA APPROVED

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DUCT SEALANTS

PRECISION ADHESIVES & CHEMICALS
YOU'LL LOVE OUR CHEMISTRY

EZ-6010

EZ-6010 DUCT SEALANT – REDDISH BROWN COLOR

The EZ-6010 is a flammable solvent based product used for sealing air conditioning and heating ducts. It has the same general composition as our EZ-4719, but the viscosity of this product is 120,000 to 140,000 centipoise, while EZ-4719 has a viscosity of approximately 20,000 centipoise. This product is the same as our PA-2084 except this is a reddish-brown color. EZ-6010 is our premium grade U.L. listed duct sealant

New Label Coming Soon

APPLICATIONS

- Sealing sheet metal joint and seam in high or low pressure duct systems.
- Sealing off sheet metal screw and rivets heads.
- Making airtight and watertight all types of galvanized, aluminum or stainless steel sheet metal seams.
- Adhering butted fiberglass duct liner joints to prevent edge pick up by high velocity air.
- Sealing and seaming air systems as used in dryers, air conditioners, etc.

ADVANTAGES

- Forms a tough airtight and watertight seal.
- Flexes with expansion and contraction of the sheet metal.
- Can be applied quickly by caulking gun, trowel, putty knife or heavy brush.
- Bonds to galvanized, stainless steel or aluminum.
- Adds structural strength to the flange or seam.
- A non-hazardous air pollutant

PROPERTIES

Composition:	An oil and water resistant rubber compound which cures into a tough flexible seal. It bonds very well to galvanized, stainless steel or aluminum sheet metal. Once cured it will not flow out of the sealed flange under pressure but will flex with expansion and contraction
Color:	Reddish Brown
Viscosity:	~120,000 cp. to 140,000 cp.
Solids:	~47%
Solvents:	Methyl Ethyl Ketone
Storability:	Store up to 6 months in tightly closed containers.
Service Temperature:	-20°F to 250°
Application and Storage:	Apply at temperatures 40°F to 110°. Store at 0°F to 120° but material should be minimum of 40°F in order to get proper bond
Application Techniques:	Caulk gun, putty knife, trowel or heavy brush
Tack Time:	Tack free for 10 - 15 minutes. Full cure in 1 to 3 days
Open Time:	
Flammability:	Wet – Flammable. Dry – slow burning
Coverage Per Gallon:	1/8" bead – 130 to 150 lineal feet 1/4" bead – 30 to 60 lineal feet

Color

Application Methods

CLASSIFIED UL 503Y R-9115

Not recommended for exposed outdoor use

PRECISION ADHESIVES
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DUCT SEALANTS

PRECISION ADHESIVES & CHEMICALS
YOU'LL LOVE OUR CHEMISTRY

EZ-6010A

EZ-6010A ZERO VOC DUCT SEALANT – REDDISH BROWN COLOR

Our EZ-6010A is our premium grade, U.L. Listed duct sealant is a LEED qualified sealant with zero reportable VOC. Great when applied with a caulking tube, knife or trowel. The EZ-6010A is a flammable product with identical properties to our aluminum colored PA-2084A

New Label Coming Soon

APPLICATIONS

- Sealing sheet metal joint and seam in high or low pressure duct systems.
- Sealing off sheet metal screw and rivets heads.
- Making airtight and watertight all types of galvanized, aluminum or stainless steel sheet metal seams.
- Adhering butted fiberglass duct liner joints to prevent edge pick up by high velocity air.
- Sealing and seaming air systems as used in dryers, air conditioners, etc.

ADVANTAGES

- Forms a tough air-tight and water-tight seal.
- LEED qualified, zero reportable VOC.
- Flexes with expansion and contraction of the sheet metal.
- Can be applied quickly by caulking gun, trowel, putty knife or heavy brush.
- Bonds to galvanized, stainless steel or aluminum.
- Adds structural strength to the flange or seam.

PROPERTIES

Composition:	An oil and water resistant rubber compound which cures into a tough flexible seal. It bonds very well to galvanized, stainless steel or aluminum sheet metal. Once cured it will not flow out of the sealed flange under pressure but will flex with expansion and contraction.
Color:	Reddish Brown
Viscosity:	~120,000 cp. to 140,000 cp.
Solids:	~50%
Solvents:	Acetone
Storability:	Store up to 6 months in tightly closed containers
Service Temperature:	-20°F to 250°
Application and Storage:	Apply from temperatures 40°F to 110°. Store at 0°F to 120° but material should be minimum of 40°F in order to get proper bond
Application Techniques:	Caulk gun, putty knife, trowel or heavy brush
Tack Time:	Tack free for 10 - 15 minutes. Full cure in 1 to 3 days
Flammability:	Wet – Flammable. Dry – slow burning
Coverage Per Gallon:	1/8" bead - 130 to 150 lineal feet 1/4" bead - 30 to 60 lineal feet

Not recommended for exposed outdoor use

Color

Application Methods

CLASSIFIED UL
503Y
R-9115

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DUCT SEALANT

PRECISION ADHESIVES

PA-4084

PA-4084 WATER BASED DUCT SEALANT

The PA-4084 is a 100 percent solvent free product used for sealing air conditioning and heating ducts. It is an extremely fast drying, odor free, environmentally friendly product. PA-4084 is a superior bond and is U.L listed. We consider this the premium water based duct sealant.

APPLICATIONS

- Sealing sheet metal joints and seams in high or low pressure duct systems.
- Sealing and seaming air passages in dryers, air conditioners, and industrial air processing units.
- Closing holes and sealing screw and rivet heads in sheet metal.

ADVANTAGES

- Forms an air-tight and water-tight seal which is tough and strong.
- Flexes with expansion and contraction of the sheet metal.
- Excellent bond to aluminum, galvanized sheet or stainless steel.
- Can be applied quickly by caulking gun, putty knife, trowel or heavy brush.
- Gray color blends well with either aluminum or galvanized metal.
- Adds structural strength to the flange or seam.
- Will not drip or sag.
- Mild odor.

PROPERTIES

Color:	Gray
Viscosity:	~100,000 cp. to 150,000 cp.
Solids:	~62%
Solvents:	Cleanup with hot water while material is still wet.
Storability:	6 months in tightly closed containers, ship and store above freezing.
Service Temperature:	0^{o}F to 190^{o}F will not support mildew growth
Application and Storage:	40^{o}F to 100^{o}F keep from freezing
Weight per Gallon:	9 pounds per gallon
Application Techniques:	
Tack time:	Tack free for 1 to 4 hours depending on weather conditions. Complete drying time is 1 to 2 days at room temperature.
Flammability:	Non-Flammable solvent free

Not recommended for exposed outdoor use

PA-4084

Color

Application Methods

CLASSIFIED UL

24Y3
R-14526

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HARDCAST
DUCT SEALANTS & INSULATION ADHESIVES

Contributes to LEED® Credit Requirements

Spray-Seal™

High Performance Indoor/Outdoor
Water Based Duct Sealant

PART NUMBERS

304133	1 5-Gallon Pail
305437	1 50-Gallon Drum

TECHNICAL DATA

Color	Gray
Consistency	Spray Grade
Base	Synthetic latex
Solvent	Water
Weight per Gallon	11.0 lbs. (4.9 kg)
Solids Content	67% +/- 2
Viscosity	> 100K cps
Coverage (per gal.)	Up to 320 lin. ft. at 3" width, 20-mil thickness
Flexibility	Passes ¼ in. mandrel bend
Time to Test	48 hours*
Service Temperature	-20°F to 200°F (28.8°C to 93.3°C)
Water Resistance	Excellent
Mildew Resistance	Mold & Mildew resistant
VOC	Exempt: 0 g/L Non-Exempt: 48 g/L (less water)
Pressure Classes	SMACNA ½, 1, 2, 3, 4, 6 and 10 inches w.g.
Seal Class	Meets Seal Class A
Packaging	5-gallon pail 50-gallon drum
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
Extractant Testing	NSF	Pass
Compounds for use in Construction of Federally Inspected Meat & Poultry Plants	FSIS	Pass
Acceptable Indoor Air Concentrations	Michigan Department of Quality Criteria (Part 201/213)	Pass
City of Los Angeles Approval RR #8069		Pass
Interior Finishes U.S. Coast Guard	46 CFR 164.012	Approved

Spray-Seal is an all purpose high performance sprayable sealant for use on all types of metal duct, fiberglass duct board, duct fabric and flex duct. Distinguished by its ability to accomodate minor vibration and movement, Spray-Seal stays flexible and will not crack. Spray-Seal decreases labor substantially and increases productivity while using less material.

APPLICATION

Temperature	40°F to 110°F (4.4°C to 44°C)
Method	For spray, use Hardcast Sealant Delivery System
Preparation	Surface must be dry and free of dirt, oil and grease.
Rate	Apply at joints and fasteners 20- to 30-mil thick wet film
Clean Up Wet	Soap and water
Clean Up Dry	UN-TACK™ or Solvent (Use safe handling practices.)
Painting	Only latex or epoxy paints

STORAGE

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

CAULKING AND SEALANTS
94PF
SURFACE BURNING CHARACTERISTICS
FLAME SPREAD..... 0
SMOKE DEVELOPED..... 0
*Applied to inorganic reinforced Cement Board *Tested as applied in one 3 in. (76.2 mm) wide strip, on center covering 16.7 percent of the exposed test sample area) at a coverage of 80 sq. ft/ gal (2 sq. M/L). Flash point of finished sealant, closed cup : No flash to boiling.

17NF
UL 181B-M
Mastic closure systems for use with flexible duct systems 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.

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2 in. wg Static Pos. or Neg. Duct Dimension	No Reinforcement Required	Reinforcement Code for Duct Gage Number							
		Reinforcement Spacing Options							
		10 ft	8 ft	6 ft	5 ft	4 ft	3 ft	2½ ft	2 ft
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
10 in. and under	26 ga.	Not Required							
11 – 12 in.	26 ga.								
13 – 14 in.	24 ga.		B-26	B-26	B-26	B-26	B-26	B-26	B-26
15 – 16 in.	24 ga.		C-26	C-26	C-26	C-26	C-26	B-26	B-26
17 – 18 in.	22 ga.		C-26	C-26	C-26	C-26	C-26	C-26	B-26
19 – 20 in.	20 ga.	C-22	C-24	C-26	C-26	C-26	C-26	C-26	C-26
21 – 22 in.	18 ga.	D-22	D-24	D-26	D-26	C-26	C-26	C-26	C-26
23 – 24 in.	18 ga.	E-22	E-24	D-26	D-26	D-26	C-26	C-26	C-26
25 – 26 in.	18 ga.	E-22	E-22	E-24	D-26	D-26	C-26	C-26	C-26
27 – 28 in.	18 ga.	F-20	E-20	E-22	E-24	D-26	D-26	C-26	C-26
29 – 30 in.	18 ga.	F-20	F-20	E-22	E-24	E-26	D-26	D-26	C-26
31 – 36 in.	16 ga.	G-18	G-20	F-22	F-24	E-24	E-26	D-26	D-26
37 – 42 in.	Not Designed	H-16	H-18	G-20	G-22	F-24	E-24	E-26	E-26
43 – 48 in.			I-18	H-20	H-22	G-22	F-24	F-24	E-24
49 – 54 in.			I-16G	I-18G	H-20G	H-20G	G-24	F-24	F-24
55 – 60 in.				I-18G	I-20G	H-20G	G-22	G-24	F-24
61 – 72 in.				J-16H	J-18H	I-20G	H-22G	H-22G	H-24
73 – 84 in.					J-16H	I-20G	I-20G	I-22G	I-22G
85 – 96 in.						J-18H	I-18H	I-20H	I-22H
97 – 108 in.						K-16I	K-18H	J-18H	I-18H
109 – 120 in.							K-16I	K-18I	J-18I

Table 2–3 Rectangular Duct Reinforcement

2 in. wg Static Pos. or Neg. Duct Dimension	5 ft Joints			5 ft Joints w/2 ½ ft Reinf. Spacing				
				Joints/Reinf.			Int. Reinf.	
	Min ga	Joint Reinf.	Alt. Joint Reinf.	Min ga	Joint Reinf.	Alt. Joint Reinf.	Tie Rod	Alt. Reinf.
10 in. and under	26	N/R	N/R	Use 5 ft Joints				
11 – 12 in.	26	N/R	N/R					
13 – 14 in.	26	N/R	N/R					
15 – 16 in.	26	N/R	N/R					
17 – 18 in.	26	N/R	N/R					
19 – 20 in.	26	N/R	N/R					
21 – 22 in.	26	N/R	N/R					
23 – 24 in.	26	N/R	N/R					
25 – 26 in.	26	N/R	N/R					
27 – 28 in.	24	N/R	N/R	26	N/R	N/R	MPT	C
29 – 30 in.	24	N/R	N/R	26	N/R	N/R	MPT	D
31 – 36 in.	22	N/R	N/R	26	N/R	N/R	MPT	D
37 – 42 in.	22	JTR	(2) C	24	N/R	N/R	MPT	E
	20	N/R	N/A					
43 – 48 in.	20	JTR	(2) E	22	N/R	N/R	MPT	F
	18	N/R	N/A					
49 – 54 in.	20	JTR	(2) E	22	N/R	N/R	MPT	F
	18	N/R	N/A					
55 – 60 in.	20	JTR	(2) H	22	JTR	(2) C	MPT	G
61 – 72 in.	18	JTR	(2) H	20	JTR	(2) E	MPT	H
73 – 84 in.	16	JTR	(2) H	20	JTR	(2) I	(2) MPT	I
85 – 96 in.	Not Designed			20	JTR	(2) I	(2) MPT	I
97 – 108 in.				18	JTR	(2) I		J
109 – 120 in.				18	JTR	(2) I		K

Table 2–17 5 ft Coil/Sheet Stock/T25a/T25b (TDC/TDF) Duct Reinforcement

N/R - Not Required

N/A - Not Applicable

JTR - Joint Tie Rod

MPT - Mid Panel Tie Rod(s)

(2) (X) - Indicates 2 external reinforcements of class (X) to be used in lieu of Joint Tie Rods

Reinf. Class		T-22 Companion Angles		T-24 Flanged		T-24a Flanged		T-25b Flanged		Slip-On Flange
	EI*	H × T	WT LF	T (Nom.)	WT LF	H × T (Nom.)	WT LF	H × T (Nom.)	WT LF	
B	1.0	Use E		Use D		Use D		Use D		Consult manufacturers for ratings established by performance documented to functional criteria in Chapter 11. *See* text S1.18 on page 2.4.
C	1.9	Use E		Use D		Use D		Use D		
D	2.7	Use E		26 ga	0.5	1 × 22 ga	0.4	26 ga	0.5	
E	6.5	C 1 × ⅛	1.7	24 ga	0.6	Use F		24 ga	0.6	
F	12.8	H 1 × ⅛	1.7	22 ga	0.7	1½ × 20 ga	0.6	22 ga	0.7	
G	15.8	1¼ × ⅛	2.1	22 ga (R) 20 G	1.0	1½ × 18 ga	0.8	22 ga (R) 20 ga	1.0	
H	26.4	C 1½ × ⅛ (+) H 1½ × ⅛	2.6	18 ga	1.1	SEE TIE ROD TEXT		18 ga	1.1	
I	69	1½ × ¼	3.7	20 ga (R)	1.0			20 ga (R)	1.0	
J	80	1½ × ¼ (+) 2 × ⅛	4.7	18 ga (R)	1.1			18 ga (R)	1.1	
K	103	2 × 3/16	5	18 ga (R)	1.1			18 ga (R)	1.1	
L	207	H 2 × ¼	6.5	18 ga (R)	1.1			18 ga (R)	1.1	

Table 2–32 Transverse Joint Reinforcement

See Section 2.1.4. *Effective EI is number listed times 10^5 before adjustment for bending moment capacity. For T-22, see tie rod downsize options in Tables 2-1 to 2-7; one rod for two angles. (R) means Tie Rodded. Accepted Pressure Mode for T-24a is (+) or (-) 2 in. wg maximum. *See* Figures 2-5 and 2-6 and tie rod text. (+) indicates positive pressure use only.

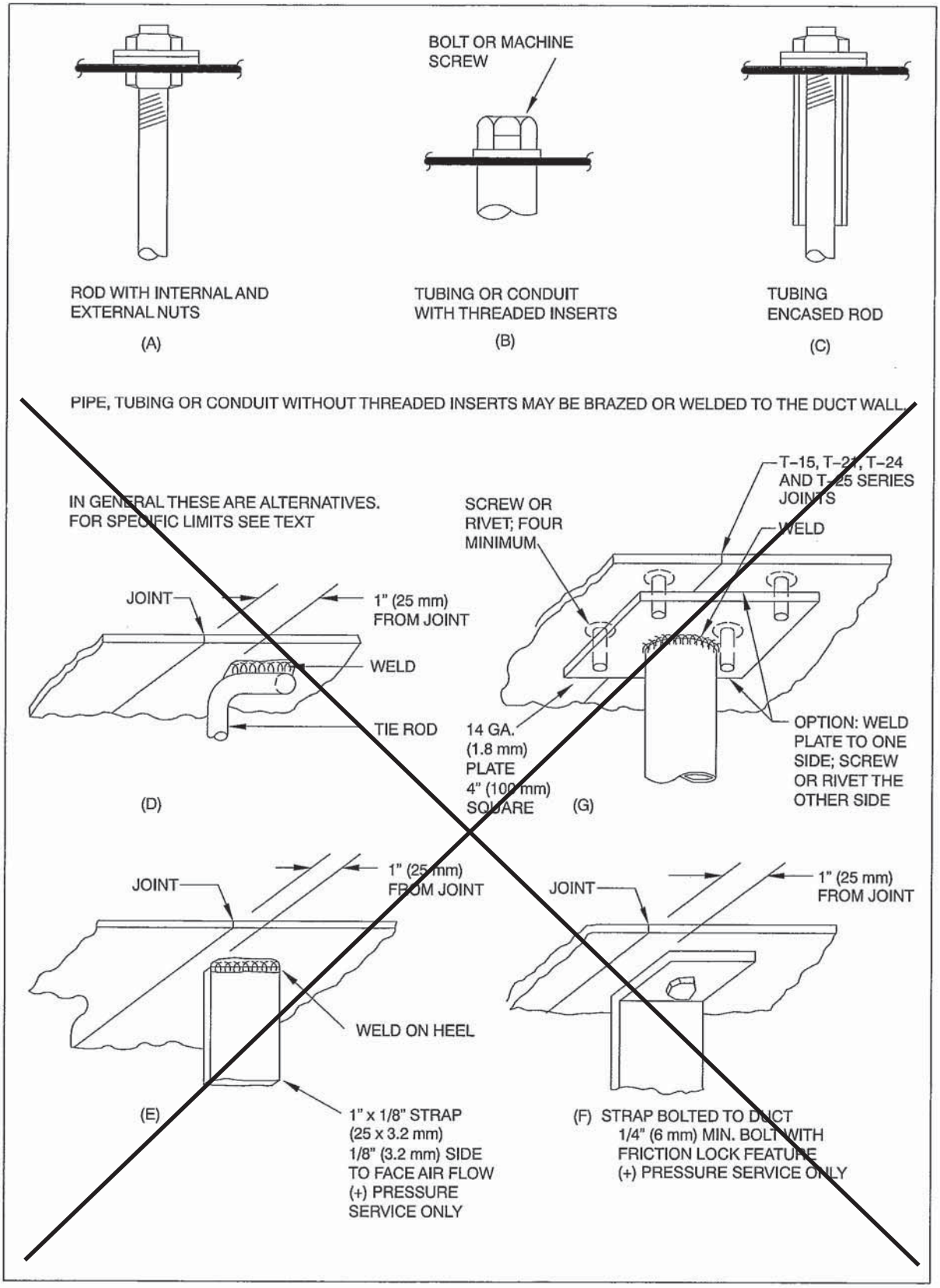


FIGURE 2–5 TIE ROD ATTACHMENTS

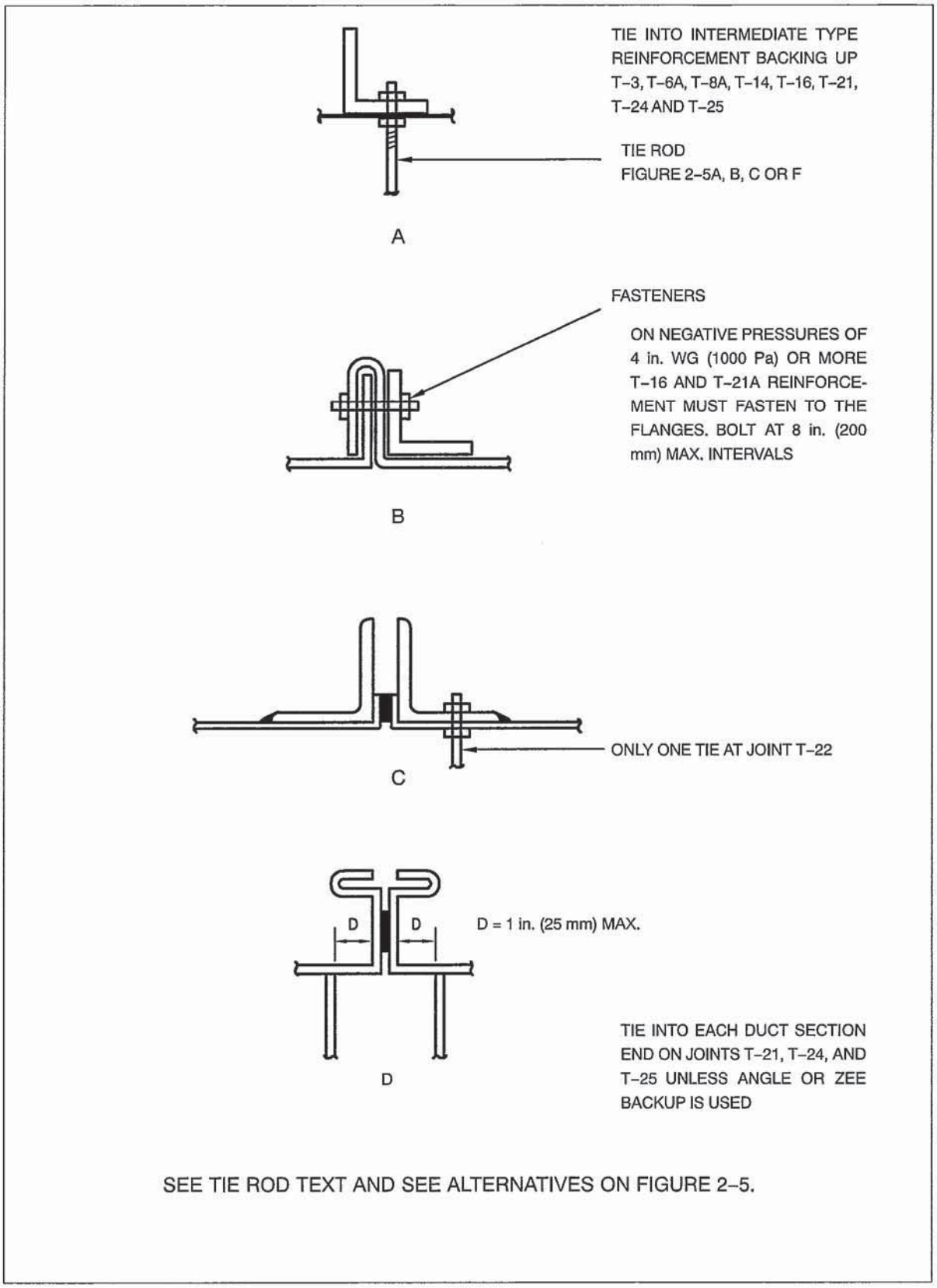


FIGURE 2-6 TIE ROD ATTACHMENTS

Static Pressure Class, in. wg									Static Pressure Class, in. wg							
W	RS	½"	1"	2"	3"	4"	6"	10"	RS	½"	1"	2"	3"	4"	6"	10"
	6 ft	47	94	188	282	396	564	940	3 ft	24	47	94	141	198	282	470
48"	5 ft	39	78	156	234	312	486	780	2.5 ft	20	39	78	117	156	234	390
	4 ft	33	62	124	186	250	372	620	2 ft	15	31	62	93	124	186	310
	6 ft	53	105	210	315	421	630	1050	3 ft	26	53	105	158	210	316	525
54"	5 ft	44	88	176	264	351	528	880	2.5 ft	22	44	88	132	176	264	440
	4 ft	35	70	140	210	281	420	700	2 ft	17	35	70	105	140	210	350
	6 ft	59	117	234	351	468	702	1170	3 ft	34	59	117	176	234	351	585
60"	5 ft	49	98	195	294	390	588	980	2.5 ft	25	49	98	147	195	294	490
	4 ft	39	78	156	234	312	468	780	2 ft	20	39	78	167	156	234	390
	6 ft	70	140	280	420	560	840	1400	3 ft	35	70	140	210	280	421	700
72"	5 ft	59	117	234	351	468	702	1170	2.5 ft	30	59	117	177	234	354	590
	4 ft	47	94	188	282	376	564	940	2 ft	23	47	94	142	188	284	470
	6 ft	82	164	328	492	656	984	1640	3 ft	41	82	164	264	328	492	820
84"	5 ft	68	137	274	411	548	822	1370	2.5 ft	34	68	137	205	274	410	680
	4 ft	55	109	218	327	436	654	1090	2 ft	27	55	109	164	218	328	546
	6 ft	94	188	366	564	792	1128	1880	3 ft	47	94	188	282	396	564	940
96"	5 ft	78	156	312	468	624	936	1560	2.5 ft	39	78	156	234	312	468	780
	4 ft	62	125	250	375	500	750	1250	2 ft	31	62	125	187	250	374	620
	6 ft	105	211	422	633	844	1266	2110	3 ft	52	105	210	315	420	630	1053
108"	5 ft	88	176	352	528	704	1056	1760	2.5 ft	44	88	176	264	352	528	880
	4 ft	70	140	280	420	560	840	1400	2 ft	35	70	140	210	288	420	700
	6 ft	117	234	468	702	936	1404	2334	3 ft	59	117	234	351	468	702	1170
120"	5 ft	98	195	390	585	780	1170	1950	2.5 ft	49	98	195	294	390	588	975
	4 ft	78	156	312	468	624	936	1560	2 ft	39	78	156	234	312	468	780

Table 2–34 Internal Tie Rod Design Load in Pounds

See the rod text and figure. "W" is width, "RS" is reinforcement spacing. The load basis is 75 percent of the pressure load on an area equal to width times reinforcement spacing. If more than one tie is used, the load is proportional. Applicable for positive and negative pressures. Not all W by RS load conditions listed in Table 2-34 occur in Tables 2-1 through 2-7. Also, loads for widths less than 48 in. may be calculated for Table 2-34.

Static Pressure Class, in. wg									Static Pressure Class, in. wg							
W	RS	½"	1"	2"	3"	4"	6"	10"	RS	½"	1"	2"	3"	4"	6"	10"
	6 ft						5/16	3/8	3 ft							
48"	5 ft							5/16	2.5 ft							
	4 ft							5/16	2 ft							
	6 ft					5/16	5/16	3/8	3 ft							5/16
54"	5 ft					5/16	5/16	3/8	2.5 ft							
	4 ft							5/16	2 ft							
	6 ft						5/16	3/8	3 ft							5/16
60"	5 ft						5/16	3/8	2.5 ft							5/16
	4 ft							5/16	2 ft							
	6 ft					5/16	3/8	7/16	3 ft						5/16	5/16
72"	5 ft						5/16	3/8	2.5 ft							5/16
	4 ft						5/16	3/8	2 ft							
	6 ft				5/16	5/16	3/8	½	3 ft						5/16	3/8
84"	5 ft					5/16	3/8	7/16	2.5 ft							5/16
	4 ft						5/16	3/8	2 ft							5/16
	6 ft				5/16	3/8	3/8	½	3 ft						5/16	3/8
96"	5 ft					5/16	3/8	7/16	2.5 ft							5/16
	4 ft					5/16	5/16	7/16	2 ft							5/16
	6 ft				5/16	3/8	7/16	5/8	3 ft						5/16	3/8
108"	5 ft				5/16	5/16	3/8	½	2.5 ft						5/16	3/8
	4 ft					5/16	3/8	7/16	2 ft							5/16
	6 ft				5/16	3/8	7/16	5/8	3 ft						5/16	3/8
120"	5 ft				5/16	5/16	3/8	½	2.5 ft						5/16	3/8
	4 ft					5/16	3/8	7/16	2 ft							5/16

Table 2–35 Internal Tie Rod Size (+) Pressure

NOTES:

¼ in. diameter is used in all blank cells in the table.

W is width. RS is reinforcement spacing.

Whenever tie rod exceeds 36 in., ⅜ in. diameter is the minimum size.

When duct width is between sizes, selection must be made for the larger W.

Allowable load on galvanized steel rods for Positive Pressure Service:

Dia.	Load (lbs.)	Dia.	Load (lbs)
¼ in.	480	7/16 in.	1600
5/16 in.	780	½ in.	2130
⅜ in.	1170	⅜ in.	3380

This assumes that threaded connections carry the load. If rod(s) are welded to lugs on the duct wall, weld stress must be limited to 13,600 PSI.

				Compression Stress Allowed (PSI)							
				9000	8000	7000	6000	5200	4700	4200	3700
		r_g	L/r_g=	130	140	150	160	170	180	190	200
Dia.	Type										
½ in.	EMT	0.235	LEN.	30 in.	32 in.	34 in.	36 in.	40 in.	42 in.	44 in.	46 in.
			LBS.	792	704	616	528	458	414	370	325
¾ in.	EMT	0.309	LEN.	40 in.	42 in.	46 in.	48 in.	52 in.	54 in.	58 in.	62 in.
			LBS.	1206	1072	938	804	697	630	563	496
1 in.	EMT	0.371	LEN.	48 in.	52 in.	54 in.	58 in.	62 in.	66 in.	70 in.	74 in.
			LBS.	1782	1584	1386	1188	1030	930	831	732
1¼ in.	EMT	0.511	LEN.	66 in.	72 in.	76 in.	82 in.	86 in.	92 in.	96 in.	102 in.
			LBS.	2655	2360	2065	1770	1534	1386	1239	1091
1½ in.	EMT	0.592	LEN.	76 in.	82 in.	88 in.	94 in.	100 in.	106 in.	112 in.	118 in.
			LBS.	3078	2736	2394	2052	1778	1607	1436	1265
2 in.	EMT	0.754	LEN.		106 in.	112 in.	120 in.	128 in.	136 in.	142 in.	150 in.
			LBS.		3480	3045	2610	2262	2044	1827	1609

Table 2–38 Internal EMT Conduit Size (–) Pressure

NOTES:

The table gives maximum length and maximum load; *see* Table 2-34 for assumed loads. Blank spaces are not economical.

EMT Conduit Data				
Dia.	EMT Conduit			Weight
	O.D. in.	t in.	A in^2	lbs/ft
½ in.	0.71	0.042	0.088	0.29
¾ in.	0.92	0.049	0.134	0.45
1 in.	1.16	0.057	0.198	0.65
1¼ in.	1.51	0.065	0.295	0.96
1½ in.	1.74	0.065	0.342	1.11
2 in.	2.2	0.065	0.435	1.41

2.7 MIDPANEL TIE ROD APPLICATIONS

2.7.1 General Requirements for Midpanel Tie Rod (MPT) Use

1. Tie rods at midpanel are acceptable economical alternatives to external intermediate reinforcements for ducts in the width range through 96 in. (2400 mm) Petitions to local authorities for acceptance under conditions other than that stipulated may be made using DCS Chapter 11, method 2.

2. Except as limited herein, this alternative applies for construction with joint spacing of 6 ft (1.8 meters) or less using transverse joints already qualified as reinforcements (within pressure limits and construction details elsewhere specified in the HVAC-DCS).

3. Internal tie rods at midpanel are not allowed in the following applications:

   a. In ducts outside of buildings when the ducts do not have waterproof external insulation or waterproof and corrosion resistant duct wall penetrations;

   b. In ducts in which condensation or grease would collect except where no wall penetrations occur or the penetration is waterproof;

   c. In underground, in-slab or under-slab ducts;

   d. In fittings on non-parallel duct sides unless they do not penetrate the duct or they use load distributing means such as shims or wedges;

   e. When the air velocity exceeds 2500 fpm (12.7 m/s);

   f. Near centrifugal and axial flow fans where SYSTEM EFFECT FACTORS apply.

4. Where fibrous glass liner particles would be exposed to airflow at a tie rod penetration of the liner, particle erosion shall be protected by use of suitable adhesive coatings, washers or other shielding.

5. MPT materials and attachments shall conform to DCS Section 2.5 and figures referenced therein. Any method shown in Figure 2-5 may be used for MPT. With Table 2-46 (2-46M) loading capacity required as minimum for MPT use, any member may be selected from Tables 2-35 to 2-40 (within the table limits) as a midpanel tie rod, *see* S1.19.4 and S1.19.5.

6. This does not prequalify MPT use for oval ducts, aluminum ducts nor polyvinyl coated steel ducts. The potential for such use is recognized; however, it requires mutual agreement between a specifying authority and a sponsor on terms of acceptable use.

7. Table 2-41 (2-41M) contains the combination of metal thicknesses, reinforcement spacings and duct widths for which midpanel tie rod (MPT) use is acceptable using one or two tie rods.

8. These schedules are not intended to preempt use of others that satisfy the requirements of DCS specification S1.2 and S1.18.

2.8 MIDPANEL TIE ROD (MPT) USE GUIDE

2.8.1 General Procedure

1. Read the General Requirements for MPT use.

2. Find the pressure, width and reinforcement spacing rating parameters in Column 8, 9 or 10 in Table 2-1 to 2-7.

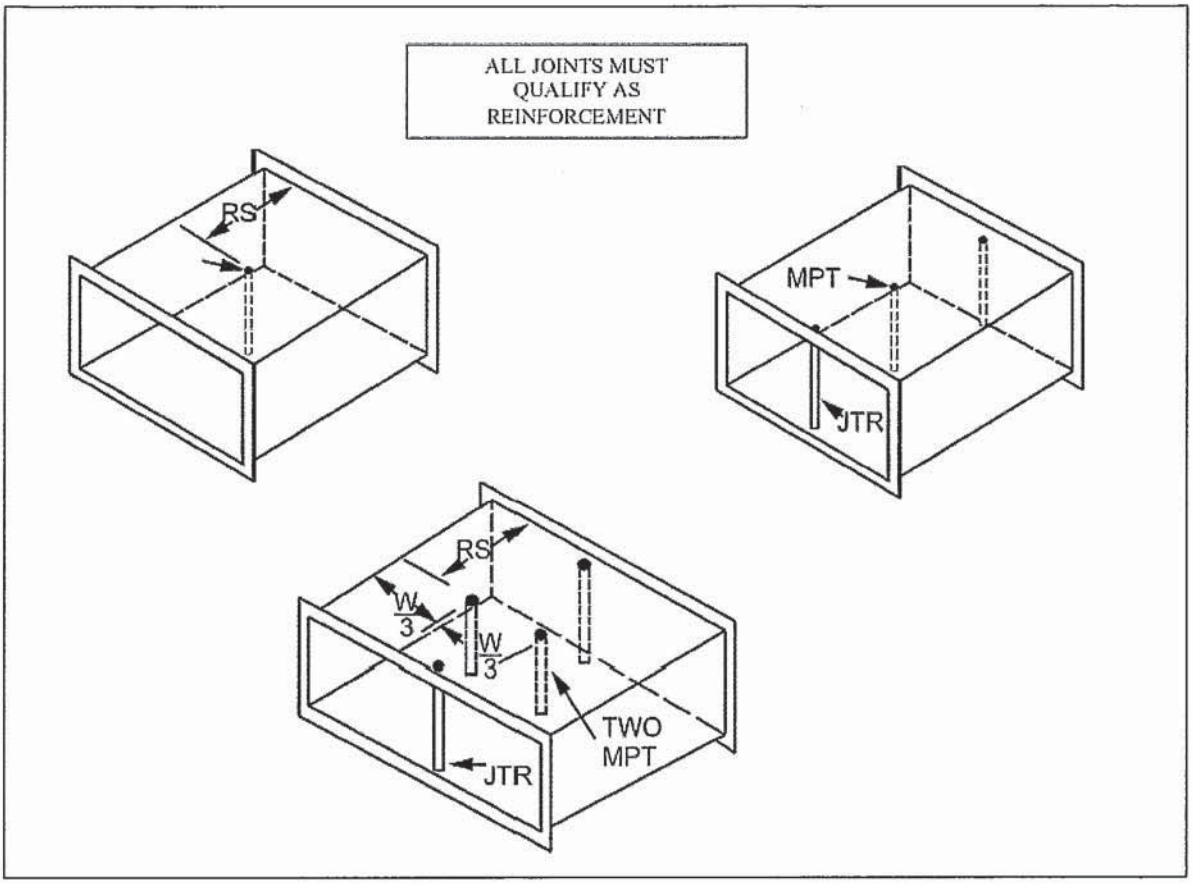
3. Confirm the duct gage required and the number of tie rods; if the joint rating in Tables 2-32 and 2-33 contains a duct wall thickness that overrides (joints T-24, 24a, 25a, 25b, 15, 16, 21 or 21a may do this), increase the wall thickness as in the case of external-integral reinforcement use. In a few instances, the thickness is greater than the minimum for external reinforcement.

4. Read Note d for Table 2-41 and consider a thickness increase that would allow fewer rods or increased width.

5. Select the optimum wall thickness and number of rods.

6. For positive pressure, select solid steel rods or EMT from Table 2-42. Typical attachments are Figures 2-5(A) and 2-5(B).

7. For negative pressure, identify the rod lengths and select them from Table 2-43, 2-44, 2-45 or use the load from Table 2-46 and the actual length to make selections from Tables 2-36 to 2-40. Typical attachments are Figure 2-5(A), 2-5(B) or by welding.



2.9 MIDPANEL TIE ROD SELECTIONS

Example No. 1:

48 × 18 in. (1200 × 450 mm) duct, 2 in. wg (500 Pa) positive pressure per Table 2-3; 5 ft (1.50 m) joint spacing; T-25a or T-25b joints:

In Table 2-3 for 48 in. (1200 mm) width, Column 6 gives reinforcement for 5 ft (1.50 m) RS (reinforcement spacing) as H-20 and Column 9 for 2 1/2 ft (0.75 m) RS as F-24; these are basic alternatives, but the joint ratings must be checked for duct gage override per text Section 2.1.4 and S1.13 and S1.14.

Therefore, for 5 ft (1.50 m) RS option Table 2-32 shows T-25 joints of H Code requiring 18 ga (1.31 mm) duct wall to satisfy the H joint rating; however, T-25 of 20 ga (1.00 mm) with tie rods at the joints (JTR) is I Code which satisfies both Tables 2-3 and 2-32. No between joint reinforcement is required. On the 18 in. (1.31 mm) wide sides, Column 2 shows that reinforcement is not required.

For 48 in. (1200 mm) width, the alternative of 2-½ ft (0.75 m) RS would only require 24 ga (0.70 mm) duct wall per Table 2-3, Column 9, but the F Code in Table 2-32 requires the use of T-25 of 22 ga (0.85 mm) duct wall, an override upgrade from Table 2-3. No tie rod is required at the joint, but one must be used at mid panel between joints (unless external reinforcement per Table 2-29 and 2-30 is used there). 22 ga (0.85 mm) metal will be used on all four sides; *see* text section 2.1.1 (3). On the 18 in. (1.31 mm) side, T-25 of 22 ga (0.85 mm) is F Code (which exceeds the C Code required in Column 9 of Table 2-3).

The requirements for tie rods at T-25 joints are the same as they would be for external reinforcement systems. The joints must qualify independently according to the reinforcement interval. For the conditions in Example No. 1, rods at T-25 joints are only required for 5 ft (1.50 m) RS intervals. Therefore, the rod size for the joint is selected based on one rod per Fig. 2-5(G) or two rods per Fig. 2-5(D) and the load from Table 2-34. In Table 2-34, the load for 2 in. wg (500 Pa) and 5 ft (1.50 m) RS on 48 in. (1200 mm) width is 156 pounds (70.76 kgs) (for one rod or 78 pounds (35.38 kgs) for each of two). From Table 2-35, ¼ in. (6.4 mm) rod suffices. From S1.19.4, ½ in. (12.7 mm) EMT is adequate.

	RS	16 ga	18 ga	20 ga	22 ga	24 ga	26 ga
±½ in. wg	3 ft				To 96(1)	To 84(1)	To 60(1)
	2 ½ ft				To 96(1)	To 84(1)	To 60(1)
	2 ft				To 96(1)	To 84(1)	To 60(1)
±1 in. wg	3 ft		To 96(1)*	To 84(1)*	To 72(1)*	To 60(1)	To 48(1)
				85-96(2)	73-84(2)	61-72(2)	
	2 ½ in.		To 96(1)*	To 84(1)*	To 72(1)*	To 60(1)	To 48(1)
				85-96(2)	73-84(2)	61-72(2)	
	2 ft		To 96(1)*	To 84(1)*	To 72(1)	To 72(1)	To 48(1)
				85-96(2)	73-96(2)		
±2 in. wg	3 ft		To 84(1)*	To 60(1)*	To 48(1)*	To 42(1)	To 36(1)
			To 96(2)	61-84(2)	49-72(2)	43-54(2)	
	2 ½ ft		To 84(1)*	To 72(1)*	To 60(1)*	To 54(1)	To 42(1)
			85-96(2)	73-96(2)	61-84(2)	55-60(2)	
	2 ft		To 96(1)*	To 72(1)*	To 60(1)	To 60(1)	To 42(1)
				73-96(2)	61-96(2)	61-72(2)	
±3 in. wg	3 ft		To 72(1)*	To 54(1)*	To 48(1)	To 42(1)	To 30(1)
			73-84(2)	55-72(2)	49-54(2)		
	2 ½ ft		To 72(1)*	To 60(1)*	To 54(1)*	To 42(1)	To 36(1)
			To 96(2)	61-84(2)	55-72(2)	43-54(2)	
	2 ft		To 84(1)*	To 72(1)*	To 60(1)*	To 54(1)	To 42(1)
			85-96(2)	73-96(2)	61-84(2)	55-72(2)	
±4 in. wg	3 ft	To 84(2)	To 60(1)*	To 54(1)*	To 48(1)	To 36(1)	To 30(1)
			61-72(2)	55-60(2)			
	2 ½ ft		To 72(1)*	To 60(1)*	To 48(1)	To 48(1)	To 36(1)
			73-96(2)	61-72(2)	49-60(2)		
	2 ft		To 84(1)*	To 60(1)*	To 60(1)	To 48(1)	To 42(1)
			85-96(2)	61-96(2)	61-72(2)	49-60(2)	
±6 in. wg	3 ft	To 72(2)	To 54(1)*	To 42(1)	To 36(1)	N/A	N/A
			55-60(2)	43-60(2)			
	2 ½ in.	To 96(2)	To 72(1)*	To 54(1)	To 48(1)	To 36(1)	N/A
			To 84(2)	55-60(2)			
	2 ft		To 72(1)*	To 60(1)*	To 48(1)	To 36(1)	N/A
			73-96(2)	61-72(2)	49-60(2)		

Table 2–41 Midpanel Tie Rod (MPT) Schedule (RS)

NOTES:

a. Table cells give duct width limit range in inches for use of one (1) and two (2) tie rods at midpanel (MPT) as a substitute for Table 2-29 intermediate reinforcements that would be centrally located between two otherwise qualified transverse joints. Joint spacings greater than six feet are not available for this alternative.

b. N/A refers to a ga not available to RS condition. RS is the Reinforcement Spacing.

c. For some conditions and joint types, the MPT option is contingent on use of tie rods at joints (JTR).

d. In some cases use of the MPT option would require that the gage be increased above those in Tables 2-1 to 2-6. An asterisk in Table 2-41 denotes a one tie rod thickness option when less thickness requires two rods.

Static Pressure Class, in. wg									Static Pressure Class, in. wg								
W	RS	½"	1"	2"	3"	4"	6"	10"	W	RS	½"	1"	2"	3"	4"	6"	10"
37"	36	25	49	99	148	198	296	494	72"	36	47	94	187	281	374	562	936
	30	21	41	82	124	165	247	412		30	39	78	156	234	312	468	780
	28	19	38	77	115	154	231	384		28	36	73	146	218	291	437	728
	24	17	33	66	99	132	198	329		24	31	62	125	187	250	374	624
	22	15	30	60	91	121	181	302		22	29	57	114	172	229	343	572
	20	14	27	55	82	110	165	274		20	26	52	104	156	208	312	520
42"	36	27	55	109	164	218	328	546	78"	36	51	101	203	304	406	608	1014
	30	23	46	91	136	182	273	455		30	43	85	169	254	338	507	845
	28	21	43	85	127	170	255	425		28	39	79	158	237	315	473	789
	24	18	36	73	109	146	218	364		24	34	68	135	203	270	406	676
	22	17	33	67	100	134	200	334		22	31	62	124	186	248	372	620
	20	15	30	61	91	121	182	303		20	28	56	113	169	225	538	563
48"	36	31	62	125	187	250	374	624	84"	36	55	109	218	328	437	655	1092
	30	26	52	104	156	208	312	520		30	46	91	182	273	364	546	910
	28	24	49	97	146	194	291	485		28	42	85	170	255	340	510	849
	24	21	42	84	125	166	250	416		24	36	73	146	218	291	437	728
	22	19	38	76	114	153	229	381		22	33	67	133	200	267	400	667
	20	17	35	70	104	139	208	347		20	30	61	121	182	243	364	607
54"	36	35	70	140	211	281	421	702	90"	36	59	117	234	351	468	702	1170
	30	29	59	117	176	234	351	585		30	49	98	195	293	395	585	975
	28	27	55	109	164	218	328	546		28	46	91	182	273	364	546	910
	24	23	47	94	140	187	281	468		24	39	78	156	234	312	468	780
	22	22	43	86	129	172	257	429		22	36	72	143	215	286	429	715
	20	20	39	78	117	156	234	390		20	33	65	130	195	260	390	650
60"	36	39	78	156	234	312	468	780	96"	36	62	125	250	374	499	749	1248
	30	33	65	130	195	220	390	650		30	52	104	208	312	416	624	1040
	28	31	61	121	182	243	364	607		28	49	97	194	291	388	582	971
	24	26	52	108	156	216	312	520		24	42	83	166	250	333	494	832
	22	24	48	95	143	191	286	477		22	38	76	153	305	458	458	763
	20	22	43	87	130	173	260	433		20	35	69	139	208	277	416	693
66"	36	43	86	171	257	343	514	858									
	30	36	72	143	215	286	429	715									
	28	33	68	133	200	267	400	667									
	24	29	57	114	171	229	343	572									
	22	26	52	104	157	210	315	524									
	20	24	48	95	143	191	286	477									

Table 2–46 Midpanel Tie Rod (MPT) Design Load in Pounds

NOTES:

a. This table applies for tie rods at midpanel. It is based on 5.2 PSF/IN. WG on an area of duct width (W) times reinforcement spacing (RS). For sizes between W intervals use the load at the larger W or calculate it. Pressure is (+) or (-). 10 in. wg data is for independent custom design use only.

½ to 3 in. wg Negative Pressure				
EMT Size and Length for Duct Width (W)		Rod Spacing Between Qualified Joints		
		3 ft RS	2 ½ ft RS	2 ft RS
	Max. L, in.	Duct Width (W)		
½ in. Dia.	46	to 83 in.	to 96 in.	to 96 in.
	42	84 - 96	–	–
¾ in. Dia.	62	to 96 in.	to 96 in.	to 96 in.
1.0 in. Dia.	74	to 96 in.	to 96 in.	to 96 in.
1 ¼ in. Dia.	96	to 96 in.	to 96 in.	to 96 in.

Table 2–43 Internal Midpanel Tie Rod (MPT) Size (Dia.)

125 to 750 Pa Negative Pressure				
EMT Size and Length for Duct Width (W)		Rod Spacing Between Qualified Joints		
		0.90 m RS	0.75 m RS	0.60 m RS
	Max. L, mm	Duct Width (W)		
12.7 mm Dia.	1168	to 2108 mm	to 2438 mm	to 2438 mm
	1067	2134 - 2438 mm	–	–
19.1 mm Dia.	1575	to 2438 mm	to 2438 mm	to 2438 mm
25 mm Dia.	1880	to 2438 mm	to 2438 mm	to 2438 mm
31.8 mm Dia.	2400	to 2438 mm	to 2438 mm	to 2438 mm

Table 2–43M Internal Midpanel Tie Rod (MPT) Size (Dia.)

FIGURE 2–9 CROSSBROKEN AND BEADED DUCT

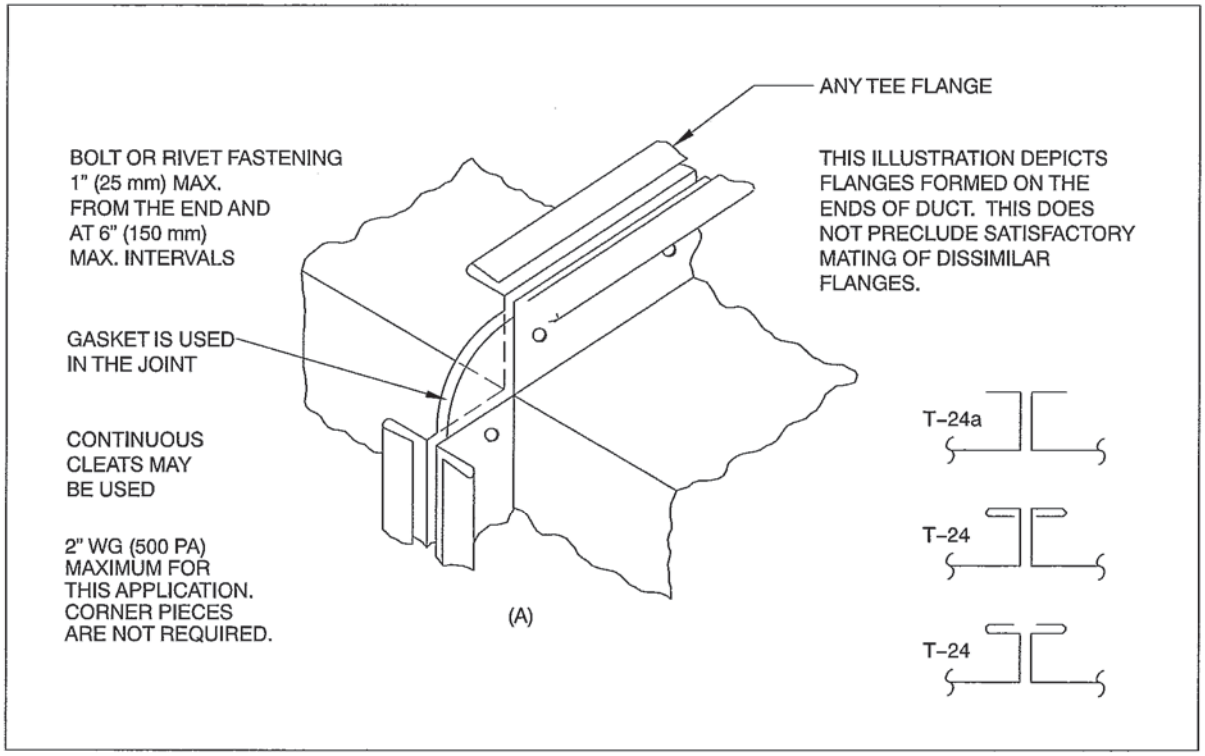
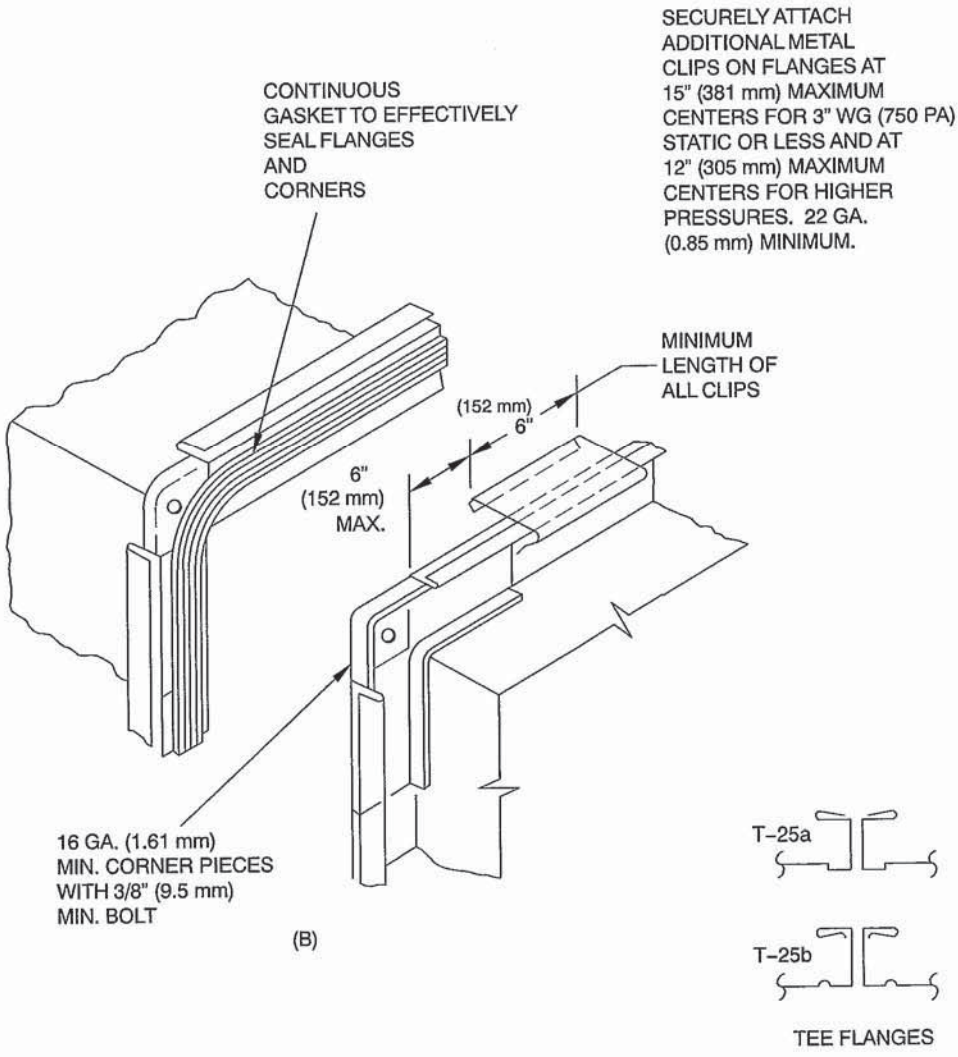


FIGURE 2-16 CORNER CLOSURES - FLANGES



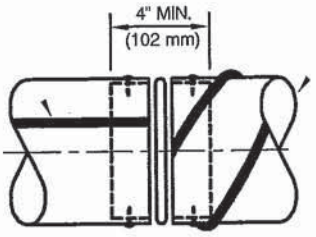
SCREWS MAY BE USED IN LIEU OF METAL CLIPS. INSTALL 1" (25MM) MAX. FROM END OF CORNER PIECE AND AT 6" (152 MM) MAX. INTERVALS.

EQUIVALENT FIXATION OF JOINTS MAY BE USED. CONTINUOUS CLEATS MAY BE USED.

FIGURE 2–17 CORNER CLOSURES – FLANGES

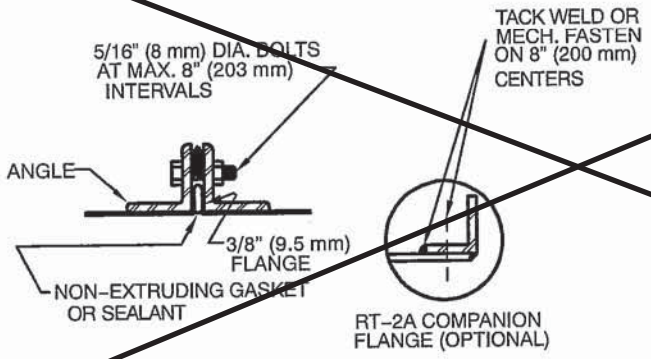
CHAPTER 3

ROUND, OVAL AND FLEXIBLE DUCT



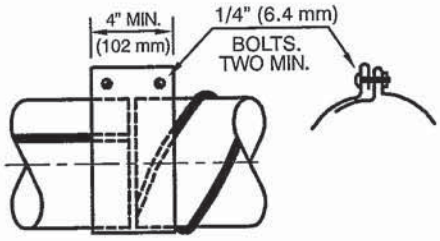
BEADED SLEEVE JOINT
RT–1

- Longitudinal or Spiral Seam
- Sleeve to be at least the same gage as duct
- Screws must be used at uniform intervals of at least 15 in. along the circumference
- Three screws minimum on 14 in. or less diameter



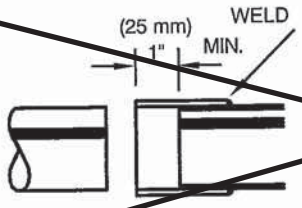
RT–2A COMPANION
FLANGE (OPTIONAL)

- Longitudinal or spiral seam
- Minimum Flange Sizes:
- 1 in. × 1 in. × 10 ga up to 14 in. Dia.
- 1 ½ in. × 1 ½ in. × ⅛ in. over 14 in. Dia. If flanges are used as reinforcement *see* Table 3-4



RT3 DRAWBAND JOINT

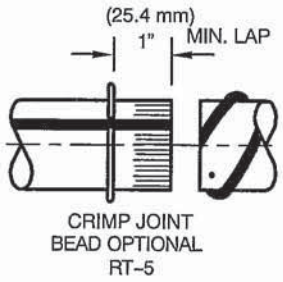
- Longitudinal or spiral seam
- Drawband to be at least same gage as duct



RT4 OUTSIDE SLEEVE

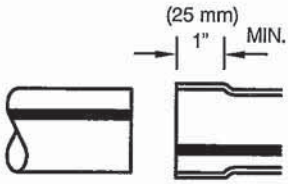
- Longitudinal seam only
- See RT-1 for screw requirements

FIGURE 3–1 ROUND DUCT TRANSVERSE JOINTS



CRIMP JOINT
BEAD OPTIONAL
RT-5

- Longitudinal or spiral seam
- See RT-1 for screw requirements



SWEDGE (BELL)
RT-6

- Longitudinal seam only
- See RT-1 for screw requirements

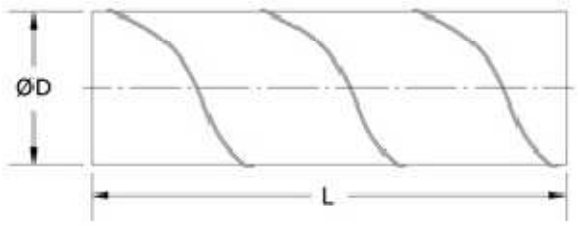
SLIP-ON
FLANGE
(CONSULT MFRS.)

- Consult manufacturers for ratings established by performance documented to functional criteria in Chapter 11.

FIGURE 3-1 ROUND DUCT TRANSVERSE JOINTS (CONTINUED)

Spiral Duct

SR



Description

spiral lock seam duct

- SMACNA RL-1 spiral seam
- evenly spaced integral seam locking feature
- multiple corrugations on all duct 8" diameter and larger
- standard length: 120"
- built in accordance with the latest SMACNA HVAC Duct Construction Standard for +10 iwg
- available in diameters 3"- 60"

Dimensions

Standard length is 120" or 10'. Also available in lengths of 12" to 240"; aluminum is the exception with a maximum 120" length.

Order Example

SR - ØD - L

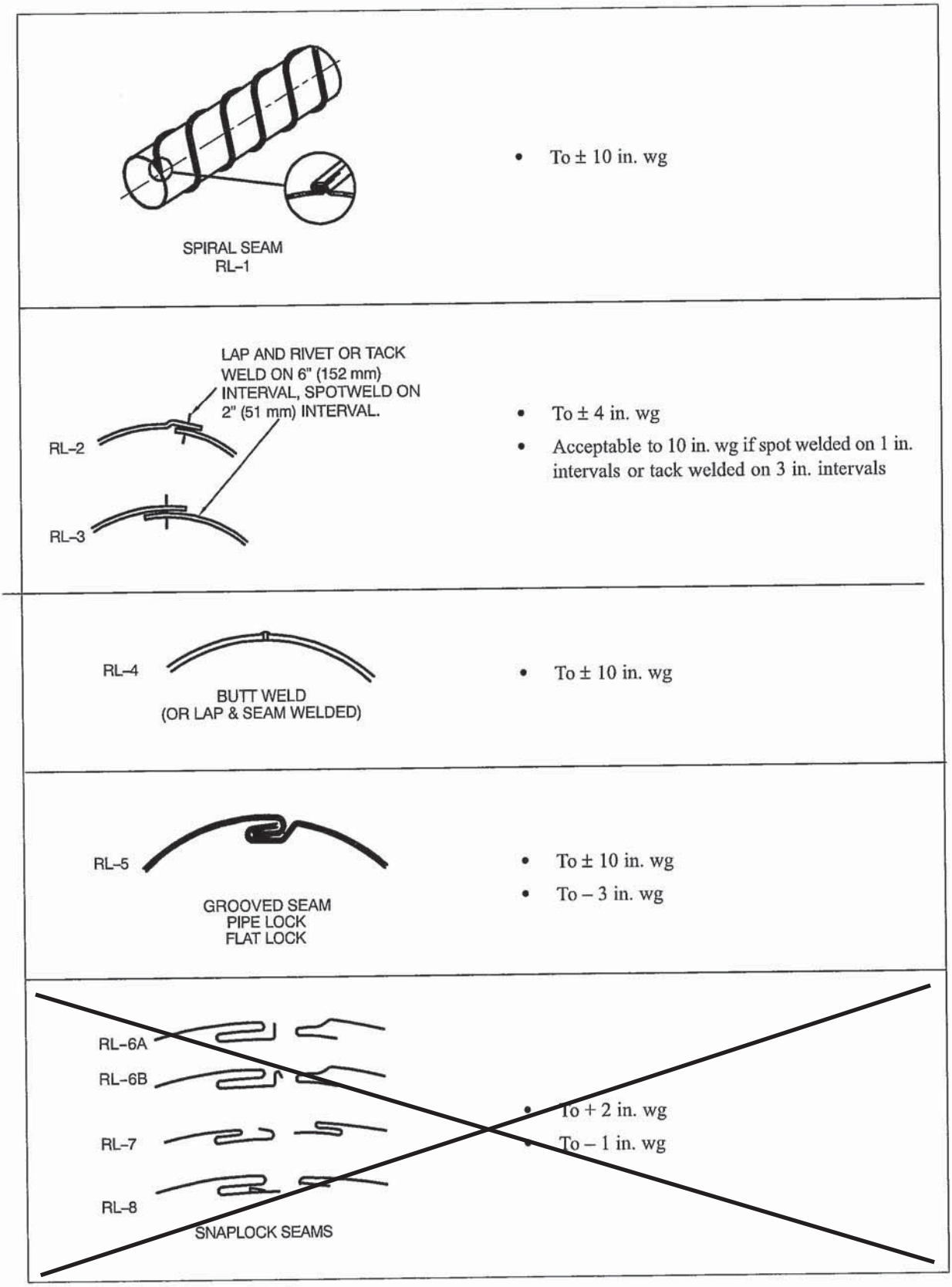


FIGURE 3–2 ROUND DUCT LONGITUDINAL SEAMS

Diameter, in.	Longitudinal Seam	Spiral Seam
4	28	28
6	28	28
8	28	28
10	28	28
12	28	28
14	28	28
16	26	26
18	26	26
20	24	26
22	24	26
24	24	26
30	22	24
36	22	24
42	22	24
48	20	22
54	20	22
60	20	22
66	18	22
72	18	20
78	18	20
84	18	20
90	18	20
96	18	20

Table 3–5 Round Duct Gage Unreinforced Positive Pressure To 10 in. wg

Neg. Pressure 2 in. wg	Stiffener Spacing											
	Unstiff.		20 ft		12 ft		10 ft		6 ft		5 ft	
Diameter, in.	GA	R	GA	R	GA	R	GA	R	GA	R	GA	R
4	28	NR	28	A	28	A	28	A	28	A	28	A
6	28	NR	28	A	28	A	28	A	28	A	28	A
8	28	NR	28	A	28	A	28	A	28	A	28	A
10	28	NR	28	A	28	A	28	A	28	A	28	A
12	28	NR	28	A	28	A	28	A	28	A	28	A
14	28	NR	28	A	28	A	28	A	28	A	28	A
16	26	NR	28	A	28	A	28	A	28	A	28	A
18	24	NR	28	A	28	A	28	A	28	A	28	A
20	24	NR	28	A	28	A	28	A	28	A	28	A
22	22	NR	28	A	28	A	28	A	28	A	28	A
24	22	NR	26	A	28	A	28	A	28	A	28	A
30	20	NR	26	A	28	A	28	A	28	A	28	A
36	18	NR	24	A	26	A	28	A	28	A	28	A
42	18	NR	24	A	26	A	26	A	28	A	28	A
48	16	NR	22	B	24	A	26	A	28	A	28	A
54	16	NR	22	B	24	B	24	A	26	A	28	A
60	N/A	NR	22	B	24	B	24	B	26	A	26	A
66	N/A	NR	22	C	24	B	24	B	26	B	26	A
72	N/A	NR	20	C	22	B	24	B	24	B	26	B
78	N/A	NR	20	D	22	C	22	C	24	B	26	B
84	N/A	NR	20	E	22	C	22	C	24	B	24	B
90	N/A	NR	20	E	22	D	22	C	24	B	24	B
96	N/A	NR	20	E	22	E	22	D	24	C	24	B

Table 3–10 Min. Required Gage for Spiral Seam Duct Under Neg. Pressure

NOTES:

a. N/A – Not Applicable

b. NR – Not Required

c. R – Reinforcement (stiffener) Class

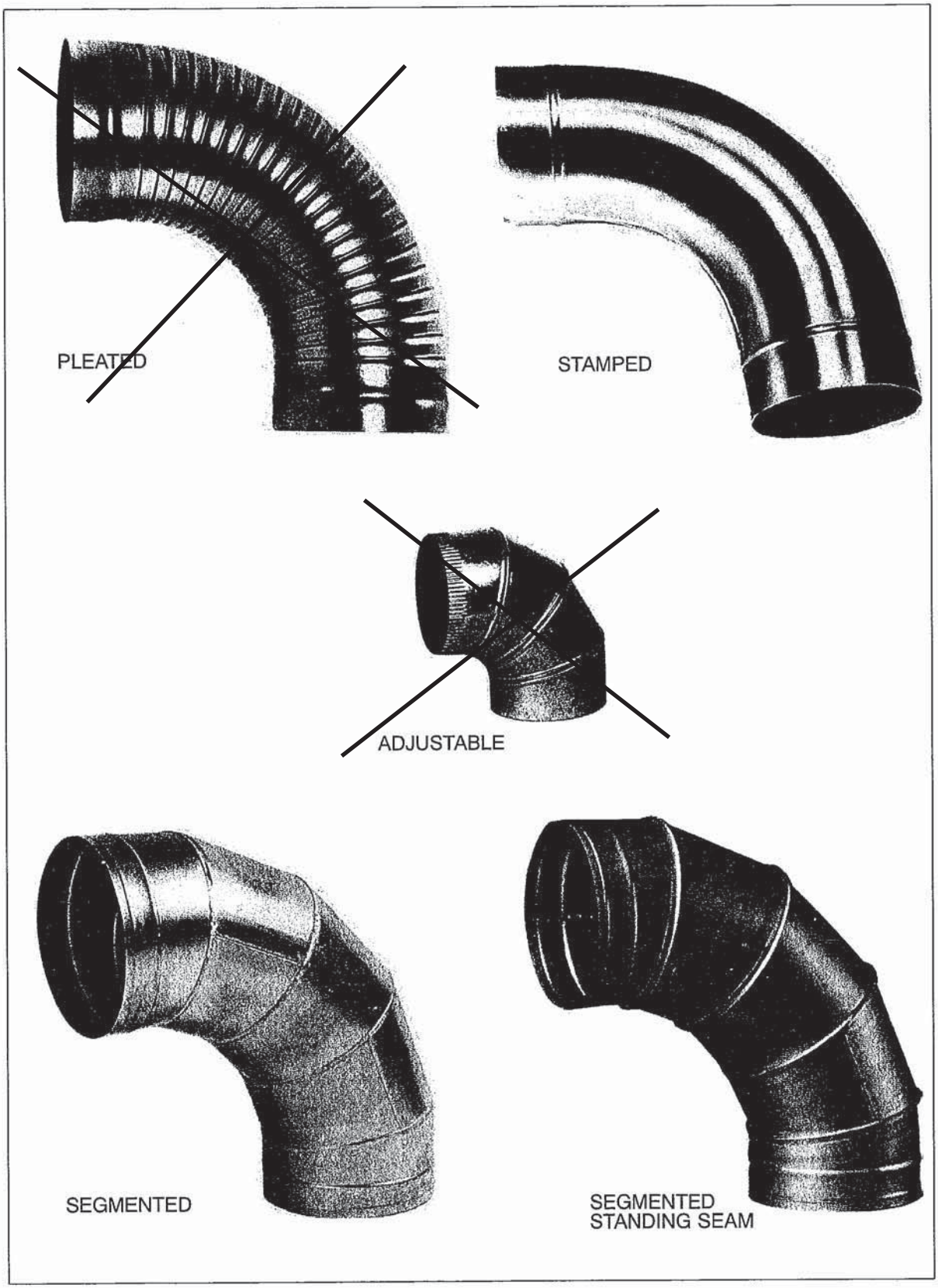


FIGURE 3–4 ROUND DUCT ELBOWS

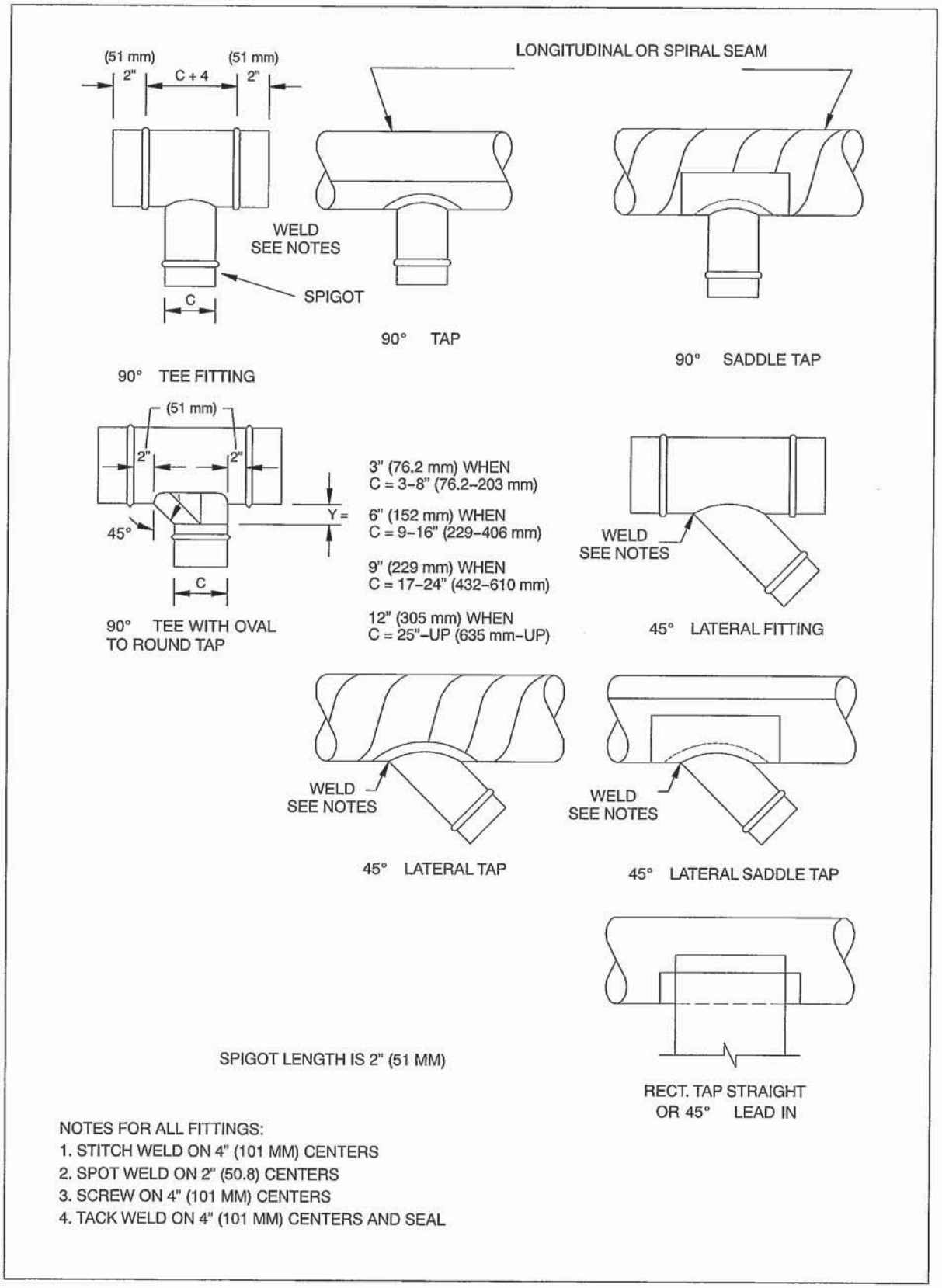
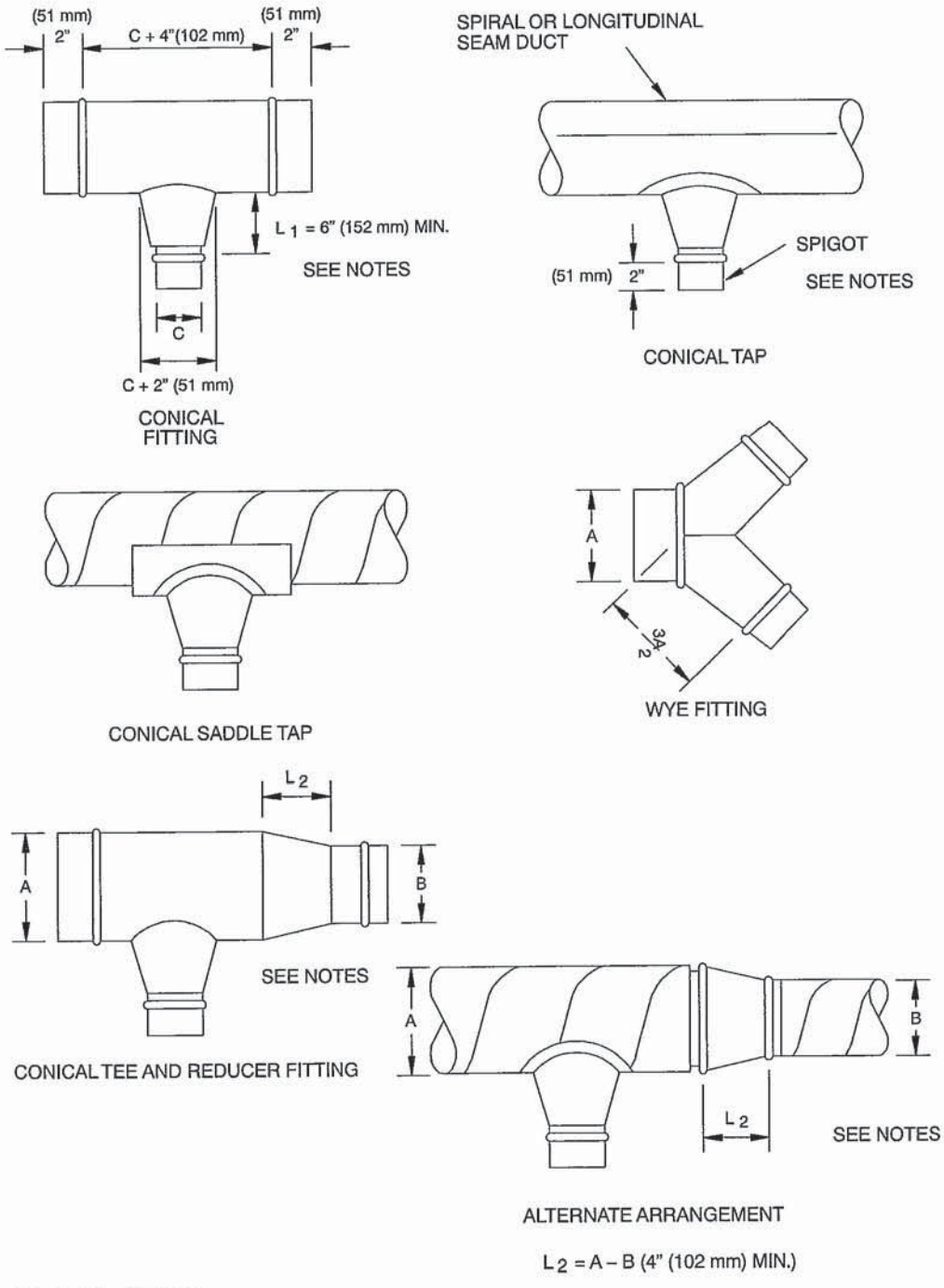


FIGURE 3–5 90° TEES AND LATERALS



NOTES FOR ALL FITTINGS:
1. STITCH WELD ON 4" (101 MM) CENTERS
2. SPOT WELD ON 2" (50.8) CENTERS
3. SCREW ON 4" (101 MM) CENTERS
4. TACK WELD ON 4" (101 MM) CENTERS AND SEAL

FIGURE 3–6 CONICAL TEES

Taps

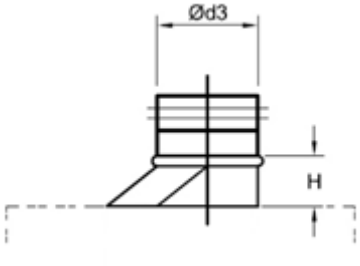
TBSU/TBSRU

Description

45° boot-style tap
• installed on flat side of duct or plenum

Dimensions

If Ød3 ≤ 8" H = 4"
If Ød3 = 9"-14", H = 7"
If Ød3 = 15"-26", H = 10"
If Ød3 = 27"-46", H = 13"
If Ød3 = 47"-60", H = 16"



Order Example

Lindab Safe®
TBSU - Ød3

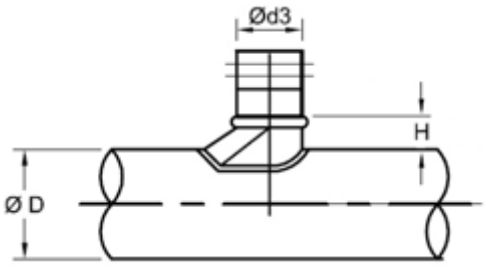
Linx Nongasketed
TBS - Ød3

Description

45° combination boot-style saddle tap

Dimensions

If Ød3 ≤ 8", H = 4"
If Ød3 = 9"-14", H = 7”
If Ød3 = 15"-26", H = 10"
If Ød3 = 27"-46", H = 13"
If Ød3 = 47"-60", H = 16"



Order Example

Lindab Safe®
TBSRU - ØD - Ød3

Linx Nongasketed
TBSR - ØD - Ød3

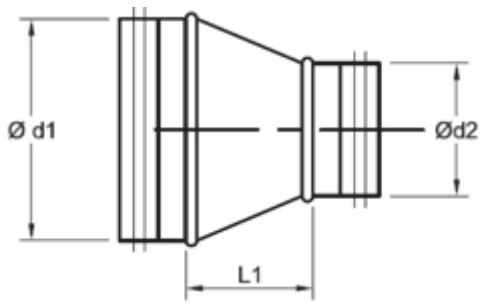
Reducers

RCLU/RLU

Description

fabricated concentric reducer
• L1 = (Ød1 - Ød2)*

(*) minimum 4"



Order Example

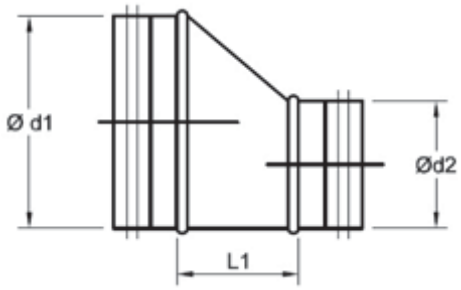
Lindab Safe®
RCLU - Ød1- Ød2

Linx Nongasketed
RCL - Ød1- Ød2

Description

fabricated eccentric reducer
• L1 = (Ød1 - Ød2)*

(*) minimum 4"



Order Example

Lindab Safe®
RLU - Ød1- Ød2

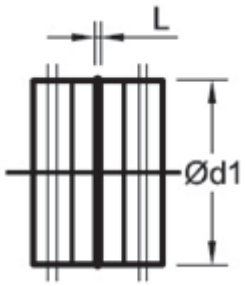
Linx Nongasketed
RL - Ød1- Ød2

Couplings

NPU/MF

Description

coupling used for joining spiral duct
- If Ø 3"-20", L = ⅜",
  If Ø 22"-26", L = ½"
  If Ø 28"-60", L = ⅝"



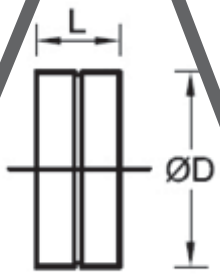
Order Example

Lindab Safe®
NPU - Ød1

Linx Nongasketed
NP - Ød1

Description

coupling for joining fittings
- If Ø 3"-9", L = 3⅝",
  If Ø 10"-14", L = 5⅛",
  If Ø 16"-26", L = 6⅝",
  If Ø 28"-38", L = 8⅝",
  If Ø 40"-60", L = 10⅝"



Order Example

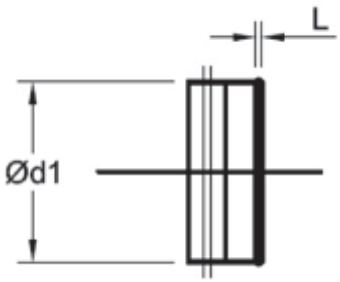
Linx Nongasketed
MF - ØD

End Caps

ESU/EPF

Description

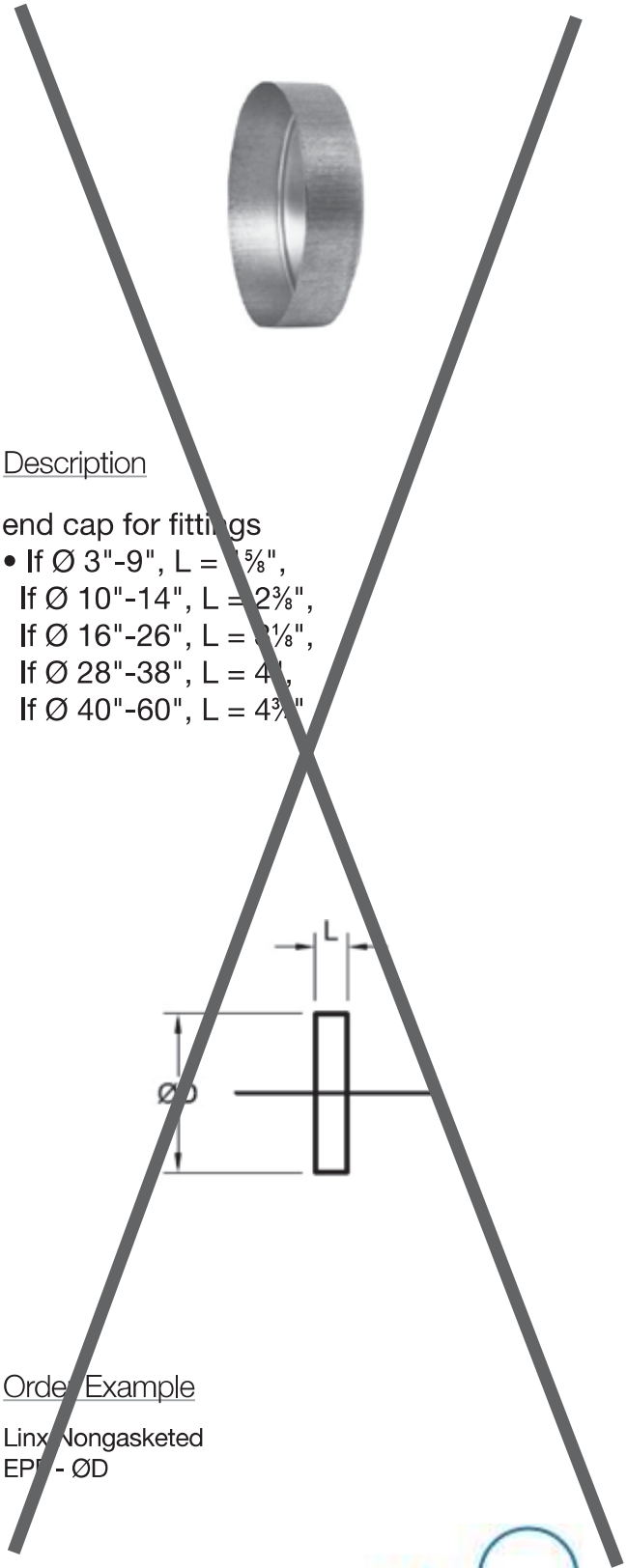
end cap for spiral duct
- If Ø 3"-20", L = ⅜",
  If Ø 22"-26", L = ½"
  If Ø 28"-60", L = ⅝"



Order Example

Lindab Safe®
ESU - Ød1

Linx Nongasketed
ES - Ød1



Description

end cap for fittings
- If Ø 3"-9", L = 1⅝",
  If Ø 10"-14", L = 2⅜",
  If Ø 16"-26", L = 3⅛",
  If Ø 28"-38", L = 4",
  If Ø 40"-60", L = 4¾"

Order Example

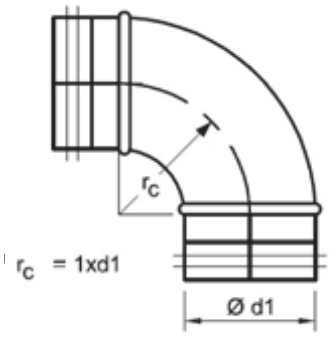
Linx Nongasketed
EPF - ØD

Elbows

BU 90 / BFU 90

Description

90° elbow
- die stamped
- continuous stitch welded
- rolled edges
- galvanized steel only
- available in diameters 3"- 12"
- note: 11" diameter is fabricated

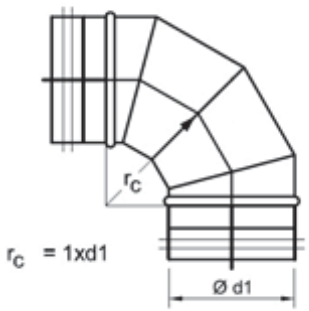


Order Example

Lindab Safe®	Linx Nongasketed
BU 90 - Ød1	B 90 - Ød1

Description

90° elbow
- 4-piece gored, standing seam
- gore locked and internally sealed
- available in diameters 14"- 48"
- note: BF/U 90 elbows 50-inch diameter and larger will be supplied as two BF/U 45° elbows and an MF coupling



Order Example

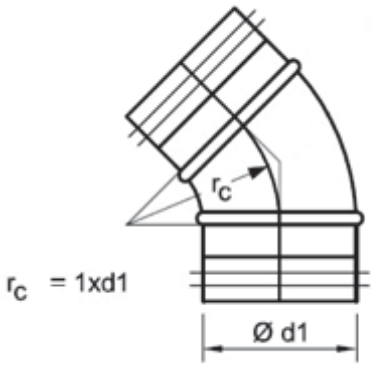
Lindab Safe®	Linx Nongasketed
BFU 90 - Ød1	BF 90 - Ød1

Elbows

BU 45 / BFU 45

Description

45° elbow
- die stamped
- continuous stitch welded
- rolled edges
- galvanized steel only
- available in diameters 3"- 12"
- note: 11" diameter is fabricated



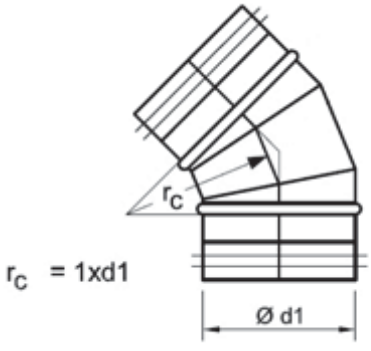
Order Example

Lindab Safe®
BU 45 - Ød1

Linx Nongasketed
B 45 - Ød1

Description

45° elbow
- 3-piece gored, standing seam
- gore locked and internally sealed
- available in diameters 14"- 60"



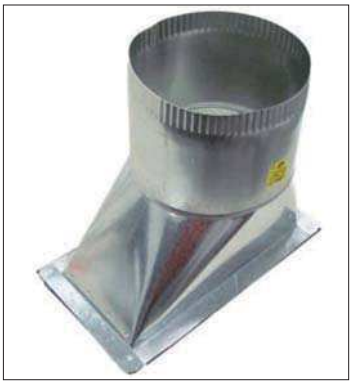
Order Example

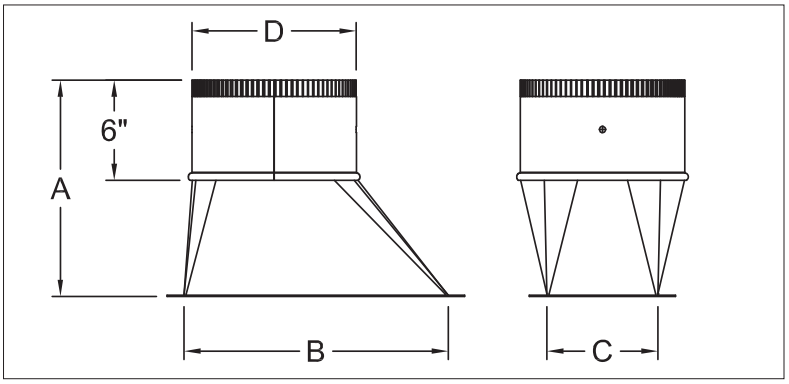
Lindab Safe®
BFU 45 - Ød1

Linx Nongasketed
BF 45 - Ød1

HET

Product Data Sheet





Description

Elgen's HET (High Efficiency Take Off) without damper is used for low & medium pressure applications.
Elgen HET (High Efficiency Take Off) without damper can be used for high pressure application (up to 10" W.G.) as a low-leakage fitting due to its welded construction.

Standard Construction

Collar - formed from 26 GA ASTM A-653 G60 material
Body - formed from 26 GA ASTM A-653 G60 material
1/8" x 1" Polyethylene "High Density" Gasket

D	B X C	A
4" Round	10"x 5"	11.75"
5" Round	10"x 5"	11.75"
6" Round	12"x 6"	11.75"
7" Round	12"x 6"	11.75"
8" Round	12"x 6"	11.75"
9" Round	15"x 6"	12.75"
10" Round	16"x 6.75"	12.75"
12" Round	18"x 8.5"	12.75"
14" Round	20"x 9.5"	12.75"
16" Round	22"x 14"	13.75"
18" Round	22"x 16"	13.75"
20" Round	24"x 18"	14"

B and C dimensions are "I.D." hole size dimensions
All dimensions +/- 0.25"

Features

Welded Seams For Added Strength
Welded Seams Provide Low Leakage
Pressure Rating – Designed Per SMACNA 3rd Edition 2005 Section 4.8 4-6 Brand Connections
Many Damper Hardware Options
Union Made Yellow Label

Optional Construction

All Volume Dampers for air control
Insulation Guard
Deep manual bead

24 GA Galvanized
G90 Galvanized
Stainless Steel 304
Stainless Steel 316
Aluminum
PCD
Galvanneal (Paint Grip)
Agion (Antimicrobial Coating)

Packaging

Size	Skid Qty	Size	Skid Qty
4"	MTO	10"	72
5"	MTO	12"	54
6"	140	14"	48
7"	MTO	16"	30
8"	140	18"	MTO
9"	MTO	20"	MTO

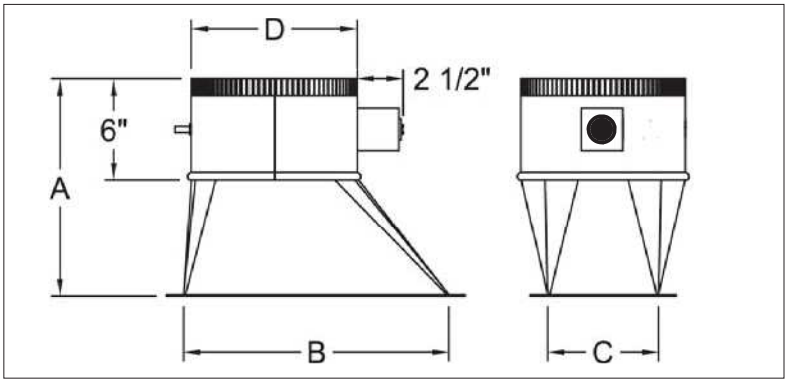
Guarantee

All Elgen products are guaranteed by Elgen Manufacturing against defective material.

Elgen Manufacturing
10 Railroad Ave, Closter NJ 07624
Tel: 800.503.9805 :: Fax: 201.964.9030
info@elgenmfg.com :: www.elgenmfg.com

HET
with Elgen Super Standoff and 3/8" Square Rod

Product Data Sheet



Description

Elgen's HET (High Efficiency Take Off) with heavy duty standoff is used for low & medium pressure applications.
Elgen HET (High Efficiency Take Off) with heavy duty standoff can be used for high pressure application (up to 10" W.G.) as a low-leakage fitting due to its welded construction.

Standard Construction

Collar - formed from 24 GA ASTM A-653 G60 material
Body - formed from 26 GA ASTM A-653 G60 material
1/8" x 1" Polyethylene "High Density" Gasket
20 GA Heavy Duty Damper Blade for 10" and larger
22 GA Heavy Duty Damper Blade for 6"- 8"
Heavy-duty standoff
3/8" aluminum square rod
Super snap-in bushing

D	B X C	A
4" Round	10"x 5"	11.75"
5" Round	10"x 5"	11.75"
6" Round	12"x 6"	11.75"
7" Round	12"x 6"	11.75"
8" Round	12"x 6"	11.75"
9" Round	15"x 6"	12.75"
10" Round	16"x 6.75"	12.75"
12" Round	18"x 8.5"	12.75"
14" Round	20"x 9.5"	12.75"
16" Round	22"x 14"	13.75"
18" Round	22"x 16"	13.75"
20" Round	24"x 18"	14"

B and C dimensions are "I.D." hole size dimensions
All dimensions +/- 0.25"

Features

Welded Seams For Added Strength
Welded Seams Provide Low Leakage
Many Damper Hardware Options
Pressure Rating – Designed Per SMACNA 3rd Edition 2005
Section 4.8 4-6 Brand Connections
Union Made Yellow Label

Optional Construction

Insulation Guard
Deep manual bead

24 GA Galvanized
G90 Galvanized
Stainless Steel 304
Stainless Steel 316
Aluminum
PCD
Galvanneal (Paint Grip)
Agion (Antimicrobial Coating)

Packaging

Size	Skid Qty	Size	Skid Qty
4"	MTO	10"	72
5"	MTO	12"	54
6"	140	14"	48
7"	MTO	16"	30
8"	140	18"	MTO
9"	MTO	20"	MTO

Guarantee

All Elgen products are guaranteed by Elgen Manufacturing against defective material.

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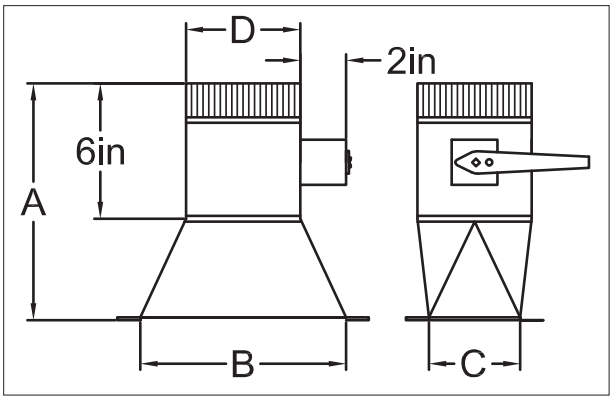
info@elgenmfg.com :: www.elgenmfg.com

Center-high HET

Product Data Sheet



Description

Elgen's HET (High Efficiency Take Off) is used for low & medium pressure applications. Elgen HET (High Efficiency Take Off) without damper can be used for high pressure application (up to 10" W.G.) as a low-leakage fitting due to its welded construction.

Standard Construction

Collar - formed from 26 GA ASTM A-653 G60 material
Body - formed from 26 GA ASTM A-653 G60 material
Welded Seams

D	B X C	A
4" Round	9"x5"	10.5"
5" Round	9"x5"	10.5"
6" Round	9"x5"	11.5"
7" Round	11"x5"	11.5"
8" Round	12"x6"	11.5"
9" Round	13"x7"	11.5"
10" Round	14"x8"	11.5"
12" Round	16"x10"	11.5"
14" Round	18"x12"	12"
16" Round	20"x14"	13"
18" Round	22"x16"	13"
20" Round	24"x18"	13"

B and C dimensions are "I.D." hole size dimensions

Features

1/8" x 1" Polyethylene "High Density" Gasket
Pressure Rating – Designed Per SMACNA 3rd Edition 2005 Section 4.8 4-6 Brand Connections
Welded Seams For Added Strength
Welded Seams Provide Low Leakage
With or Without Damper
Union Made
Many Damper Hardware Options

Optional Construction

All Volume Dampers for air control.
Insulation Guard
Available with Elgen Super Standoff
Deep manual bead
Galvanized
Stainless Steel
Aluminum
G90 Galvanized

Packaging

Size	Skid Qty	Size	Skid Qty
4"	MTO	10"	72
5"	MTO	12"	54
6"	140	14"	48
7"	MTO	16"	30
8"	140	18"	MTO
9"	MTO	20"	MTO

Guarantee

All Elgen products are guaranteed by Elgen Manufacturing against defective material.

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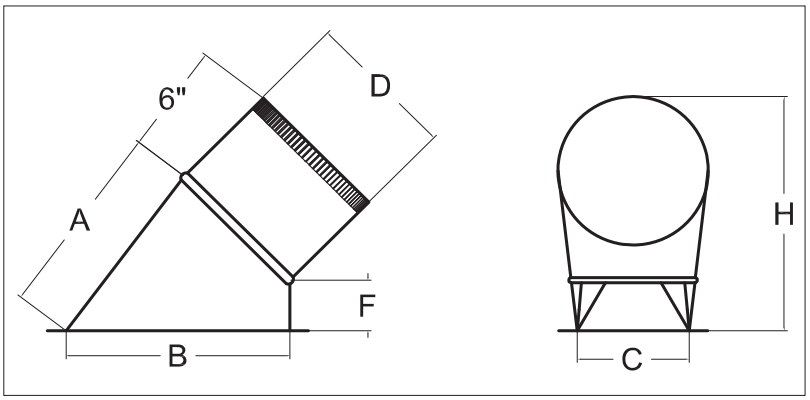
info@elgenmfg.com :: www.elgenmfg.com

Tilted HET

Product Data Sheet



Description

Elgen's HET (High Efficiency Take Off) with damper is used for low & medium pressure applications.
Elgen HET (High Efficiency Take Off) without damper can be used for high pressure application (up to 10" W.G.) as a low-leakage fitting due to its welded construction.

Standard Construction

Formed from ASTM A-653 G60 material
Welded Seams

D	B X C	A	F	H
6" Round	12"x6"	11"	2-1/2"	11"
8" Round	12"x6"	11"	2-3/4"	13"
10" Round	16"x6-3/4"	14"	2-7/8"	14-1/4"
12" Round	18"x8-1/2"	15-3/4"	3-1/4"	16"
14" Round	20"x9-1/2"	17-1/8"	3-1/4"	17-1/2"
16" Round	22"x14"	19-1/4"	3-1/4"	19-7/8"

B and C dimensions are "I.D." hole size dimensions

Features

1/8" x 1" Polyethylene "High Density" Gasket
Welded Seams For Added Strength
Welded Seams Provide Low Leakage
Pressure Rating – Designed Per SMACNA 3rd Edition
2005 Section 4.8 4-6 Brand Connections
With or Without Damper
Union Made
Many Damper Hardware Options

Optional Construction

All Volume Dampers for air control
Insulation Guard
Available with Elgen Super Standoff
Deep manual bead

24 GA Galvanized
G90 Galvanized
Stainless Steel 304
Stainless Steel 316
Aluminum
PCD
Galvanneal (Paint Grip)
Agion (Antimicrobial Coating)

Packaging

All sizes are made-to-order

Guarantee

All Elgen products are guaranteed by Elgen Manufacturing against defective material.

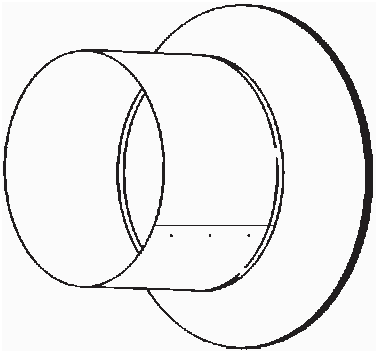
Elgen Manufacturing
10 Railroad Ave, Closter NJ 07624
Tel: 800.503.9805 :: Fax: 201.964.9030
info@elgenmfg.com :: www.elgenmfg.com

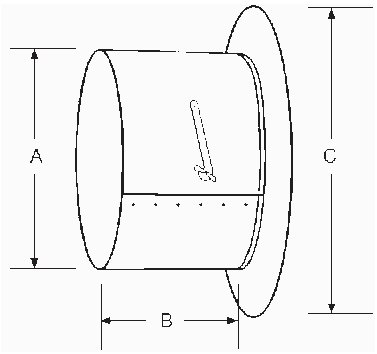
USED WHERE SPACE PROHIBITS HETO

SUBMITTAL DATA

BUCKLEY AIR-TITE CONNECTORS

Models ATM & ATMD



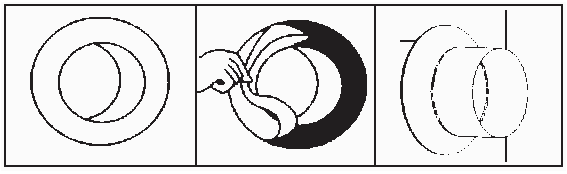


ATM (NO DAMPER)

AIR-TITE CONNECTORS

Contractor shall provide Model ATM (no damper) or Model ATMD (with damper) Air-Tite Takeoff as manufactured by Buckley Associates, Inc. Material shall be galvanized steel G-90, 26 ga. for flange and for body. Connector to include Air-Tite Neoprene gasket. Pre-drilled holes are provided for quick mounting, insuring an airtight connection.
Fittings are precision-made by automatic machinery to provide constant roundness and sizing.

Model ATMD contains 26-gauge single-blade damper.
Rings - 26 ga. galvanized steel
Gaskets-$^{1}/_{8}$" Neoprene
Note: Body Material is 26-Gauge Galvanized Steel.



1. All Air-Tite takeoffs have a neoprene gasket with an adhesive backing for easy installation. The backing is protected with paper for storage and handling to keep dust from the adhesive.

2. When ready to install Air-Tite takeoffs simply peel protective paper away from unit and apply unit to plenum. Once desired position is located, press firmly to assure a good seal.

3. After takeoff has been sealed to plenum, secure with sheet metal screws. This will assure airtight seal and give the needed support for the ductwork. On the duct board, longer screws and back plates should be used to strengthen duct board.

ATMD (WITH DAMPER)

FEATURES OF CONNECTORS

- Air-Tite Connection
- Saves at Least 30% Labor
- Quality Super Sturdy Fit for Commercial Usage
- Eliminates Taping Joint
- Neoprene Gasket on Flange with Adhesive
- Eliminates Exact Hole Sizing
- Same Fitting for Regular Ducts and Duct Boards
- Sheet Metal Union Manufactured Local 17

DIMENSIONAL DATA

Size	A	B	B	C
	OD	ATM	ATMD	OD
4	$3^{7}/_{8}$	3¼	3¾	7
5	$4^{7}/_{8}$	3	7	8
6	$5^{7}/_{8}$	3	7	9
7	$6^{7}/_{8}$	3	7	10
8	$7^{7}/_{8}$	3	7	11
9	$8^{7}/_{8}$	3	7	12
10	$9^{7}/_{8}$	3	6½	13
12	$11^{7}/_{8}$	3	6½	15
14	$13^{7}/_{8}$	3	6½	17
16	$15^{7}/_{8}$"	3	6½	19
18	$17^{7}/_{8}$	3	7	21
20	$19^{7}/_{8}$	3	7	23

BUCKLEY AIR-TITE No scoops are necessary with Buckley Air-Tites as they have tested and work better without

To maintain Buckley's policy of continuous improvement, we reserve the right to change prices, specifications, ratings or dimensions without notice or obligation. ***Manufactured by Sheet Metal Union Local 17.***

MANUFACTURED BY: Buckley Associates, Inc. HANOVER, MA

Visit us on the World Wide Web at: http://www.buckleyonline.com

9 7 4 0 4

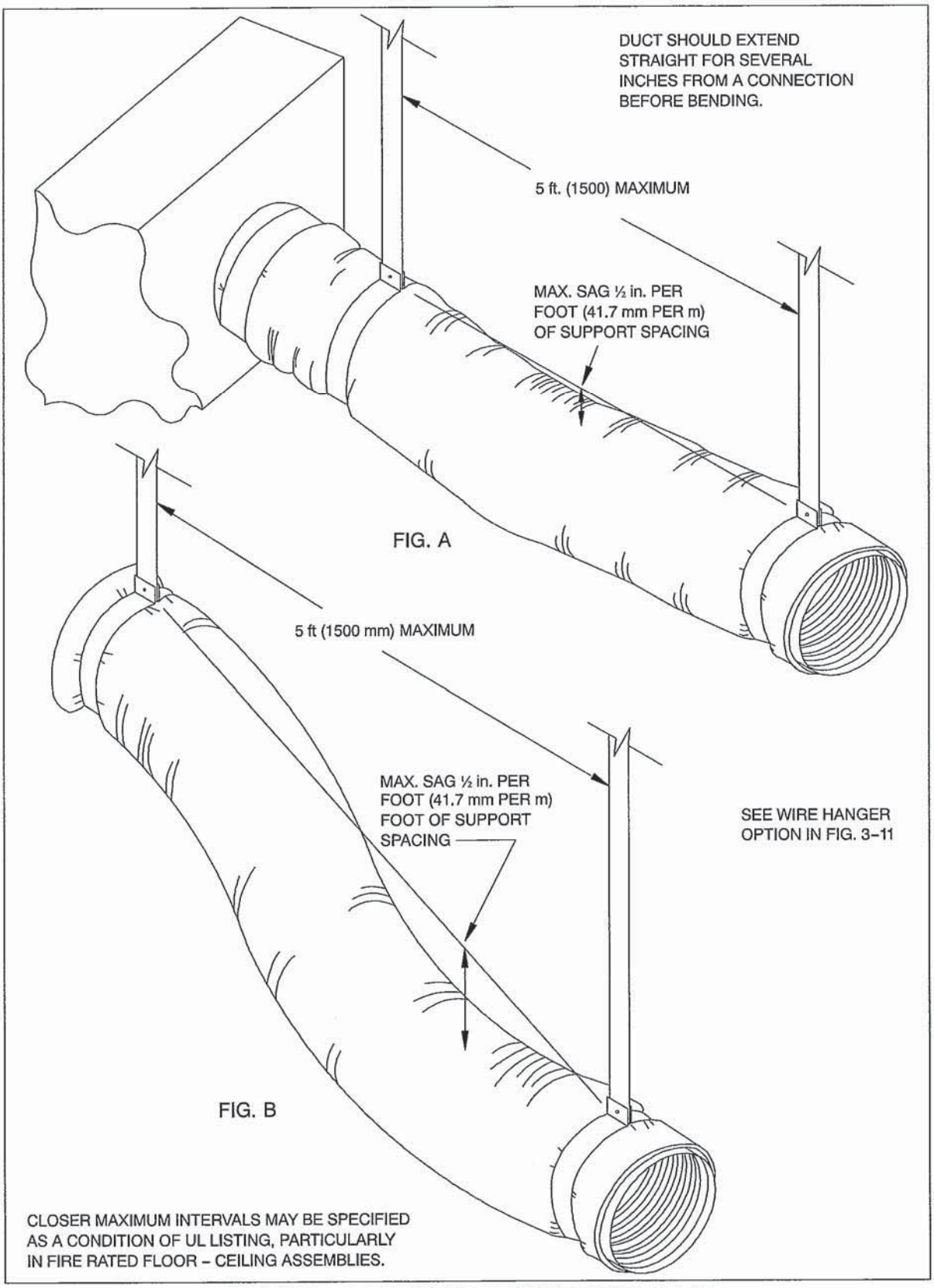


FIGURE 3–10 FLEXIBLE DUCT SUPPORTS

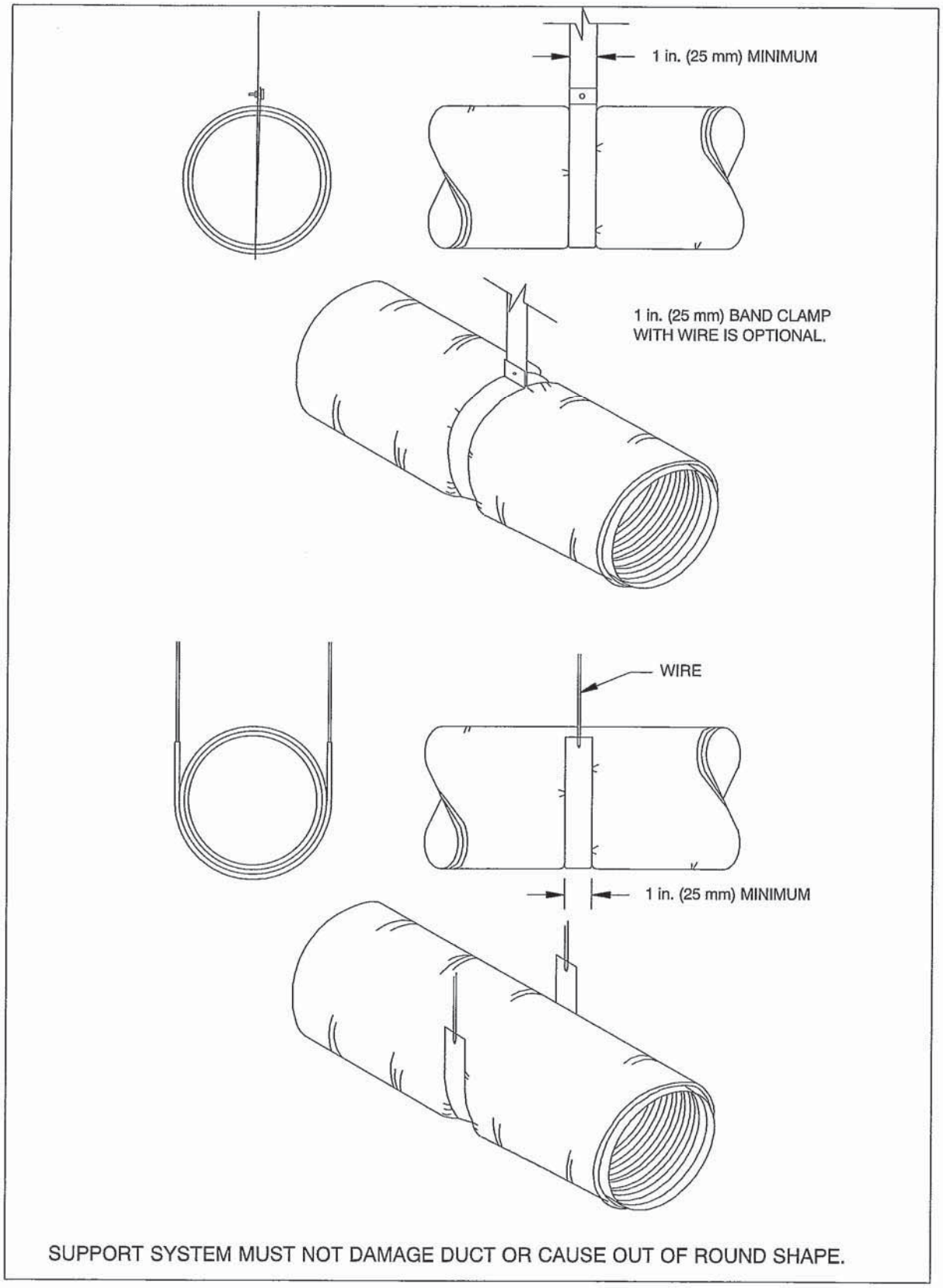


FIGURE 3–11 FLEXIBLE DUCT SUPPORTS

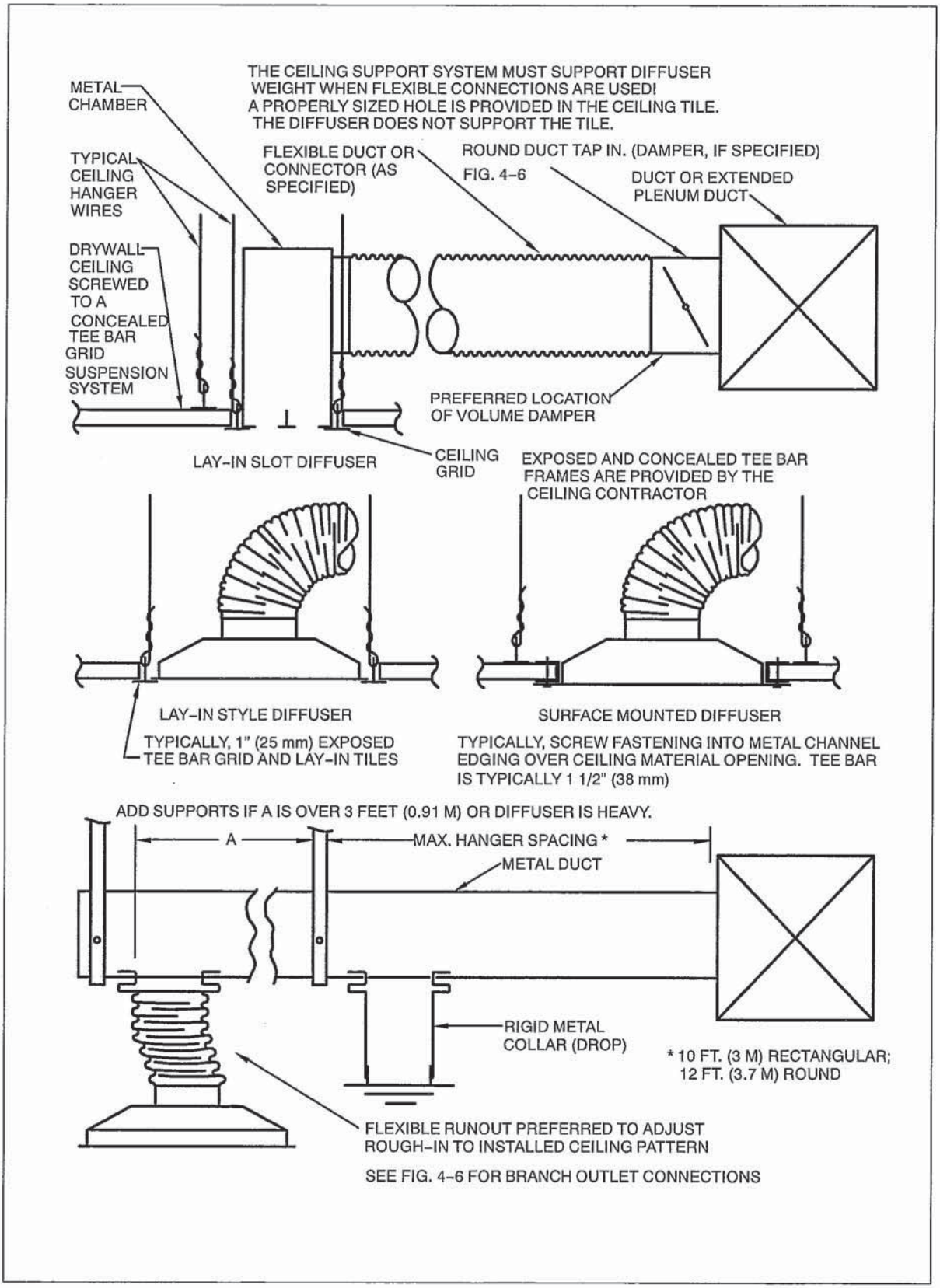
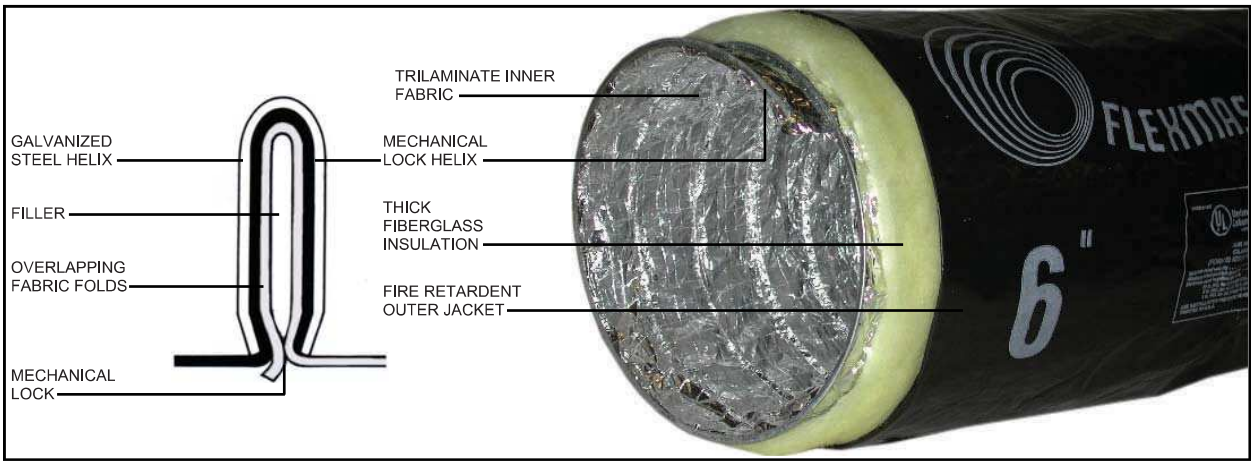


FIGURE 7-7 CEILING DIFFUSER BRANCH DUCTS

SUBMITTAL DATA

FABRI-FLEX
TYPE 3 INSULATED



CONSTRUCTION FEATURES: Buckley Type 3 is manufactured to meet the highest quality standards in strength, permeability and fire resistance required in a flexible air duct. This insulated, UL-181 Class 1 Air Duct is designed for application in a low to high pressure HVAC air distribution system.

LINER: A Trilaminate of Aluminum Foil, Fiberglass and Aluminized Polyester. Mechanically Locked Without Adhesives.

HELIX: Corrosive Resistant Galvanized Steel Formed and Mechanically Locked to Fabric.

OUTER JACKET: Black Fire Retardant Polyethylene Material, Excellent Strength at Low Temperatures. Will Not Age Harden.

INSULATION: Thick Fiberglass Insulation Blanket, Factory Wrapped.

TECHNICAL DATA

Standard Lengths (Feet)	25’
Inside Diameter (Inches)	3”, 4”, 5”, 6”, 7”, 8”, 9” 10”, 12”, 14”, 16”, 18”
Inside Bend Radius (Inches)	½ x I.D. (All Sizes)
Air Friction Loss	See Friction Loss Chart
Vapor Barrier Permeance	.1 Perm per A.S.T.M. E96, Procedure A
UL Listing	UL 181, Class 1 Air Duct
Standards, Codes	NFPA 90A AND 90B, BOCA, ICBO, SBBC HUD/FHA MIN. Property Std.
Rated Velocity (F.P.M.)	5500 F.P.M.
Internal Working Pressure (W.G.)	12” w.g. positive 10” w.g. negative, 3” thru 12” dia. 5” w.g. negative, 14” & 16” dia. 1” w.g. negative, 18” dia.
Minimum Burst Pressure	2½ times working pressure
Operating Temperature Range	-20º to +250º F
Flame Spread	Less than 25
Smoke Developed	Less than 50
Thermal Conductance	C Factor, not more than .23

THERMAL PERFORMANCE R-VALUE 6.0 (Sizes 4”-14”) R-4.2 (Sizes 16 and 18”)

To maintain Buckley's policy of continuous improvement, we reserve the right to change prices, specifications, ratings or dimensions without notice or obligation. ***Manufactured by Sheet Metal Union Local 17.***

MANUFACTURED BY: Buckley Associates, Inc. HANOVER, MA

Visit us on the World Wide Web at: http://www.buckleyonline.com 01601

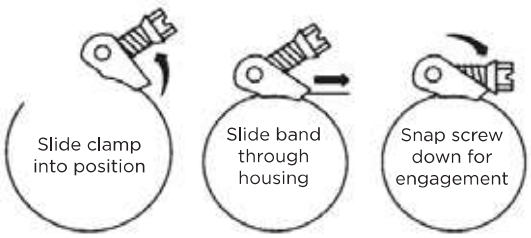
SUBMITTAL DATA

Flexmaster U.S.A.® Quick Release LS Series Clamp

Quick Release Stainless Steel Clamp

Clamp	Flex Size	Clamp Min.	Dia. Max.	Length
LS-88	4	2.06	6.00	20”
LS-88	5	2.06	6.00	20”
LS-104	6	1.75	7.00	23”
LS-152	8	2.00	10.00	32”
LS-152	9	2.00	10.00	32”
LS-188	10	2.06	12.31	40”
LS-232	12	10.19	14.00	48”
LS-258	14	10.00	16.00	52”
*LS-280	16	14.25	18.00	58”
LS-312	18	14.00	20.00	64”
LS-344	20	16.00	22.00	73”

*Can only be used on stated size.



Easy On...Easy Off...in 3 Simple Steps!

Reverse procedure for quick release and removal.

No need to disassemble connection.

All materials used in the manufacture of the subject clamp are certified by our suppliers to meet our material specifications. The band is made from AISI 201 stainless steel. The housing is made from AISI 201 stainless steel. The screw is made of AISI 1018 carbon steel. The bridge is made from AISI 410 stainless steel neutral hardened and drawn.

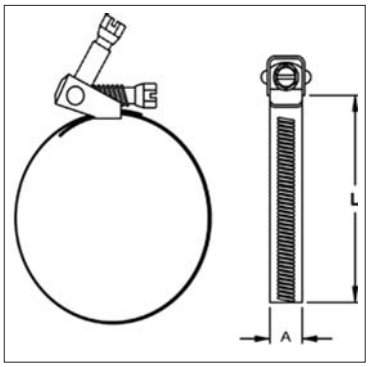
Clamps meet the Maximum Concentration Values (MCV) requirements of the following material: European Directive 2002/95/EC also known as the ROHS Directive. Therefore the clamps are ROHS compliant.

Flexmaster U.S.A.®
5235 Ted Street
Houston, TX 77040 USA
Tel. +1.713.462.7694
Fax +1.713.939.8441
www.FlexmasterUSA.com
www.Masterduct.com

FLEXMASTER U.S.A.®
A MASTERDUCT COMPANY

STAINLESS STEEL FLEX TIES

Product Data Sheet



Description

Stainless steel flex ties used to connect flexible piping to ductwork.

Features

Heavy duty adjustable mechanism for secure fit adjusts easily with a screwdriver
Zinc plated/stainless steel to prevent corrosion

Standard Construction

Screw:
5/16" hex-head
Zinc-plated yellow dichromate carbon steel

Band and Housing:
9/16" wide
Stainless Steel
Non-Magnetic

Bridge:
Zinc-plated yellow dichromate carbon steel

Maximum Diameter (in)	Width (in) A	Length (in) L
6	9/16	22
8	9/16	28.5
10	9/16	35
12	9/16	39
16	9/16	55
20	9/16	72

Packaging

Size	Box Qty
6	200
8	200
10	200
12	200
16	200
20	100

Guarantee

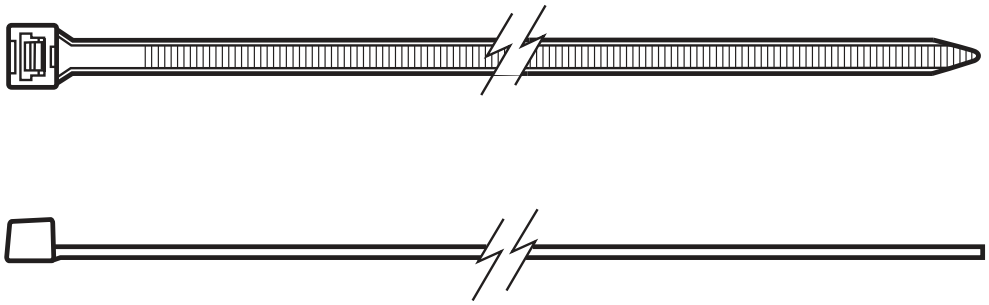
All Elgen products are guaranteed by Elgen Manufacturing against defective material.

Elgen Manufacturing
10 Railroad Ave, Closter NJ 07624
Tel: 800.503.9805 :: Fax: 201.964.9030
info@elgenmfg.com :: www.elgenmfg.com

SUBMITTAL DATA

Flexmaster U.S.A.® UL 181B-C Clamp

Nylon Clamp



Part Number	Max Dia. Formed	Length (L)	Width (W)	Thickness	Avg. Loop Tensile	Std. Pkg. Qty.
UL 181B-C	11.0 (279.4)	37.1 (942.8)	.340 (8.610)	.090 (2.300)	175 (778)	50

Material
6/6 Nylon

Color
Natural Nylon

Temp Range
-40°F to 185°F

Flammability
U.L. 94V-2

ATB
Less than 5 sec. per ASTM D635

*NOTE: Clamps adjustable for DUCT diameters 4" thru 10"; for larger diameters, join two or more clamps together. Can be used for both high and low pressure flexible duct.

UL 181 listed under file MH29946.

The Nylon clamps are manufactured by Bay State Cable Ties. Please see their website at www.baystatecableties.com for further information.

Flexmaster U.S.A.®
5235 Ted Street
Houston, TX 77040 USA
Tel. +1.713.462.7694
Fax +1.713.939.8441
www.FlexmasterUSA.com
www.Masterduct.com

FLEXMASTER U.S.A.®
A MASTERDUCT COMPANY

CHAPTER 4

FITTINGS AND OTHER CONSTRUCTION

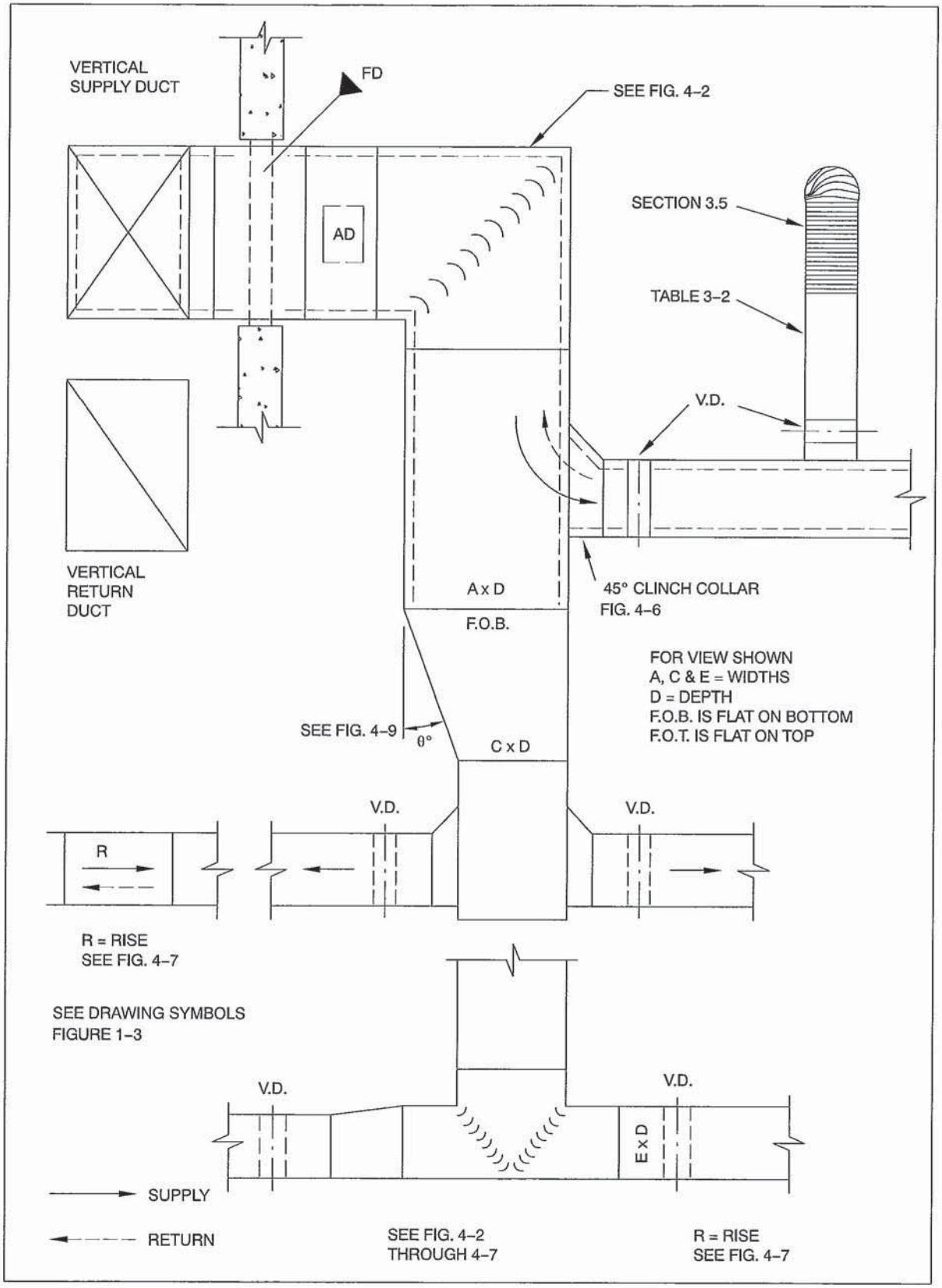
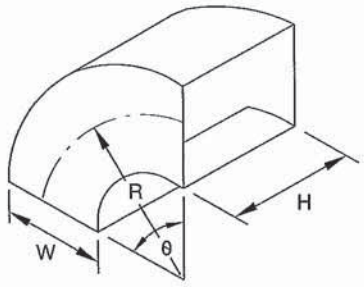
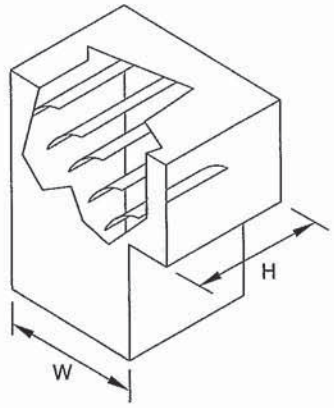


FIGURE 4–1 TYPICAL SUPPLY OR RETURN DUCT

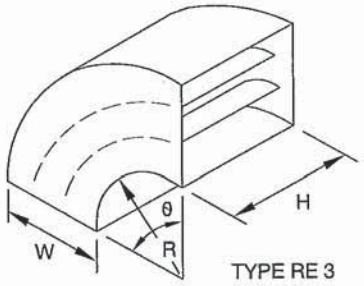


TYPE RE 1
RADIUS ELBOW

CENTERLINE R = $\frac{3W}{2}$ UNLESS OTHERWISE SPECIFIED – IS NOT RESTRICTED TO 90°
SQUARE THROAT, $\frac{R}{W}$ = 0.5, MAY BE USED, UP TO 1000 FPM (5 mps).

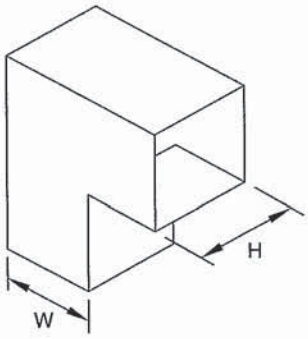


TYPE RE 2
SQUARE THROAT ELBOW
WITH VANES

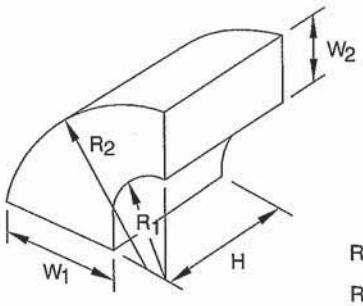


TYPE RE 3
RADIUS ELBOW
WITH VANES

NOTE:
FOR RE 3 *SEE* SPLITTER VANES IN SMACNA *HVAC SYSTEMS DUCT DESIGN*

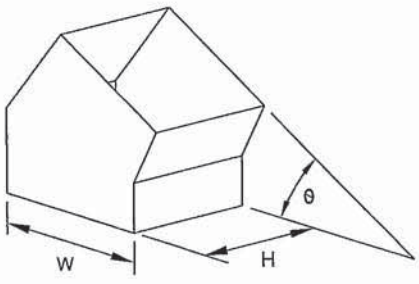


TYPE RE 4
SQUARE THROAT ELBOW
WITHOUT VANES
(1000 FPM (5 mps) MAXIMUM VELOCITY)



R_1 = 3/4 W_1
R_2 = R_1 + W_2

TYPE RE 5
DUAL RADIUS ELBOW

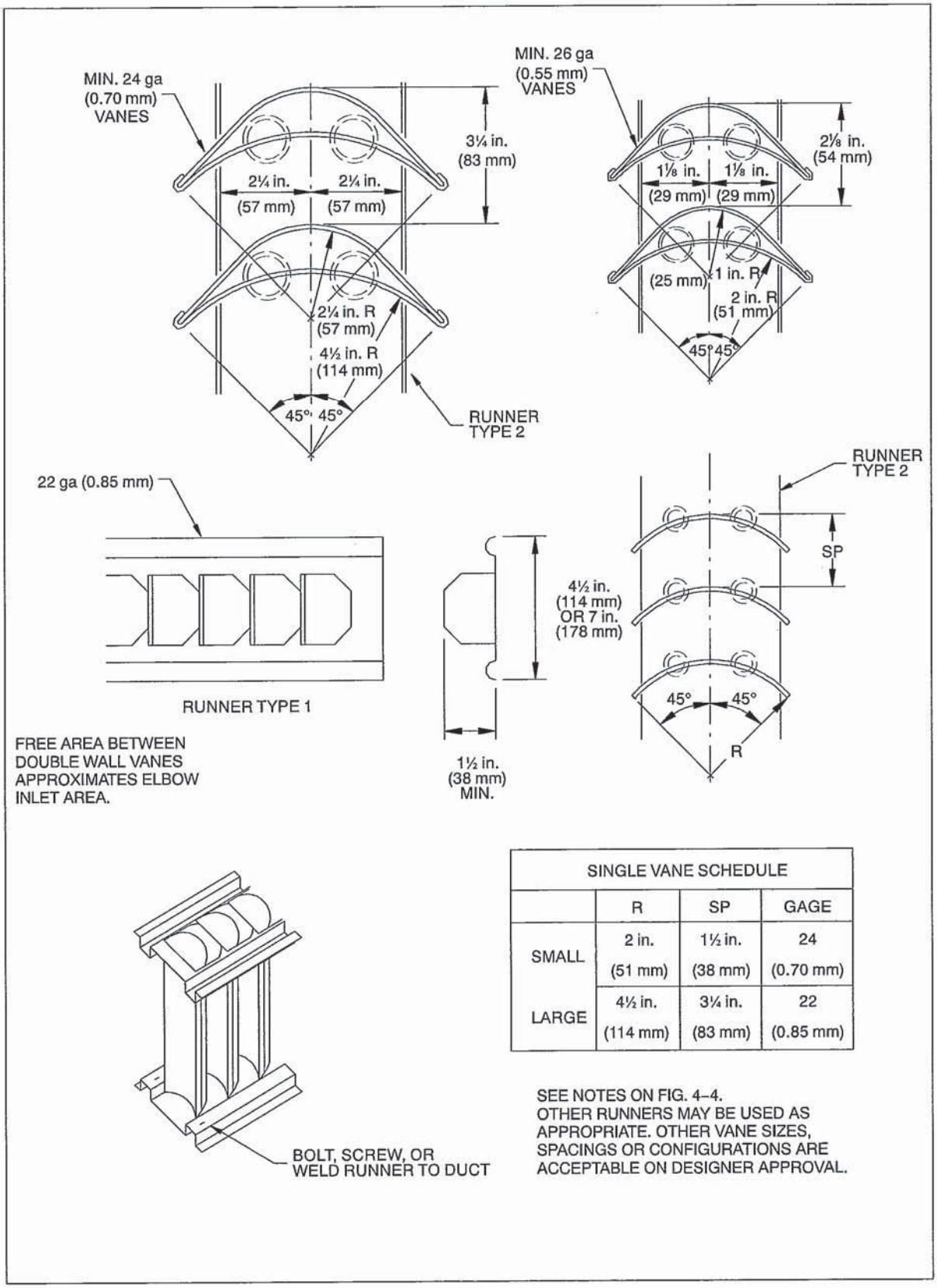


TYPE RE 6
MITERED ELBOW

BEAD, CROSSBREAK AND REINFORCE FLAT SURFACES AS IN STRAIGHT DUCT

PAGE 1 OF 2

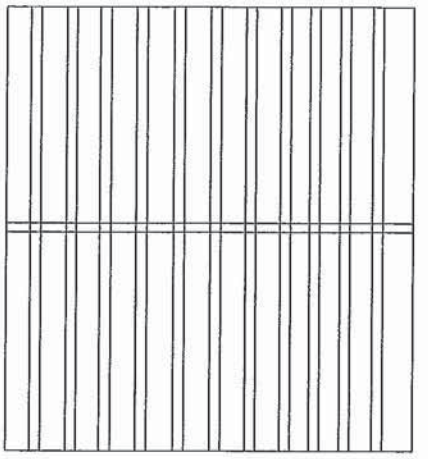
FIGURE 4–2 RECTANGULAR ELBOWS



SINGLE VANE SCHEDULE			
	R	SP	GAGE
SMALL	2 in. (51 mm)	1½ in. (38 mm)	24 (0.70 mm)
LARGE	4½ in. (114 mm)	3¼ in. (83 mm)	22 (0.85 mm)

SEE NOTES ON FIG. 4–4.
OTHER RUNNERS MAY BE USED AS APPROPRIATE. OTHER VANE SIZES, SPACINGS OR CONFIGURATIONS ARE ACCEPTABLE ON DESIGNER APPROVAL.

FIGURE 4–3 VANES AND VANE RUNNERS



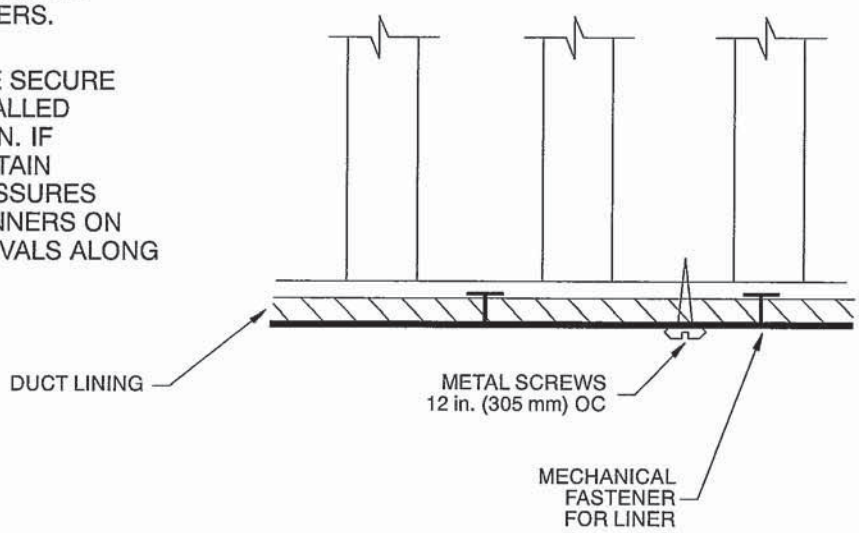
* MAXIMUM UNSUPPORTED VANE LENGTH

SMALL SINGLE VANE	36 in. (914 mm)
LARGE SINGLE VANE	36 in. (914 mm)
SMALL DOUBLE VANE	48 in. (1219 mm)
LARGE DOUBLE VANE	72 in. (1829 mm)

INSTALL VANES IN SECTIONS OR USE TIE RODS TO LIMIT THE UNBRACED VANE LENGTH.

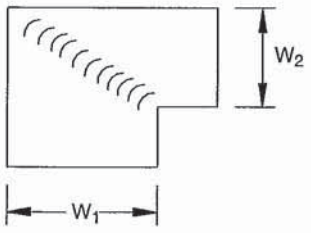
VANES SHALL BE SECURELY FASTENED TO RUNNERS.

ALL VANES SHALL BE SECURE AND STABLE IN INSTALLED OPERATING POSITION. IF NECESSARY, AT CERTAIN VELOCITIES OR PRESSURES WELD VANES TO RUNNERS ON APPROPRIATE INTERVALS ALONG RUNNERS.



TO PREVENT LINER DAMAGE CARE MUST BE EXERCISED WHEN INSTALLING VANES IN LINED OR FIBROUS GLASS DUCT.

IF W_2 DOES NOT EQUAL W_1 SPECIAL PROVISIONS MUST BE MADE IN VANE SHAPE OR ANGLE OF ENTRY AND EXIT. APPLIES TO ALL TYPES OF VANES. CONSTRUCT VANE EDGES TO PROJECT TANGENTS PARALLEL TO DUCT SIDES. VANES AS USED WHEN $W_1 = W_2$ ARE NOT ACCEPTABLE ON SIZE CHANGE ELBOWS WITHOUT MODIFICATION.



SEE FIG. 4–3 FOR VANE DETAILS.

FIGURE 4–4 VANE SUPPORT IN ELBOWS

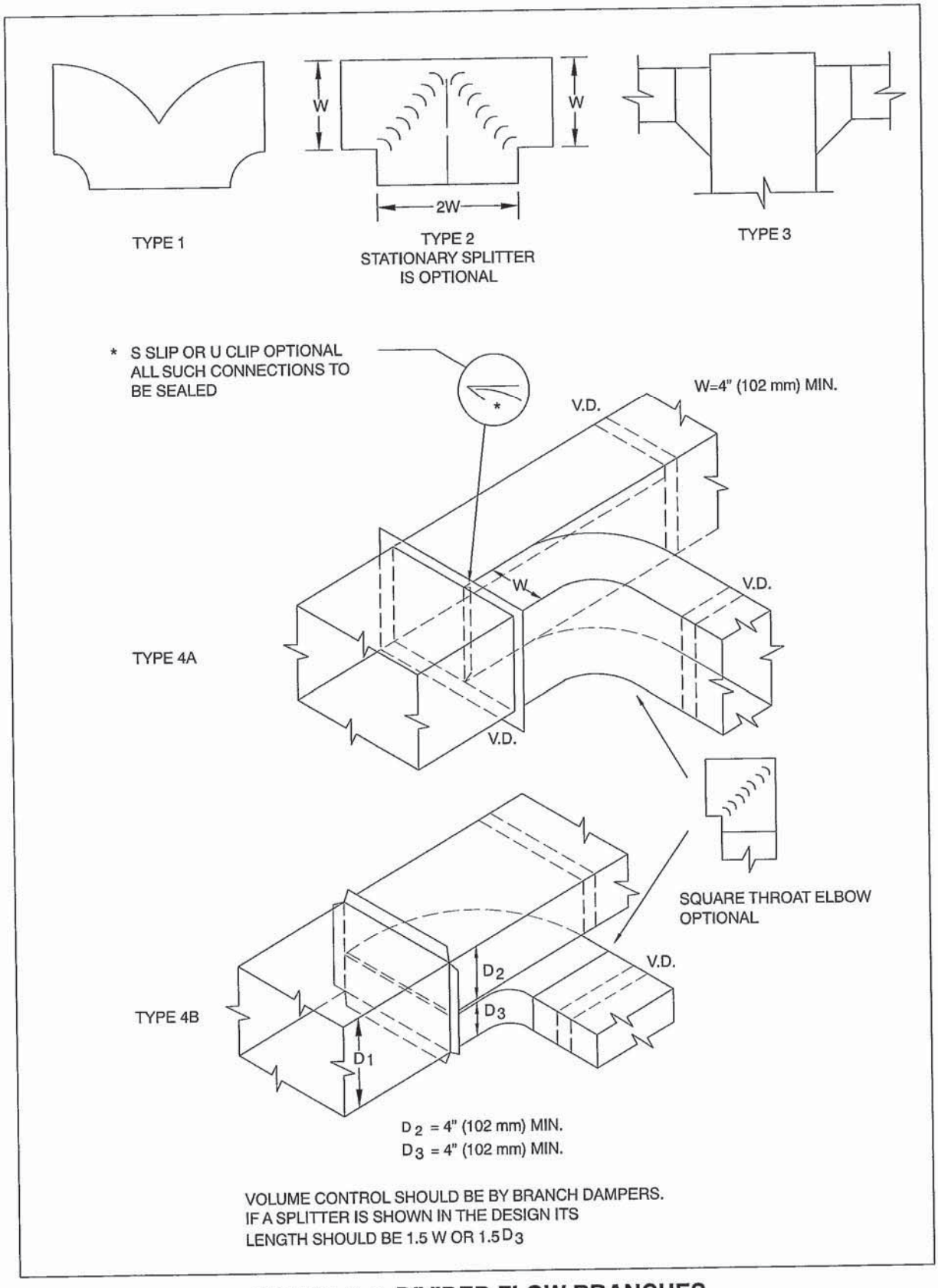


FIGURE 4–5 DIVIDED FLOW BRANCHES

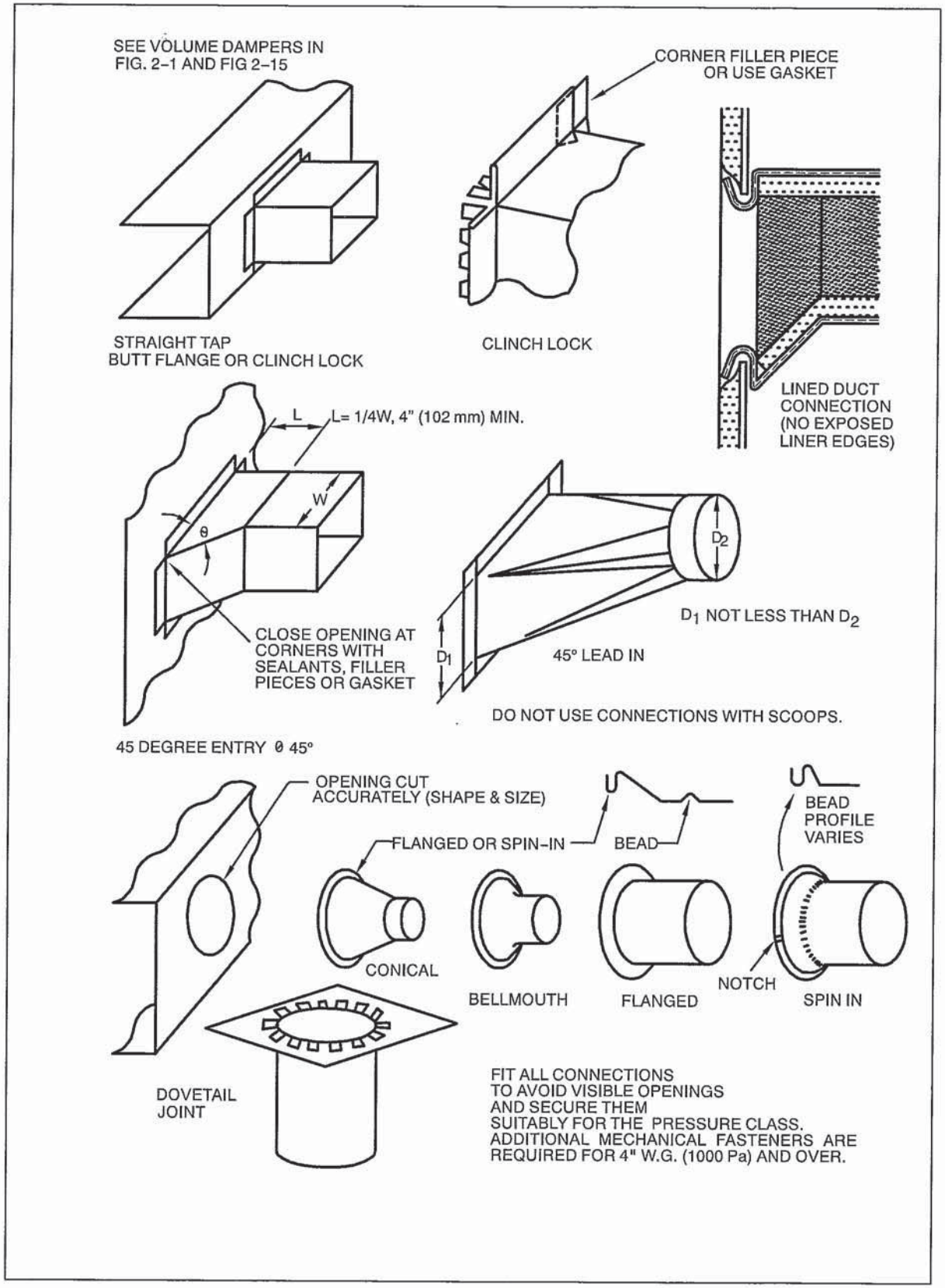
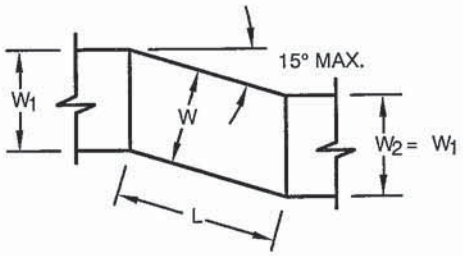
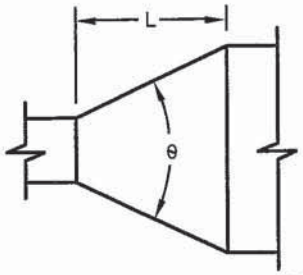


FIGURE 4–6 BRANCH CONNECTION

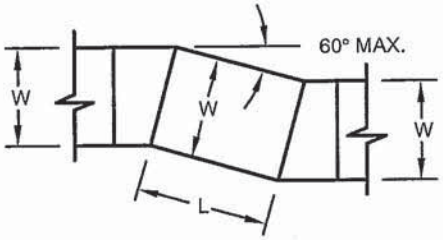
OFFSETS 2 AND 3 AND TRANSITIONS MAY HAVE EQUAL OR UNEQUAL INLET AND OUTLET AREAS. TRANSITIONS MAY CONVERT DUCT PROFILES TO ANY COMBINATION FOR RECTANGULAR, ROUND OR FLAT OVAL SHAPES.



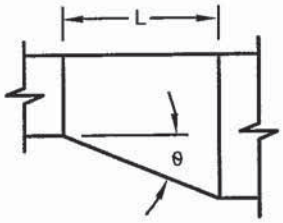
OFFSET TYPE 1
(ANGLED)



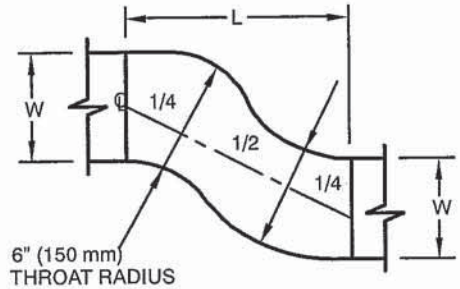
CONCENTRIC TRANSITION
θ MAX. 45° DIVERGING, 60° CONVERGING



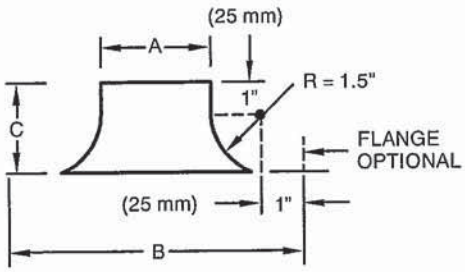
OFFSET TYPE 2
(MITERED)



ECCENTRIC TRANSITION
θ MAX. 30°
(EXCEPT 45° IS PERMITTED
AT ROUND TO FLAT OVAL)

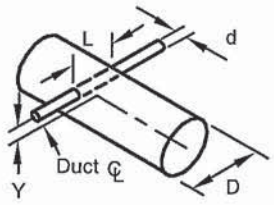


OFFSET TYPE 3
(RADIUSSED
OR OGEE)



STANDARD BELLMOUTH
(ON SHORT PATTERN BELL
C = 3" (76 mm)
B = A + 4" (102 mm))

FIGURE 4–7 OFFSETS AND TRANSITIONS



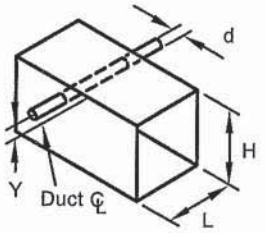


FIG. A

FIG. A IS APPLICABLE FOR UP TO 20% AREA OBSTRUCTION WITH ROUND SHAPED MEMBER AND 10% WITH FLAT PROFILE. Y IS THE DISTANCE FROM DUCT CENTER.

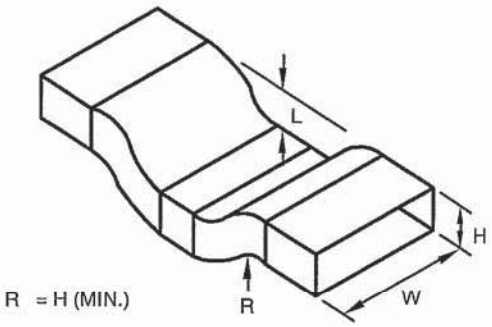


FIG. B

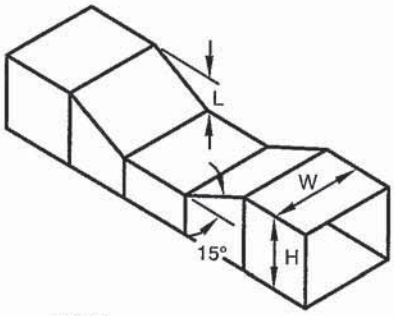


FIG. C

20% MAXIMUM AREA REDUCTION

L/H = 0.5 TO 2
B = 12" (300 mm) MIN.

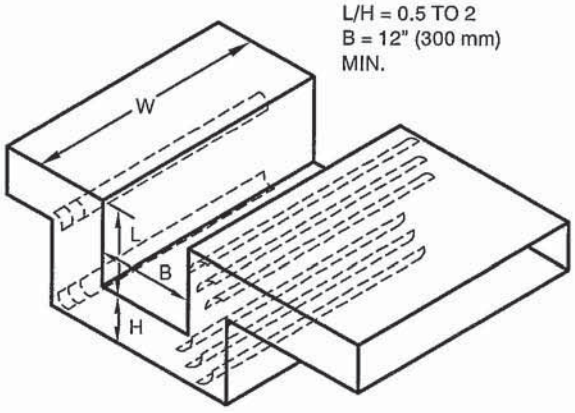
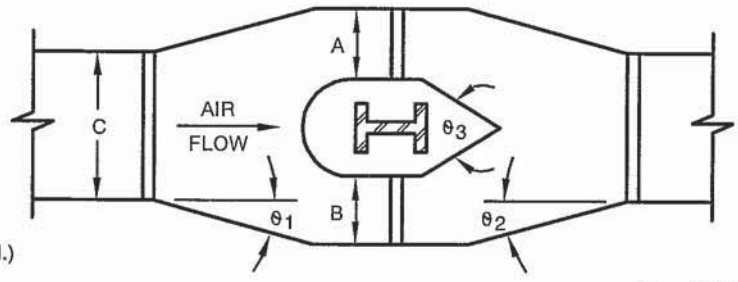


FIG. D

VANES MUST DIRECT FLOW PARALLEL TO DUCT WALL
CAUTION: HIGH LOSS COEFFICIENTS



A+B = 1.25C (MIN.) AT CONSTANT DEPTH.

FIG. E

θ_1 = 20° MAX.
θ_2 = 30° MAX.
θ_3 = 60° MAX.

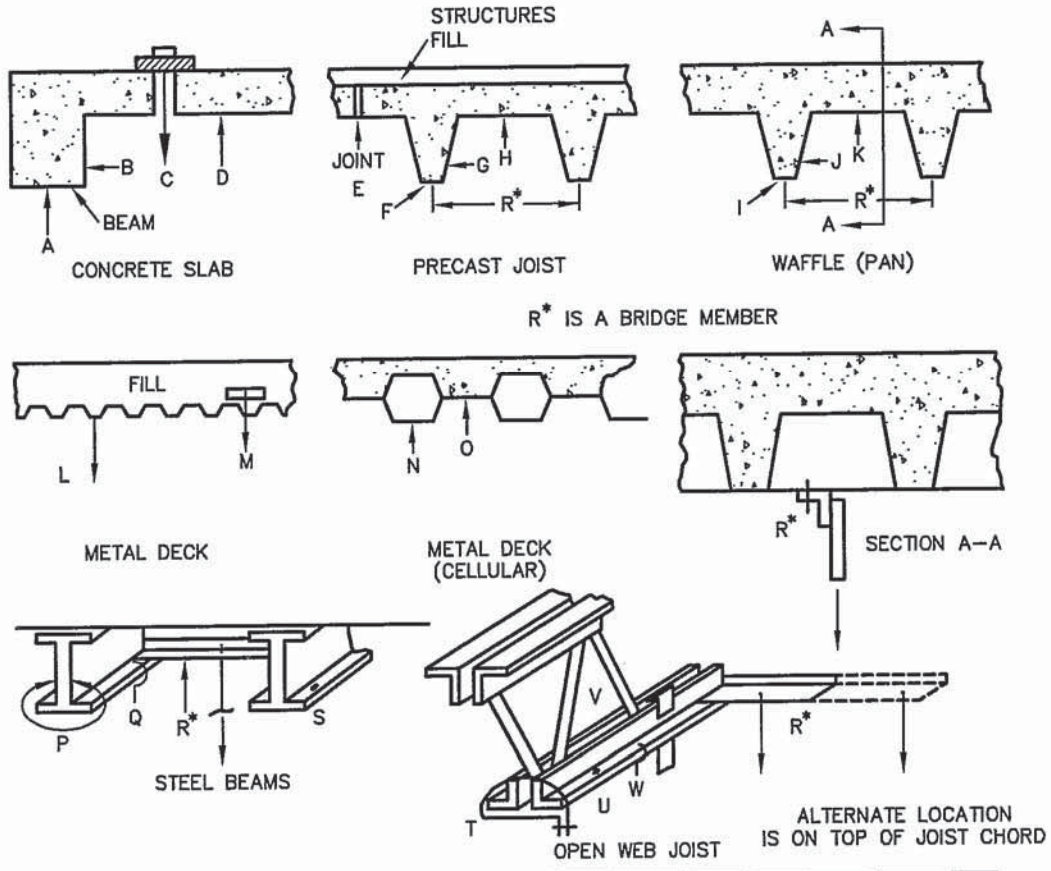
(USED WHEN OBSTRUCTION EXCEEDS 20% OF SECTION AREA AND OFFSETS AROUND ARE NOT POSSIBLE).

FIGURE 4–8 OBSTRUCTIONS

CHAPTER 5

HANGERS AND SUPPORTS

ALPHABET LETTER ONLY INDICATES AN ALTERNATIVE LOCATION OR SITUATION THAT MAY BE PERMITTED OR RESTRICTED BY DESIGN DOCUMENTS. ILLUSTRATIONS OF CONCRETE AND STEEL DO NOT PRECLUDE ATTACHMENTS TO WOOD.



CONVENTIONAL HANGER METHODS AND DEVICES

CONCRETE SCREW ANCHORS
CONCRETE INSERTS, SINGLE
CONCRETE INSERTS, SLOTTED
POWDER ACTUATED FASTENERS
GAS DRIVEN FASTENERS
"C" CLAMPS
WELDED STUDS
FRICTION CLAMPS
STRAP
ROD, THREADED, UNTHREADED
BRIDGE
BEAM CLAMP, HALF FLANGE
BEAM CLAMP, FULL FLANGE
EYE BOLT (OR ROD)
TOGGLE BOLTS
DRILLED HOLE AND BOLT
STANCHION
SELF TAPPING SCREWS PLUS STRAPS
DROP IN EXPANSION ANCHORS
KNEE BRACKET FROM WALL
LAG SCREW EXPANSION ANCHOR
NAILED PIN FASTENERS
RIVETS
SWAY BRACING
"FISH" PLATE OR WASHER AND ROD
HOOK OR LOOP
VIBRATION ISOLATOR
WIRE

NOTE: CABLE HANGING SYSTEMS WITH ADJUSTABLE MECHANICAL DEVICE SELECT HANGERS FOR TYPE OF STRUCTURE AND SUSPENSION. DO NOT EXCEED ALLOWABLE OR SPECIFIED LOAD LIMITS.

ALLOWABLE LOAD ON UPPER ATTACHMENT IS 1/4 OF FAILURE LOAD

FIGURE 5–1 HANGER ATTACHMENTS TO STRUCTURES

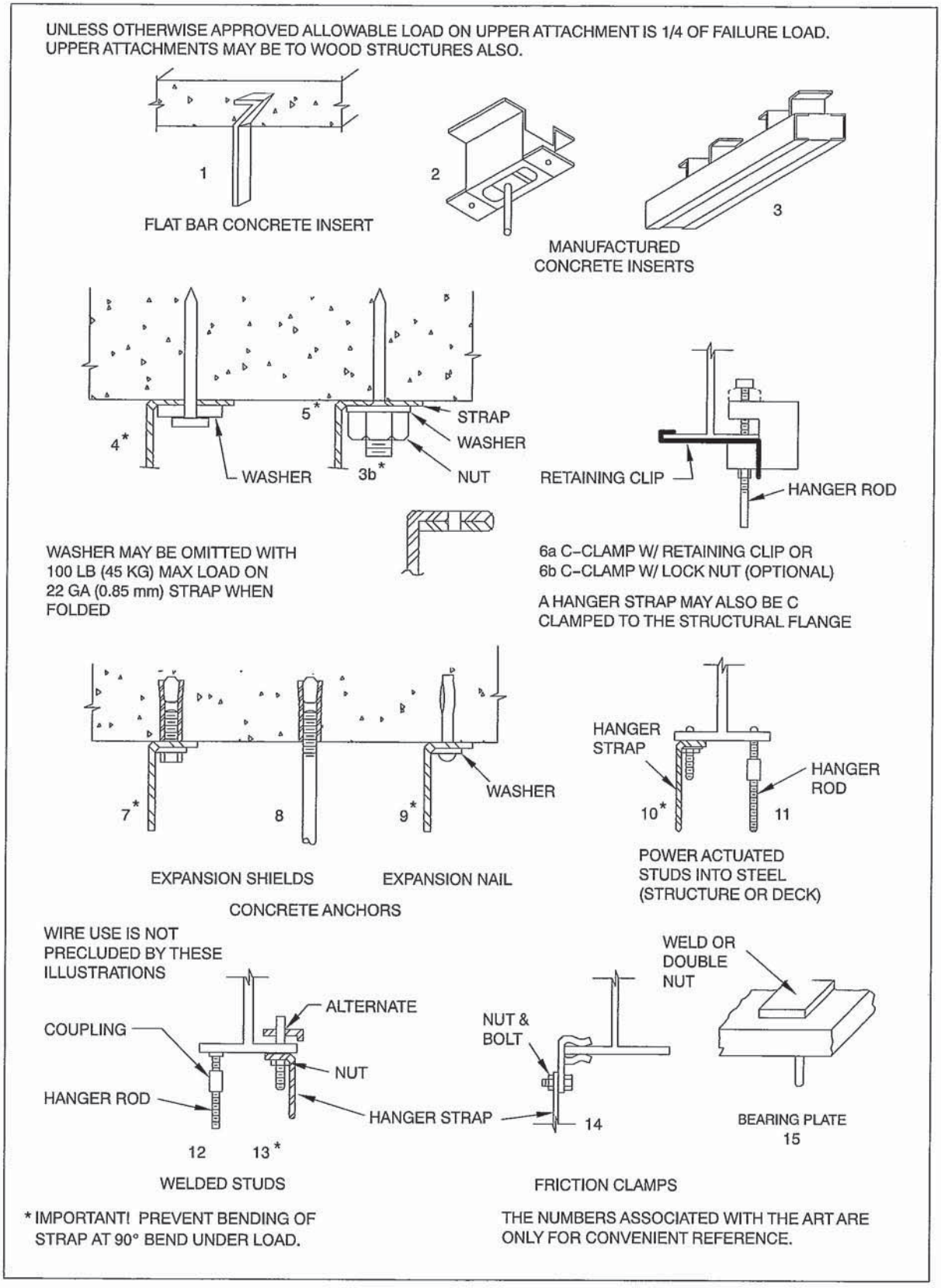
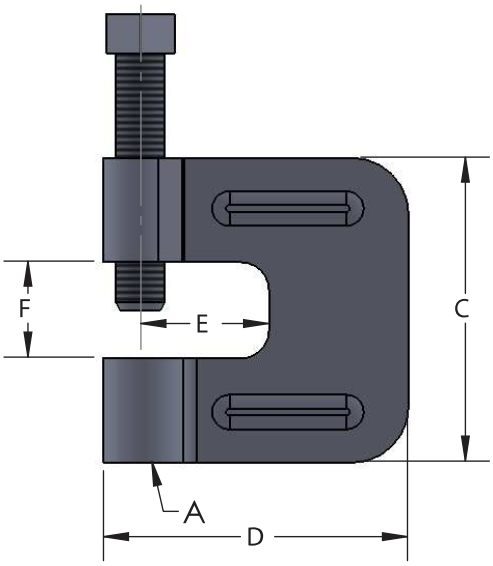


FIGURE 5–2 UPPER ATTACHMENT DEVICES – TYPICAL

EMPIRE INDUSTRIES, INC
800 243 4844
orders@empireindustries.com

FIG. 21
steel c-clamp



Materials/Finishes	Plain Carbon Steel (21B) ☐	Electro-Galvanized (21G) ☐
Variants:	Plain Carbon Steel W/ Locknut (21LB) ☐	
	Electro-Galvanized W/ Locknut (21LG) ☑	
	T-304 Stainless Steel W/ Locknut (21LSS) ☐	
	T-316 Stainless Steel W/ Locknut (21LSX) ☐	
Service:	Designed for attaching hanger rod to the bottom flange of a beam. Features the ribbed design for added strength. Hardened steel cup point set screw secures clamp to beam.	
Approvals:	UL - U.L.C. listed 3/8 and 1/2 (1/2 for 4" IPS max) with locknut only. FM approved (excluding 21lSS and 21LSX) for 3/8 only with and without locknut. Complies with Federal Specification WW-H-171-E (Type# 23), A-A-1192 A (Type# 23), Manufacturers' Standard Society SP-58 and MSS SP-69 (Type# 23).	
Ordering:	Specify figure number, finish and rod size.	
Notes:	See MSS SP-69 for proper set screw torque recommendations.	

Domestically Manufactured

c UL us LISTED

FM APPROVED

ROD SIZE A	SET SCREW	C	D	E	F	MAX PIPE SIZE	WGT EACH (lbs)		MAX REC LOAD (lbs)
							21 (W/O NUT)	21L (W/ NUT)	
3/8-16	3/8-16	2-3/8	2-3/8	1	3/4	4	.38	.40	400
1/2-13	3/8-16	2-3/8	2-3/8	1	3/4	4	.38	.40	500
5/8-11	1/2-13	2-3/8	2-5/16	7/8	3/4	5	.56	.60	550
3/4-10	5/8-11	2-3/8	2-5/16	7/8	3/4	6	.60	.68	630
7/8-9	3/4-10	3	3-5/16	1-1/4	1-3/16	8	1.76	1.88	900

PROJECT INFORMATION	APPROVAL STAMP
Project:	Notes:
Address:	
Contractor:	
Engineer:	
Date:	
Approved ☐ Approved as Noted ☐ Not Approved ☐	

HDI-P DROP-IN ANCHORS
PRODUCT DESCRIPTION

HDI-P Drop-in Anchors

Anchor System	Features and Benefits
HDI-P Drop-in Anchor 	• Optimized anchor length to allow reliable fastenings in hollow core panels, precast plank and post tensioned slabs • Shallow drilling enables fast installation • Lip provides flush installation, consistent anchor depth and easy rod alignment • HSD-G 3/8 setting tool with hand guard leaves mark on flange when anchor is set properly to enable inspection and verification of proper expansion

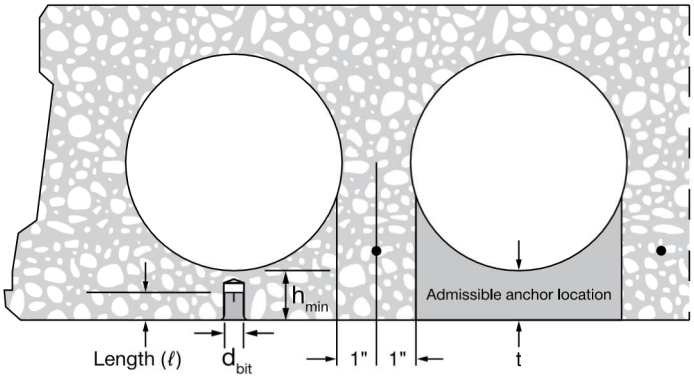
INSTALLATION PARAMETERS

Table 5 — HDI-P specifications

Setting information	Symbol	Units	Nominal anchor diameter		
			1/4	3/8	1/2
Nominal bit diameter	d_{bit}	in.	3/8	1/2	5/8
Threaded rod diameter	d_{rod}	in.	1/4	3/8	1/2
Minimum base material thickness	h_{min}	in.	1-3/8		
Anchor length	ℓ	in.	5/8	3/4	
		(mm)	(15.9)	(19.1)	(2[illegible].4)
Hole depth in base material	h_0	in.	5/8	3/4	
		(mm)	(15.9)	(19.1)	(2[illegible].4)
Minimum anchor spacing	s_{min}	in.	4-1/8		
Minimum edge distance	c_{min}	in.	3-3/4		

1 The Admissible Anchor Location must be established to prevent damage to the prestressed cable during the drilling process. Verify the location and height of the cable with the hollow core plank supplier to confirm Admissible Anchor Location.
2 Minimum compressive strength of hollow core panels is 7,000 psi at the time of installation. The minimum thickness h_{min} is 1-3/8 inches.

Figure 3 — Installation of Hilti HDI-P in hollow core concrete panels



DESIGN INFORMATION

Table 6 — Hilti HDI-P loads in hollow core concrete panels[1,2]

Nominal Anchor Diameter (inches)	Length in. (mm)	Nominal Bit Diameter in.	Allowable loads, lb (kN)[3]		Ultimate loads lb (kN)	
			Tension	Shear	Tension	Shear
1/4	5/8 (15.9)	3/8	310 (1.4)	455 (2.0)	1,550 (6.9)	2,275 (10.1)
3/8	3/4 (19.1)	1/2	420 (1.9)	800 (3.6)	2,100 (9.3)	4,000 (17.8)
[illegible]						

1 The admissable anchor location must be established to prevent damage to the prestressed cable during the drilling process. Verify the location and height of the cable with the hollow core plank supplier to confirm admissable anchor location.
2 Minimum compressive strength of prestressed concrete is 7,000 psi. Published results represent the average results conducted in local base materials. Due to variations in materials and dimensional configurations, on-site testing is required to determine the actual performance.
3 Allowable loads calculated with a factor of safety of 5.

ORDERING INFORMATION

HDI-P anchor

Description	Bit diameter	Qty / box
HDI-P 1/4	3/8	100
HDI-P 3/8	1/2	100
[illegible]		

Setting tools for HDI-P anchors HDI

Description
HST-P 1/4 Hand Setting Tool
HST-P 3/8 Hand Setting Tool
HSD-G 3/8 Hand Setting Tool with hand guard
HST-P 1/2 Hand Setting Tool

KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor 3.3.6

3.3.6.1 Product description

KWIK HUS-EZ (KH-EZ) anchors are comprised of a body with hex washer head. The anchor is manufactured from carbon steel and is heat treated. It has a minimum 0.0003 inch (8 µm) zinc coating in accordance with DIN EN ISO 4042. The KWIK HUS-EZ (KH-EZ) system is available in a variety of lengths with diameters of 1/4-, 3/8-, 1/2-, 5/8- and 3/4-in. The hex head is larger than the diameter of the anchor and is formed with serrations on the underside. The anchor body is formed with threads running most of the length of the anchor body. The anchor is installed in a predrilled hole with a powered impact wrench or torque wrench. The anchor threads cut into the concrete on the sides of the hole and interlock with the base material during installation. Applicable base materials include normal-weight concrete, structural lightweight concrete, lightweight concrete over metal deck, and grout-filled concrete masonry.

Guide specifications

Screw anchors shall be KWIK HUS-EZ as supplied by Hilti, Inc. Anchors shall be manufactured from heat treated carbon steel material, zinc plated to a minimum thickness of 8 µm. Anchor head shall display name of manufacturer, product name, diameter and length. Anchors shall be installed using a drill bit of same nominal diameter as anchor.

Product features

- Suitable for seismic and nonseismic loads.
- Quick and easy to install.
- Length and diameter identification clearly stamped on head facilitates quality control and inspection after installation.
- Through fixture installation improves productivity and accurate installation.
- Thread design enables quality setting and exceptional load values in wide variety of base material strengths.
- Anchor is fully removable
- Anchor size is same as drill bit size.
- Suitable for reduced edge distances and spacing.

3.3.6.2 Material specifications

Hilti KWIK HUS-EZ anchors are manufactured from carbon steel. The anchors are bright zinc plated to a minimum thickness of 8 µm.

3.3.6.3 Technical data

3.3.6.3.1 ACI 318-14 Chapter 17 design

The technical data contained in this section are Hilti Simplified Design Tables. The load values were developed using the Strength Design parameters and variables of ESR-3027 and the equations within ACI 318-14 Chapter 17. For a detailed explanation of the Hilti Simplified Design Method, refer to section 3.1.8. Data tables from ESR-3027 are not contained in this section, but can be found on www.icc-es.org or at www.hilti.com.

Listings/Approvals

ICC-ES (International Code Council)
ESR-3027
Cracked and Uncracked Concrete
ESR-3056
Grout-filled concrete masonry
City of Los Angeles
Research Report No. 25897

Independent code evaluation

IBC® / IRC® 2015
IBC® / IRC® 2012
IBC® / IRC® 2009
IBC® / IRC® 2006
IBC® / IRC® 2003

3.3.6 KWIK HUS-EZ (KH-EZ) Carbon Steel Screw Anchor

Table 1 - Hilti KWIK HUS-EZ specifications[1]

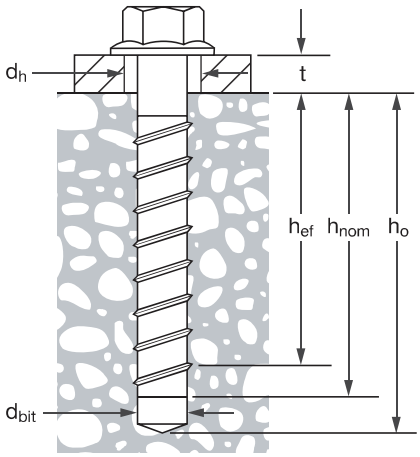
Setting information	Symbol	Units	Nominal anchor diameter											
			1/4		3/8			1/2			5/8		3/4	
Nominal bit diameter	d_{bit}		1/4		3/8			1/2			5/8		3/4	
Minimum nominal embedment	h_{nom}	in.	1-5/8	2-1/2	1-5/8	2-1/2	3-1/4	2-1/4	3	4-1/4	3-1/4	5	4	6-1/4
Minimum effective embedment	h_{ef}	in.	1.18	1.92	1.11	1.86	2.50	1.50	2.16	3.22	2.39	3.88	2.92	4.84
Minimum hole depth	h_o	in.	2	2-7/8	1-7/8	2-3/4	3-1/2	2-5/8	3-3/8	4-5/8	3-5/8	5-3/8	4-4/8	6-5/8
Fixture hole diameter	d_h	in.	3/8		1/2			5/8			3/4		7/8	
Anchor Length = h_{nom} + t	ℓ		See ordering information											
Installation torque concrete	T_{inst}	ft-lb	18		19	40		45			85		115	
		(Nm)	(24)		(26)	(54)		(61)			(115)		(155)	
Maximum impact wrench torque rating concrete[2]	$T_{impact,max}$	ft-lb	114	137	114	450		137	450		450		450	
		(Nm)	(154)	(185)	(154)	(608)		(185)	(608)		(608)		(608)	
Installation torque masonry	T_{inst}	ft-lb	21		22			34			38		70	
		(Nm)	(28)		(30)			(46)			(52)		(95)	
Maximum impact wrench torque rating masonry[2,3]	$T_{impact,max}$	ft-lb	114		114		332	332			332		332	
		(Nm)	(155)		(155)		(450)	(450)			(450)		(450)	
Wrench size		in.	7/16		9/16			3/4			15/16		1-1/8	

1 T_{inst} is the maximum installation torque that may be applied with a torque wrench.

2 Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over torquing can damage the anchor and/or reduce its holding capacity.

3 For more information on KWIK HUS-EZ installed in masonry, see ESR-3056 and section 3.3.6.3.3.

Figure 1 - Hilti KWIK HUS-EZ specifications



KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor 3.3.7

3.3.7.1 Product description

KWIK HUS-EZ I (KH-EZ I) anchors are comprised of a body with an internally threaded hex washer head. The anchor is manufactured from carbon steel and is heat treated. It has a minimum 0.0003 inch (8 µm) zinc coating in accordance with DIN EN ISO 4042. The internally threaded head is larger than the diameter of the anchor and is formed with serrations on the underside. The anchor body is formed with threads running most of the length of the anchor body. The anchor is installed in a predrilled hole with a powered impact wrench or torque wrench. The anchor threads cut into the concrete on the sides of the hole and interlock with the base material during installation. Applicable base materials include normal-weight concrete, structural lightweight concrete and lightweight concrete over metal deck.

Guide specifications

Screw anchors shall be KWIK HUS-EZ I as supplied by Hilti, Inc. Anchors shall be manufactured from heat treated carbon steel material, zinc plated to a minimum thickness of 8 µm. Anchors shall be installed using a drill bit of same nominal diameter as anchor.

Product features

- Suitable for cracked and uncracked normal-weight and lightweight concrete, and lightweight concrete over metal deck.
- Suitable for seismic and nonseismic loads.
- Quick and easy to install.
- Thread design enables quality setting and exceptional load values in wide variety of base material strengths.
- Anchor is fully removable
- Anchor size is same as drill bit size.
- Suitable for reduced edge distances and spacing.

3.3.7.2 Material specifications

KWIK HUS-EZ I anchors are manufactured from carbon steel. The anchors are bright zinc plated to a minimum thickness of 8 µm.

3.3.7.3 Technical data

3.3.7.3.1 ACI 318-14 Chapter 17 design

The technical data contained in this section are Hilti Simplified Design Tables. The load values were developed using the design parameters and variables of ESR-3027 and the equations of ACI 318-14 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8. Data tables from ESR-3027 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

Listings/Approvals

ICC-ES (International Code Council)
ESR-3027
City of Los Angeles
Research Report No. 25897
FM (Factory Mutual)
Pipe Hanger Components for Automatic Sprinkler Systems for 3/8 internal threaded diameter anchor

Independent code evaluation

IBC® / IRC® 2015
IBC® / IRC® 2012
IBC® / IRC® 2009
IBC® / IRC® 2006

3.3.7 KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor

Table 1 - Hilti KWIK HUS-EZ I specifications[1,2]

Setting information	Symbol	Units	Nominal anchor diameter	
			1/4	
Nominal bit diameter	d_{bit}	in.	1/4	
Nominal embedment	h_{nom}	in.	1-5/8	2-1/2
Effective embedment	h_{ef}	in.	1.18	1.92
Minimum hole depth	h_o	in.	2	2-7/8
Installation torque	T_{inst}	ft-lb	18	
		(Nm)	(24)	
Wrench size		in.	7/16	

1 T_{inst} is the maximum installation torque that may be applied with a torque wrench.

2 See table 2 and figure 5 of section 3.3.6 for spacing, edge distance, and concrete thickness parameters

Figure 1 — KWIK HUS-EZ I anchor installation details

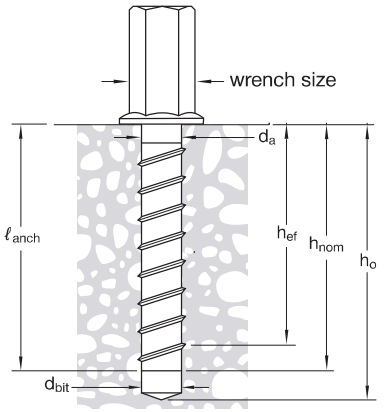


Table 2 - Hilti KWIK HUS-EZ I design strength with concrete / pullout failure in uncracked concrete[1,2,3,4,5]

Nominal anchor diameter in.	Nominal embed. depth in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)
1/4	1-5/8	585	620	675	765	1,075	1,180	1,360	1,670
	(41)	(2.6)	(2.8)	(3.0)	(3.4)	(4.8)	(5.2)	(6.0)	(7.4)
	2-1/2	1,525	1,670	1,930	2,365	2,235	2,450	2,825	3,460
	(64)	(6.8)	(7.4)	(8.6)	(10.5)	(9.9)	(10.9)	(12.6)	(15.4)

Table 3 - Hilti KWIK HUS-EZ I design strength with concrete / pullout failure in cracked concrete[1,2,3,4,5]

Nominal anchor diameter in.	Nominal embed. depth in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)
1/4	1-5/8	300	315	345	390	765	835	965	1,180
	(41)	(1.3)	(1.4)	(1.5)	(1.7)	(3.4)	(3.7)	(4.3)	(5.2)
	2-1/2	760	830	960	1,175	1,585	1,735	2,000	2,450
	(64)	(3.4)	(3.7)	(4.3)	(5.2)	(7.1)	(7.7)	(8.9)	(10.9)

1 See section 3.1.8.6 to convert design strength value to ASD value.

2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.

3 Apply spacing, edge distance, and concrete thickness factors in tables 5 and 6 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.

4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60

5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:

1/4-in diameter by 1-5/8-in nominal embedment depth - $\alpha_{N,seis}$ = 0.60
1/4-in diameter by 2-1/2-in nominal embedment depth - $\alpha_{N,seis}$ = 0.75

No reduction needed for seismic shear. See Section 3.1.8.7 for additional information on seismic applications.

Table 4 - Steel design strength for Hilti KWIK HUS-EZ I anchors[1,2]

Nominal anchor diameter in.	Nominal internal thread diameter in.	Tensile[3] ϕN_{sa} lb (kN)	Shear[4] ϕV_{sa} lb (kN)	Seismic shear[5] ϕV_{sa} lb (kN)
1/4	1/4-20 UNC	3,680 (16.4)	815 (3.6)	365 (1.6)
	3/8-16 UNC	3,680 (16.4)	790 (3.5)	670 (3.0)

1 See section 3.1.8.6 to convert design strength value to ASD value.

2 Hilti KWIK HUS-EZ I anchors are to be considered brittle steel elements.

3 Tension $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318-14 Chapter 17.

4 Shear determined by static tests with $\phi V_{sa} < 0.6 \phi A_{se,V} f_{uta}$ as noted inACI 318-14 Chapter 17.

5 Seismic shear values determined by seismic shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318-14 Chapter 17. See Section 3.1.8.7 for additional information on seismic applications.

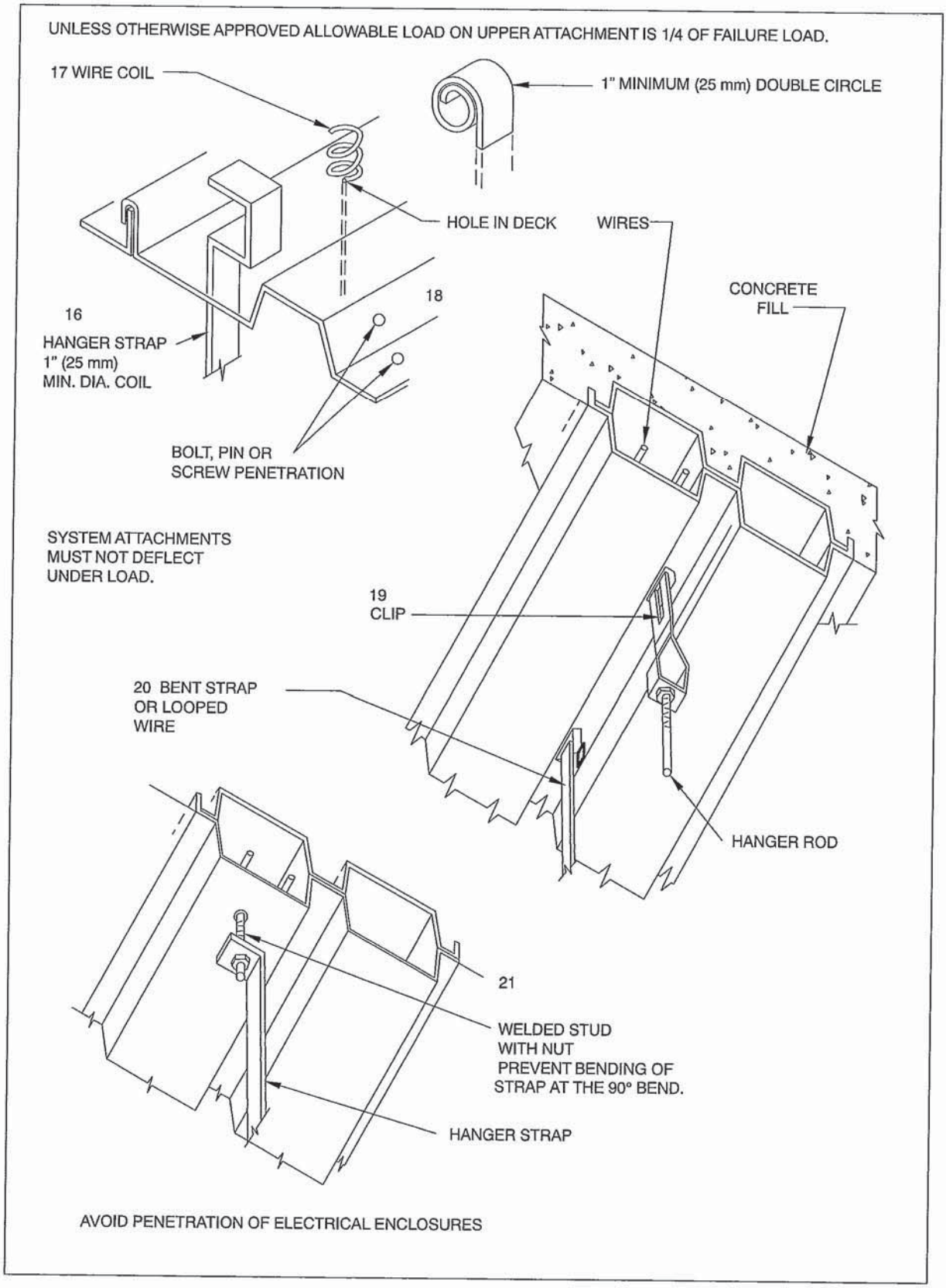


FIGURE 5–4 UPPER ATTACHMENTS – TYPICAL

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	⅜"	1" × 20 ga	¼"	1" × 22 ga	¼"	1" × 22 ga	¼"
P/2 = 96"	1" × 16 ga	⅜"	1" × 18 ga	⅜"	1" × 20 ga	⅜"	1" × 22 ga	¼"
P/2 = 120"	1½" × 16 ga	½"	1" × 16 ga	⅜"	1" × 18 ga	⅜"	1" × 20 ga	¼"
P/2 = 168"	1½" × 16 ga	½"	1½" × 16 ga	½"	1" × 16 ga	⅜"	1" × 18 ga	⅜"
P/2 = 192"	Not Given	½"	1 ½ " × 16 ga	½"	1" × 16 ga	⅜"	1" × 16 ga	⅜"
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 ¼" bolt~~ 1" × 16 ga -two ¼" dia. 1½" × 16 ga -two ⅜" 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. 1½" × 16 ga - 1100 lbs.	~~0.106" - 80 lbs.~~ ~~0.135" - 120 lbs.~~ ~~0.162" - 160 lbs.~~ ~~¼" - 270 lbs.~~ ⅜" - 680 lbs. ½" - 1250 lbs. ⅝" - 2000 lbs. ¾" - 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.

Trapeze		Angles													Channels		
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Length, in.		1" × 1" × 16 ga	1" × 1" × ⅛"	1-½" × 1-½" × 16ga	1-½" × 1-½" × ⅛"	1-½" × 1-½" × 3/16"	1-½" × 1-½" × ¼"	2" × 2" × ⅛"	2" × 2" × 3/16"	2" × 2" × ¼"	2-½" × 2-½" × 3/16"	2-½" × 2-½" × ¼"	3" × 3" × ¼"	4" × 4" × ¼"	3" × 4.1 lb/ft	3" × 6.0 lb/ft	4" × 5.4 lb/ft
18		80	150	180	350	510	650	650	940	1230	1500	1960	-	-	-	-	-
24		75	150	180	350	510	650	650	940	1230	1500	1960	-	-	-	-	-
30		70	150	180	350	510	650	650	940	1230	1500	1960	-	-	-	-	-
36		60	130	160	340	500	620	620	920	1200	1480	1940	-	-	-	-	-
42		40	110	140	320	480	610	610	900	1190	1470	1930	-	-	-	-	-
48		-	80	110	290	450	580	580	870	1160	1440	1900	-	-	-	-	-
54		-	-	-	250	400	540	540	840	1120	1400	1860	-	-	-	-	-
60		-	-	-	190	350	490	490	780	1060	1340	1800	-	-	-	-	-
66		-	-	-	100	270	400	400	700	980	1260	1720	-	-	-	-	-
72		-	-	-	-	190	320	320	620	900	1180	1640	-	-	-	-	-
78		-	-	-	-	-	210	210	500	790	1070	1530	-	-	-	-	-
84		-	-	-	-	-	-	-	380	660	940	1400	2310	4680	4650	5980	9080
96		-	-	-	-	-	-	-	-	320	600	1060	1970	4340	3870	4950	8740
108		-	-	-	-	-	-	-	-	-	-	-	2510	7240	5760	7780	15650
120		-	-	-	-	-	-	-	-	-	-	-	1220	5950	4120	5930	13200
132		-	-	-	-	-	-	-	-	-	-	-	-	4350	2540	3920	10820
144		-	-	-	-	-	-	-	-	-	-	-	-	2420	-	2000	8330
Section Properties	I_x	0.012	0.022	0.041	0.078	0.110	0.139	0.190	0.272	0.348	0.547	0.703	1.240	3.040	1.660	2.070	3.850
	Z	0.016	0.031	0.037	0.072	0.104	0.13	0.130	0.190	0.247	0.303	0.394	0.577	1.050	1.100	1.380	1.930
	A	0.120	0.234	0.180	0.359	0.527	0.688	0.484	0.715	0.938	0.902	1.190	1.440	1.940	1.210	1.760	1.590
	lb/ft	0.440	0.800	0.660	1.230	1.800	2.340	1.650	2.440	3.190	3.070	4.100	4.900	6.600	4.100	6.000	5.400

Table 5–3 Allowable Loads in Pounds for Trapeze Bars

NOTES:

a. It is assumed that steel with a yield strength of 30,000 psi or greater is used.

b. Loads above assume that a hanger rod is 6 in. max distance from the duct side for lengths of 96 in. or less, and 3 in. for greater lengths.

c. Framing Struts, *see* Table 5-4 and other steel shapes having equal or greater (Ix and Z) properties may be used in place of listed shapes. Ix is in $in.^4$, Z is in $in.^3$, and A is in $in.^2$

d. *See* Fig. 5-6 for load calculation method and Table 5-1 for rod and strap load limits.

FRAMING CHANNEL (STRUT) MAY BE USED AS AN ALTERNATIVE TO THE TRAPEZE ANGLES SHOWN IN TABLE 5–3 AS FOLLOWS:

Channel (Strut)			Section Modulus (Z)	Moment of Inertia (I)	Trapeze
H	W	GA	$in.^3$	$in.^4$	Table 5-3
1 in.	1 5/8 in.	12	0.0923	0.0533	A, B, C
1 3/8 in.	1 5/8 in.	12	0.1559	0.1209	D, E
1 5/8 in.	1 5/8 in.	12	0.2042	0.1850	F, G
2 7/16 in.	1 5/8 in.	12	0.3927	0.5203	H, I
3 1/4 in.	1 5/8 in.	12	0.5772	0.9379	J, K

Channel (Strut)			Section Modulus (Z)	Moment of Inertia (I)	Trapeze
H (mm)	W (mm)	MM	mm^3	mm^4	Table 5-3M
25.4	41.3	2.45	1500	22,200	A, B, C
34.9	41.3	2.45	2600	50,300	D, E
41.3	41.3	2.45	3300	77,000	F, G
61.9	41.3	2.45	6400	216,000	H, I
82.6	41.3	2.45	10,300	454,000	J, K

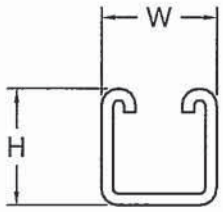
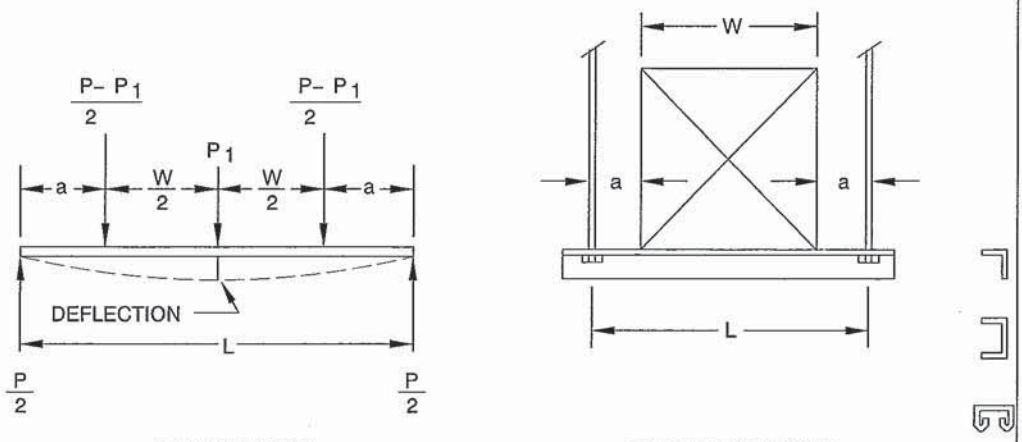


Table 5–4 Channel (Strut) Used as Trapeze



LOAD DIAGRAM TRAPEZE SUPPORT

Weight of duct material of an areaW x W in ft (m) times 2.656 lb/ft (127 newtons/m)

W = Duct Width, inches
L = Distance between supports on the trapeze, inches (mm)
a = Distance between support and duct side, inches (mm)
D = Deflection, inches, suggested maximum 3/8" (9.5 mm)
E = Modulus of elasticity (29,000,000 psi for steel) (200 x 10^6 KPa)
I = Moment of Inertia, $in.^4$ (mm^4)
Z = Section Modulus, $in.^3$ (mm^3)
P = Weight of duct, reinforcements, insulation, etc.–not to exceed allowable load for stress or deflection limits
P_1 = Weight of duct material of an area W x W in ft^2 (m^2) times 2.656 lb/ft^2 (127 newtons/m^2)
M = Moment, in.–lb. (mN x m)
S = Allowable stress, steel = 15,000 psi (103,425 KPa) for bending stress. Shear stress alone should not exceed 7,500 psi. (51,713 KPa)
F = Shear load, lbs. (Kg.)
A = Cross sectional area, $in.^2$ (mm^2)

BENDING STRESS

$$S_A = 15{,}000 \text{ psi} = \frac{M}{Z} \qquad P = 2\,\frac{SZ}{a} - P_1\left(\frac{L}{2a} - 1\right) = 30{,}000\,\frac{Z}{a} - P_1\left(\frac{L}{2a} - 1\right)$$

DEFLECTION

$$D = \frac{(P - P_1)\,a\,(3L^2 - 4a^2)}{2\,(24EI)} + \frac{P_1 L^3}{48\,EI}$$

Consult reference texts for other conditions of loading. For round duct loads on trapeze angles see the Round Industrial Duct Construction Standards

SHEAR STRESS

$$S_S = 7{,}500 \text{ Psi} = \frac{F}{A} = \frac{P}{2A} \qquad P = 15000\,A \text{ (maximum)}$$

Notice: Formula constants here are not in metric units.

FIGURE 5–6 TRAPEZE LOAD DIAGRAM

Test and Verification Report on
Gripple Hang-Fast Wire Duct Hanger System

"Gripple Hang-Fast Wire Duct Hanger Systems Number 2, 3, and 4 as Acceptable Alternatives for Use with SMACNA HVAC Duct Construction Standards Metal and Flexible, Second Edition, 1995"

The SMACNA Testing & Research Institute (STRI) verifies Gripple Hang-Fast Stranded Galvanized Rope Systems Number 2, 3 and 4 (as submitted and described below) to be acceptable alternatives to the duct hanger systems prescribed in the HVAC Duct Construction Standards (HVAC-DCS), Second Edition 1995, Chapter 4, Tables 4-1 4-1M, 4-2 and 4-2M subject to the following conditions and limitations:

1. Consistent with the HVAC-DCS requirements, upper attachment of the system directly to structures (without another drive transferring the load between the wire and the structure) shall have an allowable load not more that one-fourth of the wire system failure load.

2. Lower attachments, such as illustrated in HVAC-DVCS Figure 4-4 shall have a minimum safety factory of two and shall not be used in a manner that would deform the duct shape or cause excessive concentrated loads on ducting.
   With respect HVAC-DCS Figure 4-4, Gripple Hang-Fast System may be adapted to any of the illustrated support configurations except the two-tier trapeze method in the lower right. The adaptation also applies to the strut channel support in Figure 4-5
   With rope support of trapeze bars for oval duct suspensions relative to DCS specification S3.18 is acceptable.
   Wire rope passed continuously under round and rectangular duct (with both ends attached overhead) is acceptable provided that duct is retained and points of contact with the duct are not overstressed. Use of stress distribution saddles shall be prescribed as necessary.

3. The HVAC-DCS Table 4-1 maximum hanger spacing of 10 feet and Table 4-2 maximum spacing of 12 feet shall be maintained (and decreased as necessary to conform to Gripple #2, #3 and #4 working load limits)
   Since Chapter 4 of the HVAC-DCS has prescribed uses and limits on duct size for single wire supports and the Gripple Hang-Fast System uses stranded ropes that have larger load capacity, use is not restricted to the HVAC-DCS diametrical limits for single wires.

4. When Gripple, Inc allows its hanger wire to be in a non-vertical orientation, it shall, in accordance with accepted engineering practice, provide users with adjustments to its working loads and, as necessary to conform to manufacturers recommendations, approve the method of transfer of loadings to supporting and supported members. This stipulation shall not be construed as pre-empting any duty of an installer to obtain approval of the support system by an appropriate authority prior to making the installation. The SMACNA HVAC-DCS does not specifically provide for non-vertical hanger systems.

5. Criteria for use of Gripple Hang-Fast systems for support of risers is not included in this verification.

Gripple Hang-Fast North America submitted their Gripple Hang-Fast Wire Duct Hanger Systems Number 2, 3 and 4 which, consisted of:

A. A "system" with the following components: a zinc coated steel wire rope, a preformed loop created and maintained thereon by a manufacturer supplied and attached ferrule and an attachable loop fixing metal grip, the wire rope complying with British Standards Institution Standard BS302, parts 1 and 2 1987 Edition.

B. Each system was supplied with suitably matched, compatible load rated components with load rating performance data conducted by an accredited testing laboratory.

Conclusion

The SMACNA Testing and Research Institute conducted comprehensive evaluation of the submittal as an acceptable alternative for use with the SMACNA HVAC Duct Construction Standards Metal and Flexible, Second Edition, 1995. This analysis included: minimum and maximum working loads range that will prevent slip and separation of components of the systems; breaking strength of the wire rope; load test results for rope systems and failure load tests.

Ref: SMACNA Testing & Research Institute - July 2002

GRIPPLE®

Test & Verification Report on
Gripple Hang-Fast Wire Duct Hanger System

"Gripple Hang-Fast Wire Duct Hanger Systems Number 1 & 5 – Standard Loop, Number 2 & 3 – Toggle and Number 2 & 3 – Threaded Stud-Fast as Acceptable Alternatives for Use with the SMACNA HVAC Duct Construction Standards Metal and Flexible, Second Edition, 1995".

The SMACNA Testing & Research Institute (STRI) verifies Gripple Hang-Fast #2 & 3 – Threaded Stud-Fast (as tested and described below) to be acceptable alternatives to the duct hanger systems prescribed in the HVAC Duct Construction Standards (HVAC-DCS), Second Edition 1995, Chapter 4, Tables 4-1, 4-1M and 4-2M subject to the following conditions.

1. Consistent with the HVAC-DCS requirements, upper attachment of the system directly to structures (without another drive transferring the load between the wire and the structure) shall have an allowable load not more than one-fourth of the wire system failure load.

2. Lower attachments, such as illustrated in HVAC-DCS Figure 4-4, shall have a minimum safety factor of two and shall not be used in a manner that would deform the duct shape or cause excessive concentrated load on ducting.
   With respect to HVAC-DCS Figure 4-4, Gripple Hang-Fast system may be adapted to any of the illustrated support configurations except the two-tier trapeze method in the lower right. This adaptation also applies to the strut channel support in Figure 4-5.
   Wire rope support of trapeze bars for oval duct suspension relative to DCS specification S3.18 is acceptable.
   Wire rope passed continuously under round and rectangular duct (with both ends attached overhead) is acceptable provided that duct shape is retained and points of contact with the duct are not overstressed. Use of stress distribution saddles shall be prescribed as necessary.

3. The HVAC-DCS Table 4-1 maximum hanger spacing of 10 feet and Table 4-2 maximum spacing of 12 feet shall be maintained (and decreased as necessary to conform to Gripple #1, #2, #3 and #5 working load limits)
   Since Chapter 4 of the HVAC-DCS has prescribed uses and limits on duct size for single wire supports and the Gripple Hang-Fast System uses stranded ropes that have larger load capacity, use is not restricted to the HVAC-DCS diametrical limits for single wires.

4. When Gripple, Inc allows its hanger wire to be in a non-vertical orientation, it shall, in accordance with accepted engineering practice, provide users with adjustments to its working loads and, as necessary to conform to manufacturers recommendations, approve the method of transfer of loadings to supporting and supported members. This stipulation shall not be construed as pre-empting any duty of an installer to obtain approval of the support system by an appropriate authority prior to making the installation. The SMACNA HVAC-DCS does not specifically provide for non-vertical hanger systems.

5. Criteria for use of Gripple Hang-Fast systems for support of risers is not included in this verification.

Gripple Hang-Fast North America submitted their Gripple Hang-Fast Wire Duct Hanger Systems Number 1,2, 3 and 5 which, consisted of:

1. A "system" with the following components: a zinc coated steel wire rope, a preformed loop created and maintained thereon by a manufacturer supplied and attached ferrule and an attachable loop fixing metal trip; toggle; threaded stud; the wire rope complying with British Standards Institution Standard BS302, parts 1 and 2 1987 Edition.

Conclusion

The SMACNA Testing and Research Institute conducted comprehensive testing through an accredited testing laboratory (ASTM E8 "Standard Test Methods for Tension Testing of Metallic Materials", ASTM A370, "Standard Test Methods and Definitions for Mechanical Testing of Steel Products") and evaluation of the submittal as an acceptable alternative for use with the SMACNA HVAC Duct Construction Standards Metal and Flexible, Second Edition, 1995. This testing and analysis included: minimum and maximum working load ranges tests that will prevent slip and separation of components of the systems; breaking strength of the wire rope; load test for rope systems and failure load tests

Ref: SMACNA Testing & Research Institute July 2002

GRIPPLE®

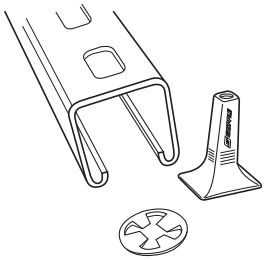
Trapeze No.2

Purpose-made single channel, ideal for use with strut support. Brand new design to facilitate site installations.

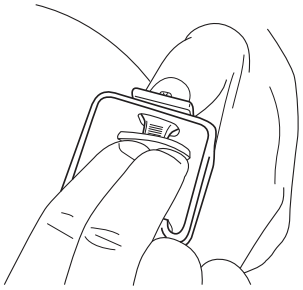
ADVANTAGES

- Ideal for fast suspension of rectangular duct, chilled beams, cable tray, etc.
- Tapered design - accommodates all slots sizes
- Discreet - fits completely inside the strut
- Pre-fits onto strut to ease working at height
- Pin allows rapid adjustment
- Aesthetic design
- Load rated at 100 lbs with a 5:1 safety factor
- Available as an accessory for multi-tiered installations
- Supplied as a ready-to-use kit

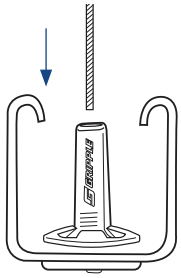
INSTALLATION



Step 1 - Install the Trapeze in one slot of the rail.



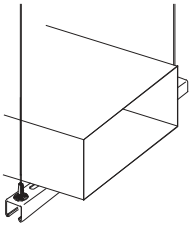
Step 2 - Push the clip until it locks the Trapeze on to the slot.



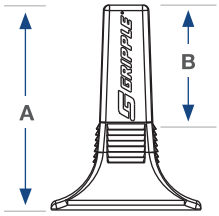
Step 3 - Pass the wire rope through the Trapeze and adjust the height.

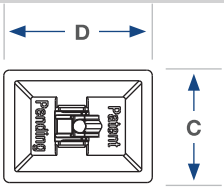
END FIXINGS

For further detailed information on any of our end fixings, please visit our website or contact us using the information below.



PRODUCT DIMENSIONS





Dimension	inches
A	1 ½
B	⅞
C	13⁄16
D	1 3⁄32

CLIP INFORMATION

This clip pre-fits and holds the Trapeze onto the channel.

In preparation for working at height, simply clip onto the Trapeze unit.

Gripple Inc | 1611 Emily Lane | Aurora, IL 60502 | USA
Tel +1 866 474 7753 **Fax** +1 800 654 0689 **email** usinfo@gripple.com
www.gripple.com

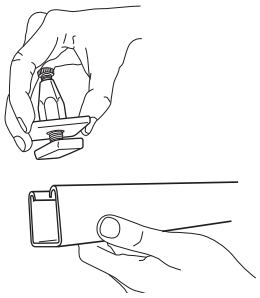
Trapeze No.3 Plus

The new, all steel Trapeze No.3 Plus (MTZ3) with stainless steel 1x19 wire rope is packed with new features to make the suspension of building services even more secure and durable.

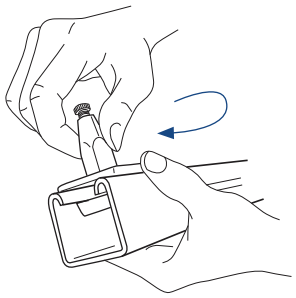
ADVANTAGES

- **Reduced time working at height:** Pre-install into channel using the M10 washer / nut supplied
- **Perfect levelling:** Easy-to-use integral adjustment button
- **Security:** Tighten the locking screw for ultimate security
- **Lightweight yet strong:** 90 kg working load with a 5:1 safety factor
- **Fire resistant:** BRE certified up to 120 minutes
- **Multi-tier:** Channel can be 'stacked' to optimise space
- **Versatile:** Stud, Eyelet and 90 Eyelet end fixings available
- Can be locked on to wire rope to prevent upward movement
- Suitable for multiple channel profiles using M10 channel nuts
- Supplied with 45 mm square plate washer and channel nut or M10 flange nut

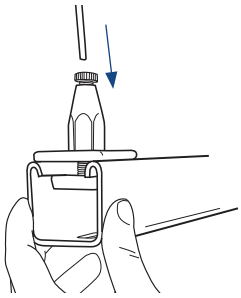
INSTALLATION



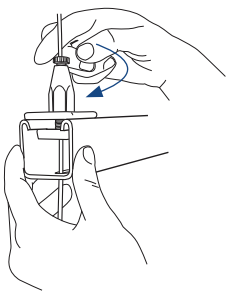
Insert the unit into the channel (compatible with either orientation).



Tighten into channel.

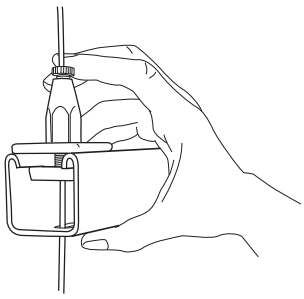


Insert the wire rope.



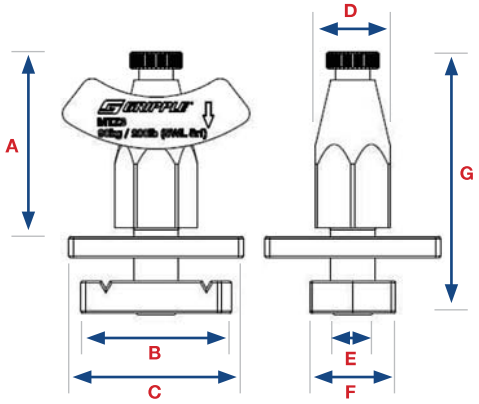
Lock into position by turning the top screw.

ADJUSTMENT



Ensure the locking nut is in the "unlocked" position, and press. Always ensure the load is removed before adjustment.

TECHNICAL SPECIFICATION



Dimension	Size (mm)
A	45
B	35
C	45 x 45 max
D	17
E	M10
F	20
G	60

Gripple Ltd | The Old West Gun Works | Savile Street East | Sheffield S4 7UQ
Tel 0800 018 4264 **Fax** 0114 275 1155 **email** info@gripple.com
www.gripple.com

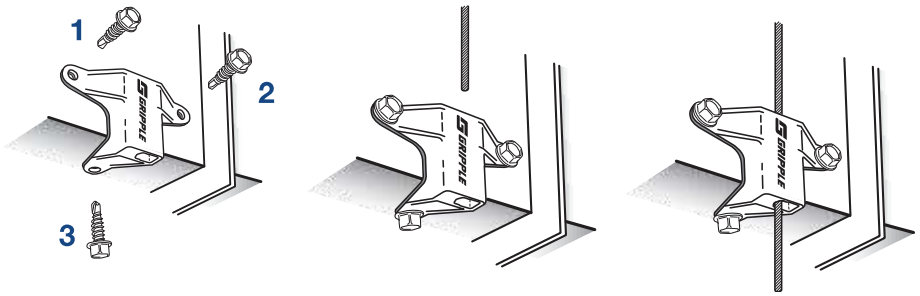
Duct trapeze

Purpose-made single channel, ideal for fast suspension of rectangular ducts.

ADVANTAGES

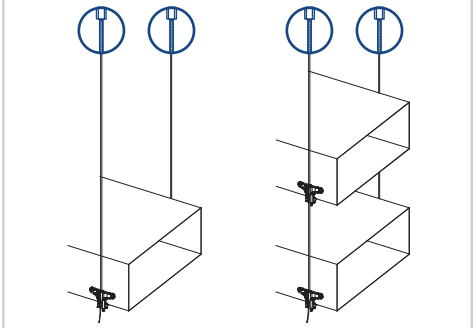
- Eliminates channel support
- 3 attachment points use self-drilling screws to equalize the load
- Pin allows rapid adjustment
- Load rated at 100 lbs with a 5:1 safety factor
- Supplied as a ready-to-use kit
- Available with a wide range of end fixings

INSTALLATION GUIDELINES

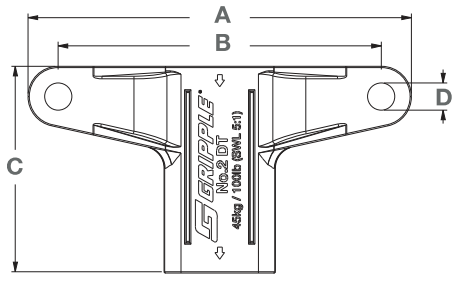


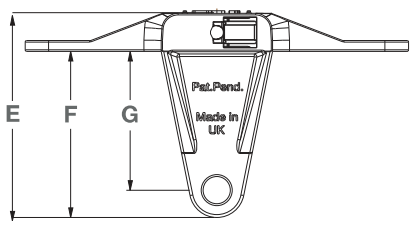
END FIXINGS

For further detailed information on any of our end fixings, please visit our website or contact us using the information below.



PRODUCT SPECIFICATIONS





Dimension	Inches
A	2 25/32
B	2 11/32
C	1 15/32
D	Ø - 13/64
E	1 1/2
F	1 13/64
G	1

Gripple Inc | 1611 Emily Lane | Aurora | IL 60502 | USA
Tel +1 866 474 7753 **Fax** +1 800 654 0689 **email** usinfo@gripple.com
www.gripple.com/us

Gripple 90° Eyelet End Fixing

Suitable for a variety of applications requiring bolting to brackets or fixtures.

PRODUCT INFORMATION

- Designed for shot firing into concrete, steel and wood using gas or powder actuated tools
- Replaces beam and purlin clamps for steel beams
- For sizes No.1, No.2 and No.3. 5:1 Safety factor.
- Large version with 11.2mm hole available in No.3

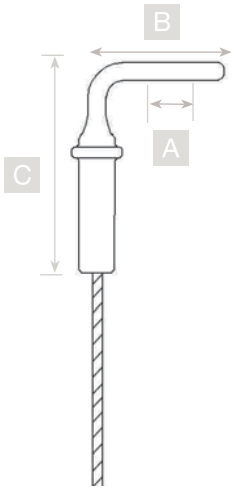
SELECTING THE RIGHT PINS

SUBSTRATE	PRODUCT	No.1	No.2	No.3
Concrete	**SPIT TAPCON®** Pan head 6.5 x 32mm with 14mm flange	✔	✔	✔
	SPIT ATLAS CL35 Spit atlas anchor (C25), *ref. 056990*	✔	✔	✗
	SPIT P370/P200/P60 Powder pin C9-25,*ref. 032520*	✔	✔	✗
	SPIT PULSA 700E GAS CG6-25, *ref. 046620*	✔	Max 30kg	✗
	Hilti DX351-MX X-DNI27P8	✔	Max 40kg	✗
Steel	**TEK SCREWS** Self tapping screw range (1.5mm steel thickness)	✔	✔	✔
	SPIT P370/P200/P60 Pin CS9-15, *ref. 032500*	✔	✔	✔
	SPIT PULSA 700E GAS SCG6-15, *ref.011210*	✔	✔	✗
	HILTI DX351-MX X-EDNI19P8 or X-EDNI22P8	✔	✔	✔
Wood	**SPIT TAPCON®** Pan head 6.5 x 32mm with 14mm flange	pull tests recommended		

90° EYELET & 90° LARGE EYELET SPECIFICATION

The 90° Gripple eyelet is made from zinc plated steel.

Size	A mm	B mm	C mm
No.1	7.5	29	38
No.2	7.5	29	38
No.3	7.5	29	38
No.3 (large)	11.2	22.5	40



Important Information

1. Construction materials and conditions vary on different sites. If it is suspected that the base material has insufficient strength to achieve a suitable fixing, contact Gripple Ltd. The responsibility for judgement of base material strength lies with the installer, and not with Gripple Ltd.

2. The information and recommendations given herein are believed to be correct at time of writing. The data has been obtained from tests done under laboratory, or other controlled conditions and it is the users responsibility to use the data given in light of conditions on site, taking account of the intended use of the products concerned.

3. Whilst Gripple Ltd can give general guidance and advice, the nature of Gripple products means that the ultimate responsibility for selecting the correct product for a particular application must lie with the customer.

4. All products must be used, handled and applied in accordance with current product instructions and manufacturers recommendations for use, published by Gripple Ltd.

5. Gripple's policy is one of continuous development and innovation. We therefore reserve the right to alter specifications, etc. without notice.

Gripple Limited, The Old West Gun Works, Savile Street East, Sheffield S4 7UQ

Gripple Toggle End Fixing

End fixing that is designed for fastening through profile roof decking, light fittings, luminaires and other cavities.

ADVANTAGES

- Combines a plate and end stop to provide a ingeniously fast and simple fixing method.
- Ideal for profile roof decking, light fittings, luminaries and other pre-drilled structures.
- Toggle end fixing is an integral part of the rope, requiring no additional accessories.
- Each size is purpose designed to fit a specific hole diameter:

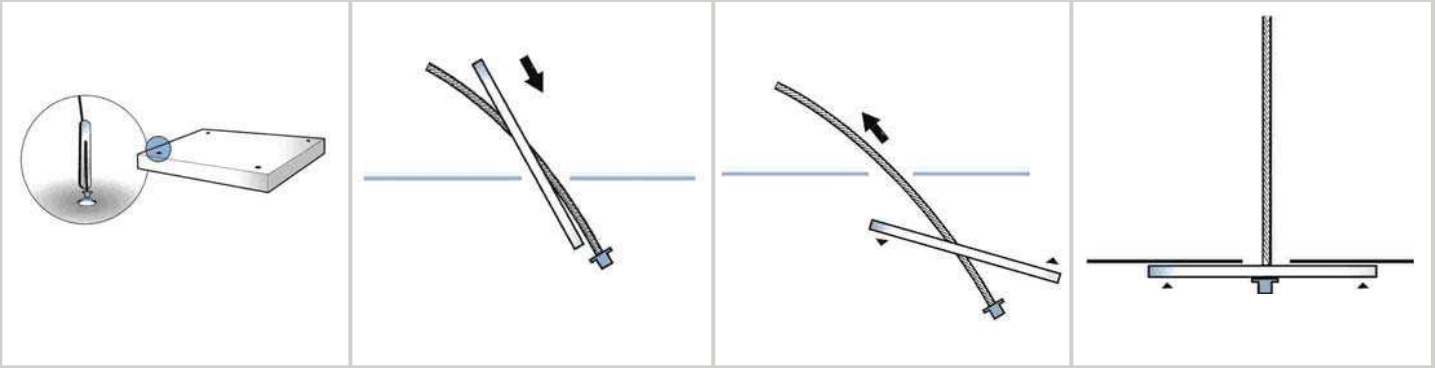
  No.1 - drill 6mm

  No.2 - drill 8mm

  No.3 - drill 10mm

  No.4 - drill 13mm

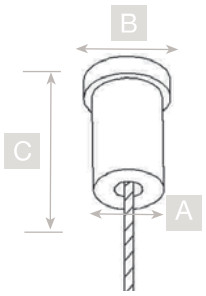
INSTALLATION



1. Push the toggle plate so that it lies almost vertical against rope.
2. Insert into the cavity.
3. Ensure the toggle plate and end stop are within the cavity.
4. Pull on the wire rope to secure the plate in place.

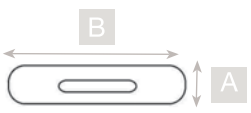
END STOP SPECIFICATION

Size	A mm	B mm	C mm
No.1	4.2	5.9	8
No.2	6.2	7.7	12
No.3	6.2	9.7	18
No.4	8.8	12.4	27



TOGGLE SPECIFICATION

Size	A mm	B mm
No.1	5.7	40
No.2	7.8	40
No.3	9.6	50
No.4	12	65



Important Information

1. Construction materials and conditions vary on different sites. If it is suspected that the base material has insufficient strength to achieve a suitable fixing, contact Gripple Ltd. The responsibility for judgement of base material strength lies with the installer, and not with Gripple Ltd.

2. The information and recommendations given herein are believed to be correct at time of writing. The data has been obtained from tests done under laboratory, or other controlled conditions and it is the users responsibility to use the data given in light of conditions on site, taking account of the intended use of the products concerned.

3. Whilst Gripple Ltd can give general guidance and advice, the nature of Gripple products means that the ultimate responsibility for selecting the correct product for a particular application must lie with the customer.

4. All products must be used, handled and applied in accordance with current product instructions and manufacturers recommendations for use, published by Gripple Ltd.

5. Gripple's policy is one of continuous development and innovation. We therefore reserve the right to alter specifications, etc. without notice.

Gripple Limited, The Old West Gun Works, Savile Street East, Sheffield S4 7UQ

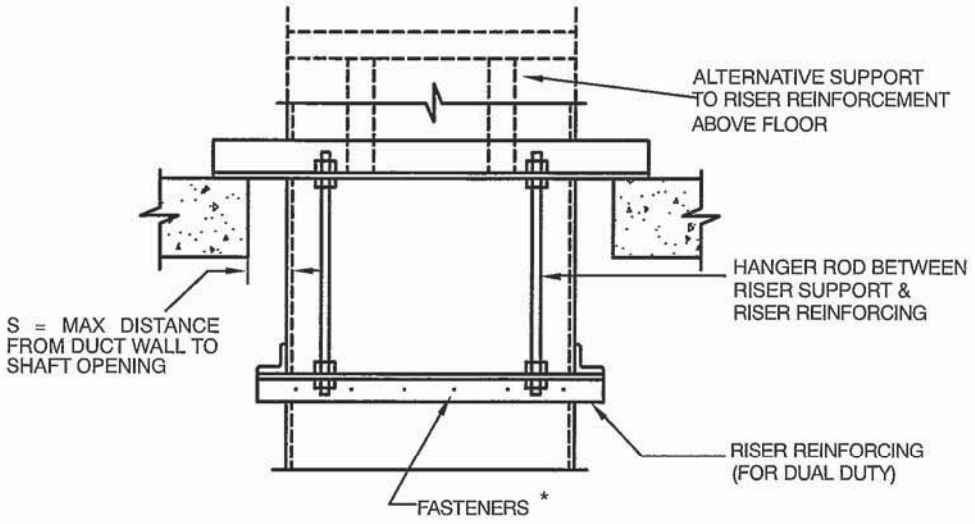


FIG. B

* MINIMUM NUMBER OF FASTENERS
ON EACH OF TWO SUPPORT BARS

LARGEST DUCT DIM.	MINIMUM NUMBER OF FASTENERS
16" and down	2
17" – 24"	3
over 24"	Largest duct dim. Divided by 8

Locate a fastener within 2" of the duct edges. Locate others at evenly spaced intervals, *see* Table 5–4 in Fig 5–9

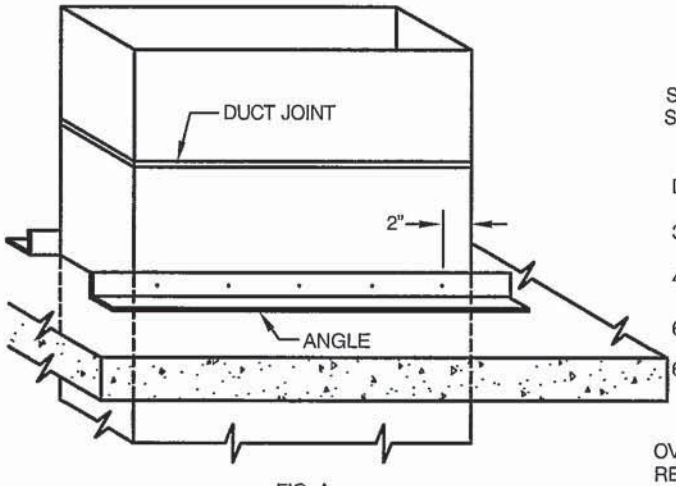


FIG. A

SUGGESTED SIZING FOR
SUPPORT OF 12 FT. OF DUCT

DUCT SIZE	ANGLE
36" x 18"	1 1/2" x 1 1/2" x 1/8"
48" x 24"	1 1/2" x 1 1/2" x 1/8"
60" x 30"	1 1/2" x 1 1/2" x 3/16"
60" x 60"	1 1/2" x 1 1/2" x 1/4" or 2" x 2" x 1/8"

OVER 60" – INCREASE ANGLE SIZE AS
REQUIRED FOR SPACE & DUCT SIZE

SUPPORT RISERS SO THAT THEY ARE IN TENSION

FOR DUCTS UP TO 96" – S = 6" MAX.
FOR DUCTS OVER 96" – S = 8" MAX.
SELECT A PAIR OF ANGLES FROM TABLE 5–3 EACH OF WHICH HAS A CAPACITY OF AT LEAST 50% OF THE DUCT WEIGHT BEING SUPPORTED

FIGURE 5–8 RISER SUPPORTS – FROM FLOOR

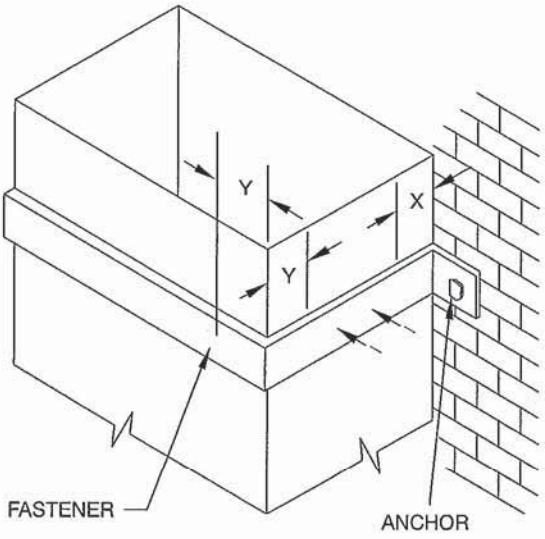


FIG. A

SHOWS SUPPLEMENTAL FASTENER LOCATIONS

FIG. A – SUGGESTED SIZING

DUCT SIZE	BAND
18"x12"	1 1/2"x16 GA.
24"x20"	1"x1/8"

DUCT GAGE	ALLOWABLE LOAD PER FASTENER*
28, 26	25 lb
24, 22, 20	35 lb
18, 16	50 lb

* WELD, BOLT OR NO. 8 SCREW (MIN.) DEVIATION PERMITTED BY OTHER ANALYSIS. X=1", Y=2"; ADD OTHERS TO ACCOMODATE LOAD. MINIMUM OF 3 ON 24" WIDTH AND UP. ADD ALONG SIDES NEAREST ANCHORS.

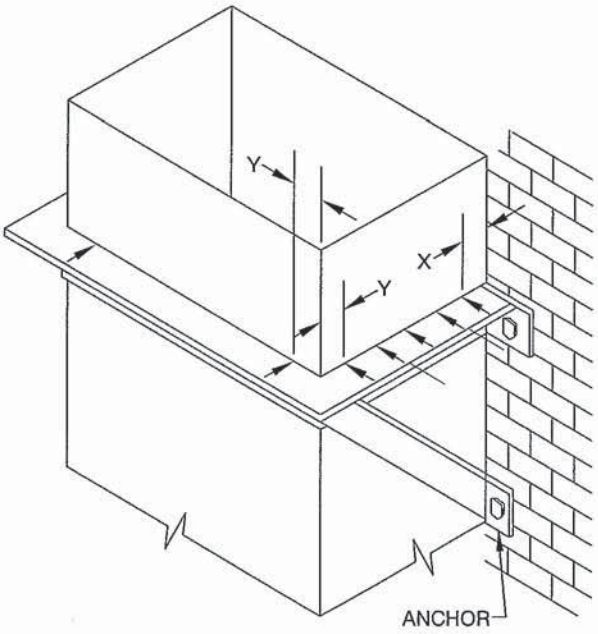
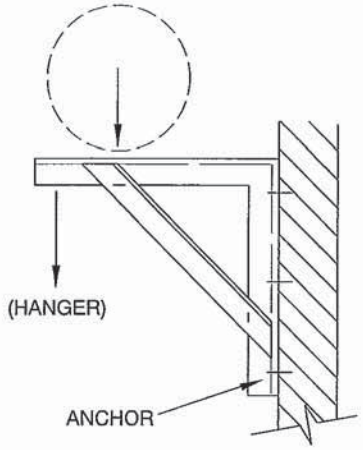


FIG. B



SEE KNEE BRACKET TABLES IN THE ROUND INDUSTRIAL STDS.

FIG. B – SUGGESTED SIZING

DUCT SIZE	ANGLE
30" x 12"	1" x 1" x 1/8"
36" x 18"	1" x 1" x 1/8"
42" x 24"	1 1/4" x 1 1/4" x 1/8"
48" x 30"	1 1/4" x 1 1/4" x 1/8"

NOTES:
1. BRACKETS ARE SIZED FOR 12 FEET OF DUCT, MAXIMUM.
2. LOCATE DUCTS AGAINST WALL OR MAXIMUM OF 2" AWAY FROM WALL.
3. EACH WALL ANCHOR SHALL SATISFY THE FOLLOWING CRITERIA UNLESS OTHER ANALYSIS IS MADE:
   A. TENSILE LOAD = 3/8 x DUCT WEIGHT; SAFETY FACTOR 4.
   B. SHEAR LOAD x 1/2 x DUCT WEIGHT; SAFETY FACTOR 4.

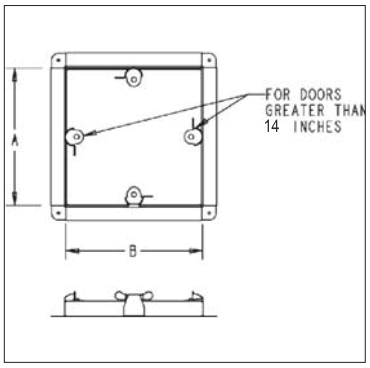
FIGURE 5–9 SUPPORTS FROM WALL

CHAPTER 7

ACCESSORIES

Access Door with press on frame (Cam Lock Only)

Product Data Sheet



Description

Elgen's access door with cam lock only frame is used to access the inside of rectangular ductwork.
Double paneled with front and back metal plates, and 1" insulation

Standard Construction

Door Panel:
Consists of 24GA GA, manufactured from ASTM A-653 G60, panels mechanically locked together.

Insulation:
1" high-density fiberglass insulation UL Classifications; FHC25/50, ASTM C 1071; Type 1, ASTM G 21, Greenguard Indoor Air Quality Certifited*, Greenguard Children and Schools, NFPA 90A and 90B.

Gasket:
Closed-cell neoprene gasket is UL94HF1 listed with service temperature range of 20° F to 200° F The gasket is bonded to the inside of the frame.

Dovetail Frame:
Measuring 6" x 6" to 12" x 12" are manufactured from 24 gauge galvanized steel. Frames measuring 14" x 14" to 24" x 24" are manufactured from 22 gauge galvanized steel. All frames are manufactured with spot welds at each corner for increased strength and an improved dovetail design for easy installation on metal duct.

Cams & Strikes:
The cam is stamped using 16 Ga galvanized steel. The latch is stamped from 20 Ga galvanized steel. Each cam is secured to the door with a rivet. The latch is secured to the frame in two locations for added rigidity.

Features

Meets 2005 SMACNA Standards for pressure class & gauges(Refer to page 7-2, figure 7-2)
Regular doors can be used up to 4"wg
High Pressure doors can be used up to 10"wg
Union Made

Optional Construction

Closed cell foam insulation(in place of fiberglass)
Additional Cams
Neoprene gasket bonded outside of the frame
Stainless Steel 304
Stainless Steel 316
Aluminum
PCD
Galvanneal (Paint Grip)

Hi-Pressure (Up to 10" W.G. +/-):
20GA and Fully Welded
1/16" Diameter Galvanized Cable-wire
Locking Haps for Padlocks

Packaging

Size A x B	Flange Size	# of Cams	Box Qty	Weight (lbs)
6 x 6	1	2	48	1.5
8 x 8	1	2	20	2.2
10 x 10	1	2	20	3
12 x 12	1	2	16	3.9
14 x 14	1	2	5	6.5
16 x 16	1	4	5	8
16 x 12	1	4	5	6.5
18 x 18	1	4	4	9.6
18 x 12	1	4	4	7
20 x 20	1	4	4	11.5
24 x 24	1	4	4	15.1
24 x 12	1	4	4	9
24 x 18	1	4	4	12.3

Guarantee

All Elgen products are guaranteed by Elgen Manufacturing against defective material.

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10 Railroad Ave, Closter NJ 07624
Tel: 800.503.9805 :: Fax: 201.964.9030
info@elgenmfg.com :: www.elgenmfg.com

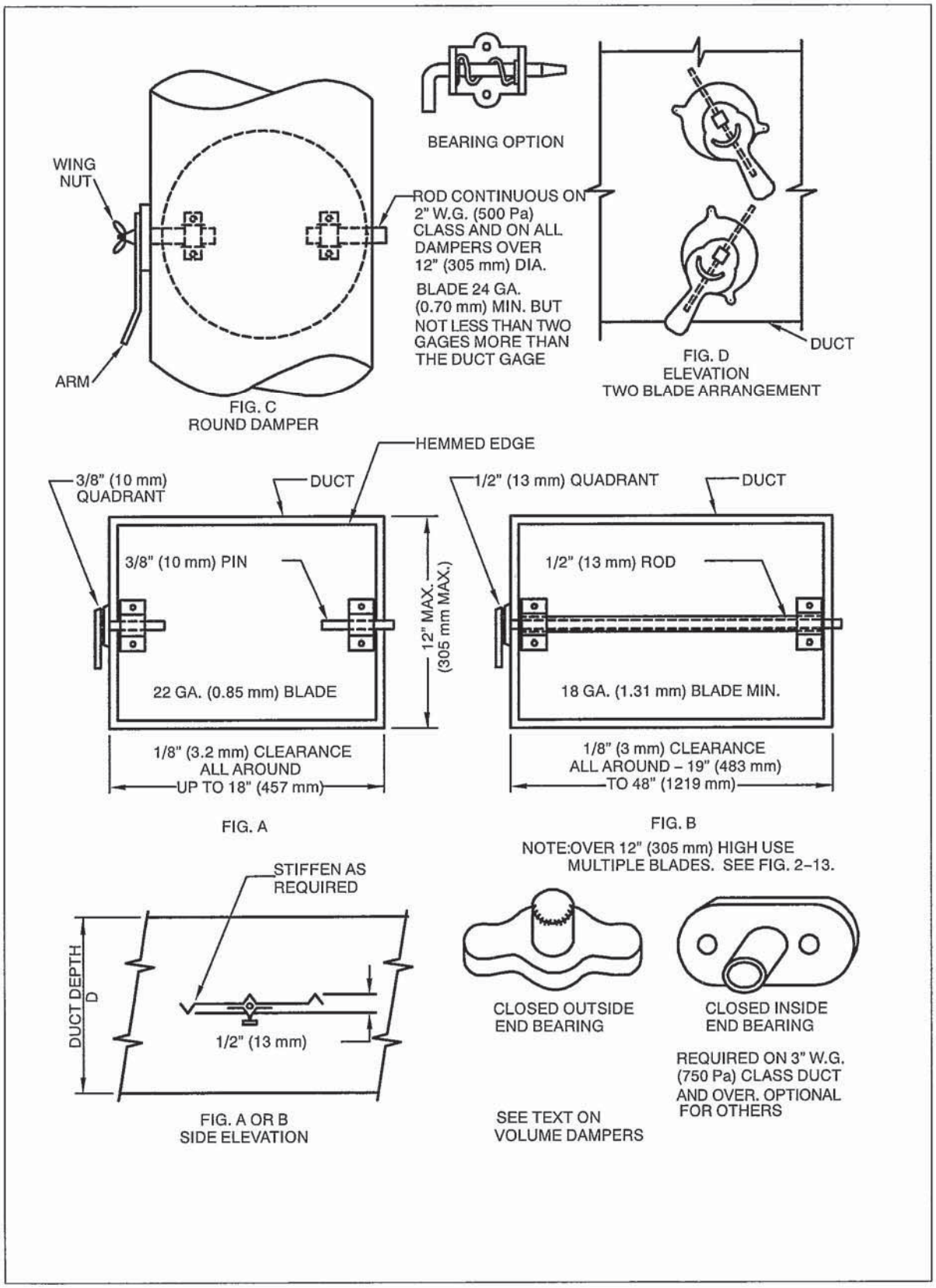


FIGURE 7–4 VOLUME DAMPERS – SINGLE BLADE TYPE

GREENHECK

MBD-15

Multi-Blade Manual Balancing Damper

Application and Design

Model MBD-15 is a manual balancing damper designed to regulate the flow of air in a HVAC system. They are not intended to be used in applications as a positive shut off or for automatic control. Design incorporates heavy gauge galvanized steel construction for durability and longevity. MBD-15 meets SMACNA's recommended construction requirements for manual balancing dampers.

Ratings

Pressure: 2.0 - 4.0 in. wg (0.5 kPa - 1 kPa) - pressure differential.
Velocity: 2000 fpm (10.2m/s)
Temperature: 180°F (82°C)

Construction	Standard	Optional
Frame Material	Galvanized Steel	-
Frame Thickness	16 ga. (1.5mm)	-
Frame Type	5 in. x 1 in. (127mm x 25mm) Channel	-
Blade Material	Galvanized steel	-
Blade Thickness	16 ga. (1.5mm)	-
Blade Type	3V	-
Blade Operation	Opposed	Parallel
Axle	1/2 in. (13mm) dia. Plated Steel	-
Axle Bearings	Synthetic (acetal) sleeve	Bronze
Linkage Material	Plated Steel	-
Operator	1/2 in. (13mm) Locking manual quadrant with 1 1/2 in. (38mm) standoff bracket for external insulation	-
Extension Pin	1/2 in. (13mm) Diagonal glass reinforced polymer extends 3 1/2 in. (89mm) beyond frame	1/2 in. (38mm) Steel extension pin

Size Limitations

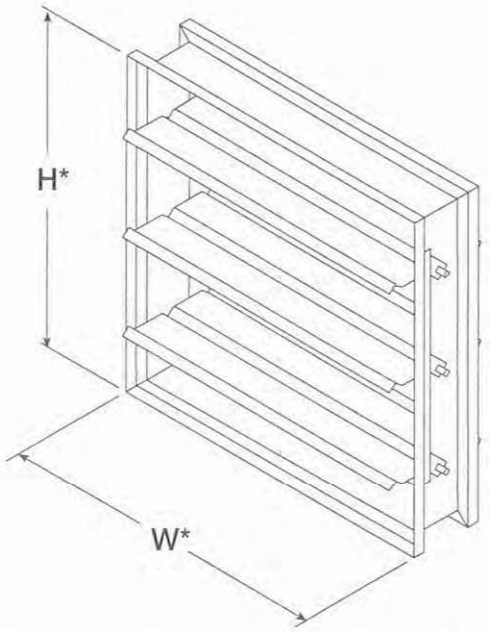
W x H	Minimum Size	Maximum Size	
		Single Section	Multiple Section
Inches	6 x 6	48 x 60	96 x 96
mm	152 x 152	1219 x 1524	2438 x 2438

Features

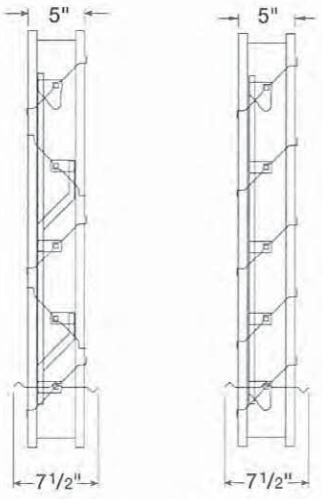
- Linkage concealed in jamb.

Options (at additional cost)

- 2 in. (51mm) stand off bracket
- Galvanized steel sleeves
- Flanges



*W&H dimension furnished approximately ¼ in. (6mm) undersize.



Opposed Blade Parallel Blade

Installation instructions available at www.greeenheck.com

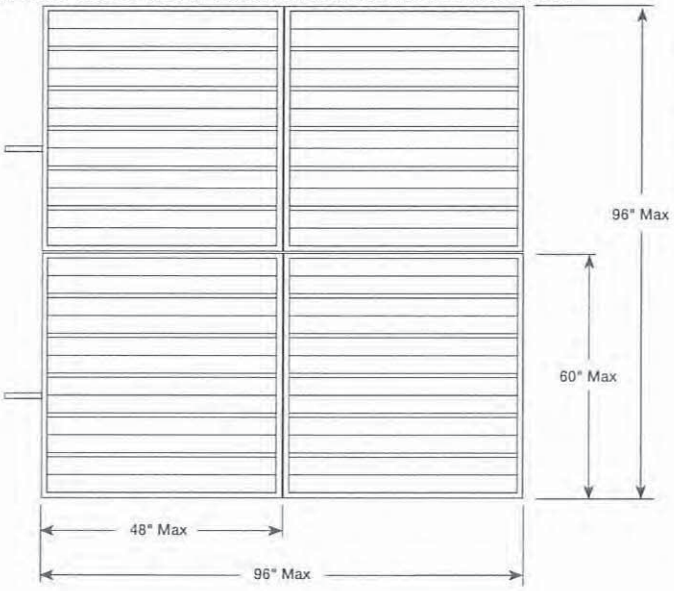
Performance Data

Damper Width in. (mm)	Maximum System Pressure in. wg (kPa)	Maximum System Velocity fpm (m/s)
48 (1219)	2 (.5)	2000 (10.2)
36 (914)	2.5 (.63)	
24 (610)	3 (.75)	
12 (305)	4 (1)	

NOTE: Maximum recommended system pressure and velocity ratings are conservative to prevent misapplication. Dampers are structurally capable of withstanding higher limits, however it is recommended that Greenheck be contacted for an engineering evaluation before exceeding these limits.

Temperature: Applications above 180°F (82°C) may require special considerations.

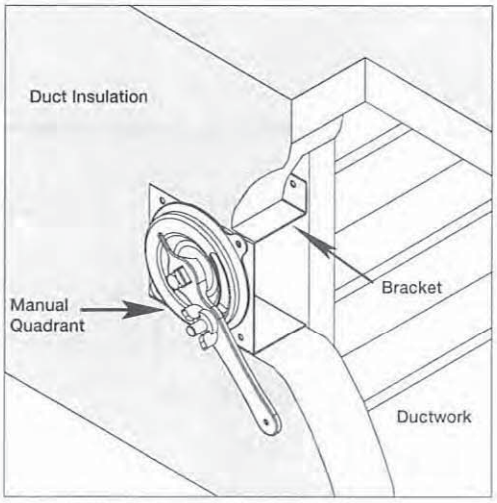
Maximum Size and Installation Information



Maximum size for a MBD-15 is 96 in. W x 96 in. H (2438mm x 2438mm). Dampers over 48 in. (1219mm) wide and/or 60 in. (1524mm) high are shipped as 2 equal sections (requiring field assembly).

For dampers larger than 96 in. W x 96 in. H (2438mm x 2438mm), use Greenheck model VCD-20 series.

Standoff Bracket



1½ in. (38mm) standoff bracket is standard. It is used to extend the manual quadrant away from the ductwork to accommodate external insulation.

Specifications

Manual balancing dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules.

Dampers shall consist of: a 16 ga. (1.5mm) galvanized steel hat channel frame with 5 in. (127mm) depth; triple V type blades fabricated from 16 ga. (1.5mm) galvanized steel; ½ in. (12mm) dia plated steel axles; external (out of the airstream) blade-to-blade linkage.

Damper manufacturer's printed application and performance data including pressure, velocity and temperature limitations shall be submitted for approval showing damper suitable for pressures to 4.0 in. w.g. (1 kPa), velocities to 2000 fpm (10.2m/s) and temperatures to 180°F (82°C). Testing and ratings to be in accordance with AMCA Standard 500-D.

Basis of design is Greenheck model MBD-15.

NOTE: Temperatures in excess of 180°F (82°C) require special consideration.

GREENHECK
P.O. Box 410 • Schofield, WI 54476-0410 • 715.359.6171 • greenheck.com

Elevated Damper Regulators

Product Data Sheet

Features

All Metal Construction
Raised handle for ease of turning
Locking mechanism allows for any angle of damper blade
Construction of punched tab on handle holds the rod firm to eliminate raddle noises

Description

Elgen's Elevated Damper Regulators are used on rectangular and round duct work. Using an elevated base allows for insulation to be flush with the handle. The size of the standoff is determined by the Engineer, or the thickness of the insulation.

Optional Construction

Stainless Steel 304
Stainless Steel 316
Aluminum

Standard Construction

Handle is stamped from 15 GA ASTM A-653 Galvanized Steel
Base is stamped from 20 GA ASTM A-653 Galvanized Steel
Bolt and wing nut are Grade 2 zinc plated.

Packaging

Item#	Box Quantity	Shaft Size	Height
EE-121	100	1/4"	1"
EE-122	100	1/4"	1-1/2"
EE-123	100	1/4"	2"
EE-124	100	3/8"	1"
EE-125	100	3/8"	1-1/2"
EE-126	100	3/8"	2"
EE-127	100	1/2"	1"
EE-128	100	1/2"	1-1/2"
EE-129	100	1/2"	2"

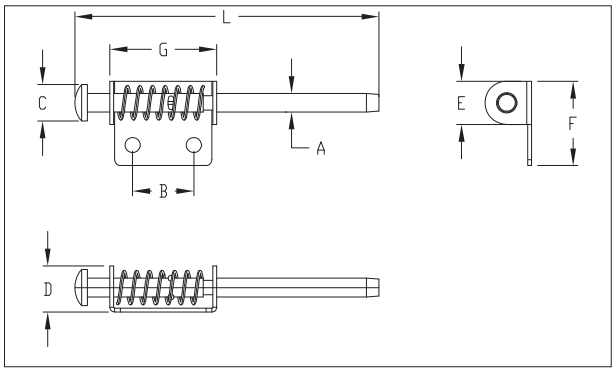
Guarantee

All Elgen products are guaranteed by Elgen Manufacturing against defective material.

Elgen Manufacturing
10 Railroad Ave, Closter NJ 07624
Tel: 800.503.9805 :: Fax: 201.964.9030
info@elgenmfg.com :: www.elgenmfg.com

SPRING END BEARINGS

Product Data Sheet



Description

Elgen's Spring End Bearing is used conjunction with damper blade or controlling the damper inside the ductwork.

Features

Corrosion resistant
The spring enables easy installation

Standard Construction

Manufactured from Zinc Plated carbon steel

Item	A (In)	B (in)	C (in)	D (in)	E (in)	F (in)	G (in)	L (in)
RP-6	1/4	5/8	3/8	1/2	1/2	7/8	1-1/8	2-1/2
RP-6XL	1/4	5/8	5/8	1/2	1/2	7/8	1-1/8	4
RP-7	3/8	7/8	7/16	3/4	5/8	1-3/16	1-7/16	2-1/2
RP-7XL	3/8	7/8	7/16	3/4	5/8	1-3/16	1-7/16	4

Packaging

Item#	Box Qty
GE1031	100
GE1007	100
GE1032	100
GE1008	100

Guarantee

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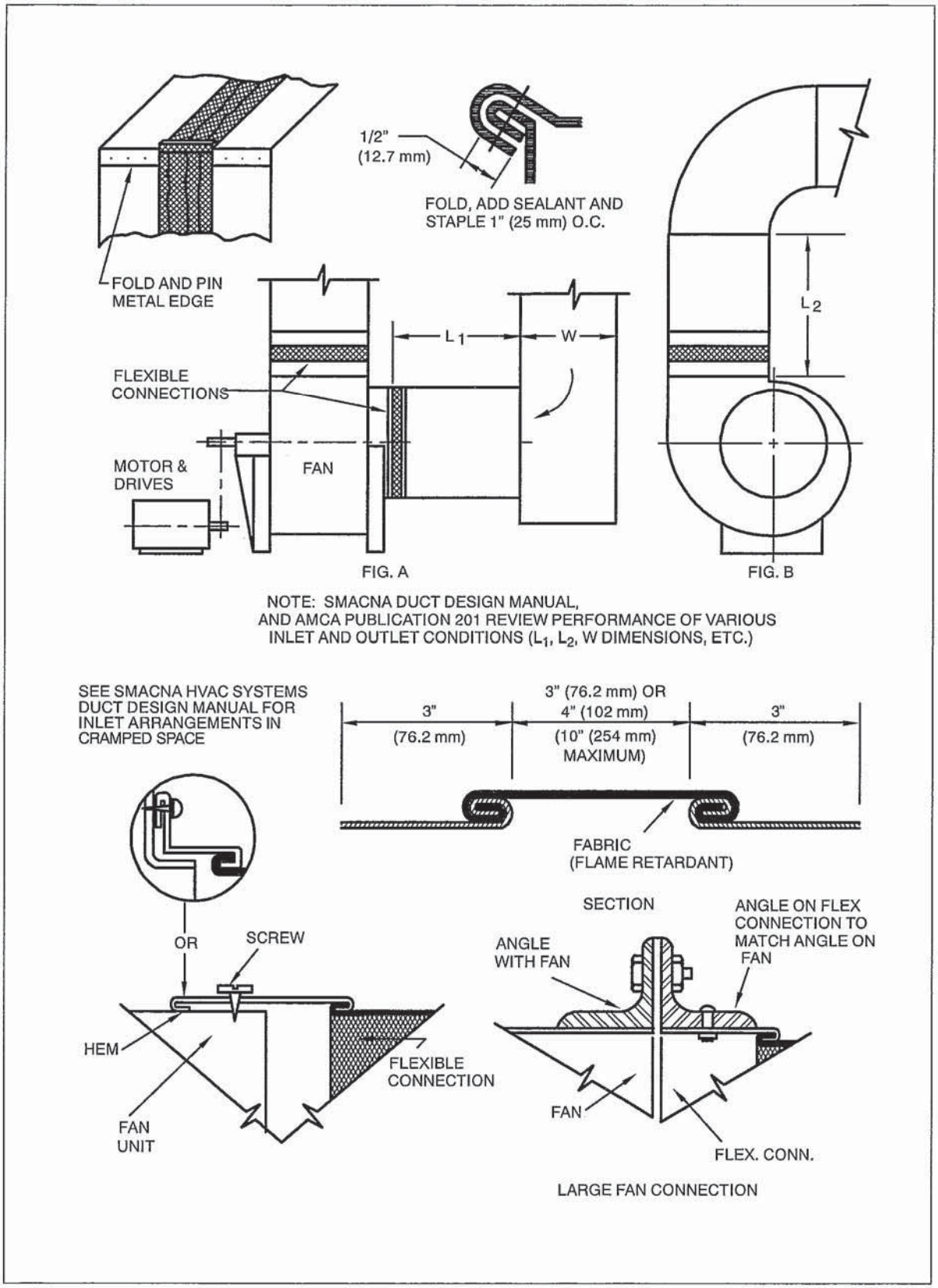
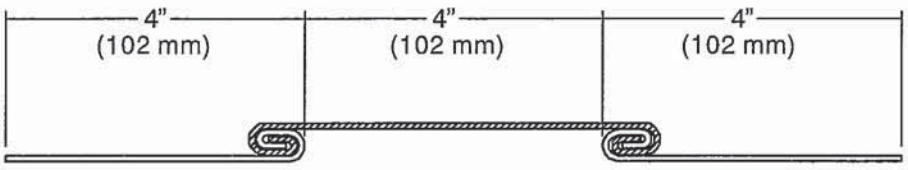
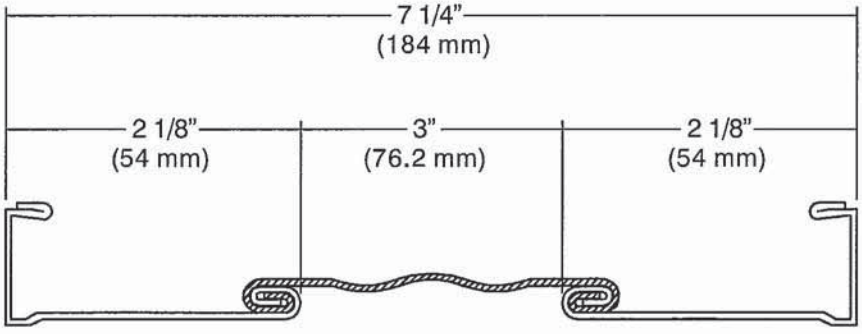


FIGURE 7–8 FLEXIBLE CONNECTIONS AT FAN



4/4/4 FLEX CONNECTION



T–25 a FLANGES
ON A 4/4/4 FLEX CONNECTION

FIGURE 7–9 ALTERNATIVE FLEX CONNECTOR DETAILS

SUBMITTAL RECORD
JOB _____
LOCATION _____
SUBMITTED TO _____
SUBMITTAL PREPARED BY _____
APPROVED BY _____
DATE _____

Submittal Form DDFDC Flexible Duct Connector

DESCRIPTION

All air duct installations for heating, cooling or ventilation are attached to mechanical equipment containing a fan or blower. Vibrations, noises and rattles resulting from operation of the fan or blower are transmitted into the metal ducts which carry the noises throughout the system.

In order to isolate the vibration and noises to the source, an air - tight flexible joint, consisting of a fabric which is attached to sheet metal on both side, must be inserted between the equipment and the ductwork. This vibration isolator is called a "Flexible Duct Connector".

RELATED NFPA 90A & 90B STANDARDS

2-3.2.2 Vibration isolation connectors in duct systems shall be made of an approved flame-retardant fabric or shall consist of sleeve joints with packing of approved material, each having a maximum flame spread index of 25 and a maximum smoke developed index of 50. Exception: Approved flame-retardant fabric having a maximum length of 10 in. (25.4 cm) in the direction of airflow-**NFPA No. 90A 1999**

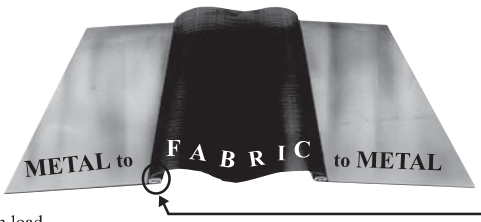
2-1.1.1 Exception No. 3: Vibration isolation connectors in duct systems shall be made of approved flame-retardant fabric or shall consist of sleeve joints with packing of approved noncombustible material. The fabric shall not exceed 10 in. (254 mm) in length in direction of airflow-**NFPA No. 90B 1999**

FABRIC COMPARISONS	Excelon[5] ☐	Neoprene ☐	Durolon ☐	Insulflex* ☐	Thermafab® ☐	Teflon ☐	Glasseal ☐
UL Classified File #	R4462	R4462	R4462	n/a	R4462	n/a	R4462
Continuous Temp. Range	-40˚F. to 180˚F.	-40˚F. to 200˚F.	-40˚F. to 250˚F.	-40˚F. to 180˚F.	-65˚F. to 500˚F.	-150˚F. to 500˚F.	-40˚F. - 180˚F.
Color	Black	Black	White	Black	Grey	Grey Outside/ Beige Inside	Grey & Black
Weight Per Square Yard	22	30	26	28 (composite weight)	17	16.5	16
Abrasion Resistance[1]	15,000 cycles	600 cycles	500 cycles	500 cycles	125 cycles	1,000 cycles	1,400 cycles
Leakage Resistance[2]	350	595	250	125	400	650	120
Tear Strength[3]	100/100	12/12	12/12	8/11	50/40	50/30	8/9
Tensile Strength[4]	240/220	500/450	225/300	70/70	200/150	400/300	90/90
Base Fabric	Woven Nylon/ Polyester Blend	Woven Fiberglass	Woven Fiberglass	Polyester	Woven Fiberglass	Fiberglass/ Satin Weave	Woven Fiberglass
Coating	Vinyl	Neoprene	Hypalon	Vinyl	Silicon Rubber	Teflon	Vinyl
Features	High Tear Strength High Abrasion Resistance	General Purpose	Excellent Ozone and Weathering Resistance Best Overall Acid Resistance Recommended for rooftop applications Unaffected by mildew	Low Smoke Emission Insulated 3-4-3 Configuration	Very Low Smoke Emission High Temperature Resistant	High Temperature Resistant High Corrosion Resistance Excellent Chemical Resistance	Resistant to Acids & Chemical Fumes Resistant to Grease & Alkalies Unaffected By Mildew
Codes							
Metal-Fab 3x3x3 Grip Loc	MBX333 (#10159)	MFN333 (#10003)	MFD333 (#10002)	IDC343 (#10173) *Gauge: 28 +Guard Loc	MFT333 (#10005)	MCT333 (#10278)	MGL333 (#10004)
Super Metal-Fab 3x6x3 Grip Loc	MB6X363 (#10160)	MF6N363 (#10012)	MF6D363 (#10011)	Not Available	MF6T363 (#10013)	Not Available	MF6G363 (#10016)
TDC/TDF 4x4x4 Grip Loc	MBX444 (#10210) MSPX444 (#10264) MBX464 (#10214)	MFN444 (#10211) MFN464 (#10246)	MFD444 (#10237) MFD464 (#10245)	Not Available	Not Available	MCT444 (#10279)	Not Available

All Metal-Fab, Super Metal-Fab and TDC/TDF Flexible Duct Connectors are manufactured with 24 gauge galvanized steel.
Duro Dyne meets or exceeds the SMACNA steel requirements for flexible duct connector.
Other materials are available upon request.
Stainless Steel configurations utilize 304 or 316 grade material.

Notes:

1. Abrasion resistance as per Federal Test Standard 191 Method #5306 using CS 17 wheel with 250 Gram load.
2. Leakage resistance as per Federal Test Standard 191 Method #5512. Results in P.S.I.
(To convert inches of water multiply P.S.I. x 27.176.).
3. Tear strength in tongue pounds as per Federal Test Standard 191 Method #5134.1 (warp/fill).
4. Tensile strength in grab pounds as per Federal Test Standard 191 Method #5100 (warp/fill).
5. Standard Excelon is not LA city approved. Use Excelon-LA when LA city approval is necessary.
(See Specification Form Excelon-LA - 203)



All Duro Dyne Flexible Duct Connector Products are suitable for pressures of -10 to +15 wg. Duro Dyne's standard 'single fold' metal to fabric grip has been tested by an independent testing laboratory to withstand a negative pressure of -10"WC and a positive pressure of +17.25" WC with no tearing or visible separation.

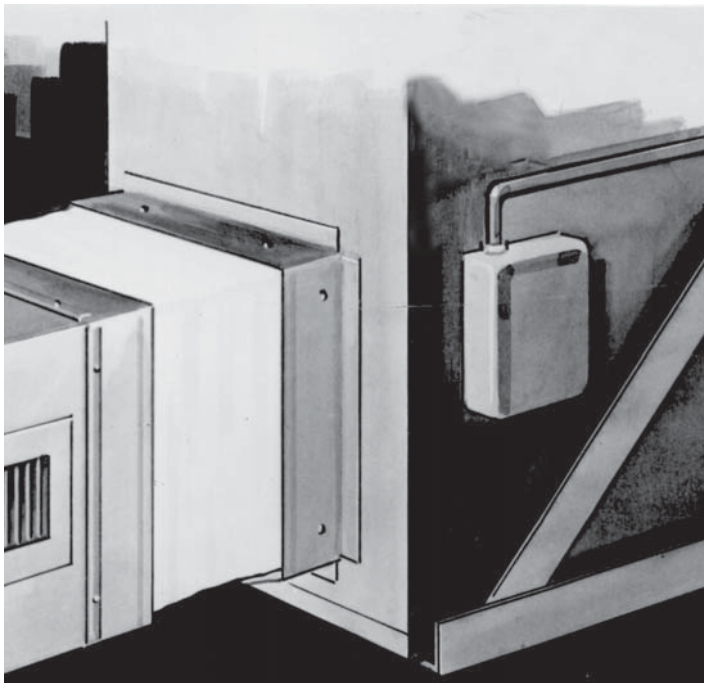
SUGGESTED SPECIFICATION

Vibration Isolating Flexible Duct Connector For Heating, Cooling & Exhaust Supplies & Returns.

At the inlet and discharge of all air handling equipment(unless otherwise noted) furnish and install vibration isolators. Vibration isolators shall be a coated woven fabric named _____ and shall be "Underwriters Laboratories Classified".

Vibration isolators shall have a tear strength of not less then _____, and a continuous temperature range of _____ .Vibration isolators shall be preassembled metal to exposed fabric to metal. Fabric and metal shall be joined by means of a double lock seam.

Vibration isolators shall be code_____ (called Flexible Duct Connectors) as manufactured by Duro Dyne Corporation, Bay Shore, N.Y.



Specifications

All Listed Duro Dyne Flexible Duct Connector Fabrics are designed to meet the following specifications:

1. MIL-C-20696B Para. 4.4.3. (Oil Resistance).
2. MIL-C-20696B Para. 4.4.4. (Hydro Carbon Resistance).
3. NFPA 90A Installation of Air Conditioning and Ventilating Systems Para. 4.3.2.2 2012 Edition.
4. NFPA 90B Warm air heating and air conditioning systems. Para. 4.1.1.1.3.1 2012 Edition. *(*See note 1 below)*
5. NFPA701 Tests for Flame Propagation of Fabrics and film.
6. California State Fire Marshal Approved.
7. Los Angeles City Approved. *(*See note 2 below*)
8. Denver City Approved.

All Duro Dyne Flexible Duct Connectors utilize galvanized steel meeting ASTM-A-525 G 60 or better.

Duro Dyne Flexible Duct Connectors are also available with 300 series stainless steel or 3003 aluminum upon request.

***Note 1* -** Standard Excelon does not currently meet NFPA 90B 2012 but does meet all previous editions. Use Excelon-LA if NFPA 90B 2012 approval is necessary.

****Note 2* -** Standard Excelon is not LA city approved. Use Excelon-LA when LA city approval is necessary. (See Submittal Form for Excelon-LA)

CHEMICAL RESISTANCE

(X = Extremely Resistant)
(NR = Not Recommended)
(O = No Data Available)

Chemical	Excelon	Neoprene	Durolon	Insulflex	Thermafab	Teflon	Glasseal
Acetic Acid	NR	X	X	NR	NR	X	NR
Aluminum Chloride	X	X	X	X	X	X	X
Aluminum Sulfate	X	X	X	X	X	X	X
Ammonia (Anhyd)	X	X	X	X	X	X	X
Ammonium Hydroxide	X	X	X	X	X	X	X
Ammonium Sulfate	X	X	X	X	X	X	X
Barium Sulfide	X	X	X	X	O	X	X
Black Sulfate Liquor	X	X	X	X	NR	X	X
Boric Acid	X	X	X	X	X	X	X
Butyl Alcohol	NR	X	X	NR	NR	X	NR
Cadmium Plating Solution	X	NR	NR	NR	O	O	X
Calcium Chloride	X	X	X	X	X	X	X
Calcium Hypochlorite	X	NR	X	X	O	X	X
Chlorine Water	X	NR	NR	X	NR	O	X
Chromic Acid	X	NR	X	X	O	X	X
Chromium Plating Solution	X	O	O	NR	O	O	X
Citric Acid	X	X	X	X	X	X	X
Copper Chloride	X	X	X	X	O	X	X
Copper Sulfate	X	X	X	X	O	X	X
Cottonseed Oil	X	X	X	X	X	O	X
Diacetone Alcohol	NR	X	X	NR	O	O	NR
Disodium Phosphate	X	NR	NR	X	O	O	X
Ethyl Alcohol	NR	X	X	NR	NR	X	NR
Ethylene Glycol	NR	X	X	NR	X	X	NR
Ferric Chloride	X	X	X	X	X	X	X
Ferric Sulfate	X	X	X	X	X	X	X
Fluroboric Acid	X	X	X	NR	O	O	X
Formaldehyde (40%)	X	X	X	X	O	X	X
Formic Acid	X	X	X	X	O	X	X
Glucose	X	X	X	X	X	X	X
Glycerine	NR	X	X	NR	X	X	NR
Heptane	NR	X	X	NR	O	X	NR
Hexane	NR	X	X	NR	O	X	NR
Hydrobromic Acid (40%)	NR	X	X	NR	O	X	NR
Hydrochloric Acid (conc)	NR	X	X	NR	NR	X	NR

Chemical	Excelon	Neoprene	Durolon	Insulflex	Thermafab	Teflon	Glasseal
Hydrofluoric Acid (100%)	NR	X	X	NR	NR	X	NR
Hydrogen Peroxide	X	NR	X	X	NR	NR	X
Hydrogen Sulfide	X	X	X	X	O	X	X
Lactic Acid	NR	X	X	NR	O	X	NR
Linseed Oil	NR	X	X	NR	X	O	NR
Magnesium Chloride	NR	X	X	NR	NR	X	NR
Maleic Acid	X	NR	X	X	X	O	X
Methyl Alcohol	NR	X	X	NR	NR	X	NR
Methyl Cellosolve	NR	X	X	NR	NR	O	NR
Mineral Oil	X	X	X	X	NR	X	X
Naptha	NR	NR	NR	NR	X	X	NR
Nickel Chloride	X	X	X	X	O	X	X
Nickel Sulfate	X	X	X	X	X	X	X
Nitric Acid (40%)	X	NR	X	X	NR	X	X
Oleic Acid	X	NR	NR	X	NR	X	X
Oleum	NR	NR	X	NR	O	X	NR
Oxalic Acid	X	X	X	X	X	X	X
Phosphoric Acid (85%)	NR	X	X	NR	X	X	NR
Pickling Solution	X	NR	X	X	O	O	X
Potassium Chloride	X	X	X	X	O	O	X
Potassium Cyanide	X	X	X	X	O	X	X
Potassium Dichromate	X	X	X	X	O	X	X
Potassium Hydroxide (40%)	X	X	X	NR	X	X	X
Potassium Sulfate	X	X	X	X	O	X	X
Propyl Alcohol	NR	X	X	NR	NR	O	NR
Sodium Chloride	X	X	X	X	X	X	X
Sodium Hydroxide (40%)	NR	X	X	NR	X	X	NR
Sodium Hypochlorite	NR	NR	X	NR	NR	X	NR
Steam	NR	X	NR	NR	O	X	NR
Sulfur Dioxide (Liquid)	NR	X	X	NR	X	X	NR
Sulfuric Acid (50%)	X	NR	X	NR	NR	X	X
Sulfuric Acid (over 50%)	NR	NR	X	NR	NR	X	NR
Tannic Acid	X	X	X	X	O	X	X
Vinegar	X	X	X	X	X	X	X

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Duro Dyne Midwest Division, Hamilton, OH 513-870-6000 Fax: 513-870-6005
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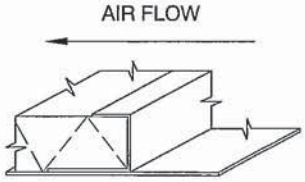
NOTE:

SEE TYPICAL DUCT BRANCH ENTRY CONDITION IN FIG. 4–6.

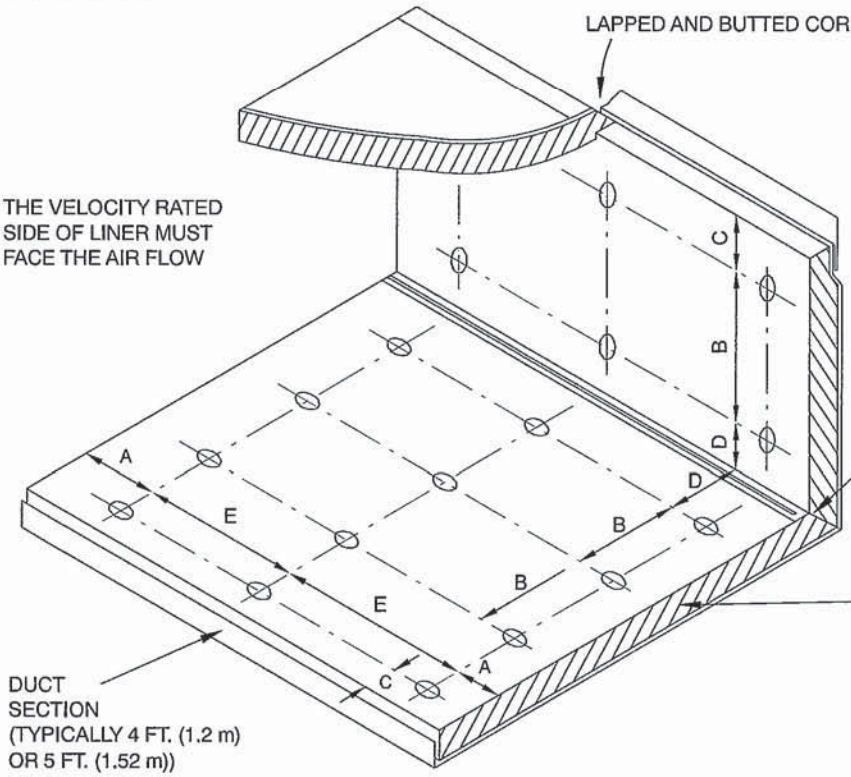
METAL NOSING MUST BE USED WHEREVER LINER IS PRECEDED BY UNLINED METAL; OTHERWISE WHEN VELOCITY EXCEEDS 4000 FPM (20.3 MPS) USE METAL NOSING ON EVERY LEADING EDGE. NOSING MAY BE FORMED ON DUCT OR BE CHANNEL OR ZEE ATTACHED BY SCREWS, RIVETS OR WELDS.



DETAIL – A

METAL NOSING
CHANNEL OR ZEE

INTERIOR WIDTH OF 8" (200 mm) AND LESS DOES NOT REQUIRE PINS.



MAXIMUM SPACING FOR FASTENERS. ACTUAL INTERVALS ARE APPROXIMATE.

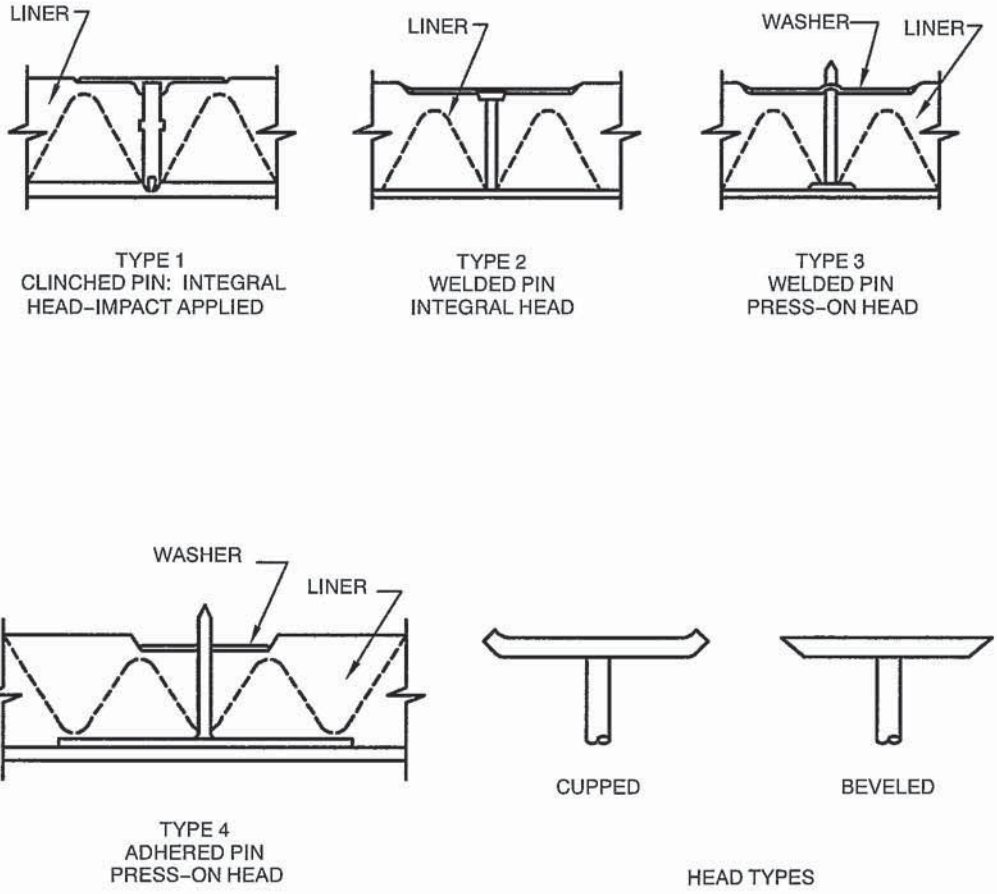
LINER ADHERED TO THE DUCT WITH 90% MIN. AREA COVERAGE OF ADHESIVE

"A" PIN ROW MAY BE OMITTED WHEN METAL NOSING IS USED. "E" THEN STARTS FROM THE NOSING.

Velocity *	Dimensions				
	A	B	C	D	E
0 – 2500 FPM (0 – 12.7 MPS)	3" (76.2)	12" (305)	4" (102)	6" (152)	18" (457)
2501 – 6000 FPM (12.7 – 30.5 MPS)	3" (76.2)	6" (152)	4" (102)	6" (152)	16" (406)

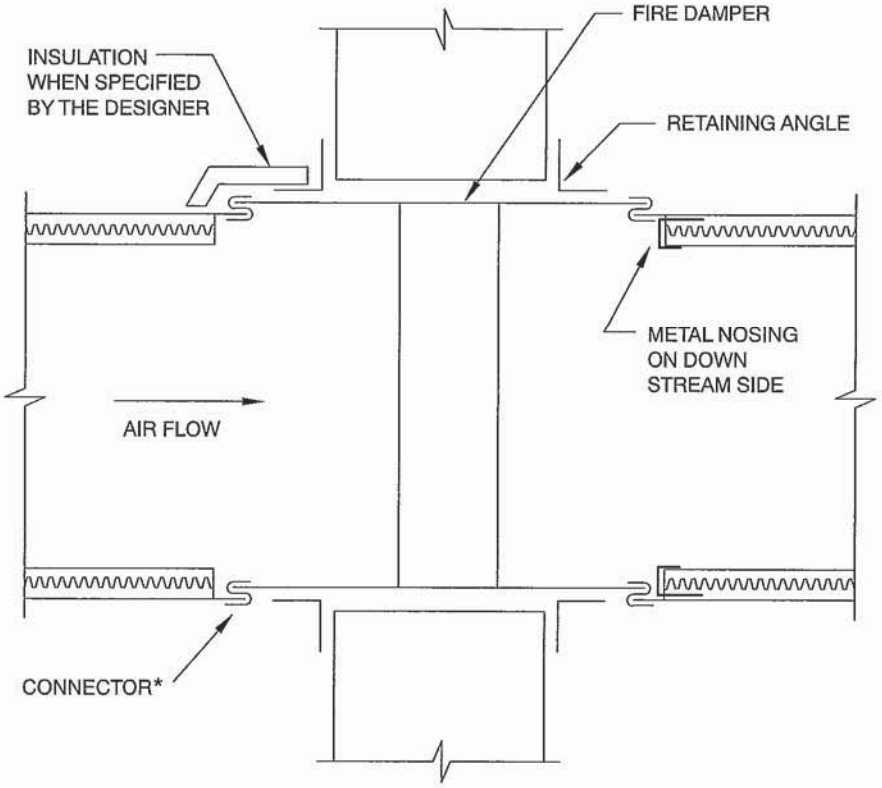
* UNLESS A LOWER LEVEL IS SET BY MANUFACTURER OR LISTING AGENCY

FIGURE 7–11 FLEXIBLE DUCT LINER INSTALLATION



INSTALLED PINS AND WASHERS SHALL NOT COMPRESS LINER MORE THAN THE CORRECT LENGTH SPECIFIED FOR THE LINEAR THICKNESS USED.

FIGURE 7–12 LINER FASTENERS



Interruption of duct liner at fire damper (to avoid impairing damper operation) is required by NFPA Standard 90A. Where 90A is applicable, installation may be made as shown and should otherwise conform to the Duct Liner Installation Standards.

The designer should consider the possibility and consequences of condensation occuring on unlined or uninsulated metal at penetrations and should specify control measures.

This illustration and text does not address features of fire damper installations unrelated to duct liner.

* S Slip illustrated; see type of connections permitted as a condition of damper listing.

FIGURE 7–14 DUCT LINER INTERRUPTION

Linacoustic® RC

Fiber Glass Duct Liner With Reinforced Coating System

Description

Linacoustic RC is a flexible duct liner insulation made from strong, glass fibers bonded with a thermosetting resin. The airstream surface is protected with JM's exclusive Reinforced Coating system, which combines our state-of-the-art Permacote® acrylic coating with a flexible glass mat reinforcement to provide a smooth airstream surface.

Factory-Applied Edge Coating

Edge coating is factory applied to the edges of the liner core, assuring coverage of the leading edges per NAIMA/SMACNA requirements. Shop fabrication cuts may be coated with the SuperSeal® Duct Butter and edge treatment products (refer to publication AHS-202).

Uses

Linacoustic RC is specifically designed for lining sheet metal ducts in air conditioning, heating and ventilating systems, providing superior acoustical and thermal performance.

General Properties

Operating temperature (max.) - ASTM C 411	250°F (121°C)
Air velocity (max.) - ASTM C 1071	6,000 fpm (30.5 m/sec)
Water repellency - INDA IST 80.6	≥6
Fungi resistance - ASTM C 1338	Does not breed or promote
Fungi resistance - ASTM G 21	No growth
Bacteria resistance - ASTM G 22	No growth

Standard Thicknesses and Packaging

Thickness		Roll Length		Roll Widths for All Thicknesses*	
in	mm	lineal feet	lineal meters	in	mm
½	13	100, 150, 200	31, 46, 61	34 to 36	864 to 914
1	25	50, 100, 150, 200	15, 31, 46, 61	44 to 48	1118 to 1219
1½	38	50, 100	15, 31	56 to 60	1422 to 1524
2	51	50	15	66 to 72	1676 to 1829

**Available in ¼" (6.4 mm) increments.*

Contact your Regional Sales Office for stock items and availability of special sizes.

Surface Burning Characteristics

Linacoustic RC meets the Surface Burning Characteristics and Limited Combustibility of the following standards:

Standard/Test Method

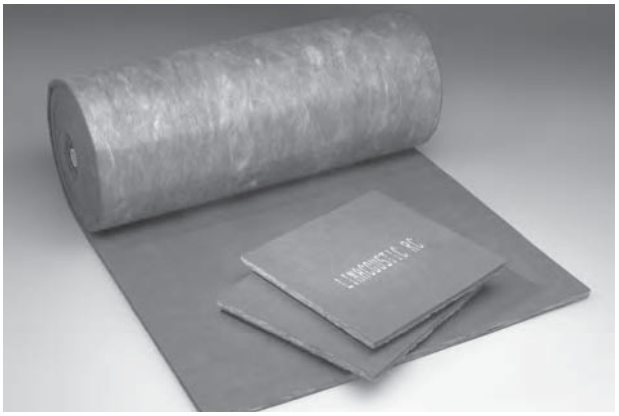
- ASTM E 84
- UL 723
- NFPA 255
- NFPA 90A and 90B
- NFPA 259
- CAN/ULC S102-M88

Maximum Flame Spread Index	25
Maximum Smoke Developed Index	50

UL labels supplied on packages when requested on order.

Specification Compliance

- ASTM C 1071, Type I
- ASTM G 21 and G 22
- ICC Compliant
- California Title 24
- ASHRAE 62
- SMACNA Application Standards for Duct Liners
- NAIMA Fibrous Glass Duct Liner Installation Standard
- Canada: CGSB 51-GP-11M and CAN/CGSB 51.11



Advantages

Improves Indoor Building Environment. Linacoustic RC improves indoor environmental quality by helping to control both temperature and sound.

Resistant to Dust and Dirt. The tough, acrylic polymer Permacote coating helps guard against the incursion of dust or dirt into the substrate, minimizing the potential for biological growth.

Will Not Support Microbial Growth. Permacote coating is formulated with an immobilized, EPA-registered, protective agent to protect the coating from potential growth of fungus and bacteria.

Linacoustic RC duct liner meets all requirements for fungi and bacterial resistance. Tests were conducted in accordance with ASTM C 1338 and ASTM G 21 (fungi testing) and ASTM G 22 (bacteria resistance testing). Detailed information is available in Johns Manville fact sheet HSE-103FS.

Note: As with any type of surface, microbial growth may occur in accumulated duct system dirt, given certain conditions. This risk is minimized with proper design, filtration, maintenance and operation of the HVAC system.

Cleanability. If HVAC system cleaning is required, the Reinforced Coating airstream surface may be cleaned with industry-recognized dry methods. See the North American Insulation Manufacturers Association (NAIMA) "Cleaning Fibrous Glass Insulated Air Duct Systems."

Highly Resistant to Water. The Reinforced Coating surface provides superior resistance to penetration of incidental water into the fiber glass wool core.

Green Building Attributes

GREENGUARD®. This certification is proof that the product meets the Environmental Institute's indoor air quality standards for VOCs.

Linacoustic® RC

Fiber Glass Duct Liner With Reinforced Coating System

Installation

Linacoustic RC installation must be performed in accordance with the requirements of the NAIMA Fibrous Glass Duct Liner Standards, or SMACNA HVAC Duct Construction Standard. All transverse edges, or any edges exposed to airflow, must be coated with an approved duct liner coating material, such as Johns Manville SuperSeal® products.

Minimizes Pre-Installation Damage. Linacoustic RC's Reinforced Coating system is highly resistant to damage that can occur during in-shop handling, fabrication, jobsite shipping, and installation.

Easy to Fabricate. Linacoustic RC is light in weight and easy to handle. Clean, even edges can be accurately cut with regular shop tools.

Thermal Performance

Thickness		R-Value		Conductance	
in	mm	(hr•ft²•°F)/Btu	m²•°C/W	Btu/(hr•ft²•°F)	W/m²•°C
1/2	13	2.2	0.39	0.46	2.61
1	25	4.2	0.74	0.24	1.36
1 1/2	38	6.3	1.11	0.16	0.91
2	51	8.0	1.41	0.13	0.74

R-Value and Conductance are calculated from the material thermal conductivity tested in accordance with ASTM C 518 at 75°F (24°C) mean temperature.

Sound Absorption Coefficients (Type "A" Mounting)

Thickness		Sound Absorption Coefficient at Frequency (Cycles per Second) of						
in	mm	125	250	500	1000	2000	4000	NRC
1/2	13	0.07	0.20	0.44	0.66	0.84	0.93	0.55
1	25	0.08	0.31	0.64	0.84	0.97	1.03	0.70
1 1/2	38	0.10	0.47	0.85	1.01	1.02	0.99	0.85
2	51	0.25	0.66	1.00	1.05	1.02	1.01	0.95

Coefficients were tested in accordance with ASTM C 423 and ASTM E 795.

ISO 9000 Certification

Johns Manville mechanical insulation products are designed, manufactured and tested in our own facilities, which are certified and registered to stringent ISO 9000 (ANSI/ASQC 90) series quality standards. This certification, along with regular, independent third-party auditing for compliance, is your assurance that Johns Manville products deliver consistent high quality.

Johns Manville

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specJM.com

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Denver, CO 80217
(800) 368-4431
Fax: (303) 978-4661

The physical and chemical properties of Linacoustic® RC Fiber Glass Duct Liner with Reinforced Coating System listed herein represent typical, average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice. Numerical flame spread and smoke developed ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions. Check with the Regional Sales Office nearest you to assure current information. **All Johns Manville products are sold subject to Johns Manville's standard Terms and Conditions including Limited Warranty and Limitation of Remedy. For a copy of the Johns Manville standard Terms and Conditions, Limited Warranty and Limitation of Remedy, and information on other Johns Manville thermal insulations and systems, call (800) 654-3103.**

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