

**MIL-W-45210A(MR)**

**15 JANUARY 1965**

**SUPERSEDING**

**MIL-W-45210(Ord)**

**1 AUGUST 1961**

## **MILITARY SPECIFICATION**

# **WELDING, RESISTANCE, SPOT: WELDABLE ALUMINUM ALLOYS**

### **1. SCOPE**

**1.1 Type of welding.** This specification covers resistance spot welding procedures for weldable aluminum alloys (see 8.1).

**1.2 Materials.** The materials to be welded under this specification include sheet, bar, and shapes of non heat-treatable alloys and the 60XX series of heat-treatable alloys.

### **2. APPLICABLE DOCUMENTS**

**2.1** The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

### **STANDARDS**

#### **MILITARY**

**JAN-STD-19** — Welding Symbols.

**MIL-STD-20** — Welding Terms and Definitions.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

**2.2 Other publications.** The following documents form a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

#### **AMERICAN WELDING SOCIETY**

**Welding Handbook.**

(Application for copies should be addressed to the American Welding Society, United Engineering Center, 345 East 47th Street, New York 17, N. Y.)

### **3. PROCEDURES REQUIREMENTS**

**3.1 Recorded welding procedure.** Unless otherwise specified in the contract or order, the contractor, prior to production fabrication of any weldment, shall establish or have the manufacturer establish and record the cleaning and welding procedures to cover all welding to be performed under this specification. This information shall be prepared in duplicate on an approved form (see app.) utilizing symbols and terms in accordance with Standards JAN-STD-19, MIL-STD-20, or as specified on the drawing. The cover sheet shall be signed by the manufacturer and the contractor. The recorded welding procedure shall be submitted to the procuring activity with the test records as specified in

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6.4. Any changes in any of the factors listed in table I shall require revision of the recorded test procedure.

3.2 Factors. The factors to be included in the welding procedure shall be as shown in table I.

TABLE I. Factors in the recorded welding procedure and changes requiring quality control test

Factor to be included in recorded welding procedure	Procedure changes requiring revised procedures and test
1. Metal alloy composition .....	When a change in alloy or alloy composition outside the aluminum producer's declared chemical range is made to either of the metals that are to be joined.
2. Thickness range of metal .....	When the thickness range is changed.
3. Weld time range	When weld cycle range is changed.
4. Metal cleaning	When method of cleaning is changed from the recorded methods in the welding procedure.
5. Welding current	When current setting changes outside the declared range are made.
6. Type of current	When a change in type or polarity is made.
7. Electrode force range .....	When changes outside the declared range are made.

#### 4. MATERIAL REQUIREMENTS

4.1 Surface preparation. The material surfaces shall be cleaned by a suitable method to remove dirt, oils, and deleterious oxides in the weld area. The application of coatings or sealers, when required, shall be included as a part of the recorded welding procedure and shall not be considered foreign matter.

#### 5. WELDING EQUIPMENT REQUIREMENTS

5.1 Welding machine. The welding machine shall consist of a suitable source of electrical energy, suitable electrodes, means of adequately cooling the electrodes, and a means of reliably controlling and indicating the magnitude of the current, the welding force, and the time of current flow to fulfill the requirements specified herein. The force and current controls shall operate so that no current flows until the welding force is applied at the welding electrodes. The current shall be cut off before the force is removed.

5.2 Weld timer. The weld timer shall control the following timing functions:

*Single impulse welding*

Squeeze time

Weld time

Hold time

#### 6. PREPRODUCTION REQUIREMENTS

6.1 Certification of welding equipment and recorded welding procedures. Prior to welding the first production assembly of each specific design, the contractor or the manufacturer, or both shall weld and test the welds in one assembly or simulated specimen under Government surveillance. The assembly or specimen shall be welded in accordance with the recorded welding procedure. This certification test shall be carried out on each welding machine that will be used for the production of weldments of each specific design (see 8.2).

6.1.1 *Simulated specimens.* When a simulated specimen is used, the material thickness, composition range, weld edge distance, spot spacing, and the general weld area contour and metal fit shall be the same as the production part. When the application of weld primer or sealer is required by the

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recorded welding procedure for production assemblies, the simulated specimens shall have these materials applied before welding in the same manner as applied to the production parts. When a substantial amount of magnetic material such as the assembly fixtures, locators, etc., are inserted in the throat of the welding machine during the welding of a production part, this condition shall be closely duplicated for the simulated specimen.

**6.2 Visual examination of welded assembly or simulated specimen.** All welds shall be subject to visual examination to determine compliance with 7.3.1.

**6.3 Testing.** The welded assembly or simulated specimen shall be subjected to the peel test in accordance with 7.3.3.

**6.4 Reporting of results.** The manufacturer shall record the results of this certification and shall submit copies of the results together with the recorded welding procedure through the contractor and contracting officer for review by the procuring activity.

**6.5 Rejection.** Failure of the welded assembly or simulated specimens to meet the requirements for visual examination (see 7.3.1) or the peel test (see 7.3.3) shall result in the rejection of the recorded welding procedure.

## **7. PRODUCTION REQUIREMENTS**

**7.1 Quality control.** The contractor shall establish or have the manufacturer establish and use a systematic quality control procedure.

**7.1.1 Production checking.** Periodically during a production run, a welded assembly or simulated specimen shall be tested as outlined in Section 6. The frequency of this testing shall be specified by the contracting officer after reviewing the production rates and types of assemblies. The contractor or the manufacturer, or both, shall keep a record of these tests indicating date, time, machine identification, machine settings and results.

**7.2 Procedure inspection.** All welding operations shall be subject to inspection for compliance with the certified welding procedures and quality control procedures of the contractor and manufacturer.

### **7.3 Weldment inspection.**

**7.3.1 Visual examination.** The outer surface of all welds shall be smooth and free of cracks, tip pickup, pits, metal expulsion, and other defects which indicate that the welds were made with contaminated electrodes, or with improperly prepared surfaces.

**7.3.2 Tolerances.** Tolerances on spot weld spacing and edge distance shall be in accordance with applicable drawings.

**7.3.3 Peel test.** The peel test shall be conducted by separating the welded components by driving a chisel between them in an unwelded area or by peeling one sheet back against the weld until failure occurs around the periphery of the weld or until the part fails. Failure of the base metal outside the weld area shall be considered evidence that the welds are satisfactory. The minimum average button diameter as measured in two perpendicular directions at the faying surface shall conform to table II.

**TABLE II. Button diameter requirements**

Thickness of thinner part <sup>1</sup>	Minimum button diameter <sup>1</sup>
<i>Inch</i>	<i>Inch</i>
0.010	0.08
.020	.11
.032	.14
.040	.16
.050	.18
.063	.20
.080	.23
.090	.24
.100	.26
.112	.27
.125	.28

<sup>1</sup> For intermediate thicknesses, direct interpolation may be used.

**7.3.4 Rejected welds.** If unsatisfactory welds are found during a production quality control inspection, the production run shall

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be stopped and necessary corrections made to the equipment or welding procedure. After correction, a weldment or simulated specimen shall be welded and shall conform to the inspection requirements in 7.3.1 and 7.3.3 before resuming production. The series of weldments in the period subsequent to the last acceptance quality control inspection shall be rejected or may be rewelded in accordance with 7.3.5.

**7.3.5 Rewelding of rejected weldments.** A weldment from each rejected series may be rewelded in accordance with the corrected procedure. The repaired weldment shall be tested for compliance with 7.3.1 and 7.3.3. If the weldment passes the inspection requirements, the remainder of the rejected series of weldments may be rewelded in accordance with the corrected procedure. A simulated sample shall not be used for determining weld quality of repair welding.

**8. NOTES**

**8.1 Intended use.** Resistance welding under this specification covers spot welding of weldable aluminum alloys for stowage boxes, vehicle fenders, air ducts, van skins, etc.

**8.2 Certification testing.** The certification test is intended to ascertain that the specific welding unit being used has the electrical and mechanical capacity to satisfactorily produce a particular weldment. This test need not be repeated so long as the design and materials of the part being welded remain unchanged, except as may be required by 7.1.

**8.3 Definitions.**

**8.3.1 Contractor.** As used in this specification, the term "contractor" is defined as the organization having a direct contract with the Government activity.

**8.3.2 Manufacturer.** The term "manufacturer" is defined as the organization actually performing the operations covered by this specification.

**8.4** It is suggested that table 69 B.3 of section 4 of the Welding Handbook (4th edition) be referred to for information pertaining to minimum spot weld spacing, edge distance, overlap and clearance for spot welding under this specification.

**8.5** For information (design) purposes, typical minimum ultimate shear strengths per spot weld should be as shown in table III.

TABLE III. *Typical minimum ultimate shear strengths per spot weld*

Thickness of thinner part <sup>1</sup>	Typical minimum ultimate shear strength per spot weld (for design purposes), pounds <sup>1</sup>
Inch	
0.010	50
.020	135
.032	235
.040	310
.050	430
.063	610
.080	855
.090	1000
.100	1170
.112	1340
.125	1625

<sup>1</sup> For intermediate thicknesses, direct interpolation may be used.

Custodian:

Army—MR

Interest:

Review:

MO

MU

MR

User:

WC

MI

Preparing activity:

Army—MR

Project No. M107-A020

*Note.* Review/User information is current as of the date of this document; draft circulation should be based on the information in the current DODISS.

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## APPENDIX

## 10. SCOPE

10.1 This appendix contains a suggested form for the submittal of the recorded joint welding procedures and the instructions for completing the forms.

## 20. INSTRUCTIONS

20.1 The recorded procedure consists of four sheets of standard forms. In completing the information required for a fabricated assembly, it may be necessary to use two or more pages of any one or all of the last three sheets of the standard form. This is shown on the attached sample of the forms completely filled out, where sheets 4 and 5 are of the same standard form. The attached sample form should be self-explanatory, however, to prevent any possible misconception of what is expected on the form, the following comments are offered:

20.1.1 Sheet one.

(a) Record number.- The number is selected by the contractor or manufacturer for use in filing and for use when referring to the records from time to time.

(b) Part name, drawing number and revision date.- Name and number appearing on the drawing as furnished by the Chief of the Supply Service involved.

(c) Manufactured by.- The name of the company actually performing the welding.

(d) Location.- The full address of the company including street and zone number.

(e) Approval.- Signatures of the manufacturer and contractor must be those of employees designated as responsible for welding procedures.

20.1.2 Sheet two.- This sheet is to have a drawing showing all the resistance-welded parts of the fabrication. It may be an isometric or perspective drawing or sketch of the assembly. Additional sheets may be used if additional views are required. Dimensions are not required but the sketch should indicate the relationship of parts and weld locations. All weld joints or parts should have a reference letter.

**MIL-W-45210A(MR)****20.1.3 Sheet three.**

(a) Joint reference.- The letter identification given to the joint on sheet 2.

(b) Welding procedure record number.- Reference given to the record number specified on sheet 1 and carried on each additional sheet.

(c) Material reference.- The code for designation of the alloy. Generally these materials will be designated by code number or applicable specification.

(d) The machine make, type, and size.- The data that are available on the name plate of the welding machine.

**20.1.4 Sheets four and five.**- One sheet should be prepared for each weld joint in the assembly or each joint requiring a different weld schedule or use of electrodes.

(a) Joint reference.- Identification letter assigned to the joint on form sheet 2.

(b) Processed condition of material at welding.- Statement of any treatment given to the material prior to welding such as wire brushing, chemical cleaning, etc.

(c) Welding sequence timing schedule.- Tabulation that is filled out as completely as possible. If means of measuring the time values are not available, record dial settings.

(d) Welding current.- The measured current values should be shown. In any case, the transformer tap setting should be given if the phase-shift control is used.

(e) Electrode force.- Applied force should be recorded as measured by a force gage, if possible. If not available, the pressure and cylinder cross-sectional area that provides the welding force should be stated.

(f) Electrodes.- The R.W.M.A. class number or commercial name should be recorded if alloy is used. Taper size of electrode should be stated. A sketch to show the welding-face shape should be used if necessary.

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APPENDIX A  
SHEET 1 of 5

RECORDED JOINT WELDING PROCEDURE  
FOR  
RESISTANCE SPOT WELDING IN ACCORDANCE WITH MIL-W-45210A(MR)

Drawing Number D3747 Nov. 28, 1963  
and Revision Date

RECORD NUMBER: R-16

Part NAME: STORAGE SHELF

Drawing NUMBER: 268-L-13

Contract Number: S143807

**CONTENTS:**

TITLE SHEET ----- Sheet 1  
DRAWING SHOWING LOCATION OF JOINTS--- Sheet 2  
SUMMARY SHEET----- Sheet 3  
RECORDED WELDING PROCEDURE----- Sheets 4, 5

MANUFACTURED BY:

JONES MFG. CO.

LOCATED AT:

\_\_\_\_\_

APPROVED BY - MANUFACTURER:

\_\_\_\_\_  
TITLE \_\_\_\_\_

APPROVED BY CONTRACTOR:

\_\_\_\_\_  
TITLE: \_\_\_\_\_

DATE OF SUBMITTAL: \_\_\_\_\_

FOR ILLUSTRATION ONLY



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APPENDIX A  
SHEET 2 of 5

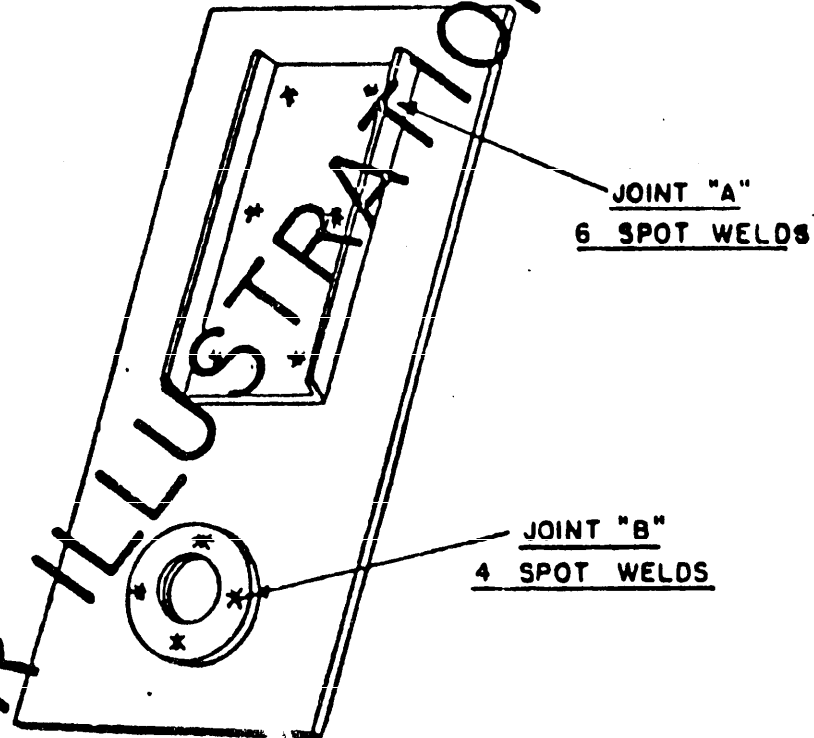
LOCATION DRAWING

Drawing Number D3747 Nov. 28, 1963  
and Revision Date \_\_\_\_\_

RECORD NUMBER: R-16

PART NAME: STORAGE SHELF

PART NUMBER: 268-L-13



NOTE: MAKE ISOMETRIC OR PERSPECTIVE SKETCH OF ASSEMBLY DESIGNATING JOINT IDENTIFICATIONS, NUMBER OF WELDS AND TYPE OF WELDING OF ALL RESISTANCE-WELDED JOINTS IN THE ASSEMBLY.



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APPENDIX A  
SHEET 3 of 5

SUMMARY SHEET

Drawing Number D3747 Nov. 28, 1963  
and Revision Date

RECORD NUMBER: R-16

PART NAME: STORAGE SHELF

PART NUMBER: 268-L-13

A. SUMMARY OF WELDING PROCEDURE:

<u>JOINT REFERENCE</u>	<u>MATERIAL REFERENCE</u>	<u>MACHINE MAKE</u>	<u>MACHINE TYPE</u>	<u>MACHINE SIZE</u>
A	5052 6061	BAILEY	PRESS	# 2
B	5052 6061	BAILEY	PRESS	# 3

B. MATERIAL COMPOSITION

<u>REFERENCE DESIGNATION</u>	<u>CU.</u>	<u>Si</u>	<u>Mg.</u>	<u>Zn</u>	<u>Al</u>	<u>Ni</u>	<u>Cr.</u>
5052 QQ-A-218	—	—	2.5	—	—	—	.25
6061 QQ-A-270	.25	.6	1.0	—	—	—	.25

FOR ILLUSTRATION ONLY

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**APPENDIX A**  
**SHEET 4 OF 5**

**WELDING PROCEDURE, JOINT A**

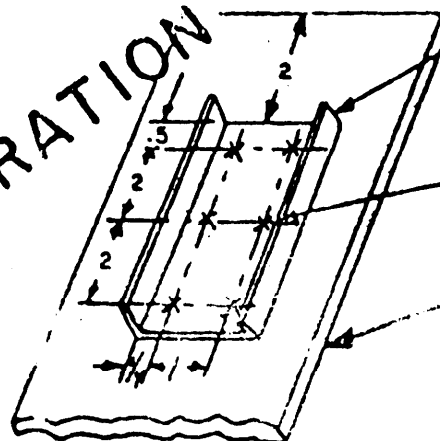
Drawing Number D3747 Nov. 28, 1963  
and Revision Date

RECORD NUMBER: R-16

PART NAME: STORAGE SHELF

PART NUMBER 268-L-13

FOR ILLUSTRATION ONLY



PART #268-L-12  
6061 X.064

6 SPOT WELDS  
AS SHOWN

PART # 268-L-10  
5052 X.125

**SKETCH OF JOINT**

(SPECIFY PART No's., MATERIAL & THICKNESS, No. OF WELDS, AND WELD LOCATIONS. INDICATE WELD PRIMER OR SEALER MATERIAL & APPLICATION IF REQUIRED)

1. JOINT REFERENCE: "A"
2. MATERIAL REFERENCE: See above sketch.
3. PROCESSED CONDITION OF MATERIAL AT WELDING: Degreased and Etched
4. MATERIAL THICKNESS: See above sketch
5. WELDING SEQUENCE TIMING SCHEDULE: \_\_\_\_\_  
SINGLE IMPULSE  
 SQUEEZE TIME - \_\_\_\_\_  
 WELD TIME - - \_\_\_\_\_  
 HOLD TIME - - \_\_\_\_\_
6. WELDING CURRENT: TRANSFORMER TAP - \_\_\_\_\_  
 PHASE SHIFT - \_\_\_\_\_  
 SECONDARY CURRENT - \_\_\_\_\_
7. ELECTRODE FORCE; GAGE PRESSURE - \_\_\_\_\_  
 CYLINDER AREA - \_\_\_\_\_  
 APPLIED FORCE - \_\_\_\_\_
8. ELECTRODES: MATERIAL \_\_\_\_\_ SIZE \_\_\_\_\_ WELDING-FACE SHAPE \_\_\_\_\_  
 UPPER \_\_\_\_\_  
 LOWER \_\_\_\_\_
9. WELDING MACH. IDENTIFICATION: BAILEY # 2 PRESS SERIAL # 2357

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APPENDIX A  
SHEET 5 of 5

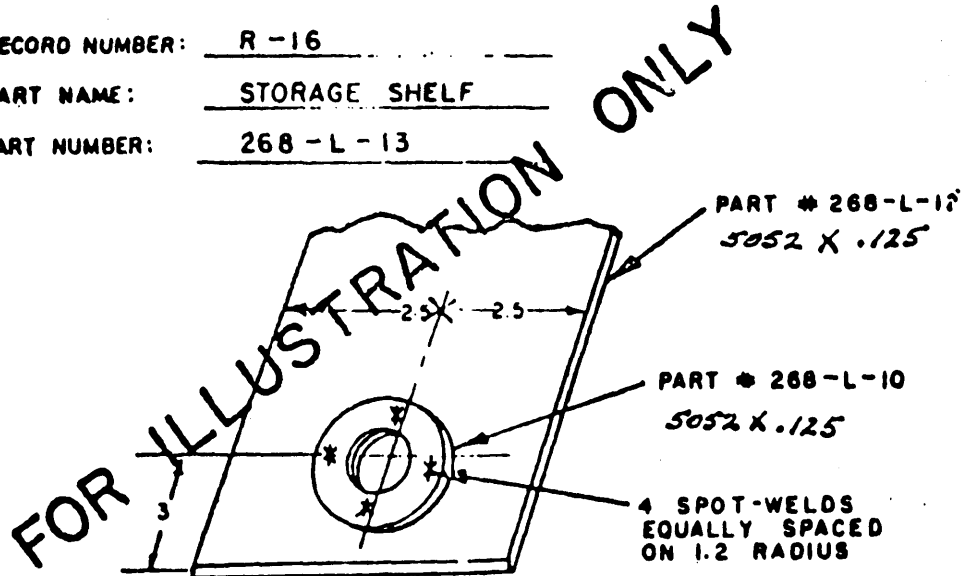
WELDING PROCEDURE, JOINT B

Drawing Number D3747 Nov. 28, 1963  
and Revision Date \_\_\_\_\_

RECORD NUMBER: R-16

PART NAME: STORAGE SHELF

PART NUMBER: 268-L-13



SKETCH OF JOINT

(SPECIFY PART No's., MATERIAL & THICKNESS, No. OF WELDS, AND WELD LOCATIONS.  
INDICATE WELD PRIMER OR SEALER, MATERIAL & APPLICATION IF REQUIRED)

1. JOINT REFERENCE: B
2. MATERIAL REFERENCE: See above sketch
3. PROCESSED CONDITION OF MATERIAL AT WELDING: DEGROAUSED AND ETCHED
4. MATERIAL THICKNESS: See above sketch
5. WELDING SEQUENCE TIMING SCHEDULE: \_\_\_\_\_

SINGLE IMPULSE

SQUEEZE TIME -  
WELD TIME -  
HOLD TIME -

6. WELDING CURRENT: TRANSFORMER TAP -  
PHASE SHIFT -  
SECONDARY CURRENT -
7. ELECTRODE FORCE: GAGE PRESSURE -  
CYLINDER AREA -  
APPLIED FORCE -

8. ELECTRODES: MATERIAL \_\_\_\_\_ SIZE \_\_\_\_\_  
UPPER: \_\_\_\_\_  
LOWER: \_\_\_\_\_

WELDING FACE SHAPE

9. WELDING MACH. IDENTIFICATION: BAILEY # 3 PRESS TAO # 341

QPS 073430

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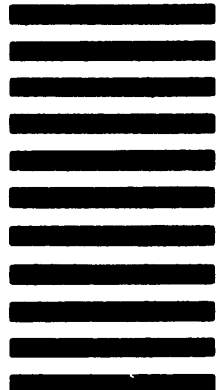
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