

**STP 8-91A15-SM-TG**

# **SOLDIER'S MANUAL AND TRAINER'S GUIDE**

## **MOS 91A MEDICAL EQUIPMENT REPAIRER SKILL LEVELS 1/2/3/4/5**



**HEADQUARTERS, DEPARTMENT OF THE ARMY**

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This manual was produced in three parts so that each file would fit on a 3.5 HD disk. You can get to any task in the manual by using the links in the table of contents in part 1. To quickly return to the table of contents, a link has been provided on the first page of parts 2 and 3.

This conversion was done by the Advanced Training Office, AHS. If you find any significant differences between this manual and the printed version or have recommendations for improving the usability of this manual, send your comments to:

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**PREFACE**

This publication is for skill level 1 through 5 soldiers holding military occupational specialty (MOS) 91A and for trainers and first-line supervisors. It contains standardized training objectives, in the form of task summaries, to train and evaluate soldiers on critical tasks which support unit missions during wartime. Trainers and first-line supervisors should ensure soldiers holding MOS/SL 91A1/2/3/4/5 have access to this publication. It should be made available in the soldier's work area, unit learning center, and unit libraries.

This manual applies to both Active and Reserve Component soldiers.

The proponent of this publication is the US Army Medical Department Center and School. Send comments and recommendations on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commandant, Academy of Health Sciences, U. S. Army, ATTN: MCCS-HTI, Fort Sam Houston, TX 78234-6122.

## CHAPTER 1

### INTRODUCTION

#### GENERAL

This manual identifies the individual MOS training requirements for soldiers in MOS 91A. Commanders, trainers, and soldiers should use it to plan, conduct, and evaluate individual training in units. This manual is the primary MOS reference to support the self-development and training of every soldier.

Use this manual with soldier's manuals of common tasks (STP 21-1-SMCT and STP 21-24-SMCT), Army training and evaluation programs (ARTEPs), and FM 25-101, Battle Focused Training, to establish effective training plans and programs which integrate soldier, leader, and collective tasks.

#### SOLDIER'S RESPONSIBILITIES

Each soldier is responsible for performing individual tasks which the first-line supervisor identifies based on the unit's METL. The soldier must perform the task to the standards listed in the SM. If a soldier has a question about how to do a task or which tasks in this manual he or she must perform, it is the soldier's responsibility to ask the first-line supervisor for clarification. The first-line supervisor knows how to perform each task or can direct the soldier to the appropriate training materials.

#### NCO SELF-DEVELOPMENT AND THE SOLDIER'S MANUAL

Self-development is one of the key components of the leader development program. It is a planned, progressive, and sequential program followed by leaders to enhance and sustain their military competencies. It consists of individual study, research, professional reading, practice, and self-assessment. Under the self-development concept, the NCO, as an Army professional, has the responsibility to remain current in all phases of the MOS. The SM is the primary source for the NCO to use in maintaining MOS proficiency. The self-development test (SDT) is an evaluation of the NCO's knowledge of the entire MOS, as well as leadership and training management. The SM is an important study reference for the NCO to use in preparing for the SDT.

Another important resource for NCO self-development is the Army Correspondence Course Program (ACCP). Refer to DA Pamphlet 351-20 for information on enrolling in this program and for a list of courses, or write to: Commandant, Academy of Health Sciences, US Army, ATTN: MCCA-HSN, Fort Sam Houston, TX 78234-6100.

Unit learning centers are valuable resources for planning self-development programs. They can help access enlisted career maps, training support products, and extension training materials.

## **TRAINING SUPPORT**

This manual includes the following information which provides additional training support information.

- **Glossary.** The glossary, which follows the last appendix, is a single, comprehensive list of acronyms, abbreviations, definitions, and letter symbols.
- **References.** This section contains two lists of references, required and related, which support training of all tasks in this SM. Required references are listed in the conditions statement and are required for the soldier to do the task. Related references are materials which provide more detailed information and a more thorough explanation of task performance.

## CHAPTER 2

### TRAINER'S GUIDE (TG)

#### GENERAL

The TG identifies the essential components of a unit training plan for individual training. Units have different training needs and requirements based on differences in environment, location, equipment, dispersion, and similar factors. Therefore, the TG is a guide used for conducting unit training and not as a rigid standard.

The TG provides information necessary for planning training requirements for the MOS. The TG--

- Identifies subject areas in which to train soldiers.
- Identifies the critical tasks for each subject area.
- Specifies where soldiers are trained to standard on each task.
- Recommends how often to train each task to sustain proficiency.
- Recommends a strategy for cross-training soldiers.
- Recommends a strategy for training soldiers to perform higher level tasks.

#### BATTLE FOCUSED TRAINING

As described in FM 25-100, Training the Force, and FM 25-101, Battle Focused Training, the commander must first define the mission essential task list (METL) as the basis for unit training. Unit leaders use the METL to identify the collective, leader, and soldier tasks which support accomplishment of the METL. Unit leaders then assess the status of training and lay out the training objectives and the plan for accomplishing needed training. After preparing the long- and short-range plans, leaders then execute and evaluate training. Finally, the unit's training preparedness is reassessed, and the training management cycle begins again. This process ensures that the unit has identified what is important for the wartime mission, that the training focus is applied to the necessary training, and that training meets established objectives and standards.

#### RELATIONSHIP OF SOLDIER TRAINING PUBLICATIONS (STPs) TO BATTLE- FOCUSED TRAINING

The two key components of enlisted STPs are the Trainer's Guide (TG) and Soldier's Manual (SM). The TG and SM give leaders important information to help in the battle-focused training process. The TG relates soldier and leader tasks in the MOS and SL to duty positions and equipment. It provides information on where the task is trained, how often training should occur to sustain proficiency, and who in the unit should be trained. As leaders go through the assessment and planning stages, they should use the TG as an important tool in identifying what needs to be trained.

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The execution and evaluation of soldier and leader training should rely on the Armywide training objectives and standards in the SM task summaries. The task summaries ensure that soldiers in any unit or location have the same definition of task performance and that trainers evaluate the soldiers to the same standard.

The diagram on the following page shows the relationship between battle-focused training and the use of the TG and SM. The left-hand side of the diagram (taken from FM 25-101) shows the soldier training process while the right side of the diagram shows how the STP supports each step of this process.

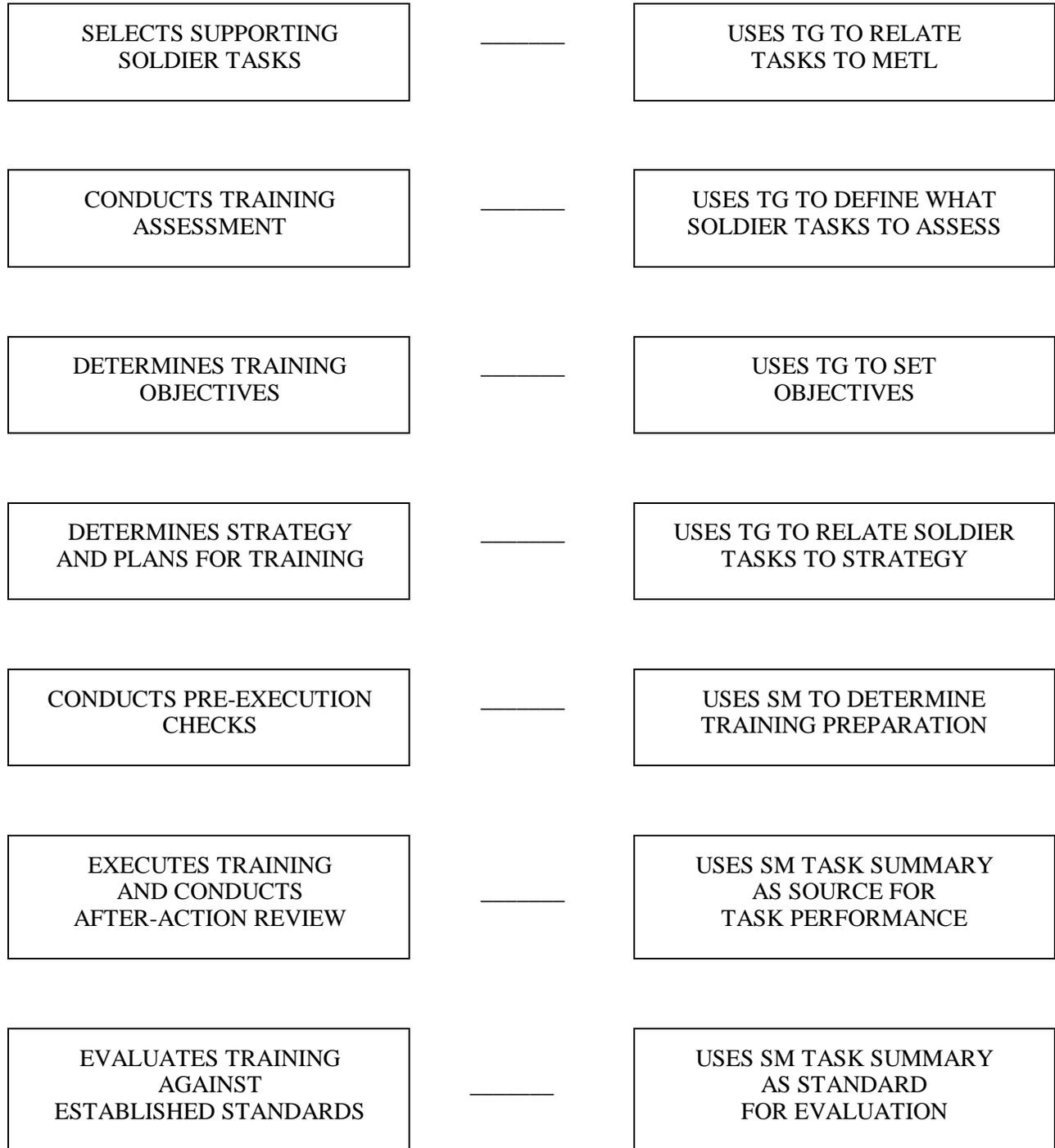
### **TRAINER'S RESPONSIBILITIES**

Training soldier and leader tasks to standard and relating this training to collective mission-essential tasks is the NCO trainer's responsibility. Trainers use the steps below to plan and evaluate training.

- Identify soldier and leader training requirements. The NCO determines which tasks soldiers need to train on using the commander's training strategy. The unit's METL and ARTEP and the MOS Training Plan (MTP) in the TG are sources for helping the trainer define the individual training needed.
- Plan the training. Training for specific tasks can usually be integrated or conducted concurrently with other training or during "slack periods." The unit's ARTEP can assist in identifying soldier and leader tasks which can be trained and evaluated concurrently with collective task training and evaluation.
- Gather the training references and materials. The SM task summary lists all references which can assist the trainer in preparing for the training of that task.
- Determine risk assessment and identify safety concerns. Analyze the risk involved in training a specific task under the current conditions at the time of scheduled training. Ensure that your training preparation takes into account those cautions, warnings, and dangers associated with each task.
- Train each soldier. Show the soldier how the task is done to standard and explain step-by-step how to do the task. Give each soldier one chance to do the task step-by-step.
- Emphasize training in mission-oriented protective posture (MOPP) level 4 clothing. Soldiers have difficulty performing even the very simple tasks in a nuclear/chemical environment. The combat effectiveness of the soldier and the unit can degrade quickly when trying to perform in MOPP 4. Practice is the best way to improve performance. The trainer is responsible for training and evaluating soldiers in MOPP 4 so that they are able to perform critical wartime tasks to standards under nuclear/chemical environment.
- Check each soldier. Evaluate how well each soldier performs the tasks in this manual. Conduct these evaluations during individual training sessions or while evaluating soldier proficiency during the conduct of unit collective tasks. This manual provides an evaluation guide for each task to enhance the trainer's ability to conduct year-round, hands-on evaluations of tasks critical to the unit's mission. Use the information in the MTP as a guide to determine how often to train the soldier on each task to ensure that soldiers sustain proficiency.

**BATTLE-FOCUS PROCESS**

**STP SUPPORT PROCESS**



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- Record the results. The leader book referred to in FM 25-101, appendix B, is used to record task performance and gives the leader total flexibility on the method of recording training. The trainer may use DA Forms 5164-R (Hands-On Evaluation) and 5165-R (Field Expedient Squad Book) as part of the leader book. The forms are optional and locally reproducible. STP 21-24-SMCT contains a copy of the forms and instructions for their use.
- Retrain and evaluate. Work with each soldier until he or she can perform the task to specific SM standards.

### **EVALUATION GUIDE**

An evaluation guide exists for each task summary in the SM. Trainers use the evaluation guides year-round to determine if soldiers can perform their critical tasks to SM standards. Each evaluation guide contains one or more performance measures which identify what the trainer needs to observe to score a soldier's performance. Each step is clearly identified by a "P" (Pass) and "F" (Fail), located under the "Results" column on each evaluation guide. Some tasks involve a process which the trainer must observe as the soldier performs the task. For other tasks, the trainer must evaluate an "end product" resulting from doing the task. The following are some general points about using the evaluation guide to evaluate soldiers:

- Review the guide to become familiar with the information on which the soldier will be scored.
- Ensure that the necessary safety equipment and clothing needed for proper performance of the job are on hand at the training site.
- Prepare the test site according to the conditions section of the task summary. Some tasks contain special evaluation preparation instructions. These instructions tell the trainer what modifications must be made to the job conditions to evaluate the task. Reestablish the test site to the original requirements after evaluating each soldier to ensure that conditions are the same for each soldier.
- Advise each soldier of the information in the Brief Soldier section of the task summary before evaluating.
- Score each soldier according to the performance measures in the evaluation guide. Unless otherwise stated in the task summary, the soldier must pass all performance measures to be scored GO. If the soldier fails any steps, show what was done wrong and how to do it correctly.
- Record the date and task performance ("GO" or "NO-GO") in the leader book.

### **TRAINING TIPS FOR THE TRAINER**

#### **1. Prepare yourself.**

- Get training guidance from your chain of command on when to train, which soldiers to train, availability of resources, and a training site.

- Get the training objective (task conditions and standards) from the task summary in this manual.
  - Ensure you can do the task. Review the task summary and the references in the reference section. Practice doing the task or, if necessary, have someone train you on the task.
  - Choose a training method.
  - Prepare a training outline consisting of informal notes on what you want to cover during your training session.
  - Practice your training presentation.
2. Prepare the resources.
- Obtain the required resources identified in the conditions statement for each task.
  - Gather equipment and ensure it is operational.
  - Coordinate for use of training aids and devices.
  - Prepare the training site according to the conditions statement and evaluation preparation section of the task summary, as appropriate.
3. Prepare the soldiers.
- Tell the soldier what task to do and how well it must be done. Refer to the standards statement and evaluation preparation section for each task as appropriate.
  - Caution soldiers about safety, environment, and security.
  - Provide any necessary training on basic skills that soldiers must have before they can be trained on the task.
  - Pretest each soldier to determine who needs training in what areas by having the soldier perform the task. Use DA Form 5164-R and the evaluation guide in each task summary to make this determination.
4. Train the soldiers who failed the pretest.
- Demonstrate how to do the task or the specific performance steps to those soldiers who could not perform to SM standards. Have soldiers study the appropriate materials.
  - Have soldiers practice the task until they can perform it to SM standards.
  - Evaluate each soldier using the evaluation guide.

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- Provide feedback to those soldiers who fail to perform to SM standards and have them continue to practice until they can perform to SM standards.

5. Record results in the leader book.

### **MILITARY OCCUPATIONAL SPECIALTY TRAINING PLAN**

One of the key components of the TG is the MOS Training Plan (MTP). The MTP has two parts to assist the commander in preparing a unit training plan which satisfies integration, cross-training, train-up, and sustainment training requirements for soldiers in this MOS.

#### **PART ONE**

Part one of the MTP shows the relationship of an MOS SL between duty position and critical tasks. The critical tasks are grouped by task commonality into subject areas. Section I lists subject area numbers and titles used throughout the MTP. Section II defines the training requirements for each duty position within an MOS and relates duty positions to subject areas and cross-training and train-up/merger requirements.

- Duty position column--contains the MOS duty positions, by skill level, which have different training requirements.
- Subject area column--lists by subject area number, the subject areas in which the soldier must be proficient for that duty position.
- Cross-train column--lists the recommended duty position for which soldiers should be cross-trained.
- Train-up/merger column--lists the corresponding duty position for the next higher SL or MOS the soldier will merge into on promotion.

#### **PART TWO**

Part two lists by subject areas, the critical tasks to be trained in an MOS, task number, task title, location, sustainment training frequency, and training SL.

- Subject area column--lists the subject area number and title in the same order as in the MTP, Part One, Section I.
- Task number column--lists the task numbers for all tasks included in the subject area.
- Task title column--lists the task title.
- Training location column--identifies the training location where the task is first trained to STP standards. If the task is first trained to standard in the unit, the word "UNIT" will be in this column. If the task is first trained to standard in the training base, it will identify the resident course where the task was taught.

Figure 2-1 contains a list of training locations and their brevity codes.

AIT	-	Advanced Individual Training
ANCOC	-	Advanced Noncommissioned Officer's Course
BCT	-	Basic Combat Training
BNCOB	-	Basic Noncommissioned Officer's Course
OSUT	-	One Station Unit Training
PLDC	-	Primary Leadership Development Course
SMC	-	Sergeants Major Course
UNIT	-	Trained in the Unit

**Figure 2-1. Training locations**

- Sustainment training frequency column--indicates the recommended frequency at which tasks should be trained to ensure the soldier maintains task proficiency. Figure 2-2 identifies the frequency codes to use in this column.

AN	-	annually
BM	-	bimonthly (once every two months)
MO	-	monthly
QT	-	quarterly
SA	-	semiannually

**Figure 2-2. Sustainment training frequency codes**

- Sustainment training SL column--lists the SLs of the MOS for which soldiers must receive sustainment training to ensure they maintain proficiency to SM standards.

- A chart at the end of the MTP indicates the ARTEPs which the individual critical tasks support. This establishes the crosswalk between individual and collective training.

**MOS TRAINING PLAN**

**MOS 91A**

**PART I. SUBJECT AREAS AND DUTY POSITIONS**

**SECTION 1. SUBJECT AREA CODES**

- |                             |                            |
|-----------------------------|----------------------------|
| 1. General                  | 6. X-ray Equipment         |
| 2. Dental Equipment         | 7. Central Material Supply |
| 3. Operating Room Equipment | 8. Supply                  |
| 4. Laboratory Equipment     | 9. Advanced Repair         |
| 5. Ward Equipment           |                            |

## MOS TRAINING PLAN

## MOS 91A

## PART I SUBJECT AREAS AND DUTY POSITIONS

## SECTION 2. DUTY POSITION TRAINING REQUIREMENTS

<b>SKILL LEVEL</b>	<b>DUTY POSITION</b>	<b>SUBJECT AREAS</b>	<b>CROSS TRAIN</b>	<b>TRAIN-UP/ MERGER</b>
SL 1	Medical Equipment Repairer	1-8	NA	NA
SL 2	Medical Equipment Repairer Sgt	1-8	NA	91A3 Medical Equipment Repairer Sgt
SL 3	Medical Equipment Repairer Sgt	1-9	NA	NA
SL 4	Medical Equipment Maintenance NCO	1-9	NA	NA
SL 5	Senior Medical Maintenance NCO	1-9	NA	NA

## MOS TRAINING PLAN

## PART II. CRITICAL TASKS

## Skill Level 1 MOS 91A

Subject Area	Task Number	Title	Training Location	Sust Tng Freq	Sust Tng SL
1. General	101-521-1133	Use The Army Master Data File Retrieval Microform System (ARMS)	AIT	AN	1-5
	101-521-1163	Prepare And Maintain A Document Register	AIT	AN	1-5
	081-874-0001	Perform Electrical Safety Checks On Medical Equipment	AIT	AN	1-5
	081-874-0053	Prepare Preventive Maintenance Schedule And Record (DD Form 314) For Medical Equipment	AIT	AN	1-5
2. Dental Equipment	081-874-0002	Perform Preventive Maintenance Checks And Services (PMCS) On A Compressor-Dehydrator	AIT	AN	1-5
	081-874-0003	Repair A Compressor-Dehydrator To Component Level	AIT	AN	1-5
	081-874-0004	Perform Preventive Maintenance Checks And Services (PMCS) On A Dental Operating Unit	AIT	AN	1-5
	081-874-0005	Repair A Dental Operating Unit To Component Level	AIT	AN	1-5
	081-874-0006	Perform Preventive Maintenance Checks And Services (PMCS) On A Field Dental X-Ray Unit	AIT	AN	1-5
	081-874-0007	Calibrate A Field Dental X-Ray Unit	AIT	AN	1-5
	081-874-0008	Repair A Field Dental X-Ray Unit To Module/Board Level	AIT	AN	1-5
3. Operating Room Equipment	081-874-0010	Perform Preventive Maintenance Checks And Services (PMCS) On A Blood Recovery Unit	AIT	AN	1-5
	081-874-0011	Verify Calibration On A Blood Recovery Unit	AIT	AN	1-5
	081-874-0017	Perform Preventive Maintenance Checks And Services (PMCS) On A Field Surgical Scrub Sink	AIT	AN	1-5
	081-874-0018	Repair A Field Surgical Scrub Sink To Component Level	AIT	AN	1-5
	081-874-0054	Perform Preventive Maintenance Checks And Services (PMCS) On An Electrosurgical Apparatus (FORCE 2)	AIT	AN	1-5
	081-874-0055	Calibrate An Electrosurgical Apparatus (FORCE 2)	AIT	AN	1-5
	081-874-0056	Repair An Electrosurgical Apparatus To Module/Board Level (FORCE 2)	AIT	AN	1-5
4. Laboratory Equipment	081-874-0019	Perform Preventive Maintenance Checks And Services (PMCS) On A Refrigerated Tabletop Centrifuge	AIT	AN	1-5
	081-874-0020	Calibrate A Refrigerated Tabletop Centrifuge	AIT	AN	1-5
	081-874-0021	Repair A Refrigerated Tabletop Centrifuge To Module/Board Level	AIT	AN	1-5
5. Ward Equipment	081-874-0023	Perform Preventive Maintenance Checks And Services (PMCS) On A Monitor-Recorder	AIT	AN	1-5
	081-874-0024	Calibrate A Monitor-Recorder	AIT	AN	1-5
	081-874-0025	Repair A Monitor-Recorder To Module/Board Level	AIT	AN	1-5
	081-874-0027	Perform Preventive Maintenance Checks And Services (PMCS) On A Defibrillator Module	AIT	AN	1-5
	081-874-0028	Calibrate A Defibrillator Module	AIT	AN	1-5
	081-874-0029	Repair A Defibrillator Module To Module/Board Level	AIT	AN	1-5

**PART II. CRITICAL TASKS****Skill Level 1 MOS 91A**

Subject Area	Task Number	Title	Training Location	Sust Tng Freq	Sust Tng SL
	081-874-0031	Perform Preventive Maintenance Checks And Services (PMCS) On A Portable Ventilator	AIT	AN	1-5
	081-874-0032	Calibrate A Portable Ventilator	AIT	AN	1-5
	081-874-0033	Repair A Portable Ventilator To Module/Board Level	AIT	AN	1-5
6. X-ray Equipment	081-874-0035	Perform Preventive Maintenance Checks And Services (PMCS) On A Single Phase Radiographic Unit (Continental X-Ray Unit)	AIT	AN	1-5
	081-874-0037	Calibrate A Single Phase Radiographic Unit (Continental X-Ray Unit)	AIT	AN	1-5
	081-874-0038	Repair A Single Phase Radiographic Unit To Module/Board Level (Continental X-Ray Unit)	AIT	AN	1-5
7. Central Material Supply	081-874-0044	Perform Preventive Maintenance Checks And Services (PMCS) On A Field Sterilizer	AIT	AN	1-5
	081-874-0045	Repair A Field Sterilizer To Component Level	AIT	AN	1-5
	081-874-0046	Perform Preventive Maintenance Checks And Services (PMCS) On A Programmable Suction Pump	AIT	AN	1-5
	081-874-0047	Calibrate A Programmable Suction Pump	AIT	AN	1-5
	081-874-0048	Repair A Programmable Suction Pump To Module/Board Level	AIT	AN	1-5
8. Supply	081-872-0043	Compute Authorized Stockage Levels For Medical Supplies Using The Days Of Supply (DOS) Computation	UNIT	AN	1-5
	101-521-1151	Order Supplies And Equipment	UNIT	AN	1-5
	081-872-0037	Prepare DA Form 3318 For The First Demand Of A Nonstocked (Fringe) Medical Repair Part	UNIT	AN	1-5
	081-872-0054	Maintain DA Form 3318 For Nonstocked (Fringe) Medical Repair Parts	UNIT	AN	1-5
	081-872-0038	Add A Medical Repair Part To The Demand Supported Prescribed Load List (PLL)	UNIT	AN	1-5
	081-872-0055	Maintain The Demand Supported Prescribed Load List (PLL) For Medical Repair Parts	UNIT	AN	1-5
	101-521-1152	Request Supply Status For High-Priority Requests	UNIT	AN	1-5

**PART II. CRITICAL TASKS**

**Skill Level 3 MOS 91A**

9. Advanced Repair	081-874-0009	Repair A Field Dental X-Ray Unit To Component Level	AIT	AN	3-5
	081-874-0012	Repair A Blood Recovery Unit To Component Level	AIT	AN	3-5
	081-874-0022	Repair A Refrigerated Tabletop Centrifuge To Component Level	AIT	AN	3-5
	081-874-0026	Repair A Monitor-Recorder To Component Level	AIT	AN	3-5
	081-874-0030	Repair A Defibrillator Module To Component Level	AIT	AN	3-5
	081-874-0034	Repair A Portable Ventilator To Component Level	AIT	AN	3-5
	081-874-0039	Repair A Single Phase Radiographic Unit To Component Level (Continental X-Ray Unit)	AIT	AN	3-5
	081-874-0049	Repair A Programmable Suction Pump To Component Level	AIT	AN	3-5
	081-874-0057	Repair An Electrosurgical Apparatus To Component Level (Force 2)	AIT	AN	3-5

## MOS TRAINING PLAN

## INDIVIDUAL TASK/ARTEP CROSSWALK

	057-30	456	476-30	478-30	705	715	725	765-30	897
081-872-0037	X	X	X	X	X	X	X	X	X
081-872-0038	X	X	X	X	X	X	X		X
081-872-0043	X	X	X	X	X	X	X	X	X
081-872-0054	X	X	X	X	X	X	X		X
081-872-0055	X	X	X	X	X	X	X		X
081-874-0001	X	X	X	X	X	X	X	X	X
081-874-0002	X	X	X	X	X	X	X		X
081-874-0003	X	X	X	X	X	X	X		X
081-874-0004	X	X	X	X	X	X	X		X
081-874-0005	X	X	X	X	X	X	X		X
081-874-0006	X	X	X	X	X	X	X		X
081-874-0007	X	X	X	X	X	X	X		X
081-874-0008	X	X	X	X	X	X	X		X
081-874-0009	X	X	X	X	X	X	X		X
081-874-0010					X	X	X		X
081-874-0011					X	X	X		X
081-874-0012					X	X	X		X
081-874-0017	X	X	X	X	X	X	X	X	X
081-874-0018	X	X	X	X	X	X	X	X	X
081-874-0019					X	X	X	X	X
081-874-0020					X	X	X		X
081-874-0021					X	X	X		X
081-874-0022					X	X	X		X

MOS TRAINING PLAN

INDIVIDUAL TASK/ARTEP CROSSWALK

	057-30	456	476-30	478-30	705	715	725	765-30	897
081-874-0023	X				X	X	X		X
081-874-0024	X				X	X	X		X
081-874-0025	X				X	X	X		X
081-874-0026	X				X	X	X		X
081-874-0027	X				X	X	X		X
081-874-0028	X				X	X	X		X
081-874-0029	X				X	X	X		X
081-874-0030	X				X	X	X		X
081-874-0031					X	X	X		X
081-874-0032					X	X	X		X
081-874-0033					X	X	X		X
081-874-0034					X	X	X		X
081-874-0035					X	X	X		X
081-874-0037					X	X	X		X
081-874-0038					X	X	X		X
081-874-0039					X	X	X		X
081-874-0044					X	X	X		X
081-874-0045					X	X	X		X
081-874-0046					X	X	X		X
081-874-0047					X	X	X		X
081-874-0048					X	X	X		X
081-874-0049					X	X	X		X

## MOS TRAINING PLAN

## INDIVIDUAL TASK/ARTEP CROSSWALK

	057-30	456	476-30	478-30	705	715	725	765-30	897
081-874-0053	X	X	X	X	X	X	X		X
081-874-0054					X	X	X		X
081-874-0055					X	X	X		X
081-874-0056					X	X	X		X
081-874-0057					X	X	X		X
101-521-1133	X	X	X	X	X	X	X	X	X
101-521-1151	X	X	X	X	X	X	X	X	X
101-521-1152	X	X	X	X	X	X	X	X	X
101-521-1163	X	X	X	X	X	X	X	X	X

## CHAPTER 3

### MOS SKILL LEVEL TASKS

#### Section I Skill Level 1 Tasks

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101-521-1133

#### USE THE ARMY MASTER DATA FILE RETRIEVAL MICROFORM SYSTEM (ARMS)

#### CONDITIONS

Necessary materials, equipment, and references: microfiche viewer, operator's manual, Army Master Data File (AMDF), United States Army Catalog Data Agency (USACDA) Pam 18-1, SB 700-20, DA Pam 25-30, Federal Supply Catalog Identification List (IL), and Federal Supply Catalog Master Cross-Reference List (MCRL).

#### STANDARDS

Complete all steps in accordance with (IAW) applicable publications.

#### TRAINING/EVALUATION

##### *Evaluation Guide*

#### Performance Measures

#### Results

**NOTE:** Refer to AMDF for steps 1 and 2; USACDA Pam 18-1 and SB 700-20 for step 2; IL for step 3 and DA Pam 25-30 for step 5.

1. Locate the microfiche number, frame number, and nomenclature of a requested item by using the AMDF, the national stock number (NSN), and the microfiche viewer. P F

**NOTE:** When looking up an NSN on the microfiche viewer, you will need the portion of the NSN called the national item identification number (NIIN). The NIIN is the NSN without the Federal Stock Class. In other words, it is the last nine numbers of the NSN. The NIIN is preceded by the country code (two digit number). Beginning with the country code, match this number up with the numbers located at the top of each AMDF slide. The number that comes the closest, without going over, is the slide that will contain the information you require.

2. Use the NSN, monthly AMDF, a microfiche viewer, and USACDA Pam 18-1 to locate an NSN and obtain information about the NSN. P F

**Performance Measures**

**Results**

- a. Some of the most common items that are referenced within the AMDF are unit of issue (UI), price, supply class, and the nomenclature of a particular item.
- b. When received (monthly), the AMDF should be compared with the unit property books to ensure that accurate information is listed on the property record.
- c. SB 700-20 also contains information about Army adopted equipment.

**NOTE:** Items in Chapter 2 are listed by line item number (LIN) grouping like items together. SB 700-20 is broken into several chapters, making it necessary to reference the index to identify which chapter the information is located in. The SB 700-20 is also used to obtain information on a piece of equipment where limited information is at hand. Appendix A identifies items by their "Army Type Designator." Example, Rifle, M16A2; the M16A2 is the Army type designator assigned to this item of equipment. Caution--many items have the same Army type designator, so additional information about the nomenclature may be necessary. Other features of SB 700-20 include NSN to LIN cross-reference, LIN deletions/revisions, and a cross-reference generic nomenclature to LIN. Keep in mind, the SB 700-20 is published only semiannually. The AMDF is the most accurate form of information for items of equipment.

- 3. Use an identification list (IL) and item description to locate information about the item. The IL is identified by the Federal Supply Classification (FSC). The IL will give detailed information on the equipment being researched. P F

**NOTE:** Procedures listed in 2 above apply to this step also.

- 4. Locate the NSN for a reference number and determine if enough information is available to fully identify the item. P F
- 5. Use DA Pam 25-30 and the microfiche viewer to identify blank forms and publications needed to request supplies and equipment. P F

**NOTE:** DA Pam 25-30 also lists information on changes to publications and gives most recent information on all available publications assigned to an item of equipment, including dates of the most current change. This information is very important when identifying the publication to be used to correctly identify all components that belong to a piece of equipment. DA Pam 25-30 also identifies forms. Use it to gather information necessary to place orders for the various forms needed in day-to-day operation of support and administrative duties.

**REFERENCES:**

*Required*

*Related*

AMDF  
DA Pam 25-30  
SB 700-20  
USACDA Pam 18-1  
IL  
MCRL

None

101-521-1163

**PREPARE AND MAINTAIN A DOCUMENT REGISTER**

**CONDITIONS**

You have been directed to prepare supply transaction documents that must be posted to the document register. Necessary materials and equipment: organization designation, activity address code, unit identification code (UIC), document register, and documents containing information requiring entry on the document register.

**STANDARDS**

The document register is prepared and maintained without losing accountability for due-ins and supplies received.

**TRAINING/EVALUATION**

*Evaluation Guide*

**Performance Measures**

**Results**

1. Prepare the document register. (See DA Pamphlet 710-2-1, Chapter 2, Section III, and Figure 2-6.)	P	F
2. Complete entries on the document register. (See DA Pamphlet 710-2-1, Chapter 2, Section III, and Figure 2-6.)	P	F
3. File the document register.	P	F
a. Place it under file number 710-2b.		
b. Disposition instructions: destroy after two years.		
(1) At the end of the year, fiscal or calendar, the register becomes inactive and a new register is started.		
(2) The old register is held in the current files area for two years; during that two years, any open transactions that are completed are closed out or posted on the old inactive register.		
(3) At the end of the two year retention period the open numbers, if any still exist, are transferred to the new document register, and the old inactive register is then destroyed.		

**REFERENCES:**

*Required*

*Related*

AR 25-400-2  
AR 710-2  
DA Pamphlet 25-400-2  
DA Pamphlet 710-2-1

None

**PERFORM ELECTRICAL SAFETY CHECKS ON MEDICAL EQUIPMENT**

**CONDITIONS**

You have received DD Form 314 requiring an electrical safety check on a specified piece of equipment. Necessary materials and equipment: a 232M safety analyzer, appropriate maintenance forms, and the technical manual (TM) or manufacturer's service literature.

**STANDARDS**

All required leakage current and resistance tests are performed. The results are recorded and compliance/noncompliance is verified in accordance with NFPA 99.

**TRAINING/EVALUATION**

*Training Information Outline*

1. Review the TM or the manufacturer's service literature.
2. Inspect the power cord of the safety analyzer for cracked or cut insulation and the electrical plug for bent or broken blades.
3. Conduct a function check of the safety analyzer.
  - a. Plug safety analyzer into a power outlet.

**NOTE:** Ensure that no equipment is plugged into the TEST RECEPTACLE and that the TEST RECEPTACLE POLARITY SWITCH is in the OFF (center) position.

- b. Turn the POWER SWITCH to ON.
- c. Set the MODE SWITCH to SELF TEST and ensure--
  - (1) The digital display reads 1000 +/- 20.
  - (2) The CURRENT SOURCE ACTIVE lamp is on.
- d. Set the MODE SWITCH to L1-L2.

**NOTE:** The display should read the line voltage +/- 10%.

- e. Set the MODE SWITCH to L1-GND.

**NOTE:** The display should read no more than 5% of the L1-L2 reading.

- f. Set the MODE SWITCH to L2-GND.

**NOTE:** The display should read approximately the same as the L1-L2 reading.

4. Conduct the power cord ground wire resistance, General & ECG Test VI.
  - a. Set the MODE switch to POWER CORD RESISTANCE.
  - b. Set the TEST RECEPTACLE POLARITY switch to OFF.
  - c. Plug the unit under test into the TEST RECEPTACLE on the top of the safety analyzer.
  - d. Connect the dual banana plug of a Kelvin cable to the two red rear panel jacks.
  - e. Connect the alligator clip to a grounded point on the case of the unit being tested.
  - f. Set the POWER SWITCH to ON and ensure--
    - (1) The CURRENT SOURCE ACTIVE lamp lights up.
    - (2) The display indicates the resistance.
  - g. Set the POWER switch to OFF.
5. Conduct the case to ground leakage, test general.
  - a. Set the MODE switch to CASE LEAKAGE.
  - b. Set the TEST RECEPTACLE POLARITY switch to NORMAL.
  - c. Plug the unit to be tested into the TEST RECEPTACLE on the top of the safety analyzer.
  - d. Connect a test lead between the rear "external meter" red panel jack of the safety analyzer and the grounded point on the case of the unit under test.
  - e. Turn the POWER switch of the safety analyzer to ON. The reading displayed is the current Grounded-Polarity Normal.
  - f. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Normal.
  - g. Release the GROUND toggle switch.

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- h. Set the TEST RECEPTACLE POLARITY switch to REVERSED POLARITY, momentarily stopping in the OFF position and ensure the reading displayed is the current Grounded-Polarity, Reversed.
- i. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Reversed.
- j. Release the GROUND toggle switch.
- k. Set the POWER switch to OFF.
- l. Turn the unit under test ON, then repeat steps 5b and 5e through 5k.

**NOTE:** If the unit under test has a motor, the unit should be turned off, and the motor should be allowed to come to a complete stop before proceeding with the Reversed Polarity test.

- m. Set the POWER switch to OFF.
  - (1) Proceed to step 6 if checking ECG equipment.
  - (2) Proceed to step 11 if performing general tests.
- 6. Conduct the case to ground leakage, ECG equipment (TEST I).
  - a. Set the MODE SWITCH to CASE LEAKAGE.
  - b. Set the TEST RECEPTACLE POLARITY switch to NORMAL.
  - c. Plug the ECG unit to be tested into the TEST RECEPTACLE on the top of the safety analyzer.
  - d. Connect a test lead between the rear "external meter" red panel jack of the safety analyzer and the grounded point on the case of the ECG unit under test.
  - e. Turn the POWER switch of the safety analyzer to ON and ensure the reading displayed is the current Grounded-Polarity, Normal.
  - f. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Normal.
  - g. Release the GROUND toggle switch.
  - h. Set the TEST RECEPTACLE POLARITY switch to REVERSED POLARITY, momentarily stopping in the OFF position and ensure the reading displayed is the current Grounded-Polarity, Reversed.
  - i. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Reversed.

- j. Release the GROUND toggle switch.
- k. Set the POWER switch to OFF.
- l. Turn the ECG unit under test ON; then repeat steps 6b and 6e through 6k.

**NOTE:** If the unit has a pen recorder, place the pen control in STANDBY to avoid excessive deflection of the pen due to stray signal pickup.

- m. Set the POWER switch to OFF.
7. Conduct the combined lead leakage test (TEST II).
- a. Connect the patient leads from the ECG unit to the corresponding connector on the top of the safety analyzer.
  - b. Ensure that the patient cable is also connected to the ECG unit.
  - c. Set the MODE SWITCH to ECG.
  - d. Set the ECG SELECTOR SWITCH to ALL.
  - e. Plug the ECG unit into the TEST RECEPTACLE on the top of the safety analyzer.
  - f. Set the TEST RECEPTACLE POLARITY switch to NORMAL.
  - g. Turn the ECG unit under test ON.
  - h. Set the POWER SWITCH to ON and ensure the reading displayed is the current Grounded, Normal.
  - i. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Normal.
  - j. Release the GROUND toggle switch.
  - k. Set the TEST RECEPTACLE POLARITY switch to REVERSED POLARITY, momentarily stopping in the OFF position and ensure the reading displayed is the current Grounded, Polarity Reversed.
  - l. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Reversed.
  - m. Release the GROUND toggle switch.
  - n. Set the TEST RECEPTACLE POLARITY switch to NORMAL, momentarily stopping in the OFF position.

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- o. Set the POWER switch to OFF.
8. Conduct the individual lead leakage test (TEST III).
- a. Set the ECG SELECTOR switch to RL.
  - b. Set the TEST RECEPTACLE POLARITY switch to NORMAL.
  - c. Turn the ECG unit under test ON.
  - d. Set the POWER switch to ON and ensure the reading displayed is the current Grounded-Normal.
  - e. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Normal.
  - f. Release the GROUND toggle switch.
  - g. Set the TEST RECEPTACLE POLARITY switch to REVERSED POLARITY, momentarily stopping in the OFF position and ensure the reading displayed is the current Grounded, Polarity Reversed.
  - h. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Reversed.
  - i. Release the GROUND toggle switch.
  - j. Set the TEST RECEPTACLE POLARITY switch to NORMAL, momentarily stopping in the OFF position.
  - k. Set the ECG SELECTOR switch to RA.
  - l. Repeat steps 8c through 8i.
  - m. Set the ECG SELECTOR switch to LA.
  - n. Repeat steps 8c through 8i.
  - o. Set the ECG SELECTOR switch to LL.
  - p. Repeat steps 8c through 8i.
  - q. Set the ECG SELECTOR switch to V1.
  - r. Repeat steps 8c through 8i.
  - s. Set the POWER switch to OFF.

9. Conduct the paired lead leakage test (TEST IV).
  - a. Set the ECG SELECTOR switch to RA-LA.
  - b. Set the TEST RECEPTACLE POLARITY switch to NORMAL.
  - c. Set the POWER switch to ON and ensure the reading displayed is the current Grounded-Normal.
  - d. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Normal.
  - e. Release the GROUND toggle switch.
  - f. Set the TEST RECEPTACLE POLARITY switch to REVERSED POLARITY, momentarily stopping in the OFF position and ensure the reading displayed is the current Grounded-Polarity, Reversed.
  - g. Depress and hold the GROUND toggle switch in the OPEN position and ensure the reading displayed is the current Ground Lifted-Polarity, Reversed.
  - h. Release the GROUND toggle switch.
  - i. Set the TEST RECEPTACLE POLARITY switch to NORMAL, momentarily stopping in the OFF position.
  - j. Set the ECG SELECTOR switch to RA-RL.
  - k. Repeat steps 9c through 9i.
  - l. Set the ECG SELECTOR switch to LA-RL.
  - m. Repeat steps 9c through 9i.
  - n. Set the POWER switch to OFF.
10. Conduct the isolation test (TEST V).
  - a. Set the ECG SELECTOR switch to ISO TEST.
  - b. Set the TEST RECEPTACLE switch to NORMAL.
  - c. Set the POWER SWITCH to ON.
  - d. Depress the red ISO TEST push button and note the leakage.

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**NOTE:** The reading displayed is the leakage that would be present if line voltage is applied to the ECG terminals.

11. Record the results and verify compliance/noncompliance.
  - a. Record results for general equipment ONLY if the unit fails the test.
  - b. Record results for all ECG equipment and defibrillators.

### *Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>	
1. Review appropriate TM and/or manufacturer's service literature.	P	F
2. Inspect the power cord and electrical plug of the safety analyzer.	P	F
3. Conduct a function check of the safety analyzer.	P	F
4. Conduct power cord wire resistance test.	P	F
5. Conduct case to ground leakage test.	P	F
6. Conduct case to ground leakage test, ECG equipment.	P	F
7. Conduct the combined ground to lead leakage test, ECG equipment.	P	F
8. Conduct individual lead leakage test, ECG equipment.	P	F
9. Conduct paired lead leakage test, ECG equipment.	P	F
10. Conduct isolation test.	P	F
11. Record the results as necessary.	P	F

### **REFERENCES:**

#### *Required*

NFPA 99

#### *Related*

AR 40-61





- (3) ST--safety test.
- (4) P/C--PMCS and calibration.
- (5) P/S--PMCS and safety test.
- (6) C/S--calibration and safety test.
- (7) AA--all of the above.

(8) Use other symbols or subsymbols as long as they do not conflict with the symbols listed above. Explain any other symbols in the REMARKS block of the DD 314 or in your standing operating procedure (SOP).

f. To schedule a service, mark the symbol (see (6) above) in pencil in the date due block.

**NOTE:** You may not always be able to perform a service when it is scheduled. There will normally be a variance stated in the PMCS section of the equipment's TM. If not, the variance you are authorized is--

- (1) Annual service--36 days before or after the scheduled day of the service.
- (2) Semiannual service--18 days before or after the scheduled day of the service.
- (3) Quarterly service--9 days before or after the scheduled day of the service.
- (4) Monthly--3 days before or after the scheduled day of the service.

2. Record the symbols to show the type of service scheduled.

a. Ink in the symbol on the date it was scheduled when performing a service within the variance time period.

b. Erase the symbols on the schedule date when completing a service outside the variance time period.

c. Ink in the symbol on the actual date you completed the service.

d. Schedule the next service from the new date.

**NOTE:** Use the variance to perform as many services as possible at the same time.

3. Record NMC days on the back of the DD Form 314.

**NOTE:** Equipment reported on DA Form 2406 will need a record of NMC time.

a. Record not-mission capable maintenance (NMCM) days.

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- (1) Show organizational NMCM days with the symbol O.
- (2) Put an S inside the O for organization or mission capable supply (NMCS).
- (3) Post organizational NMCM/NMCS days as they occur.
- (4) Use the letter X for each day the equipment is NMCM at support.
- (5) Put the letter S over the X on the days the equipment was NMCS at support.

b. If support does not give a day-by-day breakout, put the total number NMCM/NMCS days in the REMARKS block.

**NOTE:** Equipment that is NMC at the end of the day is counted for the whole day. Equipment that is fully mission capable (FMC) at the end of the day is counted FMC for the whole day. A day is the normal workday for your command.

**NOTE:** When equipment that is reportable on a DA Form 2406 is loaned to another unit, the borrowing unit will inform the owning unit of any NMC time on the equipment. It is the owning unit's responsibility to ensure that the data required for the proper maintaining of the DD Form 314 is collected.

4. Complete the block title items.

**NOTE:** When an ADP system provides printouts or automated forms with all the information from the DD Form 314, do not prepare the form.

- a. Write the last two digits of the calendar year in the shaded box at the upper or lower left of the card.

**NOTE:** For steps 1 through 3 use either the block at the top or bottom of the cards.

- b. **REGISTRATION NUMBER:** Enter the serial number of the item.
- c. **ADMINISTRATION NUMBER:** Enter the NSN of the number.
- d. **NOMENCLATURE:** Enter the noun abbreviation. For items reportable on DA Form 2406, enter the equipment category code (ECC) and line number (LIN).
- e. **MODEL:** Enter the model number.
- f. **ASSIGNED TO:** Enter the designation of the activity or section in which the equipment is located.
- g. **DATE/BLOCKS:** Show services scheduled and completed.
- h. **REMARKS:** Record any additional comments.

**NOTE:** A system DD Form 314 is needed only to combine NMC time on equipment reported as a system.

(1) (Front side of the form) In pencil note any maintenance data needed: symbols or subsymbols used, service due dates, etc. Services due the following year will also be noted here until they can be carried to a new form.

(2) (Back side of the form) Enter any NMC time reported as totals by support maintenance. (When support maintenance gives a day-by-day breakout of NMC time, mark the days in the date blocks.) Also enter the manufacturer's name.

*Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>
1. Use the front side of DD Form 314 to schedule services. Use the back side to show not-mission capable (NMC) time.	P F
2. Record the symbols to show the type of service scheduled.	P F
3. Record NMC days on the back of the DD form 314.	P F
4. Complete the block title items.	P F

<b>REFERENCES:</b>	<i>Required</i>	<i>Related</i>
	TB 38-750-2	None

081-874-0002

**PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES  
(PMCS) ON A COMPRESSOR-DEHYDRATOR**

**CONDITIONS**

You have received DD Form 314 and DA Form 2404 to perform PMCS on a compressor-dehydrator. Necessary equipment and materials: TM 8-6520-003-24&P, TB 38-750-2, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled PMCS is performed, and uncorrected unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DD Form 314.

**TRAINING/EVALUATION**

*Evaluation Guide*

**Performance Measures**

**Results**

- |  |   |   |
|--|---|---|
| 1. Inspect the case.   | P | F |
| a. Check all the latches and handles to ensure they are not broken or missing. |   |   |
| b. Check the foam inside the case to ensure it is not torn or deteriorated.    |   |   |
| c. Check the motor supports to ensure they are not bent or broken.             |   |   |
| d. Check the post supports to ensure they are not bent.                        |   |   |
| e. Check all the tubing to ensure it is not deteriorated, cut, or nicked.      |   |   |
| f. Check the air relief valve to ensure--                                      |   |   |
| (1) The push button is not broken or missing.                                  |   |   |
| (2) The push button springs back after it's released.                          |   |   |
| 2. Inspect the dryer and cooling assembly.                                     | P | F |
| a. Check the fan for bent or broken fan blades.                                |   |   |

**Performance Measures**

**Results**

- b. Check the fan guard to ensure it is not broken or missing.
- c. Check for loose clamps or missing screws.
- d. Check the humidifier indicator for--
  - (1) Cracks, dents, or broken indicator cover.
  - (2) Blue desiccant.

**NOTE:** Blue indicates desiccant is dry, and pink indicates it is wet.

- 3. Remove dust and dirt from the compressor. P    F
  - a. Check the intake silencer for heavy accumulation of dust or dirt.
  - b. Replace the intake silencer if there is a heavy accumulation of dust or dirt.

**WARNING**

Do not use any type of liquid cleaner or solvent to clean the intake silencer element.

**CAUTION**

Do not restrict air flow through air intake silencer.

- 4. Inspect the running/starting capacitors for corrosion on the terminals or indication of a chemical leak from the capacitors. P    F
- 5. Perform a function check. P    F

**NOTE:** Air is not drawn from the compressor during the operational check out procedures.

- a. Check the drain valve to ensure it opens and closes properly.
- b. Turn the unit on.

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**Performance Measures**

**Results**

c. Check the pressure gauge for--

(1) Cracked or broken dial cover.

(2) Bent or broken gauge indicator.

d. Check the compressor.

(1) The pressure reaches 80 psi in approximately 40 seconds and the compressor shuts itself off.

(2) The pressure decreases to 60 psi in approximately 31 seconds.

**NOTE:** This indicates the regeneration system is functioning.

(3) The compressor turns itself back on at 60 psi and runs until the pressure reaches 80 psi.

6. Record deficiencies uncorrected on DA Form 2404 and complete the appropriate reports and forms. P F

7. Take the unit out of service if uncorrected deficiencies present any danger to the patients or operator or if the machine could be damaged due to continued use. P F

**REFERENCES:**

***Required***

***Related***

TM 8-6520-003-24&P  
TB 38-750-2

AR 40-61

081-874-0003

**REPAIR A COMPRESSOR-DEHYDRATOR TO COMPONENT LEVEL**

**CONDITIONS**

You have received DA Form 2407 for repair of a dehydrator compressor. Necessary materials and equipment: voltmeter, DA Form 2409, TB Med 7, TB 38-750-2, TM 8-6520-003-24&P, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in manufacturer's literature. Results are recorded on DA Forms 2407 and 2409.

**TRAINING/EVALUATION**

*Evaluation Guide*

**Performance Measures**

**Results**

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| <ol style="list-style-type: none"> <li>1. Review DA Form 2407 for the operator's description of the equipment malfunction.</li> <li>2. Determine maintenance expenditure limits (MEL) for definite life equipment.             <ol style="list-style-type: none"> <li>a. Obtain the current replacement cost.</li> <li>b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.</li> <li>c. Use the chart at Figure 3-3 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.</li> <li>d. Project a horizontal line to the MEL factor.</li> <li>e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.</li> </ol> </li> </ol> | <table border="0"> <tr> <td>P</td> <td>F</td> </tr> <tr> <td>P</td> <td>F</td> </tr> </table> | P | F | P | F |
| P  | F   |   |   |   |   |
| P  | F   |   |   |   |   |

**NOTE:** Under certain conditions the MEL may be waived. (See TB Med 7.)

**NOTE:** The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 per cent. This MEL remains constant for as long as the equipment is in use, regardless of age.

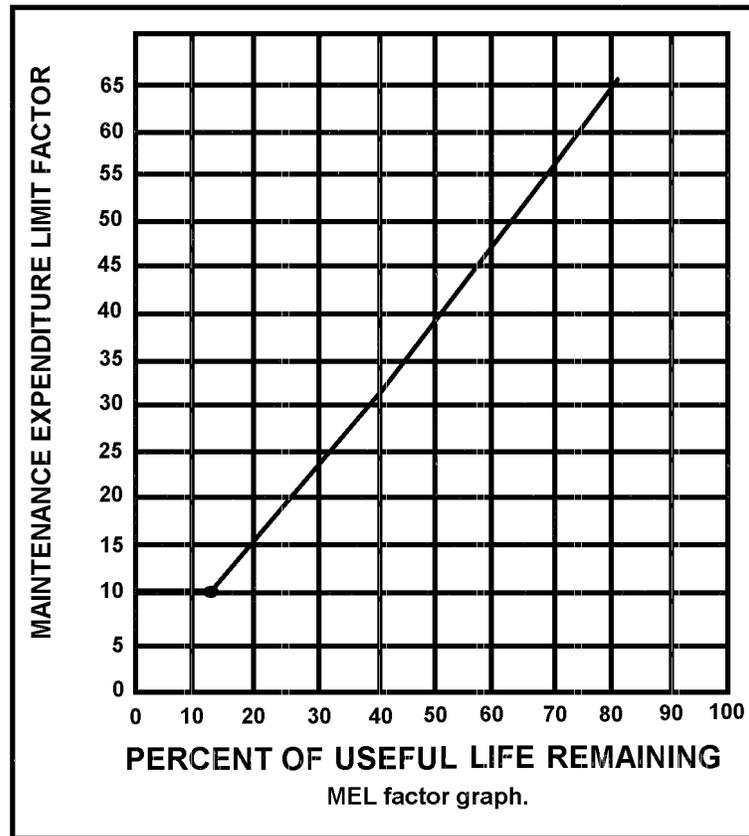


Figure 3-3

- 3. Perform a visual inspection for obvious damage to hoses, tubes, and cables. P F
- 4. Perform a function check to confirm symptoms listed on DA Form 2407. P F

**NOTE:** If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 9.)

- 5. Troubleshoot and isolate the malfunction to component level. (See Figures 3-4 through 3-7.) P F

## Performance Measures

## Results

<u>SYMPTOM</u>	<u>PROBABLE CAUSE</u>	<u>CORRECTIVE MEASURE</u>
Motor-compressor will not start or attempt to start.	Defective electrical power receptacle.	Initiate corrective action to restore electrical power.
	Defective electrical power connector or cable.	Repair or replace defective components.
	Defective power switch.	Repair or replace defective power switch.
	Defective pressure switch.	Troubleshoot and repair or replace the pressure switch.
	Defective starting capacitor.	Test the capacitor and replace as required.
Motor-compressor attempts to start but will not run.	Motor-compressor cylinder pressurizes.	Depress the red unloader valve.
	Defective unloader valve.	Repair or replace the unloader valve.
	Defective running capacitor.	Replace the capacitor.
	Bound motor-capacitor.	Turn the power switch to OFF. Insert a 6-mm Allen wrench into the hole in the finned aluminum housing on the end of the motor-compressor and attempt to turn it. It should turn freely in both directions. If not, repair or replace the motor-compressor.

Figure 3-4

## Performance Measures

## Results

<u>SYMPTOMS</u>	<u>PROBABLE CAUSE</u>	<u>CORRECTIVEMEASURE</u>
Motor-compressor runs but with unusual noises.	Loose or broken hoses or tubing.	Tighten loose connections, relocate improperly positioned components, or replace defective components.
	Broken motor-compressor inlet or outlet valves.	Repair or replace the motor-compressor.
	Defective bearings.	Replace the motor-compressor.
Motor-compressor operates but will not build up pressure to 80 psi.	Defective pressure gauge.	Replace the gauge.
	Defective pressure switch.	Repair or replace the switch.
	Obstructed intake silencer.	Replace the intake silencer.
	Drain valve leaking or open.	Close the valve or replace it.
	Defective unloader valve.	Repair or replace the valve.
	Defective internal motor-compressor.	Repair or replace motor-compressor.
Humidity indicator is not blue.	Purging cycle not functioning properly.	Perform function test and repair as required.

Figure 3-4 (Continued)

Performance Measures

Results

<u>SYMPTOMS</u>	<u>PROBABLE CAUSE</u>	<u>CORRECTIVE MEASURE</u>
Humidity indicator is not blue. (Cont'd)	Motor-compressor cycling too frequently.	Check for excessive load factors or leaks. Locate and repair problems.
	Drying chamber saturated with moisture.	Regenerate the desiccant.

Figure 3-4 (Continued)

6. Determine if the repair cost exceeds the MEL. P F

**NOTE:** If the repair cost exceeds the MEL, notify the supervisor.

7. Replace the defective component. P F

8. Determine the disposition of the unit. P F

a. Prepare to release the unit to the user if the function check is satisfactory.

b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.

c. Refer to the next higher echelon of maintenance if necessary.

9. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2. P F

a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.

b. Obtain the user's signature for receipt of the unit, as appropriate.

c. Release the unit to the user.

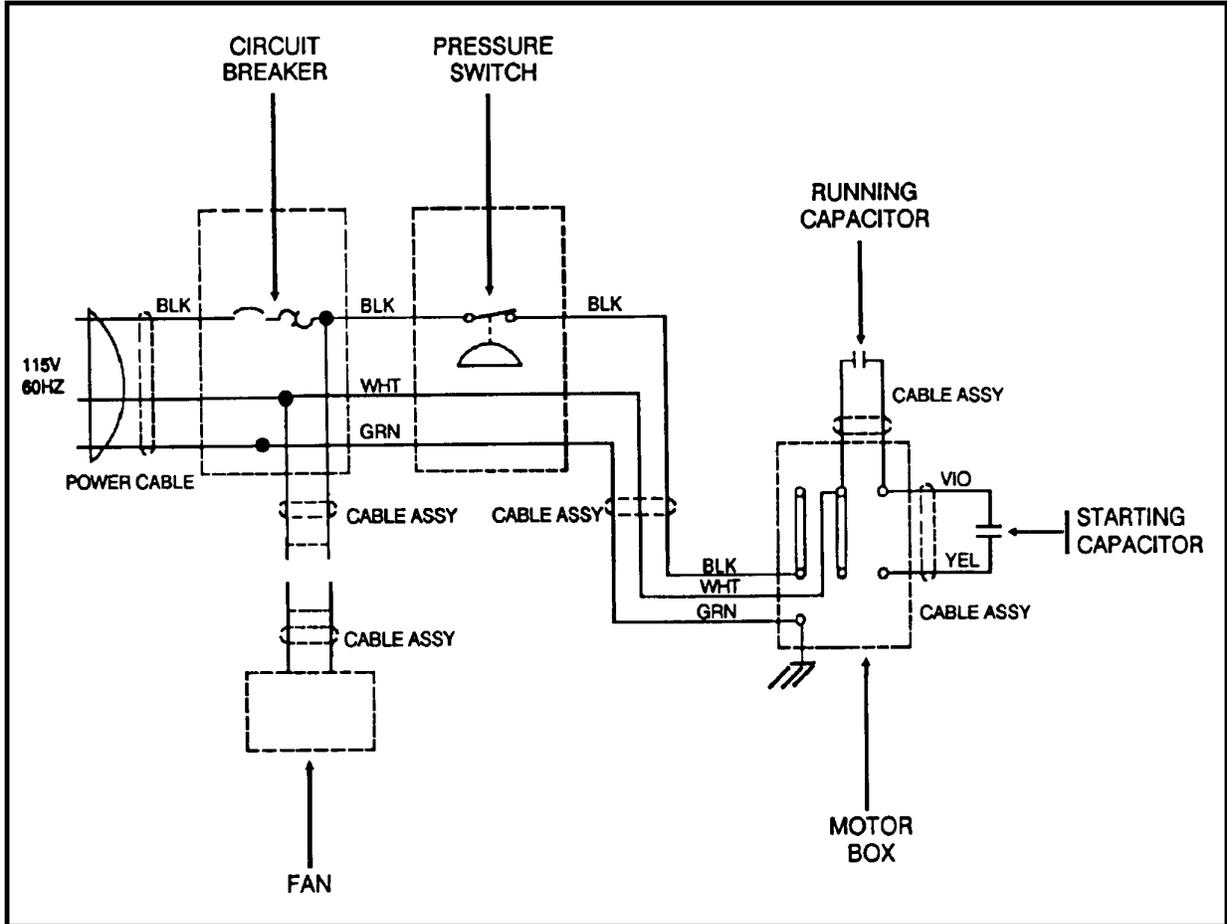
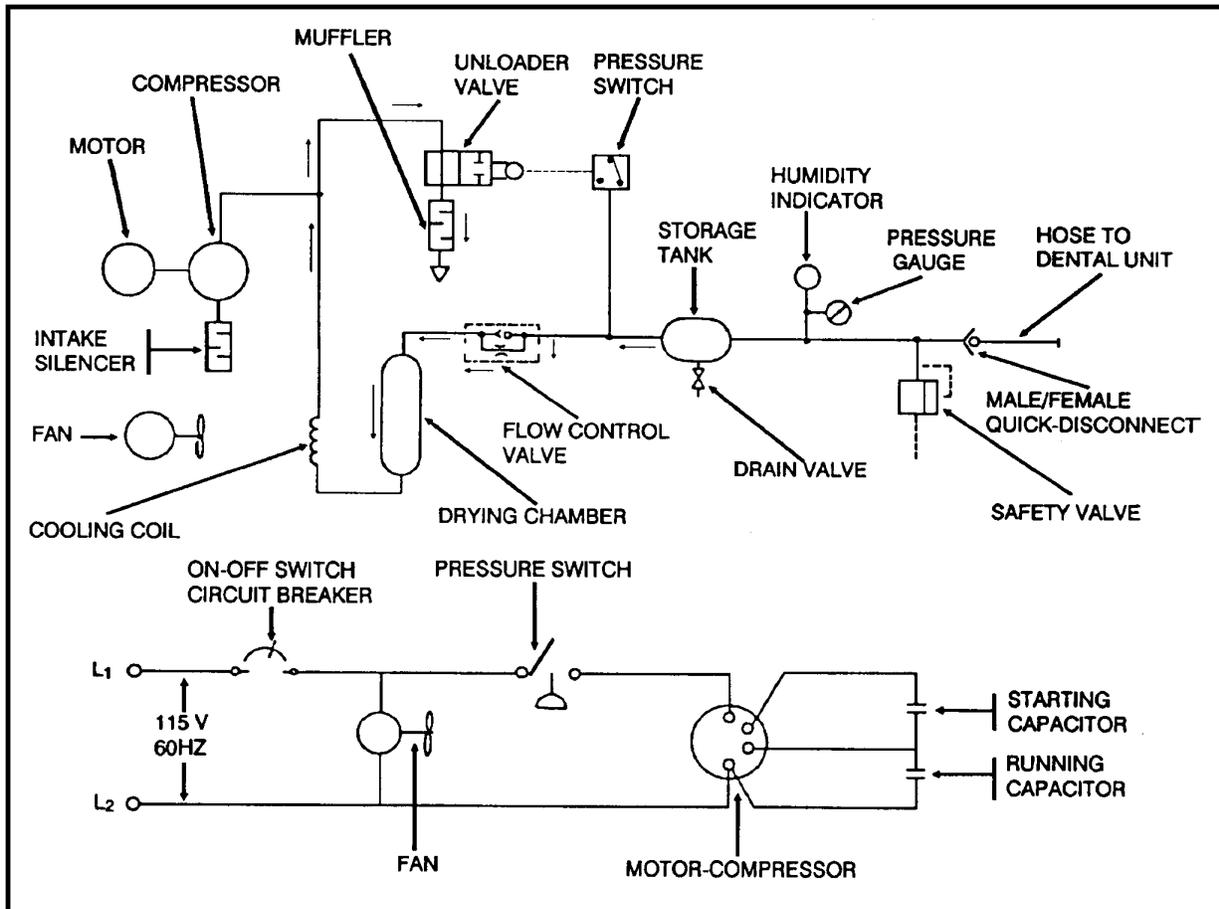


Figure 3-5

Performance Measures

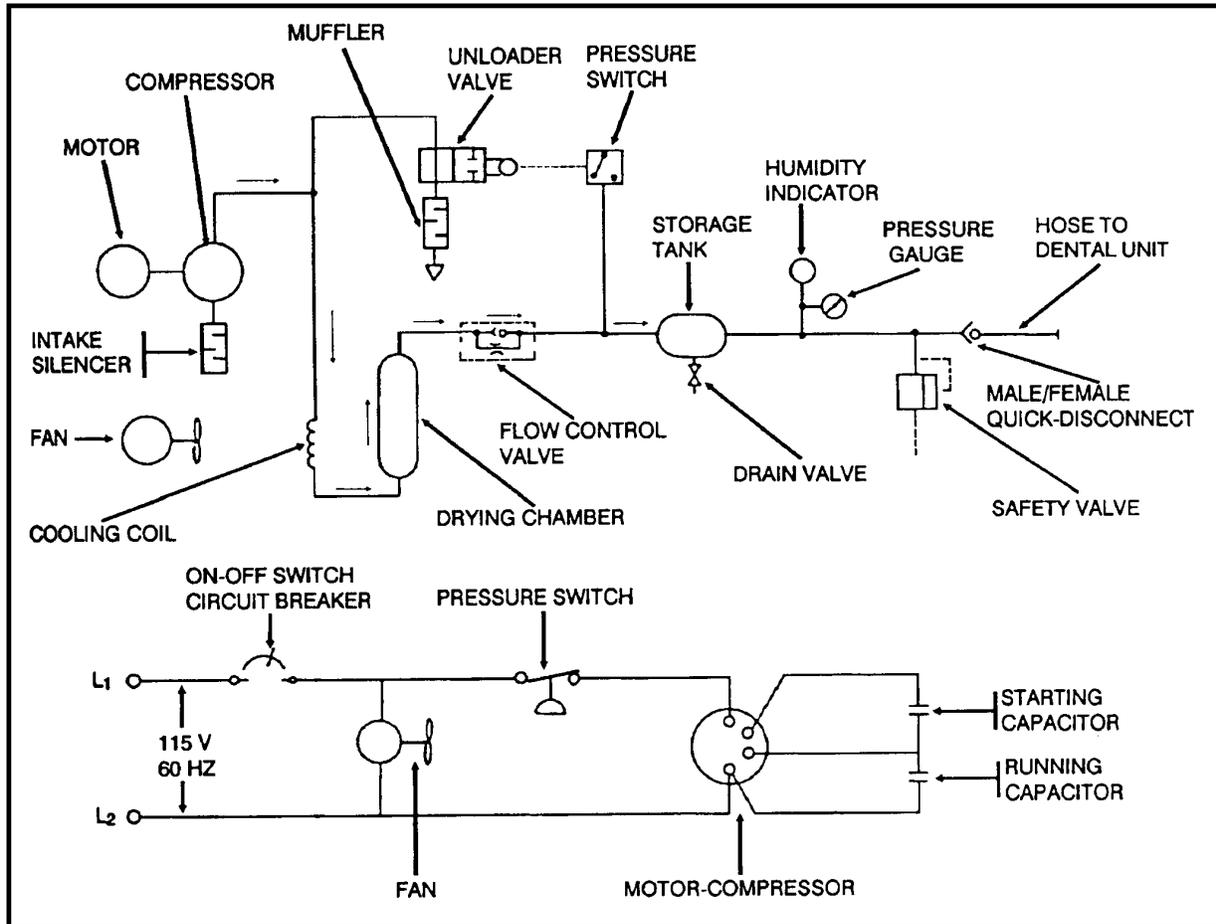
Results



Purging Cycle  
Figure 3-6

Performance Measures

Results



Pumping Cycle  
Figure 3-7

REFERENCES:

*Required*

TM 8-6520-003-24&P  
TB Med 7  
TB 38-750-2

*Related*

AR 40-61  
AR 710-2

081-874-0004

**PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)  
ON A DENTAL OPERATING UNIT**

**CONDITIONS**

You have received DD Form 314 and DA Form 2404 on a dental unit scheduled for PMCS. Necessary materials and equipment: TM 8-6520-002-24&P, TB 38-750-2, air compressor, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled PMCS is performed and all uncorrected unsafe conditions are recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DD Form 314.

**TRAINING/EVALUATION***Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>	
1. Review DA Form 2404.	P	F
<b>NOTE:</b> Refer to TM 8-6520-002-24&P for steps 2 through 6.		
2. Perform before operation B PMCS as listed in PMCS Chart. (Refer to TM 8-6520-002-24&P, Chapter 3, Section 3-9.)	P	F
3. Perform during operation D PMCS as listed in PMCS chart. (Refer to TM 8-6520-002-24&P, Chapter 3, Section 3-9.)	P	F
4. Perform after operation A PMCS as listed in PMCS chart. (Refer to TM 8-6520-002-24&P, Chapter 3, Section 3-9.)	P	F
5. Perform monthly M PMCS as listed in PMCS chart. (Refer to TM 8-6520-002-24&P, Chapter 3, Section 3-9.)	P	F
6. Perform quarterly Q PMCS as listed in PMCS chart. (Refer to TM 8-6520-002-24&P, Chapter 3, Section 3-9.)	P	F
7. Record deficiencies uncorrected on DA Form 2404 and complete the appropriate reports and forms.	P	F

**STP 8-91A15-SM-TG**

**Performance Measures**

**Results**

8. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use.

P F

**REFERENCES:**

*Required*

*Related*

TM 8-6520-002-24&P  
TB 38-750-2

AR 40-61

081-874-0005

**REPAIR A DENTAL OPERATING UNIT TO COMPONENT LEVEL**

**CONDITIONS**

You have received DA Form 2407 for repair of a dental operating unit. Necessary materials and equipment: DA Form 2409, TM 8-6520-002-24&P, TB Med 7, TB 38-750-2, air compressor, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in TM 8-6520-002-24&P. Results are recorded on DA Forms 2407 and 2409.

**TRAINING/EVALUATION**

*Evaluation Guide*

**Performance Measures**

**Results**

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| <ol style="list-style-type: none"> <li>1. Review DA Form 2407 for operator's description of the equipment malfunction.</li> <li>2. Determine maintenance expenditure limits (MEL) for definite life equipment.             <ol style="list-style-type: none"> <li>a. Obtain the current replacement cost.</li> <li>b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.</li> <li>c. Use the chart at Figure 3-8 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.</li> <li>d. Project a horizontal line to the MEL factor.</li> <li>e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.</li> </ol> </li> </ol> | <table border="0"> <tr> <td>P</td> <td>F</td> </tr> <tr> <td>P</td> <td>F</td> </tr> </table> | P | F | P | F |
| P  | F   |   |   |   |   |
| P  | F   |   |   |   |   |

**NOTE:** Under certain conditions the MEL may be waived. (See TB Med 7.)

Performance Measures

Results

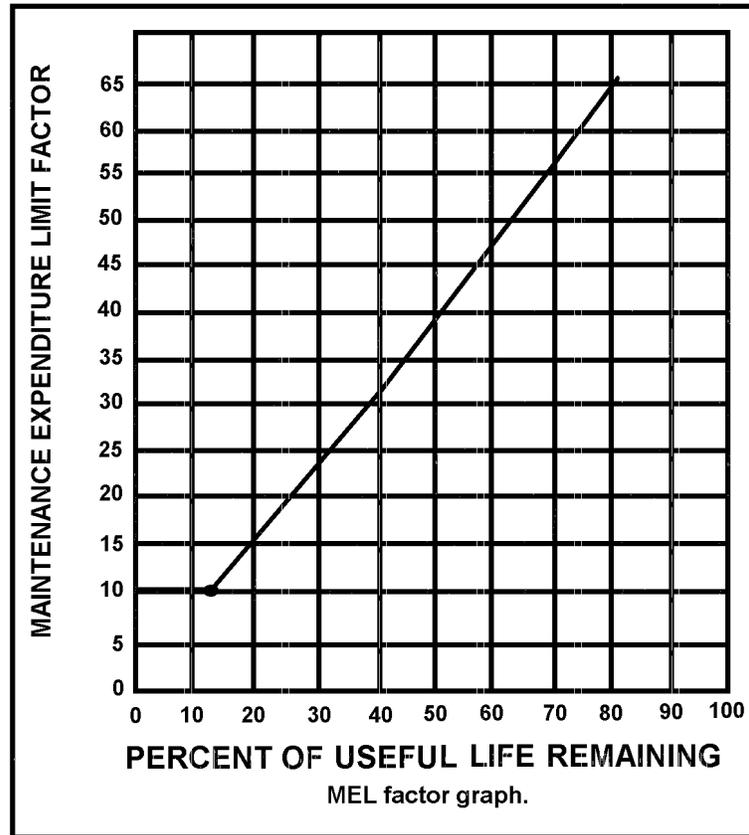


Figure 3-8

**NOTE:** The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 per cent. This MEL remains constant for as long as the equipment is in use, regardless of age.

- 3. Remove the cover from the unit. P F
- 4. Visually inspect the unit for loose, missing, or defective components. P F
- 5. Perform a function check to confirm symptoms listed on DA Form 2407. P F

**NOTE:** If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 12.)

- 6. Troubleshoot and localize the malfunction to a group of components. (Refer to TM 8-6520-002-24&P, Chapter 3, Section 3-12, Figure 3-1.) P F

<b>Performance Measures</b>	<b>Results</b>
7. Troubleshoot and isolate the malfunction(s). (Refer to TM 8-6520-002-24&P, Chapter 3, Section 3-12, and Figure 3-1.)	P F
8. Determine if the repair costs exceed the MEL.	P F
<b>NOTE:</b> If the repair costs exceed the MEL, notify the supervisor.	
9. Replace the malfunctioning component.	P F
10. Perform a function check.	P F
11. Determine the disposition of the unit.	P F
a. Prepare to release the unit to the user if the functional check is satisfactory.	
b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.	
c. Refer to the next higher echelon of maintenance if necessary.	
12. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.	
b. Obtain the user's signature for receipt of the unit, as appropriate.	
c. Release the unit to the user.	

**REFERENCES:**

***Required***

TM 8-6520-002-24&P  
 TB Med 7  
 TB 38-750-2

***Related***

AR 40-61  
 AR 710-2

081-874-0006

**PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES  
(PMCS) ON A FIELD DENTAL X-RAY UNIT**

**CONDITIONS**

You have received DD Form 314 and DA Form 2404 on a field dental X-ray unit scheduled for PMCS. Necessary materials and equipment: TB 38-750-2, manufacturer's service literature, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled PMCS is performed and all uncorrected, unsafe conditions are identified and recorded on Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DD Form 314.

**TRAINING/EVALUATION**

*Evaluation Guide*

**Performance Measures**

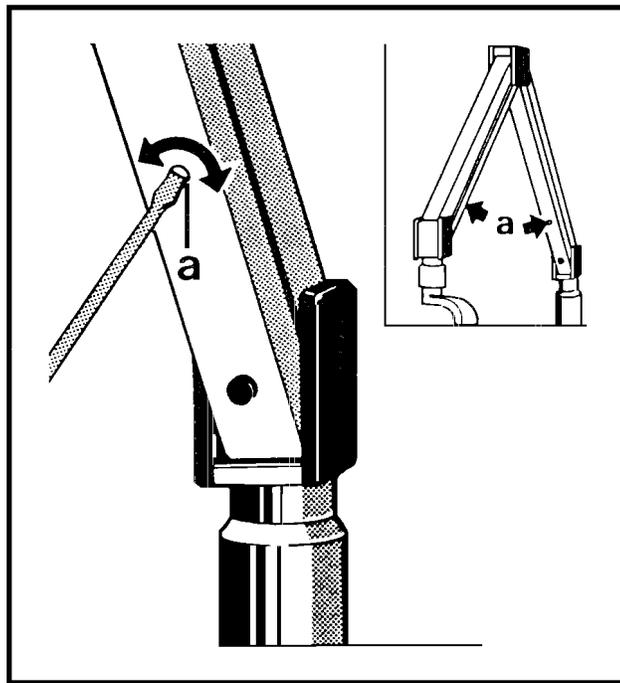
**Results**

- |  |   |   |
|--|---|---|
| 1. Inspect the carrying case to ensure that--                              | P | F |
| a. The carrying handles and latches are not broken or missing.             |   |   |
| b. The pressure relief valve is operational.                               |   |   |
| (1) The push button is not broken or missing.                              |   |   |
| (2) The push button springs back after its release.                        |   |   |
| c. The case lid gasket does not have cuts or nicks.                        |   |   |
| d. All straps are intact.  |   |   |
| e. The leveling devices are not broken or missing and they are functional. |   |   |
| 2. Inspect the seat assembly to ensure that--                              | P | F |
| a. The adjustable brackets are operational.                                |   |   |
| b. The head rest is adjustable.  |   |   |

**Performance Measures****Results**

- c. The dowel pins and chains are not broken or missing.
  - d. The seat and back rest are not splintered or broken.
3. Inspect the scissors arm assembly spring adjustment.
- a. Position the tube head in a 45° angle to the vertical scissors arm. (See Figure 3-9.)
  - b. Adjust the scissors assembly spring, as necessary.
    - (1) Loosen screws (a) by turning 1 1/2 turns. (See Figure 3-9.)

P F

**Figure 3-9**

**Performance Measures**

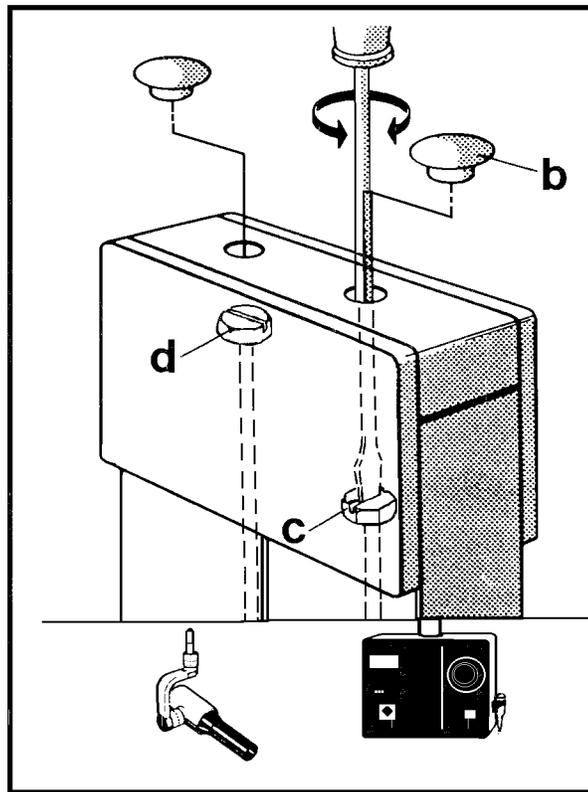
**Results**

(2) Remove the screw caps from the double joint of the scissors arm.  
(See Figure 3-10.)

(3) Spring adjustment is made with screw c if the angle is more than 45°.  
(See Figures 3-11 and 3-12.)

(4) Spring adjustment is made with screw d if the angle is less than 45°.  
(See Figures 3-11 and 3-12.)

(5) Tighten screw a by turning 1 1/2 turns. (See Figure 3-9.)



**Figure 3-10**

4. Inspect the control and tube for burned light bulb.

P F

5. Inspect the hand control cable for cuts and nicks.

P F

Performance Measures

Results

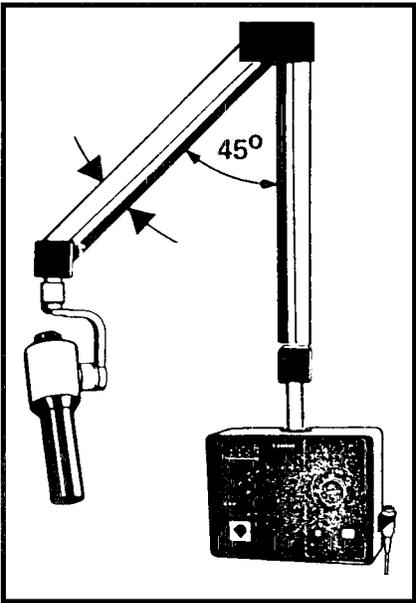


Figure 3-11

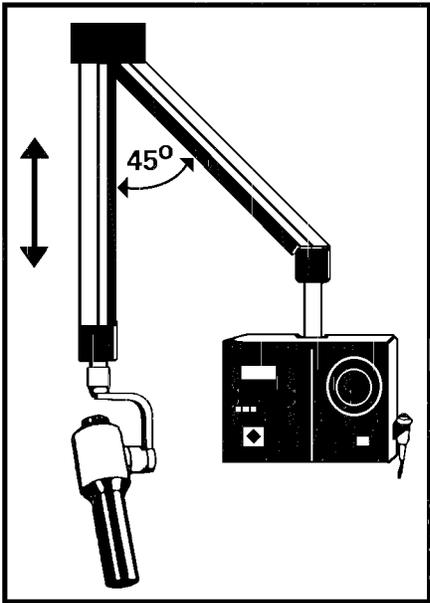


Figure 3-12

**Performance Measures**

**Results**

6. Verify adequacy of the power supply.

P F

a. Remove the front cover.

(1) Remove the two screws on top of the front cover. (See Figure 3-13.)

(2) Remove the two screws on the bottom of the front. (See Figure 3-13.)

b. Set the multimeter selector to 150 VAC.

c. Connect the multimeter leads to terminals K3 and NL. (See Figure 3-13.)

**NOTE:** Line voltage must be 109 to 133 VAC at 60 Hz or 109 to 132 VAC at 50 Hz. If the line voltage is not within tolerance, the voltage source must be replaced.

<p><b>WARNING</b></p> <p>The power supply must be grounded.</p>
---

d. Turn the unit on and allow a 5 minute warm up period.

e. Verify the voltage on the multimeter coincides with the unit's digital voltmeter (DVM).

**NOTE:** If the voltage values are not within one volt, the unit's DVM must be calibrated before continuing. (See task 081-974-0007.)

f. Ensure that the line compensation switch is adjusted and the green light emitter diode (LED) is on.

g. Record the readings with no load.

h. Set the exposure time to 3.2 seconds and make an exposure.

i. Record the readings of the unit's DVM with load.

j. Determine the voltage drop under load.

NO LOAD VOLTAGE \_\_V  
minus VOLTAGE UNDER LOAD \_\_V equals  
VOLTAGE DROP \_\_V

Performance Measures

Results

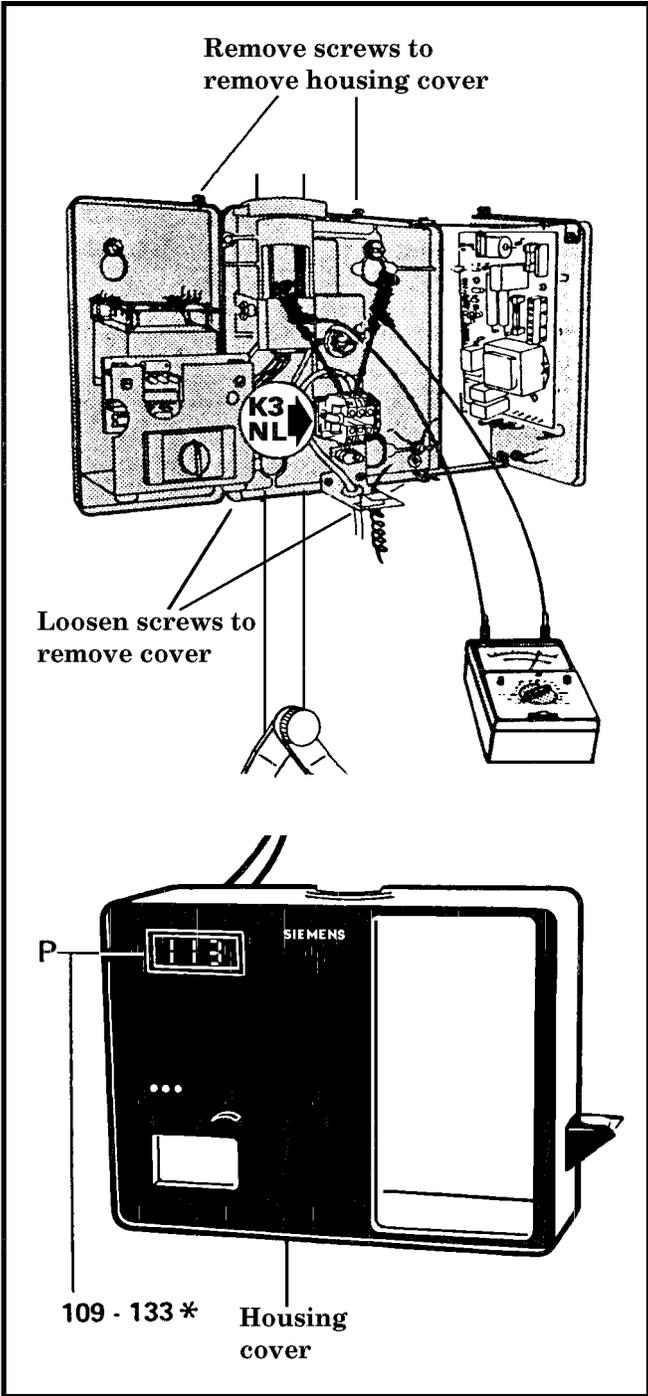


Figure 3-13

## STP 8-91A15-SM-TG

### Performance Measures

### Results

**NOTE:** The maximum permissible voltage drop between no load voltage and voltage under load must not exceed 6 volts during the entire operation. If the voltage drop exceeds 6 volts, the power source must be replaced.

- |  |   |   |
|--|---|---|
| 7. Verify the tube head current.   | P | F |
| a. Turn the unit off.  |   |   |
| b. Remove the 9-10 jumper from circuit board D1. (See Figure 3-14.)  |   |   |
| c. Connect the multimeter to D1 9-10. (See Figure 3-14.)   |   |   |
| d. Turn the unit on and allow a 5 minute warm up period.   |   |   |
| e. Set the multimeter to DC mA and range control to 10 mA.   |   |   |
| f. Set the time selector to 2.0 seconds and make an exposure by holding the exposure button down.  |   |   |
| g. Ensure the buzzer sounds and the red radiation light come on.   |   |   |
| h. Record the mA reading on the multimeter.  |   |   |
| <br><b>NOTE:</b> The reading should be 7 mA with a tolerance of +1.2 mA to -2 mA at 60 Hz or +1.0 mA to -2.5 mA at 50 Hz. If the tolerance is exceeded, circuit board D1 must be replaced or repaired. |   |   |
| i. Replace the cover on the control.   |   |   |
| 8. Inspect the tube head from stop to stop. If the tube head turns more than 540° (1 1/2 turns), the rotational part requires replacement.   | P | F |
| 9. Record and correct minor deficiencies.  | P | F |
| 10. Record deficiencies uncorrected on DA Form 2404 and complete the appropriate reports and forms.  | P | F |
| 11. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use.                                       | P | F |

Performance Measures

Results

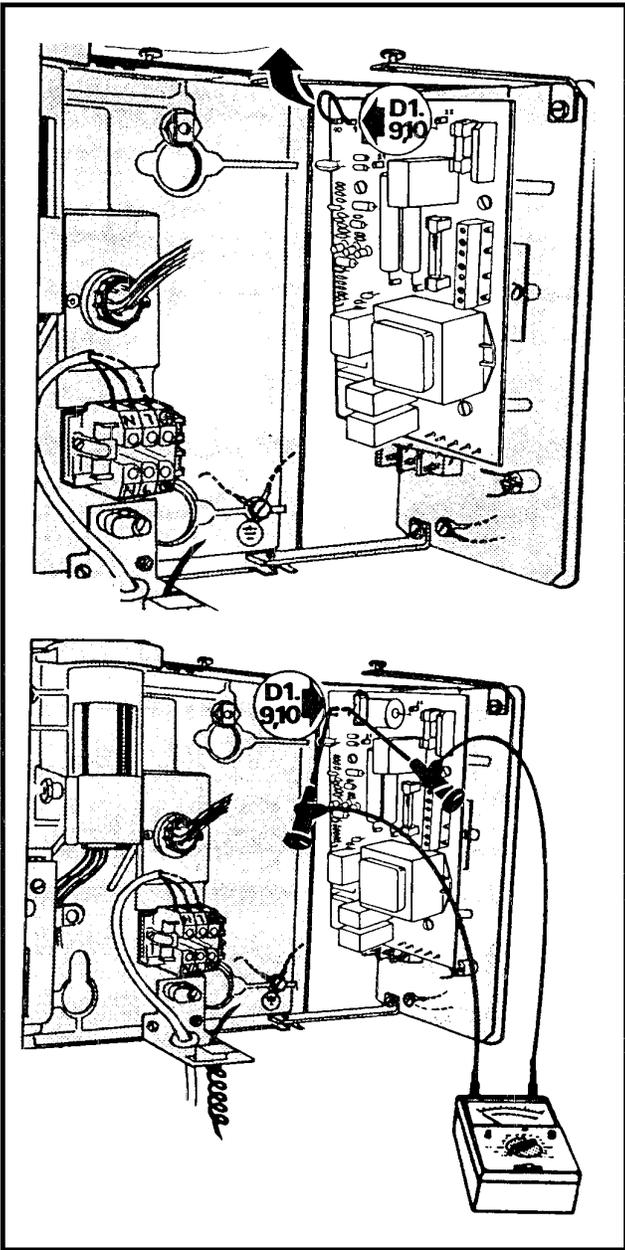


Figure 3-14

REFERENCES:

*Required*

*Related*

Manufacturer's Service  
Literature  
TB 38-750-2

AR 40-61

081-874-0007

## CALIBRATE A FIELD DENTAL X-RAY UNIT

### CONDITIONS

You have received DD Form 314 and DA Form 2404 on a field dental X-ray unit scheduled for calibration. Necessary materials and equipment: TB 38-750-2, manufacturer's service literature, digital voltmeter (DVM), electromechanical pulse counter, regulating transformer, tool kit (medical equipment organizational maintenance), and individual tool box.

### STANDARDS

The scheduled calibration is performed and all uncorrected, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the calibration. The calibration is recorded on DD Form 314.

### TRAINING/EVALUATION

#### *Evaluation Guide*

#### Performance Measures

#### Results

- |  |   |   |
|--|---|---|
| 1. Verify adequacy of the power supply.  | P | F |
| a. Remove the front cover.   |   |   |
| (1) Remove the two screws on top of the front cover. (See Figure 3-15.)        |   |   |
| (2) Remove the two screws on the bottom of the front cover. (See Figure 3-15.) |   |   |
| b. Set the multimeter selector to 150 VAC.                                     |   |   |
| c. Connect the multimeter leads to terminals K3 and NL. (See Figure 3-15.)     |   |   |

**NOTE:** Line voltage must be 109 to 133 VAC at 60 Hz or 109 to 132 VAC at 50 Hz. If the voltage source is not within tolerance, the voltage source must be replaced.

#### **WARNING**

The power supply must be grounded.

Performance Measures

Results

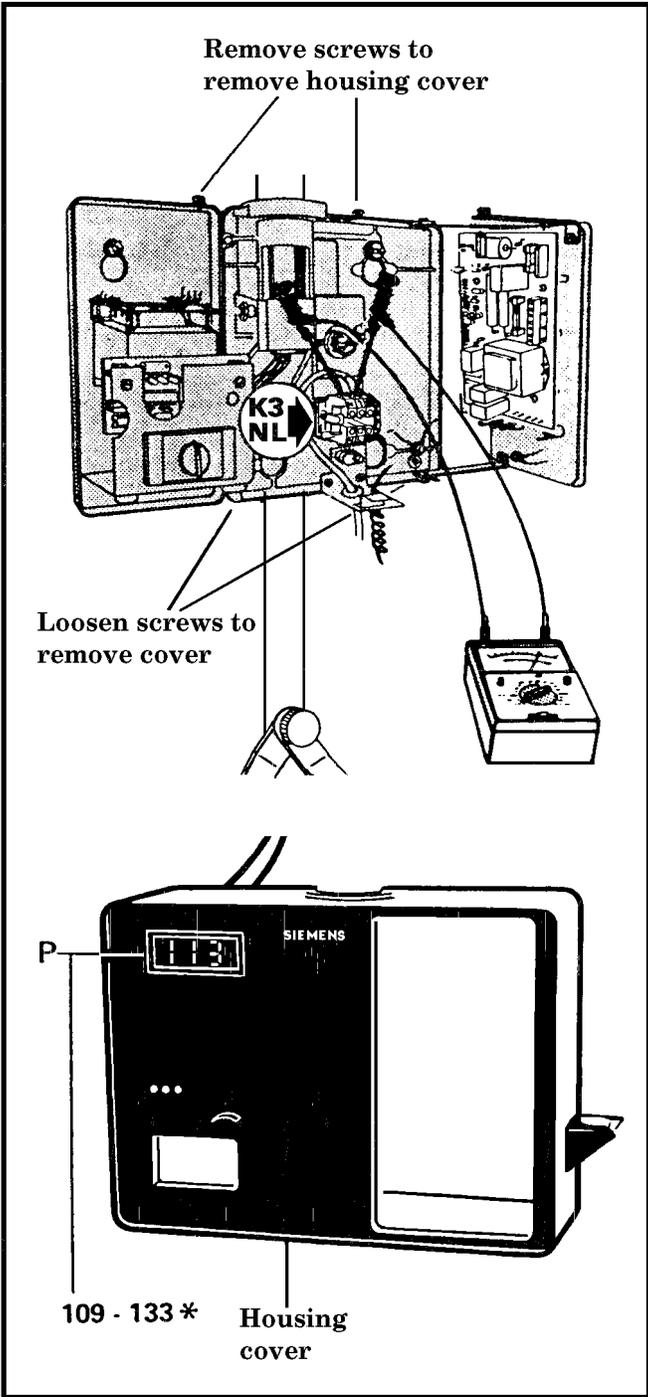


Figure 3-15

**Performance Measures**

**Results**

- d. Turn the unit on and allow a 5 minute warm up period.
- e. Ensure that the line compensation switch is adjusted and the green light emitter diode (LED) is on.
- f. Verify that the voltage on the multimeter coincides with the unit's digital voltmeter (DVM).
- g. Record the readings with no load.
- h. Set the exposure time to 3.2 seconds and make an exposure.
- i. Record the readings of the unit's DVM with load.

$$\begin{array}{l} \text{NO LOAD VOLTAGE} \quad \_\_\_\_ \text{V} \\ \text{minus VOLTAGE UNDER LOAD} \quad \_\_\_\_ \text{V equals} \\ \text{VOLTAGE DROP} \quad \_\_\_\_ \text{V} \end{array}$$

**NOTE:** The maximum permissible voltage drop between no load voltage and voltage under load must not exceed 6 volts during the entire operation. If the voltage drop exceeds 6 volts, the power source must be replaced.

2. Calibrate the unit's DVM.

P F

- a. Turn the unit off.
- b. Remove the screws from the housing cover and remove the cover.
- c. Set the multimeter to 150 VAC.
- d. Connect the multimeter test leads to terminals K3 and NL on PC-board D3. (See Figure 3-15.)
- e. Turn the unit on and allow a 5 minute warm up period.
- f. Compare the indicated value of the unit's DVM and the external multimeter.
- g. Adjust R7 on PC-board D3 until the unit's DVM reading is the same as the multimeter connected across K3 and NL. (See Figures 3-15 and 3-16.)
  - (1) Turn R7 clockwise to increase the voltage reading on the unit's DVM until it matches the reading with the multimeter connected across K3 and NL.

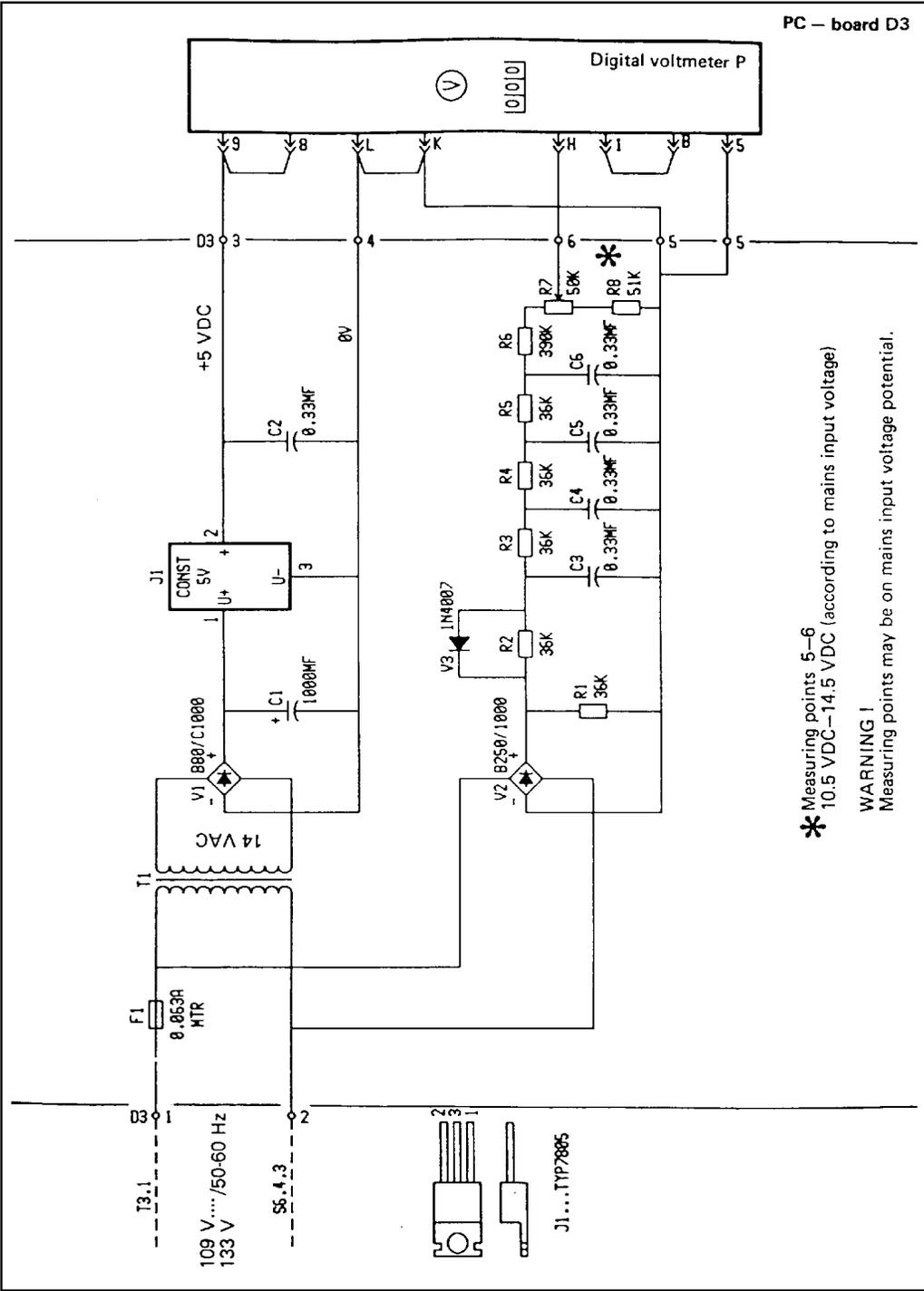


Figure 3-16

**Performance Measures**

**Results**

(2) Turn R7 counterclockwise to decrease the voltage reading on the unit's DVM until it matches the reading with the multimeter connected across K3 and NL.

**NOTE:** The incoming line voltage must be between 109 and 133 VAC at 60 Hz or 109 and 132 VAC at 50 Hz for the unit to function properly.

3. Perform exposure time calibration with a mechanical counter.

P F

a. Turn the unit off.

b. Connect the counter to test points D1.4 and D1.21 on circuit board D1.  
(See Figures 3-17 and 3-18.)

c. Turn the unit on and allow a 5 minute warm up period.

d. Set the exposure time as shown in Figure 3-19 and make an exposure. Note the pulses on the counter.

e. Record the pulses on the monitor.

**CAUTION**

Observe the cooling time between exposures. Relative power duration: 1:60/min. cooling period 20 seconds. For example, 3.2 seconds exposure time needs a pause of 3 1/2 minutes.

Performance Measures

Results

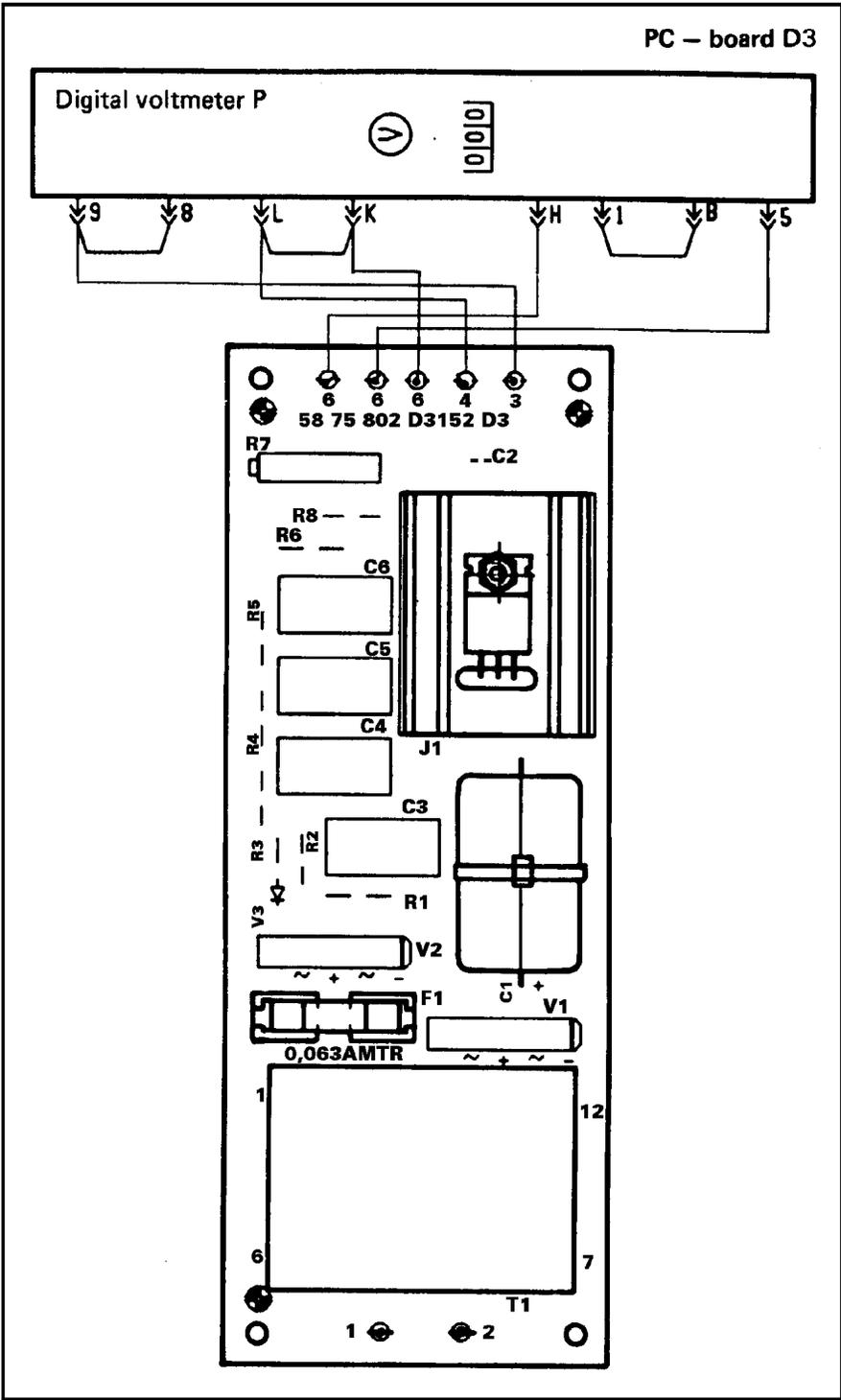


Figure 3-17

Performance Measures

Results

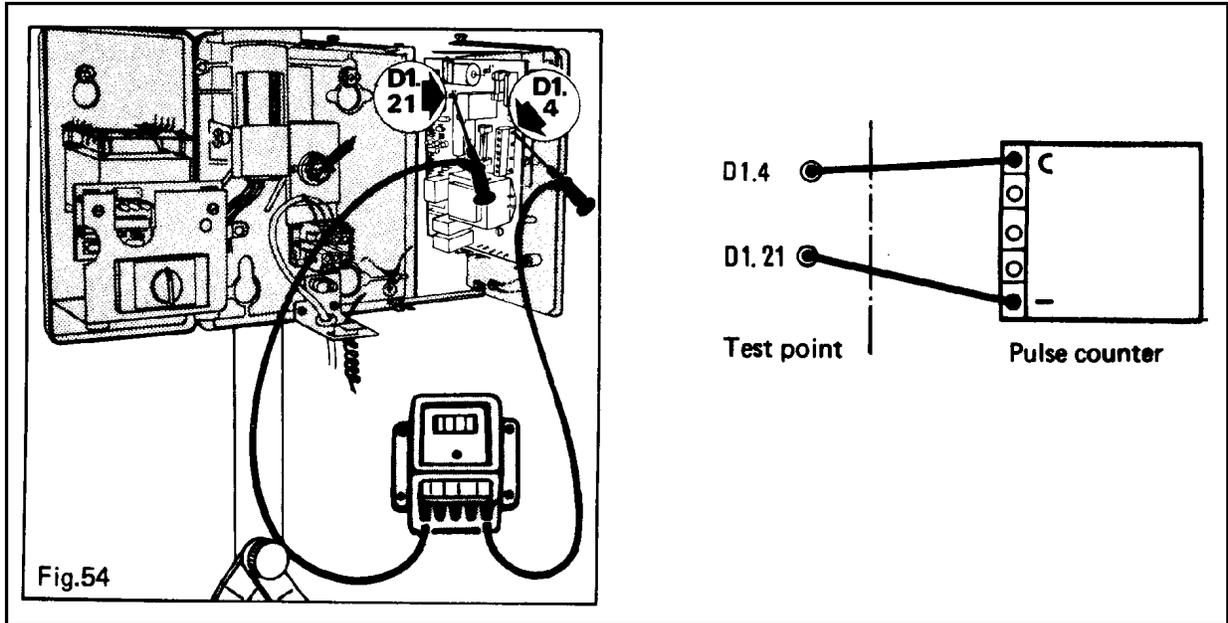


Figure 3-18

**PULSES**

Exposure	50 Hz	60 Hz	Tolerance
0.066 sec.	3	4	+ 1 pulses - 2 pulses
3.2 sec.	160	192	+ 10 pulses - 20 pulses

Figure 3-19

**Performance Measures**

**Results**

f. Adjust the exposure time, as necessary, by turning R13 on PC-board D1 until the proper pulse count is obtained. (See Figure 3-22 on page 3-54.)

- (1) Turn R13 clockwise to increase exposure time.
- (2) Turn R13 counterclockwise to decrease exposure time.

4. Record the results of the calibration on the appropriate forms and records.

P F

**REFERENCES:**

*Required*

*Related*

Manufacturer's Service  
Literature  
TB 38-750-2

AR 40-61

**081-874-0008**

**REPAIR A FIELD DENTAL X-RAY UNIT TO MODULE/BOARD LEVEL**

**CONDITIONS**

You have received DA Form 2407 for repair of a field dental X-ray unit. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, manufacturer's service literature, digital voltmeter, oscilloscope electromechanical pulse counter, regulating transformer 90-150 VAC, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's literature. Results are recorded on DA Forms 2407 and 2409.

**TRAINING/EVALUATION**

*Training Information Outline*

1. Review DA Form 2407 for the operator's description of the equipment's malfunction.
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.
  - a. Obtain the current replacement cost.
  - b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.
  - c. Use the chart at Figure 3-20 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline.
  - d. Project a horizontal line to the MEL factor.
  - e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.

**NOTE:** Under certain conditions the MEL may be waived. (See TB Med 7.)

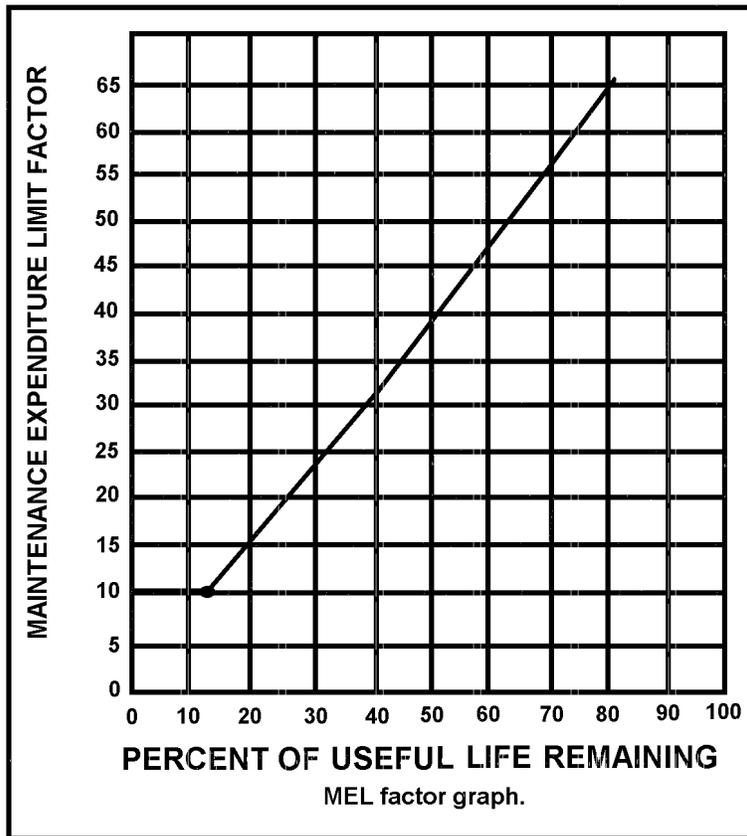


Figure 3-20

**NOTE:** The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

3. Perform a visual inspection for--
  - a. Bare exposed cable wires.
  - b. Burned light bulbs.
  - c. Cracks in the collimator.
4. Perform a function check to confirm symptoms listed on DA Form 2407.

**NOTE:** If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 10.)

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5. Troubleshoot and isolate the malfunction to module/board level. (See Figures 3-21 through 3-27).
6. Determine if the repair cost exceeds the MEL.

**NOTE:** If the repair cost exceeds the MEL, notify the supervisor.

7. Replace the defective module/board.
8. Perform a function check.
9. Determine the disposition of the unit.
  - a. Prepare to release the unit to the user if the function check is satisfactory.
  - b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.
  - c. Refer to the next higher echelon of maintenance, if necessary.
10. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.
  - a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.
  - b. Obtain the user's signature for receipt of the unit, as appropriate.
  - c. Release the unit to the user.

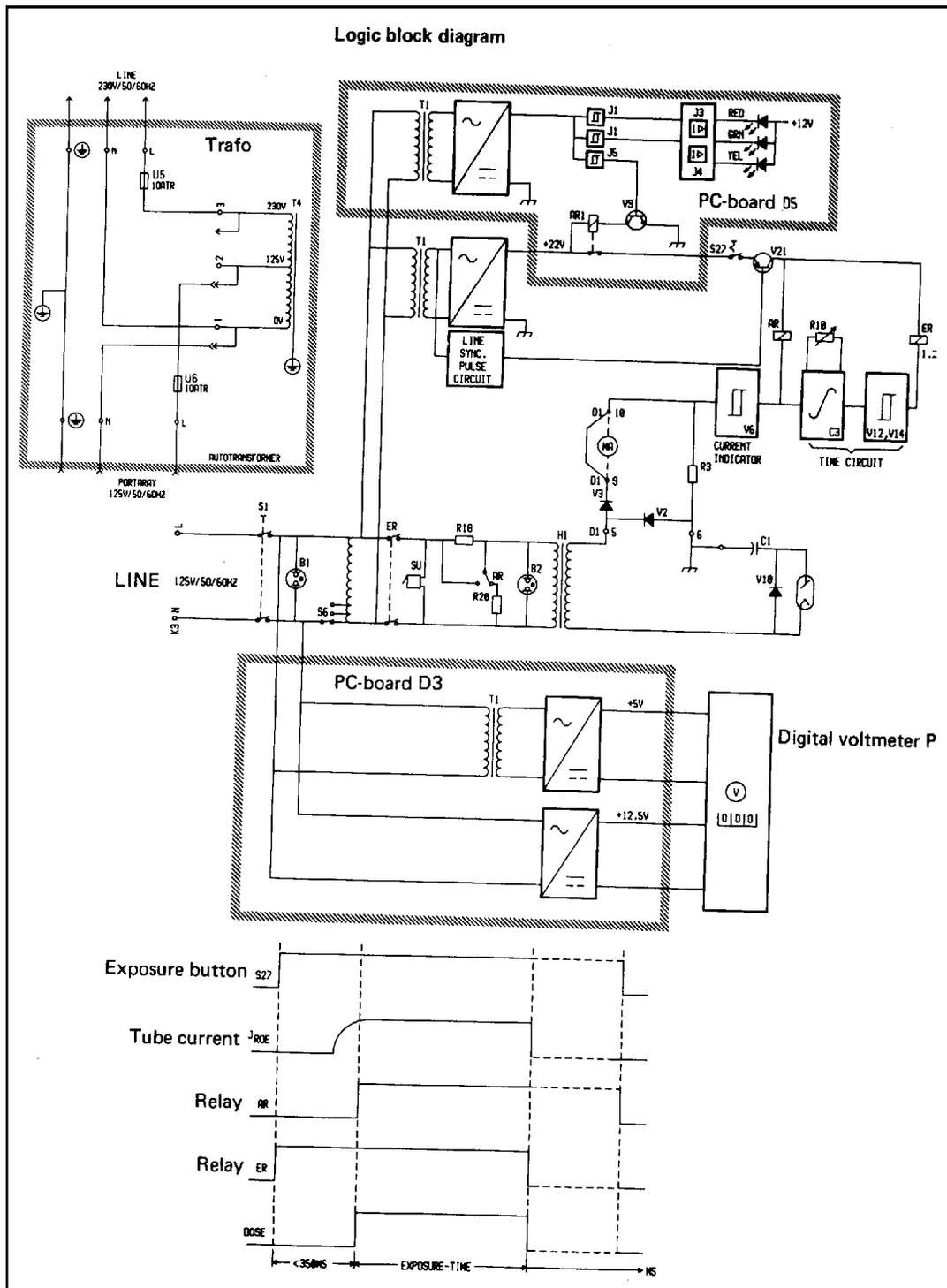


Figure 3-21

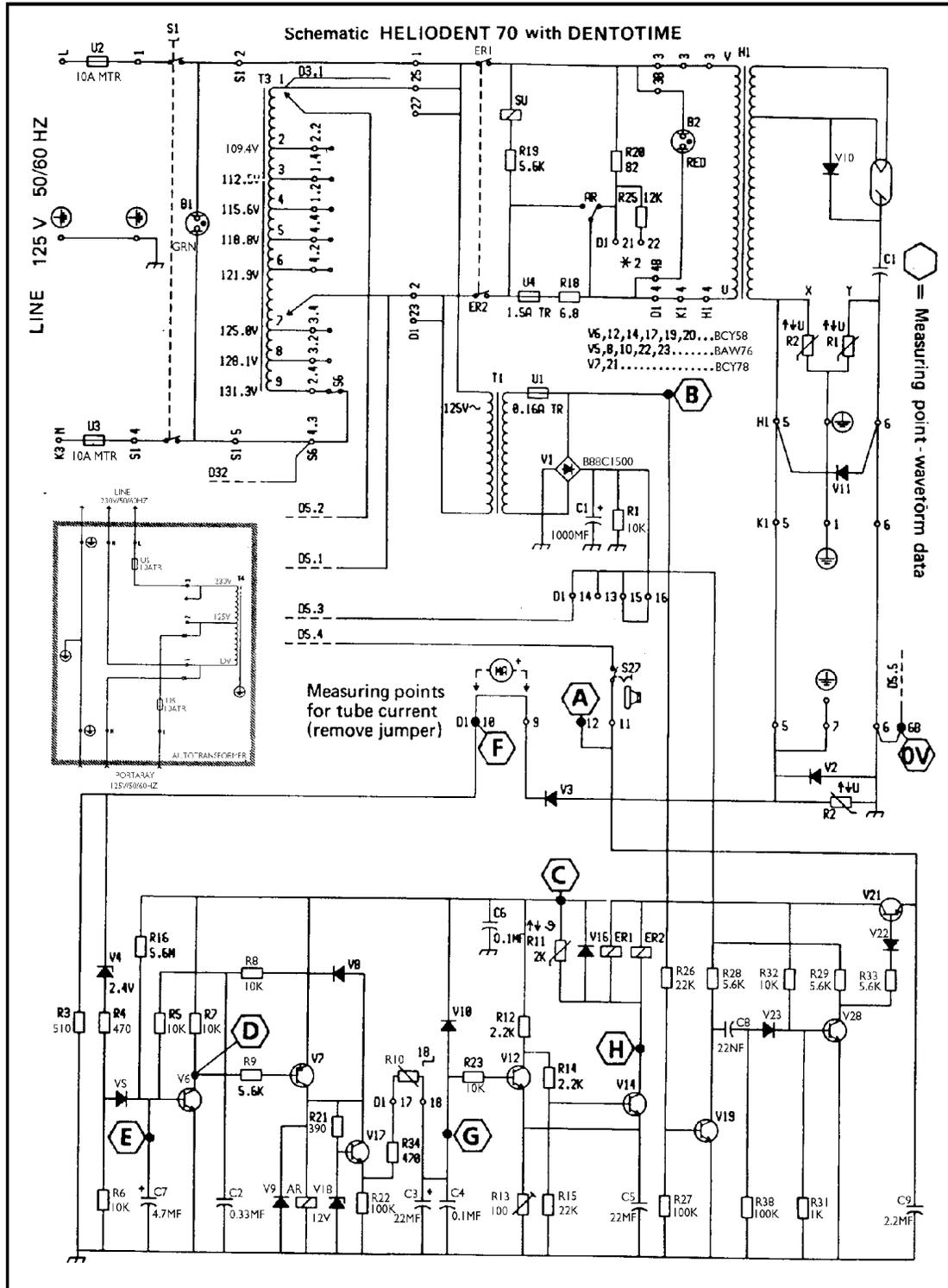


Figure 3-22

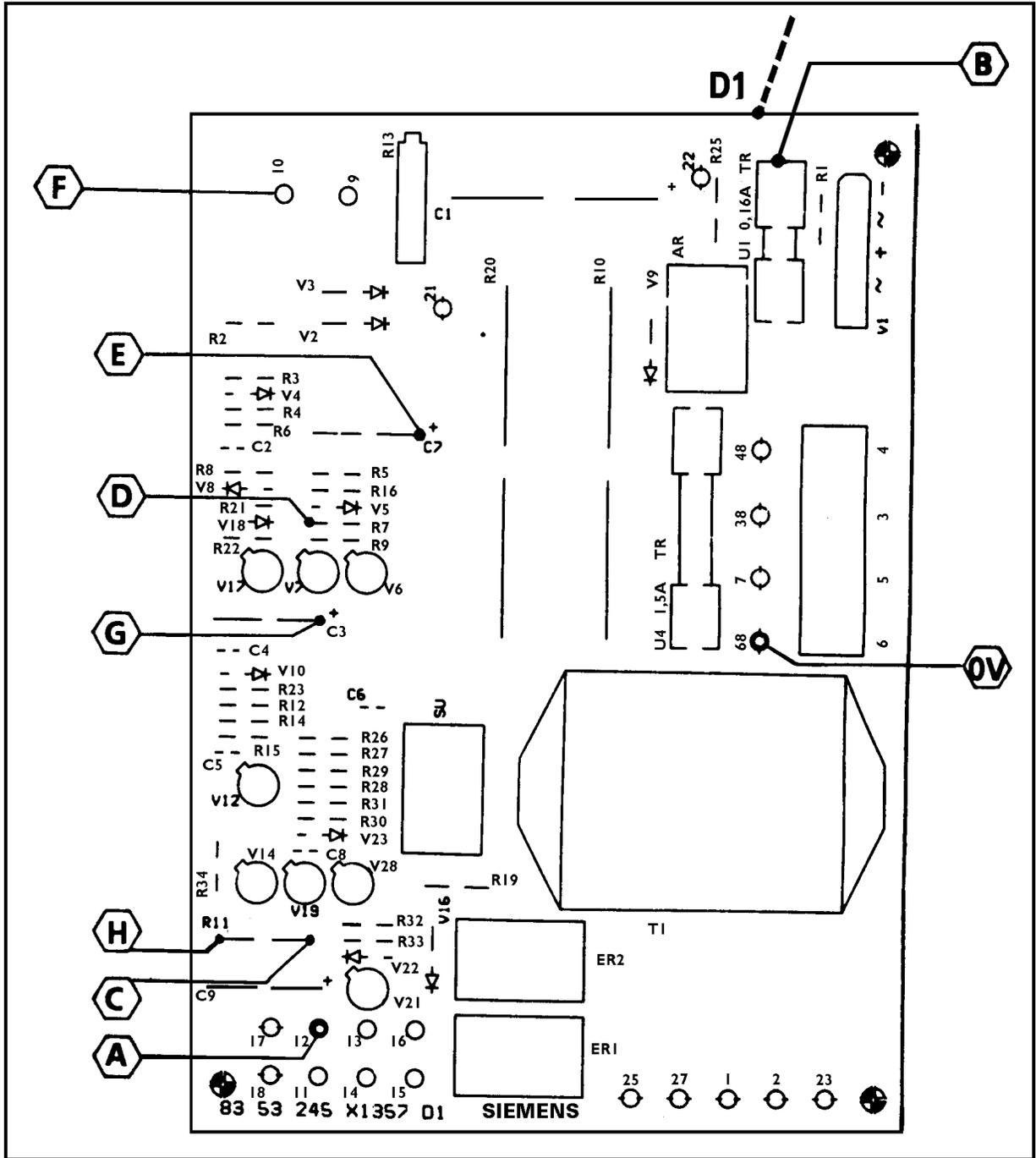


Figure 3-23

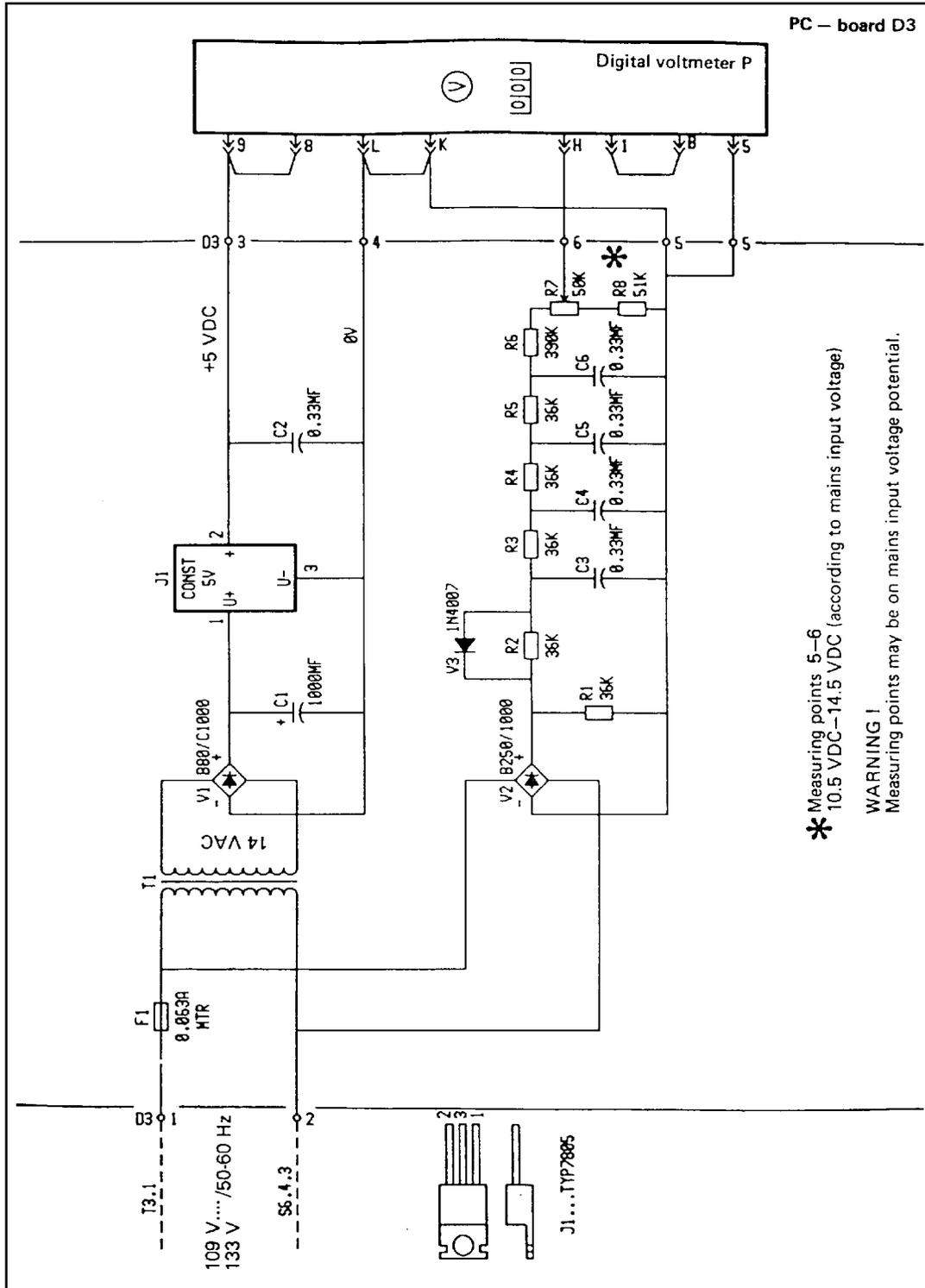


Figure 3-24

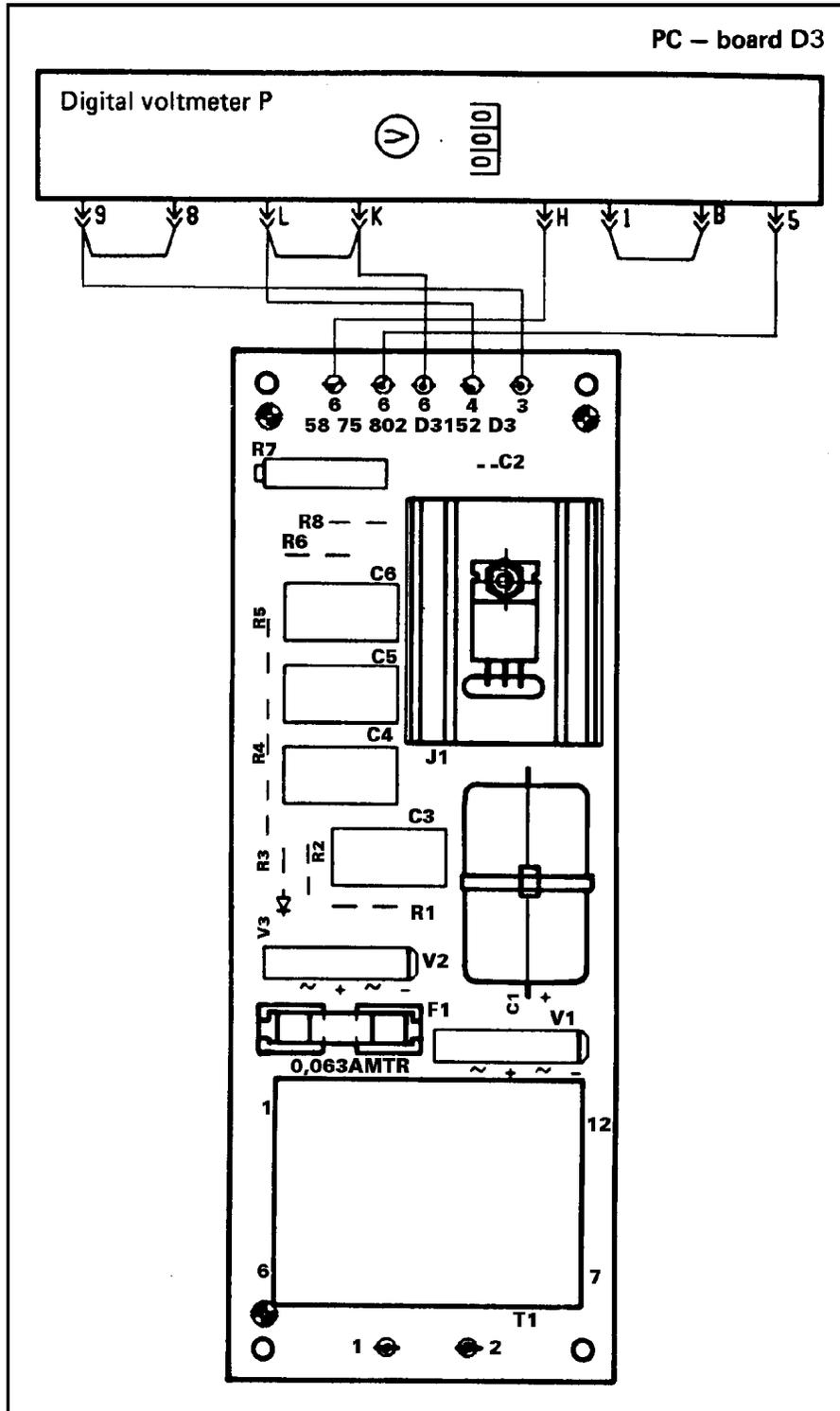


Figure 3-25



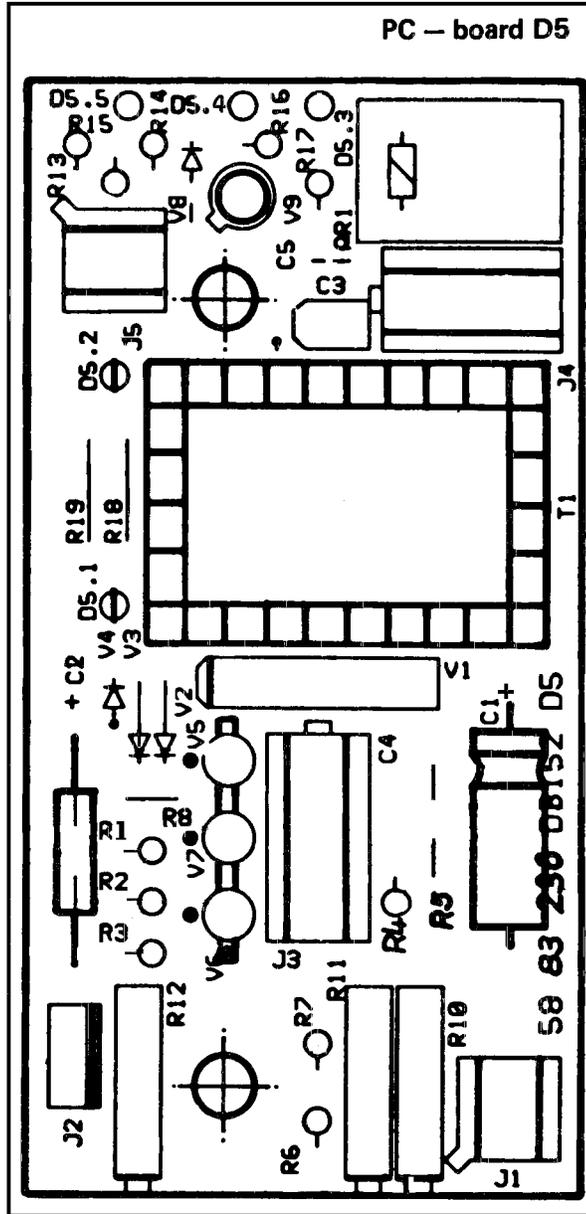


Figure 3-27

*Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>	
1. Review DA Form 2407 for the operator's description of the equipment's malfunction.	P	F
2. Determine the maintenance expenditure limits (MEL) for definite life equipment.	P	F
3. Perform a visual inspection.	P	F
4. Perform a function check to confirm symptoms listed on DA Form 2407.	P	F
5. Troubleshoot and isolate the malfunction to component level.	P	F
6. Determine if the repair cost exceeds the MEL.	P	F
7. Repair or replace the defective component.	P	F
8. Perform a function check.	P	F
9. Determine the disposition of the unit.	P	F
10. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P	F

**REFERENCES:**

*Required*

*Related*

Manufacturer's Service  
Literature  
TB 38-750-2  
TB Med 7

AR 710-2  
AR 40-61

081-874-0010

**PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)  
ON A BLOOD RECOVERY UNIT**

**CONDITIONS**

You have received DD Form 314 and DA Form 2404 on a blood recovery unit for scheduled PMCS. Necessary material and equipment: manufacturer's service literature, TB 38-750-2, continuity tester, amp clamp, digital voltmeter, leakage meter, standard volume bowl from a List No. 234 disposable set, 6 inches of 1V tubing (0.375 inch inside diameter), tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled PMCS is performed, and all uncorrectable, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DD Form 314.

**TRAINING/EVALUATION**

*Training Information Outline*

1. Perform a visual check.
  - a. Inspect all external surfaces of the blood recovery unit for--
    - (1) Physical damage.
    - (2) Breakage.
    - (3) Loose or dirty contacts.
    - (4) Missing components.
  - b. Inspect all chassis and panel mounted components for--
    - (1) Looseness.
    - (2) Breakage.
    - (3) Loose contacts or conductors.
  - c. Inspect for disconnected, broken, cut, or frayed cables or wires.
  - d. Inspect the printed circuit board surfaces for discoloration, cracks, breaks, and warping.

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2. Perform an operational checkout.

a. Install a standard volume bowl from a List No. 234 disposable set into the centrifuge chuck.

(1) Install a length (approximately 6 inches) of water-filled IV tubing (tied off at both ends), 0.375- inches inside diameter, into the air sensor.

(2) Turn power on.

(a) Check for the following displays:

1. CELL SAVER 4, 1987 REV. E  
HAEMONETICS CORPORATION
2. NORMAL PROTOCOL, 2 CYCLES, 1000 ML WASH  
FILL SPD-500 WASH SPD-600 EMPTY SPD-500
3. WARNING: AIR DETECTOR DOES NOT SEE  
AIR PUSH HELP FOR INSTRUCTIONS

**NOTE:** Each of the above displays should remain on for approximately 2 seconds.

**NOTE:** A continuous high-pitched tone is generated during the first display and then a short high-pitched tone for the third.

- (b) All LEDs illuminate and remain on.
- (c) All keys are locked out (disabled) except HELP.
- (d) Both fans are on and airflow is outward from the cabinet.
- (e) The centrifuge lamp is on.

**NOTE:** The first power-on display will always show the installed program revision level and year released. The second display (above) shows the program parameters. If the unit has been reprogrammed for the orthopedic protocol, the following display will appear:

ORTHO PROTOCOL, 2 CYCLES, 1500 ML WASH  
FILL SPD=350 WASH SPD=500 EMPTY SPD-350

**NOTE:** The values given above are default values. If these have been reprogrammed, the display may show different values.

**NOTE:** Any time a key is disabled and an attempt is made to select it, a low- pitched tone may be generated. Any time an enabled key is pressed, a single high-pitched tone is generated.

b. Remove the IV tubing from the air sensor and then replace it.

(1) Check for the following displays.

(a) OK - AIR DETECTOR IS FUNCTIONING

(b) NORMAL AUTO <TO GO - PUSH START> TO SET UP OR CHANGE PROTOCOLS PUSH

HELP

**NOTE:** Each of the above displays will remain on for approximately 2 seconds.

(c) All LEDs extinguish except the following:

START/AUTO (Flashing)

HELP

FULL/WASH

(2) All keys are enabled.

(3) A single, high-pitched tone is generated.

c. Set the system to the following parameters by pressing REPROGRAMMING:

(1) Wash control on      Fill speed = 500

(2) Normal protocol      Wash speed = 600

(3) 500/1000 wash      Empty speed = 500

(4) 2 cycles      Centrifuge speed = 5650

d. Check for the three tubing clamps to open and close.

(1) Press PAUSE/RESUME once; all three tubing clamps open.

(2) Press PAUSE/RESUME again; all three tubing clamps close.

e. Check pump for proper operation.

(1) Check for proper pump display by pressing PUMP/ONLY.

(a) PUMP ONLY PRESS A FOR CLOCKWISE PUMP SPD=0 PRESS B FOR COUNTERCLOCKWISE

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- (b) All key LEDs extinguish except PUMP ONLY, A, FULL WASH, and HELP.
- (c) All key functions are locked-out except STOP, PUMP CONTROLS, A, B, and PUMP ONLY.
- (2) Increase the pump speed to approximately 500 ml/minute by using the slew-up key.
  - (a) The pump begins rotating clockwise at the selected speed.
  - (b) The display indicates the selected speed.
- (3) Press B and after the pump stops rotating, slew the speed up to approximately 500 ml/min again.
  - (a) Ensure the pump begins rotating counterclockwise at the selected speed.
  - (b) Ensure the display indicates the selected speed.
  - (c) Ensure the B LED illuminates and A extinguishes.
- (4) Lower the pump speed to 0 and then raise it to 500 using the slew down key.

**NOTE:** Ensure the display indicates that the pump is responding by lowering and raising the speed as requested.

- (5) Press PUMP STOP.
  - (a) The pump slows down to 0 and stops.
  - (b) The display indicates 0.
- (6) Press PUMP ONLY to deselect this function and then press and hold REMOVE AIR.
  - (a) Ensure the display reads as follows:  
  
NORMAL AUTO <TO GO -- PUSH START>  
REMOVE AIR WITH REINFUSION BAG INVERTED
  - (b) The pump begins rotating clockwise at 600 ml/min.
  - (c) The EMPTY/COC (blue) tube clamp opens.
  - (d) The REMOVE AIR LED illuminates and START AUTO PROCESS extinguishes.
- (7) Release REMOVE AIR.
  - (a) Display returns to power-on ready display.

- (b) The tube clamp closes.
  - (c) The pump stops.
  - (d) The REMOVE AIR LED extinguishes and START AUTO PROCESS illuminates (flashing).
- (8) Press REPROGRAM three times and ensure that the display reads as follows:
- (1ST LINE UNCHANGED)  
CHANGE WASH VOLUME - 500/1000? (YES/NO)
- (9) Ensure that the REPROGRAM LED illuminates.
- (10) Press YES and ensure the display reads as follows:
- (1ST LINE UNCHANGED)  
USE REPGM ARROWS TO CHANGE: 500/1000
- (11) Press NO and then press YES to ensure--
- (a) The displayed volumes decrease to 250/500.
  - (b) The displayed volume returns to 500/1000.
- (12) Press EXIT.

**NOTE:** Ensure the CS 4 returns to the power-on ready state.

f. Check the NO WASH and then HALF WASH function.

- (1) Press NO WASH and then HALF WASH and ensure--
  - (a) A single high-pitched tone is generated for each key when pressed.
  - (b) The selected key LED illuminates and the previous key extinguishes.

**NOTE:** Ensure HALF WASH is selected for the remainder of the function test.

- (2) Press START AUTO PROCESS and ensure--
  - (a) The display reads as follows:  
  
FILL AUTO  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 1:2

## STP 8-91A15-SM-TG

- (b) The centrifuge begins rotating counterclockwise.
- (c) The pump begins rotating clockwise.
- (d) The FILL (red) tube clamp opens.
- (e) The FILL key LED is illuminated. The HELP extinguishes and the START AUTO PROCESS LED is on steady.

(3) Allow the pump to run for at least 30 seconds, lift the pump cover, and ensure--

- (a) The display reads as follows:

FILL AUTO (OPEN & CLOSE PUMP)  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 1:2

- (b) The pump stops.
- (c) The fill tube clamp closes.
- (d) The PAUSE/RESUME LED is flashing and HELP illuminates.
- (e) After approximately 15 seconds the centrifuge speed begins slowing to 3600 rpm.

(4) Close the pump cover, press PAUSE/RESUME, and ensure--

- (a) The display reads as follows:

FILL AUTO (RECENTRIF. DELAY)  
PUMP SPD=500 CENT. SPD=5650 NORMAL @ 1:2  
(Speed Increasing)

- (b) After approximately 25 seconds the display reads--

FILL AUTO (RECENTRIF. DELAY)  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 1:2

- (c) After the recentrifuge delay, the pump begins rotating again and the tubing clamp opens.

**NOTE:** Anytime the pump stops for approximately 15 seconds or longer and the centrifuge is running, the centrifuge will slow to idle speed (3600 rpm). If the centrifuge remains at idle for more than approximately 4 minutes, it will brake to a STOP. When the pump is restarted and the centrifuge is at idle, there is a 25 second recentrifuge delay. If the centrifuge is stopped, there is a 60 second recentrifuge delay.

(5) Remove the IV tubing from the air detector after all 16 pump revolutions and ensure--

(a) The display flashes as follows:

FILL AUTO (RESERVOIR EMPTY)  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 1:2

(b) The air sensor LED extinguishes.

(c) The pump stops.

(d) The tube clamp closes.

(e) The PAUSE/RESUME key LED is flashing.

(6) Press FINAL CYCLE and ensure--

(a) The display flashes in sequence:

PUSH THE BUTTON BELOW YOUR CHOICE  
RESUME WASH CONC STOP

(b) The key LED corresponding to the selected option flashes in synchronization with the choice option

as follows:

WASH START AUTO PROCESS  
RESUME PAUSE/RESUME  
CONC FINAL CYCLE  
STOP STOP

(c) All keys are disabled except the ones listed above.

(7) Press PAUSE/RESUME.

(a) Ensure the FILL mode is reactivated after the recentrifuge delay.

(b) Replace the IV tubing in the air detector.

(8) Press WASH and then Press START AUTO PROCESS and ensure--

(a) The display reads as follows with the wash volume value increasing as saline is pumped into the

bowl:

WASH AUTO WASH VOLUME = XXX/500  
PUMP SPD=600 CENT SPD=5650 NORMAL @ 1:2

## STP 8-91A15-SM-TG

(b) The FILL tubing clamp closes, the EMPTY clamp opens for 2 revolutions, then closes, and the wash clamp opens.

(c) The FILL LED is extinguished and WASH illuminates.

(d) The pump speed increases to 600 ml/min.

(9) Check for the following after the wash volume reaches 500 ml.

(a) During the braking cycle the display should read:

EMPTY AUTO <CENT. BRAKING DELAY>  
DO NOT ATTEMPT TO OPEN CENTRIFUGE COVER

(b) The display should then read:

EMPTY AUTO  
PUMP SPD=500 CENT SPD=0 NORMAL @ 1:2

(c) The pump stops.

(d) The centrifuge brakes to a stop.

(e) The wash clamp closes.

(f) The WASH LED extinguishes and EMPTY LED illuminates.

(g) The pump begins rotating counterclockwise once the centrifuge stops.

(h) The FILL clamp opens for the first 4 revolutions and then closes and EMPTY opens.

**NOTE:** The FILL clamp opens during the first 4 revolutions in EMPTY to purge the saline in the line which would otherwise dilute the packed red cells to be emptied. There is no purge in RETURN.

(10) After at least 26 revolutions in EMPTY, remove the IV tubing from the air sensor, reinstall, and ensure the display reads as follows:

FILL AUTO  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 2:2

(11) Press the red STOP button and ensure--

- (a) The display reads as follows while the centrifuge is braking:

FILL AUTO <CENT. BRAKING DELAY>  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 2:2

- (b) The display then should read:

FILL AUTO <STOPPED>  
PUMP SPD=500 CENT SPD=0 NORMAL @ 2:2

- (c) The pump stops.  
(d) The centrifuge brakes to a stop.  
(e) The fill clamp closes.  
(f) The STOP LED (both keys) illuminates.

- (12) Press HELP and ensure that the display reads as follows for approximately 5 seconds and then returns to the previous reading.

FILL AUTO <STOPPED>  
PROC'D VOL = XXX RET'D VOL = XXX

- (13) Press FILL and ensure--

- (a) The display reads as follows:

FILL MANUAL <SENSORS DISABLED>  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 1:2

- (b) The centrifuge begins rotating counterclockwise.  
(c) The pump begins rotating clockwise.  
(d) The fill tube clamp opens.  
(e) The fill LED is illuminated and the following extinguished:

START/AUTO, PUMP/RESUME.

- (14) Press CONC and ensure--

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- (a) The display reads as follows:  
  
CONC MANUAL <SENSORS DISABLED>  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 1:2
  - (b) The FILL clamp closes and the EMPTY clamp opens.
  - (c) The FILL LED is extinguished and CONC is illuminated.
- (15) Press WASH and ensure--
- (a) The display reads as follows:  
  
WASH MANUAL <SENSORS DISABLED>  
PUMP SPD=600 CENT SPD=5650 NORMAL @ 1:2
  - (b) The EMPTY clamp closes and the wash clamp opens.
  - (c) The CONC LED extinguishes and WASH illuminates.
- (16) Press RETURN and ensure the display reads as follows:
- WASH MANUAL RETURN? SELECT AGAIN  
PUMP SPD=600 CENT SPD=5650 NORMAL @ 1:2
- (17) Press RETURN again within 5 seconds and ensure--
- (a) The display reads as follows:  
  
RETURN MANUAL <CENT BRAKING DELAY>  
PUMP SPD=500 CENT SPD=0 NORMAL @ 1:2
  - (b) The centrifuge brakes to a stop.
  - (c) The pump stops.
  - (d) The wash clamp closes and the FILL clamp opens.
  - (e) The pump begins rotating counterclockwise.
  - (f) The WASH LED extinguishes and RETURN illuminates.
- (18) Press the white STOP button and ensure--

- (a) The display reads as follows:

RETURN MANUAL <STOPPED>  
PUMP SPD=500 CENT SPD=5650 NORMAL @ 1:2

- (b) The pump stops.
- (c) The FILL clamp closes.

- (19) Press EMPTY and ensure--

- (a) The display reads as follows:

EMPTY MANUAL <SENSORS DISABLED>  
PUMP SPD=500 CENT SPD=0 NORMAL @ 1:2

- (b) The EMPTY clamp opens.
- (c) The pump begins rotating counterclockwise.

- (20) Press STOP and power-off the CS 4.

3. Perform unit leakage current.

a. Measure the leakage current through chassis ground with the ground open in the following modes using the Bio-Tek Model 170 Leakage Meter (or equivalent):

- (1) Power-Off.
- (2) Power-On.
- (3) Fill.
- (4) Centrifuge Braking.

**NOTE:** All readings should be <100 microamperes.

- b. Reverse the polarity of the AC input lines and repeat step 3a.
- c. Verify all readings are <100 microamperes.

4. Perform ground continuity/isolated ground checks.

a. Verify ground continuity at the following points using the Associated Research Model 4040A Continuity Tester, or equivalent.

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- (1) Pump housing hardware.
- (2) Deck cover fasteners.

b. Verify there is infinite resistance between chassis ground and signal ground at the GND Test Point on the I/O pcb, using a Fluke Model 8024 digital voltmeter (DVM)( or equivalent).

5. Perform unit current draw test by measuring the current draw for the following modes at the applicable input voltage using a Fluke, Model 8024 DVM (or equivalent), and a Fluke Amp Clamp Model 801-600:

	Input voltage 115 VAC	Input voltage 230 VAC
Power off	≤ 1 amp	≤ 0.5 amp
Power on	≤ 3 amp	≤ 1.5 amp
Fill	≤ 5 amp	≤ 2.5 amp

6. Perform HYPOT test by performing a dielectric withstand test on the unit at the voltage level and duration indicated using the Associated Research, Model HD 4040A (or equivalent).

Input Voltage	Hypot Voltage	Duration
120 VUnit	1240 VAC	60 seconds
230 VUnit	1480 VAC	60 seconds

**NOTE:** This procedure should be performed with the ON/OFF switch in the ON position.

7. Perform electrical stress test.

a. Lower the input voltage to the unit under test to 100 VAC using a variac, and then measure the power supply levels at the following points:

LOCATION	VOLTAGE
Driver PCB R36	+24.0± 1.0 Vdc
Driver PCB R42	+ 5.2± 0.05 Vdc
Driver PCB R43	+15.0± 0.5 Vdc
Driver PCB R44	-15.0 ± 0.5 Vdc

**NOTE:** Attach the negative lead to the ground lug on the right front of the driver board.

**NOTE:** R36, 42, 43, and 44 are located at extreme right front of the driver board at LED indicators. Use the leg of the resistor near the front of the pcb.

- b. Repeat step 7a at 140 VAC (230 volt operation).

**NOTE:** Perform step 1 of this test at 210 and 250 volts.

- 8. Record the results of the inspection on DA Form 2404 and complete the appropriate reports and forms.
- 9. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use.

*Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>	
1. Perform a visual check.	P	F
2. Perform an operational checkout.	P	F
3. Perform unit leakage current.	P	F
4. Perform ground continuity/isolated ground checks.	P	F
5. Perform unit current draw test.	P	F
6. Perform HYPOT test.	P	F
7. Perform electrical stress test.	P	F
8. Record the results of the inspection.	P	F
9. Take the unit out of service as necessary.	P	F

**REFERENCES:**

*Required*

Manufacturer's Service  
Literature, Chapter 5  
TB 38-750-2

*Related*

AR 40-61

081-874-0011

## VERIFY CALIBRATION ON A BLOOD RECOVERY UNIT

### CONDITIONS

You have received DD form 314 and DA Form 2404 on a blood recovery unit scheduled for calibration. Necessary materials and equipment: TB 38 750-2, manufacturer's service literature, tool kit (medical equipment organizational maintenance), individual tool box, sphygmomanometer, function generator, digital voltmeter, amp clamp, variac, oscilloscope, digital tachometers (contact type), and optical test fixture (TD 2528).

### STANDARDS

The scheduled calibration is performed and all uncorrectable, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the calibration. The calibration is recorded on DD Form 314.

### TRAINING/EVALUATION

#### *Training Information Outline*

#### CAUTION

Always ensure the power unit is disconnected when disconnecting or reconnecting electrical connectors.

1. Perform a centrifuge acceleration/deceleration test.
  - a. Install a 225 ml bowl, approximately 1/2 full of water, into the chuck. Simultaneously press FILL and activate a stopwatch.
  - b. Attach a digital tachometer to the centrifuge.
  - c. Verify that the centrifuge accelerates to 5650 rpm in < 20 sec.
  - d. Verify the constant speed is 5650 rpm +/- 10 rpm.
  - e. Verify the speed is constant to  $\leq 5$  rpm.
  - f. Modify the centrifuge speed to 4050 and verify the centrifuge decelerates to 4050 +/- 10 rpm.
2. Perform bowl vibration test.

- a. Install an empty 225 ml bowl into the chuck.
  - b. Thread a length of 0.375 - inch outer diameter x 0.250 - inch inner diameter IV tubing through the pump and attach it to the bowl inlet port.
  - c. Terminate the free end in a water-filled reservoir.
  - d. Activate the manual FILL mode, slew the pump speed to 100 ml/min. and observe the water/air interface as the bowl fills with water.
  - e. Verify this interface does not become discontinuous (caused by internal vibration) for more than 30 seconds.
  - f. Verify there is no vibration as the water passes over the shoulder.
3. Perform a centrifuge cover interlock test.
- a. Power-up the unit, open the centrifuge cover, press START AUTO PROCESS, and verify--
    - (1) The display reads--  
  
FILL AUTO <CLOSE CENTRIFUGE COVER>  
PUMP SPD=500 CENTRF SPD=5650 NORMAL @1:2
    - (2) The centrifuge is not rotating.
    - (3) The pump is stopped.
    - (4) All pinch valves are closed.
  - b. Close the cover and verify that the FILL mode is activated.
  - c. Verify the cover cannot be opened with the centrifuge running.
4. Perform a centrifuge overspeed function test.
- a. Disconnect the spindle sensor harness plug (P2) from the centrifuge motor control pcb.
  - b. Insert the spindle sensor rest harness between the sensor harness and pcb.

**NOTE:** The slide terminals on the white wire should be connected.

- c. Measure the pulse voltage level and frequency of sensor 1 and 2 using the oscilloscope.
  - (1) Set the centrifuge speed at 5650 rpm with the FILL mode activated.

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- (2) Ground the scope probe on the black wire terminal.

**NOTE:** The sensor 1 signal is on the green wire terminal, and the sensor 2 signal is on the white wire terminal.

- d. Verify the voltage level is 5V +/- 0.4V, and the pulse spacing is 10.6 ms +/- 0.4 ms on both signals.
- e. Attach a function generator to the sensor 2 terminal.
  - (1) Power off the system.
  - (2) Leave the spindle sensor test harness installed.
  - (3) Disconnect the white wire slide terminals.
  - (4) Ground the generator to the black wire terminal.
- f. Set the generator of 5V; square pulse output at 90 Hz.
- g. Power-up the unit, press FILL, and slowly increase the generator output frequency.
- h. Verify that it is at 101 Hz +/- 2 Hz (approximately 420 rpm greater than selected speed).
- i. Ensure the display reads--

FILL MANUAL <SENSORS DISABLED>  
CENTF SPEED ERROR

- j. Allow the centrifuge to coast to a stop.
5. Perform a pump occlusion test.
    - a. Install a length of 0.375 inch O.D. x 0.250 inch I.D. IV tubing through the pump with the inlet end attached to a vacuum gauge.
    - b. Power-up the unit and activate the pump only A mode.
    - c. Slew the pump up to 100 ml/min.
    - d. Verify and record the pump draws a minimum vacuum of 20 mm Hg in < 1 minute.
    - e. Stop the pump.
    - f. Repeat steps 5a through 5e with the pump only B selected (counterclockwise rotation).

**NOTE:** The vacuum gauge must be moved to the opposite end of the tubing.

6. Perform programmed pump discharge rate.

- a. Verify the actual pump discharge rate has been marked on a label affixed to the left side of the cardcage enclosure.
- b. Enter the diagnostic mode by pressing the trap switch (red push button) located on the left side of the CPU pcb.
- c. Press PUMP ONLY in order to select the pump volume/revolution enter and store mode. Ensure the CS 4 display reads--

DISABLE NVRAM WRITE-PROTECT TO MODIFY  
PUMP VOLUME PER REVOLUTION = ML

- d. Locate the NVRAM write-protect enable/disable switch next to the 25 pin connector (P34) on the expansion pcb.
- e. Move the toggle to the right to disable the write-protect circuit.
- f. Verify the displayed pump volume/rev is the same as in step 6a of this test.
- g. Modify the display value by using the reprogram up and down keys, as necessary.
- h. Press EXIT and switch the enable/disable switch to the left in order to enable the NVRAM write protect circuit.

**NOTE:** The programmed value is based on the measured pump discharge rate. Any rework which affects the pump discharge rate, that is, occlusion, will necessitate the resetting and testing of the programmed value.

7. Perform a pump speed adjustment test.

- a. Install a length of 0.375 inch O.D. IV tubing through the pump.
- b. Power-up the CS 4 and enter the manual FILL mode by pressing FILL.
- c. Select a speed of 500 ml/min using the pump slew controls.
- d. Measure the pump speed by using a digital tachometer, Shimpo Model DT-105 contact type (or equivalent).
- e. Verify the pump speed is within calculated speed tolerances. (See Figure 3-28.)

<b>PUMP SPEED CALIBRATION</b>		
<b>Pump vol/rev (ml/min)</b>	<b>rpm @ 500 ml/min</b>	<b>rpm @ 1000 ml/min</b>
4.0	125+/-3	250+/-6
4.1	122+/-3	244+/-6
4.2	119+/-3	238+/-6
4.3	116+/-3	232+/-6
4.4	114+/-3	228+/-6
4.5	111+/-3	222+/-6
4.6	109+/-3	218+/-5
4.7	106+/-3	212+/-5
4.8	104+/-3	208+/-5
4.9	102+/-3	204+/-5
5.0	100+/-3	200+/-5
5.1	98+/-2	196+/-5
5.2	96+/-2	192+/-5
5.3	94+/-2	188+/-5
5.4	93+/-2	186+/-5
5.5	91+/-2	182+/-5
5.6	89+/-2	178+/-4
5.7	88+/-2	176+/-4
5.8	86+/-2	172+/-4
5.9	85+/-2	170+/-4
6.0	83+/-2	166+/-4

Figure 3-28

- f. Repeat Steps 7d and 7e with the manual EMPTY mode selected by pressing EMPTY.
8. Perform a pump discharge rate/volume accounting.
- a. Install a 5 foot length of 0.375 inch O.D. IV tubing through the pump (approximately centered).
- (1) Place the tubing exiting the left side of the pump into the air detector and into a water-filled reservoir.
- NOTE:** Placing the tubing through the air detector prevents the tubing from "creeping" into the pump while running.
- (2) Place the tubing exiting the right side of the pump into the graduated cylinder, 500 ml.
  - (3) Place a small piece of masking tape on the top, outer edge, of the pump rotor.

**NOTE:** This will facilitate counting pump revolutions.

- b. Power-up the CS 4 and select the manual Empty mode by pressing EMPTY.
    - (1) Allow the tubing to completely prime with water, then press STOP (either one).
    - (2) Ensure the graduated cylinder is emptied prior to continuing.
  - c. Press PAUSE/RESUME to start the EMPTY auto mode.
    - (1) Allow the pump to run for 50 revolutions.
    - (2) Press STOP.
  - d. Remove the tubing, measure the volume accumulated, and record this value.
  - e. Divide the volume accumulated by 50 revolutions to obtain the pump discharge rate.
  - f. Press HELP and record the display volume returned.
  - g. Verify the displayed volume is equal to the appropriate value in Figure 3-29, based on pump ml/rev.
9. Perform a pump cover interlock test.
- a. Install a length of IV tubing in the pump and activate the manual FILL mode. Lift the pump cover and verify--
    - (1) The pump stops.
    - (2) The display reads as follows:  
  
FILL MANUAL <OPEN & CLOSE PUMP>  
PUMP SPD=500- CENTF SPD=5650 NORMAL @1:2
  - b. Close the pump cover and verify the pump begins rotating after FILL is pressed.

VOLUME ACCOUNTING VALUES	
Pump mil/rev	Displayed volume per 50 rev (ml)
4.0	200+/-8
4.1	205+/-8
4.2	210+/-8
4.3	215+/-9
4.4	220+/-9
4.5	225+/-9
4.6	230+/-9
4.7	235+/-9
4.8	240+/-10
4.9	245+/-10
5.0	250+/-10
5.1	255+/-10
5.2	260+/-10
5.3	265+/-11
5.4	270+/-11
5.5	275+/-11
5.6	280+/-11
5.7	285+/-11
5.8	290+/-12
5.9	295+/-12
6.0	300+/-12

Figure 3-29

10. Perform a pinch valve occlusion test.

- a. Install a length of IV tubing through the FILL pinch valve and submerge the free end in a water-filled reservoir.
  - (1) Close the pinch valve so that the IV tube is occluded.
  - (2) Verify, by using a sphygmomanometer, the pinch valve will not leak air when pressurized to 250 mm Hg.
- b. Repeat steps 10a(1) and (2) on the EMPTY and WASH pinch valve.
- c. Verify the proper color coding of the pinch valve:
  - (1) FILL Red                      Front valve
  - (2) EMPTY Blue                Middle valve
  - (3) WASH Yellow                Rear valve

11. Perform bag weigher test.

- a. Power-up the CS 4 and press the TEST switch (red push button) on the CPU board to enter the diagnostic mode.
- b. Press START/AUTO to display the digital bag weigher reading.
  - (1) With no weight on the bag weigher, verify a reading of  $>0<25$ .
  - (2) Record the initial reading.
- c. Hang a 5 lb weight on the weigher.
  - (1) Record the reading.
  - (2) Verify the reading is  $35 + (\text{initial reading}) \pm 4$ .

**NOTE:** Reading = (weight x 7) + initial reading.

- d. Remove the 5 lb weight and replace it with a 10 lb weight and verify the reading is  $70 + (\text{initial reading}) \pm 7$ .

**NOTE:** Reading = (weight x 7) + initial reading.

- e. Remove all weights from the weigher and verify the reading returns to that recorded in step 11b(2)  $\pm 5$ .

12. Perform an air sensor test.

- a. Install a length of IV tubing, 1/2 filled with water, into the air sensor.
  - (1) Activate the FILL cycle.
  - (2) Allow the pump to run for 18 revolutions.

**NOTE:** Anytime the pump is activated, there is an 18 revolution delay before the air detector is looked at.

- b. Slowly pull the IV tube through the sensor until the unit's display reads FILL AUTO <RESERVOIR EMPTY> flashing.
- c. Verify there is a minimum 1/4 inch air gap between the sensing heads of the device and that the device LED is out.
- d. Reposition the tubing so that the device sees fluid again.
- e. Verify the LED is on and FILL can be reactivated.

13. Perform an optics aiming test.

## STP 8-91A15-SM-TG

- a. Install the optics test fixture (TD 2528) into the chuck.
  - (1) Power-up the unit.
  - (2) Allow a 10 minute warm-up.
- b. Rotate the chuck by hand until the transmitter red light falls on the fixture's gray card.
  - (1) Place the unit into the diagnostics mode by pressing the trap switch on the CPU pcb.
  - (2) Press START/AUTO to display the digital A/D channel output.
- c. Verify the digital reading is within the following specifications:  
 $121 \leq Dg \leq 159$ .

**NOTE:** Dg = Digital gray reading.

- d. Measure and record the optics gray voltage at the I/O test point using a Fluke Model 8024 DVM.
- e. Verify the measurement is within the following specifications:  
 $4.0 \text{ Vdc} \leq Vg \leq 7.0 \text{ Vdc}$

**NOTE:** Vg = Optics gray voltage.

- f. Place a black nonreflecting target tightly against the front of the optics lens.
- g. Verify the digital reading is  $23 \leq Db \leq 31$
- h. Verify the voltage reading is  $0.3 \text{ Vdc} \leq Vb \leq 2.0 \text{ Vdc}$

**NOTE:** Vb = Optics black voltage.

**NOTE:** Db = Digital black reading.

### 14. Perform a diagnostic mode check.

- a. Power-up the unit.
  - (1) Press the trap switch (red push button) located on the left of the CPU pcb, in order to enter the diagnostic mode.

- (2) Verify the CS 4 display reads:

DIA 1 2 3 B1C6 F 1D2 835C 2EF1 0F00  
ERROR:

**NOTE:** The first 3 numbers indicate the status of the 3 RAMs used in the system as follows:

- 1 - Z7 on CPU (8156)
- 2 - Z21 on CPU (4016)
- 3 - Z10 on expansion (NVRAM)

(3) A read/write is performed on each RAM successively, and upon successful completion, the corresponding number is displayed. If a RAM fails, an asterisk (\*) is displayed.

(4) Following the RAM test status numbers, the 5 EPROM calculated EPROM checksums are displayed successively, - 01 thru - 05. The five checksums represent Z6 and Z20 of the CPU board, and Z11, Z12, and Z13 of their expansion board, respectively.

(5) If the calculated checksum does not match the value last stored in NVRAM, an asterisk (\*) will appear to the right of the checksum value.

**NOTE:** This discrepancy will exist when new program chips (updated revisions) are installed. Store the new values by moving the NVRAM write-protection switch (located to the right of the 25-pin connector) on the expansion board to the right, disable position, and press HELP. If the values are successfully stored, the CS 4 will display the following statement on the second line of the display.

SWITCH TO WRITE- PROTECT

**NOTE:** Ensure that the write-protect switch is normally left in the enabled position (to the left).

(6) The second line of the display will present the last 8 error codes as detected by the system. (See Figure 3-30.) Error codes are explained fully in Chapter 4 of the manufacturer's service literature.

ERROR CODES		
Code	Message	Indication
1	ERROR 1	RESET 7. There has been a system malfunction. Powering off and on should restore operation.*
2	ERROR 2	Nonvolatile values lost.*
3	ERROR 3	The Motor Controller detected an overspeed.*
4	ERROR 4	The Motor Controller detected a centrifuge speed sensor fault.*
5	ERROR 5	Not used.
6	ERROR 6	There has been a Motor Controller communications error.*
7	ERROR 7	A centrifuge speed data error has been detected.*
8	ERROR 8	The CPU has detected a centrifuge overspeed.*
9	ERROR 9	There has been a control error.*
10	ERROR 10	The centrifuge cover latch has failed.*
11	SELF-TEST FAILURE	
12	ERROR 12	A system error has been detected.*
13	ERROR 13	A memory configuration error has been detected.*
14		The battery that supports the nonvolatile memory is low. (This error is not a shutdown error and is stored in the error history buffer only.)
15	AUTO SYSTEM FAILURE--	The optics voltage reading indicates a malfunction.

Figure 3-30

**NOTE:** When an error code message is displayed, the keyboard is locked up. The machine must be turned off and on to reset.

b. Perform special diagnostic functions to include the following:

- (1) Optics and weight display.
- (2) Membrane key switch test.

- (3) Pump volume per revolution setting.
  - (4) NVRAM re-initialization.
- c. Membrane key switch test.

**NOTE:** The diagnostic keyboard test provides a means of troubleshooting the membrane keyboard switches and associated circuitry.

- (1) Push the Pump Slew Up key down for about 1 second or until KEY appears on the second line of the display.
- (2) See Figure 3-31 for the keys and their key codes.

**NOTE:** The test also indicates multiple key closures by displaying more than one key code at the same time.

**NOTE:** The keys PUMP SLEW UP, PUMP SLEW DOWN, and REMOVEAIR cannot be tested by this test and do not display a key code. (However, the Pump Slew keys are tested indirectly when used to enter and to exit this test.) The key test is exited by pushing the Pump Slew Down key. The second line of the display is left blank. The key codes are listed in Figure 3-31.

DIAGNOSTIC KEY TEST			
CODE	KEY	CODE	KEY
START AUTO	C4	FILL	C3
CONC	CB	PAUSE/RESUME	CC
WASH	D4	HELP	C1
EMPTY	CD	FULL WASH	C9
RETURN	D5	HALF WASH	D1
STOP(WHITE)	C6	ZERO WASH	D9
STOP(RED)	CE	PUMP STOP	DA
REPROGRAM	C0	FINAL CYCLE	C5
YES	C8	PUMP ONLY	C7
NO	D0	A	CF
EXIT	D8	B	D7

Figure 3-31

**NOTE:** The protocol parameters which are reprogrammable by the user are stored in NVRAM. These values can be re-initialized to the factory default settings by pressing REPROGRAM. Note that this resets (wipes clean) the stored error codes as well. The factory settings are listed in Figure 3-32.

<b>PROGRAMMED DEFAULT SETTINGS</b>			
<b>Option</b>	<b>Normal</b>	<b>Orthopedic</b>	<b>Low Volume</b>
<b>Protocol</b>	<b>Selected</b>	<b>Deselected</b>	<b>Deselected</b>
<b># of cycles</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>FILL Speed</b>	<b>500 ml/min</b>	<b>350 ml/min</b>	<b>250ml/min</b>
<b>WASH Speed</b>	<b>600 ml/min</b>	<b>500 ml/min</b>	<b>250 ml/min</b>
<b>Option</b>	<b>Normal</b>	<b>Orthopedic</b>	<b>Low Volume</b>
<b>EMPTY Speed</b>	<b>500 ml/min</b>	<b>500 ml/min</b>	<b>300 ml/min</b>
<b>Conc Speed (not programmable)</b>	<b>500 ml/min</b>	<b>350 ml/min</b>	<b>150 ml/min</b>
<b>RETURN Speed (not programmable)</b>	<b>500ml/min</b>	<b>500 ml/min</b>	<b>300 ml/min</b>
<b>Centrifuge Speed</b>	<b>5650 rpm</b>	<b>5650 rpm</b>	<b>5250 rpm</b>

Figure 3-32

15. Power off to exit the diagnostic mode.
16. Verify that S1 on the expansion pcb is toward the P34 connector, NVRAM write-protect enabled.
17. Record the results of the calibration on the appropriate forms and records.

*Evaluation Guide*

**Performance Measures**

**Results**

- |   |   |   |
|---|---|---|
| 1. Perform a centrifuge acceleration/deceleration test. | P | F |
| 2. Perform a bowl vibration test.                       | P | F |

<b>Performance Measures</b>	<b>Results</b>	
3. Perform a centrifuge cover interlock test.	P	F
4. Perform a centrifuge overspeed function test.	P	F
5. Perform a pump occlusion test.	P	F
6. Perform a programmed pump discharge rate.	P	F
7. Perform a pump speed adjustment rate.	P	F
8. Perform a pump discharge rate/volume accounting.	P	F
9. Perform a pump cover interlock test.	P	F
10. Perform a pinch valve occlusion test.	P	F
11. Perform a bag weigher test.	P	F
12. Perform an air sensor test.	P	F
13. Perform an optics aiming test.	P	F
14. Perform a diagnostic mode check.	P	F
15. Power off to exit the diagnostic mode.	P	F
16. Verify S1 on the expansion pcb is toward the P34 connector, NVRAM write-protect enabled.	P	F
17. Record the results of the calibration on the appropriate forms and records.	P	F

**REFERENCES:**

*Required*

Manufacturer's Service  
Literature  
TB 38-750-2

*Related*

AR 40-61

081-874-0017

**PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES  
(PMCS) ON A FIELD SURGICAL SCRUB SINK**

**CONDITIONS**

You have received a DD Form 314 and DA Form 2404 to perform PMCS on a field surgical scrub sink. Necessary materials and equipment: TM 8-6545-001-24&P, TB 38-750-2, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled PMCS is performed and all uncorrectable, unsafe conditions are recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DA Form 2404.

**TRAINING/EVALUATION**

*Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>	
1. Inspect the basin for--	P	F
a. Rip.		
b. Tear.		
c. Leak.		
d. Hole in the fabric.		
2. Inspect the Velcro strips for damage and gripping ability.	P	F
3. Inspect the convenience tray.	P	F
a. Check for damage or missing bracket.		
b. Check for missing thumbscrew and ensure it holds the faucet securely.		
4. Inspect the faucet for dents and leaks.	P	F
5. Inspect the frame assembly, basin frame, and support rods for cracks, corrosion, or missing rods.	P	F

<b>Performance Measures</b>	<b>Results</b>	
6. Inspect the control box for--	P	F
a. Cracks, corrosion, and leaks.		
b. Missing or broken foot pedal, flow control knob, and/or switches.		
7. Inspect the electrical power cables and ground cable for deterioration, missing cables, and corrosion.	P	F
8. Inspect the ground fault circuit interrupter (GFCI) for proper operation.	P	F
9. Inspect the flow control valve for leaks and rotation in both directions.	P	F
10. Record and correct minor deficiencies.	P	F
11. Record deficiencies uncorrected on DA Form 2404 and complete the appropriate forms and records.	P	F
12. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use.	P	F

**REFERENCES:**

*Required*

*Related*

TM 8-6545-001-24&P  
TB 38-750-2

AR 40-61

081-874-0018

**REPAIR A FIELD SURGICAL SCRUB SINK TO COMPONENT LEVEL**

**CONDITIONS**

You have received DA Form 2407 to repair a malfunction on a field surgical scrub sink. Necessary materials and equipment: TM 8-6545-001-24&P, TB Med 7, TB 38-750-2, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The malfunction is isolated to component level and corrected. The unit is functional in accordance with operational standards specified in TM 8-6545-0001-24&P. Results are recorded on DA Forms 2407 and 2409.

**TRAINING/EVALUATION**

*Evaluation Guide*

**Performance Measures**

**Results**

- |   |   |   |
|---|---|---|
| 1. Review DA Form 2407 for the operator's description of the equipment malfunction.   | P | F |
| 2. Determine maintenance expenditure limits (MEL) for definite life equipment.  | P | F |
| a. Obtain the current replacement cost.   |   |   |
| b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.                            |   |   |
| c. Use the chart at Figure 3-33 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline. |   |   |
| d. Project a horizontal line to the MEL factor.   |   |   |
| e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair costs.   |   |   |

**NOTE:** Under certain conditions the MEL may be waived. (See TB Med 7.)

Performance Measures

Results

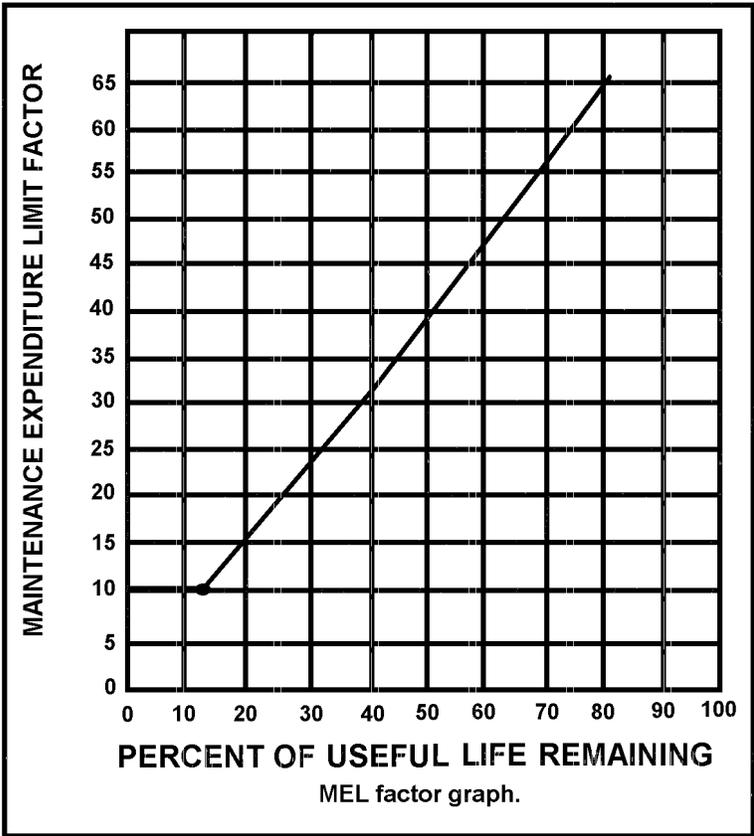


Figure 3-33

**NOTE:** The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of age.

- 3. Visually inspect the equipment for burned, broken, loose, or missing components or wires. P F
  
- 4. Perform a functional test. P F
  
- 5. Troubleshoot and isolate malfunction to component level. (See Figure 3-34.) P F

<b>GENERAL TROUBLESHOOTING</b>		
<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>	<b>CORRECTIVE ACTION</b>
Pump will not prime.	Inlet hose assembly not at the bottom of the potable water can or the can is empty.	Check the location of the inlet hose assembly and reposition it as required or fill the can with water.
	Foot pedal not depressed.	Depress foot pedal or repair it as necessary.
	Hose assemblies are kinked or twisted.	Check hose assemblies and correct kinks or twists. Repair hoses as required.
	Flow control valve closed.	Open the flow control valve.
	Primer bulb defective.	Replace bulb.
	Water circuit clogged by debris or mineral deposits.	Check and clean hose assemblies, pump, flow control valve, foot pedal assembly, and faucet.
No water flow from faucet.	Pump does not operate.	Replace pump.
	No electrical power from electrical distribution system.	Troubleshoot electrical distribution system.
	No electrical power at electrical power converter switch.	Check for open circuit in electrical power cable, control box receptacle, or an open fuse.  Repair as required or replace fuse.

Figure 3-34

Performance Measures

Results

<b>GENERAL TROUBLESHOOTING (CONTINUED)</b>		
<b>CORRECTIVE ACTION</b>	<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>
No water flow from faucet. (cont'd)	No electrical power to GFCI.	Check for defective wiring or electrical power converter switch and repair wiring or replace the switch.
	No electrical power to pump.	Check GFCI and reset, if required, or replace the GFCI.
	Incorrect voltage to unit.	Set electrical power converter to proper position.
	Flow control valve closed.	Open valve.
	Hose assemblies kinked or clogged.	Check hose assemblies, straighten kinks or twists, or replace hoses.
Water not heated.	Electrical power converter switch in wrong position.	Correct switch position.
	Foot pedal micro-switch out of adjustment or defective.	Check for correct electrical and/or mechanical operation and adjust as required or replace the microswitch.
	Heater circuitry open or the heater is defective.	Check the circuitry and the heater for the proper voltage. Replace the heater as required.

Figure 3-34 (Continued)

Performance Measures

Results

<b>GENERAL TROUBLESHOOTING (CONTINUED)</b>		
<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>	<b>CORRECTIVE ACTION</b>
GFCI activates. (Fails to reset.)	Incorrect electrical power source.	Check voltage and initiate corrective action if incorrect.
	Short circuit or excessive leakage current.	Troubleshoot the total electrical circuit of the unit and repair as required or replace the defective GFCI.

Figure 3-34 (Continued)

- 6. Replace the malfunctioning component(s). P F
  - a. Reassemble the unit.
  - b. Perform a function check to verify the malfunction has been corrected.
  
- 7. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2. P F

**REFERENCES:**

*Required*

TM 8-6545-001-24&P  
 TB Med 7  
 TB 38-750-2

*Related*

AR 40-61  
 AR 710-2

081-874-0054

**PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)  
ON AN ELECTROSURGICAL APPARATUS (FORCE 2)**

**CONDITIONS**

You have received DD Form 314 and DA Form 2404 to perform a PMCS on an electrosurgical apparatus. Necessary materials and equipment: TM 8-6515-003-24&P, TB 38-750-2, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled PMCS is performed and all uncorrected, unsafe conditions are recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DD Form 314.

**TRAINING/EVALUATION***Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>
1. Perform before (B) operation PMCS as listed in PMCS chart. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IV (Table 3-1).)	P    F
2. Perform during (D) operation PMCS as listed in PMCS chart. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IV (Table 3-1).)	P    F
3. Perform after (A) operation PMCS as listed in PMCS chart. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IV (Table 3-1).)	P    F
4. Perform quarterly (Q) PMCS as listed in PMCS chart. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IV (Table 3-1).)	P    F
5. Perform semiannual (S) PMCS as listed in PMCS chart. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IV (Table 3-2).)	P    F
6. Perform operational testing. (Refer to TM 8-6515-003-24&P Chapter 3, Section V (3-14 Thru 3-19).)	P    F
7. Record deficiencies uncorrected on DA Form 2404 and complete the appropriate reports and forms.	P    F

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**Performance Measures**

8. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use.

**Results**

P F

**REFERENCES:**

*Required*

*Related*

TM 8-6515-003-24&P  
TB 38-750-2

AR 40-61

081-874-0055

**CALIBRATE AN ELECTROSURGICAL APPARATUS (FORCE 2)****CONDITIONS**

You have received DD Form 314 and DA Form 2404 on an electrosurgical (ES) apparatus scheduled for calibration. Necessary materials and equipment: TM 8-6515-003-24&P, TB 38-750-2, electrosurgical analyzer capable of 0 to 300 watts power reading at 300 ohms, manufacturer's instructions for the electrosurgical analyzer, a multimeter, an oscilloscope, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled calibration is performed and all uncorrected, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the calibration. The calibration is recorded on DD Form 314.

**TRAINING/EVALUATION***Evaluation Guide*

<b>Performance Measures</b>	<b>Results</b>	
1. Perform the (ES) apparatus post calibration disassembly and self-test procedures. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IX, paragraph 3-37b.)	P	F
2. Perform the (ES) apparatus calibration requirements and procedures. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IX, paragraph 3-38.)	P	F
3. Perform the after calibration reassembly procedure. (Refer to TM 8-6515-003-24&P, Chapter 3, Section IX, paragraph 3-37c.)	P	F
4. Record the results of the calibration on the appropriate forms and records.	P	F

**REFERENCES:***Required*

TM 8-6515-003-24&P  
TB 38-750-2

*Related*

AR 40-61

081-874-0056

**REPAIR AN ELECTROSURGICAL APPARATUS TO  
MODULE/BOARD LEVEL (FORCE 2)**

**CONDITIONS**

You have received DA Form 2407 for repair of an electrosurgical (ES) apparatus. Necessary materials and equipment: DA Form 2409, TB Med 7, TB 38-750-2, TM 8-6515-003-24&P, multimeter, ES analyzer, manufacturer's instructions for the ES analyzer, oscilloscope, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The malfunction is isolated to module/board level and corrected. The electrosurgical (ES) apparatus is functional in accordance with operational standards specified in TM 8-6515-003-24&P. Results are recorded on DA Forms 2407 and 2409.

**TRAINING/EVALUATION**

*Evaluation Guide*

**Performance Measures**

**Results**

- |   |   |   |
|---|---|---|
| 1. Review DA Form 2407 for the operator's description of the equipment's malfunction.   | P | F |
| 2. Determine the maintenance expenditure limits (MEL) for definite life equipment.  | P | F |
| a. Obtain current replacement cost.   |   |   |
| b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.                            |   |   |
| c. Use the chart in Figure 3-35 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline. |   |   |
| d. Project a horizontal line to the MEL factor.   |   |   |
| e. Multiply the MEL factor by the current replacement cost to determine maximum allowable repair cost.  |   |   |

**NOTE:** Under certain conditions, the MEL may be waived. (See TB Med 7.)

## Performance Measures

## Results

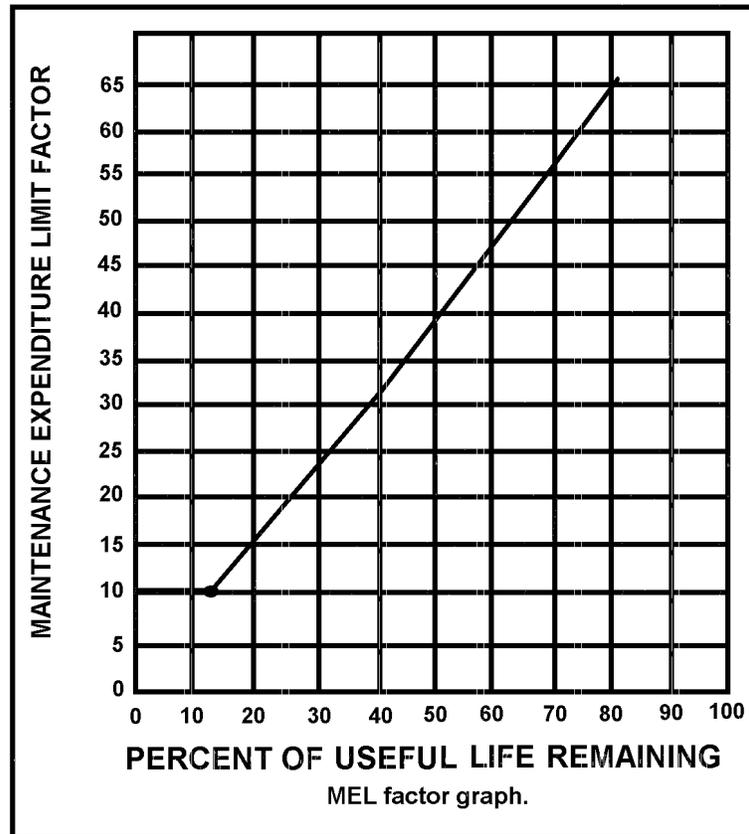


Figure 3-35

**NOTE:** The MEL for definite life equipment which has reached or exceeds its life expectancy is 10 percent. This MEL remains constant for as long as the equipment is in use, regardless of the age.

3. Perform a visual inspection. P    F
  - a. Examine all cables for signs of damage.
  - b. Examine all connectors for signs of damage.
  - c. Seat all connectors firmly in their sockets.
  - d. Check the unit for physical signs of damage or abuse.
  
4. Perform a function check to confirm symptoms listed on DA Form 2407. P    F

## STP 8-91A15-SM-TG

### Performance Measures

### Results

**NOTE:** If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user. (See step 10.)

5. Troubleshoot and isolate the malfunction(s) to module/board level. (Refer to TM 8-6515-003-24&P, Chapter 3, Section VII, paragraphs 3-23 & 3-24.) P F

6. Determine if the repair cost exceeds the MEL. P F

**NOTE:** If the repair cost exceeds the MEL, notify your supervisor.

7. Replace the malfunctioning module/board. (Refer to TM 8-6515-003-24&P, Chapter 3, Section VII, paragraphs 3-23 & 3-24.) P F

8. Perform a function check. P F

9. Determine the disposition of the unit. P F

a. Prepare to release the unit to the user if the function check is satisfactory.

b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.

c. Refer to the next higher echelon of maintenance, if necessary.

10. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2. P F

a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.

b. Obtain the user's signature for receipt of the unit, as appropriate.

c. Release the unit to the user.

### REFERENCES:

#### *Required*

TM 8-6515-003-24&P  
TB 38-750-2  
TB Med 7

#### *Related*

AR 40-61  
AR 710-2

081-874-0019

**PERFORM PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)  
ON REFRIGERATED TABLETOP CENTRIFUGE**

**CONDITIONS**

You have received a DD Form 314 and DA Form 2404 to perform PMCS on a refrigerated tabletop centrifuge. Necessary materials and equipment: manufacturer's service literature, TB 38-750-2, portable tachometer, digital multimeter, tool kit (medical equipment organizational maintenance), and individual tool box.

**STANDARDS**

The scheduled PMCS is performed and all uncorrected, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the PMCS. The PMCS is recorded on DD Form 314.

**TRAINING/EVALUATION***Evaluation Guide***Performance Measures****Results**

- |   |        |
|---|--------|
| 1. Inspect the instrument panel assembly for--                        | P    F |
| a. Broken or missing knobs.   |        |
| b. Burned light bulbs.  |        |
| c. Broken or defective gauges.  |        |
| d. Broken or defective hinges.  |        |
| e. Loose, bare, or burned electrical connections and wire insulation. |        |
| f. Broken or missing cable assembly.                                  |        |
| 2. Inspect the outside of the frame.                                  | P    F |
| a. Inspect the power cord plug and insulation.                        |        |
| b. Inspect the feet ensuring they are not broken or missing.          |        |
| c. Inspect the Velcro strips.   |        |

## STP 8-91A15-SM-TG

### Performance Measures

### Results

- d. Inspect the buckets and adapters for cracks and dirty pin wells.
- 3. Remove the access panel. P    F
- 4. Inspect the drive assembly. P    F
  - a. Inspect the belt drive for cuts and nicks.
  - b. Inspect the motor brushes for--
    - (1) Even wear.
    - (2) Condition of brush carriers.
    - (3) Broken or missing caps.
  - c. Inspect the motor armature (commutator).
  - d. Inspect the motor bearings for noise or rough feeling.
  - e. Inspect the gyro cover seal and gyro insulator for proper fit and function.
  - f. Inspect the gyro coupling to ensure it is not separated or bent.
  - g. Inspect the gyro bearings for noise or rough feeling.
- 5. Inspect the refrigeration section. P    F
  - a. Inspect the rotor for--
    - (1) Cracks.
    - (2) Dirty pins and rotor seat.
  - b. Inspect the drive insert for looseness and wear.
  - c. Inspect the fan blades.
  - d. Inspect the service ports for oil leaks.
  - e. Inspect the condenser for--
    - (1) Dirt, dust, and other foreign substances and clean the condenser as necessary.

Performance Measures	Results	
(2) Damaged fins.		
(3) Broken or damaged fan blades.		
(4) Functional fan.		
f. Inspect the start capacitor and relay contacts for arcing and pitting.		
g. Inspect the insulation around the appropriate refrigeration lines.		
6. Replace the access panel.	P	F
7. Perform a function check.	P	F
8. Check the motor speed with a portable tachometer using one of the following rotors installed in the centrifuge: A-384, A-500, or an empty H-1000.	P	F
a. Ensure 1500 rpm $\pm$ 50 rpm.		
b. Ensure 3000 rpm $\pm$ 50 rpm.		
9. Check the timer at the ten minute setting using a stopwatch.	P	F
10. Check the fault detector.	P	F
a. Ensure the fault detector with an imbalance of 10 grams at 1000 $\pm$ 500 rpm does not activate. The centrifuge should continue running without the fault light illuminating.		
b. Ensure the fault detector with an imbalance of 30 grams at 1000 $\pm$ 500 rpm activates. The centrifuge should shut down and the fault light should illuminate.		
c. Inspect the temperature sensor for over temperature by placing the sensor in warm water (approximately 50° C). The fault light should illuminate.		
d. Inspect the temperature sensor for under temperature by unplugging the temperature sensor connector (J11/P11). The fault light should illuminate.		
e. Inspect the belt function by removing the side access panel and moving the arm of microswitch SW-5. The fault light should illuminate.		

## STP 8-91A15-SM-TG

### Performance Measures

### Results

11. Inspect the door latch.

P F

- a. Inspect the operation of the door.

**NOTE:** With the door closed, the latch engaged, and the centrifuge operating, ensure the door light is not illuminated and the door cannot be opened.

**NOTE:** The centrifuge should not start if the door is opened and the door light is illuminated. The centrifuge door cannot be opened until the centrifuge is at zero speed and the door light is illuminated.

- b. Check the door mechanical override.

- (1) Ensure the door is shut and latched.
- (2) Turn the power switch off.
- (3) Pull the medal loop down with a screwdriver.

(4) Turn the door release knob clockwise and the door should open. If it does not open, repair the mechanical override.

12. Inspect the door seal.

P F

a. Place four pieces of paper approximately 3/4" wide by 6" long equally spaced around the top of the chamber door opening.

b. Close the door and pull outward on each piece of paper. All pieces of paper should fit tightly and create a frictional drag as they are being pulled out.

13. Check the centrifuge brake.

P F

- a. Place an H-1000 rotor and empty bucket in place.

- b. Set the brake switch to on.

- c. Set the timer for one minute.

- d. Set the speed control to maximum.

e. After one minute expires, ensure the rotor stops within 150 seconds. If the rotor does not stop, the brake requires repairs.

<b>Performance Measures</b>	<b>Results</b>
14. Check the slow-start function of the rotor.	P    F
a. Ensure the rotor starts to spin slowly 2-5 seconds after setting the speed.	
b. Ensure the transition to high speed occurs at approximately 600 rpm.	
15. Record deficiencies uncorrected on DA Form 2404 and complete the appropriate reports and forms.	P    F
16. Take the unit out of service if uncorrected deficiencies present any danger to patients or operator or if the machine could be damaged due to continued use.	P    F

**REFERENCES:**

*Required*

*Related*

Manufacturer's Service  
Literature  
TB 38-750-2

AR 40-61

081-874-0020

## CALIBRATE A REFRIGERATED TABLETOP CENTRIFUGE

### CONDITIONS

You have received a DD Form 314 and DA Form 2404 on a tabletop centrifuge scheduled for calibration. Necessary equipment and materials: TB 38-750-2, manufacturer's service literature, portable tachometer, digital multimeter, IC test clip (dip clip), H-1000 rotor with buckets, one 10 gram weight, one 30 gram weight, thermometer, two water beakers, tool kit (medical equipment organizational maintenance), and individual tool box.

### STANDARDS

The scheduled calibration is performed and all uncorrected, unsafe conditions are identified and recorded on DA Form 2404. Minor deficiencies are recorded and corrected during the calibration. The calibration is recorded on DD Form 314.

### TRAINING EVALUATION

#### *Evaluation Guide*

#### Performance Measures

#### Results

1. Calibrate the temperature meter adjustment.
  - a. Turn the power off.
  - b. Adjust the screw until the pointer reads -20° C. (See Figure 3-36.)

P F

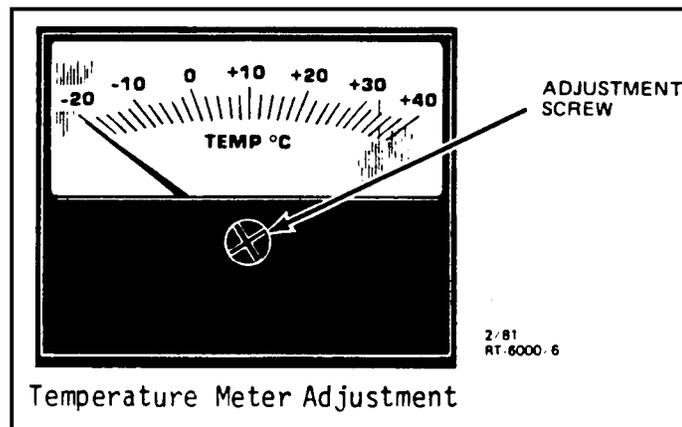


Figure 3-36

**Performance Measures****Results**

2. Calibrate the tachometer meter adjustment.
  - a. Turn the power off.
  - b. Adjust the screw until the pointer reads zero. (See Figure 3-37).

P F

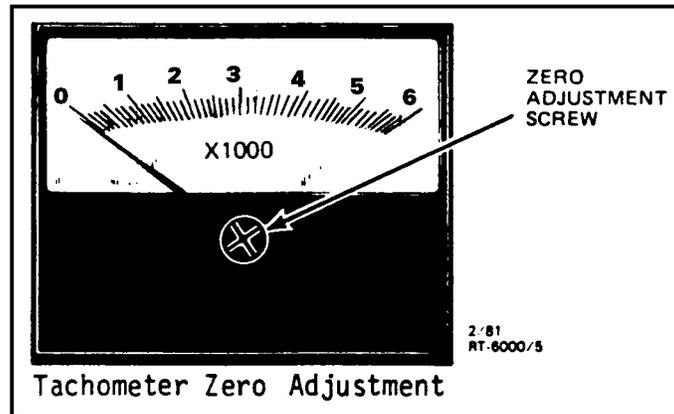


Figure 3-37

3. Calibrate the tachometer.
  - a. Open the front panel assembly.
  - b. Install the H-1000 rotor without buckets, close and lock the lid, and activate the switch.
  - c. Connect a portable tachometer onto the PORTAC JACKS. (See Figure 3-38.)
  - d. Set the timer to HOLD and set the speed control knob at 2000 rpm.
  - e. Adjust potentiometer 49 on the motor controls PC board until the portable tachometer and the centrifuge tachometer have the same reading.
  - f. Disconnect the portable tachometer.
4. Calibrate the slow start adjustment.
  - a. Place buckets on the rotor and close and lock the lid.

P F

P F

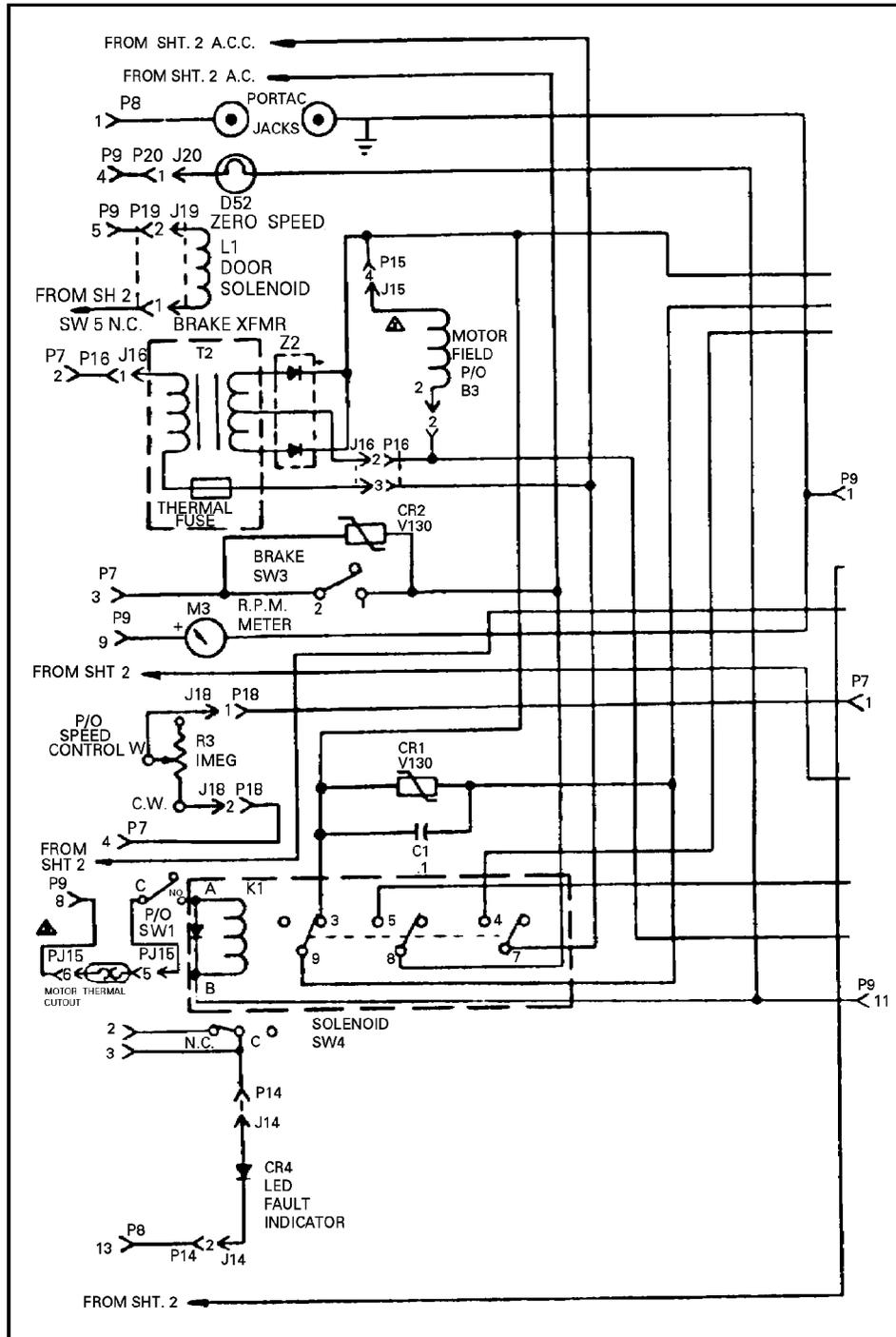


Figure 3-38

**Performance Measures****Results**

- b. Activate the power switch.
- c. Set the timer to HOLD and the speed control knob to maximum setting.
- d. Ensure the rotor begins rotating within 1 to 5 seconds.

**NOTE:** If the rotor does not start, adjust potentiometer R38 on the motor control PC board.

- e. Reassemble the front panel.
5. Calibrate the minimum speed adjustment. P    F
- a. Plug in the portable tachometer and switch to the frequency setting.
  - b. Remove the buckets from the rotor, close and lock the lid, and open the front panel.
  - c. Activate the power switch.
  - d. Set the timer to HOLD and set the speed control knob to minimum setting.

**NOTE:** Do not turn speed control knob too far as this will shut off the switch.

- e. Adjust potentiometer R64 for a speed of 600 rpm  $\pm$ 50 rpm.

**NOTE:** Whenever an adjustment to the minimum speed is necessary, recheck the maximum speed and recalibrate.

6. Calibrate the maximum speed adjustment. P    F
- a. Set the timer to HOLD and set the speed control knob to the maximum setting.
  - b. Adjust potentiometer R65 until the portable tachometer and the centrifuge tachometer read 3300 rpm, +200 rpm -0 rpm.

**NOTE:** Whenever an adjustment to the maximum speed is necessary, recheck the minimum speed and recalibrate, if necessary.

7. Calibrate the 200 rpm brake adjustment. P    F
- a. Install the buckets on the rotor and close and lock the lid.
  - b. Locate Z1 on the motor control PC board and install an IC test clip (dip clip).

## STP 8-91A15-SM-TG

### Performance Measures

### Results

- c. Connect the positive lead of the digital multimeter to pin 13 of Z1 and the negative lead to ground.
  - d. Start the centrifuge and increase the rotor speed to 1000 rpm.
  - e. Turn the break switch to the OFF position.
  - f. Turn the timer off. Pin 13 should be low.
  - g. Adjust potentiometer R42 so that pin 13 goes high at 200 rpm +50 rpm to -0 rpm when breaking.
  - h. Repeat step 7g, if necessary.
  - i. Disconnect the portable tachometer.
  - j. Remove the buckets from the H-1000 rotor.
8. Calibrate the imbalance adjustment. P    F
- a. Install four buckets on the H-1000 rotor.
  - b. Set the temperature knob to 25° C and allow the temperature to stabilize.
  - c. Place one 10 gram weight in one of the four buckets.
  - d. Close and lock the centrifuge lid.
  - e. Activate the power switch.
  - f. Ensure the speed control is set at zero.
  - g. Start the centrifuge and adjust the potentiometer on the motor control PC board (R18 counterclockwise) until the fault light comes on.

**NOTE:** This must occur before the rotor reaches 1000 rpm.

- h. Adjust R18 clockwise until the fault light comes on with rotor acceleration.
- i. Stop the centrifuge, remove the 10 gram weight, and replace it with a 30 gram weight.

**Performance Measures****Results**

- j. Start the centrifuge.
  - (1) Check for an imbalance before 1000 rpm.
  - (2) If the imbalance does not occur, adjust potentiometer R18 counterclockwise until the imbalance is tripped.
- 9. Calibrate the refrigeration system. P    F
  - a. Turn the power switch to the OFF position.
  - b. Open the centrifuge door and remove the rotor with buckets.
  - c. Locate the temperature sensor on the bottom of the bowl interior and carefully work the sensor loose.
  - d. Prepare warm water 28° C to 32° C in a beaker and immerse a thermometer in it.
  - e. Immerse the temperature sensor in the warm water beaker.
  - f. Turn the power switch to the on position and adjust potentiometer R10 on the temperature control PC board until the thermometer and the temperature sensor have the same reading,  $\pm 1^{\circ}\text{C}$ . (See Figure 3-39.)
  - g. Prepare a beaker with ice water and immerse a thermometer in it.
  - h. Immerse the temperature sensor in the ice water beaker.
  - i. Adjust potentiometer R7 on the temperature control PC board until the thermometer and the temperature sensor have the same reading  $\pm 1^{\circ}\text{C}$ . (See Figure 3-39.)
  - j. Repeat steps 9d through 9i until no further adjustments are required.

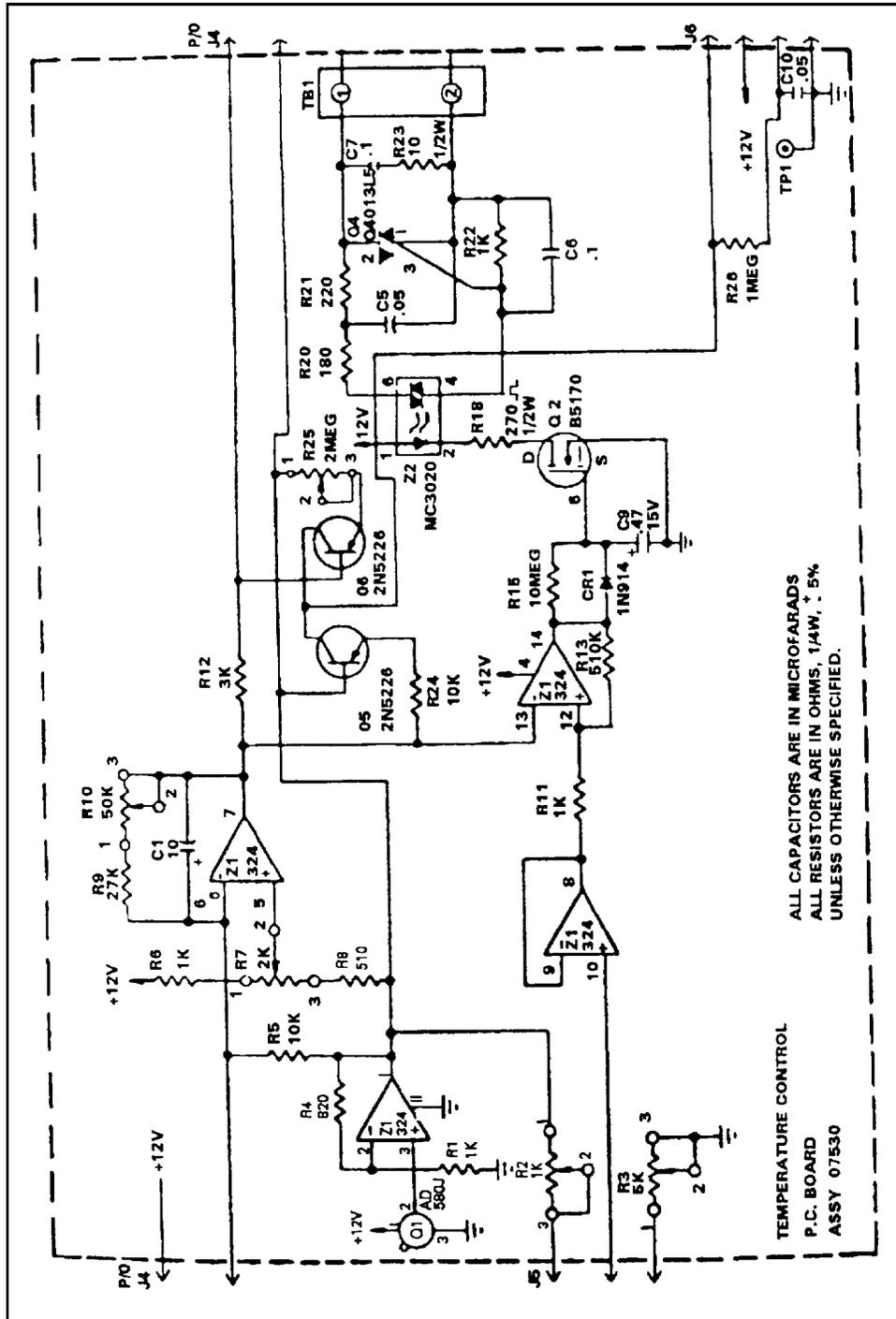


Figure 3-39

**Performance Measures****Results**

- k. Connect a digital multimeter to pin 1 and pin 7 of Z1 on the temperature control PC board.
  - l. Measure the DC voltage of both temperatures and record them.
  - m. Remove the digital multimeter test lead from pin 7 of Z1 and connect it to the center terminal of the temperature potentiometer (R2) on the front panel.
  - n. Adjust the temperature knob on the front panel to the exact temperature used in steps 9d through 9f.
  - o. Adjust R3 on the temperature control PC board to read the same measured voltage that was recorded in step 9l, warm water.
  - p. Adjust the temperature knob on the front panel to the exact temperature used in steps 9g and 9i.
  - q. Adjust R2 on the temperature control PC board to read the same measured voltage that was recorded in step 9l, ice water.
  - r. Repeat steps 9n through 9q until no further adjustment is needed.
  - s. Set the power switch to the OFF position.
  - t. Remove the digital multimeter leads.
10. Calibrate the over temperature/under temperature adjustment. P    F
- a. Place the sensor in a beaker of warm water of approximately 50°C.
  - b. Close and lock the centrifuge lid.
  - c. Set the power switch to the ON position and ensure the speed control is set at zero.
  - d. Adjust the over temperature threshold potentiometer (R25) on the temperature control PC board until the fault indicator lights. If the fault indicator is already illuminated, back off on R25 until the fault indicator light goes out and then readjust.
- NOTE:** If the PC board you are adjusting doesn't have R25, adjust potentiometer R16.
- f. Open the lid, remove the beaker, and reinstall the sensor.
  - g. Close and lock the lid. Ensure the fault indicator light goes off.

**STP 8-91A15-SM-TG**

**Performance Measures**

**Results**

h. Verify the under temperature is functioning by momentarily unplugging the temperature sensor J11/P11. (See Figure 3-39.) The fault light should turn on.

i. Open the lid and the fault indicator will reset.

11. Record the results of the calibration on the appropriate forms and records.

P F

**REFERENCES:**

*Required*

*Related*

Manufacture's Service  
Literature  
TB 38-750-2

AR 40-61

081-874-0021

## REPAIR A REFRIGERATED TABLETOP CENTRIFUGE TO MODULE/BOARD LEVEL

### CONDITIONS

You have received DA Form 2407 for repair of a refrigerated tabletop centrifuge. Necessary materials and equipment: manufacturer's service literature, TB 38-750-2, DA Form 2409, TB Med 7, multimeter, oscilloscope, tool kit (medical maintenance organizational maintenance), and individual tool box.

### STANDARDS

The malfunction is isolated to module/board level and corrected. The unit is functional in accordance with operational standards specified in the manufacturer's service literature. Results are recorded on DA Forms 2407 and 2409.

### TRAINING/EVALUATION

#### *Evaluation Guide*

#### Performance Measures

#### Results

- |   |        |
|---|--------|
| 1. Review DA Form 2407 for the operator's description of the equipment's malfunction.   | P    F |
| 2. Determine the maintenance expenditure limits (MEL) for definite life equipment.  | P    F |
| a. Obtain the current replacement cost.   |        |
| b. Calculate the percentage of useful life remaining for the item by dividing the life remaining in months by the life expectancy in months.                            |        |
| c. Use the chart in Figure 3-40 to determine the MEL factor. Read up vertically from the percent of useful life remaining to a point of intersection with the baseline. |        |
| d. Project a horizontal line to the MEL factor.   |        |
| e. Multiply the MEL factor by the current replacement cost to determine the maximum allowable repair cost.  |        |

**NOTE:** Under certain conditions the MEL may be waived (See TB Med 7.)

**NOTE:** The MEL for definite life equipment which has reached or exceeded its life expectancy is 10 percent. This MEL remains constant for as long the equipment is in use, regardless of the age.

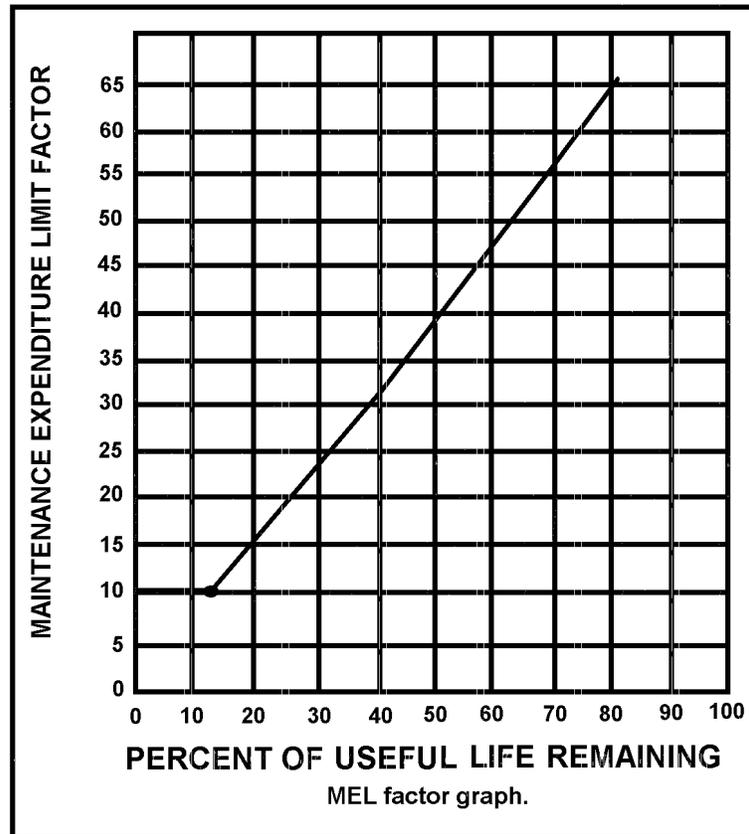


Figure 3-40

- 3. Inspect all external surfaces of the centrifuge for-- P F
  - a. Physical damage.
  - b. Breakage.
  - c. Loose or dirty contacts.
  - d. Missing components.
  
- 4. Perform a function check to confirm symptoms listed on DA Form 2407. P F

**NOTE:** If the unit operates normally and no malfunctions are detected, complete DA Form 2407 and return the unit to the user.

**Performance Measures****Results**

- | <b>Performance Measures</b>  | <b>Results</b> |
|--|----------------|
| 5. Open the front panel.   | P    F         |
| a. Inspect the circuit board surfaces for--  |                |
| (1) Discoloration.   |                |
| (2) Cracks.  |                |
| (3) Breaks.  |                |
| (4) Warps.   |                |
| b. Inspect the circuit board conductors for--  |                |
| (1) Cracks.  |                |
| (2) Breaks.  |                |
| (3) Cuts.  |                |
| (4) Corrosion.   |                |
| (5) Looseness.   |                |
| c. Inspect all assemblies for burned or loose components.  |                |
| d. Inspect the chassis and panel mounted components for--  |                |
| (1) Looseness.   |                |
| (2) Breakage.  |                |
| (3) Loose contacts.  |                |
| (4) Loose conductors.  |                |
| e. Inspect for disconnected, broken, cut, loose, or frayed cables or wires.                        |                |
| 6. Troubleshoot and isolate the malfunction(s) to module/board level. (See Figures 3-41 and 3-42.) | P    F         |

<b>GENERAL TROUBLESHOOTING</b>	
<b>PROBLEM: Door will not open</b>	
Is the power on?	If NO, turn power on or, if electrical failure, use mechanical interlock override when motor stops.
If YES, do instruments run?	If NO, and FAULT light is illuminated: (1) Use interlock override procedure and check for motor imbalance. (2) Belt malfunction. (3) Over/Under temperature.
If YES, connect 1 meter lead to J9-4 on motor control PC board and the other metal lead to ground (TP1). It should read 0-.8 VDC when door is open, and approximately 28 VDC when door is closed (with timer on and speed control on).	If NO, replace motor control PC board.
If YES, on motor control PC board, short out resistor R36. Solenoid will not energize and door light will stay illuminated all the time.	If NO, replace motor control PC board.
If YES, On motor control PC board, connect one meter lead to J8 pin 6 and the other lead to ground (TP1). Turn disc on motor to check tach input. Meter should read low AC voltage, then goes high.	If NO, replace motor control PC board.
If YES and interlock override not moving freely, check: (1) Clearance under interlock (obstruction). (2) Interference inside (around latch).	If NO, replace motor control PC board.

Figure 3-41

Performance Measures

Results

<b>GENERAL TROUBLESHOOTING</b>	
<b>PROBLEM:</b> Power switch will not illuminate and no power is present.	
Is centrifuge plugged in both at back of instrument and at wall receptacle?	If NO, plug centrifuge power cord into rear of instrument first, then into receptacle.
If YES, does power supply conform to power specification on back nameplate of instrument and does power supply function properly?	If NO, reset power supply circuit breaker or replace motor control PC board.
If NO, check voltage at circuit breaker (both entering and leaving). Does voltage exist after breaker?	If YES and if power switch does not illuminate, replace circuit breaker.
If NO, does power exist before breaker?	If YES, replace circuit breaker.
If NO, continue to take voltage and continuity checks, referring to system schematic.	

Figure 3-41 (Continued)

<b>GENERAL TROUBLESHOOTING</b>	
<b>PROBLEM:</b> Instrument will not start.	
Is door latched properly?	<p>If NO, turn the door release fully clockwise. Turn the time control to OFF and wait for open light to illuminate. Engage the door latches by turning doorknob fully counterclockwise. Set timer control.</p> <p>If YES, (1) Check rotor contents for imbalance. Check that table is reasonably level and that centrifuge has been leveled accordingly.            (2) Belt malfunction-check belt switch (S5).            (3) Over/Under temperature-check temperature meter.</p>
If NO, with timer on check voltage across coil of K1. Is voltage 24DC?	If NO, and no voltage at all, check connections; if voltage is present but K1 does not energize, replace relay.
If YES, with timer on K1 energized, check voltage across TB2-3 and TB2-5 on motor control PC board. Is voltage 120VAC?	If NO, and no voltage at all, check connections; if voltage is present but too low, replace motor control PC board.

Figure 3-41 (Continued)

Performance Measures

Results

**GENERAL TROUBLESHOOTING****PROBLEM:** Instrument will not start. (Cont'd)

If YES, add two jumpers to motor control PC board: one from the base of Q2 to ground (TP1), the other from pin 5 of Z5 to the common point between R61 and R62 (to jump slow start). Does centrifuge go right up to speed without slow start?

If NO, replace motor control PC board.

If YES, check:

- (1) Motor wiring and connections
- (2) Motor field winding resistance: approx 2 ohms

**Figure 3-41 (Continued)**

<b>GENERAL TROUBLESHOOTING</b>	
<b>PROBLEM:</b> Refrigeration system unable to provide desired temperature.	
Check condenser fins. Do they need cleaning?	If YES, clean condenser fins.
If NO, check rotor chamber. Does it need to be defrosted?	If YES, defrost rotor chamber.
If NO, are minimum clearances maintained on all sides of the centrifuge?	If NO, reposition instrument.
If YES, is compressor fan functioning?	If NO, check electrical connection; replace fan and/or motor.
If YES, is door fitting tight?	If NO, check door seal; replace seal.
If YES, check calibration of temperature meter. Is meter calibrated?	If NO, calibrate temperature meter.
If YES, check line voltage. Is voltage 90% of nameplate rating?	If NO, have power supply corrected.
If YES, check the start capacitor, start relay and thermal protector. Do components function properly?	If NO, replace defective component.
If YES, check sight glass. Is the amount of Freon correct?	If NO, fill system until correct amount of Freon 12 is attained.
If YES, are the fittings tight? Is insulation adequate?	If NO, tighten fittings. Insulate where required.

Figure 3-41 (Continued)

Performance Measures

Results

**GENERAL TROUBLESHOOTING**

**PROBLEM:** Refrigeration system unable to provide desired temperature.  
(Cont'd)

If YES, on temperature control PC board, connect meter lead to collector of Q2 and other to ground (TP1). With power on and timer set, rotate temperature control knob below temperature meter reading. Voltmeter should start light and then go low (compressor would go on), then go back light (when compressor goes off). Does it?

If NO, replace temperature control PC board.

If YES, on temperature control PC board, connect meter lead to pin 1 of TB1 and other lead to pin 2 of TB1. Reading should be 120V when compressor is off; then approximately 1-2V when compressor goes on. Are readings correct?

If NO, replace temperature control PC board.

Figure 3-41 (Continued)



<b>Performance Measures</b>	<b>Results</b>
7. Determine if the repair cost exceeds the MEL.	P F
<b>NOTE:</b> If the repair cost exceeds the MEL, notify the supervisor.	
8. Replace the malfunctioning module/board.	P F
9. Perform a function check.	P F
10. Determine the disposition of the unit.	P F
a. Prepare to release the unit to the user if the function check is satisfactory.	
b. Take the unit out of service if uncorrected deficiencies are present and they present a danger to patients or operator or if the machine could be damaged due to continued use.	
c. Refer to the next higher echelon of maintenance, if necessary.	
11. Complete and file DA Forms 2407 and 2409 IAW TB 38-750-2.	P F
a. Obtain the hand receipt copy of DA Form 2407 from the user if the equipment was repaired in the shop.	
b. Obtain the user's signature for receipt of the unit, as appropriate.	
c. Release the unit to the user.	

**REFERENCES:**

***Required***

***Related***

Manufacturer's Service  
Literature  
TB MED 7  
TB 38-750-2

AR 40-61  
AR 710-2

## GLOSSARY

### SECTION I

#### DEFINITION OF TERMS

Army Training and Evaluation Program (ARTEP). The Army's collective training program that establishes unit training objectives critical to unit survival and performance in combat. They combine the training and the evaluation process into one integrated function. The ARTEP is a training program and not a test. The sole purpose of external evaluation under this program is to diagnose unit requirements for future training.

Battle focus. A process to guide the planning, execution, and assessment of the organization's training program to ensure they train as they are going to fight.

Collective training. Training, either in institutions or units, that prepares cohesive teams and units to accomplish their combined arms and service missions on the battlefield.

Common task. A critical task that is performed by every soldier in a specific skill level regardless of MOS.

Critical task. A collective or individual task determined to be essential to wartime mission, duty accomplishment, or survivability. Critical individual tasks are trained in the training base and/or unit, and they are reinforced in the unit.

Cross training. The systematic training of a soldier on tasks related to another duty position within the same military occupational specialty or tasks related to a secondary military occupational specialty at the same skill level.

Drill. A disciplined, repetitious exercise to teach and perfect a skill or procedure; for example, fire, man overboard, abandon ship, lifeboat, and damage control drills on Army watercraft.

Individual training. Training which prepares the soldier to perform specified duties or tasks related to the assigned duty position or subsequent duty positions and skill levels.

Integration training. The completion of initial entry training in skill level 1 tasks for an individual newly arrived in a unit, but limited specifically to tasks associated with the mission, organization, and equipment of the unit to which the individual is assigned. It may be conducted by the unit using training materials supplied by the school, by troop schools, or by inservice or contract mobile training teams. In all cases, this training is supported by the school proponent.

Merger training. Training that prepares noncommissioned officers to supervise one or more different military occupational specialties at lower skill levels when they advance to a higher skill level in their career management field.

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Mission essential task list. A compilation of collective mission essential tasks which must be successfully performed if an organization is to accomplish its wartime mission(s).

Self-development. Self-development is a planned, progressive, and sequential program followed by leaders to enhance and sustain their military competencies. Self-development consists of individual study, research, professional reading, practice, and self-assessment.

Self-development test. A written test that allows NCOs to measure and guide their growth in skills and competencies they will need as they continue to develop as leaders.

Sustainment training. The provision of training to maintain the minimum acceptable level of proficiency required to accomplish a critical task.

Train-up. The process of increasing the skills and knowledge of an individual to a higher skill level in the appropriate MOS. It may involve certification.

Unit training. Training (individual, collective, and joint or combined) conducted in a unit.

## SECTION II

### ACRONYMS AND ABBREVIATIONS

AC	alternating current
ACCP	Army Correspondence Course Program
AMDF	Army Master Data File
ARTEP	Army Training and Evaluation Program
assy	assembly
DC	direct current
DCMA	direct current milliamperage
DVM	digital voltmeter
GFCI	ground faulty current interrupter
Hg	mercury
HVL	half value layer
Hz	Hertz

IAW	in accordance with
ic	integrated circuit
IMSA	Installation Medical Supply Activity
ITEP	Individual Training Evaluation Program
LED	light emitting diode
mA	milliamperage
mAs	milliamperage second(s)
MEL	maintenance expenditure limit(s)
METL	mission essential task list
ml	milliliter
mm	millimeter
MOPP	mission-oriented protective posture
MOS	military occupational specialty
MOSC	military occupational specialty code
MTP	MOS training plan
NCO	noncommissioned officer
OST	order shipping time
pcb	printed circuit board
PMCS	preventive maintenance checks and services
pot	potentiometer
psi	pounds per square inch
QDCP	quality demand in the control period
rev	revolution

## **STP 8-91A15-SM-TG**

RO	requisitioning objective
ROP	reorder point quantity
rpm	revolutions per minute
sec	second(s)s
SSA	supply support activity
SL	skill level
SM	soldier's manual
SOP	standing operating procedure(s)
TG	trainer's guide
UIC	unit identification code
VAC	voltage alternating current
VDC	voltage direct current

## REFERENCES

New reference material is being published all the time. Present references, as listed below, may become obsolete. To keep up-to-date, see the DA Pam 25-30 (FICHE) publications and Extension Training Materials (ETM) catalog DA Pam 350-100. If referenced documents are not available through your unit, borrow them from your post learning center or library.

### Required Publications

#### Army Regulations (AR)

AR 25-400-2	The Modern Army Recordkeeping System (MARKS)
AR 40-61	Medical Logistics Policies and Procedures
AR 708-1	Cataloging and Supply Management Data
AR 710-2	Supply Policy Below the Wholesale Level

#### Department of the Army Pamphlets (DA Pam)

DA Pam 25-30	Consolidated Index of Army Publications and Blank Forms
DA Pam 25-400-2	Modern Army Recordkeeping System (MARKS) for TOE and Certain Other Units of the Army
DA Pam 710-2-1	Using Unit Supply System (Manual Procedures)
DA Pam 710-2-2	Supply Support Activity Supply System: Manual Procedures

#### Technical Manuals (TM)

TM 8-6515-003-24&P	Unit, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List),for Electrosurgical Apparatus, Model Force 2
TM 8-6520-002-24&P	Unit, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List),for Dental Operating and Treatment Unit, Field, Portable, ADEC Model 3406 Porta-Cart
TM 8-6520-003-24&P	Unit, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List), for Compressor-Dehydrator, Dental, Model M5B (Serial Numbers 2700 and Above)

## **STP 8-91A15-SM-TG**

TM 8-6530-004-24&P	Unit, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List), for Sterilizer
TM 8-6530-009-24&P	Unit, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List), for Ventilator, Volume, Portable Models 750 and 750M
TM 8-6545-001-24&P	Unit, Direct Support, and General Support Maintenance Manual (Including Repair Parts and Special Tools List), for Sink Unit, Surgical Scrub, Field, Serial Numbers 201 - 400

### **Technical Bulletins (TB)**

TB Med 7	Maintenance Expenditure Limits for Medical Material
TB 38-750-2	Maintenance Management Procedures for Medical Equipment

### **Manufacturer's Instructions for :**

Field Dental X-Ray Unit

Blood Recovery Unit

Refrigerated Tabletop Centrifuge

Monitor-Recorder

Defibrillator Module

Single Phase Radiographic Unit (Continental X-Ray Unit)

Programmable Suction Pump

### **Miscellaneous Publications**

AMDF	Army Master Data File
NFPA 99	National Fire Protection Association - Standard 99
USACDA Pam 18-1	Code Reference Guide for the ARMS Monthly AMDF File

**DA Forms**

DA Form 1300-2	Computation Card
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2407	Maintenance Request
DA Form 2409	Equipment Maintenance Log (Consolidated)

**DD Forms**

DD Form 314	Preventive Maintenance Schedule and Record
DD Form 2163	Medical Equipment Verification/Certification

**Related Publications**

**Army Training and Evaluation Program**

8-057-30-MTP	Mission Training Plan for the Medical Company, Main Support Battalion, Heavy Division
8-456-MTP	Mission Training Plan for the Headquarters, Area Support Medical Battalion
8-476-30-MTP	Mission Training Plan for Headquarters and Headquarters Detachment (Dental Service), Medical Battalion (Dental Service)
8-478-30-MTP	Mission Training Plan for the Medical Company/Detachment (Dental Service)
8-705-MTP	Mission Training Plan for the Combat Support Hospital
8-715-MTP	Mission Training Plan for the Field Hospital
8-725-MTP	Mission Training Plan for the General Hospital (500 Bed)
8-765-30-MTP	Mission Training Plan for the Mobile Army Surgical Hospital
8-897-MTP	Mission Training Plan for the Medical Center (Theater Materiel Management)

## **STP 8-91A15-SM-TG**

### **Department of the Army Pamphlets (DA Pam)**

DA Pam 351-20 Correspondence Course Program Catalog

### **Field Manuals (FM)**

FM 25-4 How to Conduct Training Exercises

FM 25-5 Training for Mobilization and War

FM 25-100 Training the Force

FM 25-101 Battle Focused Training

### **Soldier Training Publications (STP)**

STP 21-1-SMCT Soldier's Manual of Common Tasks (Skill Level 1)

STP 21-24-SMCT Soldier's Manual of Common Tasks (Skill Levels 2, 3, and 4)

### **DA Forms**

DA Form 2028 Recommended Changes to Publications and Blank Forms

DA Form 5164-R Hands-On Evaluation

DA Form 5165-R Field Expedient Squad Book

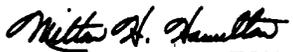
### **DD Forms**

DD Form 2164 X-Ray Verification/Certification Worksheet

STP 8-91A15-SM-TG  
2 MARCH 1995

By Order of the Secretary of the Army:

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**DISTRIBUTION:**

Active Army, USAR, and ARNG: To be distributed in accordance with DA Form 12-11E, requirements for STP 8-91A15-SM-TG, *Medical Equipment Repairer* (Qty rqr block no. 5350)