

TECHNICAL MANUAL

GS MAINTENANCE MANUAL
INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

MAGNETIC BRAKE ASSEMBLY
PART NUMBERS R460M10, R460M15,
R460M15-3 AND R460M15-11

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.

CLEANING. Avoid continued inhaling of solvent fumes, and do not permit prolonged contact of the solvent with the skin. Wash thoroughly with soap and water all skin areas which contact the solvent. Perform cleaning in a well-ventilated area, or in an approved cleaning cabinet.

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SECTION I

INTRODUCTION

1-1. GENERAL INFORMATION.

This technical manual comprises overhaul instructions for magnetic brake assembly, part no. R460M10 (figure 1-1), manufactured by Plessey Airborne Corporation (81039), Hillside, New Jersey 07205. Sections I through IV of this technical manual contain instructions for magnetic brake, part no. R460M10. Overhaul instructions for additional part numbers are provided in section V by the use of difference data sheets.

1-2. DESCRIPTION.

The magnetic brake is an electro-mechani-

cal device which is used as a variable anchorage point for the centering springs which provide artificial "feel" to the flight control system.

1-3. LEADING PARTICULARS.

The leading particulars of the magnetic brake are listed in table 1-1.

1-4. PRESERVATION, PACKAGING, PACKING AND MARKING REQUIREMENTS.

Preservation, packaging, packing and marking shall be in accordance with figure 1-2.

Table 1-1. Leading Particulars, Part No. R460M10

Normal Operating Voltage -----	26 volts dc
Operating Current -----	0.5 amp (max)
Brake Holding Torque -----	200 lb in.
Weight -----	1 lb 10 oz (approx)
Energized Condition -----	Brake "ON"
De-energized Condition -----	Brake "OFF"
Mechanical Stroke -----	24 degrees both sides of center
Gear Ratio -----	60.4 to 1

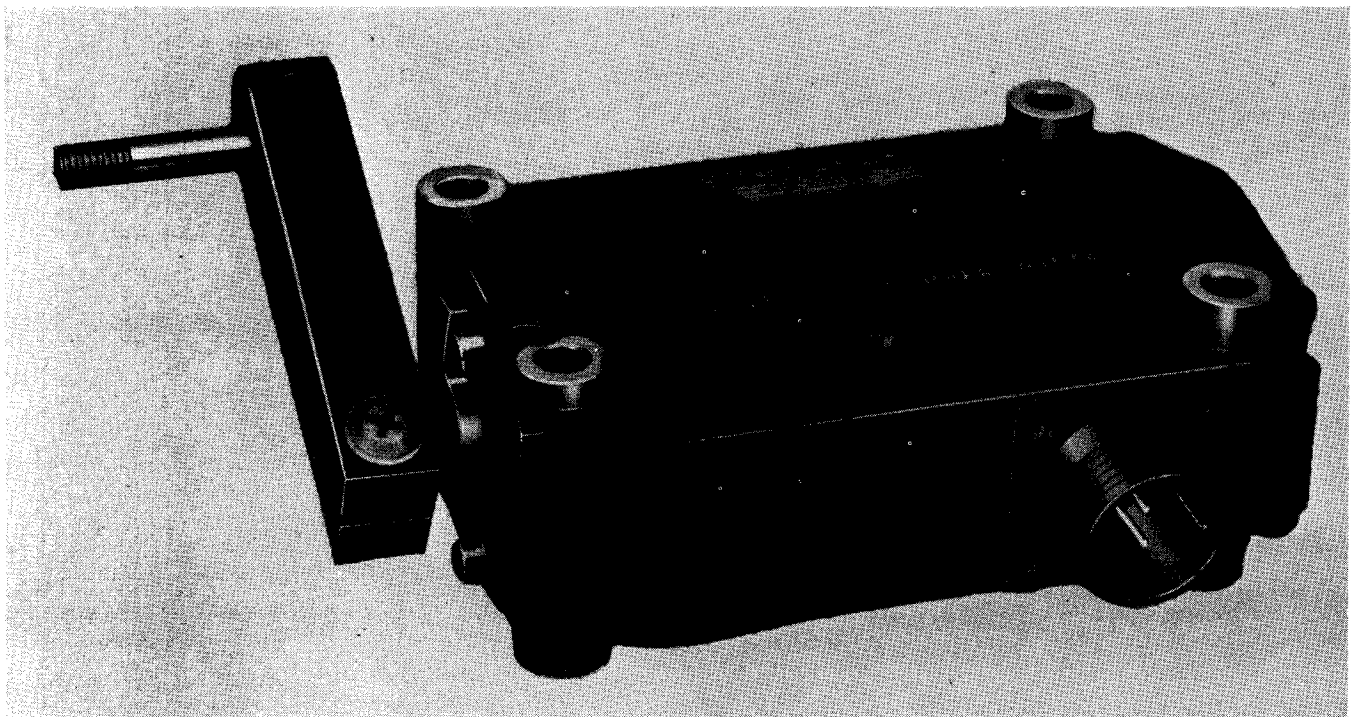


Figure 1-1. Magnetic Brake Assembly, Part No. R460M10.

PRESERVATION, PACKAGING, PACKING AND MARKING REQUIREMENTS																			
NOMENCLATURE Brake Assembly, Magnetic			STOCK NUMBER 1680-772-5599																
			PART NUMBER R460M15																
NET WEIGHT	DIMENSIONS	GROSS WEIGHT	CUBIC FEET																
<i>All specifications and standards applicable to the requirements herein shall be the issue in effect on date of invitation for bids.</i>																			
PACKAGING <input checked="" type="checkbox"/> LEVEL A <input type="checkbox"/> LEVEL C <input checked="" type="checkbox"/> PACKAGING SHALL BE IN ACCORDANCE WITH SPECIFICATION MIL-P-116. THE FOLLOWING DETAILED REQUIREMENTS SHALL APPLY:																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">UNIT</th> <th style="width: 15%;">PKG QTY</th> <th style="width: 15%;">METHOD</th> <th style="width: 15%;">PRESERVATIVE</th> <th style="width: 15%;">WRAP</th> <th style="width: 15%;">DUNNAGE</th> <th style="width: 15%;">CONTAINER</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">1</td> <td style="text-align: center;">IId</td> <td style="text-align: center;">None</td> <td style="text-align: center;">MIL-B-121 Grade A</td> <td style="text-align: center;">MIL-C-7769 or MIL-P-19644A</td> <td style="text-align: center;">MIL-D-6054</td> </tr> </tbody> </table>						UNIT	PKG QTY	METHOD	PRESERVATIVE	WRAP	DUNNAGE	CONTAINER		1	IId	None	MIL-B-121 Grade A	MIL-C-7769 or MIL-P-19644A	MIL-D-6054
UNIT	PKG QTY	METHOD	PRESERVATIVE	WRAP	DUNNAGE	CONTAINER													
	1	IId	None	MIL-B-121 Grade A	MIL-C-7769 or MIL-P-19644A	MIL-D-6054													
<input type="checkbox"/> OTHER																			
<input type="checkbox"/> PRESERVATION AND PACKAGING SHALL BE SUCH AS TO PREVENT DETERIORATION OR DAMAGE DURING HANDLING AND SHIPMENT TO THE FIRST DESTINATION																			
PACKING <input type="checkbox"/> LEVEL A <input checked="" type="checkbox"/> LEVEL C <input type="checkbox"/> ITEMS SHALL BE PACKED IN CONTAINERS CONFORMING TO SPECIFICATION NO. <input type="checkbox"/> PLYWOOD USED SHALL BE STANDARD GRADE WITH EXTERIOR GLUE OF NN-P-530, THIS PLYWOOD SHALL BE TREATED WITH A WATER REPELLANT CONFORMING TO TT-W-572. WOOD CLEATED PLYWOOD CONTAINERS SHALL BE CONSTRUCTED WITH FILLER CLEATS ON ALL PANELS; EITHER BE BEVELED OR NOTCHED 1/4 INCH ON THE BOTTOM OF EACH END, OR SHALL BE OF SUCH LENGTH AS TO LEAVE A 1/4 INCH CHANNEL FOR DRAINAGE ON EACH END, PER PPP-B-601 <input checked="" type="checkbox"/> ITEM SHALL BE PACKED IN A MANNER TO INSURE CARRIER ACCEPTANCE AND SAFE DELIVERY AT DESTINATION. CONTAINERS SHALL BE IN ACCORDANCE WITH UNIFORM FREIGHT CLASSIFICATION RULES OR REGULATIONS OF OTHER CARRIERS APPLICABLE TO THE MODE OF TRANSPORTATION. <input type="checkbox"/> OTHER.																			
MARKING <input checked="" type="checkbox"/> a. IN ADDITION TO ANY SPECIAL MARKING REQUIRED BY THE CONTRACT OR ORDER, SHIPMENT SHALL BE MARKED IN ACCORDANCE WITH STANDARD MIL-STD-129D, WITH CHANGE NOTICE 1 THRU 9, "MARKING FOR SHIPMENT AND STORAGE," DATED 28 DECEMBER 1964. THE PART NUMBER, SERIAL NUMBER, AND THE CONTROL NUMBER OF DA FORM 2410 SHALL BE MARKED ON THE UNIT CONTAINER <input checked="" type="checkbox"/> b. ADDITIONAL MARKING REQUIREMENTS. EACH INTERIOR PACKAGE SHALL BE MARKED ON AT LEAST TWO (2) SIDES WITH A SILHOUETTE OF THE AIRCRAFT. (WHERE THE SIZE OF THE UNIT CONTAINER IS TOO SMALL TO PERMIT THE APPLICATION OF TWO (2) LABELS, A SINGLE LABEL SHALL BE APPLIED. IF THE PACKAGE IS TOO SMALL FOR ONE (1), NONE WILL BE REQUIRED.) WHEN THE UNIT CONTAINER IS THE SHIPPING CONTAINER AND THE ITEM IS PACKED "LEVEL A", EACH CONTAINER SHALL BE MARKED ON TWO (2) SIDES, TOP AND ONE (1) END WITH A SILHOUETTE OF THE AIRCRAFT. THE SIZE OF THE SILHOUETTE MAY VARY, BUT WILL BE LARGE ENOUGH TO FACILITATE EASY VISUAL IDENTIFICATION WITHOUT OBSCURING OTHER MARKINGS. THE CONTRACTING OFFICER WILL SUPPLY LABELS ON REQUEST. THE NOMENCLATURE OF THE MAJOR COMPONENTS SHALL BE EXTENDED TO INDICATE THE END ITEM APPLICATION AND THE POSITION OF THE PART; e.g., GEAR BOX, MAIN FOR (APPLICABLE AIRCRAFT); WING ASSEMBLY, RIGHT, FOR (APPLICABLE AIRCRAFT). <input checked="" type="checkbox"/> c. MATERIEL CONDITION MARKING SHALL BE APPLIED IN ACCORDANCE WITH PARAGRAPH 5.5.17 OF MIL-STD-129. A MATERIEL CONDITION TAG OF THE APPLICABLE TYPE WILL BE SECURELY ATTACHED DIRECTLY TO ALL UNINSTALLED OR STORED AERONAUTICAL OR AIR DELIVERY ITEMS. WHEN SUCH ITEMS ARE PLACED OR STORED IN CARTONS, PACKAGES, CRATES OR METAL SHIPPING CONTAINERS, A DUPLICATE MATERIEL CONDITION TAG OR LABEL WILL BE SECURELY ATTACHED TO THE EXTERIOR OF THE PACKAGE OR CONTAINER IN SUCH A MANNER THAT WILL AFFORD MAXIMUM PROTECTION FROM HANDLING AND WEATHER. TAGS WILL BE COMPLETED EITHER BY TYPEWRITTEN OR PRINTED BLACK LEAD PENCIL ENTRIES. ITEMS OF A COMMON OR NONTECHNICAL NATURE (i.e., COMMON HARDWARE, BULK MATERIALS, ETC.) THE SERVICEABILITY OF WHICH IS OBVIOUS, AND THE IDENTITY AND INSPECTION REQUIREMENTS ADEQUATELY INDICATED BY COMMERCIAL TAGS, LABELS OR MARKINGS, MAY BE RECEIVED, STORED, ISSUED OR SHIPPED WITHOUT MATERIEL CONDITION TAGS.																			

Figure 1-2. Preservation, Packaging, Packing and Marking Requirements, All Models.

SECTION II

TEST EQUIPMENT, SPECIAL TOOLS, AND MATERIALS

2-1. TEST EQUIPMENT.

The test equipment required to overhaul the magnetic brake is listed in table 2-1 and illustrated in figure 2-1.

2-2. SPECIAL TOOLS.

No special tools are required to overhaul the magnetic brake.

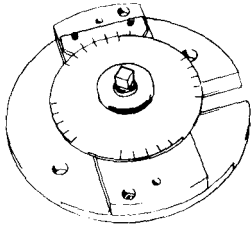
2-3. MATERIALS.

The consumable materials required to overhaul the magnetic brake are listed in table 2-2.

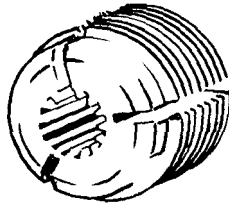
Table 2-1. Test Equipment Required

PART, MODEL, OR MIL DES (OR EQUIVALENT)	NOMENCLATURE	TECHNICAL DESCRIPTION
AT1890	Limit Setting Fixture	Used with AT1890-7, AT1977, and AT2878 to set and check required stroke limits.
AT1890-7	Limit Setting Adapter	Used with AT1890, AT1977, and AT2878 to set and check required stroke limits.
AT1939	Backlash Checking Fixture	Used with a push-pull scale to support and clamp magnetic brake during tests for backlash, free rotation, and static load.
AT1977	Limit Setting Holding Fixture	Used with AT1890, AT1890-7, and AT2878 to support magnetic brake when setting and checking stroke limits.
AT2103	Load Test Pulley	Used with AT1939 and AT2878 and appropriate weights to check free rotation torque of magnetic brake.
AT2652	Air Seal Test Panel	Used with AT2652-4 to check magnetic brakes R460M15, R460M15-3, and R460M15-11 for leaks at 0.5 psi.
AT2652-4	Air Seal Test Adapter	Used with AT2652 to check magnetic brakes R460M15, R460M15-3, and R460M15-11 for leaks at 0.5 psi.
AT2878	DC Test Panel	Used to operate magnetic brake and check current flow during tests.
AT3042	Load Test Arm	Used with AT1939 and AT2878 and appropriate weights to check static load requirement.

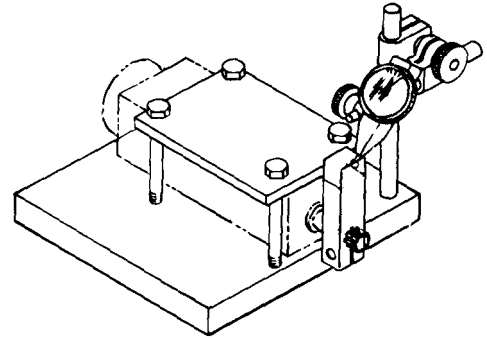
Note: Source of all items in table 2-1 is FMC 81039.



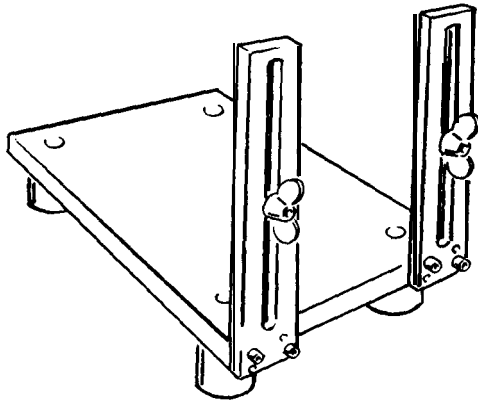
AT1890



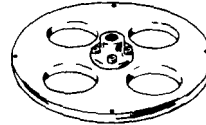
AT1890-7



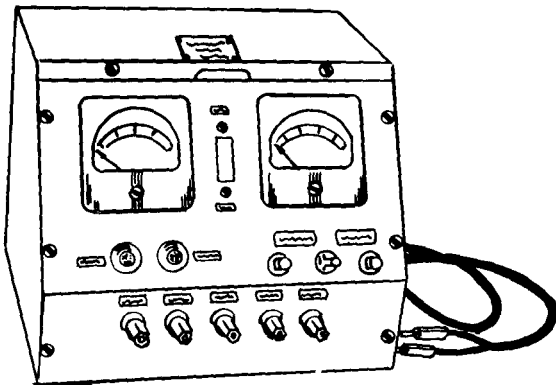
AT1939



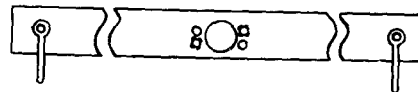
AT1977



AT2103



AT2878



AT3042

Figure 2-1. Test Equipment, General.

Table 2-2. Consumable Materials Required

ITEM NO.	MATERIAL	TYPE OR GRADE	FMC	GOVERNMENT SPECIFICATION
1	Dry Cleaning solvent	Type 1		P-D-680
2	Grease			MIL-G-23827
3	Anti-seize Compound			MIL-T-5544
4	Adhesive	Glyptal ZV903	24446	
5	Sealer	EC801	76381	
6	Crocus Cloth	Class 1		P-C-458
7	Aluminum Oxide Abrasive Cloth	Type 1		P-C-451
8	Adhesive XL-8 (clear sealant)		25592	
9	Gasket Sealant (plastic)		05972	
10	Lockwire			MS20995C20
11	Methyl-Isobutyl-Ketone			TT-M-268

SECTION iii

GENERAL SUPPORT MAINTENANCE

3-1. GENERAL.

Disassemble the magnetic brake only to the extent necessary to clean, inspect, and test parts, subassemblies, or assemblies. See figure 3-1 and refer to paragraph 3-2 for disassembly procedures. Note that in figure 3-1, attaching parts follow the parts they attach.

not remove identification plate (1, figure 3-1) unless damaged.

a. Remove self-locking nut (5), washer (6), and screw (4). Pull crank arm assembly (3) and positive stop (8), with shims (7), from splined end of output gear (30).

NOTE

The centering mark should be on the outboard face of positive stop (8).

3-2. MAGNETIC BRAKE DISASSEMBLY.

NOTE

Remove lockwire from drilled head screws. Tag all shims, recording thickness, quantity, and location to facilitate reassembly. Do

b. Remove screws (12 and 13), brake adapter (11), and mounting spacer (14). Remove screws (10, 17, 18, and 19), lay the brake assembly flat and separate gear housings (16 and 61), leaving the internal parts in gear housing (61).

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS USABLE	
			PER ASSY	ON CODE
3-1	R460M10	MAGNETIC BRAKE ASSEMBLY (CODE A)	REF	
	R460M15	MAGNETIC BRAKE ASSEMBLY (CODE B)	REF	
	R460M15-3	MAGNETIC BRAKE ASSEMBLY (CODE C)	REF	
-1	E2770M122	PLATE, Identification (ATTACHING PARTS)	1	A
-1	6021541-7		1	B
-1	6021541-17		1	C
-2	MS21318-8	. SCREW, Drive *—	2	AD
-3	E9172	. ARM ASSEMBLY, Crank (ATTACHING PARTS)	1	
-4	AN525-10R20	. SCREW, Machine	1	ABC
-5	MS21083N3	. NUT, Self locking	1	ABC
-6	AN960-10L	. WASHER, Flat — * —	1	ABC
-7	E878	. SHIM SET	AR	
-8	E9170	. STOP, Positive	1	A
-8	E9170M1	. STOP, Positive	1	BC
-9	MS3102A14S9P	. CONNECTOR, Receptacle, electrical (ATTACHING PARTS)	1	A
-9	MS3102E14S9P	. CONNECTOR, Receptacle, electrical (ATTACHING PARTS)	1	A
-10	MS35265-13	. SCREW, Machine *—	4	ABC
-11	E1356M3	. ADAPTER, Brake	1	ABC
-12	MS35265-13	. SCREW, Machine	4	ABC
-13	A500A2-3	. SCREW, Machine *—	4	ABC

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS							USABLE ON CODE
			1	2	3	4	5	6	7	
3-1-14	E1356	SPACER, Mounting							AR	A
-14	E1356M1	SPACER, Mounting							AR	BC
-14	E1356M7	SPACER, Mounting							AR	BC
-14	E1356M8	SPACER, Mounting							AR	BC
-15	E3270M5	COIL AND CORE ASSEMBLY							1	ABC
-16	*E2740M33-1	HOUSING, Gear (ATTACHING PARTS)							1	ABC
-17	AN505-8R18	SCREW, Machine							1	ABC
-18	MS35190-258	SCREW, Machine							1	ABC
-19	MS35265-47	SCREW, Machine							2	ABC
-19	E9500M1-8-12	SCREW, Machine (Optional) * ---							2	BC
-20	E9176	ECCENTRIC BUSHING (ATTACHING PARTS)							2	ABC
-21	NK505-2-5	SCREW, Machine							2	ABC
-22	E9177	RING, Retainer * ---							2	ABC
-23	E2460	RING, Retaining							1	ABC
-24	E2175M1	BEARING, Ball, special							1	ABC
-25	E878	SHIM SET							AR	ABC
-25	E381	SHIM SET (Optional)								
-26	E1024	SHIM SET							AR	ABC
-27	E779	BUSHING							1	ABC
-28	E4965	BUSHING							1	ABC
-29	E1471M1	WASHER, Shim							1	ABC
-30	E4624M7	GEAR, Internal splined output							1	ABC
-31	E1641	RING, Retaining							2	A
-32	E878	SHIM SET							AR	ABC
-32	E381	SHIM SET (Optional)								
-33	4131104-0A1A	BEARING, Ball							2	ABC
-34	E4627	LINER, Bearing							2	ABC
-35	E1024	SHIM SET							AR	ABC
-36	4131102-2A1A	BEARING, Ball							2	ABC
-37	E4594M1	GEAR, Helical							2	ABC
-38	E3924	DRUM, Brake							1	ABC
-39	41131102-2A1A	BEARING, Ball							1	ABC
-40	MS16562-194	PIN, Spring							1	ABC
-41	E4684	COLLAR							1	ABC
-42	E489	SHIM							AR	ABC
-43	E3276	WEIGHT							4	ABC
-44	E3274	DISK, Cover (ATTACHING PARTS)							1	ABC
-45	MS35190-220	SCREW, Machine * ---							4	ABC ABC
-46	E3275	SPIDER							1	ABC
-47	MS21044N04	NUT, Self-locking							1	ABC
-48	E9168	WASHER							1	ABC
-49	E7518	SPRING, Compression							1	ABC
-50	E9167	DISK, Clutch							1	ABC
-51	E9161	BUSHING, Spliced							1	ABC

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION							UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7		
3-1-52	E9165	COLLAR							1	ABC
-53	5412013	PIN, Dowel, straight, headless							1	BC
-54	MS35218-22	SCREW, Machine							4	A
-55	4131104-2A1A	BEARING, Ball							1	A
-56	E3188	SHIM							3	ABC
-57	E4595M4	GEARSHAFT							1	ABC
-58	5412100E0250A	PIN, Grooved, headless							2	A
-59	AN505-4R22	SCREW, Machine							1	ABC
-60	MS21044N04	NUT, Self-locking							1	ABC
-61	*E2740M33-2	HOUSING, Gear							1	ABC

*Part of matched set; procure as housing assembly, part number E2740M33.

c. Remove electrical connector (9) and coil and core assembly (15) as a unit. Remove screws (21), retainer rings (22), and eccentrics (20) from gear housings (16 and 61).

d. Remove output gear assembly parts (23 through 30) as a unit.

e. Remove retaining ring (23) from bearing (24), then pull the bearing and shims (25) from the splined end of output gear (30).

f. Remove shims (26), bushings (27 and 28), and washer (29) from output gear (30).

g. Remove gear assembly parts (31 through 37) from gear housing (61). Separate retaining rings (31), shims (32), and ball bearings (33) from helical gear (37). Remove bearing liners (34), shims (35), and ball bearings (36) from helical gear (37).

h. Lift gearshaft assembly (38 through 57) from gear housing (61). Remove ball bearing (39), spring pin (40), collar (41), shims (42), and spider (46), with brake drum (38), from gearshaft (57). Remove self-locking nut (47), washer (48), compression spring (49), and clutch disk (50), with splined bushing (51), from gearshaft (57). Separate clutch disk (50) and splined bushing (51). Remove collar (52), pin (53), ball bearing (55), and shims (56) from gearshaft (57). Do not remove screws (54) and pins (58) from gear housing (61) unless damaged.

i. Remove brake drum (38) from spider (46). Use care since weights (43) will fall from assembly as it is rotated.

j. If spider (46) is damaged, remove screws (45) and separate cover disk (44) and spider (46).

3-3. CLEANING.

As soon as possible after disassembly, thoroughly clean all parts of the magnetic brake as described in *a* and *b*, below.

CAUTION

Do not use dry cleaning solvent to clean electrical connector (9, figure 3-1), coil and core assembly (15), and brake drum (38).

a. Clean electrical connector (9), coil and core assembly (15), and brake drum (38) with a non-wire brush. Blow loose foreign particles from parts using dry, filtered, low pressure, compressed air. Wipe parts with a dry, lint-free cloth.

b. Clean all other parts with dry cleaning solvent (item 1, table 2-2).

3-4. INSPECTION.

Inspect all parts of the magnetic brake as described in *a* through *g*, below.

a. Visually examine all parts for damage or corrosion.

b. Inspect all threaded parts for stripped, crossed, or nicked threads.

c. Check coil and core assembly (15, figure 3-1) for continuity of winding and condition of insulation. Check to see that resistance of brake coil is 67 ± 7 ohms at 77°F (25°C).

d. Inspect brake drum (38) for worn or damaged lining.

e. Check gears for tooth deformation, stress cracks, or scored conditions.

f. Visually examine all shims and washers. All surfaces shall be free from burrs, There shall be no visible creases on the surface of shims or washers which are 0.005 inch thick or less. Shims or washers, which are 0.005 inch thick or greater, shall have surfaces flat and parallel within 0.0005 inch.

g. Inspect and replace defective bearings.

h. Measure the force required to compress spring (49) to its working length. Working length shall be 0.24 ± 0.01 inch with a 16 ± 1 ounce load applied.

3-5. REPAIR AND REPLACEMENT.

Repair and replace parts of the magnetic brake as described in *a* through *c*, below.

a. Replace all worn, damaged, and corroded parts, and all parts that do not meet inspection requirements.

b. Clean minor surface damage from steel parts, using crocus cloth (item 6, table 2-2).

c. Clean minor surface damage from aluminum parts, using aluminum oxide abrasive cloth (item 7, table 2-2).

3-6. LUBRICATION.

Prior to assembly, lubricate parts of the magnetic brake as described in *a* and *b*, below.

a. Apply a light coating of grease (item 2, table 2-2) to all ball bearings, gears, and pinions.

b. Apply anti-seize compound (item 3, table 2-2) to threads of all aluminum screws and to all steel screws that anchor into aluminum parts, except screws (19 and 54, figure 3-1).

3-7. REASSEMBLY.

Reassemble the magnetic brake in the reverse order of disassembly. (See figures 3-1 through 3-3.)

CAUTION

Insure that gear housings (16 and 61, figure 3-1) have identical matched numbers before starting assembly procedures.

a. Install retaining ring (23) on bearing (24).

b. Slide shims (25) and bearing (24) on splined end of output gear (30). Install washer

(29) and bushings (28 and 27) onto housing and output gear (30).

c. Position output gear assembly (items 23 through 25 and 27 through 30) in gear housing (61). Position gear housing (16) over gear housing (61) and secure with screws (19). Measure end play of output gear assembly. End play shall be between 0.002 and 0.007 inch. Add or remove shims (25), as required, to obtain end play limits.

d. Remove screws (19), separate housings, and place output gear assembly aside.

e. Install ball bearing (33), shims (32), and retaining ring (31) on larger shaft end of helical gear (37). Install ball bearing (36), shims (35), and bearing liner (34) on smaller shaft end of helical gear (37). Position the side gear assembly in gear housing (61), (See figure 3-2). If the shimming prevents seating of the side gear assembly, use other bore in gear housing (61, figure 3-1), Assemble and install the second side gear assembly in the same way. Alter shims (32 and 35) to eliminate end play. Helical gears (37) must be aligned with each other.

f. Repeat procedure in *e* above, using gear housing (16) in place of gear housing (61). At final assembly use the housing that requires the least number of shims (32 and 35) to eliminate end play.

g. With both side gear assemblies in position in one housing, attach the other housing and secure with screws (17, 18, and 19). Tighten screws to a torque of 10 to 20 inch-pounds. Insert finger in open end of housing assembly and verify that both side gears spin freely. Mark housing and side gear locations.

h. Remove screws (17, 18, and 19), separate housings, and remove side gears.

i. Install shims (56) and ball bearing (55) on threaded end of gearshaft (57). Insert pin (53) through hole in gearshaft (57) and position collar (52) over pin. Seat bushing (51) inside collar (52) with notch on end of bushing seated firmly on pin (53), Slide clutch disk (50) on splines of bushing (51) and against collar (52). Install spring (49), washer (48), and nut (47).

NOTE

Shim (56A) applies to R460M15 and R460M15-3.

j. Install spider (46) (minus weights (43)) on splined shoulder of gearshaft (57).

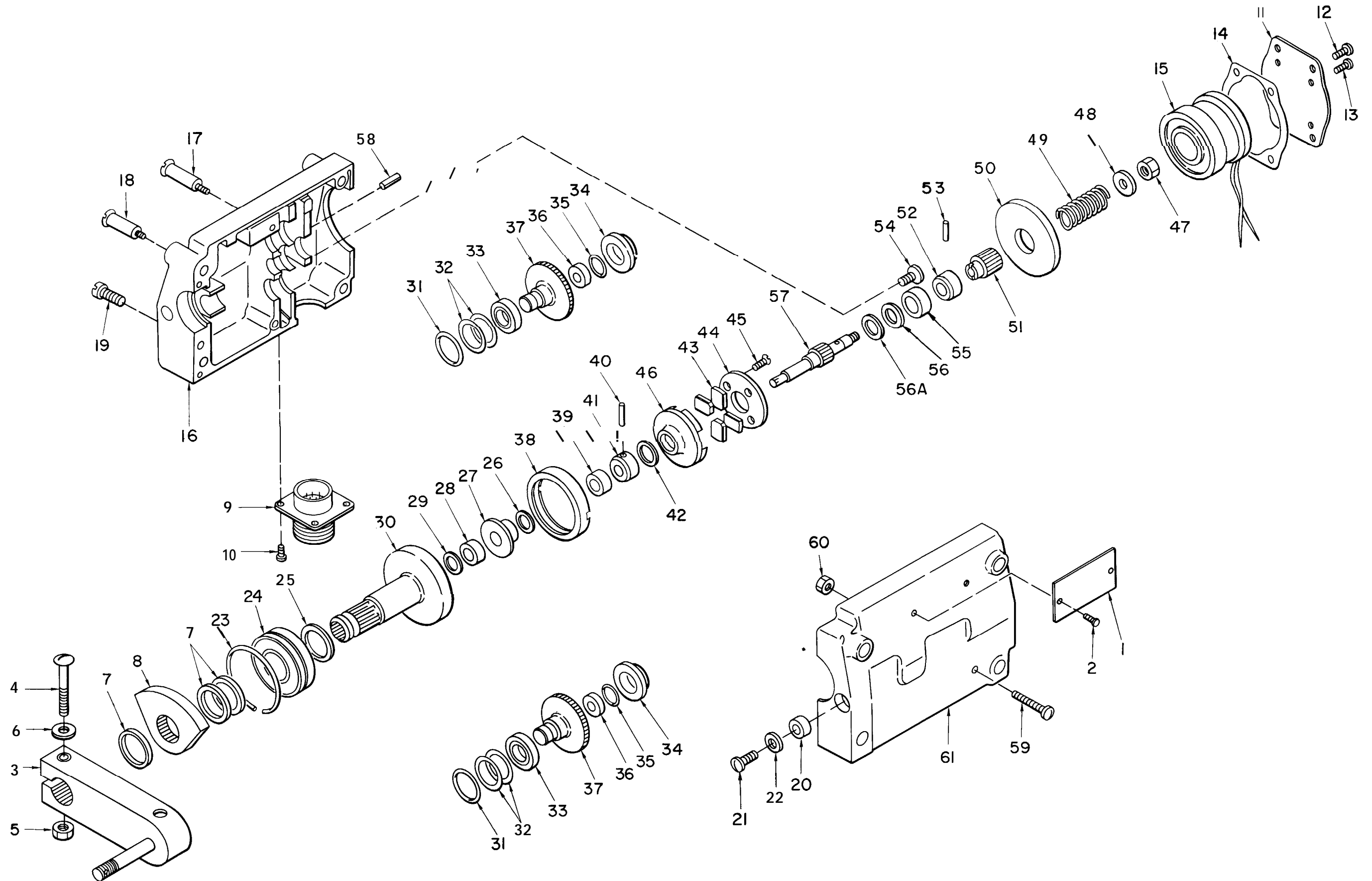


Figure 3-1. Magnetic Brake Assembly, Exploded View, Part No. R460M10, R460M15 and R460M15-3.

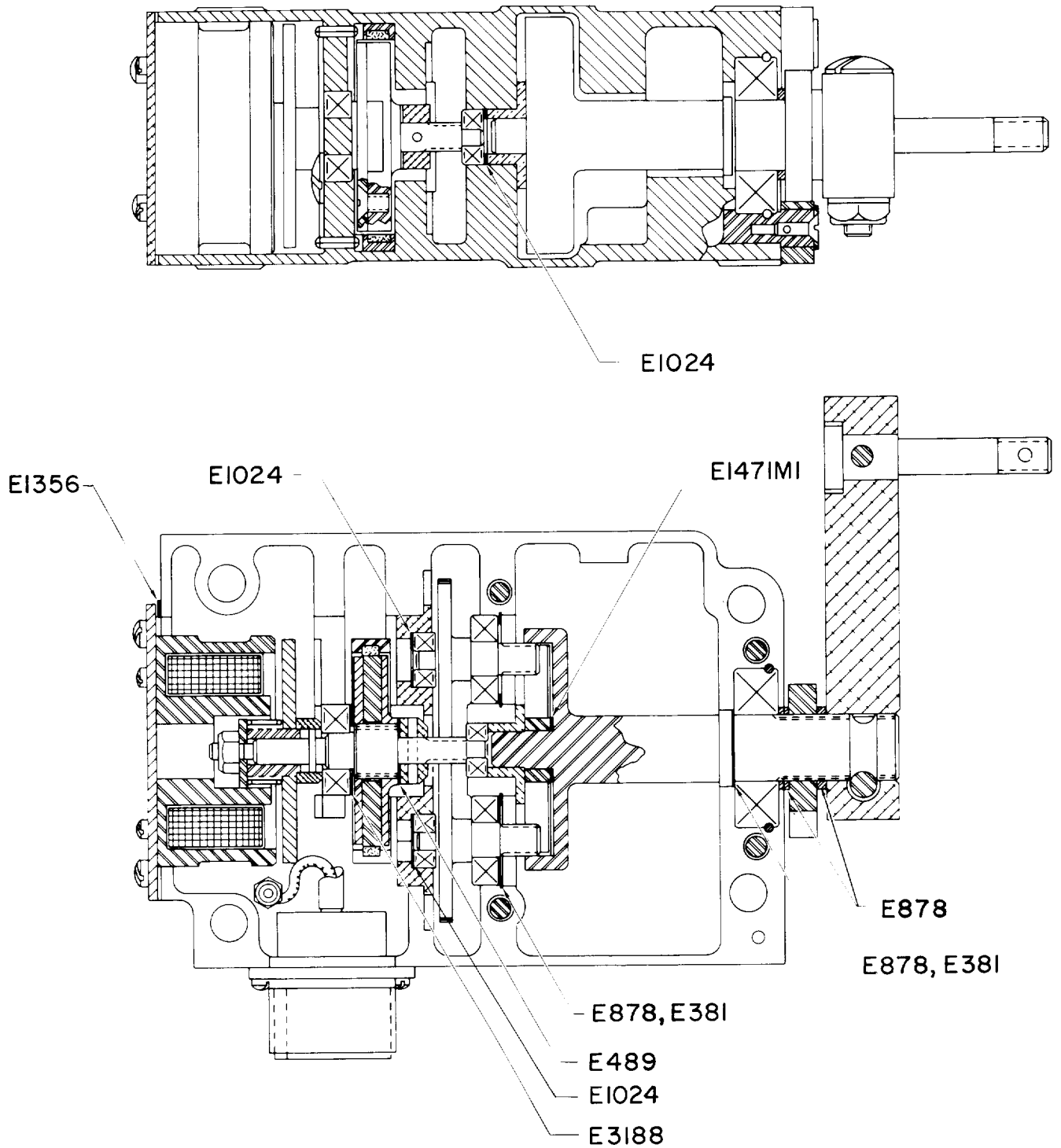


Figure 3-2. Shim Location Diagram, Part No. R460M10.

NOTE

If spider (46) and cover disk (44) were separated, secure with screws (45) and stake.

k. Install shims (42) (as required to align holes) and collar (41) on splined end of gearshaft (57). Secure collar (41), with spring pin (40), and ball bearing (39) on end of gearshaft (57).

l. Install output gear assembly in housing (step c). Install pinion assembly in housing with ball bearing (55) butted against heads of screws (54).

m. Measure space between ball bearing (39) and bushing (27). Install shims (26) sufficient to remove end play of pinion assembly and not bind. Hold ball bearing (39) and spin clutch disk (50). The pinion assembly should spin freely.

n. With output gear assembly and pinion gear assembly in position, install side gear assemblies in housing at locations marked in step g. With ball bearing (39) and gearshaft (57) not seated, hold gearshaft to prevent it from rotating, and rotate one helical gear (37), causing it to move up past the pinion five gear teeth. Seat ball bearing (39) and gearshaft (57). Press down on ball bearing (39) and helical gears (37) to seat parts. If gearshaft (57) is not seated, it will be lifted up. Mate gear housings (16 and 61) and turn assembly over. Remove top housing and repeat previous check. If incorrect seating is evident, lift gearshaft (57) and rotate helical gear (37) to skip one tooth, then repeat check of seating.

o. Mate gear housings (16 and 61). Hold securely, and using crank arm assembly (3), spin the gear train. Rotation shall be free and some coasting will occur.

p. Using crank arm assembly (3), check for backlash. If excessive backlash is evident, proceed with step q.

q. Position helical gears (37) out of lateral alignment, moving each gear approximately 0.015 inch in opposite axial directions by exchanging the necessary thickness shims (35), while maintaining the same total thickness of these shims. Record total actual shift by measuring the thickness of exchanged shims. Recheck backlash and continue axial adjustment until minimum backlash is evident.

NOTE

Do not permit meshing of helical gears (37) on run-out of pinion teeth on gearshaft (57).

r. If backlash cannot be minimized by procedure in g above, realign helical gears (37) and shift gearshaft (57), skipping one additional tooth as outlined in n above.

s. Remove pinion gear assembly from housing. Install weights (43) in spider (46) with convex surface outboard. Install brake drum (38) over weights (43) with notch of brake drum facing coil end of housing and fitting over pin (58).

NOTE

Prior to mating gear housing (16) with gear housing (61), apply a thin, smooth, even coat of sealer (item 5, table 2-2) to the mating surfaces of the housings.

t. Make electrical wiring connections between coil and core assembly (15) and connector (9), and position in housing. (See figure 3-3). Mate gear housing (16, figure 3-1) with gear housing (61) and secure with screws (17, 18, and 19). Stake screws (17 and 18) and secure screws (19) with adhesive (item 4, table 2-2).

u. Align coil and core assembly (15), and install mounting spacer (14) and brake adapter (11) on end of housing assembly. Install connector (9) on housing.

NOTE

Screws (13) must align with coil and core assembly (15). Install mounting spacers (14), as required, to set brake gap to operate between 0 and 17 VDC.

CONNECTOR

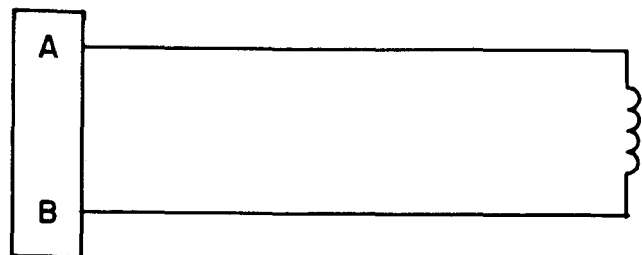


Figure 3-3. Wiring Diagram, General.

v. Install shims (7) and positive stop (8) on splined shaft of output gear (30) with convex side of stop facing up. Position crank arm assembly (3) with scribe marks on crank arm and gearshaft aligned. Secure crank arm assembly (3) with screw (4), washer (6), and nut (5).

w. Attach eccentrics (20) to housing with retainer rings (22) and screws (21).

x. After performing functional tests described in section IV, lockwire all drilled head screws with lockwire (item 10, table 2-2) using practices conforming to MS33540.

SECTION IV

FINAL TEST PROCEDURES

4-1. GENERAL.

Test the magnetic brake as described in a through *n* below. See figure 2-1 and refer to table 2-1 for test equipment required to perform the following tests:

a. Mount the magnetic brake on limit-setting holding fixture AT1977, using limit-setting adapter AT1890-7. Mount limit-setting fixture AT1890 on the holding fixture. Connect the magnetic brake to dc test panel AT2878 and energize the magnetic brake. Loosen screws (21) and turn eccentrics (20) to limit the movement of positive stop (8) (each side of center) to the mechanical stroke limits specified in figure 4-1. Secure eccentrics (20) by tightening screws (21).

b. Mount magnetic brake on its side on backlash checking fixture AT1939 with the crank arm assembly facing up and the mounting bolts facing down. Tighten mounting bolts to a torque of 40 inch-pounds.

c. Remove crank arm assembly from magnetic brake. Attach load test arm AT3042 to the output shaft on the brake, using the splined adapter supplied with load test pulley AT2103.

d. Apply 17 volts dc across the brake coil to engage the brake. Connect an ammeter in series with the power source. Using weights (10 pounds), apply 200 inch-pounds torque first in a clockwise direction, then in a counterclockwise direction. The brake shall not slip in either direction. Current drawn shall not exceed 0.5 ampere.

e. Repeat *d* above at approximately each 10-degree interval of shaft rotation in both directions of operation.

f. De-energize the brake coil. Remove load test arm AT3042 and the splined adapter installed in *c*, above.

g. Install load test pulley AT2103. Apply 40 inch-pounds torque (eight-pound weight). Allow crank arm to hit stop and check that arm backs off stop without jamming.

h. Repeat *g* above in opposite direction of rotation.

i. Install crank arm of backlash checking fixture AT1939 and position arm vertically. Energize brake coil with 28 volts dc. Using a push-pull scale, apply a one-ounce force clockwise at a 90-degree angle to the crank arm. Set dial indicator on backlash checking fixture AT1939 to zero. Remove the one-ounce force and apply a

2.5-pound force in a counter-clockwise direction to the crank arm. Total crank arm movement shall not exceed 0.005 inch as indicated on the dial indicator.

j. Repeat *i* above, reversing direction of applied force.

k. De-energize brake coil and rotate crank arm slowly by hand to detect any evidence of binding within the travel limits of the crank arm. At each point where binding occurs, check that crank arm moves through point of bind with an applied torque of 5 inch-pounds or less (using push-pull scale).

l. Remove crank arm assembly and install load test pulley AT2103 on output shaft of magnetic brake. Apply a torque of 5 inch-pounds (one-pound weight) in a counter-clockwise direction. Crank arm shall move through complete stroke. (See figure 4-1).

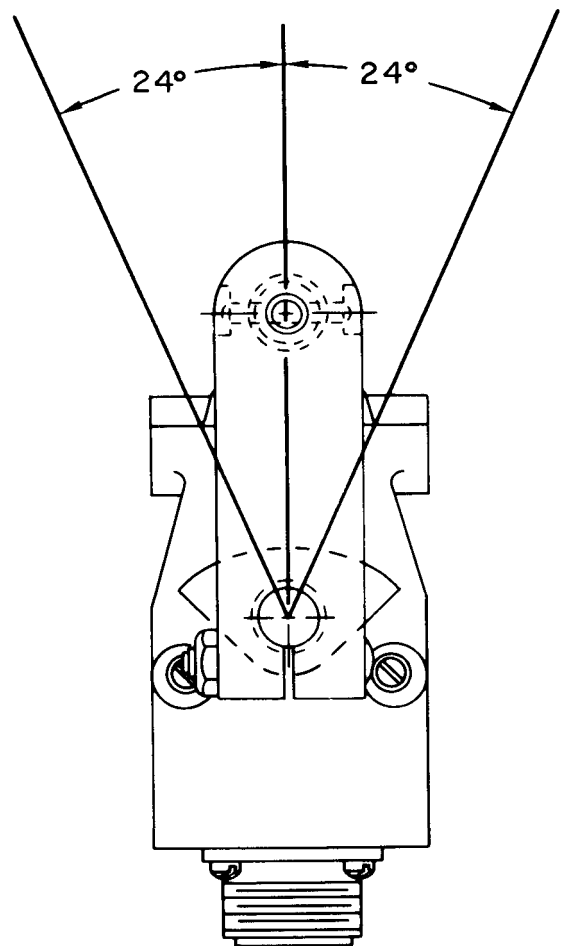


Figure 4-1. Stroke Setting Diagram, 24°, Part No. R460M10.

m. Repeat l above, reversing direction of movement.

n. Reinstall crank arm assembly (3, figure 3-1).

4-2. TROUBLESHOOTING.

If the magnetic brake fails to meet any of the test requirements and visual inspection does not disclose the cause of trouble, refer to troubleshooting table 4-1.

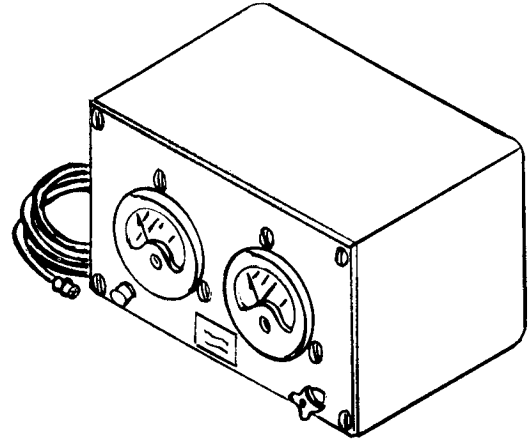
Table 4-1. Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Brake inoperative: No current.	Open connection or winding.	Check continuity of all connections.
Brake inoperative: Excessive current,	Short circuit.	Locate and correct.
Poor performance: Low current.	Low input voltage.	Check voltage.
Poor performance.	High resistance connection.	Check all connections.
High current and noise.	Mechanical interference.	Disassemble, locate, and correct.
Intermittent operation.	Binding	Disassemble, locate, and correct.
	Loose connection.	Locate and correct.

SECTION V
DIFFERENCE DATA SHEETS

NOTE

Overhaul instructions for part no. D460M15, R460M15-3, and R460M15-11 included in this section are the same as the procedures for part no. R460M10 covered in the preceding sections of this technical manual, except for the differences noted herein.



AT2652

5-1. DIFFERENCE DATA FOR MAGNETIC BRAKE, PART NO. R460M15.

The instructions contained in the preceding sections for magnetic brake, part no. R460M10, apply except for the differences noted in this difference data sheet.

5-2. *General Information.* Same as for part no. R460M10.

5-3. *Description.* Some as for part no. R460M10.

5-4. *Leading Particulars.* Substitute table 5-1 for table 1-1.

Table 5-1. Leading Particulars, Part No. R460M15

Normal Operating Voltage	_____	26 volts dc
Operating Current	_____	0.5 amp (max)
Brake Holding Torque	_____	220 lb in.
Weight	_____	1 lb 13 oz (approx)
Energized Condition	_____	Brake "ON"
De-energized Condition	_____	Brake "OFF"
Mechanical Stroke	_____	28 1.25 degrees
		both sides of center
Gear Ratio	_____	60.4 to 1

5-5. *Test Equipment.* Same as for part no. R460M10 except add air seal test panel AT2652 and air seal test adapter AT2652-4. (See figures 2-1 and 5-1).

5-6. *Special Tools.* Same as for part no. R460M10.

5-7. *Materials.* Same as for part no. R460M10 except add items 8 and 9, table 2-2.

5-8. *Disassembly.* Substitute figure 5-2 for figure 3-1. Shim (56A) shall be removed along with shim (56) as shown in paragraph 3-3h.



AT2652-4

Figure 5-1. Test Equipment Added for Part No. A460M15, R460M15-3 and R460M15-11.

5-9. *Cleaning.* Same as for part no. R460M10.

5-10. *Inspection.* Same as for part no. R460M10.

5-11. *Repair and Replacement.* Same as for part no. R460M10.

5-12. *Lubrication.* Same as for part no. R460M10.

5-13. *Reassembly.* Same as for part no. R460M10 except substitute figure 5-2 for figure 3-1, and figure 5-3 for figure 3-2. If optional stud, part no. 5690906, is to be installed in place of screw (59, figure 5-2) and nut (60), use a riveting fixture and a staking machine to rivet the stud in place. Install shim (56A) along with shim (56) as shown in paragraph 3-7i. Add the following leak check at the end of reassembly: Connect air seal test adapter AT2652-4 to air seal test panel AT2652. Remove one screw (12) and install air seal test adapter AT2652-4 in the vacated hole. Using air seal test panel AT2652, pressure test the magnetic brake for air leaks. The brake shall

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS USABLE	
			PER ASSY	ON CODE
5-2-	R460M15-11	MAGNETIC BRAKE ASSEMBLY (CODED)	REF	D
-1	6021541-16	DECAL, Identification	1	
-2	E9172	ARM ASSEMBLY, Crank (ATTACHING PARTS)	1	
-3	AN525D10R18	SCREW, Machine	1	
-4	MS21083D3	NUT, Self-locking	1	
-5	AN960PD10L	WASHER, Flat	1	
		*-----		
-6	E878	SHIM SET	AR	
-7	E9091M8	BRAKE, Stop	1	
-8	E878	SHIM SET	AR	
-9	MS3102E14S9P	CONNECTOR, Receptacle, electrical (ATTACHING PARTS)	1	
-10	MS35265-13	SCREW, Machine	4	
		*-----		
-11	4540318	COIL AND CORE ASSEMBLY	1	
-12	MS35265-15	SCREW, Machine	4	
-13	MS15795-704	WASHER, Flat	4	
-14	E1356	SPACER, Mounting	AR	
	E1356M1	SPACER, Mounting	AR	
	E1356M7	SPACER, Mounting	AR	
	E1356M8	SPACER, Mounting	AR	
-15	*E2740M58-1	HOUSING, Gear	1	
-16	AN5050-8R18	SCREW, Machine	1	
-16	E9500M1-8-12	SCREW, Machine (use with optional housing only)	1	
-17	MS35190-258	SCREW, Machine	1	
-17	E9500M1-8-12	SCREW, Machine (use with optional housing only)	1	
-18	E9500M1-8-12	SCREW, Machine	2	
-19	E9500M1-8-12	SCREW, Machine (use with optional housing only)	2	
		*-----		
-20	4131102-2A1A	BEARING, Ball	1	
-21	E3924-2	DRUM ASSEMBLY, Brake	1	
-22	E3276	WEIGHT	4	
-23	XSC119	RING, Retaining	1	
-24	5620202-1	SPIDER	1	
-25	4131206-2A1A	BEARING, Ball	1	
-26	3030632	DISK, Clutch	1	
-27	E7518-1	SPRING, Compression	1	
-28	1131049	PINION	1	
-29	E1024	SHIM SET	AR	
-30	E1641	RING, Retaining	2	
-31	E878	SHIM SET	AR	
-32	4131104-2A1A	BEARING, Ball	2	
-33	3090184	SHIM SET	AR	
-34	4131204-2A1A	BEARING, Ball	2	
-35	1061106	GEAR, Helical and pin on	2	
-36	E779-1	BUSHING	1	

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION							UNITS USABLE	
		1	2	3	4	5	6	7	PER ASSY	ON CODE
5-2-37	E5475M1									AR
-38	E2460									1
-39	E2175M1									1
-40	1091309									1
-41	512100C0250B									2
-42	5690906									1
-43	*E2740M58-2									1
-43	*E2740M100-2									1

*Part of matched set. Procure as housing assembly, part number E2740M58 or E2740M100-1.

hold 0.5 psi for one minute with pressure drop not to exceed 0.25 psi within the specified time. Remove the adapter, coat the removed screw with sealant (item 8, table 2-2), and reinstall the screw.

5-14. *Final Test Procedures.* Same as for part no. R460M10 except as follows:

a. Substitute figure 5-4 for figure 4-1.

b. Substitute the following for paragraph 4-1, step *d*: With the magnetic brake at the mid-stroke position and energized with 14 volts, apply 220 inch-pounds torque in a clockwise and counter-clockwise direction (for approximately 10 seconds at each condition). The brake must not slip. The current must not exceed 0.27 ampere.

c. Substitute the following for paragraph 4-1, step *i*: With the magnetic brake energized, position crank arm assembly at approximately mid-stroke. Apply a one inch-pound torque in a clockwise direction. Zero the dial indicator at two-inch radius on crank arm assembly. Apply one inch-pound torque in a counter-clockwise direction. Total movement of crank arm assembly from the zero position must not be greater than 0.010 inch.

5-15. DIFFERENCE DATA FOR MAGNETIC BRAKE, PART NO. R460M15-3.

The instructions contained in the preceding sections for magnetic brake, part no. R460M10, apply except for the differences noted in this difference data sheet.

5-16. *General Information.* Same as for part no. R460M10.

5-17. *Description.* Same as for part no, R460M10.

5-18. *Leading Particulars.* Substitute table 5-2 for table 1-1.

5-19. *Test Equipment.* Same as for part no. R460M10 except add air seal test panel AT2652 and air seal test adapter AT2652-4. (See figures 2-1 and 5-1.)

5-20. *Special Tools.* Same as for part no. R460M10.

5-21. *Materials.* Same as for part no. R460M10 except add clear sealant (item 8, table 2-2).

5-22. *Disassembly.* Same as for part no. R460M10. Shim (56A) shall be removed along with shim (56) as shown in paragraph 3-2h.

Table 5-2. *Leading Particulars, Part No. R460M15-3*

Normal Operating Voltage	-----	26 volts dc
Operating Current	-----	0.5 amp (max)
Brake Holding Torque	-----	220 lb in.
Weight	-----	1 lb 13 oz (approx)
Energized Condition	-----	Brake "ON"
De-energized Condition	-----	Brake "OFF"
Mechanical Stroke	-----	32.25 ±1.25 degrees both sides of center
Gear Ratio	-----	60.4 to 1

5-23. *Cleaning.* Same as for part no. R460M10.

5-24. *Inspection.* Same as for part no. R460M10.

5-25. *Repair and Replacement.* Same as for part no. R460M10.

5-26. *Lubrication.* Same as for part no. R460M10.

5-27. *Reassembly.* Same as for part no R460M10 except substitute figure 5-3 for figure 3-2. If optional stud, part no. 5690906, is to be installed in place of screw (59, figure 3-1) and nut (60), use a riveting fixture and a staking machine to rivet the stud in place. Install shim (56A) along with shim (56) as shown in paragraph 3-7i. Add the following leak check at the end of reassembly: Connect air seal test adapter AT2652-4 to air seal test panel AT2652. Remove one screw (12) and install air seal test adapter AT2652-4 in the vacated hole. Using air seal test panel AT2652, pressure test the magnetic brake for air leaks. The brake shall hold 0.5 psi for one minute with pressure drop not to exceed 0.25 psi within the specified time. Remove the adapter, coat the removed screw with sealant (item 8, table 2-2), and reinstall the screw.

5-28. *Final Test Procedures.* Same as for part no. R460M10 except as follows:

a. Substitute figure 5-4 for figure 4-1.

b. Substitute the following for paragraph 4-1, step *d*: With the magnetic brake at the mid-stroke position and energized with 14 volts, apply 220 inch-pounds torque in a clockwise and counter-clockwise direction (for approximately 10 seconds at each condition). The brake must not slip. The current must not exceed 0.27 ampere.

c. Substitute the following for paragraph 4-1, step *i*: With the magnetic brake energized, position crank arm assembly at approximately mid-stroke. Apply a one inch-pound torque in a clockwise direction. Zero the dial indicator at

two-inch radius on crank arm assembly. Apply a one inch-pound torque in a counter-clockwise direction. Total movement of crank arm assembly from the zero position must not be greater than 0.010 inch.

5-29. DIFFERENCE DATA FOR MAGNETIC BRAKE, PART NO. R460M15-11.

The instructions contained in the preceding sections for magnetic brake, part no. R460M10, apply except for the differences noted in this difference data sheet.

5-30. *General Information.* Same as for part no. R460M10.

5-31. *Description.* Same as for part no. R460M10.

5-32. *Leading Particulars.* Same as for part no. R460M10 except substitute table 5-3 for table 1-1.

5-33. *Test Equipment.* Same as for part no. R460M10 except add air seal test panel AT2652 and air seal test adapter AT2652-4. (See figures 2-1 and 5-1.)

5-34. *Special Tools.* Same as for part no. R460M10.

5-35. *Materials.* Same as for part no. R460M10 except add clear sealant (item 8) and plastic gasket seal (item 9, table 2-2).

5-36. *Disassembly.* Disassemble the magnetic brake assembly as follows: Note that attaching parts follow the parts which they attach. Record thickness of shims removed during disassembly to facilitate reassembly.

a. Cut and remove lockwire from all drilled head screws.

b. Do not remove identification decal (1, figure 5-2) unless it is illegible or otherwise damaged and requires replacement.

Table 5-3. Leading Particulars, Part No. R460M15-11

Normal Operating Voltage	26 volts dc
Operating Current	50.5 amp (max)
Brake Holding Torque	200 lb in.
Weight	1 lb 13 oz
Energized Condition	Brake "ON"
De-energized Condition	Brake "OFF"
Mechanical Stroke.....	32.25 ±1.25 degrees both sides of center
Gear Ratio	44.625 to 1

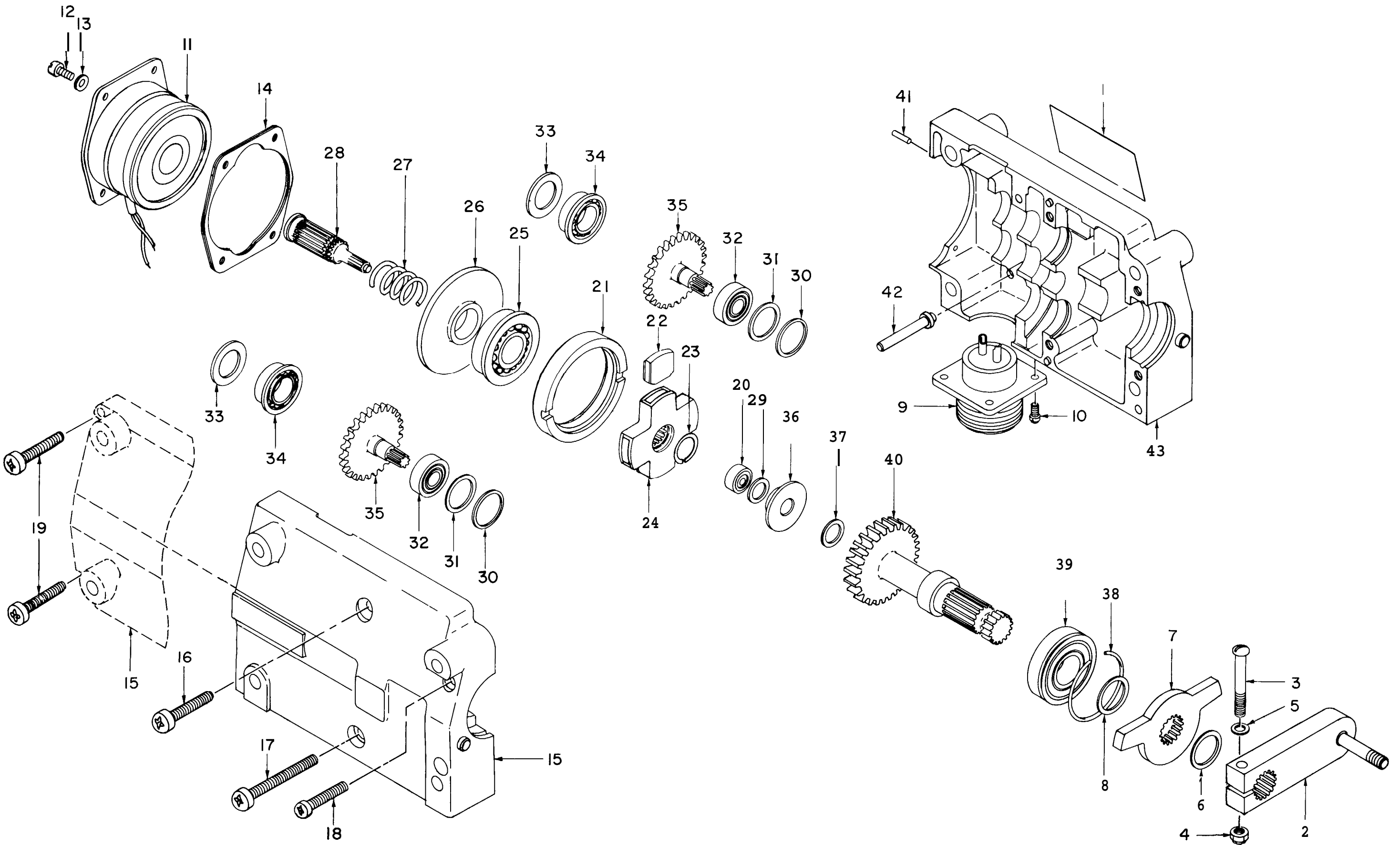


Figure 5-2. Magnetic Brake, Exploded View, Part No. R460M15-11.

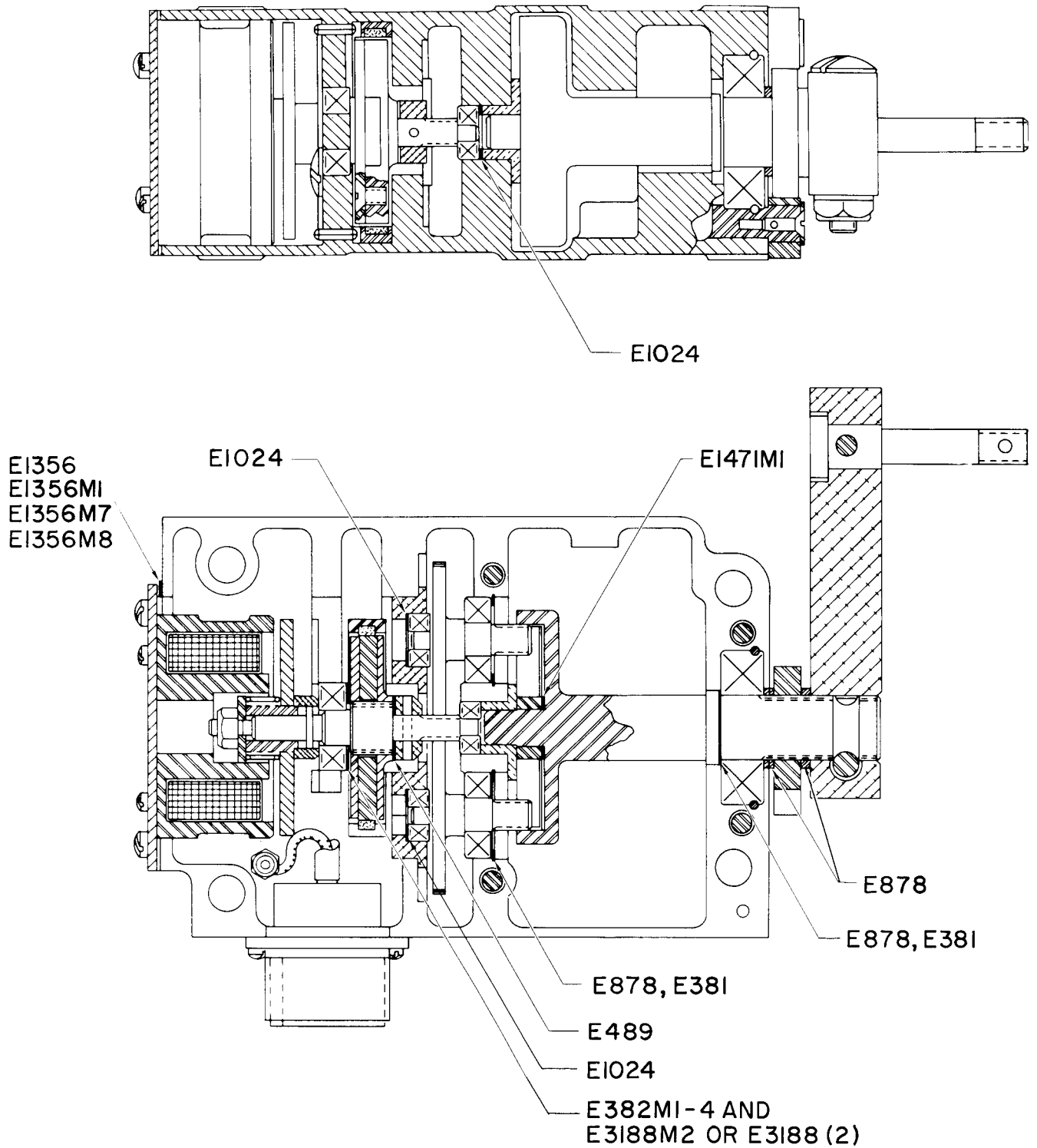


Figure 5-3. Shim Location Diagram, Part No. R460M15 and R460M15-3.

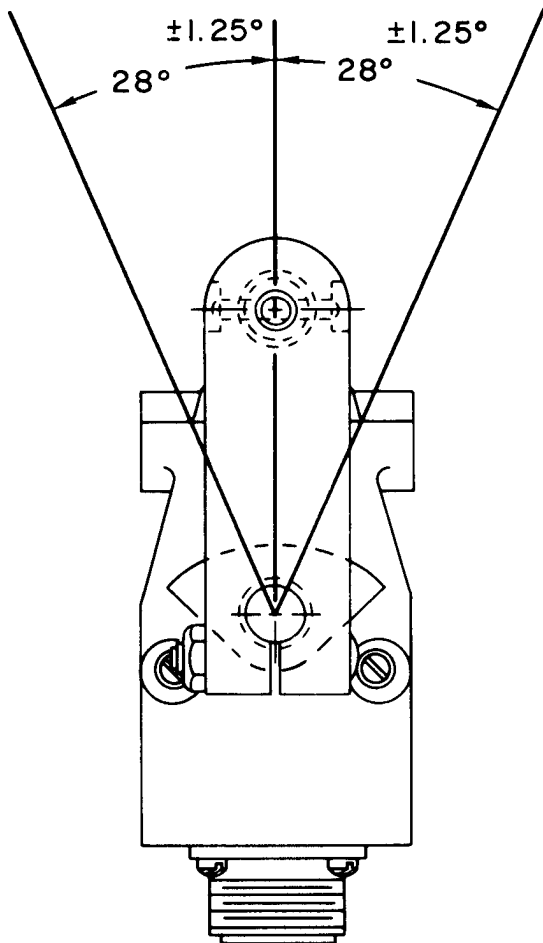


Figure 5-4. Stroke Setting Diagram, 28°, Part No. R460M15.

c. Remove crank arm assembly (2) from shaft of output gear (40) by removing screws (3), nut (4), and washer (5).

d. Remove shims (6), brake stop (7), and shims (8) from shaft of output gear (40).

e. Remove electrical connector (9) from gear housings (15 and 43) by removing screws (10). Unsolder leadwires from connector terminals and remove electrical connector (9).

f. Remove core and coil assembly (11), with attached mounting spacers (14), from gear housings (15 and 43) by removing screws (12) and washers (13).

g. Remove mounting spacers (14) from core and coil assembly (11).

h. Position the magnetic brake assembly on a suitable work surface with gear housing (43) on the bottom, and remove screws (16 thru 19) from gear housing (15).

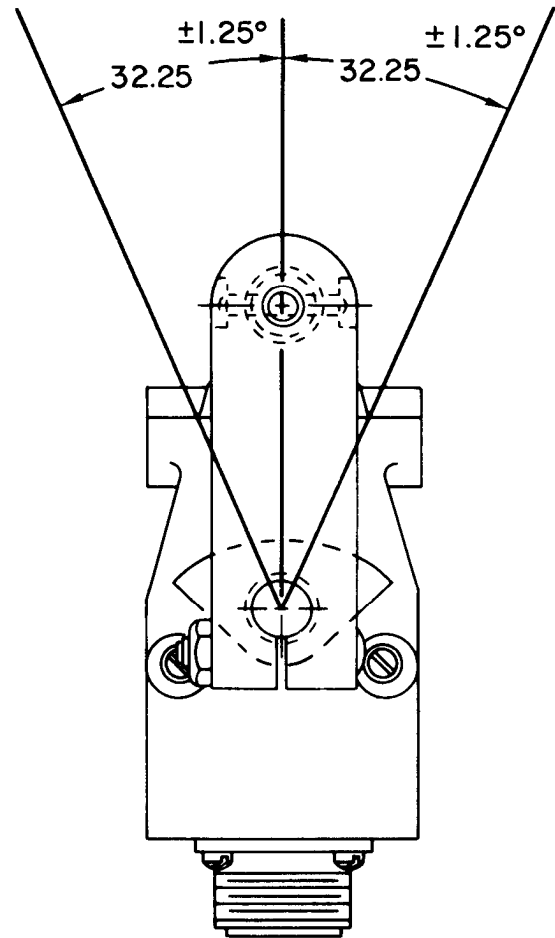


Figure 5-5. Stroke Setting Diagram, 32.25°, Part No. R460M15-3 and R460M15-11.

i. Using a suitable soft-face mallet, tap gear housing (15) lightly and remove.

CAUTION

When separating housing, do not use sharp object.

j. Remove pinion shaft (28), with attached parts, from gear housing (43) and disassemble as follows:

(1) Remove ball bearing (20), brake drum assembly (21), and centrifugal weights (22).

(2) Remove retaining ring (23), centrifugal spider brake (24), ball bearing (25), clutch disk (26), and compression spring (27) from pinion shaft (28).

k. Remove shims (29) from gear housing (43).

l. Remove helical gear and pinion (35), with

attached parts, from gear housing (43) and disassemble as follows:

(1) Remove retaining ring (30), shims (31), ball bearing (32), shims (33), and ball bearing (34) from helical gear and pinion (35).

(2) Repeat step (1) for remaining helical gear and pinion (35).

m. Remove output spur gear (40), with attached parts, from gear housing (43) and disassemble as follows:

(1) Remove bushing (36), shims (37), and ball bearing (39) with attached retaining ring (38) from shaft of output spur gear (40).

(2) Remove retaining ring (38) from ball bearing (39).

n. Do not remove pins (41) or stud (42) from gear housing (43) unless they are damaged and require replacement.

5-37. *Cleaning.* Same as for part no. R460M10.

5-38. *Inspection.* Same as for part no. R460M10.

5-39. *Repair and Replacement.* Same as for part no. R460M10.

5-40. *Lubrication.* Same as for part no. R460M10.

5-41. *Reassembly.* Assemble the magnetic brake assembly as follows: Initially install the same thickness of shims as were removed during disassembly, unless otherwise specified.

a. General.

(1) Coat all gears, bearings, and working parts lightly with grease (item 2, table 2-2).

(2) Apply clear sealant (item 8, table 2-2) to all steel screws unless otherwise specified.

CAUTION

Insure that gear housings (15 and 43, figure 5-2) have identical matched numbers before starting assembly procedures.

b. If grooved pins (41) were removed, press pins in appropriate holes of gear housings (15 and 43) to dimension shown in figure 5-6. If shouldered stud (42) was removed from gear housing (43), use a riveting fixture and electro-stake machine to rivet stud in place.

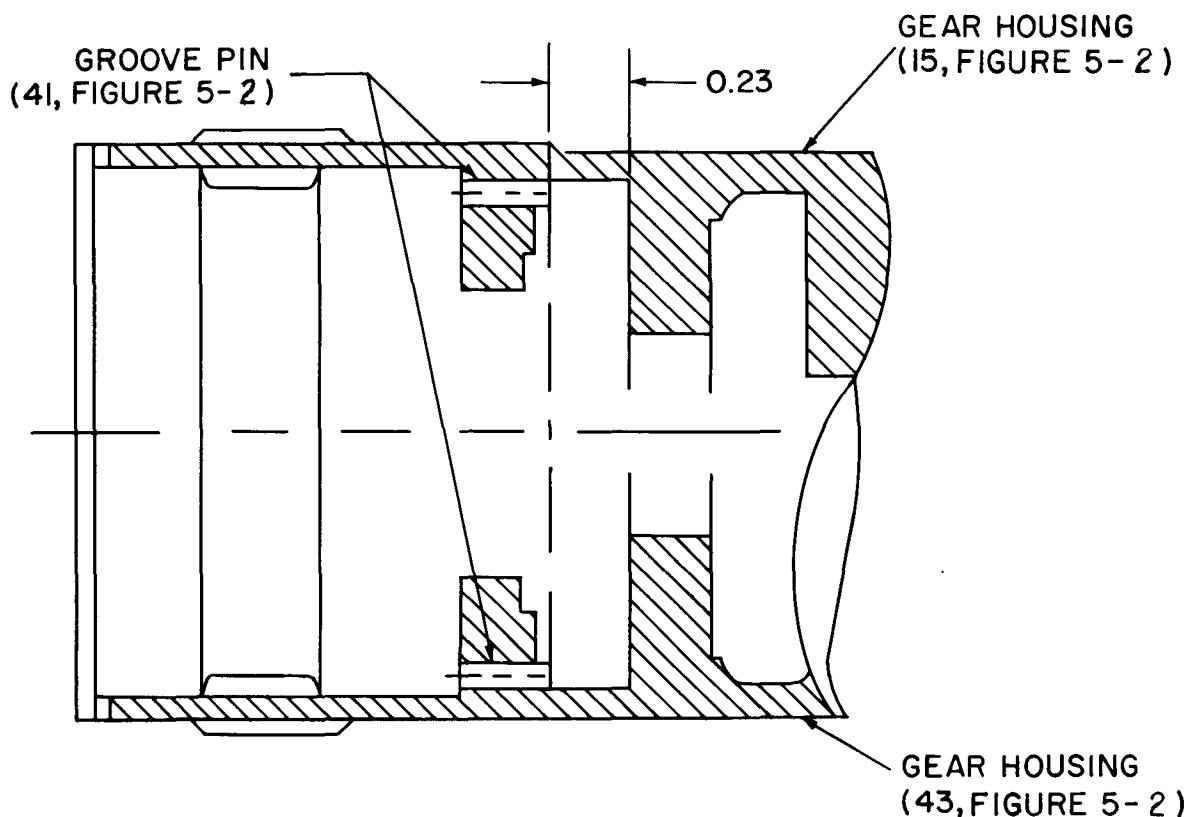


Figure 5-6. Pin Pressing Diagram, Part No. R460M15-11.

c. Coat bearing journal surface of output spur gear shaft (40) with plastic gasket seal (item 9, table 2-2). Install retaining ring (38) onto ball bearing (39) and install ball bearing onto output spur gear shaft (40) with retaining ring facing pinion end of shaft. Remove excess plastic gasket seal, using a dry, lint-free cloth.

d. Install shims (37) and bushing (36) onto opposite end of output spur gear (40), and install output spur gear into appropriate location in gear housing (43).

e. Install gear housing (15) onto gear housing (43) and secure, using screws (16 thru 19). Torque screws between 18 and 22 inch-pounds.

f. Using a suitable dial indicator, check out-

put spur gear (40) for zero end play. Remove output spur gear (40) and add or remove shims (37) to obtain required end play, (See figure 5-7.)

g. Reassemble and check end play per e and f above.

h. Using crank arm assembly (2), rotate output spur gear (40). Output spur gear is properly shimmed when zero end play exists and it moves freely.

i. Separate gear housings (15 and 43). Remove output spur gear (40), with attached parts, and set aside.

j. Using a pressing fixture, install ball bearings (32 and 34) onto helical gear (35).

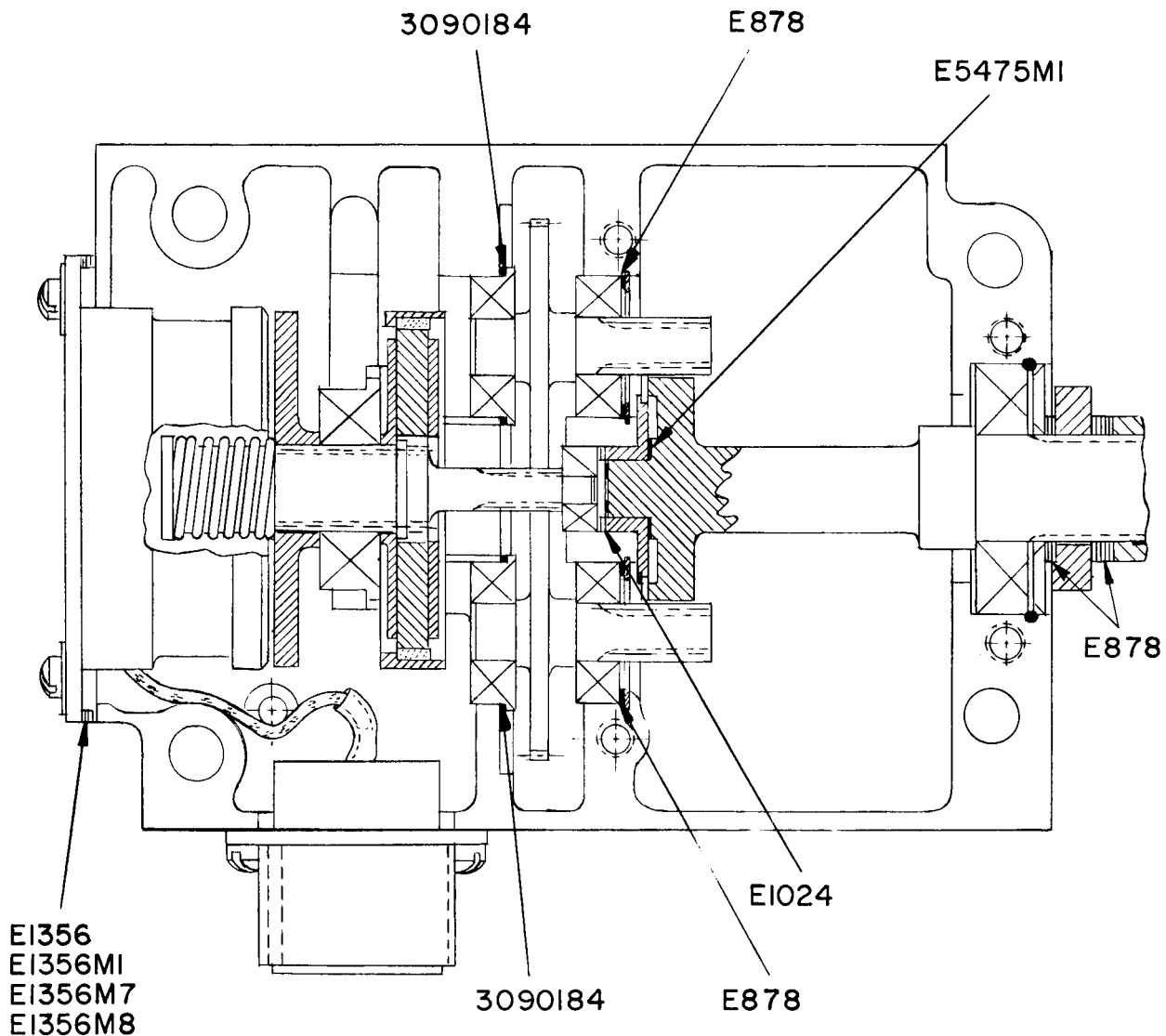


Figure 5-7. Shim Location. Diagram, Part No. R460M15-11.

k. Install shims (31) and retaining ring (30) onto pinion end of helical gear (35). Install shims (33) onto bearing (34).

l. Repeat procedure of *j* and *k* above for remaining helical gear (35).

m. Position one helical gear (35), with attached parts, into appropriate location of gear housing (43) and seat. If shimming prevents seating, try opposite location in the same housing half.

n. Repeat procedure of *m* above, for remaining helical gear (35).

o. Repeat *m* and *n* above, using opposite gear housing (15). Select the housing that uses the least amount of shims (31 and 33) to eliminate end play of helical gears (35).

p. With both helical gears (35) in position in appropriate housing half, install opposite housing and secure with screws (16 thru 19). Torque screws between 18 and 22 inch-pounds.

q. Check free rotation of helical gears (35), using finger through access opening in rear of gear housing assembly.

r. Separate gear housings (15 and 43), leaving helical gear assemblies in one housing. Align faces of helical gears (35) by exchanging necessary thickness of shims (31 and 33) maintaining the same total thickness of these shims. The thickness of shimming on both ends of each helical gear (35) should be approximately equal.

s. Measure and record the thickness and location of shimming of helical gears (35). Mark each helical gear assembly for location in selected gear housing, and remove helical gear assemblies and set aside.

t. Install compression spring (27), clutch disk (26) with flat side facing spring, ball bearing (25), and centrifugal brake spider (24) onto pinion shaft (28).

u. Using an inserting fixture, press retaining ring (23) onto pinion shaft (28).

v. Install ball bearing (20) onto pinion shaft (28), and position pinion shaft with attached parts in gear housing (43).

w. Install output spur gear (40), with attached parts, into gear housing (43). Install sufficient amount of shims (29) between ball bearing (20) and bushing (36) to remove end play of pinion shaft (28). Holding ball bearing (20) in position in gear housing bore, spin clutch disk (26). Clutch disk shall rotate freely.

x. Install helical gears (35), with attached parts, in gear housing (43) in their marked locations. With ball bearing (20) and pinion shaft (28) not seated, hold the pinion shaft to prevent rotation. Rotate one helical gear (35), causing its teeth to move up past the pinion on the pinion shaft (28). Skip five teeth in this manner.

y. Check seating of ball bearing (20) and pinion shaft (28). Using fingers, press on output spur gear (40) and helical gears (35). If pinion shaft is not properly seated, it will lift up. Mate gear housings (15 and 43) and turn assembly over.

z. Separate gear housings and repeat seating procedure of *y* above. If incorrect seating is evidenced, lift ball bearing (20) and pinion shaft (28) and rotate helical gear (35) to skip one tooth. Repeat *y* and *z* above to recheck seating.

aa. Mate gear housings (15 and 43) and, using crank arm (2), spin the gear train. Rotation shall be free and some coasting shall occur.

ab. Position gear housing assembly so that the selected housing (refer to *m* above,) is on the bottom. Separate gear housings and, using crank arm assembly (2), check to see if backlash is evident.

ac. Reposition helical gears (35) out of lateral alignment, moving each gear approximately 0.015 inch in opposite axial direction, by exchanging the necessary thickness of shims (33) while maintaining the same total thickness of these shims. Record the total actual shift by measuring the thickness of exchanged shims. Recheck the backlash and make axial adjustments until minimum backlash is obtained within free rotation limits.

CAUTION

Do not permit meshing of helical gears (35) on run-out of the pinion teeth of pinion shaft (28).

ad. If minimum backlash cannot be obtained by performing *ac* above, and further lateral offset of helical gears (35) is not possible, readjust shimming per *r* above.

ae. Reduce backlash by shifting pinion shaft (28) from center alignment, changing its mesh with helical gears (35). Repeat *x* through *z* above, skipping an additional tooth as described in *x* above.

af. Remove pinion shaft (28), with attached parts, from housing assembly and install centrifugal weights (22) in centrifugal spider (24), radius end facing outward, and brake drum assembly (21), notched side facing away from clutch disk (26). Reinstall pinion shaft assembly (28) with attached parts in housing assembly, insuring that ball bearing (20) is firmly seated and that all gears are properly meshed.

NOTE

Clean brake weights, using a clean, dry, lint-free cloth prior to installation.

ag. Install gear housing (15) onto gear housing (43) and secure, using screws (16 thru 19). Troque screws between 18 and 22 inches. Apply clear sealant (item 8, table 2-2) to face of gear housing prior to final assembly.

ah. Install approximately 0.050 inch of mounting spacers (14) on core and coil assembly (11), and install core and coil assembly with attached mounting spacers into gear housings (15 and 43). Secure, using screws (12) and washers (13).

NOTE

Clean faces of clutch disk (26) and core and coil assembly (11), using a clean, dry, lint-free cloth prior to installation.

ai. Using DC test panel AT2878, apply 10 volts dc to core and coil assembly (11). Using crank arm assembly (2), rotate output spur gear (40) at approximately 10° intervals from stop to stop, producing ON and OFF power to core and coil assembly. Brake must operate at 10 volts dc maximum. Add or remove mounting spacers (14), as required, to obtain specified brake setting.

NOTE

Decreasing the amount of spacers (14) used will decrease the voltage. Increasing the amount of spacers used will increase voltage.

aj. Install two 0.380-inch pieces of No. 16 heat-shrinkable sleeving over leadwires of core and coil assembly (11), and solder leadwires to pins of electrical connector (9). (See figure 3-3).

ak. Position heat-shrinkable sleeving previously installed over soldered pins of electrical

connector (9), and using a thermogun, shrink sleeving.

al. Install electrical connector (9) onto gear housings (15 and 43), using screws (10). Coat mounting flange face of electrical connector prior to installation with clear sealant.

NOTE

Orient keyway of electrical connector towards rear of assembly and insure that leadwires of core and coil assembly are looped under shouldered stud of gear housing (43).

am. Install sufficient amount of shims (8) onto spur gear (40) to prevent brake stop (7) from interfering with housings (15 and 43) and to obtain maximum engagement of brake stop (7) with stop pins.

an. Install brake stop (7), aligning scribe marks of brake stop with output spur gear (40). Rotate output spur gear (40) slowly by hand to detect any evidence of binding within travel limits. Any evidence of binding may necessitate relocation of brake stop (7) on output spur gear (40). (See figure 5-5.)

NOTE

If output spur gear (40) was replaced, a scribe line must be added to end of output spur gear, accurately marking the mid-position relationship of output spur gear and brake stop.

ao. Upon completion of test procedures as described in paragraph 4-1, complete assembly as follows:

(1) Stake screws (16 and 17), using a suitable center punch.

(2) Lockwire all drilled head screws in accordance with step 3-7x.

(3) Using Methyl-Isobutyl Keytone (item 11, table 2-2) and a clean, dry, lint-free cloth, clean all exposed surfaces to be sealed.

(4) Using clear sealant, spray-coat all external joints, seams, and bases of external screw heads with a thin layer of sealant. Apply per manufacturer's specification. Allow approximately one hour drying time between any additional coats that may be required to fill visible gaps or voids.

(5) Install shims (6) and crank arm assembly (2), aligning scribe mark of crank arm assembly with scribe mark of output spur gear (40). Add or remove shims (6) to eliminate end play of brake stop (7). Secure crank arm assembly by using screw (3), washer (5), and nut (4).

(6) Install identification decal to gear housing (43).

(7) Remove one screw (12) from rear of gear housing assembly and install air seal test adapter AT2652-4. Using air seal test panel AT2652, pressure-test magnetic brake assembly for air leaks. Magnetic brake assembly shall hold 0.5 psi for one minute with pressure drop not to exceed 1/4 psi within above specified time. Remove air seal test adapter and coat removed screw (12) with clear sealant and reinsert.

5-42. Final Test Procedures. Same as for part no. R460M10 except as follows:

a. Substitute figure 5-5 for figure 4-1.

b. Substitute the following for paragraph 4-1, step *d*: With the magnetic brake at the mid-stroke position and energized with 14 volts, apply 220 inch-pounds torque in a clockwise and counter-clockwise direction (for approximately 10 seconds at each condition). The brake must not slip. The current must not exceed 0.27 ampere.

c. Substitute the following for paragraph 4-1, step *i*: With the magnetic brake energized, position crank arm assembly at approximately mid-stroke. Apply one inch-pound of torque in a clockwise direction. Zero the dial indicator at two-inch radius on crank arm assembly. Apply a one inch-pound torque in a counter-clockwise direction. Total movement of crank arm assembly from zero position must not be greater than 0.010 inch.

APPENDIX A

REFERENCES

TM 38-750	The Army Maintenance Management System
MS20995	Safety Wire
MS33540	General Practices for Safety Wiring

APPENDIX B

REPAIR PARTS AND SPECIAL TOOLS LIST

(Current as of 2 June 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 brake, magnetic.

B-2. GENERAL.

This 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 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 Federal stock numbers in ascending numerical sequence, cross-referenced to the illustration figure and item number.

(2) A list of reference numbers 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 item. Source codes 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.

TM 55-1680-280-40

Code	Explanation
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.
X1	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.
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 X1 and aircraft support items as restricted by AR 700-42.

(2) Maintenance code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level codes are:

Code	Explanation
C	Crew or operator maintenance
O	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 nonrecoverable. Recoverability codes are:

Code	Explanation
R	Applied to repair parts (assemblies and components), special tools and test equipment which are considered economically repairable at direct and general support maintenance levels. When the item is no longer economically repairable, it is normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair parts, special tools, test equipment and assemblies which are economically repairable 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 repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	Higher dollar value recoverable repair parts, special tools and test equipment which are subject to special handling and are issued on an exchange basis. Such items will be repaired or overhauled at depot maintenance activities only. No repair may be accomplished at lower levels.
U	Repair parts, special tools and test equipment specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value or reusable casings or castings.

b. Federal Stock Number, Column 2. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes. Items source coded A, M, X1, or X2 are not assigned a Federal stock number.

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 reference number for the listed item, followed by the applicable five-digit Federal supply code for manufacturers, in parentheses.

(2) *Usable on code.* Indicates an alpha coding to reflect the application of the listed item to the specific manufacturer's model designation. No entries in this column indicate the item listed applies to all models. Refer to paragraph B-4b for identification of the usable on codes.

d. Unit of Measure (U/M), Column 4. A two-character alphabetical abbreviation indicating the amount or quantity of the item upon which the allowances are based (e.g., ft, ea, pr).

e. Quantity Incorporated in Unit, Column 5. Indicates the quantity of the item used in the assembly. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated.

f. Thrity-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.

(4) The basis of issue for authorized special tools, test and support equipment is the number of end items of equipment supported.

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 Equipments, 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.

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

B-4. SPECIAL INFORMATION.

a. Attaching parts are listed following the part(s) they attach and in the same indent. They are separated from the part(s) by the words "attaching parts" in the description column. When they attach an assembly which is broken down to show detail parts, the attaching parts are separated from the details of the assembly by the symbol "____ * ____." Details of the assembly are then indented one space to the right of their next higher assembly, which appears above the attaching parts.

b. Identification of the usable on codes included in column 3 of sections II and III are:

Code	Used On
A	P/N R460M10
B	P/N R460M15
C	P/N R460M15-3
D	P/N R460M15-11
BLANK	All models

c. Parts which require manufacture or assembly at a category higher than that authorized for installation will indicate in the source code column the higher category.

B-5. HOW TO LOCATE REPAIR PARTS.

a. When Federal stock number or reference number 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 Federal stock number or reference number is known:

(1) *First.* Using the index of Federal stock numbers and reference numbers, find the pertinent Federal stock number or reference number. This index is in ascending Federal stock number sequence, followed by a list of reference numbers 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 Federal stock numbers and reference numbers.

B-6. FEDERAL SUPPLY CODES FOR MANUFACTURERS.

Code	Manufacturer
02615	NYLOK Co The Division of USM Corp 611 Industrial Ave Paramus NJ 07652
71688	Cook Electric Co 6401 Oakton St Morton Grove IL 60053
76381	Minnesota Mining and Mfg Co 3 M Center St Paul MN 55101
76665	National Lock Washer Div Charter Wire 40 Haynes Somerville NJ 08876
81039	Plessey Airborne Corp 1414 Chestnut Ave Hillside NJ 07205
81348	Federal Specifications Promulgated by General Services Administration
81349	Military Specifications Promulgated by Standardization Div Directorate of Logistic Services DSA
88044	Aeronautical Standards Group Dept of Navy and Air Force
96906	Military Standards Promulgated by Standardization Div Directorate of Logistic Services DSA

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION				(4) USABLE ON CODE	(5) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY MAINT ALW			(7) 1-YR ALWPER 100 EQUIP CNTGCV	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION	
		REFERENCE NUMBER & MFR CODE							(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO	(b) ITEM NO
	1680-678-5411 1680-772-5599 1680-909-8099 1680-921-5992	R460M10 R460M15 R460M15-3 R460M15-11	(81039) (81039) (81039) (81039)	BRAKE, MAGNETIC..... BRAKE, MAGNETIC..... BRAKE, MAGNETIC..... BRAKE, MAGNETIC.....	A B C D	EA EA EA EA							1-1 1-1 1-1 1-1		
				SECTION II REPAIR PARTS MAGNETIC BRAKE R460M10, R460M15, R460M15-3											
P--H--	1680-089-2621	E2770M122	(81039)	PLATE, IDENTIFICATION.....	A	EA	1	*	*	*			3-1	1	
				ATTACHING PARTS											
P--H--	5305-253-5607 1680-066-9431	MS21318-8	(96906)	SCREW, DRIVE.....	A D	EA	2	*	*	*			3-1	2	
P--H--	5305-286-1766	E9172	(81039)	ARM ASSEMBLY, CRANK.....		EA	1	*	*	*			3-1	3	
				ATTACHING PARTS											
P--H--	5310-902-6676	AN525-10R20	(88044)	SCREW, MACHINE.....	ABC	EA	1	*	*	*			3-1	4	
P--H--	5310-167-0834	MS21083N3	(96906)	NUT, SELF-LOCKING, HEXAGON.....	ABC	EA	1	*	*	*			3-1	5	
P--H--		AN960-10L	(88044)	WASHER, FLAT.....	ABC	EA	1	*	*	*			3-1	6	
				ATTACHING PARTS											
X1----		E9173	(81039)	ARM, CRANK.....			1						3-1		
X1----		E9174	(81039)	PIN, CRANK.....			1						3-1		
P--H--	5340-917-7863	E878	(81039)	SHIM.....		EA	1	*	*	*			3-1	7	
P--H--	1680-736-8876	E9170	(81039)	STOP, POSITIVE.....	A	EA	1	*	*	*			3-1	8	
	1680-738-4598	E9170M1	(81039)	STOP, MAGNETIC BRAKE USE UNTIL.....	BC	EA	1						3-1	8	
				EXHAUSTED, NO REPLACEMENT											
	5935-201-5668	MS3102A14S9P	(96906)	CONNECTOR, RECEPTACLE, ELECTRICAL.....		EA	1						3-1	9	
				RPL-BY 5935-201-2721											
	5935-201-2721	MS3102E14S9P	(96906)	CONNECTOR, RECEPTACLE, ELECTRICAL.....		EA	1						3-1	9	
				RPLS-- 5935-201-5668 USE UNTIL											
				EXHAUSTED, NO REPLACEMENT											
				ATTACHING PARTS											
P--H--	5305-543-2024	MS35265-13	(96906)	SCREW, MACHINE.....		EA	4	*	*	*			3-1	10	
				ATTACHING PARTS											
P--H--	1680-347-7946	E1356M3	(81039)	ADAPTER, BRAKE CORE.....	ABC	EA	1	*	*	*			3-1	11	
				ATTACHING PARTS											
P--H--	5305-543-2024	MS35265-13	(96906)	SCREW, MACHINE.....	ABC	EA	4	*	*	*			3-1	12	
P--H--	5305-282-4045	AN500A2-3	(88044)	SCREW, MACHINE.....	ABC	EA	4	*	*	*			3-1	13	
				ATTACHING PARTS											
P--H--	6105-093-7411	E1356	(81039)	SHIM-MOUNTING.....		EA	1	*	*	*			3-1	14	
P--H--	5340-536-9565	E1356M1	(81039)	SHIM-MOUNTING.....	BCD	EA	1	*	*	*			3-1	14	
P--H--	1680-079-2544	E1356M7	(81039)	SHIM-MOUNTING.....	BCD	EA	1	*	*	*			3-1	14	
P--H--	1680-824-1468	E1356M8	(81039)	SHIM-MOUNTING.....	BCD	EA	1	*	*	*			3-1	14	
P--H--	1680-960-4046	E3270M5	(81039)	COIL AND CORE ASSEMBLY.....	ABC	EA	1	*	*	2			3-1	15	
P--H--	1680-988-0197	E3916	(81039)	WASHER, BRAKE, HOIST.....	ABC	EA	1	*	*	*			3-1		

(1) SHR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION				USABLE C L	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	30-DAY MAINT AI W			1-YR AL WPER 100 EQUIP CNTGCT	(8) DEPT MAINT AL WPER 100 EQUIP	(9) ILLUSTRATION	
		REFERENCE NUMBER & MFR CODE							(a)	(b)	(c)			(a) FIG NO	(b) ITEM NO
									I-ZU	ZI-90	91-100				
P--H--	1680-738-4594	89161	(81039)	BUSHING, SPLINED.....		EA	1	*	*	*			3-1	51	
P--H--	1680-724-5128	E9165	(81039)	SPACER, SLEEVE.....	ABC	EA	1	*	*	2			3-1	52	
P--H--	3110-198-0431	5412013	(81039)	ROLLER, BEARING.....	BC	EA	1	*	*	*			3-1	53	
P--H--	5305-943-8153	MS35218-22	(96906)	SCREW, MACHINE.....	A	EA	4	*	*	*			3-1	54	
P--H--	3110-240-9629	4131104-2A1A	(81039)	BEARING, ANNULAR.....	ABC	EA	1	*	*	*			3-1	55	
P--H--	5340-558-3462	E3188	(81039)	SHIM.....	A	EA	3	*	*	*			3-1	56	
P--H--	5340-558-3462	E3188	(81039)	SHIM.....	BC	EA	2	*	*	*			3-1	56A	
P--H--	1680-053-3916	E4595M4	(81039)	PINION, SHAFT.....	ABC	EA	1	*	*	2			3-1	57	
P--H--	5305-558-9442	AN505-4R22	(88044)	SCREW, MACHINE.....	ABC	EA	1	*	*	*			3-1	59	
P--H--	5310-088-0551	MS21044N04	(96906)	NUT, SELF-LOCKING, HEXAGON.....	ABC	EA	1	*	*	*			3-1	60	
P--H--	1680-919-7992	E2740M33-2	(81039)	HOUSING HALF, GEAR AND MOTOR.....	ABC	EA	1						3-1	61	
				USE UNTIL EXHAUSTED, NO REPLACEMENT											
				MAGNETIC BRAKE R460M15-11											
P--H--	1680-890-2778	6021541-16	(81039)	PLATE, IDENTIFICATION.....	D	EA	1	*	*	*			5-2		
P--H--	5305-253-5607	MS21318-8	(96906)	SCREW, DRIVE.....	A D	EA	2	*	*	*			5-2		
P--H--	1680-066-9413	E9172	(81039)	ARM ASSEMBLY, CRANK.....		EA	1	*	*	*			5-2	2	
P--H--	5305-576-7812	AN525D10R18	(88044)	SCREW, MACHINE.....	D	EA	1	*	*	*			5-2	3	
P--H--	5310-905-3081	MS21083D3	(96906)	NUT, SELF-LOCKING, HEXAGON.....	D	EA	1	*	*	*			5-2	4	
P--H--	5310-167-0753	AN960PD10L	(88044)	WASHER, FLAT.....	D	EA	1	*	*	*			5-2	5	
X1----		E9173	(81039)	ARM, CRANK.....	I		1						5-2		
X1----		E9174	(81039)	PIN, CRANK.....			1						5-216	5-2	
P--H--	5340-917-5863	E878	(81039)	SHIM.....		EA	V	*	*	*			5-2	7	
X2-H--		E9091M8	(81039)	STOP, MECHANICAL.....	D	EA	1	*	*	*			5-2	8	
P--H--	5340-917-7863	E878	(81039)	SHIM.....		EA	V	*	*	*			5-2	8	
	5935-201-2721	MS3102E14S9P	(96906)	CONNECTOR, RECEPTACLE, ELECTRICAL.....		EA	1						5-2	9	
				RPLS-- 5935-201-5668 USE UNTIL EXHAUSTED, NO REPLACEMENT ATTACHING PARTS											
P--H--	5305-543-2024	MS35265-13	(96906)	SCREW, MACHINE.....		EA	4	*	*	*			5-2	10	
P--H--	1680-824-1466	4540318	(81039)	CORE AND COIL ASSEMBLY.....	D	EA	1	*	*	*			5-2	11	
P--H--	5305-531-0298	MS35265-15	(96906)	SCREW, MACHINE.....	D	EA	4	*	*	*			5-2	12	
P--H--	5310-550-5009	MS15795-704	(96906)	WASHER, FLAT.....	D	EA	4	*	*	*			5-2	13	
P--H--	6105-093-7411	E1356	(81039)	SHIM-MOUNTING.....		EA	V	*	*	*			5-2	14	
P--H--	5340-536-9565	E1356M1	(81039)	SHIM-MOUNTING.....	BCD	EA	V	*	*	*			5-2	14	
P--H--	1680-079-2544	E1356M7	(81039)	SHIM-MOUNTING.....	BCD	EA	V	*	*	*			5-2	14	
P--H--	1680-824-1468	E1356M8	(81039)	SHIM-MOUNTING.....	BCD	EA	V	*	*	*			5-2	14	
P--H--	1680-114-1178	E2740M58	(81039)	HOUSING, MAGNETIC BRAKE ASSEMBLY.....	D	EA	1	*	*	*			5-2		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR CODE	(4) USABLE ON CODE	(5) UNIT OF MEAS	(6) QTY INC IN UNIT	(6) 30-DAY MAINTALW GS			(7) -YR #PER 100 EQUIP TGCTY	(8) DEPOT MAINT ALWPEA 100 EQUIP	(9) ILLUSTRATION	
						(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO	(b) ITEM NO
X1----		E2740M58-1 (81039)			1						5-2	15
P--H--	5305-156-2817	AN505-8R18 (88044)		EA	1	*	*	*			5-2	16
P--H--	5305-082-4895	E9500M1-8-12 (81039)		EA	1	*	*	*			5-2	16
P--H--	5305-059-4573	MS35190-258 (96906)		EA	1	*	*	*			5-2	17
P--H--	5305-082-4895	E9500M1-8-12 (81039)		EA	1	*	*	*			5-2	17
P--H--	5305-082-4895	E9500M1-8-12 (81039)		EA	2	*	*	*			5-2	18
P--H--	5305-082-4895	E9500M1-8-12 (81039)		EA	2	*	*	*			5-2	19
X1----		E2740M58-2 (81039)			1						5-2	
P--H--	3110-155-9590	4131102-2A1A (81039)		EA	1	*	*	*			5-2	20
P--H--	1680-831-4143	E3924-2 (81039)		EA	1	*	*	*			5-2	21
P--H--	1680-346-4005	R3276 (81039)		EA	4	*	*	*			5-2	22
P--H--	5340-282-0761	XSC119 (76665)		EA	1	*	*	*			5-2	23
P--H--	1680-827-2160	5620202-1 (81039)		EA	1	*	*	*			5-2	24
P--H--	3110-075-2632	4131206-2A1A (81039)		EA	1	*	*	*			5-2	25
P--H--	1680-824-1467	3030632 (81039)		EA	1	*	*	*			5-2	26
P--H--	1680-874-4583	E7518-1 (81039)		EA	1	*	*	*			5-2	27
X2-H--		1131049 (81039)		EA	1	*	*	*			5-2	28
P--H--	1680-530-6164	E1024 (81039)		EA	2	*	*	*			5-2	29
P--H--	5340-370-4629	E1641 (81039)		EA	2	*	*	*			5-2	30
P--H--	5340-917-7863	E878 (81039)		EA	2	*	*	*			5-2	31
P--H--	3110-240-9629	4131104-2A1A (81039)		EA	2	*	*	*			5-2	32
P--H--	1680-103-0017	3090184 (81039)		EA	1	*	*	*			5-2	33
P--H--	3110-864-0580	4131204-2A1A (81039)		EA	2	*	*	*			5-2	34
X2-H--		1061106 (81039)		EA	2	*	*	*			5-2	35
P--H--	X80-874-4590	E779-1 (81039)		EA	1	*	*	*			5-2	36
P--H--	5340-032-1817	E2460 (81039)		EA	1	*	*	*			5-2	38
P--H--	3110-198-2844	E2175M1 (81039)		EA	1	*	*	*			5-2	39
P--H--	1680-824-1465	1091309 (81039)		EA	1	*	*	*			5-2	40
X1----		E2740M58-2 (81039)			1						5-2	43
P--H--	5315-997-1920	5412100C0250B (81039)		EA	2	*	*	*			5-2	
MAINTENANCE SUPPLIES												
P--O--	5350-221-0872	(81348)		EA	V	*	*	*			MSUP	
P--O--	5350-246-0330	(81348)		EA	V	*	*	*			MSUP	
P--H--	5970-162-7523	ZV903 (71688)		PI	V	*	*	*			MSUP	
P--O--	6850-264-9038	(81348)		GI	V	*	*	*			MSUP	
P--F--	8030-087-8630	(81349)		LB	V	*	*	*			MSUP	
P--F--	8030-275-8117	EC801 (76381)		KI	V	*	*	*			MSUP	

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	REFERENCE NUMBER & MFR CODE	(3) DESCRIPTION	USABLE ON CODE	(4) UNLT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY GS MAINT ALW			(7) 1-YR ALWPER 100 EQUIP CNTGCTY	(8) DEPOT MAINT ALWPER 100 EQUIP	(9) ILLUSTRATION	
							(a) 1-20	(b) 21-50	(c) 51-100			(a) FIG NO	(b) ITEM NO
P--O--	9150-985-7246		(81349) GREASE,AIRCRAFT AND INSTRUMENT..... MIL-G-23827,1 LB CAN		LB	V	*	*	*			MSUP	
P--O--	9150-985-7246		(81348) WIRE,STEEL,CORROSION RESISTING..... 0.020 IN.DIA,FED QQ-W-423, 5 LB REEL		FT	V	*	*	*			MSUP	
SECTION III SPECIAL TOOLS, TEST AND SUPPORT EQUIPMENT													
P--H--	4920-934-8407	AT2103	(81039) LOAD CHECK PULLEY.....		EA	1	*	*	*				2-1
P--H--	4920-946-6939	AT1977	(81039) FIXTURE,HOLDING.....		EA	1	*	*	*				2-1
P--H--	4920-946-6940	AT1890-7	(81039) ADAPTER,TEST.....		EA	1	1	1	1				2-1
P--H--	4920-946-6941	AT1890	(81039) FIXTURE,MOUNT.....		EA	1	*	*	*				2-1
P--H--	4920-946-6987	AT1939	(81039) FIXTURE,BACKLASH CHECKING.....		EA	1	*	*	*				2-1
P--H--	4920-946-7002	AT2878	(81039) PANEL,TEST,DC.....		EA	1	*	*	*				2-1
P--H--	4920-946-7003	AT3042	(81039) ARM,LOAD TEST.....		EA	1	*	*	*				2-1
P--H--	4920-936-5533	AT2652	(81039) AIR SEAL TEST PANEL.....	BCD	EA	1	*	*	*				5-1
P--H--	4920-997-6288	AT2652-4	(81039) ADAPTER,TEST,AIR SEAL.....	BCD	EA	1	*	*	*				5-1

SECTION IV
FEDERAL STOCK NUMBER AND REFERENCE NUMBER INDEX

STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER	STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER
1680-053-3916	3-1	57	4920-946-7002	2-1	
1680-066-9413	3-1	3	4920-946-7003	2-1	
1680-066-9413	5-2	2	4920-997-6288	5-1	
1680-079-2544	3-1	14	5305-059-4573	3-1	18
1680-079-2544	5-2	14	5305-059-4573	5-2	17
1680-089-2621	3-1	1	5305-082-4895	3-1	19
1680-103-0017	5-2	33	5305-082-4895	5-2	16
1680-114-1178	5-2		5305-082-4895	5-2	17
1680-346-4003	3-1	44	5305-082-4895	5-2	18
1680-346-4004	3-1	46	5305-082-4895	5-2	19
1680-346-4005	5-2	22	5305-156-2817	3-1	17
1680-346-4005	3-1	43	5305-156-2817	5-2	16
1680-347-7946	3-1	11	5305-253-5607	3-1	2
1680-527-1703	3-1	25	5305-253-5607	5-2	
1680-527-1703	3-1	32	5305-282-4045	3-1	13
1680-530-6164	3-1	26	5305-286-1766	3-1	4
1680-530-6164	3-1	35	5305-531-0298	5-2	12
1680-530-6164	5-2	29	5305-543-2024	3-1	10
1680-535-5205	3-1	37	5305-543-2024	3-1	12
1680-575-1428	3-1	38	5305-543-2024	5-2	10
1680-662-3942	3-1	27	5305-558-9442	3-1	59
1680-678-5411	1-1		5305-576-7812	5-2	3
1680-686-1580	3-1	49	5305-660-2625	3-1	19
1680-686-1587	3-1	30	5305-901-2651	3-1	21
1680-723-9464	3-1	28	5305-943-8153	3-1	54
1680-724-5128	3-1	52	5305-957-6644	3-1	45
1680-727-5054	3-1	41	5310-088-0551	3-1	47
1680-736-8876	3-1	8	5310-088-0551	3-1	60
1680-738-4594	3-1	51	5310-167-0753	5-2	5
1680-738-4598	3-1	8	5310-167-0834	3-1	6
1680-772-5599	1-1		5310-550-5009	5-2	13
1680-795-0805	3-1	34	5310-725-3806	3-1	48
1680-824-1465	5-2	40	5310-902-6676	3-1	5
1680-824-1466	5-2	11	5310-905-3081	5-2	4
1680-824-1467	5-2	26	5310-964-3896	3-1	22
1680-824-1468	3-1	14	5315-844-5644	3-1	40
1680-824-1468	5-2	14	5315-865-9667	3-1	
1680-827-2160	5-2	24	5315-997-1920	5-2	
1680-831-4143	5-2	21	5340-032-1817	3-1	23
1680-874-4583	5-2	27	5340-032-1817	5-2	38
1680-874-4590	5-2	36	5340-282-0761	5-2	23
1680-890-2778	5-2		5340-370-4629	3-1	31
1680-909-8099	1-1		5340-370-4629	5-2	30
1680-919-7989	3-1	16	5340-536-9565	3-1	14
1680-919-7992	3-1		5340-536-9565	5-2	14
1680-919-7992	3-1	61	5340-558-3462	3-1	56
1680-921-5992	1-1		5340-558-3462	3-1	56A
1680-956-9942	3-1	20	5340-562-7870	3-1	29
1680-960-4046	3-1	15	5340-917-7863	3-1	7
1680-960-4052	3-1	50	5340-917-7863	3-1	25
1680-988-0197	3-1		5340-917-7863	3-1	32
3110-075-2632	5-2	25	5340-917-7863	5-2	6
3110-115-0759	3-1	33	5340-917-7863	5-2	8
3110-155-9590	3-1	36	5340-917-7863	5-2	31
3110-155-9590	3-1	39	5350-221-0872	MSUP	
3110-155-9590	5-2	20	5350-246-0330	MSUP	
3110-198-0431	3-1	53	5935-201-2721	3-1	9
3110-198-2844	3-1	24	5935-201-2721	5-2	9
3110-198-2844	5-2	39	5935-201-5668	3-1	9
3110-240-9629	3-1	55	5970-162-7523	MSUP	
3110-240-9629	5-2	32	6105-093-7411	3-1	14
3110-864-0580	5-2	34	6105-093-7411	5-2	14
4920-934-8407	2-1		6105-685-0085	3-1	42
4920-936-5533	5-1		6850-264-9038	MSUP	
4920-946-6939	2-1		8030-087-8630	MSUP	
4920-946-6940	2-1		8030-275-8117	MSUP	
4920-946-6941	2-1		9150-985-7246	MSUP	
4920-946-6987	2-1		9505-596-5101	MSUP	

REFERENCE NUMBER	MFG CODE	FIG NUMBER	ITEM NUMBER	REFERENCE NUMBER	MFG CODE	FIG NUMBER	ITEM NUMBER
AN500A2-3	88044	3-1	13	E878	81039	3-1	32
AN505-4R22	88044	3-1	59	E878	81039	5-2	6
AN505-8R18	88044	3-1	17	E878	81039	5-2	8
AN505-8R18	88044	5-2	16	E878	81039	5-2	31
AN525D10R18	88044	5-2	3	E9091M8	81039	5-2	7
AN525-10R20	88044	3-1	4	E9161	81039	3-1	51
AN960-10L	88044	3-1	6	E9165	81039	3-1	52
AN960PD10L	88044	5-2	5	E9167	81039	3-1	50
AT1890	81039	2-1		E9168	81039	3-1	48
AT1890-7	81039	2-1		E9170	81039	3-1	8
AT1939	81039	2-1		E9170M1	81039	3-1	8
AT1977	81039	2-1		E9172	81039	3-1	3
AT2103	81039	2-1		E9172	81039	5-2	2
AT2652	81039	5-1		E9173	81039	3-1	
AT2652-4	81039	5-1		E9173	81039	5-2	
AT2878	81039	2-1		E9174	81039	3-1	
AT3042	81039	2-1		E9174	81039	5-2	
EC801	76381	MSUP		E9176	81039	3-1	20
E1024	81039	3-1	26	E9177	81039	3-1	22
E1024	81039	3-1	35	E9500M1-8-12	81039	3-1	19
E1024	81039	5-2	29	E9500M1-8-12	81039	5-2	16
E1356	81039	3-1	14	E9500M1-8-12	81039	5-2	17
E1356	81039	5-2	14	E9500M1-8-12	81039	5-2	18
E1356M1	81039	3-1	14	E9500M1-8-12	81039	5-2	19
E1356M1	81039	5-2	14	MS15795-704	96906	5-2	13
E1356M3	81039	3-1	11	MS16562-1	96906	3-1	
E1356M7	81039	3-1	14	MS16562-194	96906	3-1	40
E1356M7	81039	5-2	14	MS21044N04	96906	3-1	47
E1356M8	81039	3-1	14	MS21044N04	96906	3-1	60
E1356M8	81039	5-2	14	MS21083D3	96906	5-2	4
E1471M1	81039	3-1	29	MS21083N3	96906	3-1	5
E1641	81039	3-1	31	MS21318-8	96906	3-1	2
E1641	81039	5-2	30	MS21318-8	96906	5-2	
E217 5M1	81039	3-1	24	MS3102A14S9P	96906	3-1	9
E217 5M1	81039	5-2	39	MS3102E14S9P	96906	3-1	9
E2460	81039	3-1	23	MS3102E14S9P	96906	5-2	9
E2460	81039	5-2	38	MS35190-220	96906	3-1	45
E2740M33		3-1		MS35190-258	96906	3-1	18
E2740M33-1	81039	3-1	16	MS35190-258	96906	5-2	17
E2740M33-2	81039	3-1		MS35218-22	96906	3-1	54
E2740M33-2	81039	3-1	61	MS35265-13	96906	3-1	10
E2740M58	81039	5-2		MS35265-13	96906	3-1	12
E2740M58-1	81039	5-2	15	MS35265-13	96906	5-2	10
E2740M58-2	81039	5-2		MS35265-15	96906	5-2	12
E2740M58-2	81039	5-2	43	MS35265-47	96906	3-1	19
E2770M122	81039	3-1	1	NK505-2-5	02615	3-1	21
E3188	81039	3-1	56	R460M10	81039	1-1	
E3188	81039	3-1	56A	R460M15	81039	1-1	
E3270M5	81039	3-1	15	R460M15-11	81039	1-1	
E3274	81039	3-1	44	R460M15- 3	81039	1-1	
E3275	81039	3-1	46	XSC119	76665	5-2	23
E3276	81039	3-1	43	ZV903	71688	MSUP	
E3276	81039	5-2	22	1061106	81039	5-2	35
E381	81039	3-1	25	1091309	81039	5-2	40
E381	81039	3-1	32	1131049	81039	5-2	28
E3916	81039	3-1		3030632	81039	5-2	26
E3924	81039	3-1	38	3090184	81039	5-2	33
E3924-2	81039	5-2	21	4131102 -2A1A	81039	3-1	36
E4594M1	81039	3-1	37	4131102 -2A1A	81039	3-1	39
E4595M4	81039	3-1	57	4131102 -2A1A	81039	5-2	20
E4624M7	81039	3-1	30	4131104-0A1A	81039	3-1	33
E4627	81039	3-1	34	4131104-2A1A	81039	3-1	55
E4684	81039	3-1	41	4131104-2A1A	81039	5-2	32
E489	81039	3-1	42	4131204-2A1A	81039	5-2	34
E4965	81039	3-1	28	4131206 -2A1A	81039	5-2	25
E7518	81039	3-1	49	4540318	81039	5-2	11
E7518-1	81039	5-2	27	5412013	81039	3-1	53
E779	81039	3-1	27	54121 00C0250B	81039	5-2	
E779-1	81039	5-2	36	5620202-1	81039	5-2	24
E878	81039	3-1	7	6021541-16	81039	5-2	
E878	81039	3-1	25				

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,
The Adjutant General.

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THE METRIC SYSTEM AND EQUIVALENTS

WEIGHT MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 lb.
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

$5/9(^{\circ}\text{F} - 32) = ^{\circ}\text{C}$
 212° Fahrenheit is equivalent to 100° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 $9/5^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
its	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
ometers per Liter	Miles per Gallon	2.354
ometers per Hour	Miles per Hour	0.621



PIN: 022310-000