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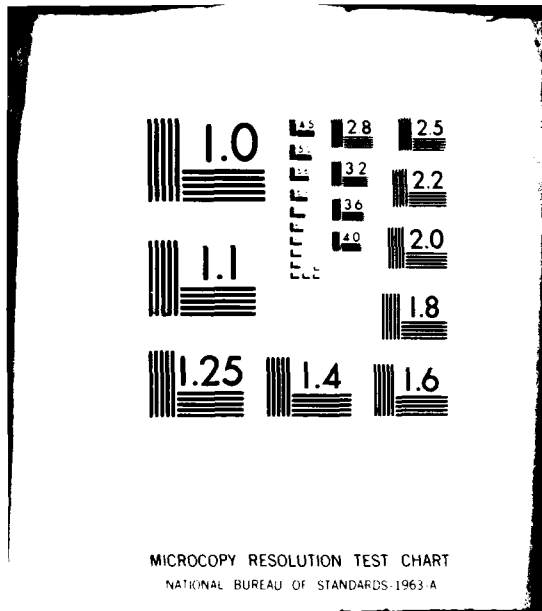
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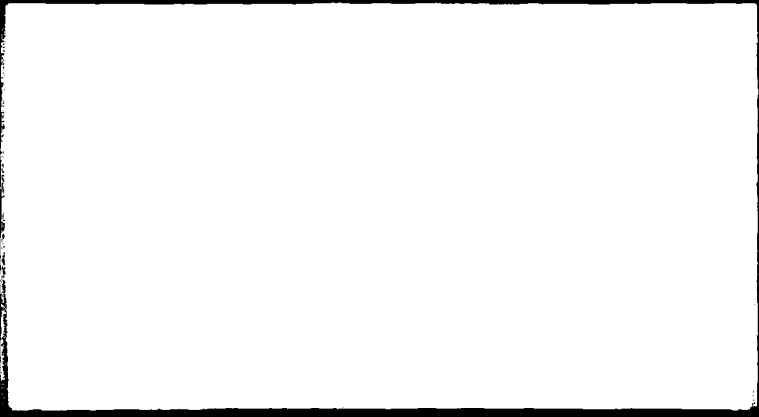
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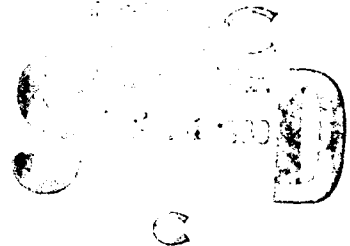
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APPENDIX 42.

COMPETENCY CURRICULA FOR  
MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT  
AND  
MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN

APPLICATION OF A SYSTEM APPROACH  
U.S. NAVY MEDICAL DEPARTMENT  
EDUCATION AND TRAINING PROGRAMS  
FINAL REPORT

AUGUST 31, 1974



Prepared under Contract to  
OFFICE OF NAVAL RESEARCH  
U.S. DEPARTMENT OF THE NAVY

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Program Manager  
Education and Training R&D  
Bureau of Medicine and Surgery (Code 71G)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The study objective consisted of a determination of what the health care personnel in the Navy's Medical Department, Bureau of Medicine and Surgery actually do in their occupations; improving the personnel process (education and training); and building a viable career pathway for all health care personnel. Clearly the first task was to develop a system of job analyses applicable to all system wide health care manpower tasks. A means of postulating simplified occupational clusters covering some 50		

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currently designated Navy enlisted occupations, 20 Naval Enlisted Classification Codes (NEC's) were computerized. A set of 16 groupings that cover all designated occupations was developed so as to enhance the effectiveness of professionals and sub-professionals alike.

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## FOREWORD

The project, "Application of a System Approach to the Navy Medical Department Education and Training Programs," was initiated in May of 1969 as a realistic, comprehensive response to certain objectives set forth in ADO 43-03X, and to memoranda from both the Secretary of Defense and the Assistant Secretary of Defense, Manpower and Reserve Affairs. The Secretary's concern was stated in his memorandum of 29 June 1965, "Innovation in Defense Training and Education." More specific concerns were stated in the Assistant Secretary's memorandum of 14 June 1968, "Application of a System Approach in the Development and Management of Training Courses." In this he called for "vigorous and imaginative effort," and an approach "characterized by an organized training program with precise goals and defined operational interrelation among instructional system components." He also noted, "Job analyses with task descriptions expressed in behavioristic terms are basic and essential to the development of precise training goals and learning objectives."

### The Project

System survey and analysis was conducted relative to all factors affecting education and training programs. Subsequently, a job-analysis sub-system was defined and developed incorporating a series of task inventories ". . . expressed in behavioristic terms . . ." These inventories enabled the gathering of job activity data from enlisted job incumbents, and data relating to task sharing and delegation from officers of the Medical, Nurse and Dental Corps. A data management sub-system was devised to process incumbent data, then carry out needed analyses. The development of initial competency curricula based upon job analysis was implemented to a level of methodology determination. These methods and curriculum materials constituted a third (instructional) sub-system.

Thus, as originally proposed, a system capability has been developed in fulfillment of expressed needs. The system, however, remains untested and unevaluated. ADO 43-03X called for feasibility test and cost-effectiveness determination. The project was designed to so comply. Test and evaluation through the process of implementation has not proved feasible in the Navy Medical Department within the duration of the project. As designed and developed the system does have ". . . precise goals and defined operational interrelation among instructional system components." The latter has been achieved in terms of a recommended career structure affording productive, rewarding manpower utilization which bridges manpower training and health care delivery functions.

### Data Management Sub-System

Job analysis, involving the application of comprehensive task inventories to thousands of job incumbents, generates many millions of discrete bits of response data. They can be processed and manipulated only by high speed computer capability using rigorously designed specialty programs. In addition to numerical data base handling, there is the problem of rapidly and accurately manipulating a task statement data base exceeding ten thousand carefully phrased behavioral statements. Through the use of special programs, task inventories are prepared, printouts for special purposes are created following a job analysis application, access and retrieval of both data and tasks are efficiently and accurately carried out, and special data analyses conducted. The collective programs, techniques and procedures comprising this sub-system are referred to as the Navy Occupational Data Analysis Language (NODAL).

### Job Analysis Sub-System

Some twenty task inventory booklets (and associated response booklets) were the instruments used to obtain job incumbent response data for more than fifty occupations. An inventory booklet contains instructions, formatted questions concerning respondent information ("bio-data"), response dimension definitions, and a list of tasks which may vary in number from a few hundred to more than a thousand per occupational field.

By applying NODAL and its associated indexing techniques, it is possible to assemble modified or completely different inventories than those used in this research. Present inventories were applied about three years ago. While they have been rendered in operational format, they should not be reapplied until their task content is updated.

Response booklets were designed in OPSCAN mode for ease of recording and processing responses.

Overall job analysis objectives and a plan of administration were established prior to inventory preparation, including the setting of provisional sample target sizes. Since overall data attrition was forecast to approximate twenty percent, final sample and sub-sample sizes were adjusted accordingly. Stratified random sampling techniques were used. Variables selected (such as rating, NEC, environment) determined stratifications, together with sub-population sizes. About fifteen percent of large sub-populations were sought while a majority of all members of small sub-populations were sought.

Administration procedures were established with great care for every step of the data collecting process, and were coordinated with sampling and data analysis plans. Once set, the procedures were formalized as a protocol and followed rigorously.

## Instructional Sub-System

Partial "competency curricula" have been composed as an integral sub-system bridging what is required as performance on the job with what is, accordingly, necessary instruction in the training process. Further, curriculum materials were developed to meet essential requirements for implementing the system so that the system could be tested and evaluated for cost effectiveness. However, due to the fact that test and evaluation was not feasible in the Navy Medical Department within the duration of the project, it was not possible to complete the development of the system through the test and evaluation phase. The inability to complete this phase also interrupted the planned process for fully developing the curricula; therefore, instead of completed curricula ready for use in the system, the curricula were partially developed to establish the necessary sub-system methodology. The competency curricula are based on tasks currently performed by job incumbents in 1971. (The currency of a given curriculum depends upon periodic analysis of incumbents' jobs, and its quality control resides in the evaluation of the performance competency of the program's graduates.)

A competency curriculum provides a planned course of instruction or training program made up of sequenced competency units which are, in turn, comprised of sequenced modules. These modules, emphasizing performance objectives, are the foundation of the curriculum.

A complete module would be comprised of seven parts: a cluster of related tasks; a performance objective; a list of knowledges and skills implied by the objective; a list of instructional strategies for presenting the knowledges and skills to the learner; an inventory of training aids for supporting the instructional strategies; a list of examination modes; and a statement of the required training time. In this project, curriculum materials have been developed to various levels of adequacy, and usually comprise only the first three parts; the latter four need to be prepared by the user.

The performance objective, which is the most crucial part of the module, is the basis for determining curriculum content. It is composed of five essential elements: the stimulus which initiates the behavior; the behavior; the conditions under which the behavior takes place; the criteria for evaluating the behavior; and the consequence or results of the behavior. A sixth element, namely next action, is not essential; however, it is intended to provide linkage for the next behavior.

Knowledges and skills listed in the module are those needed by the learner for meeting the requirements of the performance objective.

Instructional strategies, training aids, examination modes and training time have been specified only for the Basic Hospital Corps Curriculum. The strategies, aids and modes were selected on the basis of those considered to be most supportive in presenting the knowledges and skills so as to provide optimum learning effectiveness and training efficiency. The strategies extend from the classroom lecture as traditionally presented by a teacher to the more sophisticated mediated program for self-instruction. The training aids, like strategies, extend from the traditional references and handout material in the form of a student syllabus to mediated programs for self-instruction supported by anatomical models. Examination modes extend from the traditional paper and pencil tests to proficiency evaluation of program graduates on the job, commonly known as feedback. Feedback is essential for determining learning effectiveness and for quality control of a training program. The kind of instructional strategies, training aids and examination modes utilized for training are limited only by such factors as staff capability and training budget.

The training time specified in the Basic Hospital Corps Curriculum is estimated, based upon essential knowledge and skills and program sequence.

The competency curriculum module, when complete, provides all of the requirements for training a learner to perform the tasks set forth in the module. A module may be used independently or related modules may be re-sequenced into modified competency units to provide training for a specific job segment.

Since the curricula are based upon tasks performed by job incumbents in 1971, current analysis of jobs needs to be accomplished using task inventories that have been updated to reflect changes in performed tasks. Subsequent to job analysis, a revision of the curricula should be accomplished to reflect task changes. When the foregoing are accomplished, then faculty and other staff members may be indoctrinated to the competency curricula and to their relationship to the education and training system.

In addition to the primary use for the systematic training of job incumbents, these curricula may be used to plan for new training programs, develop new curricula, and revise existing curricula; develop or modify performance standards; develop or modify proficiency examinations; define billets; credentialize training programs; counsel on careers; select students; and identify and select faculty.

## The System

Three sub-systems, as described, comprise the proposed system for Education and Training Programs in the Navy Medical Department. This exploratory and advanced developmental research has established an overall methodology for improved education and training incorporating every possible means of providing bases for demonstrating feasibility and cost effectiveness. There remains only job analysis sub-system up-dating, instructional sub-system completion, and full system test and evaluation.

## Acknowledgements

The authors wish to acknowledge the invaluable participation of the several thousands of Naval personnel who served as respondents in inventory application. The many military and civilian personnel who contributed to developmental efforts are cited by name in the Final Report.

The authors also wish to acknowledge former colleagues for singularly important contributions, namely, Elias H. Porter, Ph.D., Carole K. Kauffman, R.N., M.P.H., Mary Kay Munday, B.S.N., R.N., Gail Zarren, M.S.W., and Renee Schick, B.A.

Identity and acknowledgement of the project Advisory Group during the project's final year is recorded in the Final Report.

Lastly, the project could not have been commenced nor carried out without the vision, guidance and outstanding direction of Ouida C. Upchurch, Capt., NC, USN, Project Manager.

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MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT

AND

MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN

MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT

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EQUIPMENT REPAIR

ASSISTANT

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

COMPETENCY UNIT I: DENTAL/EENT EQUIPMENT

This unit includes the following modules:

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14	Ophthalmologic Tonometer . . . . .	15
15	Phorometers . . . . .	16
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Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 1: FOOT-OPERATED DENTAL CHAIR

- TASKS
- a. Bleed hydraulic system
  - b. Determine source of leak in hydraulic system
  - c. Repair hydraulic system

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the dental chair  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is necessary, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic hydraulics  
Use of appropriate tools and test equipment  
Principles and techniques of foot-operated dental chair repair

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 2: MOTOR-OPERATED DENTAL/EENT CHAIR

- TASKS
- a. Bleed hydraulic system
  - b. Check switch using voltmeter
  - c. Replace malfunctioning switch
  - d. Replace brushes on AC motors
  - e. Repair hydraulic system

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the motor-operated chair
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is necessary, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic hydraulics  
Basic electronics  
AC motor repair  
Use of appropriate hand tools and test equipment  
Principles and techniques of motor-operated dental/  
EENT chair repair

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 3: BELT-DRIVEN DENTAL HANDPIECE

- TASKS
- a. Adjust air pressure
  - b. Adjust oil drip rate
  - c. Replace cartridges
  - d. Clean water lines
  - e. Adjust end play

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA, working with handpiece attached, will isolate the problem and attempt to remedy it through normal cleaning of handpiece and replacement of cartridge  
(Conditions) Without supervision; using system knowledge; if repair is necessary, minor defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if additional repair is necessary, handpiece must be shipped to manufacturer or depot  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) Notify supervisor/operator of completion of work, or, if necessary, ship to manufacturer or depot for additional repair. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Air, water, and pulley systems in belt-driven dental handpiece  
Venturi/atomizer lubrication theory  
Ability to manipulate small, precision parts  
Use of necessary tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 4: FIELD- AND BENCH-TYPE DENTAL ENGINES

- TASKS
- a. Lubricate equipment
  - b. Tighten nuts, bolts and screws
  - c. Replace brushes on AC motor
  - d. Replace interconnecting wiring
  - e. Replace malfunctioning switch

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of specified dental engine
- (Conditions) Without supervision; using knowledge of system; when minor repairs are necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is necessary, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

AC motors  
Electricity  
Use of necessary tools and test equipment  
Principles and techniques of field- and bench-type dental engine repair

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 5: DENTAL AND OPERATING LIGHTS

- TASKS
- a. Adjust light pattern
  - b. Adjust counterbalance spring
  - c. Make continuity check on transformer
  - d. Replace interconnecting wiring

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of dental or operating lights  
(Conditions) Without supervision; using knowledge of system; minor defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) Notify supervisor/operator of completion of work; ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Safety procedures and requirements
- Spring tension
- Basic electronics
- Adjustment of springs
- Use of necessary hand tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 6: LATHES AND POLISHERS

- TASKS
- a. Check switch using voltmeter
  - b. Replace malfunctioning switch
  - c. Replace brushes on AC motor
  - d. Replace interconnecting wiring
  - e. True scored/pitted commutator

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of lathes and polishers  
(Conditions) Without supervision; using knowledge of system; when minor repairs are necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Electricity  
Repair of AC motors  
Lathe operation  
Lathe applications  
Use of appropriate tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 7: DENTAL OPERATING UNIT, FIELD

- TASKS
- a. Replace "O" rings
  - b. Set zero-pointers on gauges
  - c. Ensure proper air/water supply to syringe
  - d. Instruct user in care and maintenance of equipment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the dental field unit
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is necessary, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Air systems  
Water systems  
Valve and gauge repair  
Use of appropriate hand tools, calculating and testing equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 3: DENTAL OPERATING UNIT, MOBILE

- TASKS
- a. Replace "O" rings
  - b. Lubricate equipment
  - c. Correct retraction mechanism
  - d. Replace pilot lamps
  - e. Sweat copper and brass joints
  - f. Ensure proper air/water supply to syringe

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of mobile dental unit  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Air systems  
Water systems  
Basic electronic systems

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 9: DENTAL OPERATING UNIT, FIXED

- TASKS
- a. Adjust cup filler
  - b. Replace "O" rings
  - c. Ensure proper air/water supply to syringe
  - d. Replace brushes on AC motor
  - e. Correct malfunctioning retractive mechanism
  - f. Sweat copper/brass joints

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of a fixed operating unit  
(Conditions) Without supervision; using knowledge of system; minor defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) Notify supervisor/operator of completion of work; ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Water, vacuum and drainage systems  
Warm water systems  
Air systems  
Electrical systems  
Valve and gauge repair  
Use of appropriate hand tools and test equipment  
Temperature adjustment (warm water)

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 10: DENTAL-MODEL TRIMMER

- TASKS
- a. Sweat copper joints
  - b. Replace malfunctioning switch
  - c. Replace interconnecting wiring
  - d. Make continuity check of transformer windings

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the trimmer  
(Conditions) Without supervision; using knowledge of system; repair on site if possible, where use of water connections and leaks can be determined; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Repairing AC motors  
Use of related hand tools and test equipment  
Soldering/sweating copper tubing  
Water and drainage systems

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 11: DENTAL MOLDING VIBRATOR

- TASKS
- a. Check switch using voltmeter
  - b. Replace malfunctioning switch
  - c. Replace interconnecting wiring
  - d. Replace rubber cover

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the dental molding vibrator
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Electric motors
- Basic electronics
- Use of appropriate tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 12: ELECTRIC DENTAL AMALGAMATOR

- TASKS
- a. Check timer
  - b. Replace brushes
  - c. Make continuity check of transformer
  - d. True scored/pitted commutator using lathe

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of electric amalgamator
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Repairing AC motors
- Mechanical timers
- Lathe operation
- Lathe application
- Use of appropriate hand tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 13: CASTING MACHINES

- TASKS
- a. Determine condition of electrical part by visual examination
  - b. Check spring tension
  - c. Check that holding pin is functioning properly
  - d. Repair electrical parts

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will isolate the problem or defect, and make necessary repairs or instruct operator on proper operation of casting machines  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) All possible precautions are taken to avoid burns; when all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Heat/centrifical force action in metal casting  
Safety procedures for high temperature materials  
Reverse winding of springs for proper tension  
Use of appropriate tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 14: OPHTHALMOLOGIC TONOMETER

- TASKS
- a. Perform preventive maintenance through proper cleaning of instrument
  - b. Check that weights will remain in place during use
  - c. Set zero-pointers on gauges

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform visual inspection to ensure that the unit is clean and that the gauge pointer will return to zero; check to ensure that weights will remain in place during use, and calibrate to zero if necessary  
(Conditions) Without supervision; repair performed on site or in shop  
(Criteria) Unit calibration must be within manufacturer's specifications  
(Next Action) Verify that unit is sterilized before patient use; ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Calibration principles and procedures  
Tonometer application

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 15: PHOROMETERS

- TASKS
- a. Replace burned-out light
  - b. Check switch using voltmeter
  - c. Replace interconnecting wiring
  - d. Bleed hydraulic system
  - e. Repair hydraulic system

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of phorometers  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, components are removed for in-shop repair  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, check out and return components

KNOWLEDGES AND SKILLS

- Basic hydraulics
- Basic electronics
- Use of appropriate tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 16: ENT OPERATING UNIT

- TASKS
- a. Clear clogged atomizer
  - b. Ensure proper air/water supply to syringe
  - c. Replace interconnecting wiring
  - d. Adjust cup filler
  - e. Sweat copper and brass joints

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the ENT unit  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required and the subcomponent can be removed, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if component has been removed, replace and check out unit

KNOWLEDGES AND SKILLS

Air, water and electrical systems  
Basic electronics  
Use of related tools and test equipment  
Sweating of joints

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit I: Dental/EENT Equipment

MODULE 17: SUCTION MACHINES/ORAL CAVITY EVACUATORS

- TASKS
- a. Replace "O" rings
  - b. Replace deteriorated tubing
  - c. Replace filters
  - d. Clean rotor and fins (motor-driven units)

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of suction machines/oral cavity evacuators  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Air venturi/vacuum principles
- Electric motor vacuum application
- Use of appropriate tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

COMPETENCY UNIT II: ANESTHESIA AND SURGICAL SUCTION APPARATUS

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Anesthesia Apparatus . . . . .	20
2	Emerson Phalen and GOMCO Suction Machines. .	21

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit II: Anesthesia and Surgical Suction Apparatus

MODULE 1: ANESTHESIA APPARATUS

TASKS

- a. Check for leaks
- b. Tighten fittings
- c. Replace gaskets and valves

PERFORMANCE OBJECTIVE

(Stimulus) Upon receipt of a work request or during preventive maintenance survey, when anesthesia unit is found to be leaking

(Behavior) The ERA will perform visual inspection and soap solutions-bubble test to isolate leak, and will tighten fittings and/or replace defective gaskets or valves as needed

(Conditions) With minimal supervision (safety); using test solutions and necessary tools and parts

(Criteria) Upon completion of repair, equipment will function properly and safely

(Consequence) A properly operating unit safe for use with explosive gases and in electrically susceptible patient locations

(Next Action) Perform quality assurance test and return to user; supervise entry or personally record necessary information on maintenance records

KNOWLEDGES AND SKILLS

Safety precautions for handling explosive gases as defined by NFPA7613-T, May 1973

System flow of unit

Leak detection tests

Use of leak detection solutions

Principles of anesthesia application

Use of appropriate hand tools

Safety precautions for electrically susceptible patient locations (ESPL)

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit II: Anesthesia and Surgical Suction Apparatus

MODULE 2: EMERSON PHALEN AND GOMCO SUCTION MACHINES

- TASKS
- a. Set zero-pointers on gauges
  - b. Replace deteriorated gaskets, packings, etc.
  - c. Replace "O" rings
  - d. Replace brushes on AC motor

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of suction machines
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Vacuum and pressure systems  
Use of appropriate tools and test equipment  
AC motors

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

COMPETENCY UNIT III: STERILIZERS AND OVENS

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Electric, Gas and Steam Autoclaves . . . . .	23
2	Field Sterilizers . . . . .	24
3	Distilling Equipment. . . . .	25
4	Ovens . . . . .	26

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit III: Sterilizers and Ovens

MODULE 1: ELECTRIC, GAS AND STEAM AUTOCLAVES

- TASKS
- a. Clean traps in return line
  - b. Replace "O" rings
  - c. Replace door gasket
  - d. Adjust door
  - e. Adjust timing mechanism

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of specified autoclave
- (Conditions) With minimal supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if unable to repair installed equipment on site, defective component is removed and repaired in shop
- (Criteria) When all defects are corrected unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Gas/steam sterilization principles
- Temperature/pressure relationships
- Basic electronics
- Pressure vessel safety principles
- Use of tools and test equipment relevant to pressure-related items
- Gas handling safety procedures

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit III: Sterilizers and Ovens

MODULE 2: FIELD STERILIZERS

- TASKS
- a. Perform preventive maintenance
  - b. Replace "O" rings
  - c. Replace door gasket
  - d. Adjust door

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of field sterilizers
- (Conditions) With minimal supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Gas/steam sterilization principles  
Temperature/pressure relationships  
Basic electronics  
Pressure vessel safety principles  
Use of tools and test equipment relevant to pressure-related items  
Gas handling safety procedures

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit III: Sterilizers and Ovens

MODULE 3: DISTILLING EQUIPMENT

TASKS                   a. Replace gaskets  
                          b. Check heating element  
                          c. Replace heating element

PERFORMANCE OBJECTIVE

(Stimulus)            Upon receipt of a work order  
(Behavior)            The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of distilling equipment  
(Conditions)          With minimal supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria)            When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action)         If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Principles of cooling steam through baffles and coils to produce distillate  
Use of related tools and test equipment  
Safety procedures concerning high temperature and pressure

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit III: Sterilizers and Ovens

MODULE 4: OVENS

- TASKS
- a. Determine condition of electrical parts
  - b. Check heating element with meter
  - c. Replace heating element
  - d. Replace interconnecting wiring
  - e. Adjust temperature regulator

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of oven  
(Conditions) With minimal supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Principles of temperature sensing element and electrical control tie-in  
Use of appropriate tools and test equipment  
Technique to adjust temperature regulators

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

COMPETENCY UNIT IV: RESPIRATORS, RESUSCITATORS AND OXYGEN-RELATED EQUIPMENT

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Intermittent Positive Pressure Breathing (IPPB) Machines . . . . .	28
2	Field Resuscitators, AMBU Machines and Inhalator-Aspirators. . . . .	29
3	Infant Respirators . . . . .	30
4	Portable Iron Lung . . . . .	31

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit IV: Respirators, Resuscitators and Oxygen-Related Equipment

MODULE 1: INTERMITTENT POSITIVE PRESSURE BREATHING (IPPB) MACHINES

- TASKS
- a. Check for condition of tubing
  - b. Replace "O" rings
  - c. Check for leaks
  - d. Check for proper adjustment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of IPPB machine  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Connections for oxygen enrichment to system  
Mechanism for addition of medication to system  
Use of related tools and test equipment  
Ability to detect minor leaks and make proper adjustment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit IV: Respirators, Resuscitators and Oxygen-Related Equipment

MODULE 2: FIELD RESUSCITATORS, AMBU MACHINES AND INHALATOR-ASPIRATORS

- TASKS
- a. Replace "O" rings
  - b. Perform preventive maintenance
  - c. Check for deteriorated parts
  - d. Replace worn rubber tubing

PERFORMANCE OBJECTIVE

(Stimulus)	Upon receipt of a work order
(Behavior)	The ERA will isolate the problem or defect, and make necessary repairs or instruct operator on proper operation of the specific device
(Conditions)	Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required work is performed in shop where additional tools and test equipment are available
(Criteria)	When all defects are corrected, unit must function within manufacturer's specifications
(Next Action)	If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Human respiratory system function
- Necessity of maintaining oxygen supply
- Use of appropriate tools and test equipment
- Pressure regulation and adjustment within limits of patient's tolerance

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (FPA)

Unit IV: Respirators, Resuscitators and Oxygen-Related Equipment

MODULE 3: INFANT RESPIRATORS

- TASKS
- a. Check for deterioration of parts
  - b. Check and adjust rate of respiration
  - c. Replace "O" rings, gaskets, etc.

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of infant respirators  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Human respiratory system and limitations for infants
- Use of related tools and test equipment
- Control adjustments for infants

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit IV: Respirators, Resuscitators and Oxygen-Related Equipment

MODULE 4: PORTABLE IRON LUNG

- TASKS
- a. Check for deteriorating parts
  - b. Test alarm system
  - c. Check motor for proper operation

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the portable iron lung  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Basic electronics
- Pulley cycle per minute ratio for adjustment of pressure
- Use of appropriate tools and test equipment
- Procedures to adjust pulley for proper respiratory rate
- Repair of AC motors

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

COMPETENCY UNIT V: STATIONARY ANODE X-RAY EQUIPMENT

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	100 Milliampere/100 Kilovolt X-Ray Unit with Stationary Anode and Hand Timer . . . . .	33

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit V: Stationary Anode X-Ray Equipment

MODULE 1: 100 MILLIAMPERE/100 KILOVOLT X-RAY UNIT WITH STATIONARY ANODE AND HAND TIMER

- TASKS
- a. Check control circuit operation
  - b. Check high-voltage circuit operation
  - c. Check filament-voltage circuit operation
  - d. Check/calibrate equipment
  - e. Make test exposures

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of x-ray unit  
(Conditions) As a safety precaution and to assist in use of test equipment, repair is performed by two ERAs or by one ERA while under supervision/observation of a second ERA or the equipment operator; if repair is necessary, on-site repair is performed, or defective component is removed, repaired in shop and reinstalled; using necessary reference materials, drawings, hand tools, and test equipment  
(Criteria) When all defects are corrected, an operational performance check and test exposure must verify that unit functions within manufacturer's specifications

KNOWLEDGES AND SKILLS

X-ray theory  
Advanced electronics  
Equipment testing, adjusting and calibrating procedures  
Tubehead limits for exposures  
Use of tools and test equipment including dual-trace oscilloscope, step ladder, spin top and test meters  
High-voltage, filament-voltage and control circuit systems

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

COMPETENCY UNIT VI: MISCELLANEOUS EQUIPMENT

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Incubator . . . . .	35
2	Laboratory Incubator. . . . .	36
3	Radiographic Film Dryer . . . . .	37
4	Water Bath With Thermostat. . . . .	38
5	Wheel Chair . . . . .	39
6	Plaster Cast Saw and Cast Cutters . . . . .	40
7	Whirlpools and Whirlpool Baths. . . . .	41
8	Circo-Electric Bed. . . . .	42
9	Paraffin Baths. . . . .	43
10	Microhematocrit Centrifuge and Laboratory Centrifuge. . . . .	44
11	Blood Refrigerators and Plasma Storage Freezers. . . . .	45
12	Refrigerated Centrifuge . . . . .	46
13	Mercury and Aeroid Sphygmomanometers . . . . .	47

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 1: INCUBATOR

TASKS

- a. Set thermostat
- b. Check alarm system
- c. Check condition of port seals
- d. Check heater element

PERFORMANCE OBJECTIVE

(Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of incubator  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Use of appropriate tools and test equipment  
Control and alarm system operation

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 2: LABORATORY INCUBATOR

TASKS                    a. Replace pilot lamp  
                          b. Check heating element  
                          c. Adjust temperature control circuit

PERFORMANCE OBJECTIVE

(Stimulus)                Upon receipt of a work order  
(Behavior)                The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the laboratory incubator  
(Conditions)              Without supervision; using knowledge of system; when repair is necessary, minor defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria)                When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action)             If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Temperature sensing devices  
Temperature control circuit operation  
Use of related tools and test equipment  
Adjustment of temperature regulator

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 3: RADIOGRAPHIC FILM DRYER

- TASKS
- a. Replace pilot lamps
  - b. Check heating element with meter
  - c. Replace heating element
  - d. Test blower fan

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the dryer  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) Upon operational performance checkout, the unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Use of appropriate tools and test equipment  
Adjustment of temperature control (if used)

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 4: WATER BATH WITH THERMOSTAT

- TASKS
- a. Check for leaks
  - b. Replace pilot lamp
  - c. Check heating element
  - d. Adjust temperature control

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the water bath  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Temperature adjustments
- Use of appropriate tools and test equipment
- Adjustment procedures

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 5: WHEEL CHAIR

- TASKS
- a. Check condition of leather/canvas
  - b. Check wheel alignment
  - c. Check position setting for legs
  - d. Adjust wheel alignment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will isolate the problem or defect and make necessary repairs  
(Conditions) Without supervision; using knowledge of unit; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools; if major repair is required, work is performed in shop where additional tools are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Principles of wheel alignment
- Use of appropriate hand tools
- Procedures and techniques of wheel alignment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 6: PLASTER CAST SAW AND CAST CUTTERS

TASKS                   a. Check switch using voltmeter  
                          b. Replace switch  
                          c. Replace brushes on AC motor

PERFORMANCE OBJECTIVE

(Stimulus)            Upon receipt of a work order  
(Behavior)            The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of cast saw and cutters  
(Conditions)          Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria)            Upon an operational performance check, the unit must function within manufacturer's specifications  
(Next Action)        If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Use of appropriate tools and test equipment  
Repair of AC motors

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 7: WHIRLPOOLS AND WHIRLPOOL BATHS

- TASKS
- a. Check water valve for leaks
  - b. Check switch
  - c. Check water-circulation motor

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of whirlpool/whirlpool bath
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, defective component is removed and work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, reinstall component and notify supervisor or operator. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Use of appropriate tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 8: CIRCO-ELECTRIC BED

- TASKS
- a. Check condition of belt, canvas, rubber pulleys and accessories
  - b. Check motor for proper operation

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the circo-electric bed
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Use of related tools and test equipment
- Repair of AC motors

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (EPA)

Unit VI: Miscellaneous Equipment

MODULE 9: PARAFFIN BATH

- TASKS
- a. Check heating element
  - b. Replace heating element
  - c. Replace interconnecting wiring
  - d. Adjust temperature control

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the bath  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair or temperature adjustment is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Basic electronics  
Use of appropriate tools and test equipment  
Temperature adjustment procedures

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 10: MICROHEMATOCRIT CENTRIFUGE AND LABORATORY CENTRIFUGE

- TASKS
- a. Replace brushes on AC motor
  - b. Check timer
  - c. Check electric brake

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the specified centrifuge  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Principles of substance separation by centrifugal force
- Use of related tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 11: BLOOD REFRIGERATORS AND PLASMA STORAGE FREEZERS

- TASKS
- a. Check alarm system
  - b. Adjust temperature controls
  - c. Isolate to compressor problems

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of refrigerator/freezer, referring compressor problems to Engineering
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required work is performed in shop where additional tools and test equipment are available
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Principles of refrigerator compressors
- Use of appropriate tools and test equipment
- Recognition of refrigeration compressor problems

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 12: REFRIGERATED CENTRIFUGE

- TASKS
- a. Replace brushes on AC motor
  - b. Check timer
  - c. Isolate to compressor problem

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedures to identify defective component, make necessary repairs or instruct operator on proper operation of the centrifuge, referring compressor or loss of cooling fluid problems to Engineering  
(Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if major repair is required, work is performed in shop where additional tools and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Use of related tools and test equipment  
Principles of refrigeration compressors  
Recognition of refrigeration compressor problems

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VI: Miscellaneous Equipment

MODULE 13: MERCURY AND AEROID SPHYGMOMANOMETERS

- TASKS
- a. Check conditions of tubing, pad, etc.
  - b. Set zero-pointers on gauges
  - c. Test against standard

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERA will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the specified sphygmomanometer  
(Conditions) Without supervision; using knowledge of system; minor defects are corrected on site, using necessary hand tools; if necessary, work is performed in shop where additional tools, parts and test equipment are available  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Safety procedures for handling mercury
- Use of needed tools and test equipment
- Procedures to test against specified standards

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

COMPETENCY UNIT VII: SHOP OPERATION

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Routine Shop Operation and Administration . .	49
2	Preventive Maintenance . . . . .	50

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VII: Shop Operation

MODULE 1: ROUTINE SHOP OPERATION AND ADMINISTRATION

- TASKS
- a. Establish stable shop operation for repair and return of equipment to users
  - b. Perform routine administrative duties

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of new directive or when operation demonstrates need for improvement
- (Behavior) The ERA will develop a smooth operation where services, assistance and/or repairs are provided with minimum delay
- (Conditions) With minimal or no technical assistance or supervision; using knowledge of regulations and appreciation of the local situation
- (Criteria) Shop functions with minimum disruption in absence of supervisor or senior repairman
- (Next Action) Prepare accurate standard operating procedures for each position when optimum efficiency has been established

KNOWLEDGES AND SKILLS

- Knowledge of human behavior
- Use of technical manuals
- Administrative techniques
- Techniques for supervising personnel
- Awareness of and response to changing situations

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR ASSISTANT (ERA)

Unit VII: Shop Operation

MODULE 2: PREVENTIVE MAINTENANCE

- TASKS
- a. Check electrical hazards
  - b. Check condition of electrical components by visual inspection
  - c. Perform standard tests
  - d. Lubricate equipment
  - e. Touch up paint

PERFORMANCE OBJECTIVE

- (Stimulus) As scheduled by manuals  
(Behavior) The ERA will perform preventive maintenance, testing, lubricating, adjusting, and/or tightening, as necessary  
(Conditions) Without supervision; performed on site using manuals and checklist  
(Criteria) Operational performance test results must be within manufacturer's specifications  
(Next Action) Notify user and ensure proper records are prepared

KNOWLEDGES AND SKILLS

- Preventive maintenance systems and procedures
- Use of appropriate tools and test equipment

EQUIPMENT REPAIR

TECHNICIAN

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

COMPETENCY UNIT I: PATIENT MONITORING AND RECORDING SYSTEMS

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Electronic Cardiac Monitor. . . . .	52
2	EKG Apparatus . . . . .	53
3	EEG Apparatus . . . . .	54
4	Electronic Thermometer. . . . .	55
5	Audiometer. . . . .	56

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit I: Patient Monitoring and Recording Systems

MODULE 1: ELECTRONIC CARDIAC MONITOR

TASKS

- a. Check patient leads
- b. Run test standard
- c. Check capacitors
- d. Calibrate equipment

PERFORMANCE OBJECTIVE

(Stimulus)	Upon receipt of work order
(Behavior)	The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the monitor
(Conditions)	Without supervision; using knowledge of system; on-site repair is performed, if possible, using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop
(Criteria)	When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected
(Next Action)	If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of appropriate tools and test equipment  
Recognition of medical responses displayed on monitor  
Principles of system repair

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit I: Patient Monitoring and Recording Systems

MODULE 2: EKG APPARATUS

- TASKS
- a. Run test standard
  - b. Adjust stylus heat
  - c. Adjust stylus position
  - d. Calibrate equipment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the EKG apparatus
- (Conditions) Without supervision; using knowledge of system; when minor repair is necessary, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of appropriate tools and test equipment  
Knowledge of information recorded and displayed

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit I: Patient Monitoring and Recording Systems

MODULE 3: EEG APPARATUS

TASKS

- a. Read schematic diagram
- b. Check printed circuit board for cracks
- c. Check tubes on tube tester

PERFORMANCE OBJECTIVE

(Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the EEG apparatus  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using manufacturer's literature, manuals, diagrams, parts list and necessary hand tools and test equipment; if on-site repair is not possible or practical work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Requirement for balanced amplifier circuits  
in system

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit I: Patient Monitoring and Recording Systems

MODULE 4: ELECTRONIC THERMOMETER

- TASKS
- a. Run test standard
  - b. Check for broken wires
  - c. Check printed circuit board for cracks
  - d. Test transistor for conductivity

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the electronic thermometer  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Heat sensor conversion to electronic digital printout  
Repair of transistor circuits

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit I: Patient Monitoring and Recording Systems

MODULE 5: AUDIOMETER

TASKS

- a. Replace ribbon
- b. Adjust table stops
- c. Run test standard

PERFORMANCE OBJECTIVE

(Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the audiometer  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Attenuator-driver system and frequency level changes

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

COMPETENCY UNIT II: PATIENT TREATMENT EQUIPMENT

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Infrared and Ultraviolet Treatment Lamps . . .	58
2	Muscle Stimulator . . . . .	59
3	Ultrasonic Therapy Unit . . . . .	60
4	Ultrasonic Nebulizer . . . . .	61
5	Isolette . . . . .	62
6	Defibrillator . . . . .	63
7	Automatic I.V. . . . .	64

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit II: Patient Treatment Equipment

MODULE 1: INFRARED AND ULTRAVIOLET TREATMENT LAMPS

- TASKS
- a. Perform operational test
  - b. Read diagrams
  - c. Calibrate equipment
  - d. Check wires and cables for cracks
  - e. Check tubes

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work request or during a preventive maintenance survey, when equipment is found to be defective/inoperative
- (Behavior) The ERT will make a visual inspection and perform operational checkout to determine if defect is calibration, a component, or an operator problem. Having isolated defect, the ERT will calibrate, repair, and/or instruct operator in proper operation of the lamp(s)
- (Conditions) Without supervision; using manufacturer's literature or technical manuals, necessary tools, parts, and test equipment
- (Criteria) After repair, calibration equipment will perform within tolerances stated in literature; operator will know proper steps in use of equipment
- (Consequence) A properly oriented operator and/or correctly functioning equipment will be available for patient treatment
- (Next Action) Return to user and supervise or record necessary information on maintenance records

KNOWLEDGES AND SKILLS

- Special safety precautions for infrared or ultraviolet rays
- Advanced electronics including transistors
- Use of test/calibrated equipment
- Use of hand tools
- Principles of heat transfer to patient

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit II: Patient Treatment Equipment

MODULE 2: MUSCLE STIMULATOR

- TASKS
- a. Check voltage output
  - b. Replace battery packs
  - c. Survey to determine serviceability

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of muscle stimulator
- (Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Reaction of muscles to low voltage/low current application

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit II: Patient Treatment Equipment

MODULE 3: ULTRASONIC THERAPY UNIT

- TASKS
- a. Run test standard
  - b. Check tubes on tube tester
  - c. Check capacitors
  - d. Calibrate equipment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the ultrasonic therapy unit
- (Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Requirement for treatment head to be protected when under test

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit II: Patient Treatment Equipment

MODULE 4: ULTRASONIC NEBULIZER

- TASKS
- a. Run test standard
  - b. Verify proper assembly
  - c. Check printed circuit board for cracks
  - d. Test transistors for conductivity

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the ultrasonic nebulizer
- (Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will no be returned to service until defects are corrected
- (Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Principles of ultrasonic transfer to create mist (tap water--not distilled--goes over transistor)

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit II: Patient Treatment Equipment

MODULE 5: ISOLETTE

- TASKS
- a. Check alarm system
  - b. Check part covers for rips and tears
  - c. Check temperature settings
  - d. Calibrate equipment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of isolette  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of related tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit II: Patient Treatment Equipment

MODULE 6: DEFIBRILLATOR

- TASKS
- a. Check wattage output
  - b. Calibrate equipment
  - c. Check tubes on tube tester
  - d. Check transistors for conductivity

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of defibrillator  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of appropriate tools and test equipment  
Fibrillation of heart and necessity for control of fibrillation  
Wattage limits applicable to shock treatment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit II: Patient Treatment Equipment

MODULE 7: AUTOMATIC I.V.

TASKS

- a. Run test standard
- b. Check printed circuit board for cracks
- c. Check transistors for conductivity
- d. Check capacitors
- e. Calibrate equipment

PERFORMANCE OBJECTIVE

(Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of automatic I.V.  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of appropriate tools and test equipment  
Photoelectric sensor and count systems  
Repair of transistor circuits

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

COMPETENCY UNIT III: LABORATORY EQUIPMENT

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Spectrophotometer . . . . .	66
2	Flame Photometer . . . . .	67
3	pH Meter . . . . .	68
4	Single-Channel Autoanalyzer . . . . .	69
5	Coulter Model S . . . . .	70
6	Automatic Sample Changer . . . . .	71

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit III: Laboratory Equipment

MODULE 1: SPECTROPHOTOMETER

- TASKS
- a. Set zero-pointer on meter
  - b. Check calibration
  - c. Determine condition of electrical parts by visual inspection
  - d. Check tubes on tube tester
  - e. Measure power supply output
  - f. Adjust/check optics
  - g. Run test standard

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of spectrophotometer  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Tests using optical reflection of light  
Adjustment of light source and optical components

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit III: Laboratory Equipment

MODULE 2: FLAME PHOTOMETER

- TASKS
- a. Adjust flame to proper level
  - b. Run test standard
  - c. Measure power supply output
  - d. Check printed circuit board for cracks
  - e. Calibrate equipment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the flame photometer  
(Conditions) Without supervision; using knowledge of system; repair on site or remove defective component, repair and reinstall, using necessary reference materials, hand tools and test equipment  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) Notify supervisor/operator of completion of work. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

- Advanced electronics including transistors
- Use of necessary tools and test equipment
- Principle of flame usage
- Safety procedures for use of gases

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit III: Laboratory Equipment

MODULE 3: PH METER

- TASKS
- a. Set zero-pointer on meter
  - b. Calibrate equipment
  - c. Run test standard
  - d. Measure power supply output
  - e. Check resistors

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of pH meter  
(Conditions) Without supervision; using knowledge of system; when possible, defects are corrected on site using necessary reference materials, hand tools and test equipment; if on-site repair is not possible or practical, work is performed in shop  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) If on site, notify supervisor/operator of completion of work; if in shop, return to user. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
(for units with printed circuit boards)  
Use of required tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit III: Laboratory Equipment

MODULE 4: SINGLE-CHANNEL AUTOANALYZER

- TASKS
- a. Run test standard
  - b. Determine condition of electrical parts by visual examination
  - c. Check rectifier/diode with oscilloscope
  - d. Calibrate equipment

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the single-channel Autoanalyzer
- (Conditions) Without supervision; using knowledge of system; repair on site or remove defective component, repair and reinstall, using necessary reference materials, hand tools and test equipment
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected
- (Next Action) Notify supervisor/operator of completion of work. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of appropriate tools and test equipment

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit III: Laboratory Equipment

MODULE 5: COULTER MODEL S

- TASKS
- a. Run test standard
  - b. Check electronic system with alternator (spider) to isolate electronic defects
  - c. Check printer sled
  - d. Calibrate unit

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of the Coulter Model S
- (Conditions) Without supervision; using knowledge of system; repair on site using necessary reference materials, hand tools and test equipment, or remove defective chassis and exchange for one supplied by manufacturer
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected
- (Next Action) Notify supervisor/operator of completion of work. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of necessary tools and test equipment  
Principles of hematology and parameters associated with test  
Principles of pneumatic and mechanical printer

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit III: Laboratory Equipment

MODULE 6: AUTOMATIC SAMPLE CHANGER

- TASKS
- a. Check mechanical functions
  - b. Check test settings and operating results
  - c. Read schematic diagram

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will perform test procedure to identify defective component, make necessary repairs or instruct operator on proper operation of an automatic sample changer  
(Conditions) Without supervision; using knowledge of system; repair on site or remove defective component/chassis, repair and reassemble, using necessary reference materials, hand tools and test equipment  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications; equipment must be labeled according to electrical leakage test results; unsafe equipment will not be returned to service until defects are corrected  
(Next Action) Notify supervisor/operator of completion of work. Repair or dispose of items with excessive electrical leakage through proper channels, attending to necessary administrative procedures. Ensure proper maintenance records are prepared

KNOWLEDGES AND SKILLS

Advanced electronics including transistors  
Use of appropriate tools and test equipment  
Technique to isolate electronic from mechanical or electromechanical defects  
Test standards for system

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

COMPETENCY UNIT IV: X-RAY EQUIPMENT

This unit includes the following modules:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	100 Milliampere/100 Kilovolt X-Ray Unit with Rotating Anode and Electronic Timer . . .	73
2	300 Milliampere/300 Kilovolt X-Ray Unit with Rotating Anode and Electronic Timer to 1/60 Second . . . . .	74
3	500 Milliampere/500 Kilovolt X-Ray Unit with Ultraspeed Rotating Anode and Electronic Timer to 1/120 Second . . . . .	75
4	1000 Milliampere/1000 Kilovolt X-Ray Unit with Three-Phase Ultraspeed Rotating Anode and Electronic Timer to 1/120 Second . . . . .	76
5	Photofluorographic X-Ray Units . . . . .	77

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit IV: X-Ray Equipment

MODULE 1: 100 MILLIAMPERE/100 KILOVOLT X-RAY UNIT WITH ROTATING ANODE AND ELECTRIC TIMER

TASKS

- a. Check control circuit
- b. Check high-voltage circuit
- c. Check filament-voltage circuit
- d. Calibrate equipment
- e. Make test exposure

PERFORMANCE OBJECTIVE

(Stimulus) Upon receipt of a work order  
(Behavior) The ERT will isolate the problem to control, high-voltage, or filament-voltage circuit and make necessary repairs, or instruct operator in proper operation of the unit  
(Conditions) As a safety precaution and to assist in use of test equipment, repair is performed by two ERTs or by one ERT while under supervision/observation of a second ERT or the equipment operator; using knowledge of x-ray equipment function and application; on-site repair is performed, when possible, or defective component is removed, repaired in shop and reinstalled, using necessary reference materials, drawings, hand tools, and test equipment  
(Criteria) An operational performance check and test exposure verify that unit functions within manufacturer's specifications

KNOWLEDGES AND SKILLS

X-ray theory  
Advanced electronics  
X-ray equipment testing, adjusting and calibration procedures  
Tubehead limits for exposures  
Principles of the control circuit, high-voltage circuit, and filament-voltage circuit  
Use of tools and test equipment, e.g., dual-trace oscilloscope, step ladder, spin top, transistor and capacitor testers

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit IV: X-Ray Equipment

MODULE 2: 300 MILLIAMPERE/300 KILOVOLT X-RAY UNIT WITH ROTATING ANODE AND ELECTRONIC TIMER TO 1/60 SECOND

- TASKS
- a. Check control circuit
  - b. Check high-voltage circuit
  - c. Check filament-voltage circuit
  - d. Calibrate equipment
  - e. Make test exposure

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will isolate the problem to control circuit, high-voltage circuit or filament-voltage circuit and make necessary repairs or instruct operator in proper operation of unit  
(Conditions) As a safety precaution and to assist in use of test equipment, repair is performed by two ERTs or by one ERT while under supervision/observation of a second ERT or the equipment operator; using knowledge of x-ray equipment function and application; on-site repair is performed, when possible, or defective component is removed, repaired in shop and reinstalled, using necessary reference materials, drawings, hand tools, and test equipment  
(Criteria) When all defects are corrected unit must function within manufacturer's specifications

KNOWLEDGES AND SKILLS

X-ray theory  
Advanced electronics  
X-ray equipment testing, adjusting and calibration procedures  
Tubehead limits for exposures  
Principles of the control circuit, high-voltage circuit, and filament-voltage circuit  
Use of related tools and test equipment, e.g., dual-trace oscilloscope, step ladder, spin top, transistor and capacitor testers

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit IV: X-Ray Equipment

MODULE 3: 500 MILLIAMPERE/500 KILOVOLT X-RAY UNIT WITH ULTRA-SPEED ROTATING ANODE AND ELECTRONIC TIMER TO 1/125 SECOND

- TASKS
- a. Check control circuit
  - b. Check high-voltage circuit
  - c. Check filament-voltage circuit
  - d. Calibrate equipment
  - e. Make test exposure

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will isolate the problem to control circuit, high-voltage circuit or filament-voltage circuit and make necessary repairs, or instruct operator in proper operation of unit  
(Conditions) As a safety precaution and to assist in use of test equipment, repair is performed by two ERTs or by one ERT while under supervision/observation of a second ERT or the equipment operator; using knowledge of x-ray equipment function and application; on-site repair is performed, when possible, or defective component is removed, repaired in shop and reinstalled, using necessary reference materials, drawings, hand tools, and test equipment  
(Criteria) When all defects are corrected, unit must function within manufacturer's specifications

KNOWLEDGES AND SKILLS

- X-ray theory
- Advanced electronics
- X-ray equipment testing, adjusting and calibration procedures
- Tubehead limits for exposures
- Principles of the control circuit, high-voltage circuit, and filament-voltage circuit
- Use of related tools and test equipment, e.g., dual-trace oscilloscope, step ladder, spin top, transistor and capacitor testers
- Phasing/voltage requirement for ultraspeed rotating anode

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit IV: X-Ray Equipment

MODULE 4: 1000 MILLIAMPERE/1000 KILOVOLT X-RAY UNIT WITH THREE-PHASE ULTRASPEED ROTATING ANODE AND ELECTRONIC TIMER TO 1/120 SECOND

- TASKS
- a. Check control circuit
  - b. Check high-voltage circuit
  - c. Check filament-voltage circuit
  - d. Calibrate equipment
  - e. Make test exposure

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a work order  
(Behavior) The ERT will isolate the problem to control circuit, high-voltage circuit or filament-voltage circuit and make necessary repairs, or instruct operator in proper operation of unit
- (Conditions) As a safety precaution and to assist in use of test equipment, repair is performed by two ERTs or by one ERT while under supervision/observation of a second ERT or the equipment operator; using knowledge of x-ray equipment function and application; on-site repair is performed, when possible, or defective component is removed, repaired in shop and reinstalled, using necessary reference materials, drawings, hand tools, and test equipment
- (Criteria) When all defects are corrected, unit must function within manufacturer's specifications

KNOWLEDGES AND SKILLS

X-ray theory  
Advanced electronics  
X-ray equipment testing, adjusting and calibration procedures  
Tubehead limits for exposures  
Principles of the control circuit, high-voltage circuit, and filament-voltage circuit  
Use of related tools and test equipment, e.g., dual-trace oscilloscope, step ladder, spin top, transistor and capacitor testers  
Three-phase power usage  
1000 milliamperes/1000 kilovolt power characteristics  
Procedures and techniques to follow three-phase paths and test each phase

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit IV: X-Ray Equipment

MODULE 5: PHOTOFLUOROGRAPHIC X-RAY UNITS

- TASKS
- a. Check radiographic selection
  - b. Check phototimed selection
  - c. Check control circuit
  - d. Check high-voltage circuit
  - e. Check filament-voltage circuit
  - f. Calibrate unit
  - g. Make test exposure

PERFORMANCE OBJECTIVE

- (Stimulus)  
(Behavior) Upon receipt of a work order  
The ERT will isolate the problem to control circuit,  
high-voltage circuit or filament-voltage circuit  
and make necessary repairs or instruct operator  
in proper operation of the photofluorographic  
x-ray unit
- (Conditions) As a safety precaution and to assist in use of  
test equipment, repair is performed by two ERTs  
or by one ERT while under supervision/observation  
of a second ERT or the equipment operator; using  
knowledge of x-ray equipment function and  
application; on-site repair is performed, when  
possible, or defective component is removed, repaired  
in shop and reinstalled, using necessary reference  
materials, drawings, hand tools, and test  
equipment
- (Criteria) When all defects are corrected, unit must function  
within manufacturer's specifications

KNOWLEDGES AND SKILLS

- X-ray theory
- Advanced electronics
- X-ray equipment testing, adjusting and calibration  
procedures
- Tubehead limits for exposures
- Principles of the control circuit, high-voltage  
circuit and filament-voltage circuit
- Use of appropriate tools and test equipment, e.g.,  
dual-trace oscilloscope, step ladder, spin top,  
transistor and capacitor testers
- Light amplification by projection of x-ray  
beam on fluorescent screen
- Timing circuits
- 70mm camera functions

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

COMPETENCY UNIT V: SHOP ADMINISTRATION

This unit includes the following module:

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Shop Administration and Management . . . . .	79

Competency: MEDICAL/DENTAL EQUIPMENT REPAIR TECHNICIAN (ERT)

Unit V: Shop Administration

MODULE 1: SHOP ADMINISTRATION AND MANAGEMENT

- TASKS
- a. Perform routine administrative duties
  - b. Arrange for expeditious repair and return of equipment
  - c. Prepare periodic reports

PERFORMANCE OBJECTIVE

- (Stimulus) Upon receipt of a new directive or when the need to change operations becomes apparent
- (Behavior) The ERT will develop a functional operation whereby services and repairs are provided with minimal delay and accurate records are maintained
- (Conditions) With minimal or no technical assistance or supervision; based on local regulations and directives
- (Criteria) Shop functions well in absence of supervisor
- (Consequence) New personnel will be able to function with minimal training
- (Next Action) When optimum efficiency is established, prepare accurate standard operating procedures and desk/repair area directives for each position

KNOWLEDGES AND SKILLS

- Principles of personnel management
- Use of technical manuals
- Administrative techniques
- Techniques to supervise personnel
- Awareness of and response to changing situations

END

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