INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

Life-Line Control

MAGNETIC GENERAL PURPOSE STARTERS

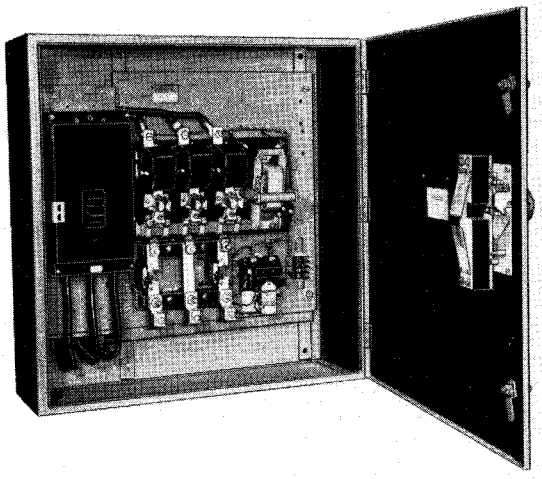


Table No. 1

BASIC CLASS NO.†	DESCRIPTION
11-200	Magnetic linestarter non-reversing
11-203	Class 11-200 with built-in non-fusible switch
11-204	Class 11-200 with built-in fusible switch
11-206	Class 11-200 with built-in circuit breaker
11-210	Magnetic Linestarter reversing
11-213	Class 11-210 with built-in non-fusible switch
11-214	Class 11-210 with built-in fusible switch
11-216	Class 11-210 with built-in circuit breaker
11-230	Multi-motor magnetic linestarter
11-950	Multi-speed magnetic linestarter non-reversing
11-951	Multi-speed magnetic linestarter reversing
11-953	Class 11-950 (or 11-951) with built-in non-fusible switch
11-954	Class 11-950 (or 11-951) with built-in fusible switch
11-956	Class 11-950 (or 11-951) with built-in circuit breaker

† For elaboration of Class Number Code, See Page 3 of Westinghouse Price List 11-020.

MAGNETIC STARTERS to which this leaflet applies are listed with their basic class numbers in Table 1.

Use this leaflet for guidance in installation, adjustment, operation, and maintenance of standard Magnetic Starters. The standard Class 11-206 Size 5 is used as an illustration. The information in this leaflet may also be used to advantage for starters which differ from the standard in 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 column "E" of Table No. 3 for list of instruction leaflets.

INSTALLATION

Short Circuit Protection. Unless the starter is of the combination type with built-in circuit breaker (or fusible line disconnect switch), protect the starter against short circuits by circuit breaker (or fuses) in accordance with the National Electrical Code provisions for motor branch circuit protection.

Overload Protection. Motor overload protection is provided in the standard starters by inverse time limit thermal overload relays.

Check the overload heater marking with Heater Table per column "D" Table No. 3, Page 4, before operating starter. 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 per Table No. 3 (shipped with starter).

Connections. See specific controller and motor diagrams for connection details. Typical elementary diagram for Class 11-200, Size 5 is shown in Fig. 1, page 2. If it is desired to use a three phase single speed starter on single or two phase applications see single speed connection Table No. 2, page 2.

Fig. 2, page 2, shows some optional master element (Pilot Device) connections for Class 11-200 linestarters. These will often apply directly or with slight modification to the combination, reversing, and multi-speed starters also. Compare the specific elementary diagram for the starter under consider-

ation with Fig. 1, page 2, to determine if modifications are necessary.

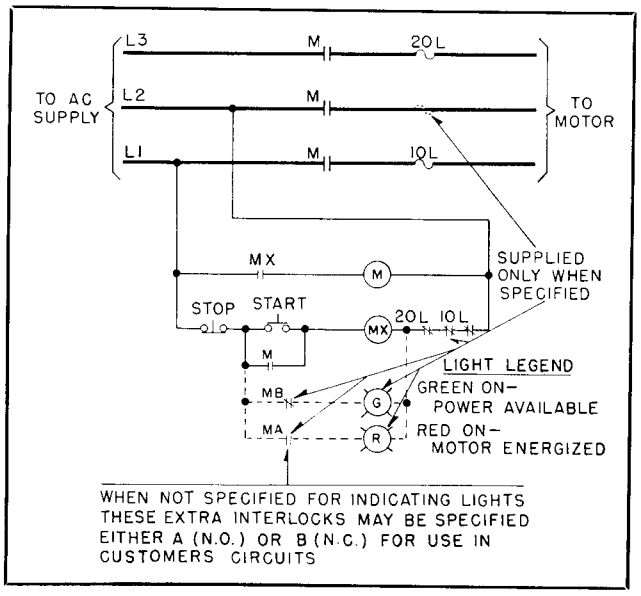


FIG. 1. Typical Elementary Diagram

The inching connection shown in Fig. 2 is a simple low cost scheme that should be applied only after due consideration of the following points:

If this scheme is used—

a. There will be no button specifically marked "Inch".

b. It is necessary for operator to rotate latch on stop button to change from normal to inch or inch to normal operation.

c. If start and stop stations are not physically located together, one operator can depress stop at its location to stop motor while another operator is depressing start at its location to start motor. Under these conditions, when safety considerations may require that stop button should take precedence and stop motor regardless of start button position, note that motor will continue to run as long as start button is held down.

d. The latch which is used to latch the stop button down is the same latch which is sometimes used to lock the stop button open for safety in maintenance or shut-down procedures. If the inching connection of Fig. 2 is used, locking the stop button down has no element of shut-down or safety protection as start button will still start motor.

As a result of above conditions, we recommend that addition of an inching relay and separate inch pushbutton be considered as the standard inching scheme for these starters and the inching connections of Fig. 2 be used only temporarily in an emergency or when local conditions are such that points A thru D above are inconsequential.

Electrical Interlocks. Additional electrical interlocks for customer sequence interlocking may often be added. See specific starter diagram and device leaflets for details.

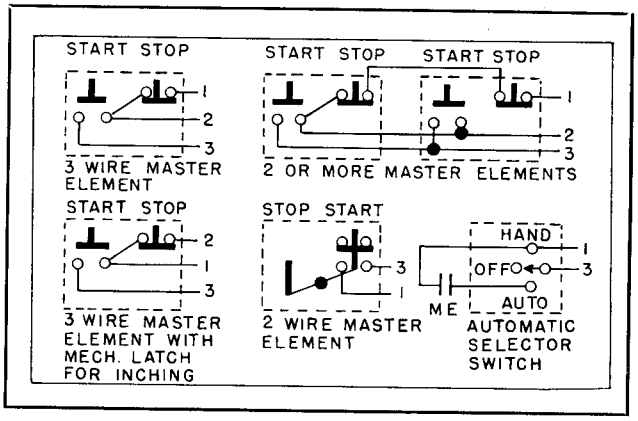


FIG. 2. Optional Connections to Master Elements Class 11-200

Table No. 2

SINGLE SPEED CONNECTIONS

L1	L2	L3	STARTER TERMINALS	T1	T2	T3
Connect Starter Terminals Above to Line as Below				Connect Starter Terminals Above to Motor Terminals Below		
Phase 1	★	Phase 1	Single Phase	T1	. . .	T2
Phase 1	Common	Phase 2	2 Phase, 3 Wire	T1	T3 & T4	T2
Phase 1	Phase 1	Phase 2 ∅	2 Phase, 4 Wire	T1	T3	T2 ∅
Phase 1	Phase 2	Phase 3	3 Phase	T1	T2	T3

★ Connect starter terminals L2 and L3 by jumper.
∅ Connect T4 of motor solid to phase 2.

TESTS AND ADJUSTMENTS

Compare motor and starter nameplates to insure that this is the correct horsepower, voltage, frequency, phase starter for the motor. Check supply line to insure that it is correct voltage, phase, frequency, and has adequate capacity for motor. Make a careful check of starter with all motor leads disconnected to insure that the equipment is in good operating condition. In particular check the following:

a. Does starter go through complete sequence properly in accordance with starter elementary diagram?

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 pushbutton station or other master element operate to control the equipment as expected?

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

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

e. Observe overload relay operation. Relay should not trip starter off at rated 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 note 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. Badly worn contacts 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 (A) metal particles in insulating material and (B) sand particles in contact faces.

7. Keep all connections tight. Particular attention should be given 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 A-C line for low voltage or single phase condition.

2. Check load and motor for overload, excessive friction, or blocking.

3. Check starting load. Is it too great for motor? Perhaps higher motor torque or a starting unloader is required.

c. If overload relay trips

1. Check A-C line for low 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. 3, page 4).

5. Inspect carefully relay, control, motor, and load for any abnormal condition and correct such condition.

6. Reset relay and attempt new start, observing carefully operation of equipment, motor, and load. If accelerating time is long, higher torque or horsepower motor may be required.

d. If starter fails to go through starting sequence completely, check interlock contacts, connections, and operation of devices. Check particularly any interlocks which starter diagram indicates should close sooner or later than other similar interlocks and consult interlock device leaflet for specific adjustment instructions.

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 general purpose motors of modern design.

Before applying starter on other voltage, frequency, motor type, horsepower rating, or number of phases, the nearest Westinghouse Sales office should be consulted.

After the fault which caused the breaker to trip has been located and repaired, move the breaker operating handle to the extreme off position to reset the breaker trip latch. This position is usually marked "Reset" on the external operating mechanism nameplate. Then move the breaker operating handle to the "On" position when ready to restore service.

INSTANTANEOUS TRIP ADJUSTMENT

Some of the type AB circuit breakers used in these starters have adjustable instantaneous magnetic trip elements. The location of the adjustments for the various standard type AB breaker frames is shown in Figs. 3. through 7, page 5. Standard combination starters are shipped from factory with these adjustments set for their high trip setting. To achieve maximum benefit and protection from this feature it is desirable to reduce this setting to the lowest which will allow normal motor acceleration at highest starting and operating load.

To avoid unnecessary interrupting duty on the breaker the final settings should be approached from the high setting side. Minimum curve of Fig. 8, may be used for first trial settings. Ampere value for high settings will be found on breaker or trip unit nameplate and is also marked adjacent to the adjustment lever on the G frame breaker (Fig. 3, page 5). Starting current may be determined from motor locked rotor code letter on motor nameplate and section 94304 of National Electrical Code as

$$\text{starting Current} = \frac{\text{(Locked kva per HP)}}{\text{Rated line volts}} \times \text{HP} \times (.577)$$

for 3 phase motors, or may be estimated as 4 to 7 times motor full load amperes for full voltage starting. For reduced voltage starting the above values should be reduced by multiplying them by

$\frac{\text{Reduced Motor Volts}}{\text{Rated Line Volts}}$ for primary resistor or reactor starting and by $\frac{\text{Reduced Motor Volts}}{\text{Rated Line Volts}} \times \frac{\text{Reduced Motor Volts}}{\text{Rated Line Volts}}$ for auto transformer type starting.

With trial settings as determined from minimum curve of Fig. 8, start motor under conditions of highest starting load. If breaker trips during starting, move trip adjustment settings individually one pole at a time slightly closer to high setting and repeat until motor starts without tripping breaker.

If breaker does not trip and closer settings are desired, move trip adjustments individually one pole at a time slightly closer to low setting and repeat above until breaker trips during starting. Then move individual pole settings slightly closer to high setting one at a time until breaker will not trip during starting.

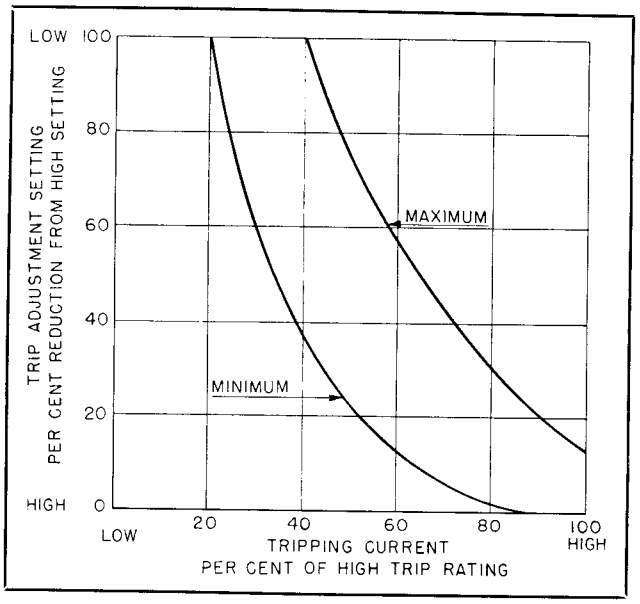


FIG. 8. Magnetic Trip Adjustment Characteristic

Mark final settings with scribe or paint so they may be quickly reset in case of subsequent accidental movement. Due to minor differences in characteristics between pole units, final close settings will usually be different for the three poles. For this reason if very close settings are desired the above procedure should be carried thru to completion of the first pole before making any adjustments to the other two poles. If this is done, the operator can then be sure that the pole being adjusted is the pole which actually tripped the breaker.

To avoid overheating motor adequate cooling time should be allowed between starts. Note that most motors will cool faster if they can be run at no load during cooling intervals.

WESTINGHOUSE ELECTRIC CORPORATION
BUFFALO PLANT • MOTOR AND CONTROL DIVISION • BUFFALO 5, N. Y.
Printed in U.S.A.

Table No. 3

Guide to Application, Heater Selection, and Instruction Literature

APPLICATION									HEATER SELECTION	REFERENCE
A NON-PLUGGING. NON-INCHING. SINGLE SPEED, CONSTANT AND VARIABLE TORQUE MULTI-SPEED. 3-PHASE, 60-CYCLE, 2-POLE				B STANDARD STARTER NEMA I EXAMPLE DESIGNATION	C§ ALL CONSTANT HP MULTI-SPEED. SINGLE SPEED, CONSTANT AND VARIABLE TORQUE MULTI-SPEED, WHEN USED ON DUTIES WHERE NORMAL OPERATION REQUIRES REPEATED OPENING OF STALLED ROTOR CURRENT 3-PHASE, 60-CYCLE, 2-POLE				D SELECT OVERLOAD RELAY HEATERS	E
MAXIMUM* HORSEPOWER AT VOLTAGE BELOW			* MAX. FULL LOAD ENCL.		** MAX. FULL LOAD ENCL.	** MAXIMUM HORSEPOWER AT VOLTAGE BELOW				
△ 220	380	440/550	Amps	Class	Amps	△ 220	380	440/550	From	Instruction Literature†
100	150	200	270	11-200NS5	200	75	125	150	I.S. 10799	NF Contactor.....I.L. 15-825-5 N Contactor.....I.L. 10449 MW52 OL Relay...I.L. 15-827-10 L-60 Interlock.....I.L. 15-829-2 L-51 Interlock.....I.L. 4871 If used KL Breaker.....I.C. 11139 L Breaker.....I.C. 3690
200	350	400	540	11-200NS6	400	150	250	300	I.L. 11-200-3	NFD6-7-8 Contactor.I.L. 15-825-8 N Contactor.....I.L. 10449 MW31 OL Relay...I.L. 10707 Rectifier.....I.L. 2338 L-61 Interlock.....I.L. 15-829-1 L-51 Interlock.....I.L. 4871 If used L Breaker.....I.C. 3690 M Breaker.....I.C. 11864 DB-15 Breaker.....I.B. 35-225-1 DB-25 Breaker.....I.B. 35-225-1 DB-50 Breaker.....I.B. 35-230-C3
300	500	600	810	11-200NS7	650	250	450	500		
450	800	900	1215	11-200NS8	900	350	600	700	I.L. 11-200-4	

△ Starters rated 220 V shall be considered adequate to take care of 208 V applications.

** Application must always be such that contactor and overload relay currents will not exceed the maximum full load enclosed ratings as given.

§ For example—Plug stop of inching duty which requires continuous operation with more than five openings per mintue.

† For general instructions covering Unpacking, Handling, Storing, Installation and Maintenance, see I.L. 1477, I.L. 4330, I.L. 4332, I.L. 7000-1, I.L. 7000-2, MB1781.

For Combination Type Starters Only

Starters having Built-In Circuit Breaker or Fusible or Non-Fusible Disconnect Switch.

OPERATING HANDLE LATCH

In certain enclosures the door or cover is latched shut by part of the breaker or switch operating handle mechanism when the breaker or switch is in the closed position. Provision is made in such cases for the emergency opening of the door or cover without opening the breaker or switch. Release the latch by turning the slotted button in the front of the door or cover with a screwdriver. Note that this button is normally covered by the breaker or switch operating handle in the off position to prevent unauthorized entry when handle is secured by padlock or padlocks.

RESETTING BREAKER

Automatic circuit breakers will not trip automatically unless a short circuit has occured in the motor branch circuit or motor. If breaker trips automatically the short circuit should be located and cleared by repairing or replacing the faulty portion of the circuit. Since the first indication of an internal motor fault is usually a winding to frame fault, wise precaution is to make insulation tests on motors periodically and particularly after a circuit breaker automatic trip for which no other faults external to the motor can be detected.

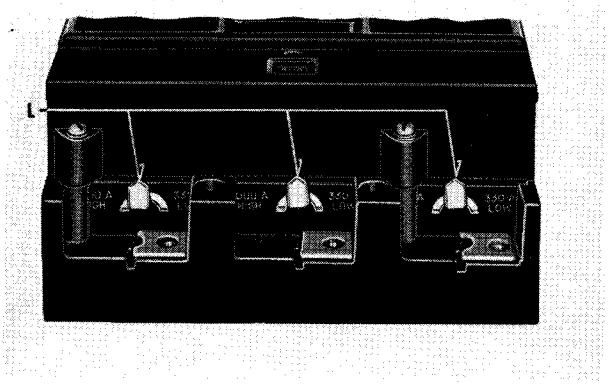


FIG. 3. "G" Frame Rotate Levers "L"

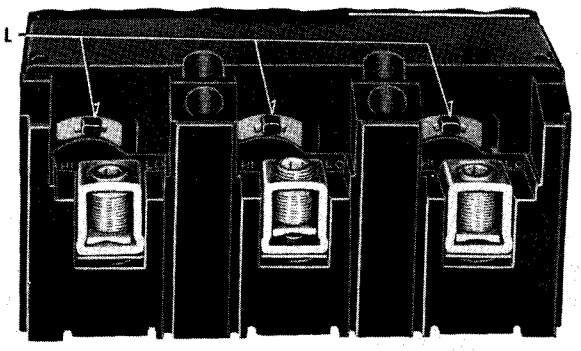


FIG. 4. "J" Frame Rotate Levers "L"

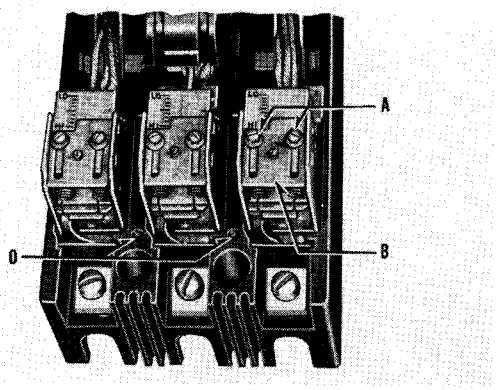
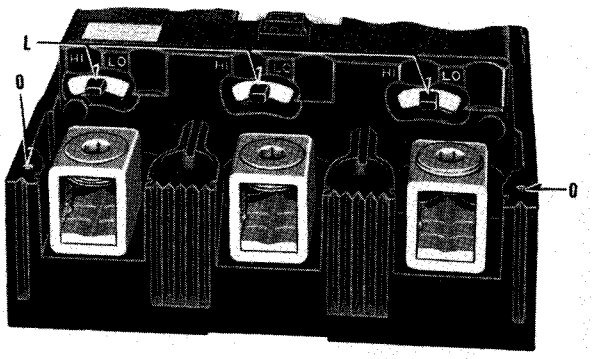


FIG. 5. "F" Frame. Remove Cover (Not Shown) by Removing Four Screws from Holes "O". Loosen Screws "A", Slide Plate "B", Retighten Screws "A". Replace Cover Before Operating.



"KL" Frame.

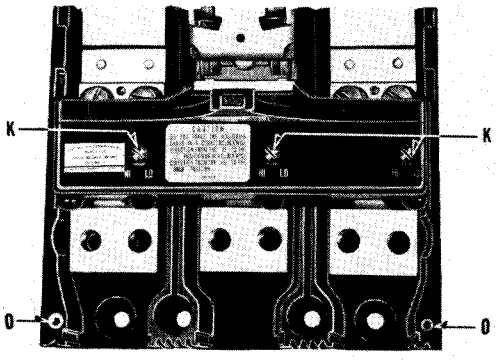
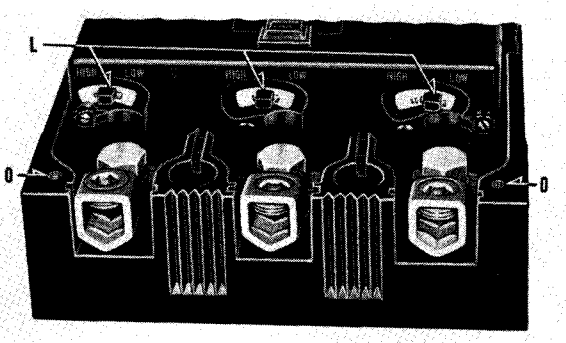


FIG. 6. "L" Frame. ("M" is Similar). Remove Cover (Not Shown) by Removing Four Screws from Inserts "O". Adjust Slotted Knobs "K" in Top of Trip Case. Replace Cover Before Operation. CAUTION—Do Not Force the Adjusting Knobs in a Counter-Clockwise Direction from the "Hi" to the "Lo" position or in a Clockwise Direction from the "Lo" to the "Hi" Position.



"K" Frame

FIG. 7. "K" and "KL" Frames. Remove Cover (Not Shown) by Removing Four Screws from Inserts "O". Rotate Levers "L" on Load End of Trip Case. Replace Cover Before Operating.

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INSTRUCTIONS

Life-Line Control

MAGNETIC GENERAL PURPOSE STARTERS

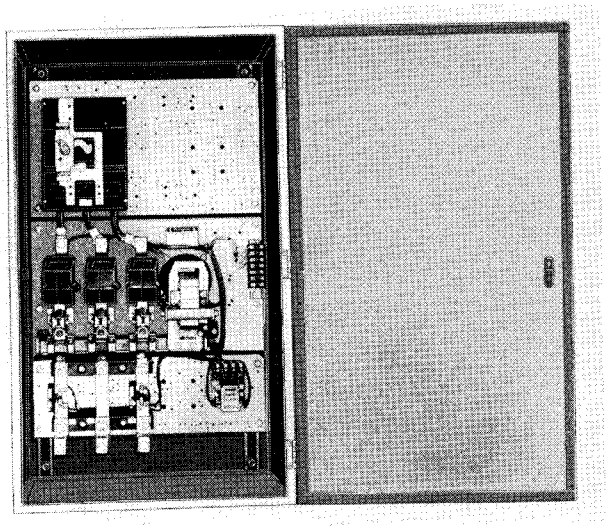

Table No. 1

BASIC CLASS NO.†	DESCRIPTION
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11-203	Class 11-200 with built-in non-fusible switch
11-204	Class 11-200 with built-in fusible switch
11-206	Class 11-200 with built-in circuit breaker
11-210	Magnetic Linestarter reversing
11-213	Class 11-210 with built-in non-fusible switch
11-214	Class 11-210 with built-in fusible switch
11-216	Class 11-210 with built-in circuit breaker
11-230	Multi-motor magnetic linestarter
11-900	Multi-speed magnetic linestarter non-reversing
11-903	Class 11-903 with built-in non-fusible switch
11-904	Class 11-904 with built-in fusible switch
11-906	Class 11-906 with built-in circuit breaker
11-910	Multi-speed magnetic linestarter reversing

† For elaboration of Class Number Code, See Page 103 of Westinghouse Price List 11-020.

MAGNETIC STARTERS to which this leaflet applies are listed with their basic class numbers in Table 1.

Use this leaflet for guidance in installation, adjustment, operation, and maintenance of standard Magnetic Starters. The standard Class 11-206 Size 5 is used as an illustration. The information in this leaflet may also be used to advantage for starters which differ from the standard in 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 column "E" of Table No. 3 for list of instruction leaflets.

INSTALLATION

Short Circuit Protection. Unless the starter is of the combination type with built-in circuit breaker (or fusible line disconnect switch), protect the starter against short circuits by circuit breaker (or fuses) in accordance with the National Electrical Code provisions for motor branch circuit protection.

Overload Protection. Motor overload protection is provided in the standard starters by inverse time limit thermal overload relays.

Check the overload heater marking with Heater Table per column "D" Table No. 3, Page 4, before operating starter. 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 per Table No. 3 (shipped with starter).

Connections. See specific controller and motor diagrams for connection details. Typical elementary diagram for Class 11-200, Size 5 is shown in Fig. 1, page 2. If it is desired to use a three phase single speed starter on single or two phase applications see single speed connection Table No. 2, page 2.

Fig. 2, page 2, shows some optional master element (Pilot Device) connections for Class 11-200 linestarters. These will often apply directly or with slight modification to the combination, reversing, and multi-speed starters also. Compare the specific elementary diagram for the starter under consider-

ation with Fig. 1, page 2, to determine if modifications are necessary.

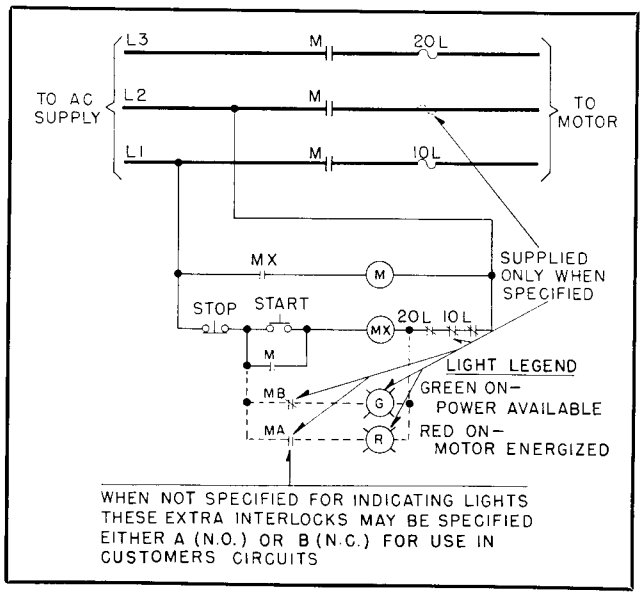

FIG. 1. Typical Elementary Diagram

The inching connection shown in Fig. 2 is a simple low cost scheme that should be applied only after due consideration of the following points:

If this scheme is used—

a. There will be no button specifically marked "Inch".

b. It is necessary for operator to rotate latch on stop button to change from normal to inch or inch to normal operation.

c. If start and stop stations are not physically located together, one operator can depress stop at its location to stop motor while another operator is depressing start at its location to start motor. Under these conditions, when safety considerations may require that stop button should take precedence and stop motor regardless of start button position, note that motor will continue to run as long as start button is held down.

d. The latch which is used to latch the stop button down is the same latch which is sometimes used to lock the stop button open for safety in maintenance or shut-down procedures. If the inching connection of Fig. 2 is used, locking the stop button down has no element of shut-down or safety protection as start button will still start motor.

As a result of above conditions, we recommend that addition of an inching relay and separate inch pushbutton be considered as the standard inching scheme for these starters and the inching connections of Fig. 2 be used only temporarily in an emergency or when local conditions are such that points A thru D above are inconsequential.

Electrical Interlocks. Additional electrical interlocks for customer sequence interlocking may often be added. See specific starter diagram and device leaflets for details.

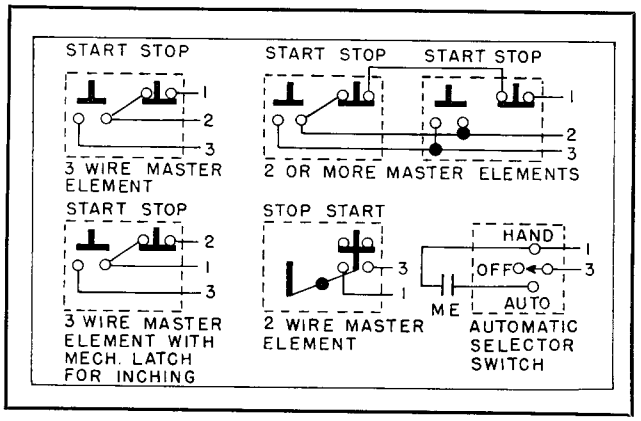

FIG. 2. Optional Connections to Master Elements Class 11-200

Table No. 2

SINGLE SPEED CONNECTIONS

L1	L2	L3	STARTER TERMINALS	T1	T2	T3
Connect Starter Terminals Above to Line as Below				Connect Starter Terminals Above to Motor Terminals Below		
Phase 1	★	Phase 1	Single Phase	T1	. . . .	T2
Phase 1	Common	Phase 2	2 Phase, 3 Wire	T1	T3 & T4	T2
Phase 1	Phase 1	Phase 2 Ø	2 Phase, 4 Wire	T1	T3	T2 Ø
Phase 1	Phase 2	Phase 3	3 Phase	T1	T2	T3

★ Connect starter terminals L2 and L3 by jumper.
Ø Connect T4 of motor solid to phase 2.

TESTS AND ADJUSTMENTS

Compare motor and starter nameplates to insure that this is the correct horsepower, voltage, frequency, phase starter for the motor. Check supply line to insure that it is correct voltage, phase, frequency, and has adequate capacity for motor. Make a careful check of starter with all motor leads disconnected to insure that the equipment is in good operating condition. In particular check the following:

a. Does starter go through complete sequence properly in accordance with starter elementary diagram?

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 pushbutton station or other master element operate to control the equipment as expected?

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

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

e. Observe overload relay operation. Relay should not trip starter off at rated 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 note 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. Badly worn contacts 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 (A) metal particles in insulating material and (B) sand particles in contact faces.

7. Keep all connections tight. Particular attention should be given 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 A-C line for low voltage or single phase condition.

2. Check load and motor for overload, excessive friction, or blocking.

3. Check starting load. Is it too great for motor? Perhaps higher motor torque or a starting unloader is required.

c. If overload relay trips

1. Check A-C line for low 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. 3, page 4).

5. Inspect carefully relay, control, motor, and load for any abnormal condition and correct such condition.

6. Reset relay and attempt new start, observing carefully operation of equipment, motor, and load. If accelerating time is long, higher torque or horsepower motor may be required.

d. If starter fails to go through starting sequence completely, check interlock contacts, connections, and operation of devices. Check particularly any interlocks which starter diagram indicates should close sooner or later than other similar interlocks and consult interlock device leaflet for specific adjustment instructions.

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 general purpose motors of modern design.

Before applying starter on other voltage, frequency, motor type, horsepower rating, or number of phases, the nearest Westinghouse Sales office should be consulted.

After the fault which caused the breaker to trip has been located and repaired, move the breaker operating handle to the extreme off position to reset the breaker trip latch. This position is usually marked "Reset" on the external operating mechanism nameplate. Then move the breaker operating handle to the "On" position when ready to restore service.

INSTANTANEOUS TRIP ADJUSTMENT

Some of the type AB circuit breakers used in these starters have adjustable instantaneous magnetic trip elements. The location of the adjustments for the various standard type AB breaker frames is shown in Figs. 3. through 7, page 5. Standard combination starters are shipped from factory with these adjustments set for their high trip setting. To achieve maximum benefit and protection from this feature it is desirable to reduce this setting to the lowest which will allow normal motor acceleration at highest starting and operating load.

To avoid unnecessary interrupting duty on the breaker the final settings should be approached from the high setting side. Minimum curve of Fig. 8, may be used for first trial settings. Ampere value for high settings will be found on breaker or trip unit nameplate and is also marked adjacent to the adjustment lever on the G frame breaker (Fig. 3, page 5). Starting current may be determined from motor locked rotor code letter on motor nameplate and section 94304 of National Electrical Code as

$$\text{starting Current} = \frac{\text{(Locked kva per HP)}}{\text{Rated line volts}} \times \text{HP} \times (.577)$$

for 3 phase motors, or may be estimated as 4 to 7 times motor full load amperes for full voltage starting. For reduced voltage starting the above values should be reduced by multiplying them by

$\frac{\text{Reduced Motor Volts}}{\text{Rated Line Volts}}$ for primary resistor or reactor starting and by $\frac{\text{Reduced Motor Volts}}{\text{Rated Line Volts}} \times \frac{\text{Reduced Motor Volts}}{\text{Rated Line Volts}}$ for auto transformer type starting.

With trial settings as determined from minimum curve of Fig. 8, start motor under conditions of highest starting load. If breaker trips during starting, move trip adjustment settings individually one pole at a time slightly closer to high setting and repeat until motor starts without tripping breaker.

If breaker does not trip and closer settings are desired, move trip adjustments individually one pole at a time slightly closer to low setting and repeat above until breaker trips during starting. Then move individual pole settings slightly closer to high setting one at a time until breaker will not trip during starting.

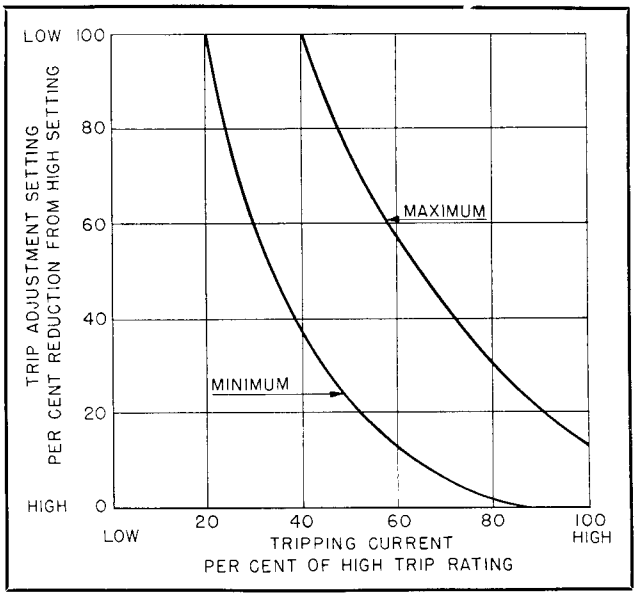

FIG. 8. Magnetic Trip Adjustment Characteristic

Mark final settings with scribe or paint so they may be quickly reset in case of subsequent accidental movement. Due to minor differences in characteristics between pole units, final close settings will usually be different for the three poles. For this reason if very close settings are desired the above procedure should be carried thru to completion of the first pole before making any adjustments to the other two poles. If this is done, the operator can then be sure that the pole being adjusted is the pole which actually tripped the breaker.

To avoid overheating motor adequate cooling time should be allowed between starts. Note that most motors will cool faster if they can be run at no load during cooling intervals.

WESTINGHOUSE ELECTRIC CORPORATION
BUFFALO PLANT • MOTOR AND CONTROL DIVISION • BUFFALO 5, N. Y.
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Table No. 3

Guide to Application, Heater Selection, and Instruction Literature

APPLICATION								HEATER SELECTION	REFERENCE
A NON-PLUGGING. NON-INCHING. SINGLE SPEED, CONSTANT AND VARIABLE TORQUE MULTI-SPEED. 3-PHASE, 60-CYCLE, 2-POLE			B STANDARD STARTER NEMA I	C§ ALL CONSTANT HP MULTI-SPEED. SINGLE SPEED, CONSTANT AND VARIABLE TORQUE MULTI-SPEED, WHEN USED ON DUTIES WHERE NORMAL OPERATION REQUIRES REPEATED OPENING OF STALLED ROTOR CURRENT 3-PHASE, 60-CYCLE, 2-POLE				D SELECT OVERLOAD RELAY HEATERS	E
MAXIMUM* HORSEPOWER AT VOLTAGE BELOW			* MAX. FULL LOAD ENCL.	EXAMPLE DESIGNATION	** MAX. FULL LOAD ENCL.	** MAXIMUM HORSEPOWER AT VOLTAGE BELOW				
△ 220	380	440/550	Amps	Class	Amps	△ 220	380	440/550	From	Instruction Literature†
100	**150**	**200**	**270**	11-200S5	**200**	**75**	**125**	**150**	I.S. 10799	GP-5 Contactor . . . . . I.L. 15-825-5 NH Relay . . . . . I.L. 11192 MW-52 OL Relay . . . I.L. 15-827-10 L-60 Interlock . . . . . I.L. 15-829-2 JKL Breaker . . . . . I.C. 12545 I.C. 82546 LM Breaker . . . . . I.C. 11864 I.C. 11865
200	**350**	**400**	**540**	11-200S6	**400**	**150**	**250**	**300**	I.L. 11-200-3	GP-6 Contactor . . . . . I.L. 15-825-6 NH Relay . . . . . I.L. 11192 MW-31 O.L. Relay . . I.L. 10707 L-60 Interlock . . . . . I.L. 15-829-2 LM Breaker . . . . . I.C. 11864 I.C. 11865
300	**500**	**600**	**810**	11-200S7	**650**	**250**	**450**	**500**		NFD-7-8 Contactor . . . I.L. 15-825-8 NH Relay . . . . . I.L. 11192 MW 31 O.L. Relay . . . I.L. 10707 Rectifier . . . . . I.L. 2338 L-61 Interlock . . . . . I.L. 15-829-1 DB-15 Breaker . . . . . I.B. 35-225-1 DB-25 Breaker . . . . . I.B. 35-225-1 DB-50 Breaker . . . . . I.B. 35-230-C3
450	**800**	**900**	**1215**	11-200S8	**900**	**350**	**600**	**700**	I.L. 11-200-4	

△ Starters rated 220 V shall be considered adequate to take care of 208 V applications.

** Application must always be such that contactor and overload relay currents will not exceed the maximum full load enclosed ratings as given.

§ For example—Plug stop of inching duty which requires continuous operation with more than five openings per minute.

† For general instructions covering Unpacking, Handling, Storing, Installation and Maintenance, see I.L. 1477, I.L. 4330, I.L. 4332, I.L. 7000-1, I.L. 7000-2, MB1781.

For Combination Type Starters Only

Starters having Built-In Circuit Breaker or Fusible or Non-Fusible Disconnect Switch.

OPERATING HANDLE LATCH

In certain enclosures the door or cover is latched shut by part of the breaker or switch operating handle mechanism when the breaker or switch is in the closed position. Provision is made in such cases for the emergency opening of the door or cover without opening the breaker or switch. Release the latch by turning the slotted button in the front of the door or cover with a screwdriver. Note that this button is normally covered by the breaker or switch operating handle in the off position to prevent unauthorized entry when handle is secured by padlock or padlocks.

RESETTING BREAKER

Automatic circuit breakers will not trip automatically unless a short circuit has occured in the motor branch circuit or motor. If breaker trips automatically the short circuit should be located and cleared by repairing or replacing the faulty portion of the circuit. Since the first indication of an internal motor fault is usually a winding to frame fault, wise precaution is to make insulation tests on motors periodically and particularly after a circuit breaker automatic trip for which no other faults external to the motor can be detected.

COMBINATION TYPE STARTERS ONLY

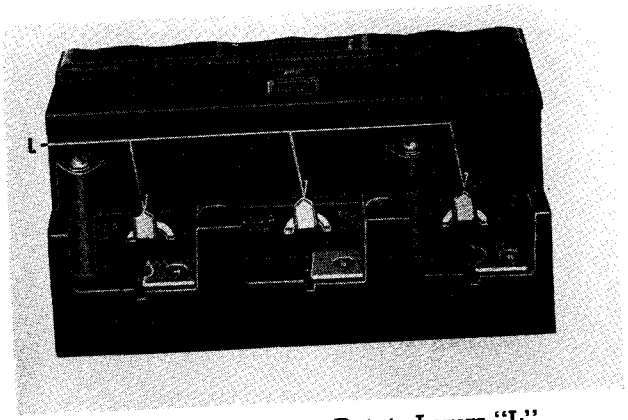


FIG. 3. "G" Frame Rotate Levers "L"

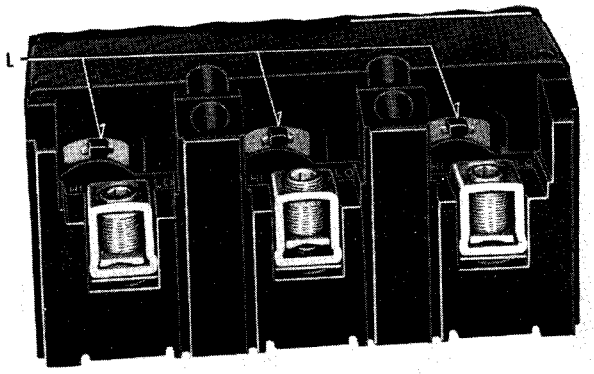


FIG. 4. "J" Frame Rotate Levers "L"

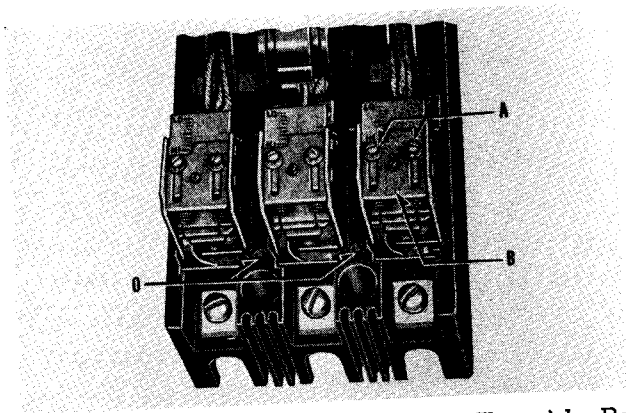
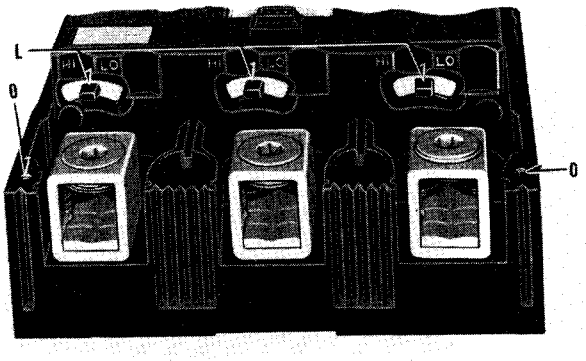


FIG. 5. "F" Frame. Remove Cover (Not Shown) by Removing Four Screws from Holes "O". Loosen Screws "A", Slide Plate "B", Retighten Screws "A". Replace Cover Before Operating.



"KL" Frame.

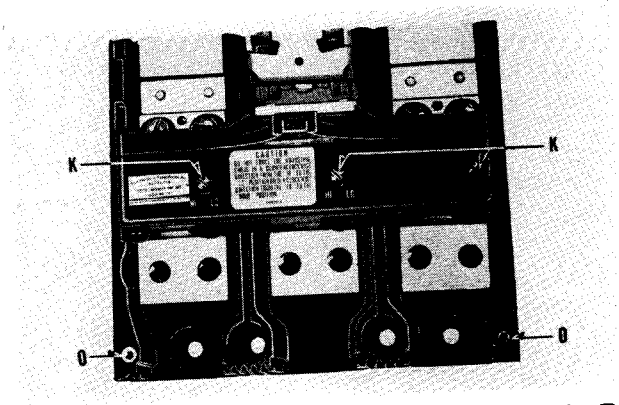
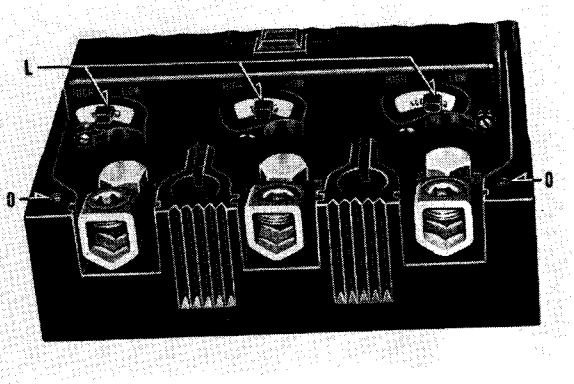


FIG. 6. "LM" Frame. Remove Cover (Not Shown) by Removing Four Screws from Inserts "O". Adjust Slotted Knobs "K" in Top of Trip Case. Replace Cover Before Operation. CAUTION—Do Not Force the Adjusting Knobs in a Counter-Clockwise Direction from the "Hi" to the "Lo" position or in a Clockwise Direction from the "Lo" to the "Hi" Position.



"K" Frame

FIG. 7. "K" and "KL" Frames. Remove Cover (Not Shown) by Removing Four Screws from Inserts "O". Rotate Levers "L" on Load End of Trip Case. Replace Cover Before Operating.