MAINTENANCE INSTRUCTION MANUAL FOR ELECTROMAGNETS & CONTROL SYSTEMS

OHIO MAGNETICS, INC.
A SUBSIDIARY OF PEERLESS-WINSMITH, INC.

5400 DUNHAM ROAD
MAPLE HTS., OHI0 44137-3687

PHONE: (800) 486-6446
MAIN FAX: (216) 662-2911
ENGINEERING FAX: (216) 662-3118
SALES FAX: (216) 662-9526
E-MAIL (SALES): sales@ohiomagnetics.com
E-MAIL (ENGINEERING): engineering@ohiomagnetics.com
INTERNET: http://www.ohiomagnetics.com

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MAGNET SYSTEM SAFETY DATA SHEETS (SDS)

OHIO lifting magnets and *Stearns* separation magnets are designed in accordance with ASME B30.20 "Below- The-Hook Devices" Safety standards. Maintenance manuals for our products are typically included along with each product that we manufacture and ship. These manuals are also available online (see our web site www.ohiomagnetics.com). For build to order products or when special engineering is required, these manuals are typically emailed along with the certified for construction dimensional drawings. The proper handling of our equipment is required for Safe and Economical operation.

WARNING: FOR SAFE OPERATION OF EQUIPMENT, LIFTING AND SEPARATION MAGNET SYSTEMS MUST BE INSTALLED AND OPERATED BY FULLY TRAINED PERSONNEL ONLY.

Danger always exists when lifting devises such as magnets are used to handle and transport ferrous materials. Consult the product manual and always follow the Magnet Operation Rules concerning Do's and Don'ts.

Electrical Dangers exist.
Once power is applied to the magnet system, dangerously high voltages are present inside the components. Do not open enclosure doors or remove equipment covers while the power is ON. Make electrical connections and disconnections ONLY when power is OFF.

DANGER - HAZARDOUS VOLTAGE - placed on covers of the rectifiers and controllers, and inside of rectifiers (WILL CAUSE SEVERE SHOCK OR BURN).

Pacemaker warning.
This area is subject to a strong magnetic field. Anyone with a pacemaker should maintain a safe distance of at least 6 m or 20 feet away from the magnet.

WARNING: STRONG MAGNETIC FIELD

Projected tag for 2014 magnetic equipment.
(MAY BE HARMFUL TO PERSON WITH PACEMAKER)

APPLY FOR PERMANENT MAGNETS ONLY.
Extreme care should be used when transporting, installing and working around Permanent magnet since it has a powerful, permanently established magnetic field.
Assure that No two magnets come in close proximity to one another when handling, and prevent magnets from coming in close proximity to carbon steel or other magnetic steel.
Keep electronic devices, credit cards away from permanent magnets.

Thermal Danger exists.
Magnets and the individual components within the magnet system may be **Hot** to the touch causing injury from extreme heat. Always allow the equipment sufficient time to cool before inspecting or performing maintenance.

WARNING: HOT SURFACE (do not touch)

Projected tag for 2014 magnetic equipment design.
The temperature on the surface of the magnet and electrical equipment can be up to 105°C.

General warning sign –placed on the cover of the Rectifiers, Controllers, BBU.

The intent of these instructions is to act as a guide and notice of the dangers that may exist in, or around, a magnet system. It is the responsibility of the owner or the operator to properly post warning signs and adequately train all personnel in the safe operation of a magnet system.

MAGNET OPERATION RULES (DON'T & DO)

DON'T:

- ***NEVER ATTEMPT TO OPERATE THE MAGNET UNTIL YOU READ AND UNDERSTAND THE MAINTENANCE INSTRUCTION MANUAL***

- ***NEVER STAND NEAR LOAD.*** Any load can potentially drop unexpectedly due to power loss or some other system failure.

- ***NEVER LIFT LOADS OVER PEOPLE OR IN CLOSE PROXIMITY TO PEOPLE.***

- ***DO NOT USE THE MAGNET AS A BATTERING RAM.*** Remember, magnets are made for lifting only. They'll last for years when treated properly. Using a magnet as a battering ram may cause damage to the coils or insulation,

- ***DO NOT USE THE MAGNET AS A DROP BALL.*** If you want to break up big pieces of scrap or slag, use a drop ball. Careless use of a magnet means unnecessary repair bills, lost production and lost time.

- ***DO NOT GREASE THE CHAIN.*** If there are abrasive particles in the air, such as foundry sand or slag dust, the grease will cause it to adhere to it. This dust will then act like a grinding compound and soon wear away at the chain material. If there is no way around greasing the chain, use graphite grease only, just grease lightly and wipe of any excess.

- ***NEVER PERFORM MAINTENANCE ON ANY PORTION OF THE MAGNET SYSTEM WITHOUT INSURING THAT POWER HAS BEEN COMPLETELY TURNED OFF AND THE MAGNET HAS BEEN PROPERLY DISCHARGED.***

DO:

√ Keep the power "OFF "until magnet is in contact with the pile. Small pieces won't jump up and prevent the magnet from getting full load. This also helps to prevent the magnet from overheating. Remember, "a hot magnet will not lift as much and won't last as long".

√ Work on deep piles. Let the magnet settle on the deepest part of the pile. Then, switch the magnet "ON". To let the magnet get a good bite, leave the power on for approximately 3 s for magnets up to a 50 A, 5 s for magnets up to 100 A and 8 s from magnets larger than 100 A.

√ Make big piles. When you are almost done cleaning up your piles, use the magnet to "sweep up" the smaller piles that have been left, into one big pile. A good magnet operator will get the largest load possible on every lift.

√ Set the magnet down easy. Set your magnet down gently and you will save money on repairs, parts and time. Our magnets are built to withstand the gaff but don't handle them carelessly.

√ Keep the bolts tight. Check your bolt tightness periodically. Bolts can become stretched, allowing the center pole shoe to come away from the face of magnet core. This will cause reduced lift and a dangerous situation. The bolts can snap allowing the center pole shoe to fall off

√ Keep the magnet dry. When you are through with the magnet, story the magnet where it is dry. Leave it off the ground, on the pile of scrap, a pile of tires or on a pallet. Letting it cool off on the ground may cause it to absorb moisture. NEVER cool a magnet with water. Rapid cooling may cause the steel section or welds to crack.

√ Watch the magnet temperature Remember to monitor your duty cycle and voltage. If you are exceeding the recommended duty cycle of the design or voltage for the unit, the magnet will overheat. When handling hot slabs or ingots, watch the temperature carefully. If it gets too hot, switch to a spare magnet to finish the job. ***DO NOT LEAVE THE POWER ON WHEN THE MAGNET IS NOT IN USE.***

SECTION 0

SYSTEM INFORMATION

&

TROUBLESHOOTING

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SYSTEM DESCRIPTION

A complete control and power system necessary to operate an electromagnet consists of the following equipment:

1. DC Power supply.

2. Manual Magnetic Disconnect Switch or fused Manual Magnetic Disconnect Switch (optional).

3. Electromagnet Controller.

4. Control master switch or pushbutton station or low voltage master control.

5. Ground Indicator (optional).

6. Cable Reel.

7. Electromagnet.

The following is a brief description relating to the above components:

1. POWER SUPPLY

230~250 V dc is the standard system voltage required to operate an electromagnet. This power is either available through direct generation or by rectification of AC power.

A DC generator is normally used on portable type cranes where Trolley wires and AC power is not readily available. The DC generator can be driven by an auxiliary shaft from the main engine with pulleys and belts to obtain the proper speed. A complete engine driven generator is another common method of providing DC power for this application.

If 3 phase AC power is available, a silicon rectified power supply for magnet service with protective surge suppressors is the normal means of converting AC power to DC. Occasionally an AC motor driven DC generator (MG set) is used as a means of converting the power. Both methods are reliable and it is a matter of personal preference and economics as to which to select.

Instruments such as voltmeters and ammeters are available with these products. Other optional equipment such as remote operated AC contactors are also available.

2. MANUAL-MAGNETIC DISCONNECT SWITCH OR FUSED SWITCH

This equipment is normally used when branch circuit protection is required, and a single power source is used for more than one load.

The accessories available with AC rectified power supplies eliminates the need for separate disconnect switches of this type.

When the magnet system is the only load on the generator, the power cables are normally connected directly from the generator to the controller. When the code requires a power disconnect switch then a special magnet safety disconnect with an auxiliary power pole and discharge resistor must be used. Two sizes are available, one rated at 100 A and one at 200 A.

3. ELECTROMAGNET CONTROLLER

A special controller is required to turn the magnet "ON" and "OFF" to dissipate the stored inductive energy, and to provide the proper demagnetizing reverse current. The controller must be sized to suit the cold current rating of the magnet.

A pushbutton station, master switch or low voltage master control with "LIFT", "OFF" and "DROP" positions is required to operate the controller.

4. SYSTEM GROUND INDICATOR

A DC system ground indicator is applicable on those systems where the magnet is the primary load on the generator. It is a two light indicator whose intensity will change on the grounded line.

5. CABLE REEL

A spring operated cable reel will allow the magnet cable to "payout" and "retrieve" depending upon the motion of the crane. The spring assembly within the reel makes this action automatic as it maintains the proper tension on the cable at all times. There should be an excess amount of cable on the reel so that it cannot be completely de-reeled under normal operation.

The cable is two conductor, flexible, rubber covered and must be sized for the current rating of the magnet. The selection of the cable reel is a function of the size and amount of cable it must handle.

TROUBLESHOOTING

A malfunction can occur in any of the seven system components just described. Isolating the problem to the defective component must be achieved before the defect can be corrected.

Being familiar with the equipment, its rating, performance, operation and instructions is a must before value judgments can be made relative to the equipment in analyzing any problem that may develop. Keep a technical folder on the equipment of each crane. The information should include wiring diagrams, operating instructions, ratings, such as power (in watts), current (in amps), resistance (in ohms), lifting capacities and ground resistance and history and dates of prior problems.

STANDARD PERFORMANCE CHECK

When the system is first installed or known to be operating good, readings of the system should be made and recorded for future reference. Measure or record magnet resistance and ground resistance (check supplier's test records). Record DC voltage full load and no load; record current, initial and hot, etc.

SYSTEM TROUBLESHOOTING

The following guide assumes that the system includes a voltmeter and ammeter panel. Solution to both rectified and generated power supply is included:

ITEM	PROBLEM	DEFECTIVE AREA AND REMEDY
I	Low Voltage Low Current (Poor Lift)	A. General: 1. Excessive line loss – wiring too small. 2. Loose Connections. 3. Cable reel brushes worn. B. DC Generator: 1. Too small overloaded. 2. Low speed belt slipping or improper pulley ratio. 3. Adjust rheostat. C. Rectified Power Supply: 1. Low AC Voltage. 2. One AC Fuse blown. 3. Defective diodes. 4. Capacity too small, overloaded.

ITEM	PROBLEM	DEFECTIVE AREA AND REMEDY
II	No Voltage No Current (No Lift)	A. General: 1. Broken Wire or connection. 2. Cable reel brushes worn. B. DC Generator: 1. Worn brushes or broken spring. 2. Broken belts or drive coupling. 3. Open rheostat. 4. Open armature or field winding. 5. Loss of residual magnetism. C. Rectifier: 1. Push reset or "ON" button. 2. No AC Voltage. 3. Blown AC Fuses. 4. Defective AC contactor. 5. Defective diodes.
III	Low Voltage	System short circuit or low resistance: Check: 1. Short or ground in cable reel. 2. Malfunction of controller. Observe for proper opening and closing of devices. 3. Short or ground at the magnet. Check magnet terminals or coil for low resistance or low ground readings.
IV	High Voltage (Good Lift)	Check DC Generator for: 1. Rheostat adjustment. 2. Over speed excessive engine speed or improper pulley ratio.
V	Fluctuating Voltage or Excessive Voltage Drop from no load to full load	A. General 1. Same as Ia. B. DC Generator: 1. Too small, overloaded. 2. Engine too small.

ITEM	PROBLEM	DEFECTIVE AREA AND REMEDY
	(Poor Lift)	3. Engine compression poor, requires overhaul. 4. Engine governor defective. 5. Belts slipping, loose or insufficient quality.
VI	No DC Amperes DC Volts OK (No Lift)	A. Controllers: 1. Check master switch and Controller for operation.
		B. Cable Reel: 1. Check for worn-out brushes.
		C. Electromagnet: 1. Check for broken terminal connections. 2. Check magnet resistance for open.
		D. General: 1. Check power cables and connections from controller to cable reel and magnet. 2. Check ammeter.
VII	Low DC Amperes DC volts OK (Poor Lift)	A. General: 1. Defective ammeter or ammeter shunt
	(High condition.	B. Electromagnet: 1. Check magnet resistance for partially open resistance) and/or grounded 2. Check magnet terminals for high resistance connections.
VIII	High DC Amperes DC volts OK (Good Lift)	A. General: 1. Check for grounds and shorts the generator, controller and cable reel.

ITEM	PROBLEM	DEFECTIVE AREA AND REMEDY
		1. Check for low resistance. (Partly shorted) B. Electromagnet: coil and/or terminals.
		2. Check ground resistance from each terminal to ground for a short circuit to ground.
IX	Poor Lift Characteristics	A. General:
		1. Check voltmeter and ammeter for correct readings and isolate the problem with one of the above eight conditions.
X	Poor Drop Characteristics	A Controller:
		1. Check controller for malfunction in the drop circuit. Refer to factory instructions and section three.
		B. Electromagnet:
		1. Partly shorted and/or grounded coil. Refer to factory instructions and section one.
XI	Poor Lift Voltage OK Current High	A. Electromagnet:
		1. Check magnet for shorted turns.

SECTION 1

MAGNET INSPECTION & MAINTENANCE

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GENERAL MAGNET INFORMATION COMMON PROBLEMS

Magnets used on severe applications suffer from terrific mechanical abuse. The result can be cracked casting; outer pole, center pole or even the case; broken or loose bolts, worn chain or ears; completely worn center or outer pole; dented bottom plate; and broken center pole weld.

Under these conditions the coil will eventually fail and appear as a grounded, shorted, or open coil; or a combination thereof. A grounded coil usually happens because the magnet seal has broken, permitting water to enter and causing the trouble. Coils can also become grounded because mechanical shock breaks or cracks the insulation. Broken insulation can also permit adjacent coil layers to arc across, causing a shorted coil. Continued pounding on the bottom plate can loosen the layer insulation and permit individual coil layers to shift, usually resulting in an open coil.

Moisture is the greatest single factor in coil failure. Water will reduce the ground reading at elevated temperature; and, if it is not removed in time and dried out, a complete short to ground will result, requiring a rewind.

A defective magnet coil will cause malfunction of the controller and usually results in poor load drop characteristics. Other problems external of the magnet will also have the same effect; these are grounded magnet terminals, leads or cable reel. When this occurs on a system having a ground also on the generator side of the controller, the reverse current resistors on the controller will overheat and eventually burn out.

SERVICE FACTOR

Magnets are wound for 50% or 75% cycle operation which means they are suitable only for intermittent duty such as thirty seconds (30 s) on and thirty seconds (30 s) off for a 50% duty cycle magnet and ninety seconds (90 s) on and thirty seconds (30 s) off for a 75 % duty cycle magnet. A poor crane operator can easily cause a magnet to become overheated by energizing it more than its rated cycle. A hot magnet loses some lifting capacity and so it is doubly important to keep it cool. Overheating a magnet may not result in a burnout, but each time this occurs the coil life will be shortened by an amount dependent on the time and temperature.

OPERATING INSTRUCTIONS FOR HOT WORK MAGNETS

Limitations

Magnetic steels become nonmagnetic from temperatures above 500ºC ~ 600ºC depending on the type of steel. Material below these temperatures can be handled economically with magnets provided the following is considered.

Skin Effect Cooling

In the cooling process, material cools from the outside in. If the outside skin is below the magnetic temperature, and is only a thin area, and the inside is still above the magnetic temperature, the magnet may not be able to develop enough pull to lift the piece. Additional time to cool must be allowed until a thick enough skin of magnetic steel develops to allow the magnet to lift the part.

Magnet Heating

When a magnet is lifting hot material, it is being heated in three ways. First, due to its own coil heating because of current passing through the windings. Second, because of direct contact with the hot parts with the pole shoes by conduction. Third, by radiation given off by the hot material and absorbed by the magnet area in direct line with the hot part.

The second and third ways of heating the magnet add great amounts of heat quickly to the magnet especially when the temperature is above 400ºC.

Reduce Heating of Magnets

There are several ways to minimize heating of the magnets. Keep the magnet in contact with the hot material only as long as necessary to move the material. Only leave the magnet energized while lifting. When the magnet is not being used, do not leave it above the hot material. Do not set the magnet on a solid floor or ground. Do not try to cool in water. Do keep the magnet in the air. If placed to rest, use a frame or blocks to allow air to circulate under the magnet. Provide fans to increase cooling. A moving magnet stays much cooler than a stationary magnet.

Monitoring Magnet Temperature

The coil and leads are the items that must be kept cool, otherwise the magnet will fail in a short time. Average coil temperature can be monitored by monitoring magnet current. However, voltage must be fairly constant to get accurate results. A variance of ±11.5 V will give ± 5% accuracy plus the accuracy of the current reading. If the accuracy of the current reading is 2% then the total accuracy is _± 7%. If you wanted to insure that the temperature rise never exceeded 180ºC rise then the hot magnet resistance should never exceed 1.67 times the cold magnet resistance.

Other methods of monitoring coil temperature is by imbedded thermocouples or thermal switches in the coil, terminal box or outside of the case. Temperature coordination of the thermal device to the average coil temperature must be made.

Specific operating times for particular magnets are difficult to predict due to the many variables involved. If operations are repeatable, typical times can be determined by monitoring magnet resistance over a period of time. The smaller the magnet, the shorter time period. Magnets of any size and/or shape can be monitored over an eight hour (8 h) period with resistance taken every one to two hours. Resistance and ambient temperatures must be taken when the magnet is cold, that is at ambient temperature throughout the magnet. Resistance readings can be taken by measuring voltage at the magnet lead (this eliminates voltage drop through the cable reel and long leads) and current with accurate meters. The resistance can be calculated by dividing voltage by current. Also, direct magnet resistance with an accurate meter is suitable. The following table can be used to determine when magnet temperature is up to coil rated temperature:

Temperature Class	Resistance Ratio max R(hot) / R(@25ºC)	Average Coil Temperature Rise 25ºC Ambient
B	1.41	105ºC
F	1.50	130ºC
H	1.60	155ºC
C	1.70	180ºC

Because of some thermal overshoot, the magnet coil temperature is continuing increase in temperature for a short time after the magnet is removed from service. It is good idea for the magnet to be removed from service and allowed to cool before the rated temperature rise is reached. The overshoot can be minimized by following the suggestion in the "Reduce Heating of Magnets" section.

General

Overheating of magnet coils is a quick way to reduce the life of the magnet. A rule of thumb, often related by insulation manufacturers, is that for ever 10ºC over the temperature class rating, the insulation life will be reduced to half. It doesn't take too high of a temperature rise over rating to reduce magnet life to months or even weeks. At the cost to rewind magnets, the above methods to increase the life of magnets should pay for themselves in short order. Operator training, along with instrumentation or information, is necessary for efficient handling of hot material.

MAGNET INSPECTION

To determine the condition of the magnet, the resistance of the coil and insulation resistance to ground must be measured. To be meaningful these readings should be compared with figures obtained from the factory for your particular magnet at the ambient temperature in which it is operating.

It can take two days for the magnet to reach ambient temperature after the magnet has been taken out of service. Preliminary readings can be taken immediately, however, and this will indicate if the magnet is grounded, shorted or open. When readings are taken of a hot magnet, consideration must be given to the values for the heated condition.

The coil resistance should be within 5% of the original value when the magnet is at room temperature (25ºC). The resistance to ground on a new magnet at room temperature should be 10 MΩ or more. When the magnet is hot the coil resistance can increase to 70% of its value and the ground resistance can drop to 0.1 MΩ.

The procedure for making the readings are as follows:

1. Obtain a resistance bridge or meter with a10mΩ resistance accuracy, and a 500 V min. ground megger.
2. Unplug the cable reel leads from the magnet and inspect the magnet leads.
3. If the magnet leads are in good condition, then connect the meter to the ends of the leads for measurement purposes.
4. If the measurement indicates a faulty condition, then remove the leads from the terminals and measure directly at the terminals.
5. If the measurement at the terminals indicates a faulty condition, then the problem is interior of the box and could be the internal leads, the coil itself, or magnet terminals.
6. Refer to the terminal replacement instructions and remove the coil leads from the terminals at the interior of the terminal box.
7. Inspect the leads for burned condition and splice a new section if this appears to be the problem. Measure the coil and if it checks faulty, the magnet should be returned to the factory for further service.
8. Inspect the terminals and measure the resistance to ground on each one. If one checks or appears bad, replace both of them.

In addition to checking the coil, inspect the magnet for worn chain or chain pins; worn center pole shoe; loose center pole bolts; worn, broken, or cracked case; and loose outer pole bolts. The chain and center pole can be replaced in the field, but if problems with the magnet case are evident, the magnet should be returned to the factory for further inspection and service.

PERIODIC MAGNET INSPECTION

AND

MAINTENANCE

Check the general physical condition of the magnet making observations on the following:

1. Chain suspension for wear.
2. Center pole shoe for wear and tight bolts.
3. Casting outer pole shoe for wear and/or cracks.
4. Leads frayed or cut leads to be replaced.
5. Lead shield for tightness.

LEADS AND TERMINAL REPLACEMENT:

The procedure for replacing terminals varies depending upon the type of magnet being serviced. The following procedure specifically describes the OHIO WX or SR series of magnets. (Refer to 499A001A1 assembly Page 1.4.1), other OHIO magnets are similar:

Proceed as follows:

A. Lead assembly replacement:

1. Remove lead shield and lead clamp.
2. Remove rubber terminal boot and disconnect lead connector from terminal with a 3/4"- 19 mm open end wrench.
3. Be careful not to turn the terminal within the Assembly.
4. If damage occurs or is evident to the threads of the terminal stud, replace terminal assembly.
5. Install lead assembly tightening nut to the threaded stud. If replacement leads are not available; a temporary repair can be made by using substitute wire, either #4 - 25 mm² or #2 - 35 mm² rubber covered and reusing the existing terminal fittings. Be careful not to over tighten or cause terminal assembly to turn.
6. Insulate external terminal with rubber boot
7. Tighten the lead clamp using the rubber bushing for strain relief.
8. Tighten lead shield using the 5/16-18 NC hex head bolts.

B. Terminal Replacement:

1. Remove lead shield, lead clamp and leads as outlined above.
2. Remove both 3.5"- 90 mm pipe plugs.

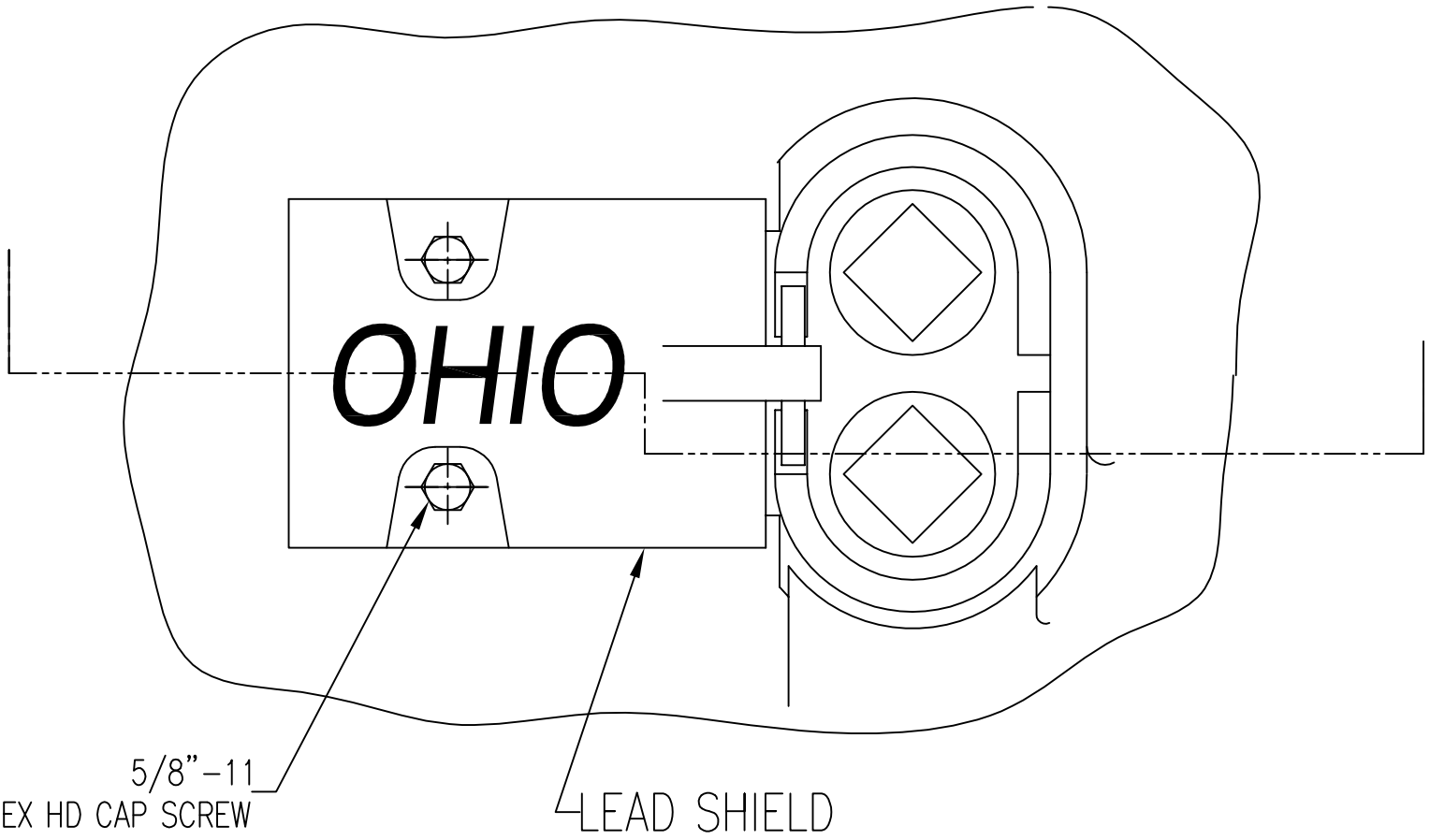
3. "Dig out" the compound from the box being careful not to cut the coil leads or damage the terminals.
4. Observe if compound is charred (black carbon type residue) at the leads or near terminal.
5 .If the leads are burned, but still within reach, splice with short length of wire using a KS-26 servit connector.
6. Remove all compound within reach and disconnect leads from terminal assembly.
7. Make a check of the coil resistance connecting directly to the leads. If the values indicate a faulty coil, replace pipe plugs, lead shield and clamps and return to the factory for further inspection. If coil checks good, continue with terminal replacement.
8. Remove terminals using a 3/4"-19 mm open end wrench to remove internal terminal nuts.
9. Remove all the loose pieces replacing with new parts. Be sure the silicon rubber sealing washer is on the external portion of the assembly. Tighten the brass nuts with ample force to prevent rotation of the terminal assembly. Tightness will be limited by the compression of the rubber sealing washer.
10. Assemble the KF-26 servit to the internal threaded stud and connect coil leads making sure there is physical separation between the wires.
11. Fill the terminal box with compound using A-950018-09 or A95001802 Kits (available in one and five US gallon (19 L) Kits). Follow instructions for mixing carefully.
12. Replace 3.5"-90 mm pipe plugs using pipe dope on the threads and tighten firmly.
13. Replace leads and lead shield per above.
14. Connecting to the cable reel leads makes the job complete.

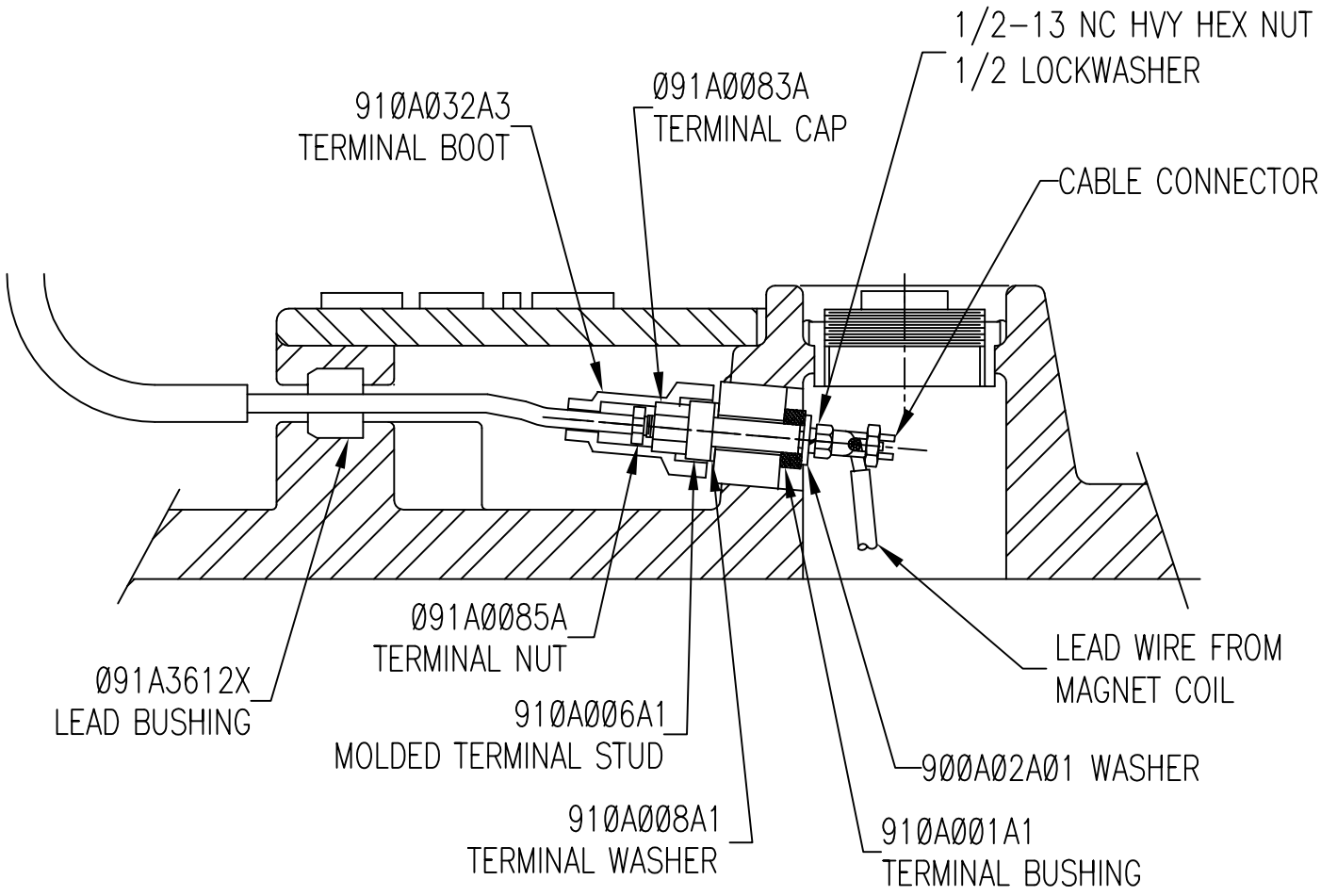
CHAIN REPLACEMENT:

Should the chain require replacement because of some accidental damage or due to normal wear replace as follows:

1. Burn off three retaining plates, one from each ear, or remove pin retainer as applicable.
2. Remove chain pins and chain using the crane hook.
3. Install new chain and chain pins. (Use new pins every time chain is replaced).
4. Weld the chain pin retainer plates to the side of the magnet chain ear, or install pin retainers.

The chain should be checked annually for wear. When any portion of the chain is worn 25% or more, it should be scheduled for replacement.





TERMINAL ASSEMBLY

FOR 910AØØ7A4 OR 910AØØ7A1

AVERAGE MAGNET RESISTANCE
(Cold Resistance 25°C Tolerance ± 5%)

SIZE	RESISTANCE (Ω)
20 POW-R-LITE (ø500)	64.4
25 POW-R-LITE (ø635)	23.0
30 POW-R-LITE (ø750)	15.5
34 POW-R-LITE (ø900)	12.1
40 POW-R-LITE (ø1000)	7.7
34 AWX (ø900 mm)	12.8
34 CWX	10.6
34 SRC	10.6
40 AWX (ø1000 mm)	8.0
40 CWX	8.0
40 SRDC	6.5
45 AWX (ø1100 mm)	5.9
45 DAWX	5.5
45 CWX	5.0
45 DAWX	5.3
47 AWL (ø1200 mm)	4.8
47 SRC	5.5
47 SRDA	5.2
47 SRDC	5.1
47 SREDC	4.7

SIZE	RESISTANCE (Ω)
48 LS (ø1200 mm)	5.5
55 AWX (ø1400 mm)	4.4
55 CWX	3.5
55 DAWX	4.0
55 DCWX	3.5
57 AWL (ø1500 mm)	4.1
57 SRC	3.4
57 SRDA	3.5
57 SRDC	3.2
57 SREDC	3.2
58 LS (ø1500 mm)	3.8
61 AWL (ø1600 mm)	2.8
65 SRC (ø1700 mm)	2.7
65 SRDA	2.7
65 SRDC	2.6
65 SREDC	3.0
66 AWL (ø1700 mm)	3.0
66 AWX	3.0
66 DAWX	2.8
66 CDX	2.2
66 DCWX	2.2
67 LS (ø1700 mm)	2.7
67 LS-X	2.7
69 SRDC (ø1800 mm)	1.9
69 SREDC	1.7

SIZE	RESISTANCE (Ω)
71 AWX (ø1800 mm)	2.4
71 DAWX	2.0
72 AWL (ø1800 mm)	2.1
76 DAWL (ø1900 mm)	1.9
77 DAWX (ø2000 mm)	1.7
77 DCWX	2.3
82 SRC (ø2100 mm)	2.3
82 SRDA	2.0
82 SRDC	1.9
82 SREDA	3.8
82 SREDC	1.9
82 SRSDC	1.6
83 DAWL (ø2100 mm)	1.6
83 AWX	1.5
83 DAWX	1.3
83 CWX	1.8
83 DCWX	1.3
93 DAWX (ø2400 mm)	1.5
93 DAWL	1.5

GROUND READINGS SHOULD BE ABOVE 100 kΩ WHEN MAGNET IS HOT.

HOT RESISTANCE MAY BE UP TO 70% HIGHER THAN COLD RESISTANCE.

WELDING INSTRUCTIONS FOR REPAIRING CRACKED MAGNET CASTINGS

Clean castings to determine the exact extent of the crack. Small racks can be welded without disassembling the magnet. Large cracks require magnet disassembly because the heating which accompanies the welding may harm the electrical insulation.

Bevel edges of material adjacent to the crack to approximately 75 % the thickness of the metal and at a 60 to 70° included angle. The beveling can be done by grinding on small cracks and thin sections or by the use of a carbon arc on large cracks and heavy sections.

Use a D C welder and set it on positive polarity. Use a high strength, low hydrogen, 6 mm (0.25 inch) rod, between 190375 A. Lay a stringer bead in the bottom of the vee. In this operation, hold the electrode vertical with the face of the work but inclined about 10° in the direction of travel. Be sure that both sides of the joint fuse with the weld metal. This may require a slight sideways motion of the electrode. Avoid overheating the base metal.

If the metal shows a tendency to drop off the electrode in globules, withdraw the electrode momentarily but not far enough to break the arc. After a short pause again lower the electrode and continue depositing weld metal. Repeat this procedure as frequently as necessary.

Upon completing the first pass, allow the metal to cool slowly. As the metal cools peen the weld metal with a peening hammer and a dull chisel to remove oxide, then with a wire brush remove loose oxide or other foreign matter. Lay other passes required to fill the vee.

Allow the metal to cool slowly. When the metal can be handled, grind out the underside of the weld, if practical, and fill the cavity with a stringer bead, one pass only. Grind this area flush.

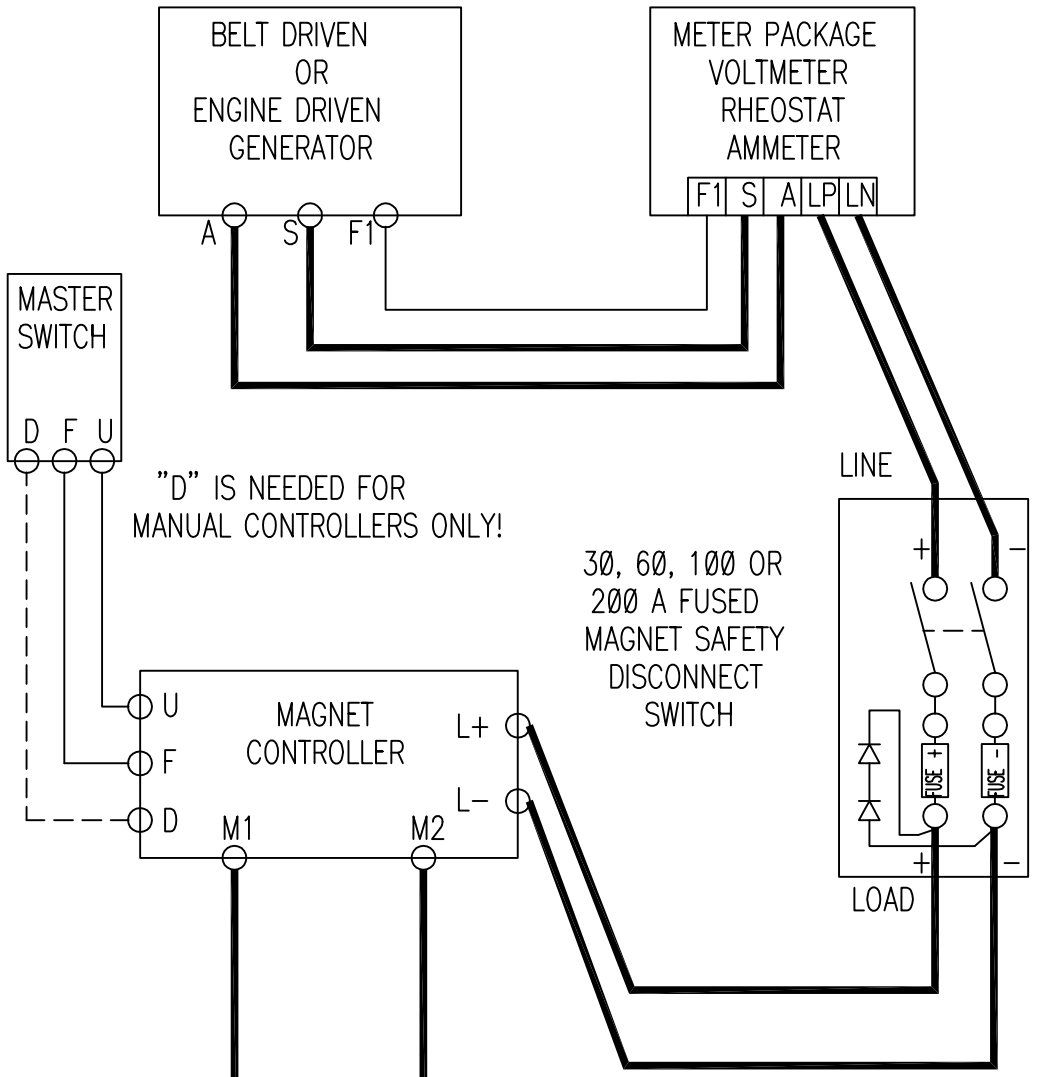
SECTION 2

SYSTEM CONNECTIONS & DETAILS

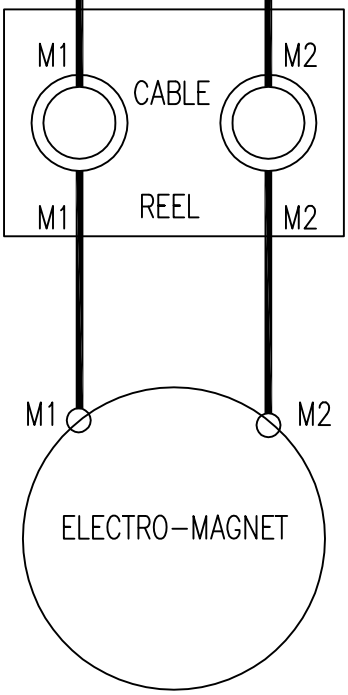
OHIO MAGNETICS, INC.
A SUBSIDIARY OF PEERLESS-WINSMITH, INC

5400 DUNHAM ROAD
MAPLE HTS., OHI0 44137-3687

PHONE: (800) 486-6446
MAIN FAX: (216) 662-2911
ENGINEERING FAX: (216) 662-3118
E-MAIL (SALES): sales@ohiomagnetics.com
E-MAIL (ENGINEERING): engineering@ohiomagnetics.com
INTERNET: http://www.ohiomagnetics.com



NOTE: FAST BLOW FUSES ONLY



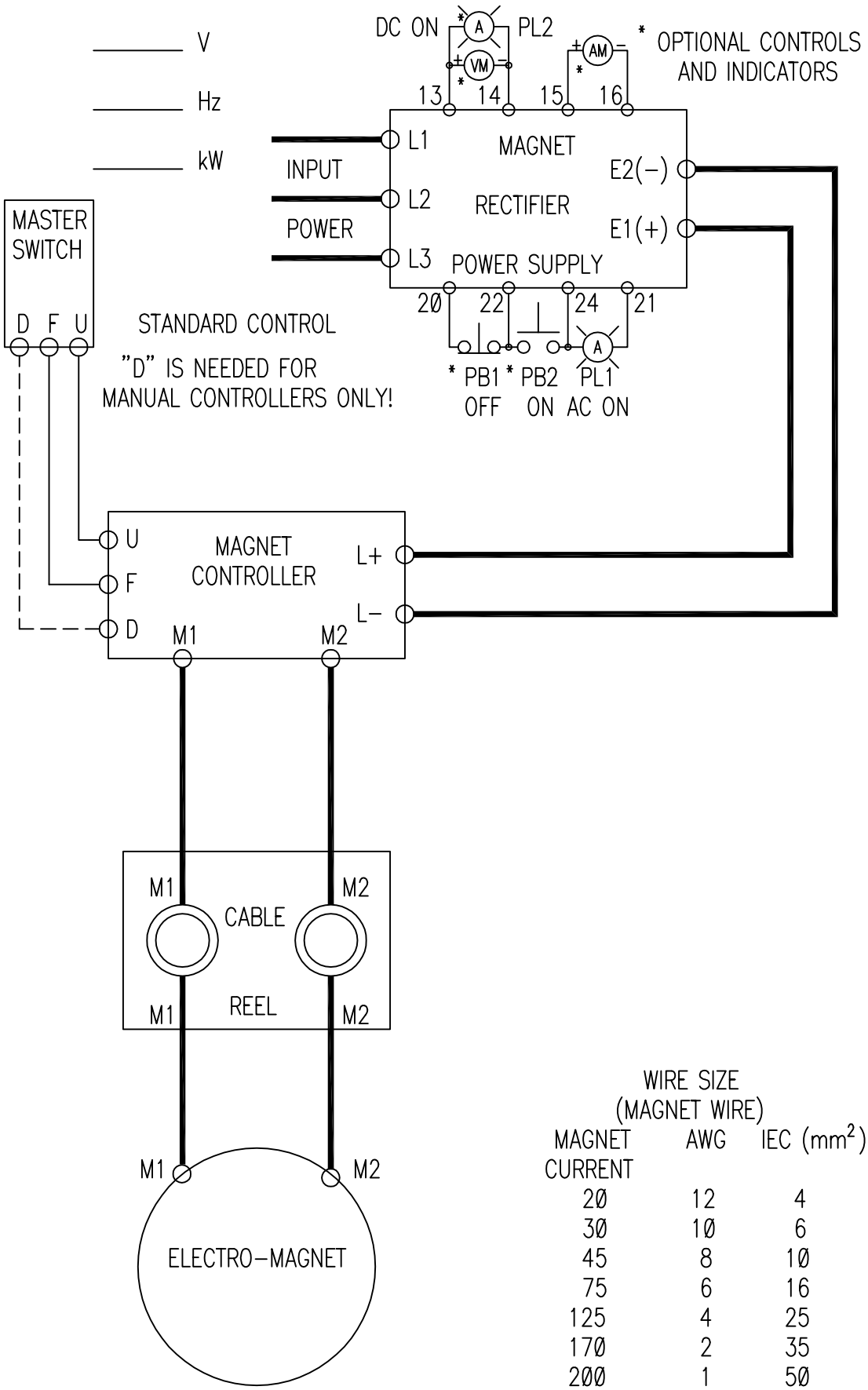
WIRE SIZE
(MAGNET WIRE)

MAGNET CURRENT	AWG	IEC (mm^2)
20	12	4
30	10	6
45	8	10
75	6	16
125	4	25
170	2	35
200	1	50
250	2/0	70
300	4/0	120
CONTROL	12	4

ELECTROMAGNET
PART: SYSTEM CONNECTION
REMARKS: BLOCK DIAGRAM
DRAWN BY: JPS DATE: 06 FEB 1991
CHECKED BY: SCALE:
PART NO: 50ØAØØ4A4

OHIO MAGNETICS, INC.
STEARNS MAGNETICS
SUBSIDIARY OF PEERLESS WINSMITH, INC.
MAPLE HEIGHTS, OHIO

02 DEC 1991	JPS	REVISED ER-3000-148
06 FEB 1991	JPS	REVISED ER-3000-131



WIRE SIZE
(MAGNET WIRE)

MAGNET CURRENT	AWG	IEC (mm^2)
20	12	4
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75	6	16
125	4	25
170	2	35
200	1	50
250	2/0	70
CONTROL	12	4

PART: ELECTROMAGNET SYSTEM CONNECTION
REMARKS: BLOCK DIAGRAM
DRAWN BY: JPS DATE: 06 FEB 1991
CHECKED BY: SCALE:
PART NO: 500A004B1

OHIO MAGNETICS, INC.
STEARNS MAGNETICS
SUBSIDIARY OF PEERLESS WINSMITH, INC.
MAPLE HEIGHTS, OHIO

05 FEB 2002	JPS	REVISED ER-3000-172
02 DEC 1994	JPS	REVISED ER-3000-148
06 FEB 1991	JPS	REVISED ER-3000-131

CRANE NO._____ DATE_____
MAGNET SIZE_____ MAGNET
MAGNET SR#_____ RESISTANCE_____

MAGNET

( ) LEADS:
( )Lead Shield tight
( )Lead in good condition
( )Terminals: good condi–tion, clean, tight

( ) CHAIN & CHAIN PINS:
( )Inspect for wear
( )Check pin retainers

( ) CASE:
( )Check for cracks
( )Check for minimum of 25 mm or 1" wear surface

( ) CENTER POLE:
( )Check C.P. bolts for tightness
( )Check shoe wearing sur–face (min 25 mm or 1")
( )Check for cracks

( ) COIL:
( )Resistance 100% cold to 170% hot
( )Ground resis–tance 100 Ω minimum

CONTROLLER

( ) CONDITION:
( )Contact tips
( )Arc shields
( )Coils
( )Pivot pins

( ) RESISTORS:
( )Open
( )Burned

( ) CONNECTIONS:
( )Tight

( ) DIRT:
( )Remove from Panel

( ) COVER:
( )Replace

( ) GROUND RESIS–TANCE:
( )Input terminals
( )Magnet terminals

( ) VOLTAGE:
( )No load
( )Full load

GENERATOR

( ) BRUSHES:
( )Wear
( )Tension
( )Arcing

( ) COMMUTATOR:
( )Wear
( )High bars

( ) BEARINGS:
( )Lubricate

( ) ACCESS COVERS:
( )Replace

( ) BELTS (PTO):
( )Wear
( )Tension

( ) RHEOSTAT:
( )Check for wear or damage
( )Adjust to develop 220–240 V full load

CABLE

( ) WIRE SIZE:
( )Adequate

( ) CONDITION:
( )Tape or splice worn or frayed portions

( ) FREE REELING:
( )To be free of knots and tangles

CABLE REELS

( ) BEARINGS:
( )Lubricate

( ) GEARS:
( )Greased

( ) SPRING:
( )Oil

( ) TENSION:
( )Proper tension

( ) BRUSHES & RINGS:
( )Wear

( ) INSULATION:
( )Brush holder
( )Slip rings

( ) COVERS:
( )Replace

INSTRUCTIONS:

Be careful when making measurements with portable instruments. To make resistance and ground readings, the power supply must be turned off.

To measure generator output voltage, connect meter leads to line terminals of the controller. Turn engine "on" and bring up to full speed. With the controller off read voltmeter for no–load condition. Now turn controller on the energize magnet and read voltmeter for full–load readings. Turn controller and power supply off before disconnecting meter leads.

Ohio Engineers are available to discuss any particular maintenance problems by calling 216/662–8484 or writing Ohio Magnetcs, 5400 Dunham Road, Maple Heights, Ohio 44137–3687.

SECTION 3

MAGNET CONTROLLER INFORMATION

OHIO MAGNETICS, INC.
A SUBSIDIARY OF PEERLESS-WINSMITH, INC

5400 DUNHAM ROAD
MAPLE HTS., OHI0 44137-3687

PHONE: (800) 486-6446
MAIN FAX: (216) 662-2911
ENGINEERING FAX: (216) 662-3118
SALES FAX: (216) 662-9526
E-MAIL (SALES): sales@ohiomagnetics.com
E-MAIL (ENGINEERING): engineering@ohiomagnetics.com
INTERNET: http://www.ohiomagnetics.com

GENERAL CONTROLLER INFORMATION

All electromagnet controllers serve the same functions of energizing and de-energizing the magnet. They dissipate the stored inductive energy in the magnet coil, apply a controlled amount of reverse current to demagnetize the magnet, and finally turn "off" completely the power to the magnet.

Although the basic functions are all common, the major manufacturers of magnet controllers use different circuitry and techniques to perform these functions. Each has its advantages and disadvantages and personal preference and economics usually dictates the selection of a specific product.

COMMON PROBLEMS

The following problems are common to all controllers and can be used as a guide in troubleshooting your magnet controller:

PROBLEM	PROBABLE REMEDY
Controller Does Not Operate	1. No or Low DC Voltage. Check power supply 2. Defective master switch on push button station. 3. Burned out or open operating coil. 4. Polarity reversed (L+ must be positive, L- must be negative).
Controller Operates No or Low Magnet Current	1. Main contact tips worn or burned out. 2. Contact tip spring broken. 3. Contact Shunt Burned or Broken. 4. Lift contactor armature not closing completely.
Controller Operates Load Dribbles From Magnet	1. Controller and Magnet not properly sized. 2. Partly Shorted Magnet. See Section 1. 3. Reverse circuit malfunction check components. 4. Polarity is reversed; CR defective and/or bypassed. 5. Diode DM1 open.
Excessive arcing of Main Contacts (Billowing Arc)	1. Open in discharge circuit. Check components, contacts & wiring 2. Diode DM1 open. 3. Polarity is reversed; CR defective and/or bypassed.

Excessive arcing of reverse contacts	1. Shorted reverse circuit resistors. 2. Contact tips worn, or contact spring bad.
Reverse contactor does not operate	1. Open reverse contactor coil or reverse circuit component. 2. Diode DM1 open. 3. Defect in pushbutton or Master Switch, for manual controllers only.
Lift & Drop come in together, Resistors overheat	1. Diode DM1 shorted.

CHECKING DIODES

On newer units employing diodes instead of the auxiliary contact, there is no maintenance required. However, should the operation of the drop cycle be faulty, the diode may be defective. The diode can be checked using a digital multi meter (DMM) with a diode check function. Refer to your meter operation manual on how to use this meter function. The diode can be checked in the following manner.

Make sure all power is off, then:

1. Disconnect the two (2) wires from the diode terminals, isolating the diode from the rest of the circuit.

2. Locate terminals 1, 2 and 3 on the diode. They are impressed to the diode molding.

3. Place the red lead of the DMM on terminal 1 and the black lead on terminal 2. The reading should be low. Reverse the leads and the reading should be high.

4. Place the red lead of the DMM on terminal 3 and the black on terminal 1. The reading should be low. Reverse the leads and the reading should be high.

5. If the readings are good then the diode is ok. If readings show a low reading or a high reading in both directions, then the diode is defective and should be replaced.

CDS CONTROLLER

Trouble Shooting

The most common difficulty experienced with magnet controllers is not primarily caused by the controller, but by a ground in the circuit outside the controller. A ground is a very low resistance reading between one of the lines and the framework of the crane.

Grounds usually occur at one of three places: 1) At the magnet; 2) At the cable reel; 3) At the generator. If a ground occurs at two of the above places then faulty operation of the controller results such as poor load drop of the magnet, delayed opening of the drop contactor, or overheating of the two outside resistors (R1 & R2) in the controller. Continued use of the controller under these conditions can burn up the resistors, or the drop contactor coil. When the grounds are cleared, and the difficulty persists, check the resistor and drop contactor coil.

If a poor load drop is experienced, and no grounds exist, then observe the operation of the controller. When the master lever is placed in the drop position the main contactor should open, and the drop contactor immediately closes and remains closed only long enough to drop the load. This is for 1 to 2 s on small magnets and 3 to 5 s on larger magnets. If the reverse contactor does not close then check the resistors, reverse contactor coil and replace burned out parts. If the reverse contactor stays closed too long then check for a shorted reverse contactor coil.

If the main contactor refuses to close, when the master is in the lift position, then check for broken wires between controller and master switch. Also check for burned out operating coil.

If the magnet is shorted, it will overheat and have a poor load drop with light material dribbling off, or heavy pieces clinging to the magnet. Have the magnet repaired if it is shorted or has a very low ground reading.

RD3A MAGNET CONTROL

MAINTENANCE INSTRUCTIONS

OPERATION:

The magnet controller is an important part of the system for furnishing DC power to the electromagnet. It provides the means for connecting and disconnecting the magnet to the power supply. The complete function of the control is as follows: 1) to apply full power to the magnet; 2) to safely dissipate the inductive energy of the magnet coil; 3) to apply reverse power to the magnet; and 4) to disconnect the magnet from the line.

Full voltage is applied from the power supply to the magnet through contactor "A" which is energized by the contacts of the master switch when the lever is in the "lift" position. On older units, Contactor "A" also has an auxiliary contact which opens when the main contacts close. This auxiliary contact opens the discharge circuit in the controller. On newer units, the controller utilizes a diode for this purpose. The discharge path includes resistor R5 which absorbs the inductive energy of the magnet coil when the lever master is turned to "OFF" position. The circuit prevents excessive arcing at the tips of "A" and "L" contactor. Then opening of "A" contacts applies reduced voltage to the magnet through Resistors R1 and R2 during the initial "OFF" phase of the drop cycle. This reduces the current to the magnet to about 60% of its normal value. Approximately one second (1 s) later, contactor "L" opens and the balance of the line voltage is removed from the magnet. The discharge circuit dissipates the remainder of the magnet current in resistor R5 at this time.

In order to achieve the time delay for the "L" contactor, a timing relay TR1 is used. The timer automatically "times out" when the master switch is moved from "lift" to "off". It is set for approximately 1.25 s and can be easily adjusted with a screwdriver for more or less time, to suit the application.

For the manual controller, unless the master switch is moved to the "drop" position, the load will begin to dribble off, and a partial load can be deposited by returning the master switch to the "lift" position. Full holding power will return to the magnet to retain the remaining load. To drop the entire load, the operator must move the lever to the "drop" position and keep it there until the load has dropped clean, at which time he releases the master switch handle and it automatically return to the "OFF" position. The automatic controller will completely drop the load when the master switch is placed in the "OFF" position. Time TR2 determines the time that the drop contactor stays closed and determines the amount of reverse current to the magnet.

In the "drop" position for the manual controller, or "OFF" position for the automatic controller, of the lever master, contactor "D" is energized which connects reverse voltage to the magnet through resistors R3 and R4, which reduces the line voltage to approximately 15% of its normal value. This is sufficient to neutralize the residual magnetism and provide a quick clean drop. In the manual operation, the operator must release the master switch at the moment all the load begins to fall; otherwise, the reverse voltage will retain a small residue of the load which will drop after the master switch is released. In automatic operation, this time is adjusted on TR2.

PERFORMANCE CHECK:

Check the voltage and ammeter for proper voltage and current levels. The voltage should be 230 V _ 10%. The current level will depend upon the operating temperature of the magnet; it should be between 70 to 100% of the cold current rating of the magnet. If the current level is below rating, and the line voltage is correct, then check the contact tips of contactor "A"; if they are worn and making poor contact, replace with new tips. If the current is still low, then check the magnet resistance with an ohmmeter. It should be between 100% and 135% of cold rating. If it is above or below these values, the magnet coil is either open, or shorted.

TROUBLE SHOOTING:

The following trouble shooting guide assumes that a DC Voltmeter and Ammeter panel is connected in the system:

ITEM	PROBLEM	SUGGESTED REMEDY
1.	No DC voltage Or Low DC voltage	Check Power supply for: a. AC input voltage b. Blown fuses c. Push reset button "ON" d. Defective AC contactor e. Defective rectifier diodes f. Defective surge suppressor
2.	No DC Amperes DC Volts O.K.	Check controller as follows: a. Operate master switch to "lift" all devices s should energize A,L, and TR 1. 230 V dc should be at M1 and M2 terminals. If not, check the devices and contact tips for wear. Replace as required. b. Check master switch contact tips. c. If 230 V dc is a M1 and M2 terminals, check cable reel, magnet lead connections and magnet for open.

3.	High DC Amperes	Check for short or ground at cable reel cable, magnet leads and magnet.
4.	Excessive Arcing of "A" or "L" Contacts	Check the following: a. Check R5 for open. b. Check R1 and R2 for open. c. Check per item 3 above. d. Check TR 1 for time delay. e. Check auxiliary contact on "A" for wear (older units) and Diode on newer units for open circuits.
5.	Poor load drop when master switchis in the "DROP"position	Ammeter should indicate 15 A maximum. If no current or excess current flows, check the following: a. Check R3 and R4 for open. b. Check contact tips on "D" for wear. c. Check master switch contact tip. d. Check timer TR 1 & TR 2 contact tips. e. Check "L" auxiliary contact tips. f. Check magnet for short or ground. g. Check for reversed polarity at L+ and L.
6.	Excessive Heating of Resistors	Check the following: a. Diode shorted.

OPERATING INSTRUCTIONS
ALL OTHER CONTROLLERS

The magnet controller is an important part of the system for furnishing DC power to the electromagnet. It provides the means for connecting and disconnecting the magnet to the power supply. The complete function of the control is as follows: 1) to apply full power to the magnet, 2) to safely dissipate the inductive energy of the magnet coil, 3) to apply reverse power to the magnet and 4) to disconnect the magnet from the line.

To activate this controller, a master switch or other control function is required with one control contact which must be maintained closed during the entire lifting mode. This contact must be opened to cause the controller to go through its automatic drop phase and release the magnet load.

The magnet control has three separate circuits to perform the required functions. During the "lift" phase, "L" contactor closes and establishes the lift circuit from L+ to L through the "L" closed contacts and energizing the magnet. Diode module DM1 or on older units the auxiliary contact of the "L" contactor is open during this time which disconnect the discharge circuit from the magnet.

To make a drop, the master switch control contact is opened which de-energizes the "L" contactor, opening the lift circuit thru the main contacts and simultaneously closing the auxiliary contact "L" (older units). On newer units, a Diode replaces the contact. It has a high resistance to current flow when in the lift state and low resistance to current flow in the discharge and drop state. This establishes the discharge circuit loop around the magnet. Within the discharge loop is a portion of the "D" (drop contactor) coil with terminals 2_4. This coil will energize and close the "D" contactor as the magnet current is being dissipated by the resistor in the discharge loop.

Closing of the "D" contacts will establish the reverse circuit which applies reduced voltage of the opposite polarity to the magnet thru the "D" contacts. Within this reverse circuit is another portion of the "D" coil with terminals 1_3. The current flowing in this circuit and "D" coil 1_3 aids in holding the "D" contactor closed. When the decay of the magnet discharge current reaches a low enough level, current will start to flow in the magnet from the line in the opposite direction. Current also reverses in direction in "D" coil 2_4 so that the polarity in both "D" coils are in opposition. As the current in the reverse circuit increases in value, a point will be reached when the fields of the two "D" coils will neutralize each other and the "D" contactor will open taking the magnet, off line.

This will be the point when sufficient reverse current will be flowing in the magnet to neutralize the magnet residual field and drop the load cleanly. The controller and magnet are now ready for another "lift" cycle.

Proper adjustment of the opening and closing of the main and auxiliary contacts (on older units) of the "L" contactor is important as excess contact arcing could result. The main contact gap should be about 20 mm (0.78") when open. The main contacts should be just opening as the auxiliary contact is about to close. On older units, the auxiliary contact gap opening of 1.5 mm (0.06") maximum at this point is acceptable. To adjust the auxiliary contact, loosen the "offset" pin retaining screw and rotate the operating pin until the above condition is reached. Tighten the screw and check the operation. For the new double contact drop assembly, unloosen the retaining nut locking the auxiliary arm stop screw. Adjust the stop screw to obtain the proper setting and tighten the locking nut.

SECTION 4

CABLE REEL MAINTENANCE

OHIO MAGNETICS, INC.
A SUBSIDIARY OF PEERLESS-WINSMITH, INC

5400 DUNHAM ROAD
MAPLE HTS., OHI0 44137-3687

PHONE: (800) 486-6446
MAIN FAX: (216) 662-2911
ENGINEERING FAX: (216) 662-3118
SALES FAX: (216) 662-9526
E-MAIL (SALES): sales@ohiomagnetics.com
E-MAIL (ENGINEERING): engineering@ohiomagnetics.com
INTERNET: http://www.ohiomagnetics.com

MAINTENANCE INSTRUCTIONS

GLEASON CABLE REEL

The operation of the reel is automatic. The spring assembly within the reel applies the proper amount of tension to reel up the entire amount of cable after it is pulled out by lowering the hoist to the full extent. There is an excess amount of cable on the reel so that it will not be completely de-reeled under normal operation.

Should the cable become frayed or damaged, it should be replaced or repaired. If the damage is near the magnet, cut off the bad section and splice on a new piece. If the cable is damaged halfway up the hoist, replace the entire cable.

Normally, cable will become worn near the magnet in which case the damaged piece can be removed and the magnet lead connector, 900B11A07, spliced back to the cable. Should the connector itself become damaged, it also should be replaced.

In general, there should be a minimum of two to three wraps of cable remaining on the reel when the cable is extended to where it touches the ground. Add sufficient new cable to the reel to meet this minimum requirement. When the upper half of the cable becomes worn or frayed, all the cable should be replaced. Measure new cable and install as follows:

I. Installation of Cable

Attach the inner end of the cable to the leads on the Reel and anchor the cable to the side of the spool with the cable clamp provided for this purpose. Wind the cable on the spool by turning the spool in the direction in which it turns free of spring tension. (A ratchet device permits the spool to turn free in one direction but winds the spring in the other direction).

II Tension Adjustment:

Remove small cover from spring housing. Insert a spanner wrench and rotate spring hub two revolutions clockwise. This will adjust spring to correct tension. Pull off cable to make sure spring will not wind tight.

III Grease and Lubrication:

Perform the following every three months:

1. Bearings:

Grease fittings are provided for the bearings, which should be lubricated with a light bearing grease every three months.

2. Gears:

The gears should be greased lightly every two to three months using a light bearing grease. If located in a dusty area, greasing should be kept to a minimum to prevent collecting of abrasive dust particles.

3. Springs:

To keep springs fully active, remove round head machine screw in spring housing and squirt 90 mL (3 oz) of Arctic Light Oil into spring housing. Never use grease.

SECTION 5

DC GENERATOR INFORMATION

OHIO MAGNETICS, INC.
A SUBSIDIARY OF PEERLESS-WINSMITH, INC

5400 DUNHAM ROAD
MAPLE HTS., OHI0 44137-3687

PHONE: (800) 486-6446
MAIN FAX: (216) 662-2911
ENGINEERING FAX: (216) 662-3118
E-MAIL (SALES): sales@ohiomagnetics.com
E-MAIL (ENGINEERING): engineering@ohiomagnetics.com
INTERNET: http://www.ohiomagnetics.com

OHIO
DC GENERATORS
FOR
MAGNET SERVICE

GENERAL:

A DC generator is an electromechanical devise designed to convert mechanical energy into DC electrical energy. It is available as a separate rotating device to be driven by an auxiliary shaft of the main engine of portable cranes. It is also available as a package unit complete with a gasoline or diesel engine.

Belt driven power takeoff generators must be operated at their rated speed in order to develop full rated voltage and power. For optimum performance the speed must be maintained within _ 50 r/min.

The generators are compound field wound units which are self regulating between zero and full load. The standard magnet generator is 230 V dc and is available in increments from 5 to 33 kW. This standard speed is 1800 r/min or the PTO units except the light weight 5, 8, and 10 kW units which are rated at 2500 r/min.

These generators are designed with extra thermal capacity to be able to withstand electromagnet service with ample safety factor. They are also mechanically rugged to resist shock and vibration present on portable cranes.

INSTALLATION OF P.T.O. UNITS:

Correct installation of the generator is essential to the proper operation and normal life expectancy of the unit. The following procedures and requirements should be observed:

1. Generator Speed:

   Pulley diameters between input and output must be correct in order to obtain rated generator speed when the engine is at normal running speed. Under no conditions should the generator run above 20 % over speed.

   Proper size and number of pulleys must be correct to drive the generator without slipping. Use pulleys for "C" size V-belts. Select the quantity of belts as follows:

POWER (kW)	NO. OF BELTS
5-7	1
8-13	2
14-32	3
33	4

Belt tension must be correct to prevent belt slippage. Excessive tension is not desirable and will result in high belt wear and possible bearing overload.

2. Alignment:

   Mount the generator on a flat surface whose plane is parallel to the axis of the drive shaft.

   Position the generator such that the two pulleys are in correct alignment for ideal belt tracking.

3. Direction of Rotation:

   The generator is fixed to rotate in one direction only. Normally it is shipped to rotate clockwise when viewed from the shaft end. It can be modified to rotate counterclockwise in the field. See instructions below.

4. Unobstructed Air Flow:

   Air circulation throughout the generator is required for proper cooling. No obstructions should be placed on either end of the generator that would obstruct the air flow.

ADJUSTMENTS FOR DIRECTION OF ROTATION:
(Excluding the 5 kW generator)

The generator is normally shipped for clockwise rotation. This is the direction the belts will rotate the generator shaft when viewed from the shaft end.

To check or change the adjustments, the two covers on the commutator end must be removed.

The following information is submitted should it be necessary to change the generator rotation.

If there is only a single position mark on the brush holder ring then the brush does not have to be shifted. If there are marks, proceed as described below: (Note: The brush holder ring may have to be rotated to see the second mark.)

TO CHANGE TO CLOCKWISE

The red mark on the brush holder ring will be in line with the edge of the aluminum housing.

Position the black mark in line with the edge of the housing, loosen the hex head screws (do not remove) holding the brush holder ring to the housing. Rotate the brush ring until the blue mark is in line with the edge of the aluminum housing. Retighten the hex head screws.

The armature and inter pole connections must be reversed in the generator junction box by connecting A2 and S2 together. Re-insulate these connections. Wires A1, S1, and F1 are to be connected to wires going to the meter rheostat box. Wires A1 and S1 are to be sized for the current rating of the generator and F1 to be #12 - 4 mm^2 wire. See the connection diagram page.

TO CHANGE TO COUNTERCLOCKWISE:

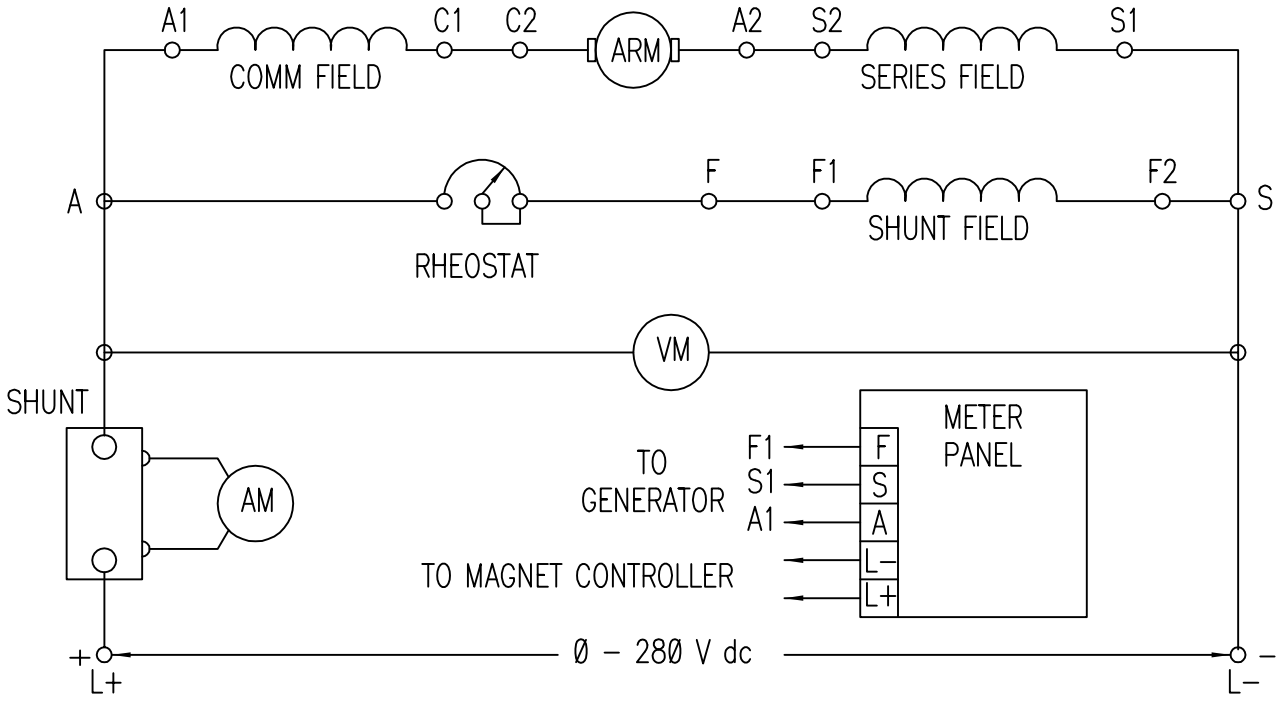
The black mark on the brush holder ring will be in line with the edge of the aluminum housing.

Position the red mark in line with edge of the housing, loosen the hex head screws (do not remove) holding the brush holder ring to the housing. Rotate the brush ring until the red mark is in line with the edge of the aluminum housing. Retighten the hex head screws.

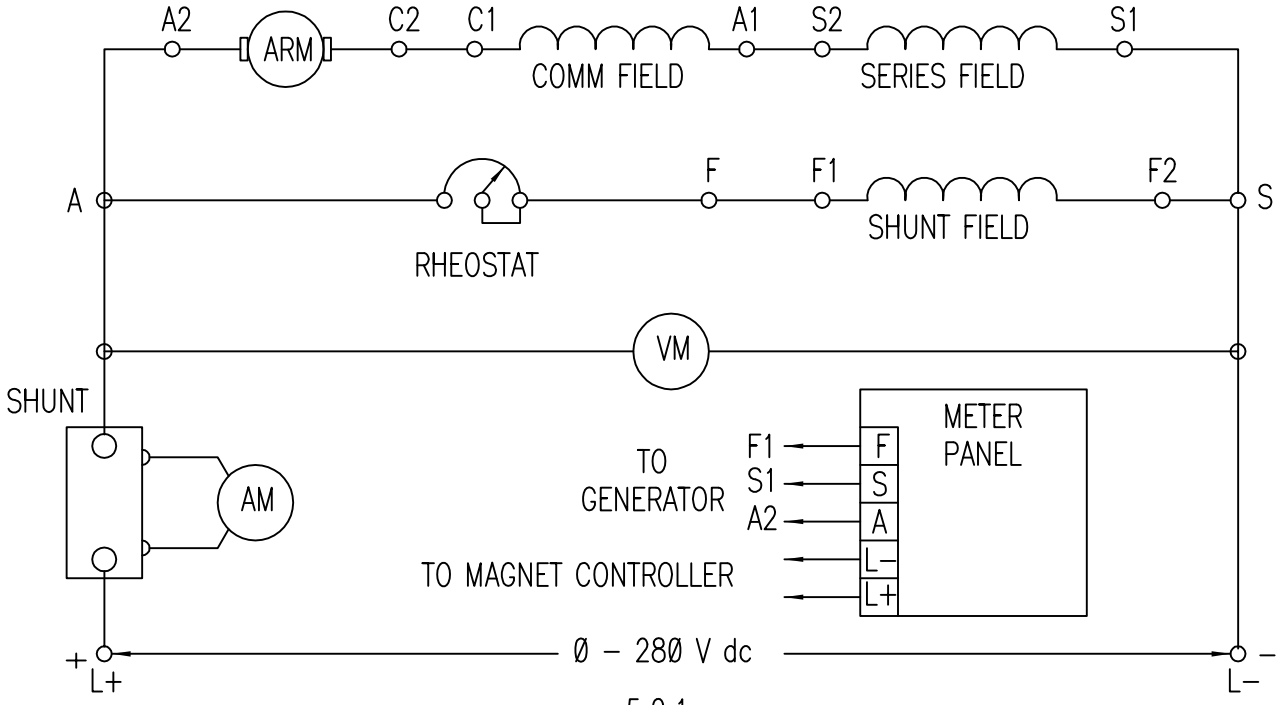
The armature and inter pole field connections must be reversed in the generator junction box by connecting A1 and S2 together. Re-insulate these connections. Wires A2, S1, and F1 are to be connected to the wires going to the meter-rheostat box. Wires A2 and S1 are to be sized for the current rating of the generator and F1 to be #12- 4 mm^2 wire. See connection diagram attached.

GENERATOR CONNECTION DIAGRAM
8 kW THRU 33 kW

CLOCKWISE ROTATION FACING SHAFT END

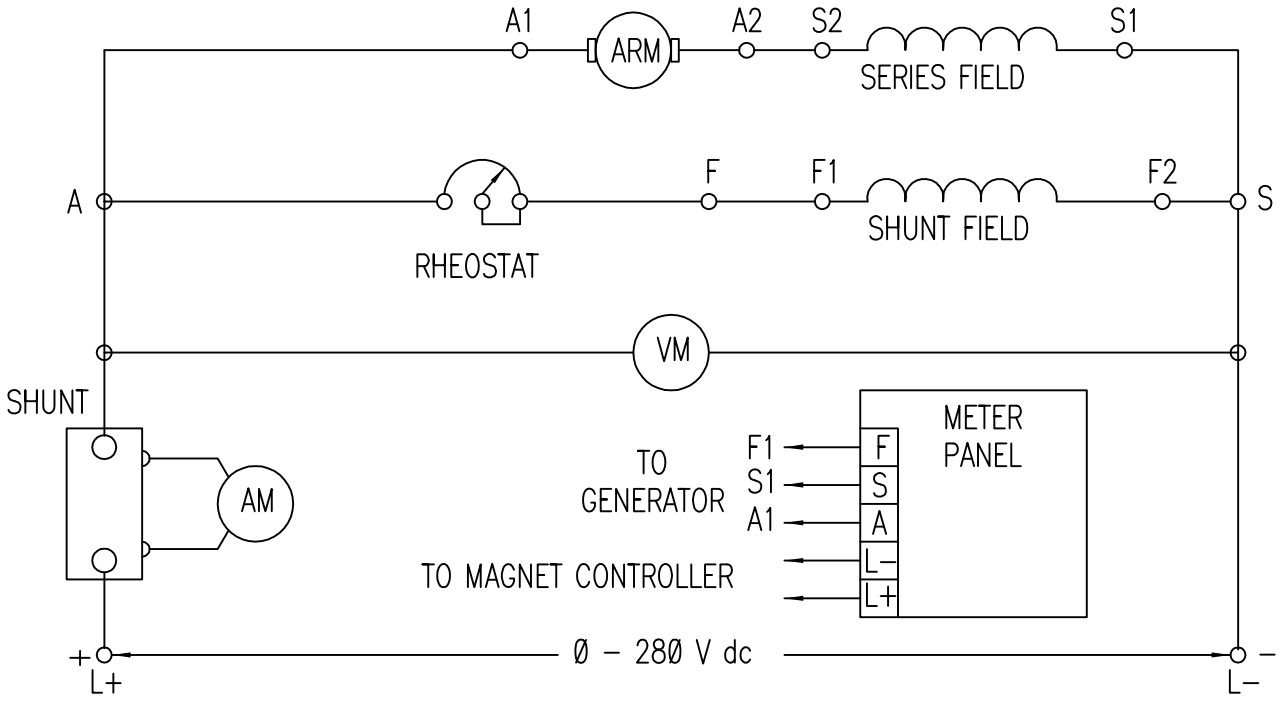


COUNTERCLOCKWISE ROTATION FACING SHAFT END

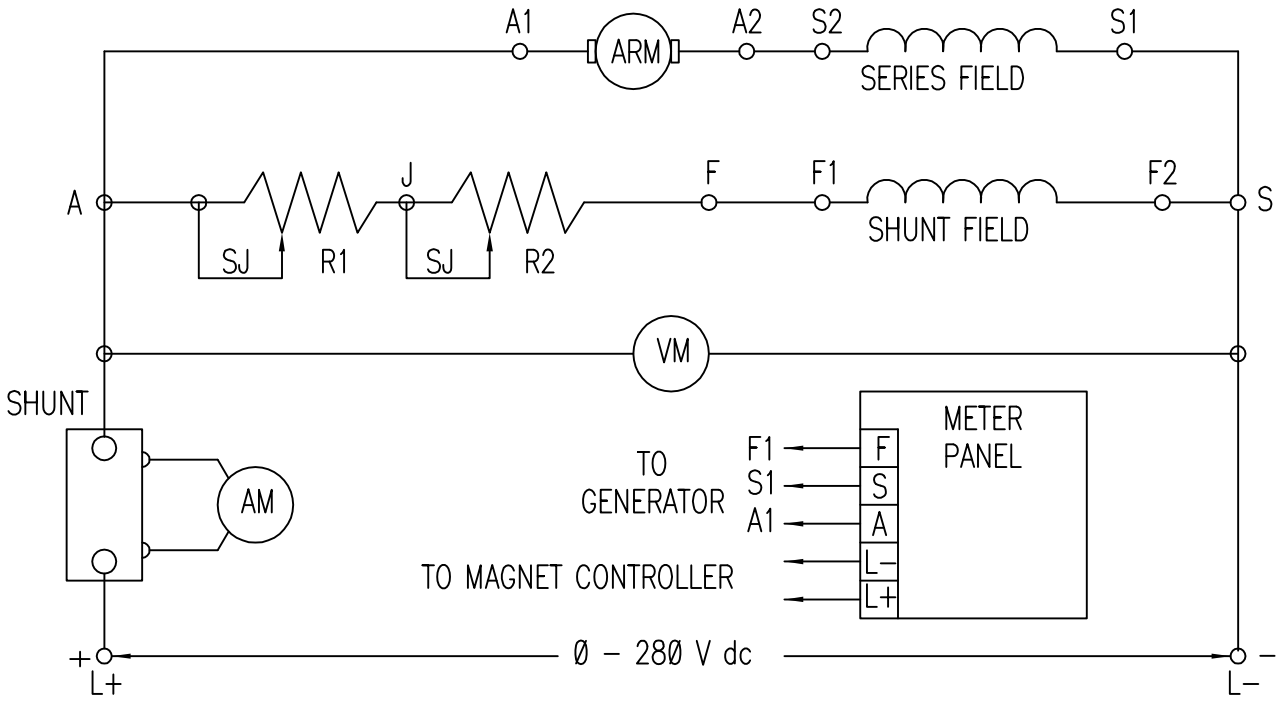


GENERATOR CONNECTION DIAGRAM
5 kW

CLOCKWISE ROTATION FACING SHAFT END

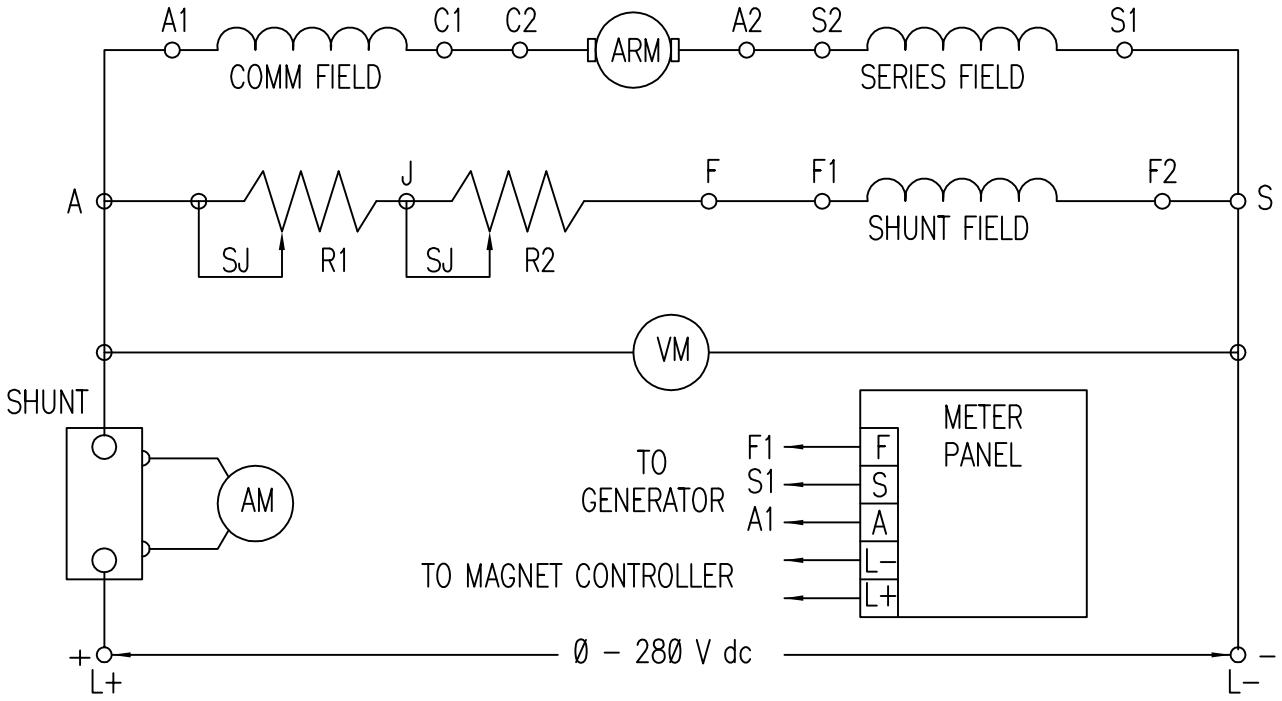


CLOCKWISE ROTATION FACING SHAFT END

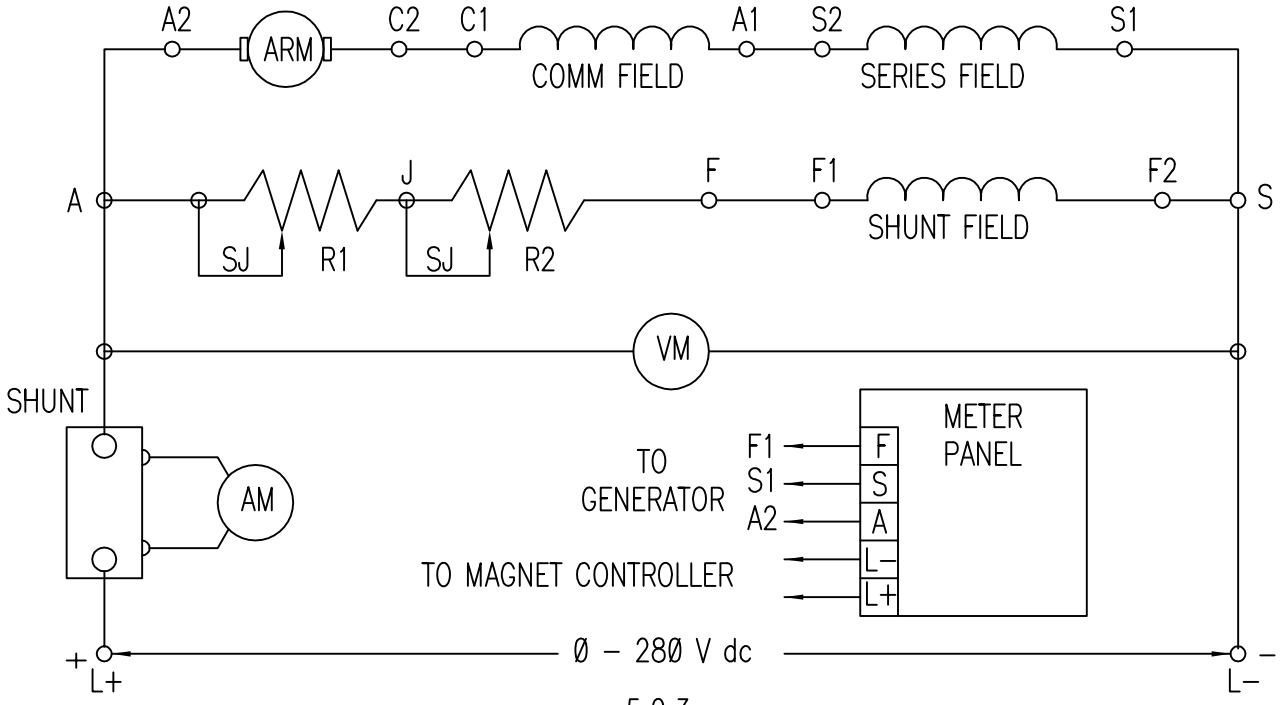


GENERATOR CONNECTION DIAGRAM
8 kW THRU 33 kW

CLOCKWISE ROTATION FACING SHAFT END



COUNTERCLOCKWISE ROTATION FACING SHAFT END



MAINTENANCE:

Periodic inspection and maintenance should be performed to prevent failure and downtime. The following items should be checked.

1. BELTS:	1. Check tension and belt condition. 2. Worn or frayed belts should be replaced.
2. BRUSHES & COMMUTATOR:	1. Worn or dirty commutator should be cleaned and dressed with a commutator stone. 2. Undercut the mica if it extends above the bars. 3. Replace worn brushes.
3. BEARINGS:	1. Noisy or loose bearings should be replaced. 2. Greasing bearings is not required as they are sealed and lubricated for life.

TROUBLE SHOOTING:

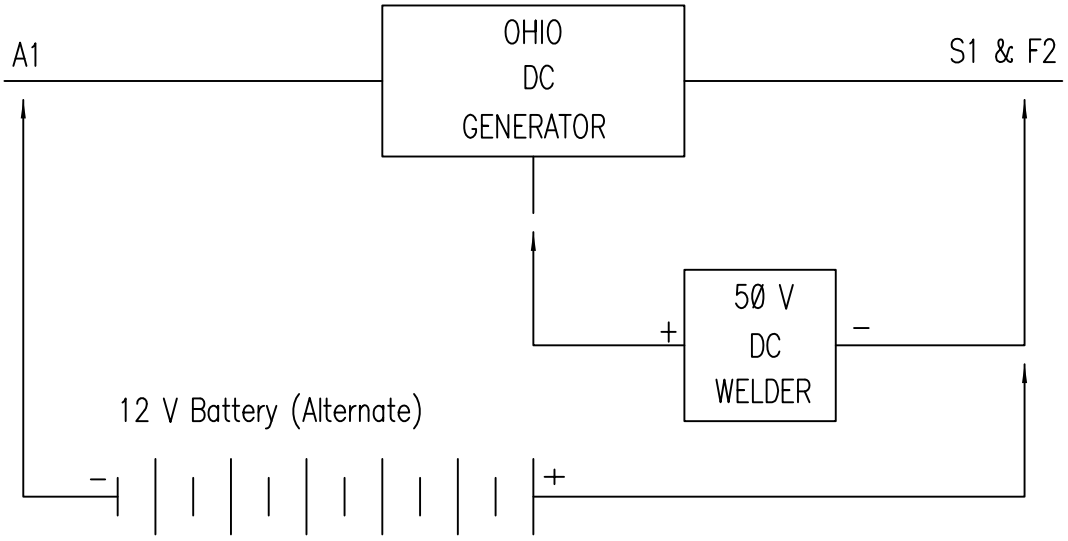
Problem	Solution
Overheating:	A. Over load magnet too large for generator. B. Shorted magnet or system. C. Obstruction at the cooling vents. D. Over speed of under speed.
No Voltage:	A. Open armature or field. B. Worn brushes and/or brush spring broken. C. Open rheostat. D. Defective Voltmeter. E. Loss of residual magnetism. Flash generator with 12 V battery and observe correct polarity. F. Clean and dress commutator.
Low Voltage:	A. Adjust rheostat. B. Low speed improper pulley ratio or belts slipping. C. Excessive line loss wiring too small.
High Voltage:	A. Adjust rheostat. B. High speed improper pulley ratio.

Fluctuating Voltage:	A. Loose terminal connections. B. Speed changing. 1. Slipping belts. 2. Defective engine governor.
Sparking Brushes:	A. Worn brushes. B. Worn commutator. C. Brushes out-of-position.

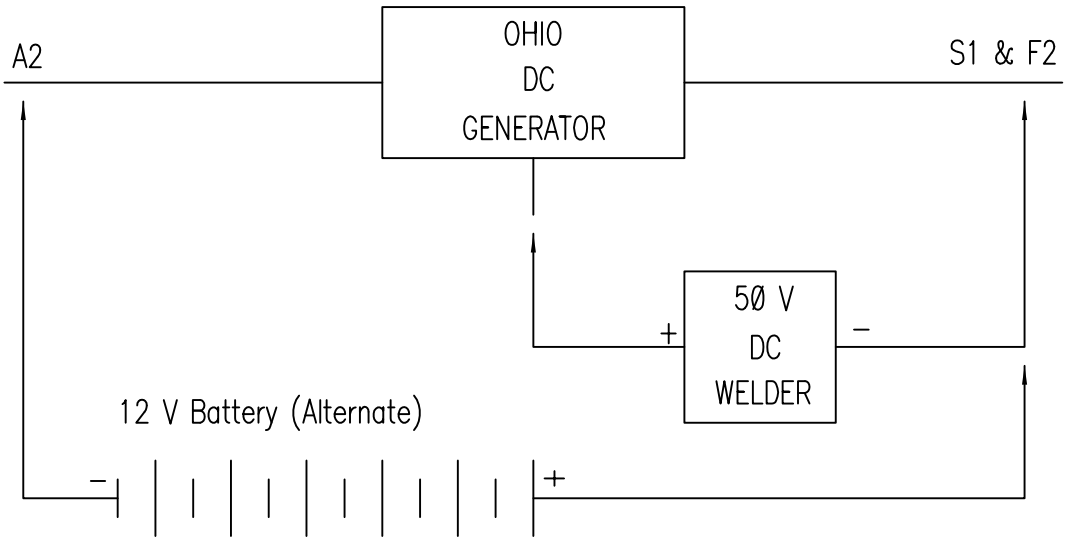
FIELD FLASHING

Restoring residual magnetism to the correct polarity, field flashing may be necessary. Either a 12 V battery or a 50 V dc welder can be used for this purpose. Follow the connection diagram below. Do not permanently connect the power sources to the generators. Contact between the power source and the generator should only be momentary.

CLOCKWISE ROTATION



COUNTERCLOCKWISE ROTATION (EXCLUDING 5 kW GENERATORS)



INSTRUCTIONS FOR ENGINE GENERATOR SETS

Ohio Engine Generator Sets, both diesel and gasoline, use reliable engines which will give long service if the instructions for starting and operation and maintenance are followed. All engines are shipped with oil already in the crankcase and in the air cleaner unless the unit was shipped by air. The oil level should be checked to make sure it is proper.

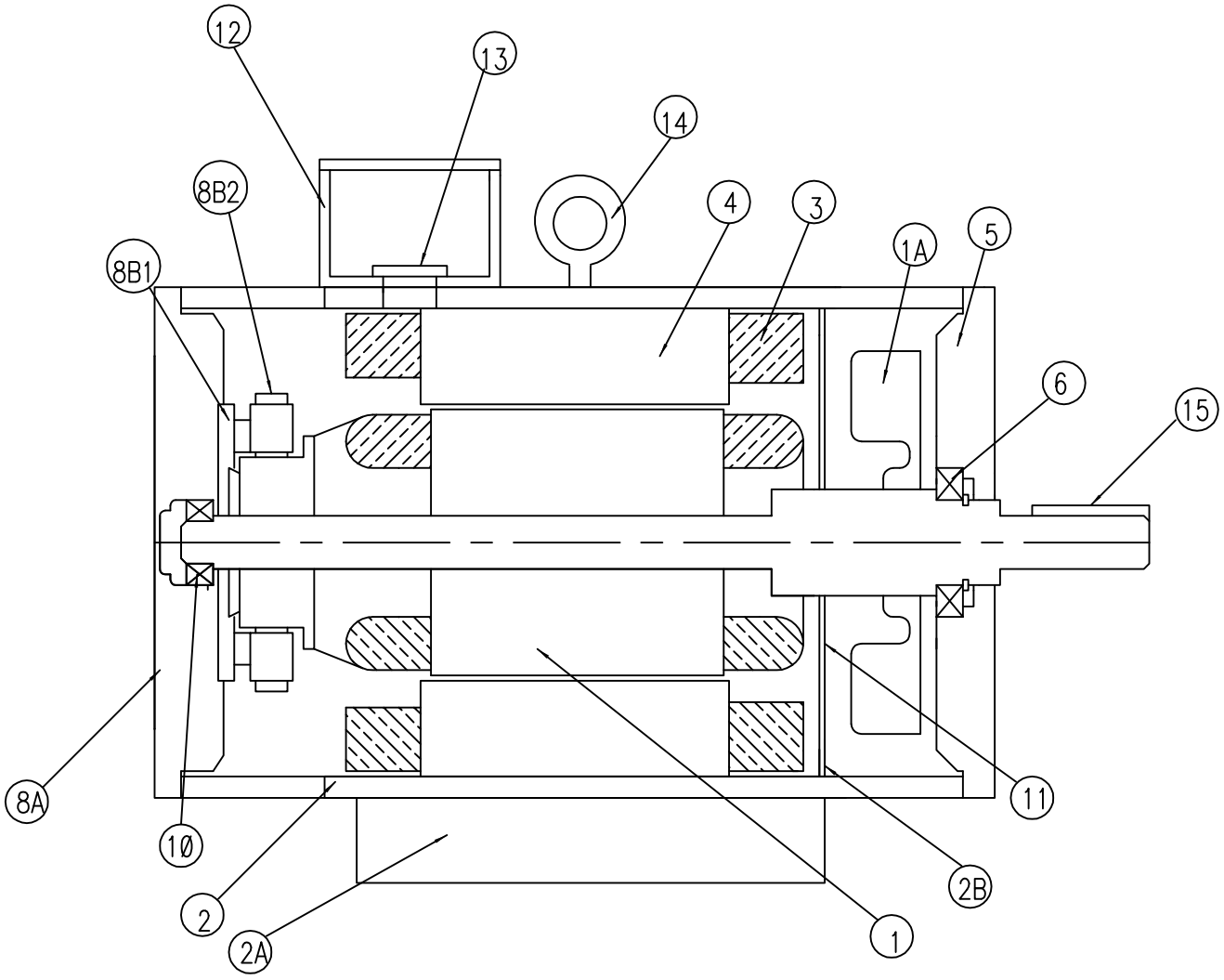
The engine generator sets are run at the Ohio factory. It can be used directly on the job. The unit should, however, be checked for nameplate speed to prevent any over speed or under speed problems. Most engines use a variable speed governor. Do not touch this control. It has been preset at the factory. In no case should the generator speed exceed 2200 r/min for a rated 1800 r/min generator or 3000 r/min for a rated 2500 r/min.

Install the engine generator on a flat surface using the bolt holes provided for mounting. Do not twist the base when tightening down the unit. Use lock washers.

Run the engine generator set and make sure it does not vibrate excessively. If there is a vibration problem, reinforce the bolt down points if they are not rigid. If the vibration is being produced by other parts of the machine, isolate the engine
generator from this vibration with isolation mounts.

Engine speed should be checked when other maintenance is done.

SPARE PARTS LIST

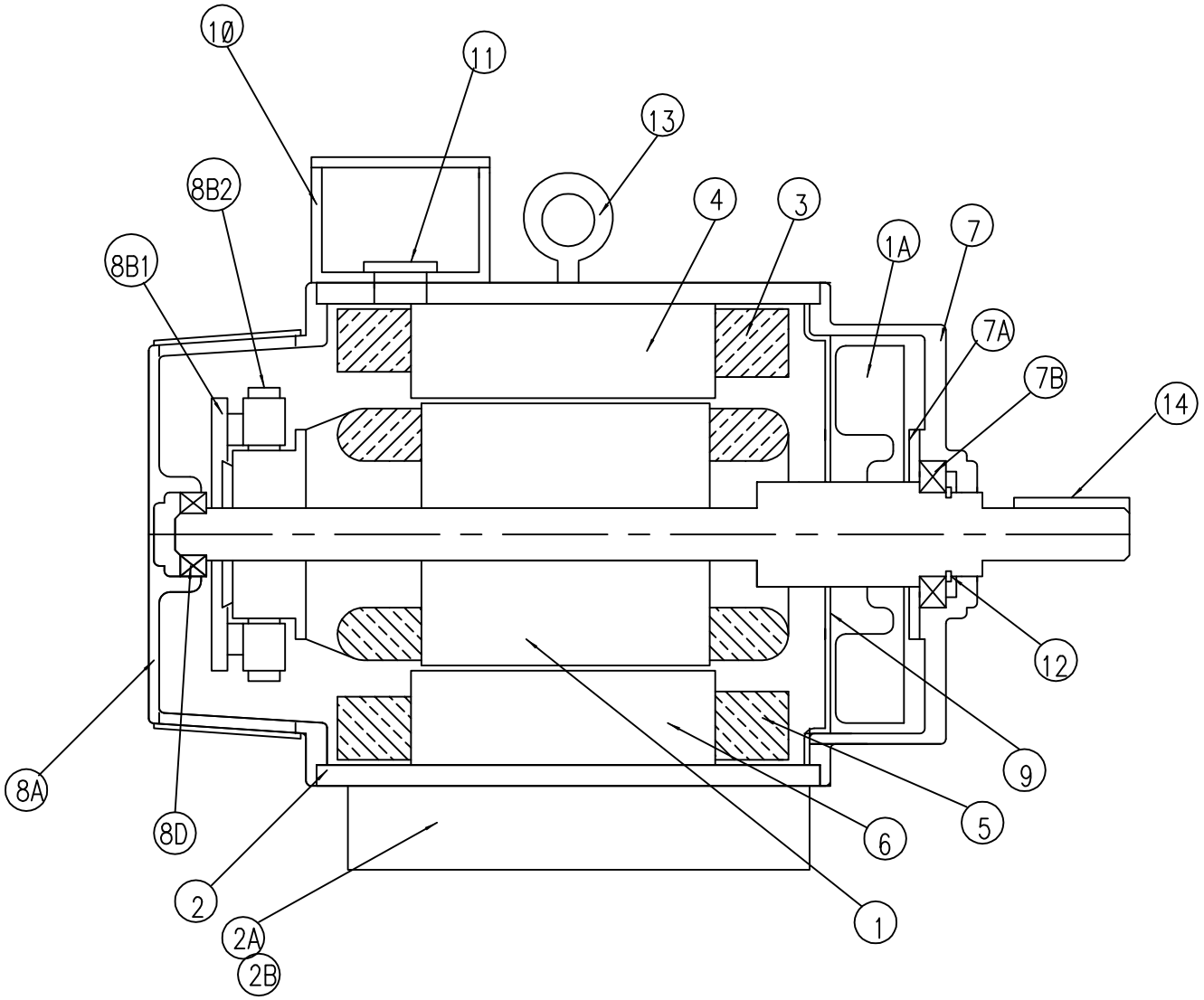


ITEM	QTY	PART NO.	DESCRIPTION
1	1	655024	CMPL ARMATURE ASSEMBLY
1A	1	307B016B1	FAN – DRILLED
2	1	307C015B1	STATOR RING & BASE ASSEMBLY
2A	2	307B015B3	BASE SECTION
2B	4	307A015A5	BAFFLE MTG BRACKETS
3	4	307B020A1	MAIN COILS
4	4	307B017A1	MAIN POLES
5	1	307C013A1	PULLEY COVER – DRILLED FOR OPT
5	1	307C013A4	PULLEY COVER – DRILLED FOR OPTH
6	1	A-900205-14	BEARING – PULLEY END
7	1	307C019A2	PULLEY COVER BAND
8A	1	307C014A1	COMM COVER – DRILLED
8B1	1	910B139A9	BRUSH RING ASSEMBLY
8B2	4	900B57B03	BRUSHES
8B3	4	910A139A14	BRUSH SPRINGS
9	1	307C019A5	COMM COVER BAND
10	1	A-900205-13	BEARING – COMM END
11	1	307B018B1	FAN BAFFLE
12	1	B-100235	TERMINAL BOX
13	1	A-900200-04	CHASE NIPPLE
14	1	A-900180-01	EYEBOLT
15	1	307A025A1	KEY

REV. 10-3-00

OPT-5-25-WI351 & OPTH-5-25-WI351

SPARE PARTS LIST

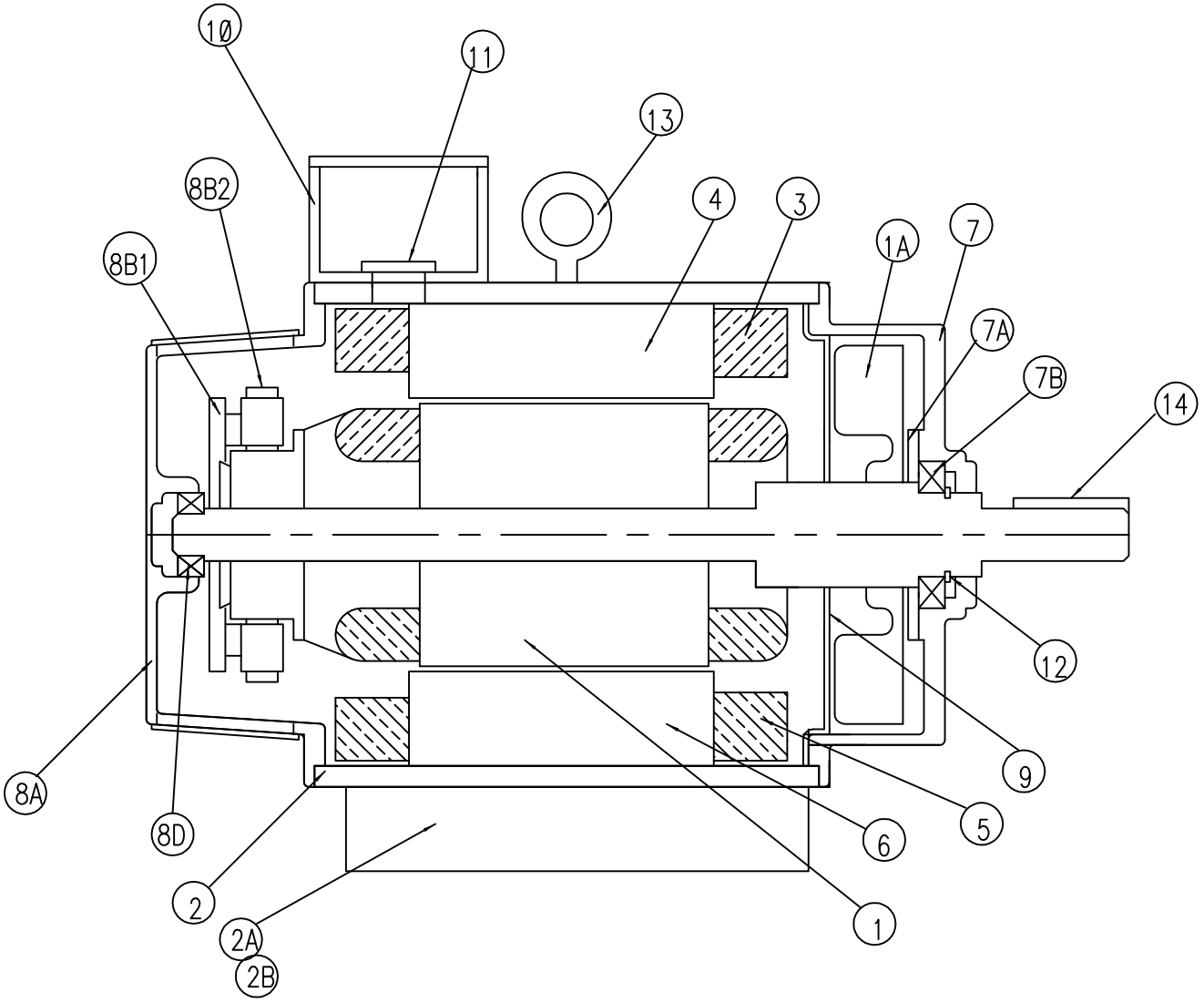


ITEM	QTY	PART NO.	DESCRIPTION
1	1	655002	CMPL ARMATURE ASSEMBLY
1A	1	B-230505-01	FAN - DRILLED
2	1	C-460101-03	STATOR RING & BASE ASSEMBLY
2A	2	A-100239-01	BASE SECTION
2B	1/1	A-690101/102	BASE SUPPORT
3	2	B-441201-03	COMM COILS
4	2	B-452001-03	COMM POLES
5	4	B-441001-03	MAIN COILS
6	4	B-451001-03	MAIN POLES
7	1	C-210522	PULLEY COVER - DRILLED FOR OPT
7	1	C-210522-01	PULLEY COVER - DRILLED FOR OPTH
7A	1	B-230506-01	BEARING CAP - DRILLED
7B	1	A-900205-27	BEARING - PULLEY END
7C	2	A-100243-02	PULLEY COVER SCREEN
8A	1	C-220515	COMM COVER - DRILLED
8B1	1	910B139A2	BRUSH RING ASSEMBLY
8B2	4	900B57B01	BRUSHES
8B3	4	910A139A14	BRUSH SPRINGS
8C	1	A-100242-03	COMM COVER SCREEN
8D	1	A-900205-13	BEARING - COMM END
8E	2	910A121A1	BRUSH INSPECTION COVER GASKET
8F	2	A-100250	BRUSH INSPECTION COVER
9	2	310C025A1	FAN BAFFLE
10	1	B-100235	TERMINAL BOX
11	1	A-900200-04	CHASE NIPPLE
12	1	A-900220-01	BEARING RETAINING RING
13	1	A-900180-01	EYEBOLT
14	1	A-100022-11	KEY

REV.
10-3-00

OPT-10-25-WI320 & OPTH-10-25-WI320

SPARE PARTS LIST

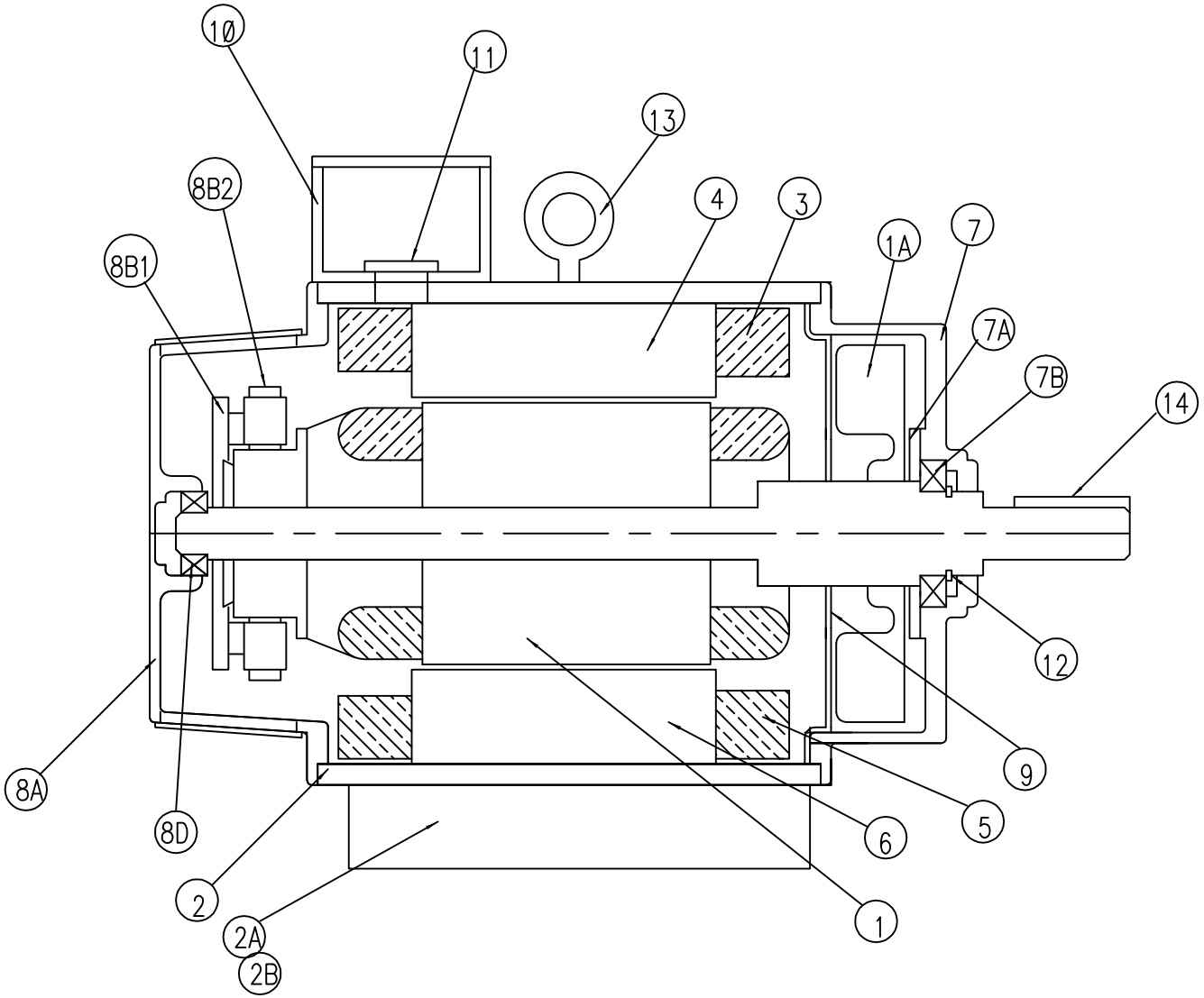


ITEM	QTY	PART NO.	DESCRIPTION
1	1	655012	CMPL ARMATURE ASSEMBLY
1A	1	B-230504-01	FAN - DRILLED
2	1	C-460100-03A	STATOR RING & BASE ASSEMBLY
2A	2	A-690100A	BASE SECTION
2B	2	A-100239-02	BASE SUPPORT
3	2	B-441200-04	COMM COILS
4	2	B-452000-04	COMM POLES
5	4	B-441000-04	MAIN COILS
6	4	B-451000-04	MAIN POLES
7	1	C-210520	PULLEY COVER - DRILLED FOR OPT
7	1	C-210520-01	PULLEY COVER - DRILLED FOR OPTH
7A	1	N/A	BEARING CAP - DRILLED
7B	1	A-900205-28	BEARING - PULLEY END
7C	2	A-100243-01	PULLEY COVER SCREEN
8A	1	C-220512	COMM COVER - DRILLED
8B1	1	910B137A2	BRUSH RING ASSEMBLY
8B2	4	900B57B02	BRUSHES
8B3	4	910A137A8	BRUSH SPRINGS
8C	1	A-100242-01	COMM COVER SCREEN
8D	1	A-900205-26	BEARING - COMM END
8E	2	910A121A3	BRUSH INSPECTION COVER GASKET
8F	2	A-100228	BRUSH INSPECTION COVER
9	2	311C025A1	FAN BAFFLE
10	1	B-100256	TERMINAL BOX
11	1	A-900200-03	CHASE NIPPLE
12	1	A-900220-02	BEARING RETAINING RING
13	1	A-900180-01	EYEBOLT
14	1	A-100022-08	KEY

REV. 10-3-00

OPT-15-18-WI306 & OPTH-15-18-WI306

SPARE PARTS LIST

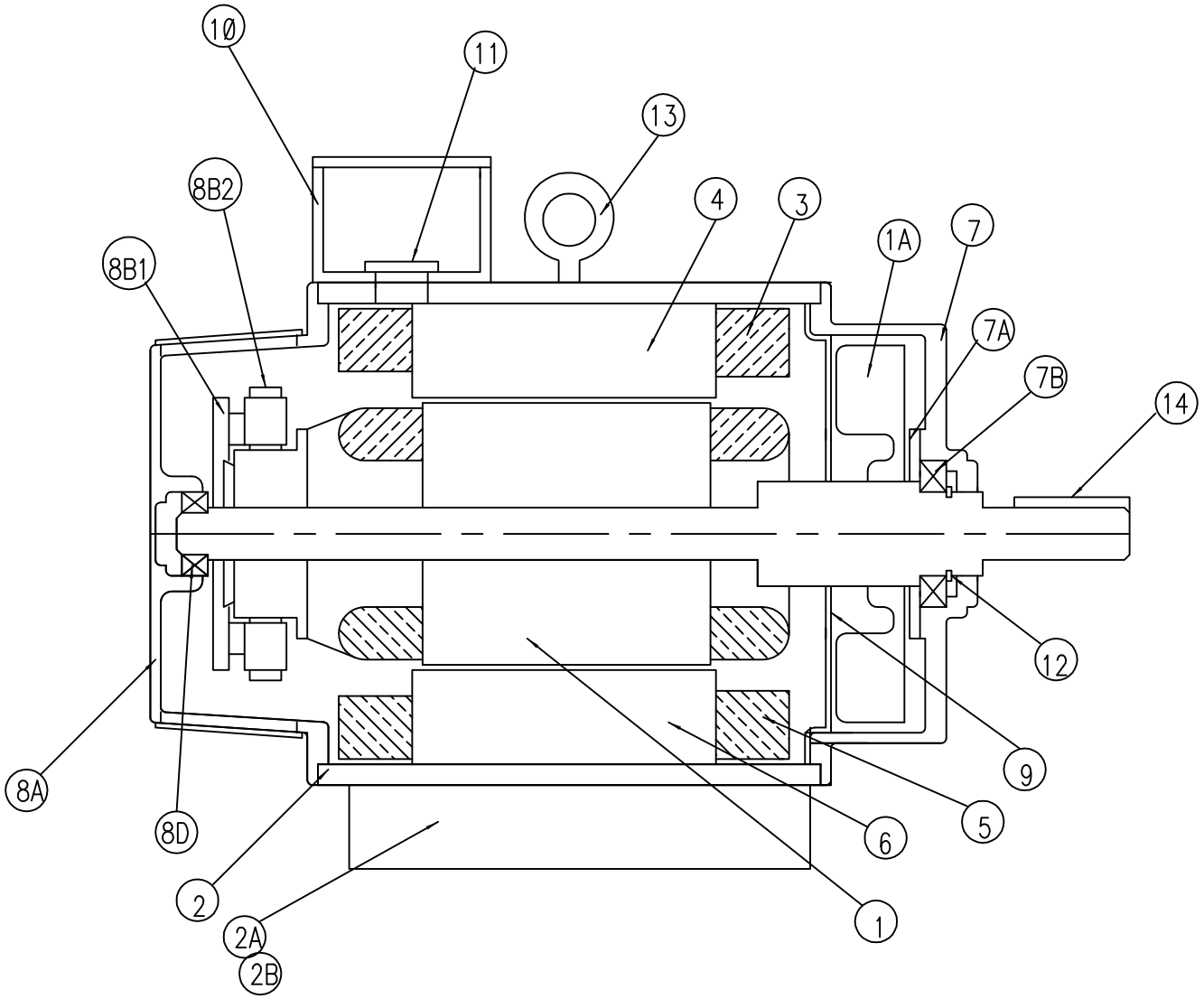


ITEM	QTY	PART NO.	DESCRIPTION
1	1	655015	CMPL ARMATURE ASSEMBLY
1A	1	B-230504-01	FAN - DRILLED
2	1	C-460100-02A	STATOR RING & BASE ASSEMBLY
2A	2	A-690100A	BASE SECTION
2B	2	A-100239-02	BASE SUPPORT
3	2	B-441200-03A	COMM COILS
4	2	B-452000-03	COMM POLES
5	4	B-441000-03B	MAIN COILS
6	4	B-451000-03	MAIN POLES
7	1	C-210520	PULLEY COVER - DRILLED
7	1	C-210520-01	PULLEY COVER - DRILLED FOR OPT
7A	1	B-230506-02	BEARING CAP - DRILLED FOR OPTH
7B	1	A-900205-28	BEARING - PULLEY END
7C	2	A-100243-01	PULLEY COVER SCREEN
8A	1	C-220512	COMM COVER - DRILLED
8B1	1	910B137A2	BRUSH RING ASSEMBLY
8B2	4	900B57B02	BRUSHES
8B3	4	910A137A8	BRUSH SPRINGS
8C	1	A-100242-01	COMM COVER SCREEN
8D	1	A-900205-26	BEARING - COMM END
8E	2	910A121A3	BRUSH INSPECTION COVER GASKET
8F	2	A-100228	BRUSH INSPECTION COVER
9	2	311C025A1	FAN BAFFLE
10	1	B-100256	TERMINAL BOX
11	1	A-900200-03	CHASE NIPPLE
12	1	A-900220-02	BEARING RETAINING RING
13	1	A-900180-01	EYEBOLT
14	1	A-100022-08	KEY

REV. 10-3-00

OPT-20-18-WI307 & OPTH-20-18-WI307

SPARE PARTS LIST

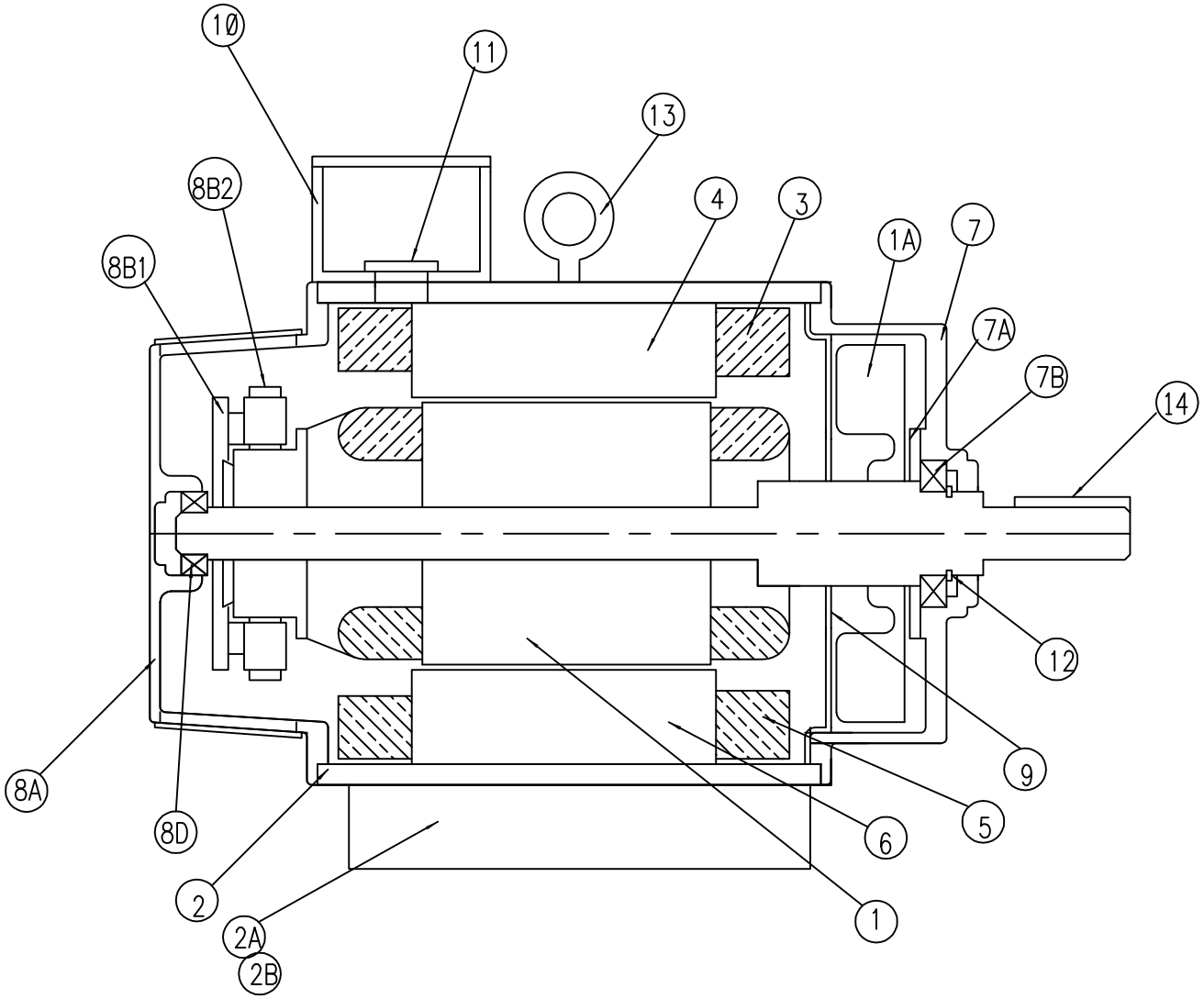


ITEM	QTY	PART NO.	DESCRIPTION
1	1	655019	CMPL ARMATURE ASSEMBLY
1A	1	B-230504-01	FAN - DRILLED
2	1	C-460100-01A	STATOR RING & BASE ASSEMBLY
2A	2	A-690100A	BASE SECTION
2B	2	A-100239-02	BASE SUPPORT
3	2	B-441200-01	COMM COILS
4	2	B-452000-01	COMM POLES
5	4	B-441000-01	MAIN COILS
6	4	B-451000-01	MAIN POLES
7	1	C-210520	PULLEY COVER - DRILLED FOR OPT
7	1	C-210520-01	PULLEY COVER - DRILLED FOR OPTH
7A	1	N/A	BEARING CAP - DRILLED
7B	1	A-900205-28	BEARING - PULLEY END
7C	2	A-100243-01	PULLEY COVER SCREEN
8A	1	C-220512	COMM COVER - DRILLED
8B1	1	910B137A2	BRUSH RING ASSEMBLY
8B2	4	900B57B02	BRUSHES
8B3	4	910A137A8	BRUSH SPRINGS
8C	1	A-100242-01	COMM COVER SCREEN
8D	1	A-900205-26	BEARING - COMM END
8E	2	910A121A3	BRUSH INSPECTION COVER GASKET
8F	2	A-100228	BRUSH INSPECTION COVER
9	2	311C025A1	FAN BAFFLE
10	1	B-100256	TERMINAL BOX
11	1	A-900200-03	CHASE NIPPLE
12	1	A-900220-02	BEARING RETAINING RING
13	1	A-900180-01	EYEBOLT
14	1	A-100022-08	KEY

REV. 10-3-00

OPT-25-18-WI308 & OPTH-25-18-WI308

SPARE PARTS LIST



ITEM	QTY	PART NO.	DESCRIPTION
1	1	655022	CMPL ARMATURE ASSEMBLY
1A	1	B-230508-01	FAN - DRILLED
2	1	C-460106	STATOR RING & BASE ASSEMBLY
2A	2	A-690109	BASE SECTION
2B	2	A-100239-03	BASE SUPPORT
3	2	B-441203-01	COMM COILS
4	2	B-452004-01	COMM POLES
5	4	B-441002-01	MAIN COILS
6	4	B-451002-01	MAIN POLES
7	1	C-210531	PULLEY COVER - DRILLED FOR OPT
7	1	C-210531-01	PULLEY COVER - DRILLED FOR OPTH
7A	1	B-230509	BEARING CAP - DRILLED
7B	1	A-900205-33	BEARING - PULLEY END
7C	2	A-100243-05	PULLEY COVER SCREEN
8A	1	C-220516	COMM COVER - DRILLED
8B1	1	910C138A2	BRUSH RING ASSEMBLY
8B2	8	900B57B02	BRUSHES
8B3	8	910A137A8	BRUSH SPRINGS
8C	1	A-100265-01	COMM COVER SCREEN
8D	1	A-900205-32	BEARING - COMM END
8E	2	910A121A4	BRUSH INSPECTION COVER GASKET
8F	2	A-100262	BRUSH INSPECTION COVER
9	1	A-100260	FAN BAFFLE
10	1	B-100259	TERMINAL BOX
11	1	A-900200-03	CHASE NIPPLE
12	1	A-900220-05	BEARING RETAINING RING
13	1	A-900180-02	EYEBOLT
14	1	A-100022-09	KEY

REV. 9-28-00

OPT-33-18-WI309 & OPTH-33-18-WI309

INSTRUCTIONS FOR REWORK OF 5 kW "CW" TO "CCW" GENERATOR

1.) Remove the key from the existing shaft extension.

2.) Remove the hole plug from the end cover opposite the existing shaft extension.

3.) Thread the new shaft extension in tapped hole provided in the armature shaft, using "lock-tite" on the threads (provided in your conversion kit) to make sure the shaft adaptor is securely attached.

4.) The key that was removed from the other shaft extension is to be used on the new extension.

5.) Remove the screws and lockwashers (on the Ø75 mm (3.00") B.C.) on the pulley cover and assemble path shaft covers over the shaft. The lower one (lower by 1.5 mm (0.06")) is to be assembled first.

The Conversion Kit Consists of: 307L02A01 Kit

(1) Tube "Lock-tite" - 6 mL - A-950049-0l
(2) Shaft Covers - (1) 307A028A1 & (1) 307A028A2
(1) Shaft Adapter - 307B021A2

ADJUSTMENT PROCEDURE FOR GENERATOR SLIDE BAR RESISTORS

REFERENCE PANEL ASSEMBLY DIAGRAM: 101CO11A9 (50 A); 101CO11A8 (100 A); 101CO11A7 (150 A); 101CO11A6 (200 A)

REFERENCE METER PANEL WIRING DIAGRAM FOR OHIO GENERATORS: 101B002H15 (50 A); 101B002H13 (100 A); 101B002H14 (150 A); 101B002H10 (200 A); 101B002H21 (50 A); 101B002H20 (100 A); 101B002H17 (150 A); 101B002H25 (200 A)

REFERENCE METER PANEL WIRING DIAGRAM FOR ONAN GENERATORS: 101B002H22 (50 A); 101B002H26 (100 A); 101B002H27 (150 A); 101B002H28 (200 A)

INSTRUCTIONS:

1.) Turn on the generator and measure the voltage. If the voltage is in the range of 230 to 250 V-dc, no adjustments need be made.

Warning: ! DANGER OF ELECTROCUTION! **Do not adjust the resistors with power on! Shut down the generator first. Also beware that resistors may be hot. Check for heat before touching resistors.**

1.) Loosen the slide contact on BOTH resistors. If the voltage is too high, slide the Rl (TOP RESISTOR) contact to the left and the R2 (BOTTOM RESISTOR) contact to the right. Move the contact no more than 10 mm at a time and equally on both resistors. If the voltage is too low, then move the contacts in the opposite direction stated above.

2.) Restart the generator and check the voltage again. If the voltage is within the proper limits, then no further adjustments need be made. If the voltage is still outside the limits, repeat step 1.

If over time, the voltage drifts out of range, repeat steps 1 and 2 to correct the error.

SECTION 6

HYDRAULIC GENERATOR PACKAGES

OHIO MAGNETICS, INC.
A SUBSIDIARY OF PEERLESS-WINSMITH, INC.

5400 DUNHAM ROAD
MAPLE HTS., OHI0 44137-3687

PHONE: (800) 486-6446
MAIN FAX: (216) 662-2911
ENGINEERING FAX: (216) 662-3118
SALES FAX: (216) 662-9526
E-MAIL (SALES): sales@ohiomagnetics.com
E-MAIL (ENGINEERING): engineering@ohiomagnetics.com
INTERNET: http://www.ohiomagnetics.com

Introduction:

The function of this document is to provide Preventive Maintenance information for an OHIO Hydraulic Generator Package and Magnet.

We recommend combining the Preventive Maintenance and Inspection Program for a magnet system (hydraulic package is included) with your general guidelines for Vehicle/Equipment Inspection.

Visual Inspection (walk around inspection) should be conducted on a daily basis or at the beginning of each shift.

All Preventive Maintenance and Troubleshooting steps should be according to OHIO's Maintenance Manual.

!! CAUTION !!

1.) The system operates under high pressure. DO NOT loosen any hydraulic fitting or hose when the system is pressurized.

2.) Collect any hydraulic fluid in accordance with all regulations to prevent harm to persons and the environment.

**** Frequency of inspection should not exceed 250 hours of operation ****

Installation

1) Mount the unit in a convenient location.

2) Ohio Magnetics recommends the use of a dedicated Hydraulic Pump to supply the Hydraulic Generator Drive. By using a dedicated pump, the balance of the hydraulic systems are not adversely affected.

3) Route the hydraulic lines to and from the Hydraulic Control Valve on the Package skid. Use hydraulic hose or lines rated for 21.0 MPa [3000 psi] (minimum). The supply line shall be Ø1" DN25 (minimum) and the return line shall be Ø1 ¼" DN32 (minimum).

4) On the 15 kW and larger generators, a case drain has to be routed back to the system tank. The motor case drain is located on the top of the motor housing to ensure the motor has lubricating oil to operate.

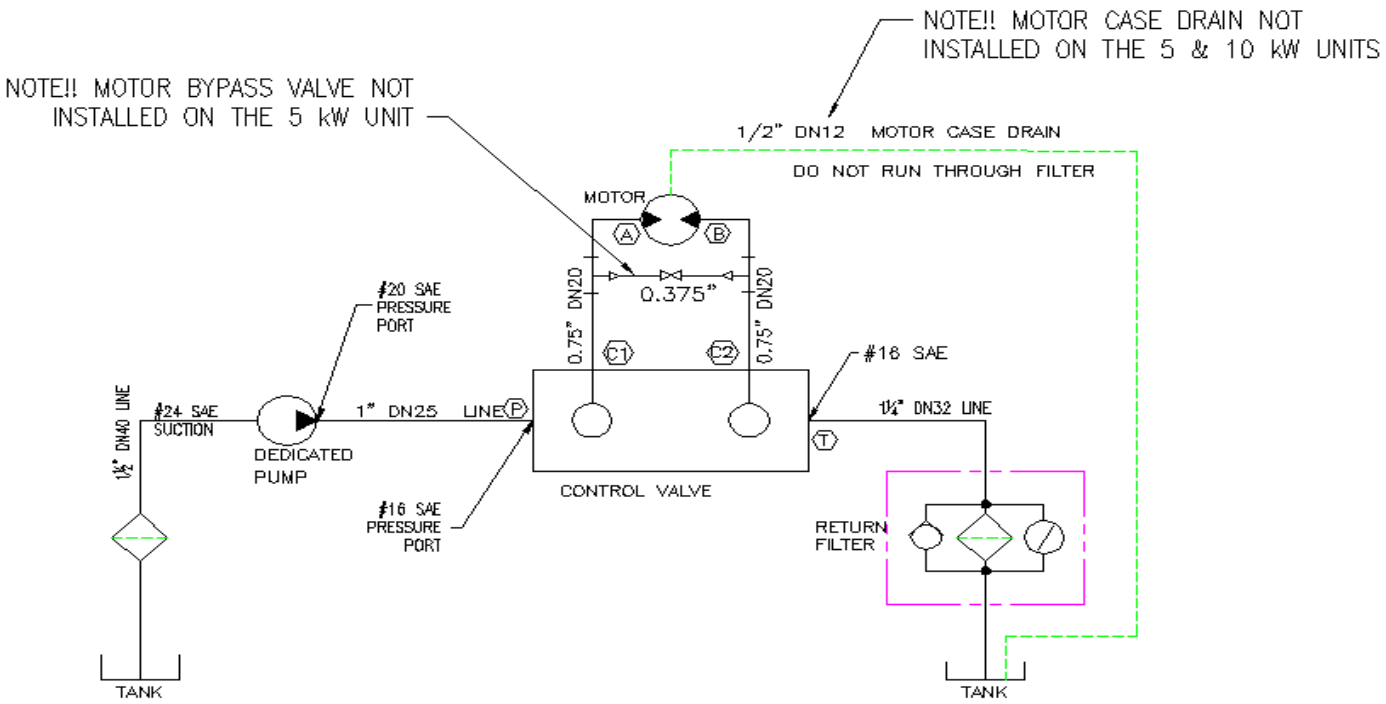


Fig. 1 Hydraulic Schematic

REQUIRED PRESSURES AND FLOWS FROM PUMP

5 KW	45 L/min [12 GPM]	@ 16.3 MPa	[2368 PSI]
10 KW	120 L/min [32 GPM]	@ 9.2 MPa	[1338 PSI]
15 KW	120 L/min [32 GPM]	@ 12.4 MPa	[1803 PSI]
20 KW	120 L/min [32 GPM]	@ 15.8 MPa	[2304 PSI]
25 KW	120 L/min [32 GPM]	@ 17.2 MPa	[2805 PSI]

Table 1. Generator Flow Requirements

OHIO STEARNS MAGNETICS
HYDRAULIC GENERATOR DRIVE

A. Preventative Maintenance

1) Ensure all hose connections are tight at the motor and control valves, inspect quarterly, with heavy use, inspect monthly.

2) Check hydraulic motor to generator shaft coupling monthly to ensure set screws are tight and that coupling halves have not slid apart. Check to see if the coupling insert (Hytrel Compound) located between the coupling halves is not fretted or showing signs of wear (missing material). Coupling guard should be snapped in place, the system should not be operated without the coupling guard in place.

3) Surface temperature of the system components should operate at or below 70°C [~160°F].

4) All jamb-nuts located on the main control valve should be inspected and ensure tightness, inspect every 6 months.

5) If checking for proper generator drive speed, ensure generator is turned off, remove coupling guard, place reflective tape on the coupling, turn system on and using a tachometer, confirm system is running turning at 2500 r/min for 5 & 10 kW Generators or 1800 r/min for 15, 20, 25 or 33 kW Generators, ±50 r/min.

6) If inspecting system pressure, pressure at the hydraulic motor while the system is running under load, the pressure should be approximately 14.7 MPa [2100 PSI]. If checking system pressure upstream of the control valve, the system pressure should be approximately 16.8 MPa [2400 PSI].

7) If inspecting system flow, flow to the hydraulic motor should be approximately 30 L/min [8 US GPM] (±4 L/min [1 US GPM]) for 1800 r/min. (Flow to the hydraulic control valve should be a minimum of 45 L/min [12 US GPM].

8) Inspect wire connections to the solenoid control valve to ensure no exposed or frayed wiring is evident.