ALTERNATORS
COMMERCIAL TYPE
OPERATING METHODS

1. GENERAL

1.01 This section describes the method of operating commercial-type alternators, KS-5245, KS-5245-01, KS-5245-02, KS-5296, KS-5296-01, KS-5467, KS-5518, KS-5550, and KS-5550-01. It also outlines general troubles which may be encountered in the operation of these machines.

1.02 It is reissued to include additional information on general and parallel machine operation. Significant changes are marked with arrows.

1.03 In offices having motor generator sets of various sizes which may be connected manually to the alternator in emergencies, or during periods of routine test runs of the alternator, it is important to recognize that the alternator may not be of sufficient size (KVA capacity) to start the sets in normal routine; namely, from the smallest to the largest set. Just prior to a test run under load, or in an emergency, stop all motor generator sets by the usual method of removing the commercial supply. It is then considered a preferable practice to start the largest motor-generator set (or motor if the building equipment is connected) required for the load; and following it with the successively smaller sets in the order of their load capacity. In the event an increase in load requires the starting of a larger motor-generator set, unless sufficient alternators are operating in parallel to give the necessary KVA capacity, all motor-generator sets, or as many as feasible, should be shut down and the starting procedure repeated beginning with the largest set. This usually does not apply where either the reserve alternators or the charging motor-generator sets are started automatically.

1.04 KS-5550-01 machines are designed for parallel operation under full automatic speed and voltage control. KS-5550 machines may be operated in parallel with KS-5550-01 or other KS-5550 machines under automatic control but with manual adjustment of the KS-5550 machine voltage occasionally as the load changes. Recommendations herein on parallel operation refer to KS-5550 machines, KS-5550-01 machines or a combination of the two. Instructions for parallel operation of more recent engine-alternator sets are furnished with the sets and such sets should be paralleled only as discussed in the engine section or as directed by the supervisor. In general such alternators would have their voltage regulators disconnected. They would be started at the same speed if of the same number of poles; wattmeters, voltmeters and ammeters if not already in the output of each machine would be added; and these meters observed frequently to be sure neither KW or KVA rating of either machine were exceeded. Any three phase machines operated in parallel must be connected for the same phase rotation as outlined in the apparatus requirements and adjusting procedure section.

2. OPERATION

Preparation for Starting

2.01 Before starting, make a general inspection to insure that nothing is in or on the alternator or the exciter which will interfere with the operation.

2.02 Check the oil level in the bearing chambers and add oil if necessary.

2.03 See that the alternator field switch, if provided, is in the fully open position on KS-5245, KS-5245-01, KS-5245-02, KS-5296, and KS-5296-01 machines. The alternator field switch, if provided, on KS-5550 and KS-5550-01 machines should be closed. Some KS-5467 and KS-5518 machines have no alternator field switch but, if provided, they should be in the closed position.

2.04 See that the alternator field rheostat, and also the exciter field rheostat when provided, are set on their marked positions.

2.05 For automatic voltage control see that the voltage regulator disconnect switch and the regulator reversing switches of the KS-5245, KS-5245-01, KS-5245-02, KS-5296, and KS-5296-01 machines are closed. On other machines, where provided, the regulator switch should be thrown to the "ON" position.

2.06 For manual voltage control see that the voltage regulator disconnect switch is open on KS-5245, KS-5245-01, KS-5245-02, KS-5296, and KS-5296-01 machines. On other machines, where provided, the regulator switch should be in the "OFF" position. Some KS-5467 and KS-5518 machines have no provision for disconnecting the regulator without removing connections. Manual voltage control should be used only if automatic control is inoperative.

MACHINES OPERATING SINGLY

Starting

2.07 See that all switches connecting the alternator to any load are open.

2,08 See that the compensating rheostat of the voltage regulator is in the all out position. (KS-5550-01 only).

2.09 Start the driving agent in the usual manner.

2.10 Examine the oil rings and see that they are delivering oil to the shaft and the bearings.

2.11 Close the alternator field switch (if open).

2.12 Close the circuit breaker or line switch and apply the load gradually.

Running

2.13 To raise the voltage of the load, adjust the voltage adjusting rheostat.

→ 2.14 Observe the bearings occasionally for evidence of overheating.

2.15 If when running with automatic voltage control it becomes necessary, or desirable, to take the regulator out of service, proceed as follows:

If the voltage is low, gradually cut out the resistance of the exciter field rheostat (increase voltage) until the regulator ceases to operate, as will be indicated by failure to hold the voltage at a fixed point. During this procedure the voltmeter should be watched to see that the alternator voltage does not rise excessively. If the voltage is high, open the voltage regulator disconnect switches, if provided, (KS-5245, KS-5245-01, KS-5245-02, KS-5296, and KS-5296-01 machines) or throw the regulator switch to the "OFF" position (KS-5550 and KS-5550-01 machines). Some other machines (KS-5467 and KS-5518) may have no regulator switch and in this case → regulator connections can only be removed → with the machine stopped.

Stopping

2.16 Remove the load.

2.17 Trip the circuit breaker or otherwise disconnect the alternator from the line.

2.18 Open the load switch.

2.19 Stop the driving agent in the usual manner.

2.20 Throw the reversing switches on the voltage regulator (when provided) to the opposite clips (KS-5245, KS-5245-01, KS-5245-02, KS-5296, and KS-5296-01 machines).

MACHINES OPERATING IN PARALLEL
(KS-5550 and KS-5550-01 only)

Starting

2.21 See that all switches connecting the alternators to any load are open. Should one of the machines to be paralleled have a load, it should be removed so that paralleling may be done with the machines unloaded.

2.22 See that the alternator field switch is closed.

2.23 See that the alternator and exciter field rheostats are set on marked positions.

2.24 See that the compensating rheostats of the voltage regulator of KS-5550-01 machines are on marked position.

2.25 Start the driving agent in the usual manner.

2.26 Examine the oil rings and see that they are delivering oil to the shaft and bearings.

2.27 Check the engine speeds of the two machines being paralleled and see that they are operating at as near the same speed as possible.

2.28 Adjust the alternator voltage of the machine being added by means of the voltage regulator adjusting rheostat until the voltage of the alternator is the same as that of the machine with which it is to be paralleled.

2.29 Open the field switch, close the circuit breaker and then immediately reclose the field switch in the order named as rapidly as possible. If the machine being added has no field switch, one will have to be provided if the machine is to be used in parallel operation. This momentary opening of the field switch, just before paralleling, puts a resistor across the alternator field to dissipate the field build-up; and allows the machine being added to be pulled into synchronism with the machine with which it is being paralleled. Field switches are required only for separate (battery) excitation or when connecting machines in parallel. Normally, if provided, the field switches may be left closed except when machines are being paralleled; and can be used as a convenient means of dumping the load quickly in an emergency such as an overload.

→ 2.30 Close the load switch, sometimes called transfer switch, and apply the load gradually.

Running

2.31 The load should be balanced so that each machine is carrying approximately

its proportional share of the load in amperes as based on machine nameplate rating; and so that no machine has a current of more than 10% in excess of its rating. Where KS-5550 machines are involved, this balancing of the load should be checked at infrequent intervals as the office load changes.

2.32 If, with the same speed and voltage adjusting rheostat adjustments as for no load, the various machine currents are not approximately proportional, turn the adjustment knob of the compensating rheostat of a KS-5550-01 machine or the voltage adjusting rheostat of a KS-5550 machine to obtain this condition. This is based on the assumption that the engines have similar load-speed characteristics. It is felt that the factory markings on the compensating rheostat of KS-5550-01 machines will usually be such that these conditions will be met without further adjustment.

2.33 To raise the voltage of the load, adjust equally the voltage adjusting rheostats of all sets operating.

2.34 Observe the bearings occasionally for evidence of overheating.

2.35 If when running with automatic voltage control it becomes necessary, or desirable, to take the regulator out of service, remove the machine from parallel operation and proceed as follows:

If the voltage is low, gradually cut out the resistance of the exciter field rheostat (increase voltage) until the regulator ceases to operate, as will be indicated by failure to hold the voltage at a fixed point. During this procedure the voltmeter should be watched to see that the alternator voltage does not rise excessively. After this, or if the voltage is high, throw the regulator switch to the "OFF" position.

2.36 If, when alternators A and B are operating in parallel and the combined load on both falls to say 90% of alternator A's rated capacity, alternator B may be dropped by operating its circuit breaker and leaving A to carry the load. Should this cause a momentary low voltage condition with the resulting tripping of motor circuit breakers, or transfers, alternator B should on future occasions be left in operation until a lower load (80-85% of A's rating) is reached. With care an experienced operator can transfer all, or the greater part, of the load from B to A by manual operation of the governor rod to reduce engine speed and the voltage adjusting rheostat of B. This usually eliminates the momentary low voltage condition with the resultant tripping of motor circuit breakers or transfers.

Stopping

2.37 Remove the load.

2.38 Trip the circuit breaker or otherwise disconnect the alternator from the line.

2.39 Open the load switch.

2.40 Stop the driving agent in the usual manner.

3. GENERAL TROUBLES

3.01 If a hot bearing develops remove the load from the machine but do not stop it. Stopping of a machine with a hot bearing, before the bearing is cooled, may result in the shaft freezing to the bearing lining.

3.02 When there is danger of the rotor striking the stator, the alternator shall be stopped regardless of the cause.

3.03 The following is a general list of troubles and their possible causes.

Trouble	Possible Cause
Overheating of Bearings. (See 3.01)	Insufficient oil. Oil rings not functioning. Rough bearing surface. Improper fitting, lining too tight. Bent alternator shaft. Improper grade of oil. Dirt or grit in oil.
Overheating of Alternator Windings.	Overload. Clogged ventilating passages. Short-circuited or grounded windings.
Excessive noise and vibration.	Loose bolts or nuts. Worn bearings. Loose coupling. Bent shaft. Loose exciter commutator segments. Rough exciter commutator. Rough collector rings.
Spotted collector rings.	Corrosion of rings under brush when machine is at a standstill. Cast iron rings.
No Exciter Field.	Poor connections. Poor contact of brushes with commutator. Defective field circuit. Defective armature winding
Overheating of commutator.	Exciter overloaded. Excessive brush tension. Excessive sparking. Defective connections. Defective commutator insulation. Winding trouble.

Trouble	Possible Cause
Excessive sparking at the commutator.	Brushes not properly seated. Incorrect brush tension. Brushes too short. Incorrect brush setting or spacing. Oily or dirty commutator. Rough or pitted commutator.
	Defective windings such as open or short-circuited.
Overheating of exciter windings.	Overload. Short-circuited or grounded windings.