



FOREWORD

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1. INTRODUCTION

This document describes the quality program which has been established by the Paragon Manufacturing Company* to satisfy the quality requirements applicable to the manufacture of Explosion Proof (XP) Electrical Enclosures for mining use.

2. SCOPE

This quality program shall apply to all XP Enclosures manufactured by Paragon for MSHA certification and mining usage. The program is tailored to meet the applicable MSHA requirements in a manner which is as direct and cost-effective as possible.

3. APPLICABLE DOCUMENTS

The following documents of exact issue date specified for government documents, and of latest issue for Paragon Documents form a part of this plan. In case of conflict between this document and government documents, the requirements of the latter shall govern. In case of conflict between this document and any others listed, the requirements of this document shall govern.

3.1 Specifications - Government (MSHA)

3.2 Other Documents

3.2.1 Paragon Implementing Procedures

3.2.1.1 Receiving Inspection and Test Procedures

3.2.1.2 In-Process Inspection and Test Procedures

3.2.1.3 Final Inspection and Test Procedures

3.2.1.4 Equipment Calibration Procedures

3.2.2 Paragon Process Control Documents

3.2.2.1 Welding Procedures

3.2.2.2 Plating Procedures

3.2.2.3 Painting Procedures

*Paragon Manufacturing Company is a fictitious company name that has been used for convenience in the writing of this document.

3.2.2.4 Cleaning and Bonding Procedures

3.2.2.5 Non-destructive Examination Procedures

4. GENERAL REQUIREMENTS

This Quality Plan describes the quality system, organization, and implementing mechanisms which will be applied by the Paragon Manufacturing Company to the manufacture and delivery of XP Enclosures for mining use. The purpose of this plan is to ensure that all XP Enclosures, associated components, spare and replacement parts, and instructions to users, consistently meet all applicable design and quality specifications. The quality system requires and will verify that XP Enclosure components procured from vendors or subcontractors also meet the specification requirements.

MSHA representatives will be permitted access to Paragon facilities as necessary to investigate problems or verify compliance with this plan. With at least 24-hour notice from MSHA, access will be granted to allow auditing of records, discussion of problems, and witnessing of any manufacturing, test or inspection activities.

5. QUALITY PROGRAM

5.1 Quality Program Management

5.1.1 Organization

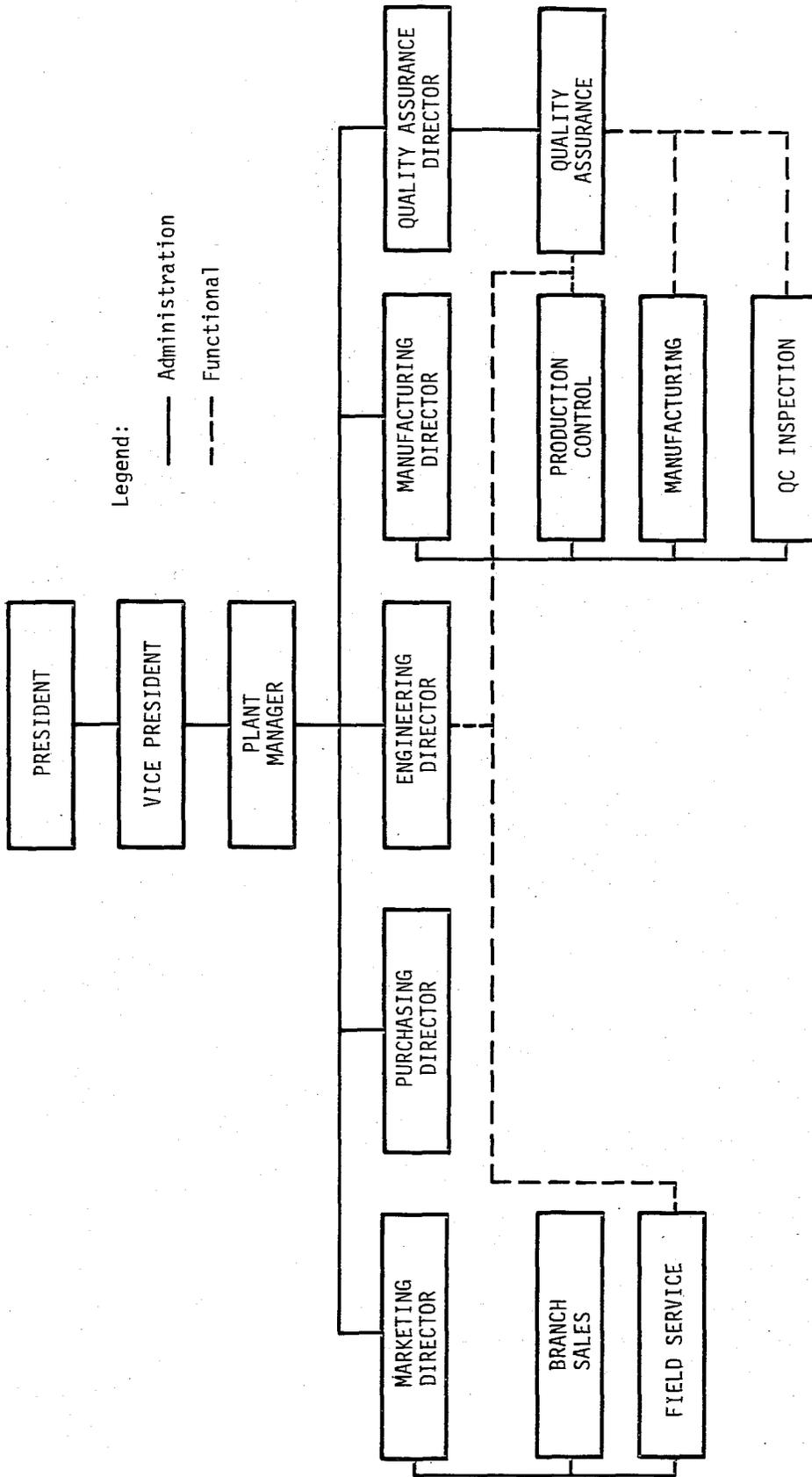
The organization chart in Figure 1 shows the organizational positions of Quality Control and Quality Assurance personnel in the Paragon Manufacturing Company. Quality Assurance has the direct access to management and the organizational freedom required to enable it to identify, evaluate and ensure adequate solutions to quality problems.

5.1.2 Responsibility

Quality Control personnel are responsible for the day-to-day activities and decisions associated with inspections, tests, and acceptance or rejection of product. Quality Assurance is responsible for surveillance and audit of quality program activities to ensure objectivity of quality control decisions, completeness of records, and adherence to the requirements of this quality plan. Its organizational independence enables Quality Assurance to ensure that quality considerations are not compromised by cost, schedule, or other production pressures.

5.1.3 Management Review

The Director of Quality Assurance shall review the performance of the quality organization and the quality program at least semi-



Legend:
 — Administration
 - - - Functional

FIGURE 1. PARAGON MANUFACTURING COMPANY ORGANIZATION CHART

annually. This review will be made to evaluate the status and effectiveness of the quality program, and to ensure its conformance to the requirements of this plan. The management review shall be documented by memorandum or other suitable means, and any corrective measures which are found necessary shall be taken promptly.

5.2 Quality Program Documentation

5.2.1 General

This quality plan and the procedures listed in Section 3.2 describe the quality program implemented by Paragon for XP Enclosures. The quality plan, the implementing procedures of Section 3.2.1, and any changes to these documents shall be approved by MSHA prior to use. The other listed procedures and any other internal Paragon documents are subject to change at the discretion of Paragon, and do not require MSHA review or approval.

5.2.2 Receiving

The nature, extent and details of inspections and tests of received items will be defined in written Receiving Inspection and Test Procedures. These procedures will be prepared as required to thoroughly evaluate procured items and materials for compliance with all applicable requirements.

5.2.3 Production

The flow chart of Figure 2 depicts the typical flow of material, parts and assemblies through the production process. Quality inspection and check points have been incorporated into the flow at appropriate points as indicated by the letters "QC" within the applicable blocks of the diagram. The nature, scope and details of the individual tests and inspections will be described in the applicable Process Inspection and Test Procedures and Final Inspection and Test Procedures.

5.2.4 Calibration

All devices used to measure characteristics which determine the quality of XP enclosures will be required to be calibrated. The Paragon calibration facility will prepare an Equipment Calibration Procedure for each item or category of inspection and testing equipment as required to support the XP Enclosure production activity. Each procedure will specify as a minimum, detailed calibration instructions, required frequency of calibration, traceability to appropriate standards, and required calibration records.

If the calibration of Paragon equipment is subcontracted to an outside facility, the subcontractor shall be required to have and use equivalent calibration procedures.

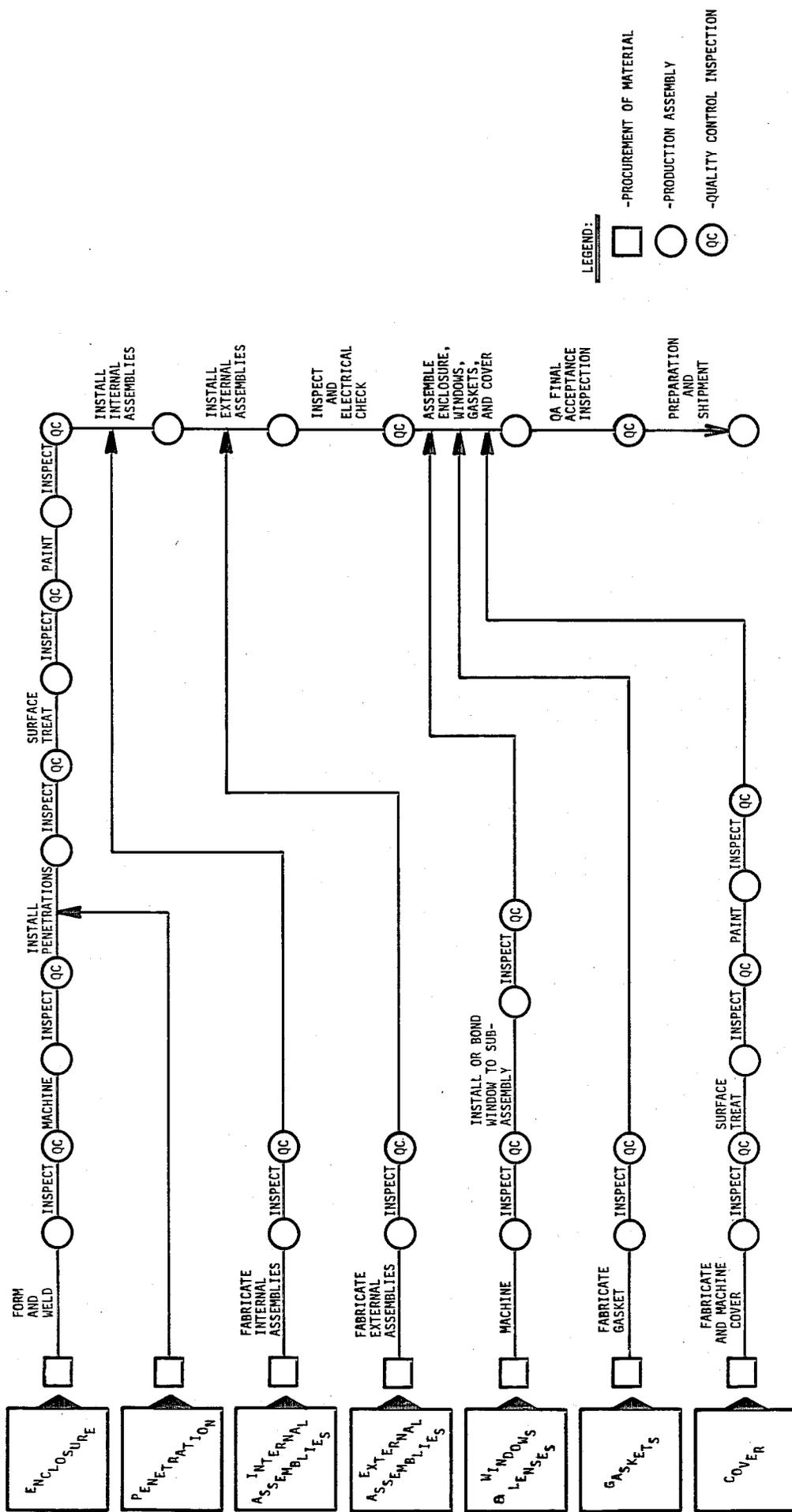


FIGURE 2. FACTORY FLOW CHART

5.2.5 Quality Forms

Appendix A presents some forms and tags typical of those which will be used in support of the quality program, and a brief description of the purpose of each is given in Table 1. More detailed discussions of the use of these forms in conjunction with the quality program appear in other sections of this plan or in the relevant procedures.

5.3 Drawings, Specifications, and Changes

All drawings, specifications and instructions used in the production of XP enclosures will be controlled by procedures which will ensure that both basic documents and subsequent changes are adequately evaluated and controlled, and that their effectivity is clearly specified. A written procedure will be prepared describing in detail the methods by which these documents will be issued, controlled, and updated.

5.4 Procurement

The procurement of XP Enclosure parts, materials, and services will be carefully controlled to ensure that all design and quality requirements are met. Previously proven parts, materials and processes will be selected whenever possible. Quality Assurance will review and approve each purchase order to verify that the specified items and vendors are appropriate, and to ensure that all applicable quality requirements have been specified. Upon receipt, incoming items will be inspected and/or tested, marked for subsequent identification, and stored as described in Section 5.7.1 of this plan.

5.5 Fabrication and Assembly

Normal fabrication and assembly activities will be controlled by clearly and completely defining all necessary requirements and procedures, and monitoring the work for compliance. Instructions will be provided by the drawings and work orders, and supplementary written procedures will be prepared as necessary to provide additional or more detailed instructions.

A shop traveler or routing sheet will be used to control and record the sequence of manufacturing steps including inspections and/or witness points, (see example in Figure A-4 of Appendix A). Inspections will be performed by Quality Control representatives. Quality Assurance will provide surveillance of fabrication and assembly activities to verify the proper performance and documentation of all required inspections, and to detect and correct any conditions which could compromise product quality.

5.6 Special Processes

Special processes are those which require specialized control and/or documentation either because of their inherent complexity or because of their specific adaptation to a particular product. Special processes typically of concern are welding, plating, cleaning and bonding, painting, and nondestructive examination.

TABLE 1. SAMPLE QUALITY PROGRAM FORMS

1. Figure A-1, Material Identification Tag, attached to material or articles to authenticate identity.
2. Figure A-2, Incoming Inspection Form, documents identity and status of material received at Paragon.
3. Figure A-3, Reject Material Tag, permits identification of rejected material.
4. Figure A-4, Manufacturing Planning Sheet, serves as a traveler for manufacturing and assembly operations.
5. Figure A-5, Inspection and Test Results Form, documents inspection and test results.
6. Figure A-6, Hold Tag, used to identify material or items which are awaiting disposition.
7. Figure A-7, Rework Material Tag, permits identification of material requiring rework.
8. Figure A-8, Test and Inspection Procedure Form.

Control of special processes will be achieved by documenting the required procedures, controls, inspections and records for each process in written procedures, and monitoring the process activity for compliance. Appropriate certification of special process personnel will be performed and documented to ensure that only qualified personnel are assigned. Certification will be required for welders, NDE examiners and any other personnel performing work crucial to end product quality and integrity.

5.7 Inspection and Test

Paragon will perform sufficient inspection and testing throughout the XP Enclosure production cycle to verify conformance to specifications in a cost-effective manner. In general, these inspections and tests can be categorized as receiving, in-process, or end-product (final) examinations. Written procedures will be prepared as necessary to adequately specify the required test or inspection equipment, procedures, data recording, and accept/reject criteria. Quality Assurance will monitor the performance of these activities to ensure conformance to all requirements of this plan and other governing documentation.

5.7.1 Receiving Inspection and Test

Subcontracted or purchased parts and materials for XP Enclosures will be inspected following receipt by Paragon to ensure that they conform to all applicable purchase order, specification, drawing or other requirements. Typically, visual inspections will be made to confirm identities and quantities, and to verify receipt of required documentation such as material certifications or test reports. The extent of additional inspection or testing will vary, depending on the nature and significance of the received item or material. The detailed requirements, scope, and methods of receiving tests and/or inspections for various items will be delineated in Receiving Inspection and Test Procedures to ensure the correct and consistent performance of these tests and inspections.

The results of receiving inspections and tests will be recorded on a prescribed form for each article or lot of articles received. Accepted items will be suitably marked to preserve their identity and transferred to the specified storage area. Rejected material will be clearly identified and placed in segregated storage to preclude its inadvertent use.

5.7.2 In-Process Inspection Test

In-process inspections and tests will be scheduled at appropriate points in the production cycle to:

- (a) Examine those characteristics which cannot be examined on the completed product.
- (b) Ensure that the final product will meet all applicable performance and quality requirements.
- (c) Identify deficiencies early enough to minimize cost and schedule impact.

In-Process Inspection and Test Procedures will be prepared to adequately define the required test or inspection equipment, procedures and data. Test and inspection personnel will be required to use these procedures in all cases. Results will be recorded on test data sheets specified in the procedures. Failures and nonconformances detected during these inspections and tests will be dispositioned as specified in Section 10 of this plan.

5.7.3 Final Inspection and Test

The final inspection and testing of the end product shall be performed in accordance with written Final Inspection and Test Procedures. These procedures will be designed to determine conformance of the end-product to the applicable design specification. They will include visual/mechanical inspection for workmanship, and suitable operational testing as appropriate.

5.7.4 Inspection Status

The inspection status of parts and material for XP Enclosures will be identifiable throughout the factory cycle. Direct monitoring of the progress of individual parts and lots will be employed to track inspection status where it is feasible. For more complicated portions of the production flow, various forms will be utilized to ensure positive control.

A material identification tag will be stamped or otherwise marked to denote successful completion of receiving inspection/test, and will be attached to the item or lot affected. Suitable shop cards or travelers will accompany items through the factory process. These will be stamped or initialed as each operation is completed to ensure that the proper sequence is followed and to produce a historical record of the completion of all required process steps.

Items which fail inspections or tests will be identified with a Hold Tag, Rework Material Tag, or Reject Material Tag, as appropriate, until the nonconformance has been resolved. The tags will then be removed and processing will be allowed to continue.

5.7.5 Sampling

All critical characteristics of XP Enclosures shall receive 100 percent inspection, if possible. Inspection of other characteristics may be accomplished on a sampling basis where equipment or part quantities warrant sampling techniques. Provisions and requirements for sampling inspection or testing will be specified in the applicable inspection or test procedures.

Where sampling inspection or testing is to be employed, the applicable inspection or test procedure will specify the sampling methods and requirements. Sampling will be in accordance with the provisions of a commonly accepted document such as MIL-STD-105D or MIL-STD-1235A.

5.8 Measuring and Test Equipment

Paragon shall provide suitable measuring and test equipment for the measurement of parameters which determine XP Enclosure quality or compliance with specifications. All such equipment, including gages, jigs, or fixtures shall be calibrated in accordance with established written procedures as described in Paragraph 5.2.4. Calibrations shall be performed at scheduled intervals against standards traceable to recognized national standards such as NBS.

If measuring or testing activities on XP Enclosures are performed by a facility other than Paragon, clearly defined arrangements shall be made and MSHA approval shall be obtained in advance. Equipment calibration requirements imposed on the performing facility shall be at least equivalent to those for calibration internally.

5.9 Corrective Action

All instances in which XP Enclosure materials, items, or operations are found to be defective or nonconforming will be thoroughly documented and analyzed to identify the cause and specify suitable corrective action in each case.

Nonconforming operations will be suspended, and personnel who are knowledgeable about the specific activity will evaluate the situation and determine appropriate corrective action. When this action has been accomplished and documented, the operation will be resumed.

Nonconforming or defective items shall be clearly identified by tags or other suitable means, and segregated if possible to prevent inadvertent use. A joint evaluation of each nonconformance will be made by representatives of engineering, manufacturing, and quality assurance to determine the cause of nonconformance and decide on appropriate corrective action. Corrective action shall include action to correct the specific nonconforming condition, and/or action to prevent recurrence as appropriate.

5.10 Preparation for Delivery

A final review of each XP Enclosure or lot of enclosures shall be made prior to shipment to ensure completion of all required actions and to confirm compliance with all applicable quality requirements. This review will be performed by a Quality Assurance representative and will include, but not necessarily be limited to, verification that all fabrication, inspection, and test operations have been accomplished. The review findings will be documented on an appropriate record form.

5.11 Records

Paragon will prepare and maintain procurement, identification, control, test, inspection, and nonconformance records for all XP Enclosure hardware produced. These records will be appropriate for effective and

economical implementation of the quality program, and they will be sufficient to provide objective evidence that quality requirements have been met. The specific information to be included in each record and the form to be used will be specified in the procedure covering the activity being documented.

During the production of XP Enclosures, Quality records will be available for review by MSHA representatives, and copies of specific records requested by MSHA will be furnished as required. All quality records will be retained by Paragon for at least three years after delivery of the devices to which the records apply.

6. TERMS AND DEFINITIONS

The terms and definitions listed below are guidelines intended to foster consistent interpretation of this plan.

(1) Audit

An activity to determine through investigation the adequacy of, and adherence to, established procedures, instruction, specifications, codes, and other applicable contractual and licensing requirements and the effectiveness of implementation.

(2) Calibration

The comparison of a measurement standard or instrument of known accuracy with another standard or instrument to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the item being compared.

(3) Control

The exercise of direction, guidance, and restraining power.

(4) Critical Characteristics

Those characteristics which are vital to the structural integrity and/or explosion-proof capabilities of the product. These characteristics are to be identified on the enclosure drawings that are approved by MSHA.

(5) Documentation

Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

- (6) Inspection
Examination, observation, or measurement to determine the conformance of materials, supplies, components, parts, appurtenances, systems, processors, or structures to predetermined requirements.
- (7) Inspection Equipment
Equipment, instruments, and materials used to perform an inspection.
- (8) Item
Any level of unit assembly, including structure, system, subsystem, subassembly, component, part, or material.
- (9) Nonconformance
A deficiency in characteristic, documentation, or procedure which renders the quality of an item unacceptable or indeterminate. Examples of nonconformance include: physical defects, test failures, incorrect or inadequate documentation, or deviations from prescribed processing, inspection, or test procedures.
- (10) Quality Assurance
All those planned or systematic actions necessary to provide adequate confidence that an item or a facility will perform satisfactorily in service.
- (11) Quality Assurance Records
Those records which furnish documentary evidence of the quality of items and of activities affecting quality.
- (12) Quality Control
Those quality assurance actions which provide a means to control and measure the characteristics of an item, process, or facility to established requirements.
- (13) Repair
The process of restoring a nonconforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpaired, even though the item still may not conform to the original requirement.
- (14) Rework
The process by which a nonconforming item is made to conform to a prior specified requirement by completion, remachining, reassembling, or other corrective means.

(15) Test and Inspection Equipment

Devices used to measure, gauge, test, inspect, or otherwise examine parts, subassemblies, equipment, etc. for compliance with specifications; production jigs, fixtures, tooling masters, templates, patterns, etc. used as media of inspection shall be considered test and inspection equipment.

(16) Testing

The determination or verification of the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental, or operating conditions.

7. DISCUSSION

A quality program plan is a document traditionally prepared by a manufacturer to describe the manner in which he intends to meet the quality requirements imposed on his product by contract, purchase order, or government agency (MSHA) provisions.

The Quality Program Plan for Explosion Proof Electrical Enclosures has been prepared as a generic or representative plan which illustrates appropriate quality program content for a manufacturer of XP enclosures or other mining equipment. This plan is intended as a guide which a manufacturer can use for developing his own quality plan, and it should not be construed as directly applicable or required for any specific application. The suitability of various parts of the plan will depend upon the size and nature of the manufacturer's organization, his production volume, characteristics of the product, and other factors.

To explain the purpose and significance of specific elements in the plan and to offer guidance for their use, explanatory notes, keyed to paragraphs and figures, have been included as Appendix B. The information in Appendix B is intended to assist the manufacturer in adapting the quality program plan for use in his particular circumstances.

Appendix C of this document contains examples of written procedures for various quality-related activities. These examples are included only to provide illustrations of approaches which have been used to effectively document and control quality-related activities. They are not necessarily recommended for any specific application. Some may be useful to specific manufacturers either directly or with modification; others may provide ideas that can be used to modify an existing form, document, or system.

APPENDIX A

SAMPLE FORMS AND TAGS

IDENTIFICATION	QA ACCEPTANCE
Date Rcvd.: _____ Project No.: _____ P. O. No.: _____ Other Ref. No.: _____ Item Descrip: _____ Item ID No.: _____ Insp. Initials: _____	

FIGURE A-1. MATERIAL IDENTIFICATION TAG

Date _____

INCOMING INSPECTION FORM USED ON ALL RECEIVED ARTICLES

<u>Purchasing References</u>		<u>Supplier Identification</u>	<u>Manufacturer Identification</u>
P. O. No. _____		Name _____	<input type="checkbox"/> Same <input type="checkbox"/> Unidentifiable
Ref. No. _____		Address _____	
Proj. No. _____		City _____	

	Item	Qty.	Unit	Description
As Ordered				

<u>Visual Identification Data from Item Nameplate, Package Label, etc.</u>	<u>Documentation Provided</u>
	<input type="checkbox"/> None <input type="checkbox"/> Physical Data <input type="checkbox"/> Certificate of Conformance <input type="checkbox"/> Electrical Data <input type="checkbox"/> Test Report <input type="checkbox"/> Inspection Data <input type="checkbox"/> Chemical Data <input type="checkbox"/> Other (List Below)

Description of Tests Performed Other Than Visual Inspection. List Equipment Used (Including Serial Number and Calibration Date). Acceptance Tolerances Imposed and Environmental Conditions If Other Than Ambient.

Item	Qty.	Unit	Accpt'd	Rejected	Reason for Rejection	Disposition

Inspection Performed by _____
 Accepted Items Delivered to _____
 Form No.: _____ Date: _____

FIGURE A-2. INCOMING INSPECTION FORM

REJECT
MATERIAL

PROJECT NO.: _____ DATE: _____

PART DESCRIPTION: _____

PART NO.: _____ SERIAL NO.: _____

CAUSE FOR REJECTION: _____

SIGNED: _____ EXT.: _____

FIGURE A-3. REJECT MATERIAL TAG

DRAWING/PART NO.: _____ DATE: _____
PART NAME: _____ PAGE NO.: _____

INSPECTION AND TEST RESULTS
PROJECT _____

Serial No.: _____ Lot No.: _____
Traceability No.: _____ Ref. Code: _____

INSPECTION OR TEST PERFORMED

- | | |
|--|--|
| <input type="checkbox"/> Visual | <input type="checkbox"/> Foam Density |
| <input type="checkbox"/> Dimensional | <input type="checkbox"/> Alloy Check |
| <input type="checkbox"/> Dye Penetrant | <input type="checkbox"/> In Process Inspection |
| <input type="checkbox"/> Ultrasonic | <input type="checkbox"/> Final Inspection |
| <input type="checkbox"/> Radiography | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> Test/Insp. Procedure No. _____ | Para. No. _____ |
| <input type="checkbox"/> Process Control Procedure No. _____ | Para. No. _____ |

RESULTS: (Attach Data Sheets as necessary)

Number of Articles Inspected or Tested: _____ of _____
Number of Conforming Articles: _____
Number of Rejected Articles: _____

OBSERVED DEFECTS: _____

REMARKS: _____

INSPECTED/VERIFIED BY: _____

FORM NO.: _____ QA APPROVAL: _____ DATE: _____
REVISION: _____
DATE: _____

FIGURE A-5. INSPECTION AND TEST RESULTS FORM

HOLD
DO NOT USE THIS MATERIAL

Date: _____ Project No.: _____

Remarks: _____

Signed: _____

Form No.

FIGURE A-6 HOLD TAG

REWORK MATERIAL

PROJECT NO.: _____ DATE: _____

REFERENCE: _____

CAUSE FOR REJECTION: _____

SIGNED: _____ EXT: _____

FIGURE A-7. REWORK MATERIAL TAG

APPENDIX B

EXPLANATORY NOTES

EXPLANATORY NOTES ON THE QUALITY PROGRAM PLAN

Para. No.	Discussion
5.1.1, 5.1.2	The key organizational consideration is that Quality Assurance (QA) must have sufficient posture and independence to ensure that quality considerations are not arbitrarily neglected in the interest of cost, schedule, etc.
5.1.3	Periodic QA management review of quality program performance is an accepted method of monitoring and improving quality programs. Documenting these reviews provides objective evidence that they were performed and a historical record of the findings.
5.2	The essential Quality Program Documentation includes two types, each vital to the effectiveness of the quality program. The <u>quality plan and procedures</u> describe <u>what</u> the quality program includes and <u>how</u> it will be accomplished. These documents present a consistent description of the program to all concerned, and provide sufficient instructions for implementing the program to ensure consistency even with personnel changes. The <u>records</u> of quality-related activities provide the required <u>objective evidence</u> that these activities were, in fact, accomplished in the manner and to the extent specified. Records typically include tags, forms, data sheets, recorder charts and tapes, logs and reports.
5.2.2	Written procedures for receiving inspections and tests must describe the nature and extent of the examinations needed to ensure that received items meet all applicable requirements. These procedures will vary from very simple "visual examination and count" of routine hardware items, to relatively extensive checks for items that are complicated and/or critical. The key points are that the procedures must ensure that receiving inspections and tests are adequate in scope and consistent in performance.
5.2.3	The purpose of production flow charts and travelers is to define and ensure adherence to a planned sequence of operations. Hold points should be included at appropriate steps to permit quality inspections which could not be performed after further shop processing. Adherence to the prescribed sequence should be mandatory (see also 5.5 and 5.7.4). The factory flow chart, which is illustrated by the example in Figure 2, can be as detailed as desired. Normally, however, the flow chart presents a skeleton or outline of the factory flow, showing only the more significant steps or activities. For example, the "form and weld" and "inspection" steps for the enclosure in Figure 2 may actually

Para. No.

Discussion

5.2.3
(cont'd)

include: forming, assembly and weld prep; inspection of dimensions and weld prep; welding; visual and/or dimensional inspection of welding. Commonly the manufacturing process contains a number of informal inspections such as interim dimensional checks of machining operations, surface finish checks, and welding fit-up. These informal inspections are usually optional and are not normally identified in the flow chart. The inspection points which are shown in the flow chart in Figure 2 are the formal hold-point inspections performed by QA or QC. These are mandatory and their results must be documented.

5.3

To ensure that the end product is manufactured as intended, the documents which control the various plant activities must be in the right place at the right time. This requires a planned system of document control which will ensure that current versions of drawings, specifications, instructions, etc. are present in the work area and that obsolete versions are promptly removed.

5.4

The QA role in the procurement cycle is to be sure that for each purchased item, both the vendor and the item specified meet all applicable quality requirements. When an item is received, QA must ensure that it is the ordered item, and that its identity and condition are suitably protected until it is installed.

5.6

The certification of welders and NDE examiners is required to verify the competence of personnel performing these specialized functions, and to enhance the consistency of the work that they perform. The certification process requires them to demonstrate proficiency in the specific application of their specialty to the hardware being produced.

5.7.2

In-process inspections or tests are typically performed to verify the successful completion of a specific process step, to check something that cannot be checked later, or simply to find a defect early enough to correct it relatively inexpensively. The optimum amount of in-process inspection and testing depends largely on the product, but is essentially determined by a trade-off of inspection and test costs against the cost of correcting problems not found until final test or inspection.

5.7.4

The requirement that the inspection status of products be identifiable throughout the production cycle serves several purposes. It helps to ensure that the correct sequence of production cycle steps is followed so that required inspections are neither omitted nor duplicated. It also facilitates the tracking of in-process items by showing clearly at any point which steps are complete and which remain to be completed.

Figure No.

Discussion

- Figure A-1 This Identification Tag provides a simple method of maintaining the identity of received parts or material until they are used. The receiving inspector enters all applicable information in the spaces provided, initials the tag and attaches it to the item or container of items. When receiving inspection is completed and the item(s) is accepted, the QA stamp of the inspector is applied in the "QA Acceptance" block and the item(s) is placed in the stock area until needed.
- Figure A-2 This Incoming Inspection Form has been used for recording and correlating purchase order information and information supplied with the delivered order. The name of the manufacturer is entered in the Manufacturer Identification block, if neither of the boxes is checked. Under "Description of Tests...", the entries will typically be "None," "Part Count," "Dimensional," or a narrative description of more detailed test/inspection, if required. A second page can be used in the rare cases where more space is needed.
- Figure A-3 The Reject Material Tag is a red tag used to clearly identify any nonconforming part or material whose use is prohibited. Items identified with this tag are usually (and preferably) placed in segregated storage as a further precaution against their use. If and when subsequent evaluation, rework or repair of the item renders it acceptable for use, the tag is removed and the item is returned to the production cycle. Typically, it is required that the tag be removed by the person who attached it, in order to avoid confusion or error.
- Figure A-4 This Manufacturing Planning Sheet is essentially just a factory traveler form which was developed for use in the manufacture and assembly of relatively complicated electronic equipment. By using these forms to define and record each processing step at all subassembly, intermediate assembly and final assembly levels, the manufacturer compiles a complete record of production and quality activities for each end product he manufactures. Production employees initial and date each process step as they complete it. Required QA inspection points are identified as hold points, and further production work cannot proceed until QA has inspected the work and stamped and dated the form.
- Figure A-5 The Inspection and Test Results form was developed to record the performance and results of in-process inspections and tests which are not documented on data sheets or other forms. The Results section of the form provides for sampling inspection entries in the event sampling methods are used.

Figure No.

Discussion

Figure A-6

This distinctively colored Hold Tag is attached to an item to temporarily suspend the processing of the item. It is used to hold an incoming item pending receipt of required documentation such as mill test reports and certificates of compliance. It may also be used, in the event of a suspected failure or nonconformance, to hold the item until its status is determined. Hold Tag removal should be accomplished by the person who attached it.

Figure A-7

The Rework Material Tag is used to facilitate the identification and control of an item requiring rework. The cause of rejection and description of the rework to be done are entered on the tag which is then attached to the rejected item. Again, the tag color is distinctive, but this tag may be removed by the person performing the rework.

Figure A-8

This Test and Inspection Procedure form was designed for documenting the many short and simple tests and inspections that are typically performed in many manufacturing facilities. With the attachment of additional pages to expand on Section A and/or B, it has also been used effectively to document more extensive test procedures.

APPENDIX C

SAMPLE PROCEDURES

Each procedure in this appendix is a separate document, chosen as an example from procedures available at Southwest Research Institute, and paged individually. The next page is the last consecutively numbered page in the paging sequence which began with (3) for the report documentation page.

The following sample procedures are included here to illustrate differences in the approach and complexity of procedures required for different applications:

- TIP-II-118 Incoming Electrical Acceptance Test of Vari-L Wideband Transformer
- TIP-II-121 Incoming Electrical Acceptance Test on ELINCO Motor-Generator Set
- TIP-216 115 VAC and DC Checks on Antenna System Test Set
- TIP-238 Integrated System Test (Units 10, 11, 112 and 113)
- 40-PC-2 Procedures for Fusion Welding
- 40-PC-3 Procedures for Dye Penetrant Inspections
- 4010-PC-1 Procedures for Applying Adhesives and Sealants

TIP-II-118 is a procedure for the incoming test of a simple device; TIP-II-121 is a similar procedure for a more complex item.

TIP-216 is typical of in-process or final test procedures used for simple devices, while TIP-238 illustrates a corresponding test procedure for a complete system or a complicated item.

The "PC" series of process control documents provide extensive and detailed procedures required to ensure adequate control of important processes.

Project No. : _____

Date: January 10, 1977

Inspection

Form No. : TIP-II-118

Revision: B

TEST AND INSPECTION PROCEDURE

Test Title: Incoming Electrical Acceptance Test of Vari-L Wideband Transformer

Component: Wideband Transformer

Type: Vari-L Model: HF-122 Series: N/A

Serial No. : As Recorded

Test Objectives: To ensure that all units function properly.

A. Test Equipments (including serial numbers and calibration data)

1. Signal Generator, HP-8640B or Equivalent
2. RF Millivoltmeter, Boonton 92BD or Equivalent
3. Special Test Fixture TIP-II-118. *
4. Various cables and connectors. *

B. Test Procedures: (include: detailed operations, method of inspection, ambient and environmental conditions, criteria for passing or failing)

1. Attach the transformer to be tested to special test fixture TIP-II-118.
2. Set up test equipment as shown in Figure 1.
3. Apply an input signal of 41 MHz at 100 millivolts rms to pin 1.
4. Measure and record on the test results sheet the output signal level for pins 2 and 3 of the transformer under test.
5. Acceptance Criteria:
The output signal level for both output pins and both frequencies shall be 100mv $\pm 10\%$.

*Calibration Not Required

T. A. Millington 2/29/80
Cognizant Design Engineer Date

T. A. Millington 2/29/80
Production Engineering Date

Form No. : 16A

Date: 24 March 1975

John E. McDonald 2/29/80

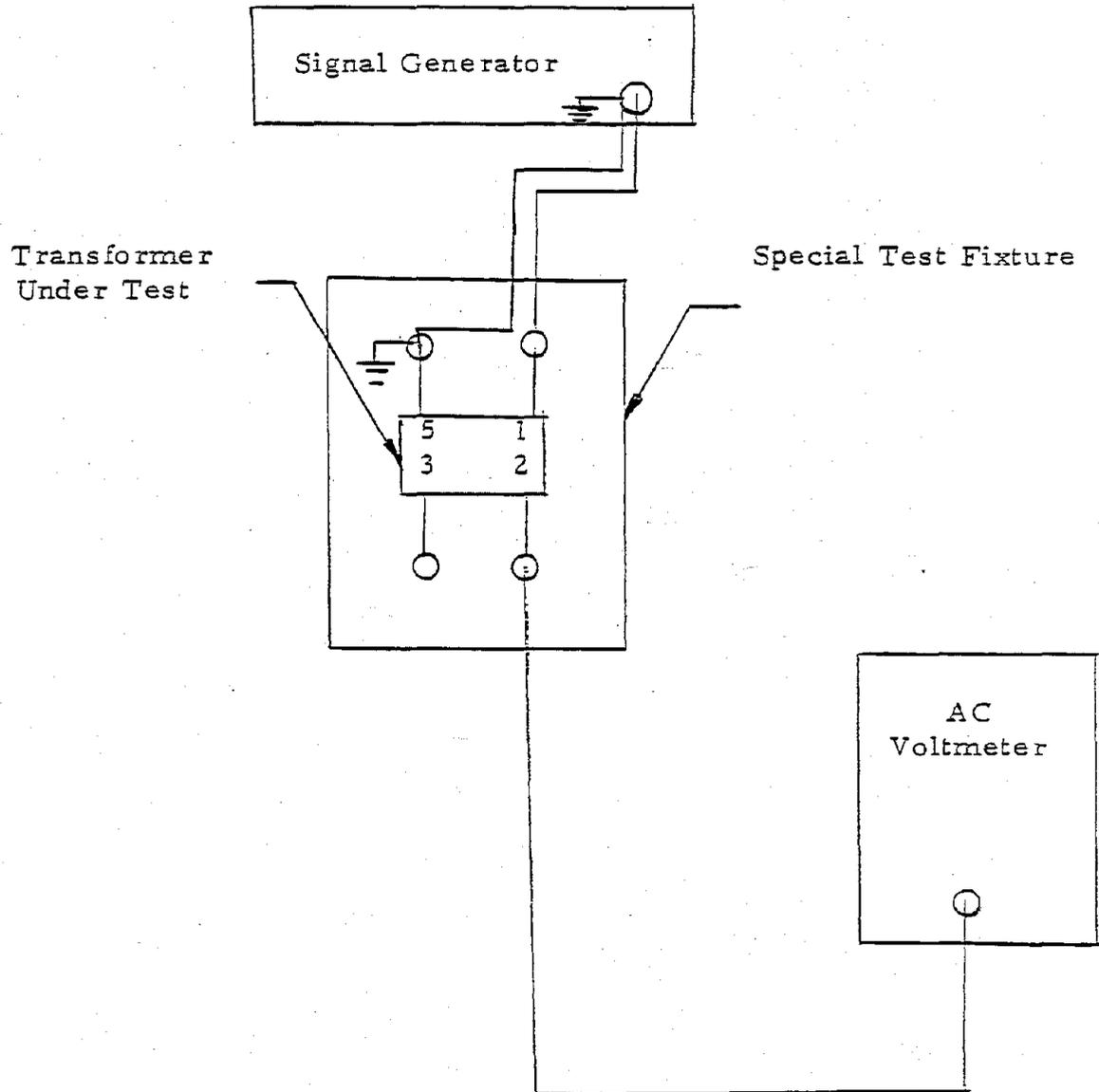


Figure 1.

TEST RESULTS SHEET
 FOR VARI-L HF-122 TRANSFORMERS

Unit Number	Serial Number	Output Pin 2 (mv) rms	Output Pin 3 (mv) rms	Accept	Reject

Signal Generator _____

Voltmeter _____

 Technician

 Date

 Quality Assurance

 Date

Project No. : _____
Date: January 4, 1977
Inspection
Form No. : TIP-II-121
Revision: A

TEST AND INSPECTION PROCEDURE

Test Title: Incoming Electrical Acceptance Test on ELINCO Motor-Generator Set

Component: Motor-Generator Set

Type: Electric Indicator Co. Model: BALJR-3018 Series: N/A
(FS-16 Generator)

Serial No. : As Recorded (2462 Motor)

Test Objectives: To ensure that all units function properly.

A. Test Equipments (including serial numbers and calibration data)

1. Oscilloscope, Tektronix 475 or equivalent.
2. Multimeter, HP-3469B or equivalent.
3. Pioneer Photo Tachometer or equivalent. CNR*
4. Capacitor, TIP-II-121
5. Thermometer (40° to 240° F range) CNR*

B. Test Procedures: (include: detailed operations, method of inspection, ambient and environmental conditions, criteria for passing or failing)

1. Connect Motor-Generator to AC as shown in Figure 1.
2. Measure and record on the test results sheet, the rpm of the motor-generator.
3. Attach thermometer to case of motor-generator being sure to use thermal compound to improve heat conduction. Allow the motor-generator to run for 3 hours, then measure and record on the test results sheet the case temperature.
4. Connect voltmeter to output (20 gauge wire) of the generator as shown in Figure 2A.

*CNR - Calibration Not Required

T. A. Millington 1/7/77
Cognizant Design Engineer Date

T. A. Millington 1/7/77
Production Engineering Date

Form No. : 16A

Date: _____

Redwood 1/7/77

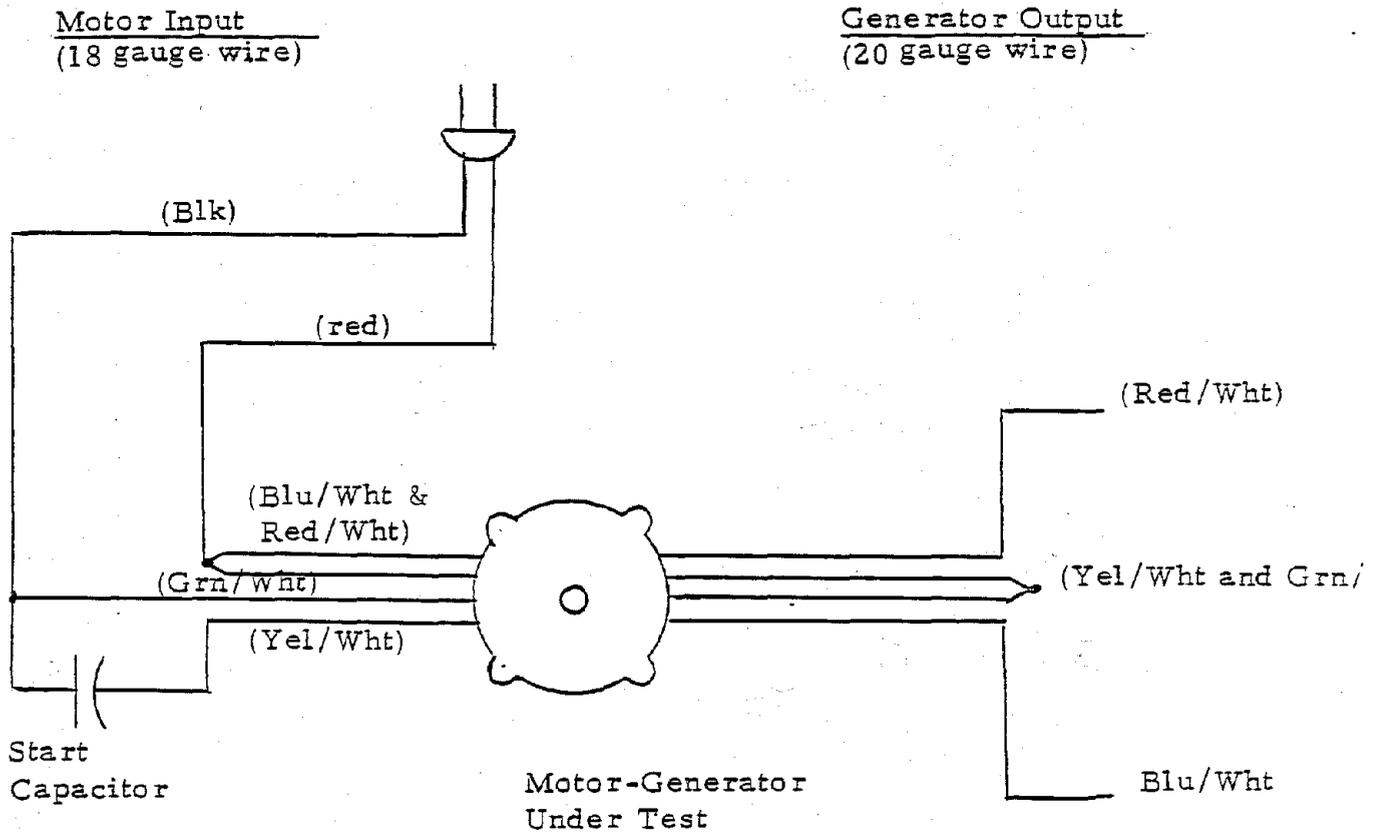
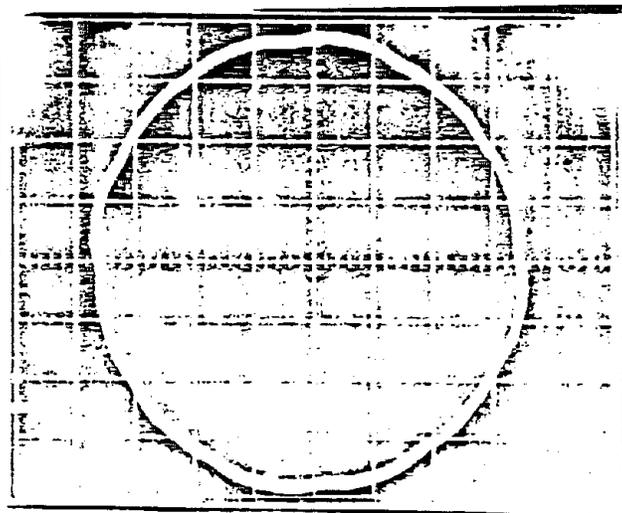


Figure 1.

5. Measure and record on the test results sheet the output rms voltage.
6. Disconnect voltmeter and connect oscilloscope as shown in Figure 2B. Compare the observed pattern to the pattern in the acceptance criteria of this TIP. Patterns should be circular and have no flat sides.
7. Acceptance Criteria:
 - (a) Motor rpm shall be 900 ± 10 rpm.
 - (b) Case temperature shall be less than ($<$) 190° F.
 - (c) The output signal amplitude shall be 12.6 ± 0.7 volts rms.
 - (d) Signal pattern shall be similar to the following:



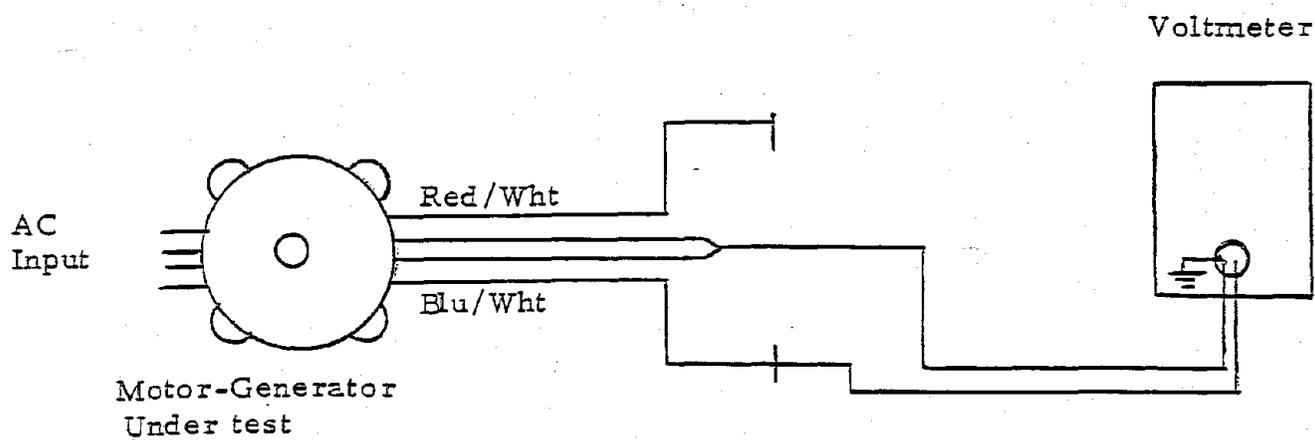


Figure 2-A

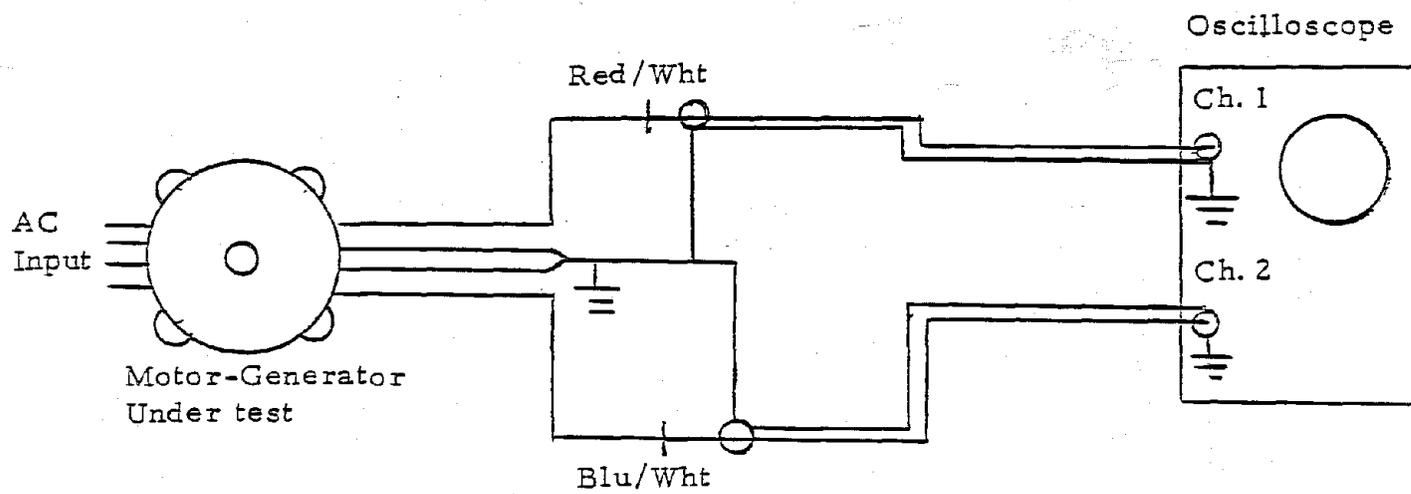


Figure 2-B

Project No.: _____

Date: 10 June 1982

Inspection

Form No.: TIP-216

Revision: F

TEST AND INSPECTION PROCEDURE

Test Title: 115 VAC and DC Checks

Component: Antenna System Test Set

Type: _____ Model: _____ Series: _____

Serial No.: _____

Test Objectives: To ensure proper operation of the unit.

A. Test Equipments (including serial numbers and calibration data)

1. Data Technology Digital Multimeter, Model 30 or equivalent.
2. Test box for TIP-216.
3. Power cable assembly. (MS3106E16-10S on one end and a three wire, three prong grounding plug connector on the other.)

B. Test Procedures: (include: detailed operations, method of inspection, ambient and environmental conditions, criteria for passing or failing)

See Page 2.

T.A. Willington 10 Jun 82
Cognizant Design Engineer Date

T.A. Willington 10 Jun 82
Production Engineering Date

L.E. McDonald 10 Jun 82

Form No.: _____

B. Test Procedures

1. Connect 115 volts, 60 Hz to 113J15 using the power cable assembly. The ground prong on the grounding connector must be wired to contact B on MS3106E16-10S.
2. On the antenna system test set (ASTS), switch the AC POWER switch ON. Observe and record on the test data sheet the response of the AC POWER indicator light on the ASTS.
 - a. Acceptance Criteria: The AC POWER indicator light should be illuminated.
3. On the ASTS, set the MONITOR SELECT (toggle) to TS.
4. On the ASTS, set the MONITOR SELECT (rotary) switch to each of the indicated positions and record the response of the MONITOR meter and voltage at the power supply. Make sure locknuts on adjustment are tight.

<u>Switch Position</u>	<u>Power Supply</u>	<u>Acceptable Meter Reading</u>	<u>Acceptable Voltage</u>
1	ALPS4 (+5VDC)	GREEN	+5 ± .2VDC
2	ALPS3 (-15VDC)	GREEN	-15 ± .4VDC
3	ALPS2 (+15VDC)	GREEN	+15 ± .4VDC
4	ALPS1 (+26VDC)	GREEN	+26 ± 1.5VDC

5. Connect the test box to J13 on the ASTS. Ground J13-8 and J13-9.
6. On the ASTS, set the MONITOR SELECT (rotary) switch to Position 5.
7. On the ASTS, switch the TEST OSC switch to ON and press the TRANSMIT switch. Observe and record on the test data sheet the response of the MONITOR meter.
 - a. Acceptance Criteria: The meter should read in the HI range.
8. On the ASTS, switch the MONITOR SELECT (rotary) switch to position 6. Observe and record on the test data sheet the response of the MONITOR meter and observe the ERROR indicator light.
 - a. Acceptance Criteria: The MONITOR meter should read in the HI range. The ERROR indicator light should be illuminated.

9. Remove grounds from J13-8 and J13-9.
10. On the test box, measure and record on the data sheet the voltage at Pin 29 of J13.
 - a. Acceptance Criteria: The voltage should be $+26 (\pm 1.5)$ VDC.

TEST DATA SHEET
 Test Set 115 VAC and DC Checks
 Unit No. 113 S/N _____

Step No.	Switch Position	Indicator Light	Monitor Meter	Voltage	Accept	Reject
B-2	AC POWER ON		X	X		
B-4	1	X				
	2	X				
	3	X				
	4	X				
B-7	5	X		X		
B-8	6			X		
B-10		Voltage at J13-29				

 Technician

 Date

 Engineering

 Date

 Quality Assurance

 Date

Project No. : _____
Date: December 2, 1981
Inspection Form No. : TIP- 238
Revision: A

TEST AND INSPECTION PROCEDURE

Test Title: Integrated System Test. Units 10, 11, 112 and 113
Component: RF Amplifier (Unit 10), DF Control (Unit 11), Antenna System Test Set (Unit 113), Signal Data Converter (Unit 112)
Type: _____ Model: _____ Series: _____
Serial No. : _____
Test Objectives: To ensure proper operation of the Units 10, 11, 112 and 113.

A. Test Equipments (including serial numbers and calibration data)

1. Test cables, RF and control, CNR*.
2. Control simulator, CNR*. # _____
3. Test Box, CNR*. # _____
4. Power supply, PMC BP10D, 0-10 volts, 4 amperes or equivalent, CNR*.
5. Two each power supply, PMC BP40D, 0-40 volts, 1.5 AMP or equiv. CNR

B. Test Procedures: (include: detailed operations, method of inspection, ambient and environmental conditions, criteria for passing or failing)

(See Page 2)

*CNR - Calibration Not Required.

NOTE: The Signal Data Converter, Unit 112 may not be available when the testing is done.

Carl A. Harris 3/28/83
Cognizant Design Engineer Date

T. A. Miller, Jr. 3/28/83
Production Engineering Date

Form No. : 16A
Date: 24 March 1975

V. E. M. Donald 3/28/83
Quality Assurance Date

B. Test Procedure

- (1) Connect Units 10, 11, 112, and 113 as shown in Figure 1.
- (2) Switch Units 10, 11 and 112 to "REMOTE".
- (3) Switch Unit 113 AC POWER to ON.
- (4) On the antenna system test set (ASTS), set the MONITOR SELECT (toggle) switch to TS, the TEST OSC switch to ON, and press the TRANSMIT switch. Set the Test Cable Box to CONTROL.
- (5) With the MONITOR SELECT (rotary) switch on the ASTS in each of the positions listed, observe the response of the ASTS MONITOR meter, then disconnect the AC power at the source (wall) and again observe the MONITOR meter. The MONITOR meter shall read as indicated. Record the results on the test data sheet.

<u>Monitor Select Position</u>	<u>Function Tested</u>	<u>AC Power On Monitor Meter Response</u>	<u>AC Power Off Monitor Meter Response</u>
1	+5 VDC in 113	Green	0
2	-15 VDC in 113	Green	0
3	+15 VDC in 113	Green	0
4	+26 VDC in 113	Green	0
5	Test Osc	Hi	0

- (6) Set the test cable box to MONITOR.
- (7) Switch +26 dc power supply ON and the control simulator ON.
 - (7a) On the ASTS, switch MONITOR SELECT to SYS.
- (8) With the MONITOR SELECT (rotary) switch in each of the positions listed, observe the response of the MONITOR meter, then switch the indicated unit or power supply OFF and again observe the meter. The MONITOR meter shall read as indicated. Instructions for intermediate steps to set controls and switches are given in the body of the table and must be followed before proceeding with the tests. Record the results on the data sheet.

<u>Monitor Select (Rotary) Position</u>	<u>Function Tested</u>	<u>Power On Monitor Meter Response</u>	<u>Power Off to Unit or Power Supply</u>	<u>Power Off Monitor Meter Response</u>
1	+24 Vdc power on from console	Green	+24 Vdc power supply To simulator	Out of Green
2	+12, +26 Vdc power supply in Unit 10, +5 Vdc power supply in Unit 11	Hi	10	Out of Hi
2			11	Out of Hi
3	+26 Vdc power supply in Unit 10	Green	10	Out of Green
4	+12 Vdc power supply in Unit 10	Green	10	Out of Green
5	+5 Vdc power supply in Unit 11	Green	11	Out of Green
<u>Transmit the frequency 180 using the SwRI SRD-19 control simulator</u>				
6	Bandswitch logic in Unit 11	Hi	10	Out of Hi
7	Attenuator (6 dB) is on in Unit 11	Hi	10	Out of Hi
8	Attenuator (6 dB) is on in Unit 11	Hi	10	Out of Hi
9	Attenuator (12 dB) is off in Unit 11	Lo to 0	n/a	n/a
10	Attenuator (12 dB) is off in Unit 11	Lo to 0	n/a	n/a

<u>Monitor Select (Rotary) Position</u>	<u>Function Tested</u>	<u>Power On Monitor Meter Response</u>	<u>Power Off to Unit or Power Supply</u>	<u>Power Off Monitor Meter Response</u>
---	------------------------	--	--	---

Transmit the frequency 155 using the SwRI SRD-19 control simulator

7	Attenuator (6 dB) is off in Unit 11	Lo to 0	n/a	n/a
8	Attenuator (6 dB) is off in Unit 11	Lo to 0	n/a	n/a
9	Attenuator (12 dB) is on in Unit 11	HI	10	Out of Hi
10	Attenuator (12 dB) is on in Unit 11	HI	10	Out of Hi
11	Test oscillators are off in Unit 10	HI	10	Out of Hi
12	Error check in Unit 11	HI	11	Out of Hi

(9) Switch the test cable box to CONTROL.

(10) With the MONITOR SELECT (rotary) switch in each of the positions listed, observe the response of the MONITOR METER, then switch the indicated unit or power supply OFF and again observe the meter. The MONITOR METER shall read as indicated. Instructions for intermediate steps to set controls and switches are given in the body of the table and must be followed before proceeding with the tests. Record the results on the data sheet.

<u>Monitor Select (Rotary) Position</u>	<u>Function Tested</u>	<u>Power On Monitor Meter Response</u>	<u>Power Off to Unit or Power Supply</u>	<u>Power Off Monitor Meter Response</u>
1	+24 VDC power on from SRD-19 console	Green	+24 VDC power supply to SwRI SRD-19 simulator	Out of Green
2	+12, +26 VDC power supply in Unit 10, +5 VDC power supply in Unit 11	HI	10	Out of Hi

010 452

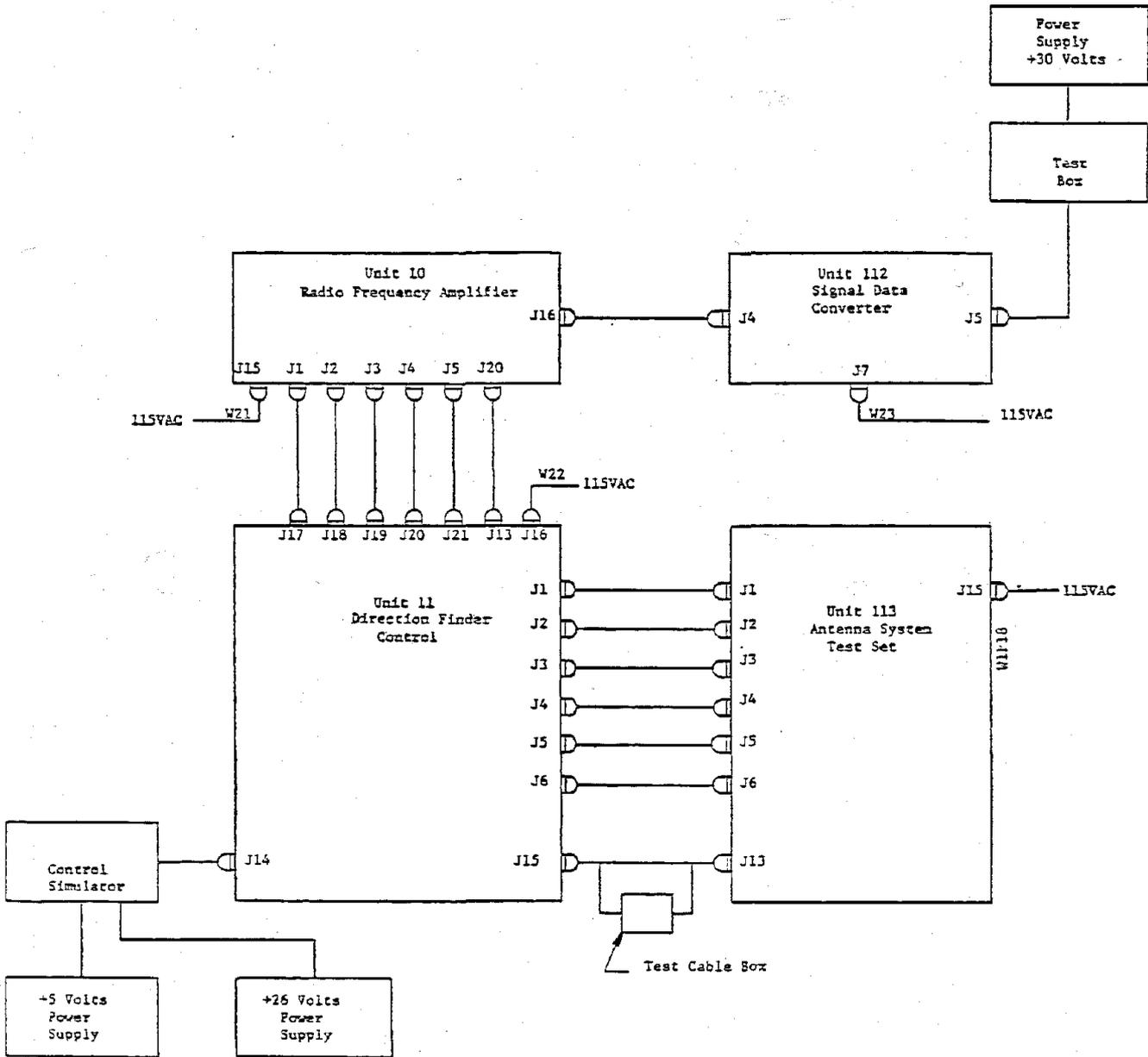


FIGURE 1. ELECTRICAL INTERFACE

<u>Monitor Select (Rotary) Position</u>	<u>Function Tested</u>	<u>Power On Monitor Meter Response</u>	<u>Power Off to Unit or Power Supply</u>	<u>Power Off Monitor Meter Response</u>
3	+26 VDC power supply in Unit 10	Green	10	Out of Green
4	+12 VDC power supply in Unit 10	Green	10	Out of Green
5	+5 VDC power supply in Unit 11	Green	11	Out of Green

Transmit the frequency 180 and TEST OSC off by using the ASTS.

6	Bandswitch logic in Unit 11	Hi	10	Out of Hi
7	Attenuator (6 dB) is on in Unit 11	Hi	10	Out of Hi
8	Attenuator (6 dB) is on in Unit 11	Hi	10	Out of Hi
9	Attenuator (12 dB) is off in Unit 11	Lo to 0	n/a	n/a
10	Attenuator (12 dB) is off in Unit 11	Lo to 0	n/a	n/a

Transmit the frequency 155 by using the ASTS.

7	Attenuator (6 dB) is off in Unit 11	Lo to 0	n/a	n/a
8	Attenuator (6 dB) is off in Unit 11	Lo to 0	n/a	n/a
9	Attenuator (12 dB) is on in Unit 11	Hi	10	Out of Hi
10	Attenuator (12 dB) is on in Unit 11	Hi	10	Out of Hi
11	Test oscillators are off in Unit 10	Hi	10	Out of Hi
12	Error check in Unit 11	Hi	11	Out of Hi

<u>Monitor Select (Rotary) Position</u>	<u>Function Tested</u>	<u>Power On Monitor Meter Response</u>	<u>Power Off to Unit or Power Supply</u>	<u>Power Off Monitor Meter Response</u>
---	------------------------	--	--	---

Transmit the frequency 300 using the ASTS

6	Band Indicate Logic in Unit 11	In Green	10	Out of Green
---	--------------------------------	----------	----	--------------

- (11) Set the following switches and controls on the ASTS as indicated.

FREQ SEL	100
TEST OSC	ON
DISPLAY SELECT (Toggle)	240 MHz
TEST SIGNAL	SYS

- (12) Switch the ASTS oscilloscope ON and after a warm-up of two to three minutes, center the dot on the scope face.
- (13) Press the TRANSMIT switch on the ASTS.
- (14) NOTE: These displays may be off the screen of the oscilloscope. This is permissible to allow for the additional loss in test cables used in field testing and acceptance testing.

Observe and record the response of the signal on the display screen as the DISPLAY SELECT (rotary) switch is set to each of the positions listed below. The S20-C20 and S0-C0 signals should be within or above the limits set on the display screen. The REF should be horizontally oriented and 6 ± 2 divisions in length. The ACQ should be vertically oriented and 6 ± 2 divisions in length.

DISPLAY SELECT Switch Positions

S20-C20
S0-C0
REF
ACQ

- (15) On the ASTS, set the FREQ SEL switch to 090 and the DISPLAY SELECT (toggle) switch to 41 MHz.
- (16) Press the TRANSMIT switch on the ASTS.
- (17) Repeat step 14 for the DISPLAY SELECT positions indicated below.

DISPLAY SELECT

S20-C20
C0-S0
REF

- (18) On the ASTS, switch the AC POWER switch to OFF.
- (19) On the AA-55 simulator, switch the +26 VDC system power to OFF.
- (20) On the BBB-48 simulator, switch the +30 VDC system power to ON.
- (21) Record on the data sheet the response of the REMOTE MOTOR and REMOTE AMPLIFIER lights on the signal data converter and the UHF REMOTE and VHF REMOTE lights on the RF Amplifier.
 - a. Acceptance Criteria: Only the REMOTE MOTOR and REMOTE AMPLIFIER light on the signal data converter should be lit and only the UHF REMOTE light on the RF Amplifier should be lit.
- (22) This completes the TIP. Turn off units 10, 11, and 112 and all test equipment. Turn off unit 13.

TEST DATA SHEET
Integrated Systems Test

RF Amplifier (Unit 10) S/N _____

DF Control (Unit 11) S/N _____

Antenna System Test Set (Unit 113) S/N _____

Signal Data Converter (Unit 112) S/N _____

B-5	Monitor Select Position	AC Power ON Monitor Meter Response	AC Power OFF Monitor Meter Response	Accept	Reject
	_____	_____	_____	_____	_____
	1	_____	_____	_____	_____
	2	_____	_____	_____	_____
	3	_____	_____	_____	_____
	4	_____	_____	_____	_____
	5	_____	_____	_____	_____

B-8	Monitor Select Position	AC Power ON Monitor Meter Response	AC Power OFF Monitor Meter Response	Accept	Reject
	_____	_____	_____	_____	_____
	1	_____	_____	_____	_____
	2	_____	_____	_____	_____
	3	_____	_____	_____	_____
	4	_____	_____	_____	_____
	5	_____	_____	_____	_____
	6	_____	_____	_____	_____
	7	_____	_____	_____	_____
	8	_____	_____	_____	_____
	9	_____	_____	_____	_____

TEST DATA SHEET (Cont'd)

<u>Monitor Select Position</u>	<u>AC Power On Monitor Meter Response</u>	<u>AC Power OFF Monitor Meter Response</u>	<u>Accept</u>	<u>Reject</u>
10	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____
11	_____	_____	_____	_____
12	_____	_____	_____	_____

<u>B-10 Monitor Select Position</u>	<u>AC Power On Monitor Meter Response</u>	<u>AC Power OFF Monitor Meter Response</u>	<u>Accept</u>	<u>Reject</u>
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
4	_____	_____	_____	_____
5	_____	_____	_____	_____
6	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____
11	_____	_____	_____	_____

XYZ CORPORATION

DOCUMENT NO. 40-PC-2

REVISION B

6 APRIL 1981

PROCEDURES FOR FUSION WELDING

PROCEDURES FOR
FUSION WELDING

APPROVALS

Prepared by: W. D. Dodge

Date 21 March 1977

Approved: *W. G. Newley*
Reliability and Quality Assurance

Date *March 29, 1977*

Approved: *W. L. L. L. L. L.*
Vice President

Date *30/3/77*

Document No. : 40-PC-2
 Revision Letter: B
 Release Date: 6 April 1981
 Page No. : i of iv

CHANGE LOG

REVISIONS					
Date	Prepared by	Dept.	Approvals		Revision Letter
			Vice.Pres.	Section	
3/21/77	W. D. Dodge	N/A	<i>[Signature]</i>	<i>[Signature]</i>	A
4/6/81	J. E. McDonald	N/A	<i>[Signature]</i>	<i>[Signature]</i>	B

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1.0 INTRODUCTION

1.1 Purpose

This document provides (1) a detailed procedure for the structural welding of electronic equipment in accordance with MIL-W-8604, and (2) a vehicle for obtaining Government approval of the inert gas shielded tungsten arc (hereafter called fusion) welding procedure as specified by Paragraphs 3.5.1, 4.2.1 and 4.2.1.1 of MIL-W-8604. Related procedures and their affiliated military specifications and standards are: Document 40-PC-1, "Procedures for the Qualification of Welders" (MIL-T-5021), Document 40-PC-4, "Procedures for Radiographic Inspections" (MIL-STD-453), and Document 40-PC-3, "Procedures for Dye Penetrant Inspections" (MIL-I-6866).

1.2 Applicable Requirements

MIL-STD-454, Requirement 13, Structural Welding, specifies MIL-W-8604 (Welding of Aluminum Alloys: Process For) for the fusion welding of aluminum alloys. The paragraph number (and titles where given) of MIL-W-8604, the applicability of each paragraph to the structural welding of electronic equipment, and the appropriate paragraph(s) and title(s) of this document, 40-PC-2 are listed in Table 1.2-1.

TABLE 1.2-1

APPLICABILITY OF THE PARAGRAPHS OF MIL-W-8604

MIL-W-8604 Paragraph	Title	Applicability	40-PC-2 Paragraph	Title
1.	Scope	Applicable	1.0	Introduction
1.1	Scope	Applicable	4.1	Process
2.	Applicable Specifications	Applicable	2.0	Applicable Documents
2.1	--	Applicable	2.0	Applicable Documents
2.2	Specifications	Applicable	1.2	Applicable Requirements
			2.1	Specifications
			2.1.1	Federal
			2.1.2	Military
			2.2	Standards
			2.2.1	Military
			2.3	Other Publications
			2.3.1	SwRI
2.3	--	Applicable	--	--
3.	Requirements	Applicable	4.0	General Requirements
3.1	Welding Operator	Applicable	5.1.2	Qualification of Welders
3.2	Equipment	Applicable	3.1	Equipment
3.2.1	General	Applicable	3.1	Equipment
3.2.1.1	--	Applicable	5.2.6	Government Participation
3.2.2	Furnaces	Not Applicable		
3.2.2.1	Cooling Ovens	Not Applicable		
3.2.3	Ventilation	Applicable	3.1	Equipment
3.3	Materials	Applicable	3.2	Materials
3.3.1	Base Metal	Applicable	3.2 (a)	(6061-T6 Alloy)
3.3.2	Filler Metal	Applicable	3.2 (b)	
3.3.3	Flux	Not Applicable		
3.3.4	Gases	Applicable	3.2 (e)	
3.4	Weld Design	Applicable	4.4.1	Joint Design
3.4.1	General	Applicable	4.4.1	Joint Design
3.4.2	Joint Design	Applicable	4.4.2	Joint Preparation
3.4.3	Accessibility	Applicable	4.4.1	Joint Design

Paragraph	Title	Applicability	Paragraph	Title
3.5	Welding Procedure	Applicable	4.1	Process
3.5.1	Procedure Certification	Applicable	5.1	Welding Procedure Qualification
3.5.2	Preparation of Surfaces	Applicable	4.4.2	Joint Preparation
3.5.3	Welding Flux	Not Applicable	4.4.3	Cleaning
3.5.4	Smoothness and Weld Contour	Applicable	5.2.3.1.3	Acceptance Criteria
3.5.5	--	Not Applicable	5.2.3.1.3	Acceptance Criteria
3.5.6	Preheating	Not Applicable		
3.5.7	Burning or Burn-Through	Applicable		
3.5.8	Cooling	Not Applicable		
3.5.9	Flux Removal	Not Applicable		
3.5.9.1	Acid Dip Method	Not Applicable		
3.5.9.2	Scrubbing Method	Not Applicable		
3.5.9.3	Scrubbing and Anodic Treatment Method	Not Applicable		
3.5.9.3.1	--	Not Applicable		
3.5.9.4	Test for Flux Removal	Not Applicable		
3.5.10	Heat Treatment	Applicable	4.7	Post Weld Treatment
3.5.11	Marking	Applicable	5.2.5	Marking
4.	Sampling, Inspection, and Tests	Applicable	5.1	Quality Assurance
4.1	General	Applicable	5.1.1.4	Facilities
4.2	Sampling	Applicable	5.2.6	Government Participation
4.2.1	Procedure Certification Sampling	Applicable	--	
4.2.1.1	Procedure Data	Applicable	5.1.1	Qualification Joints
4.2.2	Maintenance Sampling for Production	Applicable	5.1.1.2	Procedure Certification Sampling
4.2.2.1	Maintenance Sampling for Production	Applicable	5.1.1.3	Procedure Data
			--	
			5.2.1	Inspections
			5.2.3.3	Radiographic Inspection
4.2.2.2	Maintenance Sampling for Repair	Not Applicable	5.2.6	Government Participation

MIL-W-8604 Paragraph	Title	Applicability	40-PC-2 Paragraph	Title
4.3	Test Methods	Applicable	5.2.1	Inspections
4.3.1	--	Applicable	5.1.1.1	Weld Quality
4.3.2	--	Applicable	5.1.1.1.1	Weld Quality
4.3.3	--	Applicable	5.1.1.1.4	Facilities
5.	Maintenance Quality Control	Applicable	5.2	Production Quality Control
5.1	Radiographic Examination	Applicable	5.2.3.3	Radiographic Inspection
5.2	Other Examination	Applicable	5.2.6	Government Participation
5.3	--	Applicable	5.2.1	Inspections
6.	Notes	Applicable	5.2.6	Government Participation
6.1	--	Applicable	--	--
			--	--

2.0 APPLICABLE DOCUMENTS

The following documents, of the issue in effect on the contract date, form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced here and the other detail contents of Sections 3.0 through 5.0, the requirements of Sections 3.0 and 5.0 shall be considered the superseding requirements.

2.1 Specifications

2.1.1 Federal

QQ-R-566 Rods, Welding, Aluminum and
 Aluminum Alloys

2.1.2 Military

MIL-T-5021 Tests: Aircraft Welding
 Operators Certification

MIL-I-6866 Inspection: Penetrant, Method of

MIL-W-8604 Welding of Aluminum Alloys:
 Process for

MIL-H-6088 Heat Treatment of Aluminum
 Alloys

2.2 Standards

2.2.1 Military

MIL-STD-22 Weld Joint Design

MIL-STD-105 Sampling Procedures and Tables
 for Inspection by Attributes

MIL-STD-453 Inspection, Radiographic

MIL-STD-454 Standard General Requirements
 for Electronic Equipment

2.3 Other Publications

2.3.1 XYZ Corporation

40-PC-1 Procedures for the Qualifica-
 tion of Welders

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40-PC-3

Procedures for Dye Penetrant
Inspections

40-PC-4

Procedures for Radiographic
Inspections

2.3.2 American Society of Mechanical Engineers

Boiler and Pressure Vessel Code -- Section IX

3.0 EQUIPMENT AND MATERIALS

3.1 Equipment

The equipment listed below is acceptable for use in making fusion weldments. Other equipment is acceptable provided it is capable of producing quality weldments that meet the requirements of this procedure.

The welding machine shall be capable of producing alternating current with provisions for superimposed high frequency current. Welding operator control shall be provided by a remote, foot operated contactor and amperage control. Electrode size and gas cup size shall be in accordance with the detailed requirements of the appendix of this specification. Normal room ventilation shall be used to carry off any fumes resulting from the welding operations. The following machines satisfy the above requirements:

- (1) AC-DC Arc Welder, P & H, Model DAR-300
- (2) AC-DC Arc Welder, P & H, Model DAR-500
- (3) AC-DC Arc Welder, Linde, Model HDA-500
- (4) AC-DC Arc Welder, Miller Gold Star 800
- (5) Foot Control for Above Welding Machines
- (6) Torch with Appropriate "Gas Lens" Collet Body and Torch Cup Size
- (7) Any high temperature electric furnace, along with associated temperature indicating and controlling accessories, capable of reaching 1000°F and maintaining the set temperature within $\pm 25^{\circ}\text{F}$ for solution heat treatment and within $\pm 10^{\circ}\text{F}$ for precipitation hardening.
- (8) Thermocouple(s), Chromel - Alumel
- (9) Potentiometer, Leeds and Northrop 8686R MV
Potentiometer S/N 173 2265

3.2 Materials

The materials listed below are acceptable for use in making fusion weldments:

- (1) Aluminum Alloy 6061 and A356, Pipe, Tubing, Plate, and Castings
- (2) Aluminum Filler Wire 1/16" through 1/8" Diameter, AWS Type ER-4043, QQ-R-566
- (3) 1, 1, 1 Trichloroethane (inhibited), or acetone, technical
- (4) Wire Brush, Stainless Steel
- (5) Argon, 99.9% Purity or Better
- (6) Welding Electrode, Pure Tungsten, 1/16" through 1/8" Diameter
- (7) Water, Ordinary Tap Water at Room Temperature

4.0 GENERAL REQUIREMENTS

4.1 Process

This specification covers the Tungsten Inert Gas (TIG) fusion welding process used in the fabrication of electronic structures. Detailed welding procedures and welding parameters are presented in the Appendix of this Document.

4.2 Shielding Gas

Shielding gas shall be high purity (99.9%) dry argon welding grade. Gas flow rates for both the torch and back shielding are specified in the applicable procedure in the appendix.

4.3 Definitions

The following definitions apply to words and terms used herein:

(1) In-Process Rewelding

In-process rewelding consists of removing defects observed by the welding operator. Defects typically removed by in-process rewelding are arc wander, inadvertent arc stoppage, and pin holes.

(2) In-Process Repair Welding

In-process repair welding consists of removing defects discovered during visual, liquid penetrant or radiographic inspection. Defects typically removed by in-process repair rewelding are shallow pits, crater cracks, and inclusions.

(3) Rework

Rework consists of (a) making authorized changes to a completed part or assembly, and (b) removing discrepancies or defects that cannot be corrected by in-process rewelding or in-process repair. Typical rework items are alterations such as repeating fabrication steps and processes to

(a) include an authorized design change, and

(b) correct a nonconformance to drawing requirements.

(4) SwRI

Southwest Research Institute

(5) Weldment

Weldment is an assembly of one or more welded joints

4.4 Preparation of Base Metals

4.4.1 Joint Design

Joints shall be designed in accordance with MIL-STD-22.

4.4.2 Joint Preparation

Joints shall be prepared for welding by machining when necessary. Castings and forgings whose joint designs are cast or forged in accordance with the drawings shall not necessarily require machining but shall be cleaned in accordance with paragraph 4.4.3 prior to welding.

4.4.3 Cleaning

All surfaces of the base metal, all filler wire, and all parts of any jigs or fixtures in contact with the joint area shall be free of foreign material.

The base metal in the joint area shall be wire brushed and cleaned with 1, 1, 1 trichloroethane (inhibited) or acetone prior to tack welding or other welding work.

If the fitting operation requires tack welding, the tacks shall be wire brushed prior to subsequent welding.

4.5 Starting and Stopping of Welds

The welding arc shall be initiated in the joint and the current increased at the welding operator's discretion by means of remote control. To avoid crater cracking, care shall be taken to fill the crater with filler metal prior to arc extinction.

4.6 Fit-Up

Fit-up of the joint shall be such that the resultant weldment will meet applicable drawing requirements.

4.7 Post-Weld Treatments

The joint shall be left in the as-welded condition except that each weldment shall be manually wire brushed prior to visual or liquid penetrant inspection to remove oxides or discoloration.

When required by the drawing, work order or other document, the weldment shall be heat treated in accordance with MIL-H-6088, Heat Treatment of Aluminum Alloys, Tables I, III, V, VI and VII and Paragraph 4.4.2, and Appendix A of this document.

4.8 In-Process Rewelding

In-process rewelding is allowed to permit removal of defects observed by the welding operator, such as arc wander, inadvertent arc stoppage and pin holes.

4.9 In Process Repair Welding

In-process repair welding is allowed to permit removal of defects discovered during visual or liquid penetrant or radiographic inspection, such as shallow pits, crater cracks, and inclusions. The number of in-process repair welds shall be limited to three for any single area. The procedures for making in-process repair welds are:

- (1) Remove the defect by grinding or filing
- (2) Re-inspect the defect area visually and with liquid penetrant
- (3) If all traces of the defect have been removed, repeat the welding procedures used in making the original weldment. If all traces of the defect have not been removed, repeat steps (1) and (2), above.
- (4) Inspect the repair weld visually and with liquid penetrant in accordance with the original requirements.

4.10 Rework

Rework is allowed to permit (1) making authorized changes to a completed part or assembly, and (2) removing discrepancies or defects that cannot be corrected by in-process rewelding or in-process repair. All rework procedures shall be approved by the cognizant quality assurance representative in accordance with the applicable Quality Program Plan before being implemented. The type and extent of inspection will depend on the level of rework but shall include, as a minimum, visual inspection and liquid penetrant inspection. All rework shall be witnessed by the cognizant quality assurance representative.

5.0 QUALITY ASSURANCE

5.1 Welding Procedure Qualification

The procedures for manual fusion welding of electronic equipment parts and assemblies are listed in Appendix A attached. The detailed procedures to be used for each type of welded joint for end item equipment shall be qualified prior to production in accordance with this document.

5.1.1 Qualification Joints

The welding procedures shall be qualified by fitting-up and welding, in accordance with the detailed instructions in this document and its appendices, one or more (depending on size of joint and inspection requirements) full penetration tubular butt joints as specified by subparagraph 4.1.7.1 of Document 40-PC-1. Both the plane of the joint and the axis of the tube shall be inclined at angles of 45° to the vertical. The tube shall be fixed; that is, 6G position in accordance with the Boiler and Pressure Vessel Code--Section IX.

5.1.1.1 Weld Quality

The quality of the specimen weld(s) shall be demonstrated by visual and liquid penetrant inspection (see Paragraph 5.2.1 below), by radiographic inspection (see Paragraph 5.2.3.3 below), and by metallographic sectioning (see Document 40-PC-1); microscopic examination shall be a 100X magnification. Furthermore, the specimen test joint(s) shall be subjected to any other tests and inspections specified by the applicable drawings, work order, or specifications.

Heat treated test joints shall be subjected to tension testing to verify that the strength of the material is substantially the same as that prior to welding (MIL-H-6088, Table VII) and sections from heat treated joints shall be examined for eutectic melting and high-temperature oxidation (MIL-H-6088, Paragraph 4.4.2).

The results of all nondestructive and destructive tests along with the detailed welding procedures from Table A-1 in Appendix A shall be recorded on the data form in Appendix B.

5.1.1.1.1 Nondestructive Tests

The test joint(s) shall be subjected to visual inspection per subparagraph 5.2.3.1 of this document, to liquid penetrant inspection per Document 40-PC-3, and to radiographic inspection per Document 40-PC-4. Acceptance criteria for visual inspection shall be per subparagraph 5.2.3.1.3 of this document. Acceptance criteria for liquid penetrant inspection shall be per subparagraph 5.7.1 of Document 40-PC-3. Acceptance criteria for radiographic inspection shall be per subparagraph 5.2.3.3 of Document 40-PC-1.

5.1.1.1.2 Destructive Tests

Upon successful completion of the nondestructive tests, the test joint(s) shall be heat treated in accordance with Paragraph 5.2.7 and Table A-1 of Appendix A. Test joints two or more inches in diameter shall be sectioned to provide two tensile test specimens (approximately 180° apart) and one random metallographic specimen. For test joints less than two inches in diameter, one test joint shall be sectioned for metallographic examination and the other joint shall be subjected to tensile testing in full cross section.

5.1.1.2 Procedure Certification Sampling

Should the Government representative so require, he shall select the weld samples for procedure certification in accordance with MIL-W-8604, Paragraph 4.2.1.

5.1.1.3 Procedure Data

The following data, as applicable, shall be furnished for approval of welding procedures:

- Manufacturer, type and serial number of welding machine
- Brand of electrode or rod
- Nominal chemical analysis of electrode or rod
- Type, purity, and rate of flow of shielding gas
- Filler wire or rod size and alloy
- Welder's name and identification symbol
- Complete drawings of the application
- Date welded
- Results of all inspections and tests

5.1.1.4 Facilities

All visual, liquid penetrant, metallurgical, and radiographic inspection shall be made within the facilities of XYZ Corporation. Furthermore, these facilities shall be made available to the Government representative when required for determining conformance of the welding procedures with the requirements of MIL-W-8604.

5.1.2 Qualification of Welders

No welder shall be allowed to perform end item welding until he has demonstrated proficiency in welding. Qualification shall be accomplished in accordance with Document 40-PC-1.

5.2 Production Quality Control

5.2.1 Inspections

All welded assemblies shall be subjected to 100% visual inspection and 100% liquid penetrant inspection. Radiographic and other inspections shall be performed as specified below.

5.2.2 Pre-Weld Inspection

The following inspections shall be made by or under the supervision of the cognizant quality assurance representative prior to welding or welding rework:

- (1) Visually inspect the parts for freedom from dirt, grease, or other contamination and removal of burrs.
- (2) Visually inspect the assembly (fit-up) for proper preparation and fit.

5.2.3 Post-Weld Inspection

Visual inspection shall be performed on all new weldments, all weldments which have been rewelded or in-process repair welded, and all reworked weldments. Liquid penetrant inspection shall be performed on all continuous structural welds.

5.2.3.1 Visual Inspection

5.2.3.1.1 Procedure

The weldment shall be manually wire brushed prior to visual inspection. Further cleaning shall be employed as necessary to remove oxides, dirt, or discolorations from the surface of the weldment.

5.2.3.1.2 Personnel

Personnel performing visual inspections shall have a minimum of one year's experience in visual inspection of weldments. The welding operator shall not perform the final visual inspection.

5.2.3.1.3 Acceptance Criteria

The following criterial shall be used for visual inspection:

(1) Where practicable, all weld joints shall blend into the adjacent metal in gradual, smooth curves.

(2) Beads shall be smooth and shall be free of slag, undercut, or excessive spatter.

(3) Sufficient metal shall be added to provide a suitable fillet unless otherwise specified.

(4) Welds shall be free from excessive root convexity protruding through the inside diameter. Should excessive convexity exist, it may be removed by machining or grinding provided minimum wall thickness is maintained.

5.2.3.2 Liquid Penetrant Inspection

Liquid penetrant inspection shall be performed in accordance with Document 40-PC-3.

5.2.3.3 Radiographic Inspection

Unless otherwise stated on the applicable drawings, work order, or specification, samples for radiographic inspection shall be selected according to General Inspection Level II of Table I of MIL-STD-105. The "lot" or "batch" shall be the total number of welded joints produced during one continuing production run. The joints to be radiographed shall be selected at random from all welded assemblies of the same general type. Inspection shall be normal, tightened, or reduced per Tables II-A, II-B, or II-C respectively of MIL-STD-105. The acceptable quality level (AQL) shall be 1.0%. Radiographic inspection shall be performed on the designated joints per Document 40-PC-4.

5.2.4 Welding Inspection Checklist

After each subassembly has been completed and cleaned in accordance with Paragraph 4.7, the welder shall initiate the Welding Inspection Checklist shown in Figure 5.2.4-1. He shall enter the applicable drawing number, the date of welding, and his name. This checklist shall be attached to the welded part or assembly which shall then be delivered to the designated quality inspector who will perform a visual inspection. After visual inspection, the part or assembly shall be dimensionally inspection, liquid penetrant inspected and radiographically inspection as applicable. Each inspector shall mark acceptance or rejection status on the Welding Inspection Checklist immediately after each inspection. Following successful completion of all inspections, the Welding Inspection Checklist shall be stamped and dated by a representative of quality assurance and then filed with the quality records.

5.2.4.1 Rejected Assemblies

Welded assemblies which fail inspection shall be "red-tagged" and segregated (see Reject Tag in applicable Quality Program Plan).

5.2.5 Marking

Each welded assembly shall be identified by recording the applicable part number, serial number, date welded, and welder's name. These records shall be maintained in the quality assurance files and shall be available to the Government representative.

5.2.6 Government Participation

Should the Government representative so require, he shall participate in the inspection process to the extent specified by MIL-W-8604, Paragraphs 3.2.1.1, 4.1, 4.2.2.1, 5.1 and 5.3.

5.2.7 Heat Treatment

The representative of quality assurance shall verify the time and temperature of the solution heat treatment and precipitation hardening and assure that sufficient water is available for quenching and that the charge is totally submerged within the allotted time (see Table A-1 of this document). The representative shall verify that the thermocouple(s) and potentiometer are in calibration.

WELDING INSPECTION
CHECKLIST

Drawing Number _____

Date Welded _____

By _____

Visual Inspection

Accept Reject N/A

Dimensional Inspection

Accept Reject N/A

Penetrant Inspection

Accept Reject N/A

Radiographic Inspection

Accept Reject N/A

Final Acceptance _____ Stamp

Date _____

FIGURE 5.2.4-1 - WELDING INSPECTION CHECKLIST

TABLE A-1

WELDING PARAMETERS FOR MANUAL WELDING OF
6061 and A356 ALUMINUM ALLOYS

PROCEDURE WP-DFA-1

Welding Amperage	Variable to 170 ampres
Welding Voltage	N/A
Current	Alternating Current (high frequency current superimposed)
Electrode	1/16 inch through 1/8 inch diameter Pure tungsten
Electrode Geometry	60° included angle with 2/3 diameter blunt tip
Electrode Extension	Variable to 1/2 inch
Shielding Gas	Torch: 20-30 cfh Argon Backing: 5 cfh to 10 cfh Argon
Gas Cup	3/8 inch to 5/8 inch diameter (Gas lens shall be used)
Preheat	400 - 600°F for "t" greater than 1/4 inch
Filler Wire	Manual feed, 1/16 inch through 1/8 inch diameter, Type ER 4043, Federal Specification No. QQ-R-566
Solution Heat Treatment	985° \pm 25°F for a minimum of 30 minutes after the monitoring instruments indicate the entire charge has reached temperature
Quench	Within 10 seconds from the time the furnace door is opened, the entire charge shall be submerged in sufficient water initially at room temperature to cover the charge when boiling ceases
Precipitation Hardening	350°F \pm 10°F for 8 hours

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APPENDIX B
RECORD OF
WELDING PROCEDURE QUALIFICATION

RECORD OF WELDING PROCEDURE QUALIFICATION
MANUAL TIG WELDING OF 6061 AND A356 ALUMINUM ALLOYS

Description of Test Joint _____

Welding Parameters: Machine _____
Welding Amperage _____
Welding Voltage _____
Current _____
Electrode _____
Electrode Geometry _____
Electrode Extension _____
Shielding Gas: Torch _____
Backing _____
Gas Cup _____
Filler Wire _____
Welder's Name _____ Date _____

Results of Nondestructive Tests

Visual Inspection per
40-PC-2, 5.2.3.1.3 _____

Penetrant Inspection
per 40-PC-3, 5.7.1 _____

Radiographic Inspec-
tion per 40-PC-1,
5.2.3.3 _____

Results of Destructive Tests

Metallographic Sec-
tioning per 40-PC-1,
5.2.4.3 _____

Tensile Testing:
Machine Used _____
Location _____

Results: _____

Dodge

XYZ CORPORATION

DOCUMENT NO. 40-PC-3

REVISION B

23 MARCH 1977

PROCEDURES FOR
DYE PENETRANT INSPECTIONS

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PROCEDURES FOR
DYE PENETRANT INSPECTIONS

APPROVALS

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Date 23 March 1977

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Quality Assurance and Reliability Engineering

Date March 29, 1977

Approved: *F. J. [Signature]*
Vice President

Date 29 March 77

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CHANGE LOG

REVISIONS				
Date	Prepared by	Approvals		Revision Letter
		Section	Vice President	
31 Mar 1975	W. D. Dodge	<i>John B. Parr</i>	<i>A. J. Petter</i>	A
3/23/77	W. D. Dodge	<i>W. C. [unclear]</i>	<i>W. H. [unclear]</i>	B

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1.0 INTRODUCTION

1.1 Scope

This document delineates the liquid penetrant inspection process to be used for inspecting flaws which are open to the surface in fabricated parts and assemblies. It also provides a means for demonstrating compliance with MIL-I-6866. The paragraph numbers, the titles, when given, and the applicability of MIL-I-6866 are correlated with the paragraphs of this procedure in Table 1.1-1

TABLE 1.1-1

CORRELATION OF MIL-I-6866 AND 40-PC-3

MIL-I-6866 Paragraph	Title	Applicability	40-PC-3 Paragraph	Title
1.	Scope	Applicable	1.0	Introduction
1.1	Scope	Applicable	1.1	Scope
1.2	Classification	Applicable*	4.1	Classification
2.	Applicable Documents	Applicable*	2.0	Applicable Documents
2.1		Applicable*	2.1	Specifications
			2.1.1	Military
			2.2	Standards
			2.2.1	Military
			2.3	Other Documents
			2.3.1	SwRI
2.2	Other Publications	Not Applicable		
3.	Materials	Applicable*	3.0	Equipment and Materials
3.1	Materials	Applicable	3.0	Equipment and Materials
3.1.1	Manufacturer's Data	Not Applicable		
3.1.2	In-Service Quality	Not Applicable		
3.2	Compatibility With Liquid Oxygen	Not Applicable		
4.	Equipment	Applicable*	3.0	Equipment and Materials
4.1	General	Applicable*	5.6	Application of Wet Developer (5) only
4.1.1	Fluorescent Penetrant	Not Applicable		
4.1.2	Visible Penetrant	Applicable*	3.0	Equipment and Materials
5.	Process	Applicable	5.0	Procedures
5.1	Types and Methods	Applicable	5.1	General
5.1.1	Type I, Method A	Not Applicable		
5.1.2	Type I, Method B	Not Applicable		
5.1.3	Type I, Method C	Not Applicable		
5.1.4	Type II, Method A	Applicable	4.1	Classification
5.1.5	Type II, Method B	Not Applicable		
5.1.6	Type II, Method C	Applicable	4.1	Classification
5.2	Precleaning	Applicable	5.1	General
			5.2.1	Pre-Inspection Cleaning
			7.2	Pre-Examination Cleaning

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App. A

Paragraph	Title	Applicability	Paragraph	Title
5.3	Application	Applicable	5.2.3	Application of Penetrant
5.4	Removal	Applicable	5.2.4	Removal of Excess Penetrant
5.4.1	Method A	Applicable	5.2.4	Removal of Excess Penetrant
5.4.2	Method B	Not Applicable		
5.4.2.1		Not Applicable		
5.4.3	Method C	Not Applicable		
5.5	Rinsing	Applicable	5.2.4	Removal of Excess Penetrant
5.6	Developing	Applicable	7.1	Equipment and Materials Control
5.6.1	Aqueous Wet Developer	Not Applicable		
5.6.2	Nonaqueous Wet Developer	Applicable	7.1	Equipment and Materials Control
5.6.3	Dry Developer	Not Applicable		
5.7	Drying	Applicable	5.2.5	Application of Wet Developer
5.7.1		Applicable	5.2.5	Application of Wet Developer
5.8	Inspection	Applicable*	4.3	Personnel
6.	Identification	Applicable	5.2.6	Evaluation of Penetrant Indications
6.1	Marking	Applicable	5.2.6	Evaluation of Penetrant Indications
6.1.1	Etching	Not Applicable		
6.1.2	Stamping	Not Applicable		
6.1.3	Dyeing	Not Applicable		
6.1.4	Other Identification	Applicable	5.2.6	Evaluation of Penetrant Indications
6.1.4.1		Not Applicable		
6.1.5	Symbols for Inspected Parts - 100 Percent Inspection	Not Applicable		
6.1.6	Symbols for Inspected Parts - Sampling Method	Not Applicable		
7.	Notes	Not Applicable		
7.1	Intended Use	Applicable	1.1	Scope
7.1.1	Plastic Materials and Parts	Not Applicable		
7.2	Definitions	Applicable	--	--
7.2.1	Black Light	Not Applicable		
7.2.2	Fluorescence	Not Applicable		
7.2.3	Developers	Applicable	7.1	Equipment and Materials Control

MIL-I-6866
Paragraph

40-PC-3
Paragraph

MIL-I-6866 Paragraph	Title	Applicability	40-PC-3 Paragraph	Title
7.2.4	Emulsifier	Not Applicable		
7.2.5	Water Washable	Applicable		
7.2.6	Post Emulsifiable	Not Applicable		
7.2.7	Penetrant Remover	Not Applicable		
7.2.8	Penetrant Sensitivity	Applicable		
7.3	Cross-Reference Data	Applicable		
			5.5	Removal of Excess Penetrant

* Applicable only to extent stated herein.

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2.0 APPLICABLE DOCUMENTS

The following documents, of the issue in effect on the contract date, form a part of this document to the extent specified herein. In the event of conflict between the referenced documents and the detail requirements of Sections 1.0 and 3.0 through 7.0 of this document, the latter shall govern.

2.1 Specifications

2.1.1 Military

MIL-I-6866 Inspection, Penetrant Method Of

MIL-I-25135 Inspection Materials, Penetrant

2.2 Standards

2.2.1 Military

MIL-STD-410 Qualification of Inspection Personnel
(Magnetic Particle and Penetrant)

2.3 Other Documents

2.3.1 XYZ Corporation

40-FC-2 Procedures for Fusion Welding

SwRI-NDT-200-1 Liquid Penetrant Examination,
Color Contrast Method

3.0 EQUIPMENT AND MATERIALS

The following equipment and materials, or their equivalents, are approved for use with the liquid penetrant system described by paragraph 1.1. If equivalent developers and penetrants are used, they must conform to MIL-I-25135.

- (1) Tracer Tech Cleaner No. K-410A
- (2) Tracer Tech Water Washable Liquid Penetrant No. P-303A
- (3) Tracer Tech Developer No. D-495A
- (4) Heat Gun, Dayton, Model No. 2Z045A
- (5) Magnifying Glass - 10X
- (6) Precleaner, Spotcheck, Type SKC-S
- (7) Penetrant, Spotcheck, Type SKL-S
- (8) Penetrant Remover, Spotcheck, Type SKC-S
- (9) Developer, Spotcheck, Type SKD-S

4.0 REQUIREMENTS

4.1 Classification

The penetrant inspection method and materials used during production shall be Type II, Method A, visible dye - water washable or Type II, Method C, visible dye - solvent removable per MIL-I-6866.

4.2 Penetrant Material

Aerosol packaged penetrant shall be used to circumvent the possibility of penetrant contamination.

4.3 Personnel

All inspections by the liquid penetrant method will be performed by members or representatives of the quality assurance organization. Inspectors shall have a minimum of two years experience in liquid penetrant inspection and shall meet the requirements of MIL-STD-410 except that the written examination may also be based on ASNT, Level II or III, or NASA liquid penetrant testing standards and the following vision requirements:

- (1) Distant vision shall equal 20/30 in at least one eye, either uncorrected or corrected.
- (2) Near vision shall be equal to normal vision, as prescribed by the optical profession, in at least one eye, either corrected or uncorrected.
- (3) Personnel shall be capable of distinguishing and differentiating between colors used in the process involved.

5.0 PROCEDURES

5.1 General

Penetrant inspection shall be performed prior to applications of plating, anodizing, painting, buffing, power wire brushing, grinding or any similar treatment which tends to close defects or retain penetrant material. Manual wire brushing with a stainless steel brush shall be allowed to remove welding residuals. Penetrant inspection shall be performed after machining, cold forming, heat treatment or any processing operation which may in any way adversely affect the quality of the material or part. The drawing for the piece part shall specify the area to be inspected per this document.

5.2 Water Washable Penetrant Procedures

5.2.1 Pre-Inspection Cleaning

Spray areas to be inspected with Tracer Tech Cleaner No. K-410A or equivalent, and wipe or brush as necessary until free of foreign materials.

5.2.2 Pre-Inspection Drying

Allow to dry completely. A heat gun may be used to facilitate drying but the part should not be above 100°F when the penetrant is applied.

5.2.3 Application of Penetrant

- (1) Apply (either spray or brush) penetrant Tracer Tech No. P-303A or equivalent to weld areas.
- (2) Set aside for a 10 minute dwell period in accordance with manufacturer's recommendations.

5.2.4 Removal of Excess Penetrant

- (1) Remove excess penetrant by washing in a spray or stream of water. (Note: Avoid excessive rinsing that would remove penetrant from wide or shallow defects.)
- (2) Visually inspect under white light to ensure that excess penetrant has been removed.

- (3) Allow to dry completely. A warm air heat gun or stream of air may be used to facilitate drying, but in no case shall the part be heated above 100°F.

5.2.5 Application of Wet Developer

- (1) Shake can of developer to provide a uniform suspension of developer solids in the solution.
- (2) Spray developer in a light even coat over weld areas. Parts to be sprayed with developer shall be free of moisture, droplets, or puddles.
- (3) After 2 minutes, the initial evaluation of the part should be made.
- (4) Set aside and allow to develop for at least 15 minutes prior to performing the final evaluation.
- (5) Adequate ventilation must be provided when using the developer.

5.2.6 Evaluation of Penetrant Indications

- (1) Visually inspect under adequate white light using magnifying glass if needed.
- (2) Record the test results on the welding inspection checklist (see 40-PC-2) and on the Inspection and Test Results Form (see Figure 5.2.6-1) for each completed weldment.

5.3 Solvent Removable Penetrant Procedures

Procedures for the use of visible dye-solvent removable penetrants shall be as specified in Paragraphs 1.0 through 7.8.2 of SwRI-NDT-200-1 (attached as Appendix A).

5.4 Acceptance Criteria

The following are criteria for acceptable welds:

- (1) Welds shall be free of cracks, overlap and lack of fusion. Any cracking shall be brought to the attention of the quality assurance representative.

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DRAWING/PART NO.: _____
PART NAME: _____

DATE: _____
PAGE NO.: _____

INSPECTION AND TEST RESULTS--PROJECT _____

Serial No.: _____
Traceability No.: _____

Lot No.: _____
Ref. Code: _____

INSPECTION OR TEST PERFORMED

- | | |
|--|--|
| <input type="checkbox"/> Visual | <input type="checkbox"/> Foam Density |
| <input type="checkbox"/> Dimensional | <input type="checkbox"/> Alloy Check |
| <input type="checkbox"/> Dye Penetrant | <input type="checkbox"/> In-Process Inspection |
| <input type="checkbox"/> Ultrasonic | <input type="checkbox"/> Final Inspection |
| <input type="checkbox"/> Radiography | <input type="checkbox"/> Other |
| <input type="checkbox"/> TIP No. _____ | Para. No. _____ |
| <input type="checkbox"/> PC No. _____ | Para. No. _____ |

RESULTS: (Attach Data Sheets as Necessary)

Number of Articles Inspected or Tested: _____ of _____
Number of Conforming Articles: _____
Number of Rejected Articles: _____

OBSERVED DEFECTS: _____

REMARKS: _____

INSPECTED/VERIFIED BY: _____

QA APPROVAL: _____ DATE: _____

FIGURE 5.2.6-1. INSPECTION AND TEST RESULTS FORM

FORM NO.: 82
REVISION: _____
DATE: 1 Aug 1975

Document No. : 40-PC-3
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(2) Porosity shall not exceed the following:

- (a) Single pore. The maximum extent of single cavities shall not exceed $1/3$ of the thickness of the thinner material of the joint or .060, whichever is the lesser. Interconnected porosity shall be considered as a single cavity.
- (b) Scattered porosity. The sum of the areas of all the cavities contained in any one-inch length of weld must not exceed 5 percent of the surface area of a one-inch length of weld.
- (c) Linear porosity. The maximum extent of three or more adjacent porosity cavities in alignment shall not exceed $1/3$ the parent material thickness or .060 inch (whichever is less) and the width shall not exceed 10 percent of parent material thickness at any point.

6.0 DISPOSITION OF PARTS

6.1 Disposition

Disposition of parts shall be based on the quality and engineering requirements of the applicable specifications, drawings and Quality Program Plan.

6.2 Nonconforming Parts

Disposition of nonconforming parts shall be in accordance with the applicable Quality Program Plan.

6.3 Reworked Parts

Parts requiring rework shall be subject to nonconformance action as applicable per the pertinent Quality Program Plan. If the parts are reworked, they shall be reinspected in accordance with Section 5.0 of this document and the results recorded on the welding inspection checklist (40-PC-2) and on the Inspection and Test Results Form, Figure 5.2.6-1 (revision in effect at the time of inspection).

7.0 QUALITY ASSURANCE

7.1 Equipment and Materials Control

Penetrant inspection materials shall be of the type which are supplied in aerosol spray cans. The cans of penetrant inspection material shall be examined prior to use for evidence of deterioration or spoilage.

7.2 Testing Control

The developer on the parts should not be allowed to develop for more than 4 hours.

7.3 Inspection Records

Inspection results shall be recorded on the welding inspection checklist (40-PC-2) and on the Inspection and Test Results Form (Figure 5.2.6-1) for each welded assembly. These records shall be maintained as a part of the permanent quality assurance project file of test and inspection results.

7.4 Personnel

All inspections shall be performed by members or representatives of the quality assurance organization in accordance with Paragraph 4.3.

XYZ CORPORATION

DOCUMENT NO. 4010-PC-1

REVISION C

15 March 1982

PROCEDURES FOR
APPLYING ADHESIVES AND SEALANTS

PROCEDURES FOR
APPLYING ADHESIVES AND SEALANTS

APPROVALS

Prepared by: W. D. Dodge

Date: 31 March 1975

Approved: *Sam B. Parr*
Quality Assurance and Reliability
Engineering

Date: 2 April 1975

Approved: *Wm C. Allen*
Project Manager

Date: 17 April 1975

Approved: *Donald N. King*
Vice President
Electromagnetics Division

Date: 17 April 1975

XYZ CORPORATION

CHANGE LOG

The original document and all revised and change documents are identified in the following log.

Original Document Release Date: 31 March 1975

REVISIONS					
Date	Prepared by	Approvals			Revision Letter
		Quality Assurance and Reliability Engineering	Project Manager	Vice President	
3/16/77	J. E. McDonald	<i>William A. Hoadley</i>	<i>7C New</i>	<i>Doug Traves</i>	A
5/15/80	D. M. Berry	<i>LS Albert</i>	<i>7C New</i>	<i>Doug Traves</i>	B
3/15/82	J. E. McDonald	<i>J. E. McDonald 3/27/82</i>	<i>7C New</i>	<i>Doug Traves</i>	C

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1.0 INTRODUCTION

This document specifies the procedures to be followed for mixing, applying, and curing adhesives and sealants for various parts of antennas manufactured at XYZ Corporation.

2.0 APPLICABLE DOCUMENTS

The following documents of the issue in effect at the time of implementation of these procedures form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced here and other detail content of Sections 1.0 and 3.0 through 6.0 to follow, the latter shall govern.

2.1 Specifications2.1.1 Military

MIL-C-5541

Chemical Conversion Coatings
on Aluminum and Aluminum
Alloys

MIL-A-9067

Adhesive Bonding. Process
and Inspection Requirements
for

MIL-E-16400

Electronic, Interior Communication
and Navigation Equipment, Naval
Ship and Shore: General Specification
for

2.2 Standards2.2.1 Military

MIL-STD-454

Standard General Requirements
for Electronic Equipment

2.3 Drawings

2.3.1 XYZ Corporation

As applicable Antenna Element, Loop

As applicable Antenna Element, Adcock

As applicable Antenna Assembly

As applicable Electronics Assembly

2.4 Other Documents

2.4.1 XYZ Corporation

4010-PC-4 Procedures for Urethane Foam-In-Place Encapsulation

4010-PC-5 Procedures for Making the Adcock Resistor Connection

3.0 EQUIPMENT AND MATERIALS

The following equipment and materials, or equivalent, are approved for use at XYZ Corporation for applying adhesive and sealant on antenna components.

- (1) Epoxy adhesive, Tra-Bond J 1170/E18 (USAF Spec. 65 A 5683), Tra-Con, Inc., Resin Systems Div., 55 N. Street, Medford, Mass 02155
- (2) Aluminum filled epoxy, liquid, Devcon F-2, and F-3, Devcon Corp., Danvers, Mass.
- (3) Solvent, Alcohol and other degreasing types as required*
- (4) Disposable containers for mixing
- (5) Stirring rods and spatulas
- (6) Balance, accurate to 0.1 gram
- (7) Disposable wiping tissues
- (8) Brush, artist type approximate #7 to #0 size as required
- (9) Sealant, two-part polysulfide PR-380M, per LAC C-40-768, Products Research and Chemical Copr., 410-416 Jersey Avenue, Gloucester City, New Jersey 08030
- (10) Insulation tubing, size No. 22, SLV-105 or similar

* CAUTION -- Extreme care must be used when degreasing areas where the polyurethane foam is exposed. No solvent should come in direct contact with the foam. Alcohol should be the only solvent used in these areas.

4.0 REQUIREMENTS

4.1 General Requirements

MIL-E-16400, Paragraph 3.5.15 Adhesives, invokes Requirement 23 Adhesives of MIL-STD-454. Requirement 23 of MIL-STD-454 cites MIL-A-9067 Adhesive Bonding, Process and Inspection Requirements for. The procedures specified herein have been developed using the requirements of MIL-A-9067 as a guide.

4.2 Detailed Requirements

The procedures specified herein are intended to produce seals and joints meeting the following requirements:

4.2.1 Process Specification

The requirements and procedures herein specified constitute contractors process specification for the production of the adhesive bonded seals and joints.

4.2.2 Adhesive Material

The adhesive/sealant materials shall be as specified in Section 3.0 of this document.

4.2.3 Production Area

The bonding process described herein shall take place in a relatively dust free area. It is desirable to maintain temperature of 65° to 80° F and relative humidity of 40 to 65 percent where possible.

4.2.4 Pre-Fitting

The parts to be bonded shall be pre-fitted to ensure proper mating of all surfaces.

4.2.5 Surface Treatment

The parts to be bonded or sealed shall be cleaned in the solvent specified in Section 3.0 of this document. Aluminum parts may be treated with chemical film forming solutions in accordance with MIL-C-5541. Parts to be bonded shall be cleaned thoroughly adjacent to the bonding joint and shall be protected against contamination during handling.

4.2.6 Application of Adhesive/Sealant

The adhesive/sealant shall be mixed, applied, and cured in accordance with the manufacturer's directions.

4.2.7 Inspections

All joints and seals shall be inspected visually for completeness of bond or seal and for cure. When adhesives are used for structural bonding, a representative sample of each type of structural joint shall be subjected to destructive tests such as strength tests and sectioning.

5.0 PROCEDURES

The following general and detailed procedures are to be followed for sealing and/or bonding various antenna components at XYZ Corporation.

5.1 General Description

Various parts must be bonded with adhesive or sealed; for example, certain antenna assemblies have access holes to permit the physical placement of parts within the assembly and to provide access for foam encapsulation of the completed piece. The access holes are then permanently sealed with appropriate cover plates. To ensure an adequate environmental seal at these interfaces, various epoxy sealants may be used. All cover plates, in addition, are secured to the piecework by screws sealed in place with epoxy.

5.2 General Procedure

5.2.1 Readiness

All prior operations on parts must be completed before applying adhesive/sealant. Such operations include: machining, foam filling, soldered connections and surface treatments.

5.2.2 Prefitting of Parts

Examine the mating parts for burrs or other surface imperfections. Assemble the parts to verify proper fitting (where appropriate, sliding parts and tightening threaded items lightly to assure that all pieces go together smoothly without binding.) Position parts to meet parallelism and angle tolerances of the appropriate drawing, marking adjoining surfaces if required to simplify final assembly. Disassemble using a procedure that will not damage any parts.

5.2.3 Cleaning

The surfaces to be coated with adhesive and/or sealant must be carefully cleaned to remove all foreign material possible from the mating surfaces. Parts should be degreased where possible. During degreasing of foamed parts appropriate caution must be taken as noted in Section 3.0.

5.2.4 Jigging

Suitable fixtures should be used to ensure that the adhesive and/or sealant flows and fills appropriate sites, that the parts can be properly mated during the operation, and that the parts remain in firm contact during curing.

5.2.5 Expiration Date

Check the adhesive or sealant container to ensure that the materials are within shelf life expiration date.

5.2.6 Adhesive/Sealant Mixing

Mix sufficient adhesive or sealant to complete the number of parts to be bonded or sealed at one time. When using Tra-Bond J1170 adhesive, rupture the membrane separating the two compounds and mix thoroughly by kneading as indicated on the package.

In general, mix epoxy constituents (such as Devcon F-2 or F-3 resin and hardener) in a fresh, clean container. Mix thoroughly with clean spatula or other suitable stirring tool. Where required, place the cup of freshly mixed epoxy in a vacuum chamber; carefully evacuate two or three times to remove entrained air.

5.2.7 Application and Assembly

Application of adhesives and sealants must be performed with care to ensure proper contact of the material with all surfaces to be coated.

5.2.8 Curing

After applying adhesive or sealant allow the material to set undisturbed for the appropriate curing time. Cure Tra-Bond adhesive, with parts in the jigging fixture as required for 4 hours minimum at 150°F followed by 4 hours at room temperature. Devcon F-2 and F-3 require minimum curing times of 4 and 8 hours respectively at room temperature or until hard.

5.3 Specific Procedures

5.3.1 Adcock Vertical Tube Seal

Sealing open ends of the Adcock vertical tubes as used on drawings requires the following procedures:

- (1) Ascertain that the interior has been expandable foam filled per 4010-PC-4 and that the resistor has been soldered to the necked down terminal per 4010-PC-5.
- (2) About 2 grams of Devcon F-2 epoxy and 1/4 grams of hardener are required per tube. Use general mixing requirements per Subsection 5.2.6.
- (3) Apply a thin seal coat (barrier layer) of epoxy over foam surface. Allow to dry at least until tacky.
- (4) Add epoxy forming a plug in the open end of Adcock tube (See Figure 5.3.1-1). Allow to cure from 6 to 8 hours, or until sufficiently hard to allow trimming of excess epoxy.
- (5) Trim away epoxy around Adcock tube lip. File and/or sand epoxy surface forming final plug configuration. If voids should appear in plug outer surface, recondition surface with a thin coat of F-3 epoxy using a brush. Resurface plug with sandpaper until shiny surface is removed.
NOTE: Voids are normally caused by air entrapment; small (pin hole) voids are acceptable.

5.3.2 Insulator-Tube-Coupling Joint

After the end seal of the Adcock vertical tube(s) has cured, the tube can be attached to an Adcock boom.

- (1) In prefitting, insert the funnel-shaped insulator into the socket in the boom; insert the resistor through the insulator and seat the end of the Adcock tube in the socket; slide the threaded fiberglass coupling over the tube and tighten lightly. Protect resistor lead and coaxial center conductor from sealant with insulating tubing specified in Section 3.0.

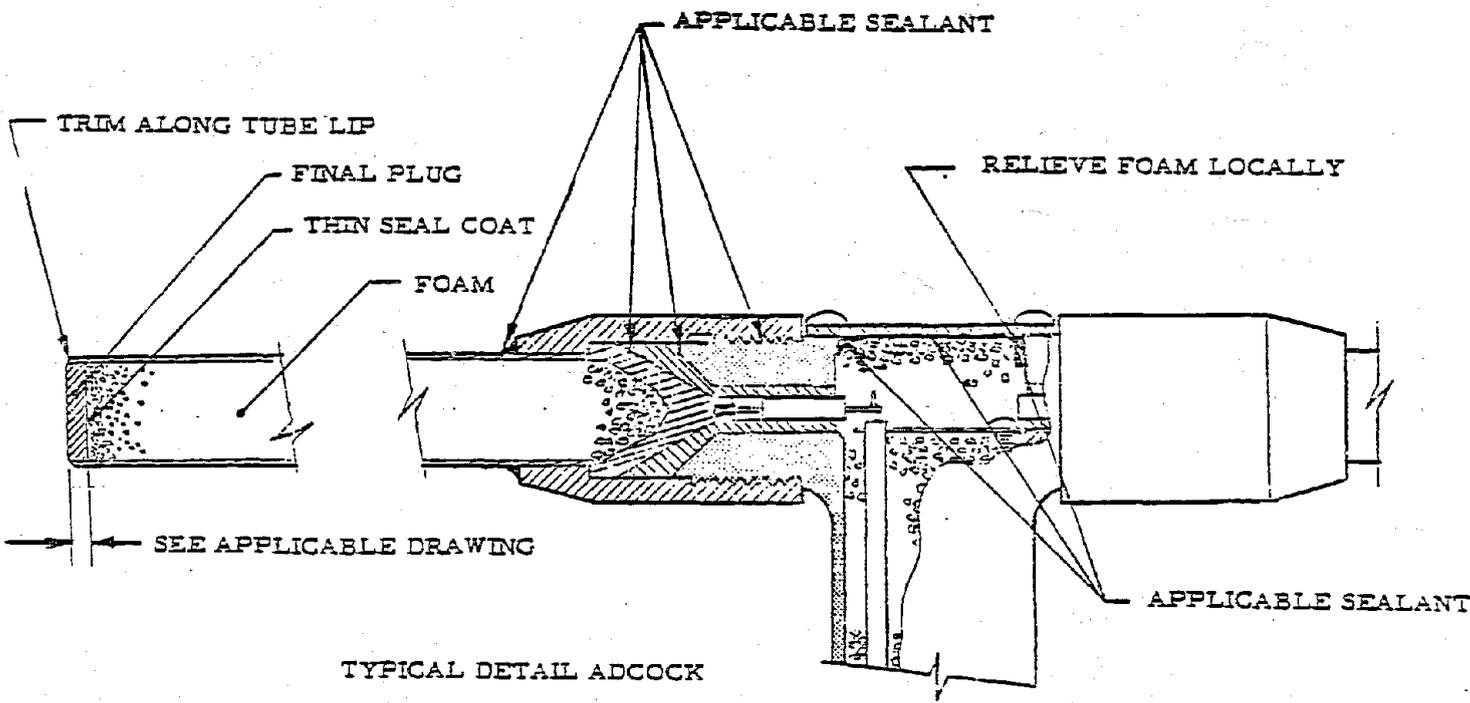


FIGURE 5.3.1-1 - TYPICAL DETAIL ADCOCK

- (2) Use one packet of Tra-Bond J1170 epoxy sealant for each insulated joint
- (3) Apply the epoxy sealant per assembly instructions on drawings.

5.3.3 Covers

Seal all covers of the antenna elements in place with PR-380M as required (refer to applicable drawings).

- (1) Degrease covers. Carefully clean the mating surfaces on the antenna element with alcohol.
- (2) Remove a small amount of encapsulating foam from the inside periphery of the Adcock Boom or Loop opening(s) (See Figure 5.3.3-1).
- (3) Mix a sufficient amount of sealant per subsection 5.3.4 to fill the exposed cavity or cavities.
- (4) Using a spatula, spread sealant over the cavity area ensuring that the sealant fills in the voided areas and is applied to the mating surfaces of the cover.
- (5) Secure the cover(s) to the fittings with screws as specified by the drawing. Draw the cover(s) down tight, squeezing out excess sealant around the edges. Wipe off excess. (It may be necessary to repeat this procedure as stresses are relieved and more sealant leaks out.)

5.3.4 Polysulfide Sealant Use

Various mechanical interfaces of equipment exposed to climatic elements are sealed with a compliant sealant, such as PR-380M per the appropriate drawings. Application instructions are as follows:

CAUTION: Avoid ingestion and all contact of PR-380M with body, especially with open breaks in the skin. Always wash hands before eating or smoking. Flush with water if accelerator contacts skin.

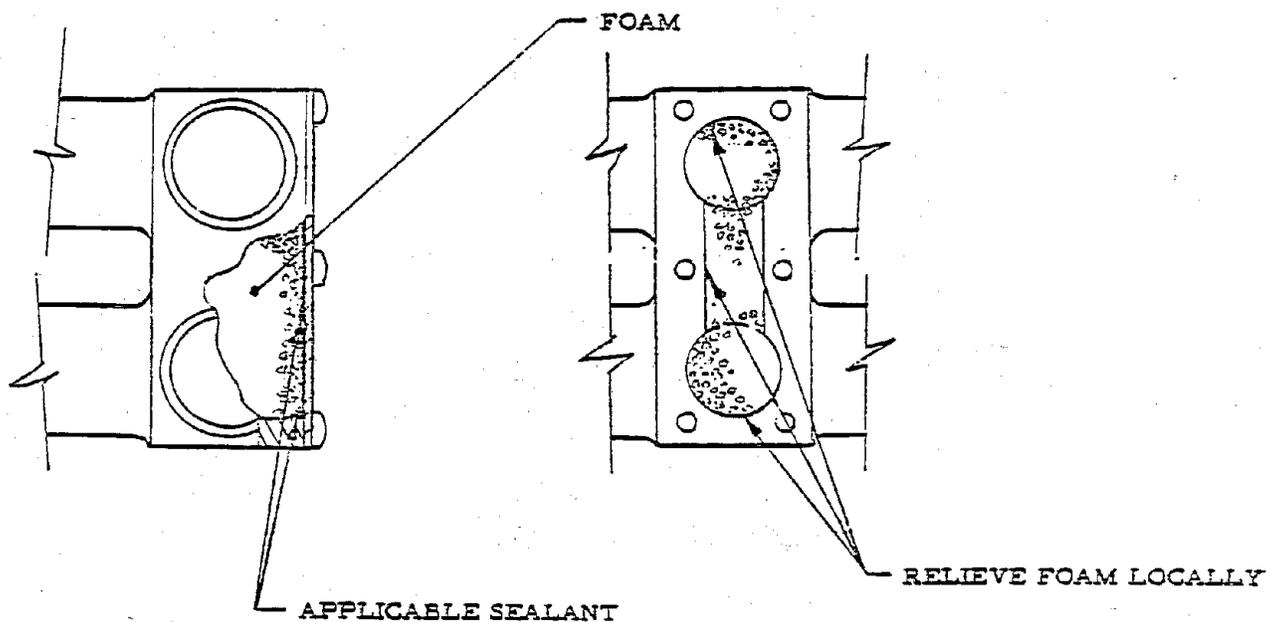


FIGURE 5.3.3-1 - TYPICAL LOOP DETAIL

- (1) Clean surfaces with an oil-free solvent which will dissolve oil and wax. Dry the areas to which solvent is applied with a clean cloth before the solvent evaporates. Light mechanical abrasion may be required on some surfaces for proper cleaning.
- (2) Thoroughly stir accelerator and base in their container, separately, for a uniform consistency before mixing accelerator and base.
- (3) Mix the two parts in the ratio of 10:1 by weight of base compound to accelerator. Stir accelerator into the base and thoroughly mix approximately 5 to 7 minutes.
- (4) Apply sealant with spatula or extrusion gun. Avoid air bubbles and voids in the sealant. Shape the sealant into fillets or shapes, as desired.
- (5) The length of cure time depends on the ambient temperature and relative humidity. Cure time at 75°F and 50 percent relative humidity is 48 hours. Cure may be hastened by applying heat to increase the temperature up to 130°F.

6.0 QUALITY ASSURANCE

6.1 Qualification Joint

When adhesive-bonded structural joints are used, at least one sample of each type of structural joint shall be made up in accordance with the procedures specified herein and tested to demonstrate a successfully fabricated joint prior to fabrication of production units. The sample joint shall be tested destructively (including sectioning) to verify cure, distribution of adhesive, strength, alignment, etc. See Subsection 4.2.7 herein.

6.2 Quality Control

To ensure compliance with the requirements contained herein, a representative of Quality Assurance shall perform or verify and stamp off the inspections of Paragraphs 6.3 and 6.4. Confirming evidence shall be provided on the Inspection and Test Results Sheet, Form 82 or Manufacturing Planning Sheet(s), Form 4010-1 (revision in effect on the date of inspection).

6.3 Surveillance Inspection

Appropriate inspections shall be made to verify compliance with the in-process requirements specified in the following subparagraphs.

6.3.1 Readiness

Ensure that all required prior operations have been performed per the applicable drawing and that the parts are ready for the application of adhesive/sealant. Prior operations include such procedures as foaming, soldered connections, and surface treatments.

6.3.2 Cleaning

Be certain that mating surfaces are clean and free of grease and that the cleaning operation does not damage the foam or other constituents of the part.

6.3.3 Expiration Date

Ensure that the expiration date for the adhesive or sealant has not been exceeded and reject any out-of-date material. (Record expiration date on the inspection form).

6.3.4 Adhesive/Sealant Mixing

Ensure that the adhesive or sealant is mixed according to instructions and that sufficient material is prepared to complete the operation.

6.3.5 Application and Assembly

Be certain that all specified surfaces are thoroughly covered with adhesive or sealant, that the material flows smoothly, without voids, and that the parts fit together smoothly and accurately.

6.3.6 Curing

Ensure that the bonds and joints are not disturbed until they have had sufficient time to cure, and that any oven curing meets the specified time and temperature requirements.

6.4 Final Inspection

A final inspection of each finished item shall be made to ensure that all operations are complete and that workmanship is in accordance with Requirement 9 of MIL-STD-454. (A copy of this requirement is presented in Appendix A).

APPENDIX A
REQUIREMENT 9
OF
MIL-STD-454

REQUIREMENT 9

WORKMANSHIP

1. Purpose. The purpose of this requirement is to establish the acceptable workmanship criteria for electronic equipment intended for use by the Department of Defense. This requirement will define those workmanship requirements not normally covered in subsidiary specifications or drawings. It is not intended to supersede any of the provisions of the contract or applicable specifications and drawings considered a part of the contract. Where actual conflict exists, the provisions of the contract or applicable specification or drawing shall take precedence over the requirements herein.

2. General. Workmanship shall be in accordance with the requirements herein and any requirements of the detail equipment specification applicable to soldering, marking of parts and assemblies, wiring, welding and brazing, plating, riveting, finishes, machine operations, screw assemblies, and freedom of parts from burrs, sharp edges, or any other damage or defect that could make the part (or equipment) unsatisfactory for the purpose intended.

3. Mounting of parts. Parts, or hardware shall be assembled, and secured or mounted in the specified manner to satisfactorily accomplish the purpose for which intended, and shall, wherever possible, be mounted such that values and part numbers containing values are visible. Terminal designations of transformers, inductors, relays, etc., shall be visible to facilitate repair. Electronic equipment having missing, inoperative, defective, bent, broken, or otherwise damaged parts will not be acceptable.

3.1 Mounted hardware installation. The installation of hardware parts, such as hinges, catches, handles, or knobs shall be accomplished in such manner as to avoid damaging the hardware or the mounting surface. Hardware or mounting surfaces damaged in this way shall be touched up to provide a continuous protective coating. A color match between the surface touched up and the original finish shall be provided.

4. Cleaning. After fabrication, parts shall be cleaned of smudges; loose, spattered, or excess solder; metal chips; or any other foreign material which might detract from the intended operation, function, or appearance of the equipment. (This would include any particles that could loosen or become dislodged during the normal expected life of the equipment.) All corrosive materials shall be removed. Whenever possible, this cleaning shall take place before the parts are assembled into the equipment. Cleaning processes shall have no deleterious effect on the equipment or parts.

5. Threaded parts or devices. Screws, nuts, and bolts shall show no evidence of cross threading, mutilation, detrimental or hazardous burrs.

5.1 Tightness. All screw-type fasteners shall be tight. The word tight means the screw shall be firmly secured and that there shall be no relative movement possible between the attached parts.

6. Riveting. The riveting operation shall be carefully performed in order to assure that rivets are tight and satisfactorily headed with the rivet heads tightly seated against their bearing surface.

7. Gear assemblies. Gear assemblies shall be aligned and meshed and shall be operable without interference, tight spots, loose spots, excessive backlash, or other irregularities that could cause unsatisfactory operation.

8. Bearing assemblies. Bearing assemblies shall be free of rust, discoloration, and imperfections of ground, honed, or lapped surfaces. Contacting surfaces shall be free of tool marks, gouge marks, nicks, or other surface-type defects. There shall be no detrimental interference, binding, or galling.

9. Insulated wire running between equipments, or subassemblies within an equipment, such as between drawers or chassis and module subassemblies, shall be formed into cables or ducted wherever practicable. Wires and cables shall be positioned or protected to avoid contact with rough or irregular surfaces and sharp edges.

9.1 Wire dress or cabling of wires shall not result in improper electrical operation or interference with mechanical operation that will lead to subsequent damage of the wire or cable. Wires and cables subject to flexing shall be protected to prevent abrasion.

9.2 Lacing of cabling shall be neat in appearance. The lacing shall be applied firmly, yet not with excessive pressure which could cut into conductor insulation.

9.3 Cabling or wiring harnesses shall be anchored to avoid damage to conductors or adjacent parts.

9.4 Insulation. There shall be no evidence of burns, abrading, or pinch marks in the insulation that could cause short circuits or leakage.

9.5 Splicing. Wires in a continuous run between two terminals shall not be spliced during the assembly of the equipment, except where a stranded conductor is spliced to a solid conductor and the two are supported at the splice.

9.6 Clearance. The clearance between wires or cables and heat generating parts, such as electron tubes and resistors, shall be such as to avoid deterioration of the wires or cables from the heat dissipated by these parts under the specified service conditions of the equipment.

9.7 Shielding. Shielding on wires and cables shall be secured in a manner which will prevent it from contacting or shorting exposed current-carrying parts. The shielding shall terminate at a sufficient distance from the exposed conductors of the cable to prevent shorting or arcing between the cable conductor and the shielding. The ends of the shielding or braid shall be secured against fraying.

10. Welding. All welds shall be free of harmful defects such as cracks, porosity, undercuts, voids, and gaps. There shall be no burn through. Fillets shall be uniform and smooth. Angular or thickness misalignment, warpage, or dimensional change due to heat from the welding operation shall be within permitted tolerances. There shall be no damage to adjacent parts resulting from the welding.