

TWO-MOTOR ALTERNATORS
AND
ASSOCIATED MOTOR CONTROLLERS AND STARTERS

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1. GENERAL

1.1 Scope

1.11 This section covers the following two-motor alternators and their associated motor controllers and starters. Related BSP numbers are also listed.

KS NUMBER	DESCRIPTION	BSP NUMBER	PLANT
5647	DC Motor Controller	024-345-701	505C
5654-01 (Mfg. Disc.)	Two-Motor Alternator	155-108-701	505C
15582	DC Motor Starter	026-384-701	505D
15520	Two-Motor Alternator	155-112-701	505D
15821	DC Motor Controller	024-345-701	508A
15844	Two-Motor Alternator	155-115-701	508A
15949	Two-Motor Alternator	155-117-701	508A
15993	Two-Motor Alternator	155-107-701	505D
15994	Two-Motor Alternator	155-109-701	505D

1.2 Associated Information

1.21 Coordinate information in this section with test of the power plant in Handbook 21. Verify all relays on the motor starters and controllers as outlined in Paragraph 4 and perform the operations indicated in this section for the machines before proceeding with plant tests in Handbook 21.

1.22 Refer to Section 101 in this handbook for definition of relay terms, such as operate, nonoperate, etc.

1.3 Precautions

1.31 Before working on equipment in service refer to the section in Handbook 0 covering cooperation with the customer, prevention of service interruptions and protection of personnel and equipment.

1.32 When work is to be done on a controller or motor alternator in operation, transfer the load to an alternate machine and close down the controller and machine completely. Remove ac and dc fuses for the machine and tag the circuits with ID-1270-A Warning Tags. Test for absence of potential before starting work. Plant test sections indicate method of transferring load and shutting down a machine.

1.4 Inspection

1.41 Remove shipping materials and inspect each piece of equipment for damage, missing parts, defects of finish and lack of freedom of movement. Check against information in the job specification. If replacements or corrections are required originate a JIM in accordance with the Job Clerical Handbook.

1.5 Description of Machines

1.51 The two-motor alternators have an ac motor, a dc motor and an alternator connected to the same shaft. Rigid or flexible couplings may be used between the motors and alternator such as on the KS-15993 or KS-15994 machines or the motor and alternator armature windings may be on the same shaft, such as on the KS-15844 and KS-15949 machines. Each two-motor alternator is started with the dc motor or station battery. Once up to speed the dc motor drive is disconnected and drive shifts to the ac motor on outside power. Failure of outside power causes the drive to shift back to the dc motor until ac power, either emergency or regular, is available at which time the drive shifts back to the ac motor.

2. INSTALLING EQUIPMENT

2.1 Tools

2.11 Sufficient tools for installation will be found in tool kits already on the job.

This section includes material from BSP's 024-345-701, 026-384-701, 155-107-701, 155-108-701, 155-109-701, 155-112-701, 155-115-701 and 155-117-701
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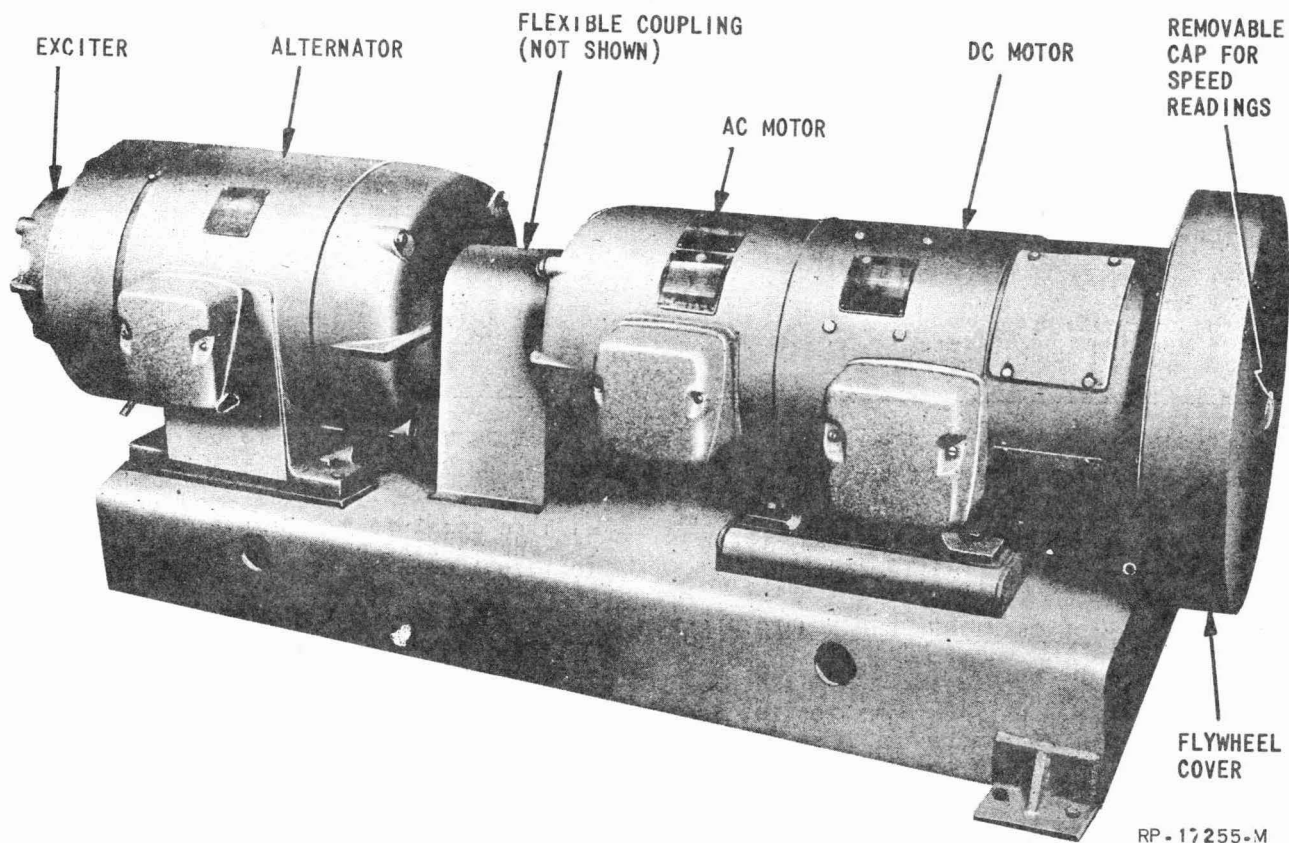


FIG.1 KS-15994 TWO-MOTOR ALTERNATOR SET

2.2 Gauges

Code	Description
R-2202	Balance, Spring, 3 lb.
R-2481	Balance, Spring, 30 lb.
KS-6909	Gauge, Feeler, .0015-.025"
131A	Gauge, Feeler, .004-.074"
R-1032	Thermometer, C

2.3 Test Sets

ITE-4040 DC Adjusting Set

2.4 Supplies

R-3163	Paper, Abrasive, 4/0 Open Coat
R-3429	Trichloroethane
KS-14666	Cloth, Cleaning

3. MACHINES

3.1 Mounting

3.11 Refer to Section 129 in this handbook for information on mounting and leveling floor-mounted machines or on leveling the table for table-mounted machines.

3.2 Machine Weights

3.21 Machine weights are approximately as follows:

KS NUMBER	Pounds
5654-01, List 1, 2	725
3, 4, 6	900
15520 List 3	4395
15993 List 1	2400
2	2900
15994 List 1	2855
2	3835
15844	1260
15949	1250

3.3 Lubrication

3.31 Ball bearings on new machines are suitably lubricated at the factory and shall not be lubricated at installation unless the machine has been in storage for two or more years.

3.32 For relubrication under the above condition use KS-7471 Grease and refer to the BSP on the machine for the method. Use Andok C (Esso Standard Oil Company) for the KS-15844 or KS-15949.

3.4 Freedom of Rotation

3.41 Before attempting to start any of these machines turn the armature by hand to make sure it is free to rotate. Be sure power is disconnected so that the machine cannot be accidentally started during this test.

3.42 If there is some restriction to turning, the machine may have been incorrectly installed, it may be misaligned, have a defective bearing or brushes may be sticking.

3.5 Direction of Rotation

3.51 The machine must rotate in the direction indicated by the arrow on the machine. Rotation can be checked as soon as the machine is started on plant tests.

3.6 Mechanical Requirements

3.61 Brushholder clearances from commutator shall be as follows:

	Minimum	Maximum
KS-5654-01	1/32"	1/8"
KS-15520	1/32"	1/8"
KS-15993	1/32"	1/8"
KS-15994	1/32"	1/8"
KS-15844	1/8"	3/16"
KS-15949	1/8"	3/16"

Remove end cover band to expose brushholders.

3.62 Brush lifting solenoids of

KS-15844 and KS-15949 machines shall lift the brushes at least 1/8 inch off the commutator.

3.621 To measure this requirement open the S1 switch in the dc starter and open the circuit breakers in the MR motor controller. Block the MR contactor relay nonoperated with a piece of wood. Insulate the A4, T4, A3 and T3 lower contacts of the M relay and block this relay operated. Insert the ac 45 ampere FN fuses. Close the circuit breakers in the MR motor controller & verify that the brushes are lifted. After checking the brush lifting requirement open the MR circuit breakers, remove the ac fuses, unblock the MR contactor relay, remove the contact insulators and unblock the M relay.

CAUTION: Do not permit the power to remain on the MR contactor relay for more than one hour while it is blocked nonoperated.

3.7 Operating Requirements

3.71 Speed and Output Voltage

3.711 Machine speeds and output voltages will be checked during the test of the plant in Handbook 21.

3.72 Temperature

3.721 The following information is to be used in conjunction with plant tests in Handbook 21 if the temperature is thought to be excessive. The temperature rises of the various machine parts above any convenient ambient temperature, within the limits of 10C (50F) and 40C (104F) shall not exceed the following values.

	Max Temp. Rise Above Ambient KS-					
	5654-01	15520	15993	15994	15844	15949
Bearings	80C	80C	40C	40C	40C	40C
Commutators, brushes and brush holders		95C	85C	65C	65C	65C
Winding of dc motor			70C	70C	50C	50C
Winding of alternator			70C	50C	50C	50C
Winding of ac motor			50C	70C	50C	50C
Winding of exciter			50C		50C	
Solenoids, transformer windings and cores					55C	55C
Windings and frame	90C	90C				
Frames, cores and other parts in contact with insulation of:						
AC Motor			50C	70C	50C	50C
Exciter			50C		50C	50C
DC Motor			70C	70C	50C	50C
Alternator			70C	50C	50C	50C

3.722 Hold the bulb of the thermometer against the hottest spot on the surface to be measured. Cover that part of the bulb not in contact with the surface with a piece of felt, or the equivalent.

3.723 If the temperature of the commutator and brushes exceeds the specified limits see that requirements in Paragraph 4.22 are met. If these requirements are met and the temperature is still above the specified limit, with the nameplate rated voltage not exceeded, report the condition as the coil or contacts may have to be replaced.

4. CONTROLLERS

4.1 Mounting and Fastening

4.11 Controllers and associated relays shall be securely mounted and fastened. Tighten loose nuts or screws as necessary.

4.12 If parts on a relay cannot be readily fastened or secured, replace the relay.

TABLE 1

RELAY MECHANICAL REQUIREMENTS (FIGURES 2 AND 3)

KS No.	Relay	Minimum Contact Pressure (Note 1)	Minimum Contact Gaps						Contact Follow				Operated Magnetic Gap	
			Main		Auxiliary				Main		NO Auxiliary			
			Inches	Adjust Par.	NO		NC		Inches	Adjust Par.	Inches Min.	Adjust	Inches Max.	Adjust
					Inches	Adjust	Inches	Adjust						
5647	AC1 AC2, LC AR SR1, SR2	10 oz. 3 lbs. Note 2 Note 2	1/2 11/16 0.025	4.241 " 4.242	ADJUST PER PARAGRAPH 4.243	5/32	ADJUST PER PARAGRAPH 4.244	Min. 1/32 Nom. 1/16 Note 4	4.245 " "	3/64	ADJUST PER PARAGRAPH 4.246	0.140 (9/64)	ADJUST PER PARAGRAPH 4.247	
15582 List 4	AC1, AC2 LC AR SR1, SR2	5 lbs. 5-1/2 lbs. 5 lbs. Note 2	3/4 3/4 1/4 0.025	1/2 1/2				3/16	Note 4 "			3/16		
15582 Lists 5, 6	AC1, AC2 AC3, LC AR SR1, SR2, SR3	5 lbs. 5-1/2 lbs. 5 lbs. Note 2	7/8 3/4 1/4 0.025	Note 3 Note 3 Note 3 4.242				1/2 1/2	3/16	Note 4 "				3/16
15821	AC1 AC2, LC SR1, SR2	10 oz. 3 lbs. Note 2	1/2 11/16 0.025	4.241 " 4.242				1/16	Nom. 1/16 "	4.245 "		3/64		0.190 (3/16)

NOTE 1: Except for SR relays contact pressures are not adjustable. Pressures fall below minimum values due to excessive wear or failing or weakening of the spring. Replace contacts and spring if pressure is below minimum.

NOTE 2: These relays have no specified contact pressure. Pressure must be sufficient to prevent excessive contact heating or buildup. See Paragraph 4.242 for readjustment of SR relay contact pressure.

NOTE 3: These contact gaps are not adjustable. If gaps are less than minimum value inspect relay for obstructions that prevent complete release of the armature.

NOTE 4: Contact follow is not adjustable on these relays. Replace the relay if follow is insufficient.

4.2 Relays

4.21 Freedom of Movement

4.211 Relay armatures shall operate freely without binding. Operate relays manually for this check. Be sure relays or controls are disconnected from the power source.

4.212 Remove dirt or other obstructions that prevent the armature from operating freely.

4.22 Contact Surfaces

4.221 Contact surfaces shall be free of gummy substances, oil, dirt, and buildups which might interfere with reliable contact. It is not necessary nor desirable to keep contacts polished or shining.

4.222 Clean surfaces with R-3429 Trichloroethane. Pour about an ounce of liquid into a small container. Do not use dirty or contaminated trichloroethane and discard it as soon as it appears dirty. Dip hairs of a clean KS-14208 brush full length into the liquid, wipe brush against edge of container, open the contacts and brush both surfaces of the contact pair with the moist brush. After surfaces dry, brush them with a clean dry KS-14208 brush.

4.223 If the trichloroethane does not clean satisfactorily, insert a piece of R-3163 Abrasive Paper between contacts, hold contacts closed and draw the abrasive paper back and forth to remove any foreign material.

4.224 Replace contacts that have pits or buildups preventing reliable contact.

4.23 Mechanical Requirements

4.231 The relays shall meet mechanical requirements in Circuit Requirement Tables. If no requirements are specified, use the values in Table 1.

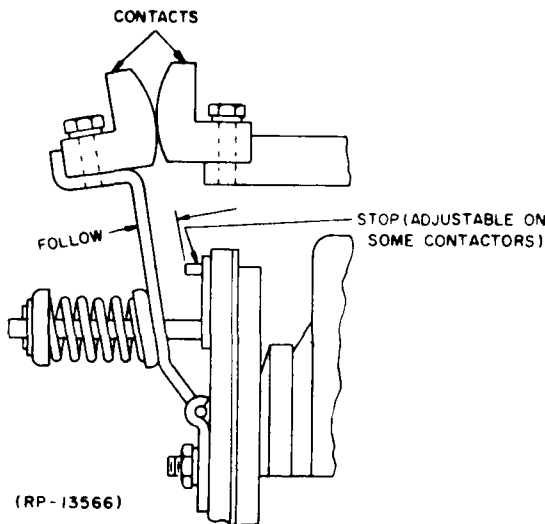


FIG. 2 FOLLOW OF MAIN CONTACTS

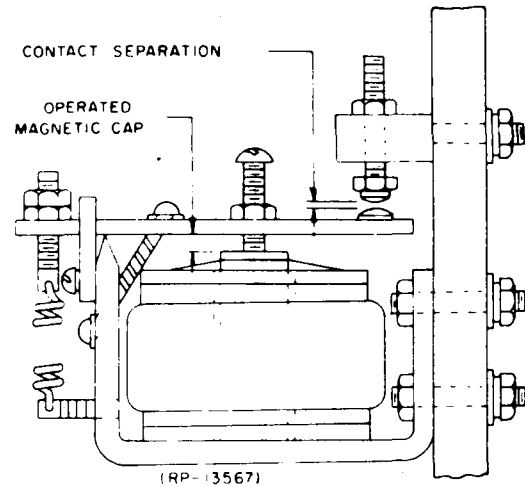


FIG. 3 SR RELAY SHOWN IN OPERATED POSITION

4.232 To measure main contact pressure of AC, AR or LC relays, pass a loop of cord around the head of the bolt which attaches the moving contact to its support. Place the hook of the Spring Balance in this loop, hold the relay operated manually and exert a pressure away from the stationary contact. Read the balance as the moving contact leaves the stationary contact.

4.24 Mechanical Readjustments

4.241 Readjust main contact gap by turning the stop screw provided on the relay armature. This adjustment affects the follow which should be rechecked.

4.242 Contact pressure of SR relays depends on the tension in the armature spring. If pressure appears to be insufficient, readjust the contact gap toward the minimum and increase tension of the armature spring. See Figure 3.

4.243 To adjust NO auxiliary contact gaps, loosen the nuts holding the stationary contact on the panel, turn the nuts along the stud as desired and tighten securely.

4.244 To adjust NC auxiliary contact gaps, loosen the nuts holding the stud on the armature, turn the nuts along the stud as desired and tighten securely.

4.245 Readjust main contact follow by moving the adjustable stop screw provided on the relay armature. This adjustment affects the contact gap, which should be rechecked. See Figure 2.

4.246 Follow of NO auxiliary contacts on AC and LC relays is adjusted by loosening the mounting nuts holding the stationary contact post in the panel and moving the post to the desired position. Then tighten the nuts securely.

4.247 To readjust operated magnetic gap on this relay, turn the adjusting screw projecting through the armature. The adjusting screw is locked by a nut. Any readjustment of this screw affects contact gap and pressure, both of which should be rechecked and readjusted, if necessary.

4.25 Electrical Requirements

4.251 Relays shall meet electrical requirements specified in circuit requirements table or other job information. These tests may be made at the temperature at which the relay is found unless H (hot) or C (cold) is specified in the table. For explanation of C or H refer to the section in this handbook on relays

and contactors. If the relays are not listed in Circuit Requirement tables they shall meet the electrical requirements in Table 2. Use ITE-4040 DC Adjusting Set. The OL relay does not require testing.

TABLE 2

ELECTRICAL REQUIREMENTS

<u>Controller</u>	<u>Relay</u>	<u>Min. Operate Voltage</u>
KS-5647	AC1, AC2	125
	LC	20
KS-15582	AC, LC	20
KS-15821	AC1, AC2	125
	LC	102

→ Arrowed lines indicate new or changed information

[Vertical lines at side of paragraphs indicates requirements.

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Reason for Reissue:

- (1) To add information on KS-15993 and KS-15994 motor-alternators.
- (2) To remove information on KS-15626 and KS-15823 motor-alternators which are M.D.
- (3) To remove information on KS-5755 and KS-15868 motor controllers which are not associated with motor-alternators covered in this section.

Replaces Section 4 dated 4-20-61.