

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

PRESERVATION OF RAILROAD EQUIPMENT FOR STORAGE

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CHAPTER 1

GENERAL

1. Purpose. The purpose of this bulletin is to provide CONUS and overseas activities, responsible for the storage of USAMECOM railroad equipment instructions and guidance relative to preservation for storage.

2. Scope. This bulletin is applicable to the preparation of locomotives, rail cars, right-of-way construction and maintenance equipment, and related supplies and equipment for long term storage. The instructions contained herein pertain mainly to the prevention of deterioration by use of preservatives and dehumidification. These instructions are sufficiently general to be applicable to all types of railroad equipment. These instructions generally parallel the requirements prescribed in item and basic packaging specifications. In many instances, this bulletin provides instructions not currently contained or detailed in the specifications. Supplementary preservation instructions for railroad equipment are provided om Department of

Army Supply bulletins, 740-series, entitled, "Storage Serviceability Standard for USAMECOM Materiel".

3. References. A listing of instructional material and specifications applicable to this bulletin is provided in appendix II.

4. Reporting of Equipment Publication Improvements. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded directly to the Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-SP 4300 Goodfellow Blvd., St. Louis, Mo. 63120.

*This bulletin supersedes TB 740-93-5, 19 December 1966, including all changes

CHAPTER 2

INSTRUCTIONS

5. General. The following general instructions cover disassembly, matchmarking, lubrication, cleaning, drying, painting, marking, precautionary, and safety measures and the use of contact preservatives and other materials involved when preserving railroad equipment. Further instructions involving each detailed process may be found in the publications mentioned in the applicable paragraphs.

6. Disassembly and Matchmarking. Disassembly will be the minimum necessary to safeguard parts known to be subject to damage or loss and to allow ventilation. Bolts, nuts, and washers will be replaced on one of the mating parts and secured. Parts removed during assembly will be preserved, packaged, identified, and stored in the toolbox or in a nailed wood box conforming to FED PPP-B-621, class 2, style optional and stored in a protected location on the equipment. Removed parts and mating parts remaining on the basic unit will be matchmarked identically, except where mating of parts is apparent, by stenciled letters or numerals with gasoline soluble paint conforming to MIL-P-13983. Parts which are too small to accommodate stencil marking will be identified by using metal tags, if available or cloth shipping tags conforming to FED UU-T-81, type A. Securely attach the tags to the parts in such a manner as to prevent damage to preservation or to the parts being identified. The marked cloth shipping tag will be waterproofed in accordance with MIL-STD-129.

7. Lubrication. Unless otherwise specified herein when lubricating railroad equipment, use the lubricants required in the applicable lubrication orders. Equipment cleaned by processes indicated in paragraph 8a(2) and (3) will be relubricated when such processes remove or contaminate previously applied lubricants.

8. Cleaning and Drying.

a. Cleaning. Equipment and components will be cleaned using the most applicable cleaning process of MIL-P-116. When possible, the entire item will be cleaned without interruption. However, when interruptions are necessary, temporary protection will be provided to the areas that have been cleaned.

(1) Special cleaning.

(a) Food handling and potable water equipment. Potable water containers, water dispensers, refrigerators, and other food handling items likely to come in contact with food and beverages must not be cleaned with any toxic material. Petroleum solvents are

toxic. If it is necessary to clean food handling or potable water equipment, the items will be cleaned with soap and water to which a water soluble compound, such as a sal soda, may be added. Thorough rinsing with potable water will then be accomplished.

(b) Batteries and battery racks. Exterior surfaces of storage batteries and battery racks which have become contaminated with spilled electrolyte will be neutralized with a solution composed of 8 ounces of soda ash or 1 pound of baking soda to a gallon of water. The cleaning solution must not be permitted to enter the battery. The cleaned surfaces will be rinsed with clear, warm water.

(2) Field cleaning. Process C1, C-3, C-14 and C-15 normally are used in field cleaning operations. Examples of mechanical means employed in the field application of process C-1 are buffing, sanding, and scratch brushing. Examples of chemical means are petroleum solvents and alkaline compounds.

(3) Shop cleaning operations. Cleaning operations performed within a building normally are accomplished by processes C-1, C-3, C-5, C-7, C-14, C-15, and C-18.

(4) Fingerprint removal. Prior to preservation, provide additional cleaning to critical and precision machined surfaces by applying process C-5 to remove fingerprints and perspiration residues.

CAUTION

Do not handle parts with bare hands after cleaning has been accomplished.

(5) Precautionary measures. Protect items made of rubber, such as hose, and electrical insulation from petroleum solvents by shielding greaseproof barrier material or other suitable material. Protect all items subject to damage by steam cleaning, such as generators, starters, magnetos, and distributors, by shielding with waterproof barrier material. When impracticable to properly shield the items, remove during the cleaning operations.

b. Drying. Immediately after cleaning, items will be thoroughly dried using the most applicable procedure of MIL-P-116. Air lines supplying compressed air for drying metal surfaces and for spraying paint or preservatives will be equipped with and water separators. These separators

will be located in the air lines approximately 25 feet from the discharge end of the hose. Drain the separator and the air compressor storage tank at frequent intervals by opening the drain cocks, by opening the drain cocks, allowing any oil and water to drain from the units.

9. Painting. Railroad equipment in storage will be spot painted unless damage to the existing paint coating is sufficient in scope to make complete repainting more economical. Variances in the shades of the paint used for spot painting from that of the original paint are not justification for complete repainting. Damaged or deteriorated portions of painted surfaces will be cleaned of all oil, grease, dirt, loose scaly type rust, and blistered paint prior to spot painting. Immediately following the cleaning operation, apply one coat of primer or paint of the same or similar type and color to the area from which the paint has been removed. Railroad equipment requiring complete painting will be treated and painted in accordance with MILIP-3320, MIL-P-3321 or MIL-P-3807 as applicable.

10. Marking. Marking of railroad equipment will be in accordance with MIL-STD-129.

11. Safety Precautions.

a. Common Hazards. Both personnel and materiel are exposed to some hazards in nearly all preservation procedure. However, with proper care, any of the materials described herein may be used safely.

(1) *Flammability.* Many cleaning materials, preservatives and sealing compounds, are flammable. Some give off flammable vapors and form explosive mixtures when the vapors combine with air. The danger is greatest when materials are used in confined space.

(2) *Skin irritation.* Many of the materials tend to irritate the skin upon contact, and exposure to the fumes or liquids has caused severe cases of dermatitis and other injuries. Cleaning materials are particularly hazardous in this respect.

(3) *Toxicity.* Some of the materials are mildly toxic. None of them should be inhaled in any great concentration. Spray applications are particularly dangerous.

b. Safety Program. A well planned and constantly enforced safety program will be provided. An effective safety program will place emphasis on ventilation, fire prevention and personnel safety.

(1) *Ventilation.* Adequate ventilation of work areas will be provided. When using volatile materials in a confined space, an exhaust system will be used to evacuate fumes from the area.

(2) *Fire prevention.* Fire fighting equipment will be kept available at all times, and the personnel engaged in preservation will be instructed in its use. They will also be instructed as to the course of action in the event of fire. Smoking and the use of fire and open lights will be prohibited in work areas. Explosion-proof electrical switches and controls will be required on all equipment used in the vicinity of and for the application of volatile materials. Electrically operated equipment and spray equipment will be grounded.

(3) *Personnel safety.* Personnel will be required to observe safety regulations concerning the use of respiratory masks when spraying, safety goggles when handling or working near cleaning solvents and all spray applications, and protective gloves when working with cleaning materials and preservatives.

12. Contact Preservatives and Other Materials. The P-type preservatives and methods of application, specified herein, are described in MIL-P-116 and TM-38-230. Other materials required to accomplish special sealing and preservation are as follows:

- (1) Bituminous coatingMIL-C-3254
- (2) Desiccant (bagged)MIL-D-3464
- (3) Lacquer-resisting synthetic primerFED TT-P-664
- (4) Pressure-sensitive tape.....FED PPP-T-60
- (5) Strippable coating.....MIL-C-16555

b. Application. Before applying coating and materials such as bituminous coating, strippable coating, lacquer-resisting synthetic primer and pressure-sensitive tape, the surfaces to which the material is to be applied will be dry and clean of oil, grease, dirt and other contamination. The following additional guides will be observed in the use of materials listed in a(1) through h(5) above.

(1) *Bituminous coating.* When applied over strippable coating, bituminous coating will be sprayed or troweled to a thickness of 1/8 inch. At least 4 hours should elapse between the application of strippable and bituminous coatings. When applied directly to metal surfaces to caulk or seal a joint, the thickness of the coating will be appropriate for the application.

(2) *Desiccant (bagged).* To minimize absorption of moisture, bagged desiccant will be kept in sealed containers until the moment it is placed within the area being dehumidified. Bagged desiccant will be used only for static dehumidification. The desiccant will be secured in a manner to prevent contact with metallic surfaces

and the area or item in which it is placed will be closed and sealed immediately.

(3) *Lacquer-resisting synthetic primer.* The primer is applied to metal clutch and brake drums to prevent corrosion. Clutch and brake facings will be removed or held clear of the surfaces to which the primer has been applied until thoroughly dry. It is not necessary to remove the primer prior to use. The first operation of the mechanism will cause the primer to be removed as a fine dust.

(4) *Pressure-sensitive tape.* Where the tape is applied in flat strips to bridge openings adhesives conforming to FED MMM-A-189 will be applied to the boundaries of the area to be covered in order to improve the adhesion of the tape. Best results are obtained if the tape is applied while the compound is slightly tacky. When applied to bridge openings, it will normally be

covered with strippable coating and bituminous coating, in that order.

(5) *Strippable coating.* Strippable coating will be applied by spraying to a thickness of approximately 0.040 inch, in order to obtain good resistance to water vapor transmission. Seams, joints, and small apertures can be sealed best by direct application of the coating. Prior application of tape or suitable exterior grade plywood or metal blanks is desirable only for the sealing of apertures too large to be bridged by the compound. Since strippable coating at best provides only moderate resistance to water vapor, it will be overcoated with bituminous coating in all cases where it is desired to seal any opening of appreciable surface area for dehumidification.

CHAPTER 3

PRESERVATION INSTRUCTIONS

SECTION I. PRESERVATION WITHOUT DEHUMIDIFICATION

13. General. This section outlines requirements for the preservation of railroad equipment without dehumidification. The preservation methods, techniques and contact preservatives specified for use herein are considered adequate to protect railroad equipment for long-term storage. Railroad equipment not specifically mentioned in this section will be preserved similar to those items having the same operational and physical characteristics.

14. Engines.

a. Combustion Chambers. When preservation of combustion chambers is specified herein, the amount of preservative lubricating oil to be sprayed into each cylinder will be determined as follows:

- (1) One-half ounce for each cylinder with displacement up to 25 cubic inches.
- (2) One ounce for each cylinder with piston displacement between 25 and 50 cubic inches.
- (3) One and one-half ounces for each cylinder with piston displacement between 50 and 75 cubic inches.
- (4) Two ounces for each cylinder with piston displacement over 75 cubic inches.

CAUTION

Precautions will be taken to assure that the amount of oil injected into the combustion chambers and manifolds will not result in hydrostatic lockup of the engine. Prior to preserving additional engines, the first engine preserved will be allowed to stand idle for 12 hours. The engine crankshaft will then be rotated manually, or by the starting motor if manual rotation is not possible, to assure that the amount of oil injected into the combustion chambers and manifolds permits free rotation of the engine.

b. Crankcases. Prior to preservation of the fuel system and combustion chambers, the engine crankcase and the crankcases of engine accessories will be preserved as follows:

(1) *Wet sump.*

(a) *Spark-ignition engines and compression-ignition engines operating at output level up to 150 psi, brake mean effective pressure (bmep).* At the beginning

of engine preservation, the engine crankcase, and the crankcases of any mounted accessories having a separate crank case from the engine, will be filled to the operating level with P-10 preservative lubricating oil, type 1, grade 10, 30 or 50 as applicable. Upon completion of engine preservation, the preservative oil will remain in the crankcases. A tag will be prepared for each crankcase indicating: THIS CRANKCASE IS FILLED TO THE OPERATING LEVEL WITH PRESERVATIVE LUBRICATING OIL GOOD FOR OPERATION UNTIL THE FIRST REQUIRED LUBRICANT CHANGE - DO NOT DRAIN - CHECK OIL LEVEL - IF LOW, FILL TO THE OPERATING LEVEL WITH THE OPERATING OIL (MIL-2104, APPLICABLE GRADE)." The tag will be attached to the crankcase fill tubes.

(b) *Compression-ignition engines operating at output levels of 150 psi (bmep) and above.* At the beginning of engine preservation, the engine crankcase, and the crankcases of any mounted accessories having a separate crankcase from the engine, will be filled to the operating level with P-10 preservative lubricating oil, type II, grade 10 or 30 as applicable. Upon completion of engine preservation, the preservative oil will remain in the crankcases. A tag will be prepared for each crankcase indicating: "THIS CRANKCASE IS FILLED TO THE OPERATING LEVEL WITH PRESERVATIVE LUBRICATING OIL GOOD FOR OPERATION UNTIL THE FIRST REQUIRED LUBRICANT CHANGE - DO NOT DRAIN - CHECK OIL LEVEL-IF LOW, FILL TO THE OPERATING LEVEL WITH THE OPERATING OIL (MIL- 2104, APPLICABLE GRADE)." The tag will be attached to the crankcase fill tubes.

(2) *Dry sump.*

(a) Crankcases of air-cooled engines that are lubricated by adding lubricating oil to the fuel, P-10 preservative lubricating oil, type I, grade 10, 30 or 50 as applicable, will be added to the fuel in the ratio specified for normal operation. The engine will be started and operated at fast idle until running smoothly. The engine will then be accelerated to 3/4 speed, without load to assure coverage of all interior surfaces of the lubricating system.

(b) Air-cooled dry sump engines which operate with no oil in the crankcase, the inspection plate, air box cover or the plugs will be re-

re interior of the crankcase will be sprayed and the interior of the crankcase will be sprayed with P-10 preservative lubricating oil, type I grade 30, while rotating the engine crankshaft at least three complete revolutions.

c. Cooling Systems.

(1) *Examination.* Thoroughly examine the cooling system for faulty or deteriorated gaskets and rubber hose, leaks, rust, dirt, loose connections, and evidence of oil seepage into the system.

(2) *Cleaning.* When cleaning is required, drain the cooling system and clean with compound conforming to MIL-C-10597. Clean all sediment from the radiator cap, drain cocks and engine block drains.

(3) *Preservation.* Fill the cooling system with a clean premixed solution of 50 percent water and 50 percent ethylene glycol conforming to FED-0-A-548, type I. For storage in areas where the temperature drops below -40°F., the system will be filled with artic type antifreeze conforming to MIL-C-11755. A warning tag will be placed on the filler neck stating: "COOLING SYSTEM FILLED WITH ARTIC TYPE ANTI-FREEZE, DO NOT DILUTE".

d. Fuel Systems.

(1) *Spark ignition gasoline engines.*

(a) *Engines with carburetors.* A portable container with two compartments will be positioned to provide gravity feed to the engine. One compartment will contain gasoline and the other compartment will contain type P-9 preservative oil. The engine fuel supply line will be disconnected at the most convenient point. A flexible line from the portable container will be connected to the fuel supply line leading to the engine. The container selector valve will be turned to the gasoline position. The engine will be started and operated at fast idle until running, then accelerated to 3/4 speed without load. At the same time the fuel supply selector valve will be switched to the preservative oil position. The instant the oil reaches the combustion chambers (evidenced by loss of speed, misfiring, and excessive smoking) the ignition will be turned off. After the engine has stopped, the line from the portable container will be disconnected from the engine fuel supply line. The engine fuel supply line will be reconnected. Fuel filters and sediment bowls will be drained.

(b) *Engines with fuel injectors.* The injector fuel return coupling will be disconnected. A line will be connected to the injector fuel return coupling on the engine to permit draining into a recovery container. The fuel system will then be preserved as specified in (a) herein. (The recovered fuel and oil mixture will not be

used to preserve other fuel systems.)

(2) *Compression-ignition engines (diesel and multifuel).*

(a) *Gasoline starting engines.* A portable container with two compartments will be positioned to provide gravity feed to the engine. One compartment will contain gasoline and the other compartment will contain type P-9 preservative oil. The flexible line from the portable container will be connected to the engine fuel pump intake line. The engine fuel return line will be disconnected at the quick disconnect coupling. A transparent plastic line will be connected to the quick disconnected engine fuel return line, and the other end will be inserted into a recovery container to collect the returned fuel. Another portable container will be provided and will contain type P-9 preservative oil. The diesel or multifuel engine fuel supply line will be disconnected at the most convenient point nearest the fuel pump. The line from the portable container will be connected to the fuel-to-engine line at the point of disconnect. Controls will be positioned for gasoline operation. The three-way valve of the two compartment container will be turned to the gasoline ON position. The engine will be started and operated until running smoothly. The engine speed will then be increased to 3/4 speed and the container selector valve turned to the preservative oil ON position. Engine will be operated until it begins to misfire, and the engine controls will be immediately be switched to diesel or multifuel operation. The engine will be operated at 1/2 speed until undiluted preservative oil is flowing into therecovery container. The engine will then be increased to 3/4 speed for approximately 15 seconds and the engine then turned off. Portable container valves will be turned to OFF position and the lines disconnected from the engine fuel intake lines. The engine fuel intake lines will be reconnected. The temporary fuel return line will be disconnected and the permanent fuel return reconnected. Fuel filters and sediment bowls will be drained. (The recovered fuel oil mixture will not be used to preserve other fuel systems).

(b) *Straight diesel and multifuel engines.* The engine fuel intake line will be disconnected at the most convenient accessible point nearest the fuel supply tank. A line from a portable container fuel conforming to FED VV-F-800 will be connected to the fuel intake line to the engine. The injector fuel return line will be disconnected at the disconnect coup-

ling. A transparent line will be connected to the injector fuel return to allow for draining into a recovery container. The fuel valve of portable container will be turned to the ON position. The engine will be started and operated at fast idle until thoroughly warm. The engine then be accelerated to 3/4 speed, at which time the fuel supply will be switched to the portable container containing type P-9 preservative oil. The engine will be operated at this speed until undiluted preservative oil is flowing into recovery container. The engine will then be stopped. The temporary fuel return line will be disconnected and the permanent fuel return reconnected. The temporary fuel intake line will be disconnected and the permanent fuel intake line reconnected. Fuel filters and sediment bowls will be drained. (The recovered fuel oil mixture will not be used to preserve other fuel systems).

(c) *Gasoline starting auxiliary (Pony) engines.* After the attached diesel or multifuel engine has been preserved, the gasoline engines will be disengaged from the diesel or multifuel engine. The gasoline engine fuel system, combustion chambers, and valves will be preserved as specified for spark-ignition engines.

e. *Combustion Chambers and Valves.*

(1) *Spark-ignition engines.* After completion of the fuel system preservation, the engine will be allowed to cool to a cylinder head temperature of maximum 100°F., measured at the spark plug area of all cylinders. Cooling may be accelerated by induced air currents. After the engine has cooled, the spark plugs will be removed. Care will be exercised to avoid damage to the threads, electrodes, and gaskets. While cranking the engine with the starting motor, one-half of the determined amount (para 14a) of P-10 preservative lubricating oil, type I, grade 30 will be atomized sprayed into each cylinder through each spark plug opening. The nozzle will be inserted into the combustion chamber maximum air pressure for spraying will not exceed 25 psi. Without cranking the engine, the additional one-half of the determined amount of the preservative lubricating oil, specified herein, will be atomized sprayed into each cylinder through each spark plug opening, after which the crankcase will not be rotated. The spark plug threads will be coated with the preservative lubricating oil specified herein. The spark plugs will be reinstalled. A tag will be prepared indicating: "ENGINE PRESERVED - DO NOT CRANK UNTIL ISSUED TO THE USER". The

tag will be attached near the engine start control switch.

(2) *Compression-ignition engines (diesel and multifuel).* After the engines have cooled to a cylinder head temperature of 100°F. or less, measure at the injector nozzle flange area surfaces of each cylinder, the combustion chambers and valves of compression-ignition engines will be preserved as follows:

(a) *Four-cycle spark-ignition (gasoline) starting engines.* The intake manifolds, the exhaust manifolds, and the rocker arm covers will be removed. The engine controls will be set for gasoline operation. The diesel or multi-fuel throttle will be completely closed. The spark plug wires will be disconnected. Each intake valve will be manually depressed, and while each valve is held open one-fourth of the determined amount (para 14a) of P-10 preservative lubricating oil, type I or type II, grade 10 will be atomized sprayed into each cylinder through the intake ports. The nozzle tip will be inserted into the port. The maximum air pressure for spraying will not exceed approximately 25 psi. Each exhaust valve will then be manually depressed and while each valve is held open, one-fourth of the determined amount of the same type and grade of preservative lubricating oil specified herein will be atomized sprayed through each open exhaust port into each cylinder. In addition to the determined amount, 1/4-ounce of the preservative lubricating oil specified herein will be atomized sprayed into each starting valve port. With the valves released, the engine crankshaft will then be rotated until all pistons have completed a full cycle. The preservation cycle will then be repeated, after which the crankshaft will not be rotated. The spark plugs will be removed. Care will be exercised to prevent damage to the threads, electrodes, and gaskets. The spark plug threads will be coated with the preservative lubricating oil specified herein. The spark plugs will be reinstalled. The exhaust manifolds and intake manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. The rocker arm assemblies, springs, guides, valve stems, push rods, and the inside of the rocker arm covers will be sprayed with the preservative lubricating oil specified herein. The rocker arm covers will be reinstalled using new gaskets if the ones originally show evidence of damage. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER." The tag will be attached near the engine start controls.

(b) *Four-cycle, straight diesel or multifuel engines.*

1, *Engines with compression release start feature.* The intake manifolds, the exhaust manifolds, and the rocker arm covers will be removed. The fuel throttle will be completely closed. Each intake valve will be manually depressed, and while each valve is held open one-fourth of the determined amount (para 14a) of P-10 preservative lubricating oil, type I or II, grade 10, will be atomized sprayed into each cylinder through each open intake port. The nozzle tip will be inserted into the open port. The maximum air pressure for spraying will not exceed approximately 25 psi. Each exhaust valve will then be manually depressed, and while each valve is held open one-fourth of the determined amount of the preservative lubricating oil will be atomized sprayed into each cylinder through each open exhaust port. The compression release will be set in the "OFF" position. With the valves released, the engine crankshaft will be rotated with the starting motor until all pistons have completed a full cycle. The preservation cycle will then be repeated, after which the crankshaft will not be rotated. The exhaust manifold and intake manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. The rocker arm assemblies, springs, guides, valve stems, push rods, and the inside of the rocker arm covers will be atomized sprayed with preservative lubricating oil specified herein. The rocker arm covers will be reinstalled using new gaskets if the ones originally used show evidence of damage. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start controls.

2. *Engines without compression release start feature.* The combustion chambers and valves will be preserved as specified in 1 herein, except that: "Due to the tendency of the engine to fire and run on the preservative lubricating oil, the crankshaft will be rocked with the starting motor in lieu of continuous rotation." The engine will be tagged as specified in 1 herein.

3. *Engines with or without compression release lever (alternate method).* The following alternate method may be used when the size and weight of the intake and exhaust manifold makes their removal impracticable. Remove plugs, access plates, or fuel injectors and completely close the diesel throttle. Position the compression release lever (when so equipped) in the release position. Atomize spray each combustion chamber and cylinder through the applicable opening, with not less than 2 ounces of P-10 preservative lubricating oil, type I or II, grade 10. Rotate

the engine crankshaft not less than 5 complete revolutions while spraying each cylinder. Without rotating the crankshaft, atomize spray an additional 1 ounce of P-10, preservative lubricating oil, type I or II, grade 10 into each cylinder. Coat the threaded surfaces of the injectors. Reinstall plugs, access plates, or injectors. A warning tag, bearing the information: "ENGINE PRESERVED - DO NOT CRANK", will be securely attached in a conspicuous location on the engine.

(c) *Two-cycle engines.*

1, *Engines with intake ports and valves.* The fuel throttle will be completely closed. The air box covers on the side of the engine opposite the blower will be removed. The exhaust manifolds and the rocker arm covers will be removed. The engine crankshaft will be rotated with the starting motor until the piston in the cylinder to be sprayed is below the intake port. The spray nozzle will be inserted into the open port. Maximum air pressure will not exceed a proximately 25 psi. one-half of the determined amount (para 14a) of P-10, preservative, lubricating oil, type I or II, grade 10, will be sprayed into the open port. The preservation cycle will be performed on each cylinder until all cylinders have been atomized sprayed with the preservative lubricating oil, after which the crankshaft will not be rotated. With each exhaust valve manually depressed, the remaining one-half of the determined amount of preservative lubricating oil will be atomized sprayed through each open exhaust valve port. The interior of the air box covers will be coated with preservative lubricating oil specified herein. The air box covers will be reinstalled using new gaskets, if the ones originally used show evidence of damage. The exhaust manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. The rocker arm assemblies, springs, guides, valve stems, push rods, and the inside of the rocker arm covers will be atomized sprayed with preservative lubricating oil specified herein. The rocker arm covers will be reinstalled using new gaskets, if the ones originally used show evidence of damage. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start control.

2. *Engines without valves.* The fuel

throttle will be completely closed. The exhaust manifolds will be removed. The engine crankshaft will be rotated until the piston in the cylinder to be sprayed is below the exhaust port.. Maximum air pressure will exceed approximately 25psi. One-half of the determined amount (para 14a) of P-10, preservative lubricating oil, type I or II, grade 10, will be atomized sprayed through the open exhaust port. The crankshaft will be rotated until each cylinder has been sprayed through its open exhaust port. The preservation cycle will then be repeated after which the crankshaft will not be rotated. The exhaust manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start control.

15. Fuel and Oil Filters. Remove and clean filters. Coat with type P-9 preservative oil and reinstall.

16. Air Cleaners.

a. Oil-Bath Type. Oil-bath type air cleaner will be filled to operating level with P-10, preservative lubricating oil, type I or II, grade 30. Unpainted surfaces above operating level will be coated with the same type and grade of preservative oil.

b. Dry-Type. After engine has been processed, when equipped with a dry-type removable filtering element, the elements will be removed. The interior surfaces will be atomized sprayed with P-10, preservative lubricating oil, type I or II, grade 30. The metallic elements will be dipped in the same type and grade preservative and the excess preservative allowed to drain prior to installation. Element will be reinstalled. Caution will be exercised to prevent preservative from contacting nonmetallic surfaces and the felt of the felt-type elements.

17. Governors.

a. Lubricated Type. (With Integral Lubricating System.) Prior to engine preservation, drain the housing of operating lubricant and fill to operating level with P-10, preservative lubricating oil, type I or II, grade 30.

b. Lubricated Type. (Without Integral Lubricating System.) The exterior surfaces of the governor housing will be atomized sprayed with P-10, preservative lubricating oil, type I or II, grade 30.

c. Dry Type. Dry type governor mechanism, such as weight, springs, pins, linkage, and other parts or assemblies within the governor housing will be atomized sprayed with P-10, preservative lubricating oil, type I or II,

grade 30. Governor control linkage, devices and pins not inclosed within the governor housing, will be coated with type P -2 preservative.

18. Reduction Gears. Reduction gears having separate lubricating systems will be inspected for level of lubricant and for evidence of water and contamination of lubricant. Add lubricant specified by the applicable lubrication order to raise existing lubricant to operating level or if contaminated, drain the lubricant, flush the gear housing with type P-3 preservative. Agitate with dry compressed air and thoroughly drain. The cleaned gear case will be filled to operating level with approved lubricant and operated under no load to insure coating of all interior surfaces and components. If impracticable to operate, agitate the lubricant with dry compressed air sufficiently to insure coverage of gears and internal parts of the housing. The flexible tube employed for air agitation will be of a smaller diameter than the opening of the housing so that pressure will be released simultaneously with the agitation process.

19. Inclosed Gears. Oil lubricated gears not otherwise provided for will be inspected for level of lubricant and for evidence of water and contamination of lubricant. Add lubricant specified by the applicable lubrication order to raise existing lubricant to operating level or if contaminated drain the lubricant, flush the gear housing with type P-3 preservative. Agitate with dry compressed air, and thoroughly drain. The cleaned gear will be filled to operating level with approved lubricant and operated under no load to insure coating of all interior surfaces and components. If impracticable to operate, agitate the lubricant with dry compressed air sufficiently to insure coverage of gears and internal parts of the housings. The flexible tubing employed for air agitation will be of a smaller diameter than the opening of the housing so that pressure will be released simultaneously with the agitation process.

20. Exposed Gears. Non-precision exposed gears subjected to the weather will be coated with type P-1 preservative. All other exposed gears will be coated with type P-2 preservative.

21. Drive Belts and Pulleys. The tension of all drive belts will be released. Pulley grooves will be coated with a thin film of rust-inhibiting lac-

quer-resisting synthetic primer conforming to FED-TT-P-664.

22. Exposed Drive Chains. Exposed drive chains will be coated with type P-3 preservative. Sufficient time will be allowed for excess preservative to drain from the chain. After draining, the chain will be coated with type P-11 preservative.

23. Clutches and Related Components. Drive clutches and related components will be preserved as follows:

a. Dry Disc-Type. Cover plates will be removed and the clutch disengaged. All accessible interior components of the clutch will be coated with a thin film of rust-inhibiting lacquer-resisting synthetic primer conforming to FED-TT-P-664. Spring loaded disc type clutches will be blocked or secured in a partially disengaged position to eliminate contact between the disc facing and pressure plates. Do not block spring loaded clutches entirely open, because prolonged, complete depression of clutch springs will cause loss of tension. Clutch equipped with snap over-center or toggle-in devices will be completely disengaged.

b. Band and Shoe-Type. Clutch drum facings, clutch control mechanism inclosed within housings, and exposed clutch control mechanisms will be coated with a thin film of rust-inhibiting lacquer-resisting synthetic primer conforming to FED-TT-P-664.

c. Cone Type. Coat the unlined surface of cone type clutches, clutch control mechanism inclosed within housings, and exposed clutch control mechanisms with rust-inhibiting lacquer-resisting synthetic primer conforming to FED-TT-P-664.

d. Jaw-Type. Coat clutch jaws, shifter yokes, and machined surfaces of shafts with type P-2 preservative. Coat unpainted exposed surfaces of clutch control mechanism enclosed within housing with rust-inhibiting lacquer-resisting synthetic primer conforming to FED-TT-P-664.

e. Clutch Air Cylinder. The drain plug will be removed and type P-9 preservative will be atomized sprayed into the cylinder through the drain plug opening. The plug will be reinstalled. The exposed surfaces of the piston rod will be coated with type P-11 preservative.

f. Hydraulic Clutch Control. Where the clutch is operated by a hydraulic system, the hydraulic housing will be filled to operating level with approved fluid. The exposed surface of the piston rod will be coated with type P-11 preservative.

24. Brakes

a. Air Brakes.

(1) *Assembled on equipment.* Air brakes on

equipment in open track storage will be preserved by operating or actuating the brakes four or five times each month during the monthly exercising of the journals (para 34).

(2) *Removed from equipment.* Air brakes removed from equipment will be preserved as follows

(a) Air brake cylinders and reservoirs. The pistons will be removed. The pistons and interior surfaces of the cylinders will be coated with type P-7 preservative. Pistons will be in stalled and all openings to the interior of the cylinder and reservoir will be sealed with tape conforming to FED-PPP-T-60, type IV.

(b) Valves, cocks, dirt collectors, and pipe openings. Seal all openings that will permit direct entry of water or foreign matter with metal or plastic inserts, caps, or plugs.

b. Hydraulic Brakes. The hydraulic brake system will be filled to operating level with hydraulic fluid required by the applicable lubrication order or technical manual. The brake drum and brake drum control mechanisms will be coated with a thin film of primer conforming to FED-TT-P-664. Care will be exercised to prevent primer from coming in contact with the brake lining and rubber impregnated parts.

c. Handbrakes. The interior surfaces of the handbrake housing will be cleaned with dry, compressed air. Interior rotating or movable parts within the housing will be coated with type P-11 preservative.

25. Air Compressors. The operating lubricant will be drained from the compressor crankcase and the crankcase refilled with P-10, preservative lubricating oil, type I or II, grade 30. The air cleaner will be disconnected from the compressor. The air cleaner will be removed and, while the compressor is being operated, 4 or 5 ounces of P-10 preservative lubricating oil, type I or II, grade 30, will be sprayed into the air intake. The compressor will be operated a sufficient length of time to assure coverage of all internal surfaces. The air cleaner and line will be reinstalled

26. Tanks.

a. Gasoline, Diesel and Oil Tanks. Gasoline, diesel and oil tanks will be drained, cleaned and preserved using the fill and drain method or the drain and spray method of preservation.

(1) Fill and drain method. Tanks not equipped with access other than filler openings

will be completely filled with P-10 preservative lubricating oil, type I or II, grade 30, and then drained. Drain plugs will be coated with the same type and grade of preservative and reinstalled. Drained preservative may be reused for processing of other fuel tanks provided not more than 10 percent of the resultant fluid is fuel or oil.

(2) *Drain and spray method.* Tanks equipped with access other than filler openings will be atomized sprayed with P-10, preservative lubricating oil, type I or II, grade 30, using atomizing equipment which will assure complete coverage all interior surfaces. Excess preservative accumulated during spraying operation will be drained. Drain plugs will be coated with same type and grade of preservative and reinstalled.

b. *Water Tanks.* Water tanks will be flushed with fresh water. All water tanks will be thoroughly dried. Contact preservatives will not be required, but ventilation will be provided.

c. *Air Tanks.* Air tanks will be dried of all moisture and atomized sprayed with P-10, preservation lubricating oil, type I or II, grade 30. Excessive preservative accumulated during the spraying operation will be drained from the tank. Drain plugs will be coated with the same type and grade of preservative and reinstalled.

27. Distributors and Magnetos. The distributor cap and rotors will be removed and all metallic surfaces within the breaker compartment, except contact points, will be coated with P-10, preservative lubricating oil, type I or II, grade 30. Exercise care in the application of the preservative to prevent contact with the wiring and non-metallic parts. Lubricate oil wick of shaft and cam with several drops of light oil. Reinstall rotors and caps.

28. Manifolds, Exhaust Pipes, and Mufflers. Manifolds, exhaust pipes, and mufflers, and those component parts that are subjected to temperatures 450°F. and higher, except cooling fins of air-cooled engines, will be cleaned and painted with heat-resisting paint conforming to MIL-P-14105 or coated with type P-1 preservative. Paint may be applied by brush or spray. Film thickness should be at least 1.5 mils, but should not exceed 2.5 mils.

29. Heating, Potable Water Systems and Water Lines. Heating, potable water systems and water lines will be drained and blown dry with dry, compressed air. Drain plugs will be bagged, identified, and secured near place of use.

30. Hydraulic Systems (Except Hydraulic Brakes.) There will be no preservative applied to the interior of the hydraulic systems. Check the fluid level and if required, and sufficient fluid of the type specified by the applicable lubrication order to fill the supply tank to operating level.

Fully retract the pistons as far as the linkage will permit and secure. Coat exposed portions of the hydraulic piston rods (ramshafts) and operating valve controls with type P-6 preservatives and wrap with type 1, grade A, class 2, greaseproof barrier material conforming to MIL-B-121, extending the wrap approximately 2 inches onto the ram cylinder. Secure the wrap in place with tape conforming to FED-PPP-T-60, type IV

31. Bearings. Sheave bearings, boom bearings, and other bearings of exposed assemblies will be lubricated as specified in the applicable lubrication order.

32. Sandboxes. Sandboxes will be emptied, cleaned and left open for air circulation.

33. Standby Heaters. Heater fuel tanks will be drained. All parts of the system will be opened as much as feasible to permit air circulation.

34. Journals.

a. *On Assembled Equipment.*

(1) *Friction bearings.* Remove packing from journal boxes and clean journals in accordance with process C-5 of MILP-116. Coat journals with lubricating oil conforming to FED VV-L-822. Install journal pads, soaked with the lubricating oil. Move equipment approximately 100 feet monthly to distribute oil over the journals.

(2) *Roller bearings.* Check lubrication of journal box for proper operating level or date of lubrication. If required, add oil or grease as specified in the applicable lubrication order to lubricant up to operating standard. Move equipment approximately 100 feet monthly to distribute lubricant over the journals.

b. *On Wheel and Axle Assemblies (Friction Type).* Prior to cleaning of journals, a surface area approximately 6 inches of the wheel disk will be cleaned by wire brushing. Care will be exercised to prevent the wire brush from contacting the surface of the journal. The journals will be cleaned in accordance with process C-5 of MIL-P-116. Immediately following the cleaning, the journals will be coated with type P-19 preservative. After the preservative has dried, apply strippable coating conforming to MIL-C-16555, class 1, by spraying to a thickness of approximately 0.040 inch over the entire surface of the journal and extending onto the wheel disk at least 4 inches.

35. Food Handling Equipment. Preservatives will be applied only to those surfaces of food

handling equipment which are vulnerable to corrosion. Such surfaces will be coated with type P-14 preservative. Doors of ice lockers and refrigerators will be blocked and secured in an open position to permit ventilation. Steam and water lines will be drained and blown dry with dry compressed air. Valves and faucets will remain in open position. Grease filters will be removed, cleaned, and reinstalled. Interior surfaces of pumps and atomizers on oil burners of ranges be coated with P-10, preservative lubricating oil type I or II, grade 30. Openings into the oil burner will be sealed with tape conforming to FED PPP-T-60, type IV. Firesides of stoves will coated with P-1 preservative.

36. Electrical Equipment.

a. Horns and Bells. Openings to the interior of horns and bells that permit direct entry of water will be sealed with tape conforming to FED PP-T-60, type IV. Removed horns and bells will be packaged method IC-2 in accordance with MIL-P-116.

b. Gages and Instruments. Gages and instruments will be cleaned using the most applicable process of MIL-P-116. No preservative materials will be applied to gages and instruments..

c. Receptacles. Receptacles exposed to the weather will be cleaned using the most applicable process of MIL-P-116. Openings to the interior surfaces of the receptacles that permit the direct entry of water will be sealed with tape conforming to FED PPP-T-60, type IV. Receptacles in compartments will not be sealed.

d. Control Cabinets, Panel Boards, and Electrical Boxes. Control cabinets, panel boards, electrical boxes, and similar items will be cleaned using the most applicable process of MILP-116. Ferrous metal bus bars and other ferrous surfaces not requiring removal of preservatives prior to use, will be coated with petrolatum. Petrolatum will not be applied to contact surfaces of switches, points of terminals. Control cabinets and panels will be ventilated.

e. Generators and Electrical Motors (Except Traction Motors). Generators and electric motors especially constructed for use on railroad equipment can endure a lengthy exposure to humidity without deterioration. Ferrous metal sliprings will be coated with type P-11 preservative. Openings in the generators and motors that may permit the direct entry of water will be sealed with tape conforming to FED PPP-T-60, type IV. Generators and electric motors removed from equipment will be preserved in accordance with method II of MIL-P-116. All tension will be released on brush springs in all motors and generators.

f. Batteries. Remove batteries and store in accordance with existing storage procedures.

37. Refrigeration Systems. Refrigerant will be pumped into reservoirs, leaving sufficient pressure in the system to prevent entry of air. Sealed systems will not be disturbed. No preservatives will be applied to interior surfaces of refrigeration systems, including refrigerant compressors. The compressor crankcase will be filled to operating level with approved operating lubricant. All bare ferrous metal surfaces will be coated with type P-11 preservative.

38. Pumps (Other Than Engine Mounted).

a. Water Pumps. Water pumps will be drained and dried with clean, dry compressed air. The interior surfaces of the pumps will be coated with type P-3 preservative. Drain the preservative from the pump. Coat drain plugs with type P-3 preservative and reinstall.

Exception: Type P-14 preservative in lieu of type P-3 will be used when it is known that water pumps will be used for pumping potable water

b. Fuel and Oil Pumps. The interior surfaces of the fuel and oil pumps including such parts as impellers, rotors, rotor shafts, pistons, air chambers, piston rods, vanes, vane slots, valve rods, thrust pins, springs, cylinder walls, and oil, air, steam or water passages will be coated with P-10 preservative lubricating oil, type I or II, grade 30. When applicable, apply preservative oil by pump spraying or fogging while slowly actuating the pump. Drain the surplus preservative oil from the pumps. Coat drain plugs with the specified above and reinstall.

39. Spare Truck Assemblies (Without Traction Motors).

a. Journals. Journals will be cleaned in accordance with process C-5 of MIL-P-116. A coating of P-10, preservative lubricating oil, type I or II, grade 30 will be applied to all journal surfaces by spraying or brushing. Journal brasses will be installed in a manner causing only the minimum disturbance of the preservative coating.

b. Journal Boxes. Journal boxes will be clean and dRy. A double thickness of greaseproof barrier material conforming to MIL-B-121, type I, grade C will be placed over the journal box opening an l the lid closed. The barrier material will be trimmed flush with the outer surface of the box. Strippable coating conforming to

MIL-C-16555 will be sprayed over the dust guard plug, between the wheel hub and back of the journal box lid to seal all openings against entrance of moisture. The thickness of the coating will be approximately 0.040 inch.

40. Spare Truck Assemblies (With Traction Motors).

a. Journals. Journals will be cleaned in accordance with process C-5 of MIL-P-116. A coating of P-10, preservative lubricating oil, type I or II, grade 30 will be applied to all journal surfaces will be applied by spraying or brushing. Journal brasses installed in a manner causing only the minimum disturbance of the preservative coating.

b. Journal Boxes. Journal boxes will be clean and dry. A double thickness of greaseproof barrier material conforming to MIL-B-121, type I, grade C will be placed over the journal box opening and the lid closed. The barrier material will be trimmed flush with the outer surface of the journal box. Strippable coating conforming to MIL-C-16555, class 1 will be sprayed over the dust guard plug, between the wheel hub and back of the journal box, and around the journal box lid to seal all openings against entrance of moisture. The thickness of the coating will be approximately 0.040 inch.

c. Traction Motors. Check gear housing for proper level and, if necessary, add lubricant specified by the applicable lubrication order to bring the lubricant up to operating level. The commutators will be covered with a strip of type I, grade A, class 1, greaseproof barrier material conforming to MIL-B-121 and secured in place with tape conforming to FED PPP-T-60, type IV. The tape will be in contact only with the barrier material. A double thickness of type I, grade C, greaseproof barrier material will be molded over the motor case in a manner to close all openings, and will be secured in place with tape conforming to FED PPP-T-60, type IV. Strippable coating conforming to MIL-C-16555, class 1 will be sprayed over the covered area and adjacent metal surfaces. The thickness of the coating will be approximately 0.040 inch. A warning tag, waterproofed in accordance with MIL-STD-129, bearing the

information: "REMOVE STRIPS OF GREASEPROOF BARRIER MATERIAL FROM COMMUTATORS PRIOR TO ANY ROTATION OF MOTOR", will be attached in a conspicuous location on or near the motor.

41. Hinges and fasteners. Hinges and fasteners will be preserved by applying a thin coat of P-10, preservative lubricating oil, type I or II, grade 30 to operating parts.

42. Miscellaneous. Exterior ferrous surfaces of shafts, chains, linkages, cables, (other than truck bolsters, couplers and related items) and other machine parts not otherwise provided for herein, will be preserved as outlined below.

a. Weather-Exposed. Items with noncritical surfaces which will be exposed to the weather in storage will be coated with type P-1 preservative.

b. Sheltered-Items. Items within compartments or otherwise protected structurally will be coated with type P-2 preservative.

43. Ventilation. Provision will be made for adequate ventilation of enclosed areas. Doors and openings used to provide ventilation will be protected with suitable covers or ventilation to prevent entry of water. In most cases, simple wood or sheet metal structures with louvered screened openings will suffice. Where such devices do not prevent condensation or excessive dampness within the equipment, rotating vane-type ventilators will be used.

44. Sealing. Unless otherwise provided for herein all openings to interior of engines, compressors, electric motors and like items will be sealed with tape conforming to FED PPP-T-60, type IV. All doors, hoods, shutters, and windows will be closed to prohibit direct entry of weather elements.

**SECTION II. PRESERVATION WITH DYNAMIC DEHUMIDIFICATION
(WITH COCOON)**

45. General. This section outlines requirements for preservation of railroad equipment with dynamic dehumidification and cocooning. This method of dynamic dehumidification will be accomplished by constructing a cocoon and installing dehumidification equipment as outlined in appendix I.

46. Engine.

a. Combustion Chambers. When preservation of

combustion chambers is specified herein, the amount of preservative lubricating oil to be sprayed into each cylinder will be determined as follows:

(1) One-half ounce for each cylinder with piston displacement up to 25 cubic inches.

(2) One ounce for each cylinder with piston displacement between 25 and 50 cubic inches.

(3) One and one-half ounces for each cyl-

inder with piston displacement between 50 and 75 cubic inches.

(4) Two ounces for each cylinder with piston displacement over 75 cubic inches.

CAUTION

Precaution will be taken to assure that the amount of oil injected into the combustion chambers and manifolds will not result in hydrostatic lock-up of the engine. Prior to preserving additional engines, the first engine preserved will be allowed to stand idle for 12 hours. The engine crankshaft will be rotated manually, or by the starting motor if manual rotation is not possible, to assure that the amount of oil injected into the combustion chambers and manifolds permit free rotation of engine.

b. Crankcases. Prior to preservation of the system and combustion chambers, the engine crankcase and the crankcase of engine accessories will be preserved as follows:

(1) *Wet sump.*

(a) Spark-ignition engines and compression-ignition engines operating at output level up to 150 psi, brake mean effective pressure (bmep). At the beginning of engine preservation the engine crankcase, and the crankcases of any mounted accessories having a separate crankcase from the engine, will be filled to the operating level with P-10 preservative lubricating oil, type I, grade 10, 30 or 50, as applicable. Upon completion of engine preservation, the preservative oil will remain in the crankcases. A tag will be prepared for each crankcase indicating : "THIS CRANKCASE IS FILLED TO THE OPERATING LEVEL WITH PRESERVATIVE LUBRICATING OIL GOOD FOR OPERATION UNTIL THE FIRST REQUIRED LUBRICANT CHANGE-DO NOT DRAIN-CHECK OIL LEVEL-IF LOW FILL TO THE OPERATING LEVEL WITH THE OPERATING OIL (MIL-L-2104, APPLICABLE GRADE)". The tags WILL be attached to the crankcase fill tubes.

(b) Compression-ignition engines operating at output levels of 150 psi (bmep) and above. At the beginning of engine preservation, the engine crankcase, and the crankcases of any mounted accessories having a separate crankcase from the engine, will be filled to the operating level with P-10 preservative lubricating oil, type II grade 10, 30 or 50, as applicable. Upon completion of engine preservation, the preservative oil remain in the crankcases. A tag will be prepared for each crankcase indicating: "THIS CRANKCASE IS FILLED TO THE

OPERATING LEVEL WITH PRESERVATIVE LUBRICATING OIL GOOD FOR OPERATION UNTIL THE FIRST REQUIRED LUBRICANT CHANGE-DO NOT DRAIN-CHECK OIL LEVEL -IF LOW FILL TO THE OPERATING LEVEL WITH THE OPERATING OIL (MIL-L-2104 APPLICABLE GRADE)". Tag will be attached to the crankcase fill tubes.

(2) *Dry sump.*

(a) Crankcases of air-cooled engines that are lubricated by adding lubricating oil to the fuel P-10 preservative lubricating oil, type I, grade 10, 30 or 50 as applicable, will be added to the fuel in the ratio specified for normal operation The engine will be started and operated at fast idle until running smoothly. The engine will then be accelerated to 3/4 speed, without load, to assure coverage of all interior surfaces of the lubricating system.

(b) Air-cooled dry sump engines which operate with no oil in the crankcase, the inspection plate, air box cover or the plugs will be removed from the bottom of the crankcase and the entire interior of the crankcase will be sprayed with P-10 preservative lubricating oil, type I, grade 30, while rotating the engine crankshaft for at least three complete revolutions.

(c) Cooling Systems. The cooling systems will be drained. Systems rusty or otherwise contaminated will be cleaned using compound conforming to MIL-C-10597. Cleaned systems will be blown dry with dry compressed air. Filler caps and drain plugs will be bagged, identified, and secured on or near the point of use.

d. Fuel Systems.

(1) *Spark-ignition gasoline engines.*

(a) Engines with carburetors. A portable container with two compartments will be positioned to provide gravity feed to the engine. One compartment will contain gasoline and the other compartment will contain type P-9 preservative oil. The engines fuel supply line will be disconnected at the most convenient point. A flexible line from the portable container will be connected to the fuel supply line leading to the engine. The container selector valve will be started and operated at fast idle until running smoothly, then accelerated to 3/4 speed without load. At the same time the fuel supply selector valve will be switched to the preservative oil position The instant the oil reaches the combustion chambers (evidenced by loss of speed, misfiring, and excessive smoking) the ignition turned off. After the engine has stopped,

the line from the portable container will be disconnected from the engine fuel supply line. The engine fuel supply line will be reconnected. Fuel filters and sediment bowls will be drained.

(b) *Engines with fuel injectors.* The injector fuel return coupling will be disconnected. A line will be connected to the injector fuel return coupling on the engine to permit draining into a recovery container. The fuel system will then be preserved as specified in (a) herein. (The recovered fuel and oil mixture will not be used to preserve other fuel systems.)

(2) *Compression-ignition (diesel and multifuel) engines (2 and 4 cycle).*

(a) *Gasoline starting engines.* A portable container with two compartments will be positioned to provide gravity feed to the engine. One compartment will contain gasoline and the other compartment will contain type P-9 preservative oil. The flexible line from the portable container will be connected to the engine fuel pump intake line. The engine fuel return line will be disconnected at the quick disconnect coupling. A transparent plastic line will be connected to the disconnected engine fuel return line, and the other end will be inserted into a recovery container to collect the returned fuel. Another portable container will be provided and will contain type P-9 preservative oil. The diesel or multifuel engine fuel supply line will be disconnected at the most convenient point nearest the fuel pump. The line at the portable container will be connected to the fuel-to-engine line at the point of disconnect. Controls will be positioned for gasoline operation. The three-way valve of the two compartment container will be turned to the gasoline "ON" position. The engine will be started and operated until running smoothly. The engine speed will then be increased to 3/4 speed and the container selector valve turned to the preservative oil "ON" position. Engine will be operated until it begins to misfire, and the engine controls will immediately be switched to diesel or multifuel operation. The engine will be operated at 1/2 speed until undiluted preservative oil is flowing into the recovery container. The engine will then be increased to 3/4 speed for approximately 15 seconds and the engine then turned off. Portable container valves will be turned to "OFF" position and the lines disconnected from the engine fuel intake lines. The engine fuel intake lines will be reconnected. The temporary fuel return line will be disconnected and the permanent fuel return line reconnected. Fuel filters and sediment bowls will be drained. (The recovered fuel oil mixture will not be used to preserve other fuel

systems).

(b) *Straight diesel and multifuel engines.* The engine fuel intake line will be disconnected at the most convenient accessible point nearest the fuel supply tank. A line from a portable container containing fuel conforming to FED VV-F-800 will be connected to the fuel intake line leading to the engine. The injector fuel return line will be disconnected at the disconnected coupling. A transparent line will be connected to the injector fuel return coupling to allow for draining into a recovery container. The fuel valve of the portable container will be turned to the "ON" position. The engine will be started and operated at fast idle until thoroughly warm. The engine will then be accelerated to 3/4 speed, at which time the fuel supply will be switched to the portable container containing type P-9 preservative oil. The engine will be operated at this speed until undiluted preservative oil is flowing into the recovery container. The engine will then be stopped. The temporary fuel return line will be disconnected and the permanent fuel return line reconnected. The temporary fuel intake line will be disconnected and the permanent fuel intake line reconnected. Fuel filters and sediment bowls will be drained. (The recovered fuel oil mixture will not be used to preserve other fuel systems.)

(c) *Gasoline starting auxiliary (pony) engines.* After the attached diesel or multifuel engine has been preserved, the gasoline engines will be disengaged from the diesel or multifuel engine. The gasoline engine fuel system, combustion chambers, and valves will then be preserved as specified for spark-ignition engines.

e. *Combustion Chambers and Valves.*

(1) *Spark-ignition engines.* After completion of the fuel system preservation, the engine will be allowed to cool to a cylinder head temperature of maximum 100°F., measured at the spark plug area of all cylinders. Cooling may be accelerated by induced air currents. After the engine has cooled, the spark plugs will be removed. Care will be exercised to avoid damage to the threads, electrodes, and gaskets. While cranking the engine with the starting motor, one-half of the determined amount (para 46a) of P-10 preservative lubricating oil, type I, grade 30 will be atomized into each cylinder through each spark plug opening. The nozzle will be inserted into the combustion chamber and maximum air pressure for spraying will not exceed 25 psi. Without cranking the engine, the ad-

ditional one half of the determined amount of the preservative lubricating oil specified herein, will be atomized sprayed into each cylinder through each spark plug opening, after which the crankcase will not be rotated. The spark plug threads will be coated with the preservative lubricating oil specified herein. The spark plugs will be reinstalled. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start control switch.

((2) *Compression-ignition engines (diesel and multifuel)*). After the engines have cooled to a cylinder head temperature of 100°F. or less, measured at the injector nozzle flange area surfaces of each cylinder, the combustion chambers valves of compression-ignition engines will be preserved as follows.

(a) *Four-cycle spark-ignition (gasoline) starting engines*. The intake manifolds, the exhaust manifolds, and the rocker arm covers will be removed. The engine controls will be set for gasoline operation. The diesel or multifuel throttle will be completely closed. The spark plug wires will be disconnected. Each intake valve will be manually depressed, and while each valve is held open, one-fourth of the determined amount (para 46a) of P-10, preservative lubricating oil, type I or II, grade 10 will be atomized sprayed into each cylinder through the intake ports. The nozzle tip will be inserted into the port. The maximum air pressure for spraying will not exceed approximately 25 psi. Each exhaust valve will then be manually depressed and while each valve is held open, one-fourth of the determined amount of the same type and grade of preservative lubricating oil specified herein, will be atomized sprayed through each open exhaust port into each cylinder. In addition to the determined amount, 1/4-ounce of the preservative lubricating oil specified herein will be atomized sprayed into each starting valve port. With the valves released, the engine crankshaft will then be rotated until all pistons have completed a full cycle. The preservation cycle will then be repeated, after which the crankshaft will not be rotated. The spark plugs will be removed. Care will be exercised to prevent damage to the threads, electrodes, and gaskets. The spark plug threads will be coated with the preservative lubricating oil specified herein. The spark plugs will be reinstalled. The exhaust manifolds and intake manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. The rocker arm assemblies, springs, guide

valve stems, push rods, and the inside of the rocker arms covers will be reinstalled using new gaskets, if the ones originally used show evidence of damage, but will be blocked open to provide circulation of air. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start controls.

(b) Four-cycle, straight diesel or multifuel engines.

1. *Engines with compression release start feature*. The intake manifolds, the exhaust manifolds, and the rocker arm covers will be removed. The fuel throttle will be completely closed. Each intake valve will be manually depressed and while each valve is held open, one-fourth of the determined amount (para 46a) of P-10, preservative lubricating oil, type I or II, grade 10, will be atomized sprayed into each cylinder through each open intake port. The nozzle tip will be inserted into the open port. The maximum air pressure for spraying will not exceed approximately 25 psi. Each exhaust valve will then be manually depressed, and while each valve is held open, one-fourth of the determined amount of the preservative lubricating oil will be atomized sprayed into each cylinder through each open exhaust port. The compression release will be set in the "OFF" position. With the valves released, the engine crankshaft will be rotated with the starting motor until all pistons have completed a full cycle. The preservation cycle will then be repeated, after which the crankshaft will not be rotated. The exhaust manifold is and intake manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. The rocker arm assemblies, springs, guides, valve stems, push rods, and the inside of the rocker arm covers will be atomized sprayed with preservative lubricating oil specified herein. The rocker arm covers will be reinstalled, using new gaskets if the ones originally used show evidence of damage, but will be blocked open to provide circulation of air. A tag will be prepared indicating: ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start controls.

2. *Engines without compression release start feature*. The combustion chambers and valves will be preserved as specified in 1 herein,

except that: "Due to the tendency of the engine to fire and run on the preservative lubricating oil, the crankshaft will be rocked with the starting motor in lieu of continuous rotation". The engine will be tagged as specified in 1 herein.
stalled

3. *Engines with or without compression releases lever (alternate method).* The following alternate method may be used when the size and weight of the intake and exhaust manifolds makes their removal impracticable. Remove plugs, access plates, or fuel injectors and completely close the diesel throttle. Position the compression release lever (when so equipped) in the release position. Atomize spray each combustion chamber and cylinder through the applicable opening, with not less than 2 ounces of P-10, preservative lubricating oil, type I or II, grade 10. Rotate the engine crankshaft not less than 5 complete revolutions while spraying each cylinder. Without rotating the crankshaft, atomize spray an additional 1 ounce of P-10, preservative lubricating oil, type I or II, grade 10 into each cylinder. Coat the threaded surfaces of the injectors. Reinstall plugs, access plates or injectors. Inspection covers of manifolds, when provided, will be loosened and blocked open to provide ventilation. A warning tag, bearing the information: "ENGINE PRESERVED-DO NOT CRANK", will be securely attached in a conspicuous location on the engine.

(c) *Two-cycle engines.*

1. *Engines with intake ports and valves.* The fuel throttle will be completely closed. The air box covers on the side of the engine opposite the blower will be removed. The exhaust manifolds and the rocker arm covers will be removed. The engine crankshaft will be rotated with the starting motor until the piston in the cylinder to be sprayed is below the intake port. The spray nozzle will be inserted into the open port. Maximum air pressure will not exceed approximately 25 psi. One-half of the determined (para 46a) of P-10, preservative lubricating oil, type I or II, grade 10, will be sprayed into the open port. The preservation cycle will be performed on each cylinder until all cylinders have been atomized sprayed with the preservative lubricating oil, after which the crankshaft will not be rotated. With each exhaust valve manually depressed, the remaining one-half of the determined amount of preservative lubricating oil, will be atomized sprayed through each open exhaust valve port. The interior of the air box covers will be coated with preservative lubricating oil specified herein. The air box covers will be reinstalled using new gaskets, if the ones originally used show evidence of

damage, but will be blocked open to provide circulation of air. The exhaust manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. The rocker arm assemblies, springs, guides, valve stems, push rods and the inside of the rocker arm covers will be atomized sprayed with preservative lubricating oil specified herein. The rocker arm covers will be reinstalled using new gaskets, if the ones originally used show evidence of damage, but will be blocked open to provide circulation of air. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start control.

2. *Engines without valves.* The fuel throttle will be completely closed. The exhaust manifolds will be removed. The engine crankshaft will be rotated until the piston in the cylinder to be sprayed is below the exhaust port. The spray nozzle will be inserted into the open exhaust port. Maximum air pressure will not exceed approximately 25 psi. One-half of the determined amount (para 46a) of P-10, preservative lubricating oil, type I or II, grade 10 will be atomized sprayed through the open exhaust port. The crankshaft will be rotated until each cylinder has been sprayed through its open exhaust port. The preservation cycle will then be repeated, after which the crankshaft will not be rotated. The exhaust manifolds will be reinstalled using new gaskets, if the ones originally used show evidence of damage. When inspection covers are provided they will remain loose and blocked open to allow circulation of air. A tag will be prepared indicating: "ENGINE PRESERVED-DO NOT CRANK UNTIL ISSUED TO THE USER". The tag will be attached near the engine start control.

47. Fuel and Oil Filters. Remove and clean filters Coat with type P-9 preservative and reinstall

48. Air Cleaners.

- a. *Oil-Bath Type.* Oil bath type air cleaners will be drained, cleaned and reinstalled.
- b. *Dry-Type.* Dry type air cleaners will be cleaned and dried. Contaminated non-metallic and felt type elements will be replaced.

49. Governors.

- a. *Lubricated Type (With Integral Lubricating System).* Prior to engine preservation, drain the housing of operating lubricant and fill to

operating level with P-10, preservative lubricating oil, type I or II, grade 30.

b. *Lubricated Type (Without Integral Lubricating System)*. The interior surfaces of the governor housing will be atomized sprayed with P-10, preservative lubricating oil, type I or II, grade 30.

c. *Dry-Type*. No preservation required.

50. Reduction Gears. Reduction type gears having separate lubricating systems will be inspected for level of lubricant and for evidence of water and contamination of lubricant. Add lubricant specified by the applicable lubrication order to raise existing lubricant to operating level or if contaminated, drain the lubricant, flush the r housing with type P-3 preservative. Agitate with dry compressed air and thoroughly drain. The cleaned gear case will be filled to operating level with approved lubricant and operated under no load to insure coating of all interior surfaces and components. If impracticable to operate, agitate the lubricant with dry compressed air sufficiently to insure coverage of gears and internal parts of the housing. The flexible tube employed for air agitation will be of a smaller diameter than the opening of the housing so that pressure will be released simultaneously with the agitation process.

51. Inclosed Gears. Oil lubricated gears not otherwise provided for will be inspected for level of lubricant and for evidence of water and contamination of lubricant. Add lubricant specified the applicable lubrication order to raise existing lubricant to operating level or if contaminated, drain the lubricant, flush the gear housing with type P-3 preservative. Agitate with dry compressed air, and thoroughly drain. The cleaned gear case will be filled to operating level with approved lubricant and operated under no load to insure coating of all interior surfaces and components. If impracticable to operate, agitate the lubricant with dry compressed air sufficiently to insure coverage of gears and internal parts of the housings. The flexible tubing employed for air agitation will be of a smaller diameter than the opening of the housing so that pressure will be released simultaneously with the agitation process.

52. Exposed Gears. Nonprecision exposed gears will be coated with P-10, preservative lubricating oil, type I or II, grade 30.

53. Drive Belt and Pulleys. The tension of all drive belts will be released. No preservation required.

54. Exposed Drive Chains. Exposed drive chains will be coated with preservative lubricating oil, type I or II,

grade 30.

55. Clutches and Related Components.

a. *Dry Disc Type*. No preservation required.

b. *Band and Shoe Type*. No preservation required.

c. *Cone Type*. No preservation required.

d. *Jaw Type*. No preservation required.

e. *Clutch Air Cylinder*. The exposed surfaces of the piston rod will be coated with P-10, preservative lubricating oil, type I or II, grade 30.

f. *Hydraulic Clutch Control*. Where the clutch is operated by a hydraulic system, the hydraulic housing will be filled to operating level with approved operating fluid. The exposed surfaces of the piston rod will be coated with P-10, preservative lubricating oil, type I or II, grade 30.

56. Brakes.

a. *Air Brakes*. The air brake system will be drained of condensation by opening the draincocks or by removal of drain plugs and blown dry with dry compressed air. The system will be left open as much as possible to permit ventilation. Removed drain plugs will be bagged, identified and secured on or near the place of use.

b. *Hydraulic Brakes*. The hydraulic brake system will be filled to operating level with hydraulic fluid required by the applicable lubrication order or technical manual.

c. *Handbrakes*. No preservation required.

57. Air Compressors. The operating lubricant will be drained from the compressor crankcase and the crankcase refilled with P-10, preservative lubricating oil, type I or II, grade 30. The air line will be disconnected from the compressor. The air cleaner will be removed and, while the compressor is being operated, 4 or 5 ounces of P-10, preservative lubricating oil, type I or II, grade 30, will be sprayed into the air intake. The compressor will be operated a sufficient length of time to assure coverage of all internal surfaces. The air cleaner and line will be reinstalled

58. Tanks.

a. *Gasoline, Diesel, Oil and Air Tanks*. Gasoline diesel, oil and air tanks will be drained, cleaned and thoroughly dried. Filler cap and drain plugs will be bagged, identified and secured on or near the point of use. All valves will be opened to allow circulation of air.

b. *Water Tanks*. All water tanks will be

drained and thoroughly dried. Contact preservatives will not be required, but ventilation will be provided.

59. Distributors and Magnetos. No preservation required.

60. Manifolds, Exhaust Pipes and Mufflers. Manifolds, exhaust pipes and mufflers, and those component parts that are subjected to temperatures of 450°F. and higher, except cooling fins of air-cooled engines, will be cleaned and painted with heat-resisting paint conforming to MIL-P-4105 or coated with type P-1 preservative. Paint may be applied by brush or spray. Film thickness should be at least 1.5 mils, but should not exceed 2.5 mils.

61. Heating, Potable Water Systems and Water Lines. Heating, potable water systems and water lines will be drained and blown dry with dry compressed air. Drain plugs will be bagged, identified, and secured near place of use.

62. Hydraulic Systems (Except Hydraulic Brakes). There will be no preservative applied to the interior of the hydraulic systems. Check the fluid level and, if required, add sufficient fluid of the type specified by the applicable lubrication order to fill the supply tank to operating level. Fully retract pistons as far as the linkage will permit and secure. Coat exposed portions of the hydraulic piston rods (ramshafts) and operating valve controls with P-10, preservative lubricating oil, type I or II, grade 30.

63. Bearings. Sheave bearings, boom bearings, and other bearings of exposed assemblies will be lubricated as specified in the applicable lubrication order.

64. Sandboxes. Sandboxes will be emptied, cleaned, and open for air circulation.

65. Standby Heaters. Heater fuel tanks will be drained. All parts of the system will be opened as much as feasible to permit air circulation.

66. Journals.

a. Friction Bearings. Remove packing from journal boxes and clean journals in accordance with process C-5 of MIL-P-116. Coat journals with P-10 preservative lubricating oil, type I or II, grade 30. The journal box lids will be left open for circulation of dehumidified air.

b. Roller Bearings. Check lubrication of journal box for proper operating level or date of lubrication. If required, add oil or grease as specified in the applicable lubrication order to bring lubricant up to operating standard and distribute lubricant over all surfaces of the journals.

67. Food Handling Equipment. No preservative materials will be applied to food handling equipment. Doors of ice lockers and refrigerators will be blocked and secured in an open position to permit ventilation. Steam and water lines will be drained and blown dry with dry compressed air. Valves and faucets will remain in open position. Grease filters will be removed, cleaned, and reinstalled. Interior surfaces of pumps and atomizers on oil burners of ranges will be coated with P-10, preservative lubricating oil, type I or II, grade 30.

68. Electrical Equipment.

a. Horns and Bells. Horns and bells will remain mounted. No preservation required.

b. Gages and Instruments. Gages and instruments will be cleaned using the most applicable process of MILP-116. No preservative materials will be applied to gages and instruments

c. Receptacles. No preservation required.

d. Control Cabinets, Panel Boards, and Electrical Boxes. No preservation required. Open to permit air circulation.

e. Generators and Electric Motors. Ferrous metal sliprings will be coated with P-10, preservative lubricating oil, type I or II, grade 30. All tension will be released on brush springs in all motors and generators.

f. Batteries. Remove batteries and store in accordance with existing storage procedures.

69. Refrigeration Systems. Refrigerant will be pumped into reservoirs, leaving sufficient pressure in the system to prevent the entry of air. Sealed systems will not be disturbed. No preservatives will be applied to interior surfaces of refrigerating systems, including refrigerant compressors. The compressor crankcase will be filled to operating level with approved operating lubricant. All bare exterior ferrous metal surfaces will be coated with P-10, preservative lubricating oil, type I or II, grade 30.

70. Pumps (Other Than Engine Mounted).

a. Water Pumps. Water pumps will be drained and dried with clean, dry compressed air. The pumps will be flushed with P-10, preservative lubricating oil, type I or II, grade 30. The preservative will be drained and the drain plug coated with the preservative oil and reinstalled.

Exception: When it is known that water pumps will be used for pumping potable water, no contact preservative will be applied. The pump will be drained and dried with dry, compressed air and left open as much as possible to

permit ventilation. Removed drain plugs will be bagged, identified, and secured to the pump.

b. Fuel and Oil Pumps. Fuel and oil pumps will be drained and dried. The pumps will be completely filled with P-10, preservative lubricating oil, type I or II, grade 30. The preservative oil will be drained, removed drain plugs will be bagged, identified and secured to the pump.

71. Traction Motors. Check gear housing for proper level and, if necessary, add lubricant specified by the applicable lubrication order to bring the lubricant up to operating level. Release tension of traction motor brushes.

72. Motor Axle Suspension. Remove packing secure cover plates in other than normal position to permit air circulation.

73. Spare Truck Assemblies (Without Traction Motors).

a. Journals. Journals will be cleaned in accordance with process C-5 of MIL-P-116. A coating of P-10, preservative lubricating oil, type I or II, grade 30, will be applied to all journal surfaces by spraying or brushing. Journal brasses will be installed in a manner causing only the, minimum disturbance of the preservative coating.

b. Journal Boxes. Journal boxes will be clean and dry.

74. Spare Truck Assemblies (With Traction Motors)

a. Journals. Journals will be cleaned in accordance with process C-5 of MIJP-116. A coating of P-10, preservative lubricating oil, type I or II, grade 30, will be applied to all journal surfaces by spraying or brushing. Journal brasses will be installed in a manner causing only the minimum disturbance of the preservative coating.

b. Journal Boxes. Journal boxes will be clean and dry.

c. Traction Motors. Check gear housing for proper level and, if necessary, add lubricant specified by the applicable lubrication order to bring lubricant up to operating level. Release tension of traction motor brushes.

75. Hinges and Fasteners. Hinges and fasteners will be preserved by applying a thin coat of P-10 preservative lubricating oil, type I or II, grade 30, to operating parts.

76. Miscellaneous. Exterior ferrous surfaces of shafts, chains, linkages, cables (other than truck bolster couplers, and related items) and other parts not otherwise provided for herein will be coated with type P-2 preservative.

CHAPTER 4
DEPRESERVATION INSTRUCTIONS

77. General. Depreservation of railroad equipment includes any necessary removal of barrier materials, blanks, plugs and caps, dehumidification systems, sensing elements, and ventilators. Also included are the insertion of drain plugs, closure of drain cocks, reassembly of disassembled items, and closure of openings made for purpose of preservation.

78. Preservation and Depreservation Guide. A Preservation and Depreservation Guide for Railroad Equipment (DA Form 3257), will be prepared, in duplicate, for each item of railroad equipment of the time of preservation. One copy will be placed in a waterproof envelope marked "Preservation and Depreservation Guide" and securely attached in a conspicuous and protected location on the equipment. One copy will be placed in the item record file.

NOTE

be annotated to reflect type and grade of lubricants specified herein.

79. Tagging. Warning and instruction tags will be used as a supplement to, but not as a substitute for, depreservation instructions. Tags will be attached to items or systems in conspicuous locations to draw attention to the need for any depreservation operation likely to be overlooked which would endanger personnel or equipment

80. Removal of Preservatives. Removal of P-type preservatives, except P-14, when required, will be accomplished by use of solvent conforming to MIL-S-18718 or FED TT-T-291, grade 1. Removal of P-14 preservative will be accomplished by use of soap and water, or with scouring powder, detergent, or other cleaner approved for cleaning of food handling equipment.

The preservation and depresservation guide will

APPENDIX I

COCOONING PROCEDURE

1. General. The basic requirements for the cocooning of railroad equipment involves the fabrication of pans, installation of dynamic dehumidification systems, shrouding of equipment, and the application of three coats of sprayable plastic coating, and one coat of aluminum coating.

2. Fabrication of Pans. Pans will be fabricated of No. 20 gage galvanized sheet metal with 3/8-inch double lock seams. Seams will not be soldered. The length of the pan will be approximately 3 feet greater than the overall length of the item. The height will be approximately 6 inches. The corners of the pan will be blunted or rounded to prevent chafing of the plastic barrier. The bottom (outside) of the pan will be coated with bituminous coating conforming to MIL-C-3254, type II before the pan is placed on the rails. Do not apply compound to the vertical lip of the pan. The seams on the inside of the pan will also be coated with the bituminous material. The pan will then be placed on the rails with one end slotted to allow the equipment wheels to enter. After positioning the equipment, patches will be secured over the slots by riveting or use of zinc coated sheet metal screws. Minor crevices will be filled from the inside, using bituminous coating. Optionally, for ease of handling, the pan may be fabricated in sections and after delivery to place of use, the sections joined by a double row of rivets. The overlap for riveting should be approximately 4 inches, to permit the rows of rivets to be 2-3/4 inches apart.

3. Installation of Ductwork. After placement of equipment on the pan, the dry air and moist air return ducts will be placed in position. The ducts will be 4-inch diameter galvanized sheet metal or flexible tubing. A sheet metal support riveted to one end of the pan is useful for securing the ducts at the points of intersection with the barrier. The dry air and moist air return lines should terminate near opposite ends of the package. The dry air line will be carried upward 6 to 8 feet above the pan. The moist air will be drawn from the bottom of the package, preferably inside the engine compartment near the floor.

4. Humidistat. A humidistat set to operate at 40 percent relative humidity will be installed near the center of the package. Wiring will be attached in accordance

with the wiring diagram furnished with the instrument.

5. Dehumidification Machine. A package dehumidifier, single desiccant bed, absorbent type, 10,000 cubic foot capacity, 110-volt, alternating current, will be attached to the dry air and moist air ducts and humidistat. The machine will be located outside the package. To prevent damage to the motor, full current (110 volts) must be delivered to the machine.

6. Preparation of the Package. Cushioning material will be applied to all sharp edges and projections of the equipment. The equipment will be covered with a snug-fitting shroud of osnaburg cloth conforming to FED CCC-C-429, or if that material is not available, with burlap conforming to FED CCC-C-647. The shroud will be fastened to the sides of the pan with adhesive conforming to FED MMM-A-189. The fabric will be the base for the sprayable plastic coating.

7. Spraying Plastic Coating. The fabric will be sprayed with three coats of sprayable plastic conforming to type I, class 2 of MIL-C-3254. Each coat will be dyed a different color as visual aid to obtain adequate coverage. The first coat is dyed yellow, the second is red, and the third blue. The plastic will be dyed by adding 2 ounces of dye to each 5 gallons of plastic solution, using butter yellow aniline dye (FSN 6820-285-8458), red aniline dye (FSN 6820-286-5484), and blue aniline dye (FSN 6820-255-8201) respectively for the first, second, and third coats. The recommended pressures are 20 to 30 pounds on the fluid tank and 70 pounds minimum atomizing pressure at the gun. The fluid pressure will be increased when more than one gun is used. The gun should be held 8 inches from, and perpendicular to, the surface being coated. The surface of the coating should appear wet and glossy. The thickness of each coat will be approximately .015 inch. When the density of color of the sprayed coat matches that of the material in the supply tank, it would indicate that the thickness is correct.

8. Bituminous Coating. The coating material will conform to type II of MIL-C-3254. The type I plastic coating must be allowed to dry thoroughly (48 to 72 hr) before the bituminous coating is applied. The coating should be approximately

.125 inch thick. Recommended air pressure at the gun is 60 to 90 pounds.

9. Aluminum Coating. The bituminous coating must be dry (usually 24 hr are needed) before the aluminum coating is applied. The aluminum coating solution will conform to type III MIL-C-3254. The coating should be .002 to .003 inch thick. Recommended gun pressure is 60 pounds.

10. Fume Exhaust. An exhaust blower, powered by an air motor or by an explosion-proof motor will be used to exhaust hazardous fumes generated by spraying of the

barrier materials. For convenience, the exhaust may be attached to the outer terminus of one of the air circulation ducts. The exhaust should be operated not only during the spraying operations, but intermittently until the materials are dry. The fumes must be thoroughly exhausted from the completed package before the dehumidifier is placed in operation.

11. Sensing Elements. Humidity sensing elements of an approved type will be placed as required within the package at a height convenient reach with a ladder.

APPENDIX II

REFERENCES

1. Military Standards

MIL-STD-129 Marking for Shipment and Storage

2. Specifications

FED O-A-548 Antifreeze, Ethylene Glycol, Inhibited
FED VV-L800 Lubricating Oil, General Purpose, Preservative, Water-Displacing Low Temperature.

FED VV-F-800 Fuel Oil, Diesel
FED VV-Li822 Lubricating Oil, Railway Car and Locomotive
FED UU-T-81 Tags, Shipping and Stock
FED TT-P-664 Primer, Coating, Synthetic, Rust-Inhibiting, Lacquer-Resisting
FED TT-T-291 Thinner, Paint, Volative Spirits
FED VV-P-236 Petrolatum, Technical
FED COCC-C-429 Cloth, Osnaburg, Cotton
FED CCC-C-467 Cloth, Burlap, Jute (or Kenof)
FED MMM-A-189 Adhesive, Synthetic Rubber, Hot or Cold Bonding
FED PPP-B-621 Boxes, Wood, Nailed, and Lock-Corner
FED PPP-T-60 Tape, Pressure-Sensitive, Adhesive, Waterproof, for Packaging
MIL-P-116 Preservation, Methods of
MIL-B-121 Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-L-2104 Lubricating Oil, Internal Combustion Engine (Heavy Duty)
MIL-L-3150 Lubricating-Oil, Preservative, Medium
MIL-C-3254 Coating-System, Bridging, Strippable, Sprayable
MIL-P-3320 Painting of Freight and Maintenance Cars
MIL-P-3321 Painting, Railway Motive Power and Work Equipment
MIL-D-3464 Desiccant, Activated, Bagged, Packaging Use and Static Dehumidification
MIL-P-3807 Painting, Railroad Cars for Passenger Service
MIL-C-10382 Corrosion Prevention, Petroleum, Spraying Application, for Machinery and Equipment
MIL-C-10597 Cleaning Compound with Conditioner and Inhibitor for Engine Cooling Systems
MIL-C-10924 Grease, Automotive and Artillery
MIL-C-11755 Compound, Antifreeze, Artic-Type
MIL-C-11796 Corrosion-Preventive Compound, Petrolatum Hot Application.
MIL-P-13983 Paint, Temporary, Lusterless, Gasoline Removable
MIL-P-14105 Paint, Heat-Resisting, Olive Drab
MIL-P-16173 Corrosion Preventative Compound, Solvent-Cutback, Cold Application.
MIL-C-16555 Coating Compound, Strippable, Sprayable
MIL-S-18718 Solvent, Safety
MIL-L-21260 Lubricating Oil, Internal Combustion Engine, Preservative and Break-In

3. Bulletins

SB 38-100 Preservation Packaging, packing and marking materials, supplies and equipment used by the Army.

4. Technical Manuals

TM 38-230-1, -2 Preservation, Packaging, and Packing Military Supplies and Equipment

5. Forms

DA Form 3257 Preservation and Depreservation Guide for Railroad Equipment

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
*General, United States Army,
Chief of Staff.*

Official:

VERNE L. BOWERS,
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The Adjutant General.*

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EAMTMTS (2)	USAERDL (5)
WAMTMTS (2)	

NG: None

USAR: None

For explanation of abbreviations used, see AR 310-50

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