



Contents

Note

This manual contains vital information for the proper installation and operation of your cooling tower. Carefully read the manual before installation or operation of the tower and follow all instructions. Save this manual for future reference.

Introduction	3
Safety	3
Field Installed Systems—Single Speed Motor	4
Field Installed Systems—Two Speed Motor	5
Control System operation	6
Single Speed Manual Operation	6
Two Speed Manual Operation	7
Single speed Automatic Operation	8
Two speed Automatic Operation	9
Disconnect Operation	14
Overload Relay	16
Single Speed, 1 Winding, 3 Phase Wiring Diagram	17
Two Speed, 1 Winding, 3 Phase Wiring Diagram	18
Two Speed, 2 Winding, 3 Phase Wiring Diagram	19
Single Speed, 1 Phase, 120V Wiring Diagram	20
Single Speed, 1 Phase, 230V, Wiring Diagram	21
Troubleshooting	22

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.

Warning

Indicates presence of a hazard which can cause severe personal injury, death or substantial property damage if ignored.

Note

Indicates special instructions on installation, operation or maintenance which are important but not related to personal injury hazards.

Introduction

These instructions are intended to assure that field connections are completed properly and the control system serves you for the maximum possible time. Since product warranty may depend on your actions, please read these instructions thoroughly prior to operation.

If you have questions about the operation and/or maintenance of this control system and you do not find the answers in this manual, please contact your Marley sales representative.

Warning

Hazard of electrical shock or burn. Be sure to turn off power to the panel before servicing. If working on equipment out of site of panel disconnect, lockout using standard lockout procedure.

Safety First

The control system by Marley uses UL listed components installed in accordance with the National Electric Code. The location of the cooling tower and field installation of the control system can effect the safety of those responsible for installing, operating or maintaining the tower and controls. However, since Marley does not control the tower location, or field installation, we cannot be responsible for addressing safety issues that are affected by these items.

Warning

The following safety issues should be addressed by those responsible for installation, maintenance or repair of the tower and controls:

- ***Access to and from the control panel (including the disconnect switch).***
- ***Proper grounding of electrical control circuits.***
- ***Sizing and protection of branch circuits feeding the control panel.***
- ***Qualification of persons who will install, maintain and service the electrical equipment.***

These are only some of the safety issues that may arise in the design and installation process. Marley strongly recommends that you consult a safety engineer to be sure that all safety considerations have been addressed.

Other safety issues are addressed in literature supplied with your tower. You should closely review the literature prior to installing, maintaining or repairing your tower.

Field Connection

Field Installed Systems - Single Speed Motor

1. Mount the control panel securely in an upright position. The disconnect switch on the control panel must be within sight of the equipment being operated and within 50 feet of that equipment or a separate disconnect switch must be provided. The best location will be at the same ambient conditions as the equipment since the overload and the motor are both temperature sensitive devices.
2. Mount the temperature switch and the vibration switch (if applicable) on the tower. Refer to the drawings supplied with the tower for details on installation of the switches.
3. Install conduit from the bottom of the control panel to the individual pieces of equipment requiring wiring. All conduit connections must be completed to provide a continuous raceway for the conductors prior to pulling the conductors through the conduit. All conduit must be supported properly in accordance with the National Electrical Code.
4. Mark the ends of the conductors for identification and pull them through the conduit. Be sure to provide a ground wire to all individual pieces of equipment. Connect the conductors to the appropriate terminal points in the control panel.
5. Make pigtail connections at the motor using hardware to fasten motor lug to the ring terminal on the power lead wire from the control panel. Wrap the pigtail with insulation putty to smooth out the points and edges and wrap the pigtail completely with vinyl electrical tape. Connect the ground lead to the ground lug in the motor conduit box.
6. Connect the wires for the vibration switch (if applicable) to the normally closed contacts of the switch. Connect the ground lead inside the switch.
7. Install temperature sensing element in its final position on the basin floor as near the basin outlet as possible. Sealer is used to attach the bracket to the basin floor. Insert the bulb into the holder. Fill the bushing where the capillary tube goes through the casing with sealer.
8. Incoming power and ground lines must be run through the side or bottom of the control panel. Conduit must be connected to the panel using a watertight or raintight fitting. Power connections are made at the top of the fusible disconnect located in the upper right hand corner of the control panel. The ground wire must be connected to the ground bar located in the control panel.

Field Connection

9. After completing the electrical connections to the panel, provide power to the panel, operate the system in the “manual” mode and verify proper direction of fan rotation on the tower. If the direction of rotation is incorrect, turn off power supplying the panel and reverse any two power leads at the fusible disconnect switch in the control panel.
10. Check the temperature and differential settings and adjust as necessary to suit your operating requirements. Be sure to maintain adequate differential between the cut-in and cut-out settings or excessive cycling of the fan motor may occur and shorten equipment life.

Field Installed Systems - Two Speed Motor

1. The installation is the same as for the single speed except direction of rotation must be checked on both speeds. If motor runs forward on one speed and backwards on the other, reverse any two wires at the motor starter connections for the speed that runs backwards.
2. The temperature switch on two speed systems has a differential that is preset by the manufacturer. The temperature setting is all that needs to be checked on this system. Remember the differential is all above the temperature setting on the two stage switch. Refer to Figure 2 on page 10.
3. Set the time delay relay for 30 seconds minimum time delay when switching from high to low speed. The time delay is adjusted by turning the range dial on the timing relay.

Operation

The control panel allows the operation of the cooling tower in either the manual or automatic mode. Automatic operation starts, stops and/or changes speed of the cooling tower fan motor based on cold water temperature. Cold water temperature obtained from an operating cooling tower will vary with the heat load, air wet-bulb temperature, water flow rate and air flow rate.

Note

When operating in the automatic mode care must be taken not to exceed five starts per hour. For two-speed motors, each speed is considered one start. Excessive cycling of the motor may reduce the life of the motor starter, motor and driven mechanical equipment.

When operating in subfreezing weather, the opportunity exists for ice to form in the colder regions of the cooling tower. Your primary concern is to prevent the formation of destructive ice in the cooling tower fill. Care must be taken not to allow temperature control settings below 40°F for automatic operation or unattended manual operation in subfreezing weather. Your understanding of cold weather operation will be enhanced if you read Marley Technical Report #H-003 "Operating Cooling Towers in Freezing Weather" and your cooling tower's "User Manual". Failure to comply with these instructions will result in damage to your tower.

Single Speed Manual Operation

1. Check all mechanical equipment to be sure it is free of obstructions and safe to operate.
2. Check all electrical equipment for proper connections and to be sure it is in good operating condition.

Note

A jumper or a normally closed device such as a N.C. vibration switch contact must be installed between points 5 and 7 on the terminal block or the control panel will not operate.

3. Turn the Hand-Off-Auto selector switch to the Off position (center position).
4. Be sure all personnel are clear of the rotating equipment.

Operation

5. Clear and remove any lock out tags on the disconnect switch, remove any locks and turn the disconnect switch to the On position.
6. Rotate the Hand-Off-Auto selector switch to the Hand position. The starter should now engage.
7. Check to be sure the fan rotation is correct. If the direction of the fan is incorrect, turn off power supplying the panel and reverse any two power leads at the fusible disconnect switch in the control panel. Access the incoming line side lug cable screw by pulling out the gray fuse cartridge holder.
8. Check the temperature and differential settings and adjust as necessary to suit your operating requirements. Be sure to maintain adequate differential between the cut-in and cut-out settings or excessive cycling of the fan motor may occur and shorten equipment life.

Two speed manual operation

1. Check all mechanical equipment in the driven system to be sure it is free of obstructions and safe to operate.

Note

A jumper or a normally closed device must be installed between points 5 and 7 on the terminal block or the system will not operate.

2. Turn the Hand-Off-Auto selector switch to the Off position.
3. Be sure all personnel are clear of the rotating equipment.
4. Clear and remove any lock out tags on the disconnect switch, remove any locks and turn the disconnect switch to the on position.
5. Select the desired speed on the High-Low selector switch.
6. Rotate the Hand-Off-Auto selector switch to the hand position. The fan will start at the selected speed. Check to be sure the fan rotation is correct in HI and LOW speeds. If motor runs forward on one speed and backwards on the other, reverse any two wires at the motor starter overload block connections for the speed that runs backwards.
7. Change the motor speed by changing the position of the High-Low selector switch. Verify the time delay is at least 30 seconds when switching from High to Low speed.
8. Rotate the Hand-Off-Auto selector switch to the Off position to stop the fan.

Operation

Single Speed Automatic Operation

1. Check all mechanical equipment in the driven system to be sure it is free of obstructions and safe to operate.
2. Check all electrical equipment for proper connection to be sure it is in good operating condition.

Note

A jumper or a normally closed device such as a N.C. vibration switch contact must be installed between points 5 and 7 on the terminal block or the control panel will not operate.

3. Close and latch the control panel door.
4. Remove the cover from the temperature switch by removing the two screws in diagonally opposite corners of the cover.
5. Check the cut-in and cut-out settings on the temperature scale. These have been factory preset at 85°F for the cut-in temperature and 80°F for the cut-out temperature. Adjust the settings as required to suit your application.

The minimum differential is 5°F. Increasing the differential will reduce the frequency of cycling the fan motor off and on resulting in longer equipment life. See Figure 1.

6. Replace the cover on the temperature switch. Be sure the gasket is tight against the case to prevent water from entering the switch.
7. Turn the Hand-Off-Auto selector switch to the off position.
8. Be sure all personnel are clear of the rotating equipment.
9. Clear and remove any lock out tags on the disconnect switch, remove any locks and turn the disconnect switch to the on position.
10. Rotate the Hand-Off-Auto selector switch to the Auto position. The fan will now start and stop automatically based on cold water temperature.

Note

The water is colder on the louver face than on the eliminator face of the fill in the cooling tower. The actual cold water temperature will be between these two extremes. For best accuracy we recommend the temperature measuring bulb be located near the basin exit in a vertical position.

Operation

Sequence of operation with single speed motor

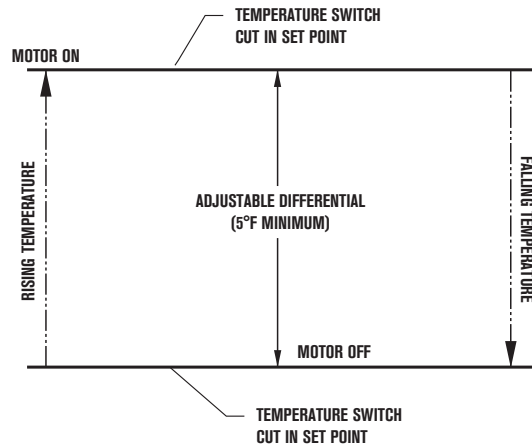


Figure 1

Johnson Controls Model A72AE-1 Thermostat

11. Check to be sure the fan rotation is correct. (You may need to operate the system manually to verify fan rotation if the cold water temperature is below the cut-in set point.)
12. Rotate the Hand-Off-Auto selector switch to the Off position to stop the fan.

Two-Speed Automatic Operation

1. Check all mechanical equipment in the driven system to be sure it is free of obstructions and safe to operate.
2. Check all electrical equipment for proper connection to be sure it is in good operating condition.

Note

A jumper or a normally closed device must be installed between points 5 and 7 on the terminal block or the system will not operate.

Operation

3. Close and latch the control panel door.
4. Remove the cover from the temperature switch by removing the two screws in diagonally opposite corners of the cover.
5. Check the temperature setting on the dial. The temperature has been preset at 72°F at the factory. The differential is fixed at 13°F and cannot be changed. Adjust the temperature as required to suit your application.

The differential is built into the switch such that the cut-out temperature will be the temperature you read on the dial. See Figure 2

6. The water is colder on the louver face than on the eliminator face of the fill in the cooling tower. The actual cold water temperature will be between these two extremes. For best accuracy we recommend the temperature measuring bulb be located near the basin exit in a vertical position.

Sequence of operation with two speed motor

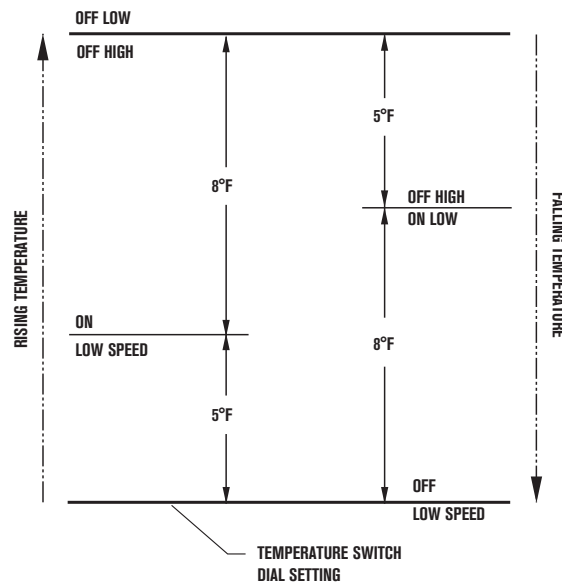


Figure 2

Johnson Controls Model A28MA-1 Thermostat

- Adjustable temperature setting
- Factory set 5°F differential for each stage
- Factory set 8°F differential between stages

Operation

7. Replace the cover on the temperature switch. Be sure the gasket is tight against the case to prevent water from entering the switch.
8. Turn the Hand-Off-Auto selector switch to the off position.
9. Clear and remove any lock out tags on the disconnect switch, remove any locks and turn the disconnect switch to the on position.
10. Be sure all personnel are clear of the rotating equipment.
11. Rotate the Hand-Off-Auto selector switch to the Auto position. The fan will now start, stop and change speeds automatically based on cold water temperature.
12. Check to be sure the fan rotation is correct. (You may need to operate the system manually to verify fan rotation if the cold water temperature is below the cut-in set point.)
13. Rotate the Hand-Off-Auto selector switch to the Off position to stop the fan.

Can-Do Control Panel Single Speed

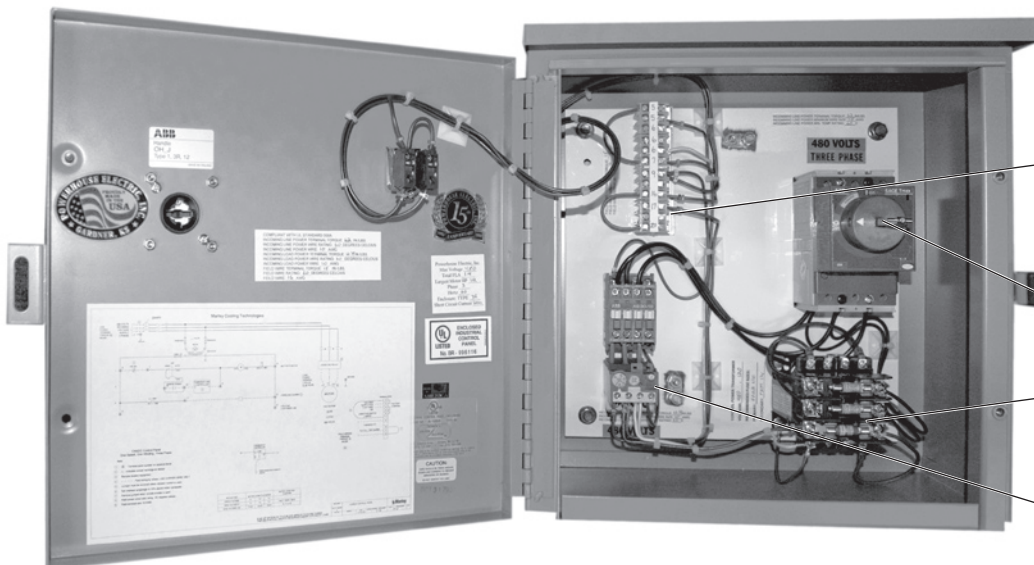


NEMA 3R Enclosure

H-O-A Selector Switch

Disconnect Switch

Lockable Door



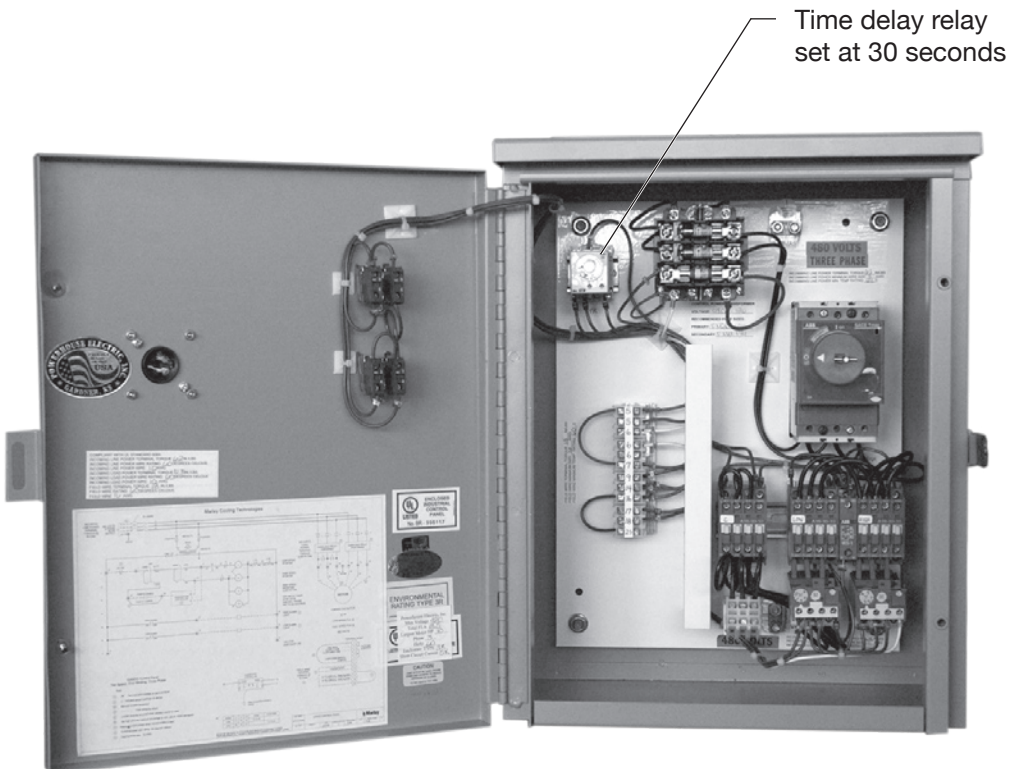
Terminal blocks for additional owner connections

Main circuit breaker

CPT

Motor starter

Can-Do Control Panel Two Speed One Winding



Time delay relay
set at 30 seconds

Operation

Disconnect

To open the panel door, first turn off the fan and turn the disconnect switch to “OFF”. Loosen hold-down screws. See Figure 3



Figure 3

The panel door will not open with the disconnect in the “ON” position. To defeat the safety feature and open the door with the handle in the “ON” position insert a small pin such as a paper clip in the hole located in the yellow bezel. With the pin inserted, swing the door open. To close the door with the handle in the on position insert the pin in the hole then swing the door closed. See Figure 4.

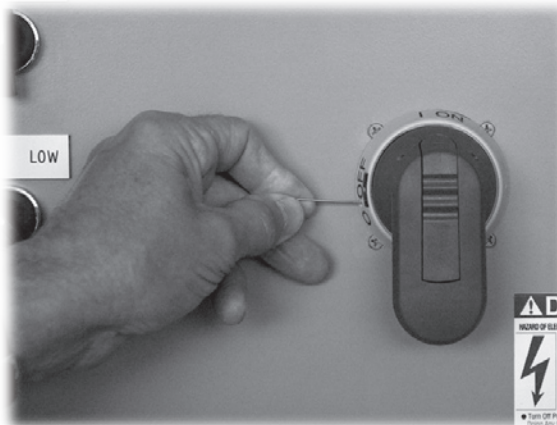


Figure 4

Operation

When servicing the cooling tower, power to the fan motor must be off. To do this, turn the disconnect switch to OFF and from behind the pistol-grip handle push the locking mechanism outward exposing a slot. Insert a lock into this slot and lock. See Figure 5



Figure 5

The main disconnect is a thermal magnetic circuit breaker which does not require adjustment. See Figures 6.

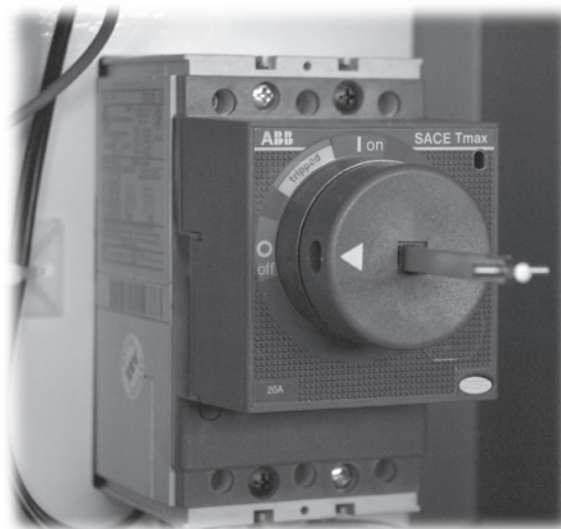


Figure 6

Operation

Overload Relay

The panel is equipped with an overload relay located directly below the contactor. See Figure 7.

The overload device is adjustable and should be set to 10% over motor full-load nameplate amps. Use the FLA rating at 1.00 service factor as noted on the motor nameplate X 1.10 to arrive at the overload setting. This setting allows the fan motor to operate during cold winter months without tripping.

If the relay trips on an overload condition, a small red indicator will be noticed on the face of the O.L. block. To reset the O.L., wait for the motor and relay to cool down for several minutes then depress the blue reset button. The red indicator should now turn black. If the O.L. relay does not reset, wait awhile allowing the bi-metals in the overload block to cool down then reset the overload

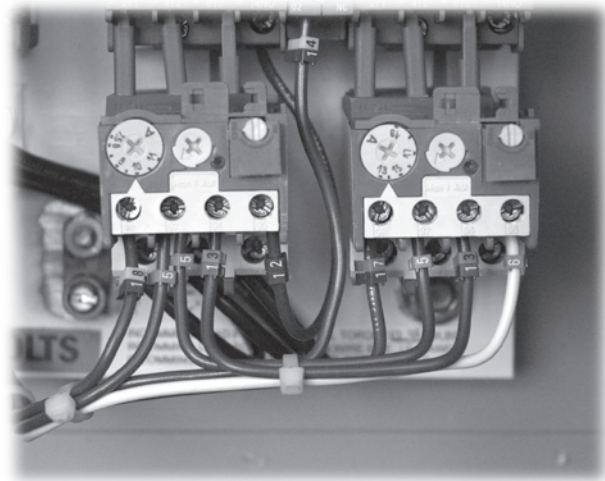
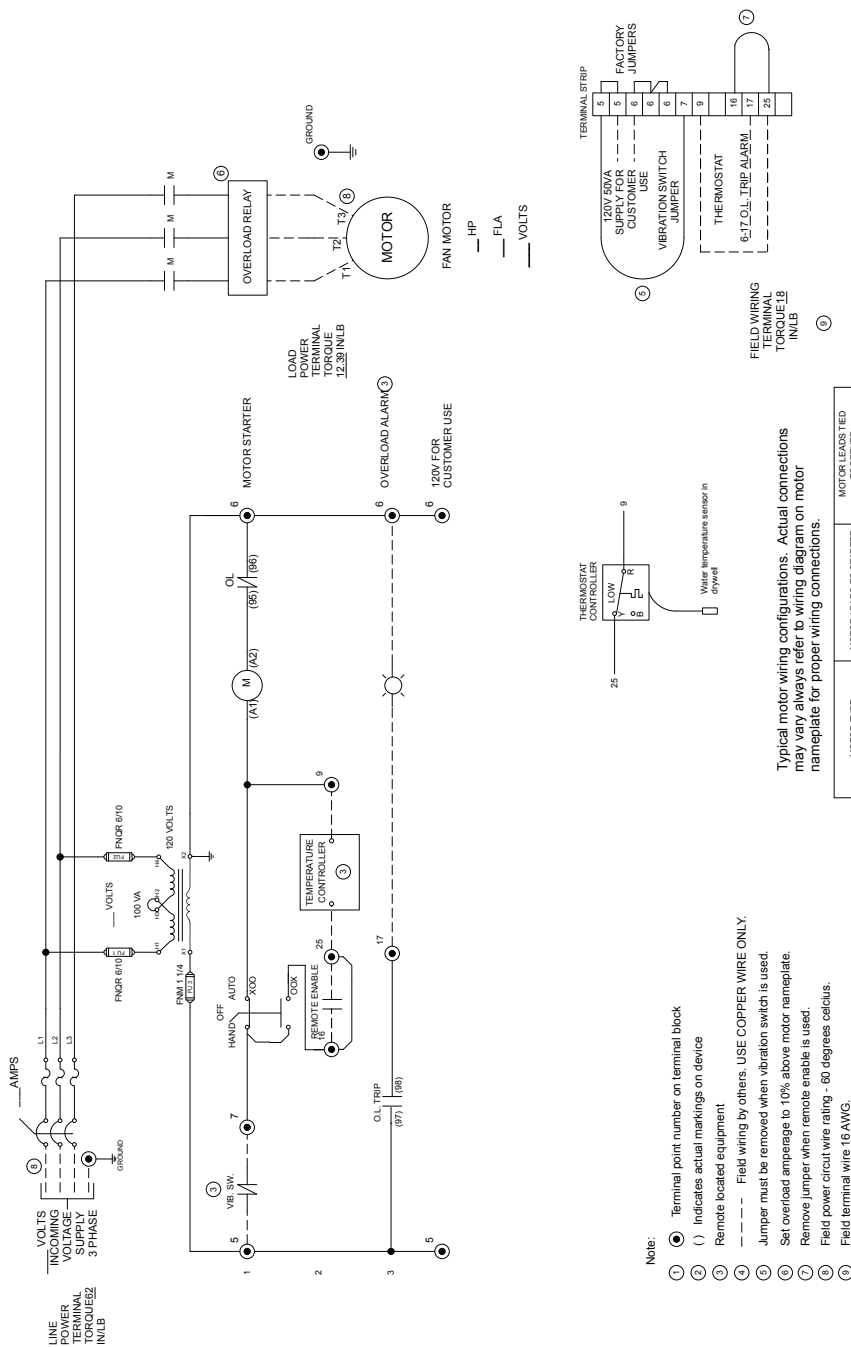


Figure 7

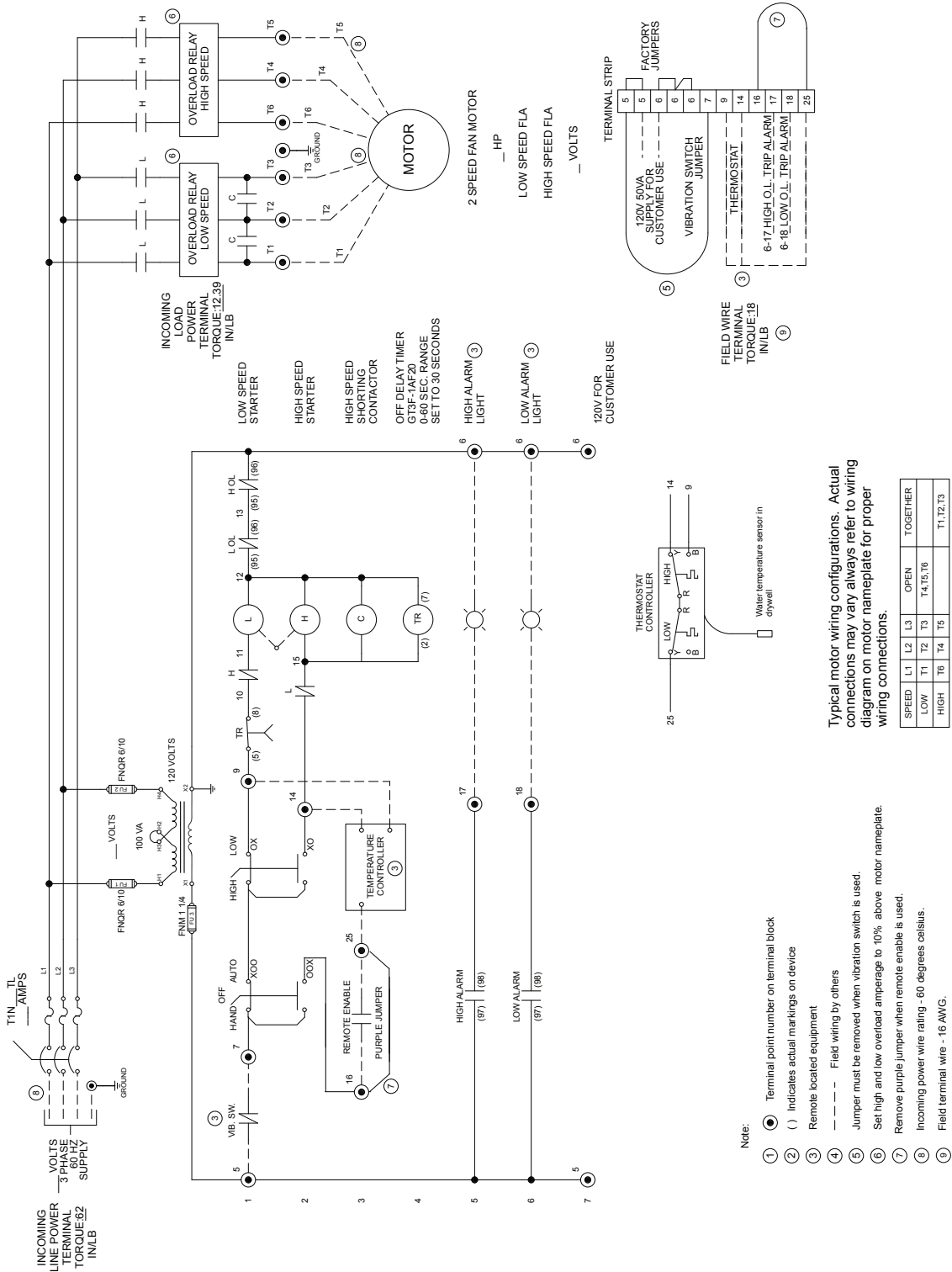
Wiring Diagram

1 speed 1 winding 3 phase

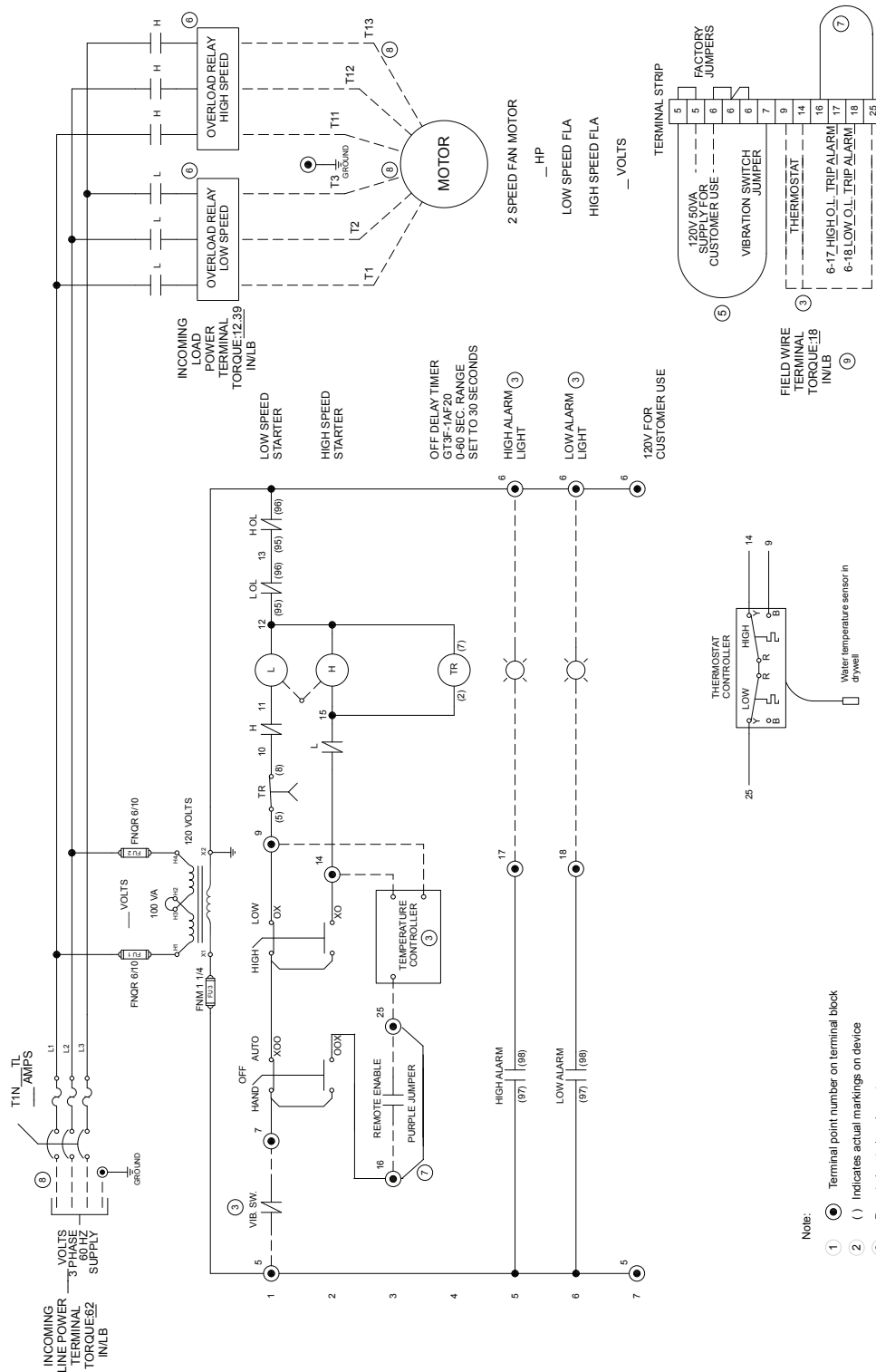


Wiring Diagram

2 speed 1 winding 3 phase



2 speed 2 winding 3 phase



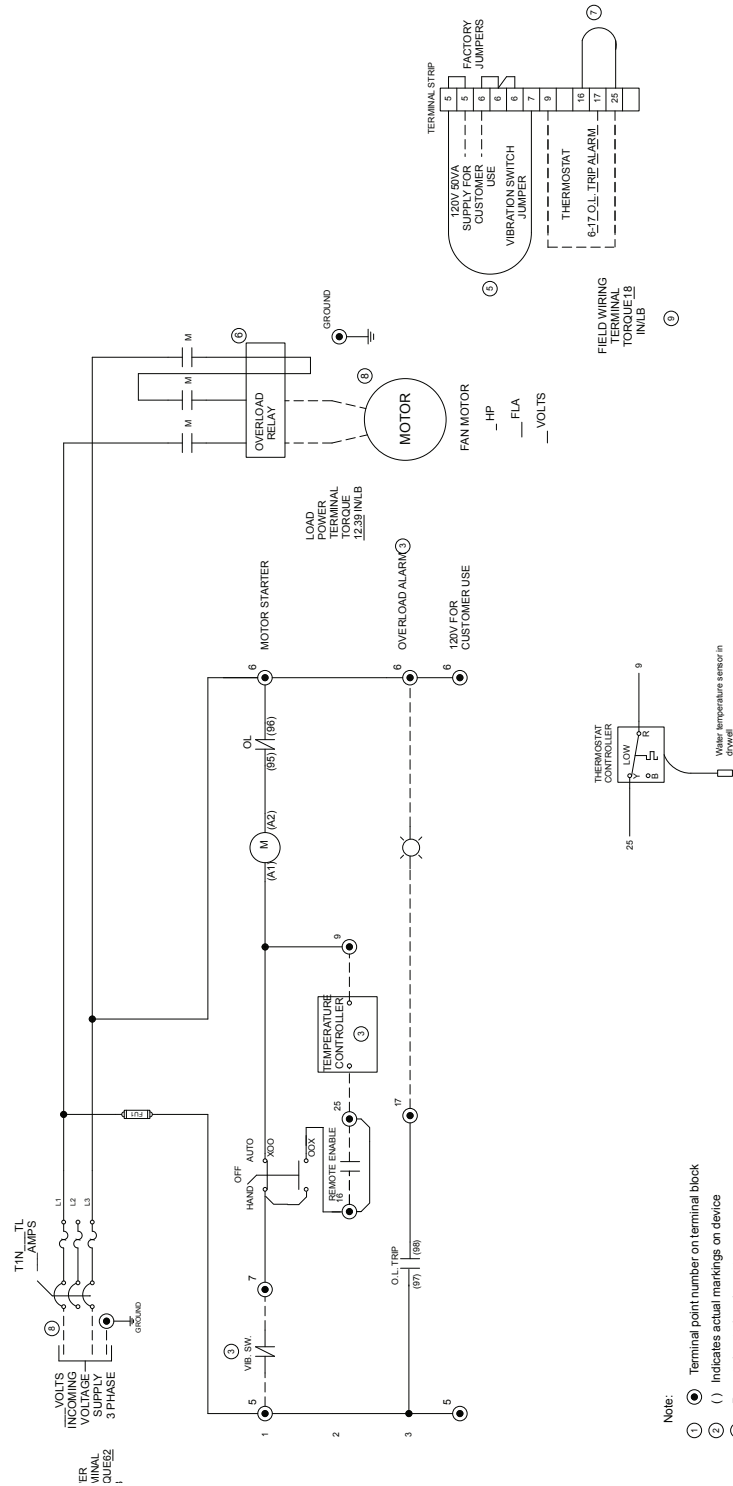
Typical motor wiring configurations. Actual connections may vary always refer to wiring diagram on motor nameplate for proper wiring connections.

SPEED	L1	L2	L3	OPEN	TOGETHER
LOW	T1	T2	T3	T1,T12,T13	
HIGH	T11	T12	T13	T1,T2,T3	

- 5 Jumper must be removed when vibration switch is used.
- 6 Set high and low overload amperage to 10% above motor nameplate.
- 7 Remove purple jumper when remote enable is used.
- 8 Incoming power wire rating - 60 degrees celsius.
- 9 Field terminal wire - 16 AWG.

Wiring Diagram

1 speed 1 phase 120V



Typical motor wiring configurations. Actual connections may vary always refer to wiring diagram on motor nameplate for proper wiring connections.

Note:
 (1) Terminal point number on terminal block
 (2) Indicates actual markings on device
 (3) Remote located equipment
 (4) Field wiring by others. USE COPPER WIRE ONLY.
 (5) Jumper must be removed when vibration switch is used.
 (6) Set overload amperage to 10% above motor nameplate.
 (7) Remove jumper when remote enable is used.

Troubleshooting

Possible causes for motor over amping / tripping

Mechanical

Tower must be operating within tower design parameters ie:

- GPM
- Incoming water temp (heat load)
- Ambient wet bulb temperature surrounding the tower

A deviation to any three of the above parameters or combination there of will affect the current being drawn by the motor. The greatest cause to an over amping motor is lack of heat load either in water volume, water temperature or ambient air temperature. If the GPM is low or the water temperature and outside air temperature is low the fan will attempt to move dense heavy air causing the motor to draw higher than normal current. The O.L. block is designed to offer motor protection when set at motor full load amps plus 10%.

Make sure there is water through the tower with heat load per tower specifications.

- Make sure fan pitch is correct
- Check for mechanical limitations or binding
- Check for cold lubrication in Geareducer (allow time for warm-up)
- Check correct gear reducer or belt pulley ratio

Electrical

- Check for unequal /imbalance of ampere readings of each phase of supplied motor voltage
- Check for low voltage in power distribution (phases of voltage should be fairly equal)
- Check to make sure there are no power connections that are loose
- Check for excessive long motor leads
- Check for bad motor (measure current in each phase/voltage leg)
- Check if the overloads are tripping, make sure they are adjusted properly for 10% above motor nameplate full load amps.



COOLING TECHNOLOGIES

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