TM 55-6680-234-40

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

GENERAL SUPPORT MAINTENANCE MANUAL

DUAL TACHOMETER INDICATOR PART NO. 41105-C5A-4-B3 AND 41105-C5A-4-E3

This copy is a reprint which includes current pages from Changes 5 through 8.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JANUARY 1968

WARNING

PRECAUTIONARY DATA

Personnel performing instructions involving operations, procedures and practices which are included or implied in this technical manual shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury, death or an aborted mission.

USING TOXIC MATERIALS. Due to the toxicity of the solvents and solutions used in cleaning procedures, adequate ventilation must be provided. Avoid prolonged contact with the solvents and solutions.

CHANGE
No. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *16 April 1975*

GS Maintenance Manual
Including Repair Parts and Special Tools List

DUAL TACHOMETER INDICATOR
PART NO. 41105-C5A-4-B3
AND 41105-C5A-4-E3

TM 55-6680-234-40, 31 January 1968, is changed as follows:

Page 3, paragraph 4. In lines 2 and 4, "calibrated" is changed to read “graduated.”

Page 14, paragraph 13l (7). In line 3, the word “calibration” is deleted.

page 14, paragraph 13l (9). In lines 2 and 6, the word “calibration” is deleted.

Page 15, paragraph 13m. In line 1, "Calibrate" is changed to read “Adjust.”

Page 15, paragraph 13m (2). In line 22, "Calibration" is changed to read “Adjustment.” in line 24, "calibrated" is changed to read “adjusted.”

Page 16, paragraph 13m (2). In line 6, "calibration" is changed to read “adjustment.”

Page 18, paragraph 15a. In line 5, the word “calibration” is deleted.

Page 18, paragraph 15b. In line 5, the word “calibration” is deleted.

Page 18. Paragraph 15c is superseded as follows:

c. Pointer Alignment. At 6300 engine rpm, the engine pointer should coincide with rotor pointer reading 309 rpm, to ensure nearest practical coincidence set engine pointer at 6600 rpm; frequency generator reading must be 4215 cpm ±15 cpm. Set rotor pointer 320 rpm; frequency generator reading must be ±15 cpm.

Page 18. Tables 7 and 8 are superseded.

Page 18. Table 9 is deleted.

Table 7. Adjustment and Test Data, Engine Pointer

Generator RPM	Desired Indication RPM	Scale Error Tolerance		
		Indication RPM + or —	Generator RPM	
			Min.	Max.
0	0	70	0	0
766	1200	70	721	811
1277	2000	60	1239	1315
1916	3000	60	1878	1954
2554	4000	55	2519	2589
3193	5000	50	3161	3225
3832	6000	40	3806	3858
4023	6300	25	4007	4039
4215	6600	25	4199	4231
4470	7000	50	4438	4502

Table 8. Adjustment and Test Data, Rotor Pointer

Generator RPM	Desired Indication RPM	Scale Error Tolerance		
		Indication RPM + or —	Generator RPM	
			Min.	Max.
0	0	3.75	0	0
797	60	3.75	747	847
1328	100	3.75	1278	1378
2125	160	3.	2085	2165
2656	200	3.	2616	2696
3719	280	2.	3692	3746
4250	320	1.13	4235	4265
4516	340	2.	4489	4543

NOTE

Use of either single cord or double cord method is acceptable.

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

DISTRIBUTION :
To be distributed in accordance with DA Form 12-31 Direct and General Support maintenance requirements for UH-lB and UH-lD/lH aircraft.

CHANGE
No. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *20 September 1974*

GS Maintenance Manual
Including Repair Parts and Special Tools List

DUAL TACHOMETER INDICATOR
PART NO. 41105-C5A-4-B3
AND 41105-C5A-4-E3

TM 55-6680-234-40, 31 January 1968, is changed as follows:

page 4, *Table 3.* Special Tools Required. The following is added.

Part, Model or Mil Des	Nomenclature	Technical Description
None	Checking fixture for Pointer Shaft P/N 149292	Tool fabrication see figure 12

Page 8. Paragraph 7d(2) is superseded as follows:

(2) Hold magnet keeper 1489071 against stator assembly (13) in housing (11). Remove rotor assembly (14) from stator directly into magnet keeper. Check rotor assembly to see if magnet is loose on shaft by applying hand pressure. If the magnet is loose refer to paragraph 13e.

Page 12, paragraph 13e. Add the following sentence before the *Note*.

"If magnet is loose on shaft place a thin bead of loctite CVV on the shaft and press magnet into position on the shaft."

Page 13. Paragraph 13h (3) is superseded as follows:

(3) Insert rear end of-rear shaft (7) into bearing (17) in rear plate (18). Install shaft assembly on checking fixture and check for alignment. If the shaft does not run true, press on side of shaft until exact alignment is secured. Replace shaft if it will not readily straighten. Remove from the checking fixture being careful not to disturb the shaft alignment.

Page 25A. Figure 12 is added.

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States
Vice Cbief of Staff

Official:
VERNE L. BOWERS
Major General, United States Amy
Tbe Adjutant General

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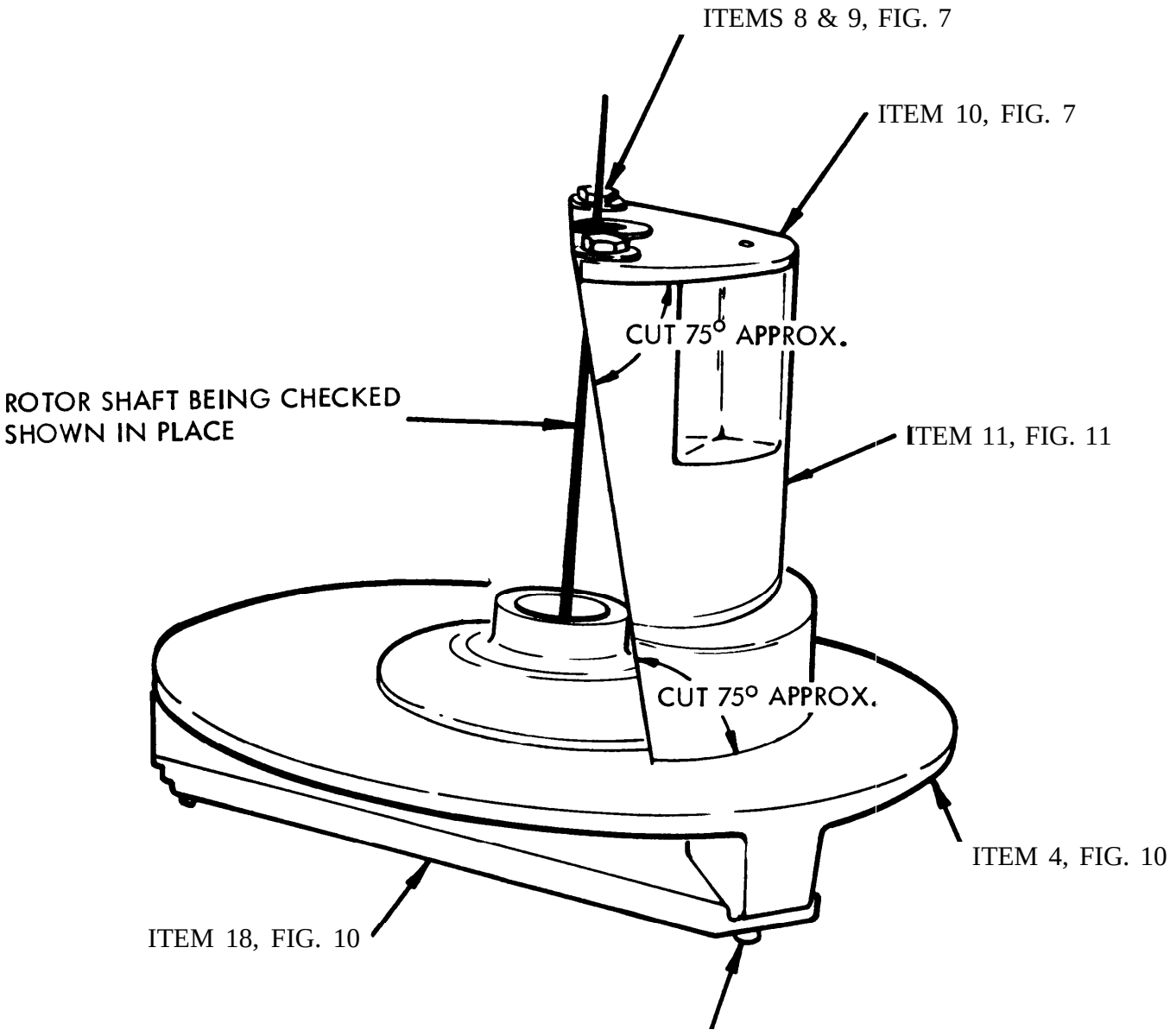

Figure 12. Fabrication of Checking Fixture

CHANGE
No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *3 February 1971*

GS Maintenance Manual
Including Repair Parts and Special Tools List

DUAL TACHOMETER INDICATOR

PART NO. 41105-C5A-4-B3
AND 41105-C5A-4-E3

TM 55-6680-234-40, 31 January 1968, is changed as follows:

Page 7. Paragraph 7c(4) superseded as follows:

(4) Refer to Figure 8. Plate (4) containing jewel (3) must be replaced with a properly machined plate, P/N 1490664-003.

Figure 2 is superseded.

Page 10. Paragraph 8(4) is superseded as follows:

(4) Clean jewel (6 of figure 8) with a piece of soft pegwood freshly tapered for each jewel.

By Order of the Secretary of the Army:

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

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
Tbe Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31 (qty rqr block nos. 337, 344, and 354, cumulative for all blocks) requirements for Direct and General Support Maintenance Instructions for UH-1A, UH-1B, and UH-1D and 1H Aircraft.

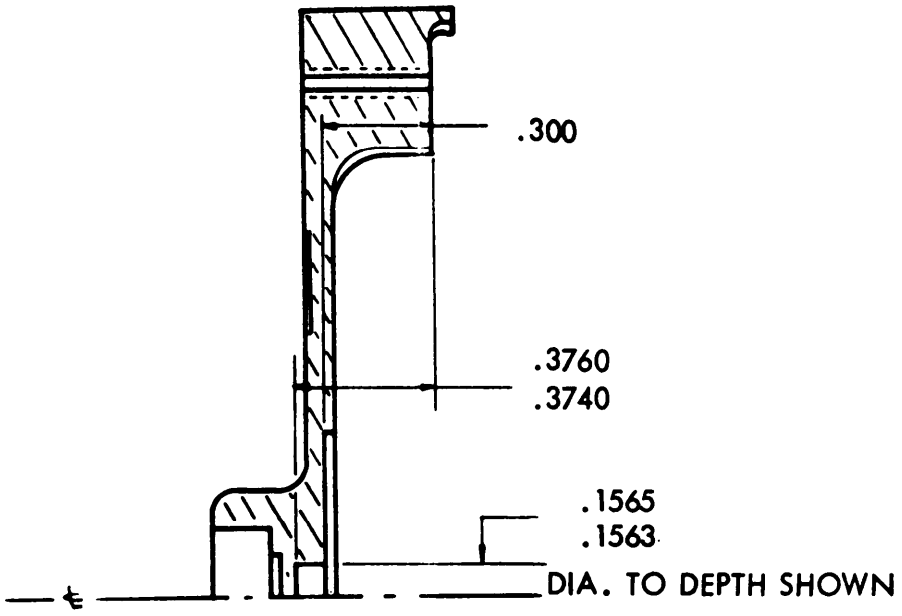

Figure 2. Modification of Front Plate P/N 1490673-0002.

GPO 944 747

CHANGE
No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *8 December 1970*

GS Maintenance Manual
Including Repair Parts and Special Tools List

DUAL TACHOMETER INDICATOR

PART NO. 41105-C5A-4-B3

AND 41105-C5A-4-E3

TM 55-6680-234-40, 31 January 1968, is changed as follows:

Cover and Page 1. (As changed by C3, 16 Feb 70.) Title is changed as shown above.

Page 1. (As added by C3, 16 Feb 70.) Add the following to Table of Contents:

APPENDIX B REPAIR PARTS AND SPECIAL TOOLS LIST Page 26

Page 4. (As changed by C1, 6 Sep 68.) In Table 2, under Part, Model or Mil Des column, line 3, "Type TTU-25/E" is changed to read "Type TTU-27E"

Page 15, paragraph 13m(2). (As changed by C4, 4 Nov 70.) In line 8 after RPM, add "for 15 minutes to provide a warm-up period."

Page 17. (As added by C2, 20 Jan 69.) Paragraph 13r is added as follows:

r. Place tachometer indicator in environmental chamber and connect to power source. While operating indicator at approximately 2000 RPM, reduce temperature to -35°C (-31°F). Maintain this temperature for 30 minutes. No condensation shall appear on inside of glass.

Page 19. (As changed by Cl, 6 Sep 68.) In Table 9 under RPM Rotor column, line 5, "223.8" is changed to read "323.8."

Page 26. Appendix B is superseded as follows:

These changes supersede Change 3, 16 February 1970, and Change 4, 4 November 1970.

APPENDIX B

REPAIR PARTS AND SPECIAL TOOLS LIST
(Current as of 23 November 1970)

Section I. INTRODUCTION

B-1. Scope

This appendix lists repair parts, special tools, test and support equipment, and maintenance supplies required for the performance of general support maintenance of the indicator, electrical tachometer.

B-2. General

The Repair Parts and Special Tools Listing is divided into the following sections:

a. Repair Parts - Section II. A list of repair parts authorized for the performance of maintenance at the general support level in figure and item number sequence. Maintenance supplies (MSUP) are listed within the section in ascending Federal stock number (FSN) sequence.

b. Special Tools, Test and Support Equipment - Section III. A list of special tools, test and support equipment authorized for the performance of maintenance at the general support level.

c. *Federal Stock Number and Reference Number Index - Section IV.* This section is divided as follows:

(1) A list of FSNs in ascending numerical sequence cross-referenced to the illustration figure and item number.

(2) A list of reference numbers (R/Ns) in ascending alpha-numerical sequence cross-referenced to the manufacturer's Federal supply code, illustration figure and item number.

B-3. Explanation of Columns

The following provides an explanation of columns in the tabular lists in sections II and III:

a. Source, Maintenance and Recoverability Codes (SMR) - Column 1.

(1) *Source code.* Indicates the selection status and source for the listed items. Source codes used are:

CODE	EXPLANATION
P	Repair parts, special tools and test equipment supplied from the GSA/DSA, or Army supply system, and authorized for use at indicated maintenance categories.
P2	Repair parts, special tools and test equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system,
P9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment, which are stocked and supplied by the Army COMSEC Logistic System and which are not subject to the provisions of AR 380-41.
P10	Assigned to items which are NSA design controlled: special tools test, measuring and diagnostic equipment for COMSEC support, which are accountable under the provisions of AR 380-41, and which are stocked and supplied by the Army COMSEC Logistic System.
M	Repair parts, special tools and test equipment which are not procured or stocked, as such, in the supply system but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies that are not procured or stocked because the failure rate is normally below that of the applicable end item of component. The failure of such part or assembly should result in retirement of the end item from the supply system.
Xl	Repair parts which are not procured or stocked. The requirement for such items will be filled by the next higher assembly or component.
X2	Repair parts, special tools, and test equipment which are not stocked and have no foreseen mortality. The indicated maintenance category requiring such repair parts will attempt to obtain the parts through cannibalization or salvage, the item may be requisitioned with exception data, from the end item manager, for immediate use.

CODE	EXPLANATION
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above the DS and GS level or returned to depot supply level.

Note: Cannibalization or salvage may be used as a source of supply for any items source coded above except those coded Xl and aircraft support items as restricted by AR 700-42.

(2) *Maintenance code.* Indicates the lowest category of maintenance authorized to install the listed items. Maintenance codes used are:

CODE	EXPLANATION
0	Organizational maintenance
F	Direct support maintenance
H	General support maintenance

(3) *Recoverability code.* Indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes used are:

CODE	EXPLANATION
R	Applies to repair parts and assemblies which are economically reparable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
T	Applies to high dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U	Applies to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.
S	Applies to repair parts and assemblies which are economically reparable at DSU and GSU activities and which normally are furnished by supply on an exchange-basis. When items are determined by a GSU to be uneconomically reparable, they will be evacuated to a depot for evaluation and analysis before final disposition.

b. Federal Stock Number - Column 2. Indicates the FSN assigned to the item and will be used for requisitioning purposes. Items source coded A, M, or X1 are not assigned an FSN.

c. Description - Column 3. Indicates the Federal item name and any additional description of the item required. The description column contains the following subcolumns:

(1) *Reference number and manufacturer's code.* Indicates a part number or other R/N for the listed item followed by the applicable five-digit Federal supply code for manufacturers in parentheses.

(2) *Usable on code.* Not applicable.

d. Unit of Measure *(U/M) - Column 4.* A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based (e.g., EA, FT, PR).

e. Quantity Incorporated in *Unit - Column 5.* Indicates the quantity of the item used in the assembly. A "V" appearing in this column instead of a quantity indicates that a definite quantity cannot be shown.

f. Thirty-day GS Maintenance Allowance - Column 6.

(1) The allowance column is divided into three subcolumns. Indicated in each subcolumn opposite the first appearance of each item, is the total quantity of items authorized for the number of equipments supported. Subsequent appearances of the same item will have the letters "REF" in this column. Items authorized for use as required, but not for initial stockage, are identified with an asterisk (*) in the allowance column.

(2) The quantitative allowance for GS level of maintenance will represent initial stockage for a 30-day period for the number of equipments supported.

(3) Determination of the total quantity of parts required for maintenance of more than 100 of these equipments can be accomplished by converting the equipment quantity to a decimal factor by placing a decimal point before the next to last digit of the number to indicate hundredths, and multiplying the decimal factor by the parts quantity authorized allowance for 51-100 allowance column. Example: authorized allowance for 51-100 equipments is 40; for 150 equipments, multiply 40 by 1.50, or 60 parts required.

g. *One-year Allowance per 100 Equipments/Contingency Planning Purposes - Column 7.* Indicates opposite the first appearance of each item, the total quantity required for distribution and contingency planning purposes. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments for one year.

h. Depot Maintenance Allowance per 100 Equipmente - Column 8. Not applicable.

i. *Illustration - Column 9.* Illustrations appear in the narrative portion of this manual. This column is divided as follows:

(1) *Figure number- column 9a.* Indicates the figure number of the illustration in which the item is shown. Appearances of the letters "MSUP" in this column indicate maintenance supplies located in section II; the letters "TOOL" indicate special tools located in section III.

(2) *Item number - column 9b.* Indicates the callout number to reference the item in the illustration.

B-4. Special Information

Oversize and undersize parts, such as studs, bushings, etc., are listed following the standard size part and in the same indent. The degree of oversize or undersize is stated in the description.

B-5. How to Locate Repair Parts

a. When FSN or R/N is unknown:

(1) *First.* Find the exploded view illustration of the assembly or subassembly to which the repair part belongs.

(2) *Second,* Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(3) *Third.* Using the Repair Parts Listing, find the figure and item number listed in the illustration column.

b. When FSN or R/N is known:

(1) *First.* Using the index of FSNs and R/Ns, find the pertinent FSN or R/N. This index is in ascending FSN sequence followed by a list of R/Ns in ascending alpha-numerical sequence, cross-referenced to the illustration figure and item number.

(2) *Second.* Using the Repair Parts Listing, find the figure and item number listed in the illustration column referenced in the index of FSNs and R/Ns.

B-6. Federal Supply Codes for Manufacturers

CODE	MANUFACTURER
02987	Bendix Corp The Flight and Engine Instruments Div South Montrose PA 18843
49673	RFL Industries Inc Powerville Road Boonton NJ 07005
81348	Federal Specifications Promulgated by General Services Administration
81349	Military Specifications Promulgated by Standardization Div Directorate of Logistic Services DSA
96906	Military Standards Promulgated by Standardization Div Directorate of Logistic Services DSA
99974	AC Electronics Div of General Motors Corp 7929 South Howell Ave Oak Creek WI 53154

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR CODE			USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY GS MAINT ALW (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-YR ALWPER 100 EQUIP CNTGCY	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION (a) FIG NO	(b) ITEM NO
	6680-932-5133	41105C5A4E3	(02987)	INDICATOR,ELECTRICAL..... TACHOMETER		EA							1	
	6680-921-6031	41105C5A4B3	(02987)	INDICATOR,ELECTRICAL..... TACHOMETER		EA							1	
				SECTION II REPAIR PARTS ELECTRICAL TACHOMETER INDICATOR										
X1----		1492513-1	(02987)	BEZEL.....			1						7	1
P--H--	6620-055-1829	1492266-1	(02987)	WINDOW,DIAL.....		EA	1	*	*	*			7	2
X1----		1490946-2	(02987)	CASE,INDICATOR.....			1						7	3
X2-H--		1492512-1	(02987)	CASE ASSEMBLY.....		EA	1						7	4
P--H--	6680-400-6998	1488749-1	(02987)	SPACER,DIAL.....		EA	1	*	*	*			7	5
P--H--	6680-400-7000	1492511-1	(02987)	POINTER ASSEMBLY,FRONT.....		EA	1	*	*	*			7	6
P--H--	6680-400-7001	1492510-1	(02987)	POINTER ASSEMBLY,REAR.....		EA	1	*	*	*			7	7
P--H--	5305-902-4765	1490637-1	(02987)	SCREW,MACHINE.....		EA	4	*	*	*			7	8
P--H--	5310-901-5030	1490027-1	(02987)	WASHER,SLOTTED.....		EA	4	*	*	*			7	9
X1----		01490685-005	(02987)	PLATE AND SHAFT ASSEMBLY.....			1						7	10
P--H--	6110-420-4306	1260205-5	(02987)	DRAG CUP ASSEMBLY.....		EA	1	*	*	*			7	11
P--H--	6105-400-6779	1490695-2	(02987)	HOUSING ASSEMBLY,MOTOR.....		EA	1	*	*	*			7	12
P--H--	5305-902-4765	1490637-1	(02987)	SCREW,MACHINE.....		EA	4	*	*	*			7	13
P--H--	5310-901-5030	1490027-1	(02987)	WASHER,SLOTTED.....		EA	4	*	*	*			7	14
X1----		01490686-004	(02987)	PLATE AND SHAFT ASSEMBLY.....			1						7	15
P--H--	5310-494-2687	3050-02-21	(02987)	WASHER,LOCK.....		EA	3	*	*	*			7	16
P--H--	5305-726-6013	8599245-043	(99974)	SCREW,MACHINE.....		EA	3	*	*	*			7	17
P--H--	6620-979-6847	1260205-3	(02987)	DRAG CUP ASSEMBLY.....		EA	1	*	*	*			7	18
P--H--	6105-400-6779	1490695-2	(02987)	HOUSING ASSEMBLY,MOTOR.....		EA	1	*	*	*			7	19
P--H--	3110-554-3820	1490079-1	(02987)	BEARING,BALL,ANNULAR.....		EA	1	*	*	*			7	20
P--H--	5365-435-8481	1489119-22-1	(02987)	SHIM-0.001 IN.THK.....		EA	V	*	*	*			7	21
P--H--	5340-250-2159	1489119-22-5	(02987)	SHIM-0.005 IN.THK.....		EA	V	*	*	*			7	21
P--H--	5340-250-2160	1489119-22-10	(02987)	SHIM-0.0010 IN.THK.....		EA	V	*	*	*			7	21
X2-H--		1490674-1	(02987)	PLATE,REAR.....		EA	1						7	22
P--H--	5310-494-2687	3050-02-21	(02987)	WASHER,LOCK.....		EA	3	*	*	*			7	23
P--H--	5305-726-6013	8599245-043	(99974)	SCREW,MACHINE.....		EA	3	*	*	*			7	24
P--H--	5330-369-3342	1492411-1	(02987)	RING,COMPRESSION.....		EA	1	*	*	*			7	25
M--H--		3070-11-1-050	(02987)	INSULATION SLEEVING.....		EA	6	*	*	*			7	26
P--H--	5325-901-5057	1492991-1	(02987)	EYELET,METALLIC.....		EA	1	*	*	*			7	27
P--H--	6610-420-7740	1490679-2	(02987)	COVER ASSEMBLY,END.....		EA	1	*	*	*			7	28
P--H--	5310-472-8519	1485329-4	(02987)	PUSH ON NUT.....		EA	2	*	*	*			7	30
X1----		1490677-2	(02987)	COVER,END.....			1						7	32
X1----		1490678-1	(02987)	CONNECTOR,RECEPTACLE.....			2						7	33

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	REFERENCE NUMBER & MFR CODE		(3) DESCRIPTION	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY GS MAINT ALW (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-YR ALWPER 100 EQUIP CNTGCY	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION (a) FIG NO	(b) ITEM NO
				FRONT PLATE AND SHAFT ASSEMBLY										
X1----		01490685-005	(02987)	PLATE AND SHAFT ASSEMBLY.....			1						8	
P--H--	5305-519-0614	1489266-156	(02987)	.SCREW,DIAL.....		EA	3	*	*	*			8	1
P--H--	6680-400-5213	A411C5A	(02987)	.DIAL,BLANK,INDICATOR.....		EA	1	*	*	*			8	2
P--H--	3110-443-5559	2270370-0001	(02987)	.BEARING,BALL,ANNULAR.....		EA	1	*	*	*			8	3
X2-H--		1490664-3	(02987)	.PLATE,DIAL.....		EA	1						8	4
X1----		1490689-3	(02987)	.PLATE ASSEMBLY.....			1						8	
P--H--	5315-443-1152	2270527-0001	(02987)	.PIN,SPRING.....		EA	1	*	*	*			8	5
P--H--	6610-983-4442	1481927-1	(02987)	.JEWEL,MOUNTED.....		EA	1	*	*	*			8	6
P--H--	6680-400-5214	1495380	(02987)	.SHAFT,FRONT,INDICATOR.....		EA	1	*	*	*			8	7
X1----		1490681-2	(02987)	.SHAFT ASSEMBLY,FRONT.....			1						8	
P--H--	6620-900-5779	1488472-2	(02987)	.SPRING,HELICAL COMPRESSION.....		EA	1	*	*	*			8	9
P--H--	6680-400-6999	1493837	(02987)	.SHIELD,HAIRSPRING.....		EA	1	*	*	*			8	10
P--H--	5310-454-0397	1489119-25-10	(02987)	.SHIM.....		EA	1	*	*	*			8	11
P--H--	6680-400-5212	1490669-2	(02987)	.HAIRSPRING.....		EA	1	*	*	*			8	12
P--H--	5305-420-5981	1489214-1	(02987)	.SCREW,HEXAGON HEAD.....		EA	1	*	*	*			8	13
P--H--	5310-107-7699	3050-02-09	(02987)	.WASHER,LOCK.....		EA	1	*	*	*			8	14
P--H--	5310-022-3128	3055-094-5-23	(02987)	.WASHER,FLAT.....		EA	1	*	*	*			8	15
P--H--	6620-762-0340	1485649-1	(02987)	.PLATE,HAIRSPRING.....		EA	1	*	*	*			8	16
P--H--	3110-453-6219	01496654-001	(02987)	.BEARING,BALL,ANNULAR.....		EA	1	*	*	*			8	17
P--H--	5340-248-3162	1489119-16-1	(02987)	.SHIM-0.001 IN.THK.....		EA	V	*	*	*			8	18
P--H--	5365-435-8480	1489119-16-5	(02987)	.SHIM-0.005 IN.THK.....		EA	V	*	*	*			8	18
P--H--	5310-145-1790	1489116-16-10	(02987)	.SHIM-0.0010 IN.THK.....		EA	V	*	*	*			8	18
P--H--	5310-251-9794	1489119-16-20	(02987)	.SHIM-0.0020 IN.THK.....		EA	V	*	*	*			8	18
P--H--	5310-251-9795	1489119-16-30	(02987)	.SHIM-0.0030 IN.THK.....		EA	V	*	*	*			8	18
P--H--	5340-248-3182	1489119-16-40	(02987)	.SHIM-0.0040 IN.THK.....		EA	V	*	*	*			8	18
P--H--	5310-454-0397	1489119-25-10	(02987)	.SHIM.....		EA	1	*	*	*			8	19
X2-H--		1494064-003	(02987)	.PLATE,REAR.....		EA	1						8	20
P--H--	5310-494-2687	3050-02-21	(02987)	.WASHER,LOCK.....		EA	3	*	*	*			8	21
P--H--	5305-726-6013	8599245-043	(99974)	.SCREW,MACHINE.....		EA	3	*	*	*			8	22
				FRONT MOTOR ASSEMBLY										
P--H--	6105-400-6779	1490695-2	(02987)	HOUSING ASSEMBLY,MOTOR.....		EA	1	*	*	*			9	
P--H--	6620-762-0346	1490068-1	(02987)	.MAGNET ASSEMBLY.....		EA	1	*	*	*			9	1
P--H--	5305-494-2600	3017-04-04-1-31	(02987)	.SETSCREW.....		EA	1	*	*	*			9	7
P--H--	5305-487-5108	3003-0414-130	(02987)	.SCREW,MACHINE.....		EA	1	*	*	*			9	8
P--H--	5310-837-2948	3062-04-20	(02987)	.NUT,PLAIN,HEXAGON.....		EA	1	*	*	*			9	9
P--H--	6620-928-6025	1494934	(02987)	.RETURN PATCH ASSEMBLY.....		EA	1	*	*	*			9	10
X1----		1494935	(02987)	.HOUSING,MOTOR.....			1						9	11
P--H--	3110-554-3820	1490079-1	(02987)	.BEARING,BALL,ANNULAR.....		EA	1	*	*				9	12
X1----		2270845	(02987)	.STATOR ASSEMBLY.....			1						9	13

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR CODE			USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY GS MAINT ALW (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-YR ALWPER 100 EQUIP CNTGCY	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION (a) FIG NO	(b) ITEM NO
P--H--	6680-220-2072	01496118-001	(02987)	.ROTOR ASSEMBLY,INDICATOR.....		EA	1	*	*	*			9	14
P--H--	5310-022-3127	3055-125-2-23	(02987)	.WASHER,FLAT.....		EA	2	*	*	*			9	15
P--H--	5310-107-7700	3052-04-21	(02987)	.WASHER,LOCK.....		EA	2	*	*	*			9	16
P--H--	5310-720-8314	3003-0412-120	(02987)	.SCREW,MACHINE.....		EA	2	*	*	*			9	17
M--H--		3070-12-1-400	(02987)	.INSULATION SLEEVING.....		EA	1	*	*	*			9	18
				REAR PLATE AND SHAFT ASSEMBLY										
X1----		01490686-004	(02987)	PLATE AND SHAFT ASSEMBLY.....			1						10	
P--H--	6110-420-7742	1492492-1	(02987)	.SHAFT,POINTER.....		EA	1	*	*	*			10	1
P--H--	3110-554-3820	1490079-1	(02987)	.BEARING,BALL,ANNULAR.....		EA	1	*	*	*			10	2
P--H--	5340-248-3191	1489119-25-3	(02987)	.SHIM-0.003 IN.THK.....		EA	V	*	*	*			10	3
P--H--	5365-435-8482	1489119-25-5	(02987)	.SHIM-0.005 IN.THK.....		EA	V	*	*	*			10	3
P--H--	5310-454-0397	1489119-25-10	(02987)	.SHIM-0.0010 IN.THK.....		EA	1	*	*	*			10	3
X2-H--		01490673-002	(02987)	.PLATE.....		EA	1						10	4
X1----		01490688-003	(02987)	.PLATE ASSEMBLY,FRONT.....			1						10	
P--H--	5315-291-5471	MS171431	(96906)	.PIN,SPRING.....		EA	1	*	*	*			10	5
P--H--	3110-947-0656	1488347-0001	(02987)	.BEARING,BALL,ANNULAR.....		EA	1	*	*	*			10	6
P--H--	6680-400-5215	1495381-003	(02987)	.SHAFT,REAR.....		EA	1	*	*	*			10	7
X1----		1490682-004	(02987)	.SHAFT ASSEMBLY.....			1						10	
P--H--	6685-867-0474	1490671-1	(02987)	.MOUNT ASSEMBLY.....		EA	1	*	*	*			10	8
P--H--	6620-900-5779	1488472-2	(02987)	.SPRING,HELICAL COMPRESSION.....		EA	1	*	*	*			10	9
P--H--	6680-400-6999	1493837	(02987)	.SHIELD,HAIRSPRING.....		EA	1	*	*	*			10	10
P--H--	5310-454-0397	1489119-25-10	(02987)	.SHIM.....		EA	1	*	*	*			10	11
P--H--	6680-420-4911	1490669-1	(02987)	.HAIRSPRING.....		EA	1	*	*	*			10	12
P--H--	5305-420-5981	1489214-1	(02987)	.SCREW,HEXAGON HEAD.....		EA	1	*	*	*			10	13
P--H--	5310-107-7699	3050-02-09	(02987)	.WASHER,LOCK.....		EA	1	*	*	*			10	14
P--H--	5310-022-3128	3055-094-5-23	(02987)	.WASHER,FLAT.....		EA	1	*	*	*			10	15
P--H--	6620-762-0340	1485649-1	(02987)	.PLATE,HAIRSPRING.....		EA	1	*	*	*			10	16
P--H--	3110-947-0656	1488347-0001	(02987)	.BEARING,BALL,ANNULAR.....		EA	1	*	*	*			10	17
X2-H--		1494064-2	(02987)	.PLATE,REAR.....		EA	1						10	18
P--H--	5310-494-2687	3050-02-21	(02987)	.WASHER,LOCK.....		EA	3	*	*	*			10	19
P--H--	5305-726-6013	8599245-043	(99974)	.SCREW,MACHINE.....		EA	3	*	*	*			10	20
				REAR MOTOR ASSEMBLY										
P--H--	6105-400-6779	1490695-2	(02987)	HOUSING ASSEMBLY,MOTOR.....		EA	1	*	*	*			11	
P--H--	6110-420-7741	1490068-2	(02987)	.HUB AND MAGNET ASSEMBLY.....		EA	1	*	*	*			11	1
P--H--	5305-494-2600	3017-04-04-1-31	(02987)	.SETSCREW.....		EA	1	*	*	*			11	7
P--H--	5305-487-5108	3003-0414-130	(02987)	.SCREW,MACHINE.....		EA	1	*	*	*			11	8

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR CODE			USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY GS MAINT ALW (a) 1-20	(b) 21-50	(c) 51-100	(7) 1-YR ALWPER 100 EQUIP CNTGCY	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION (a) FIG NO	(b) ITEM NO
P--H--	5310-837-2948	3062-04-20	(02987)	.NUT,PLAIN,HEXAGON.....		EA	1	*	*	*			11	9
P--H--	6620-928-6025	1494934	(02987)	.RETURN PATCH ASSEMBLY.....		EA	1	*	*	*			11	10
X1----		1494935	(02987)	.HOUSING,MOTOR.....			1						11	11
P--H--	3110-554-3820	1490079-1	(02987)	.BEARING,BALL,ANNULAR.....		EA	1	*	*	*			11	12
X1----		2270845	(02987)	.STATOR ASSEMBLY.....			1						11	13
P--H--	6680-220-2073	01496118-002	(02987)	.ROTOR ASSEMBLY,INDICATOR.....		EA	1	*	*	*			11	14
P--H--	5310-107-7700	3052-04-21	(02987)	.WASHER,LOCK.....		EA	2	*	*	*			11	16
P--H--	5305-207-4121	3003-0412-120	(02987)	.SCREW,MACHINE.....		EA	2	*	*	*			11	17
				MAINTENANCE SUPPLIES										
P--F--	5970-729-2966		(81349)	INSULATION SLEEVING-0.095 IN..... ID,MIL-I-631		FT	V	*	*	*			MSUP	
P--F--	5970-840-4813		(81349)	INSULATION SLEEVING-0.085 IN..... ID,MIL-I-631		FT	V	*	*	*			MSUP	
P--O--	6850-264-9038		(81348)	DRY CLEANING SOLVENT-LIQUID..... FORM,FED P-D-680,TYPE 1, 5 GAL PAIL		GL	V	*	*	*			MSUP	
P--O--	8030-081-2328		(81349)	SEALING COMPOUND-LIQUID FORM,..... PURPLE,MIL-S-22473A,GRADE E, 50 CC BOTTLE		CC	V	*	*	*			MSUP	
P--O--	9150-664-6518		(81349)	LUBRICATING OIL,INSTRUMENT-..... SYNTHETICALLY PREPARED OIL, CORROSION & OXIDATION RESISTANT MIL-L-6085,1-1/2 OZ BOTTLE		OZ	V	*	*	*			MSUP	
				SECTION III SPECIAL TOOLS, TEST, AND SUPPORT EQUIPMENT										
P--H--	4920-986-1059	HC7010-7	(49673)	COIL ASSEMBLY,TREATING.....		EA	1	*	*	*			TOOL	
P--H--	4920-105-1297	1489072	(02987)	FIXTURE,MAGNETIZING.....		EA	1	*	*	*			TOOL	
P--H--	4920-443-1127	1489447	(02987)	FIXTURE ASSEMBLY.....		EA	1	*	*	*			TOOL	
P--H--		1489071	(02987)	KEEPER,MAGNET.....		EA	1	*	*	*			TOOL	

STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER
3110-443-5559	8	3
3110-453-6219	8	17
3110-554-3820	7	20
3110-554-3820	9	12
3110-554-3820	10	2
3110-554-3820	11	12
3110-947-0656	10	6
3110-947-0656	10	17
4920-105-1297	TOOL	
4920-443-1127	TOOL	
4920-986-1059	TOOL	
5305-207-4121	11	17
5305-420-5981	8	13
5305-420-5981	10	13
5305-487-5108	9	8
5305-487-5108	11	8
5305-494-2600	9	7
5305-494-2600	11	7
5305-519-0614	8	1
5305-726-6013	7	17
5305-726-6013	7	24
5305-726-6013	8	22
5305-726-6013	10	20
5305-902-4765	7	8
5305-902-4765	7	13
5310-022-3127	9	15
5310-022-3128	8	15
5310-022-3128	10	15
5310-107-7699	8	14
5310-107-7699	10	14
5310-107-7700	9	16
5310-107-7700	11	16
5310-145-1790	8	18
5310-251-9794	8	18
5310-251-9795	8	18
5310-454-0397	8	11
5310-454-0397	8	19
5310-454-0397	10	3
5310-454-0397	10	11
5310-472-8519	7	30
5310-494-2687	7	16
5310-494-2687	7	23
5310-494-2687	8	21
5310-494-2687	10	19
5310-720-8314	9	17
5310-837-2948	9	9
5310-837-2948	11	9
5310-901-5030	7	9
5310-901-5030	7	14
5315-291-5471	10	5
5315-443-1152	8	5
5325-901-5057	7	27
5330-369-3342	7	25
5340-248-3162	8	18
5340-248-3182	8	18
5340-248-3191	10	3
5340-250-2159	7	21
5340-250-2160	7	21
5365-435-8480	8	18
5365-435-8481	7	21
5365-435-8482	10	3
5970-729-2966	MSUP	
5970-840-4813	MSUP	
6105-400-6779	7	12
6105-400-6779	7	19
6105-400-6779	9	
6105-400-6779	11	
6110-420-4306	7	11
6110-420-7740	7	28
6110-420-7741	11	1
6110-420-7742	10	1
6610-983-4442	8	6
6620-055-1829	7	2
6620-762-0340	8	16
6620-762-0340	10	16
6620-762-0346	9	1
6620-900-5779	8	9
6620-900-5779	10	9
6620-928-6025	9	10
6620-928-6025	11	10
6620-979-6847	7	18
6680-220-2072	9	14
6680-220-2073	11	14
6680-400-5212	8	12
6680-400-5213	8	2
6680-400-5214	8	7
6680-400-5215	10	7
6680-400-6998	7	5
6680-400-6999	8	10
6680-400-6999	10	10
6680-400-7000	7	6
6680-400-7001	7	7
6680-420-4911	10	12
6680-921-6031	7	
6680-932-5133	7	
6685-867-0474	10	8
6850-264-9038	MSUP	
8030-081-2328	MSUP	
9150-664-6518	MSUP	

REFERENCE NUMBER	MFG CODE	FIG NUMBER	ITEM NUMBER	REFERENCE NUMBER	MFG CODE	FIG NUMBER	ITEM NUMBER
A411C5A	02987	8	2	1490678-1	02987	7	33
HC7010-7	49673	TOOL		1490679-2	02987	7	28
MS171431	96906	10	5	1490681-2	02987	8	
01490673-002	02987	10	4	1490682-004	02987	10	
01490685-005	02987	7	10	1490689-3	02987	8	
01490685-005	02987	8		1490695-2	02987	7	12
01490686-004	02987	7	15	1490695-2	02987	7	19
01490686-004	02987	10		1490695-2	02987	9	
01490688-003	02987	10		1490695-2	02987	11	
01496118-001	02987	9	14	1490946-2	02987	7	3
01496118-002	02987	11	14	1492266-1	02987	7	2
01496654-001	02987	8	17	1492411-1	02987	7	25
1260205-3	02987	7	18	1492492-1	02987	10	1
1260205-5	02987	7	11	1492510-1	02987	7	7
1481927-1	02987	8	6	1492511-1	02987	7	6
1485329-4	02987	7	30	1492512-1	02987	7	4
1485649-1	02987	8	16	1492513-1	02987	7	1
1485649-1	02987	10	16	1492991-1	02987	7	27
1488347-0001	02987	10	6	1493837	02987	8	10
1488347-0001	02987	10	17	1493837	02987	10	10
1488472-2	02987	8	9	1494064-003	02987	8	20
1488472-2	02987	10	9	1494064-2	02987	10	18
1488749-1	02987	7	5	1494934	02987	9	10
1489071	02987	TOOL		1494934	02987	11	10
1489072	02987	TOOL		1494935	02987	9	11
1489116-16-10	02987	8	18	1494935	02987	11	11
1489119-16-1	02987	8	18	1495380	02987	8	7
1489119-16-20	02987	8	18	1495381-003	02987	10	7
1489119-16-30	02987	8	18	2270370-0001	02987	8	3
1489119-16-40	02987	8	18	2270527-0001	02987	8	5
1489119-16-5	02987	8	18	2270845	02987	9	13
1489119-22-1	02987	7	21	2270845	02987	11	13
1489119-22-10	02987	7	21	3003-0412-120	02987	9	17
1489119-22-5	02987	7	21	3003-0412-120	02987	11	17
1489119-25-10	02987	8	11	3003-0414-130	02987	9	8
1489119-25-10	02987	8	19	3003-0414-130	02987	11	8
1489119-25-10	02987	10	3	3017-04-04-1-31	02987	9	7
1489119-25-10	02987	10	11	3017-04-04-1-31	02987	11	7
1489119-25-3	02987	10	3	3050-02-09	02987	8	14
1489119-25-5	02987	10	3	3050-02-09	02987	10	14
1489214-1	02987	8	13	3050-02-21	02987	7	16
1489214-1	02987	10	13	3050-02-21	02987	7	23
1489266-156	02987	8	1	3050-02-21	02987	8	21
1489447	02987	TOOL		3050-02-21	02987	10	19
1490027-1	02987	7	9	3052-04-21	02987	9	16
1490027-1	02987	7	14	3052-04-21	02987	11	16
1490068-1	02987	9	1	3055-094-5-23	02987	8	15
1490068-2	02987	11	1	3055-094-5-23	02987	10	15
1490079-1	02987	7	20	3055,125-2-23	02987	9	15
1490079-1	02987	9	12	3062-04-20	02987	9	9
1490079-1	02987	11	12	3062-04-20	02987	11	9
1490079-9	02987	10	2	3070-11-1-050	02987	7	26
1490637-1	02987	7	8	3070-12-1-400	02987	9	18
1490637-1	02987	7	13	41105C5A4B3	02987	7	
1490664-3	02987	8	4	41105C5A4E3	02987	7	
1490669-1	02987	10	12	8599245-043	99974	7	17
1490669-2	02987	8	12	8599245-043	99974	7	24
1490671-1	02987	10	8	8599245-043	99974	8	22
1490674-1	02987	7	22	8599245-043	99974	10	20
1490677-2	02987	7	32				

By Order of the Secretary of tbe Army:

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General, United States Army,
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TECHNICAL MANUAL
No. 55-6680-234-40

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *31 January 1968*

GS Maintenance Manual

DUAL TACHOMETER INDICATOR PART NO. 41105-C5A-4-B3 AND 41105-C5A-A4-E3

SECTION I

INTRODUCTION

1. General Information

a. This technical manual comprises overhaul instructions for the dual tachometer indicator, type number 41105-C5A-4-E3 (see figure 1), and rework of 41105-C5A-4-B3 to 41105-C5A-4-E3, manufactured by the Bendix Corporation, Flight & Engine Instruments Division, South Montrose, Pennsylvania 18801, Federal Supply Code Number 02987. Sections I through IV of this technical manual contain instructions for this part number.

b. Report 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 DA Publications) and forwarded directly to the Commanding General, U.S. Army Aviation Materiel Command ATTN: AMSAV-M, Post Office Box 209, St. Louis, Missouri 63166.

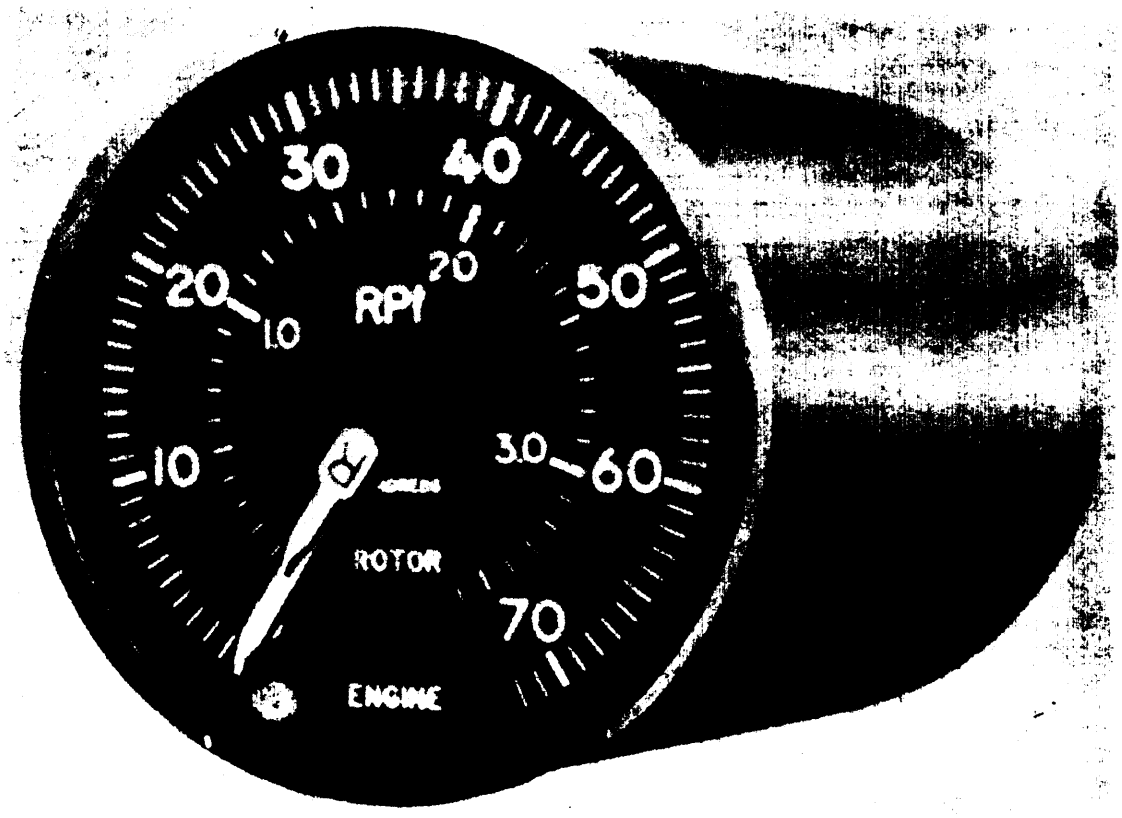


Figure 1. Dual Tachometer Indicator.

2. Purpose of the Dual Tachometer Indicator

The purpose of the dual tachometer indicator is to provide, on one dial, readings in RPM of the rotational speed of the turbojet engine shaft and of the speed of the rotor. The indicator is used with two pole tach generators conforming to Specification MS28054-1.

3. Equipment Records

The Army equipment record system and procedures established in TM 38-750 apply to this equipment. The applicable forms as required by TM 38–750 shall be used.

4. Description

The dial of the indicator is divided into two concentric scales; an outer scale, calibrated from 0 to 7200 RPM, provides readings of the engine sped while the inner scale, calibrated from 0 to 360 RPM, indicates rotor speed. Speeds are indicated by two concentrically mounted pointers. Each pointer is driven by a separate and independent internal motor assembly. The large rear pointer, indicating engine speed, is mounted directly on the shaft of the forward motor assembly. This motor is connected to and actuated by a tachometer generator that provides a signal proportional in magnitude and frequency to the engine speed. The short front pointer is mounted on an extension shaft that passes through the hub of the rear pointer and extends through the central shaft of the front motor to be driven by the rear motor. The rear motor is actuated by a tachometer generator providing a signal proportional in magnitude and frequency to the rotor speed. Each motor assembly includes a stator and housing within which a starter and rotor are mounted on the same shaft with a magnet assembly. The magnet assembly extends into and rotates within a drag cup. The drag cup is mounted on the same shaft with its associated pointer; this shaft operates against a hairspring that is wound up when the shaft is rotated in the direction of increasing dial indications. Signals in the stator cause the rotor assembly to rotate at a speed proportional to their magnitude and frequency. The magnet assembly then induces torque in the drag cup assembly propoirtional to the speed of rotation of the magnet assembly. Turning against the hairspring, the drag cup positions the pointer to correctly indicate the rotor or engine speed.

5. Leading Particulars

Table 1. Leading Particulars

Required Power	as supplied by mating tachometer generators, MS28054-1
Range	
Engine Scale	0-7200 RPM
Rotor Scale	0-360 RPM
Dial Spread	
Engine Scale	288 degrees
Rotor Scale	293.5 degrees
Temperature Range	-54 to +71° C (-64 to +159.8°F)
Case Size	.3-inch dia.
Engine Tachometer Generator RPM.	(0.6386) (indicated engine RPM)
Rotor Tachometer Generator RPM	(0.65l6) (indicated engine RPM)
Engine to Rotor RPM Ratio.	20.383 to 1.0

SECTION II

TEST EQUIPMENT, SPECIAL TOOLS AND MATERIALS

6. Test Equipment, Special Tools and Materials

The items in these three categories required to perform the overhaul and test procedures contained in this manual are listed respectively in tables 2, 3, and 4.

Table 2. Test Equipment Required

Part, Model or Mil Des	Nomenclature	Technical Description
13700-1-C	Insulation Breakdown Test Set	
Model 24-120A	Helium Leak Detector	
Type TTU-25/E	Indicator Generator	Tachometer generator in conformance with MIL-G-9398 (two required).

Table 3. Special Tools Required

Part, Model or Mil Des	Nomenclature	Technical Description
13693-1-B	Hermetic Sealing Stand	
1489036-1	Magnet Keeper	
1489071	Magnet Keeper	
1489072	Magnetizing Fixture	
1489444	Magnetizing Fixture	
1489447	Assembly Fixture	
HC7010-7	Coil Fixture Radio Frequency Laboratories Boontin, N. J.	
Model A (2075 gauss)	Gauss Meter Halltest Division Instrument Corporation 129-07 18th Avenue College Point, N. Y.	
Model 2470 or Model 2470-350	Magnet Charger Radio Frequency Laboratories Boonton, N. J.	
Model 25 Hyper Vac	Vaccum Pump Cenco (Central Scientific Co.) 1700 W. Irving Park Rd Chicago, Ill.	
Model 889A	Magnetreater Radio Frequency Laboratories Boonton, N. J.	
Model 18R	Staking Set (K & D) Hammel Riglander & CO. New York, N. Y.	

Table 4. Consumable Materials Required

Item No.	Material	Type or Grade	Government Specification
F-44	Versalube Mfg. by General Electric Co Ball Bearing Lubricant		MIL-L-6085
	Solvent		P-D-680
	Glyptal Mfg. by General Electric Co. Federal Supply Code 24446		
	Solder	68/37 Lead/Tin	MIL-STD-454

SECTION III

OVERHAUL INSTRUCTIONS

7. Disassembly (See figure 7.)

a. Open indicator and remove internal mechanism assembly as follows:

(1) Remove protective caps (31) and attach a mating connector (MS3106-14S-7S or MS3108-14S-7S) to one of receptacles (33). Place indicator in an induction coil and heat soldered joint securing end cover assembly (28) to case assembly (4) until solder has melted sufficiently that end cover assembly can be pulled free without peeling plating from end cover (32) or case (3).

Caution: **Excessive heat or force can result in separation of receptacles from end cover.**

It is not necessary, however, to remove receptacles from end cover unless one of these parts is defective. Remove excess solder from inner circumference of case; withdraw mechanism straight out from case assembly.

(2) Unsolder and remove eyelet (27). Unsolder leads from terminal pins of receptacles (33).

(3) Remove dial spacer (5) from case assembly (4).

Note. Do not disassemble case assembly (4) unless necessary to replace a defective part.

b. Mechanism assembly incorporates four major subassemblies:

(1) Front plate and shaft assembly (l0).

(2) Front motor assembly (12).

(3) Rear plate and shaft assembly (15).

(4) Rear motor assembly (19).

Separate these components as follows:

(5) Rotate pointer assemblies (6 and 7), one at a time, against stop. Being careful to avoid bending stop, gently continue rotation and pull pointers away from dial until they are free.

(6) Remove two hex head screws (18) and their "C" washers (14). Carefully detach and remove rear motor assembly (19) from mechanism. Re move rear drag cup assembly (18) from rear plate and shaft assembly (15) by turning counterclockwise against stop and pulling gently.

(7) Remove two hex head screws (8) and "C" washers (9). Detach and move front plate and shaft assembly (10) from front motor assembly (12). Remove front drag cup assembly (11) from front plate and shaft assembly (10) by turning counterclockwise against stop and pulling gently.

(8) Remove three screws (17) and their lockwashers (16). Detach and remove front motor assembly (12) from forward plate of rear plate and shaft assembly (15).

Caution: **Use care to avoid bending shaft.**

(9) Remove three screws (24) and their lockwashers (23). Remove rear motor assembly (19) from plate (22). Remove bearing (20) and shim (21) from plate (22).

c. Disassemble front plate and shaft assembly. (See figure 8.)

(1) Dial screws (1) are secured with a locking cement; break seal to remove.

(2) Remove screws (22) and lockwashers (21) from rear plate (20). Remove hex head screw (13), lockwasher (14), and flat washer (15) and remove hairspring assembly.

(3) Remove bearing (3) from dial plate (4) and bearing (17) from plate (20). Do not remove jewel (6) from front shaft (7) unless defective. Removal of a defective jewel is facilitated by first breaking up the jewel with a sharp-pointed punch so the pieces can be shaken out.

Note. Indicators with serial numbers 1 through 799 have a jewel (3) in plate (4) and a jewel (17) in rear plate (20). (See figure 8.)

(4) Refer to figure 8. Plate (4) containing jewel (3) must be replaced with a properly machined plate 1490664-13.

(5) The removal of jewel (17) in plate (20) is facilitated by striking the jewel a sharp blow with a pointed object and shaking out the pieces. The replacement bearing will fit in the area previously intended far the jewel.

d. Disassemble front motor assembly as follows. (See figure 9.)

Caution: **Magnet assemblies (1 of figure 9 and 11) should not be exposed to an open magnetic circuit which would occur at any time that they were not surrounded by suitable metal. To avoid such exposure during disassembly, hold magnet keepers 1489036-l against return paths (10 of figures 9 and 11) and slide magnet assemblies from the motor assemblies directly into the magnet keepers. Screw (8 of figures 9 and 11) is a magnetic screw and should not be removed unless defective. If removed, it should be replaced by a magnetic screw. Place magnet keepers in a non-magnetic container or on a nonmagnetic surface. Do not allow magnets to short by contacting other magnets or metals such as the surfaces of steel benches. Do not disassemble magnetic assemblies (1 of figures 9 and 11). If defective replace as an assembly.**

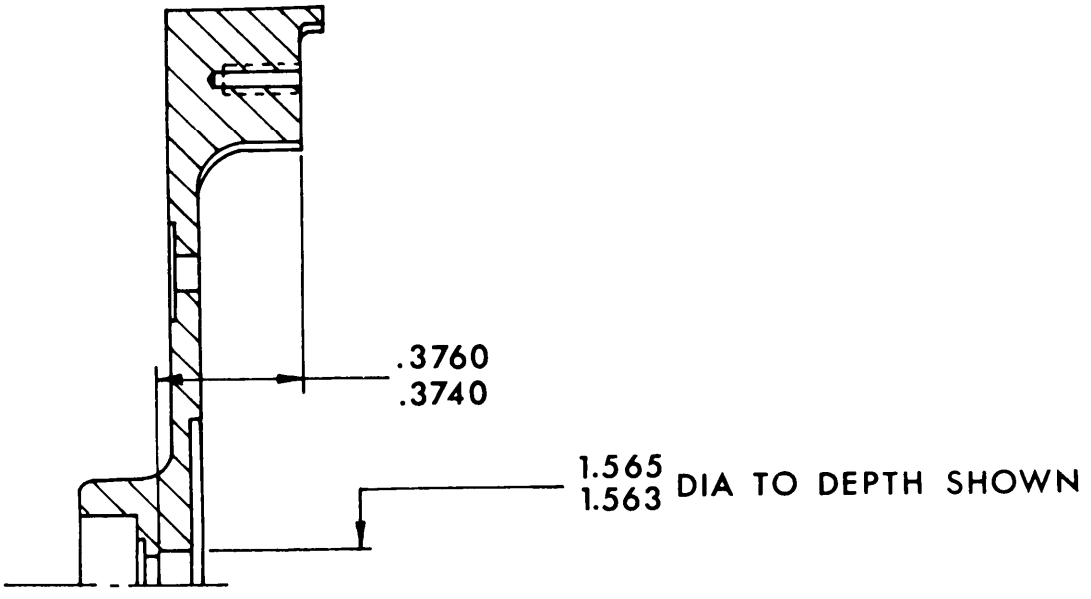


Figure 2. Modification of Front Plate.

(1) Remove hex socket set screw (7) and withthdraw magnet assembly (1) in compliance with procedure outlined in preeding caution note.
(2) Hold magnet keeper 1489071 against stator assembly (13) in housing (11). Remove rotor assembly (14) from stator directly into magnet keeper.
(3) Do not remove stator assembly (13) from housing (11) unless necessary to replace a defective part. Stator assembly is secured in housing by shrink fit. If components must be separated, heat housing to permit removal of stator.

e. Disassemble rear motor assembly in a manner similar to that described in *d* above for front motor assembly. (See figure 11.)

Note. Indicators with serial numbers 1 through 799 have a jewel (3) in plate (4) and a jewel in rear plate (20). (See figure *8).*

(1) The housings (11) of figures 9 and 11 do not have slots machined in each side. These indicators are designated type 41105-C5A-4-B3. To modify these indicators to type 41105-C5A-4-E3, these jewels must be replaced with bearings and the housings must be machined to incorporate two additional slots in each as outlined in (2) below.
(2) Machine housings (11) of figures 9 and 11 to dimensions shown in the sketch in figure 3 to incorporate adjustment slut.

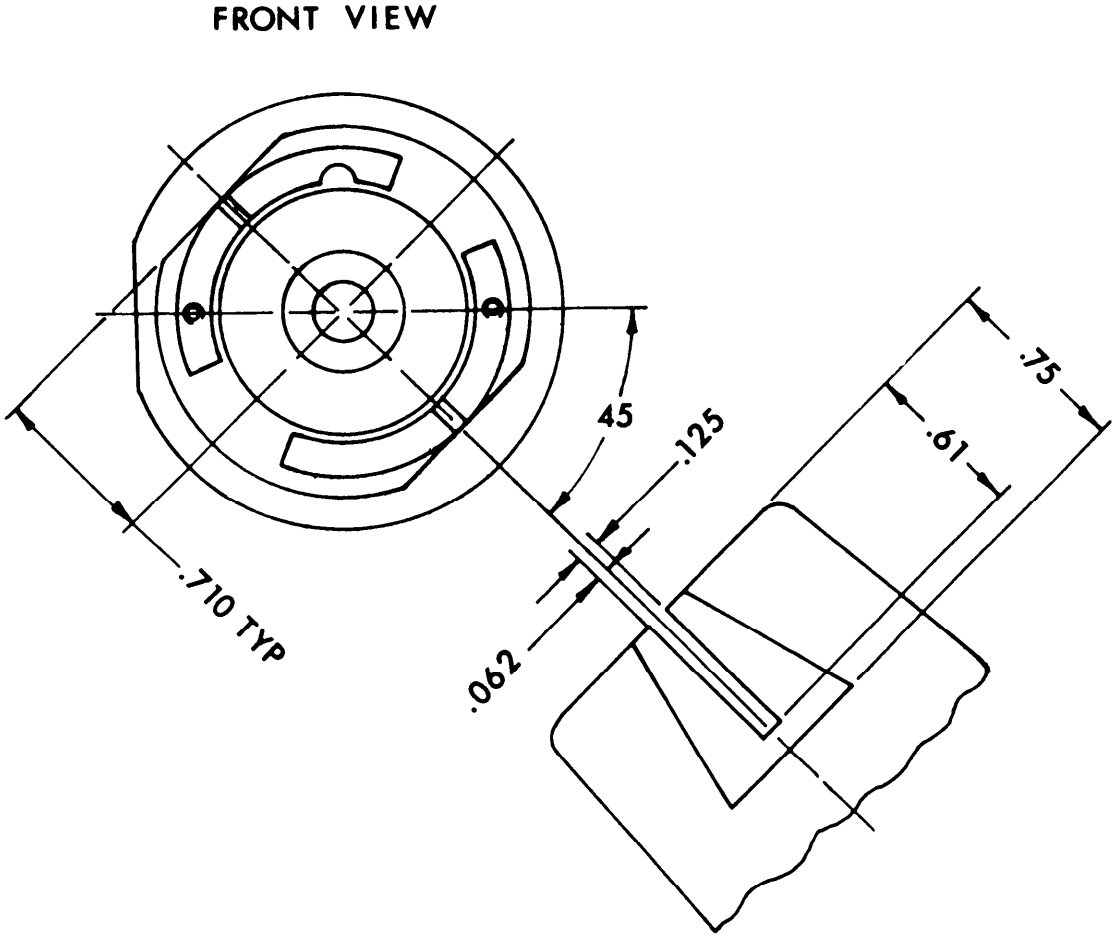


Figure 3. Modification of Housing.

f. Disassemble rear plate and shaft assembly as follows. (See figure 10.)

(1) Remove extension shaft (1) by pulling straight away from plate (4).

(2) Complete disassembly of rear plate and shaft assembly as previously outlined in paragraph c(2). Remove bearing (6) from plate (4) and bearing (17) from rear plate (18).

Note. See note following (3) above. The 41105-C5A-4-B3 indicators also have a jewel (6) in plate (4) and a jewel (17) in rear plate (18). (See figure 10.)

(3) Refer to figure 10. Place plate (4) in a suitable small arbor press with front or large bearing diameter facing up. With a tapered bushing, apply enough pressure to create a slight flange on inner diameter. This will prevent hawing (6) from coming forward in through bore from rear.

Caution: **Excessive pressure on the tapered bushing will cause bearing bore to taper, and result in outside diameter of bearing to bind at edge of taper.**

(4) Ream bearing bore in rear of plate (4) for smaller bearing (6). Do not ream deep enough to remove flange pressed in during (3) above. See dimensions in figure 2.

(5) Machine off and burnish rear shaft (7) to a diameter of 0.0466 +.0000 –.0002. W dimensions in figure 4.

(6) When reassembling rear plate and shaft assembly to obtain end play for rear shaft (7), shim on rear shaft behind bearing (6) using stainless steel shim washers with an inside diameter of 0.047 and an outside diameter of 0.109 in the thickness required if end play is excessive. If end play is insufficient, use stainless steel shim washers with an inside diameter of 0.126 and an outside diameter 0.173 in the thickness required, between legs of plate (4) and rear plate (18) by placing shim or shims in position that screw (20) passes through shim at assembly.

(7) To facilitate the insertion of bearing (17) in rear plate (18), strike jewel a sharp blow with a pointed object and shake out pieces. The replacement bearing will fit in the area previously intended for the jewel.

8. Cleaning

Clean the disassembled components in accordance with the following steps:

Warning: **Use solvent in a well ventilated area. Do not inhale solvent vapor or allow solvent to come in contact with the skin. Keep solvent away from open flame.**

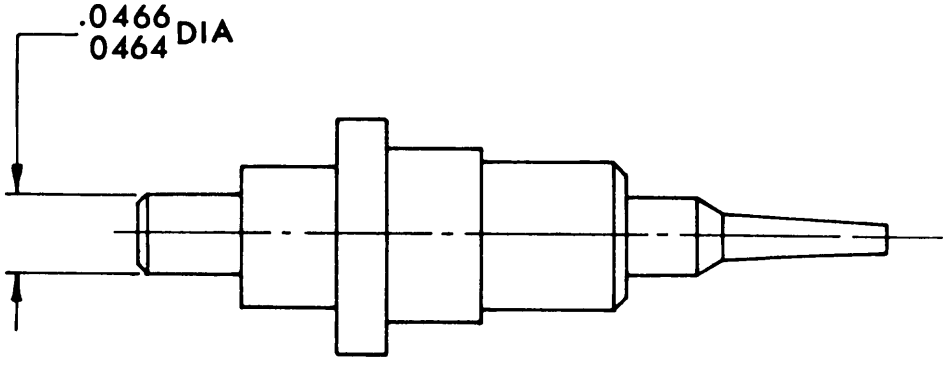


Figure4. Modification of Rear Shaft

(1) Clean all metal parts, except as noted, in solvent, Federal Specification P–D-680. Use a soft brush; dry thoroughly. Keep parts free from dust particles until reassembled.

(2) Wash dial and glass cover with pure soap and water being extremely careful to avoid damage to dial paint. Rinse and dry; keep parts free from finger marks until reassembled.

(3) Clean all bearings in P-D-680 solvent and dry thoroughly. Do not handle cleaned bearings with bare fingers; use lint free gloves or suitable tools. To avoid corrosion, inspect and relubricate bearings immediately after they have been cleaned as outlined in (1) above.

(4) Clean jewel (6 of figure 5) with a piece of soft pegwood freshly tapered for each jewel.

(5) Be certain any deposits of grease or other foreign matter are cleaned from pins, insulation, and threads of receptacle assemblies.

(6) Clean pointer assemblies with a soft eraser such as art gum.

9. Inspection

Inspect the disassembled indicator in accordance with the following steps.

(1) Visually inspect all metal parts, as applicable, for breaks, cracks, nicks, scratches, scoring, stripped or crossed threads, corrosion, distortion, worn plating, pitting, gouging, or other obvious defects.

(2) Perform nondestructive inspection as specified in table 5.

Table 5. Nondestructive Inspection Test Data

Item No.	Descriptive Nomenclature	Type of Test	Procedure	Allowable Defects
33 of figure 7	Receptacle Assemblies	Visual	Inspect for bent, broken, and loose terminal pins, for cracked, damaged, and loose insulation, and for stripped and damaged threads.	No defects acceptable.
2 of figure 7	Glass Cover	Visual	Examine for chips, cracks, and discoloration.	No defects acceptable.
6 & 7 of figure 7, 10 of figure 8	Pointer Assemblies and Dial	Visual	Examine for chipped and damaged paint.	No defects acceptable.
20 of figure 7, 3 & 17 of figure 8, 12 of figure 9, 2 of figure 10, 17 of figure 10, 12 of figure 11	Bearings	Visual	Inspect for damaged raceways and bearings.	No defects acceptable.
6 of figure 8	Jewels	Visual (under magnification)	Inspect before and after installation, for cracks and wear.	No defects acceptable.
12 of figures 8 & 10	Hairsprings	Visual	Examine for twisted, distorted, and improperly wound convolutions.	No defects acceptable.

Table 5. Nondestructive Inspection Test Data — **Continued**

Item No.	Nomenclature	Type of Test	Procedure	Allowable Defects
13 of figures 9&11	Stator Assemblies	Visual	Inspect leads, especially at point of entry into stator, for crimps, breaks and defective insulation.	No defects acceptable.
7 of figure 8, 1& 7 of figure 10	Shafts	Visual	Inspect tapers for pitting, scars, wear, and other damage Examine shaft for bending and distortion.	No defects acceptable.

10. Testing Components

Test stator assemblies for insulation breakdown using insulation breakdown test set 13700-1-C. Apply a potential of 500 volts rms at a commercial frequency for a period of five seconds between any lead and the laminations. There shall be no electrical breakdown of insulation. Failure of test requires replacement of the defective stator assembly.

11. Repair and Replacement

Replace all parts which are obviously cracked, worn, distorted, damaged beyond repair, or which do not meet inspection or testing requirements and cannot be restored to serviceable condition by allowable repairs.

12. Lubrication

Note. Items 3 & 17 of figure 8, and 6 & 17 of figure 10 are dry bearings and do not require lubrication.

Lubrication of bearings is critical. Proceed as fdllows: Lubricate each bearing (20 of figure 7, 12 of figure 6, 2 of figure 10, and 12 of figure 11) with three drops of oil from a No. 26 hypodermic needle held at an angle of 45 degrees. Use oil F-44 versalube which is a grease plating lubricant manufactured by General Electric Co.

13. Reassembly

a. Reassemble the indicator in the reverse order of disassemble y, observing the following.

b. If case assembly (4 of figure 7) was disassembly, place glass cover (2) and end of case (3) in bezel (1); place a ring of solder, Federal Specification QQ-S-571, Comp Sn 63, under the glass. Place parts in an induction coil or on a hot plate; heat to effect a proper soldered joint. If necessary, insert additional solder inside case along edge joining case and glass. Do not allow solder to remain on outer surface of case or bezel. Allow parts to cool undisturbed.

c. If either receptacle (33 of figure 7) was removed from end cover, reassemble as follows. View end cover from rear; place opening for eyelet at the 180 degree or 6 o'clock position. Solder in each receptacle so that its polarizing key is located at the 12 o'clock position in its opening in the end cover.

d. If either stator assembly (13 of figures 9 or 11) was removed from its housing, reassemble as follows. Place housing in an oven at 200. ±20°F for a period of two hours. Immerse stator assembly in dry ice or place it in a freezer at -50° F or colder for a period of two hours. Stator must be installed in housing in following position. View housing from the rear; place flat on housing at the 3 o'clock position: stator leads must extend from the housing at the 6 o'clock position. Within five minutes after removing parts from oven and dry ice or freezer, use alignment fixture shown in figure 2 to insert stator in housing in specified position.

e. If either magnet assembly (1 of figures 9 or 11) has been exposed to an open magnetic circuit, demagnetize it as follows. First use magnetreater Model 889–A to completely demagnetize the magnet assembly. Then use

magnet charger Model 2470 or 2470-350 with magnetizing fixture 1489444 to charge the magnet assembly to full magnetic strength. Discharge maximum current through the windings of the magnet charger. Remove the magnet assembly from the magnet charger directly into magnet keeper 1489036-1, being careful to avoid exposure to an open magnetic circuit. Do not remove magnet assembly from the keeper until it is inserted directly from the keeper into the return path in the indicator.

Note. In order to stabilize the magnet assembly after magnetization, perform the following temperature cycle. Immerse magnet assembly (in its keeper) in dry ice for two hours, then submege in boiling water for ten minutes. Repeat this cycle a minimum of four times.

f. If the rotor assemblies (14 of figures 9 or 11) have not been demagnetized, omit the procedure that follows and proceed to *g* below. (Demagnetization of either rotor would occur if it were exposed to an open magnetic circuit or if it shorted against another magnet or metal surface.) If either rotor assembly zation, proceed as follows. Use magenetreater Model 889A and coil fixture HC-7010-7 to completely demagnetize the rotor. Then use fixture 1489072 with magnet charger 2470 or 2470-350 to fully demagnetize the rotor. Fixture 1489072 must be used to obtain the proper magnetic charge. Demagnetize to a field strength of 380 to 420 gauss. (Somewhat higher levels of magnetization—up to 500 gauss—can be used provided that the field strength of the poles is uniform.) Insert the rotor directly from the magnetizing fixture into magnet Keeper 1489071 or immediately install it into the indicator. Do not weaken the magnetism by allowing the rotor or its keeper to" contact other magnets or magnetic materials.

g. Reassemble front plate and shaft assembly and associated components as follows. (See figure 8.)

(1) Align and press roll pin (5) into hole in dial plate (4) to such a distance that its tip extends the distance 0.100 as measured from the surface recessed in the rear side of the dial plate (4).

(2) Install bearing and dial (2) on dial plate.

(3) Align and press jewel (6) in hole in end of front shaft (7) with high point of jewel toward bottom of hole. Carefully press jewel to its seat. Inspect jewel as specified in table 5.

(4) Install hairspring shield (10) and shim (11) on front shaft (7) as follows. View shaft from rear. Place long arm of balance wheel in the 12 o'clock position; if hairspring was removed, install hairspring on shaft so the free end of hairspring faces in the clockwise direction at the 135 degree position measured from 12 o'clock. Maintain these relative positions and press hairspring (12), shim (11), and shield (10) to seat against shoulder of shaft (7). Distinguish hairspring (12) of front plate and shaft assembly (figure 5) by 8 1/2 turns from hairspring of rear plate and shaft assembly (figure 7) by 9 1/2 turns. Hairspring must be parallel to shield; in the free or unwound condition, hairspring must be centered on shaft. Outer end of hairspring must be so located that convolutions are equally spaced when hairspring is wound up approximately 150 degrees; to obtain this condition, bend tab of hairspring plate (16) if, and, as necessary, before soldering hairspring in place; do not bend hairspring,

(5) Install hairspring plate (16) on rear plate (20). Install hex head screw (13) and washers (14 and 15) through adjustment slot and secure hairspring plate in the position that will allow a gap of 0.020 to 0.060 inch between pin (5) and long arm of balance wheel (8) when hairspring is in free or unstressed condition.

(6) A shim (18) of proper thickness must be selected to obtain correct end play of shaft. Place a trial shim (18) and shim (19) on rear end of

front shaft (7) and insert rear end of shaft into bearing (17) in rear plate (20), Assemble dial (2) on dial plate (4) with bottom of dial in line with groove on boss of dial plate. Use shims (18) as required to obtain end play of 0.013 to 0.020 inches. Reassemble dial 'plate.

(7) Secure dial screws in position by sparingly applying purple glyptol lacquer 2V903 manufactured by General Electric Company. Any equivalent cement is suitable.

h. Reassemble rear plate and shaft assembly and associated components as follows. (See figure 10.)

(1) Align and press roll pin (5) into hole in plate (4) to such a distance that its tip extends 0.080 inch from flat rear surface of 'plate. Align and insert bearing (6) into plate (4). Insert bearing (6) until its forward surface is flush with bottom of bearing housing on front of plate (4).

(2) If hairspring assembly was removed, assemble balance wheel (8) on rear shaft (7). Secure in position with the cement specified in g(5) above. Install hairspring shield (10), shim (11), and hairspring (12) on rear shaft as outlined for these same respective components of g(5) above. Install hairspring plate (16) on rear plate (18). Secure with screw (13) and washers (14 and 15) approximately at midpoint of adjustment slot.

(3) Insert rear end of rear shaft (7) into bearing (17) in rear plate (18).

(4) Install plate (4) on assembled components and shim bearing (6) for shaft end play of 0.0013 to 0.0020 inches.

i. Reassemble front motor assembly and associated components as follows: (See figure 9.)

(1) Turn hex nut (9) on screw (8) and thread screw into return path (10). Insert return path into housing (11); secure with screws (17) and washers (15 and 16).

(2) Install bearing (12) and rotor assembly (14) into housing (11). (Front rotor assembly has hollow shaft.)

(3) A shim (3 of figure 10) of proper thickness is selected to obtain proper end play of front rotor assembly (14 of figure 9). Insert a trial shim (3 of figure 10) and bearing (2 of figure 10) in plate (1 of figure 10) of rear plate and shaft assembly. Install front motor assembly on plate (4 of figure 10) and check end play of shaft assembly. Install shims as required to obtain end play of 0.0012 to 0.0020 inch. Secure front motor assembly loosely on plate (4) of rear plate and shaft assembly (figure 7) with screws (17 of figure 7) and lockwashers (16 of figure 4).

(4) Place magnet keeper 1489071 containing front rotor assembly (14) against stator assembly and slide rotor assembly directly from magnet keeper into stator assembly.

(5) Place magnet keeper 1489036–1 containing front magnet assembly (1) against return path and slide magnet assembly directly from magnet keeper into return path. (Front magnet assembly (1 of figure 6) is identical to rear magnet assembly except for differences in pivot screw (2 of figure 6). Pivot screw (2) of front magnet assembly has larger through-hole and larger counterbore. Secure magnet assembly on front end of shaft with set screw (7). Sparingly apply sealant conforming to Specification MIL-S-22473 to threads of set screw (7) to secure it in position.

j. Reassemble rear motor assembly and associated components in a manner similar to that described in *i* above for the front motor assembly. (See figure 11.) A shim (21 of figure 4) of proper thickness is selected to obtain proper end play of rotor assembly (14 of figure 11). Insert a trial shim (21 of figure 7) and bearing (20 of figure 7) in plate (22 of figure 7). Install rear motor assembly on plate (22 of figure 7). Check for end play

of rotor assembly. Install shims as required to obtain end play of shaft of 0.0012 to 0.0020 inches. Secure rear motor assembly (19) to plate (22) with screws (24) and locklwashers (23).

k. Perform the starting test outlined in paragraph 15a, Section IV, Final Test Procedure. on both motor assemblies. Adjust mo tor assemblies to start at the minimum starting RPM by turning screws (8 of figures 9 and 11) in or out of return paths (10 of figures 9 and 22), Secure screws in positions of minimum starting RPM with nuts (9 of figures 9 nnd 11). If either motor assembly fails starting test, check magnetization of rotor assemblies (14 of figures 9 and 11) as outlined in *f* above,

l. Using assembly fixture 1489447, proceed as follows to assemble the front and rear plate and shaft assemblies and the front and rear motor assemblies.

(1) Remove front motor assembly from plate (1 of figure 10) or rear plate and shaft assembly. Insert rear taper of extension shaft (1 of figure 10) into hole in rear shaft (7 of figure 10) of rear plate and shaft assembly. Rear taper of extension shaft is located on end of shaft having large diameter. Lightly tap shaft to assure that it is properly seated.

(2) Install rear drag cup assembly (18 of figure 7) on rear shaft of rear plate and shaft assembly. (Rear drag cup assembly has a smaller hole in its hub than front drag cup assembly.) Lightly tap drag cup assembly ssure that it is properly seated.

(3) Extension shaft (1 of figure 10) must be exactly aligned to prevent friction in the assembled indicator. Position rear plate and shaft assembly in assembly fixture; rotate shaft to check its alignment; if shaft does not run true, press on side of shaft with finger until exact alignment is secured. Reinstall front motor assembly on plate (4 of figure 10) of rear plate and shaft assembly; carefully guide extension shaft through hollow shaft of front motor assembly. Pass leads back through large hole in plate (22 of figure 7). Secure front motor assembly on plate (4 of figure 10) with screws (17 of figure 4) and lockwashers (16 of figure 4).

(4) Install front drag cup assembly (11 of figure 7) on shaft in front plate and shaft assembly. Lightly tap drag cup to assure that it is properly seated.

(5) Install front plate and shaft assembly on front motor assembly; carefully guide extension shaft through jewel in front shaft. Secure components with screws (8 of figure 7) and “C” washers (9 of figure 7).

(6) Mount rear motor assembly on assembled mechanism. Secure with screws (13 of figure 7) and “C” washers (14 of figure 7).

(7) Press rear or engine pointer assembly on its drive shaft so that its tip falls on the zero RPM calibration mark. If necessary use a three-flute, three-degree hand-taper reamer to ream hub of pointer for proper fit on shaft,

(8) Press front or rotor pointer assembly on inner shaft. If necessary use a three-flute, three-degree hand-taper reamer to ream hub for proper fit on shaft.

(9) Engine pointer must be able to travel below the 0 RPM calibration mark by an amount equivalent to at least 200 RPM on engine scale. Rotor pointer must be capable of traveling below the 0 RPM calibration mark by an amount equivalent to at least 10 RPM on rotor scale. If necessary, check adjustments of hairsprings and hairspring plates as outlined in g(5) and (6) above to obtain these conditions.

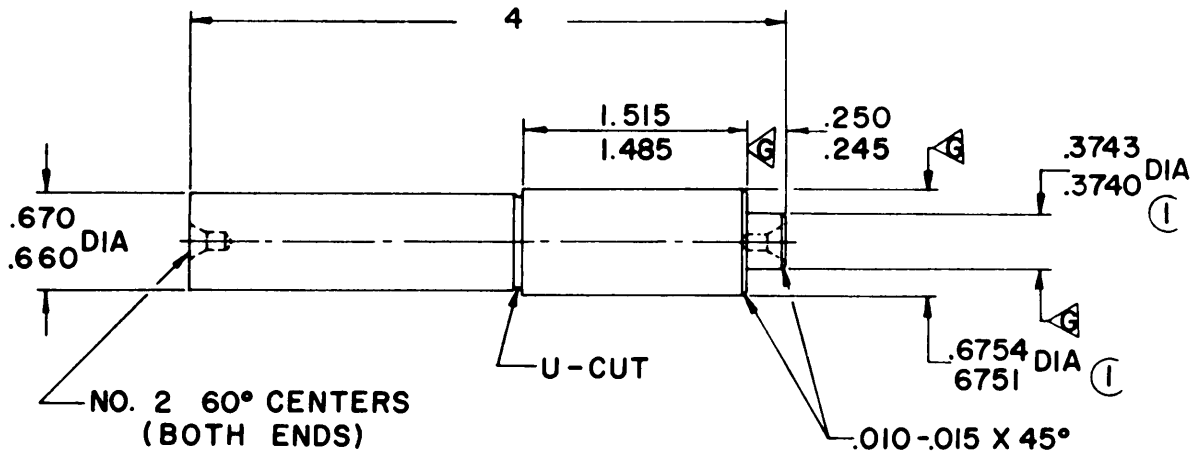
(10) Solder leads of stator assemblies to terminal pins of receptacle assemblies in accordance with figure 6,

Wiring Diagram. Note that end cover is marked "FM" and "RM" signifying front motor and rear motor; attach wires accordingly. Use solder 63/37 lead-tin mixture.

m. Calibrate the assembled mechanism as follows:

(1) Place mechanism in the vertical position (dial horizontal). Check alignment of pointers; if necessary, set pointers at zero by adjusting hairspring plate (16 of figure 8 and 10).

(2) Connect front or engine motor assembly to indicator generator TTU-25/E. Rotor assembly must start with the application of 150 RPM. If not, check magnetization of rotor assembly (14 of figure 9). Refer to *f* above. Operate indicator generator at 4470 RPM. Adjust return path (10 of figure 9) to obtain a reading of 7000 RPM on engine pointer. If necessary, check magnetism of front magnet assembly (1 of figure 9) as outlined in *e* above to obtain this reading. If magnet assembly requires remagnetization, be certain to submit it to the thermocycle described in the note following e above. Secure return path in position. Check 0, 4000, and 7000 test points specified in table 7. In table 8, check 0, 200, and 340 test points to assure that calibration is within tolerance. If mechanism is not properly calibrated at this point, the fault



NOTES:

1. ALL DIMENSIONS NOT NOTED TO BE M.
2. ALL EDGES TO HAVE .003—.005 R.
3. DIMENSIONS MARKED (I) TO BE CONCENTRIC WITHIN .0003 TIR.

ALIGNMENT FIXTURE

Figure 5. Alignment Fixture.

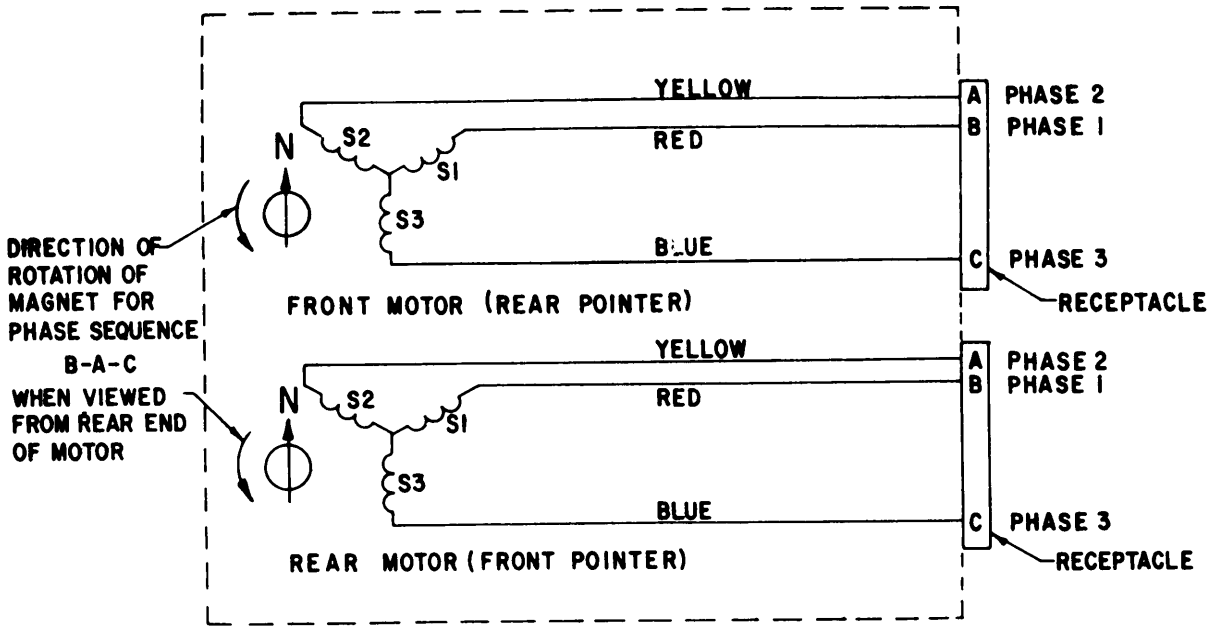


Figure 6. Wiring Diagram

lies in the adjustment of the hairspring. Recheck as outlined in g(5) and (6) above. Place mehanism in normal upright operating position (dial vertical), Balance unit, as necessary, to maintain proper calibration by adding balance springs (9 of figure 8) to arms of balance wheel (8 of figure 8).

(3) Again place mechanism in the vertical position (dial horizontal) and calibrate the rear motor assembly in a manner similar to the preceding procedure except as follows: (This motor also must start with application of 150 RPM as in (2) above.) Operate indicator generator at 4516 RPM and adjust rear return path to obtain a reading of 340 RPM.

n. Perform scale error, pointer alignment error, friction error, pointer oscillation error, and position error tests as outlined in paragraph 15 *b, c, d, e,* and *f* of Section IV, Test Procedure. When these tests have been concluded with unit within tolerance, make certain that the return paths and other components are securely locked in position with purple glyptol.

o. Final Assembly. (See figure 7.) Insert dial spacer (5) assembled mechanism into case assembly (4). Install end cover assembly (28) so centers of two receptacles are on a horizontal line with unit in normal upright operating position with polarizing key of each receptacle in the 12 o'clock position in its opening.

Note. Using solder Federa1 Specification QQ-S-571 Comp Sn 63, seal end cover (28) to case assembly (4) by heating with induction coil. Allow solder to flow around end cover (28) and case assembly (4) to provide a tight seal

Caution: **Avoid excess solder.**

p. Pressurize indicator to 20 psi and immerse it completely in clear clean alcohol. Any bubbles coming from within the use indicate a leak which must be repaired. Correct any leak by replacing the defective component or by repairing the faulty soldered joint.

q. Connect unit to vacuum pump model 25 Hyper Vac; evacuate to a pressure of 50 microns or less; with vacuum maintained, bake unit at 160 ±10 degrees for 8 hours. Backfill indicator to a pressure of approximately one atmosphere with a gaseous mixture composed of 88 to 92 percent nitrogen with the balance helium. Gas mixture must be at least 98 percent pure, free from dust particles, and it must contain not more than 0.006 milligram per liter (dew point -65 degrees C) of water vapor.

SECTION IV

FINAL TEST PROCEDURES

14. Test Conditions

Conduct the following tests at atmospheric pressure (approximately 29.92 in. Hg.) and at room temperature (approximate 25°C).

15. Tests

Perform the following tests:

a. Starting. Connect an indicator generator MS25038-4 each receptacle of the indicator under test. Increase the indicator generator shaft speed from 0 to 150 RPM. Each pointer must move from its zero calibration mark indicating that its motor has started. The indicator may be vibrated or lightly tapped during the test. In event of failure of test, refer to paragraph 13k of Section III, Reassembly.

b. Scale Error. With an indicator generator connected to each receptacle of the indicator, energize the indicator generators, one at a time, to check the scale error of each pointer at the test points specified in the calibration data compilations of table 7 and table 8. Make the tests with speeds increasing and then with decreasing speed. Determine errors either by setting the generator at a nominal speed and observing the indicator pointer reading or by setting the indicator pointer at a graduation mark and observing the generator speed. The friction error test of *d* below can be conducted simultaneously with this test. In event of failure of test, refer to paragraph 13m of Section III, Reassembly.

c. Pointer Alignment. Connect an indicator generator to each receptacle of the indicator. Operate the generators simultaneously; set them at the test points specified in table 9. The difference between the readings of the two pointers of the indicator shall not exceed the pointer alignment tolerance as noted in table 9. In event of failure of test, refer to paragraph 13m of Section III, Reassembly.

d. Friction Error. Check the engine pointer for friction error as follows: Adjust generator to set the engine pointer at the 1000, 3000, and 6300 RPM indications. At each indication, take two readings, the first before and the second after the indicator is vibrated or lightly tapped. The difference between the two readings represents friction error which shall not exceed 70, 30, and 30 RPM, respectively, at the three test points specified. The error can be determined by observing the difference in generator RPM required to produce these changes in indication (20 RPM of generator is equal to 30 engine RPM). In a similar manner, check the rotor pointer for friction at the 40, 200, and 310 RPM indications. Friction errors at these test points shall not exceed 3.5, 1.5, and 1.5 RPM, respectively. This error also can be determined by observing the difference in generator RPM required to produce these changes in indication (20 RPM of generator is equal to 1.5 rotor RPM).

e. *Pointer Oscillation.* Maintain the indicator generator driving the engine pointer at any constant speed above 800 RPM indicated. The engine pointer shall not oscillate over a range greater than 50 RPM. Now maintain the generator driving the rotor pointer at any constant speed above 40 RPM indicated. The rotor pointer shall not oscillate over a range greater than 2.0 RPM.

f. Position Error. Operate the indicator at an indicated engine speed of 6200 RPM and at an indicated rotor speed of 304 RPM. The change in these indications, caused by rotating the indicator from the normal position to

any of the following positions, shall not exceed (respectively) 30 RPM and 1.5 RPM. In event of failure, refer to paragraph 13m of Section III, Reassembly.

(1) 45 degrees to the rear (dial tilted 45 degrees back from the vertical).
(2) 45 degrees to the front (dial tilted 45 degrees forward from the vertical) .
(3) 45 degrees to the right (dial vertical).
(4) 45 degrees to the left (dial vertical).

g. *Sealing.* Use the helium leak detector, Model 24-120A, to determine helium Leak rate from indicator case. At a pressure differential of approximately one atmosphere, detected leak rate shall not exceed 0.01 micro-cubic-foot per hour.

h. Dielectric Strength. Use the insulation breakdown test set 13700–1-C to apply a potential of 200 volts rms at a commerical frequency for a minimum period of five seconds between isolated pins of the receptacle and the indicator case. There shall be no breakdown of insulation.

Table 7. Calibration Data, Engine Pointer

Generator RPM	Desired Indication RPM	Scale Error Tolerance		
		Indication RPM + or -	Generator RPM	
			Min.	Max.
0	0	60	0	0
639	1000	60	601	677
1277	2000	55	1242	1312
1916	3000	55	1881	1951
2554	4000	55	2519	2589
3193	5000	50	3161	3225
3576	5600	50	3543	3608
3832	6000	40	3807	3857
4087	6400	40	4062	4112
4470	7000	50	4438	4502

Table 8. Calibration Data, Rotor Pointer

Generator RPM	Desired Indication RPM	Scale Error Tolerance		
		Indication RPM + or -	Generator RPM	
			Min.	Max.
0	0	3	0	0
531	40	3	491	571
1328	100	3	1288	1368
2125	160	2.5	2092	2158
2656	200	2.5	2623	2689
3984	300	2.0	3958	4010
4250	320	2.0	4226	4276
4516	340	2.5	4490	4542

Table 9. Calibration Data, Pointer Alignment

Engine Generator RPM	Rotor Generator RPM	Indication	
		Engine RPM	RPM Rotor
3832	3910	6000	294.3
3959	4040	6200	304.2
*4023	4105	6300	309.1
4087	4170	6400	314.0
4215	4301	6600	223.8

Difference between pointers must not exceed 45 engine RPM.
*Pointers must coincide.

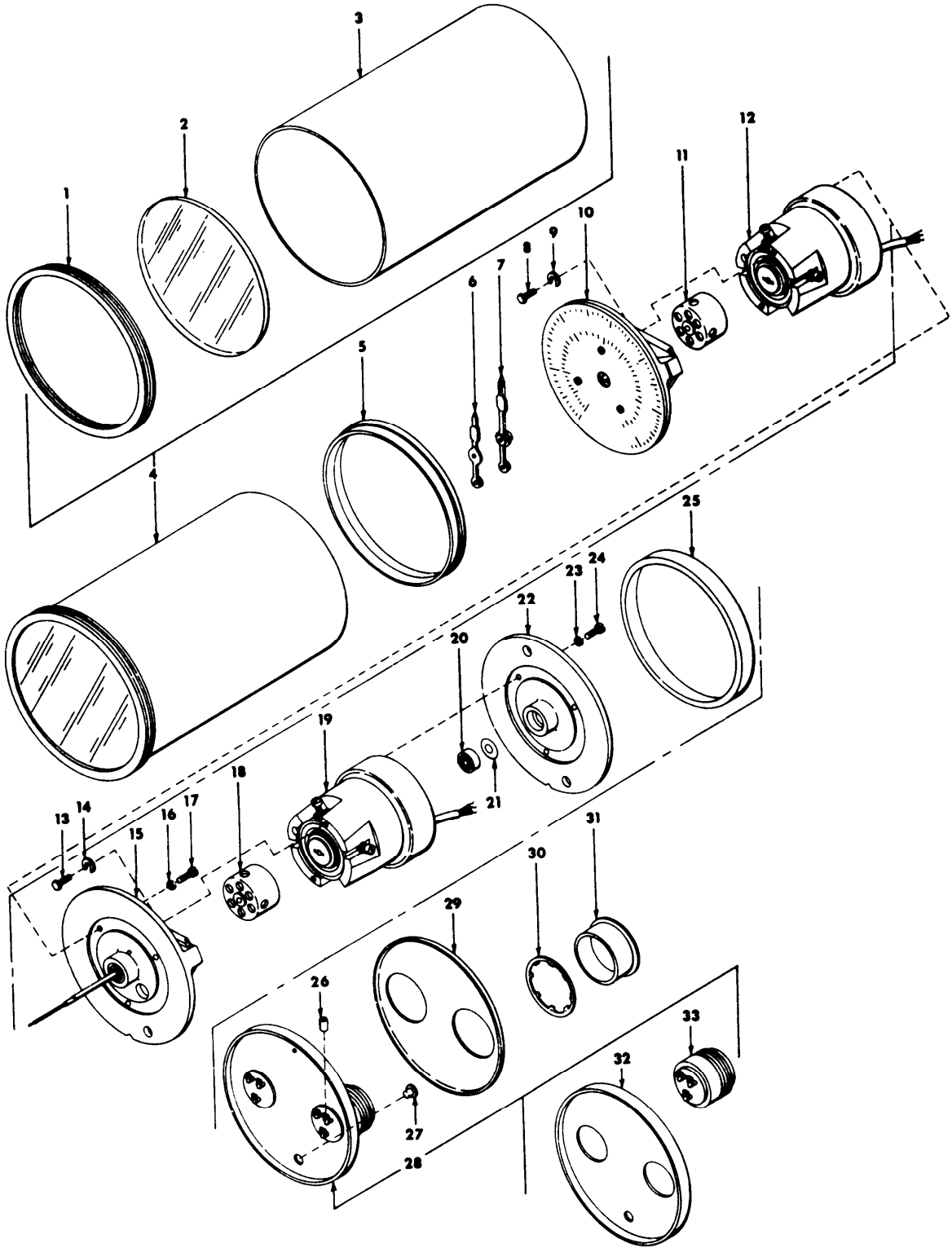
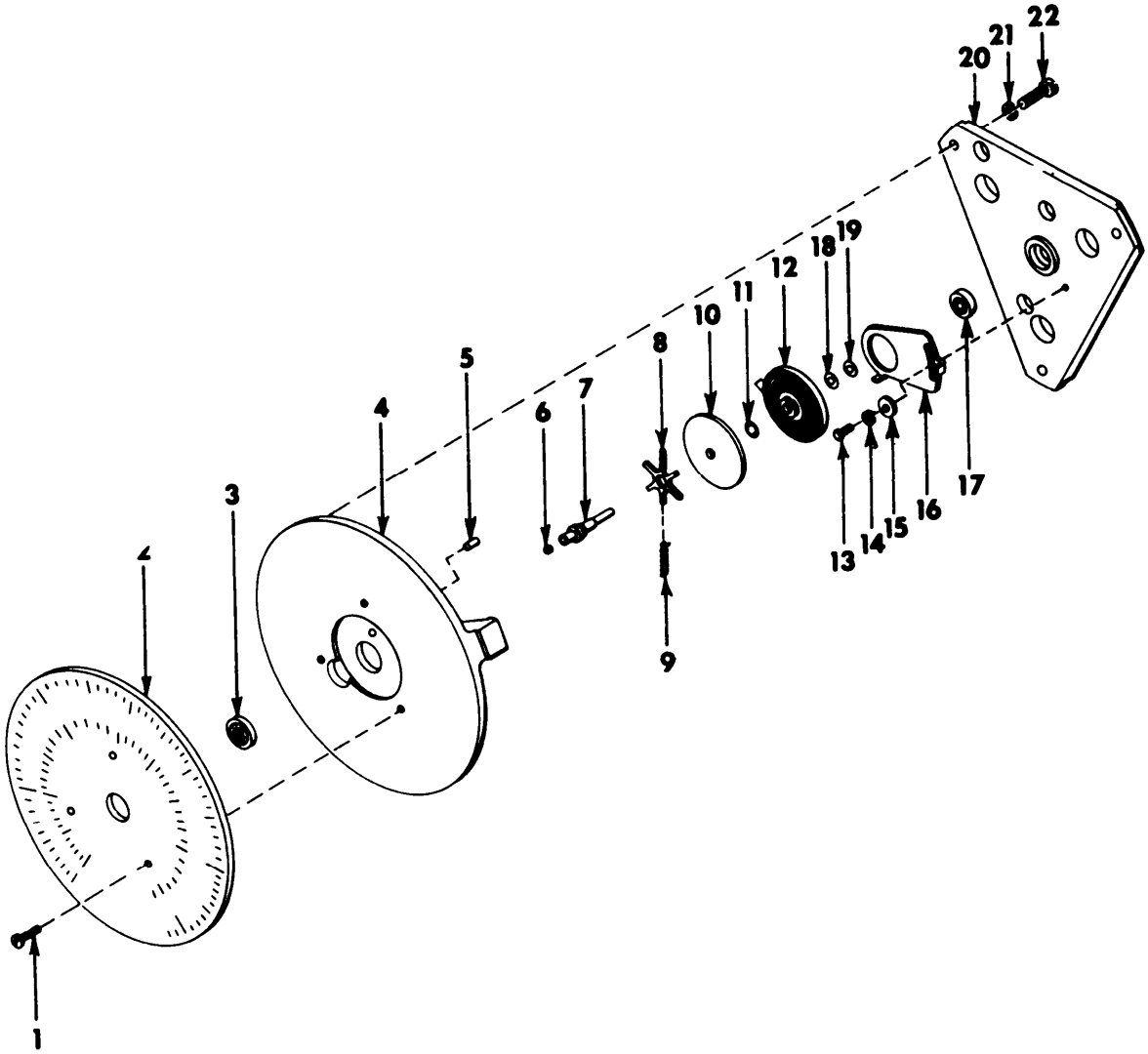


Figure 7. Dual Tachometer Indicator.

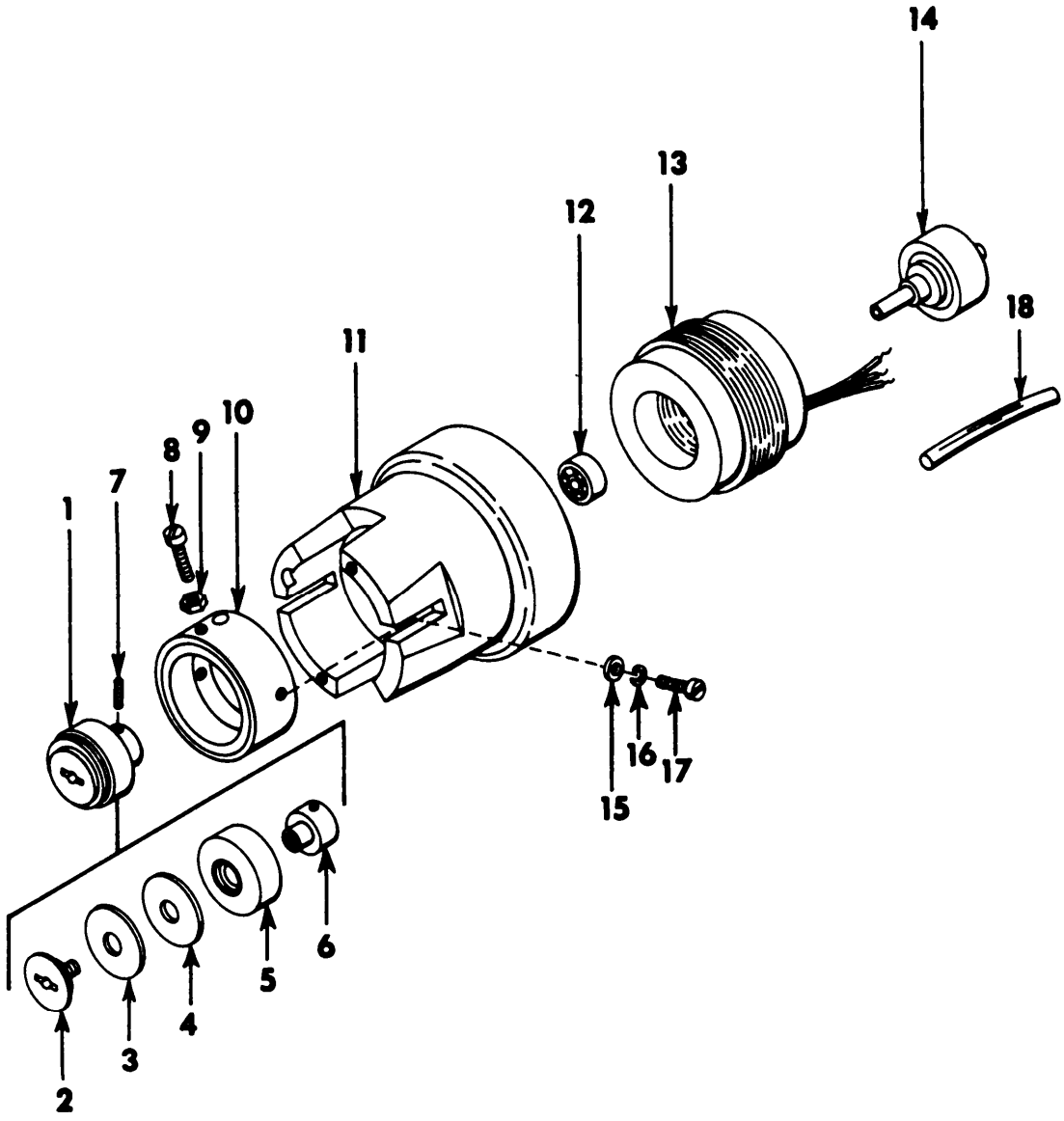
1. Bezel
2. Glass
3. Case
4. Case Assembly
5. Dial Spacer
6. Front Pointer Assembly
7. Rear Pointer Assembly
8. Hex Head Screw
9. "C" Washer
10. Front Plate and Shaft Assembly
11. Front Drag Cup Assembly
12. Front Motor Assembly
13. Screw
14. "C" Washer
15. Rear Plate and Shaft Assembly
16. Lockwasher
17. Screw
18. Rear Drag Cup Assembly
19. Rear Motor Assembly
20. Bearing
21. Shim
22. Plate
23. Lockwasher
24. Screw
25. Compression Ring
26. Tubing
27. Eyelet
28. End Cover Assembly
29. Identification Plate
30. Retaining Ring
31. Protective Cap
32. End Cover
33. Receptacle

Figure 7. —Continued



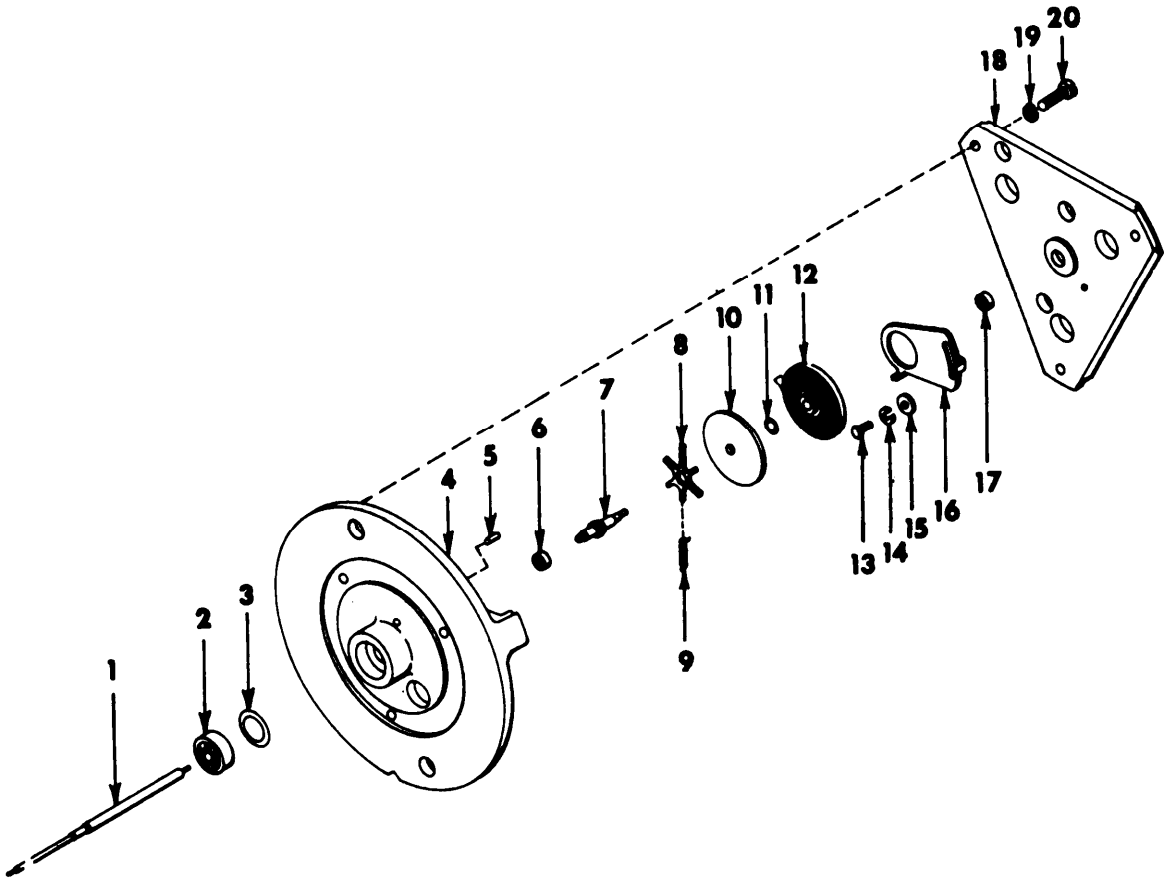
1. Dial screw
2. Dial
3. Bearing
4. Dial Plate
5. Roll Pin
6. JewelI
7. Front Shaft
8. Balance Wheel
9. Balance Spring
10. Hairspring Shield
11. Shim
12. Hairspring
13. Hex Head Screw
14. Lockwasher
15. Flat Washer
16. Hairspring Plate
17. Bearing
18. Shim
19. Shim
20. Rear Plate
21. Washer
22 Screw

Figure 8. Front Plate and Shaft Assembly.



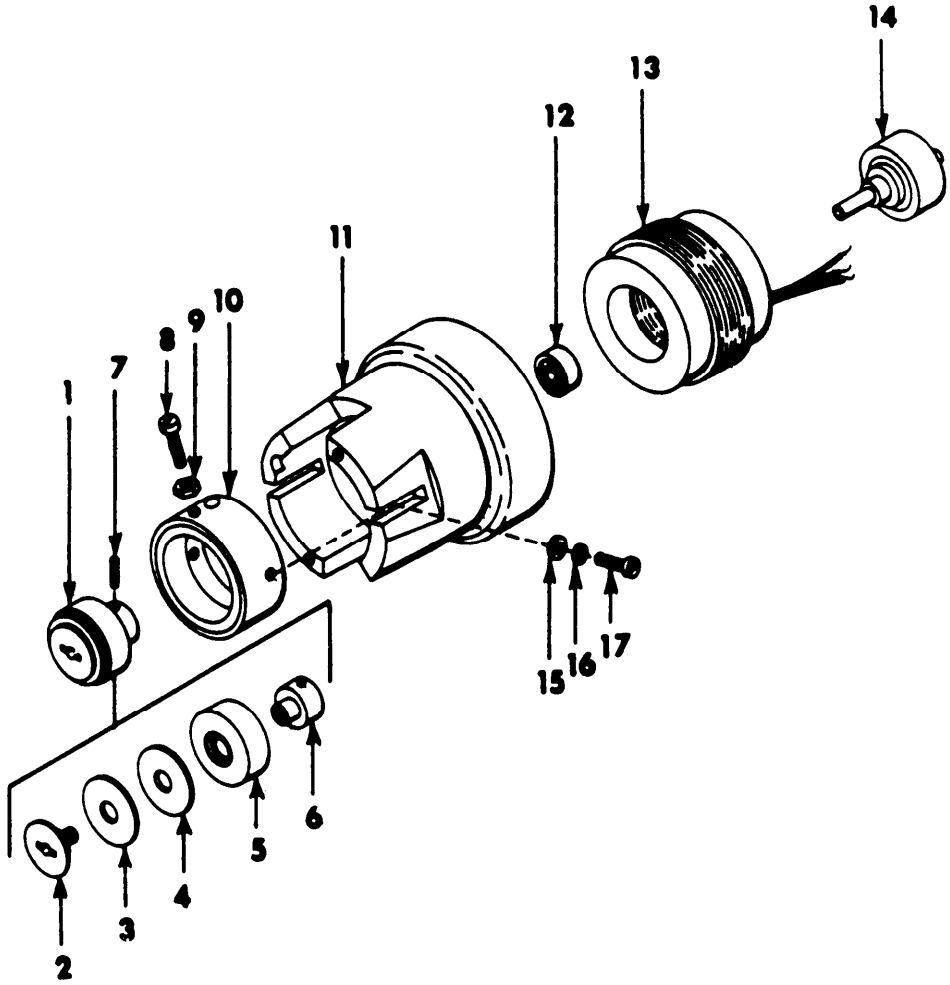
1. Front Magnet Assembly
2. Pivot Screw
3. Disc
4. Disc
5. Magnet
6. Magnet Hub
7. Set Screw
8. Screw
9. Hex Nut
10. Return Path
11. Housing
12. Bearing
13. Stator Assembly
14. Rotor Assembly
15. Flat Washer
16. Lockwasher
17. Screw
18. Tubing

Figure 9. Front Motor Assembly.



1. Extension Shaft
2. Bearing
3. Shim
4. Plate
5. Roll Pin
6. Bearng
7. Rear Shaft
8. Balance Wheel
9. Balance Spring
10. Hairspring Shield
11. Shim
12. Hairspring
13. Hex Head Screw
14. Lockwasher
15. Flat Washer
16. Hairspring Plate
17. Bearing
18. Rear Plate
19. Lockwasher
20. Screw

Figure 10. Rear Plate and Shaft Assembly.



1. Rear Magnet Assembly
2. Pivot Screw
3. Disc
4. Disc
5. Magnet
6. Magnet Hub
7. Set Screw
8. Screw
9. Hex Nut
10. Return Path
11. Housing
12. Bearing
13. Stator Assembly
14. Rotor Assembly
15. Flat Washer
16. Lockwasher
17. Screw

Figure 11. Rear Motor Assembly.

APPENDIX A

REFERENCES

TM 38-750 Army Equipment Record Procedures

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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