
2025
SMACNA ANNUAL CONVENTION
Maui, Hawaii
OCTOBER 26-29

SMACNA Technical Services

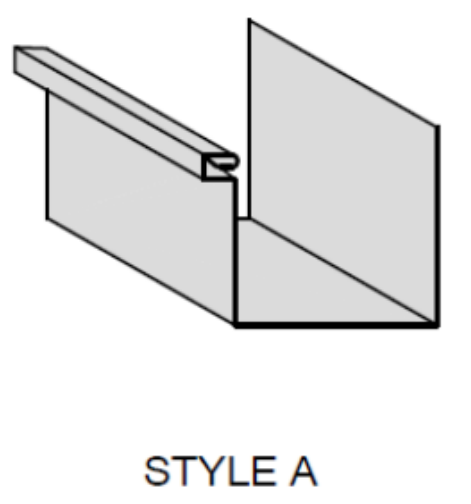
- Technical Services Department
  - Projects & Testing
  - Standards & Manuals
- Large Duct over 120 in.
- Grease Duct Construction
- Handheld Laser Welding

2025 Projects

- Rectangular/Round Industrial Duct Construction Standards
- ASME AG-1 Standards Committee on Nuclear Air & Gas Treatment
- Small Water Nuclear Reactors (SMR)
- Structural & Non-Structural Components (HVAC Ducts)
- Working on SMACNA Safety Factors
- Allowable working loads for localized buckling & shear
- Seismic Design for HVAC Ducts
  - (wind, tornado, tsunami, earthquake)
- Interpretation of Timoshenko deflection methodology

2025 Testing Programs

- **Architectural Sheet Metal Manual**



- ANSI/SPRI GT-1 Gutter Testing

- Validate compliance with International Building Code (IBC)

- Copper, Galvanized & Aluminum materials

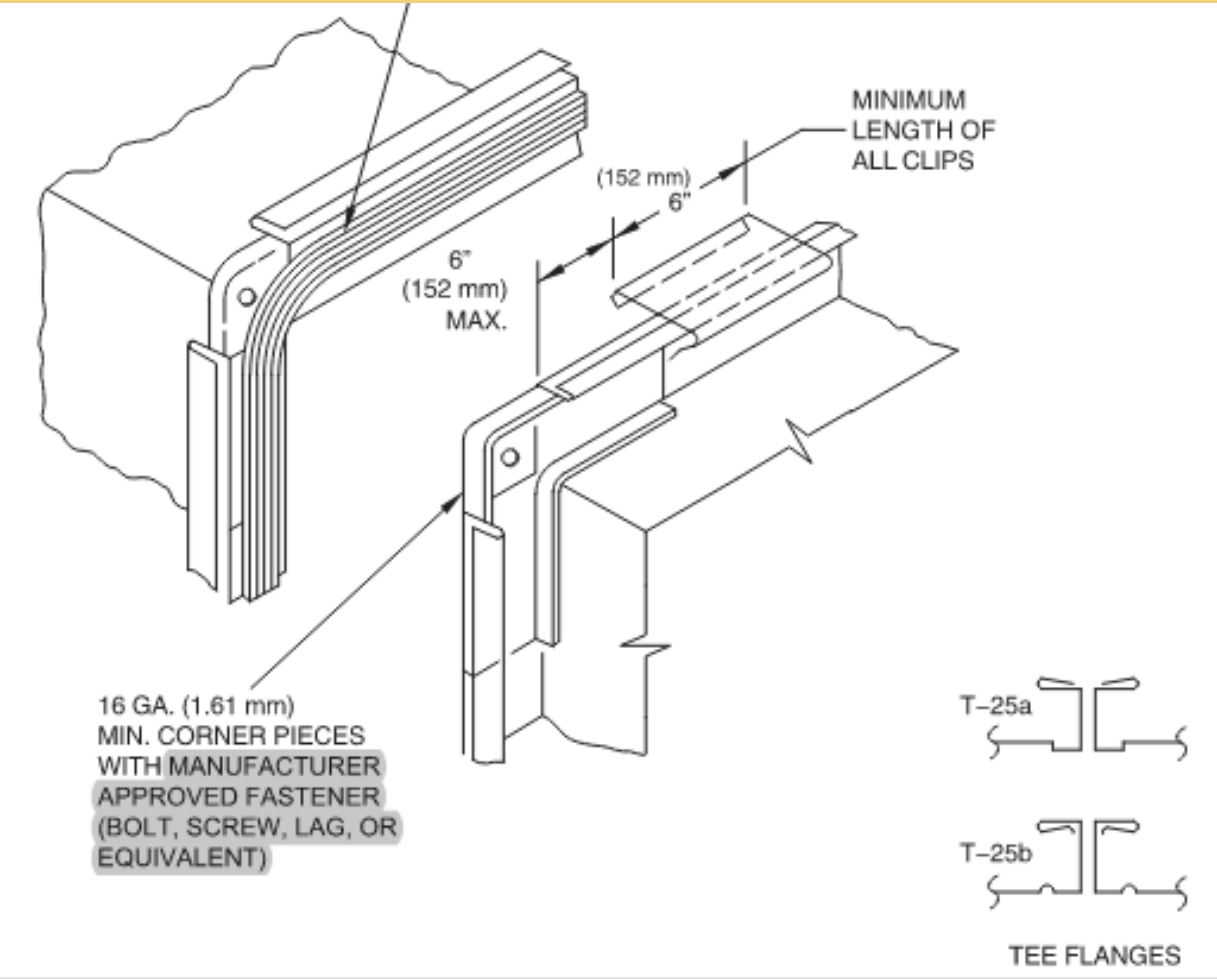
- (Stainless Steel omitted – Tensile Strength similar to Galvanized)

- Load & Pull-Out tests based on fastener spacing & gutter shape

2025 Testing Programs

- **HVAC Duct Construction Standards**
  - 16ga TDC/TDF joint testing
  - Validate Effective EI Rating
  - Validate Joint Tie-Rod requirement
  - Galvanized material only
  - 1/2” to 10” WG

2025 Technical Resources Bulletin



- **HVAC Duct Construction Standards**
  - Figure 2-18 Corner Closures - Flanges
  - T25a & T25b
  - “16ga (1.61 mm) Min. Corner Piece with Manufacturer Approved Fastener (Bolt, Screw, Lag or Equivalent)”

2025 Standards & Manuals

- ❑ Phenolic Duct Construction Standards 2nd edition
- ❑ Sound & Vibration Manual 1st edition
- ❑ Accepted Industry Practice For Industrial Duct Construction TF
- ❑ Laser Welding TF

2025 Standards & Manuals

- ❑ Architectural Wall Panels/Rainscreen Systems TF
  - ➢ Investigating NFPA 285 Certification/Testing)

- ❑ Kitchen Equipment Food Service & Kitchen Ventilation TF

- ❑ Indoor Environmental Agricultural TF

- ❑ “Clean Room Duct Fab/Install TF”

2025 Technical Projects

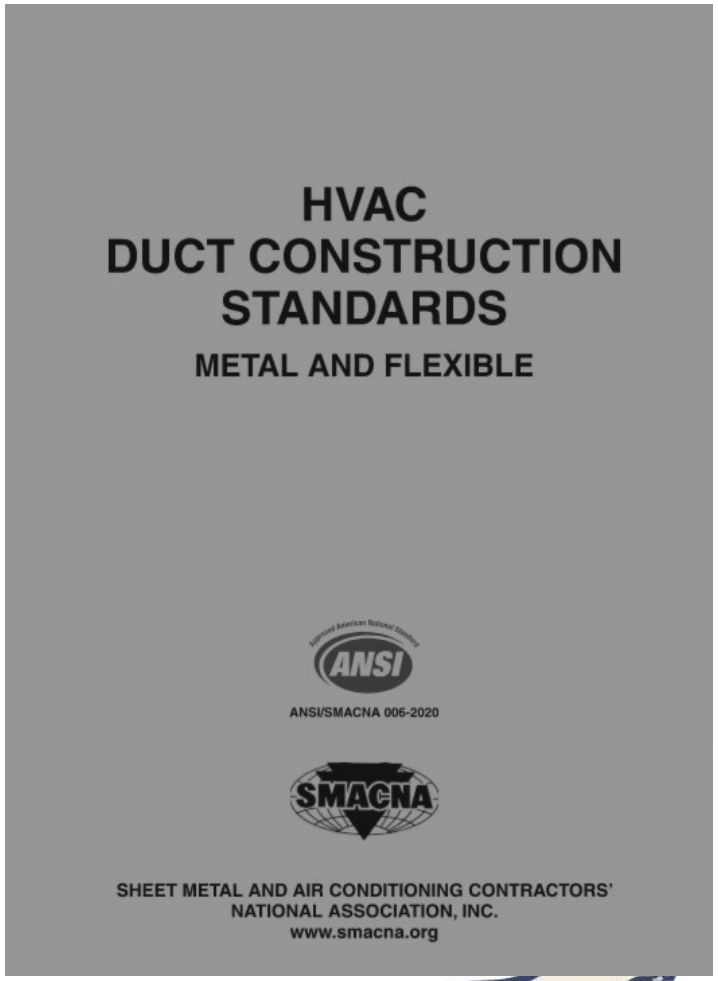
- ❑ HVAC Systems Duct Design
- ❑ HVAC Duct Construction Standard
- ❑ Spanish Translation in Progress

2025 Technical Projects

- ❑ Round/Rectangular DCS Short Video
- ❑ HVAC-DCS Duct Hanger Short Video
- ❑ Building Code Official Inspection Video

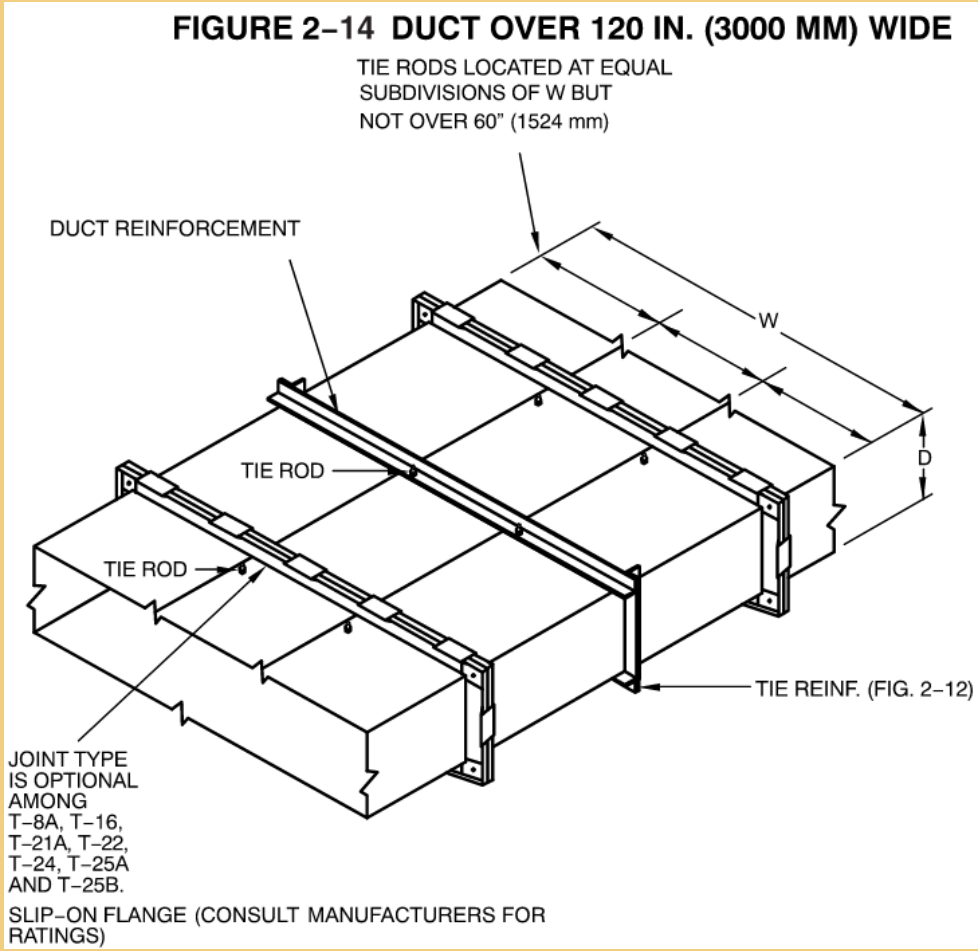
Large Duct Construction for HVAC: 121” Panels and Greater

- SMACNA HVAC Duct Construction Standards, Metal and Flexible
- 4th Edition (2020)



Large Duct Construction for HVAC: 121” Panels and Greater

- HVAC Ducts Over 120”
- Figure 2-14 and Table 2-49
- 10 in. wg. or less (+/-)
- Internal Tie-Rods ***Required***
- Multiple Connections Available



Large Duct Construction for HVAC: 121” Panels and Greater

Table 2-49: Duct over 120 in.

Duct Pressure Class

wg (Pa)	½ in. (125 Pa)	1 in. (250 Pa)	2 in. (500 Pa)	3 in. (750 Pa)	4 in. (1000 Pa)	6 in. (1500 Pa)	10 in. (2500 Pa)
Panel Ga (mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	16 (1.61 mm)
Reinf. Size	It	It	It	It	Jt	Kt	Lt
Reinf. Spacing ft (m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 (0.60 m)	2 (0.60 m)
Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

Large Duct Construction for HVAC: 121” Panels and Greater

Table 2-49: Duct over 120 in.

Duct Pressure Class

wg (Pa)	½ in. (125 Pa)	1 in. (250 Pa)	2 in. (500 Pa)	3 in. (750 Pa)	4 in. (1000 Pa)	6 in. (1500 Pa)	10 in. (2500 Pa)
Panel Ga (mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	16 (1.61 mm)
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Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

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Large Duct Construction for HVAC: 121” Panels and Greater

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Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

Large Duct Construction for HVAC: 121” Panels and Greater

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Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

Large Duct Construction for HVAC: 121” Panels and Greater

Table 2-49: Duct over 120 in.

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Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

Large Duct Construction for HVAC: 121” Panels and Greater

Duct Design Example:

Duct Size: 140” Wide x 70” Tall

- Pressure Class: +3 in. W.G.
- Joint Length: 5-Feet
- Reinforcement: 2-1/2 Feet
- Connection: TDC/TDF

Large Duct Construction for HVAC: 121” Panels and Greater

Step #1: Table 2-49

Select the 3 in. wg. Pressure Class

Duct Pressure Class

wg (Pa)	½ in. (125 Pa)	1 in. (250 Pa)	2 in. (500 Pa)	3 in. (750 Pa)	4 in. (1000 Pa)	6 in. (1500 Pa)	10 in. (2500 Pa)
Panel Ga (mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	16 (1.61 mm)
Reinf. Size	It	It	It	It	Jt	Kt	Lt
Reinf. Spacing ft (m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 (0.60 m)	2 (0.60 m)
Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	4 (1.20 m)

Table 2–49 Duct Over 120 in. (3000 mm) Duct Construction

Large Duct Construction for HVAC: 121” Panels and Greater

Step #2: Table 2-49

Record the Data into your Duct Construction Solution

- Panel Gage: 18
- Reinforcement Size: It
- Reinf. Spacing: 2.5-Feet
- Max. Tie Rod Spacing: 5-Feet

	Duct Pressure Class			
wg (Pa)	½ in. (125 Pa)	1 in. (250 Pa)	2 in. (500 Pa)	3 in. (750 Pa)
Panel Ga (mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)	18 (1.31 mm)
Reinf. Size	It	It	It	It
Reinf. Spacing ft (m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)	2 ½ (0.75 m)
Max. Tie Rod Spacing ft (m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)	5 (1.50 m)

Table 2–49 Duct Over 120 in. (3000 mm)

Duct Construction Summary - Partial

140” Wide Side

- Pressure Class: +3 in.wg.
- Joint Length: 5-Feet
- Connection: TDC/TDF with JTR
  - JTR = Internal Tie Rod = ½” EMT
  - 140” ÷ 60” = 2.33 = 2 Tie Rods
- Reinf. Spacing: 2.5-Feet
- Panel Gage: 18
- Reinforcement Size: It
  - RC-I = 2” x 2” x 3/16” Angle (c)
  - t = Internal Tie Rod = ½” EMT
- Max. Tie Rod Spacing: 5-Feet
  - 140” ÷ 60” = 2.33 = 2 Tie Rods
  - 140” ÷ 3 spans = 46.6”

70” Tall Side

- Pressure Class: +3 in.wg.
- Joint Length: 5-Feet
- Connection: TDC/TDF
- Reinf. Spacing: 2.5-Feet
- Panel Gage: 18
- Reinforcement Size: TBD
  - RC-X = TBD
  - t = Internal Tie Rod = TBD
- Max. Tie Rod Spacing: TBD

Large Duct Construction for HVAC: 121” Panels and Greater

Step #3

70” Tall Side: Table 2-18

3 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.
61 72 in.	16	JTR	(2) H	20	JTR	(2) H	2 MPT	I
73 84 in.	16	JTR	(2) K	20	JTR	(2) H	2 MPT	I
85 96 in.	Not Designed			18	JTR	(2) I	2 MPT	J
97 108 in.				18	JTR	(2) K		L
109 120 in.				18	JTR	(2) K		L

Table 2–18 5 ft Coil/Sheet Stock/T25a/T25b (TDC/TDF) Duct Reinforcement

Duct Construction Summary - Complete

140” Wide Side

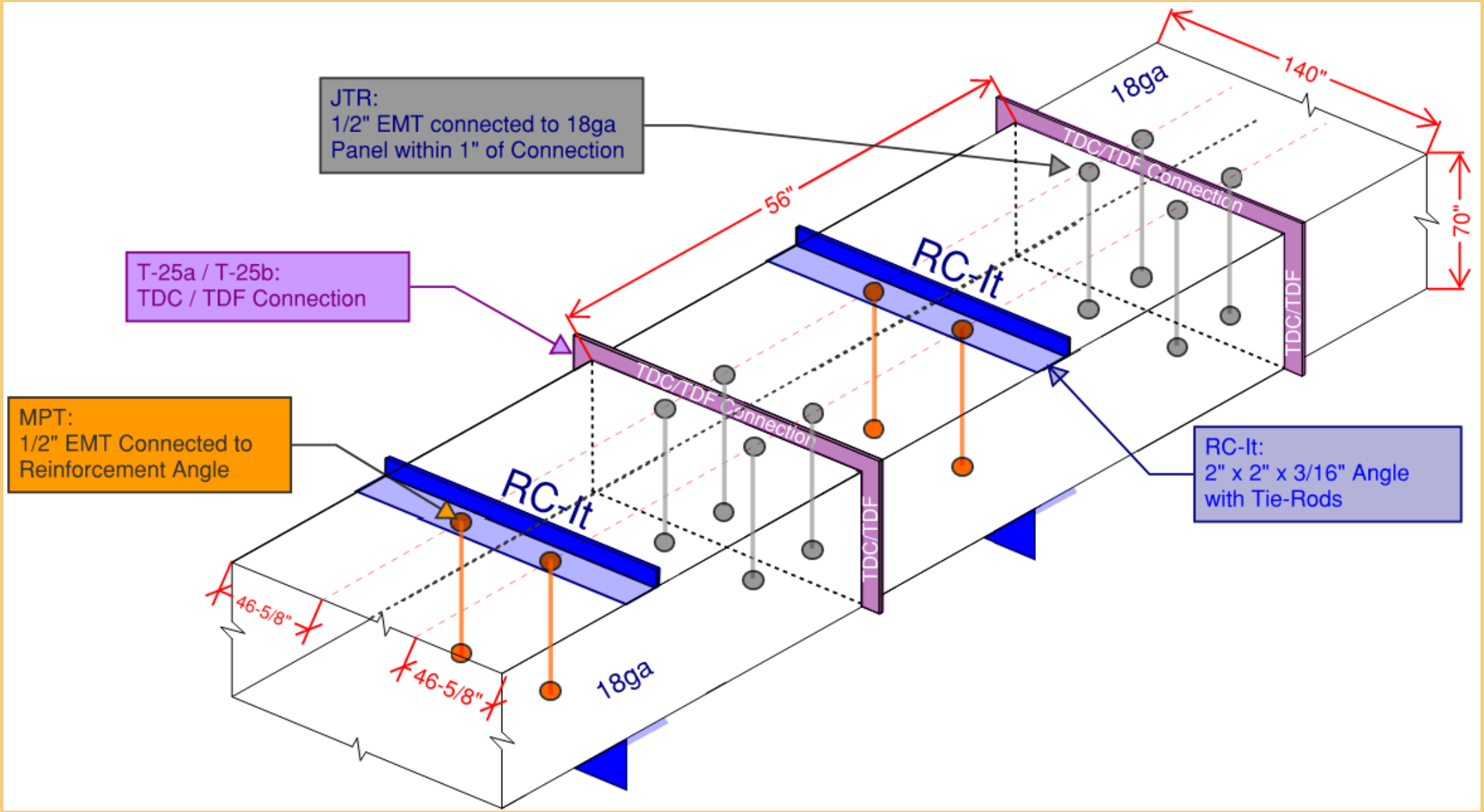
- Pressure Class: +3 in.wg.
- Joint Length: 5-Feet
- Connection: TDC/TDF with JTR
  - JTR = Internal Tie Rod = ½” EMT
  - 140” ÷ 60” = 2.33 = 2 Tie Rods
- Reinf. Spacing: 2.5-Feet
- Panel Gage: 18
- Reinforcement Size: It
  - RC-I = 2” x 2” x 3/16” Angle (c)
  - t = Internal Tie Rod = ½” EMT
- Max. Tie Rod Spacing: 5-Feet
  - 140” ÷ 60” = 2.33 = 2 Tie Rods
  - 140” ÷ 3 spans = 46.6”

70” Tall Side

- Pressure Class: +3 in.wg.
- Joint Length: 5-Feet
- Connection: TDC/TDF with JTR
  - 1 JTR = ½” EMT
- Reinf. Spacing: 2.5-Feet
- Panel Gage: 18
- Reinforcement Size: MPT
  - MPT Quantity: 2
  - MPT Size: ½” EMT

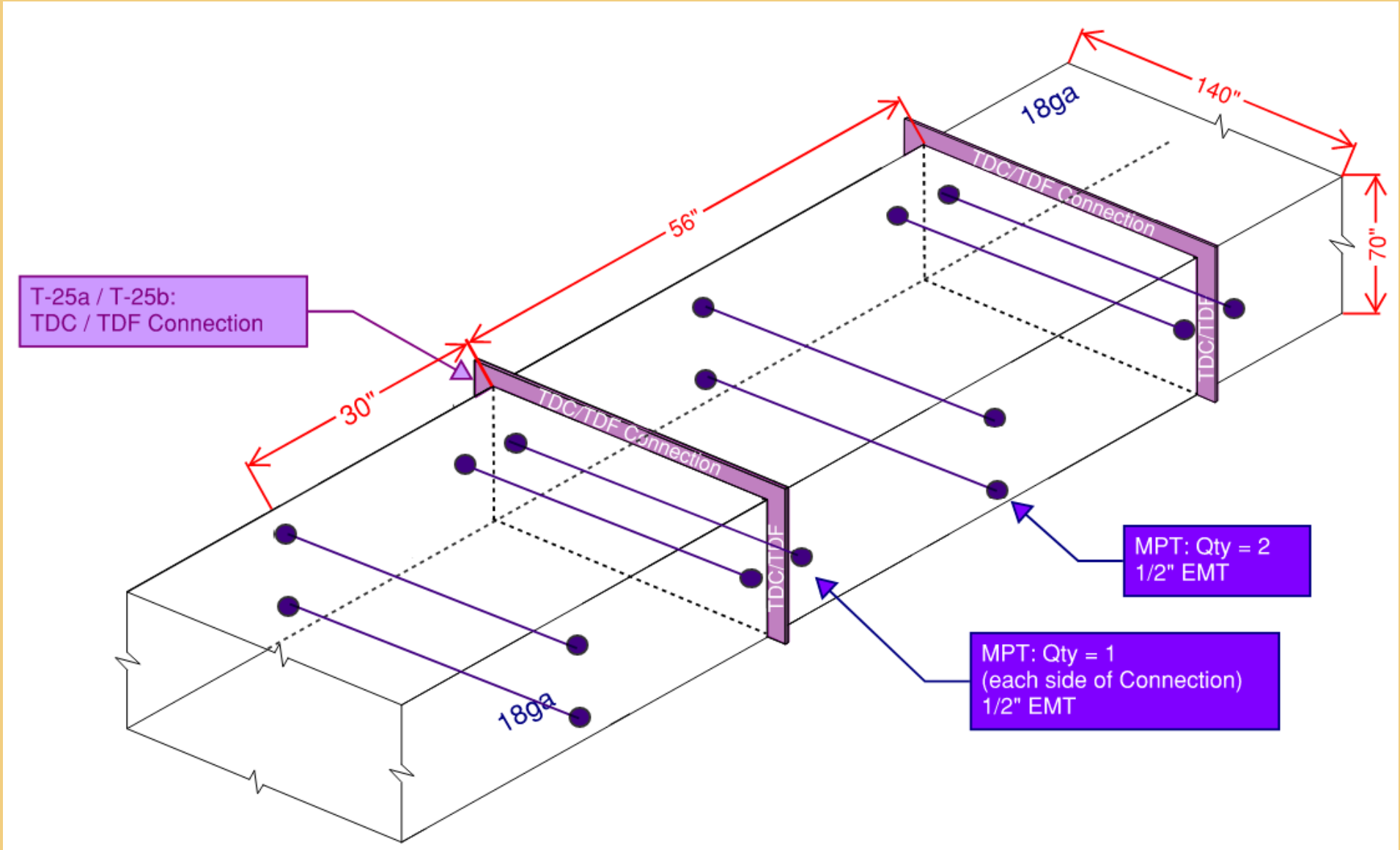
Duct Construction Sketch-01

140” Wide Side Reinforcement



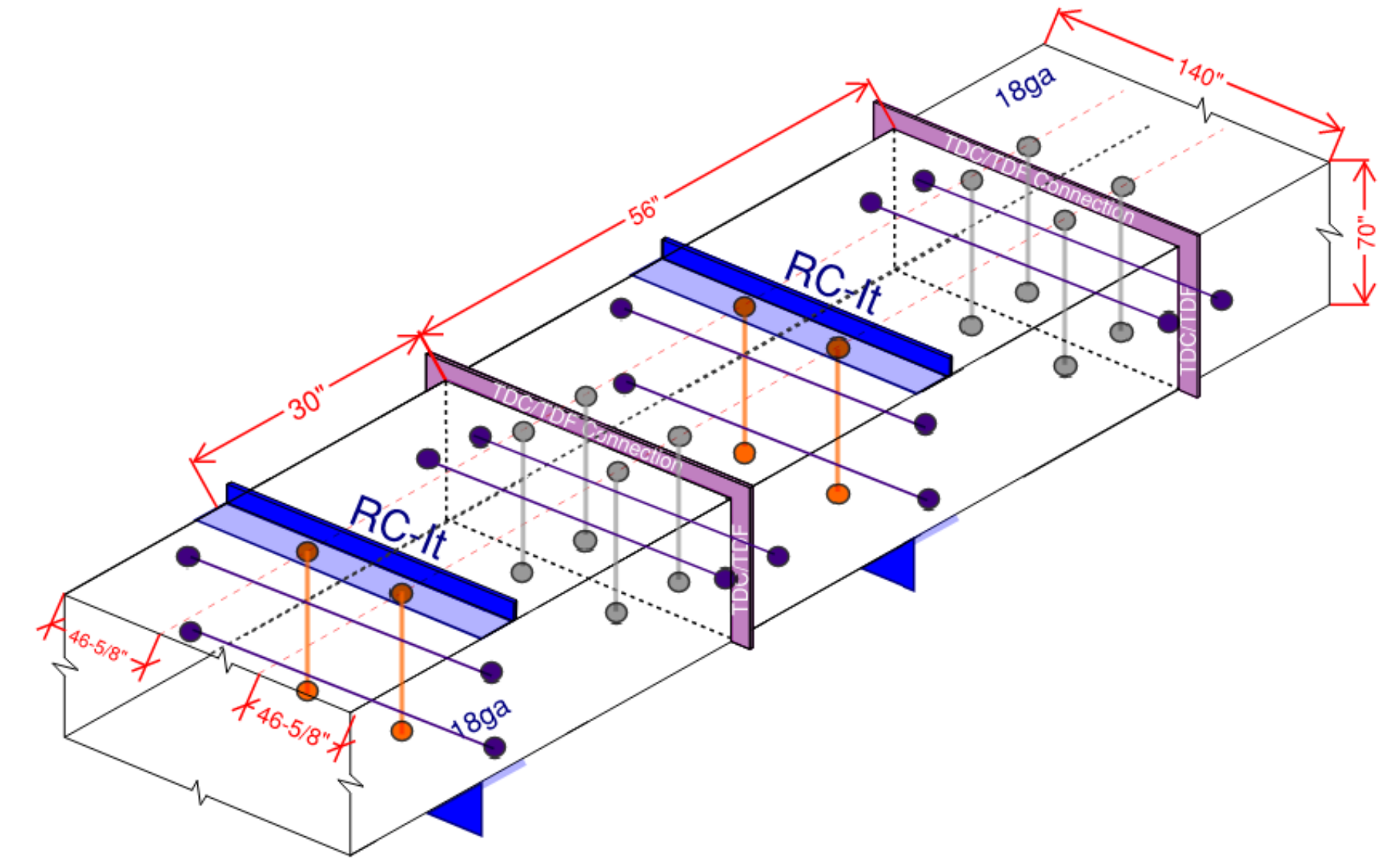
Duct Construction Sketch-02

70” Tall Side Reinforcement



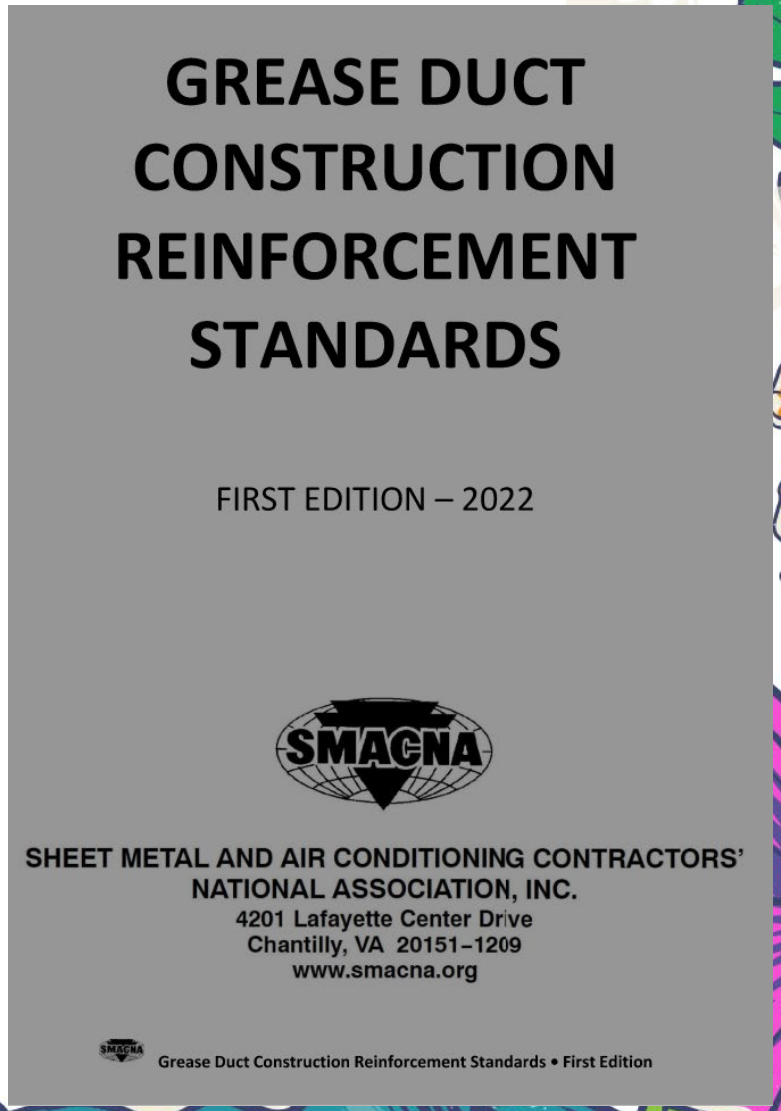
Duct Construction Sketch-03

Completed Reinforcement



Grease Duct Reinforcement: Carbon Steel

- SMACNA TRB-022
- 1st Edition of the SMACNA Grease Duct Construction Reinforcement Standards (2022)



Grease Duct Reinforcement: Carbon Steel

- 16 ga Carbon Steel
- Pressure Classes
  - 2.5 in. wg to 10 in. wg.
- 500ºF Maximum Operating Temp.
  - 400ºF for Galvanized Steel

Duct Dimension	Reinforcement Spacing Options (ft.)						
	Unreinforced	2	2.5	3	4	5	6
0 - 12 in.	11	Use Unreinforced					
13 – 18 in.	4	10	8	6	Use Unreinforced		
19 – 24 in.	1	10	8	6	4	3	2.5
25 - 30 in.		10	8	6	4	3	2.5
31 – 36 in.		10	8	6	4	3	2.5
37 – 42 in.		10	8	6	4	3	2.5
43 – 48 in.		10	8	6	4	3	2.5
49 – 54 in.		10	8	6	4	3	2.5
55 – 60 in.		10	8	6	4	3	2.5
61 – 66 in.		10	8	6	4	3	2.5
67 – 72 in.		10	8	6	4	3	2.5
73 – 78 in.		10	8	6	4	3	2.5
79 – 84 in.		10	8	6	4	3	2.5
85 – 90 in.		10	8	6	4	3	2.5
91 – 96 in.		10	8	6	4	3	2.5

Table 1. Maximum Static Pressure Capacity, in. wg, for Carbon Steel Grease Ducts for Operating Temperatures to 500°F (400°F For Galvanized Duct)

Grease Duct Reinforcement: Example-01

Grease Duct System

- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length: 4-Foot
- Material: 16ga C.S.
- Connection: T-21

Table-1: Maximum Static Pressure Capacity

Grease Duct System

- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length 4-Foot
- Material: 16ga C.S.
- Connection: T-21

Duct Dimension	Reinforcement Spacing Options (ft.)						
	Unreinforced	2	2.5	3	4	5	6
0 - 12 in.	11	Use Unreinforced					
13 – 18 in.	4	10	8	6	Use Unreinforced		
19 – 24 in.	1	10	8	6	4	3	2.5
25 - 30 in.		10	8	6	4	3	2.5
31 – 36 in.		10	8	6	4	3	2.5
37 – 42 in.		10	8	6	4	3	2.5
43 – 48 in.		10	8	6	4	3	2.5
49 – 54 in.		10	8	6	4	3	2.5
55 – 60 in.		10	8	6	4	3	2.5
61 – 66 in.		10	8	6	4	3	2.5
67 – 72 in.		10	8	6	4	3	2.5
73 – 78 in.		10	8	6	4	3	2.5
79 – 84 in.		10	8	6	4	3	2.5
85 – 90 in.		10	8	6	4	3	2.5
91 – 96 in.		10	8	6	4	3	2.5

Table 1. Maximum Static Pressure Capacity, in. wg, for Carbon Steel Grease Ducts for Operating Temperatures to 500°F (400°F For Galvanized Duct)

Table-1: Maximum Static Pressure Capacity

Grease Duct System

- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length 4-Foot
- Material: 16ga C.S.
- Connection: T-21

Maximum Rein. Spacing at 6in. wg. = 3-Feet

Duct Dimension	Reinforcement Spacing Options (ft.)						
	Unreinforced	2	2.5	3	4	5	6
0 - 12 in.	11			Use Unreinforced			
13 – 18 in.	4	10	8	6	Use Unreinforced		
19 – 24 in.	1	10	8	6	4	3	2.5
25 - 30 in.		10	8	6	4	3	2.5
31 – 36 in.		10	8	6	4	3	2.5
37 – 42 in.		10	8	6	4	3	2.5
43 – 48 in.		10	8	6	4	3	2.5
49 – 54 in.		10	8	6	4	3	2.5
55 – 60 in.		10	8	6	4	3	2.5
61 – 66 in.		10	8	6	4	3	2.5
67 – 72 in.		10	8	6	4	3	2.5
73 – 78 in.		10	8	6	4	3	2.5
79 – 84 in.		10	8	6	4	3	2.5
85 – 90 in.		10	8	6	4	3	2.5
91 – 96 in.		10	8	6	4	3	2.5

Table 1. Maximum Static Pressure Capacity, in. wg, for Carbon Steel Grease Ducts for Operating Temperatures to 500°F (400°F For Galvanized Duct)

Table-5: 16 ga Carbon Steel at 6in.wg.

Grease Duct System

- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length 4-Foot
- Material: 16ga C.S.
- Connection: T-21

Plot out:

- Panel Ranges
- Reinf. Spacing

6 in. wg Static Pos. or Neg.	Reinforcement Code for 16 gage carbon steel						
Duct Dimension	Reinforcement Spacing						
	Unreinforced	6 ft	5 ft	4 ft	3 ft	2.5 ft	2 ft
0 - 12 in.	OK	Use Unreinforced					
13 – 18 in.	Not Designed				R1	R1	R1
19 – 24 in.					R1	R1	R1
25 - 30 in.					R2	R2	R2
31 – 36 in.					R3	R3	R2
37 – 42 in.					R3	R3	R3
43 – 48 in.					R4	R4	R3
49 – 54 in.					R4	R4	R4
55 – 60 in.					R5	R5	R4
61 – 66 in.					R6	R5	R5
67 – 72 in.					R6	R6	R5
73 – 78 in.					R7	R6	R6
79 – 84 in.					R7	R7	R6
85 – 90 in.					R8	R7	R7
91 – 96 in.					R8	R8	R7

Table 5. Reinforcement Code for 16 Gage Carbon Steel with a 6 in. wg Maximum Static Pressure Capacity

Table-5: 16 ga Carbon Steel at 6in.wg.

Grease Duct System

- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length 4-Foot
- Material: 16ga C.S.
- Connection: T-21

Panel Reinforcement

- 18” = R1
- 34” = R2

6 in. wg Static Pos. or Neg.	Reinforcement Code for 16 gage carbon steel						
Duct Dimension	Reinforcement Spacing						
	Unreinforced	6 ft	5 ft	4 ft	3 ft	2.5 ft	2 ft
0 - 12 in.	OK	Use Unreinforced					
13 – 18 in.	Not Designed				R1	R1	R1
19 – 24 in.					R1	R1	R1
25 - 30 in.					R2	R2	R2
31 – 36 in.					R3	R3	R2
37 – 42 in.					R3	R3	R3
43 – 48 in.					R4	R4	R3
49 – 54 in.					R4	R4	R4
55 – 60 in.					R5	R5	R4
61 – 66 in.					R6	R5	R5
67 – 72 in.					R6	R6	R5
73 – 78 in.					R7	R6	R6
79 – 84 in.					R7	R7	R6
85 – 90 in.					R8	R7	R7
91 – 96 in.					R8	R8	R7

Table 5. Reinforcement Code for 16 Gage Carbon Steel with a 6 in. wg Maximum Static Pressure Capacity

Table-5: Notes

Notes:

1. *Maximum static pressure capacities include an allowance of 5.2 lbs/ft^2 to account for the weight of duct wrap and other loading.*
2. *Each side can be independently reinforced. It is NOT required to wrap angle on all four sides or for reinforcements to coincide*
3. *Table 5 is for carbon steel (including hot rolled steel, cold rolled steel, galvanized to 400°F and aluminized steel.)*
4. *See Table 8 for Stiffener Data.*

Table-8: Stiffener Data

Grease Duct System

- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length 4-Foot
- Material: 16ga C.S.
- Connection: T-21
- Reinforcement = 2-Feet
- 34” Wide = R2
- 18” Tall = R1

STRUCTURAL GR CS – 36 ksi
Table 6–D – Stiffener Data

Table 8. Stiffener Data for Structural GR CS-36ksi

Stiffener Type	S (Min)	I (Min)	Stiffener Size	Stiffener Description	Weight, lb/ft	S, in.^{3}	I, in.^{4}
R-1	0.031	0.022	1 × 1 × ⅛	Angle	0.80	0.031	0.022
			1 × 1 × 3⁄16	Angle	1.16	0.044	0.030
			1 × 1 × ¼	Angle	1.49	0.056	0.037
			1 × ⅜ × ⅛	Channel	0.68	0.048	0.024
			1 × ½ ×⅛	Channel	0.82	0.063	0.031
			1 × ¼	Bar	0.85	0.042	0.021
			1 × 5⁄16	Bar	1.06	0.052	0.026
			1 × ⅜	Bar	1.28	0.062	0.031
R-2	0.072	0.060	1½ × 1½ × ⅛	Angle	1.23	0.072	0.078
			1¾ × 1¾ × ⅛	Angle	1.44	0.099	0.126
			1½ × 1½ × 3⁄16	Angle	1.80	0.104	0.110
			1¼ × ½ × ⅛	Channel	1.01	0.096	0.060
R-3	0.131	0.139	1½ × 1½ × ¼	Angle	2.34	0.134	0.139
			2 × 2 × ⅛	Angle	1.65	0.131	0.190
			2 × ¼	Bar	1.70	0.167	0.167
R-4	0.190	0.272	2 × 2 × 3⁄16	Angle	2.44	0.190	0.272
			2 × 2 × ¼	Angle	3.19	0.247	0.348
R-5	0.300	0.416	2 × 2 × 5⁄16	Angle	3.92	0.300	0.416
			2 × 2 × ⅜	Angle	4.70	0.351	0.479
			2½ × 2½ × 3⁄16	Angle	3.07	0.303	0.547
			3 × ¼	Bar	2.55	0.375	0.563

- 18” Panel Reinforcement = R1 = 1”x 1” x 1/8” Angle
- 34” Panel Reinforcement = R2 = 1.5” x 1.5” x 1/8” Angle

Grease Duct Reinforcement: Example-01

Grease Duct System Construction Summary

- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length 4-Foot
- Material: 16ga C.S.
- Connection: T-21
- Reinforcement = 2-Feet
- 34” Wide = R2
  - R2 = 1.5” x 1/8” Angle
- 18” Tall = R1
  - R1 = 1” x 1/8” Angle

Grease Duct Reinforcement: Example-01

T-21 Transverse Connection

- 2-Options to form the Joint:
  1. Even Flange
     - ➢Both Flanges are allowed to be ½” Maximum

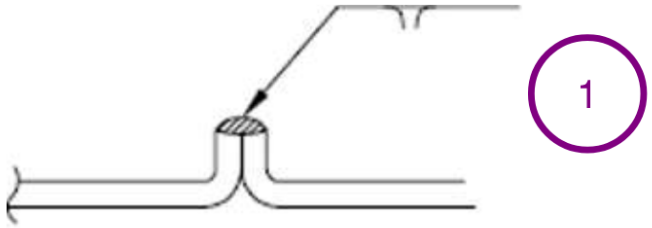


Figure 5a Even Flange Joint Maximum Height (H = ½ inch)

  2. Uneven Flange
     - ➢One side of the Flange is allowed to be ½” larger than the opposing side

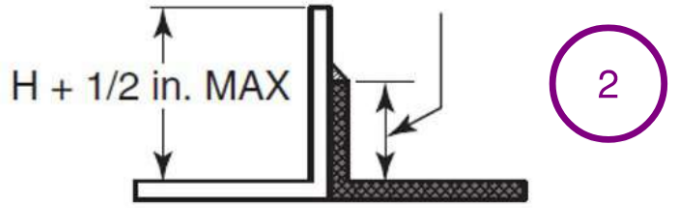
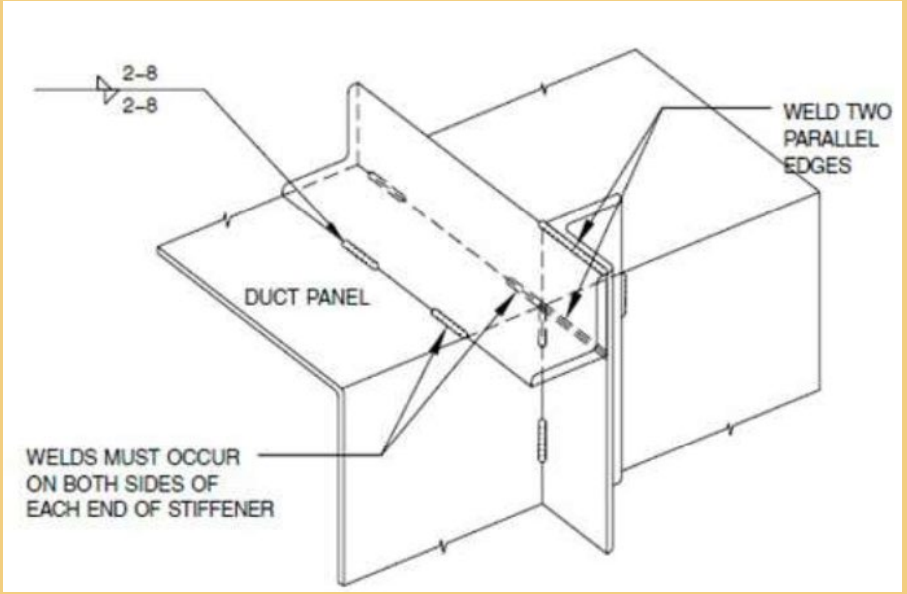


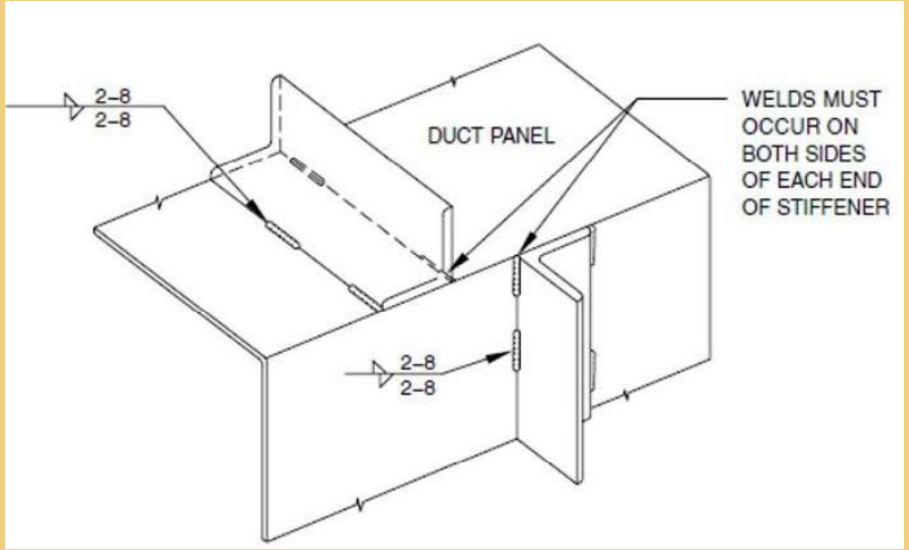
Figure 5b Uneven Flange Joint (H Defined By Shorter Flange)

Grease Duct Reinforcement: Example-01

Stiffener Placement & Attachment

- Welded to the Exterior of the Panel
  - 2” Welds on 8” Centers
    - Alternate Welds – Toe & Heel
  - Stiffeners do not need to coincide with each other

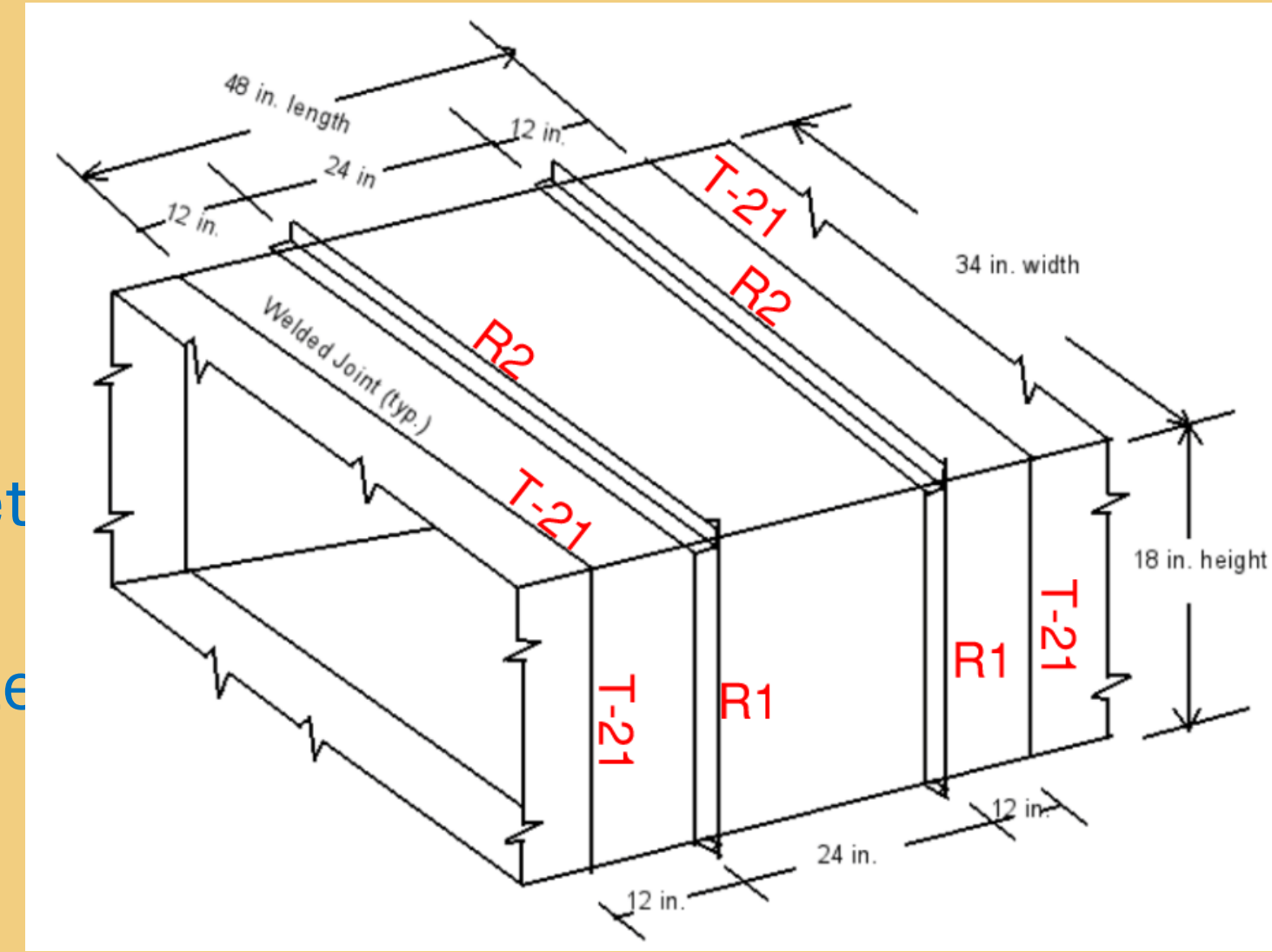




Grease Duct Reinforcement: Example-01

Duct Construction Sketch

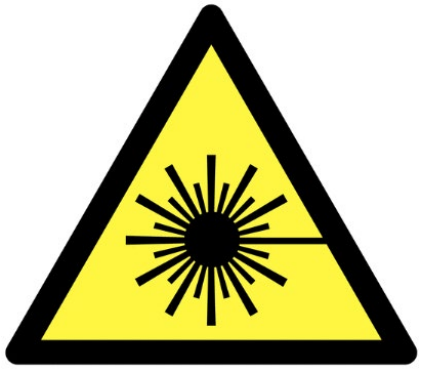
- 34” x 18”
- Neg. 6 inches W.G.
- Joint Length 4-Foot
- Material: 16ga C.S.
- Connection: T-21
- Reinforcement = 2-Feet
- 34” Wide = R2
  - R2 = 1.5” x 1/8” Angle
- 18” Tall = R1
  - R1 = 1” x 1/8” Angle



SMACNA Technical Standards

Handheld Laser Welding Guide

- **First look**



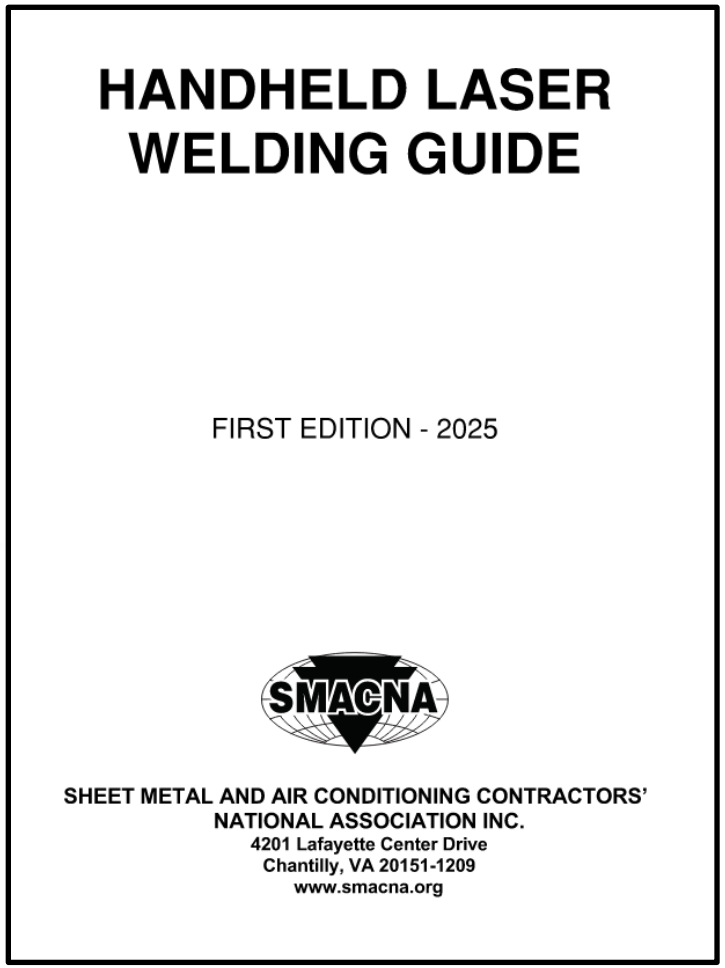


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Table of Contents

Chapter 1 – INTRODUCTION

- Introduction
- Scope
- Background
- Science
- Manual Contents

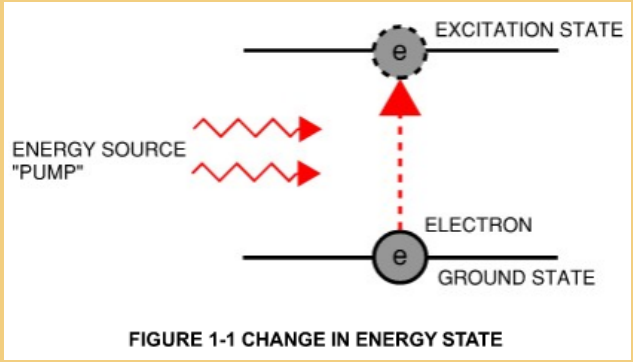


FIGURE 1-1 CHANGE IN ENERGY STATE

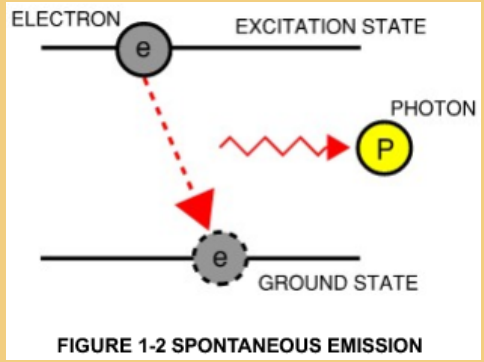


FIGURE 1-2 SPONTANEOUS EMISSION

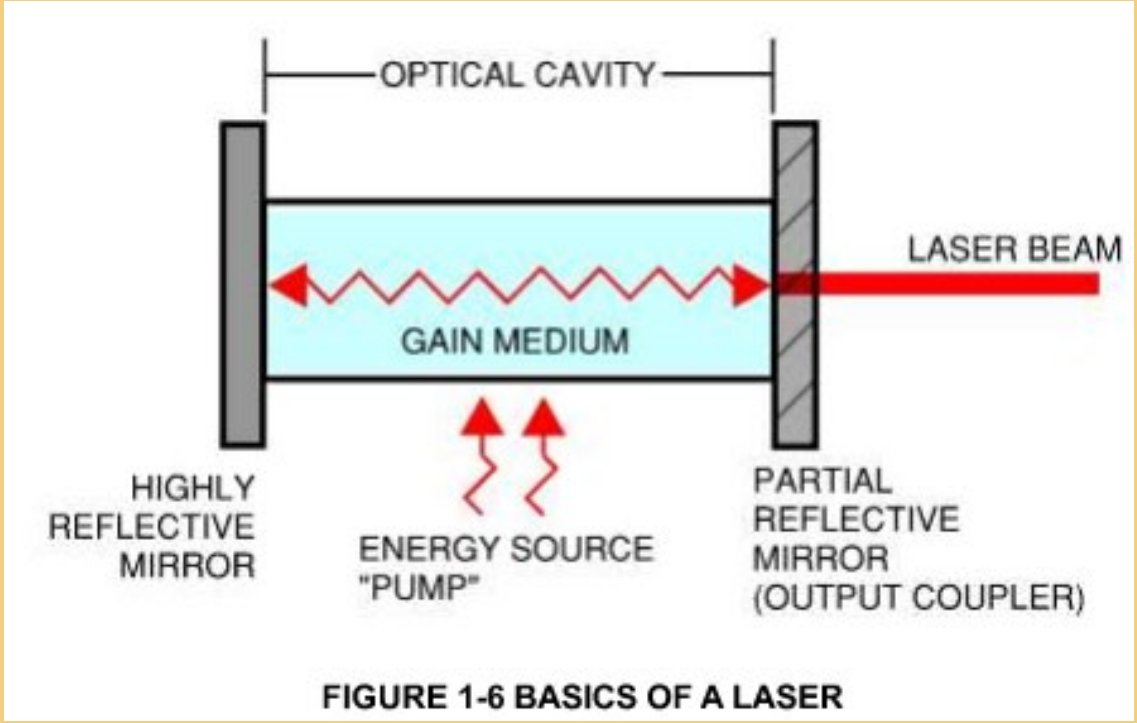
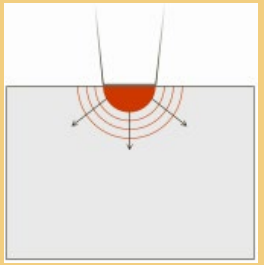


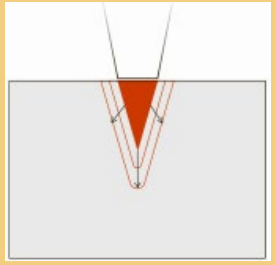
FIGURE 1-6 BASICS OF A LASER

Chapter 2 – LASER WELDING PROCESS

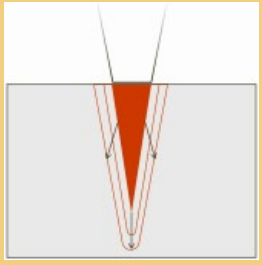
- Principles of Laser Welding
- Types of Lasers Used
- Types of Laser Welding
- Laser Welding Process
- Key Parameters to Consider
- Applications and Uses



Conduction



Transition Keyhole



Penetration Keyhole

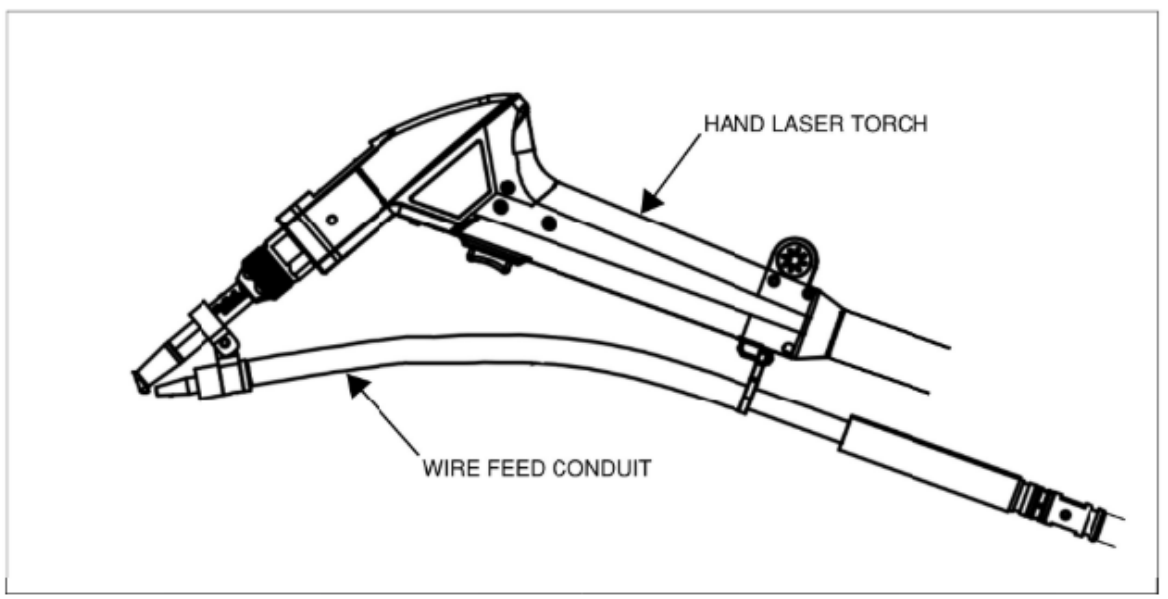


FIGURE 2-5 HAND LASER TORCH WITH WIRE FEED

Image courtesy of The Lincoln Electric Company (Flex Lase 20 Handheld Laser System)

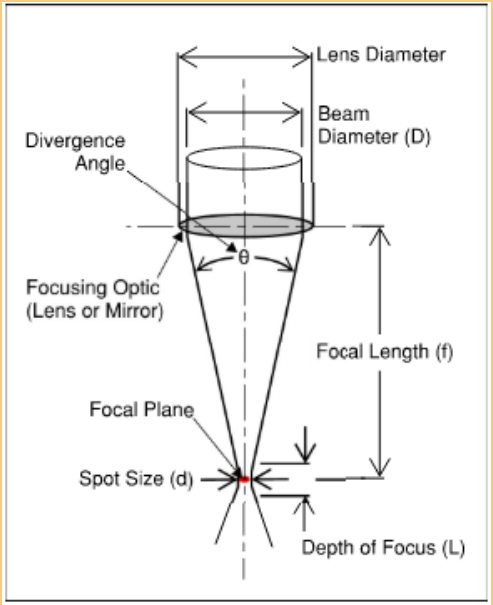


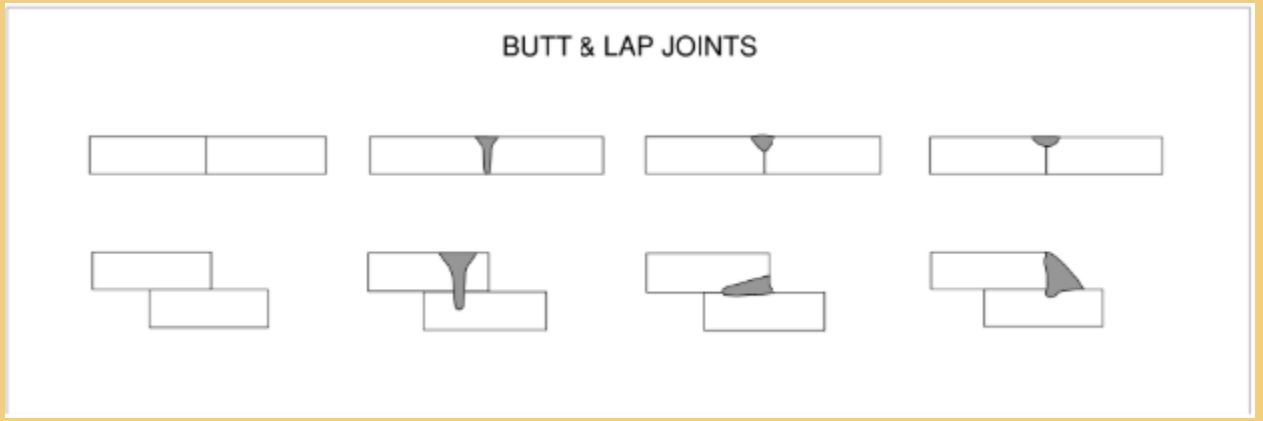
FIGURE 2-7 LASER BEAM PARAMETERS

FIGURE 2-1 WOBBLE LENGTH SETTINGS

Image courtesy of Poynter Sheet Metal

Chapter 3 – JOINT AND SEAM DESIGN

- Basic Design Considerations
- Types of Joints
- Edge Preparation
- Joint Cleaning
- Welding Symbols and Types of Welds
- Welding Positions
- Weld Strength



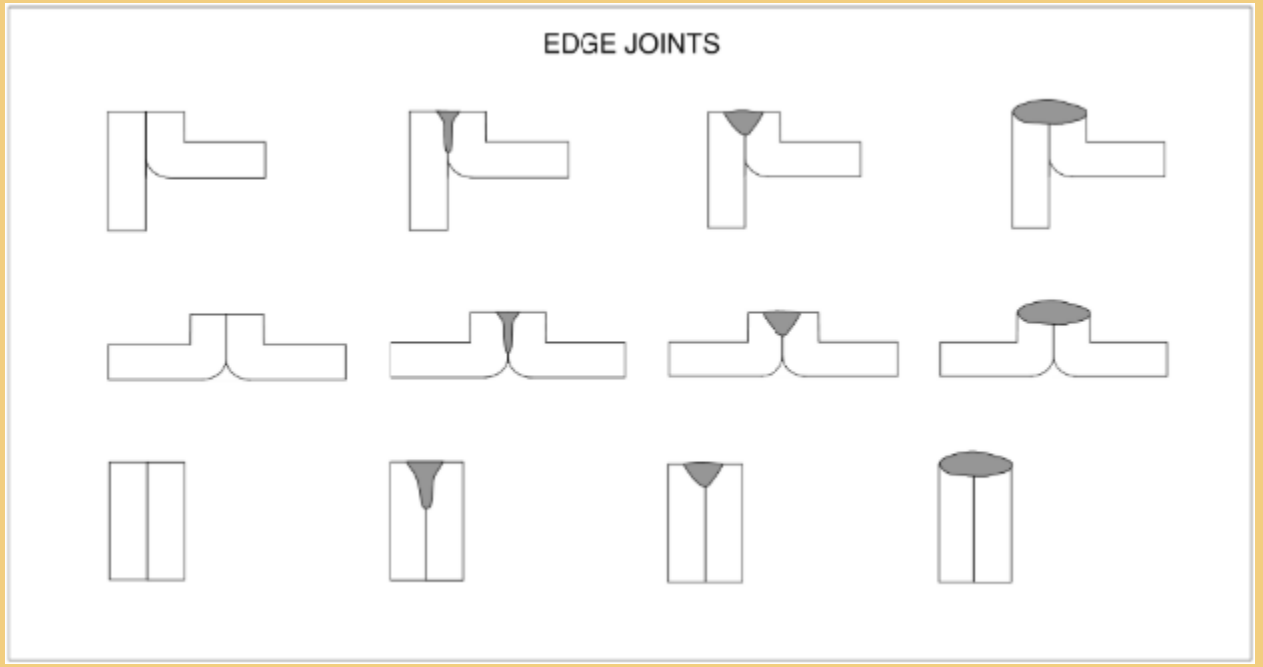
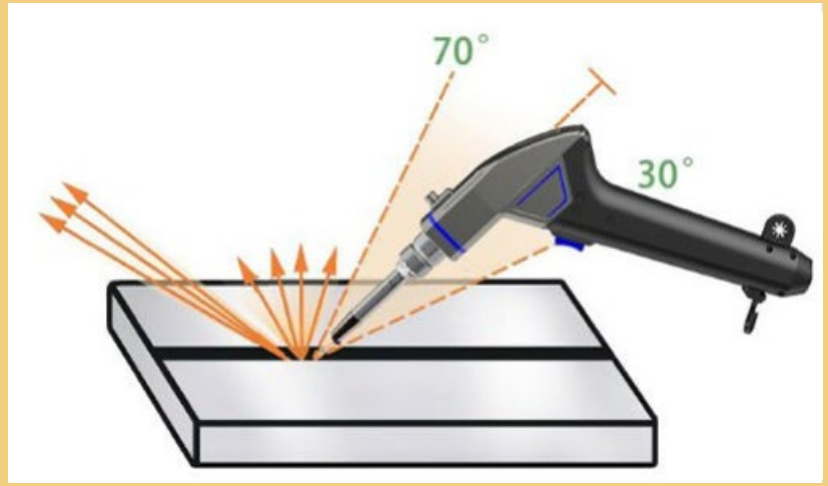


FIGURE 3-2 LASER WELDS AT JOINTS

NOTE: Adapted from AWS C7.2M:2010 with permission

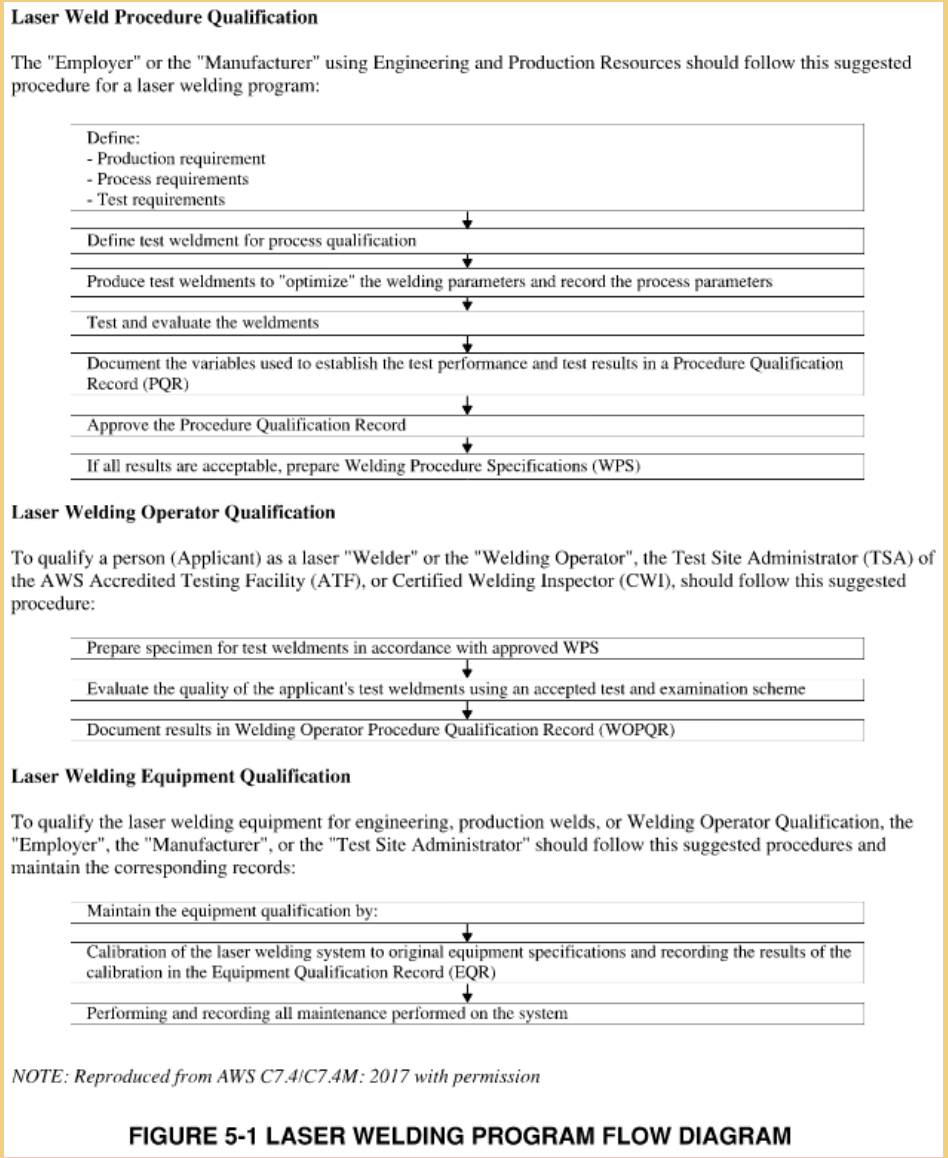
Chapter 4 – EQUIPMENT AND EQUIPMENT MAINTENANCE

- Overview
- Types of Equipment
- Setup
- Capabilities
- Maintenance
- Maintenance Schedule
- Maintenance Records
- Safety Functions and Requirements
- Trouble-Shooting



Chapter 5 – STANDARDS, CODES, AND SPECIFICATIONS

- Commentary on Standards, Codes, & Specifications
- Welding Code
- Resources
- Process Specifications & Operator Qualifications
- Documentation



Laser Weld Procedure Qualification

The "Employer" or the "Manufacturer" using Engineering and Production Resources should follow this suggested procedure for a laser welding program:

Define:
- Production requirement
- Process requirements
- Test requirements

↓

Define test weldment for process qualification

↓

Produce test weldments to "optimize" the welding parameters and record the process parameters

↓

Test and evaluate the weldments

↓

Document the variables used to establish the test performance and test results in a Procedure Qualification Record (PQR)

↓

Approve the Procedure Qualification Record

↓

If all results are acceptable, prepare Welding Procedure Specifications (WPS)

Laser Welding Operator Qualification

To qualify a person (Applicant) as a laser "Welder" or the "Welding Operator", the Test Site Administrator (TSA) of the AWS Accredited Testing Facility (ATF), or Certified Welding Inspector (CWI), should follow this suggested procedure:

Prepare specimen for test weldments in accordance with approved WPS

↓

Evaluate the quality of the applicant's test weldments using an accepted test and examination scheme

↓

Document results in Welding Operator Procedure Qualification Record (WOPQR)

Laser Welding Equipment Qualification

To qualify the laser welding equipment for engineering, production welds, or Welding Operator Qualification, the "Employer", the "Manufacturer", or the "Test Site Administrator" should follow this suggested procedures and maintain the corresponding records:

Maintain the equipment qualification by:

↓

Calibration of the laser welding system to original equipment specifications and recording the results of the calibration in the Equipment Qualification Record (EQR)

↓

Performing and recording all maintenance performed on the system

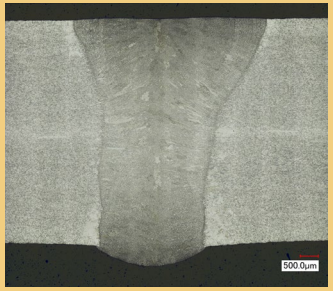
NOTE: Reproduced from AWS C7.4/C7.4M: 2017 with permission

FIGURE 5-1 LASER WELDING PROGRAM FLOW DIAGRAM

Chapter 6 – QUALITY ASSURANCE & QUALITY CONTROL (QA/QC)

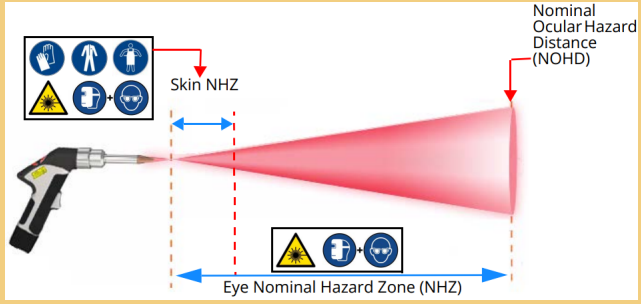
- Quality of Welds
- Pre-Weld Consideration
- Quality Assurance & Quality Control
- Weld Inspection
- Weld Testing
- Trouble-Shooting Weld Quality

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
Issues with quality of weld	Sub-Optimal laser parameters selected on HMI.	Adjust settings on HMI. Start with suggested setting and adjust as needed.
	Damaged/Incorrect Torch Nozzle	Replace with new or correct nozzle.
	Sub-Optimal Focal length on torch	Adjust focal length. Start with suggested setting and adjust as needed.
	Improper welding gas supply	Check gas connections, flow meter, regulator and obstructions to gas flow.
	Protective lens burned or contaminated with dust/dirt/ debris	Clean or replace protective lens
	Focus lens burned or contaminated with dust/dirt/ debris	Clean or replace focus lens
	Sub-Optimal wire conduit orientation.	Adjust wire conduit orientation so wire is centered on red guide beam.



Appendix A – SAFETY

- Introduction and Purpose
- Laser Classification
- Hazards
- Controls
- Laser Safety Requirements
- Guidance Document References



Appendix B – REFERENCED DOCUMENTS & OTHER RESOURCES

Glossary G – TERMS & DEFINITIONS

Tables / Figures / Charts

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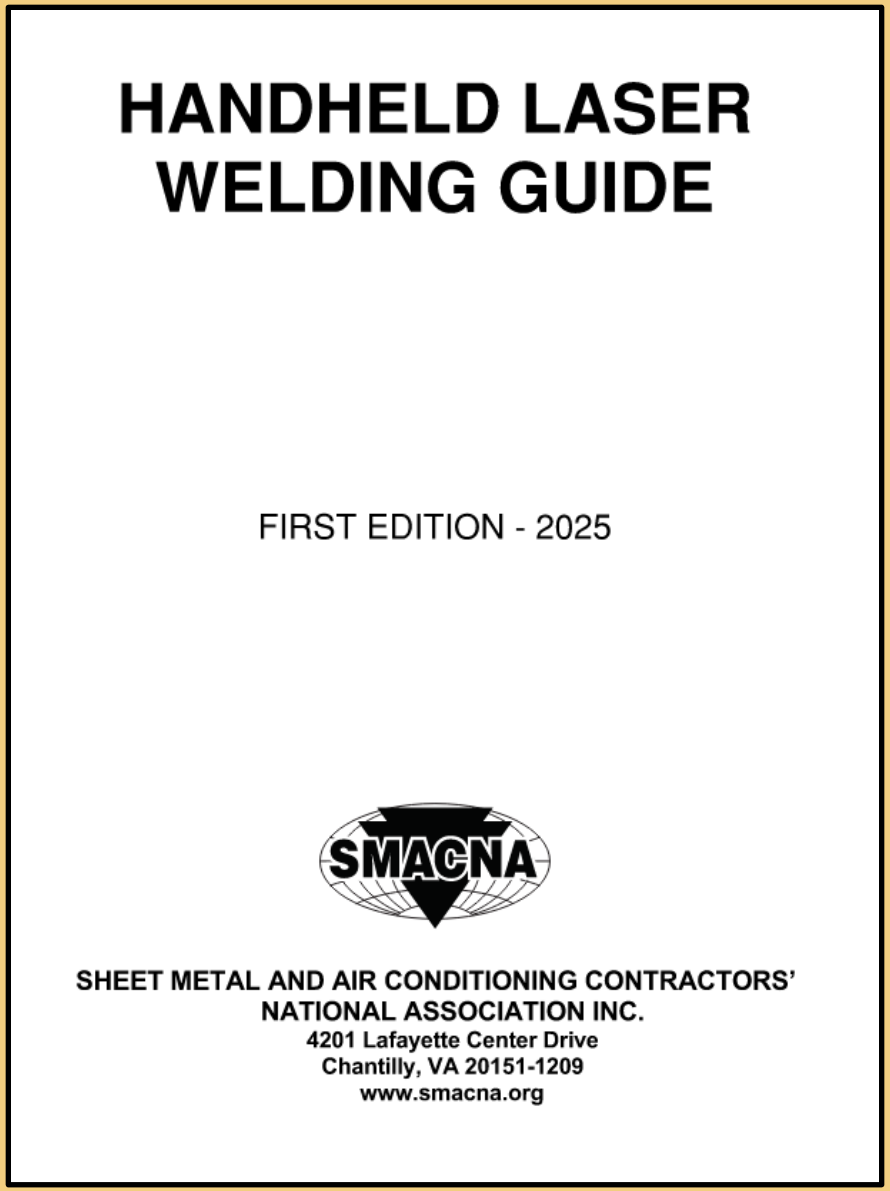
- Mobile: (571) 237-6942
- Email: gparks@smacna.org



Please take a moment to complete the session survey provided to you.