(12)

RADC-TR-84-165
Final Technical Report
July 1984

MAINTAINABILITY TIME STANDARDS FOR ELECTRONIC EQUIPMENT

Boeing Commercial Airplane Company

John Rose, John J. Voytko and Jesse A. Devolt

ROME AIR DEVELOPMENT CENTER
Air Force Systems Command
Griffiss Air Force Base, NY 13441

This report has been reviewed by the RADC Public Affairs Office (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be releasable to the general public, including foreign nations.

RADC-TR-84-165 has been reviewed and is approved for publication.

APPROVED: Thomas L Fennell

THOMAS L. FENNELL
Project Engineer

APPROVED: John J. Bart

JOHN J. BART, Acting Technical Director
Reliability & Compatibility Division

FOR THE COMMANDER: John A. Ritz

JOHN A. RITZ
Acting Chief, Plans Office

If your address has changed or if you wish to be removed from the RADC mailing list, or if the addressee is no longer employed by your organization, please notify RADC (RBET) Griffiss AFB NY 13441. This will assist us in maintaining a current mailing list.

Do not return copies of this report unless contractual obligations or notices on a specific document requires that it be returned.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION: UNCLASSIFIED	1b. RESTRICTIVE MARKINGS: N/A
2a. SECURITY CLASSIFICATION AUTHORITY: N/A	3. DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S): D6-52470	5. MONITORING ORGANIZATION REPORT NUMBER(S): RADC-TR-84-165
6a. NAME OF PERFORMING ORGANIZATION: Boeing Commercial Airplane Company; 6b. OFFICE SYMBOL (If applicable):	7a. NAME OF MONITORING ORGANIZATION: Rome Air Development Center (RBET)
6c. ADDRESS (City, State and ZIP Code): P.O. Box 3707, Seattle WA 98124	7b. ADDRESS (City, State and ZIP Code): Griffiss AFB NY 13441
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: Rome Air Development Center; 8b. OFFICE SYMBOL (If applicable): RBET	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: F30602-83-C-0019
8c. ADDRESS (City, State and ZIP Code): Griffiss AFB NY 13441	10. SOURCE OF FUNDING NOS.

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT
62702F	2338	02	1B

11. TITLE (Include Security Classification): MAINTAINABILITY TIME STANDARDS FOR ELECTRONIC EQUIPMENT

12. PERSONAL AUTHOR(S): John Rose, John J. Voytko, Jesse A. Davolt

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
Final	FROM _____ TO _____	July 1984	234

16. SUPPLEMENTARY NOTATION: N/A

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	Maintainability, Electronics, Maintenance, Time Standards
09	03		
14	04		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Data have been developed to enable predictions to be made of the time taken for the maintenance of electronic equipment. The data provided are universal and can be used for any type of electronic equipment and for any conditions that are representative of actual operating maintenance environments.

All standards are derived from General Purpose Data, a system of elemental time standards for simple sequences of body motions. Four "K" factors have been provided to enable synthesized task times to be related to actual times. The "K" factors account for personal, fatigue, and delay allowances, for learning, for skill, and for the error between actual and predicted time (or variability). The contractor's experience with the application of a similar set of elemental standard times for mechanical system maintenance resulted in a high degree of consistency and accuracy.

(Continued on reverse)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS ☐	UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL
Thomas [illegible]	(315) 330-3476	RADC (RBET)

DD FORM 1473, 83 APR — EDITION OF 1 JAN 73 IS OBSOLETE

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

Examples of testing and maintenance of an F-15 UHF set have been provided as a demonstration of the type of analysis that can be made with predetermined time standards at any stage of design, manufacture, or use.

SUMMARY

The objective for the work undertaken was to provide maintenance time standards for use in electronic equipment maintainability predictions. The standards developed provide the means of predicting times that are representative of different environments associated with maintenance of shipboard, ground, and airborne electronic equipment. Data provided include current state-of-the-art electronics such as surface mounted devices and therefore update data in MIL-HDBK-472, which cover tube technology.

The method used to develop the time standards was to synthesize them from General Purpose Data. General Purpose Data is a system of time standards previously used by both Air Force and Navy for predicting times for basic body motions. The standards can be used in conjunction with drawings or manuals and provide all the information necessary for making a prediction or establishing a work measurement standard satisfying MIL-STD-1567A. A stopwatch or field data are not required.

Study "K" factors have been provided to enable synthesized standard times to be related to field operational environments. The "K" factors account for the personal needs of the electronics technician, his working environment, unavoidable interruption, his skill, and his learning capabilities. A "K" factor is also included for prediction error (variability). While no values are currently available for the prediction error for electronics, the prediction error is expected to be small, based on previous experience with mechanical system time standards.

Approximately 100 data sheets have been provided covering electronic repair operations and other operations required to access, remove, and replace electronic equipment. A mnemonic coding system has been developed to aid the maintenance analyst in locating appropriate time standards. Illustrations have been used to show the type of components or tools being addressed by the time standards.

Several examples of the application of standards to predicting times for organizational, intermediate, and depot level repair are provided in the appendix. The examples are for test and repair of an F-15 UHF set and for test of an AGM86 missile. From the examples it can be concluded that all the time standards needed for analysis of electronic equipment testing and repair have been provided. However, four items are recommended for future work:

- Development of a classification and coding system for completed analyses similar to those in the appendix. A coding system will facilitate storage and retrieval for a DOD library of equipment-level time standards.

- Improvement of prediction accuracy by measurement of learning and skill level in a maintenance environment.

- Measurement of maintenance performance under abnormal conditions such as battle conditions and weightlessness.

- Establishment of a data bank of failure rates, by mode of failure, to facilitate the inclusion of fault isolatior in mean time to repair analysis.

The contractor believes that, with training and practice, the developed standard times can be used to predict maintenance and fault isolation times for electronic equipment with an accuracy that satisfies the requirement for Type 1 standards of MIL-STD-1567 (Reference 1-1).

PREFACE

The authors would like to express their appreciation for the help received from Mr. Harry Dashiell (DOD/DPPO) and Mr. Fred Braun (NALC, Alemeda). Special thanks go to Nina Clancy for her patience in typing the manuscript.

The expressed or implied use of commercial products or names of manufacturers in this report does not constitute official endorsement of such products or manufacturers by the Air Force or by the contractor.

Data used to develop the time standards provided in this document are available from the Defense Industrial Resources Support Office, Cameron Station, Alexandria, Virginia 22314

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0: INDEX OF STANDARDS - ELECTRONIC

PULL PCB	ETL-PC-R1
CLIP-ON HEAT SINK	ETL-PO-XX
PROBE TEST POINT	ETL-TA-XX
DESOLDER, BRAID	ETP-DS-R1
DESOLDER, PUMP	ETP-DS-R2
DESOLDER, BULB	ETP-DS-R3
DESOLDER, VACUUM	ETP-DS-R4
TIN WIRE	ETP-SE-X1
SOLDER OR UNSOLDER WIRE	ETP-SE-X2
SOLDER DIP	ETP-SE-X3
SOLDER SLEEVE OF SHIELDED WIRE	ETP-SE-X4
SMD, SOLDERED LEADLESS CHIP CARRIER	ETP-SE-X5
CHANGE BIT OR SLEEVE, WIRE WRAP TOOL	ETP-WW-D1
BUNDLE, LACE	EWH-BL-XX
BUNDLE, TIE	EWH-BT-XX
CABLE TIE	EWH-CT-XX
INSULATION, HEAT-STRIPPING	EWH-IH-XX
INSULATION, STRIP	EWH-IS-XX
PIN, INSTALL ON WIRE	EWH-PN-I1
PIN, INSTALL OR REMOVE IN PLUG	EWH-PN-I2
WIRE CRIMP, MANUAL TOOLS	EWH-WC-XX
WIRE WRAP, HAND TWISTED	EWH-WW-R1
WIRE WRAP, HAND-SQUEEZE GUN	EWH-WW-R2
WIRE WRAP, POWER GUN	EWH-WW-R3

1.0: INDEX OF STANDARDS (CONTINUED) - OTHER THAN ELECTRONIC

CONTROL, MANUALLY ACTUATED	OAC-CM-XX
BUTTERFLY LATCH, UNFASTEN, FASTEN	OAC-LP-XX
CLIMB OR DESCEND	OBM-CD-XX
WALK, OBSTRUCTED OR UNOBSTRUCTED	OBM-WO-01
HAND CLEAN, SIMPLE SHAPE TO 10-FT^2 OBJECT	OCL-HS-XX
HOLDING CLAMP, TEMPORARY	OCP-HT-XX
ESTIMATED MANUAL TIME	OEL-ET-XX
OTHER DATA	OEL-OD-XX
REPEAT SEQUENCE	OEL-RS-XX
TIME STUDY	OEL-TS-XX
EXAMINE, VISUAL	OIT-EV-XX
HINGED PANEL WITH HOLD-OPEN ROD	OJP-AC-XX
CORD, ELECTRIC, COIL AND UNCOIL	OJP-CC-XX
PROTECTIVE CAP	OJP-CF-XX
CLOCK IN, MANUALLY ACTUATED TIME RECORDER	OJP-CL-XX
CORD, ELECTRIC, PLUG IN AND DISCONNECT	OJP-CP-XX
DRAWER, OPEN AND CLOSE	OJP-DR-XX
ROPE OR CORD, FASTEN OR UNFASTEN	OJP-FT-XX
GLASSES OR GOGGLES, SAFETY, ON AND OFF	OJP-GS-XX
DRILL BIT, INSTALL	OJP-MA-01
PREPARE MICROSCOPE OR MAGNIFIER	OJP-MY-DX
ENSEMBLE, CHEMICAL DEFENSE	OJP-PA-X1
SAFETY HARNESS	OJP-SA-X1
GET AND ASIDE	OMH-LA-XX
OBTAIN OR RETURN FILED MATERIAL	OMH-OF-XX
OBTAIN OR RETURN PART OR MATERIAL	OMH-OP-XX
FASTENER, TURNLOCK	ONF-FT-XX
PRESSURE LATCH, FASTEN OR UNFASTEN	ONF-LP-XX
RING, TRU-ARC	ONF-RT-XX
SAFETY WIRE, CONTINUOUS, NONTWISTED	ONF-SC-XX
SNAP RING	ONF-SR-XX
SAFETY WIRE, TWISTED	ONF-ST-XX

1.0: INDEX OF STANDARDS (CONTINUED) - OTHER THAN ELECTRONIC

OBJECT HANDLING	OOH-OB-XX
DISENGAGE	OOH-DE-XX
POSITION OBJECT	OOH-PO-XX
TAG, ROUTING, REMOVE OR FILL OUT AND ATTACH	OOH-TR-XX
CAN, SCREW CAP, OPEN AND CLOSE	OPK-CS-XX
ENVELOPE, OPEN AND REMOVE CONTENTS	OPK-EO-XX
OBJECT, UNPACK OR PACK	OPK-OB-XX
ESTIMATED PROCESS TIME	OPT-ET-XX
TECHNICAL MANUAL, PROCESS ALLOWANCES	OPT-TM-XX
READ TECH DATA	ORD-TM-XX
COAT, AEROSOL SPRAY	OST-CA-XX
BOLT, SCREW, OR NUT, FINGER TIGHT	OTF-BF-XX
BOLT, SCREW, OR NUT, NC OR NF, MANUAL TOOLS	OTF-BM-XX
BOLT, POWER TOOL	OTF-BP-XX
CAP OR PLUG, THREADED, FINGER TIGHT	OTF-CF-XX
CAMLOC HIGH-STRESS PANEL FASTENERS	OTF-CH-XX
SCREW, MACHINE, MANUAL TOOLS	OTF-SM-XX
SCREW, MACHINE, POWER TOOLS	OTF-SP-XX
PLIERS, DIAGONAL, SIDE OR END CUTTING	OTL-PD-XX
VISE, MECHANICS, POSITION OBJECT AND REMOVE	OTL-VA-XX
WRENCH, TORQUE	OTL-WT-XX
NUMERIC DATA, TRANSFER	OWR-NT-XX
PROSE DATA, TRANSFER	OWR-PT-XX

Elapsed Time: 1) The actual time taken by a worker to complete a task, an operation, or an element of an operation. 2) The total time interval from the beginning to the end of a study.

Elemental Standard Data (ESD): Elements of work that can be traced to scientifically timed operations and that are intended for synthesis into higher level, more complex operations.

General Purpose Data (GPD): Data developed from Method Time Measurement (MTM) elements using the building block concept to assemble simple body motion into sequences of several motions.

Idle Time: Time during which a worker is not working.

Labor Hour: A unit of measure representing one person working for one hour. The combination of "n" people working for "h" hours produces "nh" labor hours. Frequent qualifications to the definition include: 1) designation of work effort as normal effort; 2) designation of time spent as actual clock hours.

Method Time Measurement (MTM): A procedure that analyzes any manual operation or method into the basic motions required to perform it and assigns to each motion a predetermined time standard determined by the nature of the motion and the conditions under which it is made.

Normal Time: The time for a qualified worker, working at a pace that can be sustained, to complete a specified operation or sequence of operations.

Personal, Fatigue, and Delay (PF&D): An allowance over and above normal time to allow a worker to compensate for attending to personal needs, for fatigue, and for delays occurring due to conditions beyond his control.

Prediction Error: The difference between an observed time and a normal time multiplied by appropriate "K" factors for PF&D, skill, and learning. Also known as variability.

Time Standard or Standard Time: The time for a qualified worker, working at a pace that can be sustained, to complete a specified operation or operations with allowances for personal comfort, fatigue, and work interruptions.

Time Measurement Unit (TMU): One hundred-thousandth of an hour, 0.00001 hour. (27.8 TMUs = 1 second, 1667 TMUs = 1 minute).

Variability: See prediction error.

ANSI	American National Standards Institute
APL	Airplane
DHU	Decimal Hour Unit (one ten-thousandth of an hour)
DIP	Dual Inline Package
DOD	Department of Defense
E	Electrical and Electronic (time standards)
GPD	General Purpose Data
GSE	Ground Support Equipment
LRU	Line Replaceable Unit
MTM	Method Time Measurement
NALC	Naval Air Logistics Center
NC	National Coarse (screw thread)
NF	National Fine (screw thread)
O	Other (time standards)
OCC	Occurrence
PCB	Printed Circuit Board
PDTS	Predetermined Time Standards
PF&D	Personal, Fatigue, and Delay
QTY	Quantity
RADC	Rome Air Development Center
SMD	Surface Mounted Devices
TDR	Time Domain Reflectometer
TMU	Time Measurement Unit (one hundred-thousandth of an hour)
UHF	Ultrahigh Frequency

3.0 INTRODUCTION

This section of the document provides a guide to understanding the development, scope, and limitations of the standards provided in Section 7.0.

3.1 Background

Maintainability prediction is one of the critical activities in equipment design and development. It impacts the definition and attainment of mission requirements. It also impacts life cycle costs. Past investigations and feedback to RADC indicated that current maintainability predictions were indirect, complex in application, only marginally accurate, and were not directly taking into account system engineering design characteristics. Further, techniques for maintainability modeling and trade-offs were virtually nonexistent. Therefore, RADC developed prediction techniques under Contract No. F30602-76-C-0242 that are based on a time synthesis model. The techniques are documented in a report entitled "Maintainability Prediction and Analysis Study", report RADC-TR-78-169, Reference 3-1. A subsequent data validation study under Contract F-30602-81-C-0081 (Reference 3-2) showed that the maintenance time standards contained in RADC-TR-78-169 were: 1) indicative of conditions resulting from repetitive performance of tasks and, 2) not characteristic of the maintenance environments associated with military systems.

As well as remedying the above criticisms, the objective for the time standards presented in this document is to use them as a basis for updating data for maintenance task time analysis presented in MIL-HDBK-472.

MIL-HDBK-472 provides four methods of predicting the maintenance times for electronic equipment, and Procedure II of MIL-HDBK-472 is also based on a time synthesis model. However, the tables in the handbook are based on old state-of-the-art components and are inadequate for present-day design analysis. Tables 3.1-1 and 3.1-2 show the type of components currently covered by MIL-HDBK-472.

TABLE 3.1-1: INTERCHANGE TIMES (FROM MIL-HDBK-472, TABLE 2-3)

PART TYPE	AVERAGE TIME (HOURS)
Plug-in tubes	0.015
Wired tubes (4 wires)	0.149
Wired tubes (more than 4 wires)	0.149 + 0.034 per wire over 4
All tubes with shield with clamp with cap	ADD 0.007 ADD 0.027 ADD 0.007
Plug-in fuses	0.010
Screw-in fuses	0.015
All fuses with screw cap	0.014

PARTS OTHER THAN TUBES AND FUSES	
PART TYPE	AVERAGE TIME (HOURS)
Parts with 2 wires or 2 tabs to be soldered	0.081
Parts with more than 2 wires or 2 tabs to be soldered with clamp	0.081 + 0.034 per wire over 2 ADD 0.027
Parts attached with screws, nuts, and washers	ADD 0.022 for each screw, nut and washer combination

TABLE 3.1-2: ELEMENT TIMES BASED ON THE WORK FACTOR SYSTEM
(FROM MIL-HDBK-472, TABLE 2-4)

ELEMENT DESCRIPTION	ELEMENT TIME* (Hours)
1. PLUG-INS (including handling)	
Pin-type tubes, plug-in parts, etc.	0.0075
Tub cap or shield	0.0035
Fuse	
Insert into horizontal holder	0.0050
Insert into vertical holder	0.0075
2. WIRING AND SOLDERING	
Wire wrapping and splicing	
Bare copper wire (1) End	0.0150
(2) Ends	0.0237
Jumper wire and cable leads (1) End	0.0134
(2) Ends	0.0265
Part with axial leads (includes part handling)	
(1) End	0.0178
(2) Ends	0.0289
Solder	
Per joint	0.0058
3. REPLACEMENT WITH HARDWARE	
Replace screw into tapped hole	0.0093
Replace screw through clearance hole	0.0023
Replace washer	0.0018
Replace nut	0.0071
Replace stop nut	0.0210
Replace set screw	0.0075
Apply glyptol screw	0.0018
4. PART HANDLING	
Pull up part and position in chassis for assembly	0.0025
5. PRINTED CIRCUIT WIRING	
Replace (insert)	0.0033/End
Solder	0.0056/End

* The interchange task aboard ship does not involve the repetitive (cyclic) factory type of regularly occurring motions; therefore, those interchange element times are based on noncyclic and irregularly occurring motions.

However, irrespective of the need to update MIL-HDBK-472, the primary objective is to provide time standards for use in synthesis of maintenance times for contemporary electronic equipment, using the application method developed in RADC-TR-78-169. The standards are representative of the nonrepetitive nature of maintenance and the environments in which it is accomplished.

3.2 Approach and Rationale

Since the contractor had previously developed time standards for maintenance of mechanical systems based on the use of Predetermined Time Standards (PDTS) (defined in Reference 3-3 and described in Reference 3-4), the same approach appeared logical for electronic equipment maintenance. The PDTS system known as Method Time Measurement (MTM) forms the foundation of the standards developed for this document. MTM is probably the most widely used time standards system used for industrial applications and consists of several sets of data that are based on 11 basic body motions:

Reach	Disengage
Move	Eye Travel and Focus
Turn	Body, Leg, and Foot Motion
Apply Pressure	Position
Grasp	Release
Crank	

The historical development, verification, and validation of the times associated with the basic body motions of MTM are described in Chapter 4 of Engineered Work Measurement, Reference 3-5. The standard motions can obviously be combined into more complex sets of motions. For instance, the pick up and position of a part might consist of a reach, grasp, move part, regrasp, position, and release. The simple body motions of MTM can thus be used to form more complex operations, and a system of standards known as General Purpose Data (GPD) has evolved from Method Time Measurement. In practice, the application of standards based on fundamental body motions,

even at a GPD level, is a time-consuming process. Higher level, more complex standards have therefore been developed that retain most of the accuracy of the fundamental General Purpose Data standards from which they are derived. A simple example of the way in which the high level standards of this document have been developed from GPD is the installation of a protective plastic cap on the end of a cable. The operation consists of the following body motions:

- o Get the cap.
- o Get the part to be capped.
- o Position the cap.
- o Apply pressure to the cap.

The motions correspond to GPD elements for:

- o A "get" of a jumbled object with one hand with a reach of 18 inches.
- o A "get" of an easily grasped object at a variable location with a reach of three to nine inches.
- o A symmetrical "place" of a closely fitting object at a distance of 18 inches.
- o An "apply pressure" case 1. (Case 1 requires orientation or adjustment to avoid loss of grip during application of force).

Since standard times exist for each of the above GPD elements, the time for installing a protective cap can be readily derived and is 96 Time Measurement Units (TMU).

The removal time can be developed in a similar manner and becomes the standard shown in Figure 3.2-1.

REMOVE		INSTALL	
FIRST	TMU	FIRST	TMU
R1	90	I1	96

Remove

Begins with getting capped part. Includes reaching to cap, applying pressure to cap, disengaging cap. Ends with asiding cap.

Install

Begins with getting protective cap. Includes getting part to be capped, positioning cap. Ends with applying pressure to complete cap installation.

Figure 3.2-1: A Typical Time Standard

If it were necessary to use a tool to remove the protective cap then the "first" removal would include the body motions to get the tool at the start of the operation and aside it at the end of the operation. An "additional" operation time would have been developed that excluded the get and aside of the tool. A number of standards with "first" and "additional" operations will be seen in Section 7.0.

Higher level elemental standards such as those of Figure 3.2-1 can still be used in many different combinations as may be seen from the examples provided in Appendix A. The examples would have consisted of many thousands of body motions at a GPD level.

An alternative to a system of synthesized elemental standards would have been to observe and time actual maintenance operations. There are several problems with this procedure. First, there must be a sufficiently large number of repetitions of the operations to determine an estimate of the mean time with a specified confidence. Second, there is a variation in time taken from one technician to another. Recorded times must therefore be leveled to those of an average technician. Finally, observation and timing can not be used for design review and critique because at that early date the equipment does not yet physically exist.

Wherever possible, use was made of existing elemental standards, mostly from DOD 5010.15.1-M, Volume VII (Reference 3-6). Where existing standards have been used, they have been checked for accuracy and suitability as electronics maintenance standards and reformatted for compatability with the new standards developed. A prerequisite for including a standard in this document is that it can be traced back to a General Purpose Data source, thus ensuring the consistency of all standards provided.

3.3 Training

MTM data on which the standards in this document are ultimately based carries with it the following warning from the MTM Association:

> Do not attempt to apply Methods Time Measurement in any way unless you understand the proper application of the data. This statement is included as a word of caution to prevent difficulties resulting from misapplication of the data.

The same caution applies to the application of standard data provided in Section 7.0. The development of a maintenance task time analysis involves a number of analytical skills. The analyst must be capable of defining, in detail, the elements of the work to be performed by a mechanic or technician. Typical task descriptions are shown in Appendix A. For the development of fault isolation times, the analyst must also have the ability to determine the failure modes, their effects on the system, subsystem, and failed component, and the failure rate associated with each mode. Examples of fault isolation analyses are also provided in Appendix A.

The knowledge necessary for time standard data application can be obtained by taking one or more of the courses detailed in DOD 5010.15.1-M (Appendix III Basic Volume, Reference 3-7). The purpose of training is to ensure that standards are uniformly applied and can be used with confidence.

4.0 THE STANDARD DATA APPLICATION METHOD

The process of making a maintenance analysis consists of five steps and assumes that the analyst is thoroughly familiar with the elemental standards available.

The first step is to match the maintenance work to be performed with the work description for first and additional operations from the standard. This step is explained in Section 4.1.

The second step is to establish the case difficulty (Section 4.2).

The third step is to determine the number of times an operation is repeated, as well as the probability of occurrence, and the number of people involved (Section 4.3).

The fourth step is to perform the simple calculations necessary to determine elapsed time and labor hours.

The final step is to apply "K" factors to cover personal, fatigue, and delay allowances, and if appropriate, skill, learning, and error factors.

Appendix A provides a series of examples showing the application of time standards to the analysis of organizational, intermediate, and depot level maintenance of electronic equipment. Application format is shown in Figure 4.0-1.

(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	
STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DMU ELAPSED	DMU TOTAL
02	RMV & INSTL MODULE, POWER SUPPLY 1A8							1161	1161
A	RMV MODULE AND COVER						100	536	536
1	LOOSEN MODULE HOLD DOWN SCREWS (EQ TO)			OTL-WT-02	1	3		108	
2	RMV COVER RETAINING SCREWS			OTF-SM-RB	1	4		428	
B	INSTL COVER & MODULE						100	625	625
1	POSN COVER			OOM-PO-OB	1			25	
2	INSTL COVER RETAINING SCREWS			OTF-SM-1B	1	4		450	
3	POSN MODULE			OOM-PO-OC	1			42	
4	TIGHTEN MODULE HOLD DOWN SCREWS (EQ TO)			OTL-WT-02	1	3		108	

Figure 4.0-1: Example of Data Application Format

The example format consists of eight columns identified in Figure 4.0-1 by numbers (1) through (8).

(1) The STEP column provides a number reference for the overall task, a letter reference for the suboperation, and a number for each element of the suboperation.

(2) A DESCRIPTION is provided for the task, suboperation, and element.

(3) Where more than one worker is required, each is identified by WORKER I/D.

(4) Work that is simultaneous is cross-referenced under SIMO by the STEP designator from column (1).

(5) Elemental standards are referenced in the column headed CODE. The coding system is explained in Section 7.1.

(6) The quantity of first and additional work elements is entered in column (6). (First elements include time to get and aside objects that are then available for additional elements.)

(7) The use of OCC (occurrencing factors) is explained in Section 4.3. They are entered as a percentage.

(8) For each element, the first and additional times that correspond to the element referenced in column (5) are multiplied by QTY, column (6), and summed to arrive at the elasped time, column (8), then multiplied by OCC, column (7), to give the total time, column (8).

In the Data Applications of Appendix A, time units are in Decimal Hour Units (DHU), which equal ten Time Measurement Units (TMU):

100,000 TMU = 1 hour
10,000 DHU = 1 hour
1 DHU = .0001 hour
2.78 DHU = 1 second
166.7 DHU = 1 minute

Suboperation summaries and task summaries are also provided with each of the tasks analyzed in Appendix A. A typical summary shown in Figure 4.0-2.

```
                              TASK CODE: 152314XM01
                                         ==========

                              PART NAME: UHF RADIO SYSTEM
SUMMARY
-------

APL MODEL: F-15          PART NO:                              ZONE:

TASK DESCRIPTION:  *    CONDUCT FLT LINE TEST TO
                   *    ISOLATE TROUBLES IN UHF RADIO
                   *    SYSTEM



PREPARED BY:  J.DAVOLT              ORG: B7463      DATE: 1-9-84P

REQUESTED BY: J.ROSE                ORG: B7463          REV.

REFERENCES:   TO 12R2-2ARC109-2

REMARKS:      THIS  ANALYSIS  IS  FOR  USE  AS  AN  EXAMPLE  OF
              MAINTAINABILITY  TIME  STANDARDS  APPLICATION.  THE
              UHF  RADIO AN/ARC109 IS INSTALLED ON F-15 AIRCRAFT.
              USING  THE  TEST  SET  AN/ARM-115  AT  THE  APL IS
              OPTIONAL  TO  REMOVING THE TRANSCEIVER, CONTROLLER
              OR  INTERCOM  SET  AND  PERFORMING  THE TESTS ON A
              BENCH SETUP. IN THIS ANALYSIS IT IS ASSUMED ACCESS
              TO  THE  UHF  SET  IS  OPEN AND A WORK PLATFORM IS
              POSITIONED  PER 112314XM01. ASSUME THE APL IS IN A
              HANGAR. POWER IS CONNECTED TO APL.

---------------------- TASK TIME SUMMARY -----------------------

   TOTAL MANHOURS:      .93 HRS ..... WITH PF&D:    1.11 HRS
    TOTAL ELAPSED:      .46 HRS ..... WITH PF&D:     .56 HRS

   OSE REQUIRED:   YES                PERSONAL:      9%
                                      FATIGUE:       6%
                                      DELAY:         5%
```

Figure 4.0-2: Example of an Application Summary

The total labor hours and total elapsed times without and with PF&D are provided with the summary. In addition, the labor hours and elapsed times without and with PF&D are shown for work at the airplane (APL). Work at the airplane excludes the primary job preparation and termination so that several jobs on the aircraft can be readily combined.

4.1 Selecting Standards

Standards are selected by breaking down the overall task into more and more detailed elements until a match with the standard job descriptions of Section 7.0 is found. A prerequisite is that the analyst is familiar with all available standards. For instance, removing a black box from an airplane can be broken down into:

1) Walking to the airplane
2) Checking that the power is off
3) Opening an access door
4) Disconnecting the cables
5) Loosening the equipment hold-downs
6) Disengaging the equipment from the airplane

Once the task has been broken into a number of suboperations, a search is made for existing predetermined times. For example, element 6 above, matches data element 00H-DE in Section 7.0, also shown in Figure 4.1-1.

00H-DE-XX DISENGAGE

DISENGAGE	TMU
0A	70
0B	120
0C	220
0D	400
0E	700

Disengage

Begins with reaching to object or tool. Includes obtaining control of object with hand(s), or with tool when tool is an extension of the hand(s), and loosening and extracting or removing one object from another. Ends with laying aside tool and/or object.

Remarks

Tools included are a putty knife, screw driver, pliers, or similar to overcome the limitations of hand or finger dexterity or access. Strength may be used with slight to considerable effort. Use of hammer is not included.

Case variable factors: distance 45%, weight 10%, control 45%.

Figure 4.1-1: Standard Times for Disengaging

Having matched the work and the standard, the analyst must next select the level of difficulty for the work. In the case of DISENGAGE, Figure 4.1-1, five levels are available from Very Easy (A) to Very Difficult (E). A typical example is also shown in Figure 4.1-2 for a standard that can be used for releasing door latches.

FASTENER, TURNLOCK TO 3/8-in. DIA **ONF-FT-XX**

	FIRST	TMU	ADDITIONAL	TMU
Unfasten	RA	110	YA	60
Unfasten	RB	160	YB	80
Fasten	IA	140	XA	90
Fasten	IB	200	XB	130

Unfasten First Piece

Begins with reaching to tool. Includes positioning tool to fastener stud and twisting to unfasten stud from receptacle. Ends with laying aside tool.

Unfasten Additional Piece

Begins with moving to fastener stud with tool. Includes positioning tool to stud and twisting to unfasten. Ends with unfastening stud from receptacle.

Fasten First Piece

Begins with reaching to tool. Includes positioning tool to fastener stud and twisting stud to secure in receptacle. Ends with laying aside tool.

Fasten Additional Piece

Begins with moving to fastener stud with tool. Includes positioning tool to stud and twisting to secure. Ends with fastening stud to receptacle.

Remarks

Applies to DZUS, CAMLOC, AIRLOCK and similar fasteners.

Case variable factors: distance 10%, weight 5%, control 85%.

Figure 4.1-2: Typical Standard Data Sheet

For ONF-FT only two levels of difficulty are provided, Very Easy (RA, YA) and Easy (RB, YB). Once case difficulty has been selected, the analyst can obtain the corresponding time from the table at the top of the sheet. However, to remove the subjectiveness of selecting case difficulty the procedure of Section 4.2 should be used. Units of time in the standard data sheets are Time Measurement Units or TMUs. (One TMU is equal to .00001 of an hour and there are 27.8 TMUs to a second.)

4.2 Case Difficulty

Some of the standard data in Section 7.0 have been developed to provide the analyst with the choice of different levels of difficulty for the operation described.

Table 4.2-1 provides examples of the three case variable percentages by which distance, weight, and control were judged to contribute to the work difficulty.

TABLE 4.2-1: EXAMPLES OF CASE VARIABLE PERCENTAGES

Standard	Case Variable Percentage		
	Distance	Weight	Control
ENF-CB-XX	10	5	85
OMH-LA-XX	80	20	0
ONF-FT-XX	10	5	85
ONF-SR-XX	10	5	85

The case variable percentages are provided with each elemental standard data sheet in Section 7.0 to which they apply. The definitions of case difficulty used in constructing the standards are shown in Table 4.2-2. When applying a standard, Table 4.2-2 can be used to remove some of the subjectiveness in selecting a level of difficulty. For example, if a two-pound object was moved to an exact location 12 inches away it would be classed as a Very Easy case. The cases for different distances and degrees of control can be determined in a similar manner.

Having decided on levels of difficulty for distance, weight, and control, a case variable multiplier is obtained from Table 4.2-3.

TABLE 4.2-2: LEVEL OF DIFFICULTY DEFINITIONS

LEVEL	DISTANCE	WEIGHT (LB)	CONTROL - SEE REACH AND MOVE BELOW*
A VERY EASY	WITHIN 18-IN. RADIUS, NO BENDING, STOOPING, OR OTHER BODY ASSISTS.	0 - 3	A,B,E REACHES - A,B,C MOVES. ACCOMPLISHMENT IS UNOBSTRUCTED, OBJECT CLEARLY VISIBLE, FIT, IF APPLICABLE, IS LOOSE AND OBJECT IS EASY TO HANDLE. (CLASS "1" POSITIONS). MAXIMUM 1-IN. RECOIL ON DISENGAGE.
B EASY	SAME AS ABOVE, WITHIN 30-IN. RADIUS AND INCLUDING BODY ASSIST BUT NO BENDING OR STOOPING.	3 - 10	C,D REACHES - C MOVES. SOME INTERFERENCE, OBJECT WHOLLY VISIBLE, OR NO INTERFERENCE, OBJECT PARTLY VISIBLE. FIT, IF APPLICABLE, IS LOOSE AND OBJECT IS DIFFICULT TO HANDLE. (CLASS "1" POSITIONS). MAXIMUM 1-IN. RECOIL ON DISENGAGE.
C MODERATE	SAME AS EASY, BUT WITHIN 4-FT RADIUS AND INCLUDING BENDING AND STOOPING.	10-25	C,D REACHES - C MOVES. INTERFERENCE, OBJECT PARTIALLY VISIBLE. FIT, IF APPLICABLE, IS CLOSE, (CLASS "2" POSITIONS). MAXIMUM 5-IN. RECOIL ON DISENGAGE.
D DIFFICULT	SAME AS MODERATE, BUT WITHIN A 6-FT RADIUS.	25-50	C,D REACHES - C MOVES. INTERFERENCE, OBJECT IS NOT VISIBLE OR INTERFERENCE AND PARTIALLY VISIBLE. FIT, IF APPLICABLE, IS EXACT. (CLASS "3" POSITIONS). OVER 5-IN. RECOIL ON DISENGAGE.
E VERY DIFFICULT	SAME AS DIFFICULT BUT WITHIN AN 8-FT RADIUS.	OVER 50	C,D REACHES - C MOVES. OBSTRUCTED AND NOT VISIBLE. FIT, IF APPLICABLE, IS EXACT, ACCOMPLISHMENT BY MULTIPLE AND/OR NONSYMMETRICAL, DIFFICULT POSITIONS. OVER 5-IN. RECOIL ON DISENGAGE.

* MTM REACH

A - TO OBJECT IN FIXED LOCATION OR TO OTHER HAND
B - TO OBJECT IN LOCATION WHICH VARIES SLIGHTLY
E - TO INDEFINITE LOCATION OR A REACH TO BALANCE THE BODY
C - TO JUMBLED OBJECTS REQUIRING SEARCH AND SELECT
D - TO A SMALL OBJECT REQUIRING AN ACCURATE GRASP

* MTM MOVES

A - MOVE OBJECT TO OTHER HAND OR AGAINST STOP
B - TO AN APPROXIMATE OR INDEFINITE LOCATION
C - TO AN EXACT LOCATION

TABLE 4.2-3: CASE VARIABLE MULTIPLIERS

Case	Multiplier M
Very Easy	0.1
Easy	0.3
Moderate	0.5
Difficult	0.7
Very Difficult	0.9

The case variable percentage from Table 4.2-1, or from individual standards in Section 7.0, multiplied by "M" from Table 4.2-3, gives the case variable factor "F". The final step is to add the case variable factors together and then use Table 4.2-4 to determine the combined case.

TABLE 4.2-4: COMBINED CASE CODES

Sum of "F" Factors	Case To Use	Case Code
0 - 19.9	Very Easy	A
20 - 39.9	Easy	B
40 - 59.9	Moderate	C
60 - 79.9	Difficult	D
80 - 100	Very Difficult	E

Example

A black box is to be removed from its mounting through a small access panel. Its fasteners and connectors have been released and removed and now it is to be disengaged and moved 30 inches. It weighs 40 pounds and is only partially visible.

1) From Table 4.2-2:
   30 inches distance is an Easy case
   40 pounds weight is a Difficult case
   "Partially visible" is a Moderate case

2) For Disengage OOH-DE-XX (Figure 4.1-1)
the case variable factors are:
Distance 45%
Weight 10%
Control 45%

3) Using the individual difficulties from (1) above in Table 4.2-3, case variable multipliers are:

Distance, Easy	0.3
Weight, Difficult	0.7
Control, Moderate	0.5

4) Percentages (2) are multiplied by the results of (3) and added:

Individual Case	%	x	M	=	F
Distance	45	x	0.3	=	13.5
Weight	10	x	0.7	=	7.0
Control	45	x	0.5	=	22.5
			Total	=	43

5) From Table 4.2-4, the combined case for a sum of F values of 43 is Moderate (40-59.9).

6) The disengage operation for the black box is given the code OOH-DE-OC in accordance with the details of the coding system provided in Section 7.1, OC being used for Moderate. A time value of 220 TMUs (or eight seconds) is now obtained from Figure 4.1-1 for a Moderate case with a code "OC".

4.3 Occurrencing

An occurrence factor has two uses. The first, and simpler, of the two uses is to represent the relative frequency with which an operation takes place. For example, if once in every three soldering operations the solder is regrasped, then the time for regrasping would be given an occurrence factor of 33%. This technique is usable in both the development and application of elemental standard data.

The second and more complex use of occurrencing is to account for both the labor hours and elapsed time for tasks involving more than one person. For example, imagine two mechanics sharing the same operation, such as the removal of four bolts, in which each mechanic requires 3070 TMU, with 6140 TMU for the total task. The reader of an analysis would see 6140 TMU displayed with a 50% occurrence factor, yielding an elapsed time of 3070 TMU. Labor hours and elapsed time are both important maintainability parameters and one method of accounting for them is illustrated by Figure 4.3-1.

TASK CODE: 152314XM01

STANDARD DATA APPLICATION — PART NAME: UHF RADIO SYSTEM

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
01	CONDUCT FLT LINE TEST TO ISOLATE TROUBLES IN UHF RADIO SYSTEM	1,2						4627	9254
A	JOB PREPARATION	1,2					200	562	1124
1	OBTAIN TECHNICAL INFORMATION REQUIRED	1	2	OMM-OF-01	1			-20	
2	OBTAIN TEST EQUIPMENT AND TOOLS	2	1	OOH-OB-01	2			96	
3	FROM SHOP TO APL	1,2		OBM-HO-01	37			333	
4	ASIDE TEST EQUIPMENT AND TOOLS	1,2		OOH-OB-02	2			96	
5	UP W/STAND TO ACCESS DOOR	1	6	OBM-HO-01	1			9	
6	TO COCKPIT	2	5	OBM-HO-01	1			-8	
7	LOCATE UHF RADIO SW	2		OIT-EV-ZB		2		20	
8	TURN OFF UHF SWITCH	2	9	OAC-CM-02	1			8	
9	TURN OFF TEST SET PWR SW	1	8	OAC-CM-02	1			-7	
B	INSTL TEST EQUIPMENT	1	C				200	1096	2192
1	POSIT TEST EQUIPMENT ADJACENT TO UHF RADIO	1		OOH-OB-01	1			48	
2	INSTL TEST CABLE ASSEMBLIES TO HOOK TEST EQUIPT PER FIO 5-1	1		ETF-CE-1C	9			765	
3	RHV SAFETY WIRE FROM ANETNNA CONNECTOR	1		OHF-ST-RB	1	1		122	
4	RHV CONNECTOR FROM ANTENNA CONNECTION TO R/T UNIT	1		ETF-CE-RC	2			142	
5	RHV CONNECTOR FROM J4 OF R/T UNIT	1		ENF-CB-RC	1			19	
C	SET CONDITIONS FOR TEST	2	B				100	-60	
1	SELECT APPROVED TEST FREQUENCY	2		OAC-CM-02					
2	SELECT MANUAL ON MODE SELECTOR	2							
3	VOLUME CONTROL TO MAXIMUM	2							
4	FUNCTION SWITCH OFF	2							
5	TONE AND SQ DISABLE SWITCHES RELEASED	2							
6	PRIMARY PWR SWITCH ON								

Figure 4.3-1: Task Analysis for Multiple Workers

In Figure 4.3-1 complete suboperations have been occurrenced. In suboperations A and B the elapsed time is factored by 200% to give the labor hours for workers one and two. The convention of a minus sign in the elapsed time column signifies an element, or suboperation, that takes place in parallel with another element or suboperation. Entries with a minus sign are ignored, not subtracted, in accumulating elapsed times. For example, while worker number one is performing suboperation B, for a total of 1096 DHUs, worker number two completes suboperation C in 60 DHUs. Worker number two's labor hours and idle time are accounted for with worker number one by the occurrence factor of 200% in suboperation B. (The analysis of Figure 4.3-1 is part of the series of examples for repair of an F-15 UHF radio provided in Appendix A.)

4.4 Use of Personal, Fatigue, and Delay Allowances (PF&D)

Since all the elemental standard data provided in Section 7.0 is based on a continuous series of body motions, it is necessary to add allowances for hygiene and personal comfort needs, for the different factors resulting in fatigue, and for uncontrollable delays and interruptions.

A comprehensive set of PF&D allowances is provided in Reference 3-7, and for convenience, the data are reproduced in Section 5.1. The PF&D allowances are for such things as working position (sitting, standing, walking), physical factors such as moving weights in different positions, heat, lighting, mental concentration, monotony, and so on.

Typical PF&D allowances are:

- Bench or shop work at a normal pace and temperature:
  - 5% personal
  - 5% fatigue
  - 5% delay
- For work below $40^{o}F$ or above $90^{o}F$:
  - 3% additional fatigue allowance
- Use of heavy protective clothing:
  - 5% additional fatigue allowance

Work on an airplane under typical conditions is shown in Table 4.4-1.

TABLE 4.4-1: TYPICAL PF&D FOR WORK ON AN AIRPLANE

Conditions			
Work Area	Equipment Handling	Inside Aircraft	Outside Aircraft
Open	Easy	18% (8-5-5)	20% (9-6-5)
Open	Difficult	19% (8-6-5)	21% (9-7-5)
Moderate	Easy	21% (8-8-5)	23% (9-9-5)
Moderate	Difficult	22% (8-9-5)	24% (9-10-5)

4.5 Environment

Environment is the term used to describe the conditions that surround the area in which maintenance is performed. Examples of natural environments are moisture, heat, cold, wave motion, rain, wind, snow, ice, sand, and dust. Induced environments include vibration, clean-room conditions, radiation, weightlessness, explosive atmosphere, and noise. Conditions such as rain, snow, and cold entail the use of protective clothing or special equipment such as heaters.

Arctic or foul-weather gear may result in interference or loss of visibility. Such gear increases the degree of control required and the increased degree of control results in higher levels of difficulty as well as higher than normal personal and fatigue allowances. A typical example, such as chemical warfare clothing that includes two layers of gloves, may result in an "easy" job element becoming "moderate" or "difficult". In addition, the outfit is hot, cumbersome, and uncomfortable (Figure 4.5-1).

A full table of fatigue allowances is contained in Section 5.1.

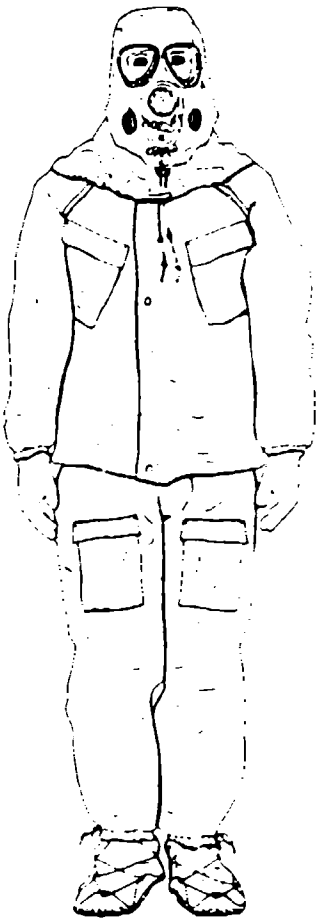


Figure 4.5-1: Groundcrew Chemical Defense Ensemble

From the fatigue tables, the percentages by which the normal time might be increased under chemical warfare conditions are:

Percent	As a Result of
2	Face shield
2	Rubber boots
4	Heavy protective clothing
5	Filter mask
3	Heat factor
2	Standing
8	Concentration and manual dexterity
1	Noise
27	**Total Fatigue Allowance**

Personal allowance for a chemical warfare environment might consist of:

Percent	As a Result of
6	Extremely disagreeable conditions
4.2	Preparation and cleanup
4.0	Adjunctive allowance for special clothing
14.2	**Total Personal Allowance**

With an allowance of 5% for unavoidable delays, the increase in work time due to PF&D would be 46% (27 + 14 + 5), compared with 15% for bench work under normal conditions. The use of a chemical warfare groundcrew ensemble also causes problems with heat stress. Periodic rest cycles are required and details are provided in Section 5.3.

4.6 Shipboard Conditions

As well as the environments provided for by the tables of Section 5.1, the environment for shipboard maintenance has the additional complication of ship's motion. For example, a destroyer commonly rolls 25 degrees from vertical and may occasionally roll 40 degrees or more during which time only vital maintenance is performed. Under such conditions maintenance includes operations such as clamping equipment (OCP-HT-XX), tieing down

tools (0JP-FT-XX), or returning tools and equipment not in use to drawers or cabinets (0MH-0P-XX). Working on superstructure -- an antenna, for example -- involves the use of a safety harness (0JP-SA-X1). In addition, linear and angular accelerations during pitch, roll, and yaw add to and subtract from gravitational acceleration and change the weight of equipment being handled, thereby changing level of difficulty to a more severe case.

5.0 ALLOWANCES AND VARIABILITY FACTORS

Section 5.0 provides data to enable an analyst to relate time standards developed using the synthesis technique described in Sections 4.1, 4.2, and 4.3 to the times that are experienced in an actual operational environment. Differences between actual and normal times are accounted for by four "K" factors. The first factor is the Personal, Fatigue, and Delay allowance, used to account for differences in times for the same work performed under different conditions and environments. PF&Ds to cover all environments are provided in Section 5.1. The second factor is for skill, capability, and motivation of individual technicians and a method of accounting for this factor is provided in Section 5.2. The third factor is that associated with how well an average electronics technician has learned to perform a given task or a given type of work. Very little data on the "K" factors for learning are available and the only substantiated data found are provided in Section 5.2. The fourth factor is an error or variability factor that accounts for the difference between the actual time taken and the predicted time.

Normal time, synthesized from the predetermined standards of Section 7.0, is thus related to actual time taken in the field by the expression:

$$AT(t) = N \left(K(PF\&D) + \left(K(S) \times K(L) \right) - 1 + K(e) \right)$$

Where:

AT(t) = Actual time after t hours or units of repetition

N = Normal time

K(PF&D) = Personal, Fatigue, and Delay factor from Section 5.1

K(S) = Skill factor from Section 5.2

K(L) = Learning factor from Section 5.3 after t hours or units of repetition

K(e) = Error or variability factor for the difference between actual and predicted time for an operation. Note that K(e) is a function of sample size.

The accuracy possible with the prediction of mechanical maintenance times by means of elemental standard data is shown in Figure 5.0-1.

Perfect correlation between predicted and demonstrated times fall on a 45-deg line (for equal times on each axis). Problem equipment that fails to meet the standard time is also readily observed.

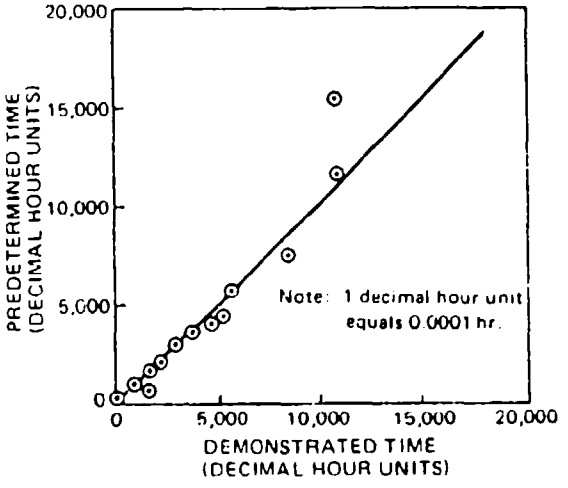


Figure 5.0-1: LRU Removal and Replacement - All Systems

Similar results should be possible with the data provided in Section 7.0 for the maintenance of electronics.

5.1 Personal, Fatigue, and Delay Factors

The remainder of this section has been abstracted from Appendix II of Reference 5-1.

PERSONAL, FATIGUE AND DELAY (PF&D) ALLOWANCES

General

Personal, Fatigue, and Delay (PF&D) is the time allowed a worker to compensate for attending to personal needs, for fatigue, and for delay occurring due to conditions beyond his control. This time is additive to the normal time required to accomplish a job. The inclusion of this allowance is common practice in the development of a labor standard. Present practices for computing PF&D have resulted in varied interpretation of the factors being considered and the use of different techniques to establish them. Variances in application range from an allowance for each element within a standard to the adoption of a fixed or blanket allowance for all standards in an organization or activity. As a result of these different practices, standards for identical work are inconsistent and result in different measurement criteria for identical jobs or functions and incomparable data at the summary levels. In order to minimize these variances, it is necessary to establish a standardized method of computing the PF&D allowances. The guidelines for developing allowances portrayed in this appendix have been accepted and used extensively for some time throughout the Department of Defense, and are established as the standardized method.

Where appropriate, a fixed PF&D allowance based on the standardized method may be developed one time for a specific function or for groups of personnel doing similar work under similar conditions. The fixed allowance applies to all standards in the function or group and precludes the need to individually compute the allowance for each standard. In work situations where the guidelines are not applicable, the fixed allowance will be developed through work measurement techniques such as time study or work sampling.

Conditions for Consideration

The development and application of PF&D allowances requires that the various conditions under which a job is performed be examined and considered. To insure that all conditions are considered, separate factors are provided for each of the three areas; Personal, Fatigue, and Delay. Analysts/technicians must be completely objective in establishing the allowances which correctly reflect the true situations inherent to the job.

Allowances for Personal Time

Consider the surroundings, working conditions, and job requirements which cause the employee to stop work from time to time to attend to necessary personal needs, (go to restroom, get a drink of water, get fresh air, etc). Since most operations allow two breaks of 10 minutes each during the 480-minute shift, the basic allowance for

this factor will be 4.2 percent (20.0 minutes). If facilities layout or management policy dictate that longer break periods are required, it will be necessary to recompute the percentage for the Basic allowance subject to approval of higher authority.

	Percent
Basic Allowance	4.2
Add:	
a. Normal office conditions	0
b. Normal shop, central heat, slightly dirty or greasy	1
c. Slightly disagreeable conditions. Exposed to inclement weather part of time, poor heating, or poor cooling.	3
d. Exposed to extremely disagreeable conditions most of time. Proximity to hot objects, continuous exposure to disagreeable odors and fumes, or to excessive temperature ranges.	6

Add the following where applicable:

a. Where time is allowed by management at the beginning of the shift to make ready and/or at the end of the shift to get/put away tools and equipment, clean up work area, or to don/remove special work clothing (aprons, smocks, etc.) allowances are as follows:

TOTAL MINUTES ALLOWED FOR PREPARATION AND CLEANUP	% ALLOWANCE
5	1.0
10	2.1
15	3.1
20	4.2

NOTE: In "super-clean" room conditions, use (b) below to supplement these allowances.

b. Adjunctive allowance - allowed for work performed in "super" clean rooms. Required when operators must utilize special clothing, which includes caps, boots, etc., and remove it when leaving work area. This includes time to invest or divest special clothing at beginning and ending of shift, at lunch, and for personal requirements. 4.0

c. Where the work period is 8 consecutive hours and 20 minutes lunch period is allowed at the expense of the Government. 4.2

Allowances for Fatigue

Physical: Consider the average weight handled per man and only those elements of time that the man is under load to determine percentage (total time for under load elements divided by base time and use the closest percentage on the chart). Also, consider the height that load must be manually lifted (average situation).

a. Weight Allowances. The percent allowances given below are based on the effective net weight being handled in the area between knees and chest. Chart also applies to laying weight on floor or low skid, or to sliding or rolling objects along a plane.

Effective Net Weight Handled	Percent of time under load				
	1-12	13-25	26-50	51-75	76-100
1-10	0	1	2	3	4
11-20	1	3	5	7	10
21-30	2	4	9	13	17
31-40	3	6	13	19	25
41-50	5	9	17	25	34
51-60	6	11	22	x	x
61-70	7	14	28	x	x
71-80	8	17	34	x	x

x - Study individual job for improvement considering job enlargement, mechanical aids, worker rotation or other stress relieving aids.

Table values will be multiplied by the following factors as dictated by conditions:

For picking up load from floor, multiply basic allowance by	1.10
For placing load above chest-height, multiply basic allowance by	1.20
For getting load from above chest-height, multiply basic allowance by	0.50

The application of the factors from this table in the computation formula on page 37 will normally provide a realistic PF&D allowance. However, in some instances the use of these factors results in an unrealistic, zero or negative denominator in the formula. When this occurs, assuming all factors are defined correctly, it will be necessary to combine related elements or standards into higher levels until a realistic allowance is obtained. "Realistic" is defined as an allowance acceptable to the worker, the supervisor, and the analyst.

b. To determine the effective net weight for sliding or rolling objects the weight must be multiplied by following coefficients of friction:

Coefficients of Friction (Average Values)

Surface	Friction Coefficient
Wood on Wood	0.4
Wood on Metal	0.4
Metal on Metal	0.3

Example: Worker sliding a 40 lb. casting from metal conveyor to wood work bench. ENW = 40 lbs. x .4 = 16 lbs.

Position: Consider the position which the employees must assume to perform the operation. Select the class which best describes the average condition. It is assumed that the job will be less tiresome if the position can be varied frequently.

Class	Percent
a. Sitting or standing	0
b. Sitting	1
c. Walking	1
d. Standing	2
e. Climbing or descending ramps, stairs or ladder	4
f. Working in close, cramped position	7

Mental: Consider the degree of concentration necessary to perform the job and the amount of variety in the tasks. Highly repetitive jobs should be low in this factor.

Class	Percent
a. Work largely committed to habit; simple calculations on paper, reading easily understood material such as routine or familiar instructions, counting and recording, simple inspection requiring attention but little discretion, arranging papers by letter or number.	0
b. Work requires full attention; copying numbers, addresses or instructions, memory of part number, name while checking stock or parts list, simple division of attention between work at hand and jobs of others, conveyor or time schedule, simple calculations in head, filing papers by subject of familiar nature.	2
c. Work requires concentrated attention; reading of nonroutine instructions, routine calculations on paper such as long division and four-place multiplication, checking numbers, parts, papers, etc.,	

requiring cross check or double check, division of attention between three components such as accounting, inspecting, and grading or driving over unfamiliar route, watching vehicle, traffic and route signs. 4

d. Work requires deep concentration; swift mental calculations or calculations on paper, memorizing, inspection work requiring interpretation and discretion of unfamiliar nature, as when working against nonroutine specifications, highly divided attention between phases of work, operations of others, hazards, etc. 8

Lighting: Consider the amount of light on the working surface in relation to the fineness of details upon which the operator works. Consider the amount of glare on the work surface and rapid changing or "hypnotic" effect on the work surface.

Class	Percent
Continual glare on work areas - Work requiring constant change in light on work area. Less than 75 foot candle power on work surface for normal job. Less than 125 foot candle power on work surface for close work.	2

Noise Factor: Consider the general noise of the work areas as well as any annoying, sharp, staccato, or intermittent noises occurring during more than 50% of the work day. If ear plugs or ear muffs are worn, their sound deadening effect must be considered when using this allowance.

Class	Percent
a. Constant, rather loud noises such as in machine shops, motor test shops, etc. (over 60 decibels)	1
b. Average constant noise level but with loud, sharp, intermittent, or staccato noise such as nearby riveters, punch presses, etc. (Example: sheet metal shop).	2

Monotony: Consider the fatigue resulting from fast, highly repetitive operations. The cycle is the time elapsed from starting one element until the same element is started again.

Cycle Time	Percent
a. 0.00-0.20 minutes	4
b. 0.21-0.40 minutes	3
c. 0.41-0.80 minutes	2
d. 0.81-2.50 minutes	1
e. 2.51 minutes or more	0

Restrictive Safety Devices and Clothing: Consider those devices which are required by the job and which cause fatigue when worn. No allowance should be made here unless it is necessary to remove the device occasionally for relief, or if wearing them causes fatigue. If more than one device is required, add the allowances.

Class	Percent
a. Face shield	2
b. Rubber boots	2
c. Goggles or welding mask	3
d. Tight, heavy protective clothing	4
e. Filter mask	5
f. Safety glasses	0

Allowances for Delay

Consider the job in relation to adjacent jobs--how long can any adjacent job be shut down before the job being studied is affected? Also, consider other delays inherent in the job, such as supervisory interruptions, moving from one work station to another, waiting for cranes, etc. No delays which can be preventad by the employee should be considered here.

Basic Allowance

Class	Percent
a. Isolated job. Little coordination with adjacent jobs	1
b. Fairly close coordination with adjacent jobs	2

Balancing Delay. Where employees are required to move from one work station to another to balance adjacent stations, add the following:

a. Move once each 5 minutes	5
b. Move once each 30 minutes	3
c. Move once each 60 minutes	2
d. Move once each 2 hours	0

5.2. Skill Level Allowance

In order to predict labor requirements, the normal time, synthesized from the data in Section 7.0 can be multiplied by K(S), where K(S) is obtained from Table 5.2-1, adapted from Reference 5-2.

TABLE 5.2-1: SKILL LEVEL FACTORS, K(S)

K(S)	DESCRIPTION
2.00	Very slow; clumsy, fumbling movements; operator appears half asleep, with no interest in the job.
1.50	Steady, deliberate, unhurried performance, as of a worker not on piecework but under proper supervision; looks slow, but time is not being intentionally wasted while under observation.
1.00 (Standard Rating)	Brisk, businesslike performance, as of an average qualified worker on piecework; necessary standard of quality and accuracy achieved with confidence.
0.80	Very fast; operator exhibits a high degree of assurance, dexterity, and coordination of movement, well above that of an average trained worker.
0.67	Exceptionally fast, requires intense effort and concentration, and is unlikely to be kept up for long period; a "virtuoso" performance only achieved by a few outstanding workers.

The factors in Table 5.2-1 are not a function of the number of times a specific task has been performed, but represent the range of variability in

workers due to differences in skill. The classification does not imply that workers always remain in a given category. Skill levels can and do change over time.

5.3 Learning

The learning process for electronic maintenance technicians involves the accumulation of cognitive skills by means of repetition of a given task. The development of manual dexterity is generally a result of highly repetitive production operations and is probably not a significant factor for electronics maintenance. A review of several alternative methods for defining task time as a function of the cumulative experience of the task is provided in Reference 5-3. The time constant model advocated is of the form:

$$K(L) = \left(Y(C) + Y(f) \times (1-e^{-t/tau}) \right)^{-1}$$

$$T(t) = N \times K(L)$$

Where:

N = Normal time
K(L) = Learning-curve factor
T(t) = Expected task time after "t" hours of repetition
Y(c) = Output index for time t = 0
Y(c) + Y(f) = Output index for time t = infinity
tau = Learning time constant

Data presented by Towill and Bevis, Reference 5-4, for eight trainees performing electronic assembly, yield values of:

Y(c) = 33.6%
Y(f) = 66.4%
tau = 3045 units x 4.14 minutes/unit
= 210 hours

Example:

Normal time for assembling an electronic unit is 0.2 hr. Determination of the expected time for an average trainee who has removed five units is obtained as follows:

$$N = 0.2$$
$$Y(c) = 0.336$$
$$Y(f) = 0.664$$
$$tau = 210$$
$$t = 0.2 \times 5 \text{ hours}$$
$$K(L) = (.336 + .664\ (1 - e^{-1/210}))^{-1}$$
$$= (.336 + .664\ (1 - .99525))^{-1}$$
$$= (.336 + .003)^{-1}$$
$$= 2.95$$

The expected task time for the fifth unit (t = 1 hour) is thus given by:

$$T(t) = N \times K(L)$$
$$= 0.2 \times 2.95$$
$$= 0.59 \text{ hours}$$

5.4 Chemical Warfare Ensemble

At elevated temperatures, heat stress becomes the overriding factor. Table 5.4-1 (Reference 5-5) provides both the maximum time and the recommended work and rest cycle times for elevated temperatures, and should be used to supplement PF&D allowances for normal ambient temperatures.

TABLE 5.4-1: SAFETY ALLOWANCES FOR CHEMICAL WARFARE ENSEMBLE

WARNING: THIS TABLE IS INTENDED AS A GUIDE ONLY. IF SIGNIFICANT HEAT STRESS OCCURS USING THIS GUIDANCE, SUPERVISORS SHOULD CONSULT WITH LOCAL MEDICAL SERVICE PERSONNEL.

GROUND SUPPORT ENSEMBLE

MAXIMUM TIME (MINUTES) WITH MINIMUM HEAT STRESS EFFECT
AIR TEMPERATURE RANGES (F)

ENSEMBLE CONFIGURATIONS	WORKLOAD	LESS THAN 70	70-79	80-89	90*
CHARCOAL OVERGARMENT OVER FATIGUE WITH PROTECTIVE MASK, HOOD GLOVES, AND BOOTS.	LOW	XXX	XXX	160	80
	MODERATE	200	115	65	40
	HEAVY	60	50	40	30
FATIGUES WITH PROTECTIVE MASK, HOOD AND GLOVES.	LOW	XXX	XXX	XXX	120
	MODERATE	XXX	XXX	120	65
	HEAVY	300	170	65	45

*FOR TEMPERATURE IN EXCESS OF 90, WORKTIME WILL BE SEVERELY LIMITED.

SUPERVISOR INFORMATION

WORK/REST CYCLE TIME (MINUTES) WITH MINIMAL HEAT STRESS EFFECTS
AIR TEMPERATURE RANGES (F)

ENSEMBLE CONFIGURATIONS	WORKLOAD	LESS THAN 70	70-79	80-89	90*
CHARCOAL OVERGARMENT OVER FATIGUES WITH PROTECTIVE MASK, HOOD, GLOVES, AND BOOTS.	LOW	XXX	XXX	40/30	20/50
	MODERATE	40/20	30/25	20/40	10/60
	HEAVY	20/25	15/30	10/50	5/70
FATIGUE WITH PROTECTIVE MASK, HOOD, AND GLOVES.	LOW	XXX	XXX	XXX	50/50
	MODERATE	XXX	XXX	50/35	30/60
	HEAVY	60/30	45/30	20/30	15/45

* FOR TEMPERATURE IN EXCESS OF 90, WORKTIME REQUIRES REST CYCLES ARE PROHIBITIVELY RESTRICTED.

LOW WORKLOAD: ADMINISTRATIVE WORK
MODERATE WORKLOAD: MOST GROUND SUPPORT OPERATIONS.
HEAVY WORKLOAD: BOMB-LOADING, HANDLING HEAVY EQUIPMENT, CONSTRUCTION TASKS.

XXX - ANY REASONABLE WORK/REST CYCLE SHOULD PREVENT HEAT CASUALTIES.

6.0 RECOMMENDATIONS FOR FUTURE WORK

The project described in the previous sections has been one of development rather than research. Existing methods and techniques have been used to develop the time standard data presented in Section 7.0. These data are the "conclusions" of the work and as the work progressed, several areas have come to light that might warrant further investigation. Recommendations for future work have therefore been made and constitute the remainder of Section 6.0.

6.1 Classification and Coding

The data in Section 7.0 have been classified with a mnemonic coding system that, after some use, permits rapid location of data without the need to refer to an index. However, the size of the data set of standards is approaching the capacity for its mnemonic coding system. Since a large number of maintenance analyses can be created from the time standards provided, their retrieval by a code that contains mnemonic fields requires the careful design of a suitable coding system. A taxonomy of equipment characteristics or maintenance operation characteristics, or both, is an alternative to the mnemonic approach. Most importantly, the system must be unambiguous if good retrieval capability and duplication of analyses are to be achieved. The benefit of the well-designed classification and coding system might be significant if the DOD decides to build a data bank of maintenance task times for specific electronic equipment.

6.2 Learning Curves and Skill Level

The development of "K" factors based on learning was addressed in Section 5.3. However, only one set of data was found for electronics and that was for manufacturing, not for maintenance. It appears that work is required that will correlate maintenance time for a given task with factors such as:

- The number of times the worker has performed the task

- o Natural ability
- o Duration and specificity of training
- o The time between identical maintenance actions
- o Years of related experience and age

A knowledge of such factors would enable the results of maintenance task time analyses to be used for:

- o Development of life-cycle costs
- o Design trades between reliability and maintainability
- o Spares and manpower planning
- o Determination of cost optimized training and retraining schedules

It is therefore recommended that time standards be developed for some weapon system not yet in service and that data be collected to enable the above "K" factors to be calculated. Where possible, variables such as training and skill level would be changed in a manner appropriate for a statistically designed experiment.

6.3 Abnormal Environments

Alluisi and Fleishman (Reference 6-1) provided more than 200 references on temporal factors and work rest cycles associated with human performance and productivity under abnormal conditions, including some that occur under military operations. A review of these reports was outside the scope of the current contract but might yield factors relevant to planning for battle or other extenuating conditions.

No reports were found on conditions of weightlessness that apply to analysis of space station maintenance. It is probable that the times for basic body motions, on which the standards in Section 7.0 are based, are significantly different for weightless conditions. Of course there may be some factor of proportionality for the same body motions on the ground and in space. Consideration should therefore be given to an analysis of existing records of different astronaut's body motions on the ground and in space to determine the "K" factor for space maintenance.

6.4 Failure Mode Rates

Two problems exist in determining fault isolation times. The first problem is the lack of suitable data on failure rates by mode. The second problem is the inordinate amount of work that is required to perform an analysis of contemporary electronic systems. There appears to be no easy solution to either of these problems.

For example, Figure 6.4-1 shows a part of a fault isolation procedure for a flight management computer.

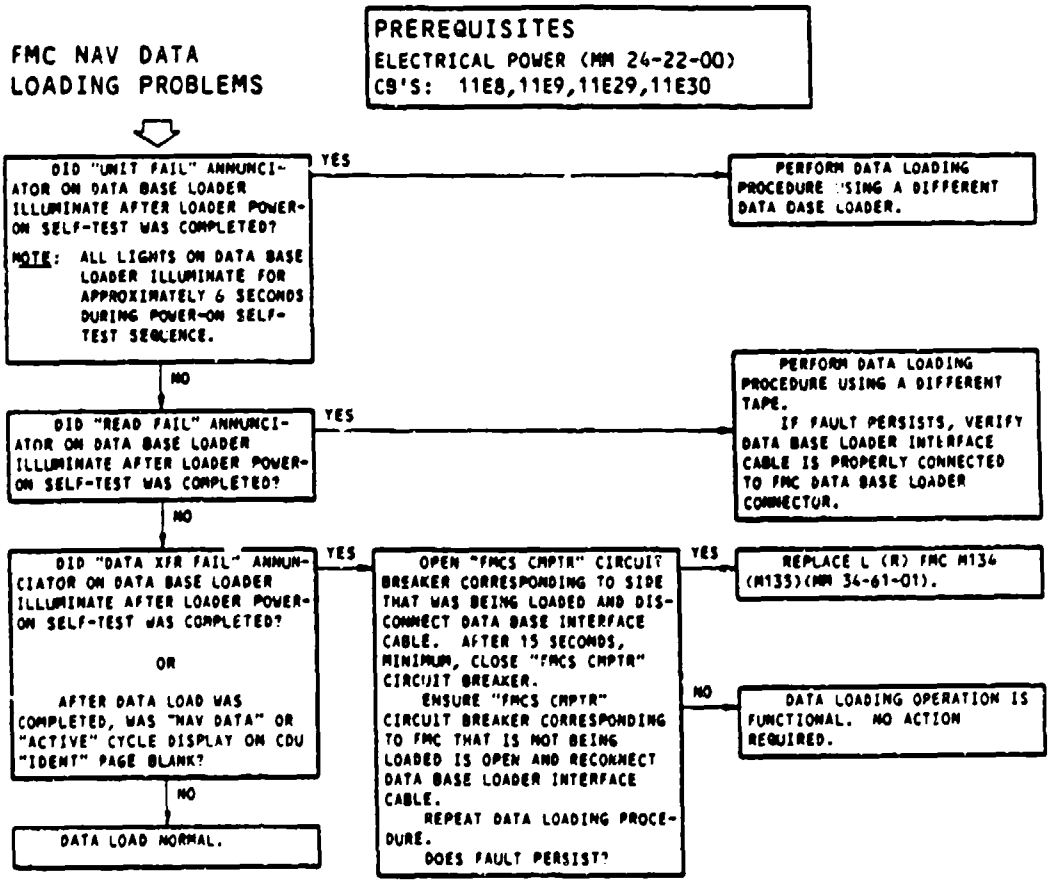


Figure 6.4-1. Fault Isolation Procedures

Times for each of the maintenance actions called for in the procedure can be determined by synthesis from the standard times in Section 7.0. However, the average time taken for fault isolation is a function of the probability of following each route through the fault isolation tree. The probability of following each route is in turn dependent on the probability of failure of the piece parts of system, on the system architecture, and in most cases on the modes of failure of the piece parts. To complete the analysis, MIL-HDBK-217 or its equivalent would have to include failure rates by mode. A computerized method of analysis might then be developed to accomplish some of the combined failure mode and effect analysis, and fault isolation time analysis. Neither of these two tasks is trivial but the payoff in terms of improved fault isolation methods could be very significant.

7.0 CODING, STANDARD DATA, AND ENVIRONMENTS

This section provides the data required by an electronic system maintenance analyst for synthesizing maintenance task times. The data consist of:

- Details of the way in which each type standard data has been classified and coded to permit easy retrieval and referencing.

- Standard data from which times for electronic systems maintenance can be synthesized.

- Standard environments that can be used to define the conditions under which maintenance is assumed to be performed.

Section 7.2, which contains the standard times, is indexed by mnemonic code for easy location. The data used to develop the standards in Section 7.2 have been deposited with the Defense Industrial Resources Supply Office, Cameron Station, Alexandria, Virginia 22314.

7.1 Coding of Elemental Standards

Each elemental standard time is uniquely identified by a seven character code that is placed in the upper corner of the data sheet.

ETP-SE-K1 TIN WIRE

TIN

FIRST	TMU	ADDITIONAL	TMU
I1	595	X1	482

Tin First

Begins with reaching to soldering iron. Includes cleaning tip, positioning iron in holder, getting wire or solder, tinning wire or terminal. Ends with asiding wire or solder and soldering iron.

Tin Additional

Begins with cleaning tip. Includes getting wire or solder. Ends with tinning wire or terminal.

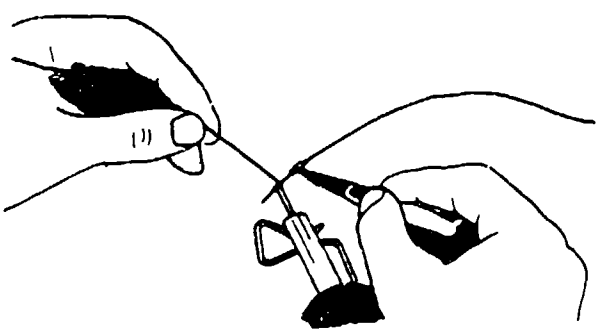


Figure 7.1-1 Mnemonic Classification Code

The code is mnemonic and is divided into three fields, the first of which is subdivided. The first character splits the data in two parts, and is either an "E" for electrical and electronic or an "O" for other. ("Other" contains the nonelectronic standards required to access or remove and replace equipment.)

The second and third characters describe the work category. Figure 7.1.1 has a "TP" for a "Tool, Powered" obtained from Table 7.1-1.

The fourth and fifth characters are qualifiers. For example, the SE of ETP-SE stands for "Solder, Electric" obtained from Table 7.1-2.

obtained from the body of the data sheet.

The sixth character, obtained from the body of the data sheet, identifies the following attributes:

R remove first piece
I install first piece
Y remove additional piece
X install additional piece
D* first piece, different than remove or install
Z additional piece, different from remove or install

* An "0" is also used in standards other than electronic.

The seventh character, obtained from the body of the data sheet, is either a number referring to a special case or an

A or F for Very Easy
B or G for Easy
C or H for Moderate
D or I for Difficult
E or J for Very Difficult

TABLE 7.1-1: WORK CATEGORY CODES (2ND AND 3RD DIGIT)

Major actions being performed, or the type of equipment involved:

AC	Actuate
BM	Body Motion
CA	Calibrate
CL	Clea.
CP	Clamp
EL	Elemental
IT	Inspect
JP	Job Preparation/Termination
MH	Material Handling
NF	Nonthreaded Fastening
OH	Object Handling
PK	Package
PT	Process Time
RD	Read
ST	Surface Treat
TF	Threaded Fastner
TL	Tool Use, Hand
TP	Tool, Powered
WH	Wire Handling
WR	Write

TABLE 7.1-2: WORK QUALIFIER CODES (4TH AND 5TH DIGIT)

AC	Access
BB	Black Box
BF	Bolt, Finger
BL	Bundle Lace
BM	Bolt, Manual
BP	Bolt, Power
BS	Bond or Seal
BT	Bundle, Tie
CA	Coat, Aerosol
CB	Connector, Bayonet
CC	Cord, Coil and Uncoil
CD	Climb or Descend
CE	Connector Electrical
CF	Cap or Connector, Friction
CH	Camloc, High-Stress
CL	Clock
CM	Control, Manual
CP	Cord, Plug
CS	Cap, Screw
CT	Cable Tie
DE	Disengage
DR	Drawer
DS	Desolder
EO	Envelope, Open
ER	Eyelet, Replace
ET	Estimate
EV	Examine, Visual
FT	Fasten
FX	Flux
GS	Glasses, Safety
HC	Hand, Clean
HS	Hand, Simple
HT	Hold, Temporary
IH	Insulation, Heat
IS	Insulation, Strip
LA	Lay Aside
LP	Latch, Pressure
MA	Manual
MY	Magnify
NT	Number Transfer
OB	Object
OD	Other Data
OF	Obtain File
OP	Obtain Part
PA	Protective Apparel
PC	Printed Circuit
PD	Pliers Diagonal
PN	Pin
PO	Position
PT	Prose Transfer
RS	Repeat Sequence
RT	Ring, Tru-Arc
SA	Safety
SC	Safety, Continuous
SE	Solder, Electric
SM	Screw, Manual
SP	Screw, Power
SR	Snap Ring
ST	Safety, Twisted
TA	Test, Automatic

Continued on page 58

TH Test, Hand

TM Technical Manual

TR Tag, Routing

TS Time Study

VA Vise, Adjust

VS Video Tape Standard

WC Wire Crimp

WO Walk Obstructed

WL Wire Lock

WT Wrench, Torque

WW Wire Wrap

7.2 Elemental Standard Data

The standard data are divided into two data sets. The first set, prefaced by an "E" code, covers the work elements that apply to electronic equipment repair only. The second data set covers the other work elements, prefaced by an "O", consisting of elements that apply to other areas of maintenance.

The data are arranged in alphabetical order of mnemonic code.

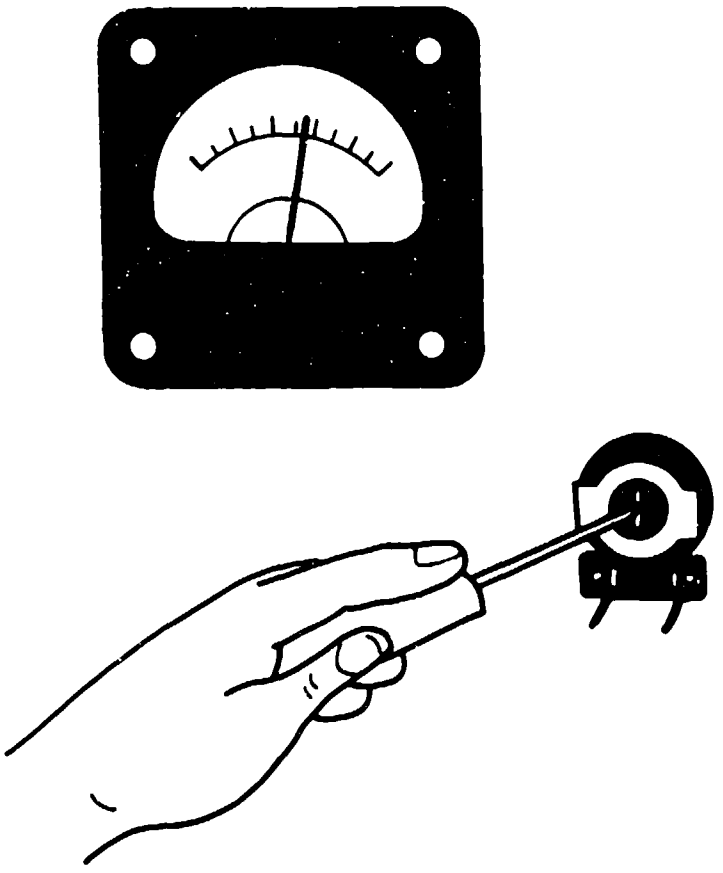
FIRST	TMU	ADDITIONAL	TMU
01	1200	Z1	670

First

Begins with reaching to tool. Includes locating adjust point, making adjustment, checking reading. Ends with asiding tool.

Additional

Begins with locating adjust point. Includes positioning tool. Ends with making adjustment.



FIRST	TMU
D1	7950
D2	4790

First (D1) (Used With 50-ohm cable)

Begins with setting controls on the Time Domain Reflectometer (TDR) tester. Includes adjusting TDR controls, removing dust caps from TDR and precision cable, connecting the precision cable to the TDR, calibrating TDR and adjusting CRT to obtain zero index with 50-ohm precision cable. Concludes (after test) with removing 50-ohm cable, stowing cable, and replacing dust caps.

First (D2) (Used With Other Than 50-ohm Cable)

Begins after setting-up tester for 50-ohm cable test. Includes getting appropriate impedance-matching adapter, removing dust caps, connecting adapter to 50-ohm precision cable, and adjusting controls to obtain zero index. Concludes (after test) with removing adapter cable, replacing dust caps, and stowing the adapter.

Remarks

Use with EIT-TA-D1, Coax Cable Test.

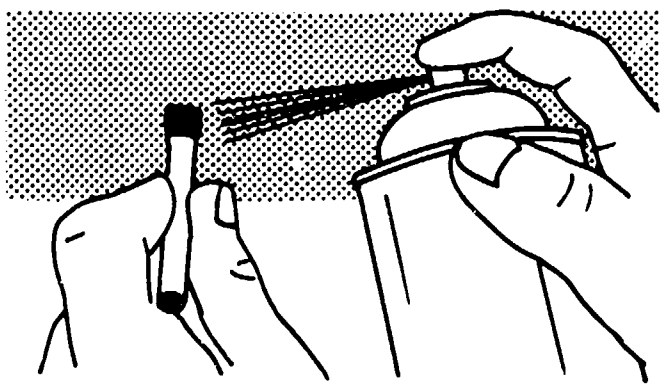
FIRST	TMU	ADDITIONAL	TMU
D1	229	Z1	84

First (Up to 3-in. stroke)

Begins with reaching to cleaning fluid. Includes removing and asiding cap, getting brush, wetting brush, cleaning flux from connection, asiding brush. Ends with getting and installing cap.

Additional (Up to 3-in. stroke)

Begins with wetting brush. Ends with cleaning flux from connector.



REMOVE

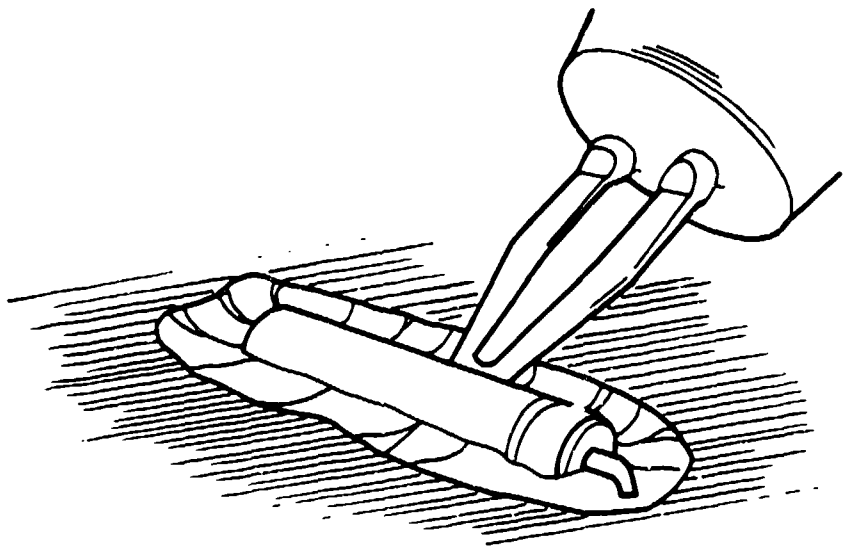
FIRST	TMU	ADDITIONAL	TMU
R1	471	Y1	308

Remove First

Begins with reaching to printed circuit board. Includes positioning board, getting heated tool, loosening conformal coating from terminal, asiding tool, getting vacuum, cleaning surface, releasing board. Ends with asiding vacuum.

Remove Additional

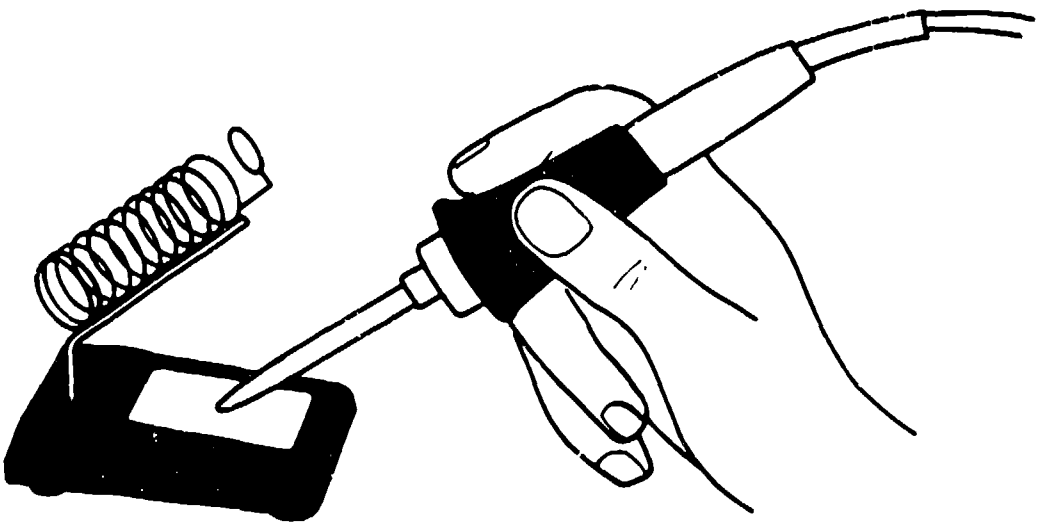
Begins with applying heated tool to terminal. Includes loosening conformal coating from terminal. Ends with cleaning additional area.



FIRST	TMU
D1	38

First

Beings with positioning iron to sponge. Includes wiping tip, regrasping iron, positioning iron back to sponge. Ends with wiping tip on other side.



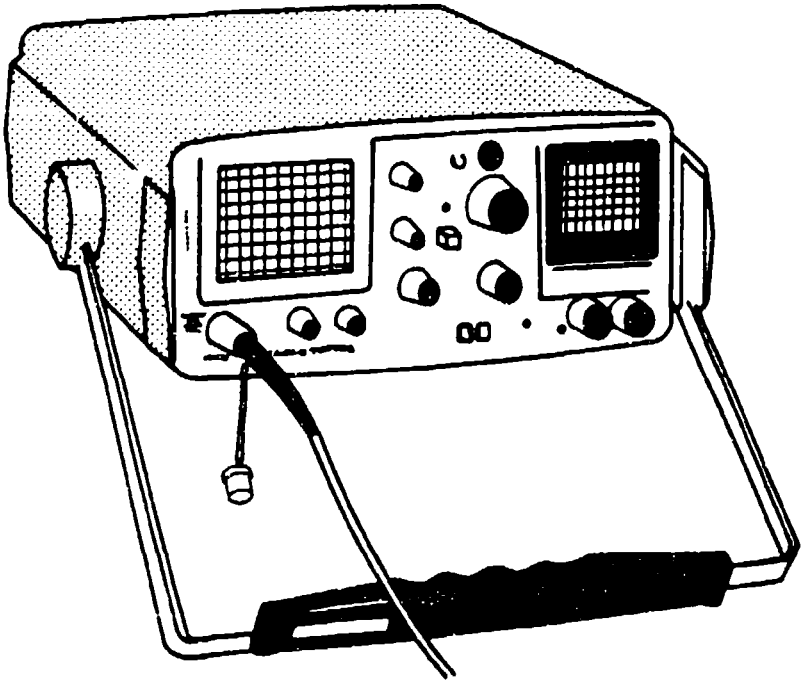
FIRST	TMU
01	2704

First

Begins with connecting the cable to be tested to adapter. Includes setting feet/division scale on TDR, checking zero adjustment, adjusting zero reference, adjusting distance dial to set pulse of graticule line, making final adjustments, actuating test switch, reading fault location indicator. Ends with disconnecting cable tested.

Remarks

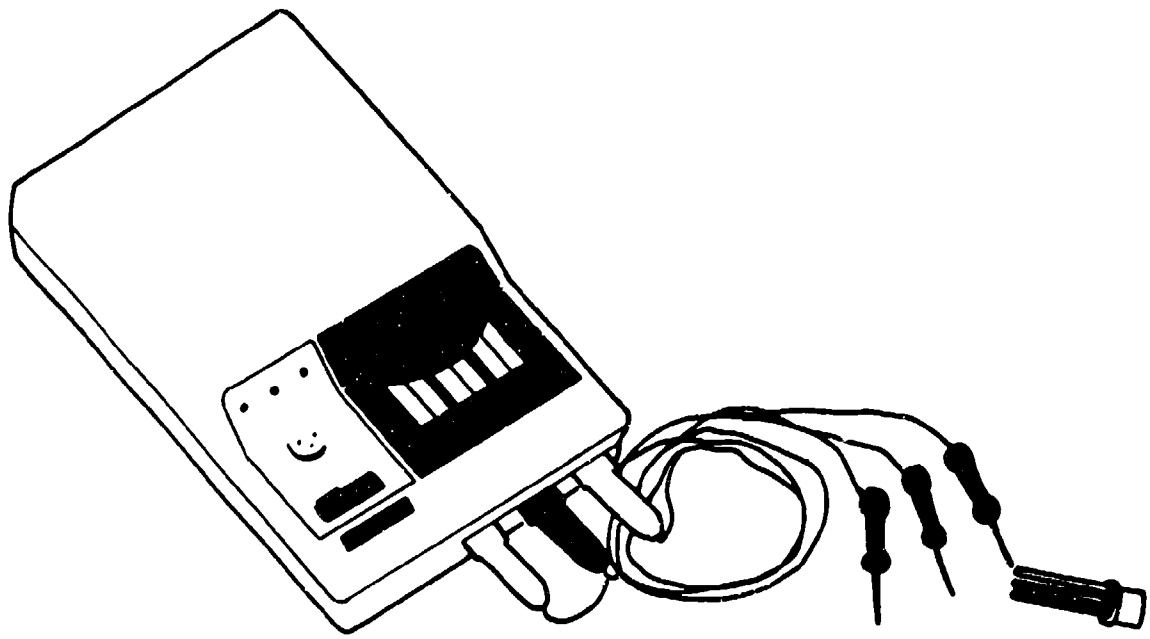
Use with ECA-TA-01/02 Time Domain Reflectometer calibration.



FIRST	TMU
D2	630

First

Begins with reaching to test leads. Includes installing test leads, positioning low-drive switch, observing good/bad indication, device polarity, and base lead identification, positioning high-drive switch, observing good/bad indication, device polarity, and base lead identification, positioning switch off. Ends with disconnecting test leads.



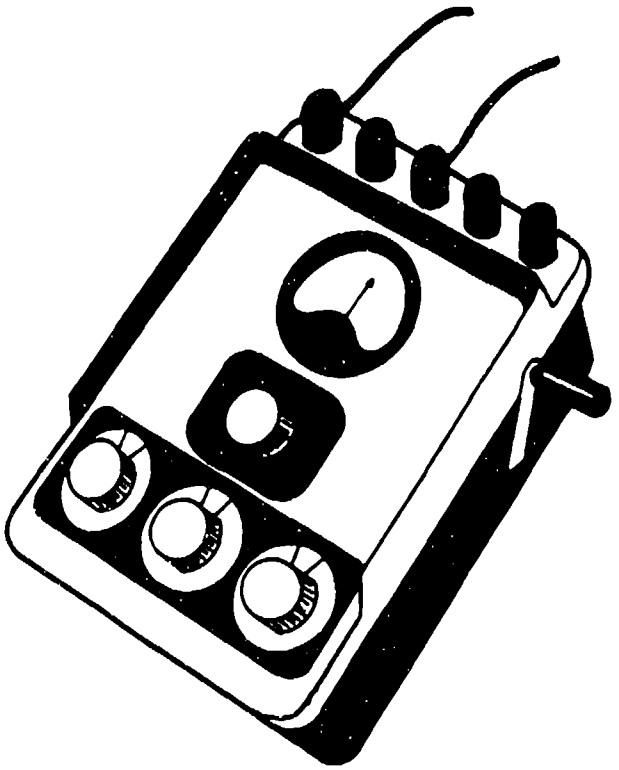
FIRST	TMU	ADDITIONAL	TMU
01	1146	Z1	776

First

Begins with getting megger, uncoiling leads. Includes installing test leads, cranking megger, checking meter indication, disconnecting and coiling test leads. Ends with asiding megger.

Additional

Begins with installing test leads, cranking megger. Ends with disconnecting test leads.



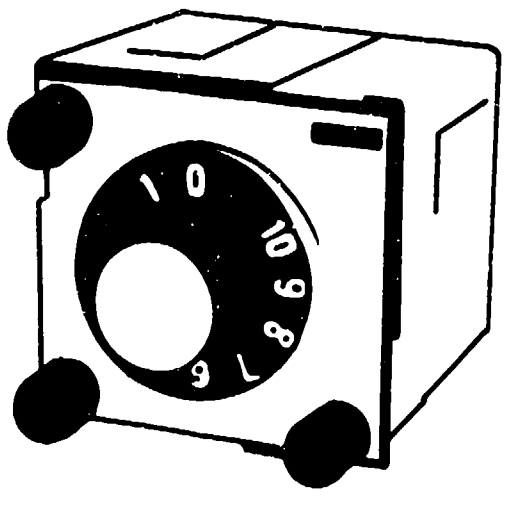
FIRST	TMU	ADDITIONAL	TMU
D2	4440	Z2	2600

First

Begins with connecting equipment. Includes loosening binding posts, positioning leads, tightening binding posts, installing and removing leads to test instrument, actuating selector switch, selecting current, setting voltage, adjusting coarse and fine controls, reading indications, adjusting decade half scale, turning down coarse and fine controls, adjusting decade, presetting voltage, adjusting coarse and fine controls, comparing readings, turning coarse and fine controls down, decade to zero, selector down. Ends with disconnecting equipment.

Additional

Begins with turning selector to current. Includes selecting voltage, adjusting coarse and fine controls, comparing indications, adjusting decade half scale, turning down coarse and fine control, presetting voltage selector to proper range, adjusting coarse and fine controls, comparing readings. Turning fine and coarse controls down, decade back to zero and selector down.



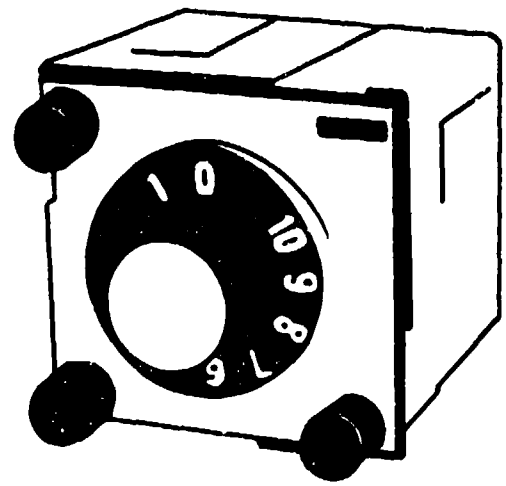
FIRST	TMU	ADDITIONAL	TMU
D3	3040	Z3	990

First

Begins with connecting equipment. Includes loosening binding posts, positioning leads, tightening binding posts, installing and removing leads to test instrument, selecting "ohms", verifying decade is set at zero, turning selector to proper range, adjusting zero control, actuating decade switch as required to obtain resistance reading, returning decade to zero. Ends with equipment disconnect which includes loosening binding posts, removing test leads, and tightening binding posts.

Additional

Begins with turning selector to proper range. Includes adjusting zero control, actuating the decade switch as required to obtain resistance reading. Ends with returning decade to zero.



FIRST	TMU
04	1420

First

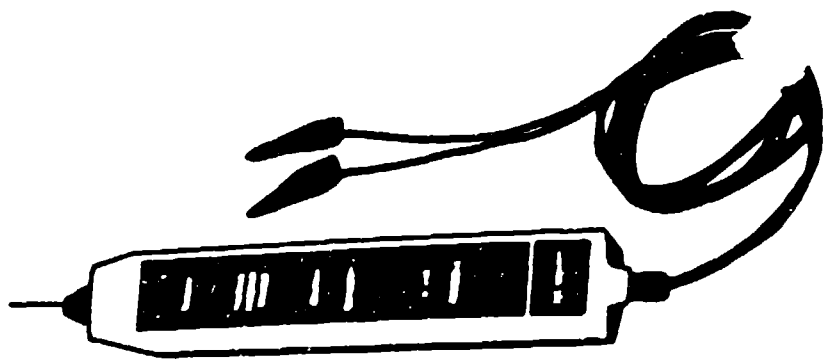
Begins with reaching to test leads. Includes positioning leads on test points, positioning ratio arm dial, actuating BA and GA switches, adjusting measuring arm dial, reading dials, removing and asiding test leads.

Remarks: Wheatstone bridge on a test bench ready for use.

FIRST	TMU
D5	520

First

Begins with reaching to probe. Includes connecting probe leads, actuating logic family switch or logic pulser switch, positioning probe to test point, observing indicator light. Ends with disconnecting leads and asiding probe.



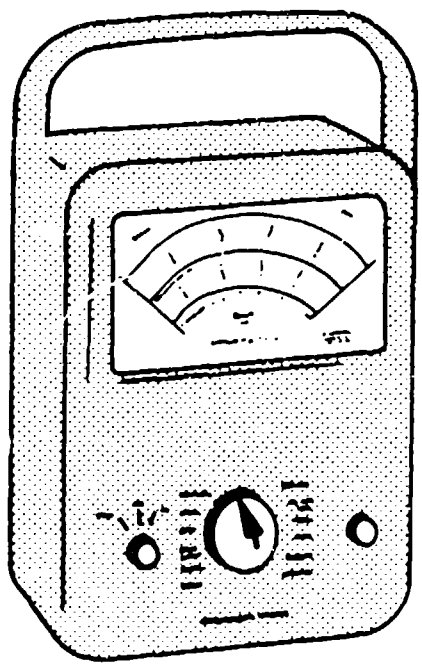
FIRST	TMU	ADDITIONAL	TMU
D6	926	Z6	296

First

Begins with reaching to volt/ohm meter. Includes positioning test leads in meter, selecting scale, zeroing meter, positioning probes to test points, reading meter indication, disengaging probes and leads. Ends with asiding meter.

Additional

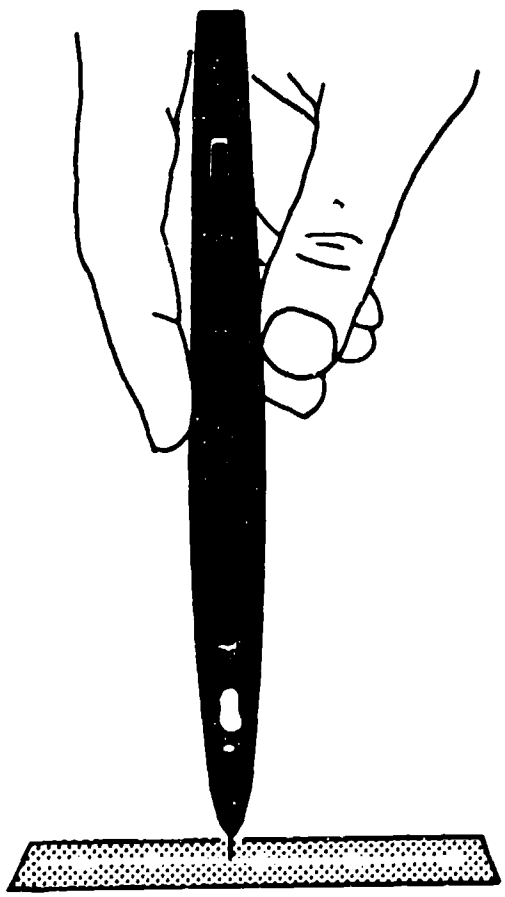
Begins with probes in hand, includes occasional resetting of meter scale, positioning probes to test points, reading meter indication.



FIRST	TMU
D7	640

First

Begins with reaching to current tracer. Includes positioning tracer probe, adjusting light sensitivity and observ indication. Ends with asiding probe.



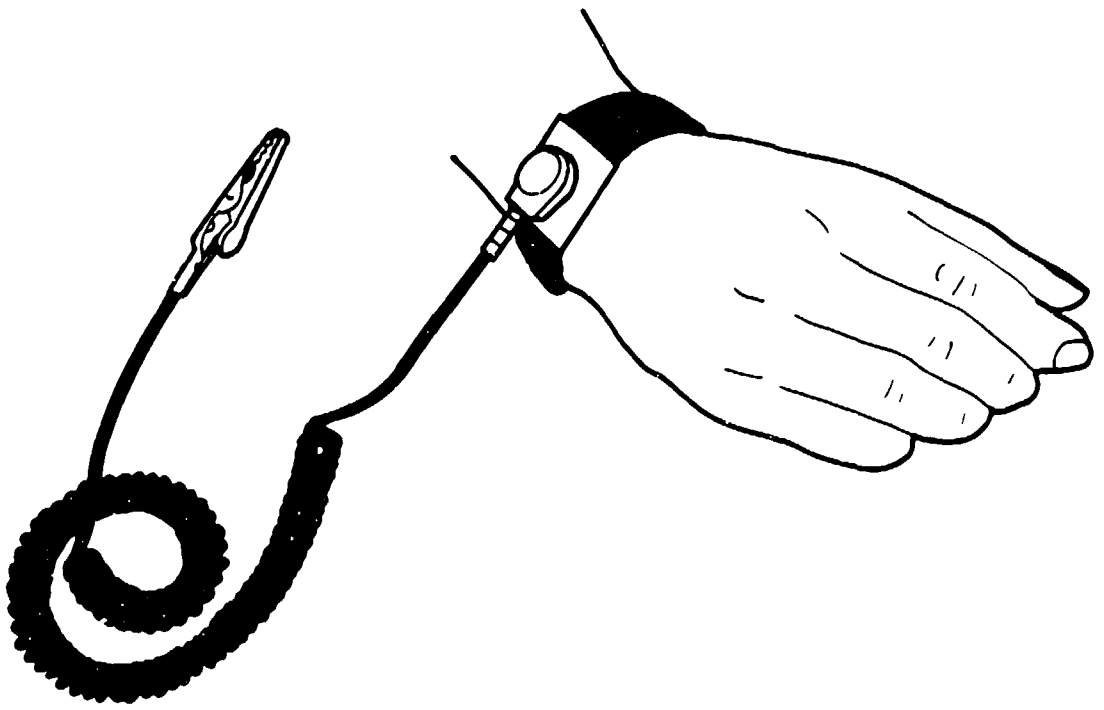
REMOVE		INSTALL	
FIRST	TMU	FIRST	TMU
R1	77	I1	104

Install

Begins with reaching to strap and ground cord. Includes all motions for installing strap to body and attaching ground cord to reliable ground.

Remove

Begins with reaching to ground cord and strap. Includes all motions for disengaging ground cord and strap. Ends with laying aside ground cord and strap.



FIRST	TMU
D1	700

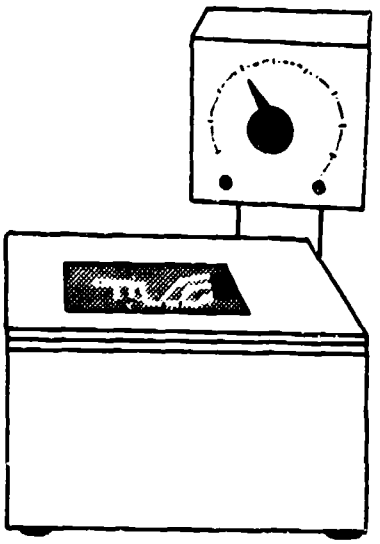
Preheating Printed Circuit Board

Begins with getting PCB and positioning it on heater. Includes adjusting heater temperature, turning heater on, allowing board to heat, turning heater off, and ends with removing board from heater.

Remarks

To be used when installing or removing surface mounted devices on PCB approved for preheating.

Analysis based on preheater HG3-2 manufactured by Manix, Division of Henry Mann Inc.



JOB PREPARATION	TMU	JOB TERMINATION	TMU
D1	7101	D2	3600

Job Preparation

Begins with getting and installing interface unit, including walking to and from interface unit storage, installing power cables to interface display, installing circuit board to be tested, walking to magnetic tape storage, selection of tape, walking to tape drive, installation of tape of drive unit, walking to keyboard. Ends with typing required information on keyboard.

Job Termination

Begins with hand-rewinding of magnetic tape, unlocking tape from drive unit, removing tape, walking with tape to tape storage, asiding tape, walking to printer, removing printout, walking to interface display unit, removing circuit board tested, carrying circuit board to work bench and return, removing unit from test set, carrying interface unit to storage unit. Ends with walking to work bench.

Remarks

For probe of test points, use ETL-TA-XX.

INSTALL	TMU
01	1510

Install

Begins with positioning device in holder. Includes opening door, positioning device and holder under lamp, closing door, setting timer, allowing for cure time, opening door, removing device and holder from chamber, closing door, removing device from holder. Ends with inspecting for proper cure.

Remarks

Ultraviolet lamp, 2kw, 200w per in.
Adhesive type MR-8153R, Panasonic Industrial Co.

INSTALL	TMU
D2	9570
D3	26270

Install

Begins with positioning device in holder. Includes opening oven door, positioning device and holder in oven, closing oven door, setting timer, allowing for type of adhesive, turning off oven, opening oven door, removing device and holder from oven, closing oven door, removing device from holder. Ends with inspecting adhesive for proper cure.

Remarks

Oven is preheated to 150^{o}C.

Adhesive Type:

D2: MR-8153R, Panasonic Industrial Co. or 124-1, Ablestik Labs
D3: DE-7, Epoxy Technology

CONNECTOR, ELECTRICAL, MULTIPIN BAYONET, 1/4 TO 1-1/2-in. DIA

REMOVE		INSTALL	
RA	80	IA	160
RB	130	IB	220
RC	190	IC	330
RD	280	ID	500
RE	390	IE	750

Remove

Begins with visually selecting cable-mounted connector to be removed. Includes loosening and removing bayonet-type collar and disengaging cable-mounted connector from fixed connector alone or in a group. Ends with releasing or laying aside cable-mounted connector.

Install

Begins with reaching to cable-mounted connector alone or in group. Includes reading cable number, visually selecting matching fixed connector and engaging cable-mounted connector. Ends with twisting to secure bayonet-type collar.

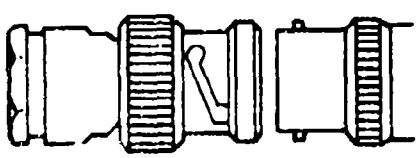
Remarks

Applies to Bendix PT-06 series connectors and similar.

Not applicable to coax connectors (OTF-CE).

Case variable factors: distance 10%, weight 5%, control 85%.

(Identical to NALC code ONF-CB-XX).



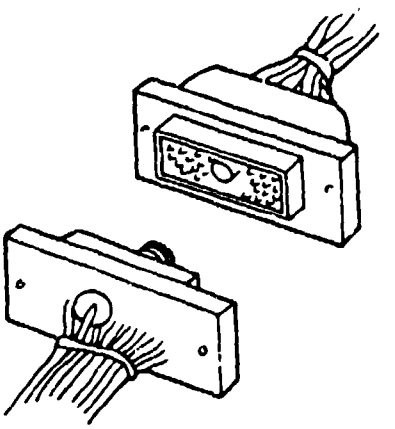
REMOVE	TMU	INSTALL	TMU
RB	2132	IB	2350
RC	3052	IC	3520
RD	4112	ID	5160

Remove

Begins with selecting cable-mounted connector to be removed. Includes reaching to tool, loosening jackscrews, disengaging connector from fixed connector. Ends with capping both fixed and loose connectors and asiding loose connector and tool.

Install

Begins with selecting cable-mounted connector to be installed. Includes removing caps from both loose and fixed connectors, positioning loose connector on fixed connector, reaching for tool and tightening jackscrews. Ends with asiding tool.



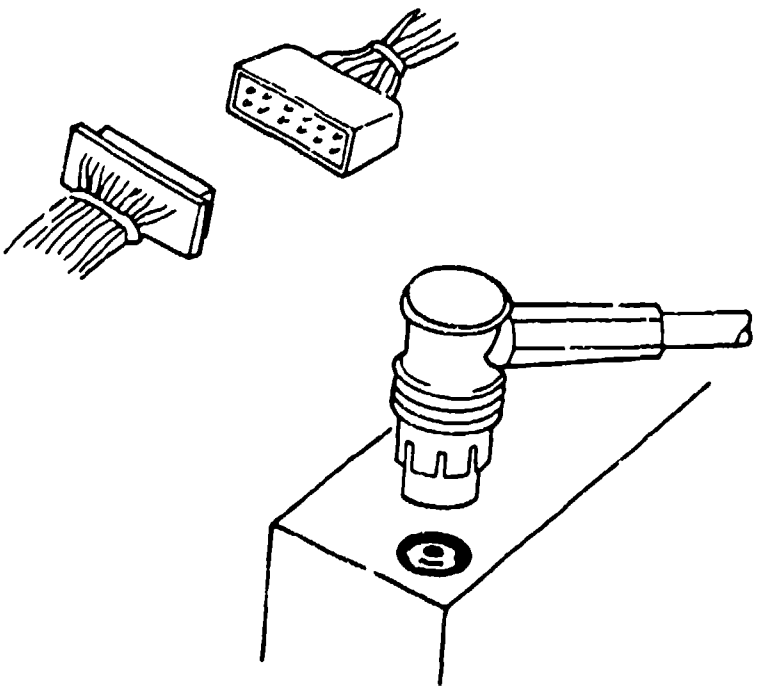
REMOVE	TMU	INSTALL	TMU
RB	312	IB	430
RC	412	IC	600
RD	592	ID	1010

Remove

Begins with visually selecting cable-mounted connector to be removed. Includes disengagement of cable-mounted connector from fixed connector. Ends with capping both loose and fixed connector and asiding loose connector.

Install

Begins with selecting cable-mounted connector to be installed. Includes removing caps from both loose and fixed connectors, positioning loose connector on fixed connector. Ends with applying pressure to mate the connectors.



REMOVE	TMU	INSTALL	TMU
R1	417	I1	2270

Remove

Begins with positioning PCB on drill press, aligning eyelet with drill, actuating handle to lower bit to eyelet, applying pressure to drill through eyelet. Ends with raising drill.

Install

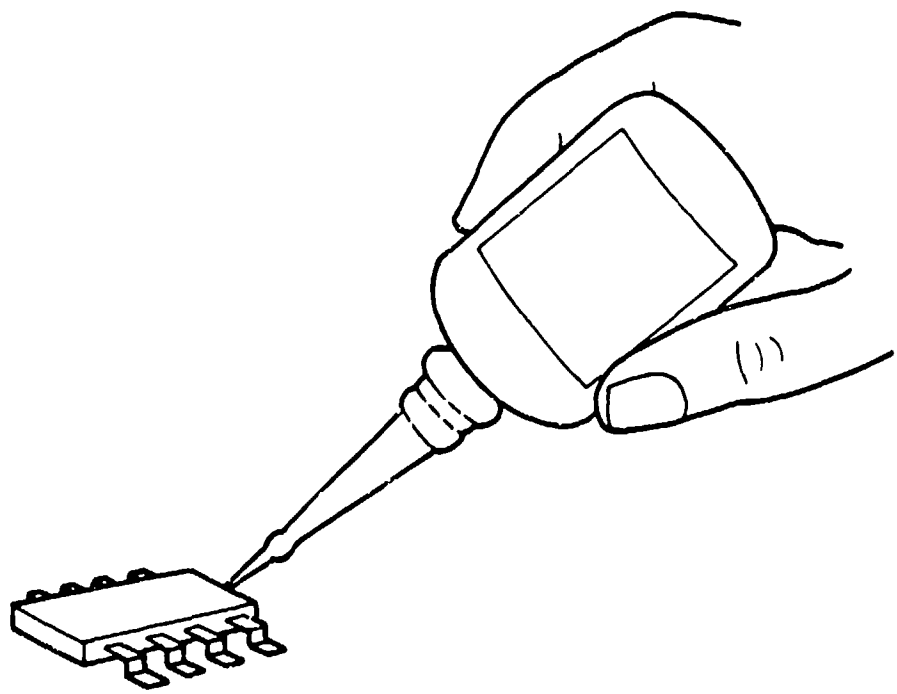
Begins with positioning PCB for work, positioning eyelet in board, moving PCB to arbor press, positioning board in press, securing eyelet by actuating press. Ends with examining installation and asiding board.

INSTALL

FIRST	TMU
I1	214

First

Begins with reaching to adhesive. Includes removing cap, applying adhesive to PCB, asiding adhesive, replacing cap, getting dual inline package (DIP) or flatpack, getting positioning tool, positioning tool to DIP or flatpack, positioning DIP or flatpack to PCB, releasing tool. Ends with asiding tool.

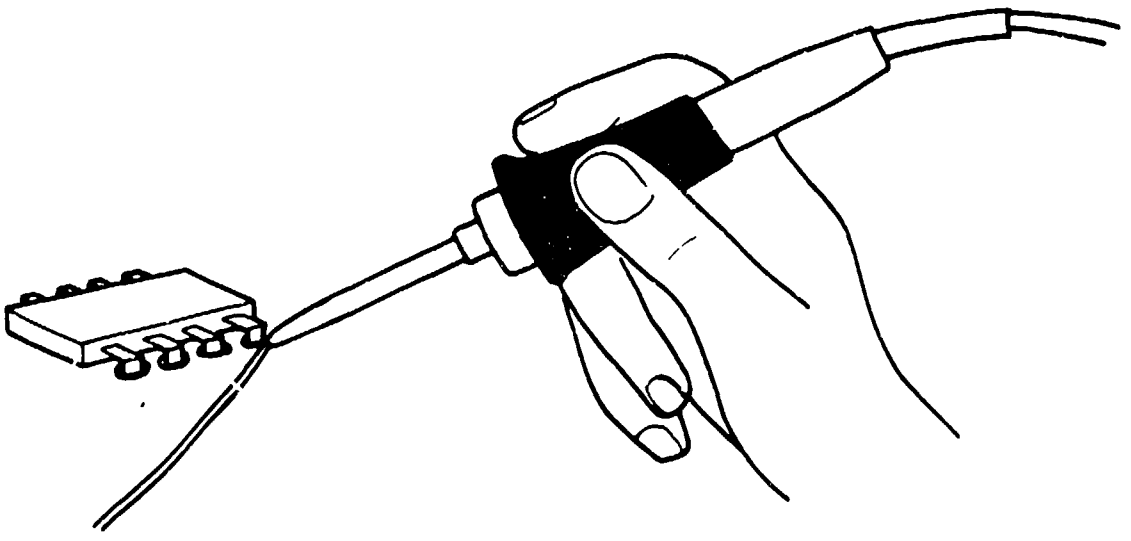


INSTALL

FIRST	TMU
I1	433

First

Begins with reaching to DIP or discrete. Includes getting positioning tool, positioning tool to DIP or discrete, positioning DIP or discrete to PCB, releasing and asiding tool, getting, applying, and asiding flux, getting and cleaning iron tip, getting solder, tacking on lead. Ends with asiding solder and iron.



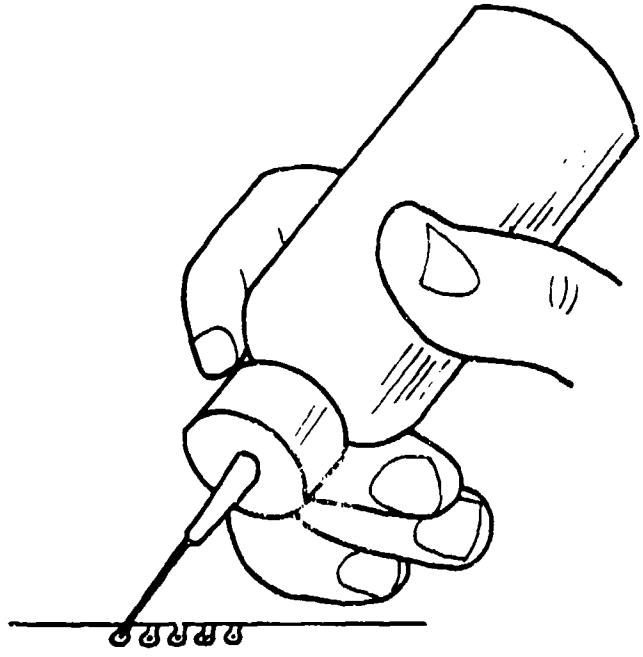
FIRST	TMU	ADDITIONAL	TMU
D1	122	Z1	40

First

Begins with reaching to open or closed flux bottle. Includes removing cap, positioning flux bottle, applying flux, replacing cap. Ends with asiding flux bottle.

Additional

Begins with positioning flux bottle. Ends with applying flux.



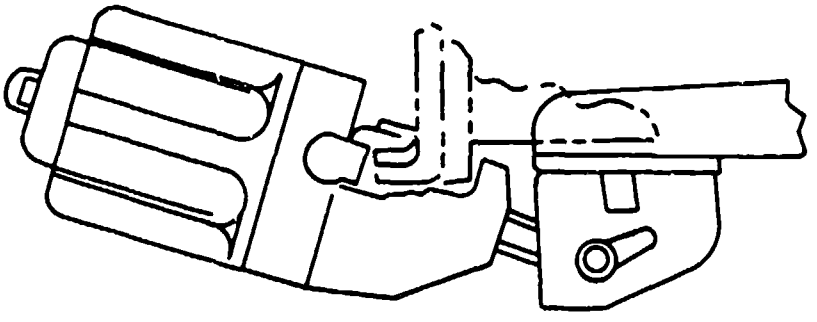
REMOVE	TMU	INSTALL	TMU
R1	497	I1	730

Remove

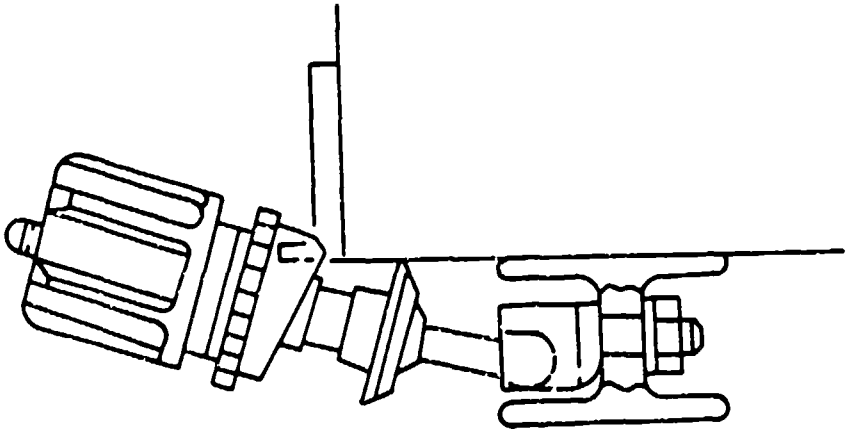
Begins with reaching to latch and releasing latch (Hollingshead), rotating knob, checking for red band and rotating keeper (Tridair). Ends with disengaging extractor.

Install

Begins with positioning the hold down/extrator, rotating the keeper (Tridair only), tightening knob, repositioning LRU, final tightening of knob. Ends with checking red band for proper exposure.



HOLLINGSHEAD



TRIDAIR

	REMOVE	TMU	INSTALL	TMU
1/4 to 1 inch				
	RA	470	IA	580
	RB	570	IB	680
	RC	710	IC	850
	RD	880	ID	1130
	RE	1080	IE	1490
1-1/16 to 1-1/4 inch				
	RF	530	IF	670
	RG	640	IG	780
	RH	830	IH	1000
	RI	1140	II	1370
	RJ	1570	IJ	1950

Remove First Piece

Begins with visually selecting cable-mounted connector to be removed. Includes loosening and removing threaded collar and disengagement of cable-mounted connector from fixed connector alone or in group. Ends with releasing or laying aside cable-mounted connector.

Install First Piece

Begins with reaching to cable-mounted connector alone or in group. Includes reading cable number, visually selecting matching fixed connector, engaging cable-mounted connector to fixed connector, starting and running down collar. Ends with final tightening of threaded collar.

Remarks

Does not include use of tools for final tightening or initial loosening of threaded collar. Does not include installation or removal of safety wire.

Applies to AN 3100, AN 3106, and similar.

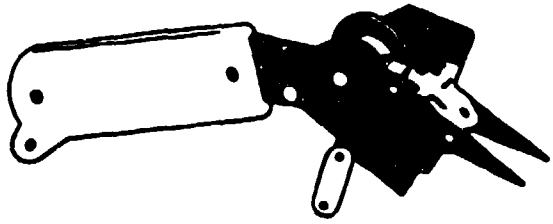
Case variable factor: distance 10%, weight 5%, control 85%.

(Identical to NALC code OTF-CE-XX).

FIRST	TMU
D1	573

First Piece

Begins with measuring PCB eyelet spacing, obtaining component, positioning component to tool and forming leads. Ends with disengaging component from tool and asiding component and tool.



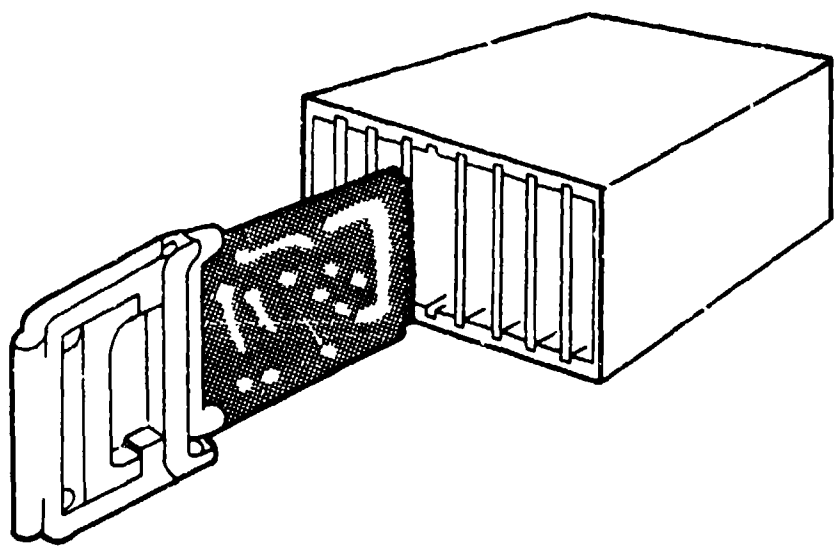
REMOVE	TMU
R1	116

Remove First Piece

Begins with reaching to PCB puller. Includes positioning puller, actuating puller, disengaging PCB, releasing puller. Ends with asiding PCB and puller.

Remarks

Use 00H-P0-XX for Install.



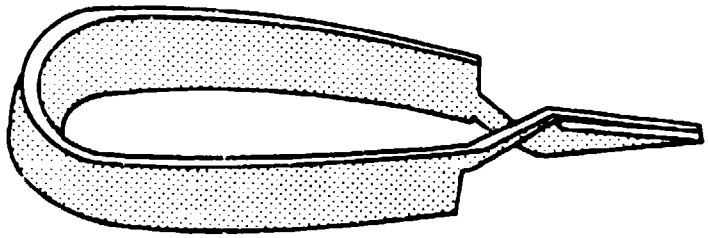
REMOVE	TMU	INSTALL	TMU
R1	79	I1	69

Install

Begins with getting heat sink. Includes opening heat sink and positioning on work object.

Remove

Begins with reaching to heat sink. Includes applying pressure to release heat sink. Ends with asiding heat sink.



FIRST	TMU	ADDITIONAL	TMU
D1	2060	Z1	830

First

Begins with walking to printer. Includes removing printout, installing a probe on interface display unit, verifying first check point from printout, locating check point on PCB, probing first test point with care. Ends with calling up test program by input to keyboard.

Additional

Starts with verifying additional test point from printout. Includes locating point on PCB, and probing.

Remarks: Use with EJP-TA-XX.

REMOVE

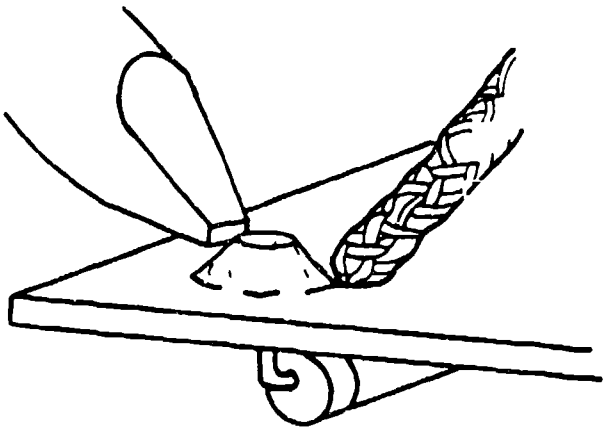
FIRST	TMU	ADDITIONAL	TMU
R1	1546	Y1	1496

Desolder First

Begins with reaching to wicking braid. Includes cutting, stripping, and forming curve in wicking braid, positioning wire to terminal, getting and cleaning soldering iron, positioning iron to terminal, wicking off excess solder. Ends with asiding iron and wicking braid.

Desolder Additional

Begins with cutting, stripping, and forming curve in wicking braid. Includes positioning wire to terminal, getting and cleaning soldering iron, positioning iron to terminal, wicking off excess solder. Ends with asiding iron.



REMOVE

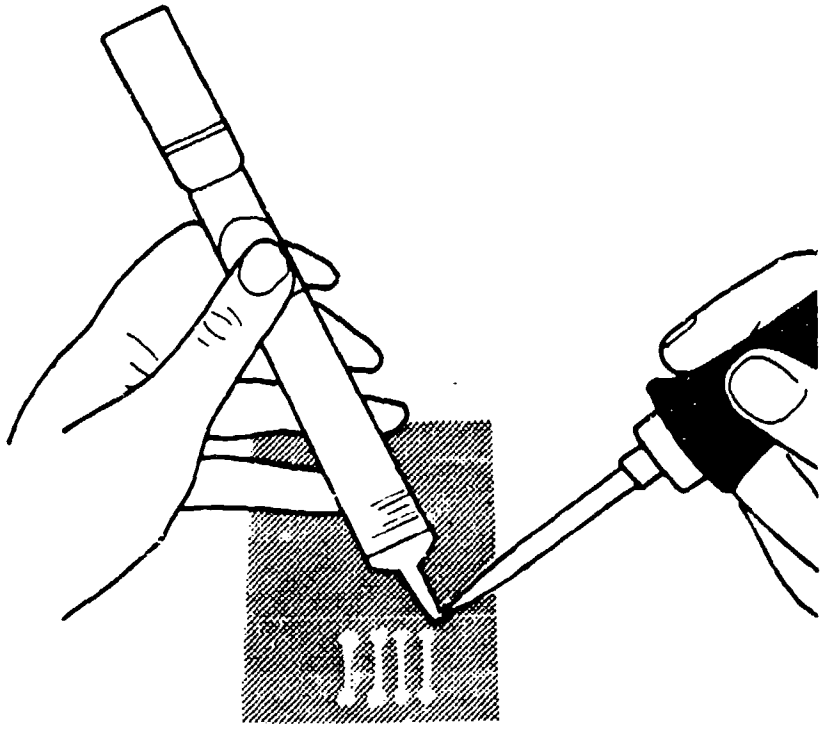
FIRST	TMU	ADDITIONAL	TMU
R2	633	Y2	440

Desolder First

Begins with reaching to desoldering pump. Includes loading plunger, getting, cleaning, and positioning iron, positioning pump, heat pin, or terminal, actuating pump plunger. Ends with asiding iron and pump.

Desolder Additional

Begins with loading plunger. Includes cleaning and positioning iron, positioning pump, heat pin, or terminal. Ends with actuating pump plunger.



REMOVE

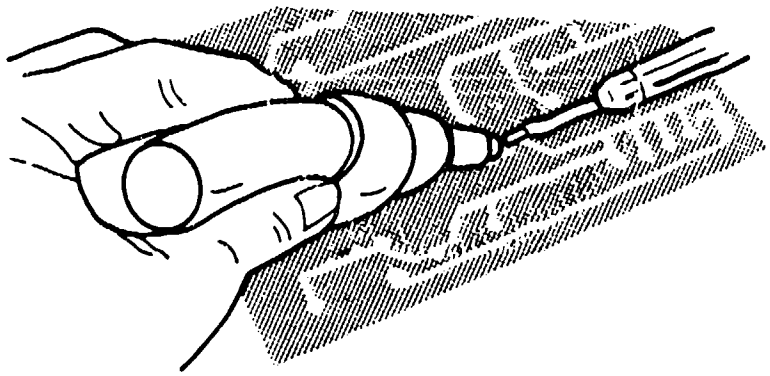
FIRST	TMU	ADDITIONAL	TMU
R3	522	Y3	422

Desolder First

Begins with reaching to squeeze-bulb. Includes getting iron, squeezing bulb, positioning iron and bulb, heating terminal, regrasping bulb. Ends with asiding bulb and iron.

Desolder Additional

Begins with squeezing bulb. Includes positioning iron and bulb, heating terminal. Ends with regrasping bulb.



REMOVE

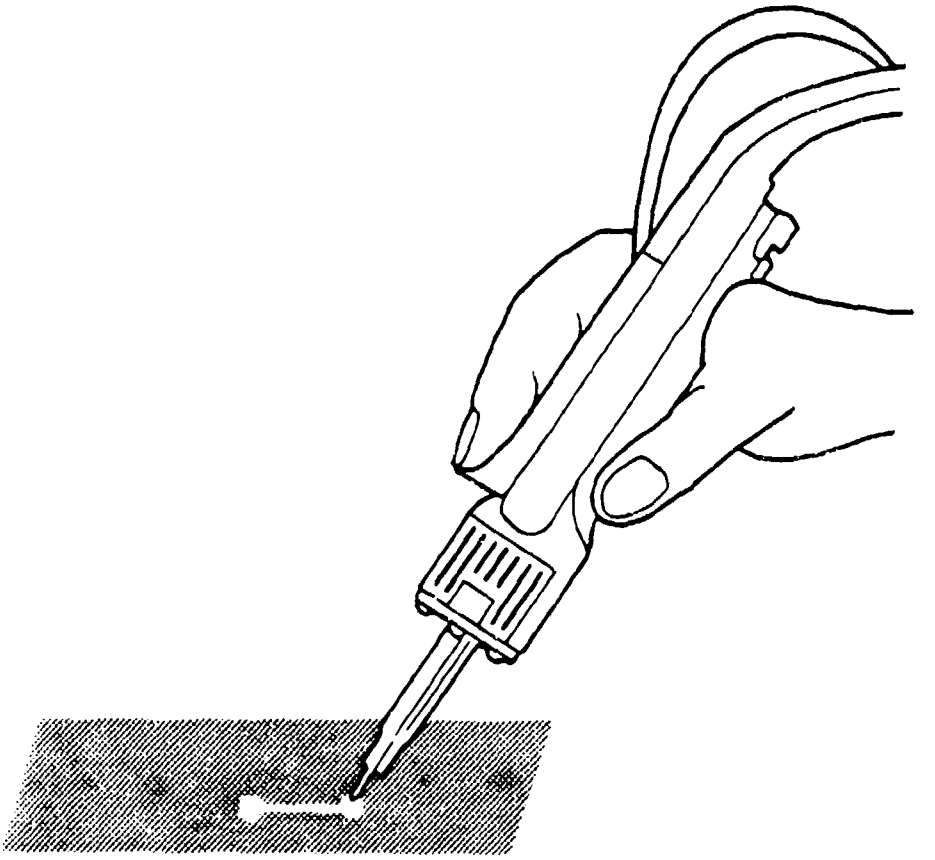
FIRST	TMU	ADDITIONAL	TMU
R4	230	Y4	140

Desolder First

Begins with positioning printed circuit board. Includes getting desoldering tool, moving foot to foot pedal, desoldering tool to terminal, heating solder, actuating foot pedal. Ends with asiding iron and removing foot from foot pedal.

Desolder Additional

Begins with moving desoldering tool to terminal. Includes heating solder and actuating foot pedal. Ends with removing desoldering tool from terminal.



TIN

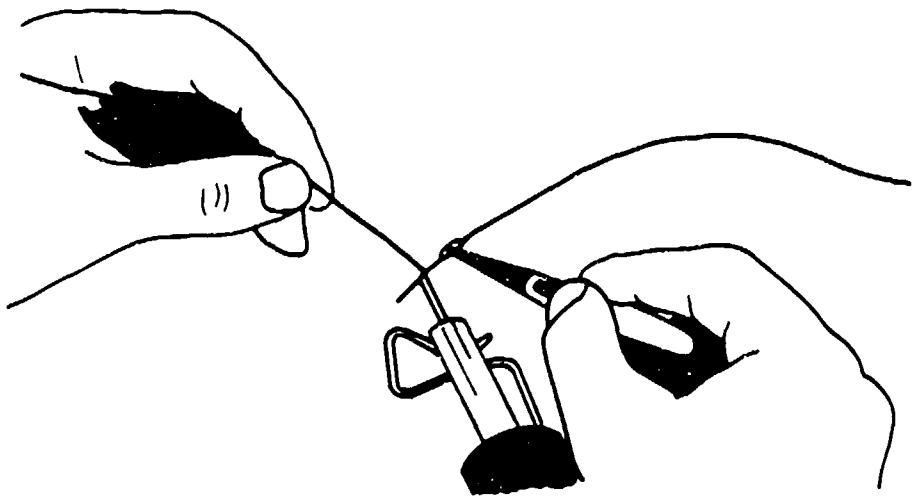
FIRST	TMU	ADDITIONAL	TMU
I1	595	X1	482

Tin First

Begins with reaching to soldering iron. Includes cleaning tip, positioning iron in holder, getting wire or solder, tinning wire or terminal. Ends with asiding wire or solder and soldering iron.

Tin Additional

Begins with cleaning tip. Includes getting wire or solder. Ends with tinning wire or terminal.



UNSOLDER				SOLDER			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
R2	220	Y2	142	I2	513	--	--

Unsolder First Piece

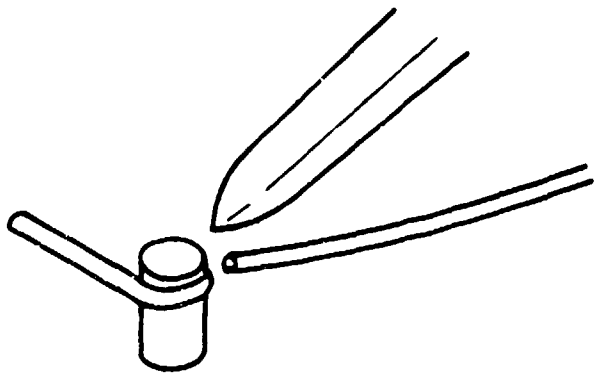
Begins with reaching to iron. Includes applying iron to terminal, unsoldering wire, disengaging wire, asiding wire. Ends with asiding iron.

Unsolder Additional Piece

Begins with positioning iron to terminal. Includes unsoldering wire, disengaging wire. Ends with asiding wire.

Solder First Piece

Begins with reaching to wire. Includes positioning wire to terminal, applying flux, getting solder and iron, cleaning iron, soldering wire to terminal, asiding iron and solder. Ends with checking connection.



SOLDER

FIRST	TMU	ADDITIONAL	TMU
I3	306	X3	166

Solder First Lead

Begins with applying flux. Includes getting solder and iron, cleaning iron, positioning solder and iron to lead, soldering lead, asiding iron and solder. Ends with checking connection.

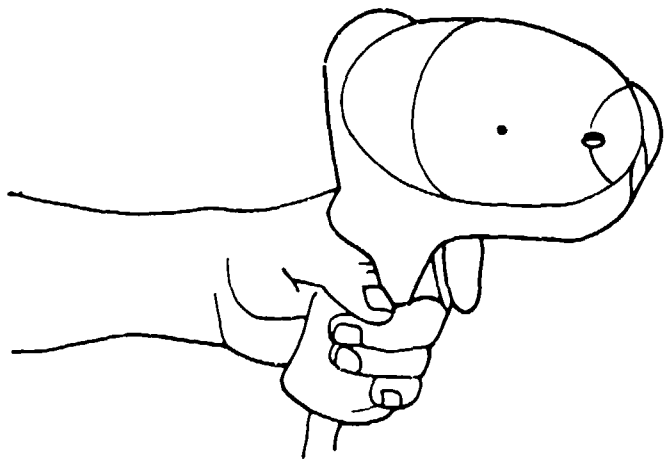
Solder Additional Leads

Begins with applying flux. Includes cleaning iron, positioning iron and solder to lead, soldering lead. Ends with checking connection.

FIRST	TMU
I4	3252

First

Begins with getting wire. Includes stripping wire, tinning wire, getting solder sleeve, positioning solder ring of sleeve over shielding, positioning jumper wire, getting Zap gun, plugging in Zap gun, adjusting Zap gun, positioning sleeve and wires in gun, actuating Zap gun, removing wire from gun, inspecting terminal, unplugging Zap gun. Ends with asiding wire and gun.



REMOVE		INSTALL	
FIRST	TMU	FIRST	TMU
R5	4762	I5	2202

Remove

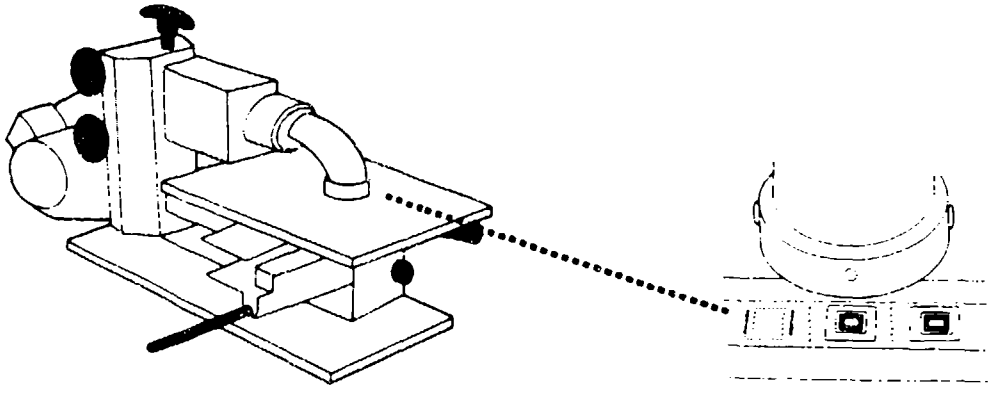
Begins with preheating PCB (EJP-SE-01). Includes positioning board in holder, coating chip to be removed with temperature-indicating fluid, applying flux, positioning heat shield, turning on hot air terminal, extending hot air tubes, adjusting air flow, waiting for solder to melt, observing temperature-indicating material, disengaging chip.

Install

(Follows removal before PCB has cooled)
Begins with getting new chip. Includes checking part number, positioning chip on board, applying flux, allowing time for solder to melt, observing solder that melts. Ends with turning off hot air terminal and removing PCB from holder.

Remarks

Analysis based on use of Hart-100 hot air terminal, manufactured by Nu-Concept Computer Systems, Inc.



REMOVE AND INSTALL

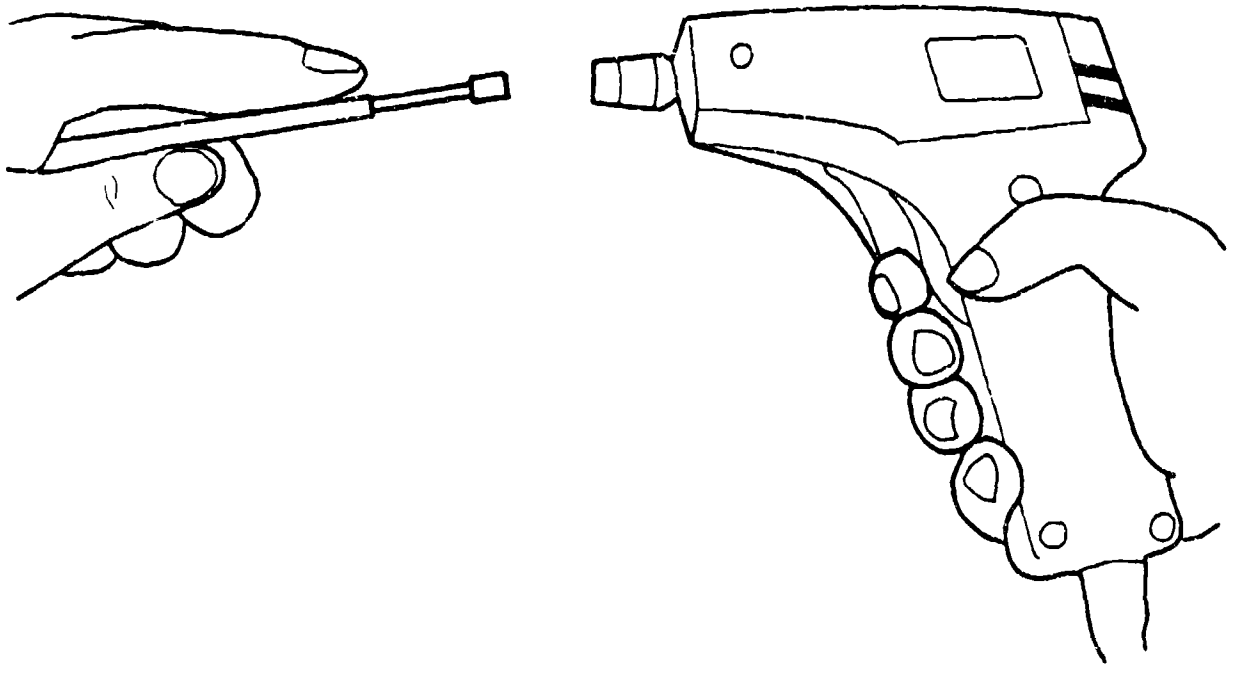
FIRST	TMU
D1	177

Remove and Install

Begins with loosening chuck. Includes removing bit or sleeve, asiding bit or sleeve, getting bit or sleeve, installing bit or sleeve. Ends with tightening chuck.

Remarks

Also applicable to other tools that do not use a chuck key.



REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
RA	150	YA	90	IA	970	XA	140
RB	240	YB	130	IB	1930	XB	330
RC	300	YC	160	IC	2830	XC	450
RD	460	YD	210	ID	5090	XD	800
RE	650	YE	280	IE	8690	XE	1580

Remove First Piece

Begins with reaching to diagonals or scissors. Includes cutting and removing cord. Ends with laying aside diagonals or scissors and cord.

Remove Additional Piece

Begins with moving to additional lace point. Includes cutting cord. Ends with removing cord.

Install First Piece

Begins with reaching to diagonals or scissors. Includes obtaining and cutting length of nylon ribbon or cord, tying wire bundle with clove hitch, additional loop and three lock stitches using tweezers or needlenose as necessary, and trimming cord end. Ends with laying aside diagonals or scissors.

Install Additional Piece

Begins with moving to additional lace point. Ends with completing one lock stitch.

(Identical to NACL code OWH-BL-XX).

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
RA	150	YA	90	IA	520	--	--
RB	240	YB	130	IB	890	--	--
RC	300	YC	160	IC	1390	--	--
RD	460	YD	210	ID	2340	--	--
RE	460	YE	280	IE	3800	--	--

Remove First Piece

Begins with reaching to diagonals or scissors. Includes cutting and removing cord. Ends with laying aside diagonals or scissors and cord.

Remove Additional Piece

Begins with moving to additional tie. Includes cutting cord. Ends with removing cord.

Install First Piece

Begins with reaching to diagonals or scissors. Includes obtaining and cutting length of nylon ribbon or cord, tying wire bundle with clove hitch, additional loop using tweezers or needlenose as necessary, and trimming cord end. Ends with laying aside diagonals and scissors.

Install Additional Piece

Not applicable.

(Identical to NALC code OWH-BT-XX).

INSTALL

	FIRST	TMU
Easy	IB	854
Moderate	IC	1324
Difficult	ID	2314

Remove

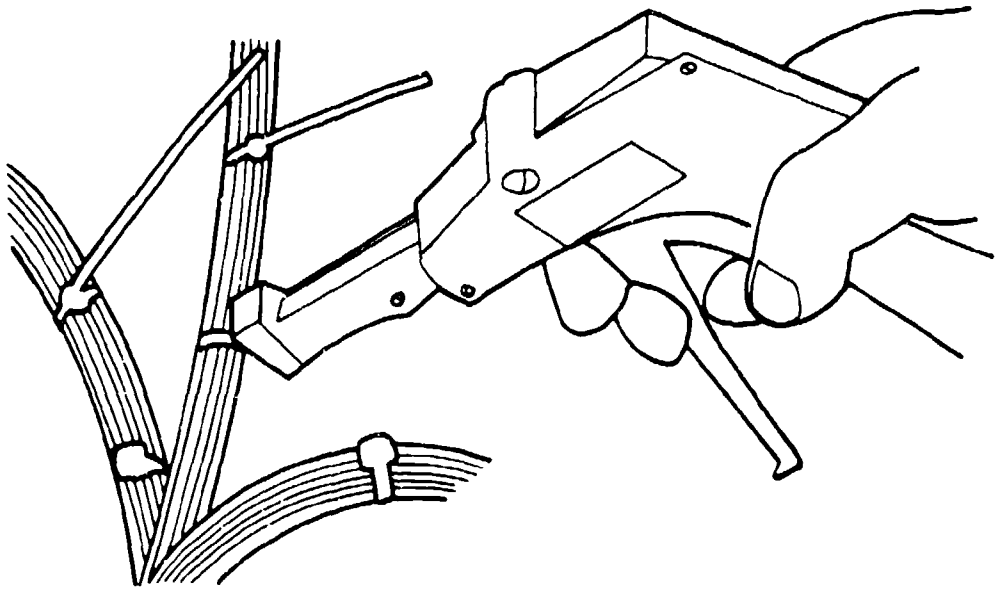
Use OTL-PD-XX.

Install

Begins with reaching to strap. Includes positioning strap around cable, getting cable-tying gun, positioning gun to strap, actuating gun. Ends with asiding gun.

Remarks

Case variable factors: distance 0%, weight 0%, control 100%.



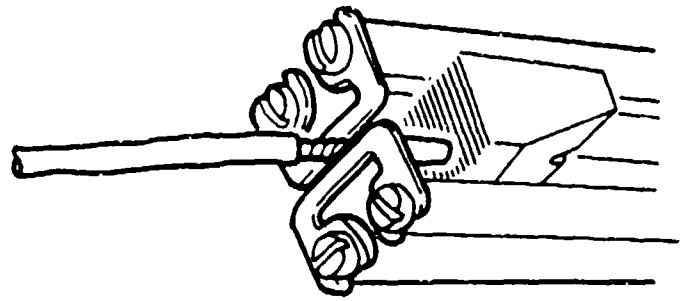
FIRST	TMU	ADDITIONAL	TMU
D1	607	Z1	487

First Wire

Begins with reaching to wire. Includes getting thermal stripper, positioning wire in stripper, actuating stripper, heating wire, disengaging wire from stripper, releasing stripper. Ends with asiding stripper and wire.

Additional Wire

Begins with reaching to wire. Includes positioning wire in thermal stripper, actuating stripper, heating wire, disengaging wire from stripper, releasing stripper. Ends with asiding wire.



For nonthermal stripping use EWH-IS-XX.

FIRST	TMU	ADDITIONAL	TMU
01	260	Z1	--
02	410	Z2	210
03	1110	Z3	1020
04	1600	Z3	--
05	4800	Z4	--

First Piece

Begins with reaching to wire(s) or cable. Includes obtaining tools, stripping shielding and/or insulation, and trimming loose threads. Ends with laying aside wire(s) or cable and tools.

Additional Piece

Begins with reaching to additional wire. Includes striping insulation and trimming loose threads. Ends with asiding wire.

Remarks

01 -- Nonshielded, single conductor, single wire. Sizes No. 22 to No. 8.
02 -- Nonshielded, single conductor, single wire of a group of loose wires. Sizes No. 22 to No. 8.
03 -- Shielded cables, center conductor. Sizes No. 22 to No. 8.
04 -- Coaxial cable. Sizes to 5/16-in. outside diameter.
05 -- Triaxial cable. Sizes to 3/8-in. outside diameter.

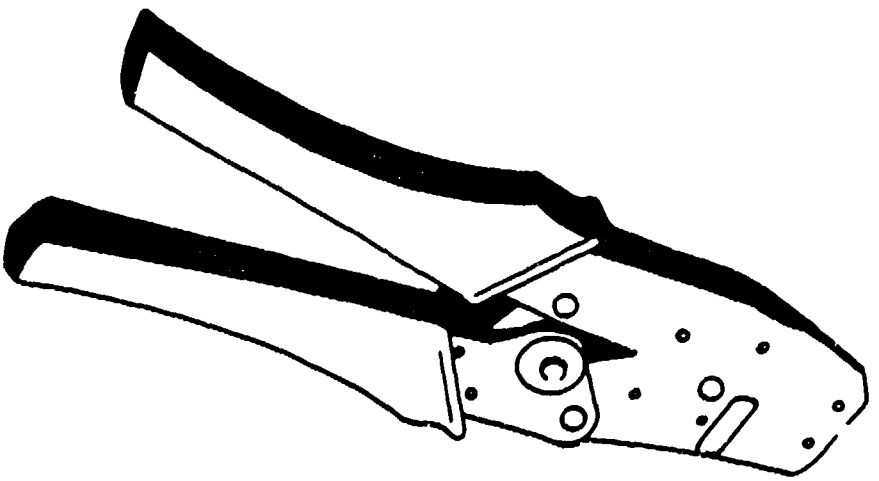
Applies to: Miller Adjustable Diagonal Stripper, Ideal Stripmaster, Pyramid E-Z Stripper. Knife cases 03, 04, and 05 apply only where accessibility is easy.

(Identical to NALC code OWH-IS-XX).

INSTALL	TMU
I1	785

Install

Begins with getting wire. Includes cutting wire, stripping insulation from end of wire, asiding strippers, twisting strands of wire together, getting pin, positioning wire in pin, verifying wire insertion into pin, getting crimper, crimping pin to wire, releasing crimper, removing wire/pin. Ends with asiding crimper and wire.



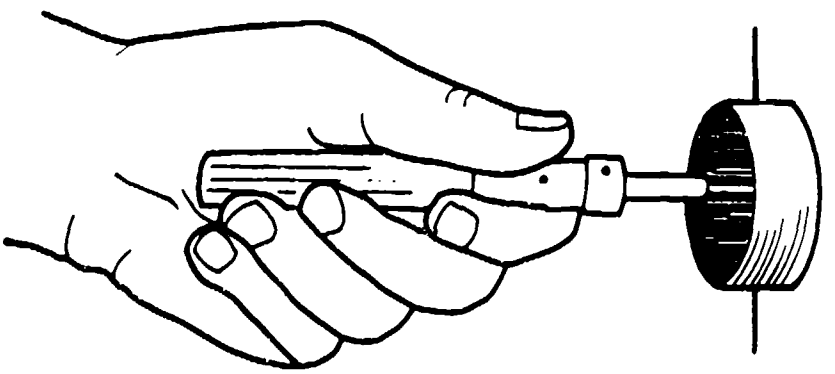
REMOVE		INSTALL	
FIRST	TMU	FIRST	TMU
R2	952	I2	1290

Remove Pin

Begins with reaching to tool. Includes checking wiring schematic, locating pin number in plug, positioning tool to pin, applying pressure to tool, disengaging pin from tool. Ends with disengaging tool from plug.

Install Pin

Begins with reaching to tool. Includes positioning pin to tool, checking wiring schematic, locating pin number in plug, positioning and inserting pin in plug, disengaging tool. Ends with checking pin.



REMOVE		INSTALL	
--	--	I1	780
--	--	I2	3080
R3	990	I3	4260
R4	1430	I4	7770
R5	4520	I5	14190

Remove First Piece

Begins with reaching to tool. Includes cutting wire and/or unsoldering and disassembling terminator as necessary. Ends with laying aside tools, wire or cable, and terminator.

Install First Piece

Begins with reaching to wire or cable. Includes obtaining stripping tools, stripping insulation, obtaining and installing terminator by crimping, soldering, and assembling as necessary. Ends with laying aside tools and wire or cable.

Remarks

I1 -- Lug or splices, No. 10 to No. 22 wire.
I2 -- Shielded cable connectors.
I3 and R3 -- Coaxial cable connectors, wedge-lock (small, single shielding).
I4 and R4 -- Coaxial cable connectors, wedge-lock (large, double shielding).
I5 and R5 -- Triaxial cable connectors, AMP 165-38-1001 or similar.

Does not include the use of special tools to strip coaxial or triaxial cables.

(Identical to NALC code OWH-TM-XX).

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
R1	474	Y1	436	I1	543	X1	492

Remove First Piece

Begins with reaching to tool. Includes positioning tool to post, unwrapping wire, disengaging tool from post, disengaging wire from post. Ends with asiding wire and tool.

Remove Additional Piece

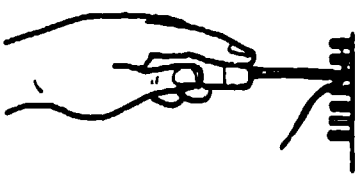
Begins with positioning tool to post. Includes unwrapping wire, disengaging tool from post, disengaging wire from post. Ends with asiding wire.

Install First Piece

Begins with reaching to tool. Includes getting wire, positioning wire in bit, positioning wire and tool to post, wrapping wire around post, disengaging tool. Ends with asiding of tool.

Install Additional Piece

Begins with reaching to wire. Includes positioning wire in bit, positioning wire and tool to post, wrapping wire around post, disengaging tool.



-1: Hand Twisted

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
R2	117	Y2	79	I2	186	X2	135

Remove First Piece

Begins with reaching to hand-squeeze gun. Includes positioning gun to post, unwrapping wire, disengaging gun from post, disengaging wire from post. Ends with asiding wire and gun.

Remove Additional Piece

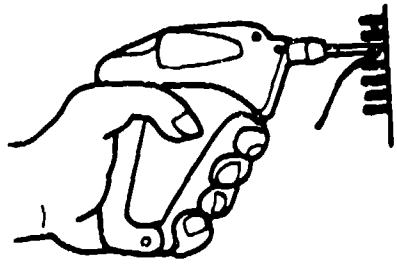
Begins with positioning hand-squeeze gun to post. Includes unwrapping wire, disengaging gun from post, disengaging wire from post. Ends with asiding wire.

Install First Piece

Begins with reaching to hand-squeeze gun. Includes getting wire, positioning wire in bit, positioning wire and gun to post, wrapping wire around post, disengaging gun. Ends with asiding gun.

Install Additional Piece

Begins with reaching to wire. Includes positioning wire in bit, positioning wire and hand-squeeze gun to post, wrapping wire around post, disengaging.



-2: Hand-Squeeze Gun

For changing tool bit or sleeve, see ETP-WW-D1

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
R3	133	Y3	95	I3	202	X3	151

Remove First Piece

Begins with reaching to power gun. Includes positioning gun to post, unwrapping wire, disengaging gun from post, disengaging wire from post. Ends with asiding wire and gun.

Remove Additional Piece

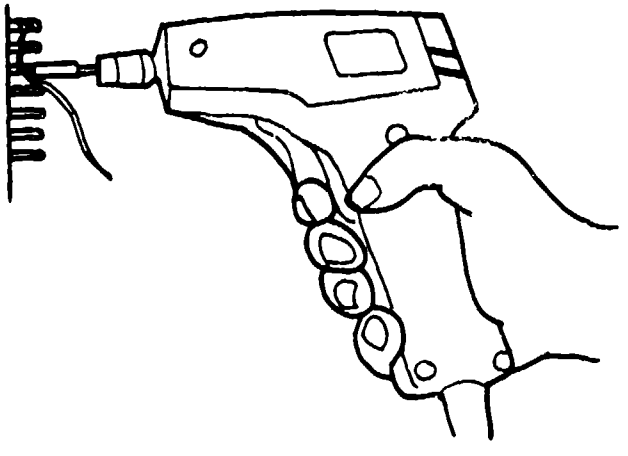
Begins with positioning gun to post. Includes unwrapping wire, disengaging gun from post, disengaging wire from post. Ends with asiding wire.

Install First Piece

Begins with reaching to powered wire wrap gun. Includes getting wire, positoning wire in bit, positioning wire and gun to post, wrapping wire around post, disengaging gun. Ends with asiding gun.

Install Additional Piece

Begins with reaching to wire. Includes positioning wire to bit, positioning wire and gun to post, wrapping wire around post. Ends with disengaging gun.



For wire wrap, hand, see EWH-WW-R1 and R2
For changing tool bit or sleeve, see ETP-WW-D1

FIRST	TMU	ADDITIONAL	TMU
01	40	Z1	20
02	80	Z2	40
03	170	Z3	140
04	470	Z4	450

First Actuation

Begins with reaching to valve, switch, knob, or lever. Includes actuating or adjusting to desired position. Ends with obtaining a gauge or dial reading.

Additional Actuation

Begins with hand on same valve or switch or knob or lever. Ends with actuating or adjusting to additional desired position, and/or obtaining a gauge or dial reading.

Remarks

01 -- Actuate single throw control or obtain instantaneous appearing reading.
02 -- Actuate control and obtain instantaneous appearing reading.
03 -- Actuate control and obtain momentarily appearing reading.
04 -- Actuate control and obtain delayed reading.

Momentarily appearing readings are defined as requiring coarse adjustments and/or stabilization with the required reading to an accuracy greater than $\pm$ 2.5% of a full-scale reading.

Delayed readings are defined as those requiring fine adjustments and/or stabilization with the required reading to an accuracy of $\pm$ 2.5% or less of a full-scale reading.

The terms coarse and fine are related to a complete operation, including start actuation, adjust, and obtain reading.

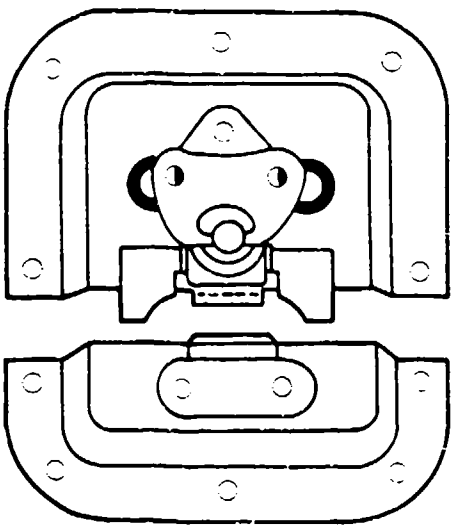
UNFASTEN		FASTEN	
FIRST	TMU	FIRST	TMU
R1	107	I1	143

Unfasten

Begins with reaching to tab. Includes turning tab to disengage, loosening latch and disengaging.

Fasten

Begins with reaching to latch. Includes positioning latch in receptacle, turning tab to engage receptacle and tightening. Ends with releasing tab.



	FIRST	TMU	ADDITIONAL	TMU
Climb Up or Down One Step	D1	72	Z1	35
Climb Up	D2	318	--	--
Climb Down	D3	288	--	--

First Step (D1)

Begins with looking to ladder or stairs. Grasp rail, place foot on rung, step up or down. Ends with placing both feet on the same level.

Additional Step (Z1)

Begins by sliding hand along rail. Step up or down, foot on rung. Ends with eye traveling to next grasp point.

Climb Up (D2)

Begins with getting and asiding object 0 to 40 pounds. Reach 40 inches height from floor to surface, raise leading foot, boost body with hands, apply pressure with foot and hands, turn body raise other foot. Ends with arising.

Climb Down (D3)

Begins with squatting to sit. Reach to surface, lower body with hands, lower leading leg, lower trailing leg apply pressure with hands, push off with hand, end with body standing on lower surface. Ends with removing object.

CASE	TMU
01	85
02	53
03	60

Case

01 -- Walk 10 ft in obstructed or unobstructed area with load of 5 to 50 lb.

02 -- Walk 10 ft in unobstructed area with load of 0 to 5 lb.

03 -- Walk 10 ft in obstructed area with load of 0 to 5 lb.

FIRST	TMU	ADDITIONAL	TMU
01	420	Z1	130
02	1250	Z2	400
03	2170	Z3	620
04	3000	Z4	880

First Piece

Begins with reaching to object to be cleaned. Includes selecting cloth, tampico brush, wire brush, scraper, or sandpaper, and removing contamination or corrosion from an area 12 in. by 12 in. by wiping, brushing, scraping, or sanding, dry or with solvent. Also includes blowing off with air and wiping. Ends with laying aside object and tools.

Additional Piece

Begins with repositioning as necessary to gain access to area to be cleaned. Includes removing contamination or corrosion from an area 12 in. by 12 in. by wiping, brushing, scraping, or sanding, dry or with solvent. Ends with blowing off and wiping.

Remarks

01 -- Light dust or small particles of dirt.
02 -- Light clinging dust and dirt or readily soluble oil or grease.
03 -- Heavy clinging dust and dirt, light stains, light corrosion, oil, or grease removable by mild scrubbing.
04 -- Heavy caked dust and dirt, heavy stains, heavy corrosion, hardened grease or preservatives, removable by extensive scraping, sanding, or brushing.

Simple surfaces are defined as readily accessible, requiring little or no repositioning during cleaning.

FIRST	TMU	ADDITIONAL	TMU
01	390	Z1	230
02	520	--	--
03	360	Z3	210
04	560	Z4	310
I4	460	X4	220
R4	110	Y4	100
05	170	Z5	90

Install First Piece

Begins with reaching to tool and/or clamp. Includes obtaining and/or adjusting clamp as necessary, and installing on work. Ends with installing clamp or laying aside tool.

Install Additional Piece

Begins with rea to clamp. Includes obtaining and adjusting clamp as necessary, and installing on work. Ends with installing clamp.

Remove First Piece

Begins with reaching to tool or clamp. Includes loosening clamp and removing from work. Ends with asiding tool and/or clamp.

Remove Additional Piece

Begins with reaching to clamp. Includes loosening clamp and removing from work. Ends with asiding clamp.

Remarks

01 -- Cleco, pliers type, install and remove.
02 -- Cleco, wing nut type, install and remove.
03 -- Toggle ("quickie") clamp or vise grip pliers, install and remove.
04 -- "C" Clamp, install and remove.
05 -- Spring clamp, install and remove.
I4 -- "C" Clamp install.
X4 -- "C" Clamp install, additional.
R4 -- "C" Clamp remove.
Y4 -- "C" Clamp remove, additional.

Limited to accomplishment containing some interference but wholly visible, or no interference and partially visible.

CASE	TMU
01	10
02	100
03	1000
04	1000

Allowed time as determined by a qualified industrial engineering technician's estimate.

Remarks

Applies to manual operations where existing standard data elements do not properly describe motions performed. Does not apply to process time.

CASE	TMU
01	10
02	100
03	1000
04	10000

Allowed time derived from standard data of acceptable quality.

Remarks

Applies to manual motion sequences and/or machine or process time.

CASE	TMU
01	10
02	100
03	1000
04	10000

Allowed time derived from repeating occurrence of a sequence of elements in the analysis of an operation.

Remarks

Applies to the repetition of any preceeding group of elements in the same time standard.

Should not be applied to the development of other elemental standard data.

Sources from which the allowed time is derived should be referenced at the point of OEL-RS-XX application.

(Adaptation of NALC code OEL-RS-XX).

CASE	TMU
01	10
02	100
03	1000
04	10000

Allowed time as determined by stopwatch time study.

Remarks

Applies to manual operations where standard data elements do not properly describe the motions performed. Does not apply to process time.

FIRST	TMU	ADDITIONAL	TMU
OA	120	ZA	50
OB	210	ZB	100

First Piece

Begins with reaching to object to be examined. Includes moving object to area of vision, selecting light or magnifying glass if required and examining one focal area (4-in. dia at 16 in. from eye). Ends with laying aside object and light or glass.

Additional Piece

Begins with repositioning of object as necessary to examine next focal area. Ends with examining focal area.

Remarks

OA -- Cursory examination permitting rapid decision (e.g., NC or NF threads to 2-in. dia or 1/2 in. of threads 2-in. to 4-in. dia; simple surface for condition of paint, plating, etc).

OB -- Close examination of particular detail (e.g., special or close tolerance threads to 2-in. dia or 1/2 in. of threads 2-in. to 4-in. dia; irregular surfaces for condition of plate or plating, surfaces that are machined, bearing, mating, etc). Applies to yes or no evaluation not requiring prolonged mental consideration. Use when no other operations are being performed or where examination is the limiting factor.

	CASE	TMU
Open hinged panel, engage hold-open rod	D1	490
Close hinged panel, stow hold-open rod	D2	490

Open

Begins at hinged panel that has been unfastened. Includes opening panel, disengaging hold-open rod, and ends with positioning hold-open rod to hold panel open.

Close

Begins at a hinged panel that is held by a hold-open rod. Includes disengaging and stowing hold-open rod, ends with closing panel.

Remarks

D1 and D2 derived from Boeing code 530101.

CASE	TMU
01	330
02	650
03	1210
04	180
05	160
06	280
07	380
08	480
09	730

Uncoil

Begins with coiled cord in hand. Includes paying out cord while walking and untangling cord as necessary. Ends with plug in hand.

Coil

Begins with reaching to end of unattached cord. Includes coiling cord for storage.

Remarks

01 -- Coil and uncoil 10-ft cord.
02 -- Coil and uncoil 25-ft cord.
03 -- Coil and uncoil 50-ft cord.
04 -- Coil 10-ft cord.
05 -- Uncoil 10-ft cord.
06 -- Coil 25-ft cord.
07 -- Uncoil 25-ft cord.
08 -- Coil 50-ft cord.
09 -- Uncoil 50-ft cord.

REMOVE		INSTALL	
FIRST	TMU	FIRST	TMU
R1	90	I1	96

Remove

Begins with getting capped part. Includes reaching to cap, applying pressure to cap, disengaging cap. Ends with asiding cap.

Install

Begins with getting protective cap. Includes getting part to be capped, positioning cap. Ends with applying pressure to complete cap installation.

FIRST	TMU
01	590
02	790
03	640
04	760
05	1370

Manually Actuated Time Recording Clock

Begins at time clock. Includes selecting in-process and planned work cards from rack, recording time on each card and job order number (pencil entry) on planned work card. Ends with replacing both cards in rack.

Transactor

Begins at transactor. Includes selecting identity card and transaction card(s), placing cards in transactor, setting one or more dials, and recording transaction. Ends with replacing cards in rack.

Remarks

Manually actuated time recording clock

01 -- Work content as stated above.
02 -- Work content as stated above except clock is at Sched-U-Man dock and includes selecting Sched-U-Man card from rack, recording time on card and replacing card in rack.

Transactor Actuated Recording

03 -- One transaction card and one dial setting.
04 -- One transaction card and one to seven dial settings.
05 -- Two transaction cards and one to seven dial settings.

CASE	TMU
01	110
02	130
03	80
04	40
05	80
06	50

Plug In

Begins with reaching to plug. Includes connecting to outlet or receptacle. Ends with plug in place.

Disconnect

Begins with reaching to plug. Includes removing plug from outlet or receptacle. Ends with plug in hand.

Remarks

01 -- Standard two- or three-prong plug.
02 -- Twist lock plug.
03 -- Plug in (standard).
04 -- Unplug (standard).
05 -- Plug in (twist).
06 -- Unplug (twist).

	CASE	TMU
Open and Close	01	77
Open	02	44
Close	03	33

Open

Begins with reaching to the drawer. Includes releasing drawer latch or lock. Ends with the drawer open and locked in position.

Close

Begins with reaching to the drawer. Ends with the drawer closed and latched.

Remarks

Drawer with or without thumb latch or similar.

(Similar to NALC code MJP-DR-XX)

FASTEN	TMU	UNFASTEN	TMU
I1	1330	R1	370

Fasten

Begins with reaching to rope or cord. Includes positioning first end of rope to object, tying a knot, positioning the second end of the rope. Ends with tying a knot in the second end.

Unfasten

Begins with reach to knot. Includes untying two knots. Ends with asiding rope or cord.

CASE	TMU
01	490
02	260

Put On

Begins with reaching to glass case or goggles. Includes removing glasses from case and cleaning glasses or goggles as necessary. Ends with glasses or goggles in place.

Remove

Begins with reaching to glasses or goggles. Includes removing and inserting in case. Ends with asiding glasses case or goggles.

Remarks

01 -- Safety glasses.
02 -- Safety goggles.

INSTALL	TMU	REMOVE	TMU
01	393	--	--

Install

Begins with selecting dril. bit, rotating chuck by hand open or close, inserting bit into chuck, tightening chuck by hand, getting and inserting chuck key, and tightening chuck. Ends with disengaging and asiding key.

Remove

(Use 00H-DE-0C for removing bit.)

	CASE	TMU
Microscope	D1	1671
Eyeglass	D2	108
Loupe	D3	125
Illuminated Magnifier	D4	500
Clean Lens	D5	91

Set Up Microscope (D1)

Begins with reaching to microscope. Includes positioning scope, plugging in and turning on light, all motions necessary to adjust height or length of plane and adjust focal setting, adjust eye width, select power. Ends with working piece in focus and asiding after use.

Position Eyeglass Mounted Loupe Down and Up (D2)

Begins with reaching to loupe. Includes positioning loupe down, reaching to loupe. Ends with loupe up.

Position Hand-Held Loupe To or From Eye (D3)

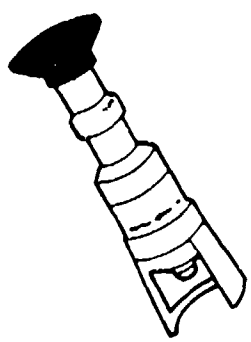
Begins with reaching to loupe. Includes positioning loupe to eye, reaching to loupe. Ends with asiding loupe.

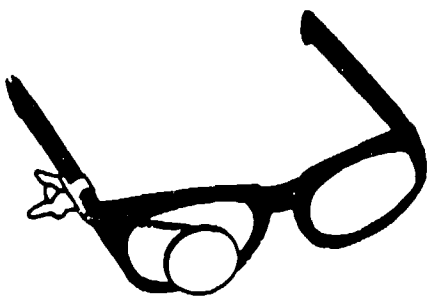
Illuminated Magnifier (D4)

Begins with positioning magnifier to work area. Includes turning on light and repositioning magnifier. Ends with turning off light and asiding magnifier.

Clean Loupe Lens (D5)

Begins with reaching to cleaning tissue. Clean lens. Ends with asiding tissue.





INSTALL	TMU	REMOVE	TMU
I1	21820	R1	11882

Install (Donning previously fitted ensemble)

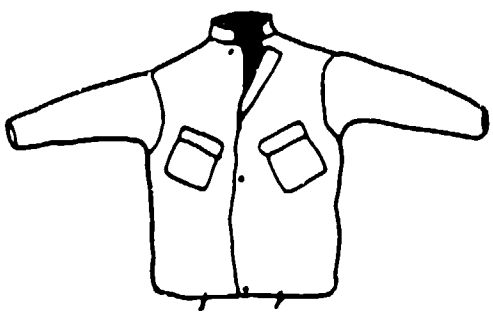
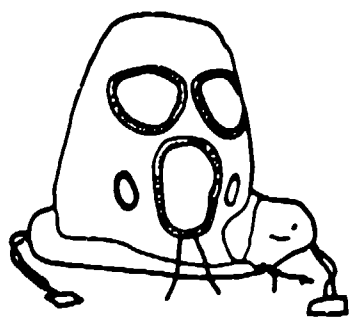
Begins with donning protective suit pants. Includes removing ensemble from ensemble storage container, unzipping, zipping, unsnapping, snapping pants fasteners. Continues with donning protective footware, protective gloves, protective coat and mask carrier, removing mask and hood from carrier, positioning mask on face and head, checking mask for leaks. Ends with poitioning and fastening straps and cords, and closing hood and mask carrier.

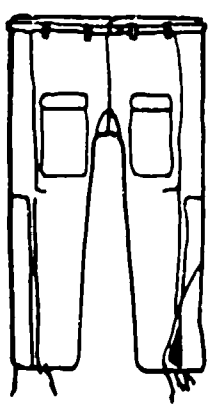
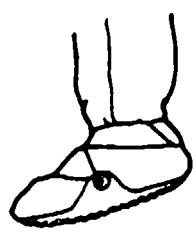
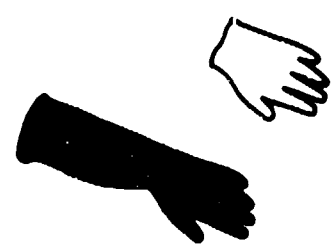
Remove (Doffing uncontaminated ensemble)

Begins with doffing mask and hood by disengaging underarm straps, loosening neck cord, positioning cape over head and removing mask and hood. Includes cleaning moisture from hood and mask, positioning hood and mask in carrier. Continues with doffing mask carrier and protective coat, doffing protective gloves, footwear, and protective suitpants. Ends with packing protective clothing in storage container.

Remarks

Ensemble has been fitted previously. Hood is attached to mask and both are stored in the carrier. It is installed over normal items of clothing when contamination is imminent.

INSTALL	TMU	REMOVE	TMU
I1	4040	R1	1220

Install

Begins with getting safety harness. Includes untangling harness, positioning shoulder straps, hooking shoulder straps, fastening belt, positioning and hooking leg straps. Ends with adjusting all straps.

Remove

Begins with unhooking leg straps. Includes unhooking belt, shoulder straps, and folding safety harness. Ends with asiding harness.

FIRST	TMU
0A	50
0B	120
0C	190
0D	270
0E	350

First Piece

Begins with reaching to object. Includes picking up and minimally controlled moving to an approximate location. Ends with releasing object.

Remarks

0A -- Move to 18 in. and weight to 3 lb.
0B -- Move to 30 in. and weight to 10 lb.
0C -- Move to 4 ft including stooping if necessary and weight to 20 lb.
0D -- Move to 6 ft including stooping if necessary and weight to 30 lb.
0E -- Move to 8 ft including stooping if necessary and weight to 50 lb.

If unusual control is required, use 00H-P0.

Case variable factors: distance 80%, weight 20%

FIRST	TMU	ADDITIONAL	TMU
01	210	Z1	110

First Piece

Begins with reaching to drawer. Includes opening unlocked drawer, searching and selecting to locate alphabetically or numerically filed identity, or positioning and removing from or replacing in drawer. Ends with laying aside identity and/or closing drawer.

Additional Piece

Begins with reaching to filed material in bin or drawer. Includes searching and selecting to locate alphabetically or numerically filed identity, or positioning and removing from or replacing in bin or drawer. Ends with identity in hand or in file.

Remarks

Filed material must be clearly identified so that only a minor separation of pieces is required to verify selection.

	FIRST	TMU	ADDITIONAL	TMU
Bin or shelf				
	01	60	Z1	60
	02	100	Z2	70
Drawer or cabinet				
	03	160	Z3	60
	04	200	Z4	70

Bin or Shelf

01 -- Single or handful or obvious part(s) lying alone or jumbled with like parts.
02 -- Single indistinguishable part among or jumbled with dissimilar parts.

First Piece

Begins at bin or shelf. Includes reaching, selecting, and picking up desired object(s) to 20 lb. Ends with laying aside object(s).

Additional Piece

Begins with placing first part on other hand. Ends with selecting and picking up desired object.

Drawer or Cabinet

03 -- Single or handful of obvious part(s) lying alone or jumbled with like parts.
04 -- Single indistinguishable part among or jumbled with dissimilar parts.

First Piece

Begins at drawer or cabinet. Includes reaching to doors or drawer, opening unlocked doors or drawer, selecting and picking up desired object(s) to 20 lb, and closing doors or drawer. Ends with laying aside object(s).

Additional Piece

Begins with placing first part on other hand. Ends with selecting and picking up desired object.

	FIRST	TMU	ADDITIONAL	TMU
Unfasten	RA	110	YA	60
Unfasten	RB	160	YB	80
Fasten	IA	140	XA	90
Fasten	IB	200	XB	130

Unfasten First Piece

Begins with reaching to tool. Includes positioning tool to fastener stud and twisting to unfasten stud from receptacle. Ends with laying aside tool.

Unfasten Additional Piece

Begins with moving to fastener stud with tool. Includes positioning tool to stud and twisting to unfasten. Ends with unfastening stud from receptacle.

Fasten First Piece

Begins with reaching to tool. Includes positioning tool to fastener stud and twisting stud to secure in receptacle. Ends with laying aside tool.

Fasten Additional Piece

Begins with moving to fastener stud with tool. Includes positioning tool to stud and twisting to secure. Ends with fastening stud to receptacle.

Remarks

Applies to DZUS, CAMLOC, AIRLOCK and similar fasteners.

Case variable factors: distance 10%, weight 5%, control 85%.

FIRST	TMU	ADDITIONAL	TMU
01	50	Z1	40

Unfasten or Fasten First Piece

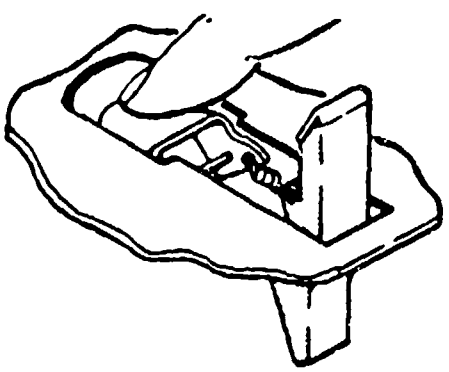
Begins with reaching to latch trigger plate. Includes placing finger or thumb to trigger plate and applying pressure to release latching plate. Ends with releasing pressure.

Unfasten or Fasten Additional Piece

Begins with reaching to latch trigger plate. Includes placing finger or thumb to trigger plate and applying pressure to release latching plate. Ends with releasing pressure.

Remarks

Applies to pressure-type trigger latches.



REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
RA	180	YA	150	IA	210	XA	170
RB	320	YB	25C				

Remove First Piece

Begins with reaching to Tru-Arc pliers. Includes inserting pliers in ring and removing ring from internal or external groove. Ends with laying aside tool and ring.

Remove Additional Piece

Begins with reaching to ring with pliers. Includes inserting pliers in ring and removing ring from internal or external groove. Ends with palming or laying aside ring.

Install First Piece

Begins with reaching to ring. Includes selecting Tru-Arc pliers, inserting in ring, and installing ring in internal or external groove. Ends with laying aside tool.

Install Additional Piece

Begins with reaching to ring. Includes inserting pliers in ring and installing ring in internal or external groove. Ends with releasing ring.

Remarks

Supplement with positions (OOH-PO) and disengages (OOH-DE) for higher cases.

Case variable factors: distance 10%, weight 5%, control 85%.

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
RA	300	YA	60	IA	650	XA	80

Remove First Piece

Begins with reaching to diagonals. Includes cutting wire between two anchor points and removing. Ends with laying aside wire and tools.

Remove Additional Piece

Begins with cutting wire to additional anchor point. Ends with removing wire.

Install First Piece

Begins with reaching to supply of wire. Includes selecting pliers and diagonals, cutting wire to length, inserting in first anchor point, inserting in second anchor point to 3-in. distance, returning to first anchor point, twisting to secure, and cutting and tucking end. Ends with laying aside tools.

Install Additional Piece

Begins with inserting wire in additional point. Ends with pulling wire tight.

Remarks

Supplement with positions (OOH-PO) and disengages (OOH-DE) for higher cases.

Case variable factors: distance 10%, weight 5%, control 85%.

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
RA	71	YA	63	IA	52	XA	48

Remove First Piece

Begins with reaching to scribe or awl. Includes inserting awl in ring and removing ring with pliers from internal or external groove. Ends with laying aside tools and ring.

Remove Additional Piece

Begins with reaching to ring with awl. Includes inserting tool in ring and removing ring from internal or external groove. Ends with palming or laying aside ring.

Install First Piece

Begins with reaching to ring. Includes selecting tool and installing ring in internal or external groove. Ends with laying aside tool.

Install Additional Piece

Begins with reaching to ring. Includes installing ring in internal or external groove. Ends with releasing ring.

Remarks

Maximum depth of snap ring is 1 in. Maximum diameter of snap ring is 4 in.

Supplement with positions (OOH-PO) and disengages (OOH-DE) for higher cases.

Case variable factors: distance 10%, weight 5%, control 85%.

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
RA	410	YA	170	IA	870	XA	320
RB	950	YB	270	IB	1420	XB	600
RC	2080	YC	580	IC	2750	XC	920
RD	4080	YD	1170	ID	4460	XD	1290
RE	7420	YE	2080	IE	6670	XE	1750

Remove First Piece

Begins with reaching to diagonals. Includes cutting wire at two anchor points and removing. Ends with laying aside wire and tools.

Remove Additional Piece

Begins with cutting wire at additional anchor point. Ends with removing wire.

Install First Piece

Begins with reaching to supply of wire. Includes selecting pliers and diagonals, cutting wire to length, inserting in first anchor point, twisting to second anchor point to 3-in. distance, inserting in second anchor point, twisting to secure, and cutting and tucking end. Ends with laying aside tools.

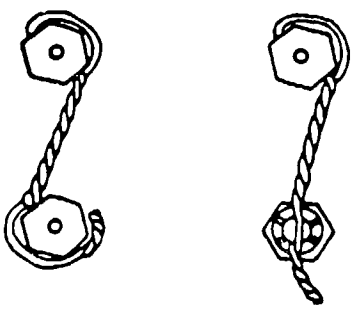
Install Additional Piece

Begins with twisting wire to additional anchor point to 3-in. distance. Ends with insertion in additional anchor point.

Remarks

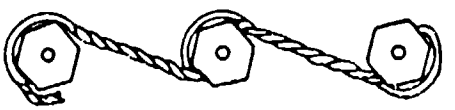
Case variable factors: distance 10%, weight 5%, control 85%.

For removal use one first and two additional



For installation use two first

For removal use one first and one additional



For installation use one first and one additional

	CASE	TMU
Get up to four light objects	D1	480
Aside up to four light objects	D2	480
Get and aside up to four light objects	D3	960
Get one medium to heavy object	D4	400
Aside one medium to heavy object	D5	400
Get and aside one medium heavy object	D6	800
Final position or aside small work stand	D7	510
Position or aside small work stand	D8	1140

Get

Begins by reaching and picking up object(s). Includes carrying object(s) up to 15 ft. Ends with asiding object(s) in hand.

Aside

Begins with object(s) in hand. Includes carrying object(s) up to 15 ft. Ends with asiding object(s).

Get and Aside

Begins with reaching and picking up object(s). Includes carrying object(s) up to 30 ft. Ends with asiding object(s).

Final Positioning or Asiding Work Stand

Begins by grasping small work stand. Includes moving work stand to desired work location or from work position to clear area. Distance allowance of 20 ft is included for getting to or from work stand and moving it.

Position or Aside Small Work Stand

Begins by getting control of small work stand. Includes moving stand up to 90 ft or walking up to 45 ft to stand and moving stand 45 ft. Ends with stand in position for work or in storage area.

Remarks

D1, D2, D3 derived from Boeing code 81A003.
D4, D5, D6 derived from Boeing code 81A004.
D7 derived from Boeing code 81A005.
D8 derived from Boeing code 81A025.

DISENGAGE	TMU
0A	70
0B	120
0C	220
0D	400
0E	700

Disengage

Begins with reaching to object or tool. Includes obtaining control of object with hand(s), or with tool when tool is an extension of the hand(s), and loosening and extracting or removing one object from another. Ends with laying aside tool and/or object.

Remarks

Tools included are a putty knife, screw driver, pliers, or similar to overcome the limitations of hand or finger dexterity or access. Strength may be used with slight to considerable effort. Use of hammer is not included.

Case variable factors: distance 45%, weight 10%, control 45%.

POSITION	TMU
0A	120
0B	250
0C	420
0D	830
0E	1670

Position

Begins with reaching to part or other object. Includes relating one part or object to another by aligning, orienting, and engaging. Ends with objects in desired relationship.

Remarks

Does not include fastening or securing operations. Does not include extremely precise or minute operations requiring high skill. Includes minimal use of tools.

Case variable factors: distance 10%, weight 5%, control 85%.

REMOVE	TMU	INSTALL	TMU
R1	300	I1	460
--	--	I2	4520

Remove

Begins with reaching to routing tag. Includes untying bow knot or untwisting wire and removing tag from point of attachment. Ends with laying aside tag.

Install (I1)

Begins with reaching to routing tag. Includes inserting wire or string through point of attachment and tying string in bow knot or twisting wire. Ends with tag secured to point of attachment.

Install (I2)

Fill out and attach tag begins with obtaining tag and pen. Includes positioning tag for writing, filling in required information, obtaining information from other material or part name plate, certifying work or condition. Ends with inserting card or tag in an envelope and attaching it to the part.

FIRST	TMU
01	210
02	380
03	290
04	460

Open Can

Begins with reaching to can. Includes unscrewing cap by hand, selecting tool to remove metal seal as required, and piercing and removing seal. Ends with laying aside seal and/or can.

Close Can

Begins with reach to cap. Includes placing cap to can and tightening with hand pressure. Ends with cap in place.

Remarks

01 -- Screw cap can, one thread, without seal to 1-gal capacity.
02 -- Screw cap can, one thread, with metal seal to 1-gal capacity.
03 -- Screw cap can, one thread, without seal, 1-gal to 5-gal capacity.
04 -- Screw cap can, one thread, with metal seal, 1-gal to 5-gal capacity.

FIRST	TMU	ADDITIONAL	TMU
01	260	Z1	70

First Piece

Begins with reaching to envelope. Includes reading nomenclature to verify content, tearing envelope with care to avoid damage to contents, and extracting a single object. Ends with laying aside object and envelope.

Additional Piece

Begins with reaching to open envelope. Includes extracting additional single object. Ends with laying aside object.

UNPACK	TMU	PACK	TMU
R1	487	I1	405
R2	1680	I2	1213
R3	1542	I3	2119
R4	881	I4	----
R5	790	I5	800
R6	1170	I6	1050
R7	163	I7	207
		I8	4022

Unpack

Begins with reaching to envelope, package, box, or bag. Open by tearing, cutting, unfolding or unlatching, removing packing as necessary, removing object. Ends with laying aside object, packing, envelope, package, box, or bag.

R1 -- Envelope or adhesive sealed package, hand tear or cut open.

R2 -- Cardboard box, flaps cemented or stapled, 0 to 8-ft perimeter of opening.

R3 -- Cardboard box flaps taped, 0 to 8-ft perimeter of opening.

R4 -- Plastic dipped or coated or "bubble" pack, up to 15 $in.^2$

R5 -- Reusable box, no latches, lid fits loose.

R6 -- Reusable box, 2 latches, lid fits loose.

R7 -- Remove object from static-shielding bag.

Pack

Begins with reach to envelope, package, box, or bag. Open the same by spreading apart, unfolding flaps, removing lid, or unlatching lid, removing packing if necessary, positioning object, positioning package, sealing edges, folding flaps, installing lid or latching. End with asiding envelope, package, box, or bag.

I1 -- Place object in envelope or package and seal.

I2 -- Place object in box, fold flaps, cement or staple closed.

I3 -- Place object in box, fold flaps, seal with tape.

I4 -- (Not a normal maintenance operation).

I5 -- Place object in box, install lid.

I6 -- Place object in box, position lid and latch.

I7 -- Place object in static-shielding bag, close bag.

I8 -- Place object in vacuum-desiccated package.

CASE	TMU
01	10
02	100
03	1000
04	10000

Process time, related to manual or machine operations, as determined by a qualified Industrial Engineering Technician estimate. Begins with the cessation of manual motion, includes all operator idle time, and ends with the resumption of manual motions.

Remarks

Use only when no other operations are performed or where process time is the limiting factor.

CASE	TMU
01	10
02	100
03	1000
04	10000

Process time, related to manual or machine operations, as required by authorized technical directive. Begins with the cessation of manual motions, includes all operator idle time, and ends with the resumption of manual motions.

Remarks

Use only when no other operations may be performed or where process time is in the limiting factor.

FIRST	TMU	ADDITIONAL	TMU
D1	3922	Z1	2572
D2	380	Z2	50

First (D1)

Begins with getting technical data. Includes locating page number desired from index, turning to page, reading text, and observing sketch or photograph. Ends with asiding data.

Additional (Z1)

Begins with data page located. Includes reading text and observing sketch or photograph.

First (D2)

Begins with getting Form 781 (or equivalent). Includes locating desired write up, reading ten words and assimilating information. Ends with asiding Form 781.

Addition (Z2)

Begins with desired page located. Includes reading and assimilating an additional ten words.

Remarks

D1 and Z1 are for a typical page of maintenance instructions with an average of 330 words.

FIRST	TMU	ADDITIONAL	TMU
01	520	Z1	70
02	550	Z2	110
03	1260	Z3	780

First

Begins with reach to aerosol spray can. Includes removing cap or cover, shaking can to agitate vehicle, positioning can for use, actuating button to coat a spot or area, inverting can, actuating button to blow vehicle from tube, and replacing cap or cover. Ends with asiding can.

Additional

Begins with can in hand. Includes positioning to additional spot or area as necessary, actuating button to coat surface, and in process vehicle agitation as necessary. Ends with can in hand.

Remarks

01 -- Spot (bolt head, rivet, nut or area to 2 $in.^2$)

02 -- Strip, linear 1 by 12 in.

03 -- Area, surface, 1 ft^2

Applies to unobstructed surface treatment with primer, rust inhibitor, dri-lube, lacquer, or similar. Does not include time for agitation of new issue or equivalent condition aerosol cans.

REMOVE	TMU	INSTALL	TMU
RA	170	IA	220
RB	420	IB	470
RC	590	IC	640
RD	1000	ID	1050
RE	1840	IE	1890

Remove First Piece

Begins with reaching to bolt, screw, or nut. Includes initial loosening, running off a maximum of 10 turns, and removing from stud or threaded hole. Ends with laying aside washer and bolt, screw, or nut.

Install First Piece

Begins with reaching to bolt, screw, or nut. Includes selecting washer, installing to stud or threaded hole, and running down a maximum of 10 threads. Ends with tightening motion.

Remarks

Applies to NF (National Fine) or NC (National Coarse) screw threads, #2 to 1/2-in. diameter.

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
No. 2 to 1/2 in.							
RA	710	YA	460	IA	840	XA	580
RB	1100	YB	850	IB	1220	XB	970
RC	1630	YC	1370	IC	1730	XC	1450
RD	2240	YD	1970	ID	2360	XD	2050
RE	2940	YE	2630	IE	3060	XE	2730
9/16 to 1 in.							
RF	1270	YF	950	IF	1500	XF	1210
RG	1710	YG	1310	IG	1920	XG	1550
RH	2310	YH	1910	IH	2570	XH	2170
RI	3020	YI	2600	II	3240	XI	2770
RJ	4080	YJ	3710	IJ	4240	XJ	3720

Remove First Piece

Begins with reaching to tools. Includes loosening and removing nut and washer(s) from screw or bolt and removing screw or bolt. Ends with laying aside parts and tools.

Remove Additional Piece

Begins with moving to nut with tools. Includes loosening and removing nut and washer(s) from screw or bolt and removing screw or bolt. Ends with laying aside parts.

Install First Piece

Begins with reaching to screw or bolt. Includes inserting screw or bolt in hole, installing of washer(s) and nut on screw or bolt, selecting tools, and tightening, but not torquing, nut. Ends with laying aside tools.

Install Additional Piece

Begins with reaching to screw or bolt. Includes inserting screw or bolt in hole and installing washer(s) and nut on screw or bolt. Ends with tightening, but not torquing.

Remarks

Note 1: Includes alignment of castellated nut to cotter pin hole.
Note 2: To allow for extra thread length, add an add'l piece, next-easiest case.
Note 3: First piece includes attaching socket and attaching extension (50% OCC.)
Note 4: Add an extra aside if bolts or screws are to be moved.

Case variable factors: distance 10%, weight 5%, control 85%.

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
R1	600	Y1	280	I1	72	X1	42
R2	1130	Y2	520				

Remove First Piece

Begins with reaching to tools. Includes loosening and removing nut and washers from bolt and removing bolt from hole. Ends with laying aside parts and tools.

Remove Additional Piece

Begins with moving to bolt with tools. Includes loosening and removing nut and washers from bolt and removing bolt from hole. Ends with laying aside parts.

Install First Piece

Begins with reaching to bolt. Includes inserting bolt in hole, installing washers and nut on bolt, selecting tools, and tightening but not separately torquing. Ends with laying aside tools.

Install Additional Piece

Begins with reaching to bolt. Includes inserting bolt in hole and installing washers and nut on bolt. Ends with tightening but not separately torquing.

Remarks

Includes impact wrench to 1/2-in. drive on bolts to 1/2-in. dia and Keller air wrench on bolts to 5/16-in. dia.

Includes torquing where tool contains fixed or adjustable slip clutch.

Note: R2 and Y2 apply to bolts that require the use of hand tools to break torque prior to removal with power tools.

REMOVE	TMU	INSTALL	TMU
RA	120	IA	140
RB	240	IB	260
RC	370	IC	390
RD	540	ID	560
RE	950	IE	970

Remove First Piece

Begins with reaching to cap or plug and part. Includes initial loosening, running off a maximum of five turns, and removing cap or plug. Ends with laying aside cap or plug.

Install First Piece

Begins with reaching to cap or plug. Includes selecting hose, tube, or part, installing cap or plug, and running down a maximum of five turns. Ends with tightening motion.

Remarks

Applies to all aluminum or plastic caps and plugs conforming to specification MIL-C-5501B, Type I, II, and III.

UNFASTEN				FASTEN			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
RA	400	YA	320	IA	440	XA	370

Unfasten First Piece

Begins with reaching to tool. Includes placing tool to fastener stud and turning to unfasten stud from receptacle. Ends with laying aside tool.

Unfasten Additional Piece

Begins with placing tool to fastener stud. Includes turning to unfasten. Ends with unfastening stud from receptacle.

Fasten First Piece

Begins with reaching to tool. Includes placing tool to fastener stud and turning stud to secure in receptacle. Ends with laying aside tool.

Fasten Additional Piece

Begins with placing tool to fastener stud. Includes turning to secure. Ends with stud fastened to receptacle.

Remarks

Applies to CAMLOC Series 4S stud and receptacle assemblies.

UNFASTEN				FASTEN			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
No. 2 to 1/2 inch dia.							
RA	610	YA	430	IA	680	XA	500
RB	1000	YB	820	IB	1060	XB	860
RC	1430	YC	1210	IC	1570	XC	1350
RD	1920	YD	1600	ID	2180	XD	1970
RE	2380	YE	2010	IE	2810	XE	2580
9/16 to 1 inch dia.							
RF	1090	YF	890	IF	1220	XF	1050
RG	1260	YG	1070	IG	1390	XG	1200
RH	1930	YH	1680	IH	2240	XH	2030
RI	2490	YI	2110	II	2890	XI	2660
RJ	3210	YJ	2830	IJ	3810	XH	3510

Remove First Piece

Begins with reaching to tool(s). Includes loosening and removing screw or nut from hole or stud and removing washer from screw or stud. Ends with laying aside parts and tool(s).

Remove Additional Piece

Begins with moving to screw or nut with tool(s). Includes loosening and removing screw or nut from hole or stud and removing washer from screw or stud. Ends with laying aside parts.

Install First Piece

Begins with reaching to screw or nut. Includes installing washer on screw or stud, installing screw or nut to hole or stud, selecting tool(s), and tightening, but not torquing. Ends with laying aside tool(s).

Install Additional Piece

Begins with reaching to screw or nut. Includes installing washer on screw or stud and installing screw or nut to hole or stud. Ends with tightening, but not torquing.

Remarks

Does not include the use of power wrench.

Applies to NF and NC machine screws and nuts.

To allow for extra long thread length use additional piece next lower case.

Case variable factors: distance 10%, weight 5%, control 85%.

REMOVE				INSTALL			
FIRST	TMU	ADDITIONAL	TMU	FIRST	TMU	ADDITIONAL	TMU
R1	430	Y1	210	I1	460	Z1	270
R2	710	Y2	450	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
R5	1920	Y5	1520	--	--	--	--

Remove First Piece

Begins with reaching to tool(s). Includes loosening and removing screw or nut from hole or stud and removing washer from screw or stud. Ends with laying aside parts and tool(s).

Remove Additional Piece

Begins with moving to screw or nut with tool(s). Includes loosening and removing screw or nut from hole or stud and removing washer from screw or stud. Ends with laying aside parts.

Install First Piece

Begins with reaching to screw or nut. Includes installing washer on screw or stud, installing screw or nut to hole or stud, selecting tool(s) and tightening, second torquing if clutching type tool. Ends with laying aside tool(s).

Install Additional Piece

Begins with reaching to screw or nut. Includes installing washer on screw or stud, and installing screw or nut to hole or stud. Ends with tightening and torquing if clutching type tool.

Remarks

Includes impact wrench to 1/2-in. drive on screws to 1/2-in. dia: Keller air wrench on screws to 5/16-in. dia.

Note: R2 and Y2 apply to screws or nuts to 3/8-in. dia that require the use of hand tools to break torque prior to removal with power tools.

R5 and Y5 apply to the use of a rivet gun and ratchet (persuader) to remove frozen Phillips or Reed Prince screws.

(X3 and X4 have been omitted to retain consistency with NALC codes.)

FIRST	TMU	ADDITIONAL	TMU
01	16	Z1	12
02	29	Z2	25

First Piece

Begins with reaching to cutting pliers. Includes obtaining wire, string or cord, placing pliers to cutting point, and cutting. Ends with laying aside pliers and wire, string, or cord.

Additional Piece

Begins with moving to additional cutting point. Ends with cutting wire, string, or cord.

Remarks

01 -- Approximate cutting point.
02 -- Exact cutting point.

Applies to soft iron wire to .040, stainless safety wire to .040, copper wire to .10-in. dia or similar.

CASE	TMU
01	530
02	190
03	300
04	230

In and Out

Begins with reaching to vise. Includes opening vise, obtaining object, and positioning within and closing vise, tightening handle, reaching to vise handle, opening vise, obtaining object. Ends with laying object aside.

Remarks

01 -- Work content as above with dimension to be clamped not in excess of 2 in. and weight not in excess of 20 lb.
02 -- Repositioning of above object.
03 -- Object in vise.
04 -- Object out of vise.

FIRST	TMU	ADDITIONAL	TMU
01	770	Z1	140
02	480	Z2	200

First Piece

Begins with reaching to torque wrench. Includes obtaining and attaching socket and extension or adapter, adjusting torque setting if necessary, placing wrench on bolt or nut and tightening to specified torque. Ends with laying aside tools.

Additional Piece

Begins with placing wrench on bolt or nut. Ends with tightening to specified torque.

Remarks

01 -- Ratchet or nonratchet snap over torque wrench to 1600 in.-lb.
02 -- Spring or dial type torque wrench to 1600 in.-lb.
Z1 -- Used for supplement to OTF-BM/SM (etc.) for second (or more) times(s) around. Also, use 02 to tighten/loosen.

Note: Use OOH-PO-XX for accessibility (one case lower than the SM/BM) since special extensions are often used to overcome an access problem.

CASE	TMU
01	80
02	180
03	300
04	470

Begins with eye traveling to source data. Includes reading numeric data and writing duplicate entry on form or other document. Ends with completing entry.

Remarks

Includes writing data retained in memory such as shop number, date, or process code. Source data must be readily available without search and select such as page location or similar. Includes selection of data within a group or desired line in a listing provided format of source data is familiar to the user.

01 -- 1 to 3 digits.
02 -- 4 to 8 digits.
03 -- 9 to 13 digits.
04 -- 14 to 20 digits.

PER WORD	TMU
01	120

Begins with eye traveling to source data. Includes reading prose data and writing duplicate entry on form or other document. Ends with completing entry.

Remarks

Includes writing data retained in memory such as part name or shop title. Source data must be readily available without search and select such as page location or similar. Includes selection of data within a group or desired line in a listing provided format of source data is familiar to the user.

(Identical to NALC code OWR-WT-XX).

7.3 Standard Environments

Some maintenance actions involve walking considerable distances to and from the areas in which work is performed. Several standard work environments have therefore been included to provide the analyst with uniform assumptions on the nature of the real world. The assumptions enable maintenance time predictions to be made for design studies involving life-cycle costing and selection of equipment. In addition, such studies can be readily changed into work measurement standards by comparison of the standard work area with the actual work area. Figures 7.3-1, 7.3-2, and 7.3-3 show standard layouts for avionic and shipboard organizational level maintenance. Figure 7.3-4 shows the layout of a repair shop appropriate for both intermediate and depot level analysis.

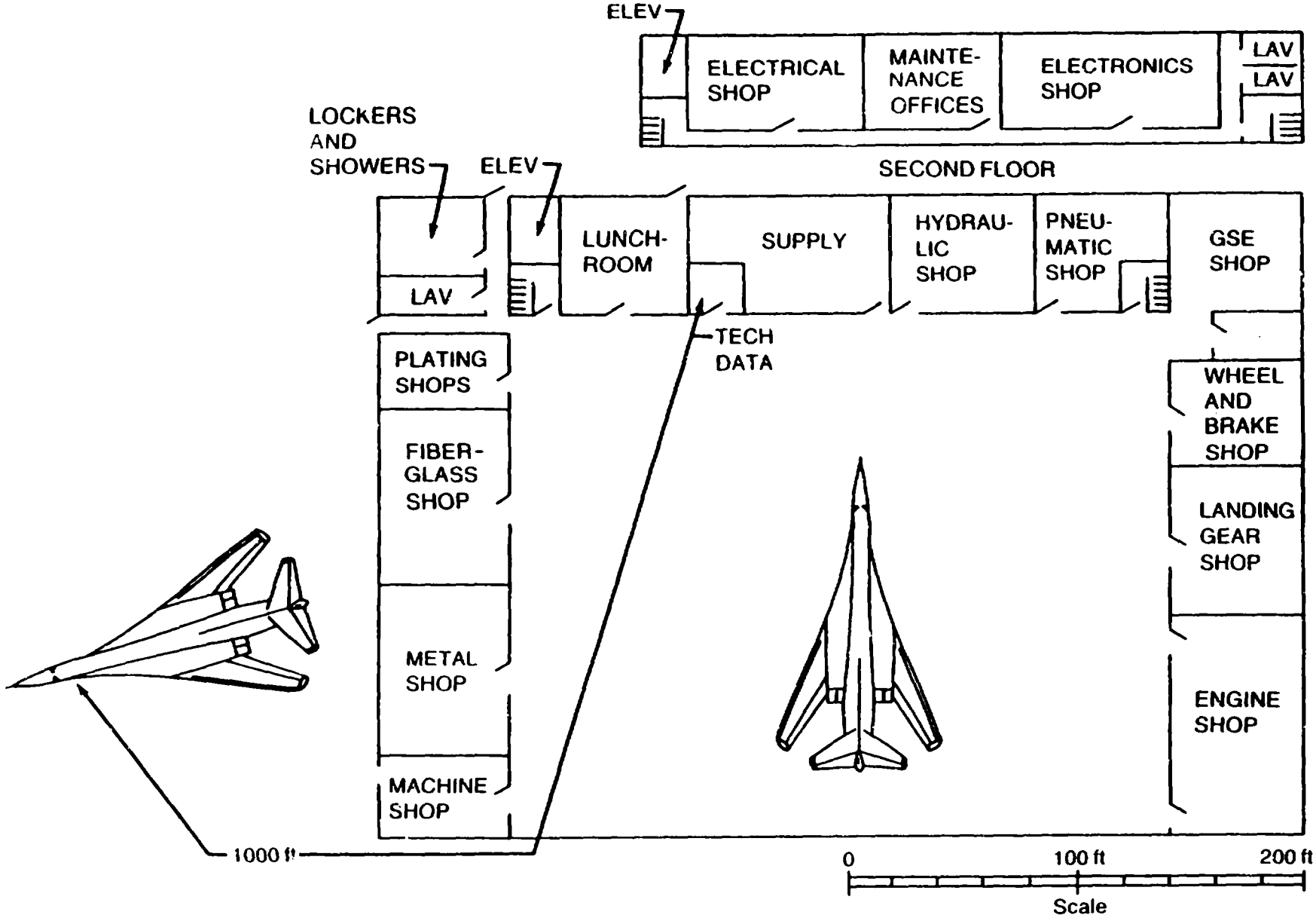


Figure 7.3-1. Standard Hanger and Flight Line Layout

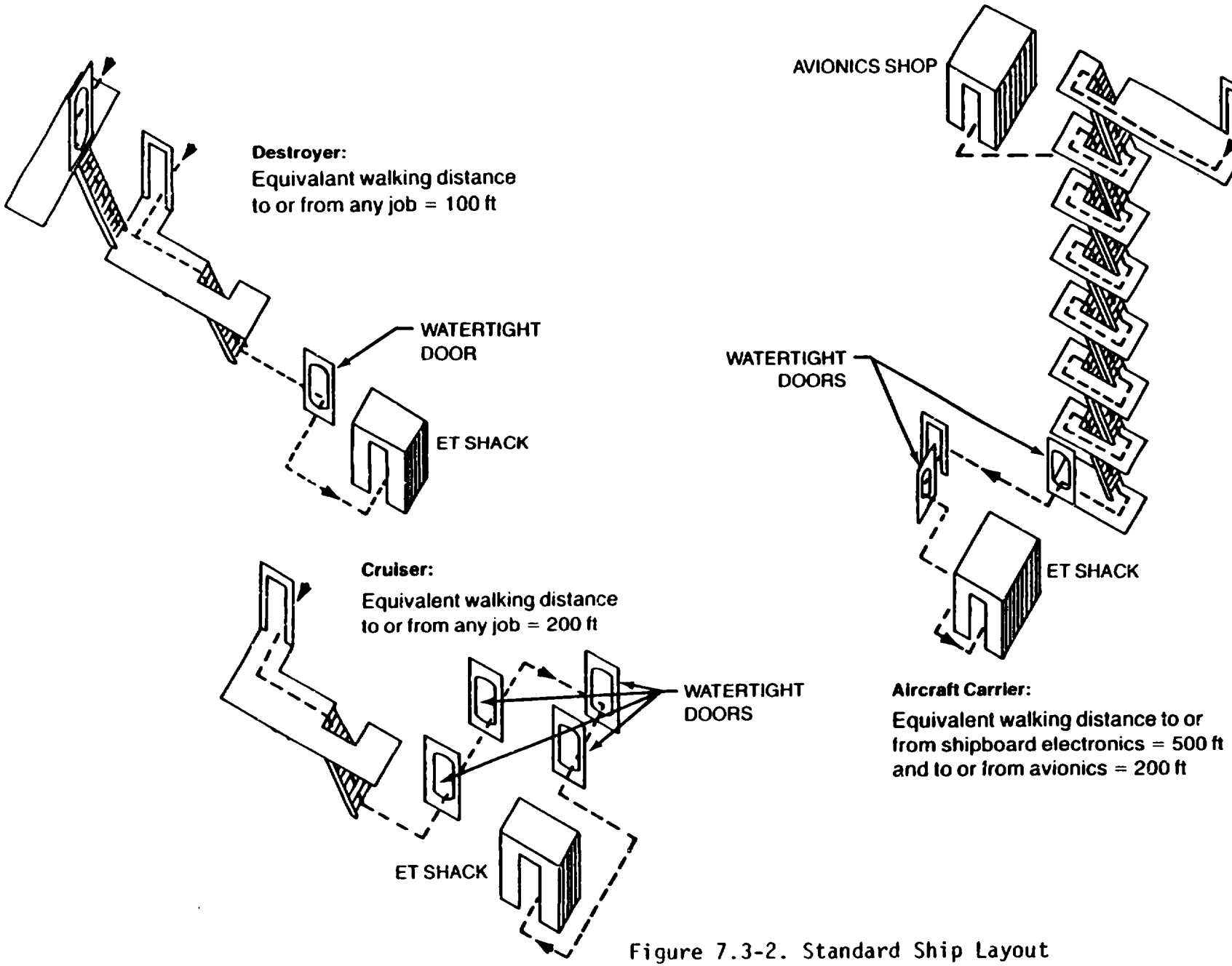


Figure 7.3-2. Standard Ship Layout

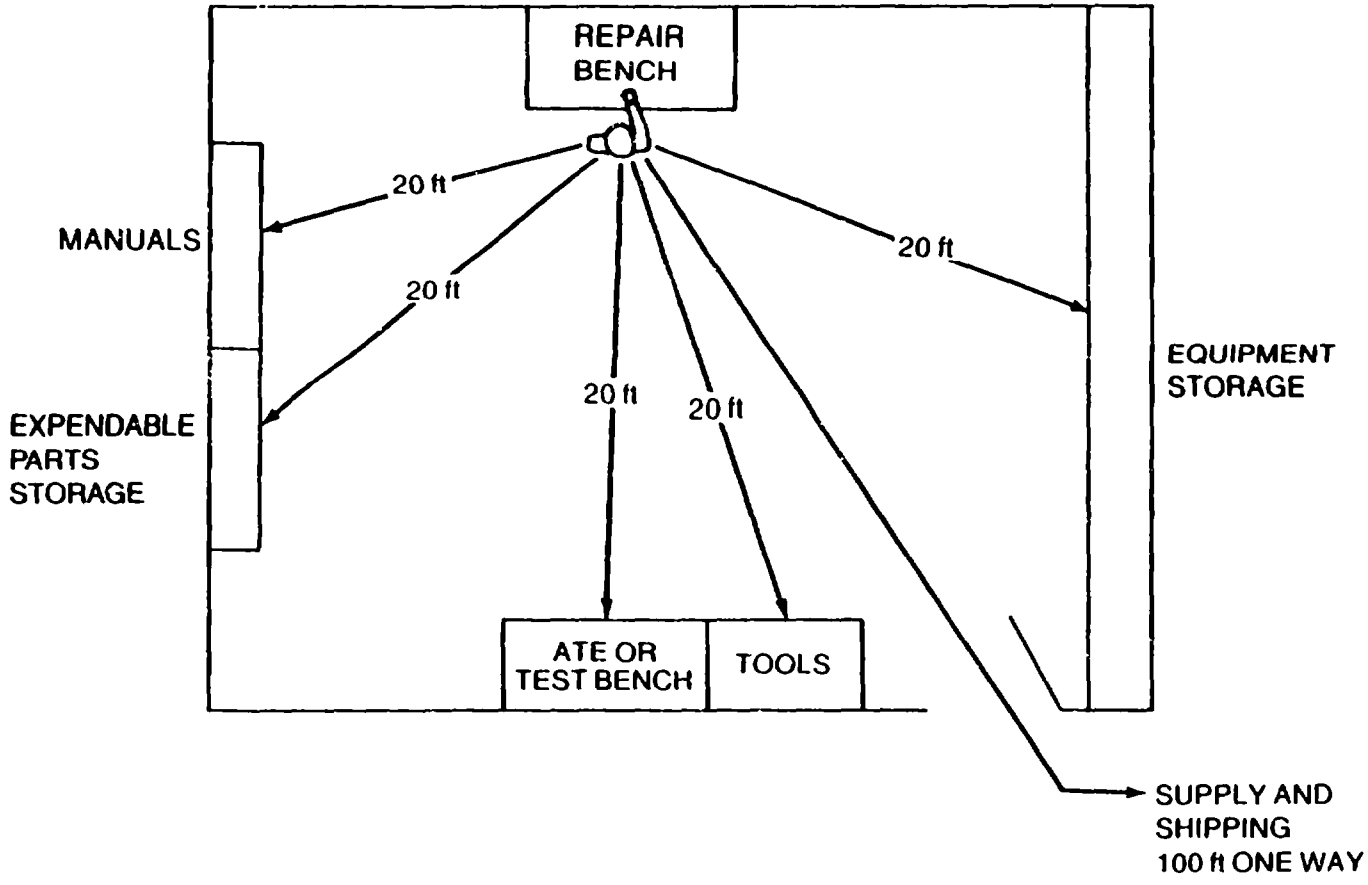


Figure 7.3-3. Repair Shop

8.0 REFERENCES

1-1 MIL-STD-1567A
Work Measurement
AFSC/PMD, Directorate of Manufacturing, Andrews AFB, DC 20334

3-1 Pliska, T.F., Jew, F.L. and Angus, J.E.,
Maintainability Prediction and Analysis Study,
RADC-TR-78-169, July 1978

3-2 DuBlanica, W., Kubeck, J. and Edwards, E.,
Validation of Maintainability Prediction,
RADC-TR-82-185, September 1982

3-3 Williams, R.L., Allegri, T.H., Bayha, F.T., et. al.,
ANSI Standard for Work Measurement and Methods
ANSI Z94.12 American Society of Mechanical Engineers, July 1972

3-4 Maynard, H.B.,
Industrial Engineering Handbook,
McGraw-Hill Book Company Inc., 1963

3-5 Karger, D.W. and Bayha, F.H.,
Engineered Work Measurements,
Industrial Press Inc., 1966

3-6 DOD 5010.15.1-M
Standardization of Work Measurement
Volume VII Bench Work Occupations
DOD/DIRSO, February 1977

3-7 DOD 5010.15.1-M
Standarization of Work Measurement
Volume I
DOD/DIRSO, February 1977

5-1 Appendix II DOD 5010.15.1-M, Basic Volume,
DOD/DIRSO, February 1977

5-2 Introduction to Work Study, Revised Edition
International Labor Office, Geneva 1969

5-3 Transfer Functions and Learning Curves,
D.R. Towill, Ergonomics 1976, Vol. 19, No. 5 623-638

5-4 Managerial Control Systems Based On Learning Curve Models,
D.R. Towill and F.W. Bevis, Int. J. Prod. Res.,
1972, Vol. II, No. 3

5-5 SAC Supplement to AFR 355-1, June 10, 1983

6-1 Human Performance and Productivity,
Vol. 3, p 237-247, E.A. Alliuisi and E.A. Fleishman,
Lawrence Erlbaum Associates, 1982

APPENDIX A

Index of Examples

Description	Level	Task Code
Conduct Flight Line Test to Isolate Troubles in UHF Radio System	Organizational	152314XM01
Remove and Install UHF Receiver-Transmitter	Orgzanizational	112314XM01
Bench Test UHF AN/ARC-109 System Using Radio Test Set AN/ARM-113 at an Intermediate Level	Intermediate	552314XM01
Fault Isolate a UHF Transceiver Confirmed to be Inoperative in Both Receive and Trasmit Modes	Depot	552314XM02
Remove and Install Module, Power Supply 1A8	Depot	112314XM02
Troubleshoot UHF Transceiver Power Supply (1A8) That Has a Faulty 26.5 VDC Output	Depot	552314XM03
Remove and Install Capacitor C8	Depot	112314XM03
Minimum Performance Test of UHF Power Supply Module 1A8	Depot	502314XM01
Perform Minimum Performance Test on UHF Radio Receiver Transmitter	Depot	502314XM02
Job Preparation-Check for Presence of Electrical Energy and Correct Continuity or Opens Prior to Connection to Missle Ordnance and Arming and Disarming Circuits	Intermediate	81ALCMST01

Appendix A provides examples of the use of the elemental standard data of Section 7.0. to analyze the repair of electronic equipment. The examples are for the F-15 airplane UHF radio and an AGM 86 missile. The examples

were selected because of the ready availability of technical manuals and test instructions. To demonstrate the use of the standard data at all levels of electronic maintenance, studies of the F-15 UHF radio system were made based on the following sequence of events:

1. An F-15 returns from a mission with a UHF radio inoperative. An AN/ARM-113 test set is used to troubleshoot the system at an organizational level. (Task Code: 152314XM01)

2. Organizational-level maintenance personnel remove and replace the UHF transceiver (T/R). (Task Code: 112314XM01)

3. The intermediate-level maintenance shop personnel bench test the T/R unit. Tests confirm that the UHF will neither transmit nor receive and the unit is shipped back to the depot. (Task Code: 552314XM01)

4. Troubleshooting at the depot reveals the main transmitter-receiver has a defective power supply module (1A8). (Task Code: 552314XM02)

5. The power supply module (1A8) is removed for troubleshooting and repair by the depot. (Task Code: 112314XM02, Step A)

6. The power supply module (1A8) is bench tested per maintenance manual troubleshooting procedure at the depot. A defective capacitor (C8) is found. (Task Code: 552314XM03)

7. The defective capacitor (C8) is removed and replaced by a depot level technician. (Task Code: 112314XM03)

8. A minimum performance test is conducted by the depot on the power supply module (1A8). (Task Code: 502314XM01)

9. The power supply module is replaced in the T/R unit by the depot. (Task Code: 112314XM02, Step B)

10. A minimum performance test is conducted on the T/R unit. (Task Code: 502314XM02)

Up to the time at which troubleshooting of modules takes place (event 4 above) the maintenance actions are independent of failure mode. In the example scenario, event 4 reveals a problem with the power supply module, 1A8. For event 4 through 9, the analyses cover work on power supply module only.

Other failure modes of the UHF radio could be analyzed in a similar manner. An analysis of all failure modes would provide sufficient information to determine the Mean Time to Repair (MTTR) for the UHF radio system using the method of calculation provided in Reference 3-1. The failure rates for each failure mode of all modules and parts are, of course, required to complete the calculation of MTTR.

In addition to the studies made of the UHF on the F-15, a study was made of the Safe Test of the AGM86 missile, in which a check is made for presence of electrical energy and correct continuity or opens prior to connection of missile ordnance, arming, and disarming circuits.

TASK CODE: 152314XM01

PART NAME: UHF RADIO SYSTEM

SUMMARY

APL MODEL: F-15 PART NO: ZONE:

TASK DESCRIPTION: * CONDUCT FLT LINE TEST TO
* ISOLATE TROUBLES IN UHF RADIO
* SYSTEM

PREPARED BY: J.DAVOLT ORG: B7463 DATE: 1-9-84P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: THIS ANALYSIS IS FOR USE AS AN EXAMPLE OF MAINTAINABILITY TIME STANDARDS APPLICATION. THE UHF RADIO AN/AR109 IS INSTALLED ON F-15 AIRCRAFT. USING THE TEST SET AN/ARM-113 AT THE APL IS OPTIONAL TO REMOVING THE TRANSCEIVER, CONTROLLER OR INTERCOM SET AND PERFORMING THE TESTS ON A BENCH SETUP. IN THIS ANALYSIS IT IS ASSUMED ACCESS TO THE UHF SET IS OPEN AND A WORK PLATFORM IS POSITIONED PER 112314XM01. ASSUME THE APL IS IN A HANGAR. POWER IS CONNECTED TO APL.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS: .93 HRS ..... WITH PF&D: 1.11 HRS

TOTAL ELAPSED: .46 HRS ..... WITH PF&D: .56 HRS

GSE REQUIRED: YES

PERSONAL: 9%

FATIGUE: 6%

DELAY: 5%

TASK CODE: 152314XM01

SUBOPERATION SUMMARY

PART NAME: UHF RADIO SYSTEM

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
01	CONDUCT FLT LINE TEST TO ISOLATE TROUBLES IN UHF RADIO SYSTEM	1,2			4627	9254
A	JOB PREPARATION	1,2		200	562	1124
B	INSTL TEST EQUIPMENT	1	C	200	1096	2192
C	SET CONDITIONS FOR TEST	2	B	100	-60	
D	PERFORM SELF TEST ON ARM-13	1,2		200	1152	2304
E	TEST USING TS-2535/ARM-113	1,2		200	404	808
F	TERMINATE TEST	1,2		200	1413	2826

TASK CODE: 152314XM01

STANDARD DATA APPLICATION

PART NAME: UHF RADIO SYSTEM

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
G1	CONDUCT FLT LINE TEST TO ISOLATE TROUBLES IN UHF RADIO SYSTEM	1,2						4627	9254
A	JOB PREPARATION	1,2					200	562	1124
1	OBTAIN TECHNICAL INFORMATION REQUIRED	1	2	OMH-OF-01	1			-20	
2	OBTAIN TEST EQUIPMENT AND TOOLS	2	1	OOH-OB-D1	2			96	
3	FROM SHOP TO APL	1,2		OBM-WO-01	37			333	
4	ASIDE TEST EQUIPMENT AND TOOLS	1,2		OOH-OB-D2	2			96	
5	UP W/STAND TO ACCESS DOOR	1	6	OBM-WO-01	1			9	
6	TO COCKPIT	2	5	OBM-WO-01	1			-8	
7	LOCATE UHF RADIO SW	2		OIT-EV-ZB		2		20	
8	TURN OFF UHF SWITCH	2	9	OAC-CM-02	1			8	
9	TURN OFF TEST SET PWR SW	1	8	OAC-CM-02	1			-7	
B	INSTL TEST EQUIPMENT	1	C				200	1096	2192
1	POSIT TEST EQUIPMENT ADJACENT TO UHF RADIO	1		OOH-OB-D1	1			48	
2	INSTL TEST CABLE ASSEMBLIES TO HOOK TEST EQUIPT PER FIG 5-1	1		ETF-CE-IC	9			765	
3	RMV SAFETY WIRE FROM ANTENNA CONNECTOR	1		ONF-ST-RB	1	1		122	
4	RMV CONNECTOR FROM ANTENNA CONNECTION TO R/T UNIT	1		ETF-CE-RC	2			142	
5	RMV CONNECTOR FROM J4 OF R/T UNIT	1		ENF-CB-RC	1			19	
C	SET CONDITIONS FOR TEST	2	B				100	-60	
1	SELECT APPROVED TEST FREQUENCY	2		OAC-CM-02	1	3		20	
2	SELECT MANUAL ON MODE SELECTOR	2		OAC-CM-01	1			4	
3	VOLUME CONTROL TO MAXIMUM	2		OAC-CM-03	1			17	
4	FUNCTION SWITCH OFF	2		OAC-CM-01	1			4	
5	TONE AND SQ DISABLE SWITCHES RELEASED	2		OAC-CM-01	2			8	
6	PRIMARY PWR SWITCH ON	2		OAC-CM-02	1			8	
D	PERFORM SELF TEST ON ARM-13	1,2					200	1152	2304
1	OBSERVE THAT ALL STATUS INDICATORS ON TEST SET INDICATE NORMAL	1		OIT-EV-0A	10			120	
2	PREFORM SELF TEST ON ARM-13	1		OAC-CM-02	4			32	

TASK CODE: 152314XM01

STANDARD DATA APPLICATION — PART NAME: UHF RADIO SYSTEM

STEP		DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	3	ASSURE ADJUSTMENT OF 960P-1 IS CORRECT	1		OPT-ET-04	1			1000	
E		TEST USING TS-2585/ARM-113	1,2					200	404	808
	1	TURN TESTER FUNCTION SELECTOR TO POSITION 1	1		OAC-CM-02	1			8	
	2	OBSERVE STATUS INDICATORS ARE ALL NORMAL?	1		OIT-EV-ZB		1		10	
	3	TURN FUNCTION SELECTOR TO POSITION 2	1		OAC-CM-02	1			8	
	4	OBSERVE RCVR/XMTR, KEY LINE AND CONTROL STATUS INDICATORS (IF A FAULT IS INDICATED, COMPONENT MUST BE REPLACED BEFORE CONTINUING)	1		OIT-EV-ZB		3		30	
	5	CONTINUE TEST IN TABLE 5-1 OF REFERENCE. WILL REQUIRE 21 SWITCH ACTUATIONS	1,2		OAC-CM-02	21			168	
	6	CONTINUING WITH TEST IN TABLE 5-1 WILL REQUIRE 18 OBSERVATIONS	1		OIT-EV-ZB		18		180	
F		TERMINATE TEST	1,2					200	1413	2826
	1	SET RADIO FUNCTION SWITCH TO OFF	2		OAC-CM-02	1			8	
	2	TURN OFF PRIMARY AIRCRAFT POWER SWITCH	2		OAC-CM-02	1			8	
	3	DISCONNECT TEST CABLES	1		ETF-CE-RC	9			639	
	4	RECONNECT ANTENNA TO R/ NIT	1	7	ETF-CE-IC	1			85	
	5	SAFETY WIRE CONNECTOR	1	7	ONF-ST-IB	1	1		202	
	6	REINSTALL CONNECTOR A J4	1	7	ENF-CB-IC	1			33	
	7	STOW TEST CABLES IN TEST BOX	2	4,5,6	OMH-OP-04	1			-19	
	8	DOWN WORK STAND	1,2		OBM-WO-01	1			9	
	9	GET TOOLS & TEST EQUIP	1,2		OOH-OB-D1	1			48	
	10	RETURN TO SHOP	1,2		OBM-WO-01	37			333	
	11	ASIDE TOOLS & EQUIPMENT	1,2		OOH-OB-D2	1			48	

TASK CODE: 112314XM01

PART NAME: UHF RECEIVER-TRANSMITTER

SUMMARY

APL MODEL: F-15 PART NO: ZONE:

TASK DESCRIPTION: * RMV AND INSTL UHF RECEIVER-
* TRANSMITTER

PREPARED BY: J.WOYTKO ORG: B7463 DATE: 12-07-83P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 1F-15A-2-23GS-00-1

REMARKS: POWER OFF. THIS ANALYSIS IS AN EXAMPLE OF MAINTAINABILITY TIME STANDARDS APPLICATION TO AN ORGANIZATIONAL MAINTENANCE TASK ON AN F-15 AIRPLANE.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.36 HRS	WITH PF&D:	.43 HRS
TOTAL ELAPSED:	.36 HRS	WITH PF&D:	.43 HRS
AT APL MANHOURS:	.31 HRS	WITH PF&D:	.38 HRS
AT APL ELAPSED:	.31 HRS	WITH PF&D:	.38 HRS

GSE REQUIRED: NO

PERSONAL:	9%
FATIGUE:	6%
DELAY:	5%

SUBOPERATION SUMMARY

TASK CODE: 112314XM01

PART NAME: UHF RECEIVER-TRANSMITTER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
01	RMV AND INSTL UHF RECEIVER-TRANSMITTER				3601	3601
A1	JOB PREPARATION (PRIMARY)	1		100	462	462
A	JOB PREPARATION (SECONDARY)	1		100	133	133
B	ACCESS DOOR 3R	1		100	207	207
C	RMV ELEC CABLES	1		100	473	473
D	RMV UHF RECEIVER-TRANSMITTER	1		100	173	173
E	GET NEW UHF RECEIVER-TRANSMITTER	1		100	255	255
F	INSTL UFH RECEIVER-TRANSMITTER	1		100	246	246
G	INSTL ELEC CABLES	1		100	729	729
H	CLOSE DOOR 3R	1		100	372	372
J	JOB TERMINATION	1		100	551	551

TASK CODE: 112314XM01

STANDARD DATA APPLICATION

PART NAME: UHF RECEIVER-TRANSMITTER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
01	RMV AND INSTL UHF RECEIVER-TRANSMITTER							3601	3601
A1	JOB PREPARATION (PRIMARY)	1					100	462	462
1	GET FORM 781			OMH-LA-OA	1			5	
2	READ DISCREPANCY			ORD-TM-D2	1			438	
3	GET TOOLS & EQUIPMENT			OMH-LA-OC	1			19	
A	JOB PREPARATION (SECONDARY)	1					100	133	133
1	ASIDE TOOLS & EQUIPMENT			OMH-LA-OC	1			19	
2	GET SMALL W/STAND			OOH-OB-D8	1			114	
B	ACCESS DOOR 3R	1					100	207	207
1	RELEASE DOOR LATCH FASTNERS			ONF-FT-RB	1	2		32	
2	DISENGAGE DOOR LATCHES			OOH-DE-OC	3			66	
3	POSN SMALL W/STAND			OOH-OB-D7	1			51	
4	UP SMALL W/STAND			OBM-WO-O1	1			9	
5	OPEN DOOR 3R WITH H/O ROD			OJP-AC-D1	1			49	
C	RMV ELEC CABLES	1					100	473	473
1	RMV QWIK DISCONNECT CABLES			ENF-CB-RC	2			38	
2	RMV SAFETY WIRE RF CABLE			ONF-ST-RC	1			208	
3	RMV RF CABLE			ETF-CE-RC	1			71	
4	CAP CABLES & CONNECTORS			OTF-CF-IB	6			156	
D	RMV UHF RECEIVER-TRANSMITTER	1					100	173	173
1	LOOSEN LRU RATCHET FASTNER			OTF-BF-RC	2			118	
2	POSN SWIVEL BOLT			OOH-PO-OA	2			24	
3	DISENGAGE UHF			OOH-DE-OC	1			22	
4	DOWN SMALL W/STAND			OBM-WO-O1	1			9	
E	GET NEW UHF RECEIVER-TRANSMITTER	1					100	255	255
1	ASIDE OLD UHF			OMH-LA-OB	1			12	
2	OPEN CARDBOARD BOX			OPK-OB-R2	1			168	
3	RMV UHF FROM DESICCATED PKG			OPK-OB-R1	1			49	
4	INSP NEW UHF			OIT-EV-OA	1	1		17	
5	UP SMALL W/STAND			OBM-WO-O1	1			9	
F	INSTL UFH RECEIVER-TRANSMITTER	1					100	246	246
1	POSN UHF			OOH-PO-OC	1			42	

TASK CODE: 112314XM01

STANDARD DATA APPLICATION

PART NAME: UHF RECEIVER-TRANSMITTER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
2	POSN SWIVEL BOLTS			OOH-PO-OA	2			24	
3	TIGHTEN LRU RATCHET FASTENER			OTF-BF-IC	2			128	
4	REPOSN UHF			OOH-PO-OA	1			12	
5	FINAL TIGHTEN LRU RATCHET FASTENER (EQ TO)			OTL-WT-Z2		2		40	
G	INSTL ELEC CABLES	1					100	729	729
1	RMV CAPS CABLES & CONNECTORS			OTF-CF-RB	6			144	
2	INSTL RF CABLE			ETF-CE-IC	1			85	
3	SAFETY RF CABLE			ONF-ST-IC	1			275	
4	INSTL QWIK DISCONN CABLES			ENF-CB-IB	2			44	
5	INSP INSTALLATION			OIT-EV-OB	1	3		51	
6	POLICE AREA			OEL-ET-03	1			100	
7	RMV RFI TAG			OOH-TR-R1	1			30	
H	CLOSE DOOR 3R	1					100	372	372
1	CLOSE DOOR 3R WITH H/O ROD			OJP-AC-D2	1			49	
2	DOWN SMALL W/STAND			OBM-WO-01	1			9	
3	REPOSN SMALL W/STAND			OOH-OB-D7	1			51	
4	POSN DOOR LATCHES			OOH-PO-OC	3			126	
5	FASTEN DOOR LATCH FASTENERS			ONF-FT-IB	3			60	
6	GET FORM 781			OMH-LA-OA	1			5	
7	RECORD ACTION TAKEN			OWR-NT-02	4			72	
J	JOB TERMINATION	1					100	551	551
1	FILL OUT & ATTACH TAG			OOH-TR-I2	1			418	
2	ASIDE SMALL W/STAND			OOH-OB-D8	1			114	
3	GET TOOLS & EQUIP			OMH-LA-OC	1			19	

TASK CODE: 552314XM01

PART NAME: UHF COMM SYSTEM

SUMMARY

APL MODEL: ALL PART NO: AN-ARC-109 ZONE:

TASK DESCRIPTION:
* BENCH TEST UHF AN/ARC-109
* SYSTEM USING RADIO TEST SET
* AN/ARM-113 AT AN INTERMEDIATE
* LEVEL.

PREPARED BY: J.DAVOLT ORG: B7463 DATE: 1-9-84P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: DEVELOPED AS AN EXAMPLE OF MAINTAINABILITY TIME STANDARDS APPLICATION. ASSUMPTIONS ARE AS FOLLOWS: BENCH TEST SETUP SIMILAR TO FIGURE 5-1 OF REF. EQUIPMENT TO BE TESTED IS DELIVERED TO SHOP. THIS TEST SIMILAR TO 152314XM01 WHICH IS PREFORMED ON APL. BENCH TEST WOULD BE USED TO CONFIRM FINDINGS ON APL PRIOR TO SENDING UNIT FOR DETAILED INSPECTION.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.18 HRS	WITH PF&D:	.21 HRS
TOTAL ELAPSED:	.18 HRS	WITH PF&D:	.21 HRS

GSE REQUIRED: YES

PERSONAL:	5%
FATIGUE:	5%
DELAY:	5%

TASK CODE: 552314XM01

SUBOPERATION SUMMARY PART NAME: UHF COMM SYSTEM

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
01	BENCH TEST UHF AN/ARC-109 SYSTEM USING RADIO TEST SET AN/ARM-113 AT ORGANIZATIONAL LEVEL.				1802	1802
A	PREPARE FOR TEST	1		100	608	608
B	TEST CONTROL (IF CONTROL ONLY IS TESTED USE STEPS 1.4 OF TABLE 5-1) (IF A FAULTY UNIT IS FOUND IT MUST BE REPLACED BEFORE CONTINUING THE TEST)			100	126	126
C	TEST TRANSCEIVER (IF TRANSCEIVER ONLY IS TESTED USE STEPS 7 THRU 17 OF TABLE 5-1). (IF A FAULTY UNIT IS FOUND IT MUST BE REPLACED BEFORE CONTINUING TEST).			100	270	270
D	TERMINATE TEST	1		100	798	798

TASK CODE: 552314XM01

STANDARD DATA APPLICATION

PART NAME: UHF COMM SYSTEM

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
								1802	1802
01	BENCH TEST UHF AN/ARC-109 SYSTEM USING RADIO TEST SET AN/ARM-113 AT ORGANIZATIONAL LEVEL.								
							100	608	608
A	PREPARE FOR TEST	1							
1	GET COMPONENTS TO BE TESTED AND LOCATE ON BENCH	1		OOH-OB-D4	2			80	
2	ASSURE THAT RADIO SET CONTROL FUNCTION SWITCH IS SET TO OFF AND THE RADIO TEST SET POWER SWITCH IS OFF	1		OAC-CM-02	2			16	
3	CONNECT UNIT TO BE TESTED TO BENCH TEST SET UP A3 SHOWN IN FIGURE 5-2	1		ETF-CE-IC	4			340	
4	SET CONTROLS PER PAR. 5-7, F1 THRU 4	1		OAC-CM-02	9			72	
5	OBSERVE STATUS INDICATOR LIGHTS ON TEST SET.	1		OIT-EV-ZB		10		100	
							100	126	126
B	TEST CONTROL (IF CONTROL ONLY IS TESTED USE STEPS 1.4 OF TABLE 5-1) (IF A FAULTY UNIT IS FOUND IT MUST BE REPLACED BEFORE CONTINUING THE TEST)								
1	ACTUATE SWITCHES AS REQUIRED BY TABLE 5-1 STEPS 1.4.	1		OAC-CM-02	7			56	
2	OBSERVE RESULTS	1		OIT-EV-ZB		7		70	
							100	270	270
C	TEST TRANSCEIVER (IF TRANSCEIVER ONLY IS TESTED USE STEPS 7 THRU 17 OF TABLE 5-1). (IF A FAULTY UNIT IS FOUND IT MUST BE REPLACED BEFORE CONTINUING TEST).								
1	ACTUATE SWITCHES AS REQUIRED BY TABLE 5-1 STEPS 7 THRU 17	1		OAC-CM-02	15			120	
2	OBSERVE RESULTS	1		OIT-EV-ZB		15		150	
							100	798	798
D	TERMINATE TEST	1							
1	TURN OFF RADIO SET FUNCTION SWITCH AND TEST SET POWER	1		OAC-CM-02	2			16	

STANDARD DATA APPLICATION

TASK CODE: 552314XM01

PART NAME: UHF COMM SYSTEM

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	SWITCH TO OFF.								
2	DISCONNECT UNIT TESTED	1		ETF-CE-RC	4			284	
3	FILL OUT DEPOSITION TAGGED FOR TESTED UNIT	1		OOH-TR-I2	1			418	
4	ASIDE TESTED UNIT	1		OOH-OB-D4	2			80	

TASK CODE: 552314XM02

PART NAME: UHF TRANSCEIVER

SUMMARY

APL MODEL: ALL PART NO: RT-749/ARC109 ZONE:

TASK DESCRIPTION: * FAULT ISOLATE A UHF TRANSCEIVER
* CONFIRMED TO BE INOPERATIVE IN
* BOTH RECEIVE AND TRANSMIT MODES

PREPARED BY: J.DAVOLT ORG: B7463 DATE: 1-9-84P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: FOR THIS TASK IT IS ASSUMED A UHF TRANSCEIVER IS INOPERATIVE AS CONFIRMED BY PREVIOUS TESTS AND IS NOW BEING EXAMINED TO DETERMINE THE MODULE CAUSING THE PROBLEM. TABLE 6-5 OF REF. T.O., NOTE 1, SUGGESTS PERFORMING PART I THEN PART V TO ISOLATE FAULT. ASSUME: PART IS ON RECEIVING TABLE IN DEPOT ELECTRONIC REPAIR SHOP.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.38 HRS	WITH PF&D:	.44 HRS
TOTAL ELAPSED:	.38 HRS	WITH PF&D:	.44 HRS

GSE REQUIRED: YES

PERSONAL:	5%
FATIGUE:	5%
DELAY:	5%

TASK CODE: 552314XM02

SUBOPERATION SUMMARY

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DMU ELAPSED	DMU TOTAL
02	FAULT ISOLATE A UHF TRANSCEIVER CONFIRMED TO BE INOPERATIVE IN BOTH RECEIVE AND TRANSMIT MODES				3812	3812
A	PREPARE FOR TEST			100	2352	2352
B	MAIN RECEIVER & TRANSMITTER INOPERATIVE TEST(PART I)			100	936	936
C	FREQUENCY GENERATING CIRCUITS INOPERATIVE TEST (PART V)	1		100	451	451
D	TEST TERMINATION			100	73	73

TASK CODE: 552314XM02

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY IST	QTY ADD	OCC	DMU ELAPSED	DMU TOTAL
02	FAULT ISOLATE A UHF TRANSCEIVER CONFIRMED TO BE INOPERATIVE IN BOTH RECEIVE AND TRANSMIT MODES							3812	3812
A	PREPARE FOR TEST						100	2352	2352
1	REVIEW TECH DATA			ORD-TM-D1	1	4		1421	
2	MOVE TR UNIT TO TEST BENCH			OOH-OB-D4	1			81	
3	DEPRESSURIZE UNIT			COH-PO-OC	2			84	
4	RMV SCREWS SECURING CASE			OIF-SM-RA	1	11		534	
5	ASSURE RADIO SET CONTROL FUNCTION SWITCH AND TEST POWER SWITCH ARE OFF			OAC-CM-02	2			16	
6	DISENGAGE OUTER CASE			OOH-DE-OD	2			80	
7	CONNECT TEST CABLES TO TR UNIT			ETF-CE-IB	2			136	
B	MAIN RECEIVER & TRANSMITTER INOPERATIVE TEST(PART I)						100	936	936
1	TURN ON TEST POWER SW AND SET RADIO SET CONTROL FUNCTION TO MAIN, TUNING MODE TO MANUAL AND MANUAL SELECTOR TO 225.000 MHz			OAC-CM-02	1	6		32	
2	MEASURE VOLTAGE AT TEST POINTS 1, 2 AND 3 (IF NORMAL GO TO B6)			EIT-TH-D6	1	2		152	
3	IF NO VOLTAGE OBSERVE L2, L3 & L4 ON TEST SET, INSPECT CABLE CONNECTIONS			OIT-EV-ZB		4		40	
4	CHECK VOLTAGE AT J4, J5 & J6 ON TEST SET-IF OUT OF TOLERANCE GO TO B-5.			EIT-TH-Z6		3		89	
5	MEASURE VOLTAGE AT F1, F2 & F3 (REPLACE FUSE IN TEST SET-IF REPLACEMENT FUSE BLOWS RMV 1A2 AND 1A8 AND RECHECK-TROUBLE IS ISOLATED TO CHASSIS WIRING OR 1A2OR1A8).			EIT-TH-Z6		3		89	
6	MEASURE VOLTAGE AT (H1) (1A8J1) AND GRD	1		EIT-TH-Z6		1		30	
7	MEASURE VOLTAGE AT (H2) (1A8J2) AND GRD (CAUTION 560 +VOLTS!)	1		EIT-TH-Z6		1		30	
8	MEASURE VOLTAGE AT (H3) (1A8J3)	1		EIT-TH-Z6		1		30	
8	AND GND	1		EIT-TH-Z6		1		30	
9	MEASURE VOLTAGE AT (H4) (1A8J4)	1		EIT-TH-Z6		1		30	

TASK CODE: 552314XM02

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	AND GRD								
10	MEASURE VOLTAGE AT (H5) (1A8J5)	1		EIT-TH-Z6		1		30	
	AND GRD								
11	MEASURE VOLTAGE AT (H6) (1A8J6)	1		EIT-TH-Z6		1		30	
	AND GRD								
12	DISCONN TEST SET AS SHOWN IN FIGURE 6-5	1		ETF-CE-RB	1	2		57	
13	CONNECT TEST SET AS SHOWN IN FIGURE 6-6	1		ETF-CE-IB	1	2		68	
14	SET RADIO SET CONTROLS PER TABLE 6-4, STEP 12 B THRU C	1		OAC-CM-02	5			40	
15	OBSERVE VOLTAGE INDICATION	1		OIT-EV-ZB		1		10	
16	PLACE TEST SET MIC KEY TO ON POSITION (IF VOLTAGE IS OUT OF TOLERANCE ADJUST 1A2R6) (IF NO VOLTAGE REPLACE 1A8) (IF FAULT REMAINS IT IS IN CHASSIS WIRNG)	1		OAC-CM-02	1			8	
17	RETURN SWITCHES TO STEP B-1 CONDITION.	1		OAC-CM-02	6			48	
18	MEASURE VOLTAGE AT .5 (J21 AND GRD) (IF ABNORMAL CHECK CONTINUITY OF CHASSIS WIRING)	1		EIT-TH-Z6		1		30	
19	ACTUATE TEST SET MIC KEY TO ON	1		OAC-CM-02	1			8	
20	MEASURE VOLTAGE AT .6 (J22 AND GRD) (IF ABNORMAL SAME AS STEP B-18)	1		EIT-TH-Z6		1		30	
21	MEASURE VOLTAGE AT .4 (J20 AND GRD) (IF ABNORMAL CHECK CONTINUITY OF CHASSIS WIRING)	1		EIT-TH-Z6		1		30	
C	FREQUENCY GENERATING CIRCUITS INOPERATIVE TEST (PART V)	1					100	451	451
1	DISCONN "TRANSMIT" HOOKUP	1		ETF-CE-RB	1	2		57	
2	CONNECT TO "RECEIVE" CONFIGURATION PER FIGURE 6-5.			ETF-CE-IB	1	2		68	
3	ASSURE MIC KEY ON TEST SET IS OFF AND SET RADIO CONTROLS AS FOLLOWS: FUNCTION SELECTOR TO MAIN, TUNING SELECTOR TO MANUAL AND MANUAL SELECTORS TO 225.000 MHZ			OAC-CM-02	6			48	
4	MEASURE VOLTAGE AT (E1) (1A5J1) (IF NO VOLTAGE FAULT IS IN FREQ	1		EIT-TH-D6	1			93	

TASK CODE: 552314XM02

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	SYNTHESIZER 1A5 REPLACE 1A5)								
5	MEASURE FREQUENCY AT (E1) (1A5J1) (IF FREQUENCY IS RANDOM PROCEED TO PART V1)	1		EIT-TH-D6	1			93	
6	MEASURE VOLTAGE AT (A4) (1A1J4) (IF INDICATION IS ABNORMAL TROUBLE IS IN RELAY 1A5K1 OR CHASSIS WIRING)			EIT-TH-D6	1			93	
							100	73	73
D	TEST TERMINATION			OAC-CM-02	2			16	
1	TURN OFF TEST POWER SWITCH AND RADIO SET CONTROL FUNCTION SWITCH.			ETF-CE-R3	1	2		57	
2	DISCONNECT CONNECTORS TO TRANSCEIVER.								

TASK CODE: 112314XM02

PART NAME: POWER SUPPLY 1A8

SUMMARY

APL MODEL: ALL PART NO: ZONE:

TASK DESCRIPTION: * RMV & INSTL MODULE, POWER
* SUPPLY 1A8

PREPARED BY: J.VOYTKO ORG: B7463 DATE: 12-07-83P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: THIS ANALYSIS IS AN EXAMPLE OF MAINTAINABILITY TIME STANDARDS APPLICATION AT THE DEPOT LEVEL.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.12 HRS	WITH PF&D:	.14 HRS
TOTAL ELAPSED:	.12 HRS	WITH PF&D:	.14 HRS

GSE REQUIRED: NO

PERSONAL:	8%
FATIGUE:	5%
DELAY:	5%

TASK CODE: 112314XM02

SUBOPERATION SUMMARY

PART NAME: POWER SUPPLY 1A8

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
02	RMV & INSTL MODULE, POWER SUPPLY 1A8				1161	1161
A	RMV MODULE AND COVER			100	536	536
B	INSTL COVER & MODULE			100	625	625

STANDARD DATA APPLICATION

TASK CODE: 112314XM02

PART NAME: POWER SUPPLY 1A8

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
02	RMV & INSTL MODULE, POWER SUPPLY 1A8							1161	1161
A	RMV MODULE AND COVER						100	536	536
1	LOOSEN MODULE HOLD DOWN SCREWS (EQ TO)			OTL-WT-02	1	3		108	
2	RMV COVER RETAINING SCREWS			OTF-SM-RB	1	4		428	
B	INSTL COVER & MODULE						100	625	625
1	POSN COVER			00H-P0-0B	1			25	
2	INSTL COVER RETAINING SCREWS			OTF-SM-IB	1	4		450	
3	POSN MODULE			00H-P0-0C	1			42	
4	TIGHTEN MODULE HOLD DOWN SCREWS (EQ TO)			OTL-W1-02	1	3		108	

TASK CODE: 552314XM03

PART NAME: UHF TRANSCEIVER PWR SUPPLY

SUMMARY

APL MODEL: ALL PART NO: 1A8 ZONE:

TASK DESCRIPTION: * TROUBLESHOOT UHF TRANSCEIVER
* POWER SUPPLY (1A8) THAT HAS A
* FAULTY 26.5 VDC OUTPUT

PREPARED BY: J.DAVOLT ORG: B7463 DATE: 1-9-84P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: THIS ANALYSIS IS AN EXAMPLE OF A DEPOT LEVEL MAINTAINABILITY TIME STANDARDS APPLICATION. IT IS ASSUMED THAT 552314XM02 INDICATED THE POWER SUPPLY MODULE (1A8) COULD NOT BE ADJUSTED TO OBTAIN 26.5 VDC. TROUBLE SHOOTING PROCEDURES FOR 1A8 MODULE WITH FAULTY +26.5 VDC OUTPUT IS USED FOR THIS ANALYSIS.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.27 HRS	WITH PF&D:	.31 HRS
TOTAL ELAPSED:	.27 HRS	WITH PF&D:	.31 HRS
GSE REQUIRED:	YES	PERSONAL:	5%
		FATIGUE:	5%
		DELAY:	5%

TASK CODE: 552314XM03

SUBOPERATION SUMMARY

PART NAME: UHF TRANSCEIVER PWR SUPPLY

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
03	TROUBLESHOOT UHF TRANSCEIVER POWER SUPPLY (1A8) THAT HAS A FAULTY 26.5 VDC OUTPUT				2732	2732
A	SET UP TEST BENCH FOR 1A8 MODULE TEST	1		100	1650	1650
B	VERIFY FAULTY VOLTAGE AT 1A8J4	1		100	141	141
C	TRANSISTOR CHECK	1		100	941	941

TASK CODE: 552314XM03

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER PWR SUPPLY

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
								2732	2732
03	TROUBLESHOOT UHF TRANSCEIVER POWER SUPPLY (1A8) THAT HAS A FAULTY 26.5 VDC OUTPUT								
							100	1650	1650
A	SET UP TEST BENCH FOR 1A8 MODULE TEST	1							
1	GET DEFECTIVE MODULE TO BENCH	1		81A003I	1			48	
2	REVIEW TECHNICAL DATA	1		84A404	1	4		1470	
3	GET POWER SUPPLY MAINT FIXTURE MT-4021/ARM-128 AND VTVM ME-243 /FQM	1		81A003I	1			48	
4	ASSURE POWER SWITCH FOR TEST SET IS OFF AND THAT RADIO SET FUNCTION SWITCH IS OFF.	1		OAC-CM-C2	2			16	
5	HOOK UP MODULE TO RECEIVER-RECEIVER TO TEST BENCH AND RF WATTMETER TO CONNECTOR J3 ON RT UNIT.	1		OTF-CE-IB	1	5		68	
							100	141	141
B	VERIFY FAULTY VOLTAGE AT 1A8J4	1							
1	TURN ON TEST POWER, FUNCTION SW TO MAIN, TUNING MODE TO MANUAL AND MANUAL SELECTOR TO 225.000 MHZ	1		OAC-CM-02	6			48	
2	CHECK VOLTAGE OUTPUT AT (H4) (1A8J4) (IF VOLTAGE IS 34 UDC CONTINUE)	1		EIT-TH-D6	1			93	
							100	941	941
C	TRANSISTOR CHECK	1							
1	WITH POWER STILL ON MAKE VOLTAGE CHECKS OF Q1, Q2, Q3 AND Q8 PER TABLE 6-35.	1		EIT-TH-D6	1	11		418	
2	TURN OFF TEST SET POWER AND RADIO SET FUNCTION SWITCH TO OFF	1		OAC-CM-02	2			16	
3	CHECK RESISTANCE OF Q1, Q2, Q3 AND Q8 PER TABLE 6-35.	1		EIT-TH-D6	1	11		418	
4	CHECK Q1 AND CR23 FOR SHORT AND Q3 FOR OPEN. (REPLACE FAULTY PARTS AND CONDUCT MINIMUM PERFORMANCE TEST.)	1		EIT-TH-Z6		3		89	

TASK CODE: 112314XM03

PART NAME: POWER SUPPLY 1A8

SUMMARY

APL MODEL: ALL PART NO: ZONE:

TASK DESCRIPTION: * RMV & INSTL CAPACITOR C8

PREPARED BY: J.VOYTKO ORG: B7463 DATE: 12-07-83P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: THIS ANALYSIS IS AN EXAMPLE OF A DEPOT LEVEL MAINTAINABILITY TIME STANDARDS APPLICATION.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.04 HRS	WITH PF&D:	.05 HRS
TOTAL ELAPSED:	.04 HRS	WITH PF&D:	.05 HRS

GSE REQUIRED: NO

PERSONAL:	8%
FATIGUE:	5%
DELAY:	5%

TASK CODE: 112314XM03

SUBOPERATION SUMMARY

PART NAME: POWER SUPPLY 1A8

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
03	RMV & INSTL CAPACITOR C8				415	415
A	RMV & INSTL CAPACITOR	1		100	415	415

TASK CODE: 112314XM03

STANDARD DATA APPLICATION

PART NAME: POWER SUPPLY 1A8

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
03	RMV & INSTL CAPACITOR C8							415	415
A	RMV & INSTL CAPACITOR	1					100	415	415
1	UNSOLDER CAPACITOR			ETP-DS-R4	1	1		37	
2	ASIDE CAPACITOR			OMH-LA-OA	1			5	
3	GET NEW CAPACITOR			OMH-LA-OA	1			5	
4	UNPK CAPACITOR			OPK-OB-R1	1			49	
5	CHECK PART NUMBER			OIT-EV-OB	1			21	
6	FORM LEADS (EQ TO)			OOH-PO-OB	2			50	
7	CUT LEADS TO LENGTH			OTL-PD-01	1	1		28	
8	APPLY FLUX TO LEADS & TERMINAL			EST-CH-D1	1	3		24	
9	POSN END OF CAPACITOR LEADS			OOH-PO-OB	2			50	
10	SOLDER LEADS			ETP-SE-I2	2			103	
11	CLEAN SOLDER JOINTS			ECL-CK-D1	1	1		31	
12	INSP INSTLN			OIT-EV-OA	1			12	

TASK CODE: 502314XM01

PART NAME: UHF TRANSCEIVER PWR SUPPLY

SUMMARY

APL MODEL: ALL PART NO: 1A8 ZONE:

TASK DESCRIPTION: * MINIMUM PERFORMANCE TEST OF UHF
* PWR SUPPLY MODULE 1A8

PREPARED BY: J.DAVOLT ORG: B7463 DATE: 1-9-84P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: DEVELOPED FOR USE AS AN EXAMPLE OF A DEPOT LEVEL MAINTAINABILITY TIME STANDARDS APPLICATION. THIS MINIMUM PERFORMANCE TEST ASSUMES TROUBLE SHOOTING HAS LOCATED A FAULTY PART. PART HAS BEEN REPLACED AND MODULE IS TO BE CHECKED PRIOR TO ISSUE FOR SERVICE. THIS TEST MAY ALSO BE USED TO ASSIST IN ISOLATING A FAULT. ASSUME THAT PWR SUPPLY IS INSTLD IN THE STANDARD TEST SET UP ON TEST BENCH.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.27 HRS	WITH PF&D:	.31 HRS
TOTAL ELAPSED:	.27 HRS	WITH PF&D:	.31 HRS

GSE REQUIRED: NO

PERSONAL:	5%
FATIGUE:	5%
DELAY:	5%

TASK CODE: 502314XM01

SUBOPERATION SUMMARY

PART NAME: UHF TRANSCEIVER PWR SUPPLY

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DMU ELAPSED	DMU TOTAL
61	MINIMUM PERFORMANCE TEST OF UHF PWR SUPPLY MODULE 1A8	1			2658	2658
A	PREPARATION FOR TEST	1		100	1410	1410
B	CONDUCT MINIMUM PERFORMANCE TEST			100	514	514
C	TERMINATE TEST			100	734	734

TASK CODE: 502314XM01

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER PWR SUPPLY

STEP	DESCRIPTION	WORKER I/C	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DMU ELAPSED	DMU TOTAL
01	MINIMUM PERFORMANCE TEST OF UHF PWR SUPPLY MODULE 1A8	1						2658	2658
A	PREPARATION FOR TEST	1					100	1410	1410
1	REVIEW TECHNICAL DATA			ORD-TM-D2	1	3		1212	
2	CHECK TEST SET UP CONNECTIONS AND AVAILABILITY OF EQUIPMENT	1		OIT-EV-Z8		15		150	
3	SET TEST PWR SWITCH TO ON. RADIO SET FUNCTION SWITCH TO MAIN, TUNING MODE SELECTOR TO MANUAL, MANUAL SELECTORS FOR 225.000 MHZ	1		OAC-CM-02	6			48	
B	CONDUCT MINIMUM PERFORMANCE TEST						100	514	514
1	CHECK VOLTAGE			EIT-TM-D6	1			93	
2	SET MIC KEY ON TEST SET ON			OAC-CM-02	6			48	
3	CHECK VOLTAGE			EIT-TM-Z6		11		326	
4	SET MIC KEY ON TEST SET OFF ABOVE ELEMENTS WILL ALLOW COMPLETING THE 6 STEPS IN TABLE 6-37. SHOULD MODULE FAIL THIS TEST THE TROUBLE ISOLATION TESTS IN TABLE 6-38 SHOULD BE CONTINUED.			OAC-CM-02	6			48	
C	TERMINATE TEST						100	734	734
1	TURN OFF TEST POWER SWITCH AND RADIO SET FUNCTION SWITCH TO OFF			OAC-CM-02	6			48	
2	DISCONN PWR SUPPLY FROM MAINT FIXTURE MT-4021/ARM-128 AND VTVM ME-243/FQM			ETF-CE-RB	4			228	
3	TAG PWR SUPPLY FOR DISPOSITION			OOH-TR-I2	1			418	
4	RETURN TEST EQUIPMENT TO STOWAGE CABINET			OOH-OB-D5	1			40	

A32

TASK CODE: 502314XM02

PART NAME: UHF TRANSCEIVER

SUMMARY

APL MODEL: F-15 PART NO: ZONE:

TASK DESCRIPTION: * PERFORM MINIMUM PERFORMANCE
* TEST ON UHF RADIO RECEIVER
* TRANSMITTER

PREPARED BY: J.DAVOLT ORG: B7463 DATE: 12-13-83P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 12R2-2ARC109-2

REMARKS: THIS ANALYSIS IS AN EXAMPLE OF A DEPOT LEVEL MAINTAINABILITY TIME STANDARDS APPLICATION. THE UHF RADIO AN/ARC 109 IS INSTALLED ON F-15 AIRCRAFT. THE FOLLOWING MINIMUM PERFORMANCE TEST IS TO BE PERFORMED TO QUALIFY THE T/R UNIT FOR SERVICE FOLLOWING REPLACEMENT OF ANY MODULE OR OTHER MAINTENANCE ON THE T/R UNIT CHASSIS. IT IS ASSUMED T/R UNIT TO BE TESTED HAS HAD A POWER SUPPLY MODULE 1A8 REPLACED.

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	2.38 HRS	WITH PF&D:	2.74 HRS
TOTAL ELAPSED:	2.38 HRS	WITH PF&D:	2.74 HRS

GSE REQUIRED: YES

PERSONAL: 5%

FATIGUE: 5%

DELAY: 5%

TASK CODE: 502314XM02

SUBOPERATION SUMMARY PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
02	PERFORM MINIMUM PERFORMANCE TEST ON UHF RADIO RECEIVER TRANSMITTER				23839	23839
A	PREPARE FOR TEST OF RECEIVER PER FIGURE 6-5 OF REF	1		100	282	282
B	MAIN RECEIVER SENSITIVITY TEST	1		100	1658	1658
C	GUARD RECEIVER SENSITIVITY TEST	1		100	504	504
D	MAIN RECEIVER SQUELCH CHARACTERISTICS	1		100	564	564
E	GUARD RECEIVER SQUELCH CHARACTERISTICS			100	522	522
F	MAIN RECEIVER AGC CHARACTERISTICS			100	1786	1786
G	GUARD RECEIVER AGC CHARACTERISTICS			100	410	410
H	MAIN RECEIVER FREQUENCY RESPONSE			100	1247	1247
I	GUARD RECEIVER FREQ RESPONSE			100	1178	1178
J	MAIN RECEIVER NOISE LEVEL			100	461	461
K	GUARD RECEIVER NOISE LEVEL			100	404	404
L	AUXILIARY AUDIO CIRCUIT			100	1629	1629
M	PREPARE FOR TRANSMITTER TESTS			100	538	538
N	TRANSMITTER RF POWER OUTPUT			100	1940	1940
P	TRANSMITTER FREQUENCY ACCURACY			100	2257	2257
Q	TRANSMITTER MODULATION CONTROL			100	3761	3761
R	TEST MODULATION FIDELITY OF TRANSFER (TEST EQUIPMENT SETUP AND ADJUSTMENTS AS IN STEP Q)			100	1313	1313
S	TEST TRANSMITTER TONE MODULATION (TEST CONFIGURATION AS			100	547	547

TASK CODE: 502314XM02

SUBOPERATION SUMMARY

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
	IN STEP R)					
T	TEST TRANSMITTER SIDETONE (TEST CONFIG AS IN STEP S)			100	176	176
U	TEST TRANSMITTER REFLECTOMETER			100	2643	2643
V	TERMINATE TEST			100	20	20

TASK CODE: 502314XM02

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
02	PERFORM MINIMUM PERFORMANCE TEST ON UHF RADIO RECEIVER TRANSMITTER							23839	23839
A	PREPARE FOR TEST OF RECEIVER PER FIGURE 6-5 OF REF	1					100	282	282
1	OBSERVE THAT SWITCHES ON TEST SET ARE OFF	1		OIT-EV-ZA		5		25	
2	POSIT R/T UNIT ON TEST BENCH	1		OOH-PO-OC	1			42	
3	WALK FROM RECEIVING TABLE TO TEST BENCH CARRYING R/T UNIT	1		OBM-WO-01	1			9	
4	CONNECT TEST CABLE TO J3	1		OTF-CE-IC	1			85	
5	RMV AUXILIARY SQUELCH 960P-1 IF INSTLD	1		OTF-CE-RC	1		50	71	36
6	CONNECT TEST CABLE TO AUXILIARY SQUELCH FORMER LOCATION ON R/T	1		OTF-CE-IC	1			85	
B	MAIN RECEIVER SENSITIVITY TEST	1					100	1658	1658
1	PLACE 3-PHASE TEST PWR SWITCH IN THE ON POSIT, OBSERVE 3-PHASE INDICATOR LIGHTS ON			OAC-CM-02	2			16	
2	PLACE RT-749/ARC109 ON-OFF SWITCH TO ON. OBSERVE INDICATORS			OAC-CM-02	1			8	
3	SET SIGNAL GENERATOR PWR SWITCH TO ON. OBSERVE INDICATORS ON			OAC-CM-02	1			8	
4	OBSERVE READING OF 150 OHMS ON VTVM AUDIO OUTPUT METER			OIT-EV-ZA		1		5	
5	ADJUST RADIO SET CONTROLS, FUNCTION TO MAIN, TUNING MODE SET TO MANUAL, VOL FULLY CW, MANUAL SELECTORS TO 399.5 MHZ AND SQUELCH TO DISABLE			OAC-CM-02	8			64	
6	ADJUST CONTROLS ON SIGNAL GENERATOR AS FOLLOWS: MOD SEL TO 1000 HZ, FREQ CONT MEGACYCLE DIAL INDICATOR FOR 399.95 MHZ, OUTPUT ATTENUATOR CONTROL FOR 10UV, AND MOD LEVEL FOR 30 PERCENT			OAC-CM-03	5			85	
7	ON SIGNAL GENERATOR ADJUST FINE FREQ ADJUST UNTIL MAX DIP IN	1		OAC-CM-04	1			47	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	AGC VOLTAGE IS INDICATED ON VTVM								
8	ADJUST SIGNAL GENERATOR LEVEL BY ADJUSTING OUTPUT ATTENTUATOR FOR 3.0 UA MODULATED 30% AT 1000 HZ			OAC-CM-04	3			141	
9	ON OUTPUT PWR METER OBSERVE AUDIO POWER OUTPUT INDICATION. SHOULD BE 15 MW MINIMUM			OIT-EV-ZB		1		10	
10	RECORD READING IN DECIBELS			OWR-NT-01	1			8	
11	SWITCH SIGNAL GENERATOR MOD SEL SW TO CW. OBSERVE AUDIO PWR OUTPUT INDICATION ON			OAC-CM-04	1			47	
12	RECORD READING IN DECIBELS			OWR-NT-01	1			8	
13	RECORD DIFFERENCE IN READING IN STEP 10 AND 12			OWR-NT-04	1			47	
14	REPEAT SENSITIVITY TESTS FOR 312.50 MHZ, 244.40 MHZ, 225.00 MHZ (STEPS 7 THRU 13)			OEL-RS-01	388		300	388	1164
C	GUARD RECEIVER SENSITIVITY TEST	1					100	504	504
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SELECTOR TO BOTH, MANUAL SELECTOR FOR FREQUENCY AT LEAST 10MHZ FROM GUARD RECEIVER FREQ, AND SQUELCH TO NORMAL			OAC-CM-Z2		6		24	
2	DISCONN DC PROBE FROM VTVM TO MAIN RCVR AGC			OOH-DE-OB	1			12	
3	CONNECT DC PROBE FROM VTVM TO GUARD RCVR AGC			OOH-PO-OB	1			25	
4	DISABLE GUARD SQUELCH SWITCH ON TEST SET			OAC-CM-02	1			[illegible]	
5	ADJUST SIGNAL GENERATOR CONTROLS AS FOLLOWS: MOD SEL TO 1000 HZ, FREQ CONTROL FOR MEGACYCLE DIAL INDICATION OF 243.00 MHZ, OUTPUT ATTENUATOR CONTROL FOR 10 UV AND MOD LEVEL FOR 30 PERCENT			OAC-CM-04	1			47	
6	REPEAT SENSITIVITY TESTS FOR 243.00 MHZ FREQ (STEPS 8? THRU			OEL-RS-01	388			388	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC ELAPSED	DHU ELAPSED	DHU TOTAL
	B13)								
D	MAIN RECEIVER SQUELCH CHARACTERISTICS	1					100	564	564
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SELECTOR TO MAIN, TUNING MODE SEL TO MANUAL VOL FULLY CW, MANUAL SEL FOR 304.75 MHZ, SQUELCH TO NORMAL			OAC-CM-Z2		9		36	
2	ADJUST SIGNAL GENERATOR CONTROLS AS FOLLOWS: MOD SEL TO 1000 HZ, FREQ CONTROL FOR MEGACYCLE DIAL INDICATION OF 304.75 MHZ, OUTPUT ATTENUATOR FOR 10.0 UV, MOD LEVEL FOR 30 PERCENT MODULATION ON PERCENT MODULATION METER, ADJUST GEN FINE FREQ ADJUST FOR MAX DIP IN AGC VOLTAGE AS INDICATED ON VTVM			OAC-CM-04	5			235	
3	OBSERVE AUDIO OUTPUT ON OUTPUT POWER METER			OIT-EV-ZA		1		5	
4	ADJUST OUTPUT ATTENUATOR OF SIGNAL GENERATOR FULLY CCW WHILE OBSERVING AUDIO OUTPUT METER. RECEIVER ADUIO SHOULD BE CUT OFF			OAC-CM-04	1			47	
5	SLOWLY ADJUST SIGNAL GEN ATTENUATOR WHILE OBSERVING OUTPUT METER. NOTE: EXACT POINT AT WHICH AUDIO OUTPUT APPEARS			OAC-CM-04	1	1		92	
6	RECORD OBSERVED POWER OUTPUT IN DECIBELS			OWR-NT-04	1			47	
7	SWITCH SIGNAL GEN MOD SEL TO CW			OAC-CM-02	1			8	
8	OBSERVE AND RECORD INDICATION ON POWER METER IN DECIBLES			OWR-NT-04	1			47	
9	RECORD DIFFERENCE IN POWER READINGS IN 8 & 6 (6 DB MIN)			OWR-NT-04	1			47	
E	GUARD RECEIVER SQUELCH CHARACTERISTICS						100	522	522
1	POSIT RADIO SET CONTROL			OAC-CM-01	1			4	

STANDARD DATA APPLICATION

TASK CODE: 502314XM02

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	FUNCTION SWITCH TO BOTH								
2	ADJUST SIGNAL GEN CONT AND RECORD OBSERVATIONS AS IN STEPS D2 THRU D9 EXCEPT ADJUST FREQ TO 243.00 MHZ MEGACYCLE DIAL INDICATION (DIFFERENCE IN DECIBELS RECORDED SHOULD BE 6 & 8 MIN)			OEL-RS-01	518			518	
F	MAIN RECEIVER AGC CHARACTERISTICS						100	1786	1786
1	ADJUST RADIO SET CONT AS FOLLOWS: FUNCTION SEL TO MAIN, TUNING MOD SEL TO MANUAL, VOL FULL CW, MANUAL SEL FOR 399.95 MHZ, SQUELCH TO NORMAL			OAC-CM-03	8			136	
2	DISCONN VTVM DC PROBE FROM GUARD RCVR AGC ON TEST SET			OOH-DE-OB	1			12	
3	CONN VTVM DC PROBE TO MAIN RCVR AGC ON TEST SET			OOH-PO-OB	1			25	
4	SET SIGNAL GEN FREQ TO 399.95 MHZ			OAC-CM-02	1			8	
5	SET OUTPUT LEVEL (SIGNAL GEN) OF 1000UV MODULATED 30 PERCENT AT 1000 HZ			OAC-CM-02	2			16	
6	ADJUST VTVM/FREQ METER FINE FREQ ADJUST UNTIL MAX DIP IN AGC VOLTAGE IS INDICATED			OAC-CM-04	1			47	
7	OBSERVE OUTPUT PWR METER INDICATION IN DECIBELS AND RECORD			OWR-NT-04	1			47	
8	ADJUST SIGNAL GEN OUTPUT ATTENUATOR FOR THE FOLLOWING: 3.0 TO 10.0 UV (+1, -5 DB) 10.0 UV TO 0.5 V (+/- 3 DB) 0.5V TO 1.5V (SHALL NOT BLOCK)			OAC-CM-04	3			141	
9	FOR EACH ADJUSTMENT OBSERVE AND RECORD INDICATION OF PWR OUTPUT METER			OWR-NT-04	3			141	
10	REPEAT STEPS F7 THRU F9 AFTER RESETING FREQ FOR 312.50, 244.40, 225.00 MHZ			OEL-RS-01	329		300	329	987

TASK CODE: 502314XM02

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
11	RESET RADIO SET AND SIGNAL GEN TO ABOVE FREQ			OAC-CM-01	15			60	
12	ADJUST RADIO SET CONT AS FOLLOWS: FUNCTION SEL TO MAIN, TUNING MODE SEL TO MANUAL, VOL FULLY CW, MANUAL SEL FOR 304.75 MHZ, SQUELCH TO NORMAL			OAC-CM-02	8			64	
13	ON VTVM CHECK AGC LEVEL AT J-10 ON TEST SET (NO SIGNAL APPLIED TO RCVR)(3.5 +/- 0.2 VDC)			OIT-EV-ZB		1		10	
14	ADJUST IF GAIN (1A6R4) AS REQUIRED TO OBTAIN 3.5 +/- 0.2 UDC			ECA-CM-D1	1		50	120	60
15	RECYCLE RECEIVER TO 304.75 MHZ			OAC-CM-01	4			16	
15	REPEAT F13			OAC-CM-01	4			16	
G	GUARD RECEIVER AGC CHARACTERISTICS						100	410	410
1	TURN RADIO SET FUNCTION SWITCH TO BOTH			OAC-CM-01	1			4	
2	SET MANUAL SEL TO AT LEAST 10 MHZ FROM GUARD FREQ			OAC-CM-02	4			32	
3	DISCONN VTVM DC PROBE FROM RCVR AGC TEST SET			OOH-DE-OB	1			12	
4	CONN VTVM DC PROBE TO GUARD RCVR AGC TEST POSIT ON TEST SET			OOH-PO-OB	1			25	
5	ADJUST SIGNAL GEN FREQ TO 243.00 MHZ WITH AN OUTPUT LEVEL OF 1000 MV MODULATED 30 PERCENT AT 1000 HZ			OAC-CM-02	1			8	
6	REPEAT STEPS F7 THRU F9			OEL-RS-01	329			329	
H	MAIN RECEIVER FREQUENCY RESPONSE						100	1247	1247
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SEL TO MAIN, TUNING MODE SEL TO MANUAL, VOL FULLY CW, MANUAL SEL FOR 304.75 MHZ, SQUELCH TO NORMAL			OAC-CM-02	8			64	
2	DISCONN VTVM DC PROBE TO GUARD AGC TEST POSIT ON TEST SET			OOH-DE-OB	1			12	
3	CONN VTVM DC PROBE TO MAIN RCVR			OOH-PO-OB	1			25	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	TEST POSIT ON TEST SET								
4	TURN ON PWR SWITCH ON AUDIO OSCILLATOR AND ADJUST CONTROLS AS FOLLOWS: RANGE TO X10, AMPLITUDE TO 10, FREQ DIAL TO 100			OAC-CM-03	4			68	
5	ALLOW FIVE MINUTES FOR WARMUP			OPT-TM-01	834			834	
6	ADJUST SIGNAL GEN CONTROLS AS FOLLOWS: MOD SEL TO EXT MOD, OUTPUT ATTENUATOR CONT FOR 1000 UV, FREQ TO 304.75 MHZ, CHECK AGC BY FINE ADJUST TO OBTAIN DIP IN AGC VOLTAGE AS IND ON FREQ METER, MOD LEVEL CONTROL FOR 30 PERCENT MODULATION INDICATION ON PERCENT MODULATION METER			OAC-CM-03	4			68	
7	ADJUST AMPLITUDE CONTROL ON AUDIO OSCILLATOR AS REQUIRED TO ACHIEVE 30 PERCENT MODULATION INDICATION			OAC-CM-04	1	75		47	35
8	OBSERVE AND RECORD AUDIO OUTPUT INDICATION IN DECIBELS (THIS IS THE REFERENCE INDICATION)			OWR-NT-04	1			47	
9	OBSERVE AUDIO OUTPUT INDICATION WHILE VARYING THE MODULATION FREQUENCY FROM 300 TO 6000 HZ (+1 TO -3 DB RELATIVE TO H8)			OAC-CM-04	2			94	
I	GUARD RECEIVER FREQ RESPONSE						100	1178	1178
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SWITCH TO BOTH, MANUAL SELECTORS TO A FREQUENCY AT LEAST 10MHZ FROM GUARD RCVR FREQUENCY			OAC-CM-01	5			20	
2	REPEAT STEPS H4 THRU H9			OEL-RS-01	1158			1158	
J	MAIN RECEIVER NOISE LEVEL						100	461	461
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SELECTOR TO MAIN, MANUAL SEL FOR 304.75 MHZ, SQUELCH TO NORMAL			OAC-CM-01	6			24	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
2	DISCONN HP 200 AB FROM SIGNAL GEN			OTF-CE-RB	1			57	
3	ADJUST SIGNAL GEN. CONTROLS AS FOLLOWS: MOD SEL TO 1000, FREQ RANGE TO 3, FREQ CONT FOR A MEGACYCLE DIAL IND OF 304.75 MHZ, OUTPUT ATTENUATOR CONT FOR 1000 MV, MOD LEVEL FOR 30 PERCENT MODULATION IND ON PERCENT MODULATION METER, CHECK ACCURACY OF FQM BY ADJUSTING FINE FREQ ADJUST FOR MAX DIP IN AGC VOLTAGE INDICATED ON FQM			OAC-CM-04	5			235	
4	OBSERVE AND RECORD AUDIO PWR OUTPUT INDICATED IN DECIBELS ON OUTPUT PWR METER (SIGNAL PLUS NOISE)			OWR-NT-04	1			47	
5	PLACE SIGNAL GENERATOR MOD SELECTOR CONTROL TO CW			OAC-CM-01	1			4	
6	OBSERVE AND RECORD PWR OUTPUT (AUDIO PWR DUE TO NOISE)			OWR-NT-04	1			47	
7	RECORD DIFFERENCE IN READINGS RECORDED FOR STEPS 4 AND 6 (MIN DIFFERENCE 30 DB)			OWR-NT-04	1			47	
K	GUARD RECEIVER NOISE LEVEL						100	404	404
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SEL TO BOTH, MANUAL SELECTORS FOR A FREQ AT LEAST 10 MHZ FROM THE GUARD REVR FREQ, SQUELCH TO NORMAL			OAC-CM-01	6			24	
2	REPEAT STEPS J3 THRU J7			OEL-RS-01	380			380	
L	AUXILIARY AUDIO CIRCUIT						100	1629	1629
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SEL TO MAIN, TUNING MODE SEL TO MANUAL, VOL FULLY CW, MANUAL SEL FOR 304.75 MHZ, SQUELCH TO NORMAL			OAC-CM-01	8			32	
2	CONN AC VTVM TO THE AUX AUDIO OUTPUT JACK ON TEST SET			OTF-CE-IB	1			68	
3	TURN AC VTVM PWR SW ON			OAC-CM-01	1			4	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
4	ALLOW FIVE MINUTE WARMUP			OPT-TM-01	834			834	
5	ADJUST AUDIO OSCILLATOR CONTROL AS FOLLOWS: RANGE TO X10, AMPLITUDE TO 10, FREQ DIAL TO 100			OAC-CM-02	3			24	
6	ADJUST SIGNAL GEN CONTROLS AS FOLLOWS: MOD SEL TO EXT MOD, FREQ RANGE TO E, FREQ CONT FOR A MEGACYCLE DIAL IND OF 304.75 MHZ, OUTPUT ATTENUATOR CONT FOR 1000MV			OAC-CM-02	4			32	
7	ADJUST ADUIO OSCILLATOR AMPLITUDE AS REQUIRED TO ACHIEVE 30 PERCENT MODULATION IND			OAC-CM-04	1		50	47	24
8	ADJUST FINE FREQ ADJUST ON SIGNAL GEN FOR MAX DIP IN AGC VOLTAGE IND ON FQM			OAC-CM-04	1			47	
9	OBSERVE AND RECORD AUDIO OUTPUT AS INDICATED ON THE AC VTVM (.25V MIN)			OWR-NT-04	1			47	
10	ADJUST AUDIO OSCILLATOR FREQ DIAL TO EACH OF THE FOLLOWING FREQUENCIES WHILE MAINTAINING 30 PERCENT MODULATION OF SIGNAL GEN: 70HZ, 500HZ, 4000HZ AND 7000HZ (SOME ADJUSTMENT OF SIGNAL ALSO REQ)			OAC-CM-04	8			376	
11	OBSERVE AND RECORD IN DECIBELS THE AUDIO OUTPUT FROM THE AC VTVM (-3 OR +3 DB RELATIVE TO REF INDICATION IN STEP 9)			OWR-NT-04	3			141	
M	PREPARE FOR TRANSMITTER TESTS						100	538	538
1	DISCONN SIGNAL GEN FROM RECEIVER AT J3			OTF-CE-RB	1			57	
2	ASIDE CABLE TO SIGNAL GEN			OMH-LA-0B	1			12	
3	DISCONN AUXILIARY SQUELCH FROM RECEIVER/TRANSMITTER			OTF-CE-RB	2			114	
4	CONN CABLE FROM TEST SET TO RECEIVER/TRANSMITTER			OTF-CE-IB	1			68	
5	CONN CABLE FROM RF WATT METER			OTF-CE-IB	1			68	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	TO R/T BEING TESTED								
6	DISCONN AC VTVM FROM J9 ON TEST SET			OTF-CE-RB	1			57	
7	CONN AC VTVM TO J4 ON TEST SET			OTF-CE-IB	1			68	
8	DISCONN OSCILLOSCOPE FROM R/T TEST SET			OTF-CE-RB	1			57	
9	DISCONN DC VTVM FROM TEST SET			OOH-DE-OB	1			12	
10	OBSERVE THAT ALL SWITCHES ON R/T AND TEST EQUIPMENT ARE OFF			OIT-EV-ZA		5		25	
N	TRANSMITTER RF POWER OUTPUT						100	1940	1940
1	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SEL TO MAIN, TUNING MODE TO MANUAL, VOL TO FULL CW, MANUAL SEL FOR 225.00 MHZ, SQUELCH TO NORMAL			OAC-CM-01	8			32	
2	PLACE 3 PHASE PWR SWITCH TO ON POSIT			OAC-CM-01	1			4	
3	OBSERVE INDICATOR LIGHTS			OIT-EV-ZA		10		50	
4	PLACE R/T ON/OFF SWITCH (S2) TO ON AND OBSERVE INDICATOR LIGHTS			OAC-CM-03	1			17	
5	ALLOW EQUIPT A 5 MINUTE WARMUP BEFORE PROCEEDING			OPT-TM-01	834			834	
6	USING THE AC VTVM, CK VOLTAGE ON TEST SET JACKS J4, J5 AND J6 (117 +/- VAC)			EIT-TH-Z6		3		89	
7	KEY TRANSMITTER BY OPERATING S3 ON TEST SET. OBSERVE OUTPUT ON RF WATTMETER (32W, MIN)			OAC-CM-04	1			47	
8	REPEAT STEP 7 IN 10MHZ INCREMENTS. CAUTION: DUTY CYCLE LIMIT, 5 MINUTES TRANSMIT, 10 MINUTES RECEIVE			OEL-RS-01	799			799	
9	ADJUST RADIO SET CONTROLS IN 10MHZ INCREMENTS			OAC-CM-01	17			68	
P	TRANSMITTER FREQUENCY ACCURACY						100	2257	2257
1	SWITCH TEST SET ON/OFF SWITCH (S1) TO OFF POSITION			OAC-CM-01	1			4	
2	DISCONN AC VTVM FROM TEST SW			OOH-DE-OA	1			7	
3	DISCONN CABLE TO RF WATTMETER			OTF-CE-RA	1			47	

TASK CODE: 502314X002

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DMU ELAPSED	DMU TOTAL
	AT MAITMETER								
4	GET FREQ METER AND CABLE FOR HOOK UP IN FIG 6-7			OMH-LA-08	2			24	
5	CONN FREQ METER AS IN FIG 6-7			OTF-CE-IA	3			174	
6	SWITCH TEST SET ON/OFF SWITCH (S1) TO ON POSITION			OAC-CN-01	1			4	
7	ADJUST RADIO SET CONTROLS AS FOLLOWS: FUNCTION SEL TO MAIN. TUNING MODE SEL TO MANUAL. MANUAL SEL FOR 225.00 MHZ			OAC-CN-01	6			24	
8	ADJUST CONTROLS ON FREQ COUNTER AS FOLLOWS: PWR SW TO ON. FUNCTION SEL TO FREQ. FREQ UNIT TO 1 SEC STB GATE TIME (AN/USM-26)			OAC-CN-01	3			12	
9	ADJUST FREQ COUNTER PLUG-IN UNIT (HP525C) CONTROLS AS FOLLOWS: INPUT FREQ TO 100MC-500 MC. FREQ DIAL FULLY CW (LOW END)			OAC-CN-01	2			8	
10	MIC KEY (S3) ON TEST SET TO ON POSIT. OBSERVE TRANSMIT LIGHT ON			OAC-CN-03	1			17	
11	ON FREQ COUNTER PLUG-IN UNIT (HP525C) SLOWLY TURN FREQ DIAL CCW WHILE OBSERVING HP525C LEVEL INDICATOR STOP ON FIRST DIAL CALIBRATION AFTER LEVEL INDICATOR ENTERS GREEN AREA OF SCALE			OAC-CN-04	2			94	
12	READJUST VARIABLE ATTENUATOR AS REQUIRED FOR POINTER TO REACH GREEN AREA			OAC-CN-04	1	75		47	35
13	OBSERVE READING ON FREQ COUNTER (AN/USM-26) AND RECORD			OMR-MT-04	1			47	
14	ADD COUNTER READING IN MHZ RECORDED IN STEP 13 TO FREQ INDICATED BY DIAL SETTING IN STEP 11 (225.00 MHZ +/- 2.0KHZ)			OMR-MT-04	4			188	
15	REPEAT STEPS 10 THRU 14 FOR THE FOLLOWING FREQ: 250.00 MHZ, 288.00 MHZ, 320.00 MHZ, 269.95			OEL-RS-01	393	400		393	1572

TASK CODE: 502314XM02

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	MHZ (FREQ ERROR +/- 2 KHZ)								
0	TRANSMITTER MODULATION CONTROL						100	3761	3761
1	SWITCH TEST SET ON/OFF SWITCH (S1) TO OFF POSITION			OAC-CM-01	1			4	
2	DISCONN OUTPUT FROM CN-318/G FROM HP525C (FIG 6-7)			OTF-CE-RA	1			47	
3	INSTL OUTPUT FROM CN-318/C TO ATTENUATOR INPUT OF TRANSFER OSCILLATOR (FIG. 6-8)			OTF-CE-IA	1			58	
4	CONNECT VIDEO OUTPUT FROM TRANSFER OSCILLATOR TO CABLE TO OSCILLOSCOPE			OTF-CE-IA	1			58	
5	CONN MICROPHONE SIMULATOR AND AUDIO OSILLATOR TO J16 OF TEST SET (FIG 6-8)			OTF-CE-IA	3			174	
6	SWITCH TEST SET ON/OFF SWITCH (S1) TO ON POSITION			OAC-CM-01	1			4	
7	TURN ON TEST EQUIPMENT PWR SWITCHES			OAC-CM-01	6			24	
8	ALLOW EQUIPMENT TO WARM UP FOR 15 MINUTES			OPT-TM-01	2500			2500	
9	SET MANUAL SEL ON RADIO SET FOR 399.95 MHZ			OAC-CM-01	4			16	
10	ADJUST TRANSFER OSCILLATOR FREQ MEGACYCLE TO 200 MC			OAC-CM-02	1			8	
11	ADJUST OSCILLOSCOPE CONTROLS AS FOLLOWS: TRIGGER LEVEL FULLY CCW, STABILITY TO PRESET, TRIGGER SLOPE TO & INT, TRIGGER MODE TO AUTOMATIC, TIME/CM TO 100 MICRO SEC, MULTIPLIER TO 2, HORIZONTAL DISPLAY TO INTERNAL SWEEP, HORIZONTAL POSIT TO CENTER, SQUARE WAVE CALIBRATOR TO 5, VOLTS, MILLIVOLTS, OFF TO VOLTS			OAC-CM-03	9			153	
12	ADJUST OSCILLOSCOPE PLUG-IN UNIT AS FOLLOWS: AC-DC TO AC, VOLTS/CM TO 2, VARIABLE CW, VERTICAL TO CENTER			OAC-CM-03	4			68	
13	SET AUDIO OSCILLATOR AS			OAC-CM-03	3			51	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	FOLLOWS: RANGE TO X10, FREQ DIAL TO 100, AMPLITUDE CONTROL FOR 0.8V OUTPUT (OPEN CIRCUIT)								
14	SWITCH ON MIC KEY (S3) ON TEST SET			OAC-CM-01	1			4	
15	ADJUST COURSE VERNIER CONTROL ON TRANSFER OSCILLATOR AND OSCILLOSCOPE CONTROLS FOR A PRESENTATION OF THE MODULATED CARRIER			OAC-CM-04	4			188	
16	CHECK PERCENT MODULATION USING THE FOLLOWING FORMULA: PERCENT MODULATION = EMAX-EMIN/ EMAX + EMIN X 100 (80 PERCENT MIN; 95 PERCENT MAX)			OEL-ET-01	400			400	
17	TURN OFF MIC SWITCH			OAC-CM-01	1			4	
R	TEST MODULATION FIDELITY OF TRANSFER (TEST EQUIPMENT SETUP AND ADJUSTMENTS AS IN STEP Q)						100	1313	1313
1	TURN ON MIC KEY SWITCH ON TEST SET			OAC-CM-01	1			4	
2	OBSERVE OSCILLOSCOPE PRESENTATION FOR PERCENT MODULATION			OEL-ET-01	400			400	
3	ADJUST AUDIO OSCILLATOR FOR 70 PERCENT MODULATION ON TRANSFER OSCILLATOR (USE FORMULA IN Q16)(70 PERCENT)			OEL-ET-01	588		100	588	588
4	DISCONN OUTPUT OF T-ATTENUATOR FROM TRANSFER OSCILLATOR			OTF-CE-RA	1			47	
5	CONNECT ABOVE TO HP420B CRYSTAL DETECTOR			OTF-CE-IA	1			58	
6	CONNECT AC VTVM TO CRYSTAL DETECTOR OUTPUT			OOH-PO-OA	2			24	
7	OBSERVE AND RECORD INDICATION ON AC VTVM IN DECIBELS			OWR-NT-04	1			47	
8	VARY THE FREQ SETING ON THE AUDIO OSCILLATOR FROM 300 TO 6000HZ WHILE OBSERVING DB INDICATION ON AC VTVM (WITHIN +1 -3DB OF DB NOTED IN STEP R7)			OAC-CM-04	3			141	
9	TURN MIC KEY OFF			OAC-CM-01	1			4	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION — PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
S	TEST TRANSMITTER TONE MODULATION (TEST CONFIGURATION AS IN STEP R)						100	547	547
1	DISCONN AUDIO OSCILLATOR FROM MICROPHONE SIMULATOR			OTF-CE-RA	2			94	
2	ON RADIO CONTROL SET MANUAL SEL TO 399.95 MHZ			OAC-CM-02	1			8	
3	ADJUST TRANSFER OSCILLERATOR FREQ MEGACYCLE TO 200MC			OAC-CM-03	1			17	
4	SWITCH TONE SWITCH (S5) TO ON			OAC-CM-01	1			4	
5	OBSERVE OSCILLOSCOPE PRESENTATION OF THE MODULATED CARRIER			OIT-EV-ZB		1		10	
6	USE FORMULA IN STEP Q16 TO DETERMINE PERCENT MODULATION (90 PERCENT MIN)			OEL-ET-01	400			400	
7	OBSERVE TONE FREQUENCY			OIT-EV-ZB		1		10	
8	SWITCH TONE SWITCH (S5) OFF			OAC-CM-01	1			4	
T	TEST TRANSMITTER SIDETONE (TEST CONFIG AS IN STEP S)						100	176	176
1	GET HEAD SET			OMH-LA-0A	1			5	
2	CONN HEADSET TO TEST SET AT J18			OOH-PO-0A	1			12	
3	PUT ON AND TAKE OFF HEADSET (EQ TC)			OJP-GS-01	1			49	
4	TURN ON MIC KEY AND TONE SWITCH ON TEST SET			OAC-CM-01	2			8	
5	ADJUST VOL CONTROL AND LISTEN FOR 1000 HZ TONE IN HEADSET			OAC-CM-04	2			94	
6	TURN OFF MIC KEY AND TONE SWITCH			OAC-CM-01	2			8	
U	TEST TRANSMITTER REFLECTOMETER						100	2643	2643
1	TURN OFF EQUIPMENT TO BE DISCONNECTED			OAC-CM-01	4			16	
2	DISCONN OSCILLOSCOPE, TRANSFER OSCILLATOR, AUDIO OSCILLATOR, MICROPHONE SIMULATOR, CH-318/G CONNECTOR			OTF-CE-RA	9			423	
3	CONN PROBE OF AC VTVM TO J4			OOH-PO-0A	1			12	

TASK CODE: 502314XM02

STANDARD DATA APPLICATION

PART NAME: UHF TRANSCEIVER

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	OF TEST SET								
4	ADJUST RADIO SET CONTROLS TO 399.95 MHZ			OAC-CM-01	4			16	
5	SWITCH MIC KEY (S3) TO ON			OAC-CM-01	1			4	
6	OBSERVE AND RECORD POWER OUTPUT INDICATED ON RF WATTMETER			OWR-NT-04	2			94	
7	OBSERVE REFLECTOMETER ON FRONT PANEL OF R/T (M2 METER) (+/- 5 WATTS OF STEP U6)			OIT-EV-ZB		2		20	
8	NOTE: IF M2 PEGS AND RF EXCEEDS 50 WATTS ON WATTMETER DIS-REGARD ABOVE TOLERANCE			OEL-ET-01	400		50	400	200
9	PUSH PRESS FOR REFL PWR BUTTON ON R/T			OOH-PO-0A	1			12	
10	OBSERVE AND RECORD REFL POWER INDICATION IN STEP 9 (3 WATTS MAX)			OWR-NT-04	1			47	
11	MIC KEY TO OFF POSITION			OAC-CM-01	1			4	
12	REPEAT STEPS U4 THRU U11 FOR FREQUENCIES 304.75 AND 225.00 MHZ			OEL-RS-01	597		300	597	1791
13	MIC KEY TO OFF POSITION			OAC-CM-01	1			4	
V	TERMINATE TEST						100	20	20
1	TURN OFF ALL TEST EQUIPMENT PWR SWITCHES			OAC-CM-01	5			20	

TASK CODE: 81ALCMST01

PART NAME: MISSILE SAFE STATE TEST

SUMMARY

APL MODEL: AGM86 PART NO: ZONE:

TASK DESCRIPTION:
* JOB PREPARATION-CHECK FOR
* PRESENCE OF ELECTRICAL ENERGY
* AND CORRECT CONTINUITY OR OPENS
* PRIOR TO CONNECTION TO MISSILE
* ORDANCE AND ARMING AND DISARM-
* ING CIRCUITS

PREPARED BY: J.DAVOLT ORG: B7463 DATE: 01-14-84P

REQUESTED BY: J.ROSE ORG: B7463 REV.

REFERENCES: TO 21M-AGM68-2-1

REMARKS: THIS ANALYSIS IS AN EXAMPLE OF MAINTAINABILITY TIME STANDARDS APPLICATION. IT IS ASSUMED THE MISSILE HAS BEEN REMOVED FROM THE CARRIER AIRCRAFT AND IS INSTALLED ON MAINTENANCE PEDESTALS. ALL ACCESS COVERS FOR MAKING THE SAFE STATE TESTS HAVE BEEN PREVIOUSLY REMOVED. PURPOSE OF TEST IS TO MAKE TEST EQUIPMENT AND MISSILE SAFE FOR INTERMEDIATE MAINTENANCE. (EXAMPLE ONLY)

---------- TASK TIME SUMMARY ----------

TOTAL MANHOURS:	.20 HRS	WITH PF&D:	.23 HRS
TOTAL ELAPSED:	.21 HRS	WITH PF&D:	.24 HRS

GSE REQUIRED: NO

PERSONAL:	5%
FATIGUE:	5%
DELAY:	5%

TASK CODE: 81ALCMST01

SUBOPERATION SUMMARY

PART NAME: MISSILE SAFE STATE TEST

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	OCC	DHU ELAPSED	DHU TOTAL
01	JOB PREPARATION-CHECK FOR PRESENCE OF ELECTRICAL ENERGY AND CORRECT CONTINUITY OR OPENS PRIOR TO CONNECTION TO MISSILE ORDANCE AND ARMING AND DISARMING CIRCUITS				2097	1976
A	SET UP SAFE STATE TEST (SST) SELF-TEST			100	87	87
B	CONNECT EXTERNAL POWER TO TESTER (B DOES NOT APPLY IF SST IS OPERATED USING INTERNAL BATTERY AS POWER SOURCE).			50	230	115
C	SET UP FOR INTERNAL BATTERY OPERATION (C DOES NOT APPLY IF SST IS OPERATED FROM EXTERNAL POWER)			50	12	6
D	CHECK OF W13 CABLE			100	258	258
E	ADAPTER/CABLE SELF-TEST			100	189	189
F	SAFE STATE TEST			100	897	897
G	TERMINATE TEST			100	425	425

TASK CODE: 81ALCMSTC1

STANDARD DATA APPLICATION — PART NAME: MISSILE SAFE STATE TEST

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
01	JOB PREPARATION-CHECK FOR PRESENCE OF ELECTRICAL ENERGY AND CORRECT CONTINUITY OR OPENS PRIOR TO CONNECTION TO MISSILE ORDANCE AND ARMING AND DISARMING CIRCUITS							2097	1976
A	SET UP SAFE STATE TEST (SST) SELF-TEST						100	87	87
1	GET AND ASIDE SST TESTER			OMH-LA-OC	2			38	
2	UNLATCH LID OF SST TESTER			ONF-LP-01	1	3		17	
3	RMV LID OT SST TESTER			OMH-LA-OB	1			12	
4	UNSTOW CABLES FROM LID OF TESTER			OJP-CC-05	1			16	
5	ENSURE POWER SW IS OFF			OAC-CM-01	1			4	
B	CONNECT EXTERNAL POWER TO TESTER (B DOES NOT APPLY IF SST IS OPERATED USING INTERNAL BATTERY AS POWER SOURCE).						50	230	115
1	OBTAIN POWER CABLE W21			OMH-LA-OB	1			12	
2	RMV DUST CAPS FROM RECEPTACLE J2 ON FRONT PANEL AND W21 CONNECTORS			OTF-CF-RA	3			36	
3	CONNECT POWER CABLE W21 TO RECEPTACLE			ETF-CE-IA	2			116	
4	CONNECT P1 OF AC POWER CABLE TO 118 VAC 400 HZ POWER			ETF-CE-IA	1			58	
5	SET SST C/B CB1AC IN			OAC-CM-01	1			4	
6	SET READOUT/RECALL/EXT ON SWITCH TO EXT ON			OAC-CM-01	1			4	
C	SET UP FOR INTERNAL BATTERY OPERATION (C DOES NOT APPLY IF SST IS OPERATED FROM EXTERNAL POWER)						50	12	6
1	SET READOUT/RECALL/EXT ON SWITCH TO CENTER POSITION			OAC-CM-01	1			4	
2	SET MODE SELECT SWITCH TO MODE1			OAC-CM-01	1			4	
3	SET SST CIRCUIT BREAKER CB3BAT IN.			OAC-CM-01	1			4	

TASK CODE: 81ALCMST01

STANDARD DATA APPLICATION — PART NAME: MISSILE SAFE STATE TEST

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
D	CHECK OF W13 CABLE						100	258	258
1	GET W13 CABLE			OMH-LA-OB	1			12	
2	RMV DUST CAPS FROM CABLE CONNECTORS AND J1 ON FRONT PANEL			OTF-CF-RA	3			36	
3	CONNECT EITHER END OF W13 TO J1 ON FRONT PANEL OF SST			ETF-CE-IA	1			58	
4	SUPPORT W13 CABLE (EQ.TO)			OOH-OB-D7	1			51	
5	SET POWER SWITCH TO ON			OAC-CM-01	1			4	
6	ALLOW 15 SECONDS FOR SST TO CYCLE AFTER POWER IS ON			OEL-OD-01	42			42	
7	CHECK EXT PWR ON INDICATOR FOR ILLUMINATION			OIT-EV-ZA		1	50	5	3
8	CHECK DIGITAL DISPLAY: BLANK IF USING BATTERY POWER; ILLUMINATED AND INDICATES IF WHEN USING AC POWER.			OIT-EV-ZA		1		5	
9	MOMENTARILY PRESS START/CONT SWITCH: VERIFY PASS/FAIL INDICATOR SHOWS WHITE THEN RETURNS TO BLACK			OAC-CM-04	1			47	
E	ADAPTER/CABLE SELF-TEST						100	189	189
1	SELECT ADAPTER TO BE TESTED			OMH-LA-OB	1			12	
2	VERIFY PART NUMBER OF ADAPTER			OIT-EV-ZA		1		5	
3	VERIFY CABLE W13 IS CONNECTED TO J1 ON FRONT PANEL OF SST			OIT-EV-ZA		1		5	
4	INSTALL SHORTING CAP ON SELECTED ADAPTER CONNECTOR J2			ETF-CE-IA	1			58	
5	CONNECT OPEN END OF CABLE W13 TO J1 OF ADAPTER			ETF-CE-IA	1			58	
6	HOLD CABLE TEST SWITCH ON		7,8,9	OAC-CM-04	1		50	47	24
7	MOMENTARILY PRESS START/CONT SWITCH		6	OAC-CM-01	1		50	-3	-1
8	VERIFY PASS/FAIL INDICATOR SHOWS WHITE AND THEN RETURNS TO BLACK		6,7	OIT-EV-ZA		1	50	-4	-2
9	VERIFY DISPLAYED CODE CORRECT FOR SELECTED ADAPTER		6,11	OIT-EV-ZA		1		-4	
10	RELEASE CABLE TEST SWITCH			OAC-CM-01	1		50	4	2
11	WHEN USING INTERNAL BATTERY, HOLD READOUT RECALL AND NOTE		9	OAC-CM-04	1		50	47	24

TASK CODE: 81ALCMST01

STANDARD DATA APPLICATION — PART NAME: MISSILE SAFE STATE TEST

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
	DISPLAY INDICATOR								
12	RELEASE READOUT RECALL-EXT ON SWITCH			OAC-CM-01	1		50	4	2
F	SAFE STATE TEST						100	897	897
1	RMV SHORTING CAP FROM ADAPTER			ETF-CE-RA	1			47	
2	CONNECT ADAPTER TO CONNECTOR CABLE INTERFACE FOR CHOSEN MISSILE COMPONENT			ETF-CE-IB	1			68	
3	MOMENTARILY PRESS START/CONT SWITCH: VERIFY PASS/FAIL INDICATOR SHOWS WHITE THEN RETURNS TO BLACK (USING AC EXT PWR) NOTE: IF SYSTEM IS OK GO TO STEP 13 AND TERMINATE TEST			OAC-CM-04	1			47	
4	ACTUATE AND HOLD READOUT RECALL/EXT ON SWITCH TO READOUT RECALL (WHEN USING INTERNAL BATTERY POWER)			OAC-CM-04	1		50	47	24
5	RECORD FAILURE CODE DISPLAYED IF FAILURE CODE IS DESIRED			OWR-NT-01	1			8	
6	SET AUTO/MANUAL SWITCH TO MANUAL			OAC-CM-01	1			4	
7	PRESS AND RELEASE START/CONTROL SWITCH TWICE			OAC-CM-01	2			8	
8	VERIFY DISPLAY SHOWS 00 (ZERO ZERO)			OIT-EV-0A	1			12	
9	MOMENTARILY PRESS AND RELEASE START/CONT SWITCH			OAC-CM-01	1			4	
10	RECORD ANY FAILURE CODE DISPLAYED			OWR-NT-01	1			8	
11	REPEAT STEPS 9 AND 10 UNTIL FAILURE CODE DISPLAYED IN STEP 5 IS REPEATED			OEL-RS-01	120		500	120	600
12	RELEASE READOUT RECALL/EXT ON SWITCH (WHEN USING INTERNAL BATTERY POWER)			OAC-CM-01	1		50	4	2
13	SET AUTO/MANUAL SWITCH TO AUTO			OAC-CM-01	1			4	
14	DISCONNECT ADAPTER FROM MISSILE CABLE CONNECTOR			ETF-CE-RB	1			57	
15	SET POWER SWITCH TO OFF			OAC-CM-01	1			4	

STANDARD DATA APPLICATION

TASK CODE: 81ALCMST01

PART NAME: MISSILE SAFE STATE TEST

STEP	DESCRIPTION	WORKER I/D	SIMO WITH	CODE	QTY 1ST	QTY ADD	OCC	DHU ELAPSED	DHU TOTAL
G	TERMINATE TEST						100	425	425
1	DISCONNECT POWER CABLE W21			ETF-CE-RA	2		50	94	47
2	INSTALL DUST CAPS			OTF-CF-IA	2		50	28	14
3	DISCONNECT ADAPTER AND W13 CABLE			OTF-CF-IA	5			70	
4	INSTALL DUST CAPS ON SST TERMINALS (J1&J2), CABLE W13(2) AND ADAPTER (1)			OTF-CF-IA	5			70	
5	INSTALL SHORTING CAP ON ADAPTER			ETF-CE-IA	1			58	
6	COIL CABLES			OJP-CC-04	2			36	
7	STOW CABLES IN TESTER COVER			OMH-LA-0C	2			38	
8	PLACE TESTER COVER ON TESTER			OMH-LA-0B	1			12	
9	LATCH COVER			ONF-LP-01	1	3		17	
10	ASIDE TESTER			OMH-LA-0B	1			12	
11	ASIDE W13 CABLE SUPPORT (EQ.TO)			00H-0B-D7	1			51	