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TM 9-1786A

WAR DEPARTMENT TECHNICAL MANUAL

ORDNANCE MAINTENANCE

ENGINE, ENGINE ACCESSORIES, CLUTCH GROUP, AND PROPELLER SHAFT FOR 13-TON, HIGH-SPEED TRACTOR M5

WAR DEPARTMENT *15 JANUARY 1944*

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TECHNICAL MANUAL

ORDNANCE MAINTENANCE: 13-TON HIGH-SPEED TRACTORS M5, M5A1, M5A2, AND M5A3: ENGINE, ENGINE ACCESSORIES, CLUTCH GROUP, AND PROPELLER SHAFT

CHANGES No. 1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *13 August 1952*

TM 9–1786A, 15 January 1944, is changed as follows:

The classification of this manual is changed to RESTRICTED Security Information.

The title of this manual is changed to: ORDNANCE MAINTENANCE: 13-TON HIGH-SPEED TRACTORS M5, **M5A1, M5A2, AND M5A3: ENGINE, ENGINE ACCESSORIES, CLUTCH GROUP, AND PROPELLER SHAFT.**

1. Scope

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of the Continental model R6572 engine, cooling system, fuel system, clutch group, and propeller shaft for the 13-ton high speed **tractors** M5, **M5A2, and M5A3.** These instructions are *** 100 series TM 9–786.

b. This manual contains a description of, and procedure for, disassembly, inspection, and repair of the engine, cooling system, fuel system, clutch group, and propeller shaft for the 13-ton, high speed, **tractors** M5, **M5A1, M5A2, and M5A3.**

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2. Field and Depot Maintenance Allocation

(Superseded)

The publication of instructions for complete disassembly and rebuild is not to be construed as authority for the performance by field maintenance units of those functions which are restricted to depot shops and arsenals. In general, the prescribed maintenance responsibilities will be reflected in the allocation of maintenance parts listed in the appropriate columns of the current ORD 8 supply catalog pertaining to the 13-ton high-speed tractors M5, M5A1, M5A2, and M5A3. Instructions for depot maintenance are to be used by main-

* This change supersedes TB 9–1786A–2, 17 March 1945.

tenance companies in the field only when the tactical situation makes the repair functions imperative. Supply of parts listed in the depot guide column of ORD 8 supply catalogs will be made to field maintenance only when the emergency nature of the maintenance to be performed has been certified by a responsible officer of the requisitioning organization. Those operations which can be performed as "emergency field maintenance" are specifically covered as such in this manual.

2.1 Forms, Records, and Reports
(Added)

a. General. Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of matériel to be inspected, to be repaired, or to be used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of matériel in the hands of troops and for delivery of matériel requiring further repair to ordnance shops in arsenals, depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the matériel upon completion of its repair.

b. Authorized Forms. The forms generally applicable to units maintaining this equipment are listed in the appendix. No forms other than those approved for the Department of the Army will be used. For current and complete listing of all forms, refer to current SR 310–20–6. Additional forms applicable to the using personnel are listed in the operators manual. For instructions on use of these forms, refer to FM 9–10.

c. Field Reports of Accidents. The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in the SR 385–10–40 series of special regulations. These reports are required whenever accidents involving injury to personnel or damage to matériel occur.

d. Report of Unsatisfactory Equipment or Materials. Any suggestions for improvement in design and maintenance of equipment, safety and efficiency of operation, or pertaining to the application of prescribed petroleum fuels, lubricants, and/or preserving materials, will be reported through technical channels, as prescribed in SR 700–45–5 to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM-Auto, using DA Form 468, Unsatisfactory Equipment Report. Such suggestions are encouraged in order that other organizations may benefit.

Note. Do not report all failures that occur. Report only REPEATED or RECURRENT failures or malfunctions which indicate unsatisfactory design or material. However, reports will always be made in the event that exceptionally costly equipment is involved. See also SR 700–45–5 and the printed instructions on DA Form 468.

CHAPTER 1.1

TROUBLE SHOOTING

(Added)

Section I. GENERAL

2.2 Purpose

Note. Information in this chapter is for use of ordnance maintenance personnel in conjunction with and as a supplement to the trouble-shooting section in the pertinent operators manual. It provides the continuation of instructions where a remedy in the operators manual refers to ordnance maintenance personnel for corrective action.

Operation of a deadlined vehicle without a preliminary examination can cause further damage to a disabled component and possible injury to personnel. By careful inspection and trouble shooting, such damage and injury can be avoided and, in addition, the causes of faulty operation of a vehicle or component can often be determined without extensive disassembly.

2.3 General Instructions and Procedures

This chapter contains inspection and trouble-shooting procedures to be performed while a disabled component is still mounted in the vehicle and after it has been removed.

a. The inspections made while the component is mounted in the vehicle are for the most part visual and are to be performed before attempting to operate the vehicle. The object of these inspections is to avoid possible damage or injury and also to determine the condition of and, when possible, what is wrong with the defective component.

b. The trouble shooting performed while the component is mounted in the vehicle is that which is beyond the normal scope of using organization. Check the trouble-shooting section of TM 9–786; then proceed as outlined in this chapter. These trouble shooting operations are used to determine if the fault can be remedied without removing the component from the vehicle and also, when subsequent removal is necessary, to indicate when repair can be made without complete disassembly of the component.

c. Inspection, after the component is removed from the vehicle, is performed to verify the diagnosis made when the component was in the

vehicle, to uncover further defects, or to determine faults if the component alone is received by the ordnance establishment. This inspection is particularly important in the last case because it is often the only means of determining the trouble without completely disassembling the component.

Section II. ENGINE

2.4 General

Most engine troubles are actually accessory troubles. The trouble-shooting section of TM 9–786, or of other pertinent operators manuals, will normally cover trouble shooting of all engine accessories while mounted on the engine. This section covers only those troubles which can develop within the engine itself.

2.5 Procedures

a. Seizure of Parts. When an engine can not be turned over by hand or starter, either seizure of parts or hydrostatic lock is the cause.

Caution: Do not tow vehicle in gear to loosen seized components. See pertinent operators manual for procedure if hydrostatic lock is present. Generally, if hydrostatic lock is not present, seizure can be isolated to the crankshaft and attached parts or the camshaft and related parts by removing the crankshaft timing gear (par. 6*m*) and turning the crankshaft and camshaft by hand. Disassemble seized unit and perform necessary repair operations.

Caution: Exercise great care in deciding what inspection and repairs must be performed. Parts in the nonseized section may be strained or bent and require replacement, or presence of chips may require a complete disassembly and cleaning of the engine lubricating system.

b. Engine Performs Erratically. If engine cranks but fails to start, to keep running, to idle evenly, or to develop full power and such performance can not be corrected by the adjustment or replacement of accessories as indicated in TM 9–786, then conduct the compression test as prescribed in that manual. If compression is not brought up to normal by the injection of oil into the cylinder, improper valve action is indicated; proceed as outlined in (1) below. If pressure approaches normal after oil sealing, it indicates that pistons, rings, or cylinders are worn or damaged; proceed as outlined in (2) below.

(1) *Improper valve action.* If valves are sticking, warped, or burned, remove valves (par. 8*a*), clean and inspect (par. 8*b* and *c*), correct deficiencies (par. 8*d*), and install (par. 8*e*).

(2) *Worn or damaged pistons, rings, and cylinders.* If pistons, rings, and cylinders are worn or damaged, disassemble engine and repair and/or replace any defective parts.

c. Engine Noises.

(1) *Clicking noises synchronized with camshaft speed.* Such noise usually indicates misadjusted values and valve tappets which can be correctly adjusted as indicated in TM 9-786. If noise persists after adjustment, inspect for broken valve, valve spring, valve retainer, misalined, wrapped, or broken valve, valve lock missing, worn, or broken. Check oil level and change oil if gritty or dirty. If necessary, make certain that the oil line is clear and is delivering oil to the valves.

(2) *Heavy knocks or thuds synchronized with crankshaft speed.*

(*a*) Crankshaft or connecting-rod bearings may be worn or burned out. Remove bearings (par. 6*p*); clean, inspect, and repair crankshaft (par. 11); install new and proper undersize bearings if needed (par. 39*a*).

(*b*) Pistons or rings may be broken or damaged or misalined connecting rod may be striking inside piston pin boss. Remove piston assemblies (par. 6*j*) and clean, inspect, repair, assemble (par. 10), and install (par. 39*l*).

d. Excessive Oil or Fuel Consumption.

(1) When excessive fuel and oil consumption is due to worn pistons, rings, cylinder walls, bearings, and the like, repair and/or replace defective components as indicated in *b*(2) and *c*(2) above.

(2) If excessive oil consumption is due to a leaking rear main bearing oil seal, remove oil seal (par. 6*p*) and install new seal (par. 39).

e. Defective Oil Pumps. If the pressure relief valve cannot be adjusted or has no effect on oil pressure after adjustment or the pump is otherwise defective, it should be removed (par. 6*i*), disassembled, cleaned, inspected, repaired, and assembled (par. 35) and installed (par. 39*n*).

6. Disassembly

* * * * * * *

The nomenclature on figure 25, is changed as follows: SLIDE HAMMER **41–P–2957–27.**

k. Remove Flywheel and Flywheel Housing.

(1) (Superseded) *Remove clutch pilot bearing.* Remove bearing from flywheel with puller and slide hammer 41–P–2957–27 (fig. 25).

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7. Crankcase

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b. Inspect.

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(2) *Crankcase.* Inspect all surfaces *** Measure cylinder bores. New bores measure **4.750 to 4.752** inches. Taper of 0.001 *** below for refinishing.

c. Rebuild.

* * * * * * *

(2) (Superseded) *Cylinder bores in crankcase.* Worn or scored bores should be rebored and honed for oversize pistons. The first time an engine is rebuilt, the bores will usually clean up at 0.020-inch oversize; second reboring will require 0.040- or 0.060-inch oversize pistons. To accommodate these oversize pistons, finish the bore to dimensions indicated in paragraph 40.1.

8. Cylinder Heads

* * * * * * *

c. Inspect.

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(5) *Valve guides.* With plug gage **41–G–254–375,** check inside diameter of valve guides. New valve guides *** worn valve guides.

d. Rebuild (Recondition).

* * * * * * *

(4) *Valve seat inserts.* Remove cracked or *** *tight in service.* The recess should be reamed to **2.1970 to 2.1980** inches for 0.010-inch oversize insert. Place new insert *** correct 45-degree angle.

* * * * * * *

9. Rocker Arms and Rocker Arm Shaft

* * * * * * *

c. Inspect.

(1) *Rocker arm shafts.* Examine rocker arm *** check with micrometers. **For dimensions of new shaft, refer to paragraph 40.3.**

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10. Connecting Rods and Pistons

* * * * * * *

c. Inspect.

(1) *Pistons.* Check pistons carefully *** a spring scale (fig. 56). The gage should pull out with a scale reading **as indicated in paragraph 40.4.**

* * * * * * *

d. Repair.

(1) *Pistons.* Pistons that are *** oversize piston pins. Piston pins 0.005-inch oversize are supplied. For 0.005-inch oversize *** step (2) following.

(2) *Connecting rods.* If old pistons *** toward top of rod. Hone bushing to 1.5003 to 1.5005 inches. **Clearance of piston pin in piston pin bushing is given in paragraph 40.6.**

* * * * * * *

11. Crankshaft

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c. (Superseded) *Repair.* Crankshaft and connecting rod bearings are supplied in 0.010-, 0.020-, and 0.040-inch undersize. When using undersize bearings, grind crankshaft to dimensions specified in paragraph 40.7 for each undersize bearing.

39. Assembly

a. Install Crankshaft. Place crankcase upside *** cannot be replaced. Install bearing cap screws with plain washers and tighten with torque wrench **as specified n paragraph 40.15.** Install thrust washer *** candlewick packing (fig. 80).

* * * * * * *

j. Install Flywheel.

(1) *Installing old flywheel on old crankshaft.* With crankcase upside *** note dial readings. The manufacturing run-out is not allowed to exceed **0.007**-inch indicator reading. Mount dial indicator *** exceed 0.006 inch.

Note. Run-out not to exceed **0.010**-inch indicator reading is permissible for clutch fall, and for flywheel housing bore and fall, on old parts.

(2) *Installing flywheel on crankshaft when either or both parts are new.* To install a *** the dowel pins. With a 0.634- to 0.635-inch reamer (**41–R–878–3**), ream out one dowel pin hole in flywheel and crankshaft. Drive in one *** *head for identification.*

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Section IV.1 TEST AND ADJUSTMENT

(Added)

39.1 General

Engines which have been rebuilt to the extent of cylinder boring or replacement, repair, or rebuild of pistons, piston rings, or other major parts will be subjected to run-in and test prior to releasing the engines (from shops) for use in vehicles or return to supply channels. The run-

in is required to break in the newly installed parts, to detect deficiencies such as leaks or faulty assembly, to make final adjustments such as tappet clearance and ignition timing, and to determine that the engine can be expected to perform satisfactorily when received by the using organization.

39.2 Preparation

a. Preliminary Adjustments. Adjust the carburetor and valves and set distributor timing n accordance with procedures prescribed in TM 9–786. Spark plugs must be checked for correct heat range and gap setting.

b. Load. During the break-in run, the engine must be coupled to a suitable load wh ch can be varied at will. This load may be imposed by one of several types of dynamometers, break-in test stands, water brakes, prony brakes, or any other loading device which is equipped with instruments or devices to measure the varied loads and speeds imposed on the engine under test.

c. Cooling. Adequate provision must be made for cooling the engine and maintaining the water temperature at 160° to 180° F., during test. This may be accomplished by use of conventional radiator and fan normally used with the engine, by means of heat exchangers, or, as a last resort, by circulating water from an outside source. When using either heat exchanger or outside circulating water, provision must be made to regulate the flow and temperature of the coolant as it enters the engine. Cold water will retard break-in and tend to negate the run-in period in addition to subjecting the engine to dangers accompanying sudden changes in temperatures. When using cooling devices other than conventional fan and radiator, an air blast must be provided to simulate normal air flow over block, oil pan, manifolds, etc., in order to maintain engine and oil temperatures within safe operating limits (refer to TM 9–786) and to preclude localized hot spots.

d. Instruments. The following instruments are considered to be the minimum required for performing a complete engine run-in test:

(1) Oil pressure gage.
(2) Oil temperature gage.
(3) Coolant temperature gage.
(4) Tachometers (engine and dynamometer speed indicators).
(5) Wet- and dry-bulb thermometers (psychrometer).
(6) Horsepower or performance indicator (connected to loading device).
(7) Manifold pressure gage.
(8) Carburetor air temperature gage.

e. Fuel System. Separate tanks must be provided for leaded and unleaded gasoline fuels. When installing test stands, provision will be