AM GENERAL
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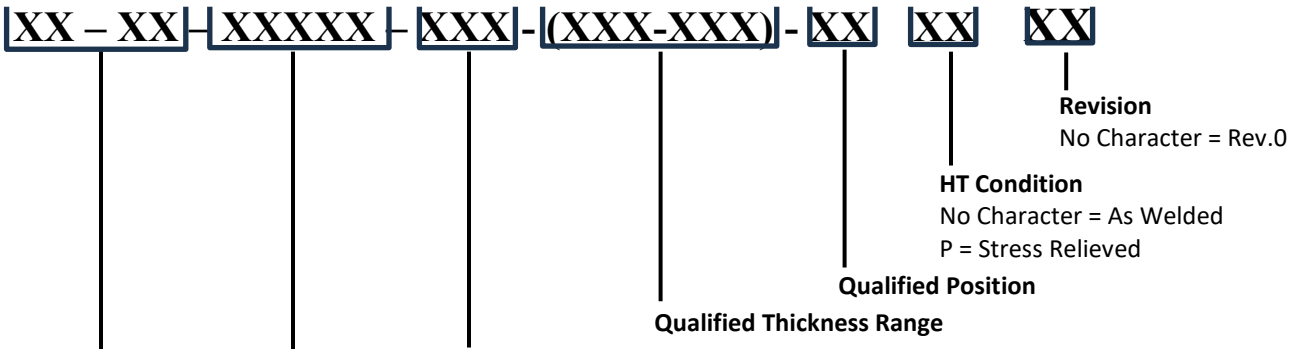
WPS/PQR Identification Legend



Revision
No Character = Rev.0

HT Condition
No Character = As Welded
P = Stress Relieved

Qualified Position

Qualified Thickness Range

Shielding Gas Mixture
A = 100% Argon
CO= 100%CO_2 C5 = 5% CO_2
C10 = 10% CO_2 C15 = 15% CO_2
C20 = 20% CO_2 C25 = 25% CO_2
O2 = 2% Oxygen He = 100% Helium
He25 = 75% Argon/25% Helium
Ar25 = 75% Helium/25% Argon

Process
M = GMAW
T = GTAW
F = FCAW

Transfer
SC = Short Circuit
PS = Pulse Spray
S = Spray

M = Manual
SA = Semi-Automatic
A or R = Automatic/Robotic

Base Metal Grouping
Use AWS B2.1 M-Numbers for all Non-Armor Base Metals

For Armor Use 3040A Table 1
S15 A: MIL-DTL-12560, Class 1 or Class 2
S15 B: MIL-DTL-12560, Class 4a
S15 C: MIL-DTL-12560, Class 4B
S15 D: MIL-DTL-46100, Class 1
S15 E: MIL-DTL-46100, Class 2
S15 F: MIL-DTL-11356, Class 1, Class 1 or Class 2
S15 G: MIL-DTL-46186
S18: MIL-DTL-32332

AM GENERAL
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PROCEDURE QUALIFICATION RECORD
PQR 3040-(XX-XXX)-XXXXX-XXX-(XXX)-2G, Rev. 0

This Procedure Qualification Record (PQR) details each essential variable that was used to successfully weld a qualification coupon, which joined.
XXX-XXX-XXXXX (XXX) Armor plate to XXX-XXX-XXXXX (XXX) Armor plate
with the
Gas Metal Arc Welding Pulse Spray (GMAW-P) process.

This PQR also documents the non-destructive and mechanical qualification test procedures and results that are required to validate the Welding Procedure Specification.

AM General's Procedure Qualification Record
PQR 3040-(XX-XXX**)-(**XX-XX-XXX**-(**XXX**)-2G, Rev. 0**
was developed and qualified in substantial conformance with the requirements of the following welding standard:
MIL-STD-3040A

Revision Log

Rev. #	Description	Author	Date

Responsible Parties

The signed parties below state that the procedure development and qualification testing were completed in substantial conformance with the requirements of the above-mentioned welding standard.

Testing Witnessed & Supervised By:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____
CWI Stamp:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____

Governing 3040 PreWPS ID:	(XX-XX)-XXXX-XXX-(XXX)-2G, Rev. 0	**3040 PQR ID:**	(XX-XX)-XXXX-XXX-(XXX)-2G, Rev. 0
Welding Process: GMAW-P	**Type:**	**Manual:** (⊙)	**Semiautomatic:** (◯) **Robotic:** (◯)

BASE METAL (See Appendix A for Coupon C of C)

Base Metal Thickness		**Welded To**	**Base Metal Thickness:**
Material Type:		**Welded To**	**Material Type:**
MIL-STD ID:		**Welded To**	**MIL-STD. ID:**
3040 Base Metal S#:		**Welded To**	**3040 Base Metal S#**
AMG Base Metal S#:		**Welded To**	**AMG Base Metal S#:**

WELD JOINT		Ultra-High Hard Armor	
Weld Type:		**Shielding Gas Composition:**	
Joint Design:		**Flow Rate:**	
Backing:		**Backing Gas Composition:**	
Bar Dimensions:		**Backing Gas Flow Rate:**	
Backing Material:		**Other:**	

POSITION		**ELECTRICAL CHARACTERISTICS**	
Groove Position:		**Current Type & Output:**	
Welding Progression:		**Polarity:**	
Other:		**Transfer Mode:**	

BASE METAL PREPARATION

Weld coupon was laser cut and then machined. After machining the weld joint the base metal was prepared by grit blasting, and the weld joint was brushed with steel wire brush. It was relatively clean, free from dirt, oxide, oil, or grease. Acetone was used to wipe coupon prior to welding.

FILLER METAL See App. B for C of C for Filler Metal		**PREHEAT AND INTERPASS TEMPERATURE**		
AWS Classification:		**Material Thickness Inches**	**Min Preheat & Interpass Temperature**	**Max Interpass Temperature**
AWS Specification:				
AWS F No.:				
3040 Filler Metal ID:				
Filler Metal Dia.:				
Number of Electrodes:				

PREHEAT TEMPERATURE MAINTENANCE & MONITORING

Preheat and interpass readings were taken with a temperature sensitive crayon. Preheat monitoring for both base metals were completed at a radius of ~3" away from weld toes. Preheat was monitored before starting to weld and after welding each bead. Interpass temperature readings were taken between the weld toe and ~ 1" from the weld toe.

WELDING PARAMETERS

Weld Layer	Process	Wire Dia.	WFS (IPM)	Volts	Amps	Travel Speed (IPM)	Heat Input kJ/in.
Tack & Root							
Fill							
Cap							

INTERPASS CLEANING	**VISUAL INSPECTION**
Each weld pass was cleaned. Cleaning was done abrasively, with disc and/or a needle gun. A stainless steel power brush and hand brush were also used.	Each weld pass was inspected by an AWS QC1 SCWI. All weld beads were uniform in appearance and met the acceptance criteria of 3040A; Table XX. Final visual inspection was performed after the required 48-hour hold.

TECHNIQUE

Stringer/ Weave Bead:		**Torch Attitude:**	
		Gas Cup Size:	
Single/Multi Pass Weld:		**Backgouge:**	
		Backgouge Method:	

POSTWELD HEAT TREATMENT - N/A

Other:	N/A		

Procedure and Results
Non-Destructive Testing

Preweld Inspection

One set of 3/8" thick weld coupons were prepared, tacked, and subsequently inspected. Final dimensions of the PQR coupon were approximately 14" x 30". Figure 1 details the weld joint geometry. The weld joint was in substantial conformance with the requirements of weld joint B1V.5, shown in Figure 3 of MIL-STD-22D.

One plate was MIL-STD-32332 (S18). The other plate was MIL-STD-46100 (S15D). Appendix A contains the certificates of conformance for the base metals. The plates were processed so the rolling direction was transverse to the weld direction. Four 1.5" long tacks were applied in the bottom of the groove joining the backing bar to the weld coupons. The application of the tack welds met the requirements of 3040A, Paragraph 5.10.7 & 5.10.7.1. Tacks were made using the welding parameters detailed in the PQR. The tacks were visually inspected by an AWS QC1 SCWI with an unaided eye in a well-lighted area (>600lx). The visual inspection procedure met the requirements of MIL-STD-3040A paragraphs 5.9.2.1.1 & 5.9.2.1.2. Final geometry of the weld coupon was compliant with MIL-STD-3040A, Figure 4. The acceptance criteria used for visual inspection met the requirements of MIL-STD-3040, Table XX. The tacks blended smoothly into the adjacent base metal. No unacceptable discontinuities were observed in the tack welds. Each tack was subsequently ground, i.e., "feathered", to allow their consumption, and optimum depth of fusion when depositing the root weld pass.

In-Process & Postweld Visual Inspection

An AWS QC1 SCWI insured that the essential variables were recorded during welding of the PQR. Each weld pass was visually inspected. The inspection was completed with the unaided eye. VT illuminance meet the requirements of paragraph 5.9.2.1.1 of MIL-STD-3040A, (>540 lx). Final VT inspection commenced after 48 hours had passed after the last weld bead was deposited. Inspection included the weld bead plus a 0.5" either side of the weld into the base metal. The inspection procedure used was in compliance with MIL-STD-3040, paragraphs 5.9.2.1.1 & 5.9.2.1.2. The criteria detailed in MIL-STD-3040A; Table XX was used for acceptance. No observable discontinuities were observed in tacks, root pass or cover pass. Table 1 summarizes the results of the visual inspection for each weld pass and layer. Appendix C provides a copy of the visual inspection work instruction and result sheet.

Table 1
Postweld Visual Inspection Results

Joint Offset		**Burn- Through**		**Incomplete Fusion**		**Melt- Through**		**Craters**	
Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐
Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐
Weld Bead(s) Appearance & Reinforcement		**Undercut**		**Porosity**		**Weld Toe Overlap**		**Cracks**	
Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐
Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐
Final Disposition of Visual Inspection:									

Mechanical Testing

Figure 2 presents a sketch of the PQR weld coupon, which illustrates the locations of the blanks used for the mechanical testing samples. Initially the blanks were removed from the welded coupon by water jet cutting. The surfaces of the blanks were grit blasted to remove the oxide from the water jet cutting. Immediately after blasting the blanks were engraved with a unique identifier that detailed the type of test and sample ID/number. The identifier will remain with the sample until each test is completed and the results are recorded.

Tensile Testing

Three blanks were removed and subsequently used for reduced section tensile tests. The tensile blanks were removed transverse to the welding direction as shown in Figure 2. The entire cross-sectional thickness was used in the tensile specimens after machining the reinforcement and backing bar. The samples were subsequently machined to the requirements of AWS B4.0, Paragraph 4.7.4, and Figure 4.2. Gauge width was 1.5". Tensile test procedure used to acquire the ultimate tensile strength was in compliance with ASTM E8. Results of the tensile testing are provided in Table 2. The criteria used for acceptance was provided in MIL-STD-3040A, Paragraph 5.7.2.1, which required that the UTS shall not be less than the minimum ultimate tensile strength specified in the applicable base or weld material specification(s) whichever is less. Appendix D contains the testing laboratory result sheet and the testing laboratory's certificate of accreditation to ISO 17025.

Table 2
Tensile Test Results

Sample ID	UTS Requirements EN ISO 14343-A; G 18 8 Mn	Individual Results UTS	Disposition
Reduced Section #1	72 ksi		
Reduced Section #2			
Reduced Section #3			
Reduced Section #4			

Impact Testing

Figure 2 of this PQR illustrates the approximate location of the blanks used for Charpy test specimens. The initial blanks for the Charpy specimens were removed from the PQR coupon using water jet cutting. The plate thickness necessitated the use of sub-size (3/4 Size) impact specimens. Because the PQR is comprised of two different base metals alloys, three sets of five (5) Charpy specimens were removed from the weld zone, machined, and tested. The locations of the Charpy specimens were in compliance with Figure 4 of MIL-STD-3040A, i.e., the long axis of each of the impact specimens was transverse to the weld direction. Figure 3 of this document illustrates the approximate V-notch location of the three sets of specimens, i.e., both HAZs and weld metal. The following bullets detail the Charpy Set ID and the location of the set within the weld zone.

Impact Testing (Cont.)

- Set A (Weld) samples shall have the length of the notch collinear with the center line of the weld and the notch is located perpendicular to test plate thickness. The sample surface was parallel with the top surface. See Figure 3.
- Set B-S15D-HAZ was located to test the impact strength of the MIL-DTL-46100 HAZ. The notch length was parallel with the fusion line and center line of the weld. The notch was encompassed in the HAZ with the notch perpendicular to test plate thickness. See Figure 3.
- Set C-S18-HAZ was located at the fusion line in the MIL-DTL-32332 HAZ. The V-notch length is parallel with the center line of the weld. The V-notch encompassed as much of the HAZ as possible with notch perpendicular to test plate thickness. See Figure 3.

The procedure used for location of the notch and testing was in compliance of 3040A, paragraph 5.7.8. The rough dimension of the longitudinal length of each specimen was extended from the finish dimension(s) to facilitate accurate location of the notch in the HAZ and in the weld. Each Charpy specimen was polished and subsequently etched with 5% Nital to reveal the macrostructure, i.e., the fusion line and HAZ. Therefore, the notch can be accurately located in the Charpy test specimen. The procedures for location the notch, the notch geometry and to complete the testing met the requirements of ASTM E23. Testing was completed at -40^0 F. Table 3 provides the Charpy specimen ID, the location of the specimen, test temperature and the resultant absorbed energy for each specimen. Acceptance criteria for the weld specimens met the requirements of 3040A, paragraph 5.7.8.2. Appendix D contains the testing laboratory result sheet and the testing laboratory's certificate of accreditation to ISO 17025.

Table 3 Charpy Impact Test Results

Sample ID	Location	Orientation	Test Temp	Req. Absorbed Energy	Absorbed Energy	Disposition
A WELD #1	Weld Metal	N/A	-40^0 F	*		
A WELD #2	Weld Metal	N/A	-40^0 F	*		
A WELD #3	Weld Metal	N/A	-40^0 F	*		
A WELD #4	Weld Metal	N/A	-40^0 F	*		
A WELD #5	Weld Metal	N/A	-40^0 F	*		
				Average		
A-HH-HAZ #1	46100 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-HH-HAZ #2	46100 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-HH-HAZ #3	46100 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-HH-HAZ #4	46100 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-HH-HAZ #5	46100 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
				Average		
A-UH-HAZ #1	32332 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-UH-HAZ #2	32332 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-UH-HAZ #3	32332 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-UH-HAZ #4	32332 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
A-UH-HAZ #5	32332 HAZ	T-L	-40^0 F	> 9 ft-lbs.		
				Average		
Overall Disposition of Impact Testing:						
*Per 5.7.8 No minimum applies from AWS/ISO Specification then data is documented only.						

Rockwell Hardness Testing

Rockwell hardness tests (C-Scale) were taken to determine the hardness of each unaffected base metal, the weld metal and both HAZ regions that were 5/8" to 7/8" from each weld interface. Three tests were taken adjacent to the top surface, mid-thickness and adjacent to the bottom surface in the unaffected base metal, the HAZ(s) and the weld. The procedure used for the hardness testing was in conformance with ASTM E18: *Standard Test Methods for Rockwell Hardness of Metallic Materials*. Figure 4 provides a sketch that details the approximate location of the hardness tests. Results of the Rockwell hardness (HRC) testing are provided in Table 5.

Metallographic Inspection

Metallographic Inspection

Four weld cross sections were removed from the weld coupon for macroscopic metallographic inspection. Each inspection was performed in compliance with 3040A; paragraph 5.7.4. Locations of the cross sections in the welded coupon are shown in Figure 2 of this PQR. After sectioning, the planes of metallographic observation were prepared by using a three-step procedure for surface grinding with sequential finer grits of silicon carbide abrasive (120, 200 and 400 grit). The metallographic preparation procedure was in substantial conformance with ASTM E340. Each cross section was inspected in the as polished and etched condition using oblique and low angle incident lighting with magnifications that ranged from 2X to 10X. The cross sections were etched with 5% Nital to reveal the macrostructure. The criteria detailed in 3040A, Table XX and Paragraph 5.9.2.1.3 was used for acceptance. Figures 5 through 8 provide photomacrographs of each cross section. Table 4 summarizes the results of the metallographic inspection.

Table 4
Result of the Metallographic Inspection

Item	Sample #	Condition	Results
1	1	As Polished	
2		Etched	
3	2	As Polished	
4		Etched	
5	3	As Polished	
6		Etched	
7	4	As Polished	
8		Etched	
Final Disposition of Macroscopic Inspection			

Microhardness Testing

Four microhardness traverses were taken on a weld cross sections that was removed from the PQR coupon. The traverses were completed on the macroetch samples (See Metallographic Inspection). Each traverse met the requirements of MIL-STD-3040A, paragraph 5.7.5 and traversed across each base metal, through the weld metal and both heat affected zones. An indent spacing of approximately 0.015" was used for each spacing.

Microhardness Testing (Cont.)

A 1kg load was used with a Knoop indenter, employing the procedure that is detailed in ASTM E384, *Standard Test Method for Microindentation Hardness of Materials.* Paragraph 5.7.5.3 of MIL-STD-3040A was used for acceptance criteria, i.e., the HAZ hardness must be greater than the minimum requirement of the base metal. Figure 4 provides a sketch that shows the approximate location of the microhardness traverses in the weld zone. Four photographs that present each weld zone, and illustrate the locations and results of the hardness indentations is provided in Figure 9 thru 12. The results of each traverse are provided in Table 6.

Table 5
Results of the Rockwell C-Scale Hardness Testing
Averaged then Converted to Brinell
Conversions were completed in conformance of ASTM E140

Traverse ID	46100 Base Metal	46100 HAZ	Weld Metal	32332 HAZ	32332 Base Metal
Adjacent to Top Surface					
Average: HRC (HBW)					
Mid Thickness					
Average: HRC (HBW)					
Adjacent to Bottom Surface					
Average: HRC (HBW)					
Final Disposition of Hardness Testing:					

Table 6
Results of the Vickers (HV.1kg)
Microhardness Traverse
Conversions were completed in conformance of ASTM E140

Traverse ID	46100 Base Metal	46100 HAZ	Weld Metal	32332 HAZ	32332 Base Metal
Top Surface					
Ave.: HV (HBW)					
Mid Thickness					
Ave.: HV (HBW)					
Bottom Surface					
Ave.: HV (HBW)					
Final Disposition of Hardness Testing:					

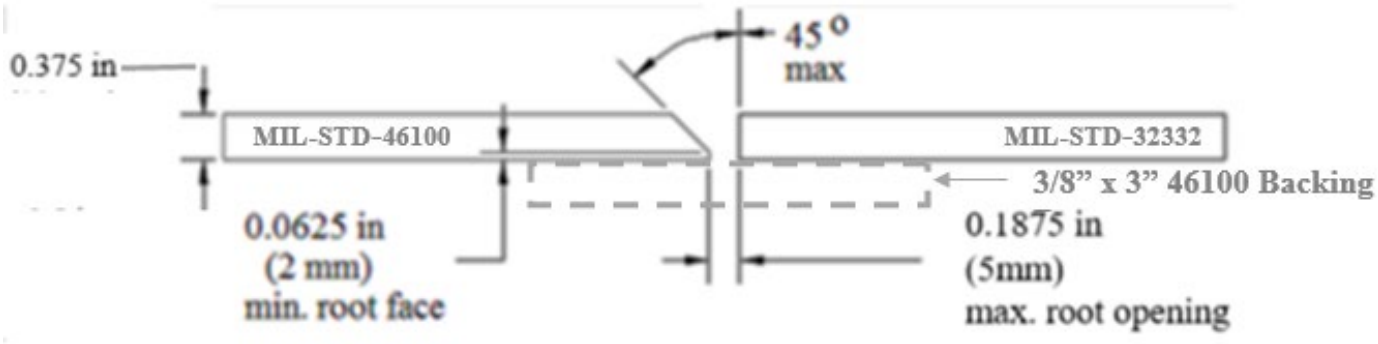

Figure 1, Sketch that illustrates the weld joint type, dimensions and tolerences. The weld was completed in the 2G position with a backing bar.

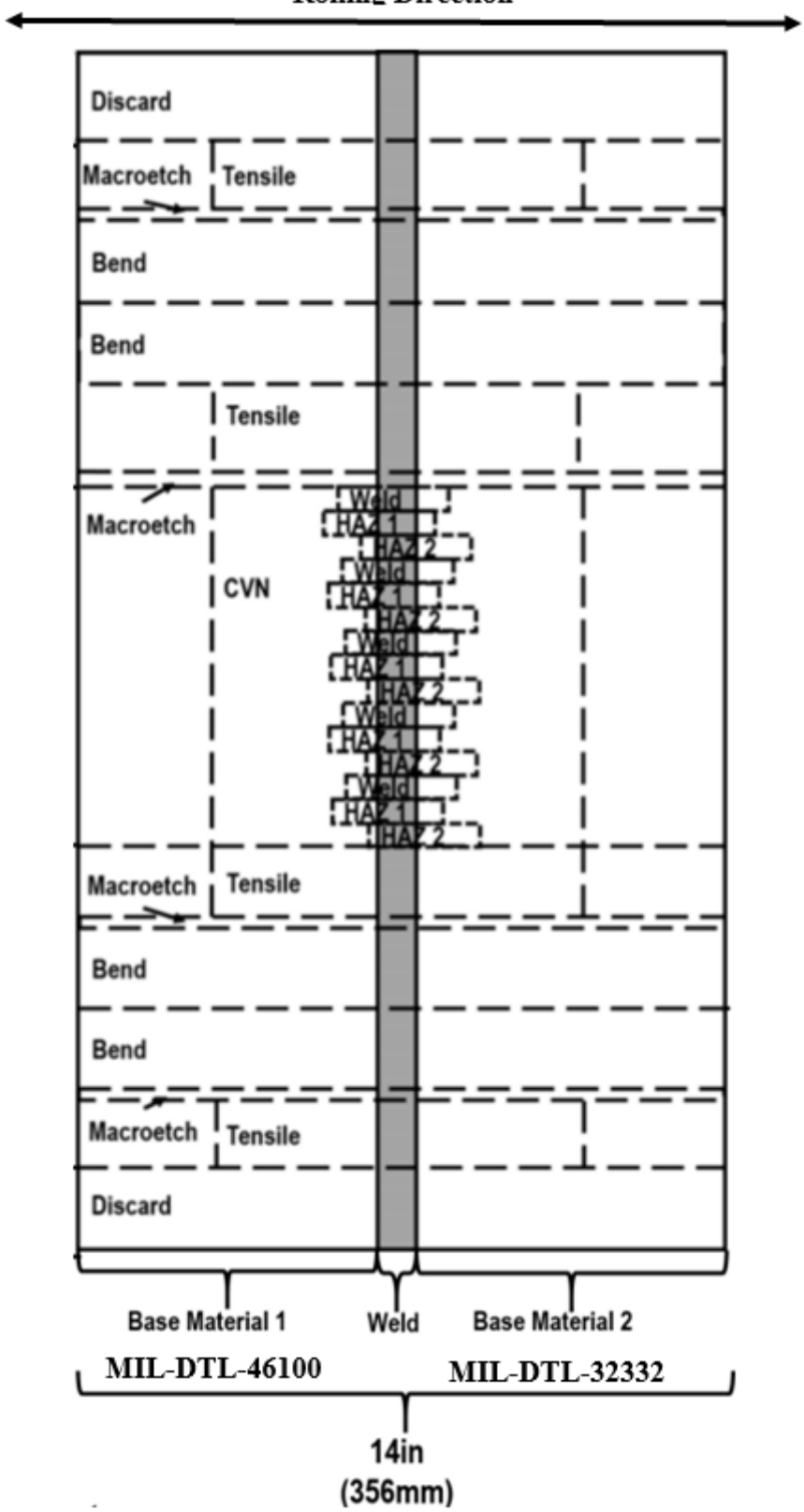

Figure 2, Sketch of the coupon(s) that illustrates the approximate location of the blanks that were removed from mechanical testing. This sketch was copied from MIL-STD-3040, Rev. A, Figure 4.

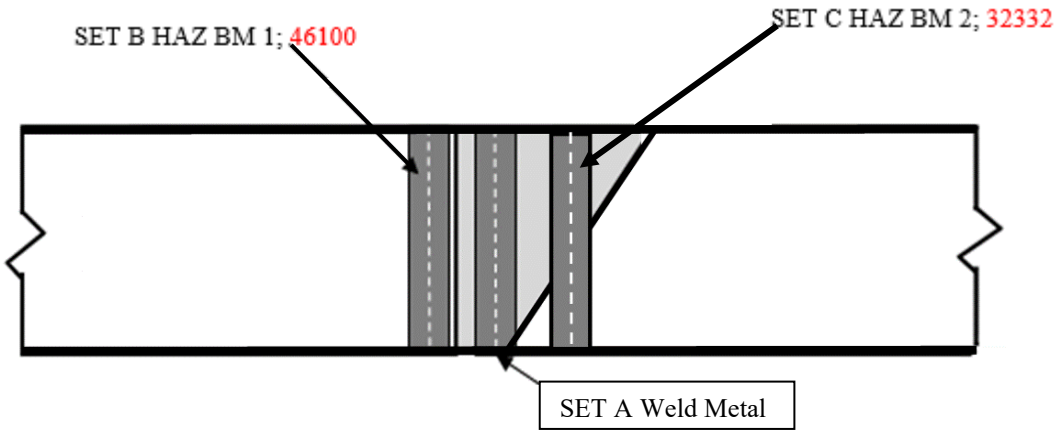

Figure 3 Sketch that illustrates the approximate location of the V-notch centerline (Dashed White Line) for the three sets of specimens, i.e., both HAZs and weld metal.

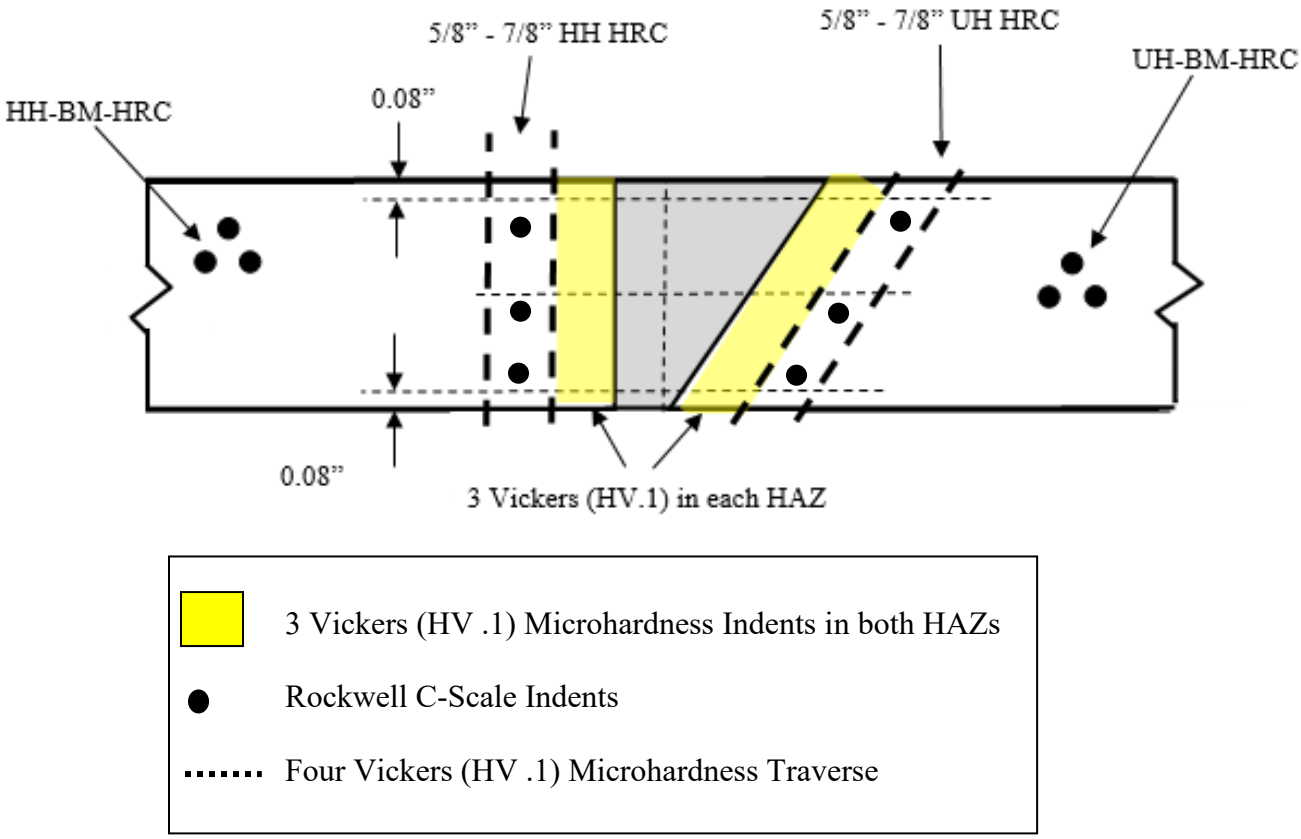

Figure 4; Sketch that illustrates the approximate location and results of the three hardness traverses.

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Original Magnification 3.5X 5% Nitric Acid
Figure 5, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #1

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Original Magnification 3.5X 5% Nitric Acid
Figure 6, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #2

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Original Magnification 3.5X 5% Nitric Acid
Figure 7, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #3.

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Original Magnification 3.5X 5% Nitric Acid
Figure 8, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #4.

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Original Magnification 3.5X 5% Nitric Acid
Figure 9, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #1.

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Original Magnification 3.5X 5% Nitric Acid
Figure 10, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #2.

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Original Magnification 3.5X 5% Nitric Acid
Figure 11, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #3.

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Original Magnification 3.5X 5% Nitric Acid
Figure 11, Photomacrograph that illustrates the cross-sectional appearance of Met Sample #4.

Appendix A
Certificate of Conformance
Weld Coupon

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C of C for MIL-DTL 46100
Page 1 of 3

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C of C for MIL-DTL 46100
Page 2 of 3

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C of C for MIL-DTL 46100
Page 3 of 3

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C of C for MIL-DTL-32332
Page 1 of 3

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C of C for MIL-DTL-32332
Page 2 of 3

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C of C for MIL-DTL-32332
Page 3 of 3

Appendix B
Certificate of Conformance
Filler Metal

Appendix C
Visual Inspection Work Instruction
And
Results Sheet

General Information		
Project Name: Visual Inspection PQR Plate	**Job Number:**	**Date:**
Project Scope: Visual inspection on welded PQR Coupon:		
VT Report ID:		
AMG VT Procedure ID:		
Governing Spec.:		**NDT Technique:**
Customers Spec:		
Test Environment:		

Part Information			
Part ID:	**Part Material Specification:**	**Alloy:** MIL-DTL- & MIL-DTL-	
Material Lot Number:	**Manufacturing Lot Number:**		

Test Part Condition, Manufacturing & Inspection Process Description:
Laser Cut Blanks, Machined Components, Tack Weld, Mechanical cleaning with wire brush, welded components arrived in VT area brushed cleaned free of slag, dirt, grease, lint or any other extraneous matter after the 48 hr. dwell.

Visual Testing Process Variables, Parameters and Procedure	
Area Inspected:	
Part Preparation:	
Type of Cleaner Mechanical:	**Type:**
Type of Cleaner Chemical:	**Serial Number:**
Method of Cleaner Application:	**Cleaner Dry Time:**
Procedure Description Part Positioning: 1) Complete pre-inspection mechanical cleaning by wire brushing if necessary. 2) Check ambient light intensity before inspection (>350 lx). Complete visual testing inspection using acceptance criteria provided in MIL-STD-3040A, Table XX.	
Ambient White Light @ Inspection Surface: >540lx	

Inspection Results					
Part Numbers Inspected: Coupon for					
Inspection Acceptance Criteria:	MIL-STD-3040A, Table XX.				
Number of Parts Inspected per PN:		**Parts Accepted:**		**Rejected:**	
Comment & Final Disposition:					

Responsible Parties			
Reported By:		**Report/WI Reviewed & Approved By:**	
Signed:			
AWS QC1 SCWI ID:		**Engineering Manager**	
Expiration Date:		**Date:**	

Appendix D
Mechanical Testing Results Sheet
and
ISO 17025 Test Lab
Accreditation

AM GENERAL
MISSION READY ★ FUTURE DRIVEN

PROCEDURE QUALIFICATION RECORD

PQR 3040-

This Procedure Qualification Record (PQR) details each essential variable that was used to successfully weld a fillet qualification coupon, which joined,
armor plate to armor plate
with the
Gas Metal Arc Welding Pulse Spray (GMAW-P) Process.

This PQR also documents the metallographic inspection, and mechanical qualification test procedures, and results that are required to validate the Welding Procedure Specification.

AM General Procedure Qualification Record
PQR 3040-
was developed and qualified in substantial conformance
with the requirements of the following welding standard:
MIL-STD-3040A

Revision Log

Rev. #	Description	Author	Date

Responsible Parties

The signed parties below state that the procedure development and qualification testing were completed in substantial conformance with the requirements of the above-mentioned welding standard.

Testing Witnessed & Supervised By:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____
CWI Stamp:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____

Governing 3040 PreWPS ID:		**3040 PQR ID:**	(XX-XXX)-XXXXX-XXX-(XXX)-XX
Welding Process: GMAW-P	**Type:** **Manual:** (○)	**Semiautomatic:** (○)	**Robotic:** (○)

BASE METAL

Base Metal Thickness		**Welded To** **Base Metal Thickness:**	
Material Type:		**Welded To** **Material Type:**	
Material Standard:		**Welded To** **Material Standard:**	
3040 Material ID:		**Welded To** **3040 Material ID:**	
AM General Material ID:	XX	**Welded To** **AM General Material ID:**	

WELD JOINT		**SHIELDING GAS (See C of C in Appendix A)**	
Weld Type:	XXX	**Shielding Gas Composition:**	
Joint Design:		**Flow Rate:**	
Backing:		**Backing Gas Composition:**	
Backing Material:		**Backing Gas Flow Rate:**	
POSITION		**ELECTRICAL CHARACTERISTICS**	
Test Position:		**Current Type:**	
Welding Progression:		**Polarity:**	

AM GENERAL
MISSION READY ★ FUTURE DRIVEN

FILLER METAL See App. B for C of C for Filler Metal

AWS Classification:	
AWS Specification:	
AWS F No.:	
3040 Filler Metal ID:	
ISO 14343 ID:	
Filler Metal Diameter:	
No. of Electrodes:	

PREHEAT AND INTERPASS TEMPERATURE

Material Thickness Inches	Min Preheat & Interpass Temperature	Max Interpass Temperature

BASE METAL PREPARATION

PREHEAT TEMP. MAINTENANCE & MONITORING

WELDING PARAMETERS

Weld Layer	Wire Dia.	WFS (IPM)	Volts	Amps	Travel Speed (IPM)	Trim	Qualified Maximum Heat Input 3040 para. 5.10.6a
Tack							
Single Weld Pass							
#1 Cover Pass							
#2 Cover Pass							

INTERPASS CLEANING

VISUAL INSPECTION

TECHNIQUE

Multi/Single Pass Weld:	**Interpass Cleaning:**
Stringer/ Weave Bead:	**Torch Attitude:**
Other:	**Gas Cup Size:**

POSTWELD HEAT TREAT (N/A)

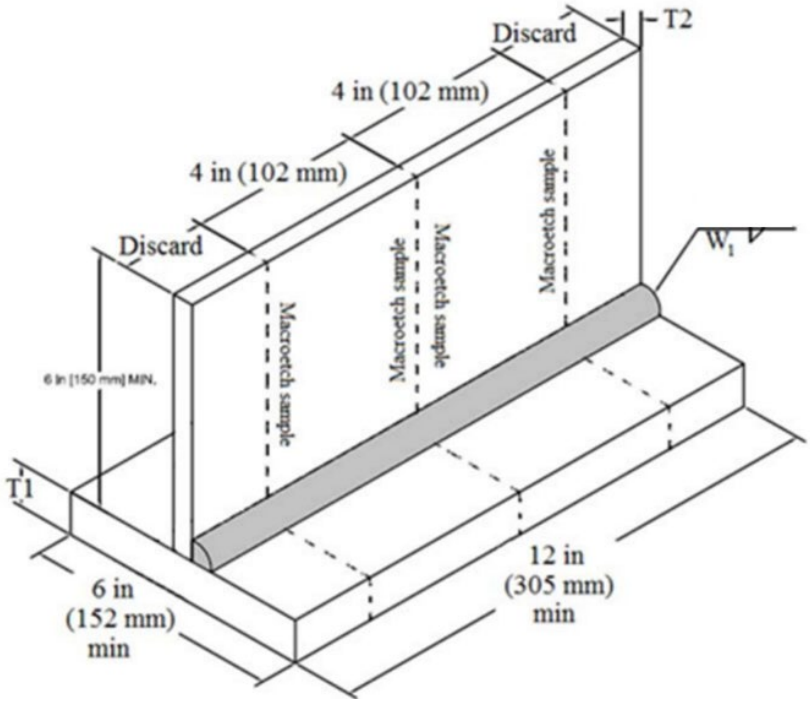

Figure 1, Sketch that illustrates the weld joint type, and dimensions.
The weld was completed in the 2F position.

Procedure and Results Non-Destructive Testing

Preweld Inspection

Two sets of 0.38" thick weld coupons were prepared, tacked, and subsequently inspected. Final dimensions of the T-joint PQR coupon were approximately 6" x 12". Figure 1 shows a sketch that details the test coupon(s). The weld joint was in substantial requirements of MIL-STD-3040A, Figure 5. One set was used for single pass qualification and the remaining set was used for the multi-pass qualification.

The vertical plate in both test coupons was fabricated from MIL-DTL- ( ). The horizontal plate was MIL-DTL- (AMG S# ID:). Appendix A contains the certificates of conformance for the base metals. Two tacks were applied using the welding parameters detailed in the PQR. The tacks were visually inspected by an AWS QC1 SCWI with an unaided eye in a well-lighted area. The weld coupon was compliant with. MIL-STD-3040, Figure 5. The acceptance criteria used for visual inspection met the requirements of MIL-STD-3040A, Table XX. Weld quality was .

In-Process & Postweld Visual Inspection

An AWS QC1 SCWI insured that the essential variables were recorded and completed the visual inspection. Each weld pass deposited on both coupons was visually inspected. The inspection was completed with the unaided eye. VT procedure meet the requirements of paragraph 5.9.2.1 of MIL-STD-3040A. Illumination was estimated to exceed 600 lx. The inspection included the weld bead plus a 0.5" either side of the weld into the base metal.

Both coupons were measured with a 5/16" fillet weld gauge and were found acceptable. A weld stop/start was observed in the weld coupons.. No observable discontinuities were observed in any of the weld passes inspected. Final visual inspection was completed following a 48 hour hold after the last weld bead was deposited. Table 1 summarizes the results of the visual inspection for each weld pass and layer. No unacceptable discontinuities were observed. Appendix C provides a copy of the visual inspection work instruction and result sheet.

Table 1

Table 1
Postweld Visual Inspection Results

Joint Offset		Burn- Through		Incomplete Fusion		Melt- Through		Craters	
Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐
Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐
Weld Bead(s) Appearance & Reinforcement		**Undercut**		**Porosity**		**Weld Toe Overlap**		**Cracks**	
Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐	Acceptable	☐
Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐	Unacceptable	☐
Final Disposition of Visual Inspection: Acceptable									

Metallographic Inspection and Mechanical Testing

Figure 1 presents a sketch of the PQR weld coupon, which illustrates the locations of the blanks used for the fillet weld samples. Initially, the blanks were removed from the welded coupon by abrasive cutting. Immediately after cutting the blanks were engraved with a unique identifier that detailed the type of test and sample ID. The identifier will remain with the sample until each test is completed and the results are recorded.

Metallographic Inspection

Metallographic Preparation and Etching

Three weld cross sections from each coupon were removed for macroscopic metallographic inspection. The locations of the cross sections are shown in Figure 1 of this PQR. After sectioning, the planes of observation were metallographically prepared by using a three-step procedure for surface grinding. The procedure used sequential finer grits of silicon carbide abrasive (100, 300 and 400 grit).

Each cross section was initially inspected in the as polished condition using oblique and low angle incident lighting with magnifications that ranged from 2X to 10X. The cross sections were then etched with Nital to reveal the macrostructure. Each cross section was then inspected again with magnifications that ranged from 2X to 10X. The inspection procedure used followed; MIL-STD-3040A; Paragraphs 5.7.4. The acceptance criteria detailed in paragraph 5.7.4.1 was used to determine the disposition after the inspection.

Figures 3 through 8 provide photomacrographs of each cross section in the etched condition for the single and multi-pass cross sections. No unacceptable discontinuities were observed in any of the single or multi-pass cross section. Each cross section exhibited excellent penetration, the theoretical throats were consumed and met the requirements of MIL-STD-3040A; Paragraph 5.9.2.1.3 and Table XX. Table 2 summarizes the results of the metallographic tests.

Table 2
Result of the Metallographic Inspection

Item	Sample #	Condition	Results
1	1	As Polished	XXX
2		Etched	XXX
3	2	As Polished	XXX
4		Etched	XXX
5	3	As Polished	XXX
6		Etched	XXX
7	4	As Polished	XXX
8		Etched	
Final Disposition of Macroscopic Inspection			

Microhardness Testing

Figure 2 provides a sketch that shows the approximate location of the microhardness traverses in the weld zone. Four microhardness traverses were taken on each weld cross section that was removed from the PQR coupon. The traverses were completed on the macroetch samples (See Metallographic Inspection). Each traverse met the requirements of MIL-STD-3040A, paragraph 5.7.5 (See Fig. 2 Traverse **A**). A baseline traverse was taken in each base metal well away from the weld in the unaffected base metal (Traverse A in Fig.2). The HAZ traverses started at the weld interface on both sides of the joint, adjacent to the weld toe. The traverses continued through each HAZ until the hardness value equaled the base metal baseline hardness value (See Fig. 2, Traverse **B**). Indent spacing was ~1.5mm and care was taken to ensure that the HAZ traverse is beneath the decarburized zone that is adjacent to the plate surface. See location(s) **B** in Figure 2.

A 1kg load was used with a Vickers indenter, employing the procedure that is detailed in ASTM E384, *Standard Test Method for Microindentation Hardness of Materials.* Paragraph 5.7.5.3 of MIL-STD-3040A was used for acceptance criteria, i.e., 1) The base metal hardness shall be within the hardness range requirement of the base metal standard. 2) There are no acceptance criteria for the HAZ or weld metal. Two photographs that present each weld zone and illustrate the locations and results of the hardness indentations are provided in Figure 9 and 10, for multi-pass and single pass, respectively. The results of each traverse are provided in Tables 3 and 4, for multi-pass and single pass, respectively.

Table 3
Results of the Vickers (HV1kg) Microhardness Traverse for the Multi Pass
Vertical Plate = MIL-DTL- , Horizontal Plate = MIL-DTL-
Conversions were completed in conformance of ASTM E140

Location	Result HV 1kg (HB)	Location	Result HV 1kg (HB)
MIL-DTL-46100 BM Surface #1		MIL-DTL-32332 BM Root #1	
MIL-DTL-46100 BM Surface #2		MIL-DTL-32332 BM Root #2	
MIL-DTL-46100 BM Surface #3		MIL-DTL-32332 BM Root #3	
MIL-DTL-32332 HAZ Surface #1		MIL-DTL-32332 HAZ Root #1	
MIL-DTL-32332 HAZ Surface #2		MIL-DTL-32332 HAZ Root #2	
MIL-DTL-32332 HAZ Surface #3		MIL-DTL-32332 HAZ Root #3	
WELD Surface #1		WELD Root #1	
WELD Surface #2		WELD Root #2	
WELD Surface #3		WELD Root #3	
MIL-DTL-46100 HAZ Surface #1		MIL-DTL-46100 HAZ Root #1	
MIL-DTL-46100 HAZ Surface #2		MIL-DTL-46100 HAZ Root #2	
MIL-DTL-46100 HAZ Surface #3		MIL-DTL-46100 HAZ Root #3	
MIL-DTL-32332 BM Surface #1		MIL-DTL-46100 BM Root #1	
MIL-DTL-32332 BM Surface #2		MIL-DTL-46100 BM Root #2	
MIL-DTL-32332 BM Surface #3		MIL-DTL-46100 BM Root #3	

Table 4
Results of the Vickers (HV1kg) Microhardness Traverse for Single Pass
Vertical Plate = MIL-DTL- , Horizontal Plate = MIL-DTL-
Conversions were completed in conformance of ASTM E140

Location	Result HV 1kg (HB)	Location	Result HV 1kg (HB)
MIL-DTL-46100 BM Surface #1		MIL-DTL-32332 BM Root #1	
MIL-DTL-46100 BM Surface #2		MIL-DTL-32332 BM Root #2	
MIL-DTL-46100 BM Surface #3		MIL-DTL-32332 BM Root #3	
MIL-DTL-32332 HAZ Surface #1		MIL-DTL-32332 HAZ Root #1	
MIL-DTL-32332 HAZ Surface #2		MIL-DTL-32332 HAZ Root #2	
MIL-DTL-32332 HAZ Surface #3		MIL-DTL-32332 HAZ Root #3	
WELD Surface #1		WELD Root #1	
WELD Surface #2		WELD Root #2	
WELD Surface #3		WELD Root #3	
MIL-DTL-46100 HAZ Surface #1		MIL-DTL-46100 HAZ Root #1	
MIL-DTL-46100 HAZ Surface #2		MIL-DTL-46100 HAZ Root #2	
MIL-DTL-46100 HAZ Surface #3		MIL-DTL-46100 HAZ Root #3	
MIL-DTL-32332 BM Surface #1		MIL-DTL-46100 BM Root #1	
MIL-DTL-32332 BM Surface #2		MIL-DTL-46100 BM Root #2	
MIL-DTL-32332 BM Surface #3		MIL-DTL-46100 BM Root #3	

Fillet Weld Break Test

Two samples were removed from the two PQR test coupons (Four Total Samples; 2-Single Pass & 2 Multi-pass). Each sample was subjected to a fillet weld break test. Procedures used for the fillet weld break test was in substantial compliance with the requirements of MIL-STD-3040A, Paragraph 5.7.6 and AWS A4.0.

The break samples were loaded in a manner to put the root in tension. The load was applied by repeated blows with a 12-pound sledgehammer until the fillet weld fractured through the throat of the weld bead(s). The fracture surface was subsequently inspected with the unaided eye. Acceptance criteria provided in MIL-STD-3040A; Paragraph 5.7.6.1 was used for the inspection. Results of the fractographic inspection revealed that the welds exhibited excellent fusion. No linear indications were observed that would have indicated lack of fusion or any intralayer linear unacceptable discontinuity. Porosity or unacceptable inclusions that had a diameter greater than 0.09" were not observed. The fracture surface exhibited a ductile morphology, no evidence of a brittle fracture surface was observed. Table 3 summarizes the results of the fillet weld break tests.

Table 3
Results of the Fillet Weld Break Test

Coupon ID	Fillet Weld Break Test Fracture Inspection Results	Fillet Weld Break Test Root Depth of Fusion Inspection Results
Single Break #1		
Single Break #2		
Multi Pass #1		
Multi Pass #2		
Final Disposition Fillet Break Test:		

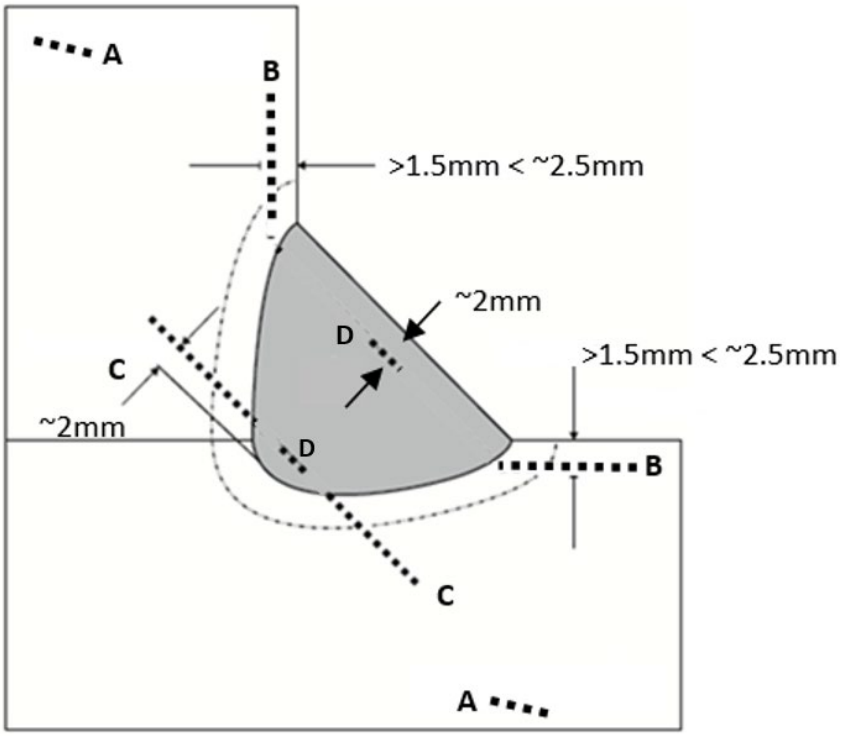

Figure 2, Sketch that details the approximate location of hardness tests.

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5% Nital Original Magnification 3X
Figure 3, Photomacrograph that shows the cross-sectional appearance of single pass weld section #1.

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5% Nital Original Magnification 3X
Figure 4, Photomacrograph that shows the cross-sectional appearance of single pass weld section #2.

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5% Nital Original Magnification 4X
Figure 5, Photomacrograph that shows the cross-sectional appearance of single pass weld section #3.

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5% Nital Original Magnification 3X
Figure 6, Photomacrograph that shows the cross-sectional appearance of Multi-pass weld section #1.

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5% Nital Original Magnification 4X
Figure 7, Photomacrograph that shows the cross-sectional appearance of multi-pass weld section #2.

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5% Nital Original Magnification 4X
Figure 8, Photomacrograph that shows the cross-sectional appearance of multi-pass weld section #3.

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Figure 9, Photomacrograph that details the location and results of microhardness traverses for the multi-pass weld.

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Figure 10, Photomacrograph that details the location and results of microhardness traverses for the single pass weld.

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Figure 11, Photograph that shows the appearance of single pass weld fillet weld break test.

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Figure 12, Photograph that shows the appearance of single pass weld fillet weld break test that illustrates the depth of fusion in the root.

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Figure 13, Photograph that shows the appearance of single pass weld fillet weld break test.

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Figure 14, Photograph that shows the appearance of single pass weld fillet weld break test that illustrates the depth of fusion in the root.

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Figure 15, Photograph that shows the appearance of multi-pass weld fillet weld break test.

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Figure 16, Photograph that shows the appearance of multi pass weld after the fillet weld break test that illustrates the depth of fusion in the root.

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Figure 17, Photograph that shows the appearance of multi-pass weld fillet weld break test.

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Figure 18, Photograph that shows the appearance of multi pass weld after the fillet weld break test that illustrates the depth of fusion in the root.

Appendix A
Certificate of Conformance
Weld Coupon

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C of C for MIL-DTL 46100

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C of C for MIL-DTL 46100
Page 3 of 3

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C of C for MIL-DTL-32332

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C of C for MIL-DTL-32332
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C of C for MIL-DTL-32332
Page 3 of 3

Appendix B
Certificate of Conformance
Filler Metal

Appendix C
C of C for the Shielding Gas

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Appendix D
Visual Inspection Work Instruction
And
Results Sheet

General Information		
Project Name:	**Job Number:**	**Date:**
Project Scope:		
VT Report ID:		
Procedure Spec.:		**NDT Technique:**
Acceptance Criteria:		
Test Environment:		

Part Information		
Part ID:	**Part Material Type:**	**Alloy(s):** MIL-DTL- , Cl. 1 & MIL-DTL-

Test Part Condition, Manufacturing & Inspection Process Description:

Visual Testing Process Variables, Parameters and Procedure	
Area Inspected:	
Part Preparation:	
Type of Cleaner Mechanical:	**Type:**
Type of Cleaner Chemical:	**Serial Number:**
Method of Cleaner Application:	**Cleaner Dry Time:**
Procedure Description Part Positioning:	
Ambient White Light @ Inspection Surface:	
Part Numbers Inspected:	

Inspection Results					
Number of Parts Inspected per PN:		**Parts Accepted:**		**Rejected:**	
Comment & Final Disposition:					

Responsible Parties			
Reported By:		**Report/WI Reviewed & Approved By:**	
Signed: **Date:**		**Signed:**	
AWS QC1 SCWI ID:		**Director of Quality:**	
Expiration Date:		**Date:**	

AM GENERAL
MISSION READY ★ FUTURE DRIVEN

WELDER PERFORMANCE QUALIFICATION RECORD (WPQR)

XXX XXXXX -XXXX
WPQR 3040- XXXXX -(XXX-U)-XXX**XX**, Rev. 0
This Welder Performance Qualification Record (WPQR) details the essential variables.
and qualification ranges necessary for a welder to successfully make fillet welds,
that join plate and wrought shapes in the flat and horizontal positions with single and multiple weld passes with the
Gas Metal Arc Welding (GMAW-P) Process.

This WPQR also details procedures and results for the qualification tests.

AM General's Welding Procedure Specification:
WPS 3040-(XX- **)- - -(**XXX-**U)- , Rev. 0**
was employed as the governing Welding Procedure Specification for this WPQR.
This WPQR was written to be in substantial conformance with the following welding standard:
MIL-STD-3040A

Revision Log

Rev#	Date:	Responsible Party	Description

Responsible Parties

The signed parties below state that the procedure development and qualification testing were completed in substantial conformance with the requirements of the above -mentioned welding Military Standard.

Testing Witnessed & Supervised By:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____
CWI Stamp:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____

AM GENERAL
MISSION READY ★ FUTURE DRIVEN

Welder Performance Qualification Record

Welders Name:		**ID No.:**	**Date:**	**Valid Thru Continuity:**	Indefinitely
Governing WPS:	3040-(U -XXX)Acceptabl	XXX -(XX -U)-XX, Rev.1	**Corrective Lens:**	No	**Vision Test**: ok

QUALIFICATION VARIABLES

QUALIFIED WITH		QUALIFIED FOR	
Welding Process:		**Process:**	
Welding Process Type:		**Process Type:**	
Position Tested Groove:		**Position Groove:**	
Position Tested Fillet:		**Position Fillet:**	
Shielding Gas:		**Shielding Gas:**	
BASE METAL			
Tested Material Type:		**Material Specification:**	
3040 Base Metal Group ID:		**3040 Base Metal Gr. ID:**	
Tested Coupon Thickness:		**Thickness Range:**	
FILLER METAL			
Class.:		**Classification:**	
AWS Spec.:		**AWS Specification:**	
EN ISO Spec.:		**EN ISO Spec.:**	
3040 Group ID:		**3040 Group**	
Filler Metal Dia.:		**Diameters:**	
WELD JOINT			
Qualified Weld Joint:		**Weld Joints:**	
Weld Size:		**Size of Weld:**	
Qualified with Backing:		**Backing:**	(XX-XX)-XXXXX-XXX-(XXX-X)-XX, Rev. (

VISUAL INSPECTION PROCEDURE & RESULTS - ACCEPTABLE

Visual inspection was performed before, during and after the welding of the coupon with the unaided eye in a well-lighted area by an AWS QC1 SCWI. The initial inspection prior to welding revealed that the coupon was in substantial conformance with the requirements of MIL-STD-3040A, Figure 5. The acceptance criteria used during the inspection of the weld surfaces is dictated in 3040A; Table XX. The inspection procedure that was used followed; MIL-STD-3040A; Paragraphs 5.9.2.1.1 thru 5.9.2.1.3. Inspections revealed that the quality of each weld bead was acceptable. All weld toes exhibited good wetting into the base metal. No cracks or other unacceptable weld discontinuities were observed. The following Table summarizes the results of the visual inspection. The illumination was estimated to be greater than 600lx. The inspection was completed after a post weld 48-hr. hold.

Surface Profile:	XXX	**Undercut:**	XXX	**Porosity:**	XX	**Cracking:**	XXX
Craters Filled:	XXXX	**Crater Cracks:**	XXX	**Concavity:**	XXX	**Toe Profile:**	

METALLOGRAPHIC INSPECTION PROCEDURE & RESULTS – ACCEPTABLE

Three weld cross sections from each coupon (i.e., single & multi-pass) were removed for macroscopic metallographic inspection. The locations of the cross sections are in compliance with 3040A; Fig. 5. The planes of observation were prepared by using a three-step procedure with sequential finer grits of silicon carbide, then etched with 5% Nital then inspected. Figures 1 through 6 provide photomacrographs of each cross section for the single pass and multi-pass welds. No unacceptable discontinuities were observed in any of the single or multi-pass cross sections. Each cross section exhibited excellent penetration, the theoretical throats were consumed and met the requirements of MIL-STD-3040A; Paragraph 5.9.2.1.3 and Table XX.

FILLET WELD BREAK TEST PROCEDURE & RESULTS – ACCEPTABLE

Procedures used for the fillet weld break test was in substantial compliance with the requirements of MIL-STD-3040A, Paragraph 5.7.6 and AWS A4.0. Acceptance criteria provided in MIL-STD-3040A; Paragraph 5.7.6.1 was used for the inspection of the fillet weld break fracture surfaces. The inspection was completed with the unaided eye in a well-lighted area. No unacceptable discontinuities were observed during the fractographic inspection. Photographs of the fillet weld break tests results are provided in Figures 7-15.

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Figure 1, Photomacrograph that shows the cross-sectional appearance of single pass weld section #1

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5% Nital Original Magnification 3X

Figure 2, Photomacrograph that shows the cross-sectional appearance of single pass weld section #2

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5% Nital Original Magnification 4X

Figure 3, Photomacrograph that shows the cross-sectional appearance of single pass weld section #3.

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5% Nital Original Magnification 3X

Figure 4, Photomacrograph that shows the cross-sectional appearance of Multi-pass weld section #1.

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5% Nital Original Magnification 4X

Figure 5, Photomacrograph that shows the cross-sectional appearance of multi-pass weld section #2.

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5% Nital Original Magnification 4.5X

Figure 6, Photomacrograph that shows the cross-sectional appearance of multi-pass weld section #3.

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Figure 7, Photograph that shows the appearance of single pass weld fillet weld break test.

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Figure 8, Photograph that shows the appearance of
single pass weld fillet weld break test.

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Figure 9, Photograph that shows the appearance of single pass weld fillet weld break test that illustrates the depth of fusion in the root.

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Figure 10, Photograph that shows the appearance of single pass weld fillet weld break test that illustrates the depth of fusion in the root.

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Figure 11, Photograph that shows the appearance of multi-pass weld fillet weld break test.

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Figure 12, Photograph that shows the appearance of multi-pass weld fillet weld break test.

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Figure 13, Photograph that shows the appearance of multi-pass weld after the fillet weld break test that illustrates the depth of fusion in the root.

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Figure 14, Photograph that shows the appearance of multi-pass weld after the fillet weld break test that illustrates the depth of fusion in the root.

WELDING PROCEDURE SPECIFICATION
WPS 3040- (XX-XX)-XXXXX-XXX-(XXX-X)-XX, R

This welding procedure specification details each essential variable that is necessary.
to successfully weld
XX Armor Plate to **XXX** Armor Plate
using single and multiple passes with the
Gas Metal Arc Welding Spray Transfer (GMAW-P) process

AM General Welding Procedure Specification
WPS 3040-(XXXXX
was developed in conformance with the requirements.
of MIL-STD-3040A welding code.

Revision Log

Rev. #	Description	Author	Date

Responsible Parties

The signed parties below state that the qualification and procedure development testing were completed in substantial conformance with the requirements of the above-mentioned welding standard.

Testing Witnessed & Supervised By:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____
CWI Stamp:

Signed: _____ **Date:** _____
Name: _____
Title: _____
Company: _____

Supporting PQR ID:

Welding Process: GMAW-P **Type:** **Manual:** (◯) **Semiautomatic:** (◯) **Automatic:** (◯)

BASE METAL

Minimum Material Thick:		**To**	**Maximum Material Thickness:**	XXX	
Material Type:		**Welded To**	**Material Type & Grade:**		
Material Standard:		**Welded To**	**Material Standard:**		
3040 Material ID:		**Welded To**	**3040 Material ID:**		
AM General Material ID:	XX	**Welded To**	**AM General Material ID:**		

WELD JOINT

Weld Type:
Joint Design:
Backing:

SHIELDING GAS

Shielding Gas Composition:
Flow Rate:
Shielding Gas Specification:

POSITION

Welding Position:
Welding Progression:

ELECTRICAL CHARACTERISTICS

Current Type:
Polarity:

FILLER METAL

AWS F No:
Classification Number:
AWS Electrode Spec.:
EN ISO 14343-A Spec. ID:
3040 Filler Metal Group ID:
No. of Electrodes

PREHEAT AND INTERPASS TEMPERATURE

Base Material Thickness	Min. Preheat & Interpass Temp.	Max. Interpass Temp.
All		

BASE METAL PREPARATION

Base metal must be clean relatively free from dirt, lubricates oil or grease. Solvent such as acetone may be used. Preparation may be done by thermal or water jet cutting, followed by shot blasting or grinding to remove oxide; final joint preparation may be completed via machining, grinding, filing and/or wire brush.

PREHEAT TEMP. MAINTENANCE & MONITORING

Preheat temperature monitoring shall be done with a temperature sensitive crayon. Crayons shall be used at ~1" & ~3" away from weld toe, for max. interpass and preheat measurements, respectively. Base metal adjacent (~3") to the weld shall meet preheat temperature before & after the weld bead has been initiated & completed. Maximum interpass temperature readings shall be taken adjacent to the weld toe to within 1" of the toe. Preheat temperature can be maintained via oxy-fuel torch or resistance blankets.

WELDING PARAMETERS

Weld Pass	Wire Dia.	WFS (IPM)	Amps	Volts	Travel Speed IPM	Trim	Maximum Heat Input kJ/in.
Tack							
Single Weld Pass							
#1 Cover Pass							
#2 Cover Pass							

POST TACK & PRE - WELD INSPECTION

Tack welds shall be made at appropriate locations. The tacks shall be inspected to insure uniformity and quality. No cracks, incomplete fusion or porosity are allowed. The tacks shall be "feathered" to allow complete fusion when welding the next pass. Criteria provided in MIL-STD-3040A; Table XX shall be used for acceptance.

TECHNIQUE

Stringer Bead:
Weave Bead:
Contact Tip to Work Distance:
Torch Attitude:
Shielding Gas Cup Size:
Multiple or Single Pass Weld:

INTERPASS CLEANING

Each pass shall be cleaned. Cleaning can be done abrasively, and/or with burr, and/or a needle gun, grinder, and/or by brushing.

IN-PROCESS & POST WELD INSPECTION

Post weld inspection shall be performed by the welder after each weld pass has been completed on relatively clean surface, wire brush if necessary. The finished fillet welds shall be measured with a fillet weld gauge. Final inspections shall be completed by an AWS QC1 CWI or designated AM General AVI after a 48 hr. hld. Visual inspection acceptance criteria are provided in MIL-STD-3040A; Table XX. **Report all unacceptable discontinuities to supervision.**