D E P A R T M E N T O F T H E A R M Y T E C H N I C A L B U L L E T I N

PROCEDURES FOR SELECTION, TRAINING, TESTING AND QUALIFYING OPERATORS OF EQUIPMENT/SYSTEMS, EXCLUDING SELECTED WATERCRAFT AND AIRCRAFT, MANAGED/SUPPORTED BY US ARMY TROOP SUPPORT AND AVIATION MATERIEL READINESS COMMAND

This copy is a reprint which includes current pages from Changes 1 through 5.

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y
2 5 J U L Y 1 9 7 7

CHANGE

NO. 5

HEADQUARTERS
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WASHINGTON, D.C., 18 April 1994

Technical Bulletin

PROCEDURES FOR SELECTION, TRAINING, TESTING, AND QUALIFYING OPERATORS OF EQUIPMENT/SYSTEMS EXCLUDING SELECTED WATERCRAFT AND AIRCRAFT, MANAGED/SUPPORTED BY U.S. ARMY TROOP SUPPORT AND AVIATION MATERIAL READINESS COMMAND

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Appendix H	---	H-1 thru H-50

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Chapter 4	9 and 10	9 and 10
Chapter 5	15 and 16	15 and 16
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PROCEDURES FOR SELECTION, TRAINING, TESTING AND QUALIFYING OPERATORS OF EQUIPMENT/SYSTEMS EXCLUDING SELECTED WATERCRAFT AND AIRCRAFT, MANAGED/SUPPORTED BY US ARMY TROOP SUPPORT AND AVIATION MATERIEL READINESS COMMAND

Headquarters, Department of the Army, Washington, DC
25 July 1977

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help Improve this manual If you find any mistakes or if you know of a way to improve the procedures. please let us know Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to Commander, US Army Aviation and Troop Command. ATTN AMISAT-I-MP, 4300 Goodfellow Blvd, St Louis. MO 63120-1798 A reply will be furnished directly to you.

*This TB supersedes TB 600-1, dated 8 May 1970

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CHAPTER 1

INTRODUCTION

1. Purpose. This bulletin outlines a system for selecting, training, testing and qualifying operators of equipment/systems, excluding selected watercraft and aircraft, managed/supported by the US Army Troop Support and Aviation Materiel Readiness Command (TSARCOM).

2. Scope. This bulletin prescribes the steps necessary in selecting and training operator instructors and examiners and in selecting training, examining and supervising operators of TSARCOM managed/ supported equipment/systems, excluding selected watercraft and aircraft.

3. Applicability. a. Every person operating any of the following equipment must possess a valid Standard Form 46 (US Government Motor Vehicles Operator's Identification Card)

(1) Electrical Power Generating Equipment 0 5 KW and above (Electric Motor Driven-EMD, Diesel Engine Driven-DED, Gasoline Engine Driven-GED, and Gas Turbine Driven-GTD Sets).

(2) Gas Generating Equipment - All sizes and capacities (oxygen, nitrogen, acetylene, etc).

(3) Water Purification Sets - All sizes and capacities.

(4) Compressors, Air All pressures, 150CFM and below (not to include installed automatically controlled units).

(5) Railroad Equipment All sizes and capacities (locomotives, locomotive cranes, and motor cars).

(6) Bridging Equipment All Bridge Erection Boats, Mobile Assault Float Bridge/Ferry, Transporters and Outboard Motors.

(7) Amphibious Equipment - All sizes and capacities (LARC 5, 15, and 60).

(8) Heating and Cooling Equipment All sizes and capacities (Air Conditioning and refrigeration units powered by liquid fuel engines, space and duct-type heaters using liquid fuel).

(9) Pumping Equipment - All pumps 50 GPM and above when powered by liquid fuel engines.

(10) Printing Presses and Paper Cutters All makes and models, excluding manually operated paper cutters.

(11) Mine Detecting Equipment, Truck Mounted - All makes and models.

(12) Utility Element (Power Plant) utilized with the Medical Unit, Self-Contained, Transportable (MUST) hospital elements - All makes and models.

(13) Trucks, Firefighting - All makes and models.

b Miscellaneous Equipment Any equipment determined by the local Commander or higher authority to warrant licensing, such as food preparation equipment, field ranges, immersion heaters, laundry equipment, detecting sets, mine portable, AN/PRS-7 and AN/PSS-11, etc.

NOTE

The procedures in this bulletin do not include selected watercraft (floating cranes, barges, lugs, freight and supply vessels, floating shops, passenger and cargo, utility and picket boats).

4. Objectives of Operator Training. a. The proper selection, training, qualification and supervision of operators is essential for efficient maintenance and operation and insuring materiel readiness.

b. A carefully planned/implemented operator training program is essential to assure selected personnel are knowledgeable in every phase of operation concerning the specific equipment/system

c. Only those of proven qualifications will be authorized to operate TSARCOM managed/supported equipment/systems.

d. Faulty operation and lack of, or improper operator maintenance are recognized as sources of major equipment/system failures Commanders, by eliminating these sources through an active/efficient program of training and supervision, will materially reduce the logistical (maintenance and repair parts) problems, and will insure compliance with the provisions of AR 750-1, regarding command responsibility.

5. Operator Training Program a. AR 750-1 states that prevention of equipment abuse is the commanding officer's responsibility The best way for him to prevent equipment abuse is by proper selection, training, examining, and supervision of operators To establish and maintain operator efficiency, certain definite and progressive steps, covered in this manual, will be followed.

b. Standard Form 46 (United States Government Motor Vehicle Operator's Identification Card) is issued only to persons who have passed examinations conducted by qualified examiners in ac-

cordance with AR 600-55. In addition, operators of:

(1) Amphibian equipment will be marine certified in accordance with AR 56-9 In addition to possessing a Standard Form 46.

(2) Bridge Erection Boats, Mobile Assault Float Bridge/Ferry, Transporter and Outboard Motors will be knowledgeable in Navigation Rules in addition to possessing a Standard Form 46.

c. To be effective, operator training must have the close cooperation and supervision of all Commanders and instructor personnel. The Commander must make certain that adequate time is allowed for training instructor personnel, the operator training program cannot succeed unless its instructors are proficient.

d. As a rule, training and examination of operators will not be decentralized below battalion level Conducting training at this level, fullest use can be made of the best instructor personnel in the organization, a more stringent control/supervision can be applied, and more efficient and economical use can be made of required special equipment.

6. Test Administration and Supply.

a. General testing conditions as outlined in AR 611-5 and AR 611-201 will apply for the administration of operator selection test.

b. Materials and manuals will be requested through normal publication supply channels in accordance with DA PAM 310-8.

CHAPTER 2

PREPARATION FOR CONDUCT OF OPERATOR TRAINING

7. Essential Features. Good operator training results from careful planning and thorough instruction Prior to the start of Instructions, an estimate of the operator training capabilities must be made. Based upon the estimate, plans and schedules are developed, instructors and assistant instructors are selected, detailed and trained. In addition, equipment and training site are obtained and placed in readiness.

8. Training Requirement Estimate. When an officer is detailed to conduct an operator training program, he must immediately make an estimate of the operator training situation Taken into consideration are such matters as:.

a. Number of instructors available.

b. Additional training required by instructor and/or assistant instructor.

c. Number of new operators to be trained.

d. Number of operators that need to be retrained or checked.

e. Caliber and general experience of personnel to be trained.

f . Facilities available, including classrooms, visual aids, shops, equipment and operating range (land and/or water).

g. Work necessary to place equipment and facilities in readiness.

h. How much time is required and available.

9. Planning and Organizing the Program. a. The information developed from the above estimate of training requirements is the basis on which the Commander makes his decision and develops his plan for organizing and carrying out the training program The following are considered:

(1) Number of operators to be trained.

(2) Program or schedule of Instruction.

(3) Student organization.

(4) Number of instructors to be selected and trained, and a schedule covering their Instruction.

(5) Assignments of duties and responsibilities to instructors.

(6) List of equipment, tools, fuel, lubricants, etc.

b. The plan should be based on, and adapted to local requirements and conditions.

10. Selection and Training of Instructors. a. The success of the program depends in a large measure upon the proper selection and training of instructors, and assistant instructors a good operator or specialist will not necessarily make a good instructor.

(1) Interviewing. A competent officer will carefully interview all prospective instructors and assistant instructors to select the best qualified from available resources. As a minimum, the following prerequisites will be considered during this interview:

(a) Is he qualified without limitations to operate the equipments.

(b) Is his technical knowledge and experience adequate for him to instruct with authority.

(c) Does he have the personality and desire to instruct?

(2) Selecting. From the information gained during the Interview, the officer groups the prospective instructors according to their potential ability and selects the best qualified and most experienced individuals for further training.

b. Technical Assistance. To assist Commanders in the training of instructors, technical assistance is available as outlined In AR 700-4 and AR 750-51.

11. Training Instructors and Examiners.

a. Instructors. Regardless of apparent qualifications the selected instructors, and assistant instructors will be given a preliminary course of instruction before being permitted to teach, even though this may delay instruction for student operators This procedure pays dividends in the long run. As a minimum, the preliminary course for instructors and assistants will cover:

(1) The entire course to be given students.

(2) Application of principles prescribed by YFM 21-6.

(3) Controlled observation, and be alert to see student error for on-the-spot correction.

(4) Training in conducting and scoring tests.

b. Examiners. The value of examination will depend largely on the competence of the examiners They should have a thorough knowledge of test administration and equipment operating techniques, and should be periodically checked to insure consistency in their test evaluation. The operator counselers assist in overcoming and correcting physical deficiencies and poor operating habits through counseling and remedial training. To perform this

function adequately, operator counselors should be selected from among those best qualified as operator instructors. They will, in addition, possess.

maturity, tact and the ability to diagnose operator deficiencies and take effective corrective action.

CHAPTER 3

SELECTION AND CLASSIFICATION OF PROSPECTIVE OPERATORS

12. General. a. The objective of a selection program for potential operators is to choose the best individuals from the available resources. Not all personnel that meet the Army's physical standards are necessarily physically, temperamentally and mentally capable of becoming efficient operators. Unless those who do not qualify as good potential operators are eliminated before training starts, they will cause loss of time, damage equipment, and endanger the safety of instructor personnel and fellow trainees.

b. Individuals selected as potential operators will be moderate in habits, alert, dependable, with good judgement and coordination.

13. Screening Prospective Operators. The first step in the selection program must be comprehensive screening of eligible personnel's records DA Form 2-2 (Personnel Qualification Record) or DA Form 348 (Equipment Operator's Qualification Record, except Aircraft) will show the standard score obtained on the Driver Selection Battery I Tests. This score should be the basis upon which selection of operator candidates is made However, to eliminate any chance of error, the results of these tests should be verified by personal interview and observation.

14. Interviewing Prospective Operators. Useful information concerning each individual under consideration may be obtained through a carefully conducted interview. The person being interviewed must understand that the purpose of the interview is to help place him in the work for which he is best qualified. The importance of truthful answers must be emphasized. During the interview any evidence of extreme nervousness, poor hearing, or other abnormal characteristics will be noted.

a. The interview may be opened with introductory remarks such as "you're going to be asked a number of questions about yourself and your operator and driver experience. Answer every question as accurately as you can. Your answers will be used to help place you in work for which you are best qualified". Information obtained during the interview is recorded on DA Form 343. The following questions, (as applicable) are suggested for use in the interview.

(1) How much experience have you had in driving a passenger car?

(2) Approximately how many miles did you drive a passenger car during the past 12 months?

(3) Have you operated any special equipment such as road construction equipment? For how long?

(4) Have you ever driven a truck/tractor- trailer combination?

(5) How much experience have you had driving a truck of 2 1/2 ton capacity or greater?

(6) How much experience have you had driving a vehicle with front wheel drive?

(7) How much experience have you had operating

(a) Generator Sets. 5KW and larger?

(b) Air Compressors, 5CFM and larger?

(c) Pumps, centrifugal, 5 GPM and larger?

(d) Turbine engine powered equipment?

(e) Air Conditioning equipments

(f) Refrigeration equipment?

(g) Bridge erection boats?

(h) Distance measuring equipment?

(i) Printing presses9

(j) Camera equipment9

(k) Bridge transporter/launcher? If yes, identify

(l) Have you any objections to becoming an equipment operator? (If so, explain)

(8) Have you operated any amphibian equipment? If so, for how long? Identify equipment

(9) How much mechanical experience have you had on gasoline and diesel engine powered equipment?

(10) How much operator and/or maintenance training have you received?

(11) Identify equipment on which operator and/or maintenance training has been received

(12) Have you had trouble hearing clearly?

(13) Do you know of any physical defects that might affect you as an equipment operator, on land?

(14) Do you know of any physical defects that might affect you as an equipment operator, on water?

b. If possible, at least 25 percent more personnel than needed should be interviewed to allow for eliminations, due to failure to pass the written or physical requirements or inability to grasp the fundamentals of operating equipment

c. When the number of personnel qualified to re-

ceive the training exceeds the number required, the data obtained during Interviews may be used to select personnel

15. Driver Selection Battery II Tests. **a**. Battery II Tests are a series of written and manual tests to determine driver judgment, visual judgment, and eye-hand coordination Battery II Tests will be administered to selected operator candidates, if the Individual's Battery I score is below 85, or in cases where the selected candidate has not taken the Battery I Tests DA PAM 310-8 provides current form numbers of test booklets, answer sheets and scoring keys.

b. DA Form 6122 (Army Emergency Judgment Test) determines individual reaction to emergency situations The test consists of pictures of situations that may happen while driving on highways and streets For each of these pictures, the student is asked a question about what he would do if he were one of the drivers

c. DA Form 6123 (Army Visual Judgment Test) determines how well the student can pick out words that have the same meaning Each question is made up of one underlined word on the left followed by five more words The student looks at the five words on the right and chooses the one that is exactly like the underlined word on the left Also, the size of the type becomes progressively smaller in the tests

d. DA Form 6124 (Two-Hand Coordination Test) is designed to determine accuracy and speed of hand movement in conjunction with eyesight on the test paper are three double paths of irregularly spaced circles. The circles represent touchdown points for the stylus. The examinee holds a stylus in each hand and at the proper signal walks the stylus from one circle to the next, starting with the left hand and alternating left, right, left, etc.

16. Physical Evaluation Measures. a Physical evaluation tests are intended for diagnostic guidance, and counseling purposes. In addition, they will insure that all operators possess at least minimum physical requirements for safe operation

b. Equipment for the physical evaluation tests is a TSARCOM Item of supply under Federal Class 6930. This equipment includes instructions and material necessary to conduct these tests.

17. Classification of Prospective Operators. The information obtained from the interview, battery tests, and physical evaluation tests is recorded on DA Form 348. This information provides a basis for classification of potential operating ability. Three distinct categories of students are those having:

a. Considerable previous experience in driving vehicles and operating equipment. This group may be the most readily trained In the shortest time, however, they may have formed bad driving and/or operating habits that are difficult to overcome.

b. Limited previous driving and/or operating experience. This group requires more time to train and also may have formed some bad driving/operating habits.

c. No previous driving and/or operating experience. Personnel from this group will often make good operators if they are selected carefully and allocated sufficient training time to compensate for lack of experience.

CHAPTER 4

OPERATOR TRAINING

Section I. PRELIMINARY OPERATOR INSTRUCTION

18. General. This phase of instruction teaches the student administrative procedures that must be performed by the operator-how the equipment is constructed, how to keep the equipment operating properly, and how operating faults are detected and corrected. For students previously qualified to operate equipment, this part of their training may be shortened to include only subjects peculiar to the specific item on which training is being conducted.

a. It is essential for the student operator to become familiar with the major components of the equipment and functions they perform, services for which the operator and other crew members are responsible, emergency repair; field expedients, how to start and warm up the engine; and safety precautions.

b. The instructions/training must be designed to permit student operators to gain sufficient experience, to enable them to demonstrate through performance a general knowledge of and familiarity with proper operation, maintenance and safety procedures. Thorough operator and maintenance training will enable the operator to obtain maximum trouble free operation with minimum mechanical difficulty.

c. The instructor and assistant instructor must assure that correct operating techniques are demonstrated on each new exercise before the student operator attempts the exercise.

19. Safety. AR 385-10 prescribes the Army's Safety Program and assigns safety as a command responsibility Emphasis must be placed on safety throughout the course of instruction/training.

a. Specific safety precautions that must be emphasized during the course of instruction/training are identified in pertinent technical manuals.

b. The student operator must receive adequate instructions on safe practices throughout the training course

c. Instructions will include reporting accidents as set forth in AR 385-40 and local command directives.

20. The Army Maintenance System. The student operator will be taught the categories o maintenance prescribed In AR 750-1, and how the system operates in carrying out maintenance functions from the more simple preventive procedures performed by the operator/crew to the complex overhaul/repair techniques employed at depot level. The importance of the operator's/crew's position in organizational maintenance must be emphasized and the student must be shown where and how the operator fits into the maintenance system/program. Students must also be told why a thorough knowledge of their job and proper performance of the individual's duties are essential for an efficient organization (AR 750-1).

21. Publications, Forms, Reports and Equipment Logbook. The equipment operator is directly concerned with publications, forms, reports and equipment logbooks used in the daily operation and maintenance of equipment. Instructions will include familiarization with the following forms and publications to insure proper maintenance and control of military equipment (DA PAM 738-750).

a. Equipment Logbook. The Army Equipment Logbook assembly is a major element of the equipment records system. It was designed to be the primary historical record for each individual item of equipment. This record begins at the time of delivery by the manufacturer and is maintained until the equipment is "phased out" of the Army inventory. The most important use of the equipment logbook is to provide commanders with up-to-date knowledge of materiel readiness of their equipment.

(1) Identical records are not maintained on all equipment. Therefore, the instructor must insure that emphasis are placed on those records prescribed in DA PAM 738-750 and local command directives for the specific equipment on which instruction/training are conducted.

(2) The student operator should be required to prepare the pertinent records throughout the training course.

b. **Publications**. The operator's manual pertaining to the equipment is carried on the equipment and contains detailed procedures for operation and operator's maintenance as well as a complete description of the equipment and its components

(1) Instructions to the student operator should include a detailed introduction to publications pertinent to operation, operator maintenance and repair parts.

(2) To become thoroughly familiar with pertinent publication(s) the student operator should be required to use the manual(s) throughout the training course.

c. Lubrication Order A lubrication order lb published for most equipment In the Army's Inventory It prescribes the types of lubricants to be used, intervals to be observed, and special precautions to be followed under unusual operating conditions These lubrication services are mandatory.

(1) Instructions to the student operator must include detailed instructions on the pertinent lubrication order(s).

(2) To assure the potential operator is thoroughly familiar with proper procedures, the student should perform a lubrication service during the training course.

d. Standard Form 46 (US Government Motor Vehicle Operator's Identification Card).

(1) The Standard Form 46 Is Issued to qualified operators by the Commanding Officer or authorized supervisor. Facsimile signatures are au thorized in accordance with AR 340-15, but do not relieve the officer whose signature is used from responsibility for the precautions (including numbering and recording the issue of permits) against misuse.

(2) The Standard Form 46 is stamped or marked "ARMY LEARNER" when issued to student operator for use during the operator training course. At the Commander's discretion, the "ARMY LEARNER" permit is not required during operator training course on non vehicular type equipment.

(3) A regular Standard Form 46 will be issued only to individuals who qualify by passing pertinent tests prescribed by AR 600 55 and completing satisfactorily the equipment operator qualification test.

(4) The Standard Form 46 will be completed and authenticated for type, model, or capacity of equipment or type of plant the individual Is qualified to operate.

(5) The battalion. or licensing agency, will maintain a ledger of all Standard Forms 46 issued, including the name of person to whom issued, date, type of equipment authenticated, and authority or certification.

(6) The Standard Form 46, standard operator's permit, will be valid as indicated in AR 600 '55 unless revoked or suspended earlier for cause.

(7) Renewal procedures will be followed when ever a licensed operator is to qualify on an additional item of equipment. Renewal procedures will consist of a re-evaluation of the operator's qualifications and capabilities, and complete satisfactorily the equipment operator qualification test.

e. **DA Form 348 (Equipment Operator's Qualification Record Except Aircraft)** This form provides a means of recording the complete history of an individual's previous operating experience. It should be initiated when the individual is administered the Battery at the reception station. Results of the Battery I will be translated into a standard score and entered on DA Form 2-2 (Personnel Qualification Record) in addition to DA Form 348. If the prospective operator has not attained a score of 85 or higher on Battery 1, he will be given Battery II and the results will be recorded. Results of the physical evaluation tests are recorded on DA Form 348. When the individual is trained to operate non-vehicular equipment, the operating performance test will be completed, when trained to operate amphibian equipment, the results of the road test will be recorded on DA Form 348. When the prospective operator passes the qualification course, the permit number, date, type of permit, and limitations when applicable, will be entered together with the specific equipment qualification in the appropriate blocks on DA Form 348. This form is a permanent record maintained in the Individual's 201 file and remains with the file when transferred. When the individual is assigned operator duties on a daily dispatch basis, DA Form 348 may be withdrawn by regular charge-out procedure and maintained by the officer responsible for unit equipment operation (AR 385 55).

f. Standard Form 91 (Operator's Report of Motor Vehicle Accident). Use of Standard Form 91 is best taught by the practical exercise type of instructions. Non vehicular, vehicular and amphibian equipment should carry Standard Form 91 and all operators must be able to fill it out properly before being issued a Standard Form 46. The student operator must be impressed with the Importance of the SF 91 and necessity for accuracy in filling it out.

g. DD Form 518 (Accident-identification Card) All motor vehicular and amphibian equipment should carry a DD Form 518. This form is used to identify the equipment and organization to which it is assigned. Only the operator's name, social security number, and date are required to complete the form at the time of accident The completed DD Form 518 is presented to the operator of the other equipment(s) involved in an accident (No statement or commitment should be made to the operator of the other equipment involved in an accident).

22. Visual Signals. Signals, when applicable, must be taught thoroughly to insure adequate control, understanding of orders, and cooperative action. They provide flexibility of maneuver in tactical situations, allow for fine adjustments of position

in congested areas, and permit commanders to control a group of motor vehicular equipments without resorting to less secure communication measures. FM 21-60 and TM 5-210 Illustrate and explain these signals.

a. Hand and arm signals can be used to prescribe direction, speed, caution, formation desired, and action expected. These signals may be augmented as need arises, however, care must be taken to avoid confusion and to keep all concerned informed on the meaning and use of additional signals.

b. Flag signals are limited by the colors and numbers of flags available. Green, orange and red flags are available through normal supply channels. Green normally means everything is operational and equipment and crew are ready for orders. Red means danger and warrants investigation. Orange usually indicates equipment out of action but no help needed. By prearrangement, combinations of 2 or all 3 colors can be used to indicate action expected or serve as a warning of gas or chemical attack.

c. Light signals indicating action expected or direction of movement are used in night exercises to control the column and move individual equipment.

d. The use of signals is taught best by illustration, demonstration, and application. Signal drills must be repeated until all students are thoroughly familiar with all signals and can recognize them instantly, demonstrate them properly, and comply with them promptly. Signals (when applicable), should be used throughout the course of instruction

23. Equipment Characteristics and Components. **a**. To become an efficient operator the potential operator must have a thorough knowledge of:.

(1) Characteristics, basic principles and functions of major components concerning the equipment to be operated.

(2) Inspections/checks and preventive maintenance services that must be performed on the equipment to be operated.

(3) The operator's manual pertaining to the equipment on which the instructions are being conducted.

b. Prospective operators should receive instructions on (but not limited to) the following as applicable to the specific equipment on which the instructions are being conducted.

(1) Tabulated data.

(2) Engine and related accessories

(a) Lubrication system, filters and breathers.

(b) Fuel system (filters, strainers, pump, Injectors, etc.).

(c) Turbocharger.

(d) Air cleaner.

(e) Electrical system (starter, alternator, regulator, etc.).

(f) Safety devices.

(g) Exhaust system.

(h) Cooling system.

(i) Cold weather starting device.

(3) Fuel tank and day tank.

(4) Instruments and controls.

(a) Cab panel instruments.

(b) Cab controls.

(c) Main instrument panel and controls.

(d) Marine operator's station instruments and controls.

(5) Lighting system.

(6) Electrical system.

(a) AC Generator.

(b) Electric governor.

(c) Voltage regulator.

(d) Excitation system assembly.

(e) Relays.

(f) Circuit boards.

(g) Load connectors.

(7) Hydraulic system.

(a) Tank.

(b) Pump.

(c) Sump.

(d) Filter.

(e) Cooler.

(f) Actuator.

(g) Cylinder.

(8) Brake system.

(9) Air system.

(10) Compressor and reservoir.

(11) Steering System, Vehicular and/or marine.

(12) Power train:

(a) Transmission.

(b) Power take-off.

(c) Universal joints.

(d) Propeller shafts.

(e) Clutch.

(f) Transfer case.

(g) Differential.

(h) Wheel suspension.

(i) Wheel wells.

(j) Filters and breathers.

(k) Propeller.

(13) Bilge pumps.

(14) Marine drive.

(15) Superstructure.

(16) Capstans.

(17) Radio-Intercom.

(18) Personnel heater

(19) Evaporator.

(20) Compressors
(21) Heat exchanger
(22) Safety valves

24. Tools and Equipment. Prospective operators should be instructed that each major item of equipment is issued with the necessary tools, publications and equipment for its operation and operator/crew maintenance. This phase of instruction must be designed for the potential operator to gain a general knowledge of the tools, publications and equipment essential for the specific equipment on which the instruction/training are conducted.

25. Fire Prevention and Firefighting. All prospective operators must be made aware of the danger of fire on or within the equipment to be operated. Rags, spilled oil, gasoline, diesel fuel and cleaning fluids in open containers must be removed from the equipment prior to working on electrical components, or starting the engine. Emphasis must be placed on fire prevention and proper use of fire extinguishers.

26. Operator Maintenance. a. The operator, although not expected to be a trained mechanic, is the most important single factor in preventive maintenance. Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain in serviceable condition and prevent breakdown. Another function that must not be neglected nor its importance overlooked is reporting potential and known malfunctions/problems which the operator is unable to diagnose and/or not authorized to repair/correct. Reporting these potential and known problems helps reduce costly repairs and overhauls.

b. During this phase of Instruction, specific emphasis should be placed on the operator's responsibility regarding maintenance. In addition, this phase of instruction must be designed for the potential operator to gain a thorough knowledge of:

(1) The operator's manual and lubrication order applicable to the specific equipment on which the instruction/training is conducted.

(2) Forms and records that must be prepared by the operator In accordance with TM 38-750 and local command policy.

(3) Preventive maintenance checks and services performed before, during and after operation. They consist of detailed inspection by the operator and/or crew before operation, observation of instruments and controls during operation, and inspection and servicing after operation. The objective of these services is to ascertain that the equipment is-ready for service before it is operated, be sure it performs properly during operation, and restore it to as near the original condition as possible after operation.

(4) Preventive maintenance services (other than routine daily check and services) They consist of detailed inspection and services not performed on a daily basis and includes lubrication services. Emphasis should be placed on service intervals that must be applied during normal and abnormal operating conditions.

(5) Early diagnosis, and prevention of common equipment failures.

(6) Proper use of tools and equipment.

(7) Proper procedures for handling of petroleum (TM 10-1101).

c. During the course of instruction/training the prospective operators should perform the preventive maintenance services, to assure proper procedures are thoroughly understood.

27. Starting, Warm-up, and Stopping Procedures. This phase of instruction/training should be designed for the potential operator to gain a thorough knowledge of proper starting, warm-up and stopping procedures.

a. The starting, warm-up, and stopping procedures are not identical for all equipment. Therefore, procedures prescribed in the pertinent equipment technical manual should be taught.

(1) Instructions should include cold weather and electrical slave starting procedures.

(2) In general, a fast idle is satisfactory for engine warm-up. Prospective operator should be aware that rapid acceleration or deceleration is harmful to a piston type engine, and that the hand throttle should be used to hold the engine at a constant speed until engine is warm and the engine oil pressure is normal. Warm-ups permit the metals to expand uniformly and engine lubricants to circulate thoroughly.

(3) After operation, the engine should run at an idle speed for a short period before stopping it, to prevent uneven cooling and distortion of metal.

b. The prospective operator should demonstrate familiarity with proper procedures by performing an engine starting, warm-up, and stopping exercise.

28. Field Expedients and Repair. Properly instructed operators/crews with thorough knowledge of their equipment, can often make temporary repairs to a disabled item of equipment that will enable them to take it to a maintenance facility. However, care must be exercised in teaching expedient repair, since some expedient repairs might make the equipment unsafe to operate and/or be extremely harmful to the equipment and should be resorted to only in case of extreme emergency.

29. Washing and Cleaning. Procedures for washing and cleaning are not identical on all equipment. The proper washing and cleaning procedures that the potential operator must be knowledgeable of are prescribed in the pertinent equipment technical manuals on which the instruction/training are conducted.

a. In general, equipment is cleaned after each day's operation, and during normal operations, should be washed on a weekly basis. In this phase of instructions attention should be directed at:

(1) Spilled oil, grease and fuel must be promptly wiped up with rags and cleaning solvent to prevent fire hazards.

(2) Mud, sticks, small stones, wire, etc. , often become lodged in and around suspension systems and wheel wells and must be removed so the operator can make a thorough inspection of the equipment.

Section II. TRAINING IN OPERATING

30. Operation of Equipment. a. The operator/crew should know how to perform every operation of which the equipment/system is capable.

(1) During this phase of instruction, the potential operator should perform each exercise satisfactorily before going on to the next.

(2) Supervision must be rigid to prevent any trial-and-error type operation and accidents.

b On each new exercise, and before the potential operator attempts the exercise, the instructor or assistant instructor will demonstrate the correct operating procedure.

c This phase of instruction/training must be designed.

(1) For the potential operator to apply knowledge gained during the preliminary training.

(2) To permit sufficient operating experience, to enable the potential operator to habitually follow the proper procedures and techniques in manipulating the controls and satisfactorily operate the equipment on which the instructions are being conducted.

d. Throughout this phase of training the potential operator should maintain a separate DA Form 2404 (Equipment Inspection and Maintenance Work Sheet) which is turned in to the instructor after each day's operation. These forms can serve as a valuable aid in determining the effectiveness of inspections and services the equipment received.

e. During this phase of instruction, emphasis should be placed on (but not limited to) the following as applicable to the specific equipment on which the instruction is conducted:

(1) Safety

(2) Before, during, and after preventive maintenance services (include procedures concerning extreme hot and cold climatic condition)

(3) Starting, warm-up and stopping procedures (should include cold weather starting and electrical slave starting).

(4) Instruments and manipulation of controls (how they work and what each signifies).

(5) Operating procedures applicable to:

(a) Non-vehicular/amphibian equipment.

(b) Motor vehicular equipment.

(6) Entering the water and vehicular-to-amphibian changeover (assure that all personnel are instructed to wear a life jacket, prior to entering the water).

(7) Amphibian operating procedures.

(a) Trimming the unit.

(b) Positioning marine drive.

(c) Bilge pumps.

(d) Vessel handling/operating, including training m navigation rules (nautical inland waterways).

(e) Operation when marine drive is not operational.

(8) Superstructure operations.

(a) Safety precautions

(b) Hydraulic controls and functions.

(c) Connecting and disconnecting procedures.

(d) Operating by hydraulic slaving in the event engine, transmission or hydraulic pump are mechanically disabled.

(9) Leaving water and amphibian-to-vehicular changeover.

(a) Piloting to shore.

(b) Amphibian-to-vehicular changeover.

(c) Leaving water.

(d) After amphibian preventive maintenance services.

(10) Procedures to apply when approaching shore and leaving water, entails operating over rock, or coral, sand and mud.

(11) To prevent damage to equipment and assure readiness, after operation instructions must include procedures concerning extreme (hot and cold) climatic conditions.

(12) Procedures concerning communication and navigation equipment must also be included.

f: As a direct result of tactics used in the past and the need for increased mobility in the future, schedules show increased emphasis on night training For the potential operator to gam confidence in blackout operations, special training and practice

time is required. Several hours should be allotted for this training or it can be included during night field problems. The special training is especially essential for amphibian and bridge, erection operations.

g. All bridge boat operators should be trained on P navigation rules (inland waterways).

CHAPTER 5

QUALIFICATION AND LICENSING

Section I. QUALIFICATION

31. General. Qualification will be based largely upon operating ability but inspections, services, and procedures must not be neglected nor their importance overlooked.

32. Mechanical Knowledge. ***a.*** As a minimum, operators selected for licensing will demonstrate satisfactorily a mechanical knowledge of the specific equipment for which a Standard Form 46 is sought Each potential operator will be examined on the:

(1) Ability to identify all major components of the equipment and their basic functions.

(2) Familiarity with the applicable operator's manual and lubrication order

(3) Ability to demonstrate satisfactorily the preventive maintenance service the operator must perform During this demonstration the potential operator should be authorized to use the pertinent operator's manual and lubrication order, and DA Form 2404, (Equipment Inspection and Maintenance Work Sheet).

b. Standards for this type of test must be high Procedures must be impartial and thorough to insure desired results. Each potential operator should be tested individually.

c. Inasmuch as Troop Support and Aviation Materiel Readiness equipment includes a wide variety, such as: poor generating, marine, bridge launching, rail equipment, etc., no single written test regarding technical knowledge is outlined for all equipment. The appendixes contain suggested questions for a written test, on selected items of equipment, that may be used to evaluate the potential operator's technical knowledge. At the Commander's discretion, similar tests may be prepared, using data from pertinent operator's manual, applicable to equipment on which instruction/training is conducted.

d. The appendixes also contain suggested instructor checklists, on selected items of equipment, that may be used to record the potential operator's ability to perform preventive maintenance services. Similar checklist should be prepared on the specific equipment on which instruction/training is conducted.

33. Operating Proficiency ***a.*** The operating proficiency test, the final examination of the potential operator, is designed to determine the individual's ability to perform every operation of which the equipment is capable

b. The manner m which the individual operates the specific equipment should clearly indicate familiarity and self confidence.

c. In cases where equipment is manned by a crew, each crew member must demonstrate familiarity and self confidence at each operating station.

d. Appendixes include suggested instructor's checklist on selected items of equipment that may be used to record the potential operator's performance during the proficiency test. At the Commander's discretion similar checklist may be prepared for the specific equipment on which the instruction/training is conducted.

Section II. LICENSING

34. Licensing. ***a.*** Successful completion of the prescribed tests qualify an individual to be licensed for the equipment(s) on which the individual passed tests. Specific nomenclature of the equipment will be entered on the Standard Form 46 (US Government Motor Vehicle Operator's Identification Card).

b. The standard operator's permit (Standard Form 46) will be issued to the individual. The permit will be completed and authenticated for type, model, or capacity of equipment the holder is qualified to operate.

c. Permits will be authenticated by the Commanding Officer or the authorized supervisor. Facsimile signatures are authorized in accordance with AR 340-15, but do not relieve the officer whose signature is used from responsibility for the precautions (including numbering and recording the issue and permits) against misuse.

d. The battalion or licensing agency, will maintain a ledger of all permits issued, including the name of the person to whom issued, date, type of permit, and authority of certification. Permits will

be valid, as indicated in AR 600-55 unless revoked or suspended earlier for cause. Renewal procedures will be followed whenever a licensed operator is to qualify on an additional item of equipment. Renewal procedure will consist of an examination of the operator's qualification record, physical evaluation, and operating performances.

e. Marine personnel will be license/certified IAW AR 56-9.

CHAPTER 6
SUPERVISION OF OPERATORS

35. Necessity for Supervision. Training and examination of equipment operators must not stop with the issuing of a Standard Form 46. To maintain operator efficiency, training and examination must be continuous. This continuous training and examination is accomplished by supervision. Any work not carefully and continually supervised will eventually fall below satisfactory standards. Operators not supervised, form one bad habit after another until maintenance facilities cannot keep the equipment operational. Usually, a high equipment deadline rate or unusually heavy maintenance workload can be traced directly to lack of adequate supervision of operators.

36. How to Supervise Equipment Operators. ***a.*** Supervision is a principal duty of every officer and noncommissioned officer in the Army. In order for anyone to supervise operators, he must know how the equipment should be operated, be able to recognize equipment abuse, and know where and when these abuses are most likely to occur.

b. A practical method of discovering operator faults and equipment abuse is to spot check operators while performing, before, during and after operation services, and while operating the equipment at the job site. On the spot instructions should be given to correct operator faults when noted. However, If not practical at the time a note should be made of any deficiencies found, so that the operator can be given required instructions on the subject after the equipment is shut down.

37. Periodic Evaluation of Operators. Equipment operators will be re-evaluated on an annual basis (more frequent when accident records or readiness posture warrants) to determine weak points and/or bad habits they may have formed. Each operator should be given additional training as needed. This re-evaluation and training procedure is essential in maintaining operator efficiency. Short of continuous on-the-spot supervision, it is the only method of discovering and correcting bad habits that even the best operators form. Reevaluating and retraining procedures should be just as thorough as those used to train and examine new operators.

38. Incentive for Operators to Excel. ***a.*** Every organization needs an incentive system to inspire its equipment operators to improve themselves and their operating ability. Competitive maintenance inspections, unannounced maintenance inspections, and surprise field exercises are only a few of the means available to the Commander that enables him to determine the state of maintenance and operator training in the unit.

b. Equipment operators who have exceptional operating performance and safety records for at least one year are eligible for safety awards under the provisions of AR 385-10 and AR 600-55. In recognition of merit, operators of special mechanical equipment may have "Army Expert" stamped on their permits. Non-vehicular equipment operators may have "Master Operator" stamped on their Standard Form 46.

CHAPTER 7

PREFACE

39. Military leaders have recognized training as the most important unit activity in peacetime. Preparing and conducting this training is the military leader's most difficult, but most important job. Accomplishment of a unit's mission can only be completed when soldiers meet the established standards of performance.

There are currently over 40,000 tactical power generators being used in the Active Army. It is obvious that with this large amount of equipment, prevention of abuse, and material readiness are prime concerns to Commanders. Improper operation and lack of operator maintenance have been identified as the direct source of major equipment failures. The best way to prevent problems of this type is by creating and implementing an efficient operator training program. However, this process is not always simple to accomplish.

Many of the Army Regulations and other directives specifying the procedures and guidance to train generator operators have been rescinded. Additionally, those publications that are still current are unclear or outdated. The intent of this packet is to specify the necessary publications and outline procedures to be used for selection, training, testing, and qualifying operators on mobile electric power generators. The information in this packet is written non-specifically and in a general format for adaptability to any unit and their organic equipment.

This packet is designed to be used in conjunction with the references listed in Chapter 13. The subjects and information listed in Annexes are written in an outline form. These subjects are required for instruction when training and qualifying personnel to operate generators. A recommended (SAMPLE) training program, to include lesson plans, performance, and written test have been incorporated in this packet (APPENDIX H). This program was written for a 5KW generator set and can be adapted, with modification, to any of the DOD family of generators. The use of the recommended training program in Appendix H, will allow flexibility and adaptability to any unit and it's mission.

With this packet, Commanders will be able to effectively train and qualify personnel to operate generators. Any comments or suggestions should be forwarded to Commandant, US Army Engineer School, ATTN: ATZT-TDI-G, Ft. Belvoir, VA 22060.

The words "he, him, and his" when used in this publication, represents both the masculine and feminine genders, unless otherwise specifically stated.

CHAPTER 8

INTRODUCTION

40. PURPOSE To provide general guidance for use in selecting, training, and qualifying operators of Electric Power Generating Equipment 0.5 KW to 100 KW gasoline or diesel engine driven.

41. SCOPE This publication identifies the steps necessary to:

a. Select instructors

b. Train instructors

c. Select Examiners

d. Train examiners

e. Select operators

f. Train operators

g. Examine and qualify operators

42. APPLICABILITY: Every person who operates generators, regardless of their size, must possess a valid Standard Form 46 (US Government Motor Vehicle Operators Identification Card). Standard Form 46 is issued only to persons who have passed examinations conducted by qualified examiners in accordance with AR 600-55.

43. OBJECTIVES OF OPERATOR TRAINING: The proper selection, training, qualification, and supervision of equipment operators is essential for efficient maintenance and safe operation. A carefully planned/implemented operator training program will assure selected personnel are knowledgeable in every phase of operation concerning their specific generator. Commanders, by initiating an active and efficient program of training and supervision, will reduce maintenance and repair parts problems, and insure compliance with the provisions of AR 750-1.

CHAPTER 9

SELECTION AND CLASSIFICATION OF PROSPECTIVE OPERATORS

44. GENERAL: The objective of selecting potential operators is to choose the best individuals from the available resources. Selection of good potential operators will prevent loss of time, damage to equipment, and will not endanger the safety of instructor personnel or other trainees. Individuals selected as potential operators will be moderate in habits, alert, dependable, with good judgment and coordination.

4**5. SCREENING PROSPECTIVE OPERATORS:** The first step in the selection of prospective operators is a comprehensive screening of eligible personnel records. DA Form 2-2 (Personnel Qualification Record) or DA Form 348 (Equipment Operator's Qualification Record, except Aircraft) will show the standard score obtained on the Driver Selection Battery I Tests and aptitude-area GM of the Army Classification Battery. The results of these tests should be verified, because these scores will establish the basis upon which the selection of operator candidates is made.

46. INTERVIEWING PROSPECTIVE OPERATORS: Useful information concerning each individual under consideration may be obtained through a carefully conducted interview. This allows the prospective operator to understand that the interview will help to place him in the work for which he is best qualified.

The interview should open with introductory remarks that will tell the person what the interview consists of and why he is being interviewed. Sample questions can be, but are not limited to the following:

a. Have you ever had any experience operating generator sets?

b. Have you any objections to becoming an equipment operator?

c. How much mechanical experience have you had on gasoline and diesel engine powered equipment?

d. How much operator and/or maintenance training have you received?

e. On what equipment did you receive the operator and/or maintenance training?

If possible, at least 25% more personnel than needed should be interviewed to allow for failures to pass the examinations, or inability to grasp fundamentals of operating equipment. If the number of personnel qualified to receive training exceeds the number required, data obtained during the interview can be used to select personnel.

47. CLASSIFICATION OF PROSPECTIVE OPERATORS: The information obtained from the interviews battery tests, and evaluation tests will be recorded on DA Form 348. This information provides a basis for classification of potential operators into three distinct categories:

a. Those having considerable previous experience in operating equipment.

b. Limited previous operating experience.

c. No previous operating experience.

CHAPTER 10

PREPARATION FOR CONDUCTING OPERATOR TRAINING

48. TRAINING REQUIREMENT ESTIMATE: After the decision to conduct operator training has been made, then an estimate of the training required should be made. Take into consideration such matters as:

a. Number of instructors available.
b. Additional training required for instructor and/or assistant instructor.
c. Number of new operators to be trained.
d. Number of operators that need to be retrained or checked.
e. Quality and general experience of personnel to be trained.
f. Facilities available, such as classrooms, visual aids, shops, equipment, and operating area.
g. Work necessary to place equipment and facilities in readiness.
h. How much time is required and available.

49. PLANNING AND ORGANIZING THE PROGRAM: Once the information from the requirement estimate has been developed, then a plan can be created for organizing and carrying out the program. Consider the following:

a. Number of operators to be trained.
b. Program or schedule of instruction.
c. Student organization.
d. Number of instructors to be selected and trained and a schedule covering their instructors.
e. Assignment of duties and responsibilities to instructors.
f. List of equipment, tools, fuel, lubricants, etc.

50. SELECTION OF INSTRUCTORS: Success of the training program largely depends upon the proper selection and training of instructors, and assistant instructors. At a minimum, instructors will possess the following qualifications:

a. Be a reliable and responsible individual.

b. Be thoroughly familiar with the instruction to be given.

c. Be willing to instruct.

d. Have adequate technical knowledge, experience, and be capable to instruct with authority.

e. Be a qualified and licensed operator for the equipment being instructed, with at least one year of operating experience.

NOTE: Remember, if you do not have qualified personnel in your unit, you should contact your Direct Support Unit (DSU) for assistance.

51. TRAINING OF INSTRUCTORS: Regardless of the apparent qualifications the selected instructors, and assistant instructors will be given a preliminary course of instruction, before being permitted to teach. At a minimum, the preliminary cause for instructors and assistants will cover:

a. The entire course to be given to the students.

b. Application of principles prescribed by FM 21-6.

c. Controlled observations, and being alert to see student error for on-the-spot correction.

d. Training in conducting and scoring tests.

52. TRAINING EXAMINERS- Examiners should have a thorough knowledge of test administration, and equipment operating techniques. They should be checked periodically to insure consistency in their test evaluation. The examiner also has the responsibility to overcome and correct physical deficiencies and poor operating habits through counseling and remedial training.

CHAPTER 11

OPERATOR TRAINING

53. GENERAL:

a. Preliminary Operator Instruction: During this phase of the instruction, the student learns about the administrative procedures to be performed by the operator; how equipment is constructed, how to keep equipment operating properly, and how operating faults are detected and corrected. Instruction and training must be designed to allow student operators to:

(1) Gain sufficient experience operating equipment.
(2) Enable them to demonstrate (through performance) a general operational knowledge of proper operating of equipment, safety, and maintenance.
(3) Familiarize themselves with proper operation procedures.

The instructor and/or assistant instructor must assure that correct operating techniques are first demonstrated to the student before he attempts the exercise.

54. SUBJECTS TO BE TAUGHT:

a. Safety: AR 385-10 prescribes the Army's Safety Program. Emphasis must be placed on safety throughout the course of instruction/training. Three major areas for instruction are:

(1) Specific safety precautions that must be emphasized during the course of instruction.
(2) The constant instructions on safe practices throughout the training course.
(3) Instruction on reporting of accidents as set forth in AR 385-40, and local directives.

Additionally, all technical manuals contain specific safety instruction that are peculiar to the individual generator they reference. These instructions must be identified and instructed throughout the course.

b. The Army Maintenance System: The student operator will be taught the categories/levels of maintenance as prescribed in AR 750-1, and how the system operates when carrying out maintenance functions. Instruction will cover procedures from the most simple preventative maintenance performed by the operator/crew to the complex overhaul/repair techniques employed at depot level The importance of the operator's/crew's position in organizational maintenance must be emphasized, and the student must be shown where and how the operator fits into the maintenance system/program. Students must also be told why a thorough knowledge of their job, and proper performance of the individuals duties are essential for an efficient organization.

c. Publications, Forms, Reports, and Equipment Records: The equipment operator is only directly concerned with those publications, forms reports, and equipment records used in daily operation and maintenance of equipment. Local standard operating procedures (SOPs) and directives may specify other records, forms, reports, etc, but at a minimum, the following equipment records will be identified, and taught by the instructor:

(1) DA Form 2404 Equipment Inspection and Maintenance Worksheet: This form is used to record equipment faults found during the operator's inspection. It will be used by all operators performing equipment inspections and checks.

(2) DD Form 1970 Motor Vehicle Utilization Record. This form supplies a record for the control of equipment usage, and is used to record data relative to the operation and status of equipment. This form is the official authorization for dispatch of your equipment.

Identical records are not maintained on all equipment. Therefore, the instructor must insure that emphasis is placed on those records prescribed in Appendix E, DA PAM 738-750, and local command directives for the specific equipment on which instruction/training is conducted.

d. Publications: The operator's manuals pertaining to the equipment is usually carried on the equipment, and contains detailed procedures for operation, operators maintenance and a description of the equipment and its components. Instruction to the student operator will include a detailed introduction to publications pertinent to operation, operator maintenance, and repair parts.

Use publications throughout the training course to insure the student operator will become thoroughly familiar with pertinent publications.

e. Lubrications Orders. There are lubrications orders published for every generator in the Army's inventory (ANNEX G). On gasoline engine driven (GED) generators, the lubrication order pertains only to the engine, on diesel engine driven generators (DED) it covers the entire generator set. (CHAPTER 13) Lubrication orders Identify the type

of lubricants to be used, intervals to be followed, special cautions to be observed, and what level of maintenance performs each service. Services listed on the lubrication order are mandatory. Two areas must be covered in the training of student operators:

(1) Detailed instructions on the use of pertinent lubrication orders.

(2) Have the student perform a lubrication service to demonstrate understanding of the service.

f. Standard Form 46 (US Government Motor Vehicle Operator's Identification Card):

(1) The Standard Form 46 is issued to qualified operators by the Commanding Officer, or authorized supervisor. Facsimile signatures are authorized, but do not relieve the officer whose signature is used from responsibility against misuse (AR 340-15).

(2) The Standard Form 46 is stamped or marked "Army Learner" when issued to a student operator for use during the training course.

(3) The regular Standard Form 46 will be issued only to individuals who qualify by passing pertinent tests prescribed by AR 600-55, and satisfactorily completing the equipment operator qualification test.

g. DA Form 348 (Equipment Operator's Qualification Record):

(1) This form provides a means of recording the complete history of an individual's training and operating experience. All training, qualification, and testing dates will be entered together with the specific equipment qualified to operate in the appropriate blocks. This form is a permanent record maintained in the individual's 201 file and remains with the file when the individual is transferred. If an individual is assigned as an operator on a daily basis, DA Form 348 may be withdrawn and maintained by the Officer responsible for unit equipment operation (AR 385-55).

Standard Form 91 (Operator's Report of Motor Vehicle Accident):

(1) Use of Standard Form 91 is best taught by the practical exercise type of instructions. The student operator must be impressed with the importance of the SF 91, and necessity for accuracy in filling it out. All operators must be able to fill out SF 91 properly before being issued a Standard Form 46.

h. Equipment Characteristics and Components:

(1) To become an efficient operator, the student must have a thorough knowledge of:

(a) he DOD Standard Family of Mobile Electric Generator Sets.

(b) Characteristics, basic principles and functions of major components pertaining to the equipment being operated.

(c) Inspections/checks, and preventive maintenance services that must be performed on the equipment to be operated.

(d) Prospective operators should receive instructions on their responsibilities applicable to the specific equipment on which the training is being conducted and their own organic equipment. Training will include, but is not limited to the following:

(1) Tabulated data

(2) Engine

(a) Lubrication system

(b) Fuel system

(c) Air intake system

(d) Electrical system

(e) Safety devices

(f) Exhaust system

(g) Cooling system

(h) Cold weather starting and operating procedures

(i) Controls and instruments

(j) Load connection and output system

(e) Only those maintenance functions authorized to be performed by the operator/crew, as listed in the maintenance allocation chart (MAC), the lubrication order, or the operating chapter in the Technical Manual will be instructed. The operator will not be trained to perform maintenance above his level.

i. Loads and Equipment: Prospective operators should be trained with the necessary tools, publications, and equipment required for the major end item operation and operator/crew maintenance. This phase of the instruction will familiarize the student operators with those items necessary at the operator level.

j. Fire prevention and fire fighting

(1) All prospective operators must be made aware of the danger of fire on or within the equipment to be operated. Rags, spilled oil, gasoline, diesel fuel. and cleaning fluids in open container must be removed from the equipment prior to working on electrical components, or starting the engine. Emphasis must be place on fire prevention and proper use of fire extinguishers.

k. Washing and cleaning: Procedures for washing and cleaning are not identical on all equipment. Operator must be knowledgeable of the procedures in the pertinent equipment technical manual. In general, equipment is cleaned after each days operation, and during normal operations, should be washed on a weekly basis. Cleaning should be directed at:

(1) Spilled oil. grease, and fuel must be cleaned up immediately to prevent fire hazards.

(2) Mud, sticks and small stones that become lodged between the skirts and shrouds of the generator must be removed so the operator can make a thorough inspection.

55. Training the Operator

a. Operation of equipment

(1) The operator/crew should know how to perform every operation of which the generator is capable.

(2) Each exercise should be performed satisfactorily by the potential operator before going on to the next.

(3) Supervision must be strict to prevent any trial-and-error type operation and accidents.

(4) On each new exercise, and before the potential operator attempts the exercise, the instructor will demonstrate the correct procedure.

(5) During this phase of training, instruction must be designed:

(a) For the potential operator to apply knowledge gained during the preliminary training

(b) To permit the student to obtain sufficient operating experience.

(c) To enable the potential operator to follow the proper procedures and techniques in manipulating the controls, and satisfactorily operate the equipment.

(d) For the potential operator to receive practical training initiating and completing DA Form 2404 (Equipment Inspection and Maintenance Work Sheet).

(6) Emphasis should be placed on (but not limited to) the following steps as applicable to the specific equipment on which the instruction/training is conducted:

(a) Safety

(b) Before, during and after preventive maintenance services (including procedures concerning extreme hot, and cold climate condition).

(c) Operating instructions as outlined in the applicable technical manual.

(d) Starting, warm up, and stopping procedures, to include cold weather and electrical slave starting.

NOTE

The starting, warm up, and stopping procedures are not identical for all generators. Procedures prescribed in the pertinent equipment technical manual will be taught.

(e) Instruments and manipulation of controls (how they work, and what each signifies).

CHAPTER 12

QUALIFICATION AND LICENSING

56. General:

a. Qualification will be based largely upon the students operating ability: however, the student must also demonstrate his ability to perform inspections, services, and operating procedures.

57. Mechanical Knowledge:

a. At a minimum, operators selected for licensing will demonstrate a satisfactory mechanical knowledge of the specific equipment for which he is seeking a Standard Form 46. Each potential operator will be examined on the:

(1) Ability to identify all major components of the equipment, and their basic functions.

(2) Familiarity with the pertinent operator's manual and lubrication order.

(3) Ability to demonstrate satisfactorily the preventive maintenance checks and services the operator must perform. During this demonstration, the potential operator will use the appropriate operator's technical manual, lubrication order, and DA Form 2404.

b. Test standards must be high. Procedures must be impartial and thorough. Since no written test regarding technical knowledge is outlined to cover all equipment, the appendixes contain sample written test questions. Similar tests should be prepared, using data from the pertinent operator manual applicable to equipment on which training/instruction is conducted. The appendixes also contain suggested instructor checklists that can be used to test the students performance of maintenance and operating proficiency. Similar checklists can be prepared on the specific equipment used for training.

58. Licensing:

1. Successful completion of the prescribed tests qualify an individual to be licensed for the equipment on which he passed the tests. Specific nomenclature of the equipment will be entered on the Standard Form 46. The permit will be issued to the individual and will be completed and authenticated for the type, model, or capacity of generators the holder is qualified to operate. Permits are authenticated by the Commanding Officer, or the authorized supervisor (AR 340-15).

NOTE: Specific guidelines for completion of SF46 and DA Form 348 are outlined in FM 55-30 (CHAPTER 13).

The Battalion, or licensing agency, will maintain a ledger of all permits issued, including the name of the person to whom issued, date, type of permit and authority or certification. (AR600-55)

CHAPTER 13

REFERENCES

Listed below are the various publications that were used in development of this packet. Also listed are the technical manuals and lubrication orders which Identify the DOD family of power generators. Be sure the manuals and regulations that you use for training are current If you are not sure that your references are up to date, or you have other equipment on hand that is not identified here, refer to the DA PAM 25-30 for a complete listing of current publications.

59 Field Manuals (FM)

FM 22-100	Military Leadership
FM 25-3	How to prepare and conduct military training
FM 20-31	Electric power generation In the field
FM 43-5	Organizational Maintenance management
FM 55-30	Al my Motor transport units and operations
FM 21-17 7	Drivers Selection. Training and Supervision, Tracked Vehicles

60. Technical Manuals (TM)

TM 9-2805-203-14	Engine, gasoline MIL-STD 6HP
TM 9-2805-256-14	Engine, gasoline MIL-STD I I/2 HP
TM 9-2805-257-14	Engine, gasoline MIL-STD 3HP
TM 9-1805-258-14	Engine, gasoline MIL-STD IOHP
TM 9-2805-259-14	Engine, gasoline MIL-STD 20HP
TM 5-6115-329-14	Generator Set 0 5KW DOD Gasoline Engine Driven
TM 5-6115-323-14	Generator Set I 5KW DOD Gasoline Engine Driven
TM 5-6115-271-14	Generator Set 3KW DOD gasoline engine driven
TM 5-6115-596-14	Generator Set 4 2KW 28V DC
TM 5-6115-332-14	Generator Set 5KW DOD gasoline engine driven
TM 5-6115-275-14	Generator Set 10KW DOD gasoline engine driven
TM 5-6115-584-12	Generator Set 5KW DOD Diesel engine driven
TM 5-6115-585-12	Generator Set I OKW DOD Diesel engine driven
TM 5-6115-464-12	Generator Set 15KW DOD Diesel engine driven
TM 5-6115-465-12	Generator Set 30KW DOD Diesel engine driven
FM 5-6115-545-12	Generator Set 60KW DOD Diesel engine driven
TM 5-6115-457-12	Generator Set I 00KW DOD Diesel engine driven
TM 9-6140-200-14	Lead acid battery maintenance

61. Lubrication Orders (LO)

LO 9-2805-203-12	Engine, gasoline MIL-STD 6HP
LO 9-2805-256-12	Engine, gasoline MIL-STD I 1/2 HP

Lubrication Orders (con't)

LO 5-2805-257-12	Engine, gasoline MIL-STD 3HP
LO 5-2805-258-12	Engine, gasoline MIL-STD 10HP
LO 5-2805-259-12	Engine, gasoline MIL-STD 20HP
LO 5-6115-584-12	Generator set 5KW Diesel DOD
LO 5-6115-585-12	Generator set 10KW Diesel DOD
LO 5-6115-464-12	Generator set 15KW Diesel DOD
LO 5-6115-465-12	Generator set 30KW Diesel DOD
LO 5-6115-545-12	Generator set 60KW Diesel DOD
LO 5-6115-457-12	Generator set 100KW Diesel DOD

62. Technical Bulletins (TB)

TB 600-1	Procedures for Licensing Operators of Equipment Managed by the US Army Troop Support and Aviation Materiel Readiness Command.
TB 600-2	Procedures for Selection, Training, Testing, Qualifying, and Licensing Operators of Construction Equipment, Materiel Handling Equipment, and Armor-Vehicle-Launched Bridge (AVLB) Managed/ Supported by US Army Tank & Automotive Readiness Command

63. Training Circulars (TC)

TC 21-5-7	Training Management in Battalions

6. Department of the Army Pamphlets

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms
DA Pam 385-1	Unit Safety Management

64. Army Regulations (AR)

AR 310-25	Dictionary of United States Army Terms
AR 385-10	Army Safety Program
AR 385-40	Accident Reporting and Records
AR 600-55	Motor Vehicle Driver Selection, Testing, and Licensing
AR 750-1	Army Material Maintenance Concepts and Policies
AR 750-5	Organization, Policies, and Responsibilities for maintenance operations

65. TEC Lessons

1-662-051-7601A	Location and Installation of GED Generator Set
1-662-051-7602F	Servicing of GED Generator Set, Part I
1-662-051-7603F	Servicing of GED Generator set, Part II

TEC Lessons (Con't)

1-662-051-7604F	Servicing of GED Generator Set, Part III
1-662-051-7605E	Servicing of GED Generator Set, Part IV
1-662-051-7606F	Preparing the GED Generator Set for Starting
1-662-051-7607F	Preparing the GED Generator Set for Starting and Stopping
1-662-051-7608F	Preparing the GED Generator set for Load
1-662-051-7609A	Tech Tables for SVC & Troubleshooting of GED Generator
1-662-051-7610E	Operation of GED Generator Set
1-662-051-7611F	Temporary expedite repair for Cables
1-662-051-7612A	Compute Load & Selecting Appropriate Generator
1-662-051-7613A	Balancing Load & Drawing Distribution System
1-662-051-7614A	Selecting Proper Line Cable

These TEC lessons should be available at your battalion learning center audio-visual center. If not, you may obtain them by writing to:

Commander
US Army Training Support Center
ATTN: ATIC-AET-TP
Fort Eustis, VA 23604

66. All applicable local Standard Operating Procedures (SOP).

APPENDIX A

REFERENCES

1. Field Manuals

FM 20-31	Electronic Power Generation in the Field
TC 2 1-5-7	Training Management in Battalions
FM 21-6	Technique of Military Instruction
FM 21-60	Visual Signals
FM 2 1-305	Manual for the Wheeled Vehicle Driver

2. Technical Manuals

TM 5-687	Repairs and Utilities, Fire Protection Equipment and Appliances Inspections Operations and Preventive Maintenance
TM 10-1101	Petroleum Handling Equipment and Operation

3. Regulations

AR 56-9	Watercraft
AR 310-25	Dictionary of United States-Army Terms
AR 310-50	Authorized Abbreviations and Brevity Codes
AR 385-10	Army Safety Program
AR 385-40	Accident Reporting and Records
AR 385-55	Prevention of Motor Vehicle Accidents
AR 600-55	Motor Drive-Selection, Testing and Licensing
AR 611-5	Arm Personnel Tests
AR 700-4	Logistic Assistance Program
AR 735-11	Accounting for Lost Damaged and Destroyed Property
AR 750-1	Maintenance Concepts

4. Pamphlets

DA PAM 738-750	US Army Maintenance Management System ■
DA PAM 108-1	Index of army Films, Transparencies, GTA Charts and Recordings
DA PAM 310 Series	Army Personnel Tests and Measurements
DA PAM 611-2	Manual ,for Administration of MOS Evaluation Test

APPENDIX B
SUGGESTED QUALIFYING PROCEDURES FOR GENERATOR OPERATORS

REFERENCE DA PAM 20-31

1. Personnel selected for testing should have a standard score of 100 In aptitude area GM of the Army Classification Battery.

2. It Is recommended that the test questions In Section I and performance test in Section III be used for all generator sets and motor generators.

3. The written evaluation test measures the potential operator's technical knowledge The passing grade is 80 percent. The test consists of 25 questions of which the first 12 are true-false questions and the balance require written (brief) answers. Each question has a value of four points. This test should represent 40 percent of the testing procedures. Applicants failing this test should not be permitted to proceed to the performance test, until the student has completed a retraining period on the technical aspects of the equipment. Answers to the questions in Section 1 are provided in Section II.

4. The performance test measures the student's performance ability on the specific equipment for which a Standard Form 46 is sought. The passing grade for this test is 80 percent, and consists of the preoperational, operational, and postoperational checks. During this performance test the student should be required to use the pertinent operator's manual. This test represents the remaining 60 percent of the testing procedures. The section for air-cooled engines has 25 items to be checked during the proportional, operational, and postoperational check period. Four points will be allowed for each item correctly performed. For liquid cooled and gas turbine engines there are 40 items to be checked. Two and one-half points will be allowed for each correct answer. The motor generator section has 25 items to be checked. Each correct answer is worth four points. Section III provides an Instructor's checklist that should be used to grade the student during the performance test.

SECTION I

TEST QUESTIONS FOR GENERATORS

A. Answer these questions by "True" or "False"

1. A direct current (DC) generator can be used to charge vehicular batteries.

2. Both alternating current (AC) and direct current (DC) generators may be used for providing power for light bulbs.

3. All generator sets should be grounded by a ground-driven metal rod prior to operation.

4. When connecting the wiring of any circuit to a generator, the generator should not be operating.

5. The commutator or slip rings on generator sets ,should be polished at all times.

6. When changing brushes on a generator, the new brushes must fit the commutator and slip rings as, precisely as possible.

7. Stop engine immediately after load operation to prevent excess fuel accumulation In engine combustion chamber.

8. You must put oil in the gasoline for all aircooled engines.

9. After two alternators have been paralleled, the load should be divided between them in proportion to their ratings. That is, the larger the generator, the larger share of the load It should carry.

10. Generator sets should always be operated on a nearly level surface to assure proper engine lubrication.

11. A three-phase 15 KW generator will deliver 15 KW on each phase.

12. If synchronizing lights vary alternately, one bright when the other is dark, vary the speed of one or the other set until the two lights are either bright or dark together.

B. Answer the following questions briefly

13. The frequency of an alternating current is the number of cycles completed in how many seconds?

14. When operating a generator with no load at 60 cycles, a load is applied and there is a cycle drop, they frequently can be corrected by turning what droop adjustment?

15. You must provide power for nine 100-watt light bulbs In a messhall, what KW capacity must the generator set have?

16. When using a three-phase generator set to operate a three-phase motor, if the motor rotates in the wrong direction, what can you do to correct it?

17. When a generator nameplate shows the generator is rated for 120/208 volts, and 240/416 volts, where can you determine which voltage connection is being used if the generator is not operating?

18. If a generator is connected for 120/208 volt operation, where do you obtain the 120 volts, and where do you obtain the 208 volts?

19. If the circuit breaker on a generator set interrupts power to a circuit, what is the most common reason?

20. If a generator is operating normally and not overloaded, but the wires going to the load are warm, what is wrong?

21. When selecting a DC generator for a specific job what are the two most important considerations?

22. When selecting an AC generator for a specific Job what are the four most important considerations?

23. If you have a 25 KW, 60 cycle power requirement on one circuit, and you have two ea 15 KW 60 cycle generators, how can you furnish the required power?

24. A man is unconscious from an electrical shock, what should you do, and In what order?

25. How is phase unbalance corrected?

SECTION II

TEST SOLUTIONS FOR GENERATORS

A.

1. True
2. True
3. True
4. True
5. False
6. True
7. False
8. False
9. True
10. True
11. False
12. False

B.

13. One Second
14. Frequency
15. 1 KW
16. Interchange any two motor leads (wires)
17. At the reconnection panel
18. The 120 volts is obtained between any line and the neutral, and the 208 volts between any two lines
19. The generator IS overloaded
20. The wires are too small
21. The operating voltage and the KW rating
22. ***a.*** Operating voltage
b. The KW rating
c. The frequency (50-60 or 400 cycles)
d. The number of phases

23. By paralleling the two generators.

24. ***a.*** First shut off the voltage
b. Apply artificial respiration
c. Get medical help

25. By equally distributing the total load on all three phases.

SECTION III

INSTRUCTOR'S CHECK LIST

PERFORMANCE TEST FOR GENERATORS

STUDENT'S NAME
RANK
SSN
UNIT/ORGN

A. Air and Liquid Cooled Generators

Preoperational Checks

Item to be checked	OK	Remarks
DA Form 2400 (Equipment Utilization Record)		
Oil		
Fuel		
Connections and Ground Rods		
Covers		
Leaks		
Cold Weather Operation		
Personnel Safety Precautions		
Visual Inspections (Exposed Wiring and Connections)		
(Above checks are to be made on air cooled machines)		
Coolant		
Switches Machine Safety Devices		
Doors and Louvers		
Control Panel		
(All checks listed under preoperational checks are to be made on liquid cooled machines)		

Operational Checks

Item to be checked	OK	Remarks
Starting Procedures		
Voltage (all phases) and Frequency (when applicable)		
Apply Load		
Vibration or Unusual Noise		
Current (alll phases)		
Indicating Lamps		
Cold Weather Operation		
Remove Load		
Stopping Procedure		
Leaks (visual)		
Visual inspection (Exposed Wiring and Connections)		
(Above checks are to be made on air cooled machines)		

Item to be checked	OK	Remarks
Oil Pressure		
Fuel Pressure		
Coolant Temperature		
Output Wattage (KW Meter)		
Paralleling Procedure		
(All checks listed under operational checks are to be made on liquid cooled machines)		

Postoperational Checks

Item to be checked	OK	Remarks
Fuel		
Leaks (visual)		
Visual inspection		
(Exposed Wiring and Connectins)		
Oil		
DA Form 2400		
(Above checks are to be made on air cooled machines)		
Coolant		
Cold Weather Checks		
a Battery Thermostat		
b Coolant Specific Gravity		
Connections		
Doors and Covers Closed		
(Above checks listed under postoperational checks are to be made on liquid cooled machines)		

B. Motor Generator Set

Preoperational Checks

Item to be checked	OK	Remarks
DA Form 2400		
Input Switches "OFF"		
Connection and Ground Rods		
Visual Inspection		
Instruments Zeroed		
Controls In Proper Position		
a Voltage Rheostat		
b Voltmeter Ammeter Selector Switch		
c Unit Parallel Switch		
Output Switch Open		
DA Form 2400		

Operational Checks

Item to be checked	OK	Remarks
Starting Procedure		
Close Input Switches		
Start Machine		
Adjust Voltage		
Check Voltage On All Phases		
Apply Load		

Item to be checked	OK	Remarks
Starting Procedure (Cont'd)		
Check Frequency		
Check Load on All Phases		
Check For Unusual Noises		
Shutdown Procedure		
Remove Load		
Stop Machine		
"Open" Input Switches		

Postoperational Checks

Item to be checked	OK	Remarks
Visual Checks		
Doors and Covers Closed		
DA Form 2400		

C. Gas Turbine Driven Generators

Preoperational Checks

Item to be checked	OK	Remarks
DA Form 2400		
Air Inlet Screens--Doors		
Control Panels		
Leaks (visual) Air, Fuel, Oil		
Major Components		
Oil Level		
Switches		
Machine Safety Devices		
Fuel Atomizer		
Flame Tube		
Vents		
Muffler or Exhaust Tube Assembly		
Personnel Safety Precautions (Clear zone) (Sound)		
Visual Inspections		
(Exposed Wiring and Loose Connections)		
Grounding and Connections		
Cold Weather Operation- Optional		

Operational Checks

Item to be checked	OK	Remarks
Operation Under Unusual Conditions		
Starting Procedures		
False Start Procedures		
Voltage (all phases) and Frequency		
Apply Load		
Current (all phases)		
Indicator Lamps (operation and safety)		
Exhaust Temperature		
Parallel Operation		
Vibration or Unusual Noise		
Leaks (visual) Air, Fuel, Oil		
Cold Weather Operation		
Remove Load		
Stopping Procedure		

Item to be checked	OK	Remarks
Visual Inspection (Exposed Wiring and Connections)		

Postoperational Checks

Item to be checked	OK	Remarks
Air Inlet Screens- Doors		
Fuel		
Connections		
Oil Level		
Vents		
Leaks (visual) Air, Oil, Fuel		
Visual Inspection (Exposed Wiring and Connections)		
Cold Weather Operation -Optional		
DA Form 2400		

APPENDIX C
QUALIFYING PROCEDURES FOR OPERATORS OF OXYGEN-NITROGEN GENERATING PLANTS

1. Personnel selected for testing should have credit for high school chemistry or physics, or have a standard score of 45 or higher on GED test 3, high school level. They should also have normal color perception, good hearing ability and a standard score of 95 or higher in aptitude area GM of the Army Classification Battery.

2. The purpose of this test is to determine if the personnel selected for licensing have sufficient technical knowledge to recognize malfunctions of the generating plant.

3. This test consists of 50 true or false, multiple choice and essay type questions and represents 40 percent of the testing procedures. Each question has a weight of two (2) points. Passing grade is 85 percent. Personnel failing this test will not be permitted to proceed to the performance test. Such failure will disqualify the student for licensing until he has completed a retraining period on the technical aspects of the equipment.

SECTION I

TEST QUESTIONS FOR OXYGEN-NITROGEN

GENERATING PLANTS

A. Answer these questions by "True" or "False"

1. The two major components of air are oxygen and nitrogen.
2. Air is composed of approximately 68 percent nitrogen.
3. Oxygen has a boiling point of -302 6°F.
4. The mixture of oxygen In the air is 21 percent.
5. The chief impurity found In liquid oxygen is Xenon.
6. The temperature of vapor cannot be liquefied, regardless of the pressure applied to it, is known as the critical temperature.
7. Liquid oxygen spilled on the flesh will produce an effect similar to a burn.
8. The fire hazard associated with liquid oxygen Is not the burning of the oxygen, but rather the ability of the oxygen to support combustion.
9. In fighting fires involving liquid oxygen, one advantage of using water is flushing the area to remove the liquid oxygen.
10. When locating the generating plant at the site of operation, the prevailing winds should be taken into consideration.
11. After starting a diesel engine or air compressor, the load should be applied immediately.
12. The air dryers in the generating plant are used to remove any acetylene from the air stream.
13. In heat exchange, heat will always flow from the body with the lower temperature and to the body with the higher temperature.
14. The component used in the refrigeration system to remove heat collected during the refrigerant cycle is known as the evaporator.
15. The function of the oxygen sub-cooler in the generating plant is to lower the temperature of the crude liquid oxygen prior to entering the low pressure column.

B. The next ten questions are multiple-choice type

16. It is extremely important that the air separation unit be perfectly level to assure proper function of the:
a. Refrigerant-air cooler.
b. Refrigerant condenser.
c. Nitrogen subcooler.
d. Distillation column.

17. The type of valve that provides the most accurate control of flow is:
- ***a.*** Globe valve.
- ***b.*** Gate valve.
- ***c.*** Check valve.
- ***d.*** Needle valve.

18. Nitrogen has a boiling point of:
- ***a.*** -109.3°F.
- ***b.*** -322.78°F.
- ***c.*** -297.3°F.
- ***d.*** -308.7°F.

19. The critical temperature of oxygen is:
- ***a.*** -181.84°F.
- ***b.*** -297.3°F.
- ***c.*** 87.9°F.
- ***d.*** -69.9°F.

20. The expansion ratio of liquid oxygen is approximately:
- ***a.*** 696.5 to 1.
- ***b.*** 841.2 to 1.
- ***c.*** 860.6 to 1.
- ***d.*** 754.2 to 1.

21. The valve which drops the pressure and temperature of the entering air and produces the first liquid air in the process is known as the:
- ***a.*** Nitrogen expansion valve.
- ***b.*** Oxygen expansion valve.
- ***c.*** Air expansion valve.

22. The separation of a liquid mixture by vaporizing one component, removing that vapor and condensing it as a separate liquid is known as:
- ***a.*** Absorption.
- ***b.*** Distillation.
- **c.** Solidification.
- ***d.*** Filtration.

23. The purpose of a refrigeration system In liquid oxygen generating plants is to:
- ***a.*** Cool the crude oxygen mixture.
- ***b.*** Cool the nitrogen stream from the low pressure column.
- ***c.*** Aid in removal of heat from the incoming air.
- ***d.*** Provide cooling for the nitrogen subcooler.

24. During production operation, the absorbent bed within the air dryers and oxygen purifiers (hydro-carbon absorbers) is periodically reactivated by a flow of:
- ***a.*** Heated nitrogen.
- ***b.*** Warm air.
- ***c.*** Clean fresh air.
- ***d.*** Carbon dioxide.

25. The valve used to control the liquid level In the high pressure column plus the pressure and rate of flow to the low pressure column is known as:
- ***a.*** Low pressure column drain valve.
- ***b.*** Air expansion valve.
- ***c.*** High pressure column drain valve.
- ***d.*** Oxygen expansion valve.

C. Answer the following questions briefly

26. The most likely cause of an overheating air compressor is _____.

27. What types of safety devices are used to prevent damage to lines and vessels in oxygen generating plants?

28. What reference is used to determine type of lubricants to use and capacities of plant components?

29. What are the functions of an expansion valve?

30. Name the component used to remove water vapor from the air stream during the compression stages.
31. Why are the air dryers necessary in an oxygen-nitrogen generating plant?
32. List the process which air must undergo prior to actual separation of the components into the liquid state.
33. During normal plant operation, what valve controls the liquid level in the high pressure column?
34. What conditions are necessary for heat exchange?
35. What is the method of heat exchange used in oxygen generating plants?
36. What are the three methods by which heat exchange may take place?
37. The temperature at which a liquid will vaporize at a given pressure is known as _____.
38. On a generating plant having the capability of filling gas cylinders, what is the function of the product pump?
39. An appreciable difference in pressure between the product pump discharge gage on the separator panel and the charging manifold gage is an indication of what?
40. How should air pressure be built up or reduced in air drier cylinders?
41. What is the importance of assuring a flow through the reactivation heater prior to turning the heater on?
42. A gradually increasing difference between the discharge pressure of the air compressor(s) and the pressure at the inlet to the air expansion valve is an indication of what?
43. For varying heat loads in a refrigeration system, the device which will allow a given maximum flow of refrigerant for a certain maximum heat load is known as a _____.
44. What four functions does the fuel Injector of a diesel engine perform?
45. A machine which converts mechanical energy into electrical energy is known as what?
46. What chemicals are used In the oxygen purity test solution?
47. What color coding is used to identify an oxygen cylinder?
48. What immediate action should be taken if any portion of the body or clothing is exposed to a chemical?
49. What items of protective clothing should a person wear when handling liquid oxygen or nitrogen in an open system?

SECTION II

TEST SOLUTIONS FOR OXYGEN-NITROGEN GENERATING PLANTS

1. True
2. False
3. False
4. True
5. False
6. True
7. True
8. True
9. True
10. True
11. False
12. False
13. False
14. False.
15. False
16. ***d.***
17. ***d.***
18. ***b.***
19. ***a.***
20. ***c.***
21. ***c.***
22. ***b.***
23. ***c.***

24. ***a.***
25. ***d.***
26. Leaking valves.
27. Pop safety valves and rupture discs
28. Official DA Lubrication Order
29. ***a.*** To reduce pressure
b. To control flow
30. Condensate traps
31. To remove remaining traces of water vapor from the air stream prior to cooling.
32. ***a.*** Filtering
b. Compression
c. Drying
d. Cooling
e. Expanding
33. Oxygen expansion valve
34. A temperature difference must exist between the two bodies involved
35. Conduction
36. ***a.*** Conduction
b. Convection
c. Radiation
37. The boiling point
38. To compress gaseous oxygen or nitrogen into gas cylinders connected to a charging manifold.
39. The high-pressure oxygen filter is becoming clogged
40. Slowly
41. To prevent burning out of the reactivation heater
42. Carbon dioxide snow or water ice is clogging the high pressure air circuit
43. Thermostatic expansion valve (TEV)
44. ***a.*** Creates the high pressure required for injection
b. Meters and Injects the fuel
c. Atomizes the fuel
d. Provides a continuous fuel flow for cooling the injector itself.
45. A generator
46. a. Ammonium Chloride
b. Ammonium Hydroxide
47. Green
48. Wash with clear water
49. ***a.*** Clean cotton coveralls
b. Asbestos gloves
c. Face shield

SECTION III

INSTRUCTOR'S CHECKLIST FOR

PERFORMANCE AND PROFICIENCY TEST

4. The purpose of the Performance and Proficiency Test is to verify the ability of the personnel selected for licensing to satisfactorily perform proportional, operational and postoperational checks and to demonstrate proficiency in operating the generating plant.

5. This test consists of a number of proportional, operational and postoperational checks and represents the remaining 60 percent of the testing procedures. There are 100 items to be checked during this test. One point will be allowed for each item correctly performed. The potential operator should be authorized to use the pertinent operator's manual during this exercise. The passing grade is 70 percent.

Proportional Checks

Item to be checked	OK	Remarks
Equipment, General		
a Correctly positioned		
b Correct and secure blocking		
c Leveling jacks secure		
d Unit level		
e Unit properly grounded		
Basic Issue Items and Operating Supplies		
a Prescribed items and quantities		
b Damage or breakage to components of purity test sets		
Visual Inspection		
Check entire plant for deficiencies such as		
a Insecure mountings		
b Loose or missing bolts and nuts		
c Damage		
Lubrication		
Lubricate in accordance with current DA LO		
Connecting Piping and Electrical Cables		
Check that there are no deficiencies, such as		
a. Improper coupling		
b Potential leaks		
c. Exposed wire or frayed insulation		
Diesel Engine(s)		
a. Visual Inspection		
(1) Secure mountings		
(2) No leaks, general		
(3) Accessories		
(4) Instruments		
(5) No damage		
b V belts proper tension and alignment		
c. Crankcase oil level		
d Radiator coolant level		
e Fuel		
f Batteries		
(1) Electrolyte level		
Cables, secure and no corrosion		
g Clutch disengaged		
Air Compressor(s)		
a. Visual Inspection		
(1) Secure mounting		
(2) No leaks, General		
(3) Instruments		
(4) No damage		
b V belts -proper tension and alignment		
c Crankcase oil level		
d Force feed lubricator		
(1) Oil level		
(2) Operation		
e Blowdown valves on condensate traps open		
Refrigerant Compressor		
a Visual Inspection		
(1) Secure mountings		
(2) No leaks, general		
(3) Instruments		
(4) Crankcase oil level		
b Manual valves properly set		
c Drive belts- proper tension and alignment		
d Condenser- no damage		
Electrical		
a. AC Generator and/or Electric Drive Motors		
(1) Properly serviced		
(2) V belts -proper tension and no wear		
(3) Secure mountings		

Item to be checked	OK	Remarks
b Personnel Heaters		
(1) Secure mountings		
(2) No damage		
c Wiring no loose connections or frayed insulation		
Air Purifier (Caustic)		
a Visual Inspection		
(1) No leaks, general		
(2) Secure pump and motor mountings		
(3) Free rotation of pump and motor shaft		
(4) Prepare fresh solution of caustic		
Air Driers and Crude Oxygen Purifiers (Hydrocarbon Absorber)		
a Determine which vessel is to be used by checking previous operational data sheets		
b Perform proper valve settings		
Valves and Controls		
a No damage or loose connections		
b Properly set		
Instruments		
Check all gauges and instruments for deficiencies, such as		
a Broken glass		
b Damage condition		
c Proper mounting		
d Loose fittings or connections		
Fire Extinguishers		
a Full charge		
b Proper quantity and correct location		
c Securely mounted		
Cleaning		
Insure that all equipment is clean and free of dirt, oil or grease		

Operational Checks

Item to be checked	OK	Remarks
Diesel Engine(s)		
a Visual Inspection		
(1) Leaks, general		
(2) Excessive vibration		
b Unusual noises		
c Observe all instrument readings--record on operational data sheet every hour		
Air Compressor(s)		
a Visual Inspection		
(1) Leaks, general		
(2) Excessive vibration		
b Unusual noises		
c Proper operation of lubricator		
d Blowdown condensate traps as required		
e Observe all instrument readings- record on operational data sheet every hour		
Refrigeration Compressor		
a Visual inspection		
(1) Leaks, general		
(2) Correct oil level		
b Unusual noises		
c Check for proper compressor cooling		
d Observe all instrument readings--record on operational data sheet every hour		
Electrical		
a. Compressor drive motor(s) -operating properly, no unusual noises		
b AC Generator supplying proper voltage, no unusual noises		
c. Condenser fan motor(s)		
d Lights		
e Proper operation of 24 volt system		
f Proper operation of personnel heaters		
g Proper operation of reactivation plant heater(s)		
Visual Inspection		
Check entire plant for deficiencies, such as		

Item to be checked	OK	Remarks
a. Insecure mountings		
b Loose or missing nuts and bolts		
c Mechanical damage		
d Drive belts slipping or misaligned		
e Valves and piping leaking		
Instruments		
a. Check all plant instrument readings and record on operational data sheet every hour		
b Check instruments periodically for erratic variations in pressures and temperature readings		
Unusual Operation and Noises		
a Vibration		
b Overheating		
c Unusual Operation		
c Unusual Operation		
d Unusual Noises		
Shutdown Precautions		
a Check that plant reactivation heater is turned off		
b Check that the refrigeration system is properly "pumped down"		
c Open condensate blowoff valves before stopping air compressor		
d. Idle diesel engine(s) with no load for 5 minutes to dissipate heat in the engine block and head		
Electrical Power Cables and Interconnection Piping		
Check for deficiencies, such as		
a Exposed wires or frayed insulation		
b Loose couplings and fittings		
Diesel Engine(s)		
a. Visual Inspection		
(1) Secure mountings		
(2) Inspect all fuel, coolant and lube oil lines and accessories for leaks		
b Inspect V-belts for signs of wear and proper tension		
c Check crankcase oil level, add oil if necessary		
d Radiator -add coolant if necessary		
e Fuel--refill fuel tank		
f Batteries -inspect and add electrolyte if necessary		
Air and Refrigerant Compressors		
a Visual Inspection		
(1) Secure mountings		
(2) Inspect drive belts for signs of wear and proper tension		
b Inspect all lines, fittings and valves for signs of leaks		
Lubricant		
Lubricate in accordance with current DA LO		

APPENDIX D
QUALIFYING PROCEDURES FOR OPERATORS OF ACETYLENE GENERATING PLANT

1. Personnel selected for testing should have credit for high school chemistry or physics, or have a standard score of 45 or higher on GED test 3, high school level. They should also have normal color perception, good hearing ability and a standard score of 95 or higher in aptitude area GM of the Army Classification Battery

2. This test consists of fifty (50) true or false and multiple choice type questions and represents 40 percent of the testing procedure. Each question has a weight of two (2). The passing grade is 85 percent.

3. Personnel failing this test will not be permitted to proceed to the performance test, such failure will disqualify the student for licensing until he has completed a retraining period on the technical aspects of the equipment.

SECTION I
TEST QUESTIONS FOR ACETYLENE GENERATING PLANT

A. Answer these questions by "True" or "False"

1. If the supply water is at a temperature of 70°F or above, it must be passed through the heat exchanger

2. C_2H_2 is the formula for acetylene in the pure state but the impurities in our form of production changes the formula to $COC_2H_2(OH)$.

3. The acetylene compressor is driven by a three phase motor.

4. The air compressor discharges at approximately 40 psig.

5. The purpose of the chock valve in the flashback arrestor is to prevent the water from draining back into the generator.

6. Always leave the resting position of the throat cleaner handle in the horizontal position so that there is no possibility of the throat being collapsed during operation.

7. There are four intercoolers to remove moisture in the acetylene compression system.

8. Fusible plugs on the acetylene cylinder may be removed and replaced if defective by the operator.

9. The air used in the safety control instruments fluctuates between 15 and 30 psig even though the compressor puts out 40 psig.

10. The generator tank check valve operates on air pressure.

11. The pulsator mechanism is employed to agitate the carbide valve.

12. The high and tow level alarm controller operates the residue drain valve.

13. The pressure setting for the standby hopper is two pounds lower than the acting on the operating hopper.

14. An increase in acetylene tank pressure causes the carbide valve to open wider and admit more carbide.

15. The inlet water valve must be kept closed during operation except when adding water to the compressor tank.

16. Make up water is delivered to the heat exchanger automatically during operation.

17. All water pumps are operated manually during normal operation.

18. All safety instruments must be adjusted daily to compensate for adverse operating conditions.

19. Acetone is used in acetylene cylinders because it acts as a stabilizing agent for acetylene.

20. Excessive pressure in the first or second stage of the acetylene compressor indicates valve trouble in the next higher stage.

B. Multiple Choice Questions

Each of the following questions or statements is followed by four possible choices. There is only one best choice Read each question carefully and mark an X through the letter representing the best choice.

EXAMPLE Which of the following is not included in stencil weight of an acetylene cylinders?

a. Weight of empty cylinder.
b. Weight of acetone it should contain.
c. Weight of the cylinder cap.
d. Weight of the cylinder valve.

1. What Is the maximum cubic feet per hour the trailer mounted acetylene plant is capable of producing?
a. 650.
b. 750.
c. 1000.
d. 1200.

2. The pulsator assembly is operated by means of:
a. Air pressure.
b. Acetylene pressure.
c. Water pressure.
d. Spring tension.

3. Which of the following is not a property of acetylene?
a. Colorless.
b. Slightly heavier than air.
c. Mildly pleasant odor.
d. Slightly anesthetic.

4. How many stages of compression does the acetylene compressor have?
a. One.
b. Two.
c. Three.
d. Four.

5. What is the purpose of the primer tank?
a. Maintain water supply.
b. Aid In starting pump.
c. Provide water for generator.
d. Primarily for water storage.

6. What is the purpose of the generator tank check valve?
a. Prevent reverse flow.
b. Regulate liquid pressure.
c. Cause pulsation's in gas.
d. Prevent forward flow.

7. After how many hours of operation should the oil In the acetylene compressor be changed?
a. 200.
b. 300.
c. 400.
d. 500.

8. Why is the acetylene system purged three times prior to operation?
a. Check functioning of equipment.
b. Remove air-acetylene mixture.
c. Insure moisture removal.
d. To relieve excessive pressure.

9. The drying agent used in the high pressure dryer is calcium:
a. Carbide.
b. Carbonate.
c. Chloride.
d. Chlorate.

10. What action should be taken with the water inlet temperature setting if water consumption for the last four hoppers of 100 pounds of carbide is 450 gallons?
a. Raise 5°F.
b. Raise 10°F.
c. Lower 5°F,

d. Lower 10°F

11. What is the purpose of the back pressure regulating valve (BPRV)?
- ***a.*** Prevent pressure from backing up.
- ***b.*** Insure proper condensate removal.
- ***c.*** Prevent excessive pressure buildup.
- ***d.*** Insure flash back extermination.

12. What is the operating range in psig for the generator charging water pump?
- ***a.*** 15-30.
- ***b.*** 20-30.
- ***c.*** 20-40.
- ***d.*** 25-40.

13. What condition most often causes low air pressure even though the air compressor is operating?
- ***a.*** Clogged air filter.
- ***b.*** Receiver drain valve open..
- ***c.*** Defective Mercoid Switch.
- ***d.*** Bristol control orifice clogged.

14. The blower In the heat exchanger circulates the air Inside the trailer to keep acetylene gas from ac cumulating. It also serves the purpose of:
- ***a.*** Cooling the water In the pump.
- ***b.*** Reducing the time element.
- ***c.*** Providing for continuous flow of water.
- ***d.*** Evaporating water on coils.

15. What type of construction is the Residue Drain Valve Controller?
- ***a.*** Differential diaphragm.
- ***b.*** Spring loaded disc.
- ***c.*** Ball spring check.
- ***d.*** Electro-magnetic.

16. What activates the water inlet valve to allow water to flow into the generator?
- ***a.*** Water.
- ***b.*** Air.
- ***c.*** Diaphragm.
- ***d.*** Spring.

17. Why are two hoppers used in the production of acetylene rather than one?
- ***a.*** Amount of carbide necessary.
- ***b.*** Increase production.
- ***c.*** Safety precautions.
- ***d.*** Continuous production.

18. What is the minimum number of 225 cu ft cylinders which should be placed on the manifold before the acetylene generator is started?
- ***a.*** 8.
- ***b.*** 10.
- ***c.*** 12.
- ***d.*** 14.

19. What is the purpose of the pulsator assembly?
- ***a.*** Agitates the carbide water mixture.
- ***b.*** Regulates the carbide flow to the generator.
- ***c.*** Prevents carbide from bridging the gap between the feed valve and seat.
- ***d.*** Provides pressure for operation of the tank check valve.

20. When is the exchanger blower used?
- ***a.*** Constantly during production.
- ***b.*** Periodically during production.
- ***c.*** During purging periods only.
- ***d.*** Only when water cooling is needed.

21. If the alarm bell has sounded and both pressure gauges on the air lines to the alarm switch read 15 psi, the trouble is:
- ***a.*** High water level.
- ***b.*** Low water level.
- ***c.*** High temperature

d. Air supply failure.

22. What Is the proper water-carbide ratio for the acetylene generator?
- ***a.*** 1 gallon of water to 2 pounds of carbide.
- ***b.*** 1 gallon of water to 3 pounds of carbide.
- ***c.*** 2 gallons of water to 1 pound of carbide.
- ***d.*** 1 gallon of water to 1 pound of carbide.

23. What is the purpose of the metal baffle plates In the generator flashback arrestor?
- ***a.*** Remove entrained lime residue.
- ***b.*** Remove entrained water vapor.
- ***c.*** Prevent reverse flow of acetylene gas.
- ***d.*** Check the water flow In the arrestor.

24. What causes the rapid pulsation of the carbide feed valves?
- ***a.*** The constant fluctuation of the diaphragm bellows.
- ***b.*** The rapid change in the rate of acetylene generation.
- ***c.*** The constant fluctuation of the tank check valve.
- ***d.*** The rapid movement of the pressure spring.

25. What action should be taken if water consumption for the last four hoppers of carbide is 355 gallons?
- ***a.*** Raise the water inlet temperature setting 5°F.
- ***b.*** Raise the water Inlet temperature setting 10°F.
- ***c.*** Lower the water inlet temperature setting 5°F.
- ***d.*** Lower the water inlet temperature setting 10°F.

26. The operating pressure of hopper No 1 is 8 psig What Is the proper pressure setting for the standby hopper No 2 in psig?
- ***a.*** 6.
- ***b.*** 8.
- ***c.*** 10.
- ***d.*** 12.

27. What condition will NOT cause the alarm bell to sound?
- ***a.*** Low water level.
- ***b.*** High temperature.
- ***c.*** Carbide supply exhausted.
- ***d.*** Air supply exhausted.

28. Which of the following indicates the proper sequence for purging?
- ***a.*** (1) Hoppers, (2) Generator, (3) Compressor, (4) Flashback Arrester.
- ***b.*** (1) Generator, (2) Hoppers, (3) Flashback Arrester, (4) Compressor.
- ***c.*** (1) Compressor, (2) Hoppers, (3) Flashback Arrester; (4) Generator

29. Which of the following conditions will cause the carbide feed valve to close during normal production?
- ***a.*** Regulating spring pressure exceeds tank pressure.
- ***b.*** Tank pressure exceeds regulating spring pressure.
- ***c.*** Lime scale forms on throat.
- ***d.*** Hoppers become exhausted of carbide.

30. Why is it necessary to provide a pressurized water supply at the generator tank water inlet valve?
- ***a.*** To minimize the possibility of operator failure.
- ***b.*** To provide metering of the inlet water.
- ***c.*** To balance the Inlet valve resistance.
- ***d.*** To overcome generator tank pressure during operation.

TEST SOLUTIONS FOR ACETYLENE PLANT

True or False

1. True
2. False
3. True
4. True
5. True
6. False
7. False
8. True
9. False
10. False
11. True
12. False
13. True
14. False

15. True
16. False
17. False
18. False
19. True
20. True

Multiple Choice

1. ***b.***
2. ***b.***
3. ***c.***
4. ***c.***
5. ***b.***
6. ***c.***
7. ***d.***
8. ***b.***
9. ***c.***
10. ***a.***
11. ***b.***
12. ***c.***
13. ***b.***
14. ***d.***
15. ***a.***
16. ***b.***
17. ***d.***
18. ***c.***
19. ***c.***
20. ***a.***
21. ***c.***
22. ***d.***
23. ***b.***
24. ***c.***
25. ***c.***
26. ***a.***
27. ***c.***
28. ***b.***
29. ***b.***
30. ***d.***

SECTION III

INSTRUCTOR'S CHECKLIST FOR

PERFORMANCE AND PROFICIENCY TEST FOR ACETYLENE

GENERATING PLANT OPERATORS

1. The purpose of this test is to verify the ability of the personnel selected for licensing to satisfactorily perform proportional, operational, and postoperational checks and to demonstrate proficiency in operating the generating plant.

2. This test consists of a number of proportional, operational and postoperational checks and represents the remaining 60 percent of the testing procedures. There are one hundred (100) items to be checked during this test. One (1) point will be allowed for each item correctly performed. The operator should be authorized to use the pertinent operator's manual during this exercise. The passing grade is 70 percent.

PERFORMANCE TEST FOR ACETYLENE GENERATING PLANT

Proportional Checks

Item to be checked	OK	Remarks
Equipment General		
a Plant correctly positioned and properly grounded		
b Semitrailer level		
c Securely blocked		
d Side and rear steps in position and securely mounted		
e Front and rear compartments properly ventilated		
f Fire extinguishers fully charged and properly mounted		
Maintenance and Operating Supplies		
Supplies are of the type prescribed, and sufficient quantity for 8 hours operation is available		
Basic Issue Items		
a. Accessory items are installed or are redily available for use		
b. Tools arethe type prescribed and are properly cleaned and stored		
Electric Generating Unit		
a Instruments clean and serviceable		
b V-belts proper tension and alignment		
c Crankcase oil level		
d Radiator coolant level		
e Fuel level		
f Battery electrolyte level		

Item to be checked	OK	Remarks
Heating System		
a. Fuel level		
b Thermostat set at required temperature		
Acetylene Compressor		
a Gauges clean and serviceable		
b V-belts proper tension and alignment		
c Crankcase oil level		
d Tank water level		
Acetylene Generator		
a Gauges, water level and hopper sight glass clean and serviceable		
b Sludge (slurry) drain hose serviceable and properly installed		
c Manual and automatic controls serviceable and properly set		
d Alarm system serviceable and properly connected		
e Water level		
Heat Exchanger		
a. V-belts proper tension and alignment		
b Water level		
Water, Fuel, Acetone and Compressed Air, Supply Systems		
a Gauges clean and serviceable		
b Controls serviceable and properly set		
Cylinder Weighing Scales		
Serviceable and properly adjusted		
Charging Manifolds and Cooling Spray System		
a. Serviceable and properly connected		
b Valves open or closed as required		
c. Sufficient quantity of cylinders available for subsequent operational period		
Check the entire plant for deficiencies such as		
a. Insecure mountings		
b Damage		
c Leaks, corrosion		
d Obstructed aisles and working areas		
e Loose or missing parts		
Lubrication		
All major components lubricated in accordance with applicable, current Lubrication Orders		
Maintenance Services		
Daily preventive maintenance services performed		
Electrical Generating Unit		
a. Proper ventilation		
b No excessive vibration		
c Supplying proper voltage frequency, etc		
d No unusual noises		
e No overheating		
Heating System		
a. No excessive vibration		
b No unusual noises		
c Air intake and outlet unobstructed		
d. Control thermostat set at required temperature and properly controlling heat output		
Acetylene Compressor		
a Water level normal		
b No excessive vibration		
c No excessive pressure		
d No overheating		
e No unusual noises		
f Condensate purged periodically		
Acetylene Generator		
a. Water levels normal		
b Pressures normal		
c Manual and automatic controls operating properly		
Heat Exchanger		
a. No excessive vibration		
b No unusual noises		
c. Water level normal		
Water, Fuel, Acetone, Compressed Air Supply Systems		
a. No excessive vibration		
b No unusual noises		
c Proper operation		

Item to be checked	OK	Remarks

Charging Manifolds and Cooling Spray System _____
a. Cylinders properly prepared, filled, and tested for leaks_____
b. Air purged from piping and manifolds before filling _____
c. Periodic check of manifold pressure and cylinder contents _____
d. No excessive heating of cylinders_____
Recording _____
a. Check instrument readings and record on operational data sheet at intervals specified_____
b. Check consumption of operating supplies and acetylene production and record on operational data sheet at intervals specified_____
Shutdown Precautions _____
a. Purge all condensate from traps _____
b. Drain all water from pumps, tanks, and lines (a and b required at only ambient temperature of -320F and below) _____
c. Drain, and flush acetylene generator tank_____
d. Remove all carbide from hoppers or insure that feed valves are closed, vents open _____
e. Inspect stocks of carbide for proper storage_____
f. Stop warm air heaters _____
g. Slow down the electrical generator engine and idle for 5 minutes under no lead, to dissipate _ heat
Lubrication _____
Lubricate all major components of the plant as directed by applicable, current Lubrication_____ Orders
Maintenance Service _____
Perform Daily Preventive Maintenance as outlined In the applicable Technical Manual (TM)____
Electrical Generating Unit _____
a. V belts for tension wear_____
b. Crankcase oil level add oil if necessary _____
c. Radiator -add water or antifreeze as necessary _____
d. Batteries- check, clean, and add water or electrolyte as necessary_____
Acetylene Compressor _____
a. V-belts for tension, wear and alignment _____
b. Crankcase oil level- add oil if necessary_____
Acetylene Generator _____
a. Tank water level _____
b. Proper drainage of sludge _____
Heat Exchanger _____
a. V belt for tension, wear, and alignment_____
b. Tank water level _____
Water, Fuel, Acetone, Compressed Air Supply Systems _____
Clean and lubricate as required _____
General Inspection _____
Check the entire plant for deficiencies such as _____
a. Cracked or broken glass _____
b. Insecure mountings _____
c. Loose or missing parts_____
d. Damaged components _____
e. Leakage _____
f. Obstructed aisles and working areas _____
Cleaning _____
Insure that the entire plant is free from _____
a. Dirt _____
b. Grease and oil _____
c. Other foreign matter _____

APPENDIX E
QUALIFYING PROCEDURES FOR OPERATORS OF LARC LX AND AVL

1. Personnel selected for testing should have normal color perception, good hearing ability, and a standard score of 100 or higher in aptitude area MM of the Army Classification Battery.

2. The purpose of this test is to determine if personnel selected for operating have sufficient technical knowledge of vehicle driving principles and practices. This test should be administered prior to the performance test.

3. Operators of tracked vehicles will be familiar with the contents of TM 21-301, Driver Selection Training, and Supervision Tracked Vehicles.

4. These tests consist of 25 true or false and multiple choice questions. Each question has a total weight of 4 points for each correct answer. Some questions, as noted, will have four answers. Therefore, each correct answer is equal to 2 points, in all cases making up a total of 4 points for each question. Passing grade is 85 percent. Students failing this test will be disqualified for licensing until he has completed a retraining period on the technical aspects of the equipment.

SECTION I

TEST QUESTIONS FOR LARC V

DELETED

All data on page E-2 deleted.

DELETED

SECTION III

TEST QUESTIONS FOR LARC LX

A. Answer these questions by "True" or "False".

1. The LARC can carry a maximum load of 120,000 pounds on land or water under ideal conditions.

2. Fuel fillers for filling diesel oil tanks are located on the forward top of deck, port and starboard sides.

3. It is not necessary to have all hull drain valves closed for safe water operation since each bilge pump is capable of pumping 100 gallons of water per minute.

4. The controls used by the operator to maneuver the LARC are grouped in the cab.

5. During water operation, the speed of the LARC can be controlled either by the accelerator pedal or throttle levers

6. Gearshift control valve should be in neutral when the LARC is operating in water.

7. Low range should be used when entering and leaving water (shallow) and ascending and descending steep grades.

8. The radiator fill caps are located In the port and starboard upper machinery area.

9. The radiator fans should always be running during land operation.

10. Two batteries for activating the electrical system of the LARC are used primarily for lighting and communication

11. The anchor, life ring, lines and boat hook are stored underneath the cargo deck

12. The hydraulic bilge pumps can all be operated from the cab.

13. For emergency starting, if air pressure is below 45 psi, air from the tires can be used to start the engines.

14. During marine operation it is not necessary to evenly distribute the cargo.

15. Draining condensate daily from air tanks is not required.

B. In the following multiple choice questions, only one answer is correct Check the correct answer.

16. Before starting the engines
- *a*. Open main air supply valves above each air tank.
- *b*. The LARC must be in a level position
- *c*. Close airbrake shut-off valves at each aft miter box

17. If engine fails to start after several attempts.
- *a*. Emergency engine shut-off lever pulled up
- *b*. Low coolant level
- *c*. Lack of hydraulic oil pressure

18. For shifting during marine operation
- *a*. Engine speed should be at least 1800 rpm when shifting directly from forward to reverse or reverse to forward
- *b*. For forward movement, marine gear control handle is pulled back toward operator
- *c.* Do not shift directly from forward to reverse or reverse to forward until marine gear oil pressure drops off and restores

19. After engines have been stopped
- *a.* Isolate the air tanks by closing the main air supply valves above each air tank
- *b*. Do not close air brake shutoff valve at each aft miter box
- *c.* Deflate tires to 35 psi

20. When traveling in loose sand or soil
- *a*. The front tires should be deflated to 60 psi and the rear to 50 psi
- *b.* All tires should have at least 35 psi
- *c.* The front tires should be deflated to 15 psi and the rear to 25 psi

21. When entering surf
- *a.* The LARC should be headed directly into any surf, tide, currents, or wind
- *b*. Wait for the wind to subside
- *c.* Set steering for four wheel steer

22. When operating the LARC In rough water
- *a*. Travel will be parallel to rollers
- *b.* Travel will be at right angles into or with the rollers
- *c*. Idle engine and put transmission in neutral

23. When landing over coral or sharp rocks-
- *a.* Back the LARC out
- *b*. Drive the LARC at high speed until completely clear of water, coral, and rock formations
- *c*. Drive the LARC at low speed until completely clear of water, coral, and rock formations

24. The following oil is used in the cargo well pump
- *a*. OE-10

b. GO-90
c. OES

25. During operation in extreme cold (below +320F):
a. Keep fuel tanks with as little fuel as possible.
b. Do not clean fuel strainers or filters.
c. Keep fuel tank as full as possible

SECTION IV

QUALIFYING PROCEDURES FOR LAUNCHER, M60A1 TANK

DELETED

DELETED

SECTION VI

TEST ANSWERS FOR APPENDIX VI

DELETED

PART III

LIGHTER AMPHIBIOUS (LARC LX)
SELF-PROPELLED, DIESEL, STEEL--60 TON
DESIGN 2303
(HULLS 5 THROUGH 60)

1. False
2. True
3. False
4. True
5. True
6. True
7. True
8. True
9. True
10. True
11. False
12. False
13. True
14. False
15. False
16. *a.*
17. *a.*
18. *c.*
19. *a.*
20. *b.*
21. *a.*
22. *b.*
23. *c.*
24. *a.*
25. *c.*

PART IV

LAUNCHER, M60A1 TANK
CHASSIS TRANSPORTING FOR BRIDGE ARMORED
VEHICLE-LAUNCHED, CLASS 60

(DELETED)

APPENDIX G

QUALIFYING PROCEDURES FOR OPERATORS OF RAILROAD EQUIPMENT

1. Personnel selected for testing should have credit for a High School diploma and/or equivalent, and a standard score of 100 or higher in aptitude area GM of Army classification battery

2. The purpose of these tests is to determine if the personnel selected for licensing have sufficient technical and maintenance knowledge to recognize malfunctions and/or deficiencies of Railway Equipment.

3. Special Skills and Knowledge.

a. Nomenclature of mechanical parts of railway equipment and their primary function.
b. Key inspection points.
c. Lubrication requirements.
d. Air brake handling.
e. Operating and safety rules.
f. Be able to read and interpret railway signal and markers.
g. Completion of required forms In accordance with TM 38-750.

4. Physical Requirements.
a. Good near, far and night vision.
b. Color discrimination.
c. Good auditory acuity.
d. Manual dexterity and eye-hand coordination.

5. These tests consist of multiple choice and true and false questions and represent fifty (50) percent of the test procedures. Passing grade is 85 percent. Personnel failing to pass this test will not be permitted to proceed with the operational test. Operational test will represent fifty (50) percent including air brake handling test as required.

SECTION I

OPERATORS LICENSING TESTS (LOCOMOTIVES)

A. The following questions are multiple choice Check the correct answer

1. You are called for a locomotive that will operate In the yards You will check your tools and onboard spares because:
a. You might need a light bulb.
b. It is listed In the preoperational check list.
c. You don't check them.

2. Your tools and onboard spares are listed in the following manner:
a. List fastened on cab wall.
b. Operators Manual -10 Issued with the locomotive.
c. No list.

3. As you approach your locomotive afoot, you notice water leaking from under the hood Would you:
a. Investigate immediately.
b. Check brake travel.
c. Start engine, then investigate.

4. What is a diesel-electric locomotive:
a. A locomotive with a diesel engine.
b. A locomotive with a diesel engine and traction motors.
c. A locomotive with a diesel engine, driving a generator, which in turn drives traction motors attached to each pair of wheels.

5. If a two cycle engine requires two strokes to complete one cycle, how many strokes does it take a four cycle engine to complete one cycle:
a. Four.
b. Six.
c. One.

6. Before you leave the ready track you are required to make a series of checks or tests What are these called:
a. Check up

b. Preoperatlonal check.
c. Not named.

7. When you press the starter button and the engine does not turn over, is the:
a. Compressor belts loose.
b. Battery switch In open position.
c. Engine out of time.

8. If the lubricating oil gage does not register when engine has started, do you:
a. Open throttle wide.
b. Shut engine down.
c. Turn fuel oil filter handle.

9. With the engine running and showing lube oil pressure, the exhaust stack shows smoke and the temperature gage does not raise, would you:
a. Close radiator shutters.
b. Fill radiators.
c. Inspect cooling fan belts.

10. With the engine running showing lube oil pressure and the temperature gage raising, the air pressure gages do not start to register, would you:
a. Open angle cocks.
b. Examine air compressor, belts or drive and Inspect locomotive piping for leaks.
c. Set independent brake valve.

11. The compressor is running and the main reservoir gage reads 120 psi The straight air or independent brake valve is moved to the ON position What should the brake cylinder pressure gage read:
a. 35 or 50 psi.
b. 60 or 70 psi.
c. 80 or 90 psi.

12. The engine is running at idle speed and it suddenly stops, would you:
a. Remove the fuel pump.
b. Check emergency fuel shut off valve.
c. Change injectors.

13. With the engine running and the throttle in idle position, you insert the reverse lever and open the throttle to the second speed The locomotive does not move What have you failed to do:
a. Position reverse handle to forward or reverse, and release Independent brakes.
b. Open sanders.
c. Turn on fuel pump.

14. The throttle normally has a specified number of positions and is opened slowly or a notch at a time. How many positions do most throttles have and why should it be opened slowly:
a. Sixteen positions and insert reverse lever.
b. Eight positions and a stop position, by opening throttle slowly the wheels will not have a tendency to slip.
c. Four positions and open sander valve.

15. The operating controls can be locked when the reverse lever is removed. What position must the throttle and the reverse lever be before the lever can be removed:
a. Lever in neutral position and throttle In idle.
b. Lever In forward and the throttle In the eighth notch.
c. Lever In reverse and throttle in the stop position.

16. The load indicating meter mounted in the cab indicates:
a. Air brake pressure.
b. Position of the double heading cock.
c. The load on the locomotive.

17. The ground relay is a protective device that will, when tripped:
a. Unload the main generator.
b. Turn on the head lights.
c. Set the air brakes.

18. When the ground relay has tripped, the engine speed will reduce to idle and remain there until:
a. The operator sets the ground relay.
b. The operator turns off the headlight.
c. The operator releases the air brakes.

19. The cooling system on a locomotive is a fan cooled liquid, radiator type The temperature of the cool-

ing water is controlled by shutters both automatic and hand operated The normal effective operating temperature is:

a. 100 to 140 degrees.
b. 140 to 160 degrees.
c. 160 to 185 degrees.

20. Operating water levels should be checked and the system Inspected:

a. Daily.
b. Weekly.
c. Semiannually.

21. The cooling system of a hot engine has been drained, it should be filled immediately with:

a. Cold water.
b. Slowly with water.
c. After engine has cooled down, slowly with warm or hot water.

22. The cooling system should not be filled above the maximum level to prevent:

a. The engine from running cool.
b. The loss of antifreeze or rust inhibitor.
c. The water pumps from being overloaded.

23. Oil under pressure Is forced thru the engine for lubricating and cooling purposes What is meant by the oil level:

a. The oil In the crankshaft.
b. The oil registered on the dip stick with the engine idling and warm.
c. The oil pressure registered in the cab.

24. The oil level and oil pressure should be checked when:

a. You think the oil is low.
b. Before starting the engine and later when the engine is operating and warm.
c. The engine needs repairs.

25. The lubricating oil pan, lines and filters must be inspected for leaks:

a. Daily with the engine warm and running.
b. With the engine cold and shut down.
c. Monthly, or when you think of It.

26. The engine has been running and the oil pressure has been low, when suddenly a light appears in the cab and the engine stops What is wrong:

a. Engine is out of fuel.
b. The low oil pressure or the hot engine switch has "kicked out" or tripped, stopping the engine.
c. The brakes have applied.

27. If the engine speed is set from 275 to 300 rpm at idle and 800 to 1000 rpm at full throttle, what will prevent the engine speed from exceeding the full throttled speed:

a. The fuel pump.
b. The load regulator.
c. The overspeed trip (A device that must be manually reset after it has tripped).

28. Some locomotives have cylinder test drains, what are their functions:

a. To check the top of the pistons.
b. To test the cylinder for water leaks from around gaskets and seals prior to starting.
c. To clean carbon from pistons.

29. The fuel system consists of the following Items:

a. Fuel tanks, fuel pumps, lines, filters and injectors.
b. Fuel tank and pump.
c. A fueling system.

30. The emergency fuel cutoff valve is:

a. A manually operated valve to cut off the fuel supply from the tank to the engine.
b. An air operated valve to the fuel pump.
c. A valve used to fill fuel tank.

31. Why must the air system be drained and how often:

a. To prevent dirt from collecting in air system-weekly.
b. To prevent moisture from collecting in air system and being carried into the air brake and control valves, drained daily.
c. Don't drain until needed.

32. The sanding system must be checked in the following manner:

a. Check sand boxes to see if they have been filled, move sander valve handle in cab to the front and rear position Then from the ground check sand pipes and the distribution of sand on the rails.

b. Check sand boxes, move valve handle.

c. Move sander valve handle, do not check sand pipes.

33. Most locomotives have two or more main reservoirs What are their purposes:

a. Store air for the cooling system.

b. Storage of an adequate supply of air to charge the brake pipe system, to apply the brakes and supply air to operate the air accessories.

c. To keep air pressure from overheating.

34. What is the standard brake cylinder travel:

a. 3 to 5 inches.

b. 5 to 7 inches.

c. 7 to 9 inches.

35. What is the purpose of a feed valve:

a. To feed oil to the brake cylinders.

b. To control the amount of air in the brake cylinder or the brake pipe.

c. To apply the brakes.

B. The following questions are true or false Check one answer only.

1. The operator of a locomotive is not required to perform a preoperation check on his locomotive.

2. The operator or locomotive engineer is not required to perform any maintenance.

3. If the operator finds a fuse blown, he should replace it and report it at the end of his tour of duty.

4. If when a locomotive is moved, the movement is rough or bumpy, the locomotive could have flat spots on the wheels.

5. The proper operation of the couplers should be included in the preoperational check.

6. When the wheels are slipping you open the sander valve.

7. If in your preoperational check you find excessive brake cylinder piston travel, you do not have it corrected.

8. You do not allow unauthorized personnel In the cab.

9. The locomotive you have been assigned to has a blue flag or lantern placed In the front and rear of it. You remove the flags or lanterns and move the locomotive.

10. Riding on the leading or front foot boards of a locomotive in motion Is prohibited.

SECTION II

OPERATORS LICENSING TEST (LOCOMOTIVE CRANES)

A. The following questions are multiple choice and one answer only is the correct answer.

1. The preoperation inspection of a locomotive crane shall be performed by:

a. Operator.

b. Shop maintenance forces.

c. Car repairmen personnel.

2. Cranes used by the Department of the Army are powered in the following manner:

a. Gasoline mechanical.

b. Steam mechanical and diesel.

c. Steam mechanical, diesel mechanical and diesel-electric.

3. The term "Wrecking Crane" applies to a crane that:

a. Swings a huge ball on its hoisting line.

b. Is a heavy duty crane, steam or diesel driven, used to pick up cars and locomotives that are derailed or wrecked.

c. A crane that has been declared surplus and is awaiting disposition.

4. Care must be taken to avoid overloading the crane. The capacities plates given the maximum rated capacities for which the crane is designed The capacities plates are located:

a. In the supply room.

b. In the onboard spares.

c. Riveted or bolted In a conspicuous place on the body of the crane.

5. The following listed steps must be taken preparatory to starting and running the engine. One step listed does not apply to this list:

a. Inspect engine and cab floor for loose bolts, nuts, tools, or other material lying around the floor or engine.
b. Close the battery and control switch.
c. Place throttle in idle position.
d. Place all operating clutches in a neutral position.
e. Set outriggers.
f. Set all brakes including hand brake if not set.
g. Press starter button. (Do not operate starter longer than 30 seconds at a time.) This is to prevent damage to the starter or run the battery down.
h. Run engine at part throttle. This is to warm engine.
i. Immediately after starting, observe the oil pressure gage If no pressure is indicated after 10 to 15 seconds, shut engine down.

6. The lubricating oil pan, lines and filters should be inspected for leaks:

a. Daily or oftener.
b. When engine is shut down.
c. Once a month.

7. Each crane is equipped with an emergency fuel cutoff valve This valve is for quickly cutting the flow of fuel:

a. To the air compressor.
b. To the engine in case of fire, collision or other emergency.
c. To the engine crankcase.

8. The air system must be drained to prevent moisture and dirt from being carried In the brake and control valve as often as:

a. Daily or a change of crew.
b. Weekly.
c. Do not drain until needed.

9. Periodic cleaning and lubricating of wire ropes and cables will materially lengthen their life and also insure freer movement over pulleys and drums Just how often cables should be cleaned and oiled is determined by the amount of work performed and the judgment of the operators How often should the above be performed:

a. When a new cable is needed.
b. Every 6 months.
c. Weekly for the average crane.

10. The hand brake should be set when the locomotive crane is to be left standing for:

a. A week.
b. Until repaired.
c. Whenever the crane engine is shut down.

11. What is the normal operating temperature of the cooling water?

a. 100 to 120°.
b. 120 to 140°.
c. 140 to 185°.

12. Should the crane become derailed, you would:

a. Rerail the crane under its own power.
b. Call the yardmaster and ask for the wreck crew.
c. Shut the engine down and leave the crane.

13. When a near capacity load is to be handled, what must be done:

a. Position and block outriggers.
b. Clean cab deck.
c. Attach clam shell bucket.

14. When operating the crane, the movements must be:

a. Fast and jerky.
b. Smooth and slowly.
c. Makes no difference.

15. When operating the crane at night with the flood lights on, the lights suddenly fade and dim, what would you do?

a. Finish the job.
b. Call for assistance.
c. Set all the brakes and check the generator belts and battery.

16. The crane operator should take signals when working from:
a. Anyone.
b. The groundman or from one man In charge.
c. The switchman.

17. The following rules apply to the use of slings One rule does not apply:
a. Take up slack and start load slowly.
b. Keep slings free from kinks, knots and twists.
c. Knots can be used to shorten chains or slings.
d. Lift from the center of the hooks, never from the point.
e. Distribute the load evenly on all legs of the sling.
f. Inspect slings regularly.

18. When a crane has traction motors, do not run it thru water:
a. That will touch the bottom of the traction motor.
b. It does not matter.
c. Move crane swiftly.

19. The crane is to be moved from one point to another not under its own power You should make preparations by:
a. Calling yardmaster.
b. Anchor the rotating deck parallel to the center line of the track with the boom trailing.
c. Raise boom and set brakes.

20. The tools and onboard spares are listed in the following manner:
a. List fastened to the cab wall.
b. No list.
c. Operators Manual -10 issued with the crane.

21. You go out to your crane and it has a blue flag fastened to the rail in front of the crane and to the rear of it. Do you:
a. Take the flags down and move the crane.
b. Proceed to the maintenance shop and have the flags removed.
c. Fill the fuel oil tank.

B. The following 25 questions are true or false

1. A crane operator must be alert and know all the hand signals used by the Department of the Army.

2. When handling heavy loads, stability and strength shall be checked by hoisting the load a short distance and holding it with the brake.

3. No warning signal is to be sounded when swinging a load over workman.

4. When using a magnet the weight of the magnet should be figured as part of the load.

5. The magnet can be used to break up heavy pieces of scrap.

6. If, when operating, the battery ammeter shows discharge, the battery is fully charged.

7. When the crane is shut down for the night, the hand brakes must be set.

8. If the engine does not start after holding the starting button in for 30 seconds, you can hold the button in for 30 seconds more immediately.

9. When the straight air brake valve is moved to the ON position, air pressure is admitted to the air brake cylinder, setting the brakes on the crane.

10. If the air pressure does not show on the air gage, the crane can be braked or stopped by reversing the traction motor or gears.

11. Before hoisting a heavy load after the crane has been idle for a long time, it is advisable to hoist the load block to the boom several times with the brakes applied lightly to dry out the moisture in the brake lining.

12. The operator must avoid rough or jerky stops at all times.

13. When lifting heavy loads with a high boom, a safety line with a heavy weight should be fastened to the boom.

14. If the ropes or cables are not spooled smoothly on the drums, they might break.

15. In case of fire, the following action should be taken: Pull emergency fuel shut-off and use fire extinguishers with the discharge directed at the base of the fire.

16. Each crane has a lubrication chart listing points to be lubricated and the proper lubricants to use It is not necessary to use or refer to this chart when crane has been operating for 30 or more days.

17. A tag line is a device used to hold a load stationary when the boom is swung or the crane is traveling and stopped suddenly.

18. The operator may allow a man to ride on a suspended load if he is holding on tight.

19. Only authorized persons are allowed in the cab when the crane is in operation.

20. It should be assumed that the power has been turned off on all overhead wiring and no danger exists if they are touched by the boom.

21. The operator shall make sure by personal observation and signals the load is well secured and balanced before raising it more than a few inches.

22. The ICC has ruled that no part of car, crane, or locomotive should be less than 2 1/2 inches above the rail. Upon your preoperation inspection, you found a brake beam 1 inch from the top of the rail. This would indicate that the crane had missing or broken parts

23. If you are operating a steam wrecker crane, you cannot test the water glass with the gage cocks.

24. The blow off cock is a valve or cock that can be opened and completely drain the water and steam from the boiler.

25. The pressure in a steam boiler is regulated by the safety pops or valves. These valves or pops are set to open at a safe boiler pressure

SECTION III

OPERATOR'S LICENSING TEST (MOTOR CARS)

A. The following questions are multiple choice. Check the correct answer.

1. Clearance must be obtained to move a motor car out on the main line. Who can give this clearances ?
- *a.* Section foreman.
- *b.* Dispatcher.
- *c.* Others.

2. Motor cars used by the Department of the Army are powered by:
- *a.* Two and four cycle gasoline engine.
- *b.* Two and four cycle diesel engine.
- *c.* DC electric motor.

3. The following list is a preoperatlon check list that must be conducted by the operator daily prior to operating the motor car One item on this list does not apply to this check.
- *a.* Check oil in crankcase (dipstick).
- *b.* Check fuel (Tank must be kept full).
- *c.* Check coolant in radiator.
- *d.* Set brakes.
- *e.* Drain transmission.
- *f.* Insert key in ignition and start engine, let engine warm up.
- *g.* Move car forward and in reverse for a short distance.

4. The motor car must be lubricated by the operator in accordance with:
- *a*. The LO or lube order.
- *b*. The lubrication points you can see.
- *c*. The points you think need lubrication.

5. If, with the engine running at half throttle, the ammeter shows discharge, you should:
- *a*. Clean the spark plugs.
- *b*. Stop engine and check fan belt, voltage regulator, generator, and battery connections.
- *c*. Stop engine and add water to the radiator.

6. The brakes on the motor cars used by the Department of the Army are to be kept adjusted and must be inspected daily. The brakes are activated by:
- *a.* Hydraulic brake fluid.
- *b.* Air pressure.
- *c.* Hand or foot mechanically operated.

7. A check must be made daily of the transmission, drive chains, belts and pulleys, and the components of these parts lubricated. This lubrication must be performed with the engine:

a. Running at idle.
b. Hot running.
c. When maintenance is required.

8. To reverse the direction of a motor car, the operator will:
a. Stop the car and move lever into reverse by means of the transmission and clutch, proceed in the opposite direction.
b. Place throttle in idle position and move reverse lever into reverse.
c. Turn car around.

9. Care should be taken and at each road crossing the car should be stopped and:
a. Turned around.
b. Flagged across the crossing and/or stop and proceed with caution.
c. Blow horn and proceed.

10. The following is a list of safety rules to be followed by the operator One rule is not applicable to this list:
a. The motor car should be operated by authorized personnel only.
b. Never allow the rail car to set on a track unattended.
c. Never board or dismount from a moving motor car.
d. Avoid sudden starts and stops.
e. Keep side steps free of dirt and oil.
f. In cold weather, the choke should be used in starting the engine.
g. Keep tools in tool trays.
h. Do not overload, all personnel should be seated before car is moved.

B. The following 20 questions are true and false. Use one answer only.

1. To move the car after the engine is running and a preoperatlonal check has been made, proceed as follows:
a. Push clutch pedal forward to disengage clutch
b. Push reverse lever from neutral to forward position
c. Move gear shift lever from neutral to forward position
d. Let clutch out gradually until clutch is engaged
e. Open throttle and pick up speed gradually
f. Shift to second gear and then third In a like manner

2. To stop the car, push the throttle lever to idle Push clutch in and move gear shift lever to neutral Let clutch out gradually and apply brakes as desired.

3. If the engine is cold, use choke to assist in starting After choke has been pulled out, it may be left in this position.

4. The wheels will not spin when car is in low gear if the throttle Is opened rapidly.

5. When car is to be used to pull loaded trailers the operator must be sure that proper couplers are used.

6. The use of chains to pull loaded trailers is dangerous.

7. A motor car must never be used to push loaded cars unless they are coupled properly.

8. It is not necessary to sound a warning when car or trailers are moved.

9. A complete understanding must be had between operators and men when coupling and uncoupling cars.

10. A trailer or a push car when coupled to a motor car is the responsibility of the motor car operator.

11. Motor cars must be operated in a safe and sane manner as safety is of the first importance in discharge of your duties.

12. Rule 802 TM 55-200 states a track car be operated only by a qualified operator Properly qualified operators will have in their possession at all times a valid operator's permit (Standard Form 46, U.S. Government Motor Vehicle Operators Identification Card).

13. Hand cars may be used on main lines without being attached to motor cars.

14. All operators of motor cars must have a copy of TM 55-200.

15. Personnel whose duties are in any way affected by the time table will be provided with a copy of the current time table and will carry It when on duty This does not affect a motor car operator.

16. The operator will not permit unauthorized persons to operate motor car.

17. The operator is not required to stop when a burning fuse Is observed on or near the track he is on.

18. The explosion of torpedoes is a signal to proceed at restricted speed A motor car is not required to reduce speed.

19. Motor cars must not be allowed to idle In a tunnel for any length of time.
20. The operator of a motor car is not required to be familiar with operating rules Chapter 4, TM 55-200.

SECTION IV
TEST ANSWERS FOR APPENDIX VII
PART I
LOCOMOTIVES

A.

1. b.
2. b.
3. a.
4. c.
5. a.
6. b.
7. b.
8. b.
9. a.
10. b.
11. a.
12. b.
13. a.
14. b.
15. a.
16. c.
17. a.
18. a.
19. c.
20. a.
21. c.
22. b.
23. b.
24. b.
25. a.
26. b.
27. c.
28. b.
29. a.
30. a.
31. b.
32. a.
33. b.
34. a.
35. b.

B.

1. False
2. False
3. True
4. True
5. True
6. False
7. False
8. True
9. False
10. True

PART II
LOCOMOTIVE CRANES

A.

1. a.
2. c.
3. b.
4. c.
5. c.
6. a.
7. b.
8. a.
9. c.
10. c.
11. c.
12. b.
13. a.
14. b.
15. c.
16. b.
17. c.
18. a.
19. b.
20. c.
21. b.

B.

1. True
2. True
3. False
4. True
5. False
6. False
7. True
8. False
9. True
10. False
11. True
12. True
13. True
14. True
15. True
16. False
17. True
18. False
19. True
20. False

21. True
22. True
23. False
24. True
25. True

PART III
MOTOR CARS

A.

1. b.
2. a.
3. c.
4. a.
5. b.
6. c.
7. b.
8. a.
9. b.
10. c.

B.

1. True
2. True
3. False
4. False
5. True
6. True
7. True
8. False
9. True
10, True
11. True
12. True
13. False
14. True
15. False
16. True
17. False
18. False
19. True
20. False

APPENDIX H
RECOMMENDED TRAINING PROGRAM
SECTION I
LESSON I SAFETY: 5KW GED OR DED GENERATOR SET

A. TRAINING OBJECTIVE

TASK: Each student will be able to install, operate and maintain a 5KW GED or DED generator set in accordance with the safety considerations outlined in the Operator's Manual.

CONDITION: Given a 5KW GED or DED generator set, ground rod assembly. TM 5-6115-332-14 or TM 5-6115-584-12, and fire extinguisher.

STANDARD: Each student will be able to install, operate and maintain a 5KW GED or DED generator set without violating any safety procedures.

B. ADMINISTRATIVE INSTRUCTIONS (to be completed by the unit)

1. When training will be given:
2. Training location:
3. Who will be trained:
4. Principal and assistant trainers:
5. Training Aids:

a.	TM 5-6115-332-14 or TM 5-6115-584-12	1 ea per student
b.	5KW Generator Set (GED or DED)	1 ea per 3 students
c.	Ground Rod Assembly	1 ea per generator set
d.	Fire Extinguisher	1 ea per generator set
e.	Ear Plugs or Ear Headset	1 ea per student

6. References: Inside front cover and paragraph 2-2(c), page 2-11 of TM 5-6115-332-14 and page 9 of TM 5-2805-258-14 or page 2-1 of TM 5-6115-584-12.

C. SAFETY RESTRICTIONS: During this lesson, no smoking will be allowed and all jewelry will be removed.

D. SEQUENCE OF ACTIVITY AND ESTIMATED TIME

1. State Reason for Class. (4 minutes)

In order to operate any generator set properly, you must have a complete knowledge of the safety considerations required for that generator set. In this lesson, we will discuss the considerations applying to the 5KW GED or DED generator set. The importance of this lesson cannot be overemphasized because improper operation of the generator set can cause serious injury or death to you, the operator. We will also discuss the steps necessary to prevent damage to the generator set because generator malfunctions may prevent mission accomplishment. Without electrical power missiles cannot be fired and communication equipment will not work. Wars could be lost.

2. Explain the safety precautions associated with the installation of the generator. The following items should be addressed: (15 minutes)

a. Fire Extinguisher
b. Ground Rod Assembly
c. Ventilation
d. Loose Tools or Parts
e. Jewelry
f. Leveling of Generator

3. Explain the safety precautions to be observed during operation. The following items will be stressed: (15 minutes)

a. High Voltage
b. Ear Protection
c. Loose Clothing
d. Emergency Shutdowns
e. Engine and Ignition System
f. Engine Cooling Shroud (Top)

4. Explain the safety precautions observed during Performance of PMCS. Discuss the safety precautions associated with dangerous gases produced by: (15 minutes)

a. Battery
b. Fuel Tank ,
   - Metal to Metal Contact (Gasoline only)
   - Refueling
c. Cleaning solutions and materials

5. Discuss Safety Precaution peculiar to your unit SOP.

E. REVIEW AND ANSWER QUESTIONS. (4 minutes)

a. What is the minimum depth a ground rod must be driven into the ground? Answer: 8 Feet
b. Why should ear protection be worn when operating a generator set? Answer Because the operating noise level is very high which can cause hearing damage.
c. Why is it dangerous to smoke when servicing the battery?
   Answer: A battery generates hydrogen, a highly explosive gas.
d. Why is it important to operate a generator set in a well ventilated area? Answer: To prevent overheating and for proper venting of exhaust gases.

During this lesson, we have discussed safety as it pertains to the 5KW generator set during all phases of operation. These precautions will prevent injury to both you and your equipment. (1 minute)

TOTAL 54 Minutes

SECTION II

LESSON II INSTALLING A 5KW GED OR DED GENERATOR SET

A. TRAINING OBJECTIVE

TASK: Each student will be able to install a 5KW GED or DED generator set.

CONDITION: Given a 5KW GED or DED generator set, 5 gallons of fuel, ground rod assembly, TM 5-6115-332-14 or TM 5-6115-584-12, a selected site, a load and necessary tools.

STANDARD: Each student will be able to install a 5KW GED or DED generator set in accordance with the installation procedures outlined in the appropriate Operator's Manual.

B. ADMINISTRATIVE INSTRUCTIONS (to be completed by unit)

1. When training will be given:
2. Training location:
3. Who will be trained:
4. Principal and assistant trainers:
5. Training Aids:

a. TM 5-6115-332-14 or TM 5-6115-584-12	1 ea per student
b. 5KW Generator Set (GED or DED)	1 ea per 3 students
c, Ground Rod Assembly	1 ea per generator set
d. 5 gallon can of fuel	1 ea per generator set
e. A load	1 ea per generator set
f. 12-inch adjustable wrench, 4-inch flat tip screwdriver sledge hammer	1 ea per generator set

6. Reference: TM 5-6115-332-14 pages 4-1 through 4-4 or TM 5-6115-584-12 pages 4-1 through 4-3.

C. SAFETY RESTRICTIONS: The generator set will be installed observing installation safety precaution. (Lesson 1)

D. SEQUENCE OF ACTIVITY AND ESTIMATED TIME

1. State Reason for Class. (2 minutes)

In order for a generator set to operate efficiently and economically, it must be properly installed. In this class we will discuss and perform those procedures that should be followed when selecting and preparing a site for a generator set.

2. Site Selection (20 minutes)

a. State that the generator set must not be operating during installation and explain the reasons the following factors are important when selecting the site for a generator set.

(Generator Protection)

DOD Generators do not require shelters, A users discretion

A. Temporary — for permanent site only

B. Semipermanent

C. Permanent

(1) Foundation (firm and level)
(2) Distance to Load
(3) Permanent mounting to foundation
(4) Ventilation (overheating and safety)
(5) Access (required to perform PMCS)

b. Insure student understanding of site selection.

3. Ground Rods and Fuel Supply. (10 minutes)

a. Explain and demonstrate how to ground the generator set using the following.

(1) Ground Rods
(2) Ground Cable
(3) Ground Clamps
(4) Generator Set Ground Terminal

b. Explain the procedure for connecting the auxiliary fuel source.
c. The proper positions for the fuel selector valve when the set tank or auxiliary fuel source is used.

4. Explain and demonstrate how to install and connect (5 minutes) the power transmission cable.

5. Explain and demonstrate the position of the output selection switch and where to connect the power transmission cable for the following outputs. (10 minutes)

a. 120 Volts 1 phase 2 wire

b. 240 Volts 1 phase 2 wire

c. 120 Volts 3 phase 3 wire

d. 120/208 Volts 3 phase 4 wire

e. Place the circuit breaker in the OFF position and explain why.

6. Discuss the specific voltage output the operator (5 minutes)
will be required to supply to his or her equipment. Insure the students understands, the using equipment technical manual will contain data concerning operating voltages, phases, frequency and load cable.

7. Have each group of 3 students install a generator set. (45 minutes)

a. Ground the Set
b. Connect the power transmission cable
c. Set the output selector switch to produce the desired output for the equipment being powered by the generator set.

8. Discuss installation procedures peculiar to your unit SOP. (2 minutes)

E. REVIEW AND ANSWER QUESTIONS. (5 minutes)

1. What are the factors to consider when selecting a site for a generator set?
ANSWER: Distance to loads, access, fuel supply, ventilation, foundation, and mounting.

2. Why is it important to position the generator set as close as is reasonably possible to the load?
ANSWER: To reduce transmission line voltage losses.

3. Where will the transmission cable be connected to power your equipment?
ANSWER: Note: The answer must be aimed to the specific piece of equipment the students will operate, i.e., a person who will be the operator of a 5KW generator that powers a _____ will connect the transmission cables to the _____ and _____ terminals.

During this lesson you have learned how to install (1 minute)
a 5KW GED or DED Generator Set and connect it to your equipment, this is only part of generating power. You must also be able to operate the generator set. In the next lesson, you will learn how to operate a 5KW Generator Set.

TOTAL 105 Minutes

SECTION III

LESSON III OPERATING A 5KW GED or DED GENERATOR SET

A. TRAINING OBJECTIVES

Training Objective 1

TASK Each student will be able to identify the controls and instruments of the 5KW generator set.

CONDITION: Given an installed 5KW GED or DED generator set, TM 5-6115-332-14 and TM 5-2805-258-14 or TM 5-6115-584-12.

STANDARD: Each student will identify, locate, and state the purpose of the various controls and instruments used to start, run, and stop the 5KW generator set.

Training Objective 2

TASK: Each student will be able to perform the operator/crew preventive maintenance checks.

CONDITION: Given an installed 5KW GED or DED generator set, DA Form 2404, pencil, and TM 5-6115-332-14 and TM 5--2805-258-14 or TM 5-6115-584-12.

STANDARD Each student will perform the before, during, and after operator/crew preventive maintenance checks in sequence using TM 5-6115-332-14 and TM 5-2805-258-14 or TM 5-6115-584-12 and complete DA Form 2404.

Training Objective 3

TASK: Each student will electric start and stop the 5KW GED or DED generator set.

CONDITION: Given an installed 5KW GED or DED generator set and TM 5-6115-332-14 or TM 5-6115-584-12.

STANDARD: Each student will electric start and stop the 5KW GED or DED generator set following the instruction in the appropriate Technical Manual.

B ADMINISTRATIVE INSTRUCTIONS (to be completed by the unit)

1. When training will be given:
2. Training location:
3. Who will be trained:
4. Principal and assistant trainers:
5. Training Aids:

a.	TM 5-6115-332-14 and TM 5-2805-258-14 or TM 5-6115-584-12	1 ea per student
b.	Installed 5KW Generator Set (GED or DED)	1 ea per 3 students
c,	DA Form 2404	3 ea per student
d.	Pencil	1 ea per student

6. References:
   a. TM 5-6115-332-14 pages 2-1 through 2-13 and 3-3-4.1
   b. TM 5-2805-258-14 pages 9 through 14
   c. TM 5-6115-584-12 pages 2-1 through 2-6, and 3-4 through 3-5.
   d. TM 38-750 pages 3-6 through 3-13
   e. LO 5-2805-258-12
   f. LO 5-6115-584-12

C. SAFETY RESTRICTION: All safety precautions will be observed during the performance of operator/crew preventive maintenance checks and starting and stopping the generator set (Lesson 1).

D. SEQUENCE OF ACTIVITIES AND ESTIMATED TIMES:

1. State Reason for Class. (3 minutes)

There are three steps in learning how to properly operate the 5KW Generator Set. The first step is to learn the controls and instruments used to start and stop the set; and those which provide the operator with sufficient information to insure proper operation of the set. The second step is to learn the items that must be inspected before, during, and after operations so that defects may be discovered and corrected before they result in serious damage or failure. The third step is to learn how to properly start and stop the generator set, so that it can perform the task which it was designed for without causing injury to you or damage to the set. In this lesson we will discuss these steps and you will put into practice what you have learned.

Note

Instructor should label each of the below components to aid in students learning.

2. State the first training objective. Locate and explain the purpose of the following: (11 minutes)

Gasoline Engine Driven

a. Engine Assembly

1. Oil dipstick
2. Oil pan baffle rod
3. Manual choke
4. Air cleaner assembly and restriction indicator
5. Governor control

b. Generator Set Assembly

1. Fuel filter
2. Fuel selector switch
3. Battery box assembly
4. Set tank (5 gallon can)
5. Set ground terminal

Diesel Engine Driven

a. Engine Assembly

1. Oil dipstick
2. Air flow indicator

b. Generator Set Assembly

1. Drain valves on set tank
2. Batteries box assembly
3. Set tank and gage
4. Drain valves on fuel filter and strainer
5. Shutter box assembly
6. Speed control assembly (throttle)
7. Set ground terminal
8. Auxiliary fuel connection

3. Review each group of students to insure their understanding of the above components (4 minutes)

4. Locate and explain the following controls and instruments. (14 minutes)

Gasoline Engine Driven

a. Outside of control panel
   1. Remote-local switch
   2. Emergency run-stop switch
   3. Start-stop switch
   4. Oil pressure indicator
   5. Time totalizing meter

Diesel Engine Driven

a. Outside of control panel
   1. Battery indicator
   2. Panel light
   3. Hour meter
   4. Percent rated current meter

Gasoline Engine Driven	Diesel Engine Driven
6. Voltage selector switch	5. Voltmeter, AC
7. Panel lights	6. Voltage adjusting rheostat
8. Voltmeter	7. Ammeter-voltmeter transfer switch
9. Voltage adjusting rheostat	8. Panellight switch
10. Circuit breaker	9. Master switch
11. Ammeter phase indicator meter	10. DC Control circuit breaker
12. Frequency meter	11. Oil pressure gage
13. Load terminals	12. Reconnection switch
14. Outlet receptacle	13. Convenience receptacle

5. Review each group of students to insure their understanding of the controls, panel controls, and instruments. (7 minutes)

6. State the second training objective. (2 minutes)
Address the following.

a. Responsibilities of crew/operator.
b. Reason for performing before, during, and after preventive maintenance checks.

7. Rave each student find the operator/crew preventive maintenance checks and service in the following manual(s). (.5 minute)

Gasoline Engine Driven	Diesel Engine Driven
a. TM 5-6115-332-12 page 3-4 (Table 3-2).	a. TM 5-6115-584-12 page 3-4 (Table 3-2).
b. TM 5-2805-258-14 page 13 (Table 3-1).	b. TM 5-6115-584-12 page 304 (Table 3-2).

8. Explain and demonstrate the preventive maintenance inspection procedures during (7 minutes)

a. Before operation
b. During operation
c. After operation

9. Explain the information the date plates contain that is used when filling out DA Form 2404. (1 minute)

10. Explain the purpose and disposition of DA Form 2404. (1 minute)

11. Perform a lead-through and fill in the following blocks of DA Form 2404. (2 minutes)

a. #1
b. #2
c. #3
d. #6
e. #7

12. Check each student's DA Form 2404 for mistakes, and make corrections as necessary. Answer any questions. (.5 minute)

13. Explain the following status symbols and check each student's understanding of each. (1 minute)

a. X
b. /

14. Demonstrate and explain that when no deficiency or shortcoming is found, the following additional blocks of DA Form 2404 is completed. (.5 minute)

a. #10c.
b. #10e

Note
Place some easy to find faults in the items listed in tables 3-1 and 3-2.

15. Lead the students through an inspection and have them list the faults found on DA Form 2404 of items listed in the before operation check of the following manuals. (10 minutes)

Gasoline Engine Driven

a. TM 5-6115-332-12 page 3-4 (Table 3-2). page 3-4 (Table 3-2).
b. TM 5-2805-258-14 page 13 (Table 3-1).

Diesel Engine Driven

a. TM 5-6115-584-12

16. When an uncorrectable fault is found, the following additional blocks on DA Form 2404 should be completed. (5 minutes)

a. 4b
b. 5
c. 8a
d. 10a
e. 10b
f. 10c

17. When an uncorrected fault is corrected the following blocks are completed. (1 minute)

a. #10d
b. #10e
c. #10b

18. Check each student's DA Form 2404 for mistakes and make the necessary corrections. (10 minutes) Use this time for questions and answers.

WARNING

All caution and warnings contained in this packet should be strictly adhered to. Otherwise, severe injury, death and/or damage to the equipment may result.

19. State the third training objective and demonstrate to each group of students how to start and stop a generator set using the following steps. (13 minutes)

Gasoline Engine Driven

Starting Instruction

a. Place circuit breaker in OFF position.
b. Position the fuel selector valve in one of the following positions, depending on source of fuel.
    1. Set tank position
    2. Auxiliary fuel source position

Diesel Engine Driven

Starting Instruction

a. Push DC circuit breaker in
*b. Pull speed control assembly out until it stops
c. Move master switch to one of the following positions depending on source of fuel

c. Position oil pan baffle rod in one of the following positions, depending on ambient temperature.

1. Above OF.
2. Below OF.

d. Position air cleaner intake shutter in one of the following positions, depending on ambient temperature.

1. Above 25 F
2. Below 25 F

*e. Position governor control in govern position.

f. Position remote-local switch in local position.

g. Position emergency run-stop switch in the normal position.

CAUTION

NEVER HOLD THE START, STOP, OR MASTER SWITCH IN THE START POSITION LONGER THAN 15 SECONDS. LET THE STARTER COOL FOR ONE MINUTE BEFORE TRYING TO RESTART IT.

h. Push the start/stop switch to the start position. Hold until engine has started and 15 to 20 psi shows on the oil pressure gage.

If engine does not start within 15 seconds repeat Step h.

i. Allow engine to warm up, three to five minutes.

j. Place AC circuit breaker in the ON position

1. Prime and run.
2. Prime and run auxiliary fuel.

(The slowing of the pump action indicates the fuel system is primed).

Note

Preheat is not required when engine is hot.

d. Move master switch to the preheat position and hold for one minute.

e. Move master switch to the start position and hold until engine starts and reaches operating speed.

If engine does not start or reaches operating speed within 15 seconds repeat Steps d and 3.

f. Allow engine to warm up, three to five minutes.

g. Place AC circuit breaker in the ON position.

Stopping Instructions	Stopping Instructions
k. Position AC circuit breaker in OFF position.	h. Move AC circuit breaker to the OFF position.
*l. Allow generator set to cool down at rated speed, three to five minutes.	*i. Allow generator set to cool down at rated speed, three to five minutes.
m. Place start/stop switch to stop position.	j. Move master switch to OFF position.
	k. Pull out DC circuit breaker.
* Denotes changes to starting and stopping procedures taken from PS magazine, Issue 331, June 1980.	* Denotes changes to the starting and stopping procedures taken from PS magazine, Issue 334, September 1980.

These changes should be placed in the starting and stopping instructions of each Technical Manual.

20. Insure student's understanding of the starting and stopping instructions. (10 minutes)

WARNING

All CAUTIONS and WARNINGS contained in this packet should be strictly adhered to. Otherwise, severe injury, death and/or damage to the equipment may result. Students should be monitored very closely during starting, operating, and stopping of this equipment.

21. Have each student start and stop the generator set several times, or until you are sure he/she can properly start and stop the generator set. (30 minutes)

a. Give assistance when needed.
b. Correct any safety hazards as soon as you see them.
c. Insure students are following the instructions in the Technical Manuals.
d. Assign each group of students to a generator set and have each perform the following:

1. Start the generator set using the appropriate Technical Manual.

2. Perform during operation preventive maintenance checks using the appropriate Technical Manual(s) and DA Form 2404.

3. Stop the generator set using the appropriate Technical Manual.

4. Perform after operation preventive maintenance checks using the appropriate Technical Manual(s).

22. Check each DA Form 2404 for mistakes and make corrections as needed. (10 minutes)
Point out any steps he/she forgot to do.

23. Discuss operating procedures peculiar to your unit SOP. (no time limit)

E. REVIEW AND TEST:

1. Before each student takes the test, put five faults on the generator set. Vary the faults for different tests and choose the five faults from the following.

Gasoline Engine Driven

a. Voltmeter off zero.
b. Frequency meter off zero.
c. Battery negative cable disconnected.
d. Missing current selector knob (use 5/64 inch allen wrench).
e. Missing battery caps.
f. Missing oil dipstick.
g. Loose ground wire.
h. Loose spark plug cable.
i. Fuel filter missing.
j. Air restriction indicator missing.
k. Positive fuel selector valve in wrong position.
l. Position oil baffle rod in wrong position.
m. Position air cleaner shutter in wrong position.
n. Position circuit breaker to the ON position.
o. Remove engine cover.

Diesel Engine Driven

a. Oil level low (drain one quart into a clean container and keep).
b. Oil dipstick missing.
c. Air restrictor indicator missing.
d. Loose ground wire.
e. Battery negative cable disconnected.
f. Battery cap missing.
g. Shutter box assembly will not close (cut a small stick approximately 2-3/8 inches long and place inside of lower shutter).
h. Missing voltage adjust knob (use 5/64 inch allen wrench).
i. Missing master switch knob (use 5/64 inch allen wrench).
j. Position circuit breaker to the ON position.

2. Write down the name of the faults you put in so that you can check the student's work during the test. Give the student any of the missing parts when he/she asks for it.

3. During the test, proceed this way.

a. Observe the student, fill out the heading on DA Form 2404.
b. Observe the student perform the before operation checks.
c. Check the student's DA Form 2404. Make corrections on DA Form 2404 and point out any step the student forgot to do in the before operation checks.
d. Observe the student start the generator set. Stop the student, if any safety precautions are violated or any starting procedure is overlooked.
e. Observe the student perform the during operation checks.
Have him/her explain what he/she is looking at and for what reasons. Point out any item the student may have forgot.
f. Observe the student stop the generator set and perform the after operation checks.
g. Check the student's DA Form 2404. Make corrections and point out any steps the student forgot to do in the after operation checks.
h. Review the test with the student after completion of the test.

During this lesson we have discussed and employed the proper procedures for operating the 5KW generator set. If these procedures are applied each time a generator is operated our mission of generating power has been accomplished. (.5 minute)

TOTAL 144 minutes

SECTION IV

LESSON IV PREVENTIVE MAINTENANCE

A. TRAINING OBJECTIVE

TASK: Each student will use the Technical Manual to become familiar with other maintenance and operation procedures of the 5KW GED or DED generator set.

CONDITION: Given an installed 5KW GED or DED generator set, TM 5-6115-332-14 and LO 5-2805-258-12 or TM 5-6115-584-12, LO 5-6115-584-12, necessary tools, forms, and an organizational repairman.

STANDARD: Each student will be able to assist the organizational repairman in the performance of a lubrication service.

B. ADMINISTRATIVE INSTRUCTIONS (to be completed by unit)

1. When training will be given:
2. Training location:
3. Who will be trained:
4. Principal and assistant trainers:
5. Training Aids:

a.	TM 5-6115-332-14 and TM 5-2805-258-14 or TM 5-6115-584-12	1 ea per student
b.	Installed 5KW Generator Set (GED OR DED)	1 ea per 3 students
c.	LO 5-2805-12 or LO 5-6115-584-12	1 ea per student
d.	DA Form 2404	1 ea per student
e.	1/2-inch combination wrench or 7/16-, 3/4- and 1-1/4-inch combination wrench	1 ea per generator set
f.	10-inch adjustable wrench	1 ea per generator set
g.	Oil drain pan	1 ea per generator set
h.	Solvent container w/solvent	1 ea per class
i.	Cleaning brush	1 ea per class
j.	Cleaning rags	2 ea per class
k.	Organizational Repairman (or the instructors with a maintenance background)	1 each per 3 students

6. References: AR 750-1, TM 38-750, TM 5-6115-332-14, TM 5-2805-258-14, and LO 5-2805-258-12 or TM 5-6115-584-12 and LO 5-6115-584-12

C. SAFETY RESTRICTIONS: Preventive maintenance will be performed observing before, during, and after operation safety precautions (Lesson 1).

D. SEQUENCE OF ACTIVITIES AND ESTIMATED TIME

1. State Reason for Class (2 minutes)

The Army has many rules, regulations, policies, doctrine, and guides that must be followed during daily activities. These rules were developed to protect you, the operator, as well as your equipment. During this lesson, we will discuss some of the rules that apply to periodic maintenance requirements of your generator set. We will also discuss specific maintenance requirements for operating your generator set under unusual conditions. Maintenance is the responsibility of everyone. In combat it is often the key to a unit's efficiency and sometimes to it's actual survival. In peacetime, a highly efficient maintenance program is essential for maximum use of the Army's resources and to insure that equipment is operationally ready. You are all familiar with the term "Combat Ready" and to be "Combat Ready" you must have a combat ready maintenance system for your generator set.

2. Define preventive maintenance and state the purpose of the following levels of maintenance. (4 minutes)

a. Organizational
b. Direct Support
c. General Support
d. Depot

3. State the responsibilities of the crew/operator and the maintenance personnel within the organizational level. (1 minute)

4. Have each student open the Technical Manual(s) to the Organizational Preventive Maintenance Checks and Services. Insure each student has the correct page. (3 minutes)

5. State: The crew/operator will be required to assist the organizational maintenance personnel in the following scheduled maintenance and services. Explain each. (10 minutes)

<u>Gasoline Engine Driven</u>

a. Weekly
b. Monthly
c. Quarterly (Engine only)
d. Periodic hourly services

<u>Diesel Engine Driven</u>

a. Monthly
b. Semiannual
c. Periodic hourly service

6. Explain to each group of students the items to be inspected and the inspection procedures of the organizational preventive maintenance checks and services listed above. (15 minutes)

7. Explain how to prepare DA Form 2404. (5 minutes)

8. Have an organizational repairman assist each group of students perform a lubrication service. (15 minutes)

Gasoline Engine Driven	Diesel Engine Driven
Lubrication Service - 50 hours	Lubrication Service - 100 hours

9. Have each student open the Technical Manual to the Operating Under Unusual Conditions (10 minutes)
Explain why it is important to learn how to operate a 5KW generator set under unusual conditions
The following conditions will be addressed.

a. Operation in extreme cold
b. Operation in extreme heat
c. Operation in dusty or sandy area
d. Operation in rainy or humid area
e. Operation in high altitudes (gasoline only)
f. If your unit is located in one of the extreme conditions, use this time for further discussion.

10. Have each student open the Technical Manual to the Consumable Operating and Maintenance Supplies. Explain the Consumable Operating and Maintenance Supplies. (5 minutes)

11. Have each student open the Technical Manual(s) to the Operator Troubleshooting Chart (10 minutes)
Explain the importance of operator troubleshooting and discuss the troubleshooting tables in the following Technical Manual(s)

CAUTION

ONLY DISCUSS THOSE MALFUNCTIONS, PROBABLE CAUSES, AND CORRECTIVE ACTIONS THAT ARE THE RESPONSIBILITY OF THE OPERATOR.)

Gasoline Engine Driven	Diesel Engine Driven
a. TM 5-6115-332-14	a. TM 5-6115-584-12
b. TM 5-2805-258-14	

12. Have each student open the Technical Manual(s) to the maintenance allocation chart (3 minutes)
Briefly discuss the purpose and how to use the maintenance allocation chart.

13. Discuss Motor Vehicle Utilization Record(DD Form 1970). The following will be addressed. (5 minutes)

a. Purpose
b. Use
c. Preparation

14. Discuss other operation and maintenance procedures peculiar to your unit SOP. (5 minutes)

15. REVIEW AND ANSWER QUESTIONS (5 minutes)

In this lesson we have discussed Preventive Maintenance as it applies to the persons at organizational level.
We also have discussed other operations and maintenance procedures of the 5KW generator set which will be valuable to you as an operator.

TOTAL 98 Minutes

SECTION V
WRITTEN TEST

A. TRAINING OBJECTIVE

TASK: Each student will be tested in a three part written test. The three parts will consist of safety, installing, and operating a 5KW GED or DED generator set.

CONDITION: Given an adequate place for testing, a pencil and the written test packet.

STANDARD: Each student will receive a GO if he/she:

1. Answers 16 out of 20 (80%) of the questions correctly.
2. Answers each question marked with an asterisk (*).
3. Completes the test within one hour.

Part I SAFETY

*1. What is the minimum depth a ground rod must be driven into the ground?

a. Four feet.

b. Six feet.

c. Eight feet.

*2. Why is it important to make sure the main circuit breaker is in the OFF position before starting?

a. To prevent damage to equipment and possible death to the operator.

b. To prevent over loading the generator.

c. To make sure the circuit breaker switch works.

*3. Why does the operator have to wear ear protection?

a. To keep dirt out of the ears.

b. To protect ears during NBC attacks.

c. The noise level of this equipment can cause hearing damage.

*4. Why must a generator set be as level as possible while operating

a. Makes equipment easier to work on.

b. For proper lubrication.

c. For proper fluid level in the batteries.

*5. Why is it dangerous to smoke or use an open flame when servicing the battery?

a. A battery generates hydrogen, a highly explosive gas.

b. Heat causes a battery to discharge.

c. Smoke and heat cause the electrolyte level to dry rapidly.

*6. Use extreme care when working near the load terminals because.

a. They contain high voltage.

b. They require a large wrench to tighten properly.

c. They must be connected in sequence from top to bottom.

Part II INSTALLING

*1. What are the factors to consider when selecting a site for a generator?

a. Distance to loads, TMs, access to fuel supply.

b. Distance to loads, TMs, ventilation and mounting.

c. Distance to loads, access, fuel supply, ventilation, foundation and mounting.

*2. Why must the generator set be positioned as close as possible to the load?

a. To reduce the time it takes the operator to check the generator during operation.

b. To reduce transmission line voltage losses.

c. To keep the equipment from overheating.

3. What item is used to turn the fuel supply off or to select between an auxiliary fuel source and the fuel can (set tank)?

a. Fuel hose connector.

b. Fuel selector valve.

c. Fuel tank valve.

*4. Before attempting to connect the load cables, make sure the generator set.

a. Is well-ventilated.

b. Is completely shut down.

c. Is set for the desired output.

5. After leveling the generator set. What is the next step?

a. Grounding.

b. Hooking up load.

c. Checking circuit breaker.

*6. What is the function of the output selector switch ,or change board.

a. Regulates fuel flow.

b. Regulates the amount of cycles.

c. Allows you to select the correct outputs for voltage, phases and wires.

SECTION VI

Part III OPERATION

*1. What before operation check must be performed prior to starting the generator set?

a. Camouflage generator.

b. Sandbag generator.

c. Engine oil level.

*2. Prior to starting. what position should the circuit breaker be in?

a. OFF position.

b. NEUTRAL position.

c. ON position.

*3. Why is it important to operate a generator set in a well ventilated area?

a. So refueling can be done when the generator set is operating.

b. To help the operator during the performance of preventive maintenance.

c. To prevent overheating and for proper venting of exhaust gases.

*4. While the generator set is running what should the operator check?

a. The weather.

b. All gages, signs of overheating, fuel and oil leaks.

c. Fuel supply.

5. While the generator set is running, the load is checked when?

a. Every five minutes.

b. Every hour.

c. Periodically.

Part III OPERATION (CONT)

*6. What must the operator do prior to stopping the generator set.

a. Move the S-1 switch to the OFF position.

b. Shut the fuel off.

c. Move the load circuit breaker to the OFF position.

7. How long must you operate the engine at rated speed before stopping the generator set?

a. One minute.

b. Three to five minutes.

c. One to three minutes.

*8. After stopping the generator set, what must the operator check prior to restarting the unit?

a. Oil and fuel levels.

b. Air cleaner damage.

c. Service batteries.

ANSWER SHEET

*= asterisk

Part I SAFETY

*1. C

*2. A

*3. C

*4. B

*5. A

*6. A

Part II INSTALLING

*1. C

*2. B

3. B

*4. B

5. A

*6. C

Part III OPERATION

*1. C

*2. A

*3. C

*4. B

5. C

*6. C

7. B

*8. A

SECTION VII

PERFORMANCE TEST

A. TRAINING OBJECTIVE

TASK: Each student will be tested on his/her ability to install. perform operator/crew preventive maintenance checks, and operate the 5KW GED or DED generator set.

CONDITION: Given a selected site, a load, a 5KW GED or DED generator set, appropriate Technical Manuals and the necessary tools, materials, and equipment.

STANDARD: Each student will receive a GO if he/she:

1. Passes 80 percent of the performance measures.
2. Passes each performance measure marked with an asterisk (*).
3. Completes the task within two hours.

B. ADMINISTRATIVE INSTRUCTIONS (to be completed by the unit)

1. When test will be given:
2. Testing location:
3. Who will be tested:
4. Principal and assistant scorers:
5. Testing station equipment and aids:

a.	5KW GED or DED generator set	1 ea per student
lb.	A load with transmission cable	1 ea per generator set
c.	Ground rod assembly	1 ea per generator set
d.	Sledge hammer or ground rod hammer	1 ea per generator set
e.	Fire extinguisher	1 ea per generator set
f.	TM 5-6115-332-14, TM 5-2805-258-14, LO 5-2805-258-12 or TM 5-6115-584-12, and LO 5-6115-84-12	1 ea per generator set
	LO 5-2805-258-12 or TM 5-6115-584-12 and LO 5-6115-584-12	1 ea per generator set
g.	5-gallon can of fuel	1 ea per generator set
h.	12-inch adjustable and 4-inch flat-tip screwdriver	1 ea per generator set
i.	Clean rags	1 ea per generator set
j.	DA Form 2404	1 ea per student
k.	Pencil 1 ea per student	

l.	Earplugs or headset	1 ea per student and scorer
m.	Clipboard	1 ea per student and scorer
n.	Wristwatch	1 ea per scorer
o.	Pen	1 ea per scorer

The following can be used:

a. Load bank
b. The end item the generator set usually powers
c. General illumination light set

6. Testing station personnel.
   Scorer — 1 each per student
7. Reference: TM 5-6115-332-14, TM 5-2805-258-14, LO 5-2805-258-12 or TM 5-6115-584-12 and LO 5-6115-584-12.

8. General Administrative Instruction.

   a. Objective. To measure the student's ability to:

      1. Install a 5KW GED or DED generator set.
      2. Perform operator/crew preventive maintenance checks.
      3. Properly operate a 5KW GED or DED generator set.

   b. This performance test contains four parts.

      PART I Installing a 5KW GED or DED generator set.
      PART II Perform before operation checks.
      PART III Electric start a 5KW generator set and perform during operation checks.
      PART IV Stopping a 5KW generator set and perform after operation checks.

   c. This performance test contains 75 performance measures. Sixty or eighty percent of the performance measures are marked with asterisks which are critical performance measures and must receive a PASS.

   d. This test should be conducted outdoors in an open area at least six by eight feet, on level dry ground, during daylight hours, and in fair weather.

e. Some performance measures are labeled Scored In Sequence and must be completed in sequence to receive a PASS.

f. This test must be completed within two hours to receive a GO.

9. Instructions To Scorers.

a. Make sure you have all items listed in the Testing Stations Equipment and Aids.

b. As a scorer, you will score the student's performance using the SCORER'S CHECKLIST.

c. The student is not to be told how well he/she is doing during the test. The scorer will check either PASS or FAIL for each performance measure as it is performed.

d. The scorer will stop the test in the event of injury or equipment damage or to prevent either of these from happening.

e. If the student is at fault, he/she will be scored FAIL on that performance measure.

f. If the student is not at fault, the problem will be corrected, the test will be restarted at the performance measure the malfunction occurred, with no time lost to the student.

g. If the student calls the equipment out of action for a suspected malfunction, stop the test.

h. If a malfunction exists, correct the malfunction, with no time lost to the student. The test will start again at the performance measure where the malfunction occurred.

i. If no malfunction is found, the student will receive a FAIL for the performance measure.

j. If it is observed that the student has failed at any part of the test, allow the student to complete the entire test in order to identify retraining needs.

k. If the student runs out of time before finishing the test, score him/her FAIL on the unfinished performance measures(s).

l. The scorer will check either GO or NO GO at the end of each part of the test and explain briefly in the REASON(S) FOR NO GO/REMARKS why the student received a NO GO.

m. The scorer will sign the scorer's block and fill in the date.

n. Coaching is not allowed.

o. At the completion of the test, the scorer will tell the student any performance measure failed and the correct procedure to perform this measure.

p. Watch for safety violations.

q. After each student has completed the test, the testing site will be prepared for the next student.

r. Give a copy of the Instructions To Student to each student and read aloud the instructions.

s. Place some faults on the generator set. Vary the faults for different tests. Use your own or choose the faults from Lesson 3, page 33.

t. Mark off the generator site so the student will understand where the site area is.

u. If generator set is in place, ask the student the factors for site selection.

v. BE REASONABLE.

10. Instructions to the Student.

a. This performance test contains four parts.

PART I Installing a 5KW GED or DED Generator Set.

PART II Perform Before Operation Checks.

PART III Electric Start a 5KW Generator Set and Perform During Operation Checks.

PART IV Stopping a 5KW Generator Set and Perform After Operation Checks.

b. This is a graded task requiring individual work.

c. There are 75 performance measures in this task of which you must complete 60 to receive a GO.

d. This test must be completed within two hours to receive a GO.

e. Everything you will need to complete this test is

f. If, at any time of the test there is a malfunction with the generator set, inform the Scorer.

g. If you should receive a NO GO, you will be counseled by the Testing Control OIC or NCOIC, receive remedial training, and be retested.

h. After you complete the test, the scorer will critique your performance. You will assist the scorer in preparing the site for the next student.

C. SAFETY RESTRICTION. All safety precautions will be strictly adhered to during installation, performance of operator/crew preventive maintenance checks, and operating the Generator Set.

SECTION VIII

SCORER' S CHECKLIST

PERFORMANCE TEST: 5KW GENERATOR SET

STUDENT NAME:

RANK:

SSN:

UNIT/ORGANIZATION:

A. GASOLINE ENGINE DRIVEN:

TIME STARTED _____

PART I INSTALLING A 5KIW GENERATOR SET

PERFORMANCE MEASURES

(Sequence is Scored)	PASS	FAIL
*1. Installing. Before attempting to install the generator set, it must be completely shutdown.	____	____
(Sequence is not Scored)		
1. Site Selection. Uses TM 5-6115-332-12 to install the 5KW generator set.	____	____
*2. Distance to Load. Position the generator set and attach the load. To prevent voltage line loss, install the generator as close as possible to the load without disrupting the user.	____	____
*3. Access. Provide enough clearance around the generator set to facilitate operation and maintenance activities.	____	____
*4. Fuel Supply. Provide an adequate supply of clean fuel to meet requirements based on operation time.	____	____
5. Fuel Selector Valve. Place in position depending on fuel source used.	____	____
*6. Foundation. Place the generator set on reasonably firm dry ground.	____	____
*7. Mounting. Position the unit so that it is reasonably level and the frame is supported on its entire bottom surface.	____	____
*8. Power Transmission Cable. Connect the cable to generator output terminals for the correct voltage and phase requirements.	____	____
9. Voltage Phase Output Selector Switch or Change Board. Position the output selector switch in accordance with the output voltage and phase requirement.	____	____
*10. Ground Generator Set. Connect one end of a ground cable not less than No. 6 AWG to the generator set ground terminal and tighten nut securely.	____	____

		PASS	FAIL
*a.	Connect the drive coupling to the first section of ground rod and drive the first section of ground rod into the ground far enough so that the second section can be connected and driven into the ground. Remove drive coupling.	____	____
*b.	Connect the second section of ground rod to the first ground rod using an adapter, connect the drive coupling to the second section and drive the second section of ground rod into the ground far enough so that the third and final section can be attached and driven into the ground. Remove drive coupling.	____	____
*c.	Slide the ground clamp over the third section of ground rod. Connect the drive coupling to the third section of ground rod and connect the third section of ground rod using an adapter and drive the third section into the ground, leaving not more than one foot extending above the ground.	____	____
*d.	Connect the other end of the ground cable to the ground clamp and tighten the bolt securely.	____	____
*11.	Smoking. No smoking or open flame during entire test.	____	____
*12.	Jewelry. All jewelry will be removed. (Wedding bands and hard to remove rings may be taped.)	____	____
*13.	Fire Extinguisher. A fire extinguisher will be placed near the generator set site.		

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____

_____

_____

_____

_____
Scorer's Signature and Date

SECTION IX

PART II PERFORM BEFORE OPERATION CHECKS

PERFORMANCE MEASURES

(Sequence is Scored)

		PASS	FAIL
*1.	Operator/Crew Preventive Maintenance Checks and Services. Open TM 5-6115-332-14 and TM 5-2805-25814 to the operator/crew preventive maintenance checks and service. Use LO 5-2805-258-12.	____	____
*2.	Generator Set. Visually inspect the generator set for fuel and oil leaks.	____	____
*3.	Oil Level. Check engine oil level. Add oil as necessary.	____	____
*4.	Generator Set Ground Terminal. Check ground terminal for tightness	____	____
*5.	Engine. Inspect the engine for loose or missing wiring and parts.	____	____
*6.	Fuel Filter. Inspect fuel filter for dirt, water, and sediment. Clean if necessary.	____	____

(Sequence is not scored)

1.	DA Form 2402. Prepare a DA Form 2404	____	____
*2.	Tools and Parts. Remove all loose tools and parts lying on any part of the generator set.	____	____
3.	Spark Plug Cables. Disconnect spark plug cables prior to engine maintenance.	____	____
4.	Electrolyte. Use extreme care when handling electrolyte (batteries)	____	____

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____
_____
_____
_____

_____
Scorer's Signature and Date

SECTION X

PART III ELECTRIC START A 5KW GENERATOR SET AND PERFORM DURING OPERATION CHECKS

PERFORMANCE MEASURES

+(Not scored in sequence)		PASS	FAIL
*1.	Circuit Breaker. Place circuit breaker in the OFF position.	____	____
2.	Operating Levers and Controls. Insure that all operating levers and controls are in the proper operating positions.	____	____
*3.	Voltage Phase Output Selector Switch, or change board. Position the output selector switch in accordance with the output voltage and phase requirement.	____	____

+ = Not scored in sequence but must be completed prior to beginning the scored in sequence performance measures.

(Scored in sequence)

*1.	Starting Instructions. Use TM 5-6115-332-4 to prepare for starting and to start 5KW generator set.	____	____
*2.	Fuel Selector Valve. Place fuel selector valve in the proper position, depending on source of fuel.	____	____
*3.	Oil Pan Baffle Rod. Place oil pan baffle rod in the proper position, depending on ambient temperature.	____	____
*4.	Air Cleaner Intake Shutter. Place air cleaner intake shutter in the proper position, depending on ambient temperature.	____	____
*5.	Governor Control. Position governor control in govern position	____	____
*6.	Remote-Local Switch. Place remote-local switch in the local position.	____	____
*7.	Emergency Run-Stop Switch. Place emergency run-stop switch in the normal position.	____	____
*8.	Ear Protection. Ear plugs or ear headset will be in place at this time.	____	____
*9.	Start-Stop Switch. Push the start-stop switch to the start position. Hold until engine has started and 15 to 20 psi shows on the oil pressure gage.	____	____

		PASS	FAIL
*10.	Start-Stop Switch. Do not hold start-stop switch in the start position longer than 15 seconds. Allow a starter cooling period of one minute before attempting to restart.	____	____
*11.	Engine will not start. Repeats performance Step 9.	____	____
*12.	Engine Warm up. Allows engine three to fifteen minutes to warm up.	____	____
*13.	Circuit Breaker. Place circuit breaker in the ON position.	____	____
*14.	Operator/Crew Preventive Maintenance Checks and Service. Uses TM 5-6115-332-14 and TM 5-2805-258-14 to perform during operation checks in sequence.	____	____
*15.	Frequency Meter. Insure frequency meter reads 60 or 400 hertz.	____	____
*16.	Voltmeter. 120/240 120/208. Rotate voltage selector to monitor the voltage of each phase combination.	____	____
*17.	Ammeter. Rotate ammeter phase selector switch to monitor the load applied to each phase. Not to exceed 100 percent.	____	____
*18.	Oil Pressure Gage. Insure oil pressure gage reads 20 to 60 psig.	____	____
*19.	Battery Charging Ammeter. Should read zero or any reading on plus side of scale.	____	____
*20.	Air Cleaner Restriction Indicator. Check indicator for red or green showing. If red, contact organizational maintenance.	____	____
*21.	Engine. Inspect engine for loose or missing wiring parts and any oil or fuel leaks.	____	____
*22.	Oil Filter. Inspect for oil leaks.	____	____
*23.	Engine and Engine Accessories. The engine and engine accessories that are hot should not be touched with the bare hands during operation or before they have cooled sufficiently.	____	____

	PASS	FAIL
24. Electrolyte. Use extreme care when handling electrolyte(batteries) .	____	____

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____
_____
_____
_____

_____
Scorer's Signature and Date

SECTION XI

PART IV STOPPING A 5KW GENERATOR SET AND PERFORM AFTER OPERATION CHECKS

PERFORMANCE MEASURES

(Scored in Sequence)

		PASS	FAIL
*1.	Stopping Instructions. Uses stopping instructions in TM 5-6115-332-14.	____	____
*2.	Circuit Breaker. Place circuit breaker in the OFF position.	____	____
*3.	Cool Down. Allows engine to cool down at rated speed three to fifteen minutes.	____	____
*4.	Start-Stop Switch. Place start-stop switch in the stop position.	____	____
5.	Ear Protection. Remove ear protection.	____	____
*6.	Operator/Crew Preventive Maintenance Checks and Service. Uses TM 5-6115-332-14 and TM 5-2805258-14 to perform after operation checks.	____	____
*7.	Generator Set. Visually inspect the generator set for fuel and oil leaks.	____	____
*8.	Fuel Tank. Refuel tank after completion of daily operation.	____	____
*9.	Refueling. Provide metal to metal contact between fuel container and fuel tank.	____	____
*10.	Engine. Inspect the engine for loose or missing wiring, parts, and any oil or fuel leaks.	____	____
*11.	Oil Level Gage. Check oil level. Add if necessary.	____	____
*12.	Fuel Filter. Inspect fuel filter for dirt, water, or sediment.	____	____
*13.	Oil Filter. Inspect for oil leaks.	____	____
14.	Fuel Selector Valve. Place fuel selector valve in the OFF position.	____	____
15.	Electrolyte. Use extreme care when handling electrolyte (batteries)	____	____

	PASS	FAIL
16. Jewelry. All jewelry, watches, and rings will be replaced.	____	____
17. Generator Set. Generator set will be cleaned for next day use.	____	____

(Not Scored in Sequence)

*1. Engine and Engine Accessories. Engine and engine accessories that are hot should not be touched with bare hands before they have cooled sufficiently.	____	____
2. Spark Plug Cables. Disconnect spark plug cables prior to engine maintenance.	____	____

TIME FINISHED_____

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____
_____
_____
_____

_____
Scorer's Signature and Date

SECTION XII

SCORER'S CHECKLIST

PERFORMANCE TEST: 5KW GENERATOR SET

STUDENT NAME:

RANK:

SSN:

UNIT/ORGANIZATION:

B. DIESEL ENGINE DRIVEN

TIME STARTED _____

PART I INSTALLING A 5KW GENERATOR SET

PERFORMANCE MEASURES

(Sequence is Scored)

		PASS	FAIL
*1.	Installing. Before attempting to install the generator set, it must be completely shut down.	____	____

(Sequence is Not Scored)

1.	Site Selection. Uses TM 5-6115-584-12 to install the 5KW generator set.	____	____
*2.	Distance to Load. Position the generator set as close as possible to the load.	____	____
*3.	Access. Provide enough clearance around the generator set to facilitate operation and maintenance activities.	____	____
*4.	Fuel Supply. Provide an adequate supply of clean fuel to meet requirements based on operation time.	____	____
5.	Fuel Selector Valve. Place in position depending on fuel source used.	____	____
6.	Foundation. Place the generator set on reasonably firm dry ground.	____	____
*7.	Mounting. Position the unit so that it is reasonable level and the frame is supported on its entire bottom surface.	____	____
*8.	Power Transmission Cable. Connect the cable to the load terminals in accordance with the output voltage and phase requirements.	____	____
9.	Voltage Phase Selector Switch, or Change Board. Position the output selector switch in accordance with the output voltage and phase requirement.	____	____

	PASS	FAIL
*10. Ground Generator Set. Connect one end of a ground cable not less than No. 6 AWG to the generator set ground terminal and tighten nut securely.	____	____
*a. Connect the drive coupling to the first section of ground rod and drive the first section of ground rod into the ground far enough so that the second section can be connected and driven into the ground. Remove drive coupling.	____	____
*b. Connect the second section of ground rod to the first ground rod using an adapter, connect the drive coupling to the second section and drive the second section of ground rod into the ground far enough so that the third and final section can be attached and driven into the ground. Remove drive coupling.	____	____
*c. Slide the ground clamp over the third section of ground rod. Connect the drive coupling to the third section of ground rod and connect the third section into the ground, leaving not more than one foot extending above the ground.	____	____
*d. Connect the other end of the ground cable to the ground clamp and tighten the bolt securely.	____	____
*11. Smoking. No smoking or open flame during the entire test.	____	____
*12. Jewelry. All jewelry will be removed. (Wedding bands and hard to remove rings may be taped.)	____	____
*13. Fire Extinguisher. A fire extinguisher will be placed near the generator set site.	____	____

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____

_____

_____

_____

_____
Scorer's Signature and Date

SECTION XIII

PART II PERFORM BEFORE OPERATION CHECKS

PERFORMANCE MEASURES

(Sequence is Scored)

		PASS	FAIL
*1.	Operator/Crew Preventive Maintenance Checks and Services. Open TM 5-6115-584-12 to the operator crew preventive maintenance checks and services. Use LO 5-6115-584-12.	____	____
*2.	DA Form 2404. Prepare DA Form 2404.	____	____
*3.	Generator Set. Make a visual inspection of entire generator set for cleanliness, loose or missing bolts, nuts, and pins. Inspect for bent, cracked, or broken parts. Inspect all wires and terminals for damage and loose connections. Inspect for evidence of oil, fuel, and exhaust leaks.	____	____
*4.	Fuel Supply. Check for an adequate supply of clear fuel to meet requirement based on operation time. Open drain on fuel tank, filters, and strainers, and remove any water or sediment.	____	____
*5.	Oil Level. Inspect oil in crank case for proper level. Add oil as necessary.	____	____
*6.	Air Flow Indication. Inspect air flow indicator. If indicator has tripped, clean or replace air cleaner element.	____	____
*7.	Shutter Box Assembly. Inspect shutter box assembly for proper operation.	____	____
*8.	Generator Set Ground Terminal. Inspect ground terminal to make certain all connections are clean and tight.	____	____

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____

_____

_____

_____

_____
Scorer's Signature and Date

SECTION XIV

PART III ELECTRIC START A 5KW GENERATOR SET AND PERFORM DURING OPERATION CHECKS

PERFORMANCE MEASURES

+(Not Scored in Sequence)	PASS	FAIL
*1. Circuit Breaker. Place circuit breaker in the OFF position.	____	____
2. Operating Levers and Controls. Insure that all operating levers and controls are in the proper operating positions.	____	____
*3. Voltage Phase Output Selector Switch, or Change Board. Position the output selector switch in accordance with the output voltage and phase requirement.	____	____
+ = Not scored in sequence but must be completed prior to beginning the Scored in Sequence performance measures.	____	____
(Scored in Sequence)		
*1. Starting Instructions. Use TM 5-6115-584-12 to prepare for starting and to start 5KW generator set.	____	____
*2. Fuel Selector Valve. Place fuel selector valve in the proper position, depending on source of fuel.	____	____
*3. Air Cleaner Indicator. Should be showing green, if not, replace element or indicator if not functional.	____	____
*4. Master Switch. Place master switch in the proper position.	____	____
*5. DC Control Circuit Breaker. Push DC control circuit breaker in.	____	____
*6. Ear Protection. Ear plugs or ear headset will be in place at this time.	____	____
*7. Make sure speed control is set properly.	____	____
*8. Master Switch. Turn switch to prime and run.	____	____
*9. Master Switch. Turn switch to start position and hold until engine comes to operating speed.	____	____

		PASS	FAIL
*10.	Master Switch. Do not hold switch in start position longer than 15 seconds. Allow a starter cooling period of one minute before attempting to restart.	____	____
*11.	Master Switch. Will return to prime and run position when released. If running from auxiliary fuel source, move master switch to prime and run auxiliary fuel position.	____	____
*12.	Check Oil Pressure on Engine Mounted Gage. Oil pressure should be at least 20 psi minimum.	____	____
*13.	Check Frequency on Frequency Meter. On control panel adjust governor, if necessary, using speed control.	____	____
*14.	Frequency Meter. Frequency meter should read 61.5 with no load. If not, pulling speed control knob out will increase frequency.	____	____
*15.	Engine Warm up. Allows engine three to five minutes to warm up.	____	____
*16.	Voltmeter 120/240 120/208. Rotate voltage selector to monitor the voltage of each phase combination.	____	____
*17.	Battery Charging Ammeter. Should read zero or any reading on plus side of scale.	____	____
*18.	Fuel Filters. Inspect for fuel leaks.	____	____
*19.	Oil Filter. Inspect for oil leaks.	____	____
*20.	Engine. Inspect engine for loose or missing wiring, parts, and any oil or fuel leaks.	____	____
*21.	Engine and Accessories. The engine and engine accessories that are hot should not be touched with the bare hands during operation or before they have cooled sufficiently.	____	____

	PASS	FAIL
*22. Water Level in Batteries. Should be at ring level .	____	____

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____
_____
_____
_____

_____
Scorer's Signature and Date

SECTION XV

PART IV STOPPING A 5KW GENERATOR SET AND PERFORM AFTER OPERATION CHECKS

PERFORMANCE MEASURES

(Scored in Sequence)

		PASS	FAIL
*1.	Stopping Instruction. Use stopping instructions in TM 5-6115-584-12.	____	____
*2.	Circuit Breaker. Place circuit breaker in the OFF position.	____	____
*3.	Cool Down. Allows engine to cool down at rated speed three to five minutes.	____	____
*4.	Master Switch. Place in OFF position.	____	____
*5.	Ear Protection. Remove ear protection.	____	____
*6.	Operator/Crew Preventative Maintenance Checks and Service. Uses TM 5-6115-584-12 to perform after operation checks.	____	____
*7.	Generator Set. Visually inspect the generator set for fuel and oil leaks.	____	____
*8.	Fuel Tank. Refuel tank after completion of daily operation.	____	____
*9.	Refueling. Provide metal to metal contact between fuel container and fuel tank.	____	____
*10.	Engine. Inspect the engine for loose or missing wiring, parts, and any oil or fuel leaks.	____	____
*11.	Oil Level. Check oil level in crank case. Add if necessary.	____	____
*12.	Fuel Filters. Inspect fuel filters for dirt, water, or sediment. Clean if necessary.	____	____
*13.	Oil Filter. Inspect for leaks.	____	____
14.	Fuel Select Valve. Place fuel selector valve in the OFF position.	____	____

	PASS	FAIL
15. Jewelry. All jewelry, watches, and rings will be replaced.	____	____
16. Generator Set. Generator set will be cleaned for next day use.	____	____

(Not Scored in Sequence)

TIME FINISHED_____

	GO	NO GO
CHECK ONE	☐	☐

REASONS FOR NO GO/REMARKS (Briefly explain)_____
_____
_____
_____

_____
Scorer's Signature and Date

By Order of the Secretary of the Army

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official.

PAUL T. SMITH
Major General, United States Army
The Adjutant General

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P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

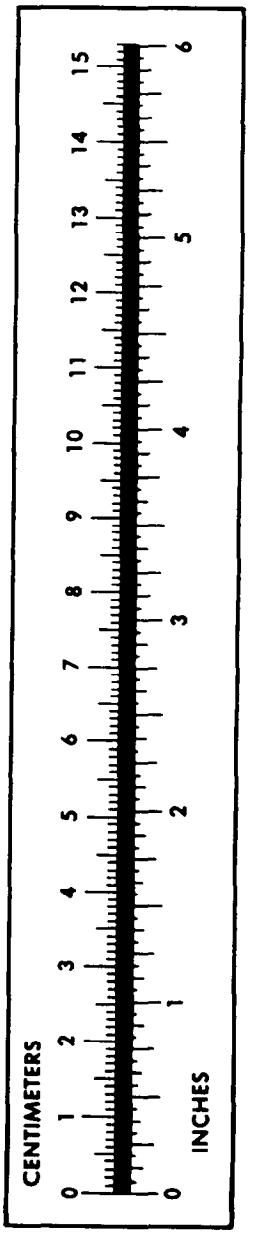
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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