ATM 601 Welded Lock Seam Strength of Corrugated Metal Pipe

TENSILE STRENGTH TEST FOR WELDED LOCK SEAMS ON GALVANIZED STEEL CORRUGATED METAL PIPE (CMP) (AN ABBREVIATION OF AASHTO T 241 HELICAL CONTINUOUSLY WELDED SEAM CORRUGATED STEEL PIPE)

1. Scope

This procedure provides instructions for determining the tensile strength of welded lock seams on galvanized steel corrugated steel pipe in accordance with AASHTO T 241.

2. Apparatus

- Tensile testing frame with minimum load capacity of 3000 pounds, resolution of 1 pound and with clamping or griping devices capable of holding test coupon ends without slippage during the test.
- Calipers capable of measuring gauge section width and single sheet metal thickness to 0.0005 inches.
- A press, vice or similar device to flatten the corrugated test specimens prior to test coupon preparation.
- Metal saw or other metal cutting device and grinders, files, or other metal working tools for preparation of test coupons.

3. Procedure

1. Three each, 2-4" wide x 6-8" long, test specimens shall be cut perpendicular across the welds from a randomly selected production section of CMP, such that each specimen contains 2-4" of welded lock seam.

2. Prepare a sequentially numbered test coupon from each test specimen.

   A suggested Coupon ID system is: Ga-w-#, where:
   Ga = Galvanized steel sheet metal gauge
   w = Nominal test coupon gauge section width (in)
   # = Test coupon number

3. Three test coupons pulled to failure shall constitute a tensile strength test.

4. Prepare test coupons to conform to Figure 1 and the following dimensions:

Nominal Thickness	Galvanized Steel Sheet Gauge	Coupon dimensions		Gauge section	
		End Width	Length	Width	Length
0.0635"	16 Gauge	3" Max.	6-8"	0.80±.05"	2"
0.0785"	14 Gauge	3" Max.	6-8"	0.65±.05"	2"
0.1084"	12 Gauge	3" Max.	6-8"	0.50±.05"	2"
0.1382"	10 Gauge	3" Max.	6-8"	0.40±.05"	2"
0.1681"	8 Gauge	3" Max.	6-8"	0.30±.05"	2"

   Radius from gauge section to coupon ends shall be 1". See Figure 1 for other dimensions.

5. Measure to nearest 0.0005" and record single layer metal thickness of test coupon in the gauge section adjacent to the welded lock seam.

6. Measure to nearest 0.0005" and record the width of the test coupon in the gauge section at the welded lock seam.
7. Multiply thickness by width to calculate the cross sectional area of the gauge section adjacent to the welded lock seam.
8. Clamp test specimen into test frame and load specimens at a constant rate of 0.20 ±10% inches per minute.
9. Test to failure and record peak test load to the nearest pound. (If specimen reaches load frame capacity without failure, record peak load applied and note that specimen did not break.)
10. Calculate tensile strength by dividing test load by cross sectional area.
11. Calculate average tensile strength of coupons in the test set (minimum of 3).
12. Discard the tested coupons.

4. Report

- Results on forms approved or provided by the Department.

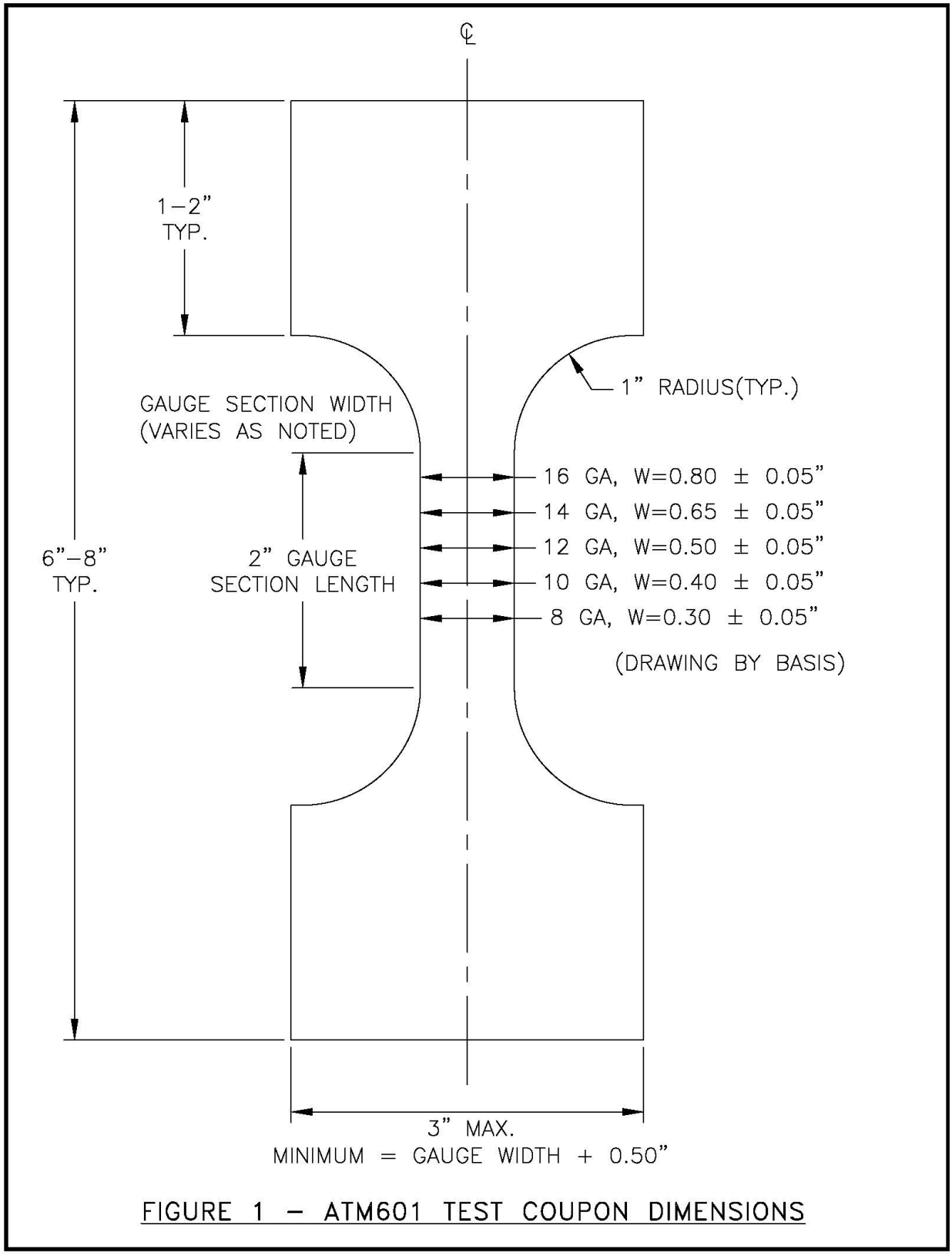

Figure 1
Test Coupon Dimensions

Welded Lock Seam Tensile Testing of Corrugated Metal Pipe (CMP)				
Welded Seam CMP testing done by:				
Test date:				
Test apparatus information:				
	Apparatus name/Mfg:			
	Model Number:			
	Max. load capacity (lb):		Load resolution (lb):	
	Loading rate (in/min):		Loading mechanism:	
	Digital or Analog display:		Load Cell Mfg/Model:	
	Calibration Date:		Calibrated by:	
Material:	Galvanized Steel Corrugated Metal Pipe			
Reference:	AASHTO T 241, AASHTO M 218			

Minimum required base metal tensile strength (psi) =				45,000	90% of base metal strength req'd =			40,500	
Coupon ID Ga-w-#[1]	Gauge (US Sheet)	Nominal Ga Thickness (in)	Measured Thickness (in)	Width (in)	Area (in^2)	Required Min Load (lb)	Test Load (lb)	Test Stress (psi)	Pass/Fail
							Average:		

Note 1:
Ga = Galvanized steel sheet metal gauge
w = Nominal test coupon width (in)
# = Test coupon number

Figure 2
Blank Test Form

Verification Procedure for Tensile Test Apparatus Used for Quality Control Testing of Welded Seam Corrugated Metal Pipe (CMP)

1. Verification of CMP producer's quality control tensile testing equipment shall be done annually.
2. Six each, 4" wide x 8" long test specimens shall be cut perpendicular across the welds from a randomly selected production section of CMP, such that each specimen contains 4" of welded lock seam.
3. Test specimens shall be numbered 1-6 sequentially along the pipe, corrugations flattened, and a test coupon prepared from each specimen. Test specimens may be adjacent to each other.
4. Three test coupons pulled to failure shall constitute a tensile strength test.
5. Test coupons shall conform to the following dimensions:

Nominal	Galvanized Steel	Coupon dimensions		Gauge section	
Thickness	Sheet Gauge	End Width	Length	Width	Length
0.0635"	16 Gauge	3" Max.	6-8"	0.80±.05"	2"
0.0785"	14 Gauge	3" Max.	6-8"	0.65±.05"	2"
0.1084"	12 Gauge	3" Max.	6-8"	0.50±.05"	2"
0.1382"	10 Gauge	3" Max.	6-8"	0.40±.05"	2"
0.1681"	8 Gauge	3" Max.	6-8"	0.30±.05"	2"

Radius from gauge section to coupon ends shall be 2". See Figure 1 for other dimensions.

6. Measure and record the thickness of the test coupon in the gauge section adjacent to the welded lock seam.
7. Measure and record the width of the test coupon in the gauge section at the welded lock seam.
8. Calculate the cross sectional area of the gauge section adjacent to the welded lock seam.
9. Coupons 1, 3, 5 shall be tested to failure with the CMP producer's tensile testing equipment. Coupons 2, 4, 6 shall be tested to failure by a certified or accredited independent lab.
10. Calculate tensile strength by dividing test load by cross sectional area.
11. Calculate average tensile strength of coupons in the test set (minimum of 3).
12. The producer's average tensile strength shall be within 5% of the independent lab strength test value.

Figure 2
Verification Procedure and Calculations
(1 of 2)

Welded Lock Seam Tensile Testing of Corrugated Metal Pipe (CMP)									
Welded Seam CMP testing done by:		CONTECH Engineered Solutions LLC, Marvin Copley							
Test date:		March 21, 2017							
Test apparatus information:									
	Apparatus name/Mfg:	Tensile Test Unit/Futek							
	Model Number:	LCM375							
	Max. load capacity (lb):	3000	Load resolution (lb):	1					
	Loading rate (in/min):	0.2 ±10%	Loading mechanism:	Hand crank					
	Digital or Analog display:	Digital	Load Cell Mfg/Model:	Dillon/FI-90					
	Calibration Date:		Calibrated by:						
Material:	Galvanized Steel Corrugated Metal Pipe								
Reference:	AASHTO T 241, AASHTO M 218								
Minimum required base metal tensile strength (psi) =				45,000	90% of base metal strength req'd =			40,500	
Coupon ID Ga-w-#[1]	Gauge (US Sheet)	Nominal Ga Thickness (in)	Measured Thickness (in)	Width (in)	Area (in^2)	Required Min Load (lb)	Test Load (lb)	Test Stress (psi)	Pass/Fail
12-0.50-1	12	0.1084	0.1040	0.5040	0.0524	2120	2712	51,700	**Pass**
12-0.50-2	12	0.1084	0.1040	0.5020	0.0522	2110	2411	46,200	**Pass**
12-0.50-3	12	0.1084	0.1020	0.5050	0.0515	2090	2839	55,100	**Pass**
							Average:	51,000	**Pass**

Note 1:
Ga = Galvanized steel sheet metal gauge
w = Nominal test coupon width (in)
# = Test coupon number

Figure 2
Verification Procedure and Calculations
(2 of 2)