YORK BY JOHNSON CONTROLS	Supersedes: 160.54-PW6 (1011) Form 160.54-PW6 (513)
WIRING DIAGRAM	**FIELD CONNECTIONS MODEL YK CHILLERS (STYLE F AND G) WITH VARIABLE SPEED DRIVE**
CONTRACTOR _____	PURCHASER _____
ORDER NO. _____	JOB NAME _____
YORK CONTRACT NO. _____	LOCATION _____
YORK ORDER NO. _____	ENGINEER _____
☐ REFERENCE DATE _____	☐ APPROVAL DATE _____
☐ CONSTRUCTION DATE _____	

JOB DATA:

CHILLER MODEL NO. YK _____

NO. OF UNITS _____

MOTOR/VARIABLE SPEED DRIVE POWER: 380, 460 OR 575 VOLTS, 3-PHASE, 60 HZ OR 400 OR 415 VOLTS, 3-PHASE, 50 HZ

Issue Date:
May 10, 2013

IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During installation, operation maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual posseses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the OptiView cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. While Johnson Controls makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest Johnson Controls Service office.

Operating/service personnel maintains the responsibility of the applicability of these documents to the competitive equipment the kit is installed on. If there is any question regarding the applicability of these documents, the technician should verify whether the equipment has been modified and if current literature is available with the owner of the equipment prior to performing any work on the chiller.

NOTES

1. All field wiring shall be in accordance with the current edition of the National Electrical Code (N.E.C.) as well as all other applicable codes and specifications.
2. Variable Speed Drive (VSD) shall be grounded in accordance with the 1999 N.E.C. (Paragraph 250-118) for equipment grounding. Flexible conduit is required for final connection to the VSD. When a separate grounding conductor is required, it must be a copper conductor only and sized per the N.E.C. (Table 250-122). Per the 1999 N.E.C. (Paragraph 250-120(f)(1)), where multiple (parallel) conduits are used each must contain a grounding conductor. See Note 8 for grounding lug wire range.
3. Wiring, electrical conduit, junction boxes, fused disconnect switches (FDS), or circuit breakers, starters (M), pushbutton stations (PB), manual-off-automatic switch (S), flow switch (FLS), and control relays furnished by others unless otherwise specified.
4. Items marked * furnished by Johnson Controls.
5. Items marked ** available from Johnson Controls at additional cost.
6. Control power supply 115V - 50/60Hz, 2.0/3.0 KVA capacity for control center only, is supplied by a control power transformer(s) (1T)/(2T) mounted inside the VSD (380V, 60Hz chiller motor code ER-EV, CW-CZ, and CA or 460V, 60Hz chiller motor code CF-CT or 575V 60Hz chiller motor code CF-CV or 50Hz 5CC-5CM) or outside the VSD (380V, 60Hz chiller motor code EF-EP or 60Hz chiller motor code CU-DB or 50Hz 5CN-5DA) as shown. It is factory wired.
7. VSD power conduit connection (cut holes to suit) locations per Product Drawing Form 160.54-PA1. Flexible conduit must be used for final connections to VSD. Multiple conduits shall contain an equal number of wires from each phase in each conduit to prevent overheating per the 1999 N.E.C. (Paragraph 300-20(a)). Use copper conductors only; DO NOT USE aluminum conductors. See Note 8 for factory furnished VSD terminal lug wire ranges and conduit connection provisions.
8. A removable cover plate with pilot knockouts is supplied for connection of power supply conduits.

TABLE 1 - POWER SUPPLY CONDUITS

INPUT VOLTAGE/ FREQUENCY	CHILLER MOTOR CODE	NUMBER OF CONDUITS – MAX T
575V/600V/60Hz	CF-CR, EF-ER	(2) 2-1/2 in.
440V/460V/480V/60Hz	CF-CN, EF-EN	
380V/60Hz	EF-EK	
415V/50Hz	5EC-5EI	
380V/400V/50Hz	5CC-5CI, 5EC-5EI	
575V/600V/60Hz	CS-CV, ES-EV	(2) 3 in.
440V/460V/480V/60Hz	CP-CT, EP-ET	
380V/60Hz	EL-EP	
415V/50Hz	5EJ-5EM	
380V/400V/50Hz	5CJ-5CM, 5EJ-5EM	
440V/460V/480V/60Hz	CU-CZ, CA, CB, DA, DB, EU-EV	(4) 3 in.
380V/60Hz	ER-EV, CW-CZ,CA	
415V/50Hz	5CP-5CX, 5EN-5EO	
380V/400V/50Hz	5CN-5CX, 5DA, 5EN-5EO	

The following terminal lugs are factory furnished for field wiring supply connections. All lugs are rated AL-9CU.

TABLE 2 - TERMINAL LUGS

INPUT VOLTAGE/ FREQUENCY	CHILLER MOTOR CODE AND VSD CIRCUIT BREAKER RATING	LINE SIDE LUGS BBL PER TERMINAL	WIRE RANGE	GROUNDING LUG WIRE RANGE, QUANTITY
575V/600V/60Hz	CF-CR, EF-ER, 400A	2	#2 AWG - 500 kcmil.	#6 AWG to 250 kcmil, two bbl.
440V/460V/480V/60Hz	CF-CN, EF-EN, 400A			
380V/60Hz	EF-EK, 400A			
415V/50Hz	5EC-5EI, 400A			
380V/400V/50Hz	5CC - 5CI, 5EC-5EI, 400A			
575V/600V/60Hz	CS-CV, ES-EV, 600A	2	3/0-500 kcmil.	#6 AWG to 250 kcmil, two bbl.
440V/460V/480V/60Hz	CP-CT, EP-ET, 600A			
380V/60Hz	EL-EP, 600A			
415V/50Hz	5EJ-5EM, 600A			
380V/400V/50Hz	5CJ-5CM, 5EJ-5EM, 600A			
440V/460V/480V/60Hz	CU-CZ, CA, CB, DA, DB, EU-EV, 1200A	4	3/0-500 kcmil.	#4 AWG to 500 kcmil, four bbl.
380V/60Hz	ER-EV, CW-CZ, CA, 1200A			
415V/50Hz	5CP-5CX, 5EN-5EO, 1200A			
380V/400V/50Hz	5CN-5CX, 5DA, 5EN-5EO, 1200A			

9. Condenser water pump motor starter (3M) holding coil to be furnished for 115V - 50/60Hz. The power requirements for the water pump starter (3M) must be a maximum of 1 Amp holding and 10 Amps inrush. If power requirements exceed this value, furnish coil for line voltage, and control relay with 115V coil.

10. Units shipped knocked down require field connection of harnesses to control center, power wiring between compressor motor and VSD, and oil pump starter to VSD. These harnesses and power wiring are furnished by Johnson Controls for field assembly and consist of proper lengths of flexible conduit with necessary connectors, and contain the wires (shown in Note 13) properly terminated and marked.

11. Wire #14 AWG copper for one way distance of less than 175 feet. Wire #12 AWG copper for one way distance of more than 175 feet, but less than 300 feet.

12. Wiring diagram for YORK control center Form 160.54-PW3. Field wiring modifications per Form 160.54-PW7. Wiring diagrams for YORK Variable Speed Drive Forms 160.00-PW1, 160.00-PW2 or 160.00-PW3.

13. The following interconnecting wires are factory supplied when a YORK Variable Speed Drive is used.

    a. VSD to control center – L, 2, 16, 24, 53; 3-conductor shielded cable; 4-conductor shielded cable (VSD harmonic filter option only).

    b. VSD to oil pump motor starter – 67, 68, 69.

14. 60Hz oil pump motor for compressor is 2 HP. Full load amperes for oil pump drive panel (furnished by Johnson Controls with VSD factory wired) and 3.0 KVA or (2) 2.0 KVA control power transformer(s) (furnished by Johnson Controls and factory wired) are:

TABLE 3 - OIL PUMP

3-PHASE VOLTAGE	HZ	OIL PUMP DRIVE PANEL (AMPS)	CONTROL POWER TRANSFORMER(S) (AMPS)	MOTOR CODES
575/600	60	2.9	5.2	CF-CV, EF-EV
440/460/480	60	3.6	6.5	CF-CT, EF-ET
380	60	4.3	7.5	EF-EP
380/400/415	50	4.3	7.5	5CC - 5CM, 5EC-5EM
440/460/480	60	3.6	8.7	CU-DB, EU-EV
380	60	4.3	10	ER-EV, CW-CZ, CA
415	50	4.3	10	5CP-5CX, 5EN-5EO
380/400	50	4.3	10	5CN - 5DA, 5EN-5EO

15. The branch circuit overcurrent protection device for the YORK VSD must be a time delay type with a rating which is the standard fuse/circuit breaker size required to protect the field supply wiring conductors per the N.E.C.

    Motor overload protection is provided by the York VSD according to UL 508C. The York VSD does not have provisions to provide motor temperature sensing, thermal memory, or thermal retention protection for motor overload conditions as a standard offering. If thermal overload protection is desired, an optional motor monitoring board and resistance thermometer devices or thermistors are available.

16. The YORK Variable Speed Drive power supply wiring ampacity shall be calculated as follows.

    Model YK minimum circuit ampacity:

    Ampacity = 1.25 (Job FLA)

    Where 125% factor per 1999 N.E.C. (Para. 440-33).

TABLE 4 - CIRCUIT BREAKER

INPUT VOLTAGE/ FREQUENCY	CHILLER MOTOR CODE	VSD CIRCUIT BREAKER RATING (AMPS) @ 600VAC, 60HZ OR 480VAC, 60HZ OR 400VAC, 50/60HZ TRIP		SEMI-CONDUCTOR FUSE RATING (AMPS) @ 700VAC WITHSTAND	GROUND FAULT TRIP (AMPS)
		TRIP	WITHSTAND		
575V/600V/60Hz	CF-CR, EF-ER	400	35,000*+	N/A	120
440V/460V/480V/60Hz	CF-CN, EF-EN	400	65,000*+		
380V/60Hz	EF-EK				
415V/50Hz	5EC-5EI				
380V/400V/50Hz	5CC-5CI, 5EC-5EI				
575V/600V/60Hz	CS-CV, ES-EV	600	50,000*+	N/A	160
440V/460V/480V/60Hz	CP-CT, EP-ET	600	100,000*+		
380V/60Hz	EL-EP				
415V/50Hz	5EJ-5EM				
380V/400V/50Hz	5CJ-5CM, 5EJ-5EM				
440V/460V/480V/60Hz	CU-CZ, EU-EV	1200	100,000*+	1100	240
380V/60Hz	ER-EV				
415V/50Hz	5CP-5CT, 5EN-5EO				
380V/400V/50Hz	5CN-5CS, 5EN-5EO				
440V/460V/480V/60Hz	CA, CB, DA, DB	1200	100,000*+	1600	240
380V/60Hz	CW-CZ, CA				
415V/50Hz	5CU-5CX				
380V/400V/50Hz	5CT-5CX, 5DA				

* Per U.L. Listing of VSD

† RMS Symmetrical Amperes

17. The VSD is equipped with a U.L. Listed ground fault sensing circuit breaker sized per the following table. Fast acting semiconductor fuses are employed after the circuit breaker to provide additional protection to the VSD. The ground fault sensor is factory set to trip instantaneously when a ground fault is detected.

18. Control circuit wiring for 3M condenser water pump motor starter is shown for cooling only application. For units with Flash miniature card software version C.MLM.01.00 through C.MLM.01.03, the condenser water pump should be wired to terminal 164 of TB2 instead of terminal 151, AND the wire from terminal 22 of TB5 to terminal 150 of TB 2 shall not be installed. For software version C.MLM.01.04 and higher, the condenser pump connection should be as shown in the figure.

19. The main power transformer should be adequately sized such that the transformer voltage drop does not exceed 10% during unit start-up. The supply voltage, at VSD input terminals, during start-up must be maintained above 489 volts for 575V/600V, 391 volts for 440V/460V/480V, 323 volts for 380V 60Hz units and 323 volts for 380V/400V, 353 volts for 415V 50Hz units. The allowable supply voltage range during normal operation is 520 to 635VAC, 3-Phase 575V/600V, 60Hz or 414 to 508VAC, 3-Phase, 440V/460V/480V 60Hz or 342 to 423VAC, 3-Phase,380V/400V 50/60Hz, or 374 to 456VAC, 3-Phase, 415 50Hz.

20. Automatic control of the chilled water pump by the control center is shown. Chilled water pump motor starter (5M) holding coil to be furnished for 115V – 50/60Hz. The power requirements for the water pump starter (5M) must be a maximum of 1 Amp holding and 8 Amps inrush. If power requirements exceed this value, furnish coil for line voltage, and control relay with 115V coil (see Note 21).

    The pumps operate during oil pump prerun, during compressor operation and during cycling shutdown.

    For manual chilled water pump control, connect a manual start/stop switch as shown in the Field Connections diagram on page 3 or 5 for 115VAC coils only.

21. Each 115VAC field-connected inductive load, i.e. relay coil, motor starter coil, etc. shall have a transient suppressor wired (by others) in parallel with its coil, physically located at the coil. Spare transient suppressors are factory supplied in a bag attached to the keypad cable clamp in the OptiView Control Center.

22. The Condenser Flow Switch is optional. If not present, a jumper must be installed between TB4-11 and TB4-1.

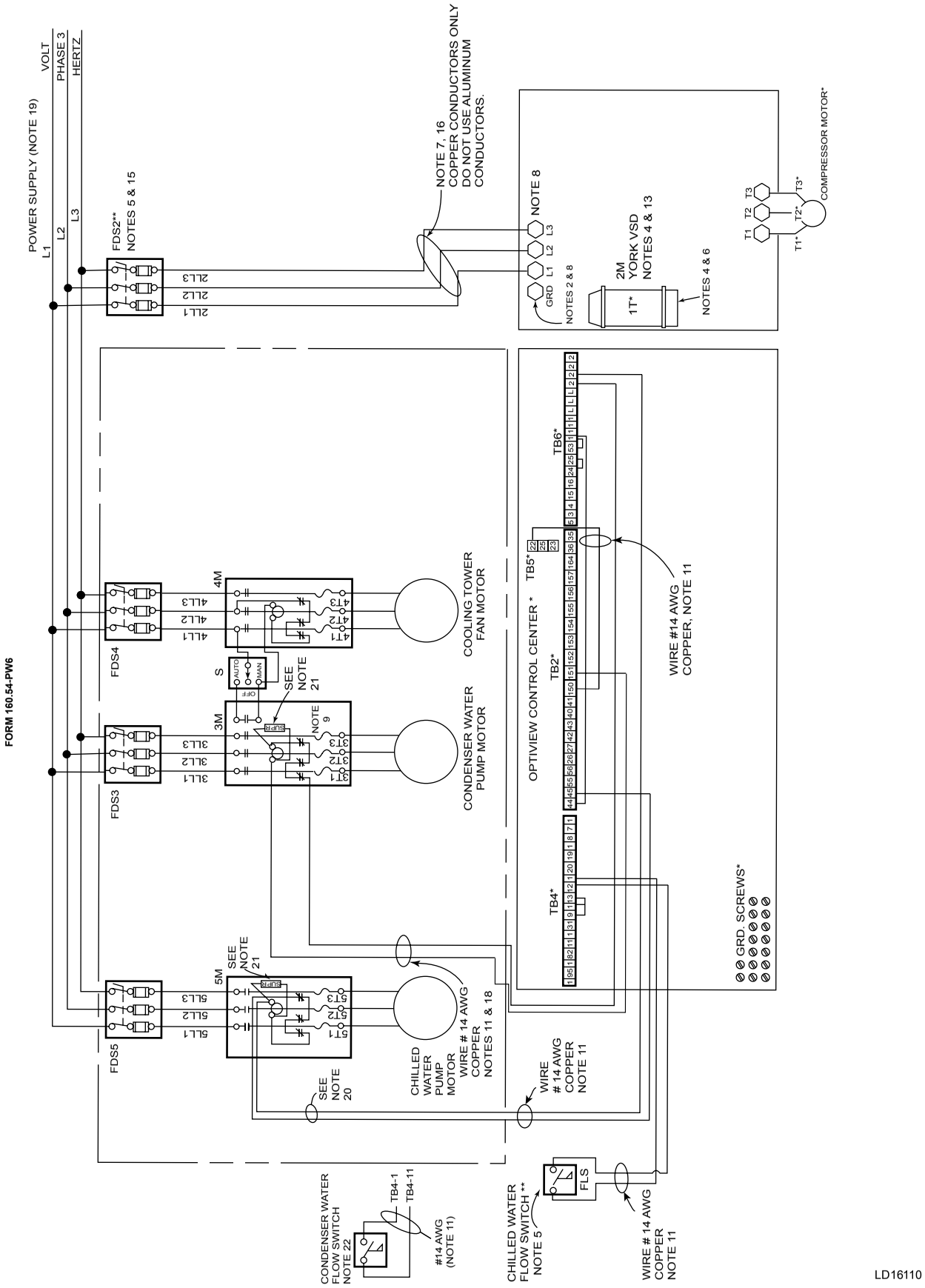

FIGURE 1 - WIRING DIAGRAM – FIELD CONNECTIONS (VARIABLE SPEED DRIVE - MOTOR CODES CF-CT, EF-ET (440V/460V/480V) OR CF-CV, EF-EV (575V/600V) OR EF-EP (380V) OR 5CC-5CM, 5EC-5EM (380V/400V) OR 5EC-5EM (415V)

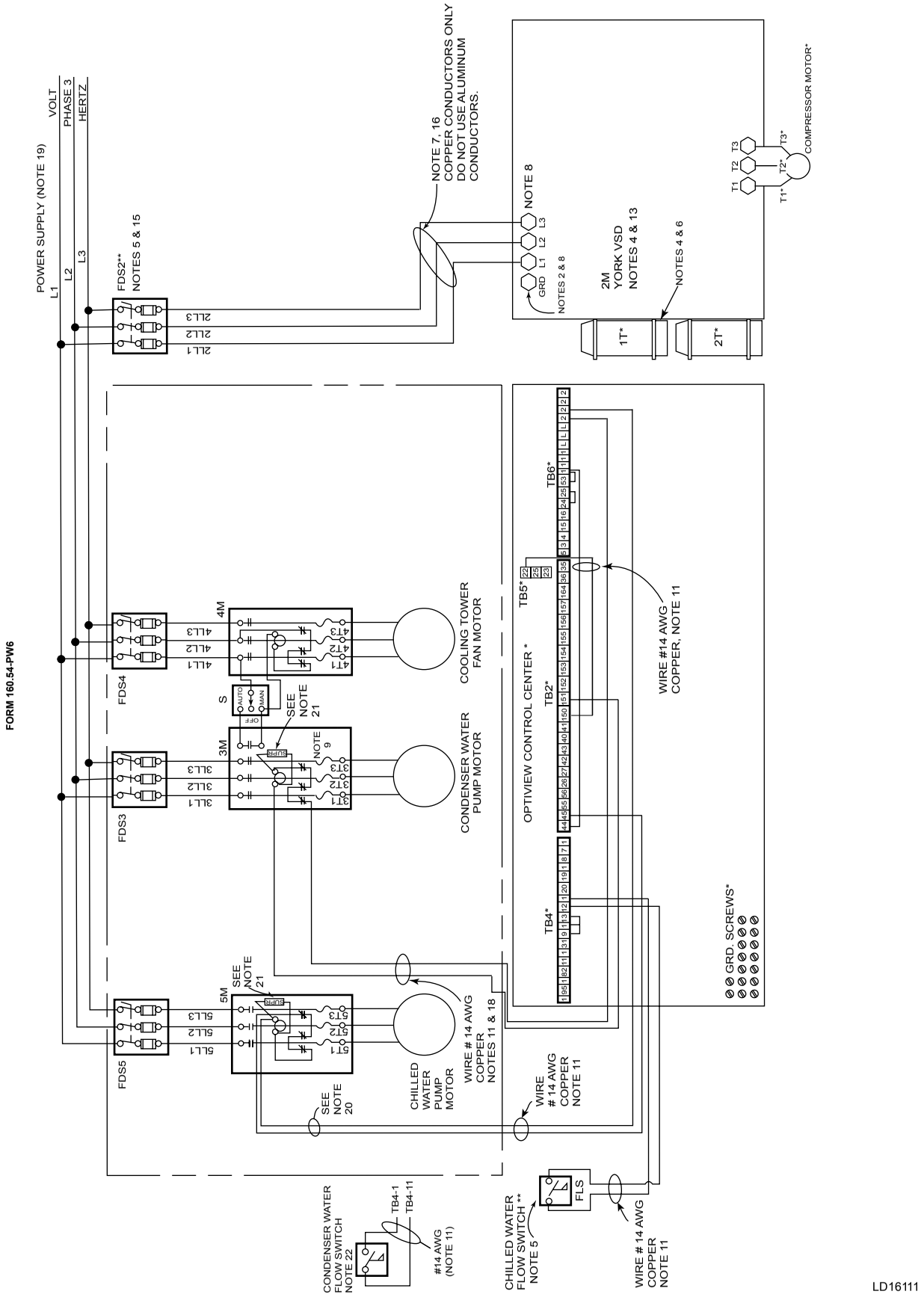

FIGURE 2 - WIRING DIAGRAM – FIELD CONNECTIONS (VARIABLE SPEED DRIVE - MOTOR CODES CU-DB, EU-EV (440V/460V/480V) OR ER-EV, CW-CZ, CA (380V) OR 5EH-5EO, 5CN-5DA (380V/400V) OR 5EN-5EO, 5CP-5CX (415V)

NOTES

The following factors can be used to convert from English to the most common SI Metric values.

TABLE 5 - SI METRIC CONVERSION

MEASUREMENT	MULTIPLY ENGLISH UNIT	BY FACTOR	TO OBTAIN METRIC UNIT
Capacity	Tons Refrigerant Effect (ton)	3.516	Kilowatts (kW)
Power	Horsepower	0.7457	Kilowatts (kW)
Flow Rate	Gallons / Minute (gpm)	0.0631	Liters / Second (l/s)
Length	Feet (ft)	304.8	Meters (m)
	Inches (in)	25.4	Millimeters (mm)
Weight	Pounds (lbs)	0.4538	Kilograms (kg)
Velocity	Feet / Second (fps)	0.3048	Meters / Second (m/s)
Pressure Drop	Feet of Water (ft)	2.989	Kilopascals (kPa)
	Pounds / Square Inch (psi)	6.895	Kilopascals (kPa)

TEMPERATURE

To convert degrees Fahrenheit (°F) to degrees Celsius (°C), subtract 32° and multiply by 5/9 or 0.5556.

Example: (45.0°F - 32°) x 0.5556 = 27.2°C

To convert a temperature range (i.e., a range of 10°F) from Fahrenheit to Celsius, multiply by 5/9 or 0.5556.

Example: 10.0°F range x 0.5556 = 5.6 °C range

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