



# DESCRIPTION • OPERATION • MAINTENANCE INSTRUCTIONS

## INTERLOCKED MOTOR-DRIVEN OPERATING MECHANISM

For No-Load Tap Changers

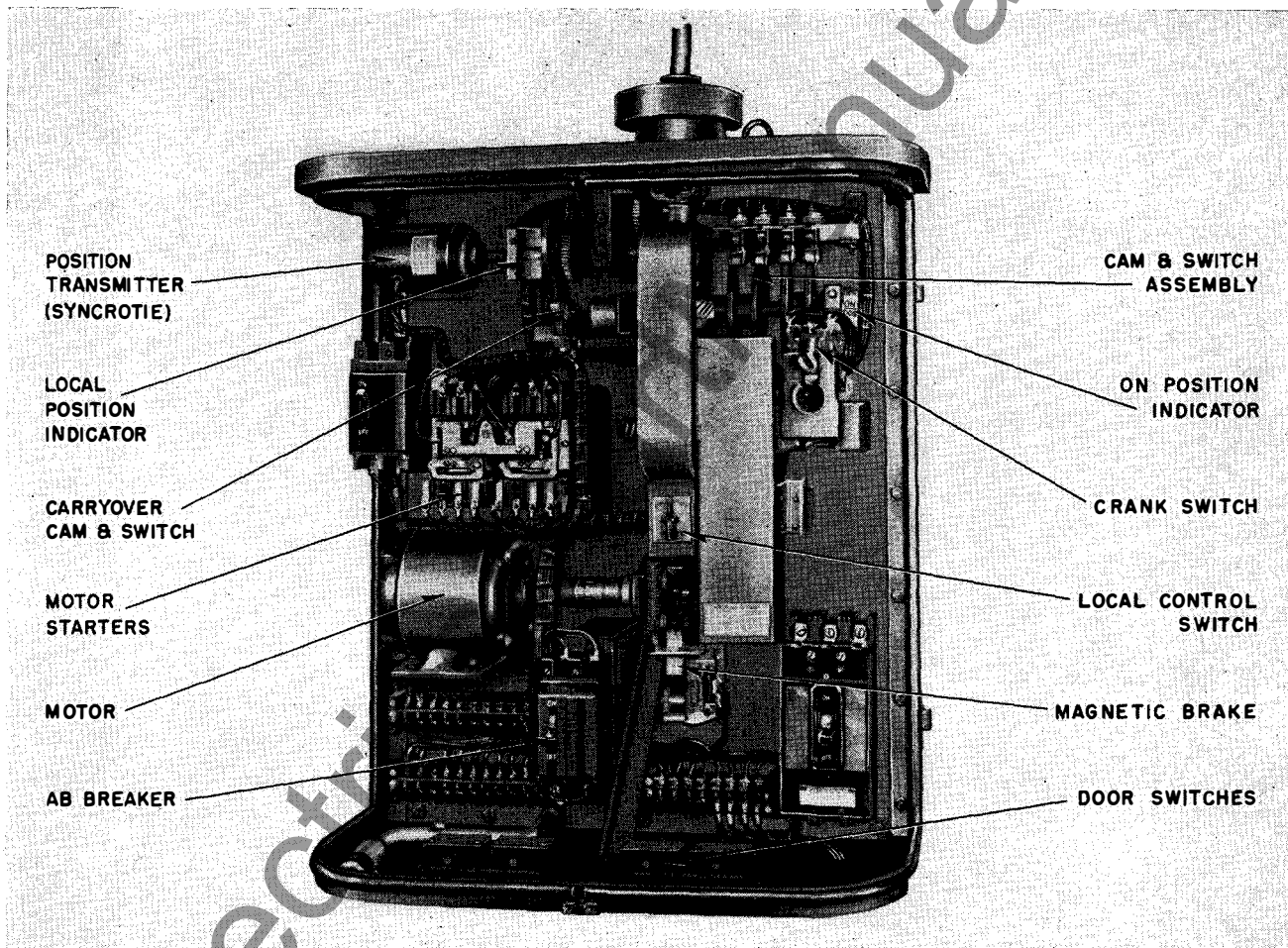


FIG. 1. Motor-Driven Operating Mechanism with Syncrotie.

THE INTERLOCKED MOTOR-DRIVEN OPERATING MECHANISM is used to operate no-load tap changers and is interlocked in such a way that tap changes can be made only under certain predetermined conditions, insuring that the tap changer contacts will not be opened under load.

**Important:** Mechanical interlocks to the breaker are not provided for prevention of hand operation under conditions of loss of circuit breaker control voltage and therefore, before operating by hand, the transformer

must be de-energized, with the breakers open and steps taken to see that they remain open as long as the tap changer is off position, or the operating mechanism cabinet is open.

### DESCRIPTION

The mechanism of a typical unit consists of a steel base plate on which is mounted the motor and brake, reduction unit, motor starter, motor protection breaker, motor pilot switches, interlock switches, tap position indicator, and drum switch

## OPERATING MECHANISM

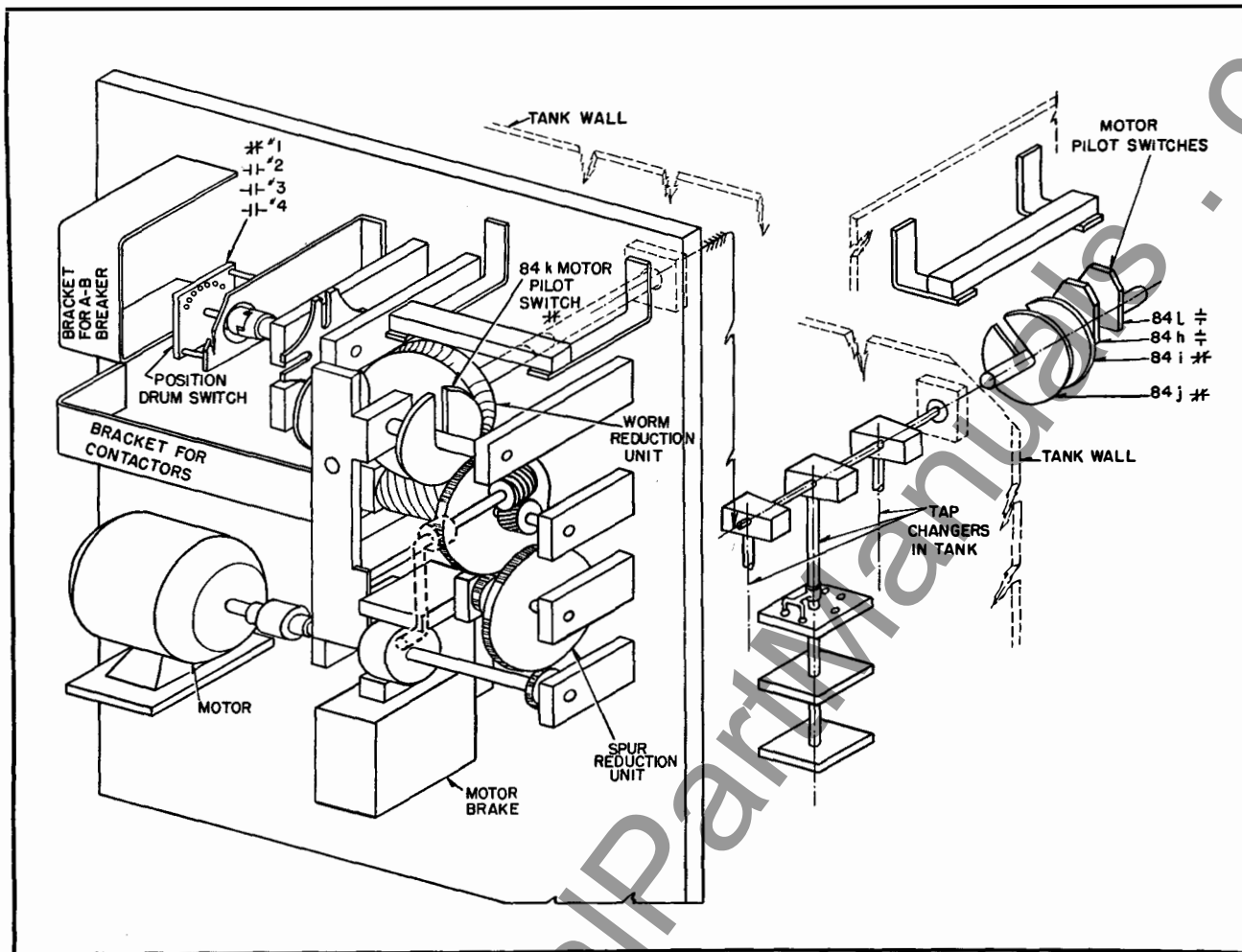


FIG. 2. Schematic Diagram Showing Location of Motor Pilot Switches in Furnace Application.

for remote electrical position indicator lamps. The entire mechanism is enclosed in a sheet steel, weatherproof housing with hinged access door which has a glass window through which the position indicator is visible.

Details of the mechanism are shown in Fig. 1. The motor is connected to the drive shaft of the mechanism through a gear reduction unit. A solenoid-operated brake is mounted on the motor and is applied as soon as the motor circuit is opened.

A typical arrangement used on furnace transformers is shown in Fig. 2. In this arrangement the motor pilot switches are not in the housing but are located at the extreme end of the tap changer drive shaft.

Tap changes are normally made by remote control from the switchboard, but provision is made for operation by a hand crank in case of necessity.

On units that cannot be operated beyond definite positions without damage, extra limit switches are provided in both "raise" and "lower" direction. The mechanism is so designed that when on the extreme tap positions, should the operator inadvertently attempt to operate the tap changer beyond the normal position, no damage will result.

### RECEIVING

The mechanism is usually shipped mounted on the transformer.

After the transformer has been set in place, inspect the tap changer operating mechanism to see that parts have not been damaged during shipment. Remove blocking from the motor starter and check to see that the contact arm moves freely. Operate the tap changer over the complete range by means of the hand crank. Remove the hand crank and operate the tap changer electrically. Insertion or removal of hand crank causes operation of crank

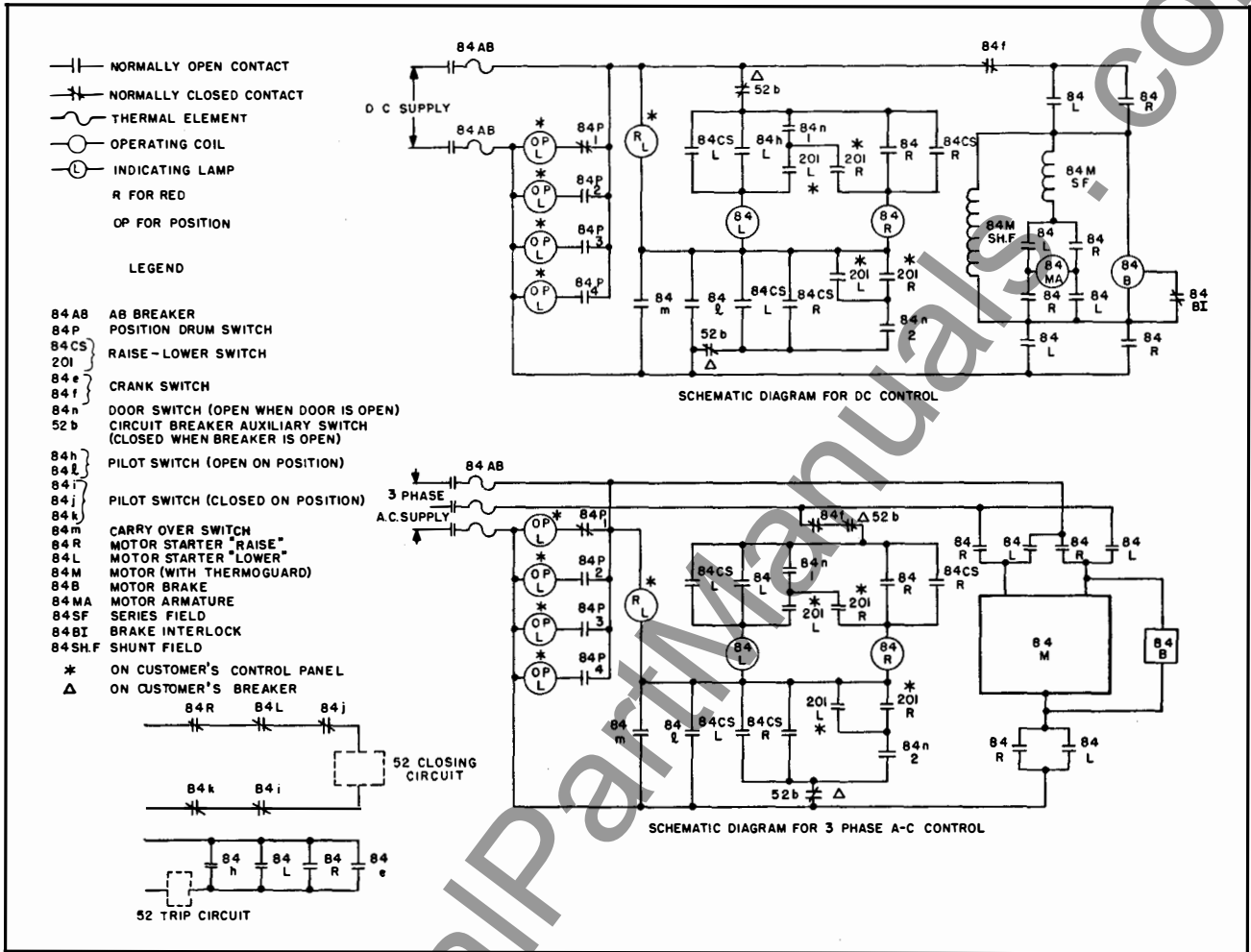


FIG. 3. Schematic Diagram for A-C and D-C Control.

switches 84e and 84f, explained under operation. The tap changer should stop on position, and if it should not do so, check the adjustment of the brake shoes. Inspect this adjustment at regular intervals, to make any necessary adjustments.

**OPERATION**

The schematic control circuits for three-phase a-c, and d-c, control voltages are shown, in Fig. 3, on Position 1, de-energized with door open and crank out of position.

The "Raise-Lower" control switch (20I located on the customer's control panel and 84CS located in the mechanism housing) operates the respective "raise" or "lower" (84R, 84L) contactor switches in the mechanism housing to change tap positions. The breaker control on the customer's panel should be operated to open the breaker before attempting to change taps. Once the mechanism has started to change taps, switch 84l closes, sealing in the motor starter and insuring the completion of the

operation. In the circuit breaker trip circuit, switches 84h, 84R and 84L close to energize the trip coil of the circuit breaker in order to trip the breaker, in case it is closed, before the tap changer contacts open, and to prevent any closing of the circuit breaker while the tap changer is in operation. This is a new added protective feature, to guard against mechanism linkage failure, tap changer brake failure or control voltage failure, but is not a substitute for good maintenance.

The breaker control should not be operated to close until the tap change is completed. Switches 84i, 84j, and 84k prevent the closing of the circuit breaker while the tap changer is being operated either electrically or by hand, except of course in the case of circuit breaker control voltage failure. Switches 84L and 84R in the circuit breaker closing circuit are contacts on the motor starter for the "lower" and "raise" positions respectively, and are additional safety measures—being open when the starter contacts are closed. The position lights on

## OPERATING MECHANISM

the remote control panel are lighted in the proper sequence by means of the drum switch  $\frac{84P}{1}$ ,  $\frac{84P}{2}$ , etc., in the operating mechanism. When the tap changer is off position, a red light (RL) on the control panel is lighted. Carry-over switch 84m closes, when it is desired to operate the tap changer mechanism past any "omitted" position on the tap changer.

Other electrical interlocking is accomplished by three additional sets of switches. The door switches (84n) cut off the tap changer control circuit power, thus preventing a tap change by remote control when the mechanism door is open. The crank switch (crank shown out of position in Fig. 3) 84e, for operating the tap changer by hand, closes the circuit breaker trip-circuit, and 84f opens the control circuit to the tap changer when the crank is inserted in the cranking position. It thus trips the breaker and insures that the transformer is de-energized while manually changing taps (as long as circuit breaker control voltage is available and breaker controls are properly connected and maintained). The circuit breaker pallet switches (52b), which are on the main circuit breaker, are open when the circuit breaker is closed and thus prevent remote operation of the mechanism when the transformer is energized.

**Caution:** Circuit breaker should not be operated by the hand closing lever if the tap changer is being operated or is off position.

**Remote Control Operation.** For making a tap change by remote control:

1. Disconnect the transformer from the line by operating both the high and low-voltage circuit breakers.

2. Turn the control switch (201) to "Raise" or "Lower" until the desired tap change has been made.

*Note: It is necessary to hold the tap changer control switch in position only long enough to start the tap change as the control circuit is so arranged that once a tap change has been started by remote control, it is automatically completed regardless of the action of the operator.*

3. When the indicating lamps show that the desired change of taps is completed, connect the transformer to the line by closing the circuit breaker switch. Do not close this switch until the tap changer is on position.

**Manual Operation.** For making a tap change by manual operation:

1. Disconnect the transformer from the line by opening both the high and low-voltage circuit breakers.

2. Open the mechanism door, remove the hand crank from its holder, and place it in position for hand cranking.

3. Release the brake and at the same time rotate the hand crank until the desired change of taps has been made. The brake may be released by depressing the brake plunger at the bottom of the brake. A brake lock is provided which will hold the plunger down when applied to the plunger operating arm. It may be unlocked by hand or by applying full brake voltage to the brake coil.

4. Remove the hand crank and replace in its holder.

5. Close the door, making sure that it is tightly latched.

6. Connect the transformer to the line by closing the circuit breakers.

## MAINTENANCE

These mechanisms require no special care and maintenance other than a periodic inspection of the brake shoes for wear and brake adjustment. Adjust brake shoes according to the instructions on the brake nameplate.

Any questions pertaining to operation and maintenance not covered by this leaflet should be referred to the nearest Westinghouse Office or Service Department.

**Renewal Parts.** If renewal parts are required, order from the nearest Westinghouse Office giving a description of the parts needed, together with the S.O. and serial number as stamped on the nameplate attached to the operating mechanism house.



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# DESCRIPTION • OPERATION • MAINTENANCE INSTRUCTIONS

## MOTOR-DRIVEN OPERATING MECHANISM For De-Energized Switching

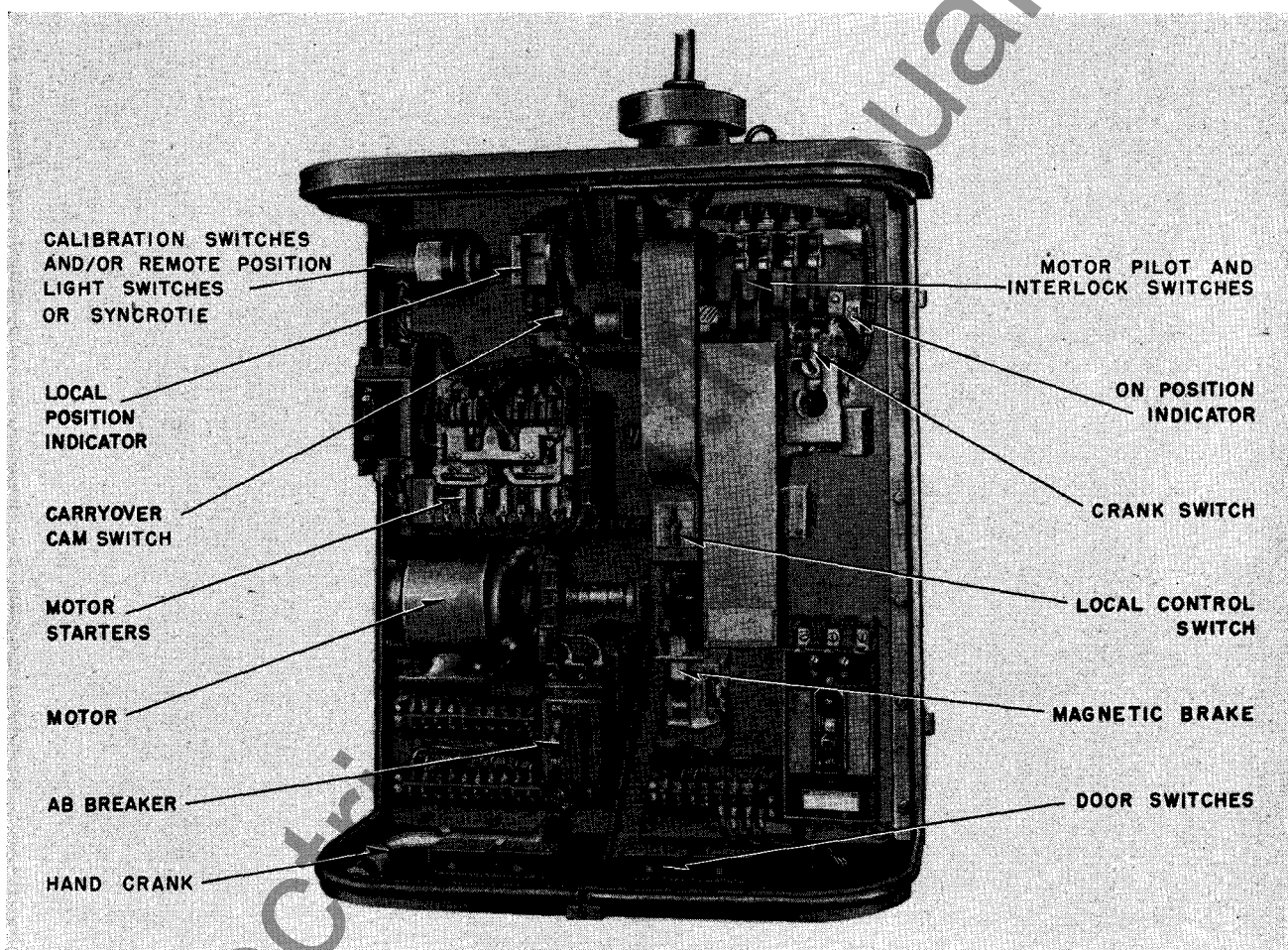


FIG. 1. Motor-Driven Operating Mechanism with Syncrotie.

**THE MOTOR-DRIVEN OPERATING MECHANISM** is used for de-energized switching and is interlocked in such a way that tap changes can be made only under certain pre-determined conditions, insuring that the tap changer contacts will not be opened with the transformer energized.

**Important:** Mechanical interlocks to the breaker are not provided for prevention of hand operation under conditions of loss of circuit breaker control voltage and therefore, before operating by hand, the transformer

must be de-energized, with the breakers open and steps taken to see that they remain open as long as the tap changer is off position, or the operating mechanism cabinet is open.

### DESCRIPTION

The mechanism of a typical unit consists of a steel base plate on which is mounted the motor and brake, reduction unit, motor starter, motor protection breaker, motor pilot switches, interlock switches, tap position indicator, and drum switch

## OPERATING MECHANISM

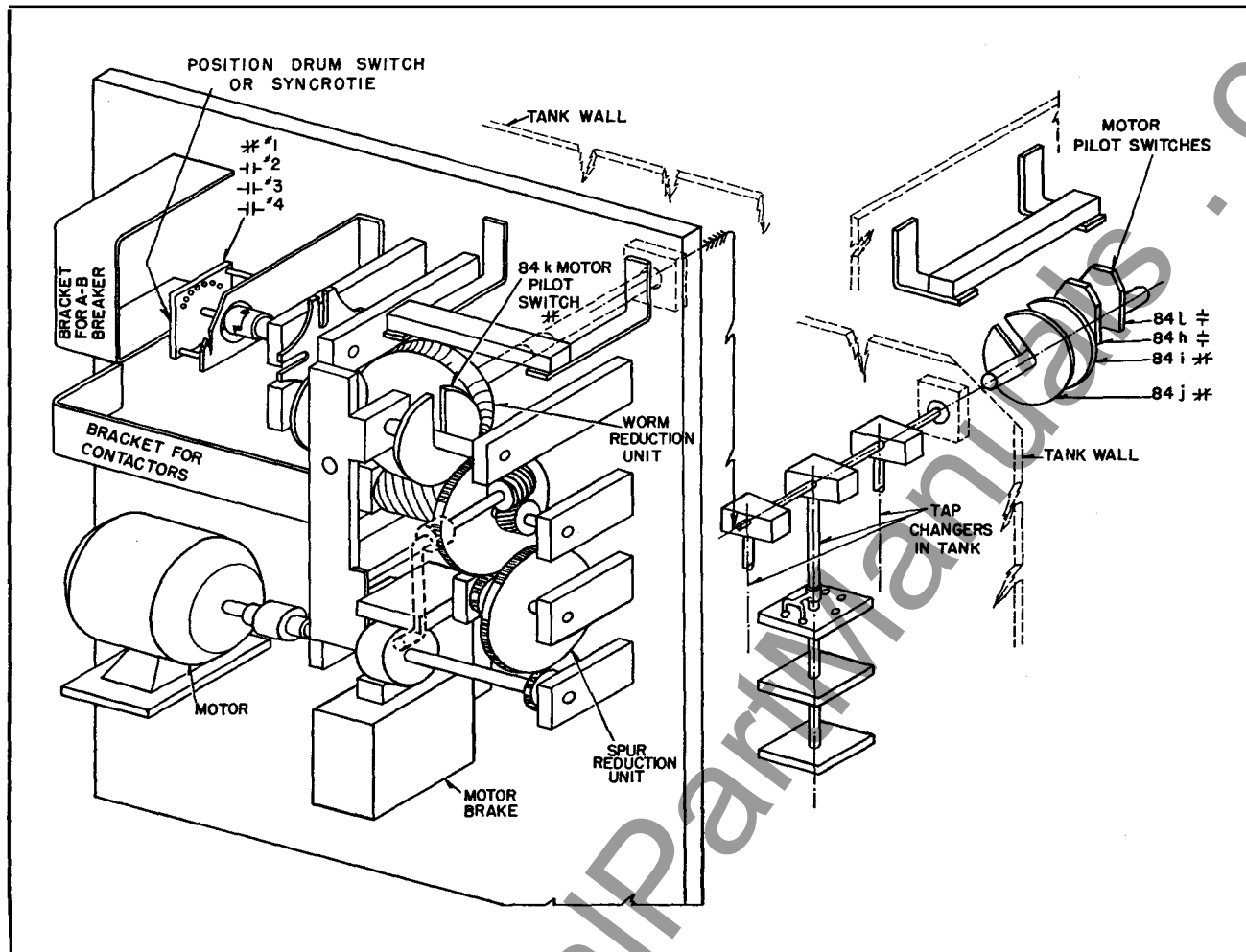


FIG. 2. Schematic Diagram Showing Location of Motor Pilot Switches in Furnace Application.

for remote electrical position indicator lamps. The entire mechanism is enclosed in a sheet steel, weatherproof housing with hinged access door which has a glass window through which the position indicator is visible.

Details of the mechanism are shown in Fig. 1. The motor is connected to the drive shaft of the mechanism through a gear reduction unit. A solenoid-operated brake is mounted on the motor and is applied as soon as the motor circuit is opened.

A typical arrangement used on furnace transformers is shown in Fig. 2. In this arrangement the motor pilot switches are not in the housing but are located at the extreme end of the tap changer drive shaft.

Tap changes are normally made by remote control from the switchboard, but provision is made for operation by a hand crank in case of necessity.

On units that cannot be operated beyond definite positions without damage, extra limit switches are provided in both "raise" and "lower" direction. The mechanism is so designed that when on the extreme tap positions, should the operator inadvertently attempt to operate the tap changer beyond the normal position, no damage will result.

### RECEIVING

The mechanism is usually shipped mounted on the transformer.

After the transformer has been set in place, inspect the tap changer operating mechanism to see that parts have not been damaged during shipment. Remove blocking from the motor starter and check to see that the contact arm moves freely. Operate the tap changer over the complete range by means of the hand crank. Remove the hand crank and operate the tap changer electrically. Insertion or removal of hand crank causes operation of crank

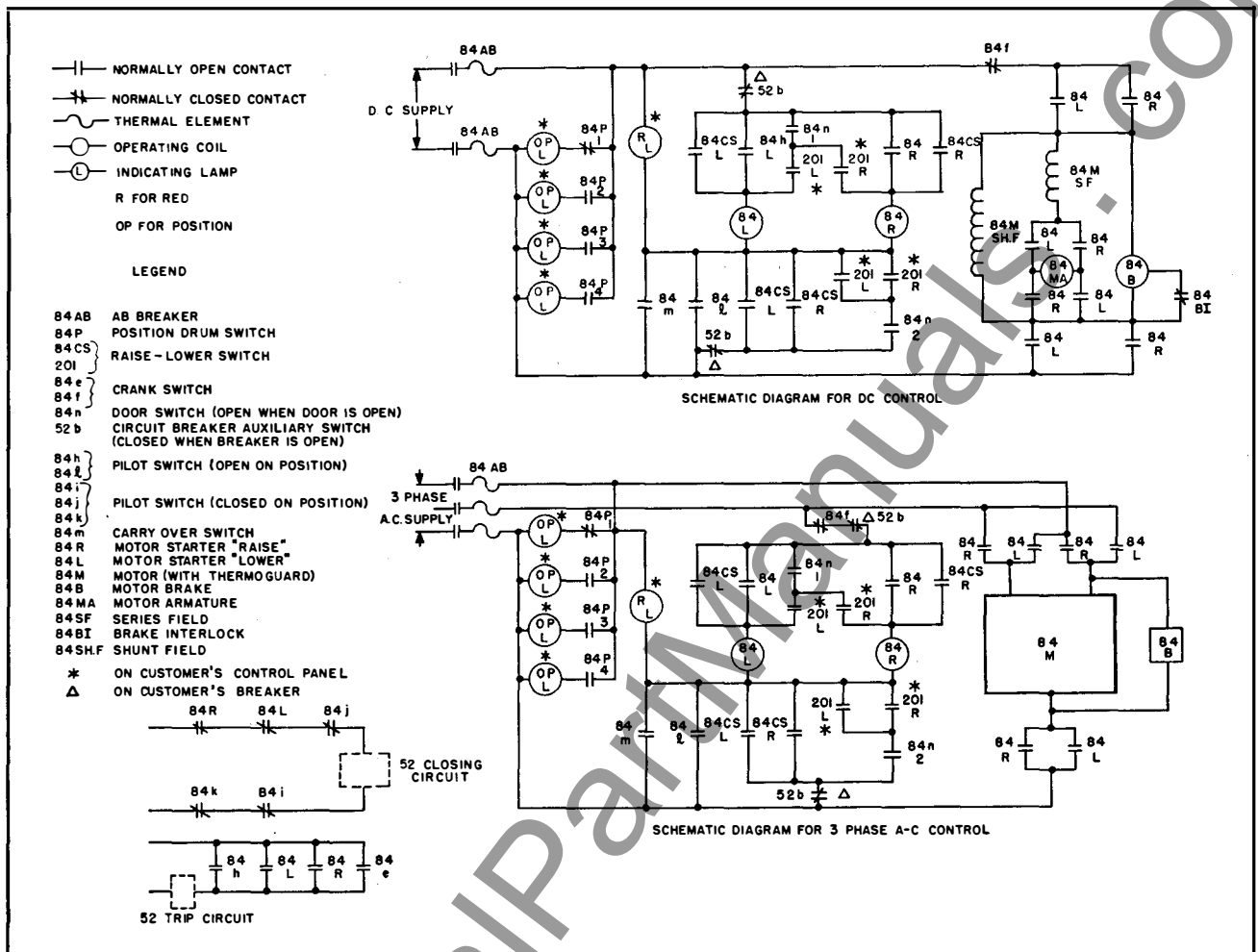


FIG. 3. Schematic Diagram for A-C and D-C Control.

switches 84e and 84f, explained under operation. The tap changer should stop on position, and if it should not do so, check the adjustment of the brake shoes. Inspect this adjustment at regular intervals, to make any necessary adjustments.

**OPERATION**

The schematic control circuits for three-phase a-c, and d-c, control voltages are shown, in Fig. 3, on Position 1, de-energized with door open and crank out of position.

The "Raise-Lower" control switch (201 located on the customer's control panel and 84CS located in the mechanism housing) operates the respective "raise" or "lower" (84R, 84L) contactor switches in the mechanism housing to change tap positions. The breaker control on the customer's panel should be operated to open the breaker before attempting to change taps. Once the mechanism has started to change taps, switch 84i closes, sealing in the motor starter and insuring the completion of the

operation. In the circuit breaker trip circuit, switches 84h, 84R and 84L close to energize the trip coil of the circuit breaker in order to trip the breaker, in case it is closed, before the tap changer contacts open, and to prevent any closing of the circuit breaker while the tap changer is in operation. This is a new added protective feature, to guard against mechanism linkage failure, tap changer brake failure or control voltage failure, but is not a substitute for good maintenance.

The breaker control should not be operated to close until the tap change is completed. Switches 84i, 84j, and 84k prevent the closing of the circuit breaker while the tap changer is being operated either electrically or by hand, except of course in the case of circuit breaker control voltage failure. Switches 84L and 84R in the circuit breaker closing circuit are contacts on the motor starter for the "lower" and "raise" positions respectively, and are additional safety measures—being open when the starter contacts are closed. The position lights on

## OPERATING MECHANISM

the remote control panel are lighted in the proper sequence by means of the drum switch  $\frac{84P}{1}$ ,  $\frac{84P}{2}$ , etc., in the operating mechanism. When the tap changer is off position, a red light (RL) on the control panel is lighted. Carry-over switch 84m closes, when it is desired to operate the tap changer mechanism past any "omitted" position on the tap changer.

Other electrical interlocking is accomplished by three additional sets of switches. The door switches (84n) cut off the tap changer control circuit power, thus preventing a tap change by remote control when the mechanism door is open. The crank switch (crank shown out of position in Fig. 3) 84e, for operating the tap changer by hand, closes the circuit breaker trip-circuit, and 84f opens the control circuit to the tap changer when the crank is inserted in the cranking position. It thus trips the breaker and insures that the transformer is de-energized while manually changing taps (as long as circuit breaker control voltage is available and breaker controls are properly connected and maintained). The circuit breaker pallet switches (52b), which are on the main circuit breaker, are open when the circuit breaker is closed and thus prevent remote operation of the mechanism when the transformer is energized.

**Caution:** Circuit breaker should not be operated by the hand closing lever if the tap changer is being operated or is off position.

**Remote Control Operation.** For making a tap change by remote control:

1. Disconnect the transformer from the line by operating both the high and low-voltage circuit breakers.

2. Turn the control switch (201) to "Raise" or "Lower" until the desired tap change has been made.

*Note: It is necessary to hold the tap changer control switch in position only long enough to start the tap change as the control circuit is so arranged that once a tap change has been started by remote control, it is automatically completed regardless of the action of the operator.*

3. When the indicating lamps show that the desired change of taps is completed, connect the transformer to the line by closing the circuit breaker switch. Do not close this switch until the tap changer is on position.

**Manual Operation.** For making a tap change by manual operation:

1. Disconnect the transformer from the line by opening both the high and low-voltage circuit breakers.

2. Open the mechanism door, remove the hand crank from its holder, and place it in position for hand cranking.

3. Release the brake and at the same time rotate the hand crank until the desired change of taps has been made. The brake may be released by depressing the brake plunger at the bottom of the brake. A brake lock is provided which will hold the plunger down when applied to the plunger operating arm. It may be unlocked by hand or by electrical operation of the motor mechanism.

4. Remove the hand crank and replace in its holder.

5. Close the door, making sure that it is tightly latched.

6. Connect the transformer to the line by closing the circuit breakers.

## MAINTENANCE

These mechanisms require no special care and maintenance other than a periodic inspection of the brake shoes for wear and brake adjustment. Adjust brake shoes according to the instructions on the brake nameplate.

Any questions pertaining to operation and maintenance not covered by this leaflet should be referred to the nearest Westinghouse Office or Service Department.

**Renewal Parts.** If renewal parts are required, order from the nearest Westinghouse Office giving a description of the parts needed, together with the S.O. and serial number as stamped on the nameplate attached to the operating mechanism house.



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DESCRIPTION • OPERATION • MAINTENANCE

# INSTRUCTIONS

## MOTOR-DRIVEN OPERATING MECHANISM

For De-Energized Switching

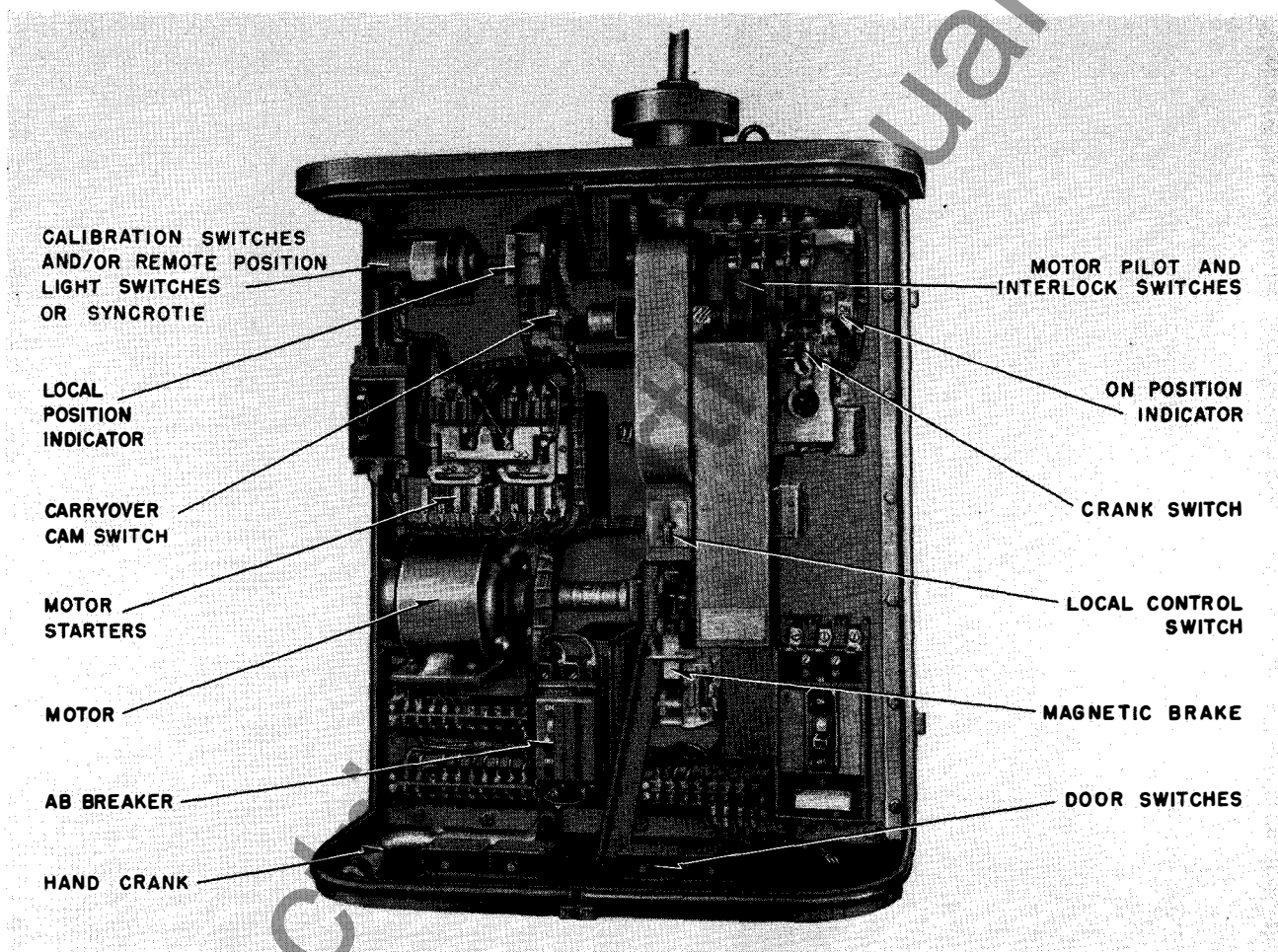


FIG. 1. Motor-Driven Operating Mechanism with Syncrotie.

**THE MOTOR-DRIVEN OPERATING MECHANISM** is used for de-energized switching and is interlocked in such a way that tap changes can be made only under certain pre-determined conditions, insuring that the tap changer contacts will not be opened with the transformer energized.

**Important:** Mechanical interlocks to the breaker are not provided for prevention of hand operation under conditions of loss of circuit breaker control voltage and therefore, before operating by hand, the transformer

must be de-energized, with the breakers open and steps taken to see that they remain open as long as the tap changer is off position, or the operating mechanism cabinet is open.

### DESCRIPTION

The mechanism of a typical unit consists of a steel base plate on which is mounted the motor and brake, reduction unit, motor starter, motor protection breaker, motor pilot switches, interlock switches, tap position indicator, and drum switch

## OPERATING MECHANISM

the remote control panel are lighted in the proper sequence by means of the drum switch DLS1, DLS2, etc., in the operating mechanism. When the tap changer is off position, a red light (RL) on the control panel is lighted. Carry-over switch 126 closes, when it is desired to operate the tap changer mechanism past any "omitted" position on the tap changer.

Other electrical interlocking is accomplished by three additional sets of switches. The door switches (DS) cut off the tap changer control circuit power, thus preventing a tap change by remote control when the mechanism door is open. The crank switch (crank shown out of position in Fig. 3) CS1, for operating the tap changer by hand, closes the circuit breaker trip-circuit, and CS2 opens the control circuit to the tap changer when the crank is inserted in the cranking position. It thus trips the breaker and insures that the transformer is de-energized while manually changing taps (as long as circuit breaker control voltage is available and breaker controls are properly connected and maintained). The circuit breaker pallet switches (52b), which are on the main circuit breaker, are open when the circuit breaker is closed and thus prevent remote operation of the mechanism when the transformer is energized.

**Caution:** Circuit breaker should not be operated by the hand closing lever if the tap changer is being operated or is off position.

**Remote Control Operation.** For making a tap change by remote control:

1. Disconnect the transformer from the line by operating both the high and low-voltage circuit breakers.
2. Turn the control switch (201) to "Raise" or "Lower" until the desired tap change has been made.

*Note: It is necessary to hold the tap changer control switch in position only long enough to start the tap change as the control circuit is so arranged that once a tap change has been started by remote control, it is automatically completed regardless of the action of the operator.*

3. When the indicating lamps show that the desired change of taps is completed, connect the transformer to the line by closing the circuit breaker switch. Do not close this switch until the tap changer is on position.

**Manual Operation.** For making a tap change by manual operation:

1. Disconnect the transformer from the line by opening both the high and low-voltage circuit breakers.
2. Open the mechanism door, remove the hand crank from its holder, and place it in position for hand cranking.
3. Release the brake and at the same time rotate the hand crank until the desired change of taps has been made. The brake may be released by depressing the brake plunger at the bottom of the brake. A brake lock is provided which will hold the plunger down when applied to the plunger operating arm. It may be unlocked by hand or by electrical operation of the motor mechanism.
4. Remove the hand crank and replace in its holder.
5. Close the door, making sure that it is tightly latched.
6. Connect the transformer to the line by closing the circuit breakers.

## MAINTENANCE

These mechanisms require no special care and maintenance other than a periodic inspection of the brake shoes for wear and brake adjustment. Adjust brake shoes according to the instructions on the brake nameplate.

Any questions pertaining to operation and maintenance not covered by this leaflet should be referred to the nearest Westinghouse Office or Service Department.

**Renewal Parts.** If renewal parts are required, order from the nearest Westinghouse Office giving a description of the parts needed, together with the S.O. and serial number as stamped on the nameplate attached to the operating mechanism house.



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**INSTRUCTIONS**

**MOTOR-DRIVEN OPERATING MECHANISM**  
**For De-Energized Switching**

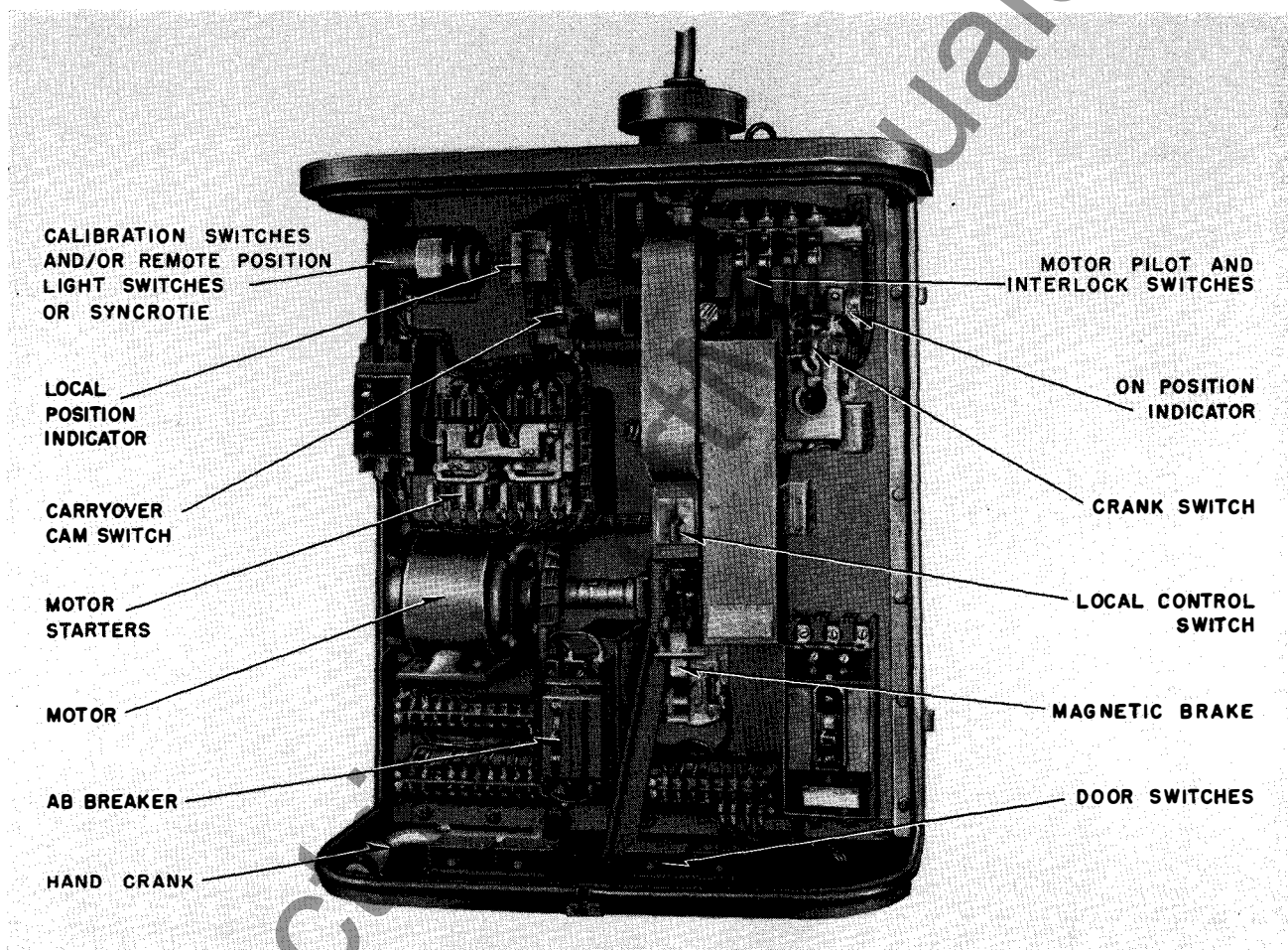


FIG. 1. Motor-Driven Operating Mechanism with Syncrotie.

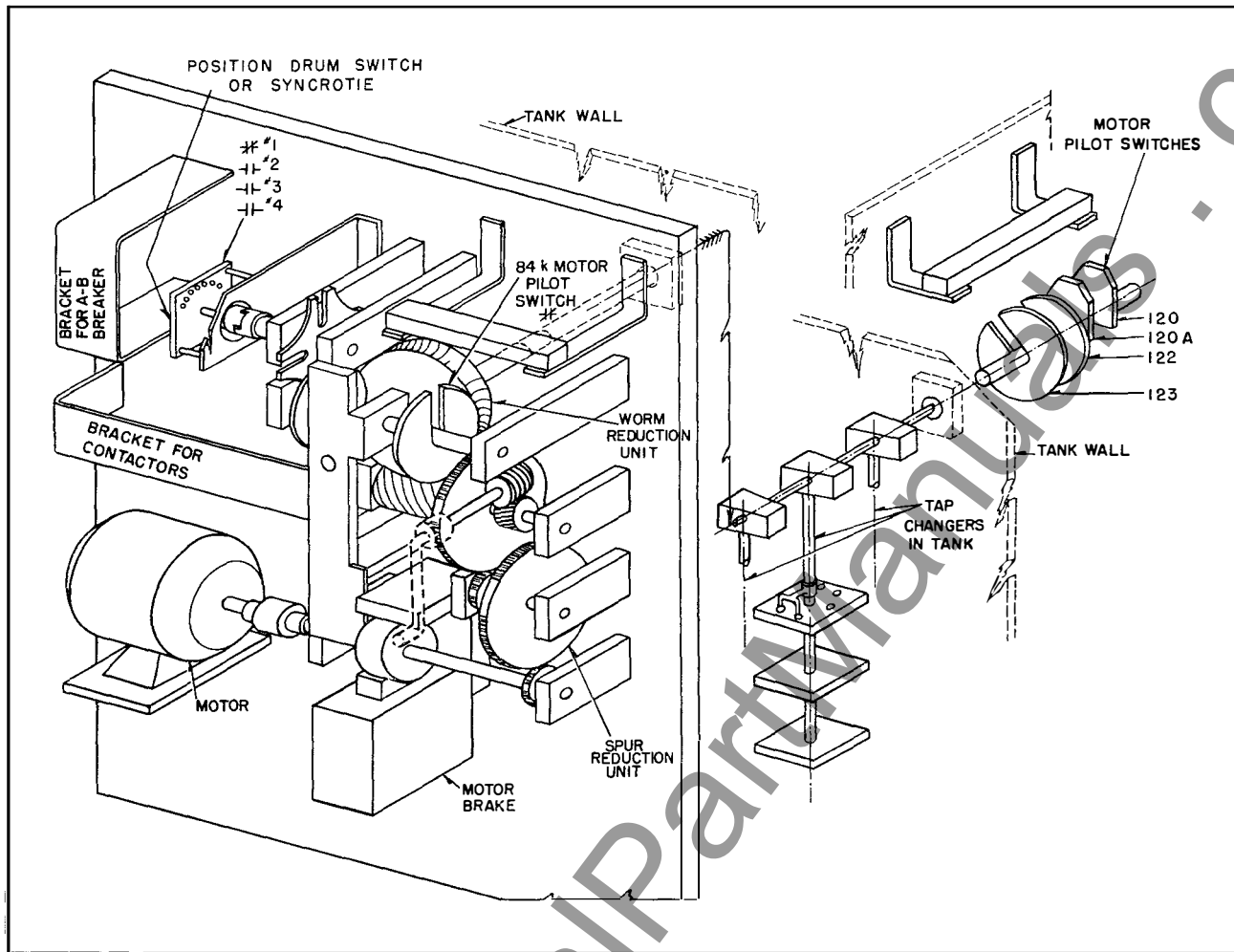
**THE MOTOR-DRIVEN OPERATING MECHANISM** is used for de-energized switching and is interlocked in such a way that tap changes can be made only under certain pre-determined conditions, insuring that the tap changer contacts will not be opened with the transformer energized.

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must be de-energized, with the breakers open and steps taken to see that they remain open as long as the tap changer is off position, or the operating mechanism cabinet is open.

### DESCRIPTION

The mechanism of a typical unit consists of a steel base plate on which is mounted the motor and brake, reduction unit, motor starter, motor protection breaker, motor pilot switches, interlock switches, tap position indicator, and drum switch



**FIG. 2. Schematic Diagram Showing Location of Motor Pilot Switches in Furnace Application.**

for remote electrical position indicator lamps. The entire mechanism is enclosed in a sheet steel, weatherproof housing with hinged access door which has a glass window through which the position indicator is visible.

Details of the mechanism are shown in Fig. 1. The motor is connected to the drive shaft of the mechanism through a gear reduction unit. A magnetically-operated brake, which is mounted on the base plate and acts on the input to the gear reducer, is applied as soon as the motor circuit is opened.

A typical arrangement used on furnace transformers is shown in Fig. 2. In this arrangement the motor pilot switches are not in the housing but are located at the extreme end of the tap changer drive shaft.

Tap changes are normally made by remote control from the switchboard, but provision is made for operation by a hand crank in case of necessity.

On units that cannot be operated beyond definite positions without damage, extra limit switches are provided in both "raise" and "lower" direction. The mechanism is so designed that when on the extreme tap positions, should the operator inadvertently attempt to operate the tap changer beyond the normal position, no damage will result.

**RECEIVING**

The mechanism is usually shipped mounted on the transformer.

After the transformer has been set in place, inspect the tap changer operating mechanism to see that parts have not been damaged during shipment. Remove blocking from the motor starter and check to see that the contact arm moves freely. Operate the tap changer over the complete range by means of the hand crank. Remove the hand crank and operate the tap changer electrically. Insertion or removal of hand crank causes operation of crank

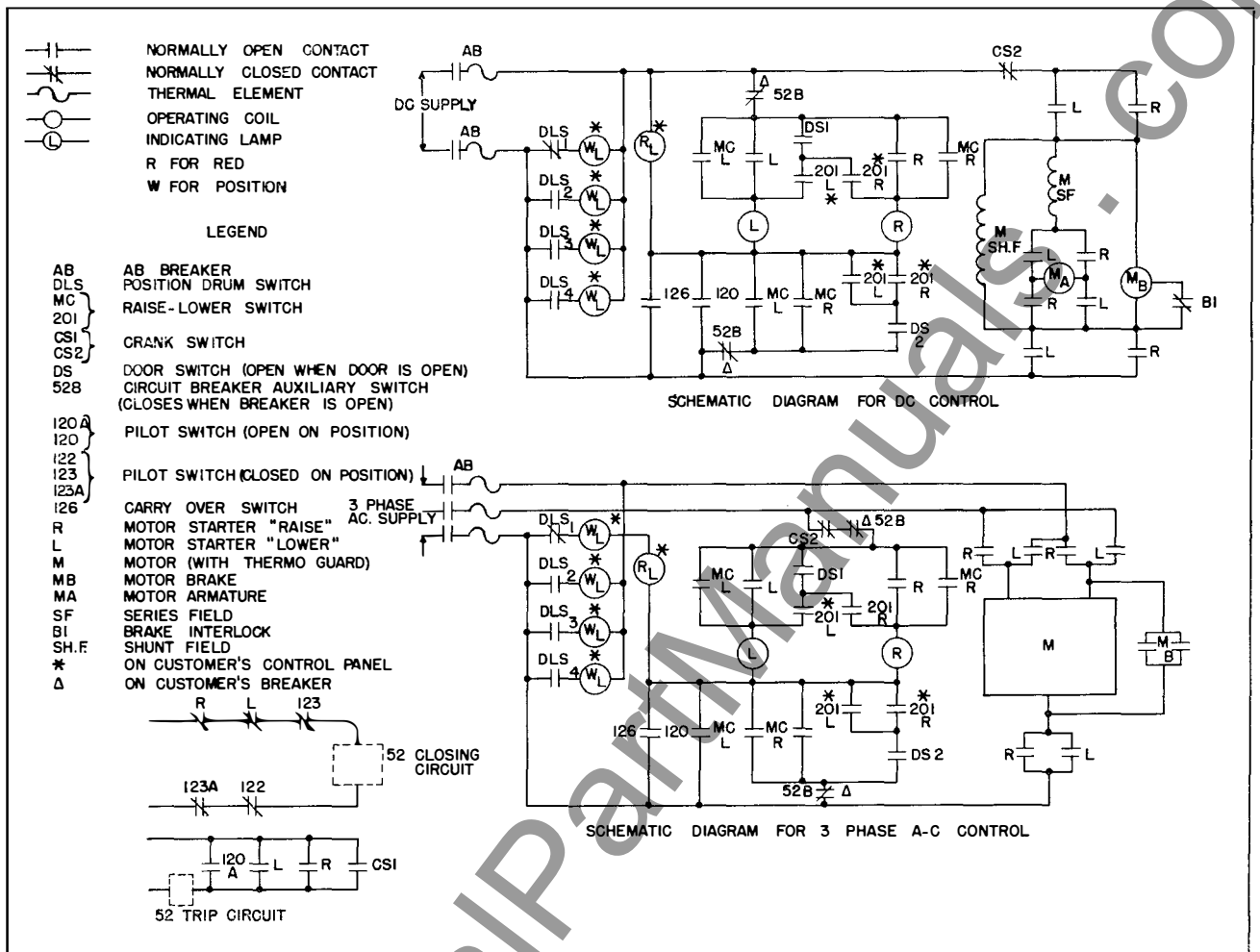


FIG. 3. Schematic Diagram for A-C and D-C Control.

switches CS1 and CS2, explained under operation. The tap changer should stop on position, and if it should not do so, check the adjustment of the brake shoes. Inspect this adjustment at regular intervals, to make any necessary adjustments.

**OPERATION**

The schematic control circuits for three-phase a-c, and d-c, control voltages are shown, in Fig. 3, on Position 1, de-energized with door open and crank out of position.

The "Raise-Lower" control switch (201 located on the customer's control panel and MC located in the mechanism housing) operates the respective "raise" or "lower" (R, L) contactor switches in the mechanism housing to change tap positions. The breaker control on the customer's panel should be operated to open the breaker before attempting to change taps. Once the mechanism has started to change taps, switch 120 closes, sealing in the motor starter and insuring the completion of the

operation. In the circuit breaker trip circuit, switches 120A, R and L close to energize the trip coil of the circuit breaker in order to trip the breaker, in case it is closed, before the tap changer contacts open, and to prevent any closing of the circuit breaker while the tap changer is in operation. This is a new added protective feature, to guard against mechanism linkage failure, tap changer brake failure or control voltage failure, but is not a substitute for good maintenance.

The breaker control should not be operated to "close" until the tap change is completed. Switches 122, 123 and 123A prevent the closing of the circuit breaker while the tap changer is being operated either electrically or by hand, except of course in the case of circuit breaker control voltage failure. Switches L and R in the circuit breaker closing circuit are contacts on the motor starter for the "lower" and "raise" positions respectively, and are additional safety measures—being open when the starter contacts are closed. The position lights on

## OPERATING MECHANISM

the remote control panel are lighted in the proper sequence by means of the drum switch DLS1, DLS2, etc., in the operating mechanism. When the tap changer is off position, a red light (RL) on the control panel is lighted. Carry-over switch 126 closes, when it is desired to operate the tap changer mechanism past any "omitted" position on the tap changer.

Other electrical interlocking is accomplished by three additional sets of switches. The door switches (DS) cut off the tap changer control circuit power, thus preventing a tap change by remote control when the mechanism door is open. The crank switch (crank shown out of position in Fig. 3) CSI, for operating the tap changer by hand, closes the circuit breaker trip-circuit, and CS2 opens the control circuit to the tap changer when the crank is inserted in the cranking position. It thus trips the breaker and insures that the transformer is de-energized while manually changing taps (as long as circuit breaker control voltage is available and breaker controls are properly connected and maintained). The circuit breaker pallet switches (52b), which are on the main circuit breaker, are open when the circuit breaker is closed and thus prevent remote operation of the mechanism when the transformer is energized.

**Caution:** Circuit breaker should not be operated by the hand closing lever if the tap changer is being operated or is off position.

**Remote Control Operation.** For making a tap change by remote control:

1. Disconnect the transformer from the line by operating both the high and low-voltage circuit breakers.
2. Turn the control switch (201) to "Raise" or "Lower" until the desired tap change has been made.

*Note: It is necessary to hold the tap changer control switch in position only long enough to start the tap change as the control circuit is so arranged that once a tap change has been started by remote control, it is automatically completed regardless of the action of the operator.*

3. When the indicating lamps show that the desired change of taps is completed, connect the transformer to the line by closing the circuit breaker switch. Do not close this switch until the tap changer is on position.

**Manual Operation.** For making a tap change by manual operation:

1. Disconnect the transformer from the line by opening both the high and low-voltage circuit breakers.
2. Open the mechanism door, remove the hand crank from its holder, and place it in position for hand cranking.
3. Release the brake and at the same time rotate the hand crank until the desired change of taps has been made. The brake may be released by depressing the brake plunger at the bottom of the brake. A brake lock is provided which will hold the plunger down when applied to the plunger operating arm. It may be unlocked by hand or by electrical operation of the motor mechanism.
4. Remove the hand crank and replace in its holder.
5. Close the door, making sure that it is tightly latched.
6. Connect the transformer to the line by closing the circuit breakers.

## MAINTENANCE

These mechanisms require no special care and maintenance other than a periodic inspection of the brake shoes for wear and brake adjustment. Adjust brake shoes according to the instructions on the brake nameplate.

Any questions pertaining to operation and maintenance not covered by this leaflet should be referred to the nearest Westinghouse Office or Service Department.

**Renewal Parts.** If renewal parts are required, order from the nearest Westinghouse Office giving a description of the parts needed, together with the S.O. and serial number as stamped on the nameplate attached to the operating mechanism house.



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