

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 gripping 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"

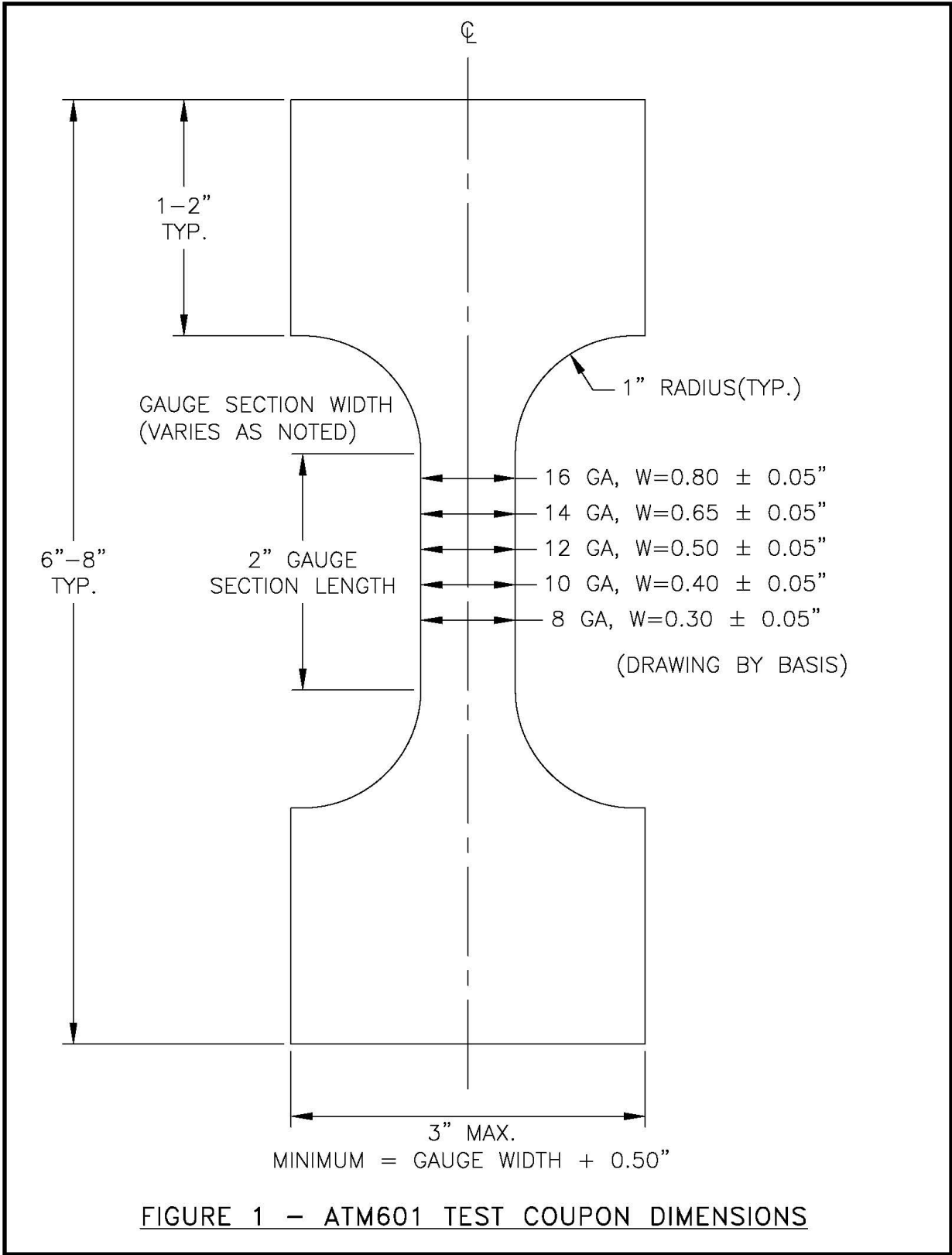
Radius from gauge section to coupon ends shall be 1". See Figure 1 for other dimensions.

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 $0.20 \pm 10\%$ 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	Gauge	Nominal Ga	Measured	Width	Area	Required Min	Test Load	Test Stress	Pass/Fail
Ga-w-# ¹	(US Sheet)	Thickness (in)	Thickness (in)	(in)	(in ²)	Load (lb)	(lb)	(psi)	
Test date:									
Average:									
Test date:									
Average:									
Test date:									
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 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 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) - Verification of Tensile Testing Apparatus										
Welded Seam CMP Fabricator:		CONTECH Engineered Solutions LLC								
Fabricator's testing date:		March 21, 2017								
Certified Independent Laboratory:		Alaska DOT&PF Central Region Lab								
Certified Lab's testing date:		March 22, 2017								
Material:		Galvanized Steel Corrugated Metal Pipe								
References:		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	Gauge	Nominal Ga	Measured	Width	Area	Required Min	Test Load	Tensile	Pass/Fail	
Ga-w-# ¹	(US Sheet)	Thickness (in)	Thickness (in)	(in)	(in ²)	Load (lb)	(lb)	(psi)		
Pipe fabricator's test values:										
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 Tensile Strength:						51,000				Pass
Certified independent laboratory test values:										
12-1.00-1	12	0.1084	0.1005	0.9965	0.1001	4060	5190	51,800	Pass	
12-1.00-2	12	0.1084	0.1030	0.9920	0.1022	4140	6053	59,200	Pass	
12-1.00-3	12	0.1084	0.0990	0.9940	0.0984	3990	4952	50,300	Pass	
12-1.00-4	12	0.1084	0.1010	1.0180	0.1028	4160	5460	53,100	Pass	
Average Tensile Strength:						53,600				Pass
95% of Average:						50,920				
105% of Average:						56,280				
Verification calculation (Fabricator average test stress within 5% of Certified lab average test stress?):								TRUE		

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)