



* Revised to be in compliance with SMACNA HVAC Duct Construction Standards, 2nd ed., 1995.

Duct Construction Standards

For

Positive & Negative Static Pressures

And

Submittal Data Engineering Specifications

WARD
INDUSTRIES

CONSULTANTS TO THE SHEET METAL INDUSTRY

111 Riverview Drive • Monessen, PA 15062 • (724) 684-5500 • 1-800-466-9374 FAX (724) 684-8697 • www.wardind.com

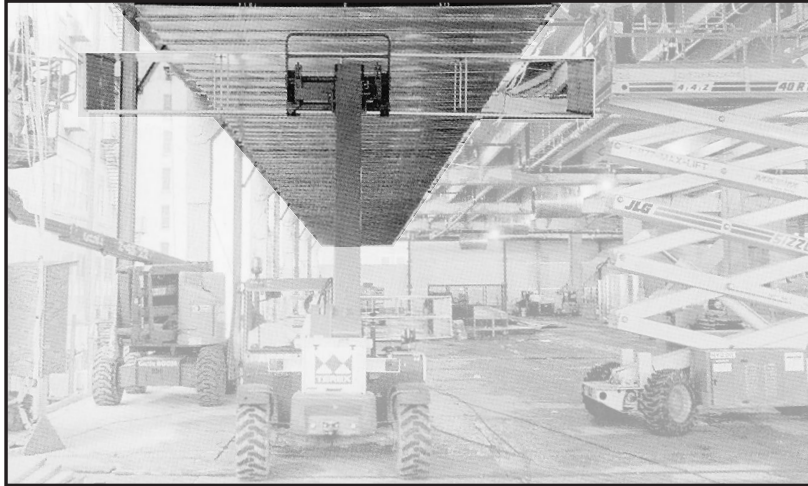


Foreword

For twelve years Ward Industries has pioneered the use of the four-bolt system for transverse duct connection. Ward Industries was one of the first to bring the four-bolt connector to the market and through engineering and innovation it has also been a leader in improvements.

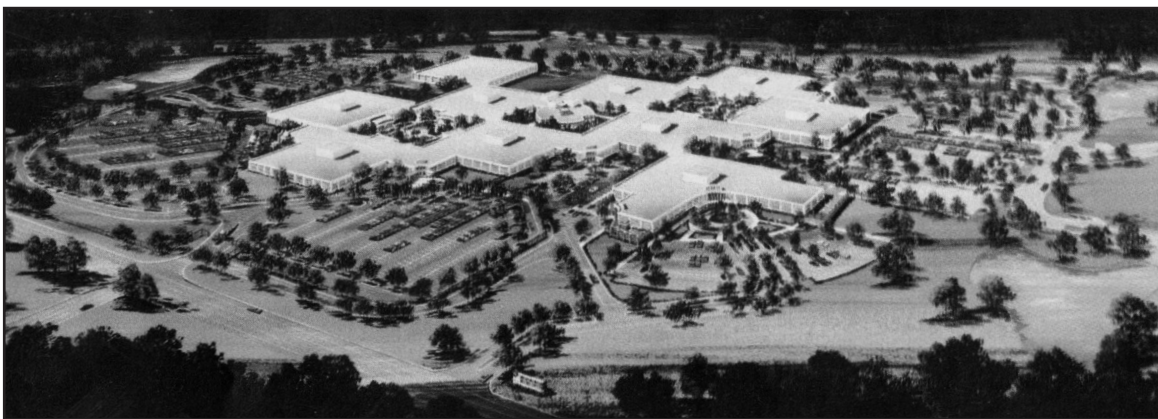
Over the years, Ward customers have successfully installed over 375 million feet of flange in thousands of installations. Examples of Ward products at work are shown below.

David L. Lawrence Convention Center – Pittsburgh, PA



Because of the Four – Bolt Connection, the 20' wide sections of ductwork can be lifted into place with a forklift. Using this method, more than 40 feet of the huge system can be installed per day.

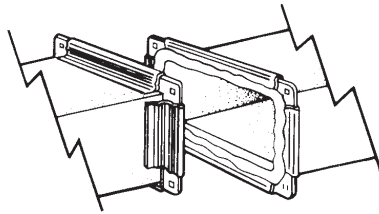
IRS Service Buildings – Memphis, Tennessee



Building Complexes cover over 30 acres under one roof.

42 Miles of Ward H and J Flange Installed
Tested at 9" Static Pressure
Less than 1% Leakage

WARD INDUSTRIES SYSTEMS ARE



. . . . AN ENERGY SAVING DUCT REINFORCEMENT CONNECTION

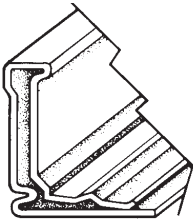
THE THREE WARD INDUSTRIES SYSTEMS . . .

provide an innovative means of joining two sections of sheet metal ductwork and provide a stronger, tighter leakproof duct connection which . . .

- Lower the cost of the sheet metal installation and
- provide a significant savings in operating costs.

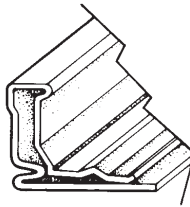
WARD INDUSTRIES COMPONENTS

Recommended for 26 ga. through and including 14 ga. ductwork



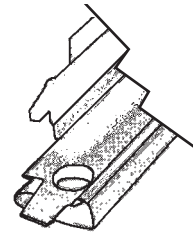
J SYSTEM

Rollformed from 20 ga.
galvanized steel.
11 Ga. Galvanized Corner



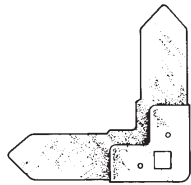
H SYSTEM

Rollformed from 22 ga.
galvanized steel.
11 Ga. Galvanized Corner
Large sealant pocket on all three flange systems



E SYSTEM

Rollformed from 26 ga.
galvanized steel.
No Corners Needed
patent#5450879

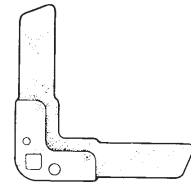


J CORNER

11 ga. galvanized steel

SEALANT

Flame Spread - 5
Smoke Density - 0
Fuel Contribution - 0
Life Expectancy - 20 year minimum

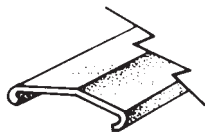


H CORNER

11 ga. galvanized steel

WARD INDUSTRIES METAL CLEAT

- Available in both 6" pieces and 10' lengths
- Suitable for driving in tight installations
 - Also available in PVC



Roll formed from
20 ga. galvanized steel

WARD INDUSTRIES GASKET

Available in Butyl and Closed Cell Neoprene

BUTYL GASKET

Flame Spread - 20
Fuel Contribution - 0
Smoke Density - 0
Thickness - 3/16"
Life Expectancy - 20 yr. min.
Flash Point - 300° F
Compression set - none

NEOPRENE GASKET

Flame Spread - 10
Fuel Contribution - 0
Smoke Density - 0
Thickness - 5/16"
Unlimited Shelf Life



To Whom It May Concern:

SUBJECT: Duct construction other than
that in the HVAC-DCS-1985

The foreword of the 1985 HVAC-DCS states that "Although standardization intrinsically involves selection, no intention of discrimination against the use of any product or method that would serve a designer's need equally or better exists." Additionally, recognition of equivalent or other construction is acknowledged in the text as follows:

1. Italicized wording in Paragraph One on page 1-12 states "a fifth alternative, that of using non-illustrated construction, is recognized — based on sponsor demonstrated equivalency subject to the approval of authorities regulating use of this voluntary acceptance standard. SMACNA does not validate equivalency."
2. Text on page 1-14 states that "certain joints have been assigned maximum pressure classes. Such restrictions are not intended to prohibit consideration of other limits where evidence of acceptability is presented under the equivalent construction principle."
3. Paragraph S 1.18 on page 1-15 states that "Other construction that meets the functional criteria in Section VII or is as serviceable as that produced by the construction tables may be provided."
4. A sentence on page 1-37 says "See Figure 1-4A for commentary on proprietary joint systems and see Section VII for joint performance evaluation."
5. The text on page 1-38 "invites authorities to consider alternative constructions" and says "consult the manufacturers of alternative systems for ratings, assembly requirements and recommendations".
6. Note 3 on page iv states that "the Association refrains from endorsement of proprietary products." Note 4 on this page says "the Association will not review or judge products of components as being in compliance with the document."
7. Paragraph S 3.3 on page 3-2 says "Nothing herein is intended to constitute implied disapproval of the designer's consideration of other methods of construction."
8. Paragraph S 3.26 on page 3-13 states that "Illustrations of accessories and sleeves and collars are representative of a class of such items and are not intended to preclude the use of components not precisely identical to these."
9. Three alternative procedures for rating construction relative to the SMACNA tables are given on page 7-5, analysis, historical track record and testing. Commentary on witnessing tests and on use of test data is provided in the last paragraph on page 7-11, ending with "Authorities are invited to evaluate such construction based on evidence presented by sponsors." Otherwise, the performance criteria used for the SMACNA rectangular duct tables are given in Section VII. General performance requirements are discussed on Page 1-3.

We think that these statements from the HVAC-DCS reflect a clear policy of SMACNA's abstention from judging unillustrated components and systems as being equivalent while encouraging consideration of them based on evidence presented by sponsors. Otherwise, SMACNA has not published or authorized any addenda for the 1985 HVAC-DCS.

Sincerely,

John H. Stratton
Director, Technical Services

1/2" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS RECTANGULAR DUCT REINFORCEMENT Minimum Rigidity Class* - Minimum Gage Duct Reinforcement Spacing												
	8'	6'	5'	4'	3'	2 1/2'	2'						
26" dn	E-26	E-26	E-26	E-26	E-26	E-26	E-26						
27-30"	E-26	E-26	E-26	E-26	E-26	E-26	E-26						
31-36"	E-24	E-26	E-26	E-26	E-26	E-26	E-26						
37-42"	E-24	E-24	E-26	E-26	E-26	E-26	E-26						
43-48"	E-22	E-24	E-26	E-26	E-26	E-26	E-26						
49-54"	H-20	H-22	E-26	E-26	E-26	E-26	E-26						
55-60"	H-20	H-22	E-24	E-24	E-26	E-26	E-26						
61-72"	H-18	H-20	H-22	J26T	H-24	H-24	H-24	H-24					
73-84"	J-16	H-18	H-22	J26T	H-24	H-24	H-24	H-24					
85-96"	J-16	J-18	J22T	H-20	J22	H-22	H-22	H-22	H-22				
97-108"			J22T	J-18	J22T	J-18	J22T	H-18	J-22	H-18	J-22	H-18	J22
109-120"			J22T		J22T		J22T	J-18	J22T	H-18	J-22	H-18	J22

When referring to Table 1-3 thru Table 1-10 in the SMACNA HVAC Duct Construction Standards, 2nd ed., 1995,

- Use the Ward "E" Angle on Rigidity Class "E" and below;
- Use the Ward "H" Angle on Rigidity Class "F", "G" and "H"
- Use the Ward "J" Angle on Rigidity Classes above "H"

The tables as shown herein are the SMACNA Tables with those interpretations already substituted.

By conducting Joint Performance Testing as described in Section VII of the SMACNA HVAC Duct Construction Standards, 2nd ed., 1995, it was found that in some tests, the Ward Angles (E,H and J) permitted a more liberal interpretation of the SMACNA Tables.

These tests results are shown as follows:

SMACNA Table



Variation
permitted per
certified test.

It is understood that some awarding authorities might not permit the "variation" even though its acceptance is described in the SMACNA HVAC Duct Construction Standards, 2nd ed., 1995, and therefore both options have been shown. The results of these certified tests which permit the variation are shown on the back page of this manual. *Also, both options have been shown, so as to provide this manual as a quick reference to SMACNA Standards.*

¹ Other 4 bolt manufacturers have prepared duct construction standards, but Ward Industries is the only manufacturer that is in full compliance with the SMACNA HVAC Duct Construction Standards 2nd ed. in so much as they have had all of their flanges tested in accordance with Chapter 7, and also have certified tests from an outside independent testing laboratory (Pittsburgh Testing Laboratories) for all the optional variations from the SMACNA HVAC Duct Construction Standards 2nd ed. as shown.

1" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS RECTANGULAR DUCT REINFORCEMENT Minimum Rigidity Class* - Minimum Gage Duct Reinforcement Spacing											
	8'	6'	5'	4'	3'	2 1/2'	2'					
14" dn	E-26	E-26	E-26	E-26	E-26	E-26	E-26					
15-20"	E-26	E-26	E-26	E-26	E-26	E-26	E-26					
21-24"	E-24	E-26	E-26	E-26	E-26	E-26	E-26					
25-30"	E-24	E-26	E-26	E-26	E-26	E-26	E-26					
31-36"	E-22	E-24	E-24	H-26	E-26	E-26	E-26					
37-42"	H-20	E-22	E-24	H-26	E-26	E-26	E-26					
43-48"	H-18	H-20	H-22	H-26	H-26	E-26	E-26					
49-54"	H-18	H-20	H-22	J26	H-24	J-26	E-24	J-26	E-24	J-26	E-24	J-26
55-60"	H-18	H-20	H-22	J26	H-24	J-26	H-24	J-26	E-24	J-26	E-24	J-26
61-72"		H-18	H-18	J ₂₄ ²⁴ / _{26T}	H-22	J26T	H-24	J26T	H-24	J-26	H-24	J-26
73-84"		J-16	J-18	J24T	J-20	J22	H-22	J22	H-22	J-24	H-22	J-24
85-96"			J-16	J-20	J-18	J-20	J-20	J22	H-20	J-22	H-22	
97-108"				J22T	J-18	J22T	J-18	J22T	J-18	J-22	J-18	J-22
109-120"				J22T		J22T	J-18	J22T	J-18	J-22	J-18	J-22

* Each duct system shall be constructed for the specific duct pressure classifications shown on the contract drawings for the project. Where no specific duct pressure class designations are provided by the designer, the 1" water gage pressure class is the basis of compliance with these standards, regardless of velocity in the duct, except when the duct is variable volume: All variable volume duct upstream of VAV boxes has a 2" w.g. basis of compliance when the designer does not give a pressure class.

*Because total pressure decreases in the direction of the flow, a duct construction pressure classification equal to fan outlet pressure (or to fan total static pressure rating) cannot economically be imposed on the entire duct system. Pressure in ducts near room air terminals is nearly always below 1/2" w.g.

*Asterisks indicate wording that is taken directly and verbatim from the SMACNA HVAC Duct Construction Standards, 2nd ed., 1995.

SMACNA TABLE 1-2 DUCT SEALING REQUIREMENTS		
Seal Class Class	Sealing Required	Static Pressure Construction Class
A	All transverse joints, longitudinal seams and duct wall penetrations	4" w.g. and up
B	All transverse joints and longitudinal seams	3" w.g.
C	Transverse Joint	2" w.g.

In addition to the above, any variable air volume system duct of 1" and 1/2" w.g. construction class that is upstream of the VAV boxes shall meet Seal Class C.

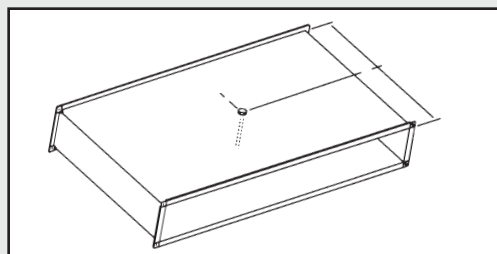
2" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS RECTANGULAR DUCT REINFORCEMENT Minimum Rigidity Class* - Minimum Gage Duct Reinforcement Spacing												
	8'	6'	5'	4'	3'	2 1/2'	2'						
12" dn	E-26	E-26	E-26	E-26	E-26	E-26	E-26						
13-18"	E-24	E-24	E-26	E-26	E-26	E-26	E-26						
19-26"	E-22	E-24	E-26	E-26	E-26	E-26	E-26						
27-30"	H-20	E-22	E-24	E-26	E-26	E-26	E-26						
31-36"	H-18	H-20	H-22	E-24	E-24	E-26	E-26						
37-42"	H-16	H-18	H-20	E-24	E-24	E-24	E-24						
43-48"	J-16	H-18	H-20	H22 J26T	H-22	J26T	H-24	H-24					
49-54"		J-16	H-18	J ²² _{26T}	H-20	J ²² _{26T}	H-24	H-24					
55-60"		J-16	J-18	J ²² _{26T}	H-18	J ²² _{26T}	H-22	H-24					
61-72"			J-16	J24T	J-18	J26T	H-22	H-22	H-24				
73-84"				J22T	J-18	J22T	J-20	J-24	J-22	J-24	J-22	H-24	
85-96"				J22T	J-18	J22T	J-18	J-20	J-20	J-22	J-22	J-22	
97-108"				JT22T		JT22T	K-18	JT22T	J-18	J-22	J-18	J-22	
109-120"				JT22T		JT22T		JT22T	K-18	J-22	J-18	J-22	

Tie Rod Installations

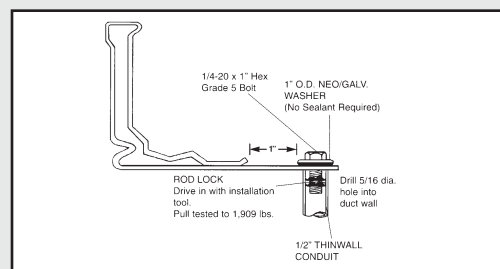
TIE ROD OPTION CONSTRUCTION:

Using the Ward RODLOCK (Conduit Type Tie Rod) Ward Industries, in their certified testing program (in accordance with Chapter 7 of the SMACNA HVAC Duct Construction Standards, 2nd ed., 1995) has used the Rodlock being attached to the duct wall alone as the reinforcement for the panel tie rod.

Example: 22 T Center tie rod:



Where the Rodlock is used as a flange reinforcement, "JT" or "HT", the conduit type tie rod is installed as shown below:



Negative Pressure

NOTE: Do not use internal duct wall supports (tie rods) on negative pressure duct systems without first consulting with Ward Industries Inc.

3" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS RECTANGULAR DUCT REINFORCEMENT Minimum Rigidity Class* - Minimum Gage Duct Reinforcement Spacing											
	8'	6'	5'		4'	3'	2 1/2'		2'			
12" dn	E-24	E-26	E-26		E-26	E-26	E-26	E-26	E-26	E-26		
13-18"	E-22	E-24	E-24	H-26	E-26		E-26	E-26	E-26	E-26		
19-22"	E-20	E-22	E-24	H-26	E-24	H-26	E-26	E-26	E-26	E-26		
23, 24"	E-18	E-22	E-24	H-26	E-24	H-26	E-26	E-26	E-26	E-26		
25, 26"	H-18	E-22	E-24		E-24		E-26	E-26	E-26	E-26		
27, 28"	H-18	H-20	H-22	E-24	E-24		E-26	E-26	E-26	E-26		
29, 30"	H-18	H-20	H-22	E-24	E-24		E-26	E-26	E-26	E-26		
31-36"	H-16	H-18	H-20	E-24	H-22	E-24	H-24	E-24	E-26	E-26		
37-42"		H-18	H-20	E-24	H-22	E-24	H-24	E-24	H-24	E-24	E-26	
43-48"		J-16	J-18	J26T	H-20	J26T	H-22		H-24		H-24	
49-54"			J-18	J26T	J-18	J26T	H-22		H-24		H-24	
55-60"			J-16	J24T	J-18	J24T	H-20		H-22		H-24	
61-72"				J24T	J-16	J24T	J-20	J24T	J-22	J-24	J-24	
73-84"				J20T		J20T	J-18	J20T	J-20	J-22	J-22	
85-96"				JT20T		JT20T	K-18	JT20T	J-18	J-20	J-20	
97-108"				JT20T		JT20T		JT20T	L-18	JT20	K-18	JT20
109-120"				JT20T		JT20T		JT20T	L-18	JT20	L-18	JT20

This table shows some typical duct sizes and the weight that can be saved by changing gage per certified test:

SMACNA Table

--	--

Variation permitted per certified test.

Duct Size	Sq. Ft. per 5" Sect.	Lbs./Sq. Ft.	Lbs./Sq. Ft.	Lbs./Sq. Ft.	Lbs./Sq. Ft.	Lbs./Sq. Ft.
		.91 26 ga.	1.16 24 ga.	1.41 22 ga.	1.66 20 ga.	2.16 18 ga.
30/18	40	40	51	62	73	95
36/24	50	50	64	76	83	119
42/24	55	55	70	85	100	131
48/24	60	60	76	93	110	143
54/24	65	65	83	101	119	154
60/30	75	75	96	116	137	178
72/36	90	90	115	140	164	214
84/48	110	110	140	171	201	261
96/48	120	120	153	186	219	285

4" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS RECTANGULAR DUCT REINFORCEMENT Minimum Rigidity Class* - Minimum Gage Duct Reinforcement Spacing											
	8'	6'	5'	4'	3'	2 1/2'	2'					
10" dn	E-22	E-26	E-26	E-26	E-26	E-26	E-26	E-26	E-26			
11,12"	E-22	E-24	E-26	E-26	E-26	E-26	E-26	E-26	E-26			
13,14"	E-22	E-22	E-24	E-26	E-26	E-26	E-26	E-26	E-26			
15,16"	E-20	E-22	E-24	E-26	E-26	E-26	E-26	E-26	E-26			
17-20"	E-20	E-22	E-24	E-24	E-26	E-26	E-26	E-26	E-26			
21,22"	E-18	E-20	E-24	E-24	E-26	E-26	E-26	E-26	E-26			
23-26"	H-18	H-20	H-22	E-24	E-24	E-26	E-26	E-26	E-26			
27-30"	H-18	H-18	H-22	E-24	H-24	E-24	E-26	E-26	E-26			
31-36"		H-18	H-20	H-22	H-22	H-24	H-26	E-26	E-26			
37-42"		J-16	J-18	H-22	H-20	H-22	H-24	H-26	E-26			
43-48"			J-18	J26T	J-18	J26T	H-22	H-24	H-24			
49-54"			J-16	J24T	J-18	J24T	J-20	H-22	H-24			
55-60"			J-16	J22T	J-16	J22T	J-20	J-22	H-24			
61-72"				J20T		J20T	J-18	J-20	J-20	J-24	J-22	H-24
73-84"				J20T		J20T	K-16	J20T	J-18	J-20	J-20	J-22
85-96"				JT20T		JT20T		JT20T	K-18	JT20	J-20	
97-108"				JT18T		JT18T		JT20T	L-18	JT20	L-18	JT20
109-120"				JT18T		JT18T		JT18T	L-18	JT18	L-18	JT18

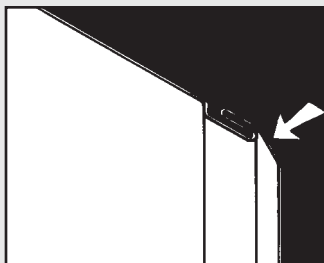
PRECAUTIONS

In any given duct system, accidental over pressure could occur and must be accounted for by design provisions, such as fail safe features, replaceable release panels and static pressure switches that can shut down the entire system.

Note: On all duct systems that are to be tested for leakage, it is recommended that the first 100 feet of completed ductwork be tested before proceeding to complete the installation.

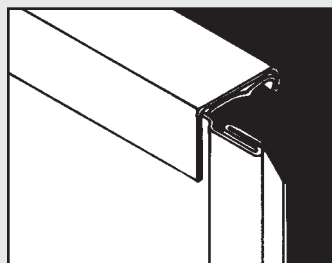
SHIPPING L SHAPED DUCT WITH THE ANGLE INSTALLED

STEP ONE



Notch the "hammer edge" of the female Pittsburgh Lock 1/4" on a 45 degree angle as shown

STEP TWO



In the shop, install the angle on the duct without the corner piece.

STEP THREE



In the field insert a corner piece into the angle at the male end of the Pittsburgh Lock

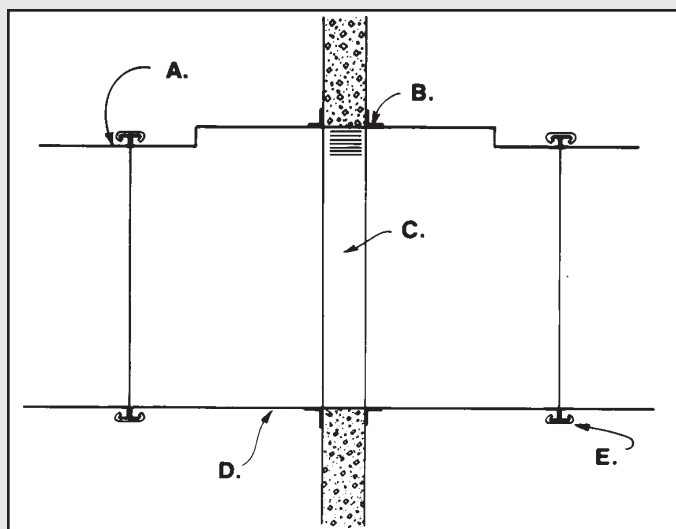
STEP FOUR

Complete the frame and bend over the hammer edge of the Pittsburgh Lock in the standard manner.

6" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS RECTANGULAR DUCT REINFORCEMENT Minimum Rigidity Class* - Minimum Gage Duct Reinforcement Spacing											
	8'	6'	5'	4'	3'	2 1/2'	2'					
10" dn	E-20	E-22	E-26	E-26	E-26	E-26	E-26					
11,12"	E-20	E-22	E-24	E-24	E-26	E-26	E-26					
13,14"	E-20	E-20	E-22	E-24	E-26	E-26	E-26					
15,18"	E-18	E-20	E-22	E-24	E-26	E-26	E-26					
19-22"	H-18	H-20	H-22	H-24	E-24	E-26	E-26					
23,24"	H-18	H-20	H-22	H-22	E-24	E-26	E-26					
25-28"	H-16	H-18	H-20	H-22	H-24	E-24	E-24					
29,30"		H-18	H-18	H24T	H-22	H-24	H-24					E-24
31-36"		J-16	J-18	H24T	H-20	H-22	H-24					H-24
37-42"			J-16	H24T	J-18	H24T	H-20	H-22	H-24	H-22	H-24	
43-48"				H24T	J-18	H24T	J-18	H-22	J-22	H-24	H-22	H-24
49-54"				J20T	J-16	J20T	J-18	J-20	J-20	J-20	J-22	
55-60"				J20T		H20T	J-18	H20T	J-20	J-20	J-22	
61-72"				JT20T		JT20T	K-16	JT20T	J-18	J-20	J-20	
73-84"				JT20T		JT20T		JT20T	L-16	JT20	K-18	JT20
85-96"				JT18T		JT18T		JT18T	IT16	JT18	L-18	JT18
97-108"				JT18T		JT18T		JT18T	JT16	JT18	L-18	JT18
109-120"				JT18T		JT18T		JT18T	KT16	JT18	KT18	JT18

Ward Industries Angle as a Breakaway Connection

- A. Ward Industries frame.
Use neoprene gasket between the frames.
Secure duct to sleeve.
- B. Retaining angle, secured to sleeve only.
- C. Fire damper secured to sleeve.
- D. 20 ga. Sleeve up to 54" x 54" — 18 ga.
Sleeve 54" and up.
- E. Melt away (200° F) pvc cleat (typ). Install 6"
pieces 12" on center starting cleat at extreme
end (corners).



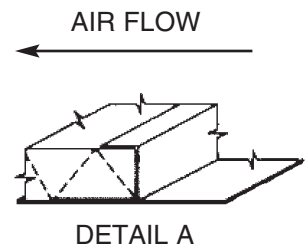
NOTE: Install duct and fire damper sleeve per normal installation procedures with bolts at the corners until all ductwork is installed and testing is completed. After successful testing, the bolts at the corners of the fire damper sleeves are to be removed so as to insure that duct will break away once cleats reach melting temperature of 200 degrees F.

10" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS RECTANGULAR DUCT REINFORCEMENT Minimum Rigidity Class* - Minimum Gage Duct Reinforcement Spacing									
	8'	6'	5'	4'	3'	2 1/2'		2'		
8" dn	E-20	E-22	E-24	E-24	E-26	E-26		E-26		
9", 10"	E-20	E-20	E-22	E-24	E-26	E-26		E-26		
11", 12"	E-18	E-20	E-22	E-24	E-26	E-26		E-26		
13", 14"	E-18	E-18	E-20	E-22	E-24	E-26		E-26		
15-18"	H-16	H-18	H-20	H-20	E-24	E-24		E-26		
19", 20"	H-16	H-18	H-18	H-20	H-22	E-24		E-24		
21-24"		H-18	H-18	H-20	H-22	H-24		H-24		
25-28"		J-16	J-18	H-18	H-22	H-24		H-24		
29", 30"			J-16	J-18	H-22	H-24		H-24		
31-36"			J-16	J-18	J-20	H-22		H-24		
37-42"			J16T	J-16	J-18	J-20		J-22		
43-48"				JT16	J-18	J-18		J-22		
49-54"					K-16	JT16	J-18		J-20	
55-60"					L-16	JT16	K-18	JT18	J-20	
61-72"							L-16	JT16	L-18	JT18
73-84"									LT16	JT16
85-96"									LT16	JT16
97-108"									LT16	JT16
109-120"									LT16	JT16

**Compliance to the 1998 California Mechanical Code Addendum and
City of Los Angeles Research Reports are available upon request.**

NOTE:
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.

AS DESCRIBED ON PAGE 2.24, FIGURE 2-19 OF THE **SMACNA HVAC DUCT
CONSTRUCTION STANDARDS, 2ND ED., 1995**



INSTALLATION INSTRUCTIONS

H FLANGE & J FLANGE



1. CUTTING THE ANGLE

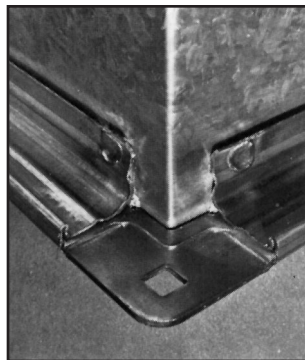
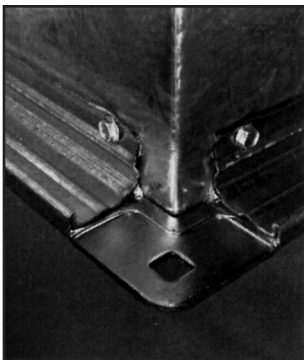
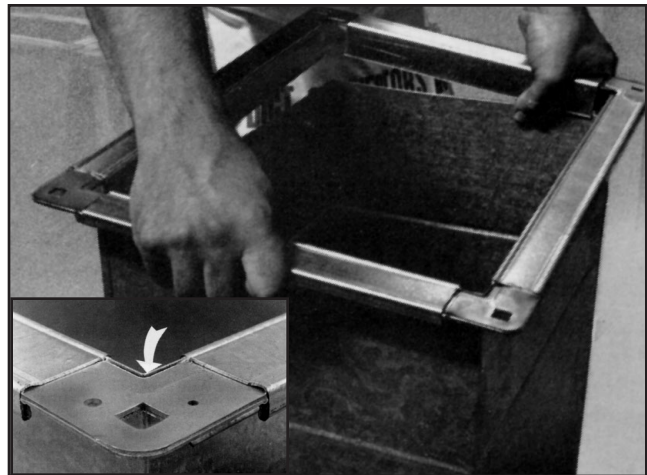
The angle should be cut $1 \frac{5}{16}$ " shorter than the duct dimensions, cutting the angle with the spine pointing up. Using a chop saw with a 3 h.p. motor and a metal cutting blade helps to insure a clean edge with no burrs.

2. FRAME ASSEMBLY AND SEATING

Using a mallet, insert the corners into the shorter angles; install the larger angles to complete the frame. The raised portion of the corner should be facing inward with the "Ward" name visible from the outside.

Starting at a corner, using a mallet, hammer the completed frame onto the raw edge of the duct section. Moving in one direction, make sure the duct is seated into the mastic.

NOTE: The duct section should not be notched.



3. FASTENING THE FRAME

The frame can be fastened to the ductwork with either Hex Tex screws ($10 \times 3/4$) or spot welds.

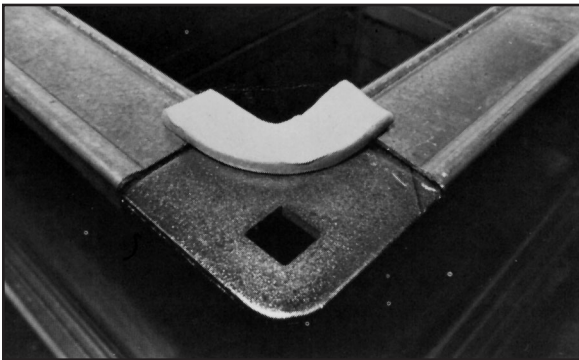
NOTE: On installations of 3" s.p. or above or on systems where leakage is to be less than 1%, spot welding is recommended.

Tek screwing of the angle or spot welding must start within $3/4$ " of each end of the angle at the duct section corners.

(See Chart on next page.)

Important: since sheet metal ductwork installations are sometimes used by the other trades as scaffolding, actual job conditions should really dictate the amount of spot welding and tek screwing.

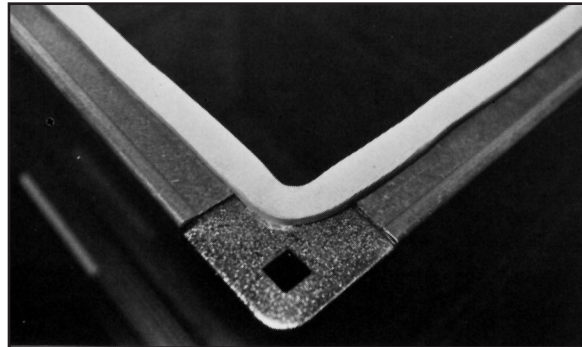
STATIC PRESSURE	DUCT SIZE	RECOMMENDED CENTERS
1/2" to 1"	To 48" 49" to 96" Over 96"	At 4 corners & centerline 30" centers 18" centers
1" to 2"	To 42" 43" to 96" Over 96"	At 4 corners & centerline 18" centers 12" centers
2" to 3"	To 36" 37" to 72" Over 72"	At 4 corners & centerline 18" centers 12" centers
3" to 6"	To 24" 25" to 60" Over 60"	At 4 corners & centerline 18" centers 12" centers
Over 6"	To 18" 19" to 48" Over 48"	At 4 corners & centerline 12" centers 8" centers



4. GASKET APPLICATION

Apply a 2 to 3" strip of gasket on the 4 exposed corners of one frame, as pictured.

Starting at the center of the other mating frame, apply a single strip of gasket completely around the inside edge of the frame. **IMPORTANT:** This gasket must also cover the exposed edge of the duct section and the gap between the duct wall and the corner.



NOTE: On installations where the operating pressures are 4" or higher and the leakage requirements are less than 3% special care must be given to the treatment of the corners. Special butyl patches (2" x 3") are available.

5. INSTALLING THE CLEAT

Snap a 4" piece of either metal or PVC cleat over the mating frames, using the following recommendations:

- 1/2" to 2" sp — 1 piece on 24" centers
- 2" to 3" sp — 1 piece on 18" centers
- 4" to 6" sp — 1 piece on 12" centers
- Over 10" sp — continuous cleat



Professional Service Industries, Inc.
Pittsburgh Testing Laboratory Division

Report To: Ward Industries
1001 Lebanon Church Rd.
Pittsburgh, PA 15236
Attn: Lou Ward

Project: LN PHY-21119 828-26235

Report Of: Witnessing of Pressure
Test on Duct Assemblies

Date: 6-8-92

On June 5, 1992, a representative of PSI/Pittsburgh Testing Laboratory, Mr. J. Peter Merther, visited the JWP Brandt Co. in Dallas, Texas to witness testing of a duct section as described below.

The duct system was reinforced as indicated below and per sketch attached.

The following is a description of duct assembly and results of the testing, SMACNA test procedures were used as a guideline.

Duct Size: 108" wide x 58" deep 18Ga.
Duct Length: 5' (60") Sections
Flange Connector: Ward J Connector
Reinforcement: 2" x 2" x 3/16" angle (see sketch for location and spacing)

3/8" threaded rod in 1/2" conduit (sketch for location and spacing)

Results: 10" Positive Water Pressure

Flange Deflection: 1/4" at 10"

No structural failure or leakage

Residual Deflection at 0": 1/32"

At 12" & 16" Positive Pressure no structural failure or leakage

10" Negative Water Pressure

Flange Deflection: 3/16" at 10"

No structural failure

Test Witnessed By:

J. Peter Merther
J. Peter Merther, P.E.
Staff Engineer

PROFESSIONAL SERVICE INDUSTRIES, INC.

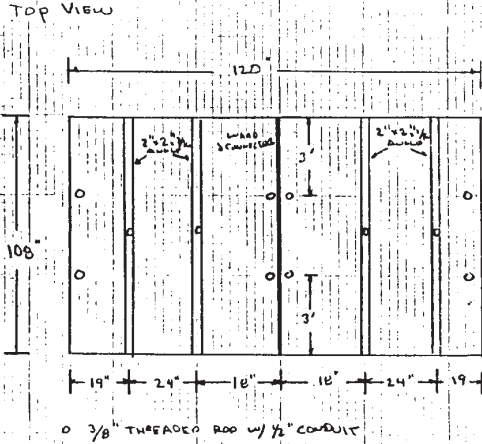
Gregory W. McKewan
Gregory W. McKewan
Manager, Physical Testing

cc: 1-Client
caj

850 Poplar Street • Pittsburgh, PA 15220 • Phone 412-922-4010 • Fax 412-922-4014

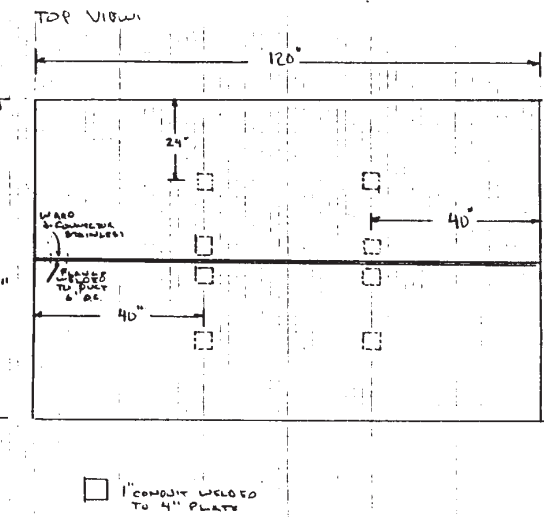
	Client	WARD INDUSTRIES	Client Order No.	
	Project	JWP BRANDT	PTL Order No.	
	DWG/Sketch No.	1	Scale	
	Prepared By	JPM	Date Prepared	6/6/92
			Lab No.	
			Page	1 of 1

108" LOCATION OF DUCT REINFORCEMENT 108" x 58" DUCT TEST



	Client	WARD INDUSTRIES	Client Order No.	
	Project	JWP BRANDT	PTL Order No.	878
	DWG/Sketch No.	2	Scale	
	Prepared By	JPM	Date Prepared	6/6/92
			Lab No.	
			Page	1 of 1

120" x 42" DUCT TEST



Professional Service Industries, Inc.
Pittsburgh Testing Laboratory Division

Report To: Ward Industries
1861 Lebanon Church Rd.
Pittsburgh, PA 15236
Attn: Lou Ward

Project: LN PHY-21119 828-26235

Report Of: Witnessing of Pressure
Test on Duct Assemblies

Date: 6-8-92

On June 5, 1992, a representative of PSI/Pittsburgh Testing Laboratory, Mr. J. Peter Merther, visited the JWP Brandt Co. in Dallas, Texas to witness testing of a duct section as described below.

The duct system was reinforced as indicated below and per sketch attached.

The following is a description of duct assembly and results of the testing, SMACNA test procedures were used as a guideline.

Duct Size: 120" wide x 42" deep 16Ga. Stainless
Duct Length: 4' (48") Sections
Flange Connector: Ward J Stainless Connector
Reinforcement: 1" Conduit welded to 4" plates (see sketch for location and spacing)

Flange connector welded to duct at 6" o.c. horizontal and vertical seams

Results: 10" Negative Water Pressure

Flange Deflection: 1/16" at 10"

No structural failure

At 12" Negative Water Pressure

No structural failure

Test Witnessed By:

J. Peter Merther
J. Peter Merther, P.E.
Staff Engineer

PROFESSIONAL SERVICE INDUSTRIES, INC.

Gregory W. McKewan
Gregory W. McKewan
Manager, Physical Testing

cc: 1-Client
caj

850 Poplar Street • Pittsburgh, PA 15220 • Phone 412-922-4010 • Fax 412-922-4014

ALUMINUM RECTANGULAR DUCT REINFORCEMENT

1/2" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS ALUMINUM RECTANGULAR DUCT REINFORCEMENT Ward J Flange - Roll Formed from .063 Aluminum Minimum Gauge Duct - Reinforcement Spacing			
	5'	4'	2 1/2'	2'
54"-Down	0.032	0.032	0.032	0.032
55"-60"	0.04	0.04	0.032	0.032
61"-72"	0.05	0.04	0.04	0.04
73"-84"	0.05	0.04	0.04	0.04
85"-96"	0.063	0.05	0.05	0.05
97"-108"			0.071	0.071
109"-120"			0.071	0.071

3" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS ALUMINUM RECTANGULAR DUCT REINFORCEMENT Ward J Flange - Roll Formed from .063 Aluminum Minimum Gauge Duct - Reinforcement Spacing			
	5'	4'	2 1/2'	2'
12"-Down	0.032	0.032	0.032	0.032
13"-26"	0.04	0.04	0.032	0.032
27"-30"	0.05	0.04	0.032	0.032
31"-36"	0.063	0.05	0.032	0.032
37"-42"	0.063	0.05	0.04	0.032
43"-48"		0.063	0.04	0.04
49"-54"			0.04	0.04
55"-60"			0.05	0.04

1" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS ALUMINUM RECTANGULAR DUCT REINFORCEMENT Ward J Flange - Roll Formed from .063 Aluminum Minimum Gauge Duct - Reinforcement Spacing			
	5'	4'	2 1/2'	2'
30"-Down	0.032	0.032	0.032	0.032
31"-42"	0.04	0.032	0.032	0.032
43"-60"	0.05	0.04	0.04	0.04
61"-72"	0.071	0.05	0.04	0.04
73"-84"			0.05	0.05
85"-96"			0.063	0.05

4" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS ALUMINUM RECTANGULAR DUCT REINFORCEMENT Ward J Flange - Roll Formed from .063 Aluminum Minimum Gauge Duct - Reinforcement Spacing			
	5'	4'	2 1/2'	2'
12"-Down	0.032	0.032	0.032	0.032
13"-26"	0.04	0.04	0.032	0.032
27"-30"	0.05	0.04	0.032	0.032
31"-36"	0.063	0.05	0.032	0.032
37"-42"		0.063	0.04	0.032
43"-48"			0.04	0.04
49"-54"			0.05	0.04
55"-60"				0.05

2" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS ALUMINUM RECTANGULAR DUCT REINFORCEMENT Ward J Flange - Roll Formed from .063 Aluminum Minimum Gauge Duct - Reinforcement Spacing			
	5'	4'	2 1/2'	2'
26"-Down	0.032	0.032	0.032	0.032
27"-30"	0.04	0.032	0.032	0.032
31"-36"	0.05	0.04	0.032	0.032
37"-42"	0.063	0.04	0.04	0.04
43"-48"	0.063	0.05	0.04	0.04
49"-54"	0.071	0.063	0.04	0.04
55"-60"		0.071	0.04	0.04
61"-72"			0.05	0.04

6" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS ALUMINUM RECTANGULAR DUCT REINFORCEMENT Ward J Flange - Roll Formed from .063 Aluminum Minimum Gauge Duct - Reinforcement Spacing			
	5'	4'	2 1/2'	2'
12"-Down	0.04	0.032	0.032	0.032
13"-24"	0.05	0.05	0.032	0.032
25"-28"	0.063	0.05	0.04	0.04
29"-30"	0.071	0.05	0.04	0.04
31"-36"		0.071	0.04	0.04
37"-42"			0.05	0.05
43"-48"				0.063

10" W.G. Static pos or neg Duct Dimen.	SHOP STANDARDS ALUMINUM RECTANGULAR DUCT REINFORCEMENT Ward J Flange - Roll Formed from .063 Aluminum Minimum Gauge Duct - Reinforcement Spacing			
	5'	4'	2 1/2'	2'
8"-Down	0.04	0.032	0.032	0.032
9"-12"	0.05	0.04	0.032	0.032
13"-18"	0.063	0.063	0.04	0.032
19"-26"	0.071	0.063	0.05	0.05
27"-30"			0.05	0.05
31"-36"			0.063	0.05

COMMENTARY - DISSIMILAR MATERIALS

The Aluminum Association, Inc. permits aluminum to zinc contact.

SMACNA's HVAC Duct Construction Standards, Section Edition 1995, allows galvanized steel reinforcement on aluminum duct.

However, if there is moisture present, the galvanized reinforcement should be painted with zinc chromate.

Do not connect a section of aluminum ductwork to a section of galvanized ductwork without isolation.

SHOP STANDARDS
RECTANGULAR INDUSTRIAL DUCT REINFORCEMENT
CLASS 1 SYSTEM CLASSIFICATION

Duct Size	2'0" Duct Section				4'0" Duct Section			
	16 GA		14 GA		16 GA		14 GA	
	Flange	Static Pressure	Flange	Static Pressure	Flange	Static Pressure	Flange	Static Pressure
12-18"	J	17"	J	22"	J	8"	J	11"
19-24"	J	17"	J	22"	J	8"	J	11"
25-30"	J	17"	J	22"	J	8"	J	11"
31-36"	J	17"	J	22"	J	8"	J	11"
37-42"	J	17"	J	22"	J	8"	J	11"
43-48"	J	15"	J	15"	J	8"	J	8"
49-60"	JT	15"	JT	15"	JT	7"	JT	8"
61-72"	JT	9"	JT	9"	JT	4"	JT	4"
73-84"	JT	6"	JT	6"	JT	3"	JT	3"
85-96"	JT	4"	JT	4"	JT	2"	JT	2"
97-108"	JT	3"	JT	3"		1.5"	JT	1.5"
109-120"	JT	2"	JT	2"		1"		1"
121-144"	JT	1.5"	JT	1.5"		.5"		.5"

COMMENTARY

The Ward J Flange was specifically designed to receive 14 ga. sheetmetal material.

We have listed below some possible uses of the J Flange with 16 ga. and 14 ga. sheetmetal material.

These are some typical uses, however, Ward Industries will furnish the necessary engineering calculations for other applications.

GALVANIZED STEEL *TRAPEZE HANGERS* FOR DUCTWORK

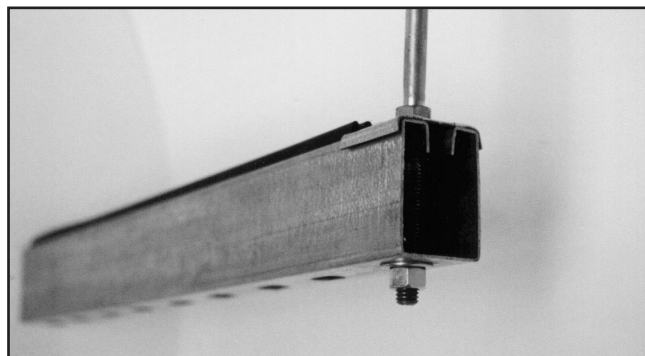
SHIPPING INFO	AVAILABLE IN 10' AND 20' LONG BUNDLES	
	20' BUNDLE	
	18 GA.	16 GA.
WT/LIN. FT.	1.25#	1.54#
PCS. PER BUNDLE	35	35
FEET PER BUNDLE	700	700
WT PER BUNDLE	875#	1078#
	10' BUNDLE	
WT/LIN. FT.	1.25#	1.54#
PCS. PER BUNDLE	35	35
FEET PER BUNDLE	350	350
WT. PER BUNDLE	440#	540#
WASHERS: 150 PER BOX - APPROXIMATE WEIGHT: 20 LBS.		
RUBBER ISOLATION PAD ALSO AVAILABLE		

ENGINEERING INFORMATION:

ANGLE EQUIVALENT	18 GA. HANGER 2x2x3/16	16 GA. HANGER 2x2x1/4
ALLOWABLE LOADS: LENGTH		
36"	920	1200
42"	900	1190
48"	870	1160
54"	840	1120
60"	780	1060
66"	700	980
72"	620	900
78"	500	790
84"	380	660
96"		320

APPROXIMATE WEIGHTS OF HANGER APPLICATIONS			
EQUIPMENT			
AIR HANDLING UNITS		UNIT HEATERS	
2000 CFM (5 TON)	250#	100,000 BTU	175#
3000 CFM (7.5 TON)	365#	200,000 BTU	250#
4000 CFM (10 TON)	475#	300,000 BTU	360#
6000 CFM (15 TON)	685#	400,000 BTU	450#

UNLINED SHEET METAL DUCTWORK - 5 FT. SECTIONS					
TYPICAL DUCT SIZE	24 GA.	22 GA.	20 GA.	18 GA.	16 GA.
36/24	64#	76#	83#	119#	135#
42/24	70#	85#	100#	131#	150#
48/24	76#	93#	110#	143#	160#
60/30	96#	116#	137#	178#	200#
72/36	115#	140#	164#	214#	240#
84/48	140#	171#	201#	261#	300#
96/48	153#	186#	219#	285#	320#



– NOTES –

TEST RESULTS

The following tests of rectangular duct sections and transverse joints were conducted in accordance with Section VII of the SMACNA HVAC Duct Construction Standards, 2nd ed., 1995.

Certified copies of these tests are available upon request.

WARD INDUSTRIES WILL PERFORM ANY ADDITIONAL TESTING THAT ANY ENGINEER, ARCHITECT, AUTHORITY, OWNER OR CONTRACTOR WOULD DEEM NECESSARY.

OPERATING PRESSURE	DUCT SIZE	SECTION LENGTH	DUCT GAUGE	CONNECTOR TYPE	CONNECTOR DEFLECTION	DUCT DEFLECTION
1"	72/12	60"	18 ga.	H	.249	.650
1"	48/12	60"	26 ga.	H	.050	.750
1"	60/21	60"	26 ga.	J	.060	.750
1"	84/12	60"R	24 ga.	J	.072	.384
1"	96/12	60"	20 ga.	J	.290	.750
1"	84/21	60"T	26 ga.	J	.060	.350
2"	60/21	60"T	26 ga.	J	.050	.010
2"	84/12	48"	18 ga.	J	.250	.740
2"	72/12	60"R	24 ga.	H	.258	.725
2"	72/12	60"	19 ga.	J	.230	.650
2"	48/12	60"	24 ga.	H	.120	.820
2"	84/36	60"R	20 ga.	J	.168	.670
2" see note	84/21	60"T	26 ga.	J	.040	.468
3"	48/12	60"	20 ga.	H	.165	.730
3"	72/12	60"R	24 ga.	J	.140	.702
3"	60/12	60"	18 ga.	J	.131	*
3"	76/44	60"R	20 ga.	J	.220	.500
3"	60/15	60"	16 ga.	H	.148	.740
3"	60/21	60"T	26 ga.	J	.090	.040
4"	72/12	60"R	24 ga.	J	.231	.498
4"	48/12	60"R	24 ga.	H	.164	.498
4"	48/12	60"	20 ga.	H	.245	.830
4"	60/12	60"	18 ga.	J	.160	*
4"	76/44	60"R	20 ga.	J	.278	.600
4"	60/21	60"T	26 ga.	J	.120	.100
5"	48/12	60"R	24 ga.	H	.210	.525
5"	48/12	60"	18 ga.	H	.250	<.750
5"	60/12	60"	18 ga.	J	.211	*
6"	60/12	48"R	20 ga.	H	.215	.730
6"	48/12	60"R	24ga.	H	.259	.620
6"	48/12	60"	18 ga.	H	.300	.780
6"	60/12	60"	18 ga.	J	.279	*
10"	42/12	48"	16 ga.	H	.200	.730
10"	108/58	60"R	18 ga.	J	.250	<.750
10"	120/42	48"R	16 ga.	J	.100	<.750
10"	42/24	60"R	16 ga.	J	.090	.340

R=Midpoint Reinforcement

T=Conduit Type Tie Rods

*=These tests were done as comparative tests, and the actual duct deflection was not recorded. They did not exceed SMACNA Deflection Standards.

Note: Two (2) Tie Rods — equally spaced (28" Centerline) were used

Rectangular Duct Deflection Limits
(As taken from the SMACNA HVAC Duct Construction Standards, 2nd ed., 1995.)

Duct Wall	Limit
W=12" or less	3/8"
W=13" to 18"	1/2"
W=19" to 24"	5/8"
W=25" to 84"	3/4"
W=85" to 120"	1"
Tolerance of +10%	
Joints & Reinforcements	Limit
W=48" or less	1/4"
W=49" to 120"	W/200
Tolerance of 7.5%	

PROJECT _____

LOCATION _____

ENGINEER _____

SUBMITTED BY _____

DATE _____