MODEL ACWC-SC
Screw Type
AIR COOLED
PACKAGED CHILLERS

SERVICE MANUAL
I & O 6500A

INSTALLATION, OPERATION
&
MAINTENANCE INSTRUCTIONS

TABLE OF CONTENTS

BOHN HEAT TRANSFER
A Gulf+Western Company
Danville, Illinois 61832•(217)446-3710

INSPECTION & HANDLING

When unit is received, it should be checked for visible or concealed damage. If damage has occurred it should be reported to the carrier immediately and claim filed.

Models ACWC 160SC thru 215SC are factory mounted on two (2) permanent angle beam, carbon steel skids. Eight (8) 2⅞" lifting eyes are provided in the skids to allow rigging. Spreader bars must be used between rigging lines to prevent damage to the unit. Rollers may be used under the skids to facilitate moving the unit a short distance. **Physical damage to the unit, after acceptance, is not the responsibility of the factory.**

LOCATION & MOUNTING

Model ACWC Air Cooled Packaged Water Chillers are designed for outdoor application and may be mounted on roof or at ground level. Air flow through the condenser is vertical and the unit may be located adjacent to outside of building or on roof without regard for prevailing wind direction.

Since these units are air cooled, the flow of air to and from the condenser coil must not be impeded. There must be no obstruction above the unit that would tend to deflect discharge air downward where it could be recirculated back to the inlet of the unit. The required overhead air space should be a minimum of eight (8) feet. Ductwork must not be applied to the fan outlets.

The unit must be installed with sufficient clearance for air entrance to the condenser coil and for servicing access. The unit should be located no closer than four (4) feet from any wall or other obstruction. Clearance must be provided at either end of the unit to permit removal of tubes from the chiller.

Unit must be set on a solid and level foundation.

On roof installations the unit should be mounted on support beams which span load-bearing walls to prevent excessive vibration.

On ground level installations, the unit should be mounted on a substantial base that will not settle. A one-piece concrete slab with footings extended below the frost line is recommended. A space should be left between the slab and the building to prevent the transmission of sound and vibration.

Vibration mounts may be used for roof mounted units or other locations where noise might be objectionable.

WIRING

A unit wiring diagram showing the required power supply characteristics and all factory supplied wiring details is provided with unit. Separate, field supplied, disconnects must be installed in the power supply and should be within the sight of the unit.

Separate 115 volt power source must be field supplied to provide power for control and heater circuits.

CHILLER PIPING

The chiller inlet (return) water pipe should be connected to the water connection closest to the control panel end of the unit and the outlet (supply) water pipe connected to the water connection on the opposite end of the cooler(s).

A flow switch must be installed in a straight horizontal section of the chilled water piping.

Gauges should be installed in the piping to and from the chiller to measure the pressure drop and to insure the proper (GPM) flow rate in accordance with submittal data. A strainer should be installed in the piping on the inlet side of the chiller and vibration eliminators should be employed on both the inlet and outlet pipes. Air vents should be located at all high points in the piping system. Vents should be located to be accessible to servicing. Drain connections should be provided at all low points to permit complete drainage of chiller and piping system.

The chilled water piping should be insulated to reduce heat pickup and to prevent condensation. If the system is for year-round operation or if it will not be drained in the winter, the chilled water piping should be protected against freezing by electrichea ting cable or other suitable means.

Upon completion of chiller piping, start the system water pump and purge air from the system. Air purging should be done from the high points in the water circuit. Purging of the chiller barrel may be accomplished through the vent pipe located on the top of the chiller compartment. Failure to purge air from the water circuit will result in inadequate water flow and may cause the unit to cutout on low water flow freeze protection.

START-UP

Refer to start, test, and check list included with this manual.

Check all electrical and mechanical connections for shipping looseness and tighten all screws or electrical terminals.

Activate the 115 volt chiller and crankcase heater circuit 24 hours prior to unit start-up.

Rotate each fan prior to start-up. Fans should turn freely. Check belt tension and pulley alignment. After two (2) weeks of operation, readjust belt tension to accommodate for belt stretching.

Check all control settings as specified in Table 1.

Check the compressor oil level through the crankcase sight glass. The oil level should be to the top of the glass. If the level is low, add oil in accordance with the directions in the maintenance instruction (page 3).

CAUTION:

The discharge line valve must be open before starting the compressor. Liquid line valves must also be open for sustained operation.

All compressors are solid mounted on isopads, therefore, compressor hold-down bolts must not be loosened. Loosening these bolts will cause excessive vibration of the compressor and may result in refrigerant line breakage. Prior to start-up check all compressor hold-down bolts for tightness.

MAINTENANCE

CONDENSER

Units equipped with belt drive fans have inherently protected motors. Fan belts, fan bearings and motor bearings require periodic maintenance as follows:

1. **Fan Belts** — After two (2) weeks operation, the belts will have nearly reached their permanent stretch, therefore, each belt should be checked again and proper adjustments made. To maintain good fan and motor operation, the belt tension should be checked at three (3) month intervals.
2. **Fan Bearings** — Each fan shaft is provided with ball bearings of the relubricatable type. Each bearing is provided with grease fittings, accessible through the individual motor access panels. It is recommended the bearings be greased by adding 4 to 5 shots with a hand gun. The suggested greasing interval is indicated on a sticker attached to the unit.
3. **Motor Bearings** — Each motor is equipped with ball bearings. Ball bearings consume a very small amount of lubricant, but enough must be present at all time to prevent motor injury. The length of time a bearing can run without having grease added or replaced will depend upon the operating conditions. Under normal operating conditions, the motor bearings should be lubricated at 2000 hour operating intervals. The lubricant should be from a clean closed container and should be an anti-friction type bearing grease-free from solid fillers or other harmful ingredients. Lubricant should have a safe operating temperature of 2000° F.

   The air inlet of the condenser coil should be kept clean through a regular preventative maintenance program.

COMPRESSOR

1. **OIL LEVEL** — The oil level in the compressor(s) should be checked periodically, with the compressor either running or stopped. If the oil level is below one-half (½) the sight glass, oil must be added.

   Oil should be added only with the compressor shut off. To do so, turn the return water thermostat (T1) to a higher temperature setting, and wait for the unit to pumpdown and shutoff. Place the system "ON-OFF" switch in the "OFF" position. Close the line valve in the discharge line between compressor and condenser.

   Refrigerant pressure inside of the compressor will now be approximately 80 to 90 PSIG. The low pressure cut-out setting is 35 PSIG, but the residual discharge pressure (upstream of the discharge check valve) will equalize back into the suction side after the compressor stops.

   Locate the discharge pressure port adjacent to solenoid valve UL-3 (see drawing below); remove the cap and release the residual pressure by pushing in on the pressure port fitting itself. Pump oil into this port until the oil level is to the top of the sight glass.

   Replace the discharge port cap. **Re-open the discharge line valve. Do not allow compressor to run with discharge valve closed.**

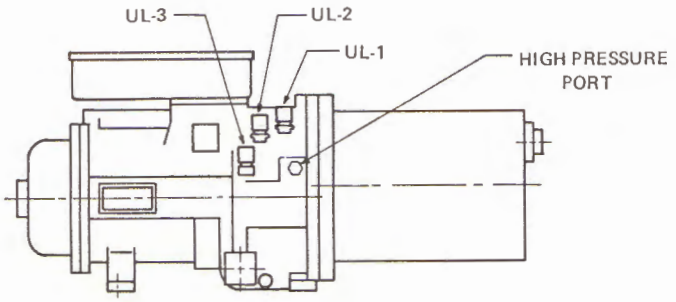
   Place the system "ON-OFF" switch in the "ON" position. Using a jumper wire, make a "short" for five (5) seconds between terminal #4 on terminal block TER5 and the switched terminal of a solenoid valve feeding the circuit you have just "blown" (e.g. terminal #121 on TER4 to energize SOL1). Reset return water thermostat (T1) to the operational temperature setting and allow unit to return to normal operation.
2. **RECOMMENDED OIL** — The unit is factory-charged with BOHN SR-30 refrigeration oil.

   Do not add any other type of oil to this factory charge.

   Do not operate compressor if oil level is below one-half (½) sight glass.

   If the oil level is below the minimum specified above, and BOHN SR-30 is not on hand, you may **drain the entire factory oil charge,** then refill with SUNISO 4GS refrigeration oil. The factory (BOHN) oil is of the synthetic type and **will not mix** with SUNISO 4GS. Do not attempt to operate the screw compressor with any oil other than these two specified above.

   It is suggested that a gallon or more of BOHN SR-30 oil be obtained and kept on hand at the job site. The substitution of SUNISO 4GS oil, as outlined above, will result in a 2% to 4% capacity loss, and no reduction in input K.W.
3. **COMPRESSOR REPAIRS (Internal)** — Contact factory or an authorized BOHN Service Agency if a compressor malfunction is suspected.
4. **COMPRESSOR REPAIRS (External)** — Proper operation of unloaded start, loading, and unloading is controlled by solenoid valves UL-1, UL-2 and UL-3. Any of these three (3) solenoid valves may be repaired or replaced in the field, as required.



SLIDE VALVE
UNLOADING SYSTEM

The Bonn screw compressor capacity control system for infinite modulation consists of a slide valve and hydraulic piston/cylinder operator internal to the compressor; plus three hydraulic solenoid valves (UL-1, UL-2 & UL-3) piped externally.

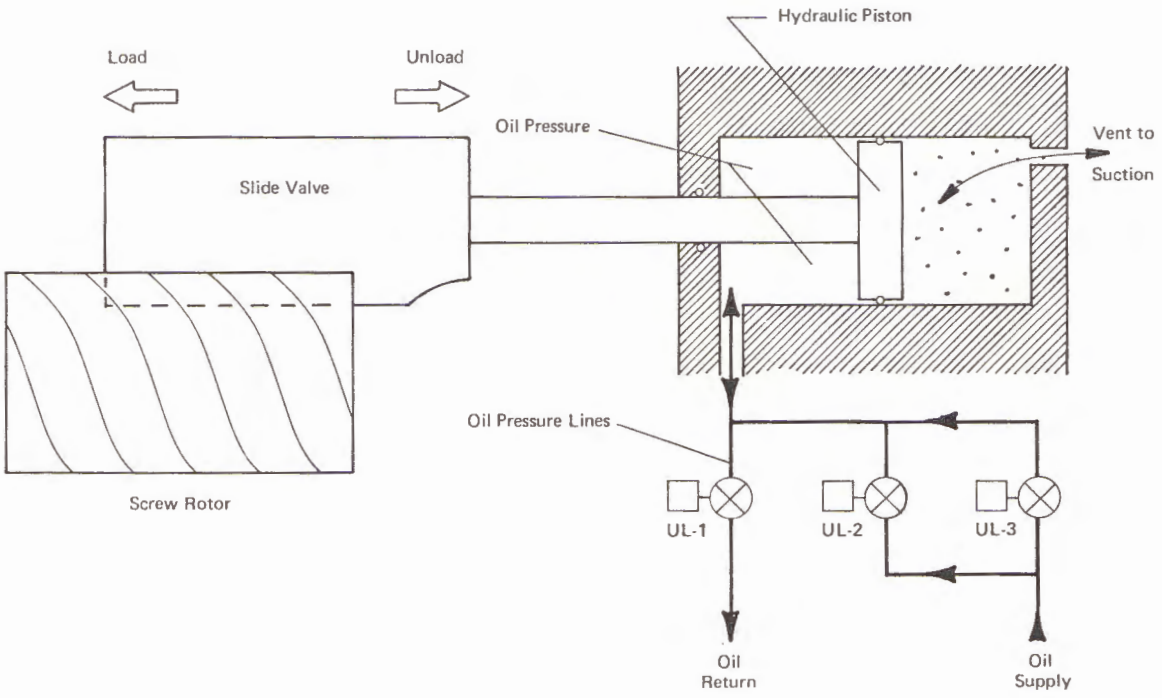
The slide valve forms a portion of the chamber wall in which the rotors turn; thus, its position with respect to the rotors determines the effective rotor length and thereby the percent of full load capacity.

Upon compressor start-up, UL-3 is opened. This allows oil pressure to act upon the hydraulic piston, holding it in the fully unloaded position. After 30 seconds, during which time full oil flow is established to all bearings surfaces, UL-3 is closed. At this point, the temperature controller is free to open and close UL-1 or UL-2 in response to the supply water temperature.

The slide valve will move to the left (loading) by force of discharge pressure, whenever UL-1 opens to permit flow to the oil return (low pressure) line. The slide valve will move to the right (unloading) whenever UL-2 opens the oil supply (high pressure) line, since the force of the oil exceeds that of the discharge gas.

The temperature controller sends a series of power (energizing) "pulses" to the appropriate solenoid to adjust to load conditions. The further the supply water temperature is from the controller set point, the longer is the duration of the pulses. The series of pulses will continue until the controller is satisfied. As the water temperature approaches the set point, the pulses become quite brief to prevent overshooting the set point.

This method of compressor unloading in conjunction with supply water sensing minimizes action/reaction lag time and overshoot resulting in an exceptionally precise and stable control of supply water temperature.



The following table lists solenoid valve position for all three operating modes.

	UL-1	UL-2	UL-3
Starting	Close	Close	Open
Loading	Open	Close	Close
Unloading	Close	Open	Close

LOW AMBIENT OPERATION

Due to the wide range of applications, it is sometimes necessary to operate the Air Cooled Packaged Water Chillers at ambients below summer conditions. Without proper control, when ambients drop below 60° F. the pressure differential between the condenser and the evaporator is below the level to insure proper thermal expansion valve operation. As a result, the unit may cycle on low pressure control with the possibility of evaporator freezing. Three types of system control are available allowing the units to operate at the ambients indicated:

FAN CYCLING
MEDIUM AMBIENT CONTROL TO 30° F.
(STANDARD EQUIPMENT —FACTORY INSTALLED)

A fan cycling control is standard on all Air Cooled Packaged Water Chillers to provide proper operating head pressures, in ambient conditions to 30° F.

This is an automatic operation in which the condenser fans are cycled on and off, as required, in response to head pressure. With two compressors running, three fans are cycled (in sequence) on five-fan units; four fans on six-fan units; and five fans on seven-fan units. With one compressor running, all but the lead fan are cycled in sequence, in response to head pressure.

This arrangement provides positive start-up control down to +30° F. by delaying the condenser fan operation until a predetermined head pressure is obtained.

GRAVITY (Discharge) DAMPERS
LOW AMBIENT CONTROL TO 0° F.
(OPTIONAL EQUIPMENT — FACTORY INSTALLED)

All condenser fans are equipped with gravity dampers mounted on the fan discharge to minimize the effect of prevailing winds; and to prevent convection drafts up through the condenser coil in still air.

All compressors are enclosed in individual insulated housings. An auxiliary heater is included to supplement the standard crankcase heater; the temperature within the compressor compartment is thermostatically controlled.

The standard condenser fan cycling package, operating in conjunction with the discharge dampers, will maintain suitable head pressure down to 0° F. ambient. A 90-second time delay relay provides an electrical bypass around the low pressure freezestat to prevent nuisance trip-out during cold start-up.

ACWC-SC
CONTROL SETTINGS

PRESSURE ACTUATED	LEGEND	FACTORY SETTING	
High Pressure Control (Manual Reset) Pumpdown Control (Auto Reset)	HP-1 HP2 & HP3 PD1 PD2 & PD3	Cut-In Cut-Out Cut-In Cut-Out	300 PISG 365 PSIG 55 PSIG 35 PSIG
Fan Cycling Pressure Control (Adjustable)	2 Fan Cell FCP 1 FCP 2 3 Fan Cell FCP 1 FCP 2 FCP 3 4 Fan Cell FCP 1 FCP 2 FCP 3 FCP 4	Cut-In (PSIG) 280 295 260 275 290 260 275 285 295	Cut-Out 170 180 160 175 215 160 175 210 235
Low Pressure Freeze Control (Manual Reset)	LPF 1 LPF 2 & LPF-3	Cut-Out	54 PSIG

TEMPERATURE ACTUATED	LEGEND	FACTORY SETTING	
Chiller Low Water Temperature Thermostat	T2	Cut-Out	37° F.
Chiller Water Cycling Thermostat (Adjustable)	T1	Dial Set At	55° F.
Chiller Heater Thermostat (Non-Adjustable	Included With CBH1 Heater	Cut-In Cut-Out	40° F. 45° F.
Oil Temperature Safety Control (Adjustable) Manual Reset	OTS 1 OTS 2 OTS 3	Cut-Out	240° F.
Capacity Control Thermostat (Adj.) Mode Control Position	T3	Dial Set At	44° F.

UNIT OPERATING LIMITATIONS

1. Maximum ambient air to condenser is 115° F. (60 Hertz operation).
2. Maximum allowable cooler water pressure is 150 PSIG.
3. Maximum allowable water temperature to cooler is 75° F.
4. Units must not have leaving water temperatures of 42° F. or lower unless used with a glycol solution.
5. Unit must be allowed to pumpdown at the end of each operating cycle (except on safety control shutdown).

KEY TO WIRING DIAGRAM INDEXING SYSTEM

The wiring diagrams and sequence instructions on the following pages have been devised to simplify the understanding and tracing of circuit theory. The following key shows how the indexing system can be used.

12 Line number on wiring diagram

[12] Line number in text

(R5) Component identification symbol in text (Relay #5)

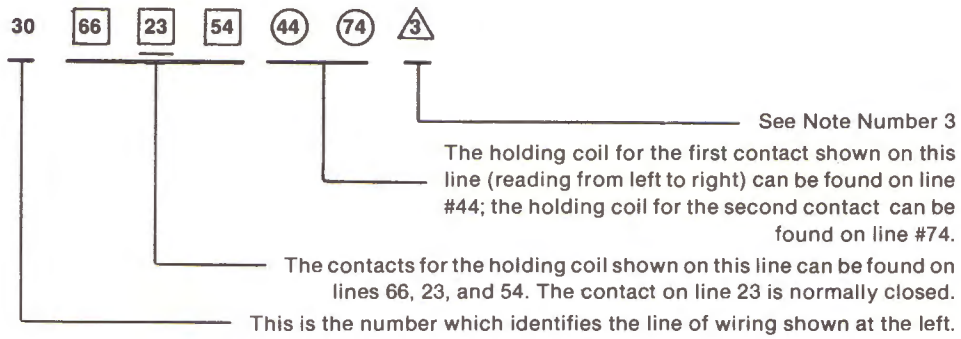
34 Normally open contact — line number location

34 Normally closed contact — line number location

18 Holding coil — line number location

6 Note number

EXAMPLE



SEQUENCE OF OPERATION MODELS ACWC 160 To 200 SC

The following sequence of operation is typical for the ACWC 160 to 200 SC (see Pages 10 and 11 for typical wiring diagram). Refer to the wiring diagram furnished with unit for specific information.

( ) Control Identification Symbol

[ ] Circuit Line Number

Important Note!

The compressor crankcase heater must be energized and remain active for a minimum fo 24 hours prior to unit start-up.

PRELIMINARY SEQUENCE

Place control circuit "ON-OFF" switches (SW1 thru SW4) in the "OFF" position, and set the staging thermostat (T1) to its highest temperature.

Activate the 115 volt electrical service to terminals #2 and #4 [1 and 3] on terminal board (TER5) to distribute power to the control circuit up to the control circuit switches. Crankcase heater relay contacts (R19) [3], (R20) [5], and (R21) [7] are closed and are supplying power to the compressor crankcase heaters. Power is also supplied to the chiller barrel heater (CBH1) [11], the receiver heaters (RH1, 2, 3) [8, 9, 10] (optional), and the low ambient crankcase heaters (SCH1, 2, 3) [3, 5, 7] (optional).

Close the main power disconnect switch. Check to see that the red indicating light on the phase loss monitor (PLM1) is lit **(NOTE: There will be two phase loss monitors, (PLM1) and (PLM2), on 208-230 volt models).** This light must be on to indicate proper phase rotation for the compressor(s). If the light is not on, the main control circuit to the compressors will not be energized. Reverse any two phase legs at the **Main Incoming Power Terminal Block. DO NOT** reverse the leads on the phase loss monitor, for this will allow the compressor to run backwards, causing severe damage, and **WILL VOID THE COMPRESSOR WARRANTEE!**

Start-up the chilled water pump. The water flow is confirmed when the water flow switch completes an electrical circuit across terminals #12 [58] and #13 [60] of terminal board (TER5). Terminals #14 [61] and #15 [63] provide an interlock for the water pump starter(s); either contact (R14), (R16), or (R18) [62] will close any time a compressor is running.

Set the staging thermostat (T1) to the design range of operation (e.g. 54° F. return water). Set the capacity control thermostat (T3) to the design range of operation (e.g. 44° F. supply water).

Place the four (4) control circuit switches (SW1-SW4) in the "ON" position, thus energizing the balance of the control circuit. **The system will be in the "Time-In" mode for five minutes before any compressor will start.**

STAGE 1 LOADING

Upon demand for cooling, the first step of the staging thermostat (T1) will close, energizing relay (TD10) [63] and staging relay (R1) [62], closing (R1) contacts 7-4 [22], 8-5 [25], and 9-6 [16]. If the safety controls and switches are closed, the control circuit [16] for compressor No. 1 and liquid line solenoid (SOL1) [25] will energize, allowing the compressor to start. Fan contactor (C13) [21] will also close, bringing power to the line side of fan cycling pressure controls (FCP1) and (FCP2) (see Power Wiring Diagram — Pages 16 and 17). Fan motor #1 will start as soon as the head pressure reaches the "cut-in" setting of (FCP1).

NOTE: ALL FAN MOTORS ARE CONTROLELD BY THEIR OWN FAN CYCLING CONTROL AND WILL CUT IN AT DIFFERENT HEAD PRESSURES.

Relay (R19) [20] contact 7-1 [3] opens, de-energizing compressor #1 crankcase heater(s). Relay (R14) [19] contact 8-5 [24] closes, energizing (TD7) [23]. This will force compressor #1 to run for five minutes. **COMPRESSOR #2 CANNOT BE STARTED UNTIL (TD7) TIMES OUT.**

Time delay relay (TD10) [63] contact C-NC [26] holds the compressor in an unloaded condition for 30 seconds. When relay (TD10) times out, it will energize relay (R4) [27], closing contacts 9-6 [71] and 7-4 [74]. This allows the capacity control thermostat (T3) to energize solenoid valve (UL1-1) [71], loading the compressor; or to energize solenoid valve (UL2-1) [74], unloading the compressor.

Relay (R14) [19] contact 7-4 [62] closes, which completes the interlock circuit for the water circulating pump.

STAGE 2 LOADING

Upon a further increase in return water temperature, the second step of the staging thermostat (T1) will close. If the lock-out timer (TD5) and the lock-in timer (TD7) [64] have timed out, relays (R2) [64] and (TD11) [65] will be energized, closing (R2) contacts 9-6 [32], 8-5 [40], and 7-4 [37]. If the safety controls and switches are closed, the control circuit [32] for compressor #2 and liquid line solenoid (SOL2) [40] will energize, allowing the compressor to start.

Relay (R20) [36] contact 7-1 [5] opens, de-energizing crankcase heater(s). Contact 9-6 [44] closes, energizing fan contactor (C14) [44], bringing power to the line side of the balance of the fan cycling pressure controls (see power wiring diagrams). Fan motor #3 will start as soon as the head pressure reaches the "cut-in" setting of (FCP3).

Relay (R16) [35] contact 8-5 [39] closes, energizing (TD8) [38]. This will force compressor #2 to run for five minutes. **Compressor #3 cannot be started until (TD8) times out.**

Time delay relay (TD11) [65] contact C-NC [41] holds compressor #2 in an unloaded condition for 30 seconds. When (TD11) times out, it will energize (R5) [42], closing contacts 9-6 [72] and 7-4 [75]. This allows the capacity control thermostat (T3) to energize solenoid valve (UL1-2) [72], loading the compressor; or to energize solenoid valve (UL2-2) [75], unloading the compressor.

STAGE 3 LOADING

Upon a further increase in return water temperature, the third step of the staging thermostat (T1) will close. If the lock-out timer (TD6) and the lock-in timer (TD8) [66] have timed out, relays (R3) [66], (R7) [68], and (TD12) [67] will be energized. Relay (R3) contacts 9-6 [48], 7-4 [53], and 8-5 [56] close. If the safety controls and switches are closed, the control circuit [48] for compressor #3 and liquid line solenoid (SOL3) [56] will energize, allowing the compressor to start.

Relay (R21) [52] energizes, opening contact 7-1 [7], de-energizing compressor #3 crankcase heater(s). Relay (R18) [51] contact 8-5 [55] closes, energizing (TD9) [54]. This will force compressor #3 to run for five minutes.

Relay (R7) contact 9-6 [70] closes, energizing solenoid valve (UL1-1), thus locking compressor #1 in the fully loaded position. Relay (R7) contacts 8-2 [71] and 7-1 [74] open to disconnect the capacity control thermostat (T3) from compressor #1 capacity control solenoid valves.

Time delay relay (TD12) [67] contact C-NC [57] holds compressor #3 in an unloaded condition for 30 seconds. When (TD12) times out, it will energize relay (R6) [58], closing contacts 9-6 [73] and 7-4 [76]. This allows the capacity control thermostat (T3) to energize solenoid valve (UL1-3) [73], loading the compressor; or to energize solenoid valve (UL2-3) [76], unloading the compressor.

Compressor #1 is fully loaded.

Compressors #2 and #3 are being capacity-modulated.

PUMPDOWN SEQUENCE

STAGE 3 PUMPDOWN

A decrease in return water temperature will cause the third step of the staging thermostat (T1) to open, thereby de-energizing staging relay (R3), opening contacts 8-5, 9-6, and 7-4. Liquid line solenoid (SOL3) will de-energize, stopping the flow of refrigerant to chiller circuit #3. The compressor will continue to run until the chiller circuit has been cleared of refrigerant and the suction pressure is approximately 35 PSIG. Low pressure control (LP3) contact will then open, de-energizing compressor contactors (C5) [49] and (C6) [50], stopping compressor #3; and de-energizing relays (R18) and (R21). Relay (R18) N.C. (normally closed) contact 2-8 [54] energizes lock-out timer (TD6), preventing compressor #3 re-start for five minutes. Relay (R21) energizes the compressor crankcase heater(s).

Staging thermostat (T1) also de-energizes relay (R7), opening contact 9-6, releasing compressor #1 from continuous full-load operation. Relay (R7) contacts 8-2 and 7-1 close, allowing the capacity control thermostat (T3) to operate capacity control solenoid valves (UL1-1) and (UL2-1) as required.

STAGE 2 PUMPDOWN

A further decrease in return water temperature will de-energize staging relay (R2), closing liquid line solenoid (SOL2). When chiller circuit #2 has pumped out, low pressure control (LP2) opens, stopping compressor #2; and de-energizing relays (R16) and (R20). Relay (R16) N.C. contact (8-2) [38] energizes lock-out timer (TD5), preventing compressor #2 re-start for five minutes. Relay (R20) [36] energizes compressor #2 crankcase heater(s); and also de-energizes fan contactor (C14) [44], stopping the fan motor(s) servicing the two-circuit condenser slab.

STAGE 1 PUMPDOWN

Step 1 of the staging thermostat (T1) will open when the return water temperature is reduced to the set point. This de-energizes staging relay (R1), closing liquid line solenoid (SOL1), stopping refrigerant flow to chiller circuit #1. Compressor #1 continues to run until chiller circuit #1 pressure is down to the low pressure control (LP1) set point. The (LP1) contact opens, de-energizing compressor contactors (C1) [17], (C2) [18], and fan contactor (C13) [21], stopping compressor #1 and the remaining fan motor(s).

Relay (R14) N.C. contact 8-2 [23] energizes lock-out timer (TD4), preventing compressor #1 re-start for five minutes; relay (R14) contact 7-4 [62] opens, removing the circulating pump starter interlock. Relay (R19) de-energizes, closing contacts 7-1 [3], energizing compressor #1 crankcase heater(s).

SAFETY CONTROLS

Each refrigerant circuit is protected by seven standard safety controls, and one optional safety control.

1. High Pressure (HP)
2. Low Pressure Freeze (LPF)
3. High Discharge Temperature (OTS)
4. Low Oil Temperature (LOT)
5. Compressor Solid State Module (CSTM)
6. Low Water Temperature (T2)
7. Low Pressure (LP)
8. Compressor Starter Overloads (OLH) (Optional)

If any of these devices should open due to abnormal conditions, the compressor will automatically stop. All controls must be manually reset, except Low Oil Temperature (LOT), Low Pressure (LP) and Compressor Solid State Module (CSTM), which resets itself after a two minute bleed-down period. The compressor motor windings are also equipped with a thermal protector, automatic reset, which is not shown on the wiring diagram.

SEQUENCE OF OPERATION
MODEL ACWC 215 SC

The following sequence of operation is typical for the ACWC 215 SC (see pages 12 to 15 for typical wiring diagram). Refer to the wiring diagram furnished with unit for specific information.

( ) Control Identification Symbol

[ ] Circuit Line Number

Important Note!

The compressor crankcase heater must be energized and remain active a minimum of 24 hours prior to unit start.

PRELIMINARY SEQUENCE

Place control circuit "ON-OFF" switches (SW1 thru SW5) in the "OFF" position, and set the staging thermostat (T1) to its highest temperature.

Activate the 115 volt electrical service to terminals #2 and #4 [1 and 3] on terminal board (TER5) to distribute power to the control circuit up to the control circuit switches. Crankcase heater relays (R20) [3], (R21) [5], (R22) [8], and (R23) [10] are closed and are supplying power to the compressor crankcase heaters. Power is also supplied to the chiller barrel heaters (CBH1) [17] and (CBH2) [20], the receiver heaters (RH1, 2, 3, 4) [12, 13, 15, 16] (optional), and the low ambient crankcase heaters (SCH1, 2, 3, 4) [3, 5, 8, 10] (optional).

Close the main power disconnect switch. Check to see that the red indicating lights on the phase loss monitors (PLM1) and (PLM2) are lit. These lights must be on to indicate proper phase rotation for the compressor(s). If the lights are not on, the main control circuit to the compressors will not be energized. Reverse any two phase legs at the **main incoming power terminal block. DO NOT** reverse the leads of the phase loss monitor, for this will allow the compressor to run backwards, causing severe damage, and **WILL VOID THE COMPRESSOR WARRANTEE!**

Start-up the chilled water pump. The water flow is confirmed when the water flow switch completes an electrical circuit across terminals #12 [89] and #13 [91] of terminal board (TER5). Terminals #14 [92] and #15 [94] provide an interlock for the water pump starter(s); either contact (R11), (R12), (R13), or (R14) [95] will close any time a compressor is running.

Set the staging thermostat (T1) to the design range of operation (e.g. 54° F. return water). Set the capacity control thermostat (T3) to the design range of operation (e.g. 44° F. supply water).

Place the five control circuit switches (SW1 thru SW5) in the "ON" position, thus energizing the balance of the control circuit. **The system will be in the "time-in" mode for five minutes before any compressor will start.**

STAGE 1 LOADING

Upon demand for cooling, the first step of the staging thermostat (T1) will close, energizing relay (TD15) [94] and staging relay (R1) [93], closing (R1) contacts 7-4 [32], 8-5 [35], and 9-6 [26]. If the safety controls and switches are closed, the control circuit [26] for compressor #1 and liquid line solenoid (SOL1) [35] will energize, allowing the compressor to start.

Relay (R20) [30] contact 9-6 [39] closes, energizing fan contactor (C13) [39], bringing power to the line side of fan cycling pressure controls (FCP1) thru (FCP6) (see Power Wiring Wiring Diagram on Pages 16 and 17). Fan motor #1 will start as soon as the head pressure reaches the "cut-in" setting of (FCP1).

NOTE: ALL FAN MOTORS ARE CONTROLLED BY THEIR OWN FAN CYCLING CONTROL AND WILL CUT IN AT DIFFERENT HEAD PRESSURES.

Relay (R20) contact 7-1 [3] opens, de-energizing compressor #1 crankcase heater(s). Relay (R11) [29] contact 8-5 [34] closes, energizing (TD9) [33]. This will force compressor #1 to run for five minutes. **COMPRESSOR #3 (Stage 2) CANNOT BE STARTED UNTIL (TD9) TIMES OUT.**

Time delay relay (TD15)]94] contact C-NC [36] holds the compressor in an unloaded condition for 30 seconds. When relay (TD15) times out, it will energize relay (R5) [37], closing contacts 9-6 [106] and 7-4 [112]. This allows the capacity control thermostat (T3) to energize solenoid valve (UL1-1) [106], loading the compressor; or to energize solenoid valve (UL2-1) [112], unloading the compressor.

Relay (R11) [29] contact 7-4 [95] closes, which completes the interlock circuit for the water circulating pump.

STAGING 2 LOADING

Upon a further increase in return water temperature, the second step of the staging thermostat (T1) will close. If the lock-in timer (TD9) [95] and lock-out timer (TD7) [95] have timed out, relays (R2) [95] and (TD16) [96] will be energized, closing (R2) contacts 9-6 [62], 7-4 [67], and 8-5 [70]. If the safety controls and switches are closed, the control circuit [62] for compressor #3 and liquid line solenoid (SOL3) [70] will energize, allowing the compressor to start.

Relay (R22) [66] contact 7-1 [8] opens, de-energizing crankcase heater(s). Contact 9-6 [74] closes, energizing fan contactor (C14) [74], bringing power to the line side of fan cycling pressure controls (FCP7) thru (FCP12) (see power wiring diagrams). Fan motor #4 will start as soon as the head pressure reaches the "cut-in" setting of (FCP7).

Relay (R13) [65] contact 8-5 [69] closes, energizing (TD11) [68]. This will force compressor #3 to run for five minutes. **Compressor #2 cannot be started until TD11) times out.**

Time delay relay (TD16) [96] contact C-NC [71] holds compressor #3 in an unloaded condition for 30 seconds. When (TD16) times out, it will energize (R7) [72], closing contacts 9-6 [108] and 7-4 [113]. This allows the capacity control thermostat (T3) to energize solenoid valve (UL1-3) [108], loading the compressor; or to energize solenoid valve (UL2-3) [113], unloading the compressor.

STAGE 3 LOADING

Upon a further increase in return water temperature, the third step of the staging thermostat (T1) will close. If lock-in timer (TD11) and lock-out timer (TD6) [66] have timed out, relays (R3) [97], (R9) [99], and (TD17) [98] will be energized. Relay (R3) contacts 9-6 [45], 8-5 and 7-4 [50] close. If the safety controls and switches are closed, the control circuit [45] for compressor #2 and liquid line solenoid (SOL2) [53] will energize, allowing the compressor to start.

Relay (R21) [49] energizes, opening contact 7-1 [5], de-energizing compressor #2 crankcase heater(s). Relay (R12) [48] contact 8-5 [52] closes, energizing (TD10) [51]. This will force compressor #2 to run for five minutes. **Compressor #4 cannot be started until (TD10) times out.**

Relay (R9) contact 9-6 [105] closes, energizing solenoid valve (UL1-1), thus locking compressor #1 in the fully loaded position. Relay (R9) contacts 8-2 [106] and 7-1 [112] open to disconnect the capacity control thermostat (T3) from compressor #1 capacity control solenoid valves.

Time delay relay (TD17) [98] contact [54] holds compressor #2 in an unloaded condition for 30 seconds. When (TD17) times out, it will energize relay (R6) [55], closing contacts 9-6 [109] and 7-4 [114]. This allows the capacity control thermostat (T3) to energize solenoid valve (UL1-2) [109], loading the compressor; or to energize solenoid valve (UL2-2) [114], unloading the compressor.

Compressor #1 is full loaded.

Compressors #2 and #3 are being capacity-modulated.

STAGE 4 LOADING

Upon a further increase in return water temperature, the fourth step of the staging thermostat (T1) will close. If the lock-in timer (TD10) and the lock-out timer (TD8) [100] have timed out, relays (R4) [100], (R10) [102], and (TD18) [101] will be energized. Relay (R4) contacts 9-6 [79], 7-4 [84], and 8-5 [87] close. If the safety controls and switches are closed, the control circuit [79] for compressor #4 and liquid line solenoid (SOL4) [87] will energize, allowing the compressor to start.

Relay (R23) [83] energizes, opening contact 7-1 [7], de-energizing compressor #4 crankcase heater(s). Relay (R14) [82] contact 8-5 [86] closes, energizing (TD12). This will force compressor #4 to run for five minutes.

Relay (R10) contact 9-6 [107] closes, energizing solenoid valve (UL1-3, thus locking compressor #3 in the fully loaded position. Relay (R10) contacts 8-2 [108] and 7-1 [113] open to disconnect the capacity control thermostat (T3) from compressor #3 capacity control solenoid valves.

Time delay relay (TD18) [101] contact C-NC [88] holds compressor #4 in an unloaded condition for 30 seconds. When (TD18) times out, it will energize relay (R8) [89], closing contacts 9-6 [110] and 7-4 [115]. This allows the capacity control thermostat (T3) to energize solenoid valve (UL1-4) [110], loading the compressor; or to energize solenoid (UL2-4) [115], unloading the compressor.

Compressors #1 and #3 are fully loaded.

Compressors #2 and #4 are being capacity-modulated.

PUMPDOWN SEQUENCE

STAGE 4 PUMPDOWN

A decrease in return water temperature will cause the fourth step of the staging thermostat (T1) to open, thereby de-energzing staging relay (R4), opening contacts 8-5, 9-6, and 7-4. Liquid line solenoid (SOL4) will de-energize, stopping the flow of refrigerant to chiller circuit #4. The compressor will continue to run until the chiller circuit has been cleared of refrigerant and the suction pressure is approximately 35 PSIG. Low pressure control (LP4) contact will then open, de-energizing compressor contactors (C7) [80] and (C8) [81], stopping compressor #4; and de-energizing relays (R14) and (R23). Relay (R14) N.C. (normally closed) contact 2-8 [85] energizes lock-out timer (TD8), preventing compressor #4 re-start for five minutes. Relay (R23) energizes compressor #4 crankcase heater(s).

Staging thermostat (T1) also de-energizes relay (R10), opening contact 9-6, releasing compressor #3 from continuous full-load operation. Relay (R10) contacts 8-2 and 7-1 close, allowing capacity control thermostat (T3) to operate capacity control solenoid valves (UL1-3) and (UL2-3) as required.

STAGE 3 PUMPDOWN

A further decrease in return water temperature will de-energize staging relay (R3), closing liquid line solenoid (SOL2). When chiller circuit #2 low-side has pumped out, low pressure control (LP2) opens, stopping compressor #2; and de-energizing relays (R12) and (R21). Relay (R12) N.C. contact 2-9 [51] energizes lock-out timer (TD6), preventing compressor #2 re-start for five minutes. Relay (R21) energizes compressor #2 crankcase heater(s).

Staging thermostat (T1) also de-energizes relay (R9), opening contact 9-6, releasing compressor #1 from continuous full-load operation. Relay (R9) contacts 8-2 and 7-1 close, allowing the capacity control thermostat (T3) to operate capacity control solenoid valves (UL1-1) and (UL2-1) as required.

STAGE 2 PUMPDOWN

A further decrease in return water temperature will de-energize staging relay (R2), closing liquid line solenoid (SOL3). When chiller circuit #3 has pumped out, low pressure control (LP3) opens, stopping compressor #3; and de-energizing relays (R13) and (R22). Relay (R13) N.C. contact 2-8 [68] energizes lock-out timer (TD7), preventing compressor #3 re-start for five minutes. Relay (R22) energizes compressor #3 crankcase heater(s); and also de-energizes fan contactor (C14) [74], stopping the fan motor(s) on the "lag" half of the condenser slab.

STAGE 1 PUMPDOWN

Step 1 of the staging thermostat (T1) will open when the return water temperature is reduced to the set point. This de-energizes staging relay (R1), closing liquid line solenoid (SOL1), stopping refrigerant flow to chiller circuit #1. Compressor #1 continues to run until chiller circuit #1 pressure is down to the low pressure control (LP1) set point. The (LP1) contact opens, de-energizing compressor contactors (C1) [27] and (C2) [28], and relay (R20), stopping compressor #1. Relay (R20) de-energizes fan contactor (C13), stopping the remaining fan motor(s); and also energizes compressor #1 crankcase heater(s). The (LP1) contact also de-energizes relay (R11). Relay (R11) N.C. contact 2-8 [33] energizes lock-out timer (TD5), preventing compressor #1 re-start for five minutes. Relay (R11) contact 7-4 [95] opens, removing the circulating pump starter interlock.

SAFETY CONTROLS

Each refrigerant circuit is protected by seven standard safety controls, and one optional safety control.

1. High Pressure (HP0)
2. Low Pressure Freeze (LPF)
3. High Discharge Temperature (OTS)
4. Low Oil Temperature (LOT)
5. Compressor Solid State Module (CSTM)
6. Low Water Temperature (T2)
7. Low Pressure (LP)
8. Compressor Starter Overloads (OLH) (optional)

If any of these devices should open due to abnormal conditions, the compressor will automatically stop. All controls must be manually reset, except Low Oil Temperature (LOT), Low Pressure (LP) and Compressor Solid State Module (CSTM), which resets itself after a two minute bleed-down period. The compressor motor windings are also equipped with a thermal protector, automatic reset, which is not shown on the wiring diagram.

STAR-DELTA STARTING

OPEN TRANSITION

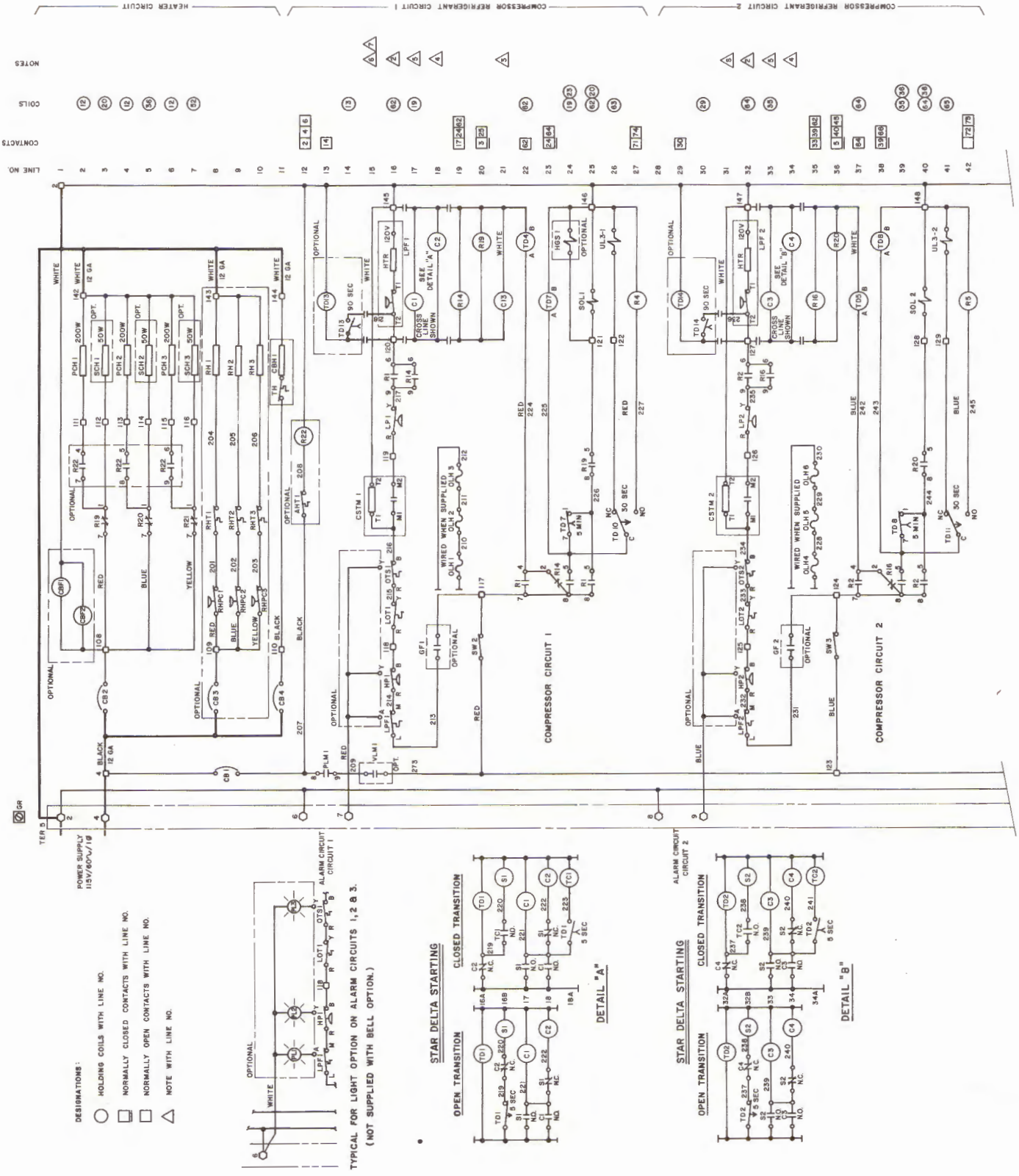
The following starting sequence applies to the power wiring diagrams on Page 17 as well as the control wiring on Pages 10 thru 15. Detail "A" on Page 10 is typical of all screw compressor star-delta start, and will be used as an example.

Staging relay (R1) contact 9-6 [16] closes, energizing star contactor (S1) [16B] and the 5 second transition timer (TD1) [16A]. The (S1) power contacts close, tying the center legs of the motor windings together into the "star" (wye) configuration. The (S1) N.C. (normally closed) auxiliary contact [18] opens to prevent contactor (C2) from energizing. The (S1) N.O. (normally open) auxiliary contact [17] closes, energizing (C1) [17]. The (C1) power contacts close, applying power to the motor. The (C1) N.O. auxiliary contact closes, locking (C1) in the energized position.

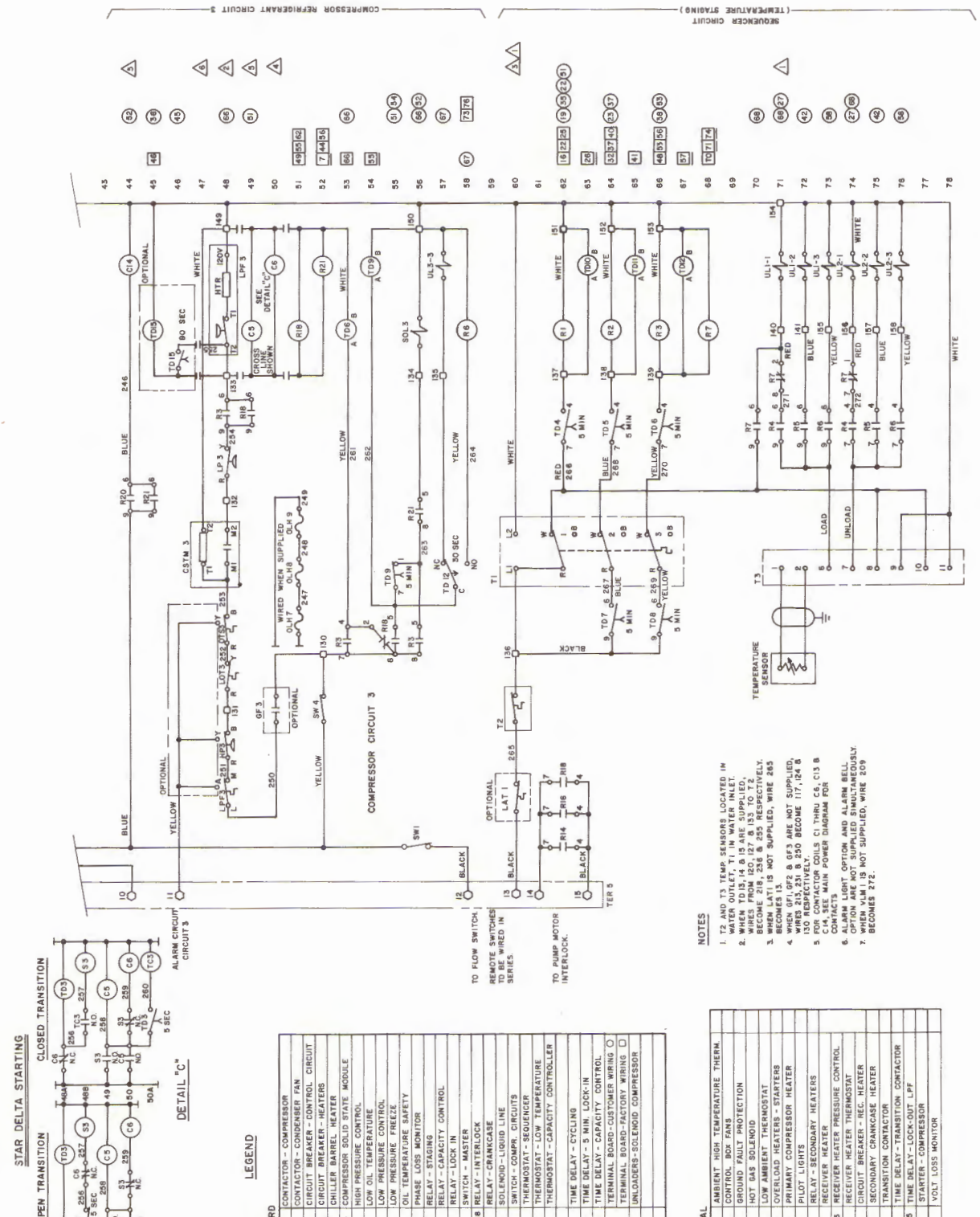
The compressor operates in the star mode until (TD1) times out (5 seconds) at which time (TD1) contact [16B] opens, de-energizing (S1). The (S1) N.C. contact [18] closes, energizing contactor (C2) [18], closing (C2) power contacts, thereby completing the Delta wiring configuration. (C2) N.C. auxiliary contact [16A] opens, preventing (S1) from energizing until the next starting sequence.

There is an instant of time (the "open transition") between the opening of (S1) power contacts and the closing of (C2) power contacts, in which power across the motor windings is interrupted.

TYPICAL CONTROL WIRING ACWC 160 THRU 200 SC



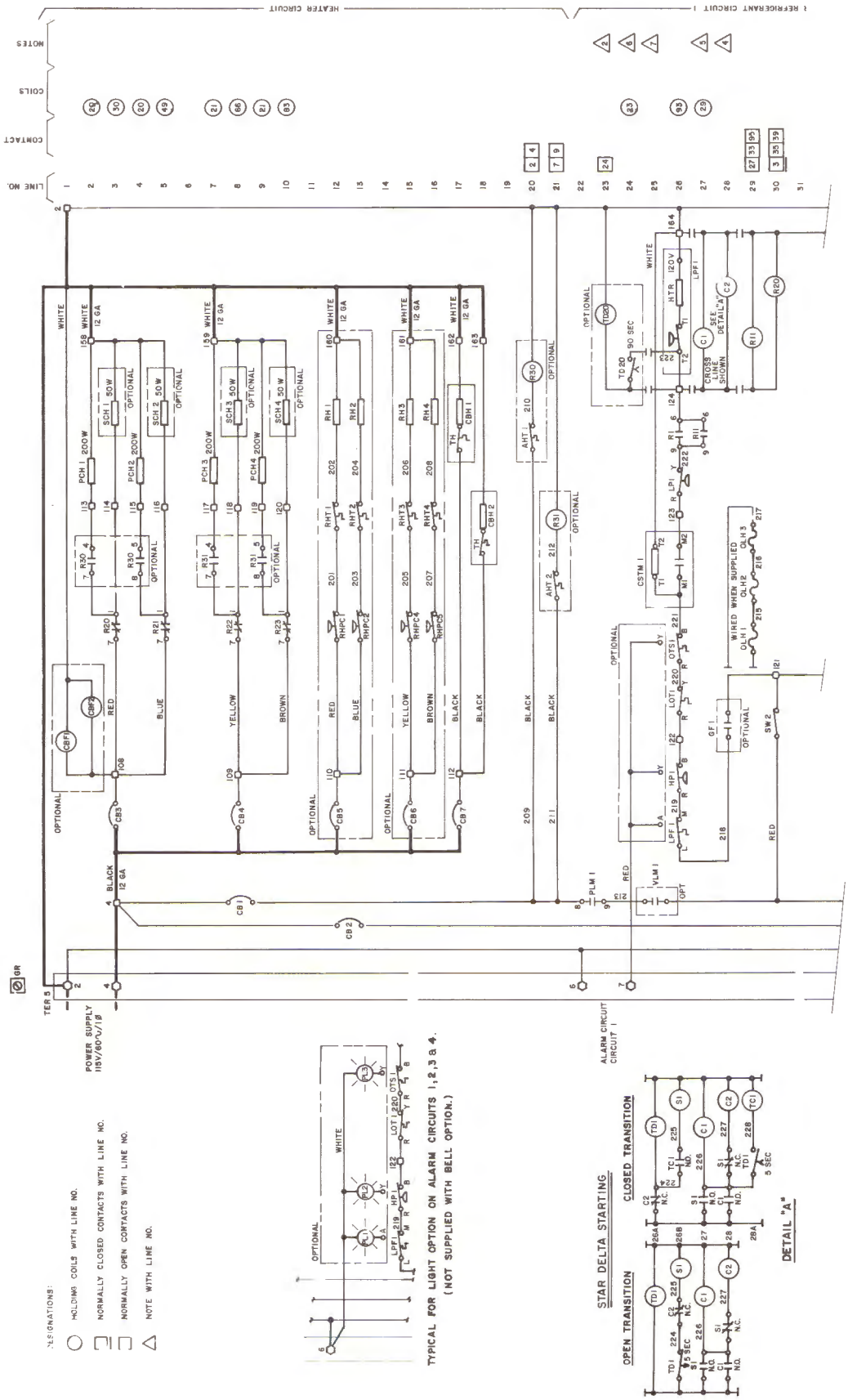
TYPICAL CONTROL WIRING ACWC 160 THRU 200 SC



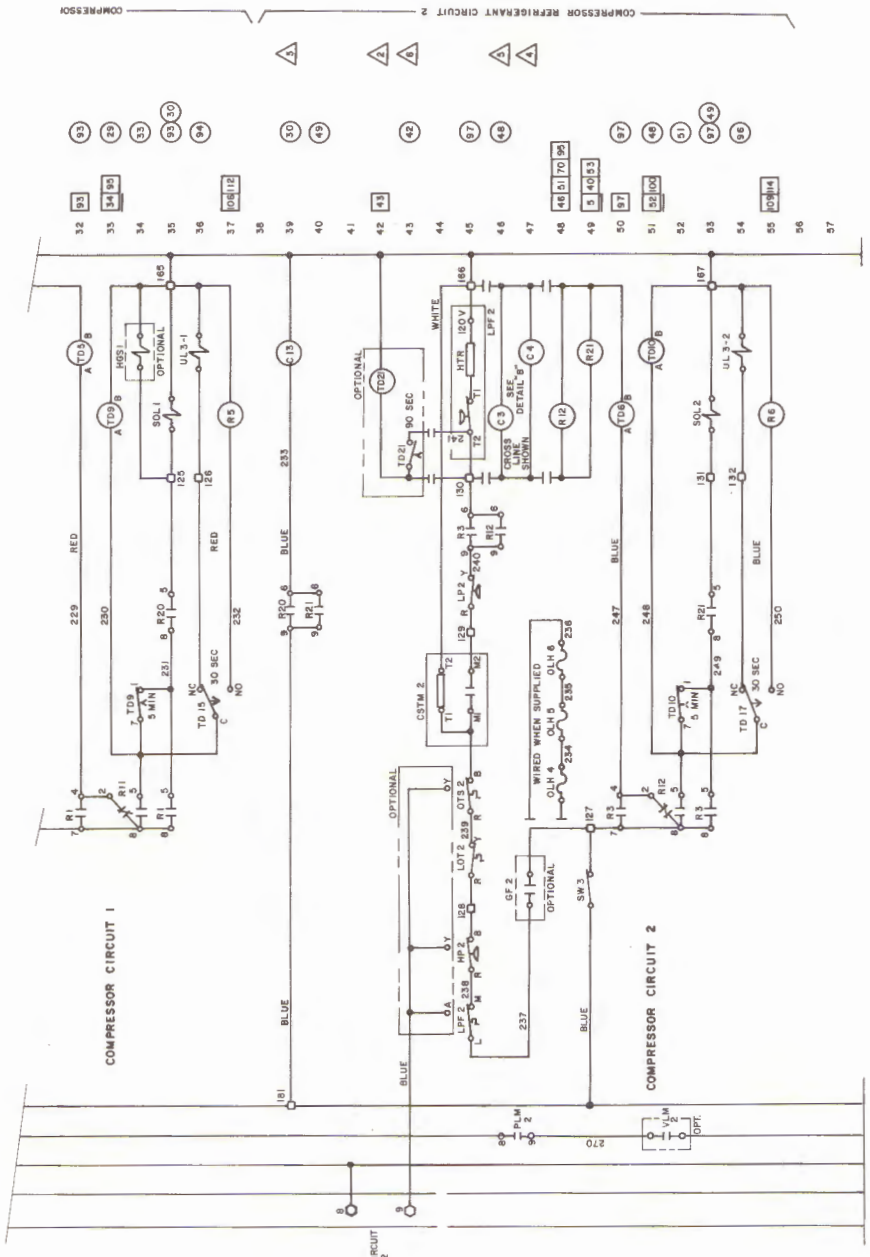
C1-6	CONTACTOR - COMPRESSOR
C13-14	CONTACTOR - CONDENSER FAN
CB1	CIRCUIT BREAKER - CONTROL CIRCUIT
CB 2, 4	CIRCUIT BREAKER - HEATERS
CBH1	CHILLER BARREL HEATER
CSTM 1-3	COMPRESSOR SOLID STATE MODULE
HPI 1-3	HIGH PRESSURE CONTROL
LOT 1-3	LOW OIL TEMPERATURE
LPI 1-3	LOW PRESSURE CONTROL
LPF 1-3	LOW PRESSURE FREEZE
OTS 1-3	OIL TEMPERATURE SAFETY
PLM 1	PHASE LOSS MONITOR
R1-3	RELAY - STAGING
R 4-6	RELAY - CAPACITY CONTROL
R 7	RELAY - LOCK IN
SW 1	SWITCH - MASTER
R14, 16, 18	RELAY - INTERLOCK
R 19-21	RELAY - CRANKCASE
SOL 1-3	SOLENOID - LIQUID LINE
SW2- 4	SWITCH - COMPR. CIRCUITS
T1	THERMOSTAT - SEQUENCER
T2	THERMOSTAT - LOW TEMPERATURE
T3	THERMOSTAT - CAPACITY CONTROLLER
TD 4-6	TIME DELAY - CYCLING
TD 7-9	TIME DELAY - 5 MIN. LOCK-IN
TD10-12	TIME DELAY - CAPACITY CONTROL
TER 5	TERMINAL BOARD-CUSTOMER WIRING ○ TERMINAL BOARD-FACTORY WIRING □
ULI-3	UNLOADERS-SOLENOID COMPRESSOR

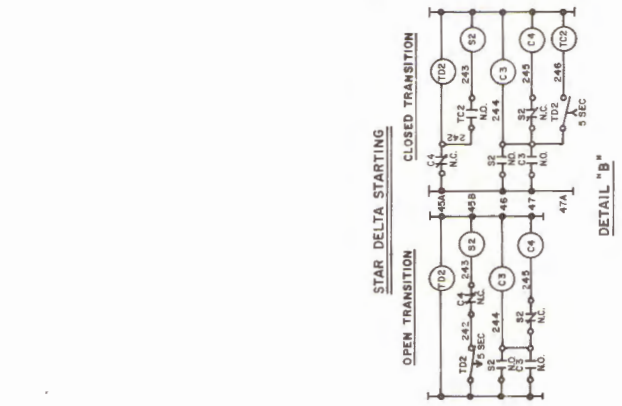
AHT 1	AMBIENT HIGH TEMPERATURE THERM.
CBF 1-2	CONTROL BOX FANS
GF 1-3	GROUND FAULT PROTECTION
HGS 1	HOT GAS SOLENOID
LAT 1	LOW AMBIENT THERMOSTAT
OLH 1-9	OVERLOAD HEATERS - STARTERS
PCH 1-3	PRIMARY COMPRESSOR HEATER
PLI- 9	PILOT LIGHTS
R 22	RELAY - SECONDARY HEATERS
RH 1-3	RECEIVER HEATER
RHPC 1-3	RECEIVER HEATER PRESSURE CONTROL
RHT 1-3	RECEIVER HEATER THERMOSTAT
CB 3	CIRCUIT BREAKER - REC. HEATER
SCH 1-3	SECONDARY CRANKCASE HEATER
TC 1-3	TRANSITION CONTACTOR
TD 1-3	TIME DELAY - TRANSITION CONTACTOR
TD13-15	TIME DELAY - LOCK-OUT LPF
ST 1-3	STARTER - COMPRESSOR
VLM 1	VOLT LOSS MONITOR

TYPICAL CONTROL WIRING ACWC 215 SC

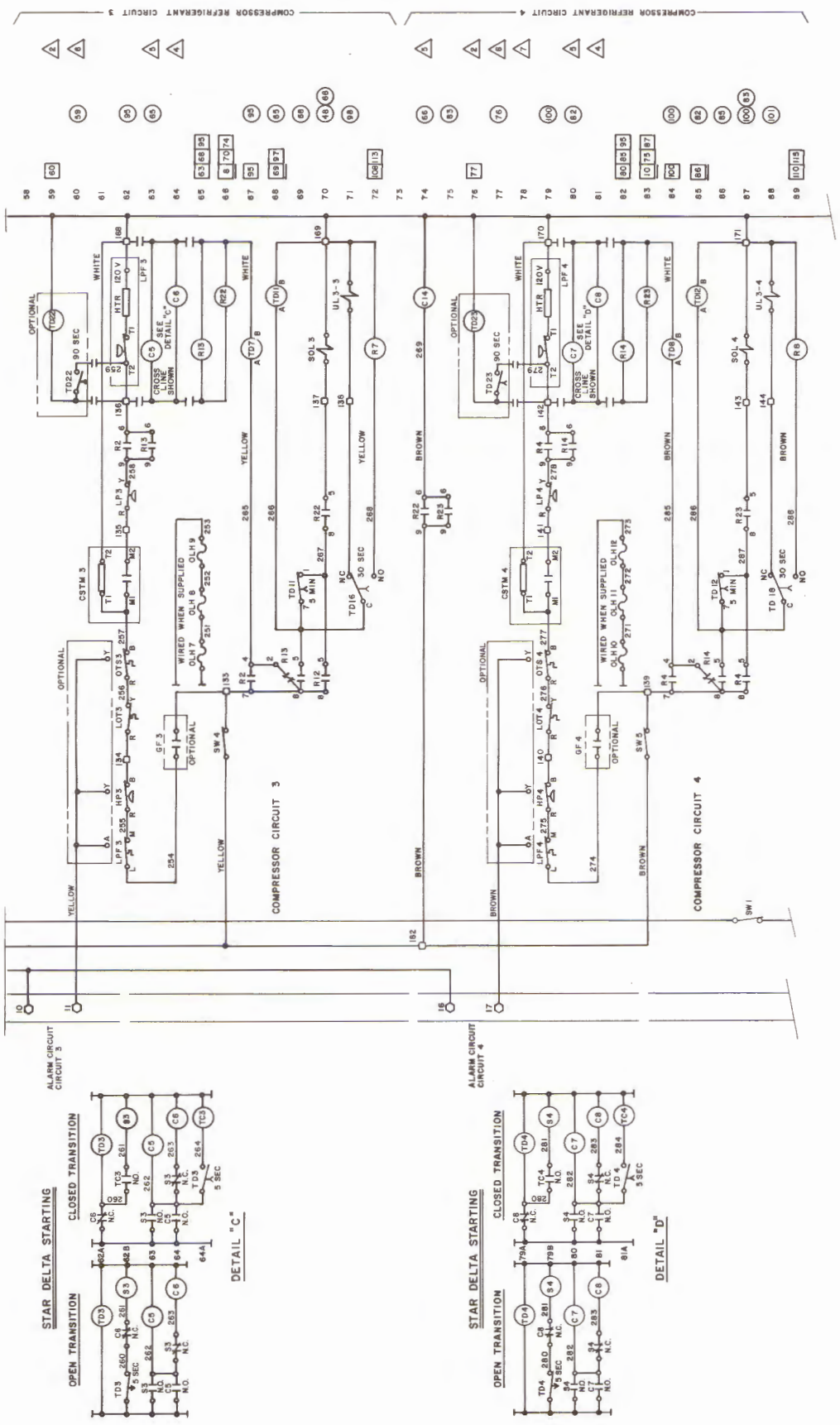


TYPICAL CONTROL WIRING ACWC 215 SC

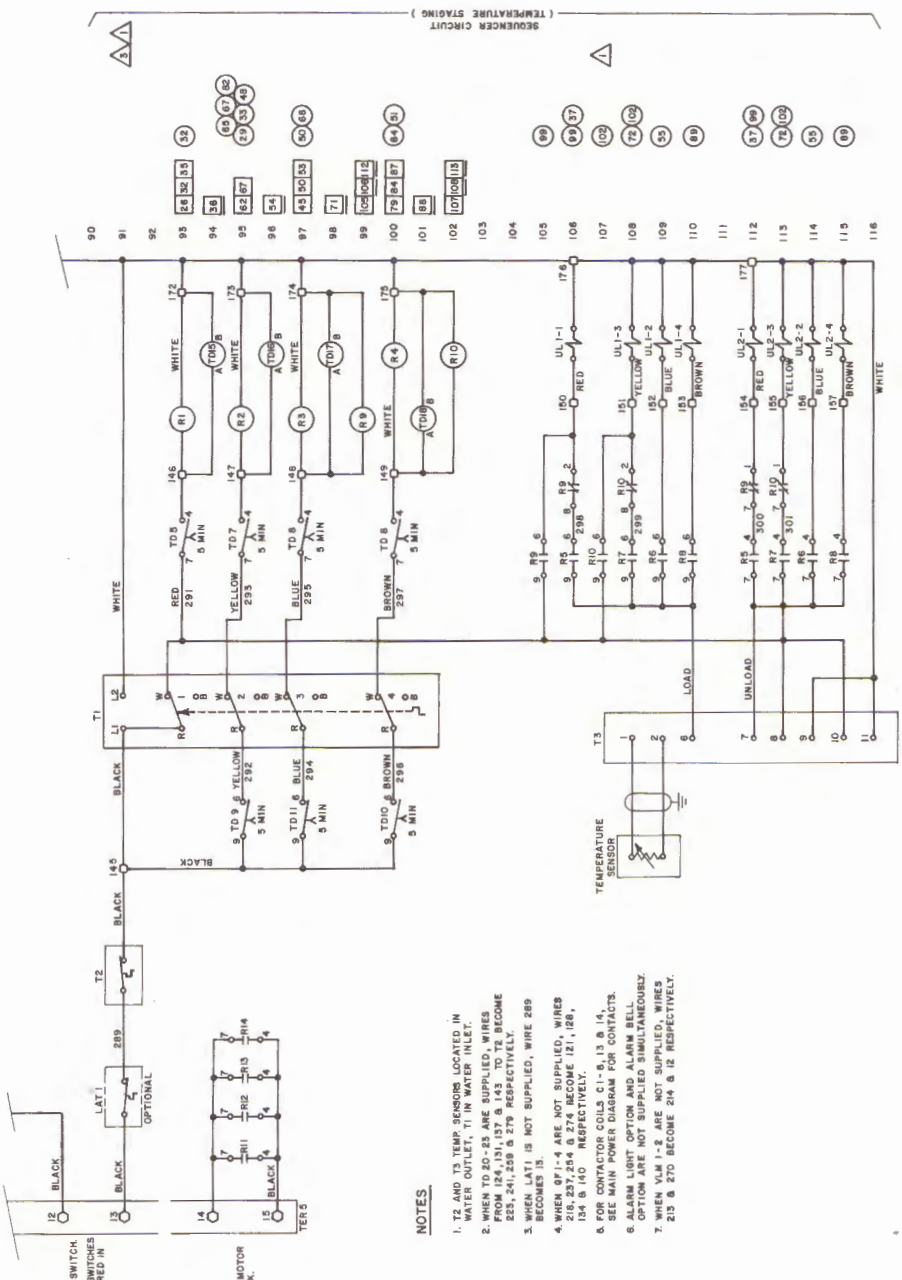




TYPICAL CONTROL WIRING ACWC 215 SC



TYPICAL CONTROL WIRING ACWC 215 SC



LEGEND

STANDARD

C1 - 8	CONTACTOR - COMPRESSOR
C15 - 16	CONTACTOR - CONDENSER FAN
CB 1 - 2	CIRCUIT BREAKER - CONTROL CIRCUIT
CB 3 - 4,7	CIRCUIT BREAKER - HEATERS
CBH 1 - 2	CHILLER BARREL HEATER
CSTM 1 - 4	COMPRESSOR SOLID STATE MODULE
HP 1 - 4	HIGH PRESSURE CONTROL
LOT 1 - 4	LOW OIL TEMPERATURE
LP 1 - 4	LOW PRESSURE CONTROL
LPF 1 - 4	LOW PRESSURE FREEZE
OTS 1 - 4	OIL TEMPERATURE SAFETY
PLM 1 - 2	PHASE LOSS MONITOR
R 1 - 4	RELAY - STAGING
R 5 - 8	RELAY - CAPACITY CONTROL
R 9 - 10	RELAY - LOCK IN
SW 1	SWITCH - MASTER
R 11 - 14	RELAY - INTERLOCK
R 20 - 23	RELAY - CRANKCASE
SOL 1 - 4	SOLENOID - LIQUID LINE
SW 2 - 5	SWITCH - COMPRESSOR CIRCUITS
T1	THERMOSTAT - SEQUENCER
T2	THERMOSTAT - LOW TEMPERATURE
T3	THERMOSTAT - CAPACITY CONTROLLER
TD 5 - 8	TIME DELAY - CYCLING
TD 9 - 12	TIME DELAY - 5 MIN. LOCK - IN
TD 15 - 18	TIME DELAY - CAPACITY CONTROL
TER 5	TERMINAL BOARD-CUSTOMER WIRING ○ TERMINAL BOARD-FACTORY WIRING ○
UL1 THRU 4	UNLOADERS - SOLENOID COMPRESSOR
PCH 1 - 4	PRIMARY COMPRESSOR HEATER

OPTIONAL

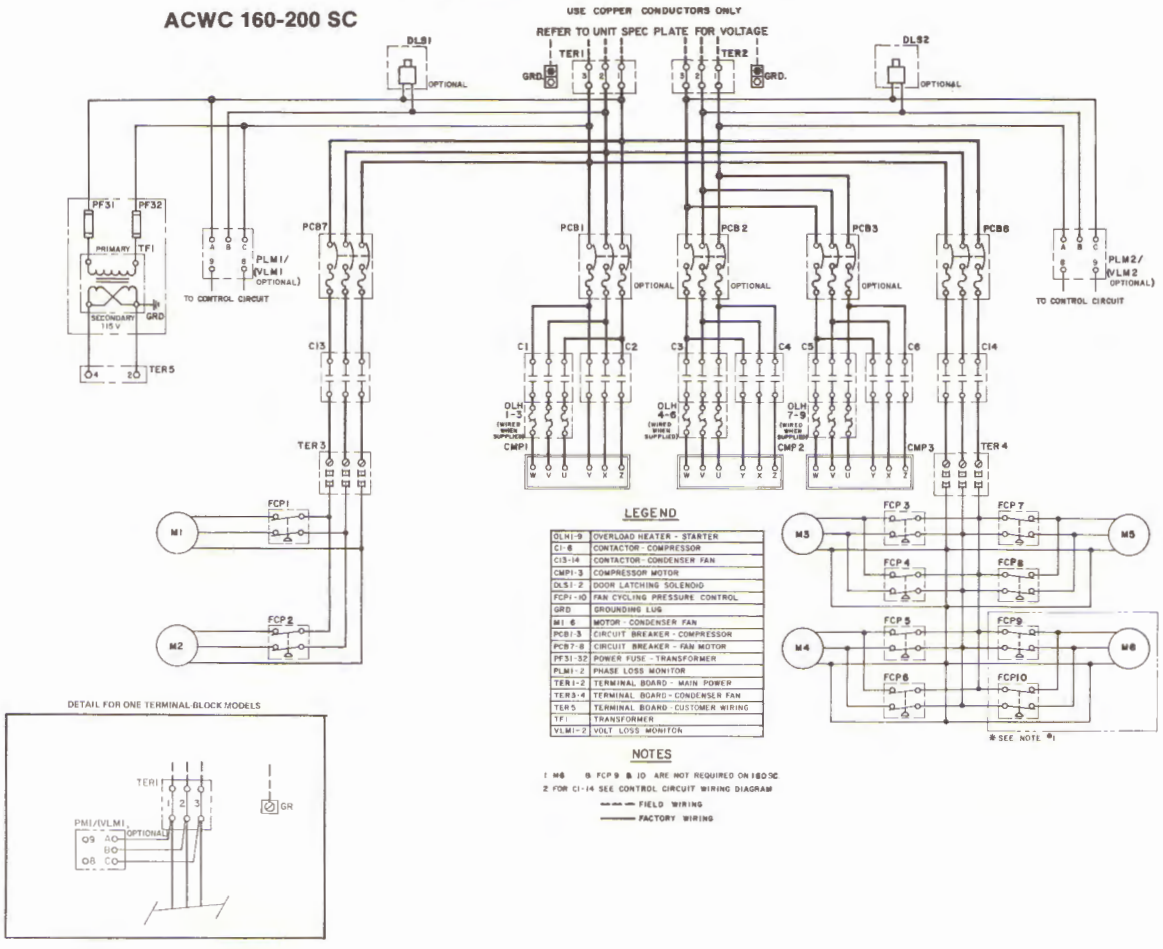
AHT 1 - 2	AMBIENT HIGH TEMPERATURE THERM.
CBF 1 - 2	CONTROL BOX FANS
GF 1 - 4	GROUND FAULT PROTECTION
HGS 1	HOT GAS SOLENOID
LAT 1	LOW AMBIENT THERMOSTAT
OLH 1 - 12	OVERLOAD HEATERS - STARTERS
PCH 1 - 4	PRIMARY COMPRESSOR HEATER
PL 1 - 12	PILOT LIGHTS
R 30 - 31	RELAY - SECONDARY HEATERS
RH 1 - 4	RECEIVER HEATER
RHPC 1 - 4	RECEIVER HEATER PRESSURE CONTROL
RHT 1 - 4	RECEIVER HEATER THERMOSTAT
CB 5 - 6	CIRCUIT BREAKER - REC. HEATER
SCH 1 - 4	SECONDARY CRANKCASE HEATER
TC 1 - 4	TRANSITION CONTACTOR
TD 1 - 4	TIME DELAY - TRANSITION CONTACTOR
TD 20 - 23	TIME DELAY - LOCK OUT LPF
ST 1 - 4	STARTER - COMPRESSOR
VLM 1 - 2	VOLT LOSS MONITOR

NOTES

1. T2 AND T3 TEMP. SENSORS LOCATED IN WATER OUTLET, T1 IN WATER INLET.
2. WHEN TD 20 - 23 ARE SUPPLIED, WIRES FROM 124, 131, 137 & 143 TO T2 BECOME 225, 241, 259 & 279 RESPECTIVELY.
3. WHEN LAT1 IS NOT SUPPLIED, WIRE 289 BECOMES 15.
4. WHEN GF 1 - 4 ARE NOT SUPPLIED, WIRES 218, 237, 254 & 274 BECOME 121, 120, 134 & 140 RESPECTIVELY.
5. FOR CONTACTOR COILS C1 - 8, 13 & 14, SEE MAIN POWER DIAGRAM FOR CONTACTS.
6. ALARM LIGHT OPTION AND ALARM BELL OPTION ARE NOT SUPPLIED SIMULTANEOUSLY.
7. WHEN VLM 1 - 2 ARE NOT SUPPLIED, WIRES 215 & 270 BECOME 214 & 12 RESPECTIVELY.

TYPICAL POWER WIRING
ACROSS-THE-LINE START

ACWC 160-200 SC



LEGEND

OLH1-9	OVERLOAD HEATER - STARTER
C1-8	CONTACTOR - COMPRESSOR
C13-14	CONTACTOR - CONDENSER FAN
CMP1-3	COMPRESSOR MOTOR
DLS1-2	DOOR LATCHING SOLENOID
FCP1-10	FAN CYCLING PRESSURE CONTROL
GRD	GROUNDING LUG
M1-6	MOTOR - CONDENSER FAN
PCB1-3	CIRCUIT BREAKER - COMPRESSOR
PCB7-8	CIRCUIT BREAKER - FAN MOTOR
PF31-32	POWER FUSE - TRANSFORMER
PLM1-2	PHASE LOSS MONITOR
TER1-2	TERMINAL BOARD - MAIN POWER
TER3-4	TERMINAL BOARD - CONDENSER FAN
TER5	TERMINAL BOARD - CUSTOMER WIRING
TF1	TRANSFORMER
VLM1-2	VOLT LOSS MONITOR

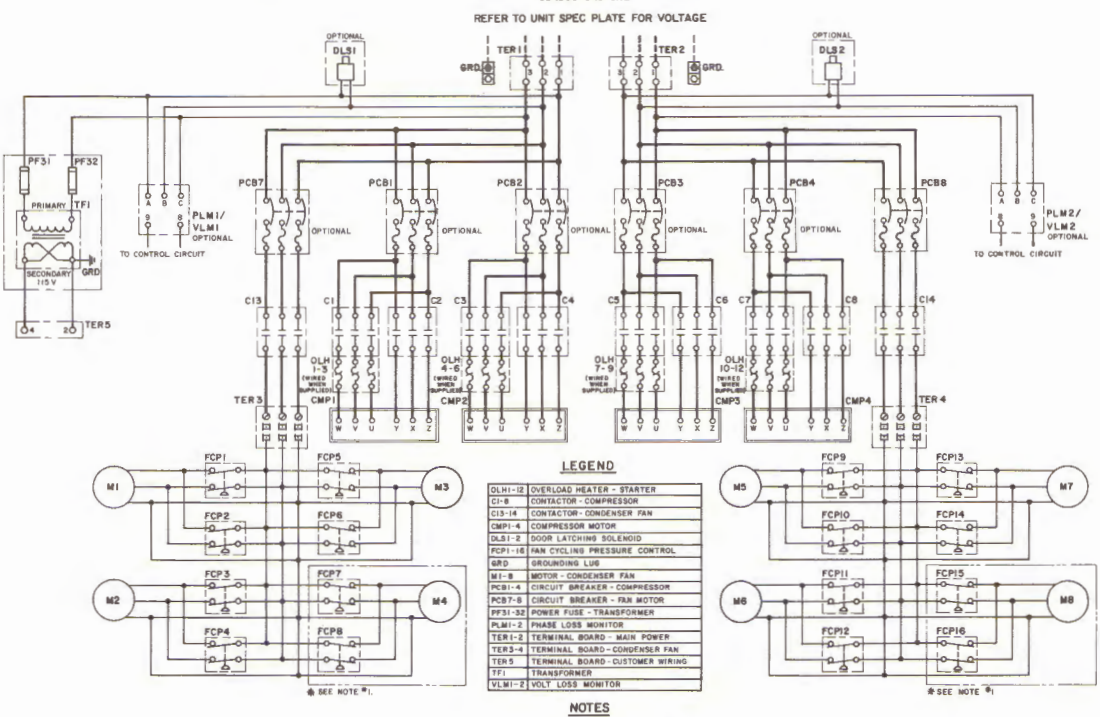
NOTES

1. M6 & FCP 9 & 10 ARE NOT REQUIRED ON 180 SC
2. FOR C1-14 SEE CONTROL CIRCUIT WIRING DIAGRAM

— — — FIELD WIRING

——— FACTORY WIRING

ACWC 215 SC



LEGEND

OLH1-12	OVERLOAD HEATER - STARTER
C1-8	CONTACTOR - COMPRESSOR
C13-14	CONTACTOR - CONDENSER FAN
CMP1-4	COMPRESSOR MOTOR
DLS1-2	DOOR LATCHING SOLENOID
FCP1-16	FAN CYCLING PRESSURE CONTROL
GRD	GROUNDING LUG
M1-8	MOTOR - CONDENSER FAN
PCB1-4	CIRCUIT BREAKER - COMPRESSOR
PCB7-8	CIRCUIT BREAKER - FAN MOTOR
PF31-32	POWER FUSE - TRANSFORMER
PLM1-2	PHASE LOSS MONITOR
TER1-2	TERMINAL BOARD - MAIN POWER
TER3-4	TERMINAL BOARD - CONDENSER FAN
TER5	TERMINAL BOARD - CUSTOMER WIRING
TF1	TRANSFORMER
VLM1-2	VOLT LOSS MONITOR

NOTES

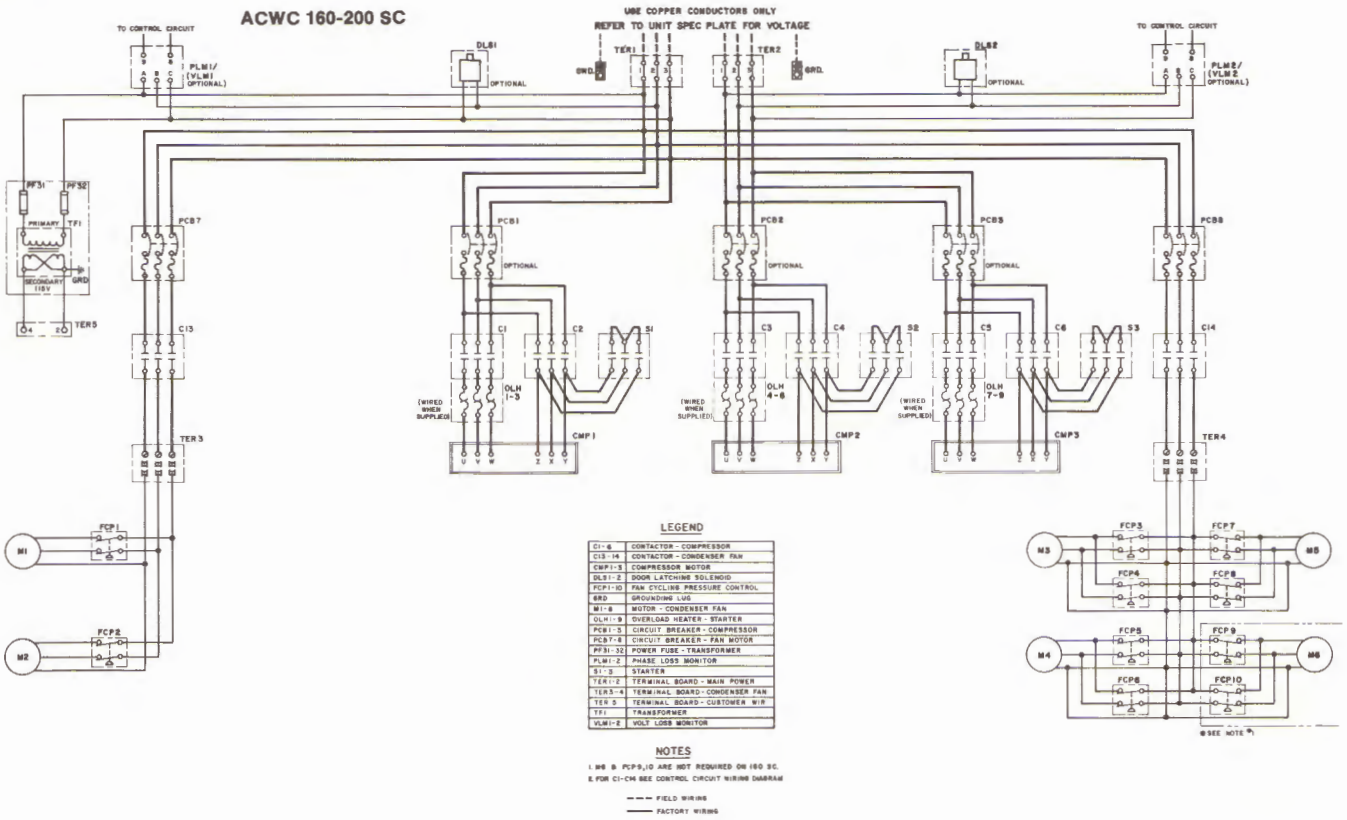
1. M4, M8 & FCP 7, 8, 15, 16 ARE NOT REQUIRED ON 215 SC.
2. FOR C1-14 SEE CONTROL CIRCUIT WIRING DIAGRAM.

— — — FIELD WIRING

——— FACTORY WIRING

TYPICAL POWER WIRING
STAR-DELTA START

ACWC 160-200 SC



LEGEND

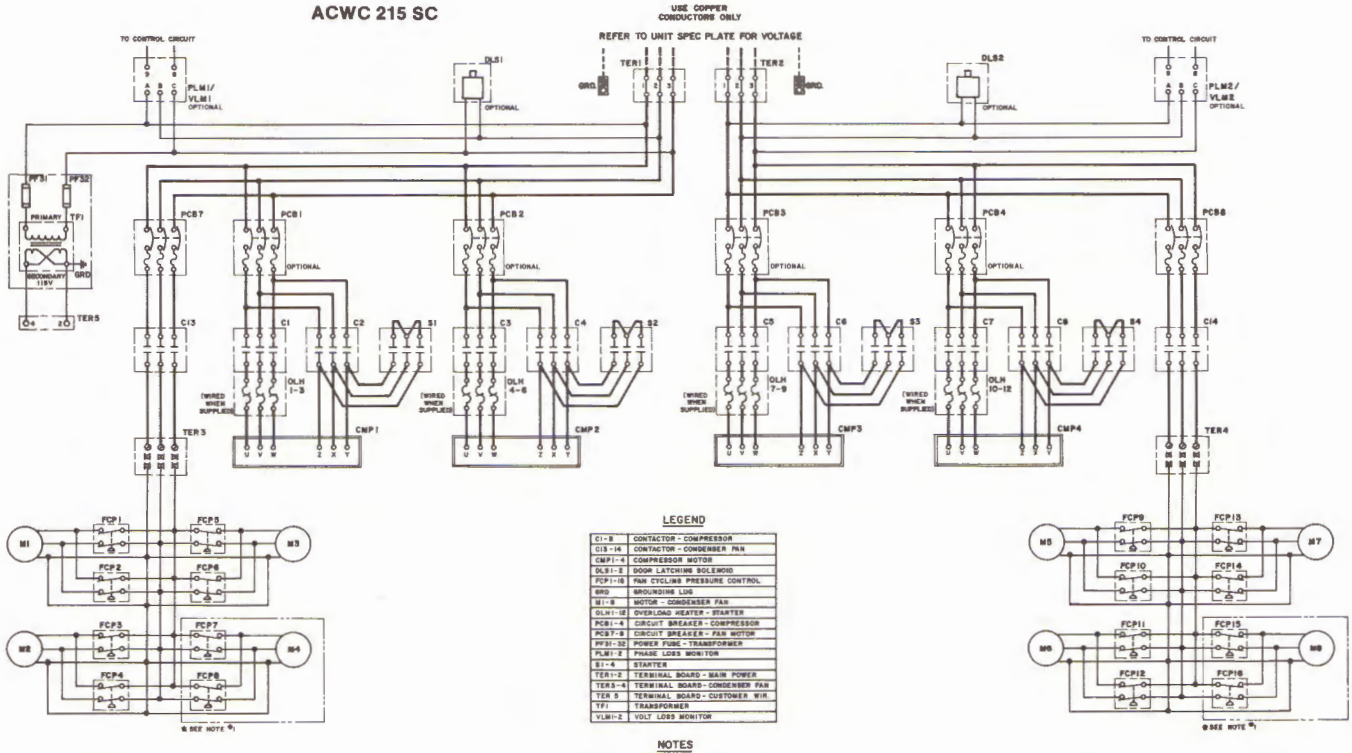
C1-8	CONTACTOR - COMPRESSOR
C13-14	CONTACTOR - CONDENSER FAN
CMP1-3	COMPRESSOR MOTOR
DLS1-2	DOOR LATCHING SOLENOID
FCP1-10	FAN CYCLING PRESSURE CONTROL
GRD	GROUNDING LUG
M1-8	MOTOR - CONDENSER FAN
OLH1-9	OVERLOAD HEATER - STARTER
PCB1-5	CIRCUIT BREAKER - COMPRESSOR
PCB7-8	CIRCUIT BREAKER - FAN MOTOR
PF31-32	POWER FUSE - TRANSFORMER
PLM1-2	PHASE LOSS MONITOR
S1-3	STARTER
TER1-2	TERMINAL BOARD - MAIN POWER
TER3-4	TERMINAL BOARD - CONDENSER FAN
TER 5	TERMINAL BOARD - CUSTOMER WIR
TF1	TRANSFORMER
VLM1-2	VOLT LOSS MONITOR

NOTES

1. M6 & FCP9,10 ARE NOT REQUIRED ON 160 SC.
2. FOR C1-C14 SEE CONTROL CIRCUIT WIRING DIAGRAM

--- FIELD WIRING
—— FACTORY WIRING

ACWC 215 SC



LEGEND

C1-8	CONTACTOR - COMPRESSOR
C13-14	CONTACTOR - CONDENSER FAN
CMP1-4	COMPRESSOR MOTOR
DLS1-2	DOOR LATCHING SOLENOID
FCP1-16	FAN CYCLING PRESSURE CONTROL
GRD	GROUNDING LUG
M1-8	MOTOR - CONDENSER FAN
OLH1-12	OVERLOAD HEATER - STARTER
PCB1-4	CIRCUIT BREAKER - COMPRESSOR
PCB7-8	CIRCUIT BREAKER - FAN MOTOR
PF31-32	POWER FUSE - TRANSFORMER
PLM1-2	PHASE LOSS MONITOR
S1-4	STARTER
TER1-2	TERMINAL BOARD - MAIN POWER
TER3-4	TERMINAL BOARD - CONDENSER FAN
TER 5	TERMINAL BOARD - CUSTOMER WIR
TF1	TRANSFORMER
VLM1-2	VOLT LOSS MONITOR

NOTES

1. M4,M8 & FCP7,8,15,16 ARE NOT REQUIRED ON 215 SC.
2. FOR C1-C14 SEE CONTROL CIRCUIT WIRING DIAGRAM

--- FIELD WIRING
—— FACTORY WIRING

ELECTRICAL DATA 60 HZ.

Model ACWC	TOTAL UNIT CHARACTERISTICS								COMPRESSORS				CONDENSER FANS		
	VOLTAGE		Min. Circuit Amps[2]		Max. Fuse Size[3]		Suggested Wire Size[4]								
	Name Plate	Range	Circuit 1[1]	Circuit 2[1]	Circuit 1[1]	Circuit 2[1]	Circuit 1[1]	Circuit 2[1]	Qty. H.P.	Type Start	Rated Load Amps Each	Locked Rotor Amps Each	Phase	Full Load Amps Each	Locked Rotor Amps Each
160SC	208-230	187-253	322	460	450	600	400	700	(3)60	ATL*	205	1228	3	13.2	92.0
	460	414-506	326	—	400	—	400	—			90	491		6.6	46.0
185SC	208-230	187-253	335	468	450	600	400	750	(1)60	ATL*	205	1228	3	13.2	92.0
									(2)75		208	1415			
	460	414-506	350	—	400	—	500	—	(1)60		90	491		6.6	46.0
									(2)75		98	562			
200SC	208-230	187-253	339	468	500	600	500	750	(3)75	ATL*	208	1415	3	13.2	92.0
	460	414-506	358	—	450	—	500	—			98	562		6.6	46.0
215SC	208-230	187-253	501	501	700	700	900	900	(4)60	ATL*	205	1228	3	13.2	92.0
	460	414-506	222	222	300	300	0000	0000			90	491		6.6	46.0
	460[5]	414-506	420	—	500	—	600	—			90	491		6.6	46.0

*ATL — Across The Line

[1]208-230 voltage requires two field wiring supplies (circuits).

[2]Minimum circuit ampacity is per N.E.C. Section 430-24.

[3]Use time delay (dual element) fuses only. Suggested fuse sizes based on N.E.C. Section 440-22.

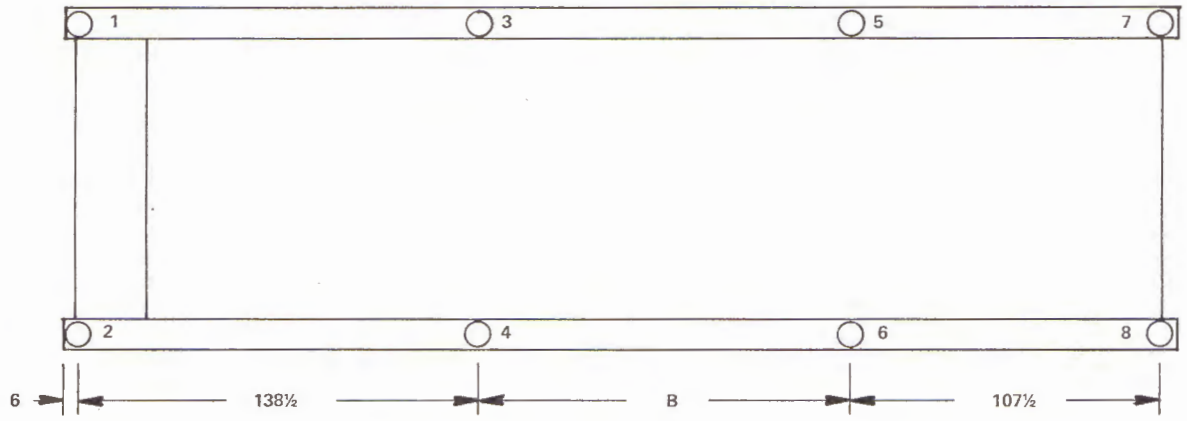
[4]Wire size based on copper conductors with 75° C. insulation per N.E.C. Table #310.16.

[5]Single point power terminals

NOTE:
Maximum inrush amps is L.R.A. of lag compressor + R.L.A. of all other compressors + F.L.A. of all fans.
Lag Compressor: 75 H.P. on 185SC.

COOLER WATER PRESSURE DROP
(Feet of Water)

Model ACWC	GALLONS PER MINUTE													
	320	340	360	380	400	420	440	460	480	500	520	540	560	580
160SC	12.0	13.7	15.4	17.1	18.8	20.6	—	—	—	—	—	—	—	—
185SC	—	—	10.6	11.9	13.1	14.3	15.7	17.1	18.6	20.2	—	—	—	—
200SC	—	—	—	—	13.1	14.3	15.7	17.1	18.6	20.2	—	—	—	—
215SC	—	—	—	—	—	11.1	12.2	13.3	14.4	15.5	16.7	17.9	19.4	20.8



Model ACWC	LOADING (LBS.) LOCATION POINT NUMBER								Dim.
	1	2	3	4	5	6	7	8	B
160SC	2120	2120	2120	2120	1830	1830	1510	1510	74
185SC	2280	2280	2280	2280	1960	1960	1630	1630	129
200SC	2340	2340	2340	2340	2010	2010	1670	1670	129
215SC	2330	2330	2330	2330	2150	2150	2150	2150	129

START-UP CHECK LIST

		YES	NO
Equipment Inspection:	a. Unit damaged on arrival		
	b. Material received agrees with shipping papers		
Setting Unit:	a. Vibration isolator used		
	b. Spring isolator adjusted for equal height		
	c. If rubber-in-shear isolators are used, is unit leveled by shimming		
Wiring:	a. Power wiring complete		
	b. Control wiring complete		
	c. Electric service adequate for load		
	d. Power source voltage correct for motor(s) used		
	e. Motor circuit has proper size fusetrons		
	f. System wired per diagram		
	g. All lead connections tight		
	h. Wiring complies with local codes		
Piping:	a. Piping complies with applicable codes		
	b. External piping independently supported		
	c. Chilled water lines insulated		
Alignment:	a. All belts adjusted and checked for tension		
	b. All pulleys checked and adjusted for proper pitch, tightness and alignment		
Before Start-Up:	a. Open compressor discharge service valve		
	b. Open liquid valve(s)		
	c. Open suction, and discharge valves to pressure gauges (if supplied)		
	d. Check rotation of all fan motors		
	e. All motors and bearings lubricated		
	g. Start auxiliary equipment (pumps, fans, etc.)		
	h. Is crankcase heater operating?		
After Start-Up:	a. Check high pressure control		
	b. Check oil temperature safety switch		
	c. Check and adjust low pressure or temperature freeze control		
	d. Check and adjust operating thermostat		
	e. Check and adjust low pressure operating control		
	f. Check and adjust expansion valve superheat		
	g. Check and adjust capacity control thermostat		

OPERATING DATA

CHILLER

Voltage: L-1 _____ L-2 _____ L-3 _____

Pressure Gauge Readings:

a. Suction _____ psig b. Discharge _____ psig

High pressure switch setting: (Cut-In) _____ psig _____ psig (Out)

Checked Setting _____ Yes _____ No

Low Pressure Switch Setting: (Cut-In) _____ psig _____ psig (Out)

Checked Setting _____ Yes _____ No

Low Pressure Freeze Control _____ Cut In _____ Cut Out

Oil Temperature Safety Switch _____ Cut Out

If Star-Delta start, time delay is _____ seconds.

Temperature of air entering condenser _____ °F.

Temperature of air leaving condenser _____ °F.

Temperature of chilled water entering chiller _____ °F.

Temperature of water (chilled) leaving chiller _____ °F.

Chilled water pressure entering chiller _____ psig

Chilled water pressure leaving chiller _____ psig