

DUNHAM-BUSH®

FORM NO: MS0455A

Products That Perform...By People Who Care

**WATER-COOLED SEMI-HERMETIC
SCREW COMPRESSOR WATER CHILLERS**

HXWC SERIES

R134a

205 to 560 Tons

60Hz



INTRODUCTION

Dunham-Bush's **HXWC** water cooled chiller is the newest addition to rotary screw chillers. Multiple compressor units provide redundancy, and favorable part load efficiency.

HXWC Chillers combine the efficient operation of multiple semi-hermetic screw compressors and microprocessor control to yield the best total energy efficiency and significant operating savings under any load.

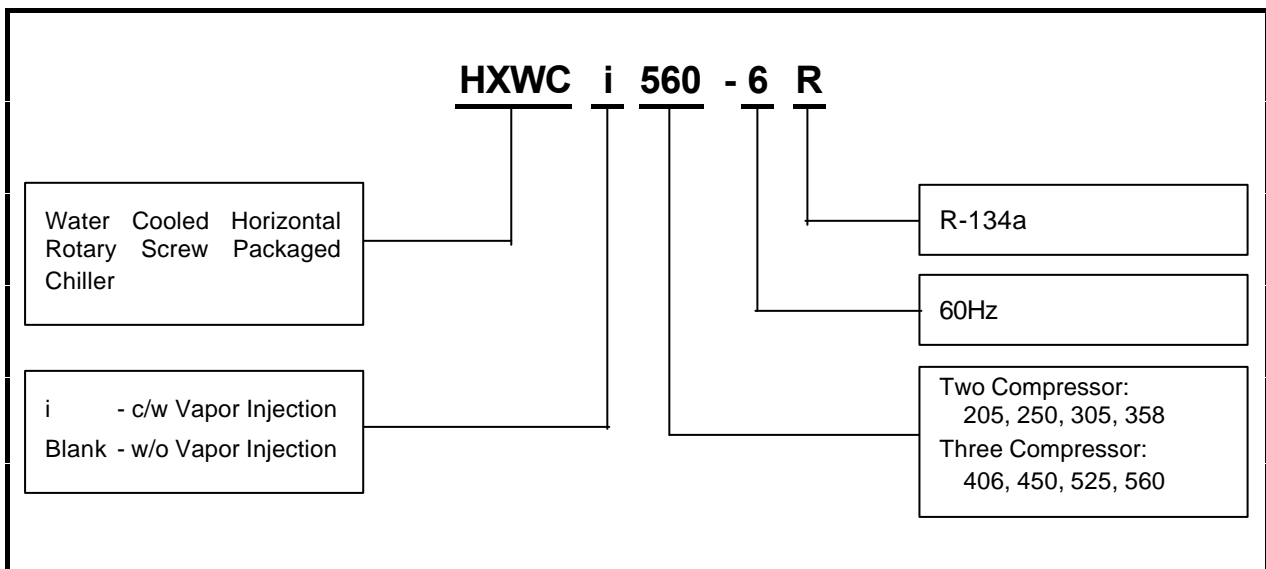
Dunham-Bush, the world's acknowledge leader in Screw Compressors chillers has a proven track record of superior performance and high reliability, unmatched by others!

All chillers are factory run tested before shipment.

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NOMENCLATURE



UNIT FEATURES

ARI CERTIFICATION

ARI Certification Program

The performance of Dunham-Bush Water-Cooled R134a Rotary Screw Water Chillers has been certified by the Air Conditioning and Refrigeration Institute (ARI) in accordance with ARI Standard 550/590-98.

Full load ratings, part load ratings, and water pressure drop data are regularly tested under this certification program. This provides an independent, third party verification of water chiller performance with a laboratory-rated performance test utilizing calibrated instrumentation.

The ARI Seal of Certification shows the commitment to quality and to our customer's peace of mind. You will get the industry's standard for efficiency and reliability when you purchase a Dunham-Bush water chiller.

This certification program does not include low temperature applications (Ice Bank) or units utilizing glycol.

Computer Performance Ratings

Dunham-Bush HXWC, the many combinations of heat exchangers make it impractical to publish tabular ratings for each combination. Optional vessels are offered to meet Ashrae 90.1-2001 chiller minimum efficiency guidelines. A chiller may be custom matched to certain building requirements by your Dunham-Bush Sales Representative utilizing the Dunham-Bush Selection Program or Electronic Catalogue which has performance rated in accordance to ARI Standard 550/590-98. Data which can be provided to you will include:

- ✿ Chiller Capacity
- ✿ KW Input
- ✿ Evaporator and Condenser Water Pressure Drop
- ✿ Evaporator and Condenser Tube Water Velocities
- ✿ IPLV/ NPLV
- ✿ Part-Load Performance

Contact your local Dunham-Bush Sales Representative to discuss what Real Solutions

Dunham-Bush can offer to solve your chiller selection questions.

PART LOAD PERFORMANCE

The Air Conditioning and Refrigeration Institute (ARI) has established a system, in ARI Standard 550/590-98, for measuring total chiller performance over full and part-load conditions. It defines the Integrated Part-Load Value (IPLV) as an excellent method of comparing diverse types of equipment on an equal basis. The IPLV is a single number estimate of a chiller's power use weighted for the number of hours the unit might spend at each part-load point. IPLV's are based on Standard Rating Conditions.

The formula for calculating an IPLV is:

$$IPLV = \frac{1}{\frac{0.01}{A} + \frac{0.42}{B} + \frac{0.45}{C} + \frac{0.12}{D}}$$

where: A = kW/ton at 100% load point
B = kW/ton at 75% load point
C = kW/ton at 50% load point
D = kW/ton at 25% load point

STANDARD FEATURES

Size/Range

- ✿ 8 Models from 205 to 560 tons.
- ✿ Multiple compressor units provide redundancy, and favorable part load efficiency.
- ✿ One-year parts warranty at no extra cost.

Compressor

- ✿ Quiet, reliable Semi-Hermetic Screw Compressors.
- ✿ Multiple rotary screw compressor for fail-safe reliability and redundancy.
- ✿ Stepless loading and unloading with dependable slide valve mechanism.
- ✿ Insured continuous oil flow with high efficiency external oil separator.

UNIT FEATURES

Evaporator/Condenser

- ✿ Cleanable and Removable Integral Fin Copper Tubes.
- ✿ Removable Water Heads.
- ✿ Victaulic Groove Water Connections.
- ✿ Vessels designed and constructed according to ASME Code, vessels can be constructed to comply and certified with ASME, JKPP and PED Standards.
- ✿ Relief Valve(s) standard - 3/4" FPT.
- ✿ Full Pump Down Capacity in Condenser.

Microcomputer/Electrical

- ✿ Proactive Microcomputer Controller adapts to abnormal operating conditions.
- ✿ Tolerant and accommodating of extreme conditions at start-up.
- ✿ Capable of controlling multiple chillers, cooling towers, pumps, etc.
- ✿ Circuit Breaker on each multiple compressor unit.
- ✿ Unit Mounted Contactor and Time Delay for reduced Inrush Start.
- ✿ Current transformer.
- ✿ Under Voltage Phase Failure Relay.
- ✿ Indicator lights for Compressor Overloads, Micro Alarm, Control Power, Compressor Control Circuit.

ENERGY EFFICIENCY

- ✿ Designed to provide the greatest amount of cooling for the least kilowatt input over the entire operating range of your building.
- ✿ Delivers outstanding efficiency and total energy savings through the use of microcomputer controlled slide valve and evaporator leaving water temperature control.
- ✿ High efficiency external oil separator guarantees removal of oil carried over in the refrigerant and maintains the heat exchangers

at their maximum efficiency at both full and part load.

- ✿ Rating according to ARI Standard 550/590-98 "Centrifugal or Rotary Screw Liquid Chilling Packages".

GLYCOL FREEZE PROTECTION

If the chiller or fluid piping may be exposed to temperatures below freezing, glycol protection is recommended if the water is not drained. The recommended protection is 10°F (5.6°C) below the minimum ambient temperature in the equipment room and around piping. Use only glycol solutions approved for heat exchanger duty. DO NOT use automotive anti-freeze.

If the equipment is being used for applications below 38°F (3.3°C), glycol should be used to prevent freeze damage. The freeze protection level should be 10°F (5.6°C) lower than the leaving brine temperature.

Table 1: Ethylene Glycol

%E. G. By Mass	Freeze Point	
	°F	°C
10	26.2	-3.2
15	22.2	-5.3
20	17.9	-7.9
25	12.7	-10.8
30	6.7	-14.1
35	-0.2	-17.8
40	-8.1	-25.8
45	-17.5	-27.5
50	-28.9	-33.8

Table 2: Propylene Glycol

%P. G. By Mass	Freeze Point	
	°F	°C
10	26.1	-3.3
15	22.9	-5.1
20	19.2	-7.2
25	14.7	-9.7
30	9.2	-12.8
35	2.4	-16.6
40	-6.0	-21.3
45	-16.1	-27.0
50	-28.3	-33.8

SPECIFICATION GUIDELINES

CONTROL CENTER

The Control Center is to be a fully enclosed steel cabinet with hinged access doors. Dual compartments, separating safety and operating controls from the power controls, are to be provided. Controls shall include:

- * High pressure cutout, manual reset
- * Low pressure cutout, manual reset
- * Compressor, solid state, thermal sensing overloads, manual reset
- * High refrigerant discharge temperature, manual reset
- * Low water temperature freeze protection, manual reset
- * Protection against low voltage, phase loss and phase reversal (auto-reset)
- * Power terminal block for single or dual source power
- * Compressor starter including current sensing overload protection
- * Microprocessor based controller and factory installed sensor including integral anti-cycle protection
- * Complete labeling of all control components
- * Numbered terminal strips for easier wire tracing

DISPLAY INFORMATION



Microcomputer Control (DB-Director)

Information is displayed in a large character LCD display that can be seen in bright or dim lighting.

Incorporates a 16 functional keypad that is so user friendly it rarely requires a manual and a battery backed up Real Time Clock that requires minimal attention. Information displayed includes :

- * Current capacity status
- * Current circuit/compressor status
- * Leaving chilled water temperature
- * Evaporator pressure of each refrigerant circuit
- * Condenser pressure of each refrigerant circuit
- * Compressor elapsed run time
- * Number of compressor starts
- * Compressor contactor status
- * Remove chilled water reset input (optional)
- * Entering fluid temperature monitoring (optional)
- * Compressor amperage monitoring (optional)

Provide microcomputer to include the following :

Control

- * Staging and loading
- * Lead/tag and load balance
- * Ramp up at start up
- * Alarm output and customer interlocks
- * Compressor current limit

System Protection

- * Low suction pressure
- * High discharge pressure
- * High motor temperature/over current
- * Freeze protection
- * Compressor run error
- * Low oil pressure
- * Power loss
- * Chilled water flow lost
- * Sensor error
- * Anti-recycle timing
- * Time delay

Readouts

- * Analog inputs: amps, leaving water temperatures, evaporator and condenser pressure.
- * Digital inputs : compressor contactor, flow switch (optional), customer on/off

SPECIFICATION GUIDELINES

Setpoints

Leaving water temperature, freeze up temperature, high and low pressure, amp limit, ramp up.

UNIT OPTIONS

ALARM HISTORY

Alarm information is provided in simple English for the previous 32 alarms, with data shown down to the second. The system provides 'last time' enabled & disabled, number cycles and total run hours.

Control Stability

A slope algorithm control function with all analogs read 10 times per second provides unparalleled stability.

Fuzzy Logic Control Zone

Based on leaving fluid temperature that reduces compressor cycling, and improves unit part load efficiency.

Remote Monitoring

A choice of high speed RS232 port operating at 19,200 baud for connection to a local PC up to 100 feet away or RS485 port at 38,400 baud rate up to 6000 feet away. Alternatively, the RS232 can be hooked up to a modem at 14,400 baud rate communications for remote communication.

Multiple Authorization Levels

This is available to provide complete security of the control system.

Automatic Power Monitoring System

This is designed to protect your system.

Extended Temperature Range

To allow operation in either hot or cold climates.

PC Control Programming

Programming download/pullback in only 45 seconds.

Compressor Protection

A proactive compressor protection logic for protecting against low or high discharge pressure

to minimize compressor cycling and nuisance trips.

Short Circuit Protection

Individual compressor (fusing) (circuit breakers) shall be provided.

Pressure Gauges

Provide factory mounted and piped suction and discharge pressure gauges for each refrigerant circuit. Each gauge is supplied with its own manual shut-off-valve.

Control Circuit Transformer

Provide a factory mounted and wired control circuit transformer for the 115 volt control circuit.

Pressure Sensing Freezestart

A pressure sensing freeze-start shall be provide, in addition to the temperature sensing freeze-start, on each circuit complete with a two minute time delay to prevent nuisance trips. (Standard with micro option).

Indicator Lights

Provide externally visible indicator lights that signal control circuit operation, individual compressor operation and safety failure for each refrigerant circuit.

Water Flow Switch

Provide a flow switch, for field installation, to shut down the unit on loss of chilled water flow.

Vibration Isolator

Provide (rubber-in-shear) (spring vibration) isolators, for field installation, under unit base members.

Acoustical Enclosure

Provide a sound attenuating cabinet for the compressor(s), constructed of 18 gauge galvanized steel and completely insulated with 1", 3LB. Density sound absorbing insulation.

PHYSICAL SPECIFICATIONS

MODEL	HXWC	210-6R	250-6R	310-6R	360-6R	410-6R	450-6R	530-6R	560-6R
NOMINAL CAPACITY	(TONS)	205	250	305	358	406	450	525	560
MIN % UNIT CAPACITY REDUCTION		12.5%	12.5%	12.5%	12.5%	8.33%	8.33%	8.33%	8.33%
COMPRESSOR									
MODEL	(QTY)	HX1711(2)	HX1811(2)	HX1813(1) HX1816(1)	HX1816 (1) HX1817(1)	HX1813(3)	HX1813(2) HX1816(1)	HX1816 (3)	HX1817 (3)
RPM		3550	3550	3550	3550	3550	3550	3550	3550
ELECTRICAL INFORMATION									
COMPR.	RLA, EACH	114.5	133.9	143.8/186.1	186.1/200.3	143.8	143.8/186.1	186.1	200.3
	LRA, EACH	665	725	1075/1210	1210/1455	1075	1075/1210	1210	1455
UNIT	MIN CIRCUIT AMPS	257.6	301.3	376.4	436.5	467.4	520.2	604.8	651.0
	MAX. ALLOW. FUSE SIZE	350	400	500	600	600	700	700	800
EVAPORATOR									
MODEL		X1R	X2R	X3R	X4R	X5R	X6R	X10R	X10R
WATER CONNECTION	(INCH)	8	8	8	10	10	10	10	10
NOMINAL WATER FLOW	(GPM)	493	601	733	861	976	1082	1263	1345
NOMINAL PRESSURE DROP	(FT WG)	16.9	16.6	18.2	18.1	17.5	19.7	17.5	14.3
CONDENSER									
MODEL		Z1R	Z2R	Z3R	Z4R	Z5R	Z6R	Z10R	Z10R
WATER CONNECTION	(INCH)	6	6	8	8	8	8	10	10
NOMINAL WATER FLOW	(GPM)	593	718	878	1031	1165	1290	1506	1607
NOMINAL PRESSURE DROP	(FT WG)	17.9	17.6	16.7	17	17.5	17.8	14.8	16.6
GENERAL INFORMATION									
UNIT LENGTH	(INCH)	171	171	171	171	171	171	185	185
UNIT WIDTH	(INCH)	57 5/8	59 5/8	63 5/8	65 5/8	82	82	82	84
UNIT HEIGHT	(INCH)	81 1/8	84 1/8	88 1/8	90 1/8	88 1/2	88 1/2	92 1/2	94 1/2
SHIPPING WEIGHT	(KG)	4965	5520	6530	7550	8560	9100	11950	12735
OPERATING WEIGHT	(KG)	5370	5965	7055	8155	9280	9900	13145	14010
APPROX. R134a REF. CHARGE	(KG)	265	325	395	465	530	585	685	730

Notes: 1.) Nominal capacity is based on standard condition, actual capacity depends on the specified operating conditions.
2.) Evaporator and condenser models are based on standard condition and are both 2 pass. Model might change for non-standard conditions or application.

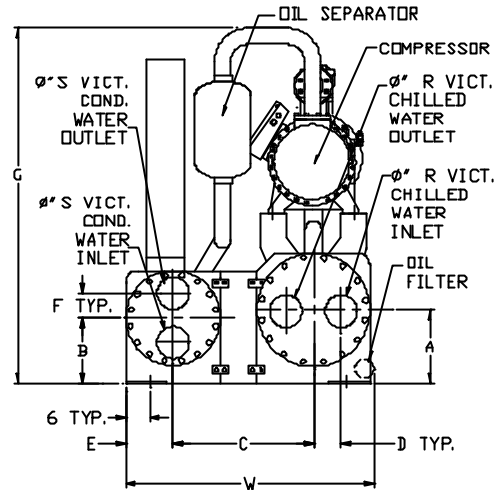
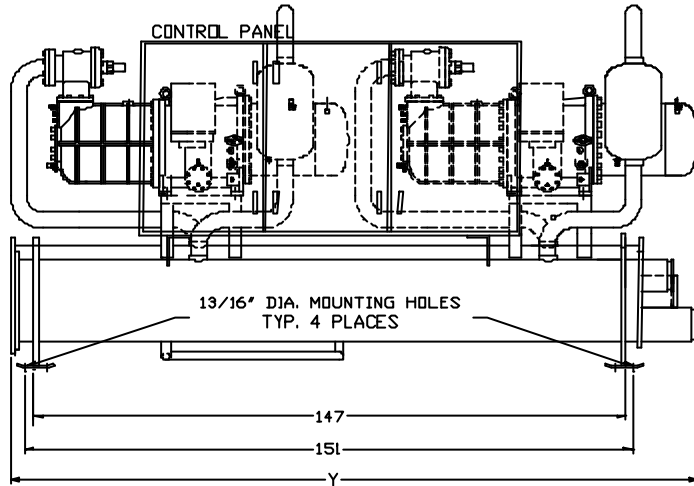
PERFORMANCE DATA

LEAVING CHILLED WATER TEMP. °F	MODEL HXWC	Entering Condenser Water Temperature , °F							
		75		85		90		95	
40	210-6R	195.9	136.2	187.9	142.1	181.8	147.6	175.6	154.0
	250-6R	238.7	159.4	229.3	166.2	221.8	172.6	214.2	180.3
	310-6R	291.3	196.0	279.8	204.8	270.7	212.6	261.4	221.9
	360-6R	342.3	229.7	328.7	239.8	318.0	249.0	307.1	259.9
	410-6R	387.6	256.2	372.3	267.9	360.2	278.1	347.8	290.2
	450-6R	429.9	281.3	412.9	294.1	399.5	305.3	385.7	318.7
	530-6R	502.0	334.1	481.7	348.8	465.8	362.7	449.6	379.3
42	210-6R	204.3	137.1	196.3	143.3	190.0	148.7	183.5	155.3
	250-6R	249.4	160.5	239.5	167.5	231.8	174.1	223.8	181.3
	310-6R	304.2	197.7	292.3	206.4	282.8	214.4	273.1	224.0
	360-6R	357.5	231.5	343.4	241.8	332.3	251.2	320.9	262.3
	410-6R	404.8	258.4	388.9	269.9	376.3	280.3	363.4	293.0
	450-6R	448.9	283.8	431.3	296.4	417.4	307.9	403.1	321.7
	530-6R	524.1	336.8	503.2	351.9	486.7	365.8	469.8	382.7
44	210-6R	213.2	138.2	205.0	144.4	198.5	150.0	191.7	156.8
	250-6R	260.2	161.8	250.1	169.0	242.1	175.6	233.9	183.3
	310-6R	317.5	199.0	305.2	208.1	295.4	216.3	285.4	225.9
	360-6R	372.9	233.0	358.6	243.7	347.1	253.2	335.3	264.6
	410-6R	422.5	260.4	406.1	272.1	393.1	282.8	379.7	295.3
	450-6R	468.5	285.8	450.4	298.8	436.0	310.6	421.1	324.3
	530-6R	547.2	338.8	525.5	354.8	508.4	368.9	490.9	385.8
46	210-6R	222.5	139.3	214.0	145.5	207.2	151.3	200.2	158.1
	250-6R	271.4	162.7	261.1	170.3	252.8	176.9	244.3	185.0
	310-6R	331.2	200.7	318.7	209.8	308.5	218.0	298.1	227.8
	360-6R	389.1	234.8	374.4	245.7	362.4	255.3	350.2	266.8
	410-6R	440.6	262.6	424.0	274.4	410.5	285.1	396.6	297.8
	450-6R	488.7	288.2	470.2	301.3	455.2	313.0	439.9	327.0
	530-6R	570.8	341.7	548.6	357.6	530.9	372.0	512.8	389.2
48	210-6R	232.5	140.1	223.4	146.6	216.3	152.5	209.1	159.4
	250-6R	283.2	163.7	272.6	171.6	263.9	178.4	255.0	186.5
	310-6R	345.6	201.9	332.6	211.4	322.1	219.8	311.2	229.6
	360-6R	406.0	236.4	390.7	247.6	378.3	257.4	365.3	268.9
	410-6R	459.7	264.2	442.5	276.4	428.5	287.4	414.1	300.3
	450-6R	509.9	290.0	490.8	303.5	475.3	315.6	459.3	329.8
	530-6R	595.4	343.9	572.6	360.4	554.3	375.1	535.4	392.3
50	210-6R	242.1	141.2	236.2	147.8	225.8	153.8	218.2	160.7
	250-6R	295.3	165.1	284.4	173.0	275.4	179.9	266.3	188.0
	310-6R	360.4	203.4	347.1	213.0	336.1	221.5	324.9	231.6
	360-6R	423.3	238.1	407.7	249.5	394.9	259.3	381.7	271.2
	410-6R	479.6	266.2	461.8	278.6	447.2	289.6	432.3	302.9
	450-6R	531.9	292.2	512.2	305.9	496.0	318.0	479.5	332.6
	530-6R	620.8	346.5	597.6	363.2	578.5	378.2	559.0	395.6
	560-6R	661.6	372.7	636.6	390.9	616.3	406.9	595.5	425.8

DIMENSIONAL DATA

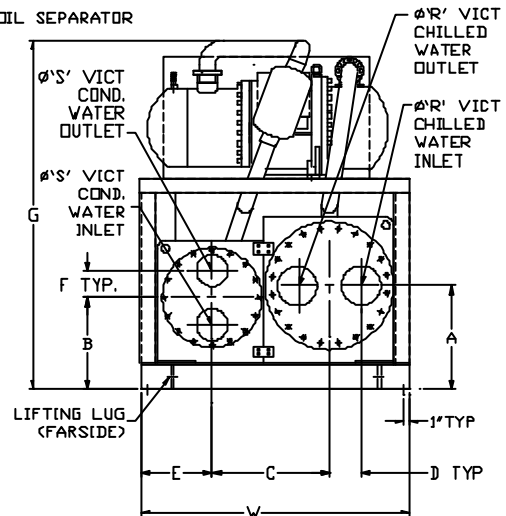
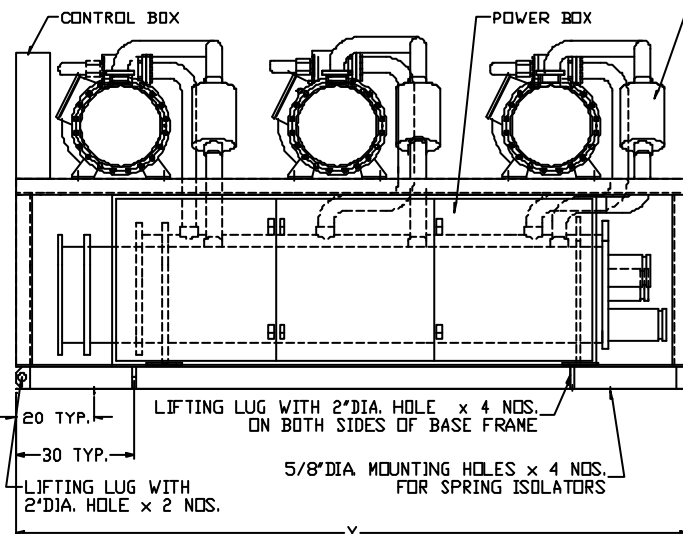
HXWC 210-6R, 250-6R, 310-6R, 360-6R

MODEL HXWC	A	B	C	D	E	F	G	R	S	W	Y
210-6R	17 1/4	14 1/4	31 7/8	5 7/8	9 3/4	4 1/2	81 1/8	8	6	57 5/8	171
250-6R	17 1/4	15 1/4	32 7/8	5 7/8	10 3/4	5 5/8	84 1/8	8	6	59 5/8	171
310-6R	18 1/4	16 1/4	34 7/8	6 7/8	11 3/4	6 1/8	88 1/8	8	8	63 5/8	171
360-6R	19 1/4	16 1/4	35 7/8	7 7/8	11 3/4	6 1/8	90 1/8	10	8	65 5/8	171



HXWC 410-6R, 450-6R, 530-6R, 560-6R

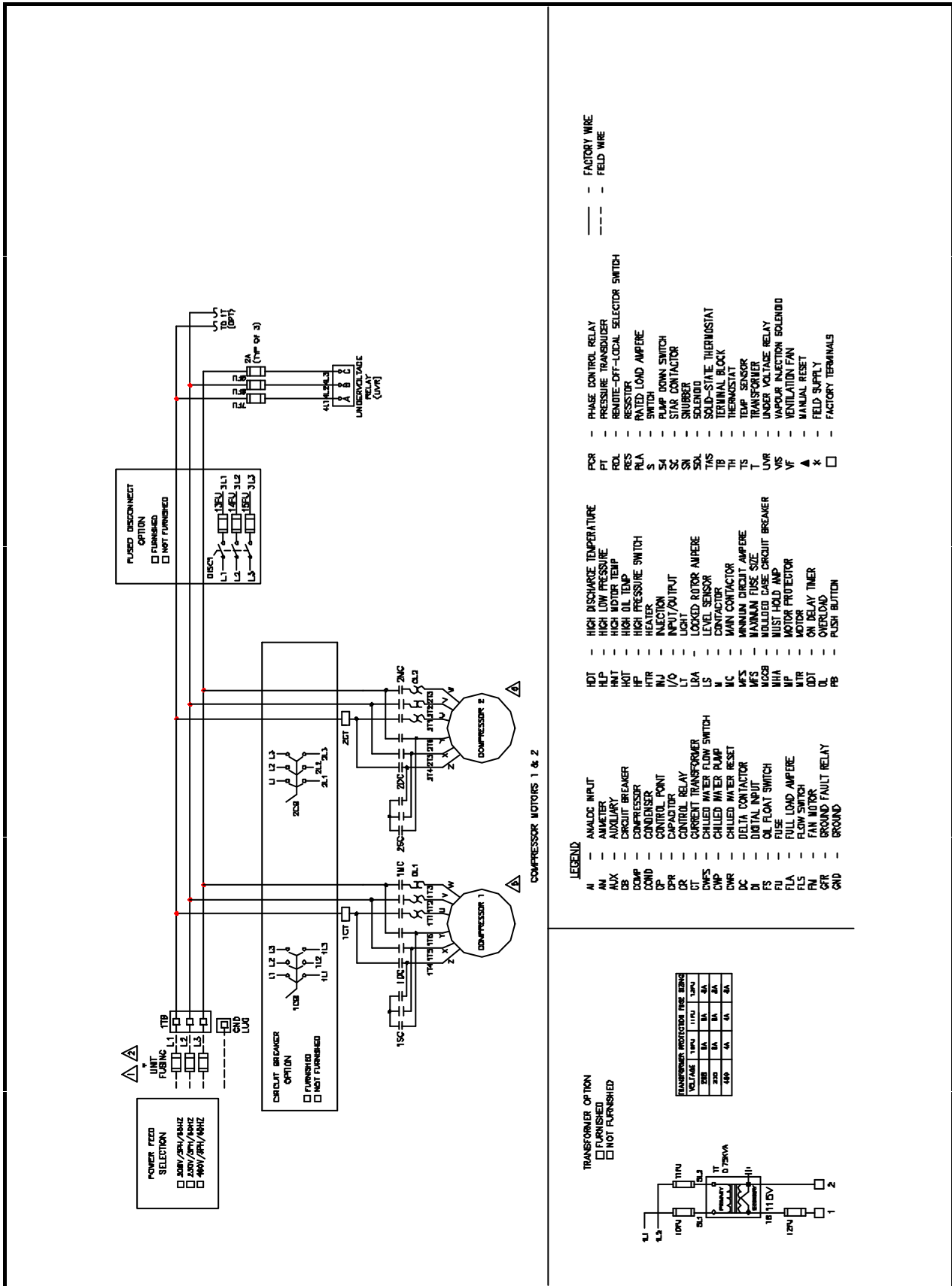
MODEL HXWC	A	B	C	D	E	F	G	R	S	W	Y
410-6R	26 1/2	23 1/4	29 7/8	8 1/8	19 7/8	6 7/8	88 1/2	10	8	82	171
450-6R	26 1/2	23 1/4	29 7/8	8 1/8	19 7/8	6 7/8	88 1/2	10	8	82	171
530-6R	28	26	37 1/2	8 5/8	21 7/8	7 3/8	92 1/2	10	10	82	185
560-6R	29	27	38 1/2	8 5/8	21 7/8	7 3/8	94 1/2	10	10	84	185



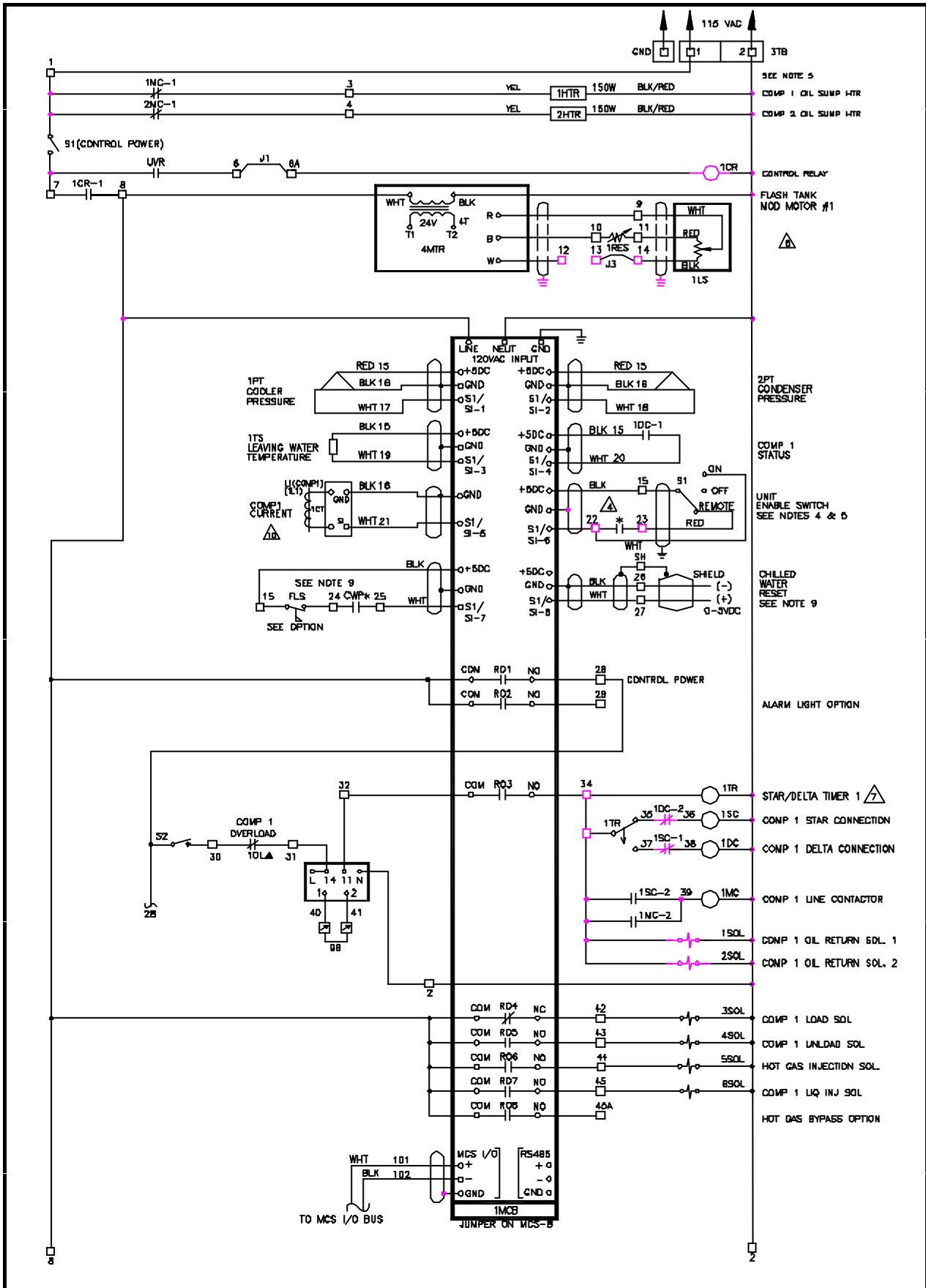
NOTE: ALL DIMENSIONS ARE IN INCHES.

TYPICAL WIRING SCHEMATIC

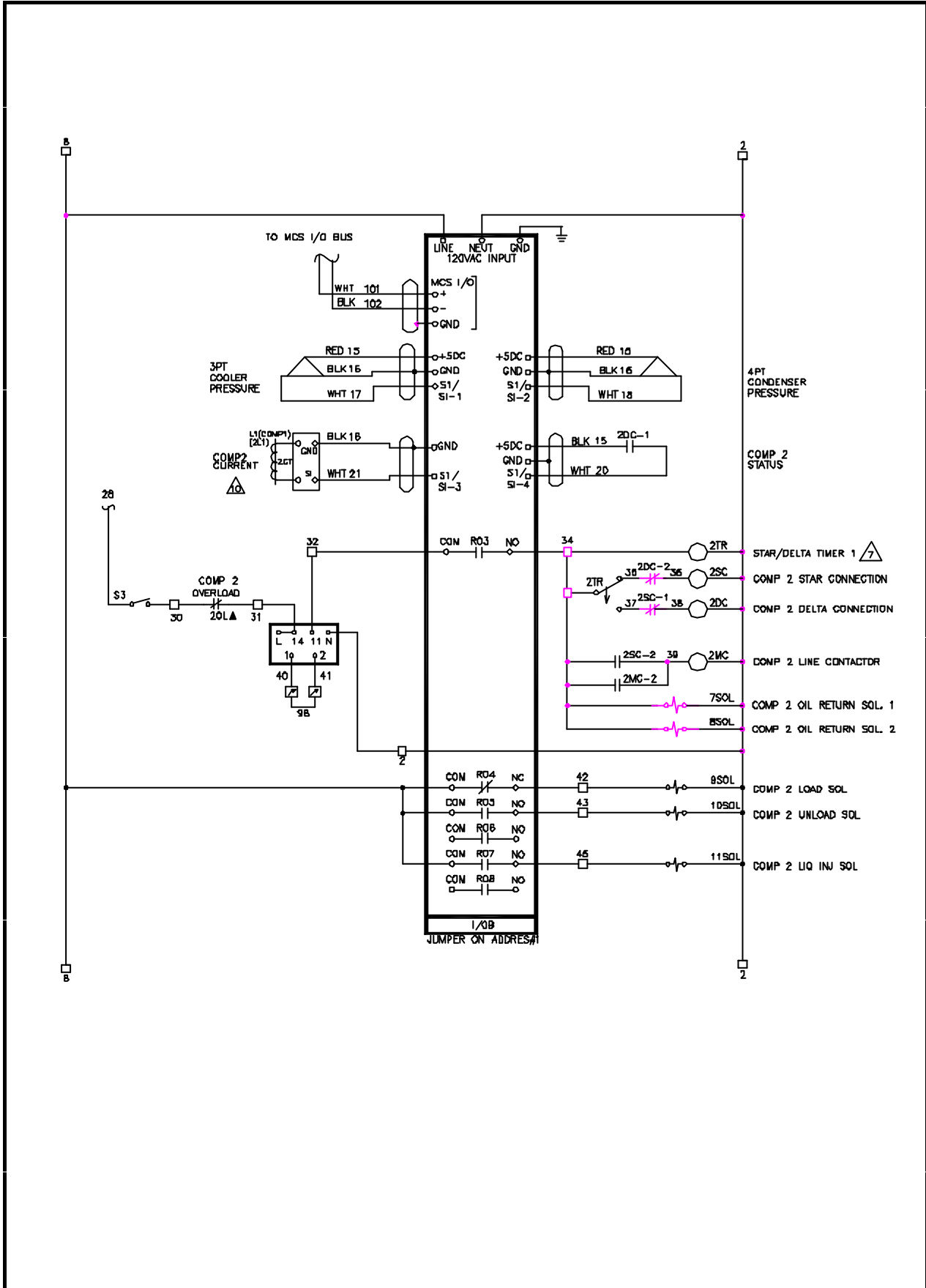
2 COMPRESSORS



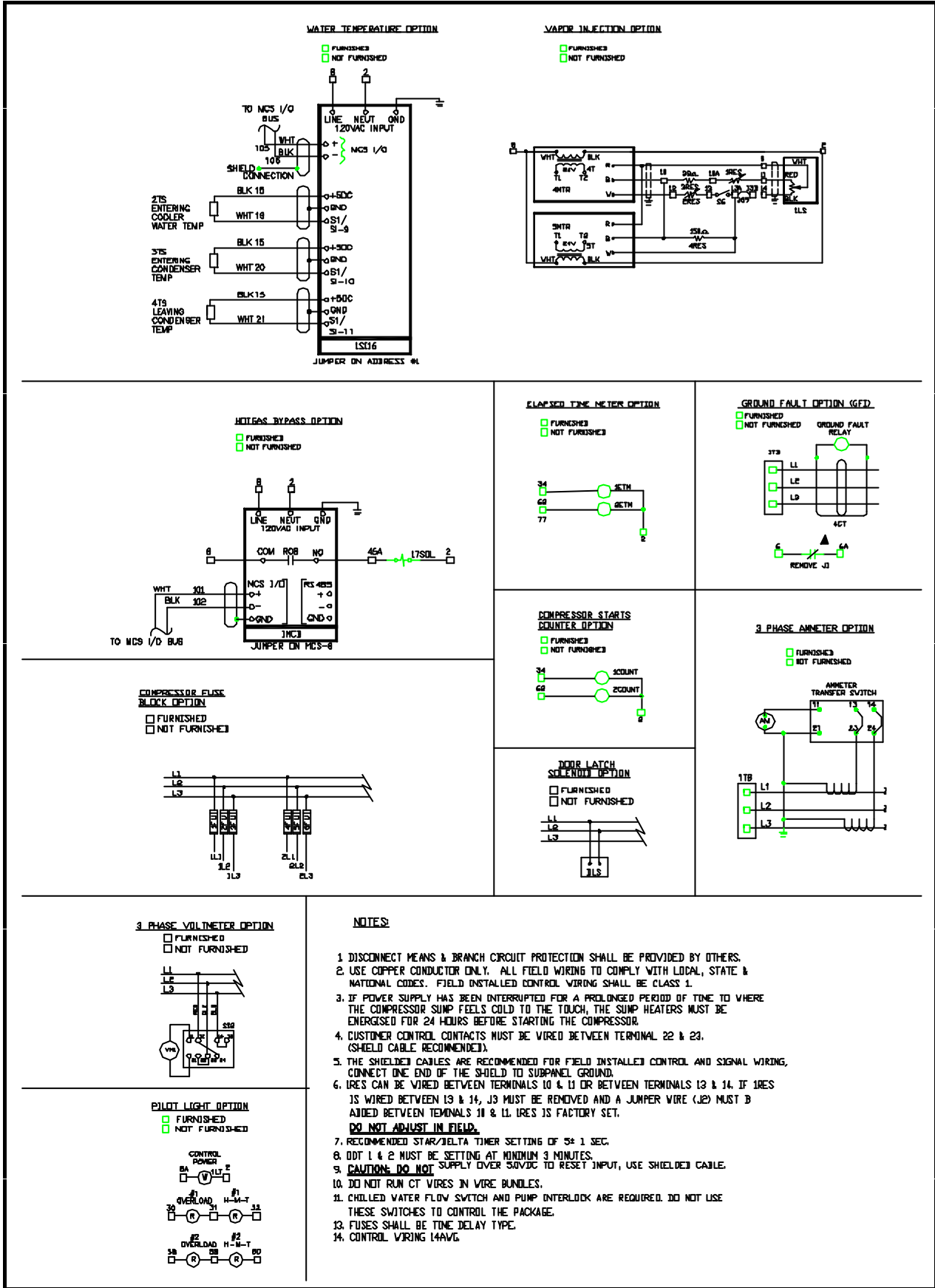
TYPICAL WIRING SCHEMATIC



TYPICAL WIRING SCHEMATIC



TYPICAL WIRING SCHEMATIC



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AT ANY TIME WITHOUT PRIOR NOTICE.

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11-05