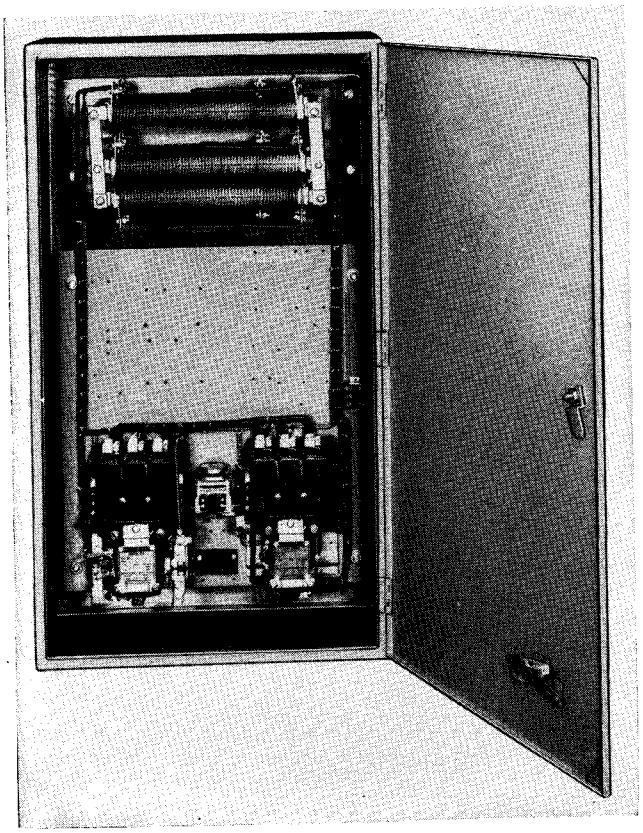
INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

Life-Line* CONTROL

MAGNETIC REDUCED VOLTAGE STARTER

Primary Resistance Type **Time Limit Acceleration**



MAGNETIC REDUCED VOLTAGE STARTERS to which this leaflet applies are listed with their basic class numbers in Table No. 1.

This leaflet has been prepared for guidance in installation, adjustment, operation, and maintenance of standard Magnetic Reduced Voltage Primary Resistance Type Starters. The standard Class 17-400 starter is used as an illustration. The information in this leaflet may also be used to advantage for special and non-standard designs which differ from the standard only in minor electrical or mechanical modifications.

This leaflet, the specific diagram of connections, and the general and specific device leaflets shipped with the starter should all be carefully studied before attempting to install, adjust, operate, or service the equipment and its devices. See reference column of Table No. 3 for list of instruction leaflets.

Use of primary resistance for reduced voltage starting provides an accelerating torque which gradually increases as the motor comes up to speed, gives a closed transition to running connection, but requires more line current per unit of motor accelerating torque than the autotransformer type starter.

Resistor assemblies for standard starters are designed for use with standard hermetic compressor motors of modern design and have the following detail design objectives:

1. Produce 40 to 60% of line voltage at the motor terminals at the instant of starting.

2. Allow maximum resistor unit rise of 375°C on repeated duty cycle of 2 seconds on at 50% of motor rated locked rotor current followed by approximately 20 minutes off with 40°C ambient free air ventilation.

Table No. 1

BASIC CLASS NO.†	DESCRIPTION
17-400	Non-reversing 2-point Standard
17-403	Class 17-400 with built-in non-fusible De-ion® switch
17-404	Class 17-400 with built-in fusible De-ion switch
17-406	Class 17-400 with built-in De-ion circuit breaker
17-410	Reversing (Non-plugging) 2-point Standard
17-413	Class 17-410 with built-in non-fusible De-ion switch
17-414	Class 17-410 with built-in fusible De-ion switch
17-416	Class 17-410 with built-in De-ion circuit breaker
17-420	Multi-step (Not Network)
17-421	Reversing (Non-plugging) Multi-step (Not Network)
17-440	Network (Increment)
17-441	Reversing (Non-plugging) Network (Increment)

† For elaboration of class number code, see page 3 of Westinghouse Price List 11-020.

NEW INFORMATION

* Trade Mark

When used on the full rated repetitive duty cycle, the equivalent continuous heat rate will be 30 to 50 watts per kva of motor rating, so ventilation will require particular attention if this full duty cycle is required. This type of starter is therefore seldom practicable in an application requiring a tight enclosure unless resistors can be remotely located in a ventilated enclosure. Where application requires a tight enclosure, the autotransformer type reduced voltage starter is suggested.

Raceway or conduit wiring to remotely mounted resistor assemblies may be selected for standard starters (resistor Class 116) by multiplying the motor full load current by 0.5 and using this value as motor full load current in the National Electric Code Table 20, making the usual allowances for more than three conductors in raceway, ambient, etc., as for any other motor or controller external wiring. Termination of this wiring at the resistor units requires some attention to avoid subsequent damage to the wiring insulation by heat from the resistor units. Arrangement of these terminations with the wire approaching resistor terminals from befow and at right angles to the units, and stripping the insulation back from the termination should avoid difficulty from heat damage to insulation.

A rough test of resistor temperature for the gray metal edge wound ribbon type resistor units is to observe the resistor ribbons while starting for radiant energy color. In general, if the resistor ribbon begins to show a dark red color in subdued lighting, its *standard* temperature rating has already been exceeded and it is approaching its maximum continuous temperature limit of 600 deg. C. An occasional display of dark color in subdued lighting should cause no particular concern, but frequent operation with color visible in daylight will probably reduce the useful life of the resistor materially.

The cast iron type of resistor which may be used on the larger horsepower ratings should not be operated on a duty so severe as to cause them to show radiant energy color as their life will be shortened materially at temperatures lower than the threshold of radiant energy.

Increment type starters are designed for use on network distributing systems where starting current limitations are such that standard starters will not give small enough increment of starting current.

It is the current ***increment*** which is of importance to the network regulators and the starter will ordinarily meet network requirements even though the motor may not accelerate at all until all resistance has been cut out by the starter.

Resistor assemblies for increment starters are therefore designed and supplied for a particular motor's characteristics and may not be suitable for use on other motors of the same ampere, voltage, speed, and frequency rating which have different values of locked full voltage line current and power factor.

DESCRIPTION AND INSTALLATION

The standard basic three-phase starter includes a three-pole starting contactor, a three-pole running contactor, suitable interposing relays to handle the contactor coil current when required, a set of overload relays, a timing relay, a resistor assembly, and necessary connection, wiring, and terminal details as required. Interposing relays are not supplied on the standard Sizes 1, 2, 3, and 4 starters. See Fig. 1 for typical elementary diagram.

The starting contactor applies reduced voltage to the motor through the resistor assembly when the pilot device first operates to start the motor and timing relay. After the time set on the timing relay has elapsed, the timing relay energizes the running contactor which connects the motor to the line at full voltage.

Short Circuit Protection. Unless the starter is provided with built-in line fuses or circuit breaker, the user should protect the starter against short circuits by one of the following methods:

1. Fuses rated at not more than four times rated motor current.

2. Time Limit circuit breaker set at not more than four times rated motor current.

Overload Protection. Overload protection is provided by inverse time limit thermal overload relays which are connected in the motor circuit during starting as well as running conditions. Before putting the starter in service check the overload heater markings against the heater table per Table No. 2.

If the overload relay has optional reset feature, select type of reset action desired and adjust relay accordingly. For details on mounting heaters and optional reset adjustment see specific overload relay leaflet (Ref. column, Table No. 2).

Connections. See specific controller and motor diagrams for connection details. Typical elementary diagram is shown in Fig. 1. When making connections insert the bared cable or wire end into the connector so it is squeezed between the back of the tang and the collar when the fastener is tightened.

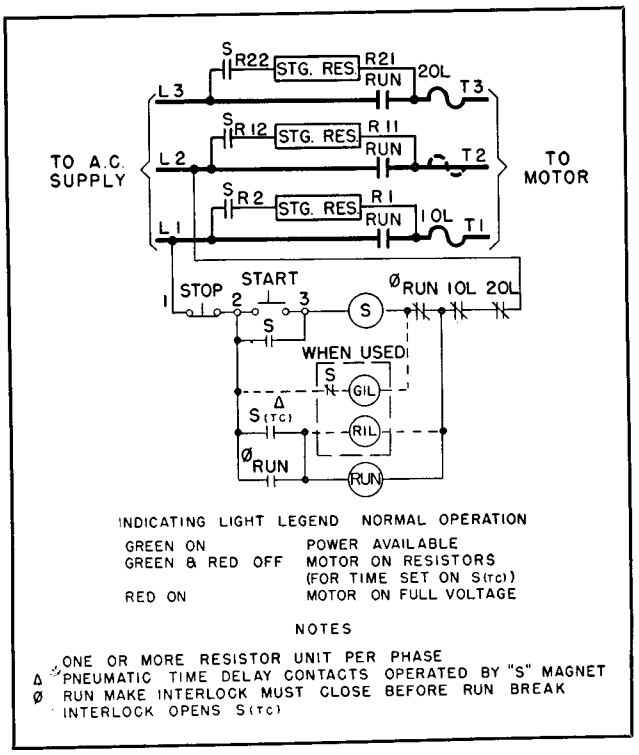


FIG. 1. Typical Elementary Diagram

Figure 2 shows some optional master element (pilot device) connections. The inching connection shown in Fig. 2 is a simple low cost scheme that should be applied with caution as it is not a fool-proof inching arrangement. Should fool-proof inching be required for safety or other operational considerations, do not use this scheme. Starters with inching relays are recommended for fool-proof inching.

Inching with the scheme of Fig. 2 is accomplished by latching the stop-button open to set the starter up for inching and operation will depend upon whether latch depresses stop button fully or only partially. (Both arrangements are in use and available). Should the latch only depress the stop button partially, then the stop and start buttons must both be manually depressed for inching intervals longer than the setting of the timing relay. If start button only is used for inching and it is held down longer than the setting of the timing relay, the starter will be unable to transfer to run and will continue to repeat starting cycles. Such operation may damage resistors if it exceeds their *on* time rating without adequate cooling time.

Should the latch depress the stop button fully, then inch operations using start button only will be normal with starter transfer to run occurring automatically at the end of the starting period.

Electrical Interlocks. Additional electrical interlocks for customer sequence interlocking may often be added. See specific controller diagram and device leaflets for details. Note that the type AMB relay used on Sizes 2, 3, and 4 starters prevents addition of the left hand outboard interlock on the start contactor and the right hand outboard interlock on the *run* contactor for these three starter sizes.

TESTS AND ADJUSTMENTS

Make a careful check of the controller with all motor leads disconnected to insure that the equipment is in good operating condition. In particular, check the following:

a. Does controller go through complete sequence properly?

b. Trip overload relay contacts open manually.

Caution. Do not bend bimetal. Relay calibration may be destroyed if bimetal is forced. Type MW relay contacts may be opened manually by depressing reset fully.

Does relay drop out contactors?

c. Does the timing relay operate properly to energize the run contactor after a definite preset time? Factory setting for this relay is 2 seconds.

d. Does the pushbutton station (or other master switch) operate to control the equipment as expected?

After tests as above, make temporary motor connections and make further tests and adjustments as follows:

e. Check direction of rotation of motor and correct if necessary.

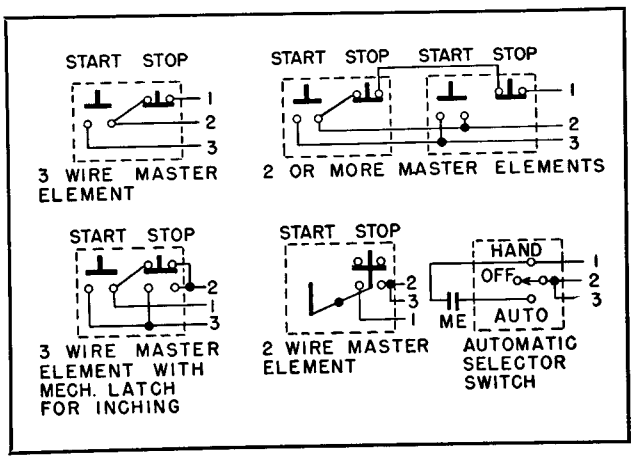


FIG. 2. Optional Connections to Master Switches

Table No. 2

Application, Heater Selection, and Instruction Literature Guide

APPLICATION		HEATER SELECTION		REFERENCE
RATINGS	STANDARD STARTER NEMA I ENCLOSED	SELECT OL RELAY HEATERS FROM		INSTRUCTION LITERATURE†
	Class	Table	Instructions	Individual Device Instructions
*SEE STARTER NAMEPLATE FOR RATINGS	11-400NS2	25.3	I.S. 10701	NR Contactor.....I.L. 17-825-1 AMB Relay.....I.L. 15-827-15 MW Relay.....I.L. 10707 L-60 Interlock.....I.L. 10708
	11-400NS3	26.3	I.S. 10702	
	11-400NS4	26.4	I.S. 10705	
	11-400NS5	26.5	I.S. 10799	NF Contactor.....I.L. 17-825-2 NR Contactor.....I.L. 17-825-1 AMB Relay.....I.L. 15-827-15 N Contactor.....I.L. 10449 MW51 Relay.....I.L. 15-827-10 L-60 Interlock.....I.L. 15-829-2

* Application must always be such that contactor and relay continuous currents will not exceed the 8 hr. rating.

† For general instructions covering unpacking, handling, storing, installation and maintenance, see I. L. 1477-D, I.L. 7000-2, I.L. 4332, I. L.7000-1 and MB 1781-G.

Starters designed for 220 volts will operate on 208 V. network systems. For isolated 208 V. systems contact nearest Westinghouse Sales office and state minimum operating voltage.

f. Observe overload relay operation. Relay should not trip starter off at rated motor load.

After above tests and adjustments are completed, motor leads may be permanently connected and insulated if necessary.

MAINTENANCE

In operating, servicing, and adjusting the equipment, the attendant should consult the specific diagram and the general and specific device instruction leaflets and particularly remember the following points:

1. Warning. All circuits should be de-energized and disconnecting devices locked open when working on equipment.

2. The equipment should be kept clean at all times.

3. Periodic inspection should be made of all equipment to insure that all apparatus is kept in working condition.

4. Contacts becoming badly worn should be replaced before they cause a serious failure. Proper spring pressure should be maintained at all times.

5. Do not oil contactor bearings.

6. Do not use emery paper around electrical apparatus. Sandpaper or file only when absolutely necessary and use care to avoid embedding metal particles in insulating materials.

7. Keep all connections tight. Particular attention should be given to thermal overload relay heater connections to keep them clean and tight.

In Case of Trouble.

a. *If control fuses blow* check carefully for shorted or damaged coils or wires; repair equipment and replace fuse.

b. *If motor fails to accelerate properly*

1. Check AC line for low voltage or single phase condition.
2. Check load and motor for overload, excessive friction, or blocking.

c. *If overload relay trips*

1. Check AC line for load voltage or single phase condition.
2. Check motor and load for overload, excessive friction, or blocking.
3. Check condition of heater connections. Clean and tighten if necessary.
4. Check ambient temperature at relay when relay trips. Heaters may have been selected for a lower ambient than actually exists. See heater table and overload relay instruction leaflet (Table No. 2 reference).
5. Inspect carefully relay, control, motor, and load for any abnormal condition. Correct such condition.

6. Reset relay and attempt new start, observing carefully operation of equipment, motor and load.

d. If starter fails to go through starting sequence completely, check interlock contacts, connections, and operation of devices. Check particularly, the controller diagram for any interlock sequence information such as note ⌀ Fig. 1 and see that the proper sequence is being obtained.

If any major repairs become necessary, we recommend that the nearest Westinghouse Sales office be asked for their recommendations.

Each equipment is designed and supplied for a particular voltage, frequency, horsepower, and number of phases, as marked on nameplate, based on standard hermetic compressor motors of modern design. Before applying starter on other voltage, frequency, motor type, or ampere rating, the nearest Westinghouse Sales office should be consulted.

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