

Instructions for Cutler-Hammer Limited Service Electric Fire Pump Controllers



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INSTALLATION & MAINTENANCE MANUAL FOR THE LIMITED SERVICE ELECTRIC FIRE PUMP CONTROLLER

In order to familiarize yourself with the Limited Service Electric Fire Pump Controller, please read the instruction manual thoroughly and carefully. Retain the manual for future reference.

1. Installation and Mounting of the Controller

Carefully unpack the controller and inspect thoroughly.

The controller should be located as close as is practical to the motor it controls and shall be within sight of the electric motor, preferably ten feet or less.

The controller is designed for either wall or floor mounting. Note that the controller is not free standing and must be mounted with feet or bolted securely to a wall. For dimensional and weight data please refer to the respective data sheets for the various types of Fire Pump Controllers.

2. System Pressure Connection

The Limited Service Controller is equipped with a Pressure Switch. The controller is provided with a 1/4" NPT female system pressure connection located on the bottom, external side of the enclosure. The connection should be installed as per NFPA, pamphlet No. 20.

NOTE: Water lines to the pressure switch must be free from dirt and contamination.

The pressure should not exceed what the pressure switch is rated for.

3. Electrical Connections

All electrical connections should meet national and local electrical codes and standards.

The controller should be located or so protected that they will not be damaged by water escaping from pumps or pump connections. Current carrying parts of controllers shall be a minimum of 12 inches (305 mm) above the floor level.

- Prior to starting verify all data on the nameplate such as, catalog number, AC line voltage, grounding and system pressure.

- Inspect all electrical connections, components and wiring for any visible damage and correct as necessary. Ensure that all electrical connections are tightened before energization.
- Refer to the appropriate field connection drawing included in this manual, for all wiring information pertaining to the incoming AC power supply and motor wiring.
- Install necessary conduit using proper methods and tools.
- Incoming AC line voltage is clearly marked L1, L2, L3 and ground, located at the top of the main disconnect switch/enclosure.

3.1 Wire Sizes

- For control wiring, use #14 AWG wire for all electrical connections.

3.2 Electrical Checkout Instructions

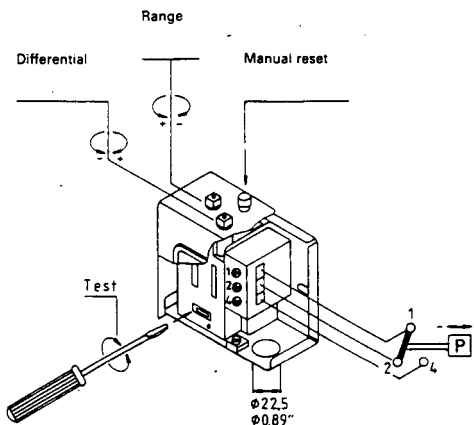
WARNING: *The following procedures should be carried out by a qualified electrician familiar with the electrical safety procedures associated with this product and its associated equipment..*

- 3.2.1 To ensure the pump does not start upon energizing the controller, disconnect the pressure (PS). With the controller isolated (circuit breaker CB open), disconnect the control wires from one connection of the pressure switch. If two wires must be removed from the connection, maintain the circuit between the wires by temporarily bolting the two wire lugs together with a machine screw and nut. Temporarily insulate the connection.
- 3.2.2 Phase Sequence Check: The phase reversal relay PRR is connected to work properly when the supply phase sequence at the breaker is L1, L2, L3. Energize the controller by closing the circuit breaker CB. If the phase sequence is correct, only the green light on the phase reversal relay should be on. If both red and green lights are on, disconnect the supply to the fire pump controller and reverse the phase sequence to the supply of the circuit breaker CB. Recheck for correct operation of PRR.
- 3.2.3 Motor Rotation Check: With the controller energized, operate the 'START' pushbutton immediately followed by the 'STOP' pushbutton to check the direction of the pump rotation. If rotation is incorrect disconnect power and reverse connection of the load terminals of the motor contactor T1, T2, T3 .
- 3.2.4 Adjust the pressure switch set point as described on page 3. These instructions check out automatic starting and stopping.
- 3.2.5 Starting and Stopping: With the controller isolated, reconnect the pressure switch. Energize the controller. If the system water pressure is lower than the pressure switch set-point pressure, the pump will start. If the controller is set up for fully automatic operation, the pump will stop when pressure is restored and then the running period timer RPT has completed its time interval. If the controller is set up for semi-automatic operation, the "STOP" pushbutton must be operated to stop the pump.
- For both automatic and semi-automatic operation, if the water pressure is not restored, the pump will stop while the "STOP" pushbutton is held closed. Upon releasing the "STOP" pushbutton, the pump will restart. Each time the "STOP" pushbutton is depressed the RPT timer resets.
- If the pump does not start when the controller is energized, or after it has been stopped as described above, operate the "START" pushbutton and check that the pump starts. Operate the "STOP" pushbutton and check that the pump stops; running period timer RPT has no effect in this case.
- 3.2.6 Circuit Breaker Setting: Factory set. Do not adjust
- 3.2.7 Running Period Timer: The RPT must be set for a minimum of 10 minutes. A calibrated dial is provided on the front of the timer.
- 3.2.8 Sequential Start Timer (Option): These SST devices are supplied in two pump systems. The lead pump SST should be set at 2 - 3 seconds delay, and the lag SST at 12 - 13 seconds delay.

3.3 Pressure Switch Setting Instructions

Before attempting to set the pressure switch, de-energize the fire pump controller by opening the Isolating Switch and Circuit Breaker. This is done for safety, and so that the fire pump will not start and interfere with the adjustment procedure.

3.3.1 ALCO Pressure Switch

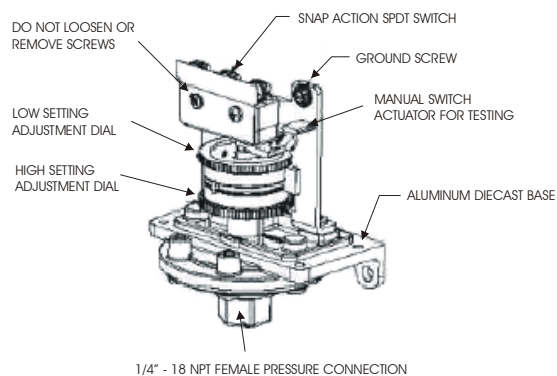


1. Set the differential adjustment on the pressure switch to minimum by turning the Differential Adjusting Screw fully counter clockwise. Set the operating pressure to well below the required pump starting pressure. Turn the Range Adjusting Screw clockwise to reduce the pressure and observe the scale on the switch.
2. Bleed the fire protection water system until the pressure is reduced to the required pump starting pressure. Hold this pressure by closing the drain valve.
3. Slowly rotate the Range Adjusting Screw counter clockwise until a click is heard from the pressure switch. The switch is now set to the required pump starting pressure.
4. If it is necessary to re-adjust the differential, the operating pressure of the switch will also be changed and should be reset.

NOTE: The cut-in (start point) pressure is the cut-out (range adjusting setting) pressure minus the differential setting.

3.3.2 Adjustable Deadband Pressure Switch

1. The two thumb adjustment dials are used to adjust the set point and reset point of the switch.
2. The dial scales and pointer may be used to give an indication of the low and high set points.
3. The high setting adjustment dial is calibrated for increasing pressure. The low setting adjustment dial is calibrated for decreasing pressure.
4. The minimum deadband (minimum span between set and reset points) may be obtained at any point in the operating range of the switch.
5. The repeatability of the set and reset points is typically +/- 1% of the operating range.



3.4 Circuit Breaker

When the circuit breaker (CB) is in its "OFF" position, the controller is isolated from the power supply and the controller door can be opened. The operator is interlocked so that the enclosure door cannot be opened with the handle in the "ON" position, except by qualified electrical personnel by use of a defeater screw located on the side of the operator handle.

The circuit breaker is used to disconnect a running pump motor if necessary. In addition, this thermal magnetic breaker provides overload and short circuit protection

If the breaker trips at the moment of starting the motor, check that the rating of the breaker matches the rating listed on the drawing inside the controller door. Check that the horsepower and voltage of the pump motor match the information listed on the drawing. If everything matches, contact the equipment supplier immediately.

If the breaker trips at any other time, the entire controller/pump system must be checked by a qualified electrician for electrical or mechanical overload, component failure or short circuit.

3.5 Emergency Handle

When pushed and turned counterclockwise, this handle mechanically closes the power contactor and starts the fire pump motor, provided there is electrical power available and the MIS and CB are closed.

The microswitch (MSH) fitted, is actuated early in the stroke of the emergency handle. The MSH attempts to close the contactor electrically before the power contacts can close mechanically by means of the handle.

Without pushing the handle in the full stroke, the pump should continue to run and can be stopped by the STOP pushbutton. If the pump does not continue to run, or the contactor does not latch electrically, push and turn the handle counterclockwise to latch it in place. To turn off the pump, first turn off the CB and then unlatch the handle.

If the emergency starting handle must be used, as the only means to start the fire pump, this shows that there is some malfunction within the controller. The controller should be checked and repaired by a qualified electrician without delay, in order to regain full fire protection.

3.6 Contactor

The contactor connects the pump motor to the supply, under the control of the pressure switch, "START" pushbutton(s) or emergency handle.

The contactor coil is connected to the supply voltage of the controller. If a replacement coil is ever required, its voltage rating must be correctly ordered. One auxiliary contact provides a signal for supervisory purposes to indicate that the pump is running.

3.7 Pilot Devices

The red "POWER ON" light should be illuminated at all times when the circuit breaker is closed. If it is not then either there is no supply power to the controller or the lamp is burned out. Corrective action should be taken immediately.

The "START" pushbutton provides a manual start of the fire pump. After a manual start, the "STOP" pushbutton must be used to stop the fire pump. In all fully automatic controllers, if the "START" pushbutton is operated while the pump is already running because of a pressure switch start, the manual stopping provisions take over and the "STOP" pushbutton must be used to stop the fire pump after pressure have been restored.

3.8 Pressure Switch

The pressure switch (PS) is the normal means of starting the fire pump in response to a lowering in water pressure in the fire protection system. The PS contact is closed on low pressure and open on normal water pressure.

3.9 Remote Start/Manual Start Relay

The remote start/manual start relay (1CR) is provided to facilitate the connection of a normally open remotely located starting contact. Installation of this relay allows the use of a remote starting contact rated at 120 volt, 60 Hz with a making capacity of 70 VA and a continuous capacity of 10 VA minimum.

3.10 Phase Failure Relays

The phase failure relays (PF1 and PF2) provide SPDT signal contacts wired to the terminal block for remote indication of phase failure. When all phases are present, both PF1 and PF2 relays are energized. If any phase fails, either PF1 relay or PF2 relay will be de-energized and provide indication of a phase failure. In single phase controllers only one phase failure relay (PFR) is provided.

3.11 Phase Reversal Relay

The phase reversal relay (PRR) provides DPDT signal contacts wired to the terminal block for remote indication of phase reversal. When the phase sequence is correct, a green indicating light on the front of the relay is illuminated and the relay is in the "OFF" state. If there is a phase reversal, the relay changes to the "ON" state, the relay contacts operate, and a red indicating light on the front of the relay becomes illuminated. On all controllers a red light is also visible on the controller flange. In the phase reversal state, both the green and red indicating lights are illuminated. Note that this relay is not used in single phase applications.

3.12 Low Suction (Option)

An additional pressure switch (LSPS) may be provided to signal low suction pressure by means of a white pilot light on the controller enclosure.

4. Operation of the Controller

4.1 Semi-Automatic or Automatic Operation

Controllers with a pressure switch, but with the Running Period Timer (RPT) disabled, are capable of semi-automatic operation only. Such controllers will start automatically in response to the pressure switch but must be manually stopped with the "STOP" pushbutton. For sprinkler or standpipe systems where an automatically controlled pumping unit constitutes the sole supply, the controller shall be wired for manual shutdown (per NFPA 20). Manual shutdown shall also be provided where required by the authority having jurisdiction.

Controllers fitted with the RPT option are capable of fully automatic operation. Such controllers will start automatically in response to the pressure switch and stop automatically when the pressure has been satisfied and the RPT has timed out. Provision is made to convert automatic controllers to semi-automatic operation by disabling the effect of the RPT. This is done by means of a jumper wire "b" between two points (33 & 33A) on the terminal block as shown on the controller drawing.

For both automatic and semi-automatic operation, if the water pressure is NOT restored, the pump will stop while the STOP pushbutton is held closed. Upon releasing the STOP pushbutton, the pump will restart. Note that the RPT will reset each time the STOP pushbutton is pressed.

Furthermore, if the controller is started manually, either by the local/ remote start pushbutton or emergency handle, then it MUST be stopped manually by depressing the STOP pushbutton.

4.2 Running Period Timer

The running period timer (RPT) in conjunction with the pressure switch relay (2CR) performs the automatic stopping function in a fire pump controller after a start initiated by the pressure switch (PS). The RPT is set in the factory for a delay of 10 minutes minimum. If the pressure switch (PS) responds to a loss of water pressure by closing its contact, 2CR is energized, in turn energizing the power contactor. Relay 2CR is maintained energized through a normally closed, timed open RPT contact for the preset time interval even if the PS contact re-opens in the interim. At the end of the time interval, the RPT contact opens; if the PS contact is open at that point, meaning system pressure has been restored, 2CR is de-energized and the pump stops. If the PS contact is still closed, 2CR remains energized and the pump continues to run until the PS contact opens. When 2CR is de-energized, the RPT is reset in readiness for the next cycle.

The purpose of the running period timer is to ensure that the pump motor is not subjected to frequent starts in response to a situation in which the pressure switch (PS) contact repeatedly closes and opens at short time intervals. RPT timing may be reduced for convenience in testing the controller by turning the dial on the front of the timer.

NOTE: The timing must be reset to 10 minutes minimum when the controller is put into service.

4.3 Sequential Start Timer (Option)

"The controller for each unit of multiple pump units operating in parallel shall incorporate a sequential timing device to prevent any one motor from starting simultaneously with any other motor. If water requirements call for more than one pumping unit to operate, the units shall start at intervals of 5 to 10 seconds. Failure of a leading motor to start shall not prevent subsequent pumping units from starting" – NFPA, Pamphlet 20, Chapter 7.

The sequential start timer (SST) delays the starting of the fire pump in response to the closing of the PS contacts. It does not delay a pushbutton or emergency handle start. This timing is accomplished by means of an electronic timing device which energises the 2CR relay. This provides 2CR with timed contacts. The timed contacts are used to delay starting the motor for a preset time after the PS contacts close.

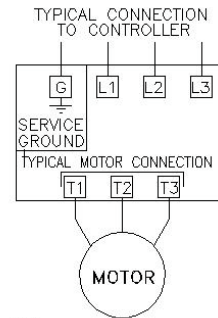
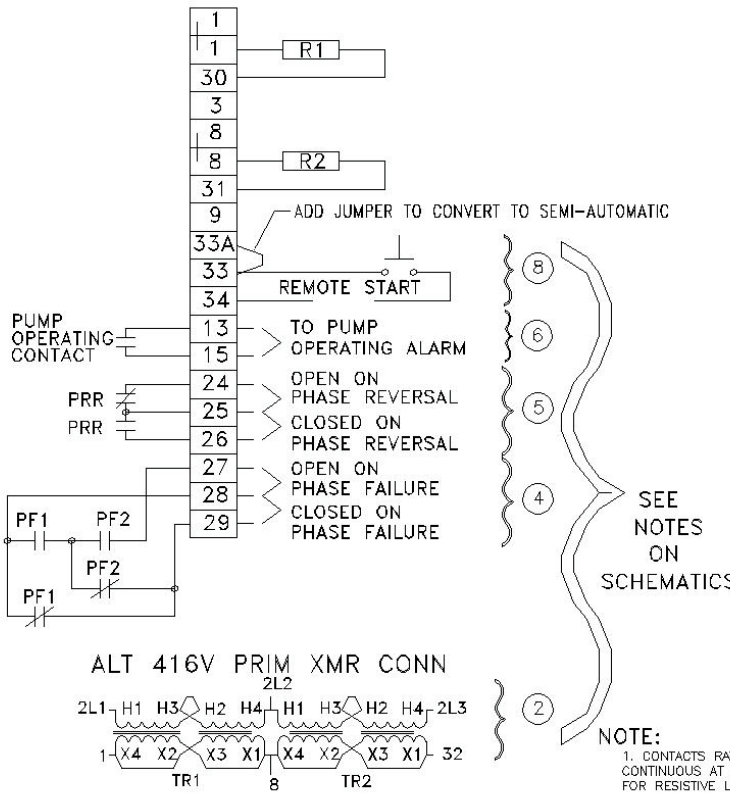
On pressure loss, if the pressure switches (PS) operate more or less simultaneously, the starting of all but the lead pump must be delayed. This ensures that the starting inrush currents of all the pump motors are not simultaneously imposed on the power supply. With a sequential start timer in each controller, any pump may be selected as the lead pump by appropriate setting of the timers. If the lead pump restores the pressure in less than the time delays applied to the lag pumps, then the lag pumps will not start.

In addition, the provision of a sequential start timer, set to a few seconds delay, will prevent the lead pump controller from responding to momentary hydraulic transient pressure loss which would otherwise start the fire pump unnecessarily. (This feature may be considered as a "Time Delay Start" option.)

The sequential start timing device can provide a delay from 1-10-60 seconds. Adjustment is by means of a dial on the front of the timer. The lead pump would normally have its time delay set to minimum and the lag pump would have its time delay set to 10 seconds. If hydraulic transients are a problem, both timers can be adjusted for a few seconds extra time delay.



Field Connections
Limited Service **FD20**
FT20



NOTE:
 1. MOTOR CONNECTIONS VARY. PLEASE REFER TO SPECIFIC MOTOR CONNECTION DIAGRAM.
 2. PLEASE OBSERVE PROPER PHASE ROTATION, A,B,C-L1,L2,L3, AS CONTROLLER IS PHASE SENSITIVE.
 3. CABLE SIZE TO BE 125% OF FULL LOAD CURRENT. REFER TO WIRE SIZE TABLE IN NFPA 70.

SEE NOTES ON SCHEMATICS

NOTE:
 1. CONTACTS RATED FOR 8A CONTINUOUS AT 250VAC FOR RESISTIVE LOADS.

LINE TERMINALS ON MAIN ISOLATING SWITCH (INCOMING CABLES)

MAX. HP	LINE VOLTAGE					QTY. & CABLE SIZES	SERVICE ENTRANCE GND.LUG QTY. & CABLE SIZES
	200-208	220-240	380-416	440-480	550-600		
	30	30	30	30	30	(1)#14-1/0 PERØ(CU/AL)	(1)#14-3/0(CU/AL)
MAX. HP	LOAD TERMINALS (TO MOTOR)						
	10	15	25	25	25	(1)#14-#3 PERØ(CU)	
	25	30	30	30	30	(1)#14-1/0 PERØ(CU/AL)	
	30					(1)#6-250MCM PERØ(CU/AL)	

* FOR PROPER CABLE SIZE REFER TO NATIONAL ELECTRICAL CODE NFPA-70.



ROUTING	DWG#	FCFD201	
1 - VAULT	DATE	03/21/02	REV. F
1 - FM			

FIGURE #1



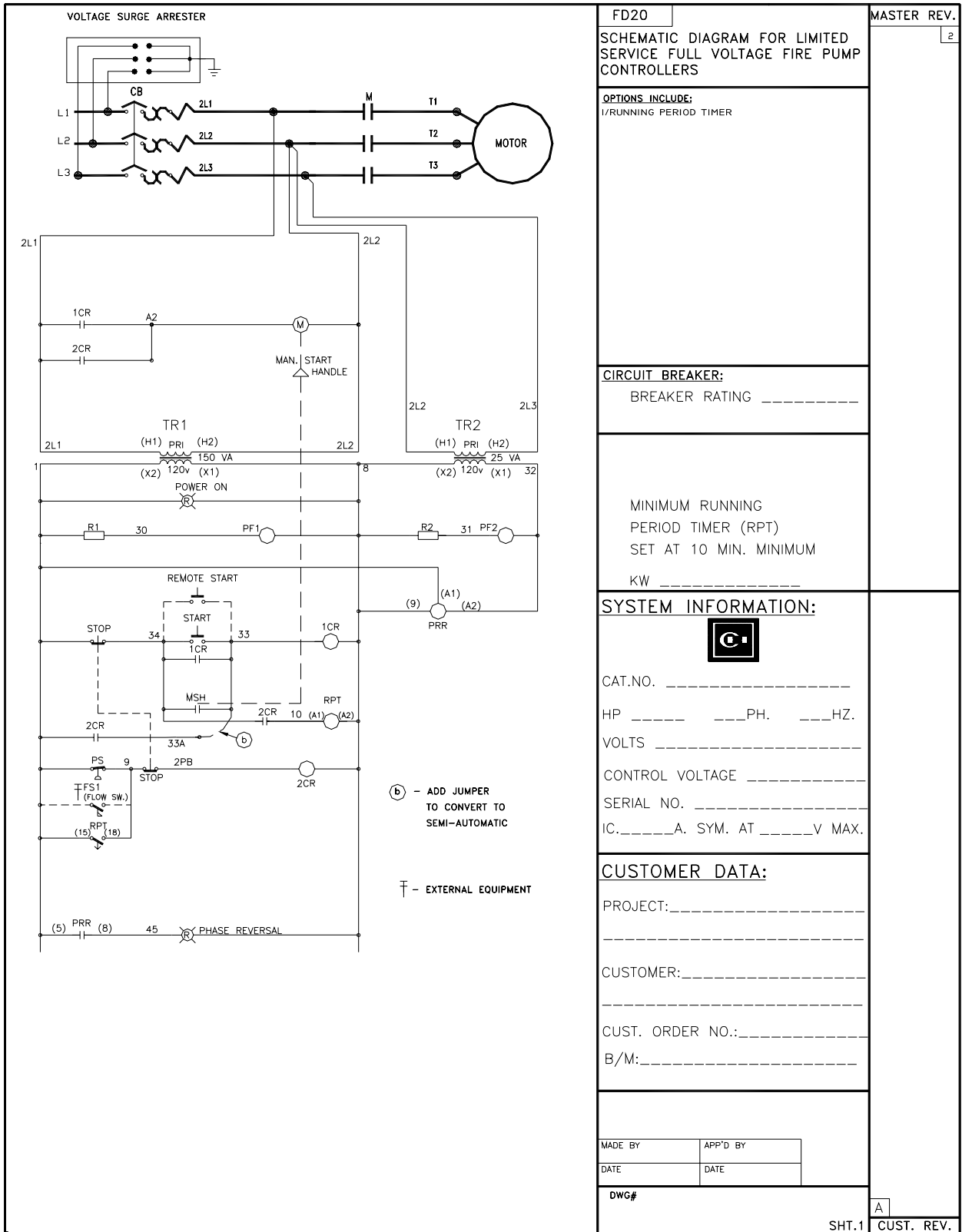


FIGURE #2

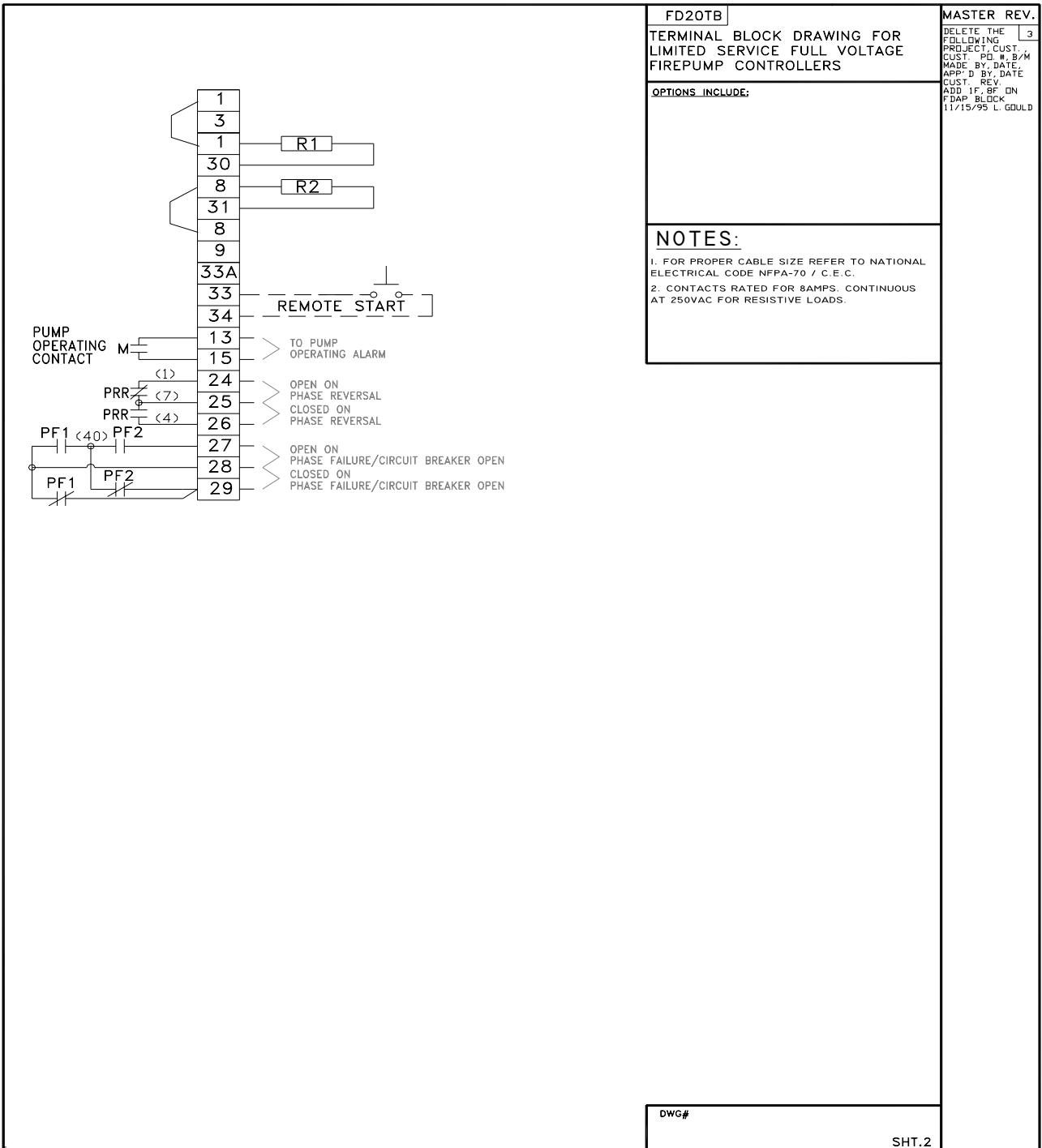


FIGURE #3

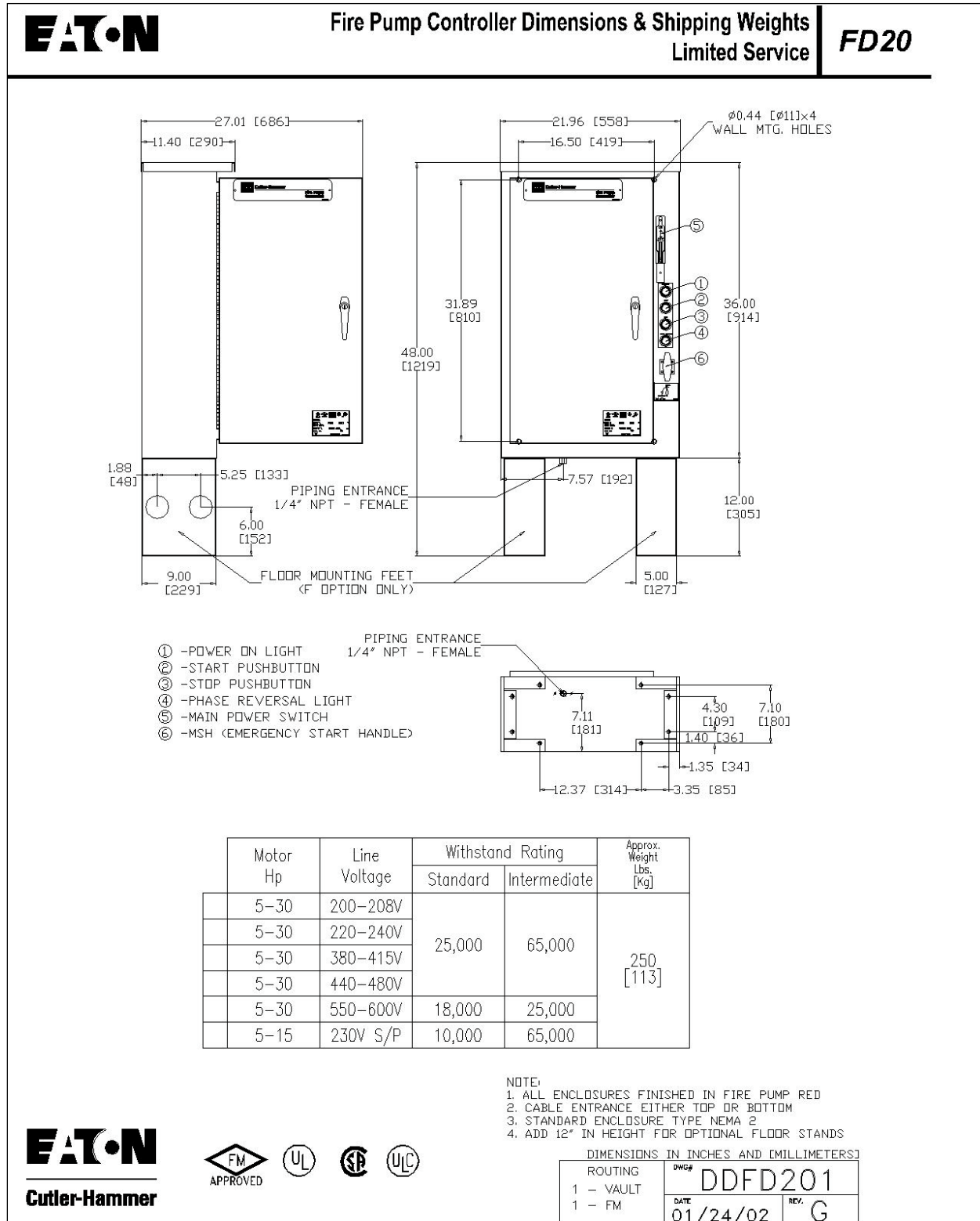


FIGURE #4

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