CLASS 4241 MODEL C MAGNETIC PART WINDING MOTOR STARTERS

TIME LIMIT ACCELERATION

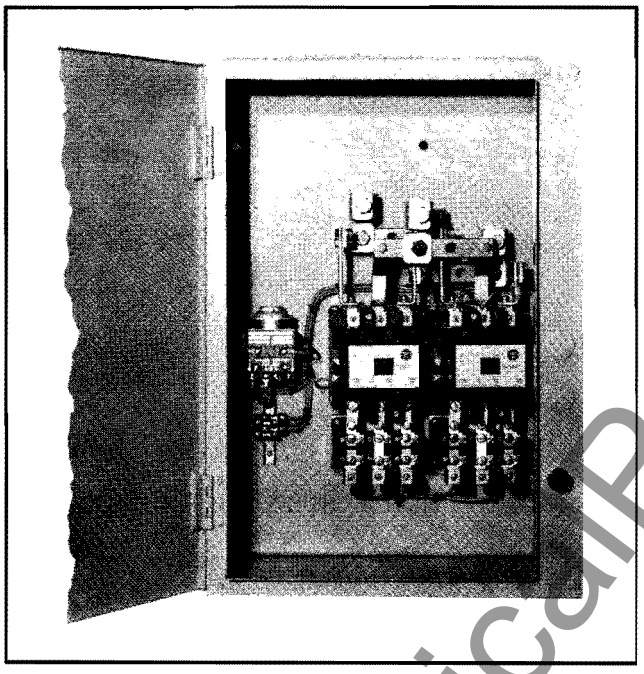

FIG. 1. CLASS 4241 MODEL C Part Winding Motor Starter

MAGNETIC PART WINDING MOTOR STARTERS to which this leaflet applies are listed with their apparatus numbers in Table No. 1 below.

TABLE NO. 1

CAT. NO. CLASS	CAT. NO. STYLE*	DESCRIPTION
4241	NP	Part winding reduced inrush starter without short circuit protection.
4241	NF	Part winding reduced inrush starter with non-fused disconnect switch.
4241	FD	Part winding reduced inrush starter with fused disconnect switch.
4241	CB	Part winding reduced inrush starter with molded case circuit breaker.

*The two letters in this column are part of the catalog number and are located in the 5th. and 6th. place after the class number.

This leaflet has been prepared for guidance in the installation, operation, maintenance and adjustment of standard magnetic part winding motor starters. The standard three-phase 4241 size 4 starter is used as an illustration. This information may also be used to advantage for special and non-standard designs which differ from the standard only in minor electrical or mechanical modifications.

Note: This leaflet, together with the leaflets shipped with the starter, and the specific diagram of connections should be carefully studied before attempting to install, adjust, operate or service the equipment and its devices. See "Reference" column and footnote in Table No. 2, page 3, for list of leaflets giving detailed instructions for the individual devices, and general instructions covering unpacking, handling, storing, installation and maintenance.

STARTING METHOD

Part winding starting is a simple scheme for starting motors with less line disturbance and lamp flicker than would result if these motors were line-started. The starting sequence first applies voltage to part of the motor windings, usually about half of the total active conductors. After a time delay preset on the adjustable timing relay, the remaining windings are energized. In some cases the motor will accelerate to a fairly high speed on the first part of the winding and the final inrush current will be appreciably less than would be obtained with line-starting. If the load torque requirements are such that the motor cannot accelerate to a reasonably high speed with only the first part of the winding energized, then the final inrush current may be almost as large as would be obtained with line-starting. However, the line disturbance and lamp flicker may still be appreciably less than would be obtained with line-starting because the change in current is less and generator or feeder regulators are given time to respond to the initial inrush.

Standard dual voltage motors are often used for part winding starting.

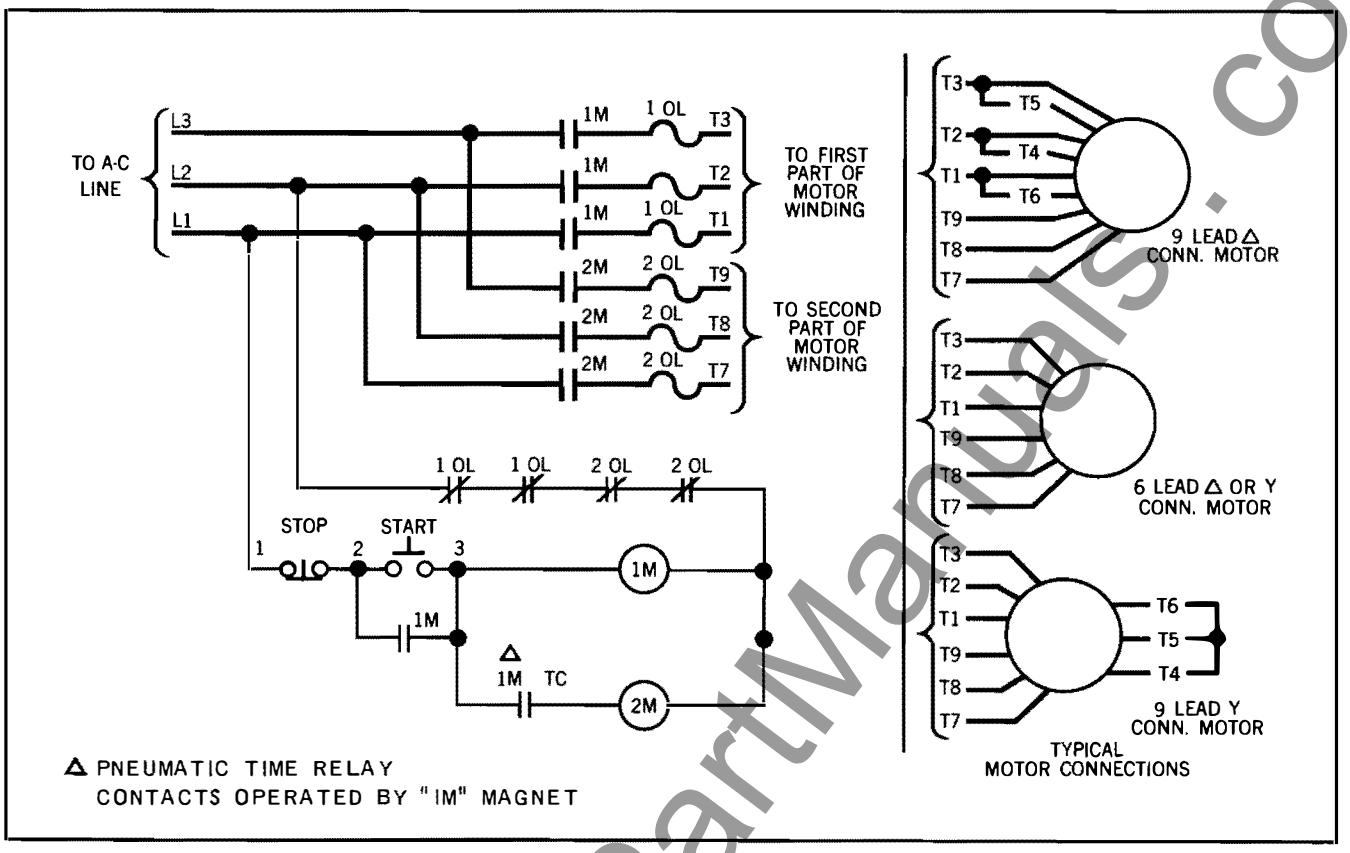

FIG. 2. Typical Elementary Diagram and Motor Connections

DESCRIPTION and INSTALLATION

The standard basic starter includes two contactors each complete with overload relays, a timing relay, interposing relays when required, and the necessary connection, wiring, and terminal details. Interposing relays are not supplied on the standard size 1 through 4 starters. One contactor and set of overload relays (diagram designation 1M) supplies full voltage to the first part of the motor winding when the starter pilot device (pushbutton or master switch) is first operated to start the motor. The timing period is started when this contactor closes. At the end of the preset time delay, the second contactor energizes the remaining motor windings through its set of overload relays.

SHORT-CIRCUIT PROTECTION

Unless the starter is provided with built-in line fuses or circuit breaker, the customer should protect the starter against short circuits by one of these methods:

1. Fuses rated at not more than four times rated motor current.
2. Inverse time limit circuit breaker set at not more than four times rated motor current.
3. Instantaneous trip circuit breaker set for approximately 1.5 times motor full winding locked amperes.

OVERLOAD PROTECTION

An overload on either part of the motor winding during starting or running will stop the motor. Before putting the starter into service, check the overload heater marking against the "Heater" column in Table No. 2. If the overload relay has an optional reset feature, select the type of reset action desired and adjust the relay accordingly. For details on mounting heaters and optional reset adjustment, refer to the specific relay leaflet listed in the "Reference" column of Table No. 2.

CONNECTIONS

See specific controller and motor diagrams for specific connection details. Typical elementary diagram and standard motor connections are shown in Fig. ②. Optional pushbutton and master switch connections are shown in Fig. ③. When making connections, insert the bared cable or wire into the connector so it is squeezed between the back of the tang and the collar when the fastener is tightened.

ELECTRICAL INTERLOCKS

Additional electrical interlocks for customer sequence interlocking may often be added. See specific device leaflet and specific controller diagram for details.

Table No. 2. CLASS 4241 PART WINDING STARTERS

Application, Heater Selection, and Instruction Literature Guide

Note: Read headings. Then select horizontal line for motor type and horsepower
Find starter class, heater selection and literature references in same horizontal line.

APPLICATION								HEATER SECTION TO SELECT				REFERENCE
FOR MOTOR	3–Phase, 60–Cycle □ 2–Pole, Approximate Maximum Motor Horsepower* at Voltage					Contactor and Relay Enclosed 8–Hour Rating* Maximum Amperes	Standard Starter NEMA 1 Enclosed Catalog Series No.	HEATERS FOR		Multiply Motor Total Full Load Current By	And Use This Value as Full Load Motor Current in Heater Table	INSTRUCTION LITERATURE† Timing Relay Factory Setting 2 Seconds Unless Specified Otherwise on Order
	208	220	380	440	550			Contactor and Overload Relay Diagram Designation	Function		Instructions	Individual Device Instructions
NEMA Standard Wye Connected Dual Voltage and Special 6 Lead Part Winding	15	15	20	20	20	27	4241 CA13	1M	Start Run	0.5	CLASS 54 | 92	4102 Contactor I.L. 4102–01–A " O.L. Relay I.L. 5480–02 " Elect. Interlock I.L. 5470–01–A
								2M	Run	0.5		
	30	30	50	50	50	45	4241 CA23	1M	Start Run	0.5		" Contactor I.L. 4102–02–A " O.L. Relay I.L. 5480–02 " Elect. Interlock I.L. 5470–01–A
								2M	Run	0.5		
	60	60	100	100	100	90	4241 CA33	1M	Start Run	0.5		" Contactor I.L. 4102–03–A " O.L. Relay I.L. 5480–03 " Elect. Interlock I.L. 5470–01–A
								2M	Run	0.5		
	100	100	175	200	200	135	4241 CA43	1M	Start Run	0.5		" Contactor I.L. 4102–03–A " O.L. Relay I.L. 5480–03 " Elect. Interlock I.L. 5470–01–A
								2M	Run	0.5		
	200	200	350	400	400	270	4241 CA53	1M	Start Run	0.5		" Contactor I.L. 4102/4204–50 " O.L. Relay I.L. 5480–02 " Elect. Interlock I.L. 5470–01–A
								2M	Run	0.5		
	400	400	–	800	800	540	4241 CA63	1M	Start Run	0.5		" Contactor I.L. 4102–60 " O.L. Relay I.L. 5480–02 " Elect. Interlock I.L. 5470–01–A
								2M	Run	0.5		

* Application must always be such that contactor and relay continuous currents will not exceed 8–hour enclosed rating.
† For general instructions covering unpacking, handling, storing, installation and maintenance, see I.L. 1477–D, I.L. 0334, I.L. 4332, I.L. 0007–1, I.L. 0007–2 and MB 1781–G.
□ To be in line with NEMA Standards ICS–2–321 E.

TESTS and ADJUSTMENTS

The general and specific device leaflets and diagram should all be available to and followed by the installation and starting-up personnel before making the following tests and adjustments.

1. 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. Check overload relay for heater, before running. Trip overload relay. Does it remove equipment from the line?

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 unless specified otherwise on order.

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

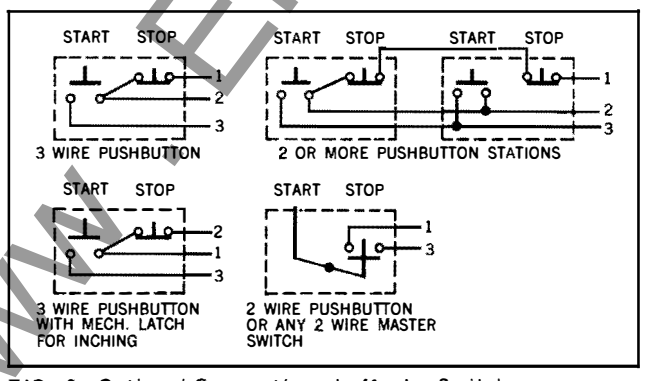

FIG. 3. Optional Connections to Master Switches

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

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

b. Observe motor acceleration time and adjust timing relay setting to apply full winding as soon as the motor rate of acceleration becomes noticeably reduced. If the starting load on the motor is variable, this adjustment should be made with the larger values of load. Some compromise setting may be desirable if the larger values of load seldom occur.

Warning. Abnormal motor heating during starting on first part winding is more severe than line start conditions with full winding. It is therefore most important to transfer to full winding in as short a time as practicable. Do not allow motor to remain on first part winding after motor has stopped accelerating.

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

d. Wye connected motors having the neutral points of their two part windings tied electrically together have the sometimes valuable property of allowing the pull-in torque and accelerating sound level on first part winding to be altered by interchanging corresponding motor phase connections (for example T1—T7 or T2—T8 or T3—T9). If objectionable sound level or insufficient pull-in torque are observed and it can be reliably determined that:

1. Motor is wye connected and

2. Neutral points of second part winding are tied electrically together and to neutral points of first part winding, it may be helpful to try interchanging corresponding phase connections to try to minimize sound level or maximize pull-in torque.

Warning. Do not interchange phase leads without first reliably determining that above conditions are met as NEMA standard dual voltage wye connected motors do not normally have these electrical connections of neutrals supplied by motor manufacturer and attempted single phase starting can quickly damage motor.

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

4. Contacts becoming badly worn should be replaced before they cause 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 necessary, and use care to avoid damaging insulation by metal particles.

7. Keep all connections tight; particular attention should be given overload relay heater connections, to keep them clean and tight.

TROUBLE CHECKING.

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

2. If motor fails to accelerate properly:
   a. Check a—c line for low voltage or single—phase conditions.
   b. Check load and motor bearings for overload, excessive friction, or blocking.

3. If overload relay trips:
   a. Check a—c line for low voltage or single—phase condition.
   b. Check motor and load for overload, excessive friction, or blocking.
   c. Check condition of heater connections. Clean and tighten if necessary.
   d. Check ambient temperature at relay when relay trips. Heaters may have been selected for a lower ambient than actually exists. See heater data and overload relay instruction leaflet in Table No. 2.
   e. Carefully inspect relay, control, motor, and load for any abnormal condition. Correct such condition before restarting.
   f. Reset relay and attempt new start, carefully observing operation of equipment, motor, and load.

4. If starter fails to go through starting sequence completely, check interlock contacts, connections, and operation of the devices.

5. Each equipment is designed and supplied for a particular voltage, frequency, horsepower, and type of motor. Before applying starter on other voltage, frequency, motor type or horsepower rating, check the application with the nearest **Federal Pacific Electric Sales Office.**

Likewise, if any major repairs become necessary, contact the **Sales Office** for recommendations.

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