TM 9-7820-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

SERVICE DEPARTMENT

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FIELD AND DEPOT MAINTENANCE
STEERING GEAR ASSEMBLY
7966753 (ROSS MODEL S12)

HEADQUARTERS, DEPARTMENT OF THE ARMY

FEBRUARY 1958

This manual is correct to 15 January 1958

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TECHNICAL MANUAL
No. 9-7820-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *4 February 1958*

STEERING GEAR ASSEMBLY—7966753 (ROSS MODEL S12)

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for field and depot maintenance of the Ross steering gear assembly Model S12. It contains a description of and procedure for disassembly, inspection, repair, rebuild, and assembly of the steering gear assembly.

b. The appendix contains a list of current references, including supply manuals, forms, technical manuals, and other available publications applicable to the steering gear assembly.

c. This first edition is being published in advance of complete technical review of all concerned. Any errors or omissions will be brought to the attention of the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA Form 468 (Unsatisfactory Equipment Report).

d. The pertinent vehicle operator's manual contains operating and lubricating instructions for the material and all maintenance operations allocated to using organizations in performing maintenance work within their scope.

e. The pertinent vehicle organizational maintenance manual contains instructions for the maintenance of the material within the scope of organizational maintenance, as well as the maintenance allocation chart.

2. Field and Depot Maintenance Allocation

Refer to maintenance allocation chart in pertinent vehicle organizational maintenance manual.

3. Forms, Records and Reports

Refer to pertinent vehicle operator's manual and organizational maintenance manual. Additional authorized forms are listed in the appendix of this manual.

Section II. DESCRIPTION AND DATA

4. Description and Operation

a. Description. The steering gear assembly is a manually operated cam and lever type unit. A tapered stud, fixed in the upper end of the lever shaft, engages in a cam groove which is cut in the cam of the steering gear shaft. The cam is machine welded to the steering gear shaft with the outer ends acting as inner races for the cam thrust bearing balls. The thrust bearings are secured to the cam with bearing cups and snap rings. The complete unit is mounted in a housing with the splined end of the lever shaft extending through the housing to accommodate the Pitman arm shaft. The steering gear shaft extends through the upper cover and is rotated by the steering wheel. An adjusting screw is placed in the side cover for adjustment of the lever shaft stud in the cam. This screw bears against the end of the lever shaft and moves the entire shaft when adjusting the stud position. A locknut is provided to hold the screw at the proper adjustment.

b. Operation. The lever shaft stud engages the groove of the steering gear cam. The cam, being integral with the steering gear shaft, is rotated whenever the steering wheel is turned. The stud, being engaged with the cam groove, moves up or down on the cam as the steering wheel is turned. This motion results in angular movement of the Pitman arm, which is splined to the end of the lever shaft. The angular movement of the Pitman arm is transferred through the steering system linkage to turn the front wheels.

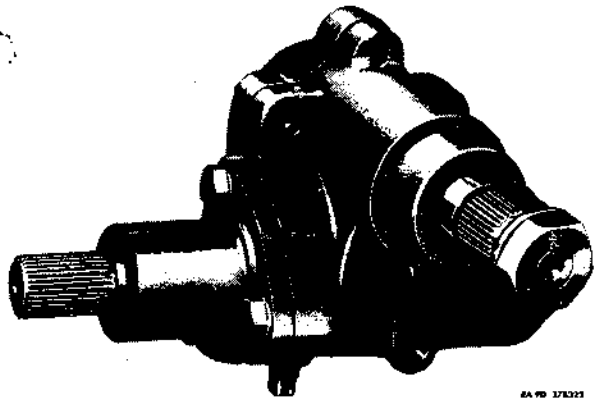

Figure 1. Stearing gear assembly.

5. Data

Model	S12
Angular travel of lever shaft	76 deg
Number of cam thrust bearing balls	10 each end
Ratio	14:1

Malfunction	Probable causes	Corrective action
	Improper cam thrust bearing adjustment.	Adjust bearings (par. 26).
	Improper lever shaft stud adjustment.	Adjust lever shaft stud (par. 27).

CHAPTER 4
REBUILD OF STEERING GEAR ASSEMBLY

Section I. DISASSEMBLY

13. General

For removal instructions of the steering gear assembly, refer to pertinent vehicle organizational maintenance manual.

14. Remove Lubricant

Remove the pipe plug (fig. 3) from the steering gear housing and allow lubricant to drain.

15. Remove Lever Shaft

a. Remove Side Cover (fig. 3). Remove the four cap screws and washers securing the side cover to the steering gear housing and remove cover. Remove the locknut and adjusting screw from the cover. Remove and discard the gasket.

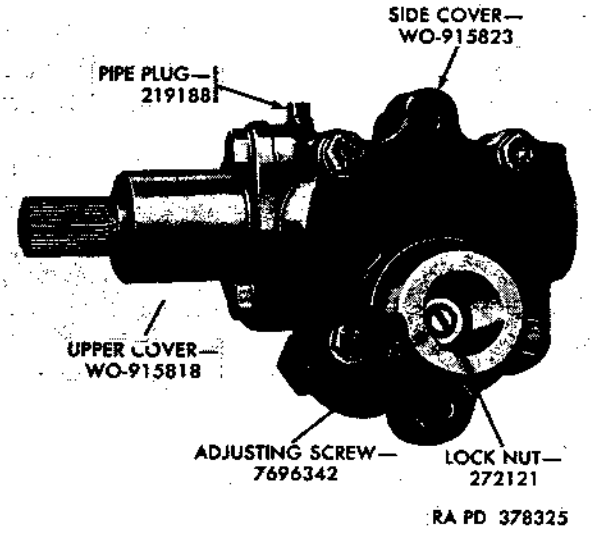

Figure 3. Steering gear side cover.

b. Remove Lever Shaft (fig. 4). Remove locknut and washer from end of lever shaft. Check the end of the lever shaft for burs which might damage the lever shaft bushings recessed in the housing. Use a fine mill file to remove burs; then pull the shaft out of the housing.

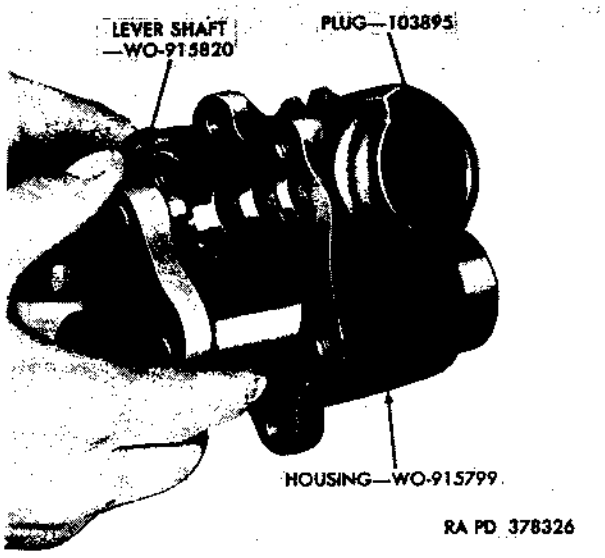

Figure 4. Removing lever shaft.

16. Remove Steering Gear Shaft

a. Remove Upper Cover (fig. 3). Remove the three screws and washers securing the upper cover to the steering gear housing, and remove cover.

b. Remove Steering Gear Shaft (fig. 5). Carefully pull the steering gear shaft out of the housing. Be careful not to damage the cam groove when removing the shaft.

c. Separate Steering Gear Shaft and Upper Cover. Grasp cam end of steering gear shaft and pull off upper cover and shims. Remove the two oil seals from the cover and discard seals.

d. Remove Cam Thrust Bearings (fig. 6). Use a screwdriver to remove the retaining rings securing the cam thrust bearings to the steering gear shaft. Remove the bearing cups from the shaft being careful not to lose the bearing balls. Discard the retaining rings.

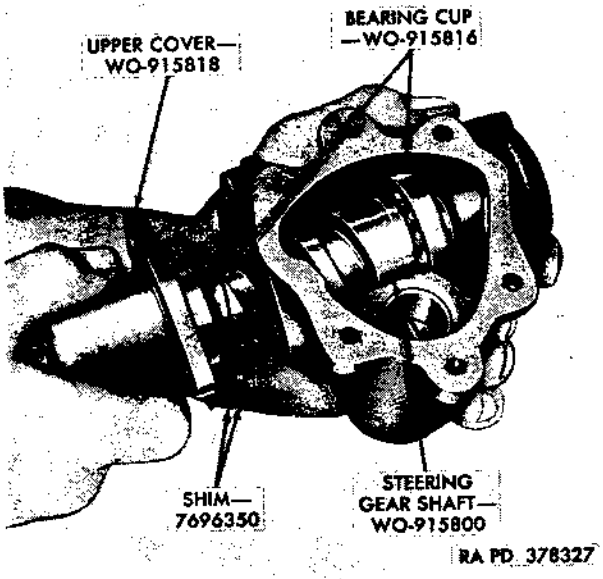

Figure 5. Removing steering gear shaft.

17. Remove Expansion Plug and Lever Shaft Bushings

a. Remove Plug (fig. 4). The expansion plug in the lower end of the housing need not be removed from the housing unless evidence of oil leakage is noted around the plug. To remove the plug, press or drive it out of the housing.

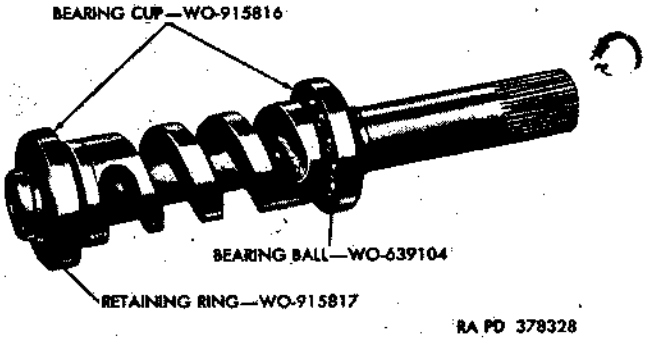

Figure 6. Cam thrust bearings.

b. Remove Lever Shaft Bushing. Remove the oil seal from the housing. The lever shaft bushings need not be removed from the housing unless the lever shaft is replaced or the bushings are damaged (par. 19). If the bushings must be replaced, use an arbor press and suitable adapter to press the bearings out of the housing.

Section II. CLEANING, INSPECTION, AND REPAIR

18. Cleaning

a. Use dry-cleaning solvent or mineral spirits paint thinner to clean grease, oil, or dirt from all metal parts. Hard crusts may be removed with a stiff bristle brush that has been dipped in the cleaning agent.

b. Use lint free cloths to clean machined surfaces of the steering gear shaft.

c. After parts are cleaned, dry the parts, except bearings, with dry compressed air.

Caution: Bearings must not be dried or spun with compressed air. Refer to TM 37–265 for care and maintenance of bearings.

19. Inspection

a. Steering Gear Shaft. Inspect the cam groove for chipping or scoring. Inspect the bearing race at each end of the shaft for signs of wear or scoring. Inspect the splines on the end of the shaft for flat spots, nicks, or evidence of twist or fracture.

b. Lever Shaft. Inspect the tapered stud in the lever shaft for nicks and flat spots. Inspect the splines on the end of the shaft for flat spots, nicks, or evidence of twist or fracture. Check the shaft for dimensions specified in paragraph 29.

c. Cam Thrust Bearing. Inspect bearing balls individually for galling or flat spots. Inspect the inner surface of each bearing cup for wear or galling.

Note. Refer to TM 37–265 for care and maintenance of bearings.

d. Lever Shaft Bushings. Inspect the lever shaft bushings for signs of wear. Check the bushings for dimensions specified in paragraph 30. If necessary to remove the bushings from the housing, refer to paragraph 17.

e. Housing, End Cover, and Side Cover. Inspect the machined surfaces in the housing for burs, nicks, or fine cut marks. Inspect the outer surface for signs of cracks. Inspect end and side covers for signs of cracks.

20. Repair

a. Steering Gear Shaft and Lever Shaft. Remove small nicks and flat spots from splines on ends of shafts with a three-corner file. Damage to the cam groove or bearing race of the steering gear shaft is cause for replacement of the shaft. Replace lever shaft if tapered stud is damaged.

b. Lever Shaft Bushings. Replace lever shaft bushings if inspection (par. 19) revealed signs of damage. If lever shaft is replaced, replace the bushings.

Section III. ASSEMBLY

Note. The key letters shown below in parentheses refer to figure 7 except where otherwise indicated.

21. Install Lever Shaft Bushings and Plug

a. Install Lever Shaft Bushings. If the lever shaft bushings (G) were removed (par. 17), position one new bushing in the bore inside the housing and press in with replacer 7010318 (fig. 8). Turn housing over and press in second bushing with replacer 7010318 (fig. 9). Drill the oil hole in the outer bushing using a 0.190 drill. After installing both bushings, burnish the bushings to the dimensions specified in paragraph 30, using burnisher 7010317 (fig. 10). Install new oil seal (H) in housing.

b. Install Plug. If expansion plug was removed (par. 17), insert new plug (E) in lower end of housing and drive into place.

22. Install Steering Gear Shaft

a. Install Cam Thrust Bearings. Assemble 10 lower bearing balls (N) in the lower bearing cup (M). Position the bearing on the lower machined surface at the lower end of the cam and install retaining ring (L) to secure bearing cup. Assemble 10 upper bearing balls (Q) in upper bearing cup (R). Position bearing on upper machined surface of cam and secure with retaining ring (S).

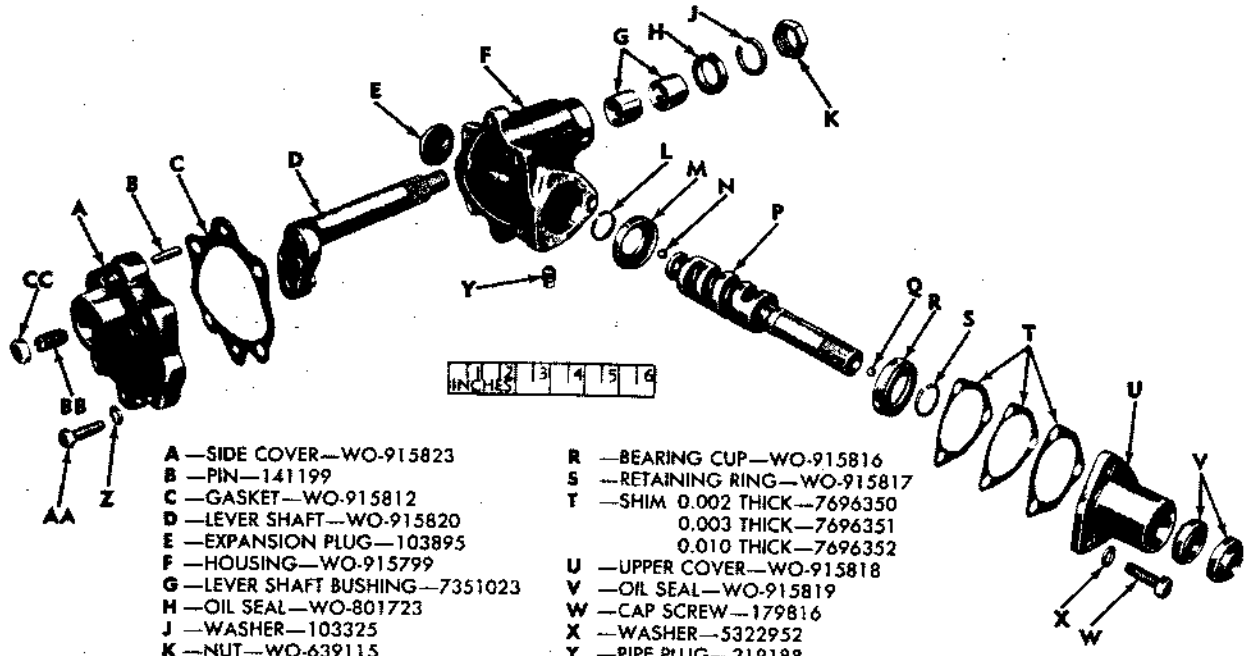

Figure 7. Steering gear assembly—exploded view.

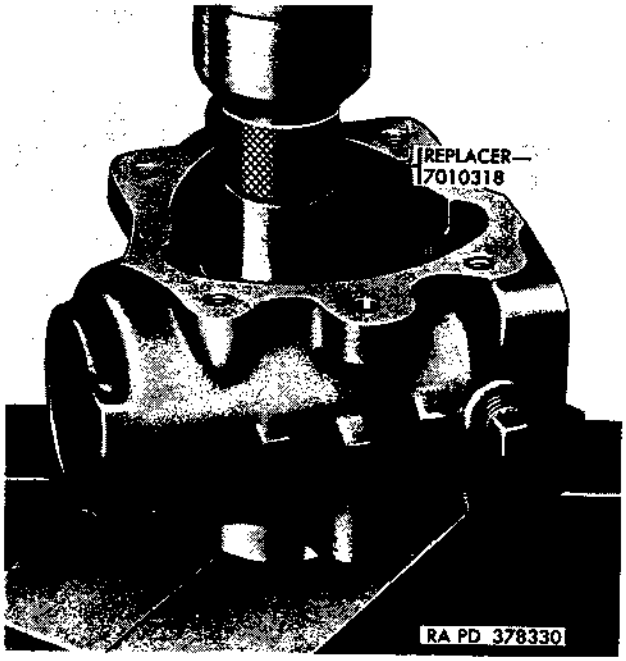

Figure 8. Installing inner lever shaft bushing.

b. Install Steering Gear Shaft. Position steering gear shaft (P) in housing (F), being careful not to damage the cam groove. Work the shaft back and forth until the lower thrust bearing is seated in the recess in the housing.

c. Install Upper Cover. Install two new oil seals (V) in upper cover (U). Position shims (T) and cover on the housing. Initial shim thickness should be 0.015 inch. Turn cover to position upper cam thrust bearing in the recess in the housing and cover. Install three 5/16 x ¾ cap screws (W) and 5/16-inch washers (X) securing cover to housing. Adjust the preload on the cam thrust bearings as described in paragraph 26.

23. Install Lever Shaft

a. Install Lever Shaft. Position the lever shaft (D) in the housing with the tapered stud

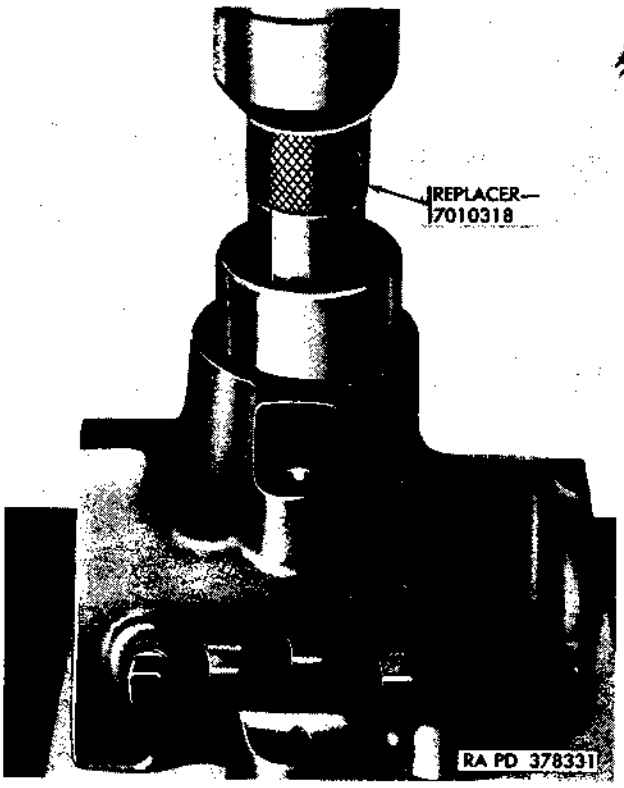

Figure 9. Installing outer lever shaft bushing.

at the approximate center of the cam groove. Install washer (J) and locknut (K) on end of shaft. Adjust backlash of stud in groove as described in paragraph 27.

b. Install Side Cover. Position a new gasket (C) on the side cover (A) and secure cover to housing with four 5/16 x 1 cap screws (AA) and 5/16-inch washer (Z). Install adjusting screw (BB) and locknut (CC). Do not tighten the adjusting screw until the stud has been adjusted in the cam groove (par. 27).

24. Lubrication

Lubricate steering gear assembly as instructed on the pertinent vehicle lubrication order and install pipe plug (Y).

Section IV. ADJUSTMENT

25. General

Two adjustments are required on the steering gear assembly. The first adjustment, preload on the cam thrust bearings (par. 26), is made prior to installing the steering gear assembly in the vehicle. The second adjustment, backlash of the stud in the cam groove (par. 27), is made after completing the cam thrust bearing adjustment and with the steering gear assembly mounted in the vehicle.

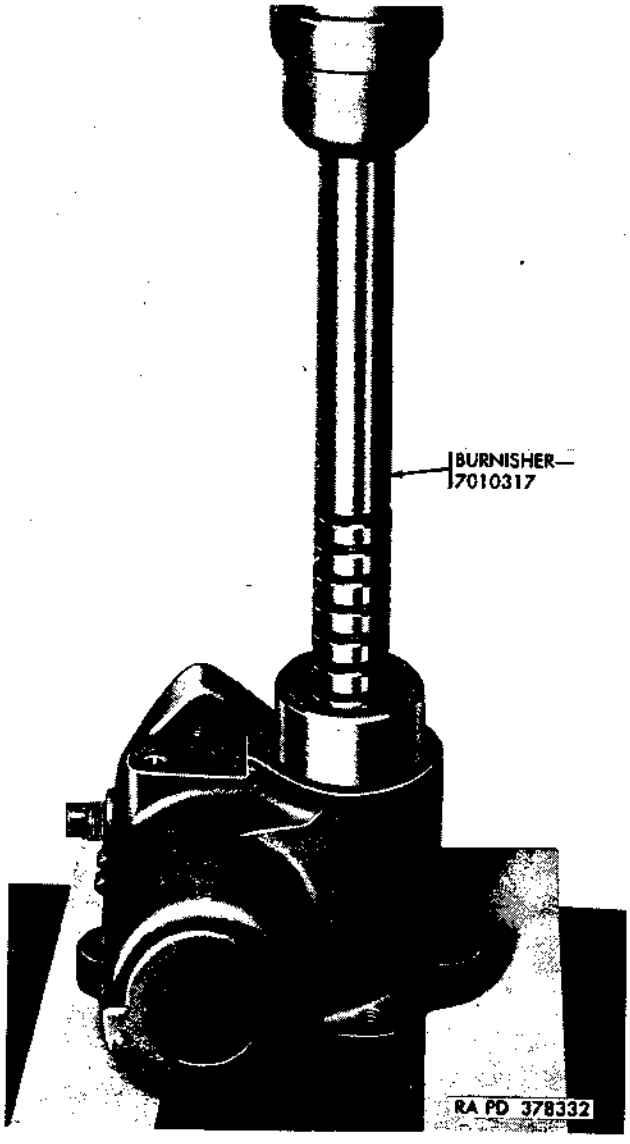

Figure 10. Burnishing lever shaft bushings.

26. Cam Thrust Bearings Adjustment

a. Find the midposition of steering gear shaft travel by counting the number of turns required to turn the shaft from one extreme position to the other and back off one-half the number of turns. Check preload of the cam thrust bearings by rotating the shaft with a torque indication wrench. Read torque wrench while wrench is in motion to obtain accurate results. The pull at midposition must be 1 to 4 pound-inches torque.

b. If the torque is greater than the maximum value, add a 0.003-inch shim between the upper cover and housing (par. 22). Check the new adjustment and add shims as required to attain proper preload. If torque required is below the minimum value, reduce the shim thickness.

27. Lever Shaft Stud Adjustment

a. Install the steering gear assembly in the vehicle. Refer to pertinent vehicle organizational maintenance manual.

b. Rotate the steering wheel from one extreme position to the other, making note of the number of turns required. Turn the steering wheel back one-half the total turns. This places the stud in the lever shaft in the normal straightahead position.

c. Rotate the steering wheel with a torque indicating wrench. Read torque wrench while wrench is in motion. Use a screwdriver to adjust the adjusting screw (fig. 3) until the pull at the center position is 5 to 9 pound-inches torque. After adjustment, tighten the locknut securing the screw.

Section V. REPAIR AND REBUILD STANDARDS

28. General

The repair and rebuild standards included herein give the minimum, maximum, and key clearances of new or rebuilt parts. They also give wear limits which indicate that point to which a part or parts may be worn before replacement, in order to receive maximum service with minimum replacement. Normally, all parts which have not been worn beyond the dimensions shown in the "Wear limits" column or damaged from corrosion will be approved for service. An asterisk (*) in the "Wear limits" indicates that the part or parts should be replaced when worn beyond the limits given in the "Sizes and fits of new parts" column. In the "Sizes and fits of new parts" column, the letter L indicates a loose fit (clearance) and the letter T indicates a tight fit (interference).

29. Lever Shaft

Fig. No.	*Ref. letter*	*Point of measurement*	*Sizes and fits of new parts*	*Wear limits*
11	A	Shaft diameter..	0.8735 to 0.8725	0.871
	A–B	Fit in bushing....	0.0005L to 0.00025L	0.007

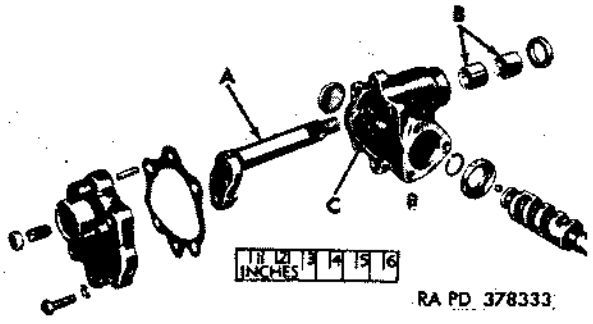

Figure 11. Repair and rebuild of standard points of measurement.

30. Lever Shaft Bushings

Fig. No.	*Ref. letter*	*Point of measurement*	*Sizes and fits of new parts*	*Wear limits*
11	B	Inside diameter (burnish)	0.874 to 0.875	0.878
	B	Outside diameter	1.003 to 1.001	(*)
	B–C	Fit in housing bore	0.001T to 0.005T	

APPENDIX
REFERENCES

1. Publication Indexes

The following indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to materiel covered in this manual.

Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.	DA Pam 108–1
Military Publications:	
Index of Administrative Publications.	DA Pam 310–1
Index of Blank Forms....	DA Pam 310–2
Index of Graphic Training Aids and Devices.	DA Pam 310–5
Index of Supply Manuals —Ordnance Corps.	DA Pam 310–29
Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.	DA Pam 310–4
Index of Training Publications.	DA Pam 310–3

2. Supply Manuals

a. Repair and Rebuild.

Antifriction Bearings and Related Items.	ORD 5 SNL H–12

Note. Portions superseded by SM 9–1–3110, 30 June 1956 will not be reprinted.

List of all Service Parts and Field and Depot Maintenance Allowances for Steering Gear Ross Model S12.	TM 9–7820–35P
Major Items and Major Combinations of Group G.	SM 9–5–2300
Oil Seals.....	ORD 5 SNL H–13
Pipe and Hose Fittings.....	ORD 5 SNL H–6
Standard Hardware.....	ORD 5 SNL H–1

3. Forms

DA Form 9–71, Locator and Inventory Control Card.
DA Form 9–77, Job Order Register.
DA Form 9–78, Job Order.
DA Form 9–79, Parts Requisition.
DA Form 9–80, Job Order File.
DA Form 9–81, Exchange Part or Unit Identification Tag.
DA Form 446, Issue Slip.
DA Form 447, Turn-In Slip.
DA Form 865, Work Order.
DA Form 866, Consolidation of Parts.
DA Form 867, Status of Modification Work Order.

4. Other Publications

a. Destruction To Prevent Enemy Use.

Ordnance Service in the Field.	FM 9–5

b. General.

Packaging and Packing for Shipment and Storage of Spare Parts for Military Vehicle.	MIL–P–1143 (ORD)
Packaging General Supplies.	ORD M3–5
Packaging of On Vehicle Material (OVM) for Military Vehicles, Transport and Combat.	MIL–P–12841 (ORD)
Supplies and Equipment (Motor Vehicles).	AR 700–2300–1

c. Operation.

Operator's Manual (pertinent to vehicle).	TM 9–8034–10
Organizational Spare Parts and Special Tools (pertinent to vehicle).	TM 9–8034–20P

d. Maintenance and Repair.

Disposal of Supplies and Equipment; Uneconomically Repairable Ordnance Vehicle.	AR 755–2300–2
Instruction Guide: Welding Theory and Application.	TM 9–2852

e. Maintenance of Supplies and Equipment.

Expenditure Limits for Repair of Tactical Type Transport Vehicles.	AR 750–2300–7

f. Ordnance Maintenance.

Steering Gears.....	TM 9–8615

[AG 451.21 (30 Jan 58)]

By Order of *Wilber M. Brucker,* Secretary of the Army:

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Ord PG
Ord Arsenals
Mil Dist
Ord Proc Dist
MAAG
Mil Mis
JBUSMC
JUSMAG (Greece)
Fld Comd, AFSWP
Ord Tk Autmo Comd

NG: State AG; units—same as Active Army.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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