SECTION 0

SYSTEM INFORMATION

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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 push-button 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 (M-G 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 push-button 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.

TROUBLE SHOOTING

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 judgements 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 TROUBLE SHOOTING

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. Overspeed -excessive engine speed or improper pulley ratio.
V	Fluctuating Voltage or Excessive Voltage Drop from no load to full load (Poor Lift)	A. General 1. Same as Ia. B. DC Generator: 1. Too small, overloaded. 2. Engine too small. 3. Engine compression poor, requires overhaul. 4. Engine governor defective. 5. Belts slipping, loose or insufficient quantity.

ITEM	PROBLEM	DEFECTIVE AREA AND REMEDY
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. B. Electromagnet: 1. Check magnet resistance for partially open (High resistance) and/or grounded condition. 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. B. Electromagnet: 1. Check for low resistance, (Partly shorted) coil and/or terminals. 2. Check ground resistance from each terminal to ground for a short circuit to ground.

ITEM	PROBLEM	DEFECTIVE AREA AND REMEDY
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.