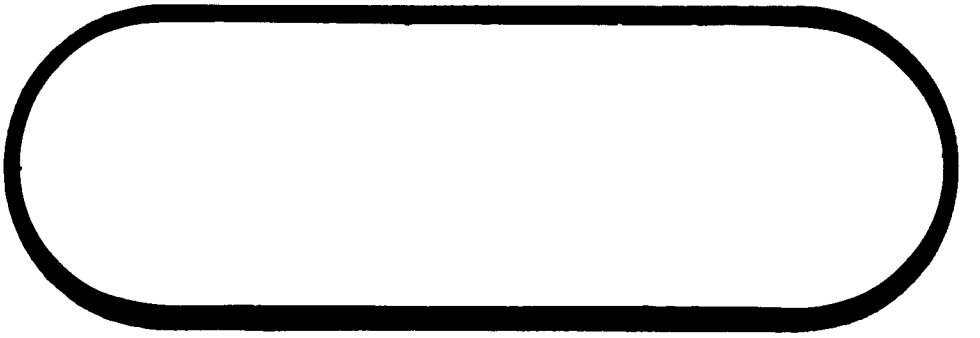
63-3-5

BOEING



SEATTLE, WASHINGTON

THE BOEING COMPANY

CODE IDENT NO. 81205

NUMBER D2-14351

TITLE TECHNICAL SPECIFICATIONS - ELECTRICAL SURGE ARRESTER INSTALLATION - WARREN AIR FORCE BASE (U)

MODEL NO. WS-133-A CONTRACT NO. AF04(694)-107

ISSUE NO. 41 ISSUED TO Defense Doc Center

SPECIAL LIMITATIONS ON ASTIA DISTRIBUTION

ASTIA may distribute this report to requesting agencies subject to their security agreement, approved fields of interest, and the following

☑ UNLIMITED—To all agencies of the Department of Defense and their contractors

☐ LIMITED—To U S Military organizations only

This report may be distributed to nonmilitary agencies not approved above subject to Boeing approval of each request.

NOTE the LIMITED category may be checked only because of actual or potential patent proprietary ethical or similar implications

CHECKED	L. Morris	5-13-3
PREPARED BY	P. Waldron	5-13-3
SUPERVISED BY	J. R. Strauss	5-13-3
APPROVED BY	A. H. Bixler	5-14-3
APPROVED BY	H. M. Stuvenide	5-14-3
CLASS & DISTR APPROVED BY	G. A. Gutkowski	5/14/63 (DATE)

REV SYM _____

VOL. NO. I	OF I
SECT. I	PAGE 1

U3 4287 9038 ORIG. 8/62

2-5142-2

ACTIVE PAGE RECORD

SECTION	ORIG REL PAGE NO.	REV SYM	ADDED PAGES						SECTION	ORIG REL PAGE NO.	REV SYM	ADDED PAGES					
			PAGE NO.	REV SYM	PAGE NO.	REV SYM	PAGE NO.	REV SYM				PAGE NO.	REV SYM	PAGE NO.	REV SYM	PAGE NO.	REV SYM
I	1																
	2																
	3																
	4																
	5																
	6																
	7																
	8																
	9																
	10																
	11																
	12																
	13																
	14																
	15																
	16																

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED

TABLE OF CONTENTS

1. REFERENCES

1.1 MILITARY STANDARDS

MIL-T-6094	Lacquer Thinner
MIL-I-7798	Insulation Tape, Electric Pressure Sensitive Adhesive Plastic
MIL-Q-9858	Quality Control System Requirements

1.2 FEDERAL SPECIFICATIONS

TT-E-489	Enamel, Alkyd, Gloss
TT-E-527	Enamel, Alkyd, Lusterless
TT-E-529	Enamel, Alkyd, Semi-gloss
TT-P-636	Primer Coating, Synthetic, Wood and Ferrous Metal

2. INTRODUCTION

This document gives specific installation requirements to assure that the Electrical Surge Arresters (ESA's) for the LCC for WS-133-A at Warren AFB are correctly installed.

3. SCOPE

This document establishes general and specific installation requirements to act in conjunction with the applicable Boeing installation drawing when installing the electrical surge arresting equipment for the WS-133-A Operational Program at Warren AFB.

It is the intent of this document to act as an adjunct to information found on the Boeing installation drawings, and this document shall not in any manner make subordinate the information found on the installation drawings. In all cases where the Boeing installation drawings and this document conflict, the Boeing installation drawings shall govern. This document shall govern, however, in all areas where disagreement exists as to the interpretation of the requirements of the Boeing installation drawings between any parties bound by this document. In any areas where the Boeing installation drawings or this document do not provide definitive requirements for the installation work involved, Air Force Regulation No. 93-24 shall be used.

4. PURPOSE

The purpose of this document is to establish the general codes, specifications and standards to be adhered to when installing the electrical surge arresting equipment and associated appurtenances for the WS-133-A Operational Program at Warren AFB. In addition where deemed necessary, this document sets forth the specifications to be used in accomplishing certain phases of installation to assure that an entirely reliable operational system will result upon the completion of installation.

5. ABBREVIATIONS

Boeing	The Boeing Company
WS-133-A	Minuteman Weapon System
Contractor	Installation Contractor

6. GENERAL FIELD INSTALLATION REQUIREMENTS

6.1 The following are general field installation requirements and reflect the overall requirements to be met in executing the installation of WS-133-A Weapon System Equipment Installation for Warren AFB.

6.2 WORKMANSHIP

Installation shall be made in a thoroughly reliable and workmanship-like manner. Particular attention shall be given to adhering to the Boeing installation drawings and associated requirements. Where existing Boeing drawings are not definitive, the requirements of this document and the referenced specifications, documentations and codes of this document shall govern.

6.3 INSTALLATION DRAWINGS

All dimensions for the location of equipment, pipes, conduits, supports and hangers are approximate (to allow a limited variation from the drawings to cover interferences which do not affect the function and which comply with the codes) unless tolerances are specified directly after the given dimension or covered by general notes on the Boeing Installation Drawings.

6.4 CODES AND SPECIFICATIONS

All installations resulting from the above action shall conform to applicable codes and specifications.

6.5 STORAGE AND TEMPORARY PROTECTION OF EQUIPMENT

All material and equipment furnished to the Contractor shall upon receipt be stored in an environment as follows:

6.5 (Continued)

Temperature - 35°F. to 150°F.; Altitude - Sea Level to 10,000 feet; Relative Humidity of 60% maximum up to a maximum of 92 grains H_2O vapor per pound of dry air; Atmospherec Pressure - 31.30 hg. maximum and 8.9 hg. minimum.

ESA panels should not be unpacked until lowered into site and should at no time be allowed to be exposed to sand or dust.

6.6 INSPECTION

6.6.1 Inspection for compliance will be in accordance with Specification GEEIA-B-50000, Section 4.

6.6.2 Prior to installation, the ESA assemblies shall be inspected for broken or damaged "pig-tails", loose or missing mounting hardware, and for visible physical damage to the individual ESA's.

7. ELECTRICAL BONDING AND GROUNDING

7.1 MATERIALS CONTROL

7.1.1 Abrasive; paper or cloth, closed coat.

1. Aluminum Oxide, "Grit 180 or finer" or "Garnet, Grit 180 or finer".

2. "Garnet cloth discs, 3/4 inch diameter, 150 Grit".

7.1.2 Lacquer thinner, MIL-T-6094.

7.2 SURFACE CLEANING

7.2.1 The general requirements for cleaning of bonding and grounding surfaces are as follows:

1. Determine the exact surfaces that are to be bonded or grounded from engineering drawings.

2. Remove all dirt, grit, oil, grease, moisture and similar extraneous matter from the actual and immediate vicinity of the areas to be bonded before the removal of non-conducting finishes and also just prior to connecting these parts together.

3. Remove all non-conducting finishes such as paints, anodizing, alodising, iridite, etc., from the areas to be bonded. Lacquer thinner specification MIL-T-6094 may be used to remove paint, particularly on alclad parts which shall not be scratched.

7.2.1 (Continued)

4. The cleaned area to be bonded or grounded shall be slightly larger than the actual contact area as necessary to assure that the metal to metal connection is completely and securely made.

5. In all cleaning operations, only the minimum amount of the base metal shall be removed. During the abrading operation, the part surface shall be examined frequently to assure complete cleaning with a minimum removal of part metal. The disc abrasive has a tendency to fill up with use. Frequent disc changes are necessary to prevent part galling.

6. Caustic solutions shall not be used to remove surface finishes.

7. Cadmium or zinc plating and tinning shall not be removed.

7.2.2 The basic methods of cleaning surfaces for bonding and grounding are as follows: (The specific method to be used shall be as called out by engineering drawings.)

7.2.2.1 FAYING SURFACE CLEANING

Clean both bonding areas in such a manner as to produce surfaces that are both uniform and smooth. This is necessary to avoid "point contacts". Use abrasive paper of a size that would make contact with the largest possible area of the surface to be cleaned. Rub the surface applying gentle and uniform pressure.

7.2.2.2 SPOT SURFACE CLEANING

This method is to be used when the drawings require cleaning of relatively small areas such as around holes or on surfaces containing bonding or grounding studs. Manual or mechanized means will be used.

1. The manual cleaning procedure shall be the same as for cleaning of faying surfaces. (See paragraph 7.2.2.1)

2. The mechanized cleaning procedure shall utilize a small electric drill or other suitable drive applying a stainless steel wire brush bonding tool or abrasive cloth discs per paragraph 7.1.1, Item 2, on a mandrel. Keep the cutting surface of the wire brush or abrasive disc parallel with the surface being cleaned at all times. Apply intermittent power to the driver until all the non-conductive coating or finish is removed.

7.3 RE-SURFACING CLEANED AREAS

After the bond has been made, re-prime the adjacent exposed metal surfaces with one coat of the primer with which the part was originally painted. Also apply top coat(s) as required by engineering drawings.

7.4 BONDING JUMPERS

Bonding jumper installation shall meet the following requirement:

1. The use of two or more standard length bonding jumpers in series to make up the necessary length is not allowed.

7.5 BONDING CONNECTION FOR JUMPERS AND FAYING SURFACES

7.5.1 Non-metallic material in compression shall not be depended on to maintain the tightness of connections and shall not be included in the stack of surfaces in contact between compression points.

7.5.2 The bolt or screw size for ground connections shall be as shown on the cable installation drawing. Existing bolts or screws may be used except that screws used for the attachment of support clamps shall not be used for a bond connection.

7.5.3 Bonding connections shall be so installed that vibration, expansion, contraction, or relative movement incidental to normal service will not break the bonding connections nor loosen them so that the resistance will increase above the accepted value.

7.6 TESTING BONDS

All electric bonds as shown on installation drawings unless otherwise specified shall be tested as follows:

1. The resistance values specified shall be the overall resistance, as measured across the bond from object to structure. All structural grounds will not exceed 0.005 ohms maximum resistance. All lightning grounds will not exceed 0.05 ohms maximum resistance.

2. The controlling points for measuring the resistance shall be within the limits of the cleaned area to be bonded and within .25 inch of the exterior limits of the Jumper Terminal, or bonding means.

3. When the cleaned areas are inaccessible after assembly because they are faying surfaces, the measurement shall be made at the nearest accessible point.

4. Low resistance values shall be measured by means of a Ductor low-resistance testing set or a Smallcross Milliohmmeter. High resistances shall be measured with a resistance bridge, vacuum tube voltmeter-ohmmeter or a megger. Instruments shall be checked monthly for accuracy of the readings.

8. ELECTRICAL CABLE INSTALLATION

8.1 TESTING CONTINUITY, SHORTS AND GROUNDS OF WIRES AND CABLES

8.1.1 It is suggested that continuity and absence of shorts and grounds of every wire and cable shall be checked prior to installation. For bundle assemblies containing electric components or parts, the tests on these components shall be conducted before these components or parts are connected to the wire bundle. When this is not practical, testing of these wires shall be "programmed" so that no test voltage is applied to such components or parts.

8.1.2 After installation has been completed, a continuity check and a check for the absence of shorts and grounds on wiring in the ground complex shall be conducted prior to the application of normal operating potentials on all wiring that can be electrically isolated from components or parts. The check for absence of shorts and grounds shall be from each wire in a bundle to all other wires and connector shells in the bundle except no test voltage* shall be applied to wires connected to components or parts that may be damaged.

* This does not include functional test per engineering drawings.

8.2 BEND RADIUS

Cables shall be installed maintaining the minimum bend radius as shown on the applicable installation drawings. If because of individual site peculiarity, or for any other reason, the cable cannot be installed and maintain the minimum bend radius indicated, the problem shall be reported to the inspecting authorities and resolved prior to installation.

8.3 PROTECTION FROM ABRASION

All electrical cables shall be installed to avoid possible abrasion from sharp edges. If the electrical cables cannot be installed to meet the drawing requirements and to avoid possible abrasion, the cable may be wrapped as required with polyvinylchloride pressure sensitive tape per MIL-I-7798.

9. FORMED CHANNEL INSTALLATION

9.1 Formed channel shall be installed in the positions and in the manner shown on the installation drawings. The channels are to be used for supporting the electrical cables at the required intervals.

9.2 The ends of the formed channel and any scratches or mars shall be refinished.

1. Bare metal shall receive one coat of primer per TT-P-636. Minimum dry film thickness of primer shall be 0.8 MIL. Drying time before top coating shall be 24 hours minimum at room temperature.

9.2 (Continued)

2. Top coat with two or more coats of enamel to yield a minimum dry film thickness of 3.0 MILs (.003). Enamel shall conform to TT-E-489, TT-E-527 or TT-E-529 and shall match the existing color.

10. INSTALLATION OF THREADED FASTENERS

10.1 MATERIAL REQUIREMENTS

All nuts, bolts and washers called out on the installation drawings shall be Cadmium plated steel and shall comply with the Federal Standard applicable to the part. Unless otherwise specified on the drawing, parts shall have a minimum tensile strength of 125,000 PSI. Welded studs do not require plating.

10.2 BOLT HOLES

Unless otherwise specified by drawing, bolt holes shall be drilled perpendicular within 2° to the surface against which the installed bolt head will bear.

10.3 REQUIREMENTS OF INSTALLATION AND FIT

10.3.1 The adjustment of grip length by one size (longer or shorter) to meet other requirement herein shall be allowed. A maximum of two standard spacer-washers may be used under a nut where necessary to adjust for bolt grip lengths.

10.3.2 To protect the surface from injury while tightening, one standard spacer-washer may be used under the nut or bolt head, whichever is being turned. A total of three washers will be allowed: two for adjustment of grip length and one for surface protection when washers are required and are not specified on the drawing. The material shall be similar to that of the material against which the washer will bear, i.e., Cadmium plated steel against Cadmium plated steel.

10.3.3 Nuts shall not engage first incomplete thread next to bolt grip. All threads of the nut shall be engaged and the complete chamfer visible on the end of the bolt. Flat end bolts and screws shall extend at least 1/32 inch through the nut.

10.3.4 With the exception listed below, no lubrication other than that which is on the nut as purchased shall be used on bolt installation.

Exception: Bolts and nuts finished with any type of Cadmium plating shall be lubricated with stearic acid before installation.

10.3.5 Accumulations of foreign material on threads shall be cleaned away before installation. Cleaning of bolts, nuts and washer by solvent degreasing shall be permitted as required immediately prior to installation. Unplated studs, nuts and washers shall be re-oiled prior to installation.

10.3.6 All mechanical locking safety devices shall be installed in accordance with drawing requirements.

10.3.7 Holes and countersinks shall not require a protective coating prior to installation of bolts or screws, except in cases where they are installed in dissimilar metals or a protective coating is called out on the drawing. In cases where a protective coating is required on the bare holes and countersinks, primer or anti-corrosion compound shall be applied immediately prior to installation of fastener.

10.4 MULTIPLE BOLT INSTALLATIONS

10.4.1 Finger tighten all nuts or bolts first.

10.4.2 Snug-up opposite bolts or nuts all around.

10.4.3 Torque opposite bolts or nuts all around.

10.5 TORQUE REQUIREMENTS (INCH-POUNDS)

10.5.1 The "Torque Range" columns in Table I, shall be used for all installations not covered by specific drawing callout relating to torque control.

10.5.2 TORQUES FOR TABLE I ARE FOR:

1. Clean bolts and nuts as lubricated by the manufacturer's specifications.

2. Bolts and nuts surface finished with any type of Cadmium plate and lubricated with stearic acid.

3. Bolts and nuts where the engineering drawing requires the application of "loctite C".

10.5.3 REQUIREMENTS FOR TORQUING BOLTS FROM THE HEAD SIDE

1. Only "snug fitting" drivers which fill the bolt head recess shall be used. Minumum driver hardness of Rockwell C-50 together with toughness suitable for this type of tool shall be required.

2. Driver shall be held in alignment with the recess. Use of special drivers or adapters to facilitate keeping this alignment is recommended.

3. Axial load, sufficient to prevent the tendency of slot drivers from "climbing" out of the recess, shall be applied.

TABLE I
Steel Bolts
(125,000 PSI Minimum Heat Treat)

BOLT SIZE	TORQUE RANGE (in lbs.)	(Maximum)*
10	20-25	40
1/4	50-70	100
5/16	100-140	225
3/8	160-190	390
7/16	450-500	840
1/2	480-690	1100
9/16	800-1000	1600
5/8	1100-1300	2400
3/4	2300-2500	5000
7/8	2500-3000	7000
1	3700-5500	10,000
1 1/8	5000-7000	15,000
1 1/4	9000-11,000	25,000
1 3/8	9000-11,000	25,000
1 1/2	9000-11,000	25,000

NOTE: When torquing bolts from head side, the higher torque value of the torque range shall be used.

* Allowed for alignment of castellated nut and hole for cotter pin or other safety device.

11. WELDING

Welding shall be accomplished per AWS "Standard Rules for Field Welding of Steel Storage Tanks", unless otherwise specified on the drawing.

11.1 WELDING OPERATOR QUALIFICATIONS

The welding operator shall have been certified under AWS "Qualification Procedures" B 30 F 41T, Part II, Item 202 a (1) and (2) and 208, Table 3.

11.2 CLEANING OF SURFACES TO BE WELDED

Surfaces shall be clean and free of loose scale, slag, heavy rust, grease, paint or any foreign material. Such surfaces shall also be smooth, uniform and free from burrs, tears or other defects which may adversely affect proper welding. A fine film of rust adhering on cut or sheared edges after brushing need not be removed.

11.3 WELDING

11.3.1 After each layer of a multi-layer weld, the welder shall inspect for proper cleaning, sidewall fusion, weld contour, and slag pockets. Defects shall be removed by grinding, chipping or wire-brushing before the next layer is deposited.

11.3.2 The start and stop of each weld bead shall be ground or chipped as necessary to eliminate cracks or excessive porosity prior to covering the area with subsequent weld bead.

11.3.3 Where a weld crosses or intersects a previously deposited weld, all flux or slag must be removed from the first weld before application of the second weld.

11.4 WELD CHARACTERISTICS (VISUAL INSPECTION ONLY)

11.4.1 Inclusions, unfused areas, lack of joint penetration and cracks of any size in the weld metal or adjacent to the weld are not acceptable.

11.4.2 Excessive weld bead size shall not be cause for rejection, provided the utility of the part is not reduced or hampered by weld bead size.

11.5 REPAIR AND REWORK OF WELDED ASSEMBLIES

Defects such as cracks, pin holes, incomplete fusion and incomplete penetration may be repaired after the defective area has been chipped or ground out.

11.6 WELD ELECTRODE

Weld electrodes shall be E-7016 or E-7018, per ASTM A-316-58T.

12. STUD WELDING OF STEEL

12.1 PRE-PRODUCTION CHECK

1. Immediately before initiation of production welding at least five (5) test studs shall be welded. Stud, material thickness and condition, and welding conditions shall be the same as for the production parts.

2. Each test stud shall withstand bending 90° by hammer blows without failure in the weld area.

3. All welded studs shall have uniform filleting.

12.2 WELDING REQUIREMENTS

1. Surfaces upon which studs are to be welded shall be free from loose mill scale, dirt, grease, oil, and paint. A light film of rust or mill scale adhering after wire brushing need not be removed.

2. Studs shall be positioned by templates, guides, or other such means to insure the accuracy and alignment as required by the drawing.

3. Collets shall be maintained in a clean unpitted condition and shall grip the stud with sufficient force to prevent dropping when the gun is being positioned.

4. Only ferrules of the size and type required for the stud being welded shall be used.

5. The welding gun shall not be removed for a period of at least five (5) seconds following the end of the weld current cycle.

6. Welding shall be accomplished without changing the machine settings from those established per 12.1.

12.3 ROUTING PRODUCTION CHECK

Immediately after production welding, three (3) test studs shall be welded per 12.1. If the test studs should fail in the weld area, the last three (3) production welds shall be tested in the same manner. If one (1) or more of these three (3) studs fail, additional studs shall be tested, proceeding back from the last production stud welded until five (5) consecutive studs have passed the test.

12.4 REMOVAL OF STUDS

Studs tested as previously described, or misfires, or other studs of inferior quality shall be cut off. The area shall be chipped or ground free of weld metal prior to replacement of weld stud. Replacement of weld stud shall be in accordance with 12.2.

12.5 MAINTENANCE CONTROL

1. Studs shall be stored in such a manner as to prevent contamination by dirt, grease, oil, paint, etc., and shall be pretected from corrosive atmosphere.

2. Ferrules shall be protected against breakage and moisture.

12.6 INSPECTION

Inspection shall see that all requirements of this specification are met.

1. Visual inspection shall indicate a weld having uniform filleting. The minimum fillet diameter shall be 1/8" greater than the stud diameter. The minimum fillet height shall be .06" or 1/3 the stud diameter, whichever is the lesser.

2. Visual inspection shall indicate a weld having a uniform metallic color completely about the circumference.

3. Stud burn-off shall be 1/8" $\pm$ 1.32".

4. Cracks, cavities, or voids in the weld or adjacent base metal shall be cause for rejection.