INSTRUCTIONS

MAGNETIC CONTROLLERS
INSTALLATION

Location. The location of the controller should provide protection, accessibility, and ventilation. The controller should be located as near the controlled machine as possible and preferably in sight of the operator. The master switch should be in sight of the controlled machine.

Open control panels and panels with general purpose enclosures should be located in a clean dry atmosphere. Various kinds of atmospheric contamination are permissible for special enclosures as indicated by the NEMA names for these enclosures—dust-tight, dustproof, watertight, etc. Particular care should be taken during installation in a building still under construction to protect the controller against dust, dirt, and falling objects. The degree of protection provided against injurious elements, such as dust, water, oil, or acid, will to a large extent determine the life and dependability of the controller.

Accessibility requirements for connecting and servicing controllers vary for different designs. Check the outline drawing carefully to determine the minimum space requirements. Allow space for a service man to stand, to use tools, to remove arc boxes, and to open hinged cabinet doors.

Open control panels should have an ambient temperature of 40°C or less. Enclosed controllers should have an ambient temperature less than 30°C. Locate ventilated enclosures so that walls and other structures do not obstruct the ventilation openings. Provide a flow of air for controllers which dissipate a large amount of heat—such as resistance starters for motors which reverse frequently.

Foundation. Foundations for floor mounted controllers should be level. Supports for wall mounted controllers should be vertical. Foundations and supports should be free of excessive vibration.

The foundation should include conduits or other means for connecting the controller to the controlled machine, master switch, and other devices. Check the outline drawing to determine the location at which conduits may enter the controller. Check the external connection diagram to determine the number of conduits and their termini. Check the National Electric Code or other applicable code to determine the conduit size for the required number of conductors of the required size. Ground all conduits.

Mounting. Set the controller in place, level it, and secure it by means of imbedded bolts, through bolts, or other suitable hardware. If a floor mounted controller has a channel base, it should be grouted to the floor.

Connection. Connect the apparatus according to the external connection diagram. If this diagram specifies a maximum allowable resistance for any particular set of connections, choose a wire size which will keep the resistance of these connections below the limit. For the connections between a d-c ammeter shunt and a remotely mounted ammeter, choose a wire size which will give the lead resistance specified on the dial of the ammeter. A remotely mounted ammeter may have a calibrating resistor to compensate for insufficient lead resistance. In this case choose an oversize wire and adjust the calibrating resistor to obtain the correct lead resistance. Choose all other wire sizes from the National Electric Code or other applicable code.

Wires can be pulled through conduits most successfully if all the wires in any one conduit are the same size. Therefore, armature circuit connections and shunt field circuit connections should usually be in separate conduits.

Place both wires of a single phase a-c circuit in a single conduit. Place all wires of a polyphase a-c circuit in a single conduit.

Preparation. Open the circuit to the power supply. Remove blocks and ties from all contactors, relays, instruments, and other devices. With a clean dry rag, clean thoroughly the contact surfaces and magnet gap surfaces of all contactors and relays. The gap surfaces of some a-c magnets are coated at the factory with a film of petrolatum to inhibit rusting in storage. Remove this film to prevent the

magnet from collecting dust. Tighten any hardware which may have worked loose during shipment.

Operate all contactors and relays manually to be sure that they are free of friction, that the contact surfaces seat properly, and that the various springs work properly. Check mechanical interlocks to be sure they prevent the contacts of one contactor from touching when the other contactor is closed. Release the brake manually and rotate the motor manually to be sure that they are free of friction and free of foreign matter.

Tests. Open the circuit from the controller to the controlled machine. Close the circuit from the power supply to the controller. Operate the master switch and other pilot devices. Check the sequence of relay and contactor operation. This sequence has been checked at the factory. An additional check will call attention to any faulty external connections or to any damage that may have been done during shipment. Open the circuit to the power supply, and reclose the circuit to the controlled machine.

Close the circuit to the power supply. If a motor controller has separate switches for the power circuit and for the control circuit, always close the power circuit switch first and the control circuit switch last; this sequence will prevent picking up the contactors and then line-starting the motor with the power switch.

If a d-c motor has both a shunt field and a series, field, their polarities should be the same. To check the relative polarities of these two fields, disconnect the shunt field and jog the motor with the series field alone; then reconnect the shunt field and jog the motor again; if the motor jogs in the same direction both times, the relative polarities of the shunt and series fields are correct.

If the controlled motor rotates in the wrong direction, check its field polarity and the power supply polarity or phase rotation to be sure they agree with the diagram. If so, for a d-c motor interchange the armature connections A1 and A2 (do not change the motor internal connection between the brush holder and the commutating field coil). Or, for a three phase a-c motor interchange any two of the power connections to the motor. For other a-c motors refer to the instructions on the motor nameplate.

If the controlled generator has the wrong polarity or phase rotation, check the field polarity to be sure it agrees with the diagram; check the direction of rotation to be sure it agrees with the nameplate on the generator or on the machine which is coupled to the generator. If both agree, for a d-c generator interchange the armature connections A1 and A2. Or, for a three phase a-c generator interchange any two of the power connections to the generator.

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BUFFALO PLANT • MOTOR AND CONTROL DIVISION • BUFFALO 5, N.Y.
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INSTRUCTIONS

MAGNETIC CONTROLLERS
INSTALLATION

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Open control panels should have an ambient temperature of 40°C or less. Enclosed controllers should have an ambient temperature less than 30°C. Locate ventilated enclosures so that walls and other structures do not obstruct the ventilation openings. Provide a flow of air for controllers which dissipate a large amount of heat—such as resistance starters for motors which reverse frequently.

Foundation. Foundations for floor mounted controllers should be level. Supports for wall mounted controllers should be vertical. Foundations and supports should be free of excessive vibration.

The foundation should include conduits or other means for connecting the controller to the controlled machine, master switch, and other devices. Check the outline drawing to determine the location at which conduits may enter the controller. Check the external connection diagram to determine the number of conduits and their termini. Check the National Electric Code or other applicable code to determine the conduit size for the required number of conductors of the required size. Ground all conduits.

Mounting. Set the controller in place, level it, and secure it by means of imbedded bolts, through bolts, or other suitable hardware. If a floor mounted controller has a channel base, it should be grouted to the floor.

Connection. Connect the apparatus according to the external connection diagram. If this diagram specifies a maximum allowable resistance for any particular set of connections, choose a wire size which will keep the resistance of these connections below the limit. For the connections between a d-c ammeter shunt and a remotely mounted ammeter, choose a wire size which will give the lead resistance specified on the dial of the ammeter. A remotely mounted ammeter may have a calibrating resistor to compensate for insufficient lead resistance. In this case choose an oversize wire and adjust the calibrating resistor to obtain the correct lead resistance. Choose all other wire sizes from the National Electric Code or other applicable code.

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Preparation. Open the circuit to the power supply. Remove blocks and ties from all contactors, relays, instruments, and other devices. With a clean dry rag, clean thoroughly the contact surfaces and magnet gap surfaces of all contactors and relays. The gap surfaces of some a-c magnets are coated at the factory with a film of petrolatum to inhibit rusting in storage. Remove this film to prevent the

magnet from collecting dust. Tighten any hardware which may have worked loose during shipment.

Operate all contactors and relays manually to be sure that they are free of friction, that the contact surfaces seat properly, and that the various springs work properly. Check mechanical interlocks to be sure they prevent the contacts of one contactor from touching when the other contactor is closed. Release the brake manually and rotate the motor manually to be sure that they are free of friction and free of foreign matter.

Tests. Open the circuit from the controller to the controlled machine. Close the circuit from the power supply to the controller. Operate the master switch and other pilot devices. Check the sequence of relay and contactor operation. This sequence has been checked at the factory. An additional check will call attention to any faulty external connections or to any damage that may have been done during shipment. Open the circuit to the power supply, and reclose the circuit to the controlled machine.

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If the controlled generator has the wrong polarity or phase rotation, check the field polarity to be sure it agrees with the diagram; check the direction of rotation to be sure it agrees with the nameplate on the generator or on the machine which is coupled to the generator. If both agree, for a d-c generator interchange the armature connections A1 and A2. Or, for a three phase a-c generator interchange any two of the power connections to the generator.

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INSTRUCTIONS

MAGNETIC CONTROLLERS
INSPECTION AND MAINTENANCE

PREVENTIVE MAINTENANCE

Equipment well cared for will provide satisfactory and dependable operation with a minimum of trouble. A plan of periodic and systematic maintenance should therefore be worked out. Following such a plan will often prevent expensive replacement of complete apparatus under breakdown conditions. Any plan of preventive maintenance should include cleaning, lubrication, and inspection.

Cleaning. Clean the dust from the apparatus. If possible, blow the dust out with dry compressed air. In the absence of an air supply, clean the equipment with a brush or with dry rags. Do not use oily rags as they will leave an oil film on the equipment which will collect dust particles.

Lubrication. Do not lubricate the contacts, bearings, or any other points of any relay or contactor. Oil sparingly the limit switch and master switch bearings, starwheel, and pawl, but do not oil the contacts of these switches.

Inspection and Replacement. Check the connections for loose terminals. Check all devices and operate them manually to locate loose hardware, weak springs, and parts which are developing excessive friction. Tighten loose hardware, and replace worn or defective parts. If the replacement of a component requires the removal of connections, be sure to replace the connections in exactly their original locations. Inspect contacts, springs, and shunts carefully.

1. Contacts. Inspect each pair of contacts for signs of wear, for adequate overtravel, and for adequate force. A rough contact surface does not necessarily indicate a defective contact.

a. Copper Contacts. If copper contacts become severely pitted or burned, dress them with a fine file. Do not use emery cloth or sandpaper as abrasive granules may become imbedded in the contact surface.

b. Silver Contacts. Blackening of a silver contact is not an indication of high contact resistance. Normally dressing is not necessary, but, if the surfaces are deeply pitted or burned, some dressing with a fine file is advisable.

When contact wear has reduced the overtravel to the minimum value specified in the instruction leaflet for the device, replace both the stationary and the moving contacts. Clean the contact seating surfaces thoroughly, bolt the new contacts firmly in place, reassemble the device, check the contact alignment, and check the contact force and overtravel.

2. Springs. Weak springs may cause low contact pressures and may cause contacts to bounce. Low contact pressures may cause the contacts to overheat. Bouncing contacts may cause the contact surfaces to weld. Therefore, inspect the springs for signs of deterioration.

Comparison of a used spring with a new spring as to size, shape, color and tension will indicate roughly whether the used spring has lost its strength. If there is any doubt about the condition of the spring, measure the spring tension and compare it to the recommended value. The instruction leaflets for the individual devices describe the measurement of spring tensions and give correct values of spring tensions.

If a spring is weak, replace it with a new spring. The instruction leaflet describes the installation and adjustment of a new spring.

3. Shunts. Inspect flexible shunts of fine stranded copper for broken strands and for loose terminals. Replace worn shunts.

CORRECTION OF TROUBLE

Even with the best plan of preventive maintenance it is possible for trouble to develop. If a device fails to operate, check it systematically for:

1. Disconnected power supply or low voltage.
2. Loose or broken connection from the power supply to the device.
3. Short-circuited or open-circuited coil.
4. Mechanical interference or excessive friction.
5. Incorrect spring tension.
6. Welded contacts.

Then take the appropriate action to correct the trouble.

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If the controlled generator has the wrong polarity or phase rotation, check the field polarity to be sure it agrees with the diagram; check the direction of rotation to be sure it agrees with the nameplate on the generator or on the machine which is coupled to the generator. If both agree, for a d-c generator interchange the armature connections A1 and A2. Or, for a three phase a-c generator interchange any two of the power connections to the generator.

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