INDUCTION MOTORS
TWO AND THREE PHASE
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers apparatus requirements and adjusting procedures for induction motors per the following specifications:

KS-5007	KS-5137-02
KS-5123	KS-5137-03
KS-5123-01	KS-5396
KS-5123-02	KS-5396-01
KS-5123-03	KS-5396-02
KS-5123-04	KS-5442
KS-5137	KS-5668
KS-5137-01	KS-5668-01

CHARGE GEN → KS-5123-03
RINGING GEN → KS-5396-02
ALSO SEE 159-512-701

It may also be used for the motors for the 200-ampere, 65-volt sets manufactured by the Hertner Electric Company previous to the KS-5668 sets.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 Additional information necessary for the proper application of the requirements listed herein is covered in General Requirements and Definitions Section 020-010-711.

1.04 Requirements and associated procedures marked with a number sign (#) need not be checked by the installer unless it is thought that the requirement is not being met, or performance indicates that such a check is advisable.

1.05 Requirements and associated procedures marked with an asterisk (*) need not be checked during maintenance unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

1.06 Normal operation may be defined as a condition in which the motor is carrying any load from no load to full load with the power service within commerical limits.

1.07 The speed of these induction motors is fixed by the design and is not adjustable. At full load it will be approximately 3500, 1750, or 1167 rpm instead of the 3600, 1800, or 1200 rpm which may be found stamped on the nameplate.

2. REQUIREMENTS

2.01 Lubrication

Oil Ring Bearings

(a) Oil ring bearings shall be lubricated with 220-260 S100 oil. The oil level in the gauge shall be
Min. 1/2 full
Max. 3/4 full
Gauge by eye.

#(b) Except as covered in (c), the oil shall be replaced with fresh oil every 2 years.

#(c) In KS-5123 and KS-5137 type motors installed since the beginning of 1943 and still equipped with the original bearing linings, the oil shall be replaced with fresh oil annually.

(d) Oil rings shall turn and deliver oil to the shaft and bearings.

(e) Oil gauges shall be free from leaks, and glass gauges, where provided, shall be free from cracks.

(f) If dirt has entered a bearing chamber and heating is experienced or expected, the dirt shall be flushed out of the chamber with lubricating oil.

Waste-packed Bearings

(g) Waste-packed bearings shall be lubricated with six or seven drops

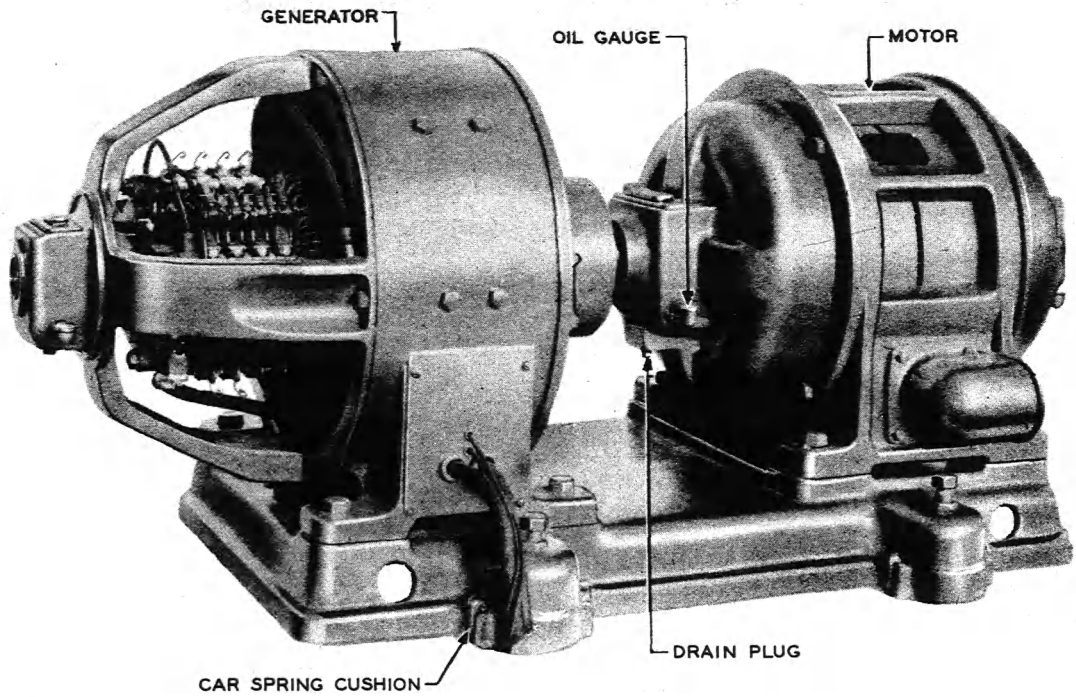

Fig. 1 - Motor-Generator Set - Oil Ring Type - 3-phase Motor Driving 300-ampere, 65-volt Generator

of 130-190 S100 oil at installation and every 3 months thereafter. Since operating conditions, including room temperature, vary widely, this interval or the amount of oil should be modified as required to obtain adequate, but not excessive, lubrication.

Ball Bearings

(h) Bearings equipped with grease pressure fittings and grease drain plugs shall be relubricated with 260-300P grease annually in service or after being dismantled. Normally, ball bearings shall not be lubricated when a machine is being put into service, but if it has been in storage for two or more years before being installed, they shall be lubricated.

#(i) Bearings not equipped with pressure fittings shall be relubricated with 260-300P grease every 3 years in service.

2.02 Capacity: The motor shall be capable of starting its associated generator under no load and of driving it under all normal operating conditions.

*#2.03 Bearings: The bearing linings or ball bearings shall be free from excessive wear. If the motor operates satisfactorily under all conditions of load and the other requirements of this section are met, the bearings may be considered to be in a satisfactory condition.

Note: Abnormal noise from a ball bearing is an indication of excessive wear.

#2.04 Air-gap: The air-gap at all points between the rotor and stator shall be
Minimum 0.005 inch
Use thickness gauge.

Note: A motor of one of the larger sizes, having an air-gap approaching the minimum, is likely to have excessive noise and vibration. See requirement 2.07.

2.05 Freedom of Rotating Parts: The motor rotor shall turn freely in its bearings. Gauge by feel.

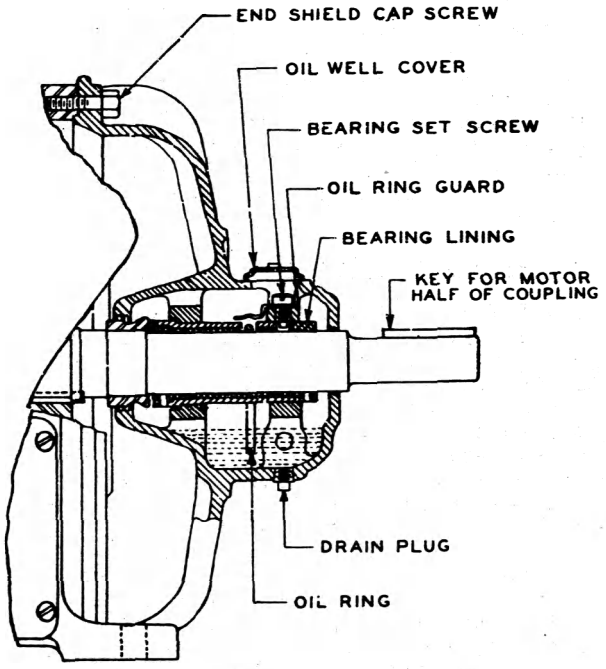

Fig. 2 - Oil Ring Type Bearing

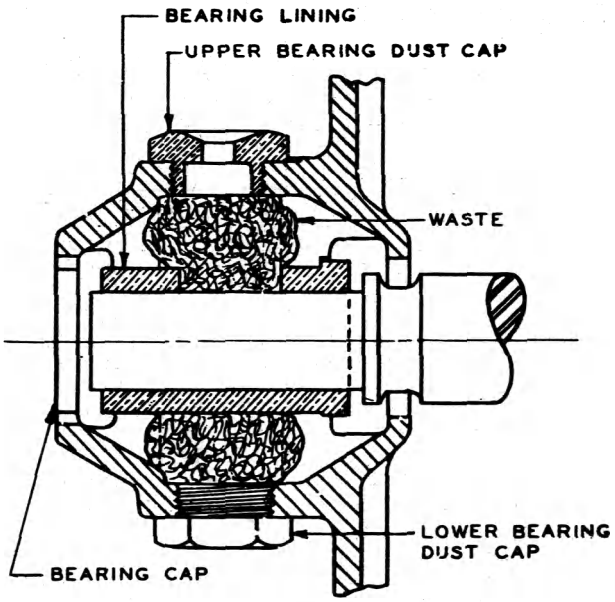

Fig. 3 - Waste-packed Bearing

*#2.06 End Play: The end play shall be sufficient to permit the armature to run freely, but shall not interfere with the proper operation of the motor or its associated generator.

2.07 Noise and Vibration: The noise and vibration of a motor under any normal operating condition shall not be excessive at any load from no load to full load. Gauge by sound and feel.

*#2.08 Temperature: The temperature shall not exceed the following:

	Maximum
Bearings	80C (176F)
Windings and frame	90C (194F)

If the temperature is thought to be excessive, measure with thermometer.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Materials (Equivalents may be substituted)

Tools

Brush, typewriter, toothbrush type
Oiler, Gem 1704, 1/2 pint
Gun, grease, push type, Lincoln No. 5958
Screwdriver, 3" cabinet
Stick, orange, KS-6320
Wrench, adjustable, single end, 8", R-2512
Wrenches, open end, double or single, with the following openings: 1/2", 19/32", 11/16", 7/8", 1-1/16", 1-7/16", and 1-5/8"

Gauges

Gauge-nest, thickness, KS-6909
Indicator, speed, Jones No. 5B or Hasler Style A
Scale, steel 6", R-8550
Thermometer, R-1032, Detail 1

Materials

Cleaning Cloth, KS-14666
Compound, sealing, KS-6824
Felt pad
Grease, 260-300P
Measure, 1 qt, funnel attached for adding oil to oil ring bearings)
Oil, 130-190 S100
Oil, 220-260 S100
Oil, KS-2245
Pail
Spirits, petroleum
Waste, yarn, wool

3.01 Lubrication (Rq.2.01)

Oil Ring Bearings

(1) To lubricate an oil ring bearing, with the motor stopped, pour the oil slowly into the bearing chamber until the proper level is indicated in the oil gauge. The oil should be poured slowly to permit the level to rise at the same rate in the gauge as in the bearing chamber. If the oil does not rise in the gauge, it is an indication that the passage to the gauge, or the vent in the top of a glass gauge, is blocked and should be cleaned. A small bare copper wire will be found advantageous in cleaning the passage. A quart measure with a funnel attached will be found convenient for adding the oil.

(2) To lubricate an oil ring bearing equipped with an oil gauge having a gasketed cover without provision for overflow, such as on the KS-5123-04 and the KS-5137-03 motors, stop the motor and add oil through the gauge until the proper level is indicated. For this purpose, use an oiler. Any spilled oil should be removed from the outside of the housing before the motor is started.

#(3) To replace the oil in an oil ring bearing, remove the drain plug in the bottom of the bearing chamber and drain the old oil into a pail or other receptacle. Clean the drain plug and associated threads in the casting, coat the threads of the plug with sealing compound, and replace plug.

Note: Particular care should be taken with a motor equipped with a drain plug so located that it does not normally drain the bottom of the chamber. To insure the removal of all the oil, tilt the entire set, or if this is not feasible, remove the end shield cap screws and rotate the end shield, as required, to drain the bearing chamber.

(4) If an oil ring is bent or damaged, it should be replaced.

(5) If an oil gauge leaks, the oil should be drained from the bearing chamber. If the leak occurs at the point where the gauge is screwed into the machine casting, the gauge should be removed, cleaned, the threads coated with sealing compound, and replaced. Replace a cracked glass.

(6) To flush a bearing chamber, drain out the old oil, replace the plug, fill the chamber with the regular lubricating oil, and run the motor for several minutes. Stop the motor, and when it has come to rest allow the oil to drain out. After the oil and dirt have been removed, replace the drain plug under the procedure given in (3) above and fill the chamber to the proper level with lubricating oil. See note under (3) above.

Waste-packed Bearings

(7) Before oiling a waste-packed bearing of the type equipped with an oil gauge, observe the amount of oil in the gauge and test for oil by pressing down on the waste with an orange stick. If oil appears on the orange stick and there is more than a trace of oil in the gauge, the lubrication has been excessive and the amount of oil should be reduced or the interval between oilings lengthened. If, on the other hand, no oil appears on the orange stick and there is no oil in the gauge, the lubrication has been inadequate and the amount of oil should be increased or the interval between oilings shortened. Adequate lubrication will lie between these extremes.

(8) Before oiling a waste-packed bearing of the type equipped with upper and lower dust caps, remove the lower cap, observe the condition of the waste at that point, and test the waste through the upper cap as in (7) above. If oil appears on the orange stick and more than a few drops run out of the bearing, the lubrication has been excessive, and the amount of oil should be reduced or the interval between oilings increased. If, on the other hand, the waste at the bottom of the bearing has little or no oil in it and the orange stick shows no oil, the lubrication has been less than adequate, and the amount of oil should be increased or the interval between oilings shortened. Adequate lubrication will be indicated by oil showing on the orange stick and the waste at the bottom of the bearing appearing to be well saturated. If the bearing runs dry, the waste next to the shaft may glaze. Any glazed waste should be replaced.

Ball Bearings

(9) Where the ball bearing housing is equipped with both a pressure fitting and a drain plug, proceed as follows with the machine stopped:

(a) Wipe off the pressure fitting with a clean cloth to avoid forcing dirt into the bearing chamber and place a pan under the drain hole to catch excess grease.

(b) Remove the drain plug and scoop out as much of the old grease from the drain hole as is possible to reach with an orange stick. This should remove old coagulated grease and permit pressure relief as the new grease is forced in.

(c) While pumping new grease into the pressure fitting, watch the drain hole and the shaft adjacent to the bearing housing carefully. Stop greasing when grease appears at the drain hole or if grease oozes out along the shaft before it appears at the drain hole. If grease does ooze along the shaft before it comes out the drain hole, remove the pressure fitting to relieve the grease pressure. With a clean cloth wipe off any grease that may have oozed along the shaft.

Note: In any case, do not pump more than one full gun (approximately 5 ounces) into the bearing chamber even if grease does not appear at the drain hole or shaft.

(d) Start and run the machine until hot. (This may take several hours.) This will expand the grease and force the excess grease out of the drain hole (or pressure fitting hole if this fitting was removed). After the grease has expanded fully and stopped coming out, stop the machine and scoop out as much grease from the drain hole (or pressure fitting hole) as is possible to reach with an orange stick. Replace the drain plug (and pressure fitting if removed).

(10) To relubricate a ball bearing not equipped with a pressure fitting, or in a motor which has been in storage or not operating for two or more years, dismantle as required for access and proceed in accordance with (11) below.

(11) To relubricate a ball bearing in a motor which has been dismantled, remove all grease from the accessible side with a clean cloth and an orange stick. Apply a few drops of KS-2245 oil and rotate the bearing a few times, if feasible, to assist the oil in working past the ball retainer. Apply the grease, filling the space between the ball rings. Fill the bearing chamber 1/3 full of grease.

3.02 Capacity (Rq.2.02)

If the motor gives evidence of difficulty in starting or driving its normal load, check for freedom of rotation of the set.

*#3.03 Bearings (Rq.2.03)

(1) Replace any worn bearings. To do this, it will be necessary to dismantle the set, in which case the matter should be referred to the supervisor.

(2) It is recommended that the replacement of bearing linings, particularly in the larger sizes, be done by the supplier's local service shop or a similar organization.

#3.04 Air-gap (Rq.2.04)

(1) With the rotor in any position, measure the air-gap between the rotor and stator with the thickness gauge. Particular care should be taken in measuring the air-gap in the lower half of the frame, as this is where it is most likely to be less than the allowable minimum. Turn the rotor approximately 1/4 of a revolution and repeat. Checks should be made with the rotor in at least four different positions. If the air-gap is less than the specified amount, it will be necessary to replace the bearings or bearing linings, in which case the matter should be referred to the supervisor.

3.05 Freedom of Rotating Parts (Rq.2.05)

(1) Examine the motor and driven equipment and remove any foreign objects which might interfere with rotation. Also check to see that all bolts are firm, and tighten, if necessary. Check for brushes binding or for worn bearings and adjust or replace, if necessary.

*#3.06 End Play (Rq.2.06)

(1) If the end play is excessive, it may be necessary to replace the bearings. See procedure 3.03.

3.07 Noise and Vibration (Rq.2.07)

(1) Where excessive noise and vibration are present, see that all holding-down bolts and coupling bolts are drawn up firmly. If this does not clear the trouble, refer to the supervisor as it may be necessary to check the alignment of the set.

(2) If the noise and vibration continue to be excessive after the above adjustments have been made, the trouble may be caused by worn bearings. If this is found to be the case, the bearings should be replaced. See procedure 3.03.

*#3.08 Temperature (Rq.2.08)

(1) The temperature of the bearings should be taken in one of two ways outlined below, with the machine running. One method (for bearings having oil rings) is to place the bulb of a thermometer in the lubricating oil of the bearing for at least 5 minutes, if the oil well opening is large enough to permit this, taking care that the thermometer does not strike the shaft or interfere with the proper operation of the oil ring. This method is to be preferred, but where the bearing construction makes it impractical, the second method may be used.

(2) The second method is to hold the bulb of the thermometer against the hottest spot on the outside of the bearing housing as near as possible to where the bearing is located, covering that part

of the bulb which is not in contact with the housing with a piece of felt or the equivalent, and observe the highest temperature indicated.

(3) The windings and machine frame may be measured for temperature in a similar manner, but with the motor stopped, if required for safety. If the temperature exceeds the specified limits, see that the other requirements of the section are met. If these requirements are met and the temperature is still outside the specified limits, refer the matter to the supervisor as the motor may have to be replaced.