Form No: M-M-0496A-0214

DUNHAM-BUSH

Products that perform...By people who care

INSTALLATION, OPERATION & MAINTENANCE MANUAL

AIR COOLED SCREW FLOODED CHILLERS

R134a

AHRI CERTIFIED www.ahridirectory.org Air-Cooled Chillers AHRI Standard 550/590

ASHRAE 90.1 COMPLIANT

MODEL:

AFVXB Series

60Hz

TABLE OF CONTENTS

1.0 INTRODUCTION

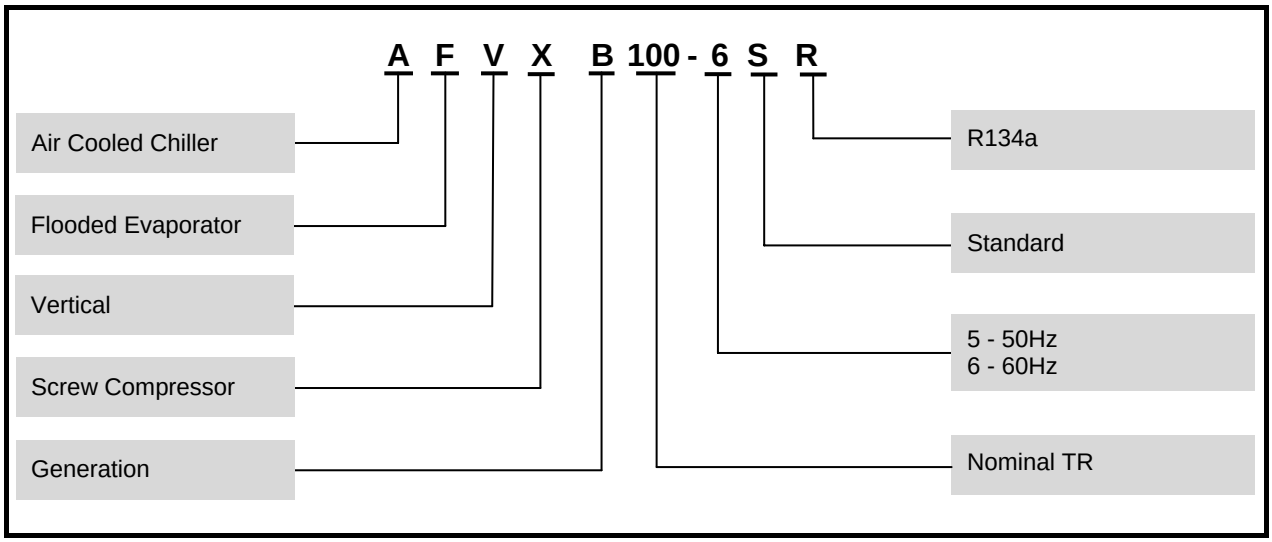
This manual is designed to provide all the necessary information for installation, operation and maintenance of the latest generation of the Dunham-Bush medium screw compressor air-cooled packaged chillers.

To use this manual effectively, you must first identify your unit model from the unit nameplate.

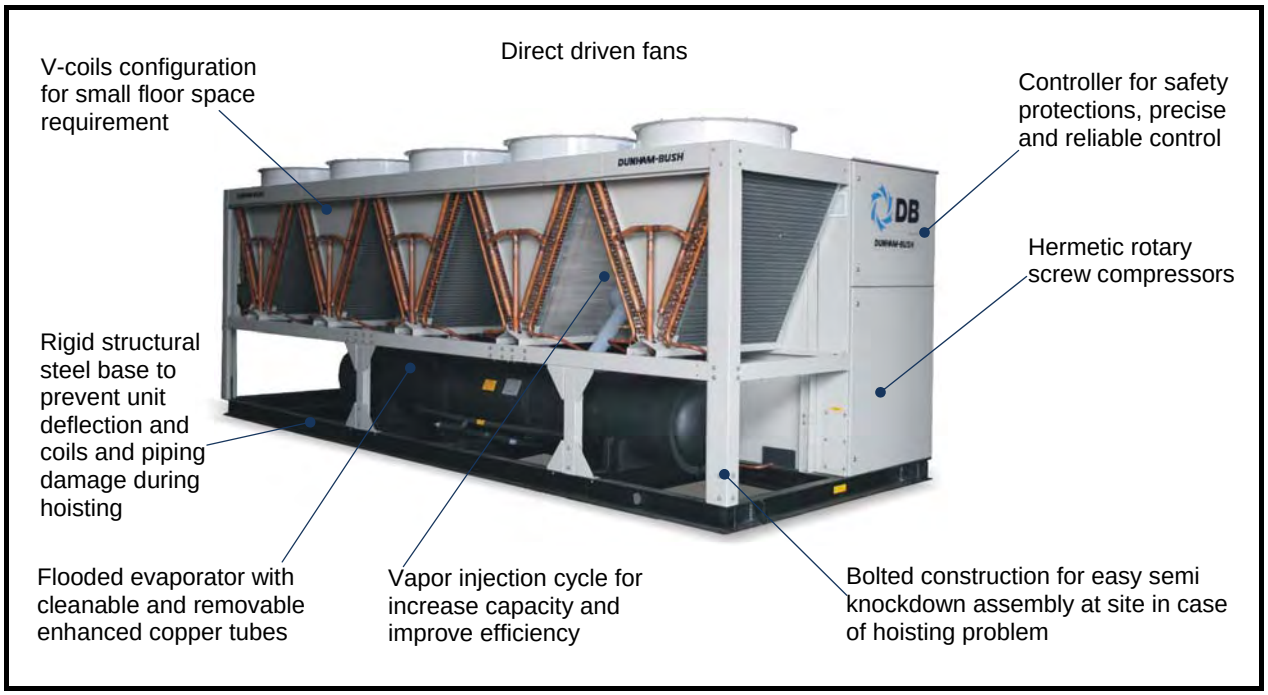
Your Dunham-Bush package has been manufactured under a careful quality control system. If the package is installed, operated and maintained with care and attention to the instructions contained herein, it will give many years of satisfactory service.

It is assumed the user of this manual and those who install, operate and maintain this equipment are experienced and qualified air conditioning equipment personnel.

1.1 NOMENCLATURE



1.2 COMPONENTS



1.0 INTRODUCTION

1.3 PHYSICAL SPECIFICATIONS

Model AFVXB		100-6SR	120-6SR	135-6SR	165-6SR	200-6SR	225-6SR	260-6SR
Cooling Capacity	TR	99.6	116.0	132.2	164.9	192.3	216.0	251.9
	kW	350	408	465	580	676	760	886
Power Input	kW	118.0	137.7	156.9	195.1	226.7	249.9	291.6
Energy efficiency	kW/TR	1.185	1.187	1.187	1.183	1.179	1.157	1.157
COP	[kW_o/kWi]	2.97	2.96	2.96	2.97	2.98	3.04	3.04
Compressor								
Model (Qty)		1215 (1)	1218 (1)	1222 (1)	1222 (1)	1227 (1)	1230 (1)	2233 (1)
RPM		3500	3500	3500	3500	3500	3500	3500
Min. % Unit Capacity Reduction		25%	25%	25%	25%	25%	25%	25%
Compressor Power	kW	99.5	119.2	138.4	171.3	197.7	220.9	257.2
Compressor Rated Current	Amp	154	193	224	224	259	311	363
Compressor Starting Current	Amp	512	634	679	679	881	946	1464
Evaporator								
Model (Qty)		C4R(1)	1CR(1)	1DR(1)	2ER(1)	2FR(1)	EBR(1)	JAR (1)
Water Connector	inches[mm]	4 [101.6]	5 [127]	5 [127]	6 [152.4]	6 [152.4]	6 [152.4]	8 [203.2]
Nom. Water Flow	USgpm[l/s]	223.4 [14.1]	260.4 [16.4]	311.8 [19.7]	383.5 [24.2]	461.5 [29.1]	518.4 [32.7]	604.6 [38.1]
Nom. Water Pressure Drop	ft.wg[kPa]	8.7 [26]	18.7 [56]	19.3 [58]	20.7 [62]	22.6 [68]	22.8 [68]	21.3 [64]
Condenser								
Coil Row		5	5	5	5	5	5	5
Total Face Area	sq.ft[sq.m]	165 [15.3]	165 [15.3]	165 [15.3]	212.2 [19.7]	259.3 [24.1]	259.3 [24.1]	306.5 [28.5]
No of Fans		7	7	7	9	11	11	13
Fan Dia	mm	900	900	900	900	900	900	900
Fan Motor HP		3.4	3.4	3.4	3.4	3.4	3.4	3.4
Fan Motor FLA	amp	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Electrical								
Nom. Voltage		460	460	460	460	460	460	460
Unit RLA	amp	186	216	239	293	341	376	439
Unit Max. Inrush	amp	512	634	679	679	881	946	1464
General								
Unit Length	inches[mm]	185.4 [4710]	185.4 [4710]	185.4 [4710]	230.7 [5860]	283.9 [7210]	283.9 [7210]	329.1 [8360]
Unit Width	inches[mm]	88 [2235]	88 [2235]	88 [2235]	88 [2235]	88 [2235]	88 [2235]	88 [2235]
Unit Height	inches[mm]	88 [2235]	88 [2235]	88 [2235]	88 [2235]	93.2 [2368]	93.2 [2368]	93.2 [2368]
Shipping Weight	lbs[kg]	8578 [3891]	8847 [4013]	9560 [4336]	11160 [5062]	12337 [5596]	13845 [6280]	15464 [7014]
Operating Weight	lbs[kg]	8843 [4011]	9211 [4178]	9979 [4256]	11601[5262]	12778 [5796]	14330 [6500]	16015 [7264]
Operating Charge R134a	lbs[kg]	240 [109]	280 [127]	335 [152]	412 [187]	496 [225]	556 [252]	648 [294]

Model AFVXB		280-6SR	330-6SR	360-6SR	400-6SR*	450-6SR*	520-6SR*
Cooling Capacity	TR	278.8	328.7	359.0	384.6	432.0	503.8
	kW	981	1156	1263	1353	1519	1772
Power Input	kW	330.6	390.2	425.4	453.5	499.8	583.1
Energy efficiency	kW/TR	1.186	1.187	1.185	1.179	1.157	1.157
COP	[kW_o/kWi]	2.97	2.96	2.97	2.98	3.04	3.04
Compressor							
Model (Qty)		1222(1)/ 1218(1)	1222 (2)	1227 (1)/ 1222 (1)	1227 (2)	1230 (2)	2233 (2)
RPM		3500	3500	3500	3500	3500	3500
Min. % Unit Capacity Reduction		12.5%	12.5%	12.5%	12.5%	12.5%	12.5%
Compressor Power	kW	283.1	342.7	377.9	395.4	441.7	514.5
Compressor Rated Current	Amp	224/193	224/224	259/224	259/259	311/311	363/363
Compressor Starting Current	Amp	679/634	679/679	881/679	679/679	946/946	1464/1464
Evaporator							
Model (Qty)		Q1R(1)	S1R(1)	S2R(1)	2FR(2)	EBR(2)	JAR (2)
Water Connector	inches[mm]	8 [203.2]	8 [203.2]	8 [203.2]	6 [152.4]	6 [152.4]	8 [203.2]
Nom. Water Flow	USgpm[l/s]	639.8 [40.]	767.0 [48.4]	839.8 [53.0]	923.0 [58.2]	1036.8 [65.4]	1209.1 [76.3]
Nom. Water Pressure Drop	ft.wg[kPa]	6.8 [20]	7.4 [22]	7.1 [21]	22.6 [68]	22.8 [68]	21.3 [64]
Condenser							
Coil Row		5	5	5	5	5	5
Total Face Area	sq.ft[sq.m]	424.4 [39.4]	424.4 [39.4]	424.4 [39.4]	518.6 [48.2]	518.6 [48.2]	613 [56.9]
No of Fans		18	18	18	22	22	26
Fan Dia	mm	900	900	900	900	900	900
Fan Motor HP		3.4	3.4	3.4	3.4	3.4	3.4
Fan Motor FLA	amp	5.4	5.4	5.4	5.4	5.4	5.4
Electrical							
Nom. Voltage		460	460	460	460	460	460
Unit RLA	amp	510	586	635	341/341	376/376	439/439
Unit Max. Inrush	amp	906	972	1180	881/881	946/946	1464/1464
General							
Unit Length	inches[mm]	453.1 [11510]	453.1 [11510]	453.1 [11510]	567.7 [14420]	567.7 [14420]	658.2 [16720]
Unit Width	inches[mm]	88 [2235]	88 [2235]	88 [2235]	88 [2235]	88 [2235]	88 [2235]
Unit Height	inches[mm]	93.2 [2368]	93.2 [2368]	93.2 [2368]	93.2 [2368]	93.2 [2368]	93.2 [2368]
Shipping Weight	lbs[kg]	19961 [9054]	20656 [9370]	22483 [10198]	24674 [11192]	27690 [12560]	30927 [14028]
Operating Weight	lbs[kg]	20512 [9304]	21318 [9670]	23365 [10598]	25556 [11592]	28660 [13000]	32030 [14528]
Operating Charge R134a	lbs[kg]	686 [311]	822 [373]	902 [409]	1111 [504]	1111 [504]	1296 [588]

* Unit is modular construction. It shall be shipped in two (2) separate modules.

Note: Nominal data is based on LWT 44°F and condenser ambient 95°F. Actual capacity depends on the specified operating conditions.

2.0 INSTALLATION

2.1 GENERAL

Packaged chillers are designed to cool water or other non-corrosive liquids. The liquid to be cooled is to be circulated through the tubes of a refrigerant evaporator where the temperature is reduced to the desired level. The heat absorbed by the refrigerant in the evaporator is rejected via the condenser coils where it raises the temperature of cross flow air.

Care should be taken to see that the equipment is properly installed and adjusted. An installer or operator should first become familiar with the information contained in this manual.

2.1.1 APPLICATION PRECAUTIONS

The following instructions are intended to help assure proper and successful application of your water chilling machine.

2.1.2 CHILLED WATER FLOW

The Dunham-Bush AFVXB Packaged Water Chiller is designed for a constant chilled water flow rate, even when the cooling load is varying. The machine will generally perform satisfactorily with steady flow rates deviating from design by as much as ±10%. However, varying water flow rates can cause control instability which will result in undesirable system effects, particularly poor control of leaving chilled water temperature. If two-way valves are used to control flow through cooling coils, some means such as an automatic modulating valve should be provided in the system to maintain steady flow through the evaporator.

2.2 INSPECTION

When the equipment is delivered, it is important that the following inspection be completed in the presence of the forwarder's representative.

1.) Check all crates and cartons received against the Bill of Lading/ Shipping Papers to be sure they agree.
2.) Check the model number and the electrical characteristics on the nameplate to determine if they are correct.
3.) Check for freight damage, shortages or other discrepancies and note them on the delivery receipt before signing.

In the event that any damage is found, a damage claim should immediately be filed by the purchaser against the forwarder as all shipments are F.O.B. Factory.

2.3 RIGGING

2.3.1 GENERAL

Each unit has been carefully tested and crafted at the factory where every precaution is taken to assure that the unit reaches you in perfect condition. It is very important that the riggers and movers should use the same care and precaution in moving the equipment into place. Make sure that chains, cables. or other moving equipment are placed so as to avoid damage to the unit or piping. The refrigerant piping must not be used as a ladder or as a hand hold. Do not attach a chain hoist sling to the piping or equipment. Move the unit in an upright position and let it down gently from trucks or rollers.

2.3.2 RIGGING AND MOVING

Any unit mounted on skids may be moved with a forklift, but care must be taken not to damage the unit with forks. The skids should not be removed until the unit is at its final location.

The AFVXB model is to be rigged through the holes in the base side rails. In all cases, spreader bars must be used between rigging lines to prevent coil or fan deck damage. The unit must be lifted using **All Rigging Points.** Refer to Rigging Instructions on Figure 2.3.2.

All models can be pushed or pulled (with chains) from the unit end only. Truck forks must be kept level and not tilted back. Do not raise the end of the unit more than 2" [51mm] off the floor.

2.4 SPACE REQUIREMENTS AND CLEARANCE

2.4.1 GENERAL

The dimensional data and clearances that follow are useful for determining space requirements. The unit should be placed to make the clearance noted available for servicing properly. Failure to allow these clearances will cause serious trouble and result in higher costs for operation, maintenance and repair.

2.4.2 AFVXB

The dimensional data are shown in Figure 2.4.2 and space requirements are shown in Figure 2.4.1. The most important consideration which must be taken into account when deciding upon location of air cooled equipment, is provision for a supply of ambient air to the condenser, and removal of heated air from the condenser area. Where this essential requirement is not provided, it will result in higher condensing temperatures, which cause poor operation, higher power consumption and possibly, eventual failure of equipment. Units must not be located in the vicinity of steam, hot air or fume exhausts.

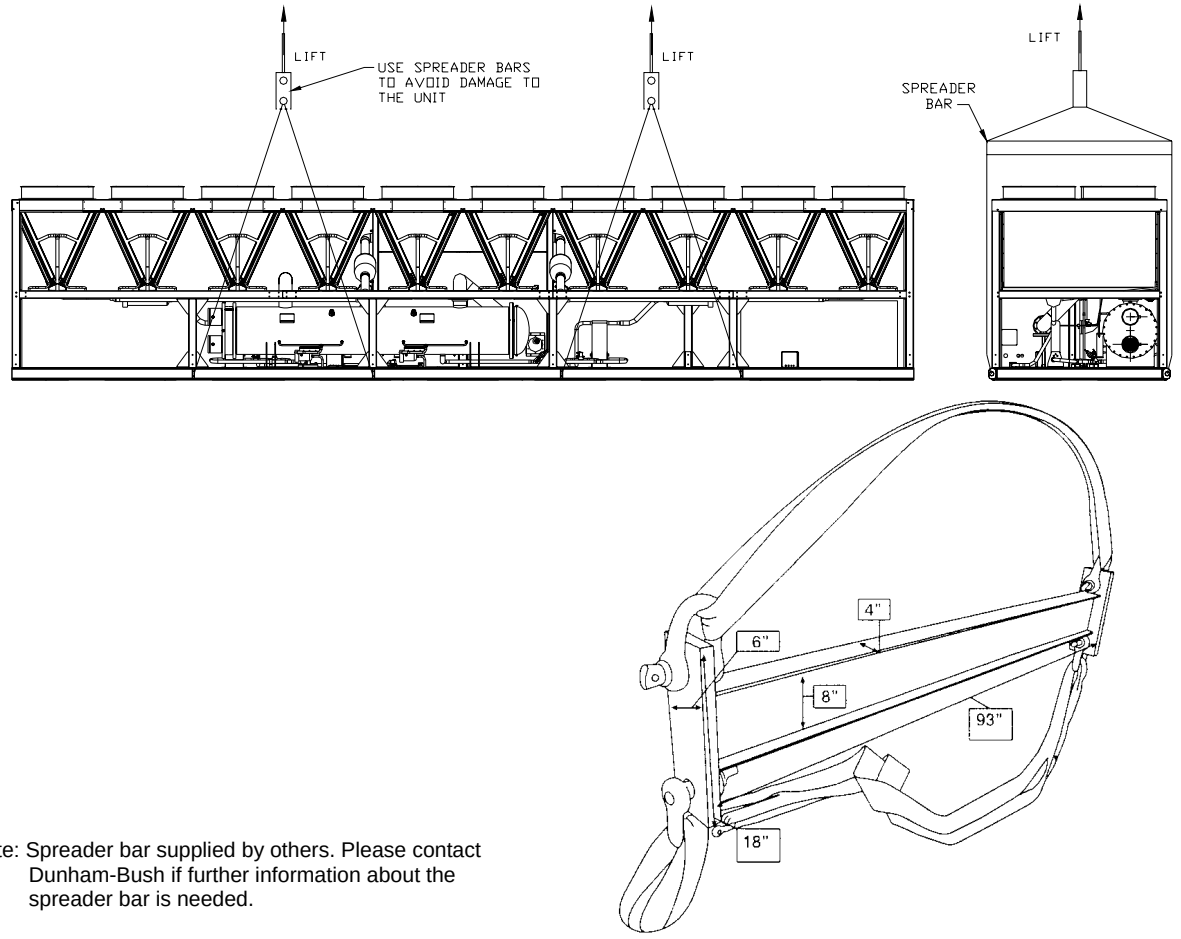
Another consideration which must be taken into account is that the unit should be mounted away from noise sensitive spaces and must have adequate support to avoid vibration and noise transmission into the building. Units should be mounted over corridors, utility areas, rest rooms or other auxiliary areas where sound levels are not an important factor. Sound and structural consultants should be retained for recommendations on critical installations.

2.5 FOUNDATION

Refer to index for unit dimensions and load points. Foundations must be level for proper operation and functioning of controls and provision must be made for supporting the individual load points as shown in the unit dimensions. Roof mounted units must be supported on adequate steel structure. If units are located on the ground level, a concrete base is recommended.

2.0 INSTALLATION

FIGURE 2.3.2 TYPICAL RIGGING

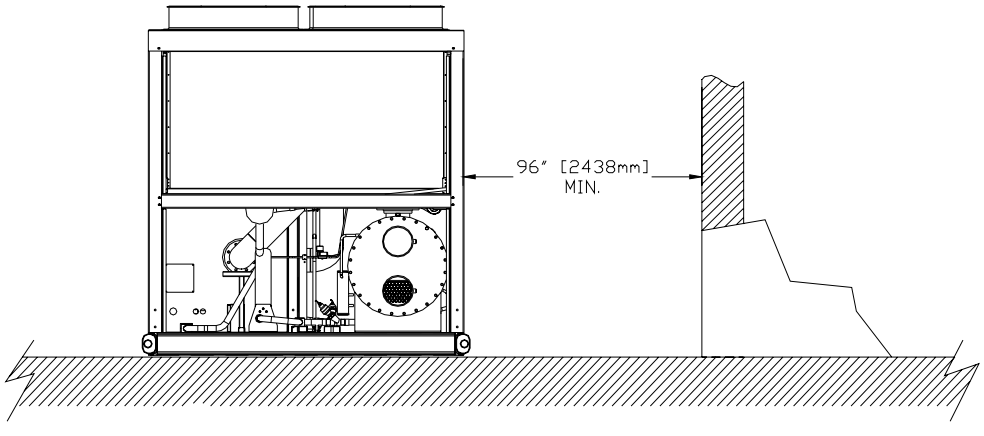


Note: Spreader bar supplied by others. Please contact Dunham-Bush if further information about the spreader bar is needed.

FIGURE 2.4.1 SPACE REQUIREMENTS

WALLS OR OBSTRUCTIONS

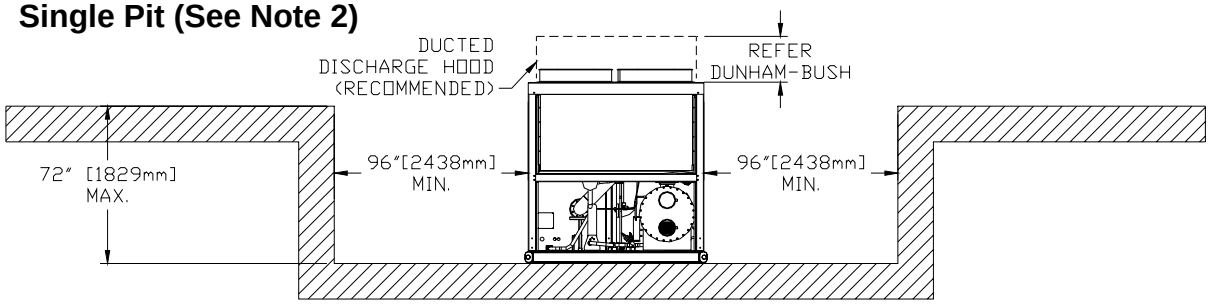
The unit should be located so that air may circulate freely and not be recirculated. For proper air flow and access all sides of the unit must be a minimum of eight feet [2438mm] away from any wall or obstruction. It is preferred that this distance be increased whenever possible. Care should be taken to see that ample room is left for maintenance work through access doors and panels. Overhead obstructions are not permitted. When the unit is in an area where it is enclosed by three walls the unit must be installed as indicated for units in a pit.



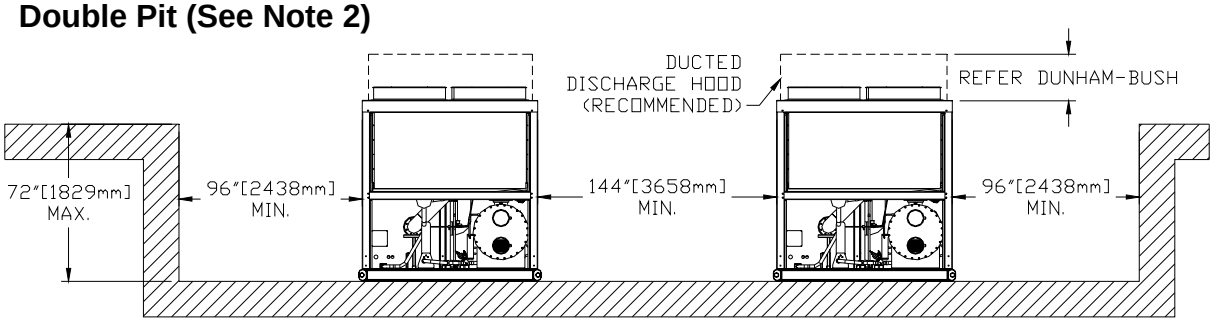
2.0 INSTALLATION

FIGURE 2.4.1 SPACE REQUIREMENTS

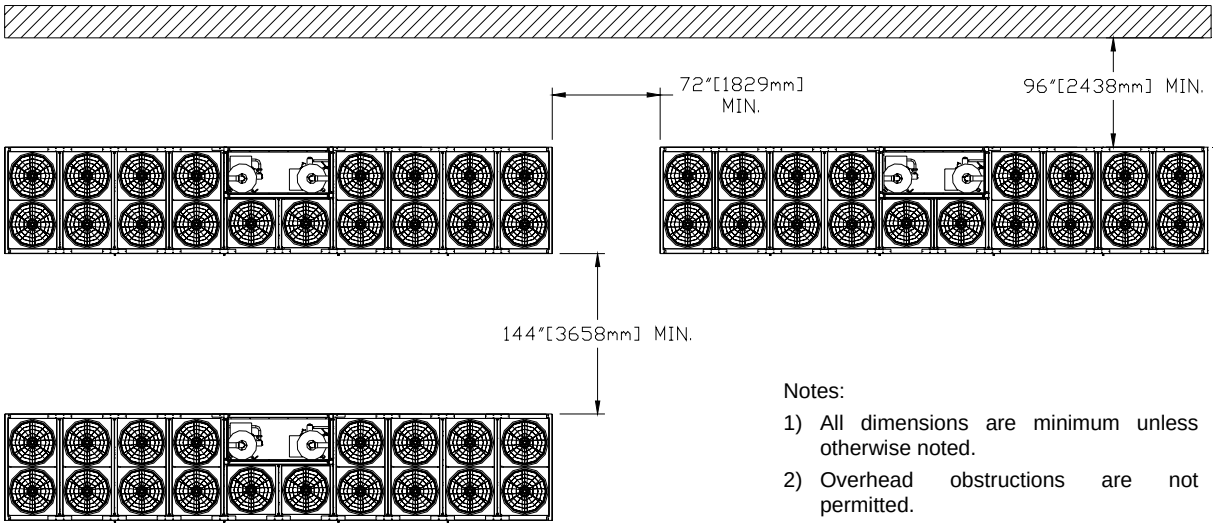
Single Pit (See Note 2)



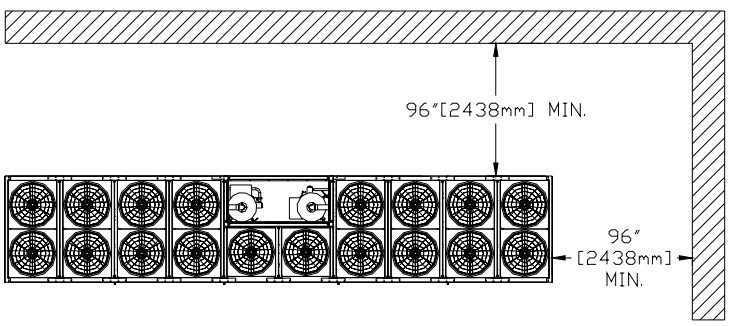
Double Pit (See Note 2)



Multi Pit



Corner Wall



Notes:

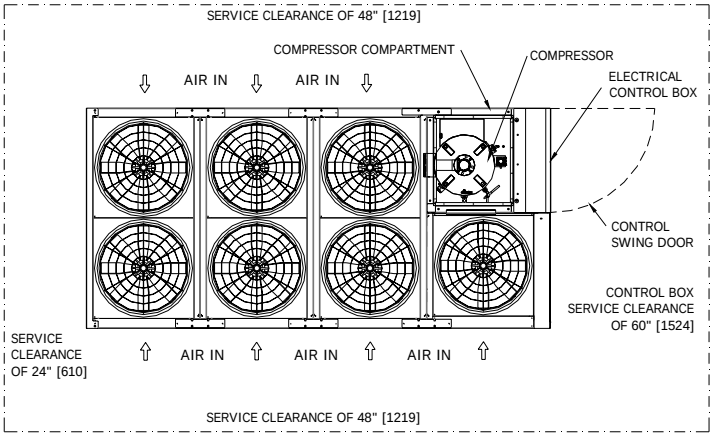
1) All dimensions are minimum unless otherwise noted.
2) Overhead obstructions are not permitted.
3) Pit installations are not recommended. Re-circulation of hot condenser air in combination with surface air turbulence cannot be predicted. Hot air re-circulation will severely affect unit efficiency (EER) and can cause high pressure or fan motor temperature trips. Contractor shall be responsible for ducting fans to a higher level to alleviate the discharge air and prevent backflow of air, consult Dunham-Bush or our Representative for the correct design recommendation.

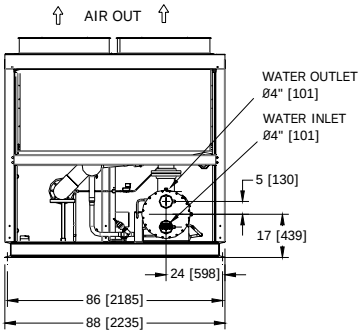
2.0 INSTALLATION

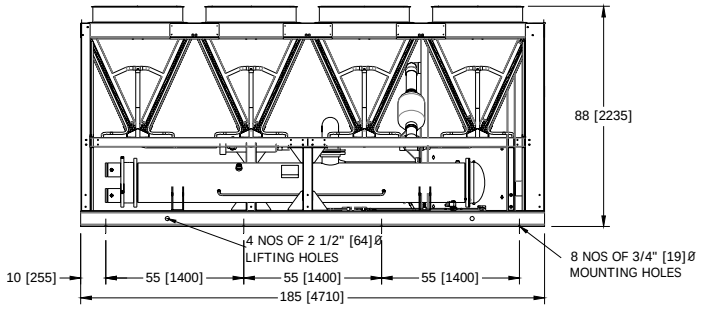
FIGURE 2.4.2 DIMENSIONAL DATA

AFVXB 100-6SR, 120-6SR, 135-6SR

NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

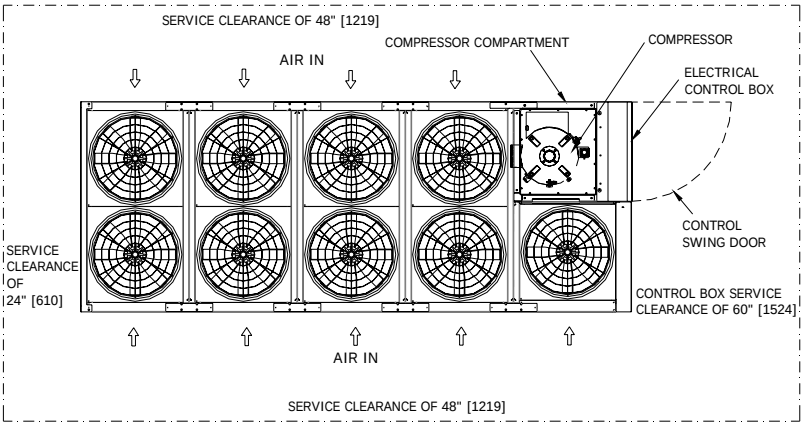


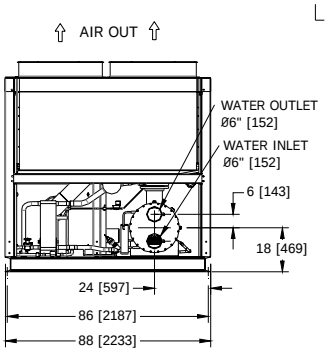


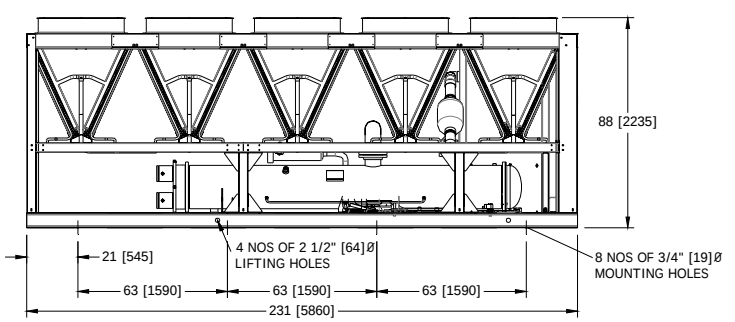


AFVXB 165-6SR

NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



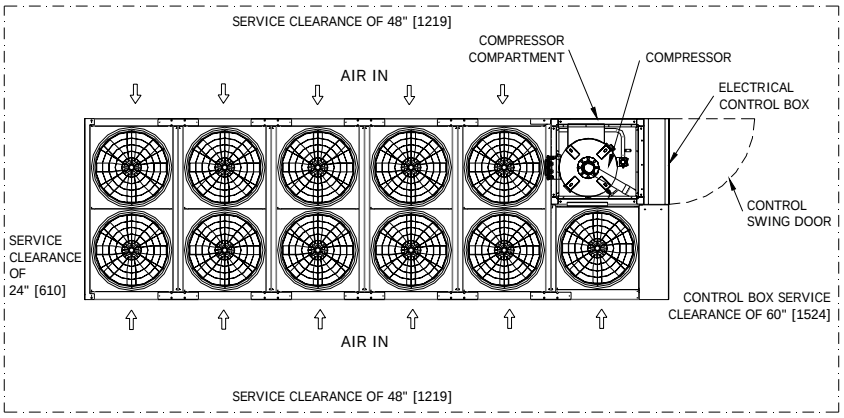


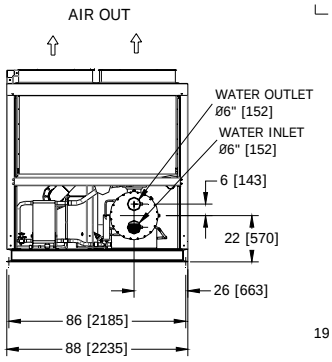


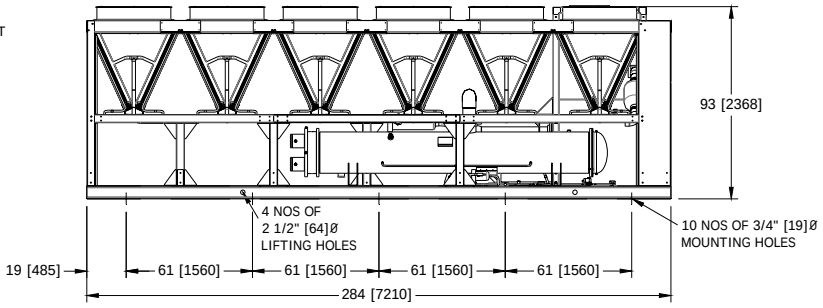
2.0 INSTALLATION

AFVXB 200-6SR, 225-6SR

NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

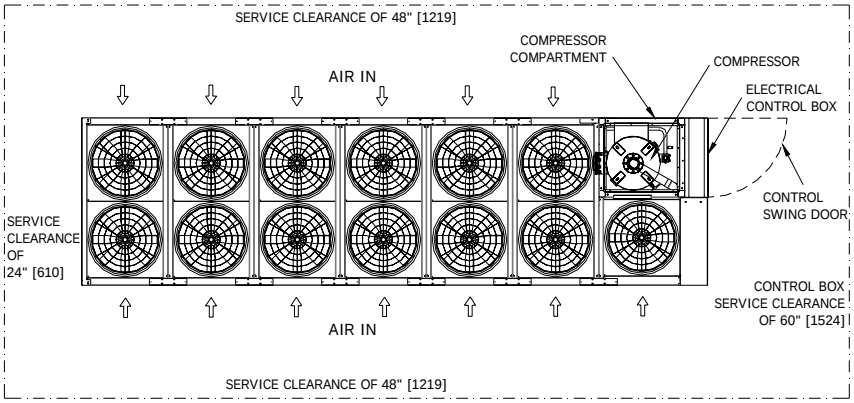


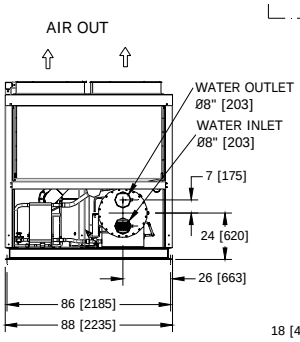


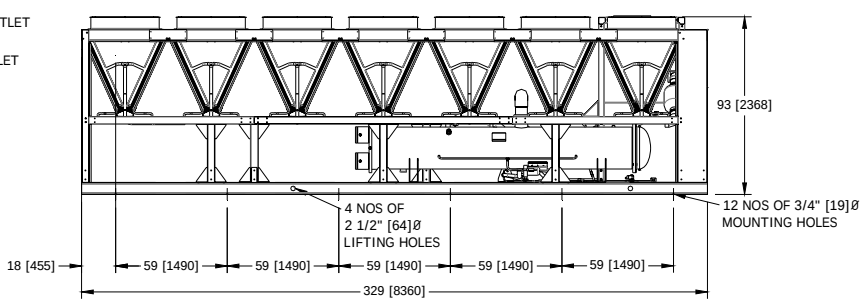


AFVXB 260-6SR

NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



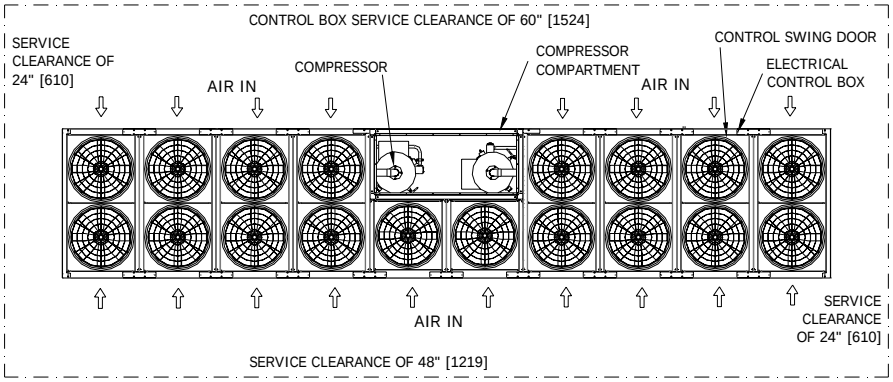


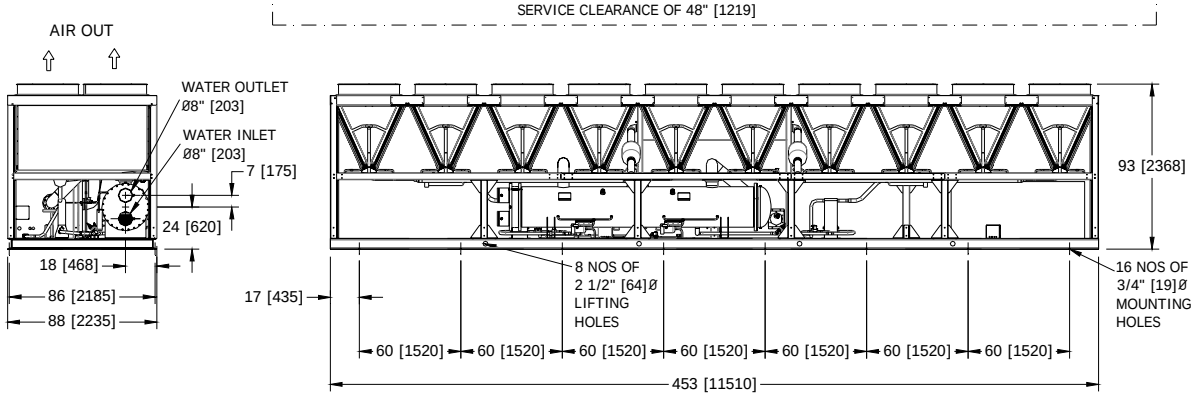


2.0 INSTALLATION

AFVXB 280-6SR

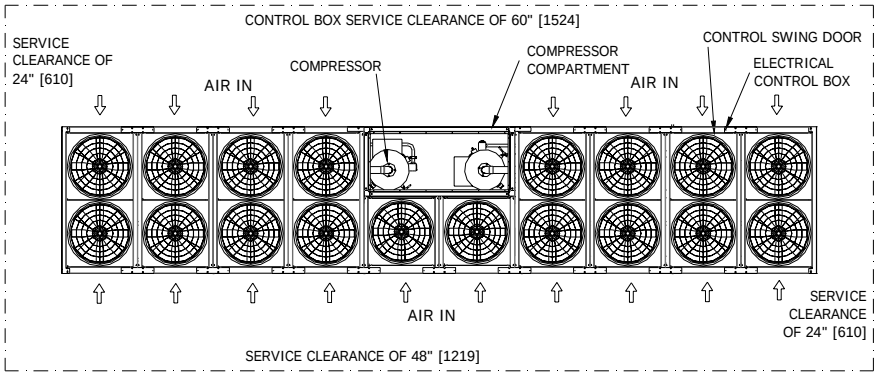
NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

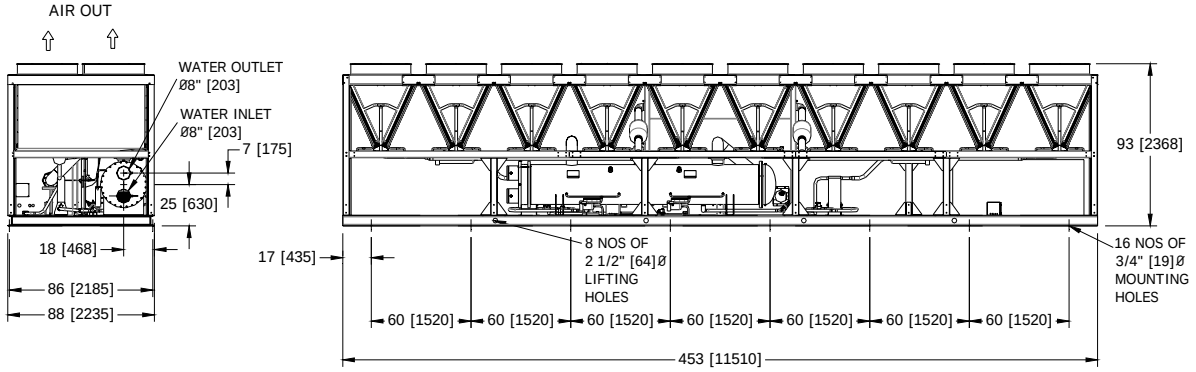




AFVXB 330-6SR. 360-6SR

NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

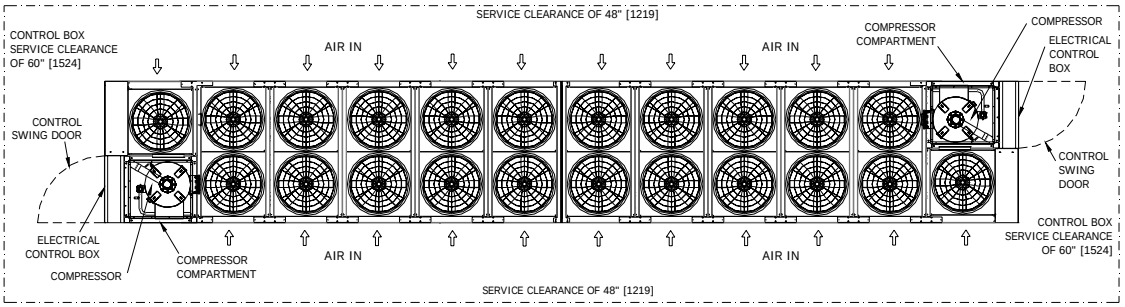


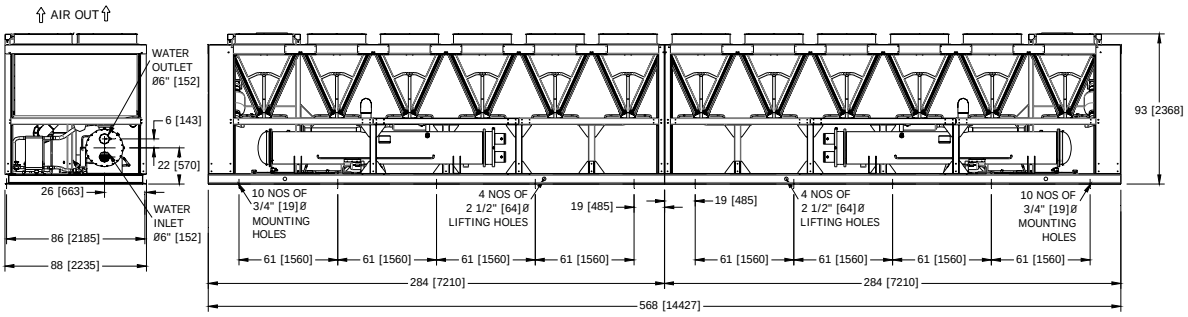


2.0 INSTALLATION

AFVXB 400-6SR*, 450-6SR*

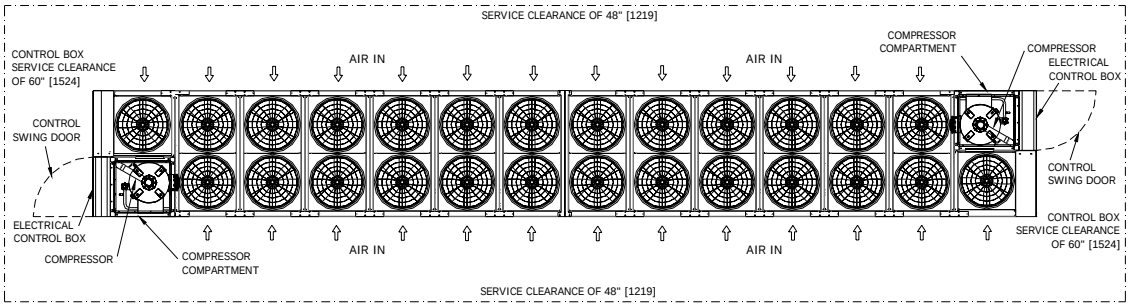
NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

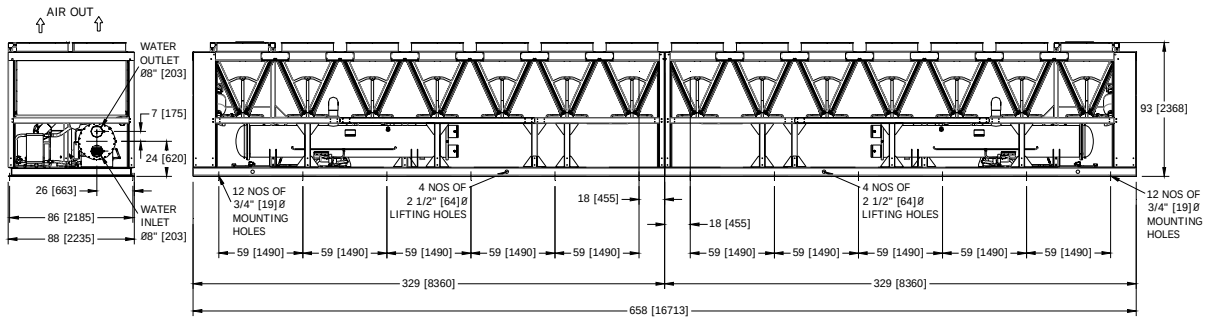




AFVXB 520-6SR*

NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND MILLIMETERS.
2. ALLOW 60" [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
3. USE MINIMUM 36" [914mm] FLEXIBLE CONDUIT TO CONTROL BOX TO ISOLATE UNIT.
4. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



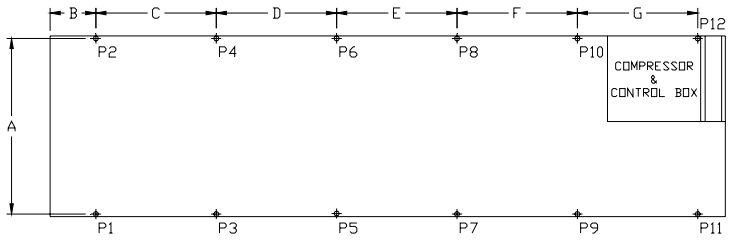


* Unit is modular construction. It shall be shipped in two (2) separate modules.

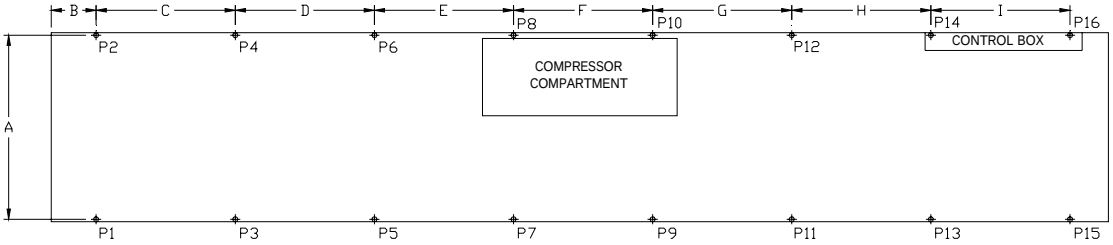
2.0 INSTALLATION

FIGURE 2.5 FLOOR LOADING DIAGRAM

AFVXB 100-6SR, 120-6SR, 135-6SR, 165-6SR, 200-6SR, 225-6SR, 260-6SR



AFVXB 280-6SR, 330-6SR, 360-6SR



POINT LOAD LOCATION

Model AFVXB	Dimensions - inches[mm]								
	A Dim.	B Dim.	C Dim.	D Dim.	E Dim.	F Dim.	G Dim.	H Dim.	I Dim.
100-6SR	86 [2184]	10 [255]	55 [1400]	55 [1400]	55 [1400]	-	-	-	-
120-6SR	86 [2184]	10 [255]	55 [1400]	55 [1400]	55 [1400]	-	-	-	-
135-6SR	86 [2184]	10 [255]	55 [1400]	55 [1400]	55 [1400]	-	-	-	-
165-6SR	86 [2184]	21 [545]	63 [1590]	63 [1590]	63 [1590]	-	-	-	-
200-6SR	86 [2184]	19 [485]	61 [1560]	61 [1560]	61 [1560]	61 [1560]	-	-	-
225-6SR	86 [2184]	19 [485]	61 [1560]	61 [1560]	61 [1560]	61 [1560]	-	-	-
260-6SR	86 [2184]	18 [455]	59 [1490]	59 [1490]	59 [1490]	59 [1490]	59 [1490]	-	-
280-6SR	86 [2184]	19 [492]	65 [1645]	65 [1645]	65 [1645]	65 [1645]	65 [1645]	-	-
330-6SR	86 [2184]	17 [435]	60 [1520]	60 [1520]	60 [1520]	60 [1520]	60 [1520]	60 [1520]	60 [1520]
360-6SR	86 [2184]	17 [435]	60 [1520]	60 [1520]	60 [1520]	60 [1520]	60 [1520]	60 [1520]	60 [1520]

POINT LOAD DATA

Model AFVXB	Point Load - lbs[kg]																Total Operating Weight
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	
100-6SR	1096 [497]	893 [405]	1117 [507]	1019 [462]	1139 [516]	1146 [520]	1160 [526]	1272 [577]	-	-	-	-	-	-	-	-	8843 [4011]
120-6SR	1168 [530]	920 [417]	1186 [538]	1045 [474]	1204 [546]	1170 [531]	1222 [554]	1296 [588]	-	-	-	-	-	-	-	-	9211 [4178]
135-6SR	1191 [540]	997 [452]	1223 [555]	1170 [531]	1254 [569]	1343 [609]	1285 [583]	1516 [687]	-	-	-	-	-	-	-	-	9978 [4526]
165-6SR	1292 [586]	1060 [481]	1403 [637]	1314 [596]	1515 [687]	1568 [711]	1627 [738]	1821 [826]	-	-	-	-	-	-	-	-	11601 [5262]
200-6SR	1108 [503]	944 [428]	1193 [541]	1111 [504]	1277 [579]	1278 [580]	1362 [618]	1445 [656]	1446 [656]	1613 [731]	-	-	-	-	-	-	12778 [5796]
225-6SR	1254 [569]	1052 [477]	1347 [611]	1239 [562]	1440 [653]	1426 [647]	1533 [696]	1612 [731]	1627 [738]	1799 [816]	-	-	-	-	-	-	14330 [6500]
260-6SR	1140 [517]	1005 [456]	1216 [552]	1139 [517]	1292 [586]	1272 [577]	1368 [620]	1406 [638]	1443 [655]	1540 [698]	1519 [689]	1673 [759]	-	-	-	-	16014 [7264]
280-6SR	1416 [642]	1225 [556]	1394 [632]	1226 [556]	1371 [622]	1226 [556]	1348 [611]	1227 [557]	1325 [601]	1228 [557]	1303 [591]	1228 [557]	1280 [580]	1229 [557]	1257 [570]	1230 [558]	20511 [9304]
330-6SR	1466 [665]	1294 [587]	1441 [653]	1292 [586]	1416 [642]	1290 [585]	1391 [631]	1288 [584]	1365 [619]	1286 [583]	1340 [608]	1284 [582]	1315 [597]	1282 [581]	1290 [585]	1280 [581]	21318 [9670]
360-6SR	1627 [738]	1410 [640]	1598 [725]	1406 [638]	1568 [711]	1402 [636]	1539 [698]	1399 [634]	1509 [685]	1395 [633]	1480 [671]	1391 [631]	1450 [658]	1387 [629]	1420 [644]	1383 [627]	23364 [10598]

2.0 INSTALLATION

2.6 VIBRATION ISOLATION

In case of structure-borne vibration may be of concern, it is recommended to install vibration isolators under the base of the Packaged Chiller.

Rubber-in-shear or spring vibration isolators are offered as optional items. When spring isolators are used, flexible connections must be installed in the water piping system and in the refrigerant lines if it is a split system. Note: These flexible connectors must be suitable for the fluid and pressures involved.

All piping which is external to the chiller must be supported by spring mounted hangers and any piping which goes through the wall, ceiling or floor should be properly sheathed to prevent transmission of piping vibration to the structure.

When spring isolators are used, electrical service to the unit must also be connected by means of a 36" [914mm] section of flexible conduit.

The installation of spring isolators shall follow the instructions as below:

1. Place all the spring isolators in place on the foundation, according to the isolator models and locations in the provided GA drawing.
2. **(For spring isolator models DHB only)** Unscrew leveling screw bolt (assembled with spring isolator) by turning counter-clockwise, (CCW) from the spring isolator.
3. Lift up the chiller as per the instructions in Section 2.3 Rigging, and position the chiller on top of the upper housing of the spring isolators.

(For spring isolator models DHB only)

4. Align mounting hole of the chiller base with the leveling screw bolt hole of the upper housing of the spring isolators.
5. Pass through leveling screw bolt & turn Clock-Wise (CW) to load spring until desired level (FH & OH) is achieved. Leave the locking nut loose for moment.
6. After completing level adjustment of all spring isolators, lock the locking nut of the spring isolators tight. (CW)
7. Bolt down the spring isolators to the floor.

(For spring isolator models YRS only)

4. Align mounting hole of the chiller base with the tapped hole of the upper housing of the spring isolators.
5. Adjust the leveling screw bolt until desired level (FH & OH) is achieved. Turn clock-wise (CW) to load spring or counter-clockwise (CCW) to unload spring.
6. After completing level adjustment of all spring isolators, lock the tapped bolt tight (CW) to fix the spring isolators to the chiller.
7. Bolt down the spring isolators to the floor.

2.7 PIPING CONNECTIONS

Refer to the dimensional drawings for water piping connection locations. After the unit has been leveled and isolators (if any) installed & adjusted, connect evaporator water piping, keeping in mind that the evaporator tubes may require cleaning or replacement at some future date, and removable sections of piping will be required to permit evaporator head removal.

Piping must be supported to avoid excess stress on the evaporator heads. Cut piping holes in the panel at the end of the unit. If there is any. Install air vent points to permit complete air purging of the chilled water circuit. Install drain valves in similar low points to facilitate complete water system drainage. Install temperature & pressure indicators in the water piping at the unit to monitor water flow. Install shut-off valves to isolate the unit from the piping system during unit servicing.

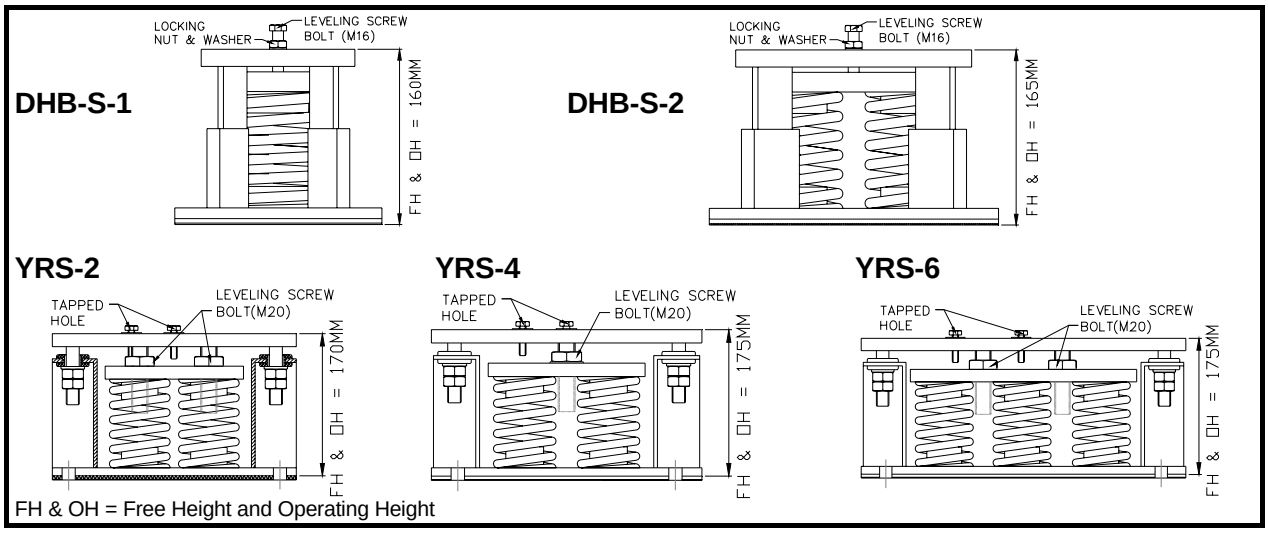
Note: Due to possible high pressures resulting from rising temperatures, do not close shut-off valves with cold water in the evaporator.

It is important that the chilled water system be cleaned before startup to avoid collecting debris in the evaporator. After filling the system with water (or a glycol solution), start pump, bleed off trapped air, and check for proper flow rate by measuring water pressure drop across evaporator.

NOTE: WATER QUALITY - AFVXB

Evaporators used in these packages are made of steel, copper and brass and are suitable for operation with well-maintained water systems. However, if the water used in evaporator is corrosive, high in mineral content or entrained solids, the water can cause reduced performance and even failure of heat exchangers. Therefore, it may be necessary to obtain the services of a water treatment consultant and to provide and maintain water treatment. This is particularly important with glycol solution systems.

FIGURE 2.6 SPRING VIBRATION ISOLATORS



FH & OH = Free Height and Operating Height

2.0 INSTALLATION

2.8 ELECTRICAL WIRING

In connecting power wiring to the unit, the following precautions should be taken:

1.) All field wiring is to be in accordance with the National Electric Code and must comply with state and local codes. See Electrical Data for minimum circuit ampacity and fuse size.

2.) Check unit wiring for damage and all terminal connections for tightness. Unit terminal blocks are to be connected with copper conductors only, sized per ampacity listed on unit data plate.

3.) Connections to unit should match the unit nameplate in volts, phase, and Hertz. Voltage must not vary beyond ±10% of nameplate value and voltage imbalance between phases must not exceed 2% at any time during operation of the unit.

4.) Phase sequence to connectors L1, L2 and L3 shall be in that order. Check with Amprobe phase sequence adapter PSA-1 or equivalent.

2.9 CONTROLS

2.9.1 CONNECTIONS

Controls which are to be field installed should be connected in accordance with the appropriate wiring diagram accompanying the unit. The following connections should be made where applicable:

1.) Connect a set of normally open auxiliary contacts from chilled water pump contactor into unit controls as shown on unit wiring diagram.

2.) Install a chilled water flow switch (paddle type recommended) (or differential pressure switch) in straight length of chilled water piping to avoid turbulence. Connect in same electrical circuit as (1.)

2.9.2 SETTINGS

All controls are factory set, however operating control settings are not always applicable under all operating conditions. For recommended control settings, see wiring diagram accompanying unit. Safety controls must be set to factory recommendations.

2.10 REQUEST FOR START-UP REPRESENTATIVE

After the installation has been completed and checked, Form 9180 must be filled out and sent to the Dunham-Bush Service Department for authorized start-up representative to perform the initial start-up of the Dunham-Bush packaged chiller. The purchaser will have competent service and operating personnel in attendance to assist in the work involved, and also to be trained in the service and maintenance of this unit. (During the warranty period, the manufacturer is responsible for parts only upon proof of defective workmanship or manufacture).

Following receipt of the signed Form 9180, a representative will be sent to the customer. He will inspect the installation to determine whether it meets Dunham-Bush, requirements; perform the initial start-up of the installation; determine whether it is in satisfactory operating condition; and instruct the specified customer personnel in its operation and maintenance for the length of time specified in the purchase contract.

NOTE: Sump oil heaters should be energized for a minimum of 24 hours and the oil sump temperature must be at a minimum of 100°F [38°C] prior to arrival of start-up representative. This will ensure that the oil is warm enough to vaporize any dissolved refrigerant and that the oil is within the normal operating temperature range.

WARNING: The compressor(s) should be started initially ONLY under the direct supervision of an Authorized Dunham-Bush, Start-Up Representative.

2.11 SOUND

Another consideration is the chiller must not be located near noise sensitive spaces. The chiller must have adequate support to avoid vibration and noise transmission into the building. Chiller could be mounted over corridors, utility areas, rest rooms or other auxiliary areas where sound level is not an important factor. Sound and Structural consultants should be consulted for critical installations.

TABLE 2.11 SOUND PRESSURE DATA

Model AFVXB	Octave Band (Hz)								Total dB (A)
	63	125	250	500	1K	2K	4K	8K	
100-6SR	56	44	47	50	62	56	47	39	64
120-6SR	57	45	48	50	63	57	47	39	65
135-6SR	57	45	48	50	63	57	47	39	65
165-6SR	56	45	48	51	63	57	47	40	65
200-6SR	56	45	48	51	62	57	48	40	65
225-6SR	56	45	48	51	62	57	48	40	65
260-6SR	54	45	50	50	60	54	53	43	63
280-6SR	59	47	50	53	65	59	50	42	67
330-6SR	59	47	51	53	65	59	50	42	67
360-6SR	59	47	50	53	65	59	50	42	67
400-6SR	59	55	64	68	70	68	64	59	75
450-6SR	59	55	64	68	70	68	64	59	75
520-6SR	55	55	64	69	70	68	65	60	75

Note: Unit Sound Pressure Level (Lp) @ 33 ft[10m] (free field), ± 2 dB tolerance.

3.0 OPERATION

3.1 GENERAL

The unit should be started up only by a refrigeration technician who is familiar with accepted operation practices for refrigeration systems.

Use small screw unit start-up report to record all temperature, pressure, electrical readings and control settings. A copy must be forwarded to Dunham-Bush, before the warranty will be honored.

3.2 UNIT PIPING

Each unit has a separate refrigerant circuit for each compressor. See Figure 3.2 for typical unit piping schematic.

3.3 SYSTEM WATER FLOW RATE

The quantity of chilled water being circulated can be measured quite accurately (±5%) by determining the water pressure drop through the evaporator and reading flow rate from the evaporator pressure drop curve. Connect reliable pressure gauges to valves installed in evaporator entering and leaving water vent connections and read pressure difference with chilled water pump in operation. An alternative method of determining flow rate is to measure pressure difference from pump inlet to outlet and read flow rate from pump curve.

However due to the quality of water at the jobsite, the accuracy of the curve might vary. Conditions such as water hardness, organic material, suspended solids and water velocity may contribute to a greater fouling. The quality of the water could be maintained by chemical treatment and periodical cleaning. The curve plotted is based on a clean water system.

3.4 UNIT OPERATION INCLUDING OVERNIGHT SHUT-DOWN AND MORNING RESTART

Caution: These units may equipped with manifold installed manual discharge valve that must be opened before attempting to start.

Important: Do not use chilled water pump operation via the flow switch or Aux chilled water pump contacts to start & stop this unit. These are safety controls, not operational controls.

3.4.1 AIR COOLED PACKAGE CHILLER START-UP

The unit is ready for start-up when the following procedures have been completed.

1. Water piping for the evaporator is installed and tested.
2. Electrical connections are made and properly fused.
3. Unit has been leak tested. leaks corrected, and charge completed.
4. ***Compressor crankcase heater(s) has been energized for a minimum of 24 hours.***
5. Calibrated refrigerant gages have been connected to the suction and discharge.
6. Turn on the chilled water pump, check direction of rotation and adjust the water flow through the evaporator to the specified flow rate. Bleed off all entrained air.
7. Manually energize the fan starters and check the fan rotation. Fans should pull air through the condenser coil and discharge vertically upwards.
8. Check all refrigerant valves to be sure they are open.
9. Proceed to System Start-up.

Compressor #1 will start in about 15 minutes & proceed to load up if leaving water temperature is above setpoint. Compressor #2 will follow as the demand dictates.

3.5 SYSTEM START UP

1. Before starting the compressor(s), check all three phases of supply voltage, of all legs of the motor. They must be within ±10% of the nameplate voltage. Check to be sure compressor is not running backwards.
2. Start compressor(s), check the gages and note if the pressures are within the prescribed limits.
3. Stage unit down until all compressors are off and check the compressor crankcase sight glass for oil level. It should be 1/2 to 3/4 of the compressor sight glass.
4. The electrical control settings should be checked and if necessary, reset to those settings indicated on the wiring diagram. Safety controls are factory set and must be maintained at settings indicated on the wiring diagram.
5. The temperatures of the chilled water both in and out, should be checked to insure the unit is operating within the desired temperatures.

3.6 SHUT-DOWN (OVERNIGHT OR WEEKEND)

To shut down in the unit with compressors on or off, turn each individual compressor switch. Do not close any valve. The chilled water pump shall then be turned off. Finally, do not open the main unit disconnect. Main power is required to keep the sump heaters.

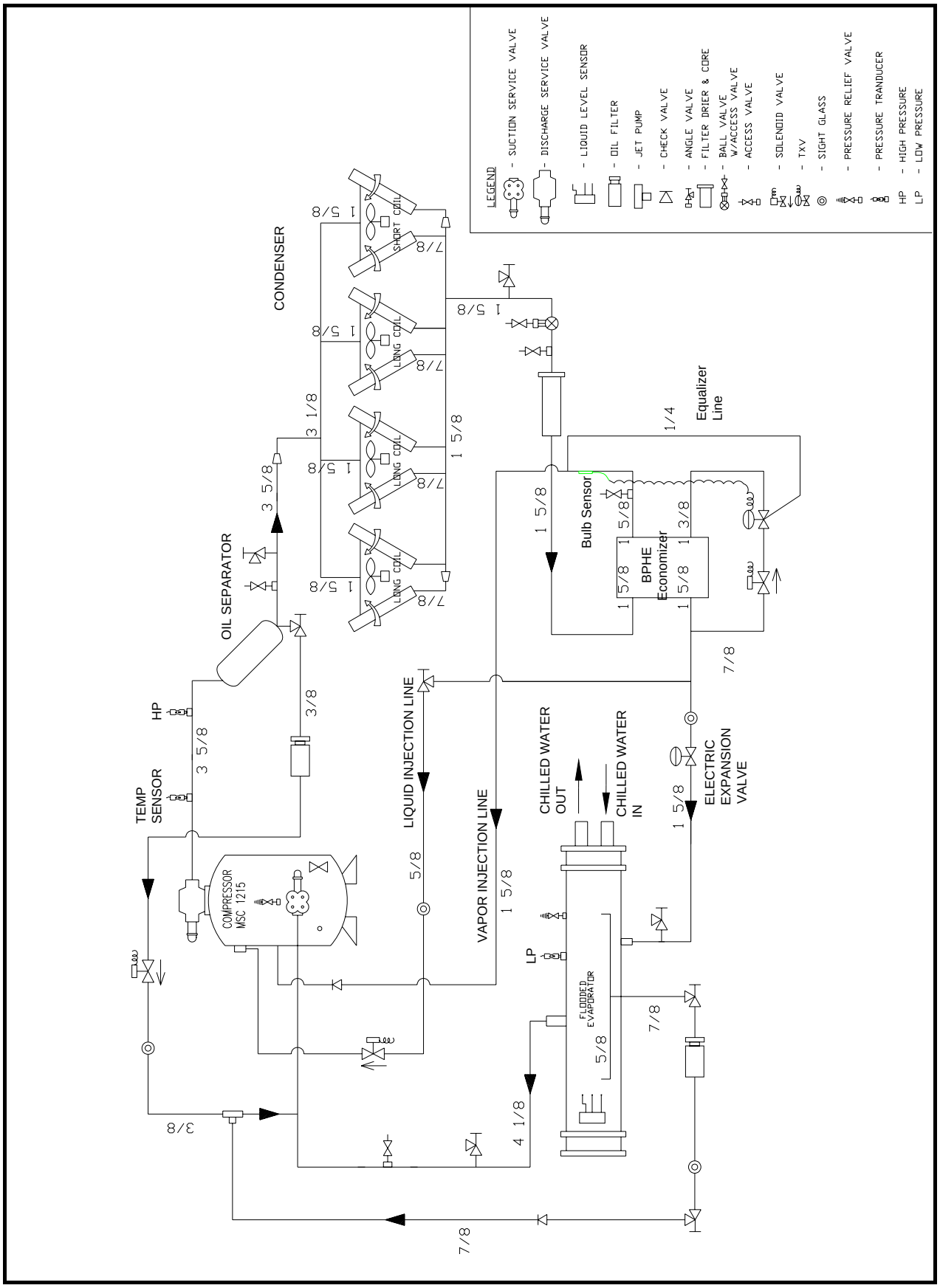
Important: Discontinue chilled water pump operation when unit is not operational.

Note: For chillers operating in low ambient, if it is possible that the overnight ambient will drop below 45°F [7.2°C], it is preferable to leave the chilled water pump on.

3.0 OPERATION

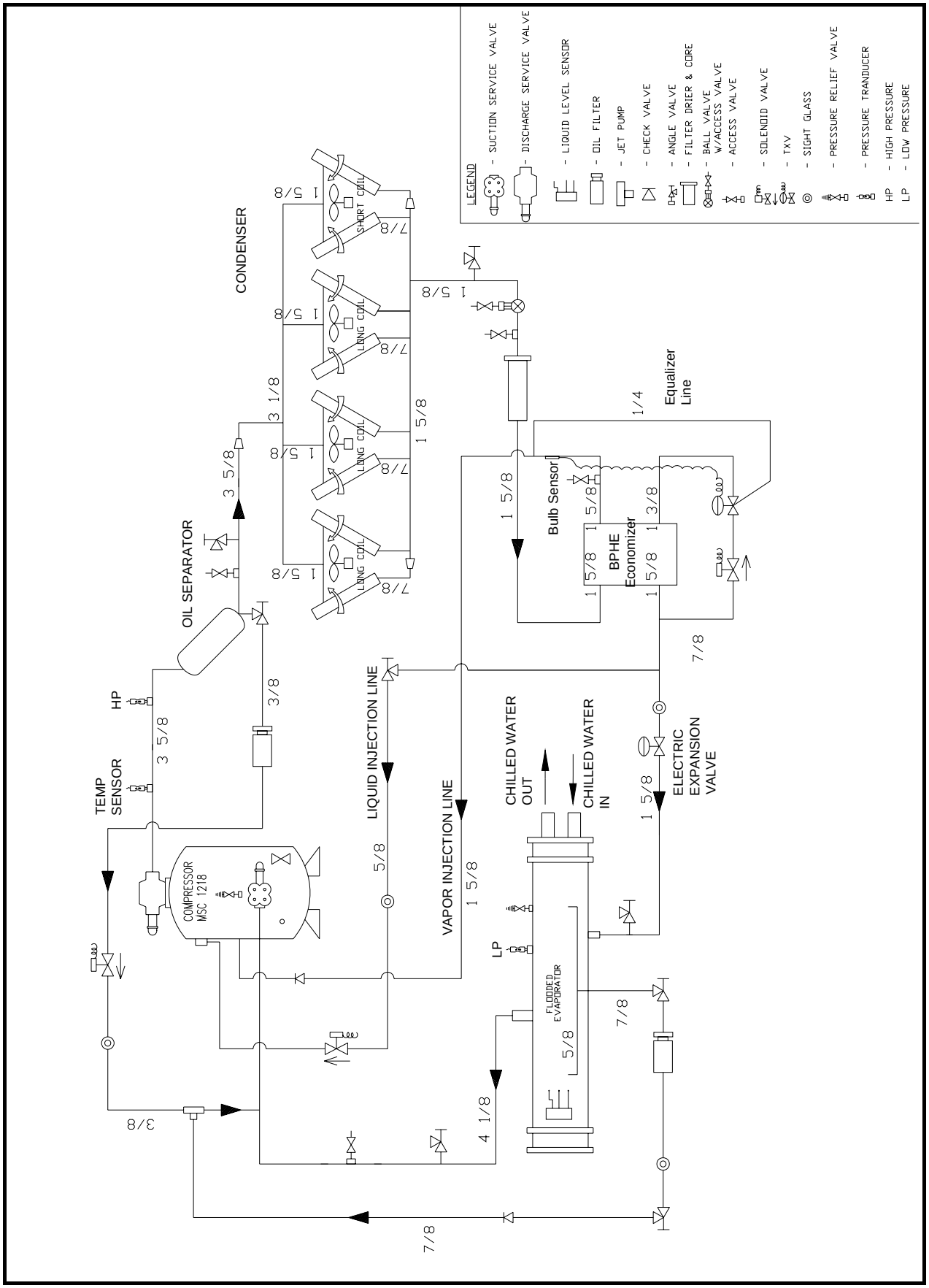
FIGURE 3.2 TYPICAL PIPING SCHEMATIC

1.) AFVXB 100-6SR



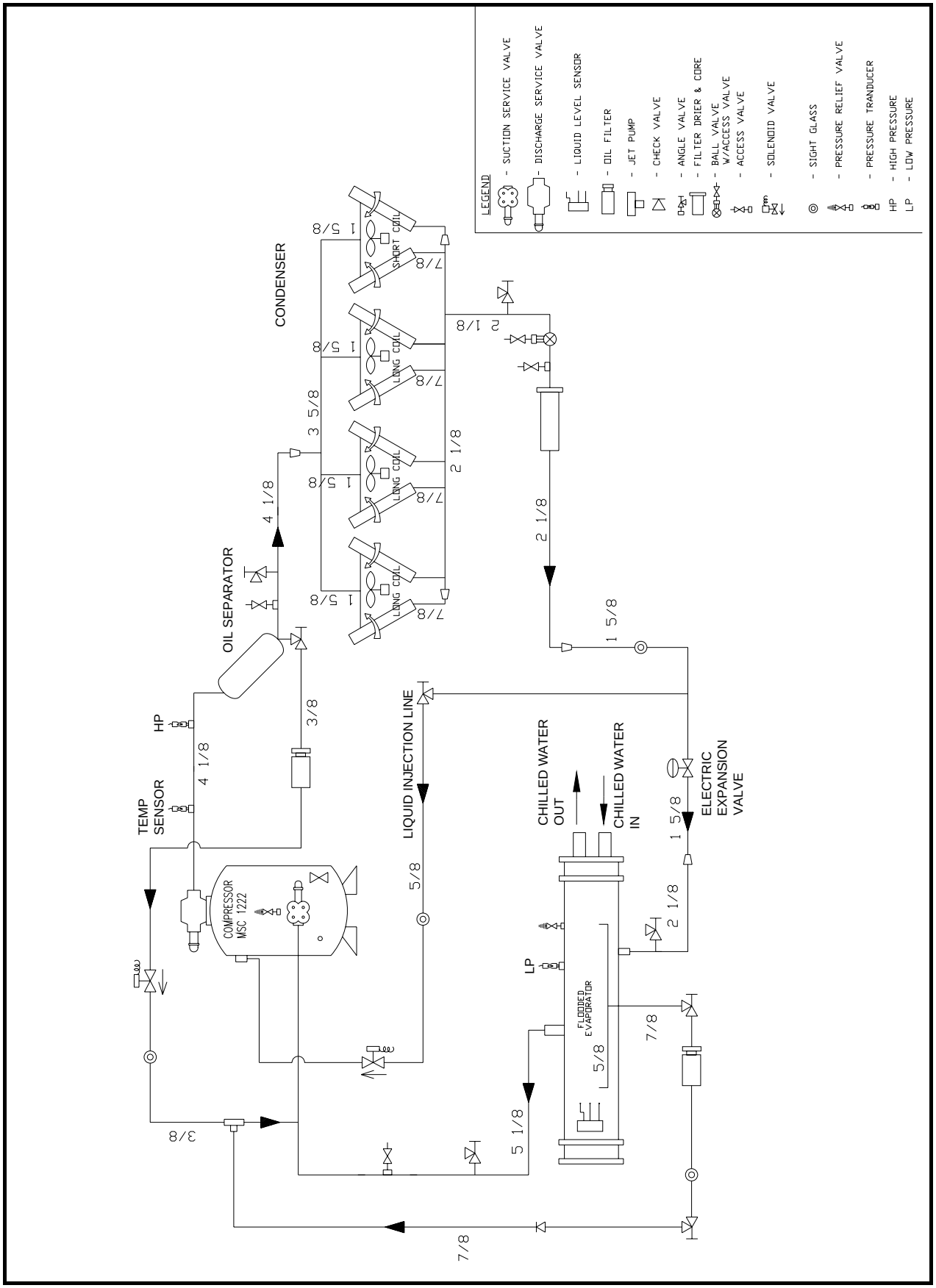
3.0 OPERATION

2.) AFVXB 120-6SR



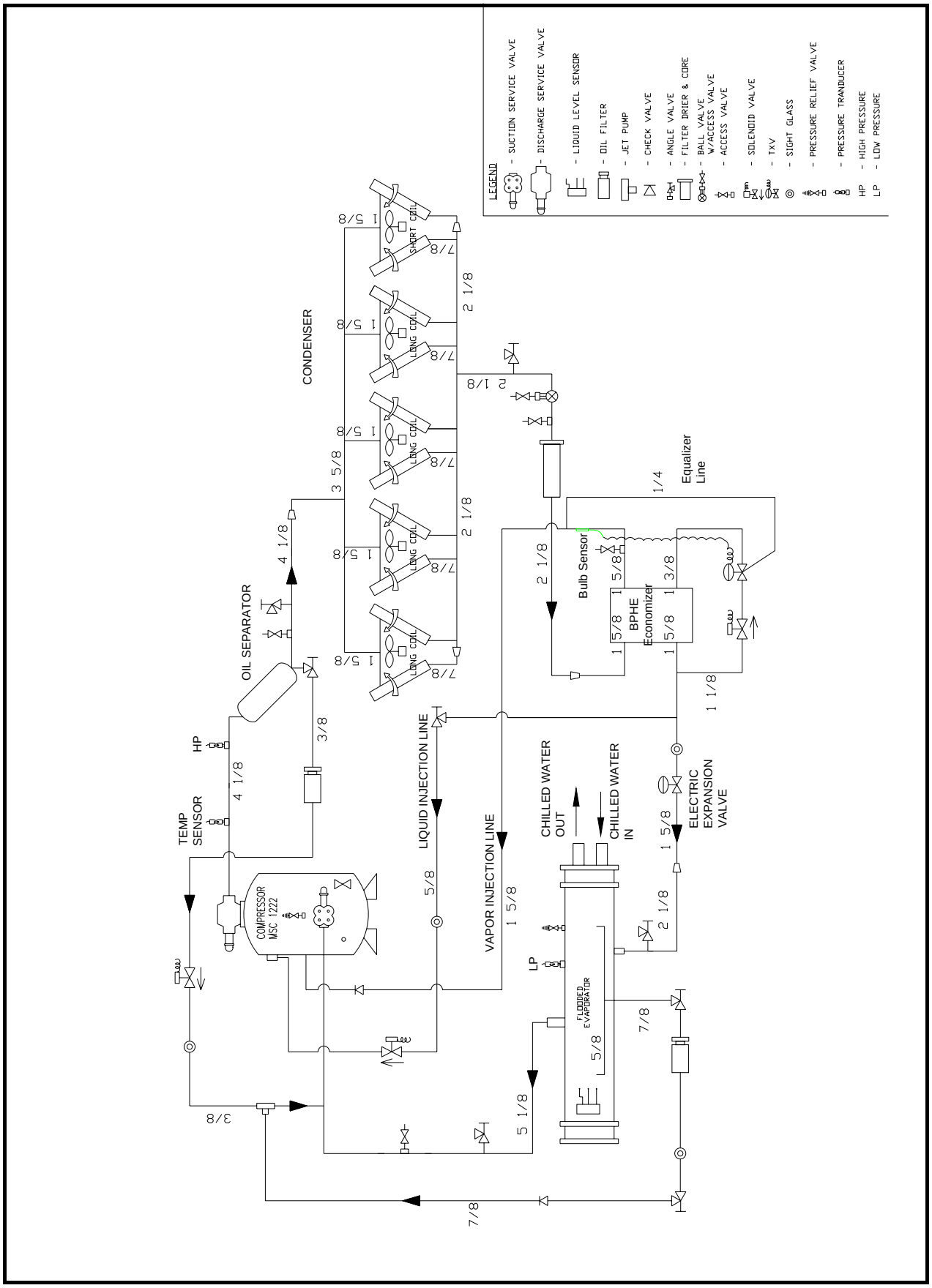
3.0 OPERATION

3.) AFVXB 135-6SR



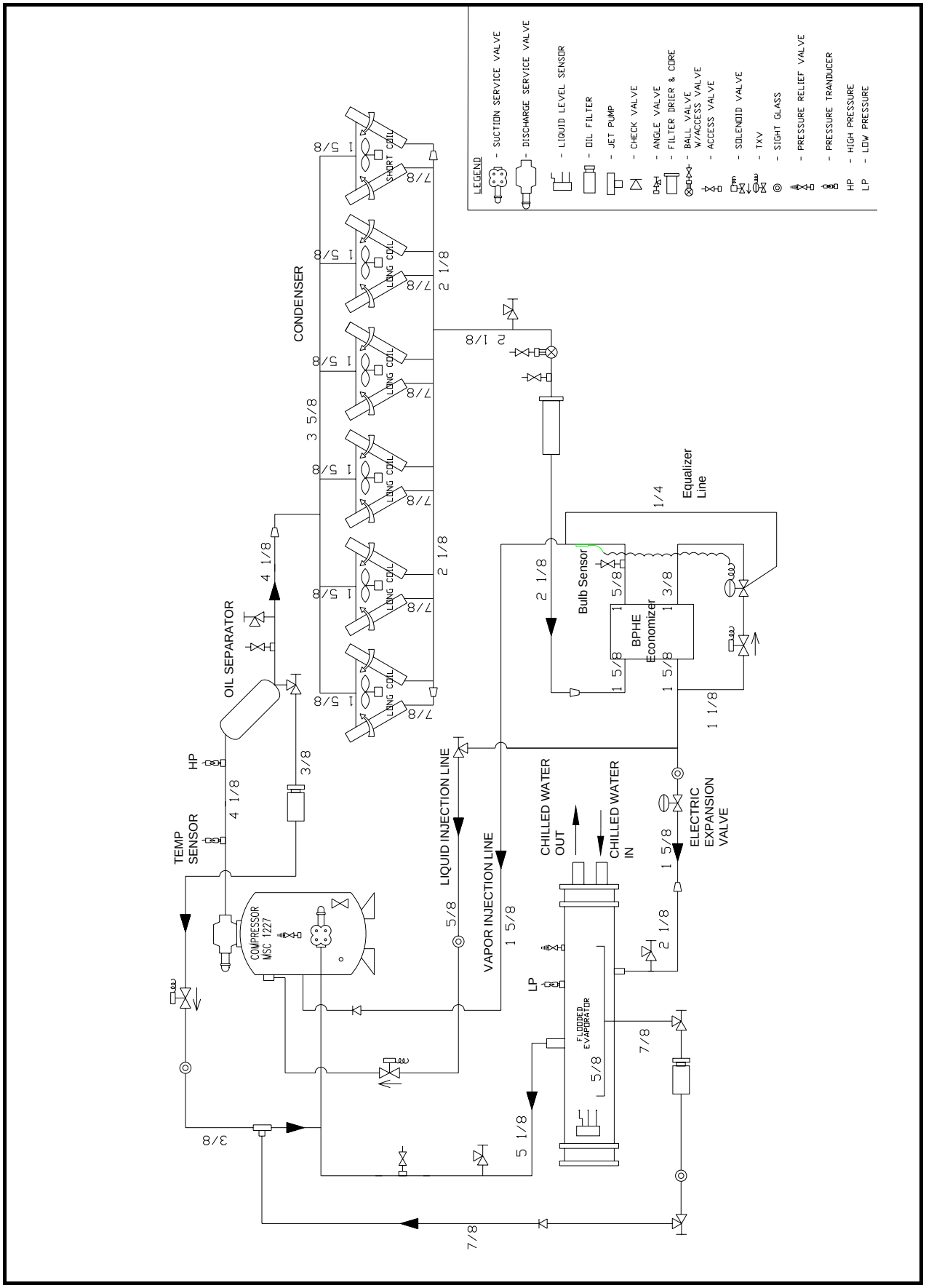
3.0 OPERATION

4.) AFVXB 165-6SR



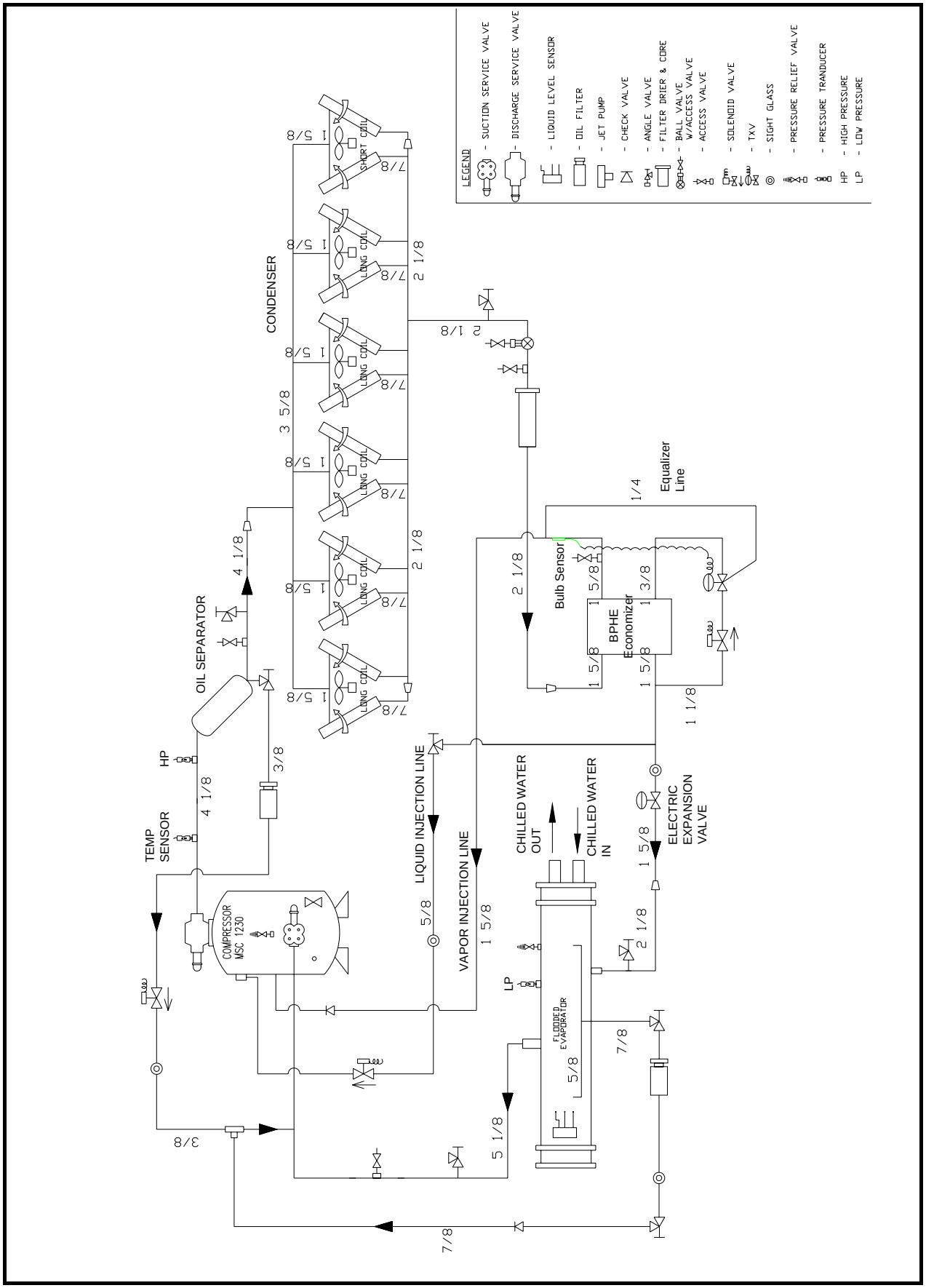
3.0 OPERATION

5.) AFVXB 200-6SR



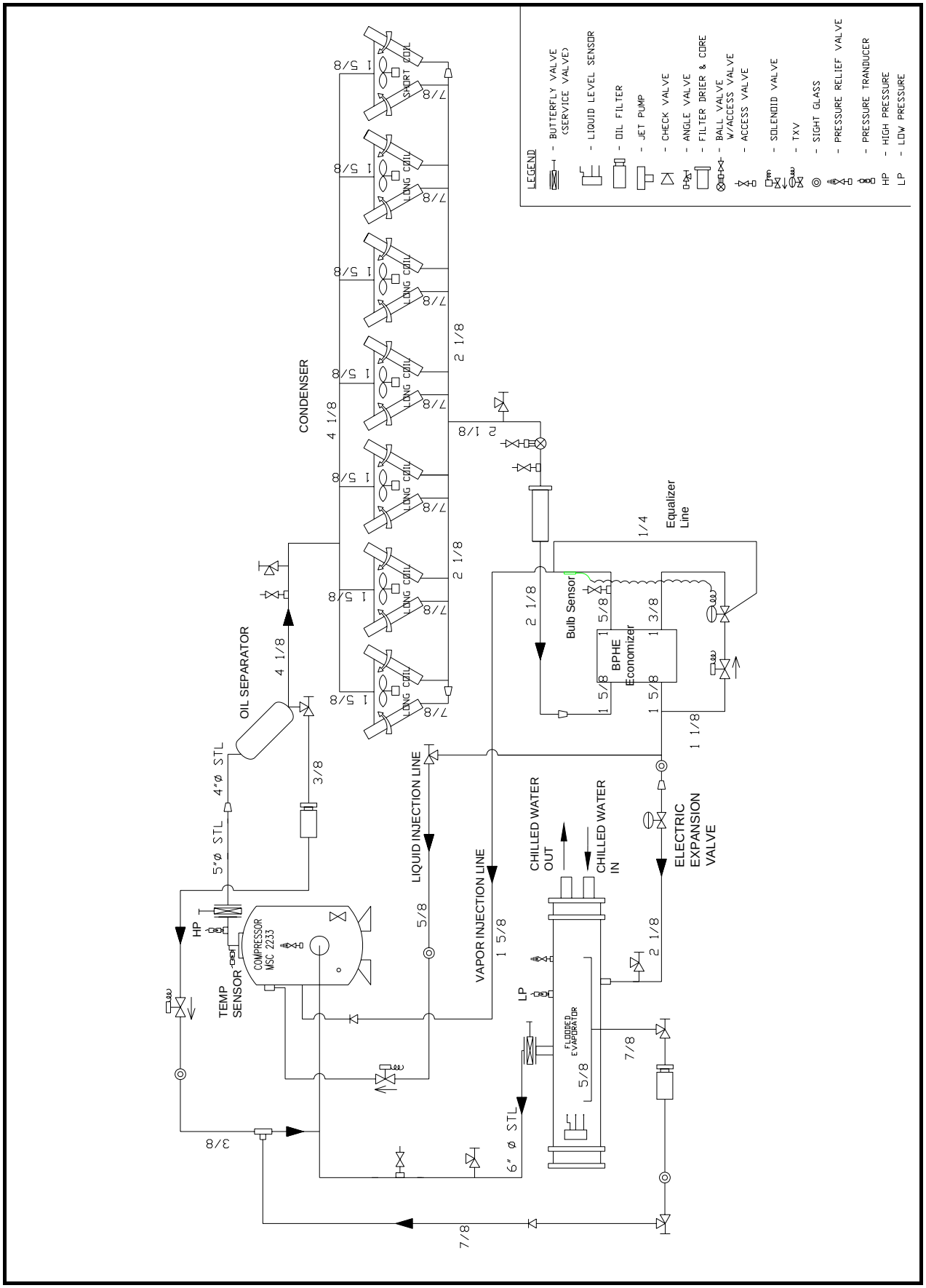
3.0 OPERATION

6.) AFVXB 225-6SR



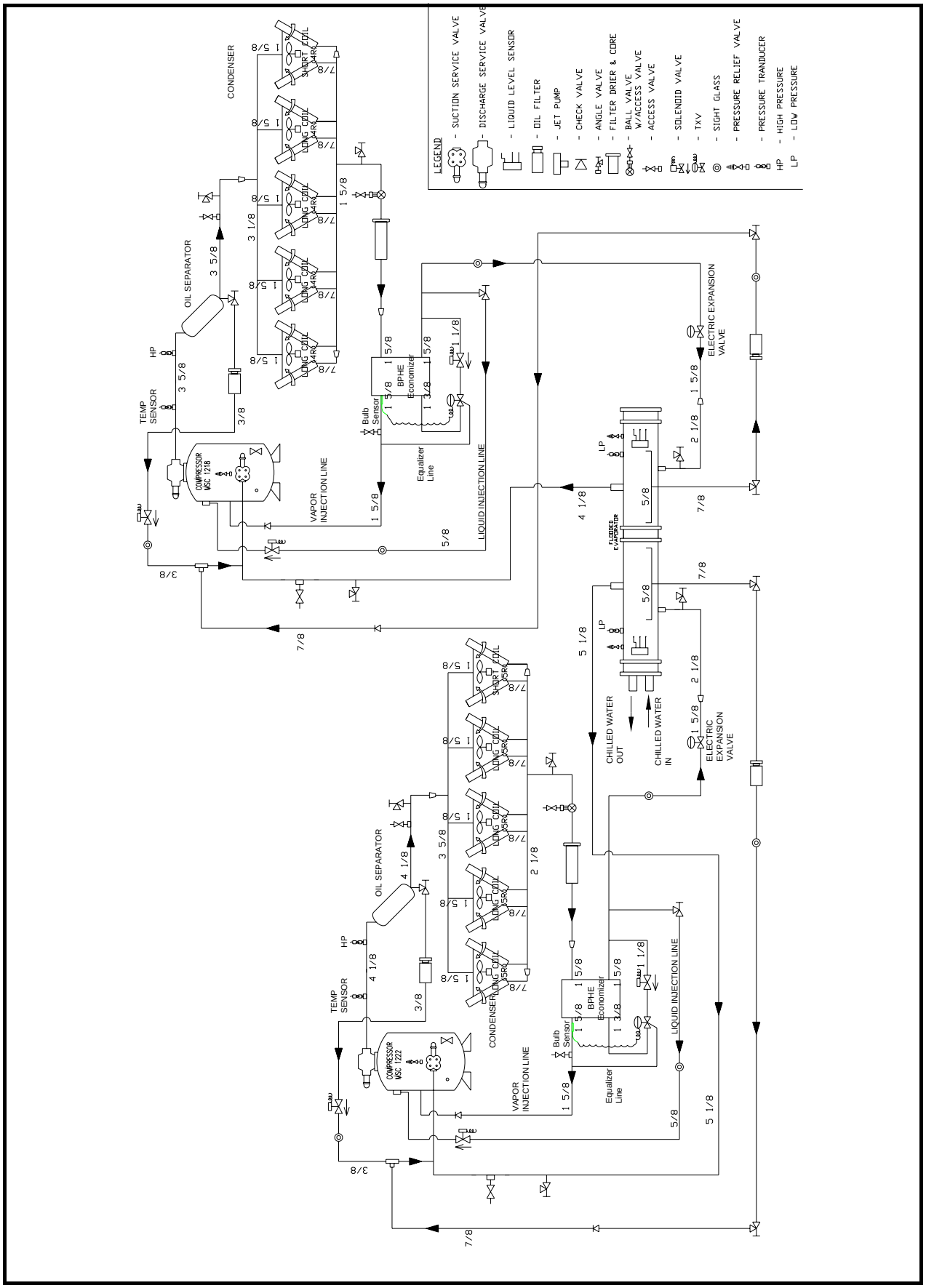
3.0 OPERATION

7.) AFVXB 260-6SR



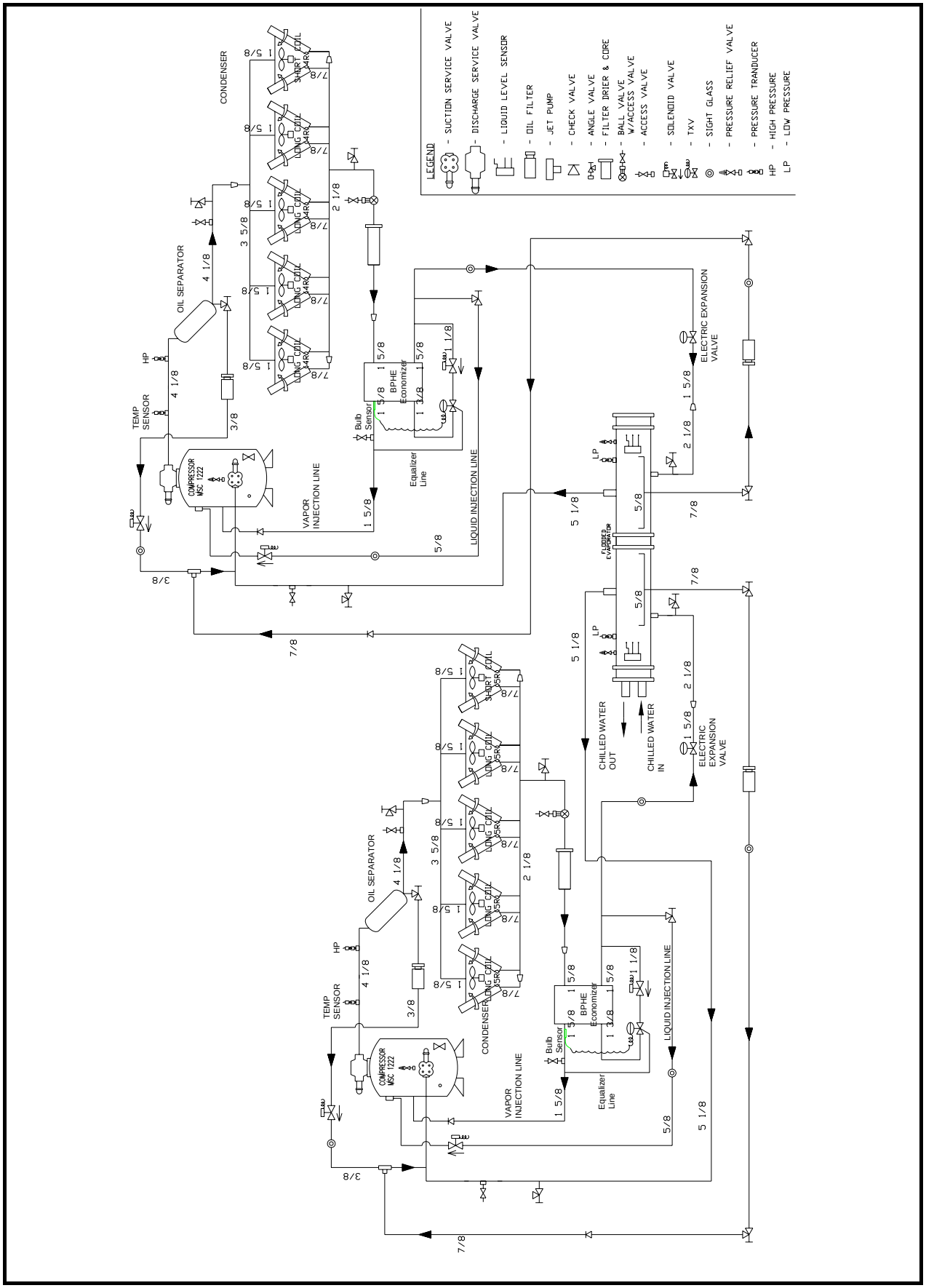
3.0 OPERATION

8.) AFVXB 280-6SR



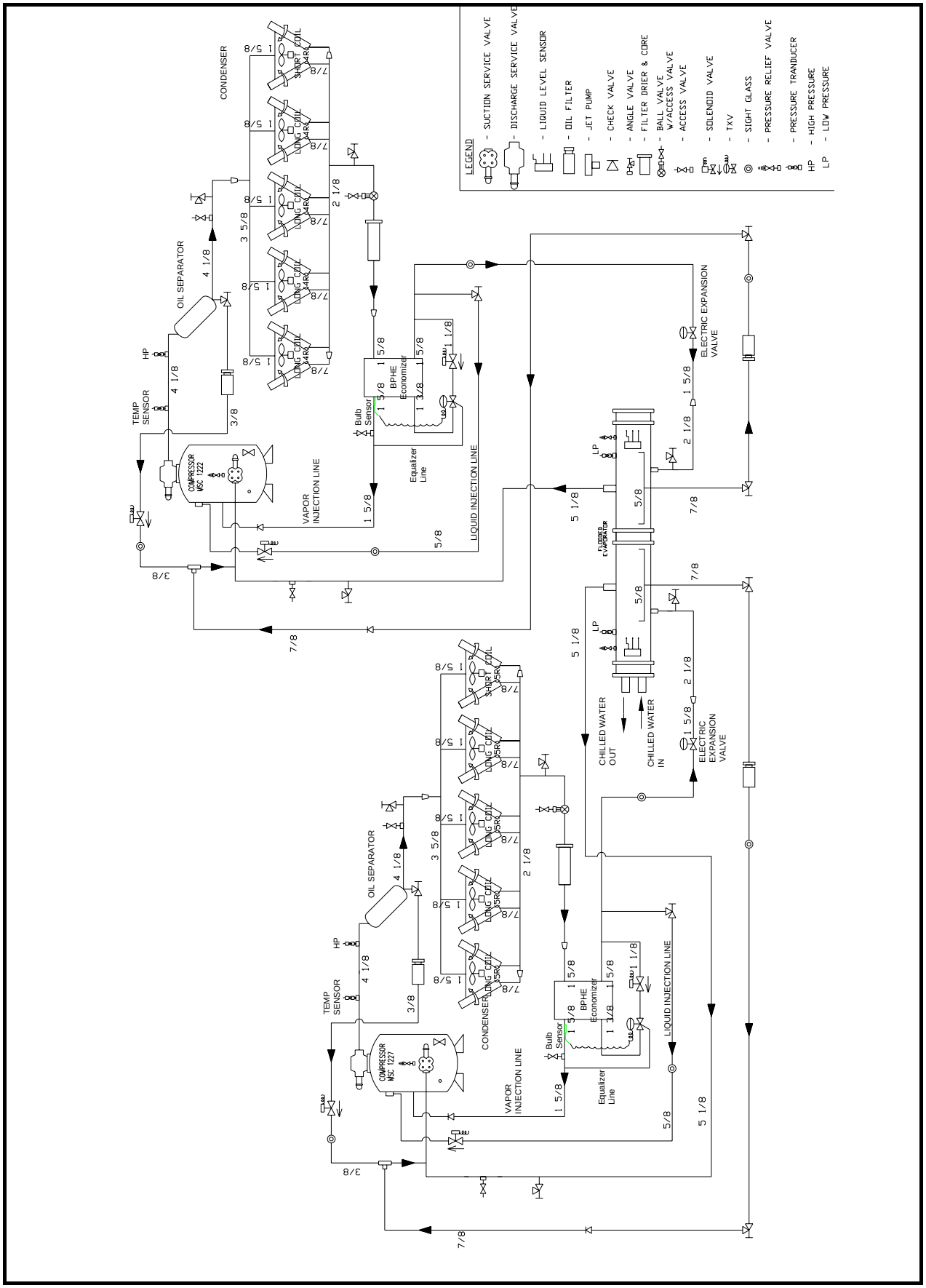
3.0 OPERATION

9.) AFVXB 330-6SR



3.0 OPERATION

10.) AFVXB 360-6SR



3.0 OPERATION

3.7 SEASONAL SHUT-DOWN PROCEDURE

Standard Ambient Units

1. Follow standard overnight shut-down procedure
2. Turn off chilled water pump
3. Close manual discharge valve
4. Close liquid valve on sealpot
5. If ambient temperature during the extended shut-down period will not get below freezing, the chilled water system may be left filled, If the ambient temperature will be below freezing, drain all water thoroughly, removing all vent & drain plugs from both heads of the evaporator, and blow out tubes will compressed air to avoid serious stagnant water corrosion.
6. Finally, it is recommended that an oil sample be taken from each compressor & submitted for lab analysis. Dunham-Bush offers this service in its "Oil Kare" program. This analysis should be done at the end of each operating season or every 6 months if the unit is used year round

   The power supply to the unit may be de-energized to conserve energy. Just remember that all heaters will now be inactive, and the evaporator could freeze-up if not properly drained.

3.8 SEASONAL START-UP PROCEDURE

1. Check fan drives for wear, rust, propeller clearance, etc. and make necessary repairs & adjustments. Grease main fan shaft bearings with a good grade of EP ball bearing grease.
2. Check & clean condenser fin surface if necessary. Use a warm water soap solution, being careful not to bend fins. Comb out bent fin areas.
3. Check all power supply connections at all points, and all control terminal screws for tightness.
4. Energize main power to unit & leave on for at least 24 hours in order for compressors to thoroughly warm up.
5. Start chilled water pump and verify correct flow-rate, glycol % if required. Bleed-off system air if necessary.
6. Open main discharge valve in discharge header.
7. Open liquid valve on sealpot.
8. Turn control circuit power switch on, and all individual compressor circuit switches. Press computer keyboard reset key (RST). Compressors should start after start-up clock times out and will come on in sequence to satisfy the existing load.

3.9 SAFETY RELIEF VALVES

Each pressure vessel is protected by a safety relief valve as required by ASME Code. Each compressor is protected by a relief valve which is vented to atmosphere. Never install any kind of shut-off valve in a safety relief vent line.

3.10 REFRIGERATION CYCLE -MULTIPLE COMPRESSOR AFVXB

Following is the normal sequence of operation for a unit installed in a typical air conditioning system. Refer to Figure 3.2, the typical piping schematic for multiple compressor AFVXB unit. Each vertical screw compressor discharges hot, high pressure gas through service valve or stop valve and then flow into air cooled, condenser where it condenses, rejecting heat to the outdoor air drawn through the coil by fans. The liquid refrigerant from the condenser is drain out from bottom of the condenser into the economizer feed line.

Liquid refrigerant enters the flooded evaporator uniformly where it absorbs heat from water flowing through the evaporator tubes. The vaporized refrigerant is then drawn into the suction port of the compressor where the positive displacement compression begins.

This partially compressed gas is then combined with additional gas from the vapor injection port at an intermediate pressure. Compressed gaseous refrigerant is then discharged into the integral oil separator where oil, which is contained in the refrigerant vapor, is removed and returned to the oil sump.

Fully compressed and superheated refrigerant is then discharged into the condenser, where air is being drawn through the condenser tube by the propeller fan cools and condenses the refrigerant. The liquid refrigerant then passes through the economizer. A portion of liquid refrigerant is tapped passes through the first expansion device back into the economizer for further subcooling of main liquid refrigerant flow.

The gaseous refrigerant is then drawn out of the economizer and into the vapor injection port of the compressor. The remaining subcooled liquid refrigerant then passes through a second expansion device which reduces refrigerant pressure to evaporator levels where it is then distributed evenly into the evaporator.

With the additional subcooling, the enthalpy of the refrigerant flowing into the evaporator is reduced which increases the refrigeration effect and improves the efficiency of the refrigeration cycle.

3.11 FAN CYCLING

On start-up, all fan will remain off (some units may have base fans which run together with compressor). As the head pressure builds up, next fan stage will start. Subsequently fan stage will start if the head pressure continues to rise. Refer wiring circuit diagram for number of fan stage.

3.0 OPERATION

3.12 LIQUID INJECTION

Each compressor is fitted with a liquid injection system designed to feed refrigerant liquid into the compressor to provide additional motor cooling as required. The liquid injection is turn on / off by solenoid valve to hold the compressor discharge gas temperature below 170ºF [77°C], the maximum discharge operating temperature of these compressors.

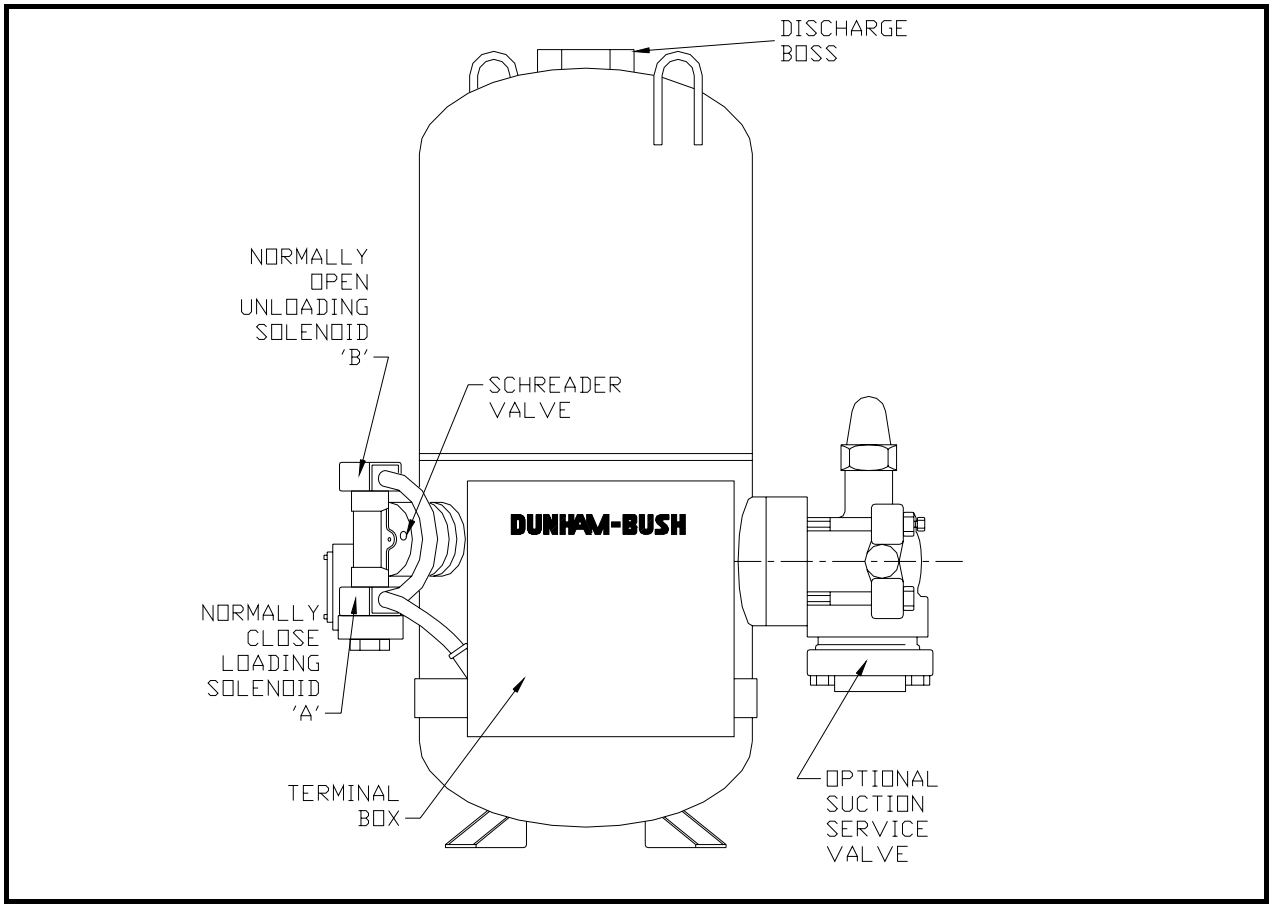
3.13 HYDRAULIC CAPACITY CONTROL SYSTEM

Each compressor has a hydraulic control system to supply the proper force necessary to actuate the capacity control slide valve, thereby regulating compressor loading for maximum unit capacity. It is composed of a normally closed valve (A), a normally open solenoid valve (B), an internal pressure regulating valve, with valves A and B both energized (A open, B closed) during normal compressor operation, high pressure oil is directed to the slide valve. This pressure acts on the surface of the slide valve piston creating a force which is sufficient to overcome the opposing spring force and to move the valve in the direction of increasing capacity. When the compressor is given a "hold" command, valve A is de-energized (closed) and slide valve is halted. The internal pressure regulating valve allows oil to bleed from the slide valve chamber during the hold condition. If valve B is then de-energized (open), the high pressure oil acting on the slide valve will be vented to suction, and the pressure in the slide valve chamber will be reduced. The slide valve spring will now move the slide valve back toward the minimum capacity position.

Under standard conditions, the compressors will load in 60 seconds and unload in 55 seconds.

	SLIDE VALVE POSITION		
	UNLOADING	**LOADING**	**HOLD**
SOLENOID VALVE A (NORMALLY CLOSED)	CLOSED (DE-ENERGIZED)	OPEN (ENERGIZED)	CLOSED (DE-ENERGIZED)
SOLENOID VALVE B (NORMALLY OPENED)	OPEN (DE-ENERGIZED)	CLOSED (ENERGIZED)	CLOSED (ENERGIZED)

FIGURE 3.13 COMPRESSOR CAPACITY CONTROL DETAIL



4.0 ELECTRICAL

4.1 ELECTRICAL DATA

Model AFVXB	Compressor Data					Cond. Fan Motor Data			Unit Electrical Data		
	Qty	Model	RLA	STA	LRA	Qty	HP	FLA	RLA	MCA	MFS
100-6SR	1	MSC1215	148.1	512	788	7	3.0	5.4	185.9	223	371
120-6SR	1	MSC1218	178.7	634	976	7	3.0	5.4	216.5	261	440
135-6SR	1	MSC1222	201.3	679	999	7	3.0	5.4	239.1	289	491
165-6SR	1	MSC1222	244.4	679	999	9	3.0	5.4	293.0	354	599
200-6SR	1	MSC1227	282.0	881	1295	11	3.0	5.4	341.4	412	694
225-6SR	1	MSC1230	316.9	946	1391	11	3.0	5.4	376.3	455	772
260-6SR	1	MSC2233	369.1	1464	2122	13	3.0	5.4	439.3	532	901
280-6SR	1 1	MSC1222 MSC1218	234.6 178.7	679 634	999 976	18	3.0	5.4	510.5	569	804
330-6SR	1 1	MSC1222 MSC1222	244.4 244.4	679 679	999 999	18	3.0	5.4	586.0	647	892
360-6SR	1 1	MSC1227 MSC1222	288.2 250.1	881 679	1295 999	18	3.0	5.4	635.5	707	996
400-6SR	1 1	MSC1227 MSC1227	282.0 282.0	881 881	1295 1295	22	3.0	5.4	341.4 341.4	412 412	694 694
450-6SR	1 1	MSC1230 MSC1230	316.9 316.9	946 946	1391 1391	22	3.0	5.4	376.3 376.3	455 455	772 772
520-6SR	1 1	MSC2233 MSC2233	369.1 369.1	1464 1464	2122 2122	26	3.0	5.4	439.3 439.3	532 532	901 901

Notes: 1.) Larger compressor models MSC2233 and MSC2236 are using star-delta starting method. Others compressor models are using double-delta starting.

2.) MCA - Minimum Circuit Amps. MFS - Maximum Fuse Size RLA - Rated Load Amps
LRA - Locked Rotor Amps FLA - Full Load Amps STA - Starting Amps

4.2 WIRING DIAGRAM

Figure 4.2 are typical wiring diagrams for a 1-compressor unit. This may not be an accurate representation of your unit. It is best to use the wiring diagram mounted in the package control panel. A copy of that diagram is furnished with the unit owner's manual.

4.3 TYPICAL OPERATION

In order to start a compressor, the following conditions must be met:

- System voltage above undervoltage relay (UVR) setting
- Chilled water pump running
- Chilled water flow switch made
- Compressor circuit breakers on
- Customer unit control contact closed
- Control switch and compressor switches on
- Reset pressed on controller keypad
- Power has been on the controller for 15 minutes
- All safety conditions satisfied
- Leaving chilled water temperature 2°F [1.1°C] or more above setpoint

A compressor is started by first energizing 1M1 followed by 1M2. Anti-recycle time of 15 minutes is initiated within the computer at start.

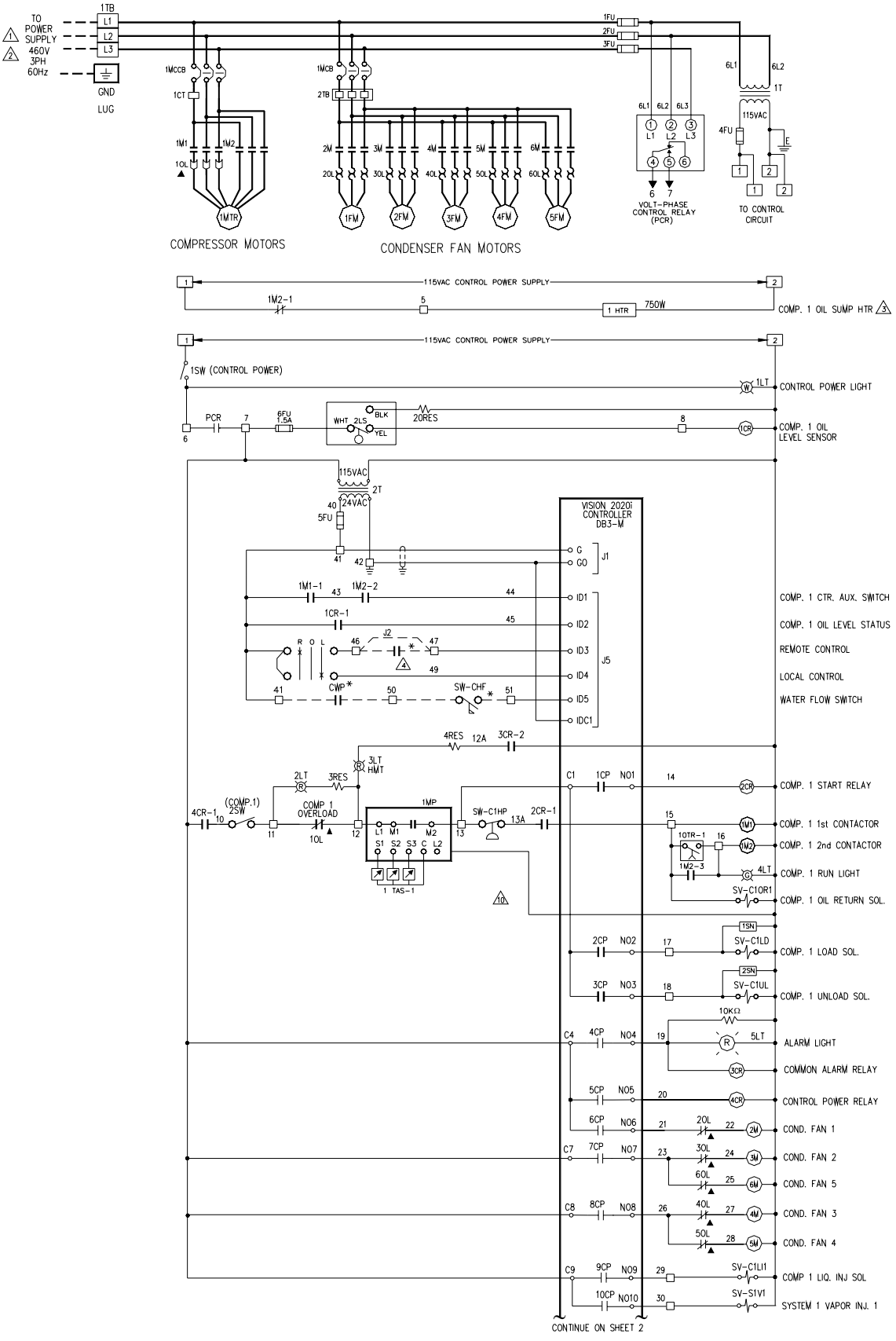
When the compressor starts, the controller monitors amperage by means of 1CT, voltage using 3T, leaving water temperature using TS, and condensing pressure. These inputs are used to control the loading and staging of the compressor.

The compressor's loading is controlled by pulsing signals to the load and unload solenoids.

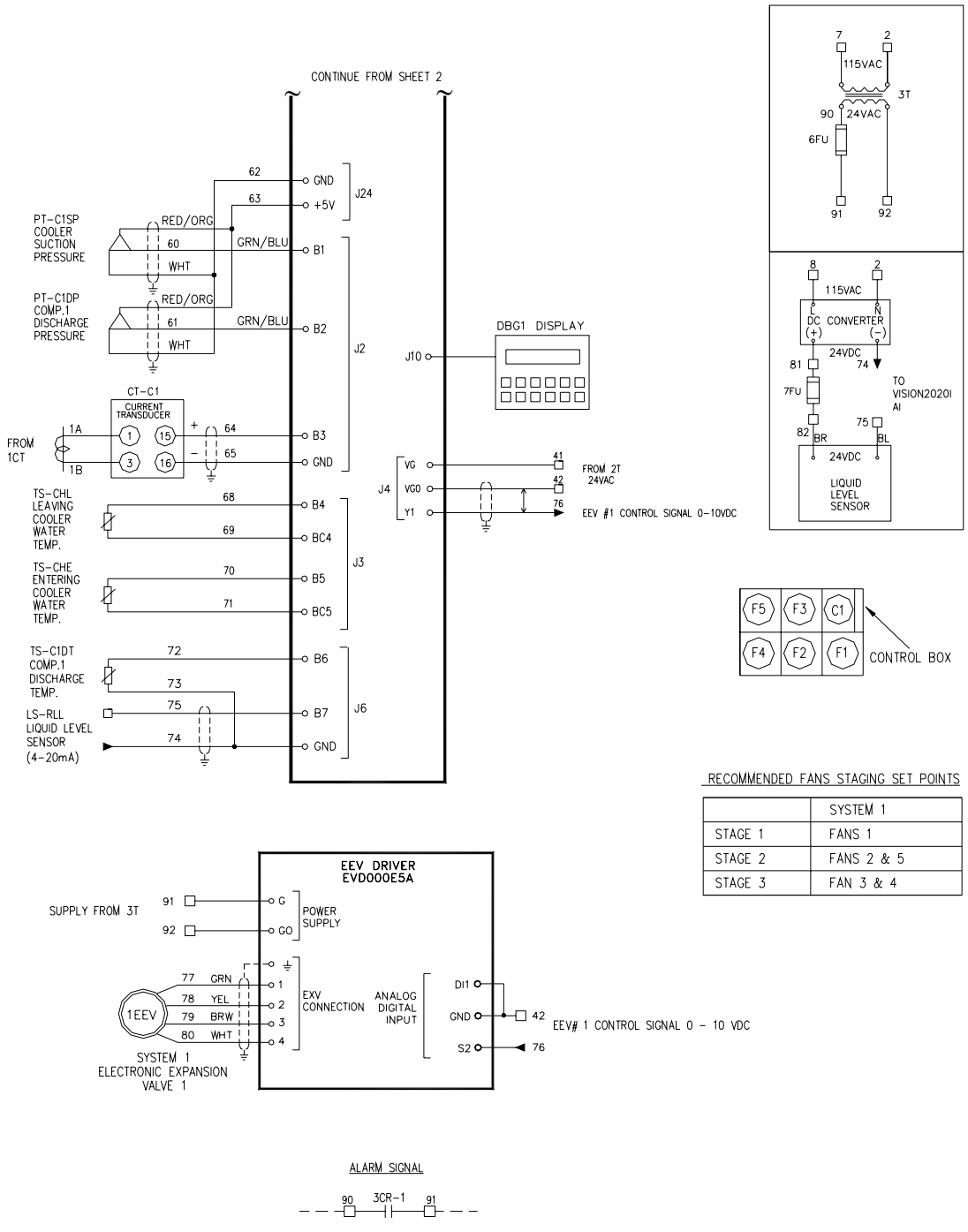
To shut down the unit automatically, the customer control contacts must be opened. To shut down the unit manually, simply shut off the compressor switches. This will cause a no-run alarm that must be reset to restart the compressor.

4.0 ELECTRICAL

FIGURE 4.2 TYPICAL WIRING SCHEMATIC (1 compressor)



4.0 ELECTRICAL



RECOMMENDED FANS STAGING SET POINTS

	SYSTEM 1
STAGE 1	FANS 1
STAGE 2	FANS 2 & 5
STAGE 3	FAN 3 & 4

NOTES:

1. DISCONNECT MEANS & BRANCH CIRCUIT PROTECTION SHALL BE PROVIDED BY OTHERS.
2. USE COPPER CONDUCTOR ONLY.
3. IF POWER SUPPLY HAS BEEN INTERRUPTED FOR A PROLONGED PERIOD, OIL SUMP HEATERS MUST BE ENERGIZED FOR 24 HOURS MINIMUM BEFORE STARTING COMPRESSOR.
4. CUSTOMER CONTROL CONTACTS MUST BE WIRED BETWEEN TERMINAL 17 & 18. (SHIELD CABLE RECOMMENDED). SELECT POSITION 'R' FOR REMOTE START, POSITION 'O' FOR UNIT SHUT DOWN AND POSITION 'L' FOR LOCAL START.
5. THE SHIELDED CABLES ARE RECOMMENDED FOR FIELD INSTALLED CONTROL AND SIGNAL WIRING, CONNECT ONE END OF THE SHIELD TO GROUND.
6. CHILLED WATER FLLOW SWITCH AND PUMP INTERLOOCK ARE REQUIRED. DO NOT USE THESE SWITCHES TO CONTROL THE PACKAGE.
7. IF 4-20mA RESET IS USED, SET SETPOINT TO RESET DESIRED AT 4-20mA INPUT OPTIONAL.
   CAUTION: DO NOT SUPPLY OVER 20mA TO INPUT TERMINAL.
8. JUMPER WIRE ON MOD MOTOR CONTROL IS A CUSTOMER OPTION TO TAKE OUT OR KEEP IN.
9. LOCKOUT ON MOTOR PROTECTION MODULE CAN BE RESET BY TURNING OFF COMP. ON/OFF SWITCH 2SW MOMENTARILY FOR 5 SEC.

LEGEND

AI	–	ANALOG INPUT
COMP	–	COMPRESSOR
COND	–	CONDENSER
CP	–	CONTROL POINT
CR	–	CONTROL RELAY
CT	–	CURRENT TRANSFORMER
CWP	–	CHILLED WATER PUMP
DI	–	DIGITAL INPUT
FU	–	FUSE
HOT	–	HIGH OIL TEMP
HTR	–	HEATER
INJ	–	INJECTION
I/O	–	INPUT/OUTPUT
LT	–	LIGHT
LS	–	LEVEL SENSOR
M	–	CONTACTOR
MCB	–	MINIATURE CIRCUIT BREAKER
MCCB	–	MOULDED CASE CIRCUIT BREAKER
MTR	–	MOTOR
OL	–	OVERLOAD
PCR	–	PHASE CONTROL RELAY
PT	–	PRESSURE TRANSDUCER
ROL	–	REMOTE-OFF-LOCAL SELECTOR SWITCH
RES	–	RESISTOR
SN	–	SNUBBER
SOL	–	SOLENOID
SW	–	SWITCH
SW-CHF	–	CHILLED WATER FLOW SWITCH
TB	–	TERMINAL BLOCK
TS	–	TEMP. SENSOR
T	–	TRANSFORMER
▲	–	MANUAL RESET
*	–	FIELD SUPPLY
□	–	FACTORY TERMINALS
———	–	FACTORY WIRE
— —	–	FIELD WIRE

4.0 ELECTRICAL

4.4 VISION 2020i CONTROLLER AND TERMINAL

Vision 2020i controller is equipped with a user friendly 132x64 pixels back-lit graphic display terminal. It is connected with controller through telephone cable. This terminal allows carrying out all program operations. The user terminal allows displaying the unit working conditions, compressor run times, alarm history at any time and modifying the parameters. The terminal also has an automatically self-test of the controller on system start-up. Multiple messages will be displayed by automatically scrolling from each message to the next. All of these messages are spelled out in English language on the LCD screen.

4.4.1 OPERATOR KEYPAD

The operator keypad consists of 15 polycarbonate buttons:

Figure 4.4.1 : Vision 2020i keypad

The top right 'Authorization' button is for password log in to gain authorization, to the access setting menu.

The top left six operator buttons functions are to view status only, except the 'Setpoint' button also allows setting changes after gained authorization.

The three buttons at the bottom left are to access different level of setting changes.

These are 'User', 'Technician' and 'Factory' levels, from left.

It can only be access depend on the password level. The higher password can access the lower password level's setting and not vice versa.

4.4.1.1 The fifteen polycarbonate buttons:

a) Seven polycarbonate buttons at top row

Button		Description
	INPUT STATUS	Displays the analog inputs and digital inputs status measured by the probes/sensors.
	OUTPUT STATUS	Displays the relay outputs and analog outputs status.
	COMPRESSOR STATUS	Displays the status of Compressor 1, 2 and so on.
	SETPOINT	Displays the status of set points.
	CLOCK/ SCHEDULE	Displays the date, time and day.
	ALARM HISTORY	Display the alarm history.
	AUTHORIZATION	To log in the level of passwords.

b) Eight polycarbonate buttons at bottom row

Button		Description
	USER	User Control Changeable Settings.
	TECHNICIAN	Technician Control Changeable Settings.
	FACTORY	Factory Control Changeable Settings.
	MENU	Unit information / Compressor Information.
	ALARM RESET	Display the active alarms and to perform alarm manual resets.
	UP	Scroll the various screens when the cursor is in the top left of the display. If the cursor is inside a numeric field, the button increases or decreases the corresponding value. If the field is a selection, pressing the button displays the available options.
	DOWN	See the UP arrow
	ENTER	To move the cursor around the screens and to save the values of the set parameters

4.0 ELECTRICAL

4.4.2 STATUS READING

4.4.2.1 Input status key

To read inputs status press input status key:

The display is showing the data as follows:

ANALOG INPUTS

Supply Temp	044.8 °F [07.1°C]
Return Temp	055.6 °F [13.2°C]
Suction Pres	073 PSI [05.2BAR]
Disch Press	179 PSI [12.9BAR]

Press down arrow key or input key to go to next screen:


The display is showing the data as follows:

ANALOG INPUTS

C1 Amps	101A
C1 Disc T	125.2°F [51.8°C]

Repeat the same steps to go to other sensor inputs screen:

4.4.2.2 Output status key

To read relay outputs status press output status key:

The display is showing the data as follows:

RELAY OUTPUTS

Comp 1	ON-LOAD
Alarm Status	OFF
Control Power	ON
SDD Control	OFF
C1 Liquid Inj	OFF
CW Pump	ON

Press down arrow key or output key to go to next screen:


The display is showing the data as follows:

C1 Vapor Inj	OFF
Hot Gas Bypass	OFF

Repeat the same steps to go to other relay outputs screen:

4.4.2.3 Compressor status key

To read compressor status press compressor status key:

The display is showing the data as follows:

COMPRESSOR 1 STATUS

Comp 1 OK
Amps= 100A
FLA1= 230A
Capacity= 025.5%
Status=ON-LOAD

Press down arrow key or press compressor key to go to next screen:


The display is showing the data as follows:

COMPRESSOR 1 HISTORY 1

	Today	Total
Run Hour	05	0006
Cycle	02	0006
Last On	04/24	19:06
Last Off	04/24	19:03

4.4.2.4 Setpoint key:

To read the setpoint value press setpoint key

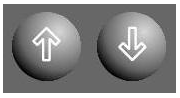
The display is showing the data as follows:

SETPOINT 1

Supply Water Temp
Set point= 44.0 °F [06.7°C]
Dead band= 0.8 °F [0.5°C]

To alter setpoint data, you must be authorized. See the authorization procedure and you must be authorized at least as user level.

Press enter key to select the setpoint to alter and use the up-down arrow key to change the value and press enter key to confirm.

Press down arrow key or press setpoint key to go to next screen:


Repeat the same steps to go to other setpoints screen and perform setpoint modification.

4.4.2.5 Clock key:

To read the current day, time and date, unit scheduling and ice-cel mode scheduling (optional), press the clock key

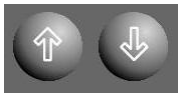
The display is showing the data as follows:

REAL TIME CLOCK

Day > MONDAY
Time > 16:10
Date > 05/12/05

To set the date and time, you must be authorized. See the authorization procedure and log in at least as user level.

Press enter key to select the date or time to alter and use the up-down arrow key to change the value and press enter key to confirm.

4.4.2.6 Alarm history key:

To view the unit alarm history press alarm history key:

The display is showing the data as follows:

ALARM HISTORY
001-C1 Starter
19:03 05/12/05
TR: 030.2 LWT: 64.3 [17.9]
DP: 191 [13.6]
SP: 076 [5.4]
C1 AMP: 054

Press down arrow key or press alarm key to go to next screen for other alarm history:


To clear alarm history, press input key and authorization key together and then press the alarm key again. Now the display should be showing “No alarm”


4.4.3 AUTHORIZATION

4.4.3.1 Authorization key

To get authorization level, press authorization key:

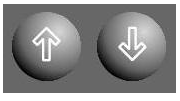
The display is showing the current access level as view only:

AUTHORIZATION

Please Enter your
Password

PASSWORD= 0000
Status=View

Press enter key and use the up-down arrow key to change the password settings and press enter key to confirm.

Now the authorization status change to different access level.

4.4.4 Advanced user key and menu

4.4.4.1 User Key

User key is use to view and change the pressure, ampere safety limits and liquid injection temperature setpoints, unit of measurements. In order to gain access to this button, you must be authorized and log in at least as user level.

Press the user key and display is showing the data as follows:

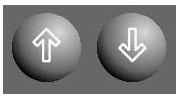
USER SETPOINT 1

High Pressure Safety Limits

Hold=	246PSI [17.0BAR]
Unload=	256PSI [17.7BAR]
Cutout=	270PSI [18.6BAR]

Press down arrow key or user key to go to next screen for other setpoint:


To alter setpoint data, press enter key to select the setpoint to alter and use the up-down arrow key to change the value and press enter key to confirm.

Repeat the above steps for others setpoints.

4.4.5 TECHNICIAN KEY and MENU

4.4.5.1 Technician Status Key

This key is use to view and change the compressor FLA setpoint, sensors calibration, manually control digital inputs and outputs, manually control compressor. In order to gain access to this button, you must be authorized and log in at least as user level. See the authorization section about this procedure.

4.4.5.2 Technician Status Key- Main Menu

Press technician key to go to technician setpoints main menu:

The display is showing the data as follows:

Technician Setpoints
Main Menu
Comp FLA Calibration
Sensor Calibration
Manual Control
Compressor Control
Sensors Override

Press enter key to move the cursor to the sub-menu.

The display is showing the data as follows:

Technician Setpoints
Main Menu
Comp FLA Calibration ■
Sensor Calibration
Manual Control
Compressor Control
Sensors Override

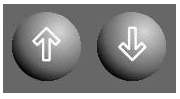
4.4.5.3 Compressor FLA Calibration:

To calibrate compressor FLA, press down arrow key to go the sub-menu 'Comp FLA Calibration',

The display is showing the data as follows:

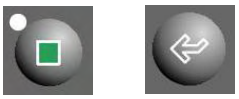
Technician Setpoint 1
Comp 1 FLA CALIBRATION
211x00.66+97.80
FLA = 237A
Capacity C1 = 000.0%
Min. Percent Cal = 25.0%
Max. Percent Cal = 00A

Press enter key to move the cursor to calibrate the comp FLA and use the up-down arrow key to change the value and press enter key to confirm.

4.4.5.4 To perform Sensor Calibration:

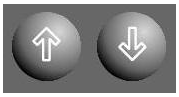
Press technician key to go to technician setpoints main menu and press enter key twice to move the cursor to the sensor calibration sub-menu:



The display is showing the data as follows:

```
        Technician Setpoints
             Main Menu
Comp FLA Calibration
Sensor Calibration          ■
Manual Control
Compressor Control
Sensors Override
```

Use up or down arrow key to move the cursor to the desired 'Sensor Calibration',



The display is showing the data as follows:

```
      Sensor Offset 1
      Suction Press
Current  =        076PSI [5.4BAR]
Average =         187PSI [8.6BAR]
24Hrs MAX  =      200PSI [11.4BAR]
24Hrs MIN  =      074PSI [4.6BAR]
Calibration   =   00PSI [0.0BAR]
```

Press enter key to move the cursor to calibrate the desired sensor and use the up-down arrow key to change the value and press enter key to confirm.

Repeat the above steps for others sensors calibrations.

4.4.5.5 Manual Control:

A digital input sensor or relay output can be controlled manually with the keypad. Digital input sensor or relay output can be turned on, off manually and placed back to auto mode.

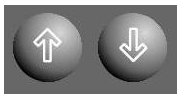
To place a digital input or relay output in manual control, the operator must be authorized at technician level or higher.

Press technician key to go to technician setpoints main menu and press enter key three times to move the cursor to the manual control sub-menu:

The display is showing the data as follows:

```
        Technician Setpoints
             Main Menu
Comp FLA Calibration
Sensor Calibration
Manual Control    ■
Compressor Control
Sensors Override
```

Use up or down arrow key to move the cursor to the desired digital input or relay output,



The display is showing the data as follows:

```
        Digital Inputs
        Manual Control
C1 Starter=          Auto
C1 Oil Lvl=          Auto
Unit Enable=         Auto
Flow Switch=         Auto
```

Press enter key to move the cursor to the desired point for manual control and use the up or down arrow key to change the status of the digital input or relay output to AUTO/CLOSE/OPEN or AUTO/ON/OFF.

The display is showing the data as follows:

```
        Relay Outputs
        Manual Control
Alarm Relay          Auto
SDD Relay            Auto
Liquid Inj C1        Auto
CW Pump              Auto
Vap Inj Relay        Auto
```

Press enter key to confirm the change.

4.4.5.6 Compressor Control:

Screw compressors can be controlled manually with the keypad. A compressor can be turned on, off, or placed in computer control. When a compressor is controlled manually, it can be commanded to load, hold, or unload. If safety limiting condition is active, it will not accept a load command.

To place a compressor in manual control, the operator must be authorized and log in as technician level and higher.

Press technician key to go to technician setpoints main menu and press enter key four times to move the cursor to the manual control sub-menu:


The display is showing the data as follows:

```
        Technician Setpoints
            Main Menu
Comp FLA Calibration
Sensor Calibration
Manual Control
Compressor Control          ■
Sensors Override
```

Use down arrow key to move the cursor to the desired compressor control screen, then press enter key to move the cursor to compressor status position, AUTO /MAN/OFF


The display is showing the data as follows:

```
        Compressor Control
          Manual Override
COMPRESSOR 1=AUTO
St=  0005
Amps=  071.8
Capacity= 025.0%
Status = OFF
```

Use up or down arrow key to select MAN and press enter key to confirm the change. The compressor will start or continue to run in hold state. Press the user key to continue hold, press the technician key to load and factory key to unload.


Manual Hold


Manual Load


Manual Unload

If a safety condition is exceeded while operating manually, the compressor will shutdown.

CAUTION: Anti-recycle timer is bypassed by manual control. DO NOT start a compressor more than once every 15 minutes.

NOTE: All compressors will revert back to automatic control if the computer is the computer is not given a load, unload, or hold command at least once every 15 minutes. A command can be repeated to meet the 15 minute requirement for manual control.

To the change the settings of compressor load/Unload, follow the above steps and go to compressor control. Use down arrow key to move the following and press to change the settings.

```
        Load/Unload Control

Manual Pulse Settings
Pulse Rate=          001sec
Pulse Width=         001sec
```

4.4.5.7 Sensors Override

Value of analog readings can be temporary override during sensor failure.

To override the analog readings, the operator must be authorized at technician level or higher.

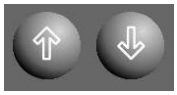
Press technician key to go to technician setpoints main menu and press enter key five times to move the cursor to the 'Sensors Override' sub-menu:


4.0 ELECTRICAL

The display is showing the data as follows:

Technician Setpoints
Main Menu
Comp FLA Calibration
Sensor Calibration
Manual Control
Compressor Control
Sensors Override

Use up or down arrow key to move the cursor to the desired analog reading,

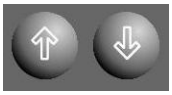


The display is showing the data as follows:

Sensors Manual
Override

Supply Water Temp
Man Reading = 45.0 °F [7.2°C]
Manual Override = NO

Press enter key to move the cursor to the "Man Reading" and use the up or down arrow key to change the value of the analog reading, press enter key move the cursor to the "Manual Override" to enable, or disable the manual override control.



Repeat the above steps for other sensors override.

Caution: Sensors override require continuous monitoring and observation by the field service personnel at all time during the unit operation. Faulty sensor shall be replaced as soon as possible in order to allow the unit to be running in automatic mode.

4.4.6 CONTROL FUNCTIONS

4.4.6.1 Chilled Water Pump Interlock And Flow Switch (CWP And CWFS)

These are field installed switches, both of which are used to ensure chilled water flow before the unit is allowed to start. Failure of either one during operation will cause the compressor to shut down.

A water flow alarm will be generated and 'Rest Alarm' must be pressed to clear the alarm.

4.4.6.2 Customer Control Interlock

Control contacts from an external controller can be used to enable or disable operation of the unit. The wiring diagram specifies the terminals to which the contacts must be wired. To enable the unit, the contacts must be closed. To disable the unit, the contacts must be opened.

4.4.6.3 Anti-Recycle Timer

The compressor motor requires an anti-recycle time delay which prevents restart for 15 minutes after a start. The purpose of this feature is to avoid frequent starts which tend to elevate the motor winding temperature and impose undue wear on contactors. The controller will not restart the compressor motor until the 15 minutes have elapsed.

4.4.6.4 On Delay Timer

A Compressor on delay timer of one or two minutes is incorporated to prevent two compressors from starting at the same time and ensures that the system load requires another compressor. The compressor output status will display the timer count-down during this timing.

4.4.6.5 Load Control

The controller controls the leaving water temperature within a narrow deadband by pulsing load and/ or unload solenoids on the compressor. The load and unload solenoids position the slide valve within the compressor to control its capacity. The controller determines a desired level of loading and varies pulse duration depending on difference between load target and actual load. The load target is varied based on rate of approach to desired temperature preventing significant temperature oscillations. The status of the compressor can be observed by displaying the compressor control point.

4.4.6.6 Ramp Control

Another feature of the controller is ramp control, which is the ability to vary load time of the machine from start. Often when the machine is started, the water in the chilled water circuit is warm, and the unit will go to full load quickly. With ramp control, the user can program the computer so that it loads at a predetermined rate. This is a valuable tool, since it can help reduce power consumption and demand charges. Two variables are

used to define the ramp profile: Ramp rate and start point. Ramp rate defines the length of time the unit takes to load from start point to full load. Start point is the percent of full load at which the ramp begins. The ramp rate A setpoint can be set anywhere from 0.1 to 1.0, smaller values producing slower loading rates. The ramp start B setpoint can be set anywhere between 0 and 50%. The compressor will load quickly to this value and then follow the ramp slope from there. See Table 4.4.6.6 for ramp rates at various settings.

TABLE 4.4.6.6 Ramp Rates for Several Setpoints (In Minutes)

Ramp Rate Setpoint	1 Comp. Start Point Setpoint			2 Comp. Start Point Setpoint		
	30%	50%	75%	30%	50%	75%
0.1	12.0	9.0	4.5	22.0	18.5	14.0
0.2	6.0	5.0	2.0	11.5	10.0	8.0
0.3	4.0	3.0	1.5	8.0	7.0	5.5
0.4	3.0	2.5	1.0	6.5	5.5	4.5

Ramp Rate Setpoint	3 Comp Start Point Setpoint			4 Comp Start Point Setpoint		
	30%	50%	75%	30%	50%	75%
0.1	29.0	25.5	21.0	33.0	29.0	25.0
0.2	16.0	14.0	12.0	18.0	16.0	14.0
0.3	11.0	10.0	9.0	13.0	12.0	11.0
0.4	9.0	8.0	7.0	11.0	10.0	9.0

4.4.6.7 Staging Control

On multiple-compressor machines, when the controller determines that a compressor is fully loaded and temperature is not being maintained, another compressor is added. When unloading, a compressor is taken off line when the computer determines that the remaining compressors can control water temperature.

4.4.6.8 Modmotor Setback Control

A computer contact and a resistor are wired in parallel in the modmotor control circuit. The contact is controller controlled to open under light load conditions. This lowers liquid level slightly, preventing excessive liquid level in the evaporator.

4.4.6.9 Sump Heater Control

Each compressor is fitted with an oil sump band-heater. The heater is energized at all times when compressor is off and de-energized when the compressor is running.

Its purpose is to prevent refrigerant migration into the oil during shut down. For this reason, it is essential that heaters be energized for 24 hours before starting a compressor.

4.4.6.10 Suction/ Discharge Pressure Differential Control (SDD Control)

This control function seeks to prevent a low differential pressure alarm. It monitors the difference between condenser and evaporator pressure. If this difference is less than 25 psid [1.7BAR] for more than 10 seconds, and evaporator pressure is above 39 psig [2.7BAR], the controller will open a set of contacts in the modmotor circuit, causing valves to travel in the closed direction. This starves the evaporator, which increases pressure difference. When this difference exceeds 25 psid [1.7BAR], modmotor control returns to normal.

CAUTION: Do not start compressor manually more than once every 15 minutes. Verify that chilled water flow switch is closed.

4.4.6.11 Evaporator Freeze Shutoff

If the leaving chilled water temperature drops below the freeze setpoint, the controller will shut down the unit and store the freeze alarm. After solving the problem, press ‘Reset Alarm’ on the controller to clear the alarm.

4.4.6.12 Low Pressure Cut-off

This function protects the unit from operating at abnormally low evaporator refrigerant pressure. The controller will shut down the compressor when evaporator pressure falls below the low pressure setpoint and turn on the alarm pilot light.

A low pressure alarm will be recorded by the controller. Reset by pressing the ‘Reset Alarm’ button on the controller. Standard setpoint is 28 psig [1.9BAR].

4.4.6.13 High Pressure Cut-off

This function protects the compressor from operating at abnormally high discharge refrigerant pressures. The controller will shut down the compressor when condenser pressure reaches the high pressure set point, and turn on the alarm indicator lamp on the control box. The high discharge pressure alarm will be recorded by the controller. Reset by pressing the ‘Reset Alarm’ button on the controller. Standard setpoint is 270psig[18.6BAR].

4.0 ELECTRICAL

4.4.6.14 Optical Oil Level Sensor (LS)

An optical oil level sensor is located in each compressor. If low oil indication (digital input is OFF) persists for 60 seconds during compressor operation, the controller will then shut down the compressor. The status of the oil level sensor can be seen on the computer display.

Failure is indicated on the alarm pilot light. The low oil alarm will be recorded by the computer.

4.4.6.15 High Oil Temperature Thermostat (12TAS)

A thermostat is located in each compressor which will open the compressor run circuit if oil temperature exceeds 203°F [95°C]. The high oil temperature pilot light will indicate an excessive oil temperature and a No-Run error will be recorded by the computer. Reset is activated by pressing the 'Reset Alarm' button on controller.

4.4.6.16 Overload Protector (M2OL)

A solid state overload protects each compressor by three phase current monitoring to prevent high current draw. The trip setting is factory set and is reset by pressing button on overload after correcting problem. The 'Reset Alarm' button on controller must also be pressed to clear the alarm. A no-run error is stored in the controller.

4.4.6.17 Phase Control Relay (PCR)

The PCR protects the unit from the following electric supply malfunctions: Undervoltage, phase reversal and single phasing. If the PCR trips, a control relay (lCR) will de-energize and open the control circuit. A green LED indicates presence of power supply. The yellow LED indicates a good voltage supply. The power loss setpoint is factory set to AUTO to allow automatic start after PCR failure. Compressor will not start for 15 minutes after failure. To select manual reset, set power loss setpoint to MANUAL. In this case, a power loss alarm will be stored by the controller and 'Reset Alarm' must be pressed to start.

4.4.6.18 Sensor Alarm

If the computer measures an analog value (temperature, pressure.) that is far beyond normal operating values, the associated compressors are shutdown. The computer then stores the alarm code corresponding to the sensor alarm. A sensor alarm indicates a problem in the analog measurement system.

4.4.6.19 No-Stop Alarm

If the controller turns off a compressor, but the compressor digital input does not turn off, a No-Stop alarm is generated. The computer will turn off the control power relay which disables all compressor control circuits and will turn on the alarm light. This alarm indicates a wiring or hardware error.

4.4.6.20 Low Differential Pressure Alarm

For proper lubrication, a compressor requires a 25 psid [1.7BAR] differential pressure between condenser and evaporator pressures. If the differential pressure is less than 25 psid [1.7BAR] for 3 minutes while a compressor is operating, all compressors will be shut down. The controller will store the low differential pressure alarm code and turn on the alarm light. The 'Reset Alarm' key must be pressed to clear the alarm.

4.5 CONDENSER FAN CONTROL LOGIC

If the differential pressure is less, the controller provides two types of control logic for air-cooled condensers. The type of control will be governed by the physical condenser layout of the unit. Each method of control is enhanced with adaptive, self-learning, fan control logic. The end result is condenser control that offers significantly reduced fan cycling and improved efficiency. The two types of air-cooled condenser control logic are explained as follows:

1. Adaptive Individual Air-cooled Condenser Control

   This type of control is based upon a single compressor per circuit. The individual discharge pressure on that circuit will be the controlling pressure.

2. Adaptive Air Combined Air-cooled Condenser Control

   This type of control is based upon a condenser that is controlled by the highest discharge pressure from any one of the compressors sharing that circuit (compressor 1&2 - share; compressor 3&4 - share). The highest discharge pressure between the sharing compressors will be the controlling pressure.

4.0 ELECTRICAL

4.5.1 Air Cooled Condenser Control Setpoints

The air-cooled condenser setpoints are as follows:

Setpoint COND Stage 1 ON-	Condenser stage 1 on.
Setpoint COND Stage 2 OFF-	Condenser stage 2 off.
Setpoint COND DIFF ON-	Differential pressure for additional condenser stages.
Setpoint COND DIFF OFF-	Differential pressure for subtracting condenser stages.

A compressor must be operating for the condenser fans to operate. The condenser points (i.e. fans) will turn on based upon the value in setpoint COND Stage 1 ON. When the discharge pressure exceeds this value, the first condenser point is turned on. If additional condenser points exist, they will be turned on when the pressure exceeds the previous cut in value (COND Stage 1 ON for the first stage) plus the value contained in COND DIFF ON setpoint.

Condenser points (i.e. fans) will be turned off based upon the value in the setpoint COND ST2 OFF (COND Stage 2 turn OFF point). As the discharge pressure is reduced, the condenser points will be turned off based upon the COND ST2 OFF setpoint, plus the value in the COND DIFF OFF setpoint for each stage number above stage 2. Stage 2 of condenser staging will be turned off based upon the value in the setpoint (COND ST2 OFF). See below for an example of condenser staging.

4.5.2 Increasing Condenser Pressure (Example of 4 stage fan cycling)

COND FAN1 ON when discharge pressure is > 140psig [9.7BAR] (COND Stage 1 ON setpoint)

COND FAN2 ON when discharge pressure is > 156psig [10.8BAR] (COND Stage 1 ON plus 1xCOND DIFF ON setpoint values)

COND FAN3 ON when discharge pressure is > 172psig [11.9BAR] (COND Stage 1 ON plus 2xCOND DIFF ON setpoint values)

COND FAN4 ON when discharge pressure is > 188psig [13.0BAR] (COND Stage 1 ON plus 3xCOND DIFF ON setpoint values)

And so on for the number of condenser fans supplying the circuit.

4.5.3 Decreasing Condenser Pressure (4 fan example "continued")

COND FAN4 OFF when discharge pressure is < 124psig [8.5BAR] (COND Stage 2 OFF plus 2xCOND DIFF OFF setpoint values)

COND FAN3 OFF when discharge pressure is < 118psig [8.1BAR] (COND Stage 2 OFF plus 1xCOND DIFF OFF setpoint values)

COND FAN2 OFF when discharge pressure is < 112psig [7.7BAR] (COND Stage 2 OFF setpoint value)

COND FAN1 OFF when discharge pressure is < 105psig [7.2BAR] (COND Stage 1 OFF setpoint value)

4.5.3.1 Adaptive Control Logic

The controller enhances the condenser control logic above with a unique, adaptive, self-learning fan control logic. These enhancement results in a control scheme that offers reduced fan cycling and improved efficiency. Adaptive Control Logic automatically adjusts the fan cut-in offset based upon the following criteria:

1. If the last fan turned on (including FAN 1) is cycled off in 10 minutes or less, then a COND ON OFFSET value will be incremented by 5 psig [0.3 BAR]. This increases the fan 1 turn on value (COND ST1 ON plus COND ON OFFSET) which in turn increases all of the fan turn on settings. This process will continue until fan cycling ceases or the adjusted turn on point for the last fan stage is 217 psig [15.0BAR]. This will also be a setpoint.
2. The cut-in offset (COND ON OFFSET) will be decreased by 5 psig [0.3 BAR] if the last fan to be turned on has not cycled off within 1 hour. The offset will continue to decrease by 5 psig [0.3 BAR] every 10 minutes unless fan cycling begins again.

The Adaptive Control Logic will only affect the condenser fan turn on logic, it will not affect the fan turn off logic.

4.6 MASTER/ SLAVE CONTROL SEQUENCE

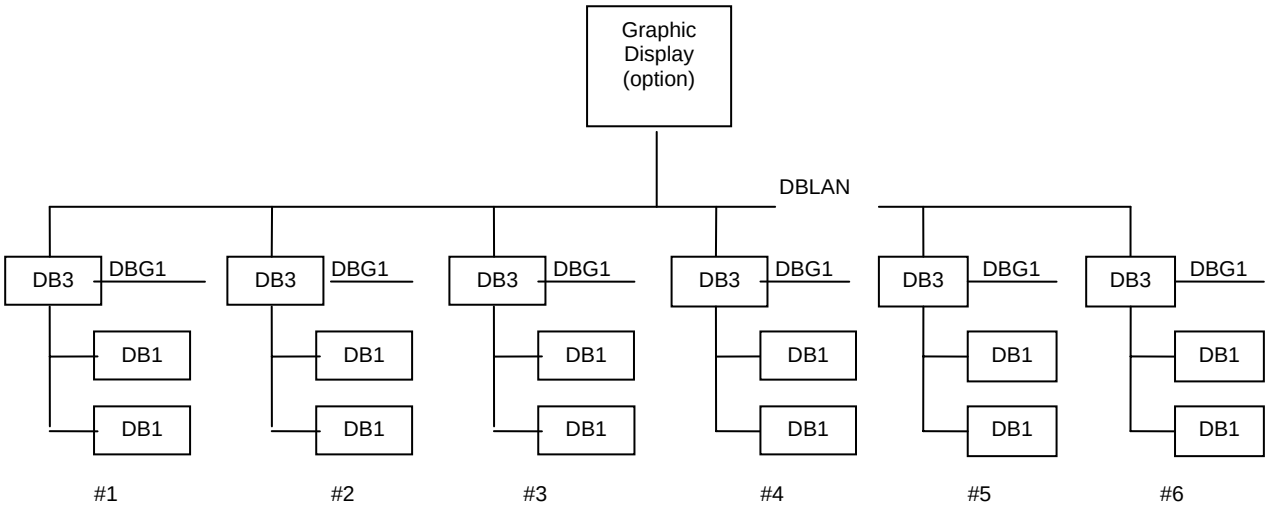
The optional master/slave control sequence is used to sequence multiple chillers in one installation according to the building load demand. It also controls the dedicated chilled water pump or motorized valve.

Vision 2020i Controller offers this feature with minimized field wiring cost compare to conventional method that involves lots of hardware cost. It is carried out this control function via the advanced DBLAN communication bus to implement the network management for multiple chillers lead/lag communication, sequencing and monitoring.

4.0 ELECTRICAL

4.6.1 Sensor Principle of Operation via DBLAN communication bus

Example: 6 chillers network with 4 units on duty and 2 units standby



Notes

a) Each chiller has a stand-alone master DB3 board and dedicated graphic display with multiple DB1 expanders board connected to J23 on DB3

b) Each chiller DB3 will be connected to DBLAN network through J11 connector

c) The chiller lead/lag selection can be determined by

- Manual lead/lag setpoint
- Schedule and holiday setup
- Alarm conditions

d) The lead/lag selection determine the chiller operation sequence as follows,

Lead chiller selection	Normal chillers operation sequence	When DBLAN fails
1	1, 2 & 3 on duty, 4, 5 & 6 standby	1, 2 & 3 on duty
2	2, 3 & 4 on duty, 5, 6 & 1 standby	2, 3 & 4 on duty
3	3, 4 & 5 on duty, 6, 1 & 2 standby	3, 4 & 5 on duty
4	4, 5 & 6 on duty, 1, 2 & 3 standby	4, 5 & 6 on duty
5	5, 6 & 1 on duty, 2, 3 & 4 standby	5, 6 & 1 on duty
6	6, 1 & 2 on duty, 3, 4 & 5 standby	6, 1 & 2 on duty

e) If the lead/lag selection is changed over to a different chiller, the sequence of operation will be rotated

f) Each chiller will use a network address setpoint to determine individual chiller network address

g) Each chiller will require a dedicated chilled water pump or motorized valve digital output, unit enable and chilled flow status digital inputs as well as enable next output command.

4.6.2 Sequence Of Operation

1. When the customer enable input is ‘on’ to start the lead unit, the chilled water pump starter or motorized valve control point will close and water will start to flow through the evaporator, this will activate the flow switch. The flow switch and water pump status are interlocked and feedback as digital input to the chiller and upon receipt of a valid 'on' signal, the lead chiller will begin to execute its running program.
2. The controller will start and load the compressor(s), upon achieving full load; it will send an output signal via the DBLAN to enable second unit (lag 1)
3. The second unit will now command its chilled water pump to start if the customer unit enable is activated. The second chiller will start and load the compressor(s) until it reaches full load
4. When the second chiller or lag 1 unit reaches full load, it will enable the third chiller.
5. The chiller will keep cascading until all chillers on duty are at full load.
6. If the leaving water temperature falls below setpoint, all of the chillers will begin to unload evenly.
7. If the load drops below 45% total capacity, delay the last unit (lag 3) will be disabled, and the remaining three units will load up to compensate if necessary. The pump for chiller 4 will be shut off.
8. As the load demand falls, the lag 2 unit will be disabled below 45% total capacity, and so on until the load falls enough to shut off the lead chiller.
9. Each unit in the network can monitor the operation of other units via DBLAN. If the master unit is having critical alarm, the lag 1 will take over as the master unit automatically.
10. In order to enable next unit, the following conditions must met
    a) LWT ≥ (LWT Setpoint + Enable Next deadband)
    b) After a enable next time delay of 3 minutes (adjustable) and
    c) When the lead unit’s packaged capacity is higher than “Next on setpoint”,

for example, WCFX2, %FLCP C1 & %FLCP C2 ≥ Next on setpoint or it is being lockout by an alarm.

4.7 VISION 2020i LOCAL AREA NETWORK (DBLAN)

A DBLAN network is made up of several chillers’ controller. Each unit’s controller can be programmed and connected to the local DBLAN network that allows multiple units sequencing control without additional hardware.

Every DBLAN node must be addressed to be identified by the other nodes. Each address (an integer number) must be unique in the network for avoiding messages mismatch: in case two or more nodes have the same identifying address the network cannot work.

The max address number selectable is in the 1-16 for the Vision 2020i controller boards and 17-32 range for the Vision 2020i User terminal.

The three chiller unit combinations:

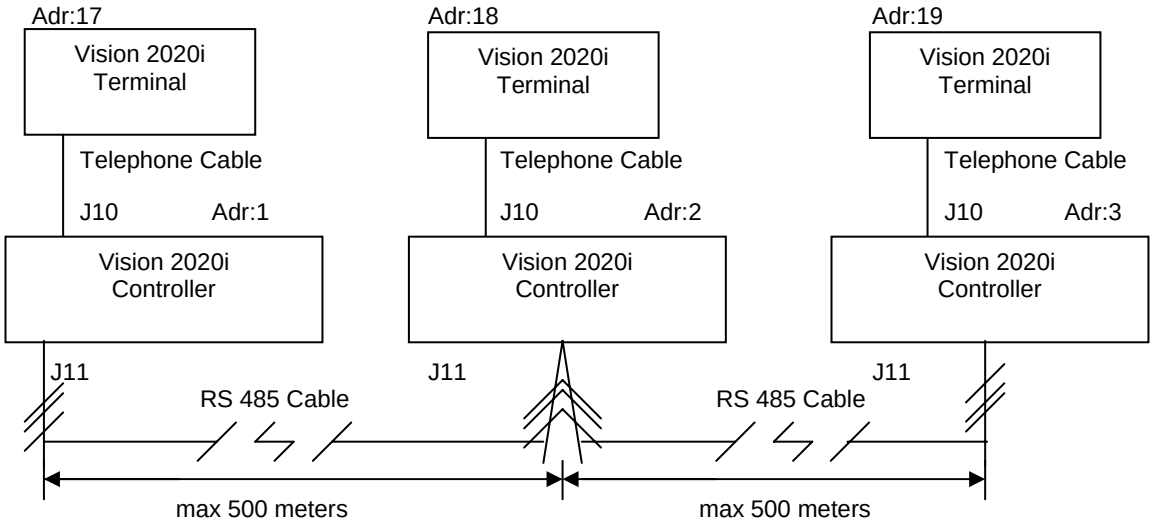
Controller with address of 1 connect to Terminal with address of 17

Controller with address of 2 connect to Terminal with address of 18

Controller with address of 3 connect to Terminal with address of 19

Follow the following steps:

4.8 NETWORK CONNECTION DIAGRAM

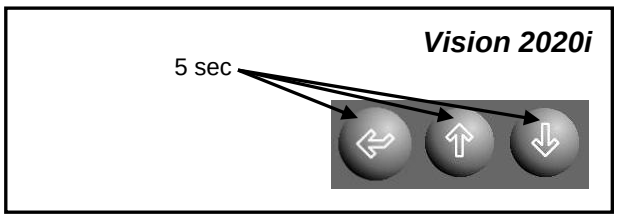


The 6 core telephone cables (to J10 socket) are supply by the manufacturer.
The 3 core RS 485 data cables (to J11 socket) are supply by the customer.
Pay attention to the network polarity:
RX+/TX+ on one controller must be connected to RX+/TX+ on the other controller; the same is true for RX-/TX- and GND.

4.9 HARDWARE SETTINGS

4.9.1 Addressing the Vision 2020i controller

At the Vision 2020i terminal, push simultaneously the last three keys on the lower right corner of the Vision 2020i terminal keyboard. Push them for at least 5 seconds.



This display will appear:

```
Display address
Setting…….      :   17

I/O Board address:      01
```

Change the display address setting to 0 as follow.

```
Display address
Setting…….      :   0
```

Turn off DB3 controller.

At the Vision 2020i DBG1 terminal, hold simultaneously the “Alarm” key and “Up arrow” key, turn on DB3 controller and hold these keys until “Self Test” mask is appeared.


```
************************************
SELF TEST
PLEASE WAIT
************************************
```

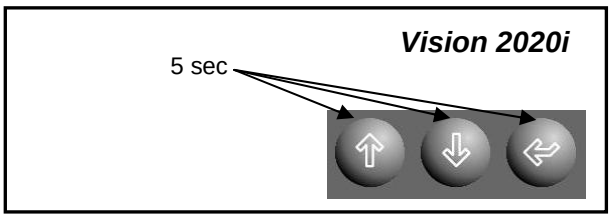
The following mask will appear. Set pLAN address to 1 (or accordingly) using “Up” and “Down” arrow key. Press “Enter” key to save and exit.

```
PLAN Address :  1
Up : Increase
Down : Decrease
Enter : Save & Exit
```

The terminal display will become blank after “Enter” key is pressed. Please proceed to next section on Addressing the Vision 2020i DBG1 Terminal.

4.9.2 Addressing the Vision 2020i DBG1 terminal

At the Vision 2020i DBG1 terminal, hold simultaneously the last three keys on the lower right corner of the Vision 2020i terminal keyboard. Hold them for at least 5 seconds.



The display will appears:

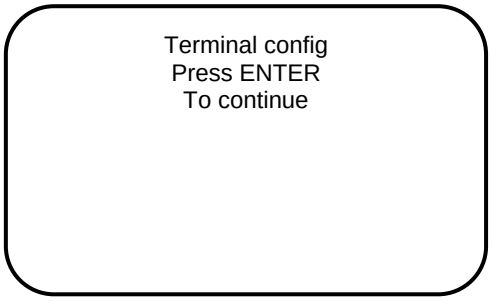
```
Display address
Setting…….      :   17

I/o Board address:      01
```

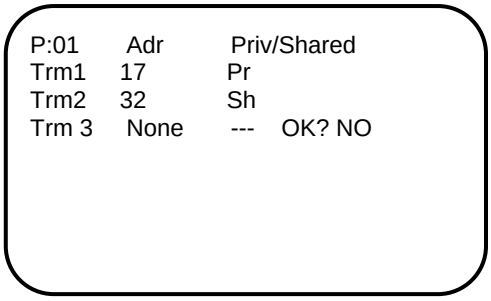
4.0 ELECTRICAL

The first line is the address of the terminal display that you are using, (for first chiller, it is 17). The next line allows you to select the Vision 2020i controller address (for first chiller, it is 01) that you want to configure. Once you select the address then press 'enter' button

The display will appears:

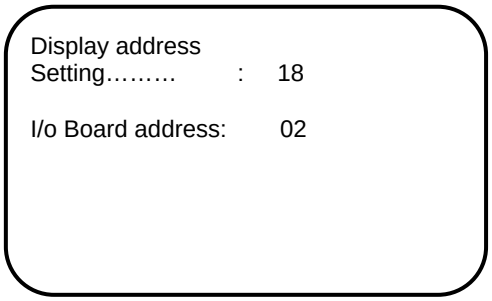


Push 'enter' to continue.
Then the display appears:

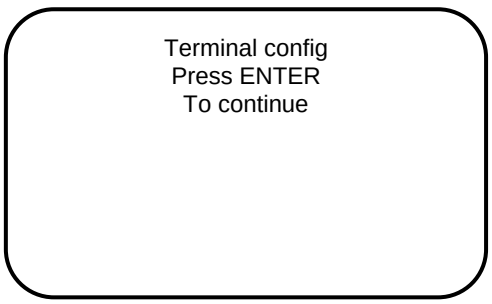


Set **Trm1**, **Trm2** and **Trm3** to '**17 Pr'**,'**32 Sh**' and '**None ---**', change the '**NO**' to '**YES**'(to confirm and save) and press 'enter'.
Note: Pr = Private, Sh = Share.

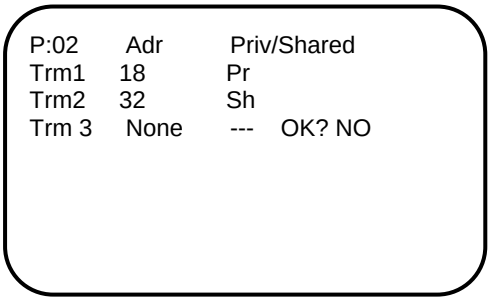
For multiple units with master-slave sequencing control features, at the second chiller unit Vision 2020i terminal; repeat step 1 by holding the three keys again. The display will appears:



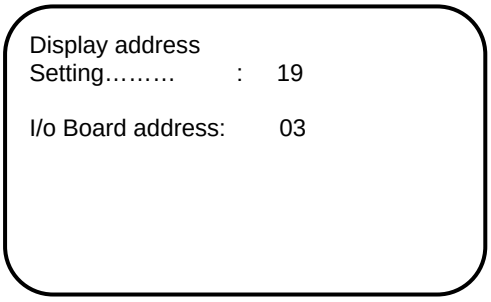
The address display (18) is the correct setup for the second chiller unit with the controller address of two (P:02).Press 'enter' to confirm the settings and the display will appears:



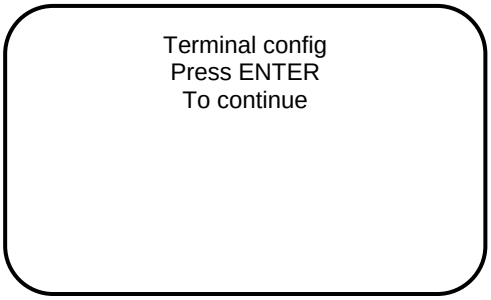
Set **Trm1**, **Trm2** and **Trm3** to '**18 Pr'**,'**32 Sh**' and '**None ---**', change the '**NO**' to '**YES**'(to confirm and save) and press enter.



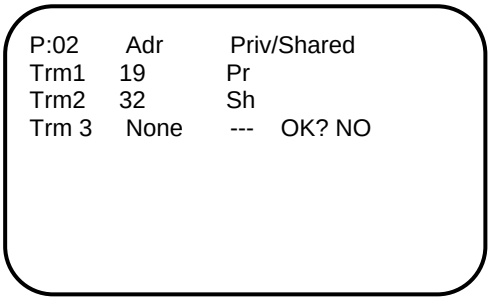
At the third chiller unit Vision 2020i terminal:
Press the three keys again, the display will appears:



The address display (19) is the correct setup for the third chiller unit with the controller address of three(P:03).Press 'enter' to confirm the setting and the display will appears:



Set **Trm1**, **Trm2** and **Trm3** to '**19 Pr'**,'**32 Sh**' and '**None ---**', change the '**NO**' to '**YES**'(to confirm and save) and press enter.



With the above settings, terminal with address 17 will only work with the controller with address 1, terminal 18 will only work with the controller with address 2, terminal 19 will only work with the controller with address 3 and a terminal with address 32 will work with both.

4.0 ELECTRICAL

4.9.3 Vision 2020i Controller LED Status

Vision 2020i controller have three LEDs between the J3 and J4 connectors for indicating basic node status. They are Red, Yellow and Green coloured.

Red Yellow Green

At the start-up all LEDs are ON and after few seconds OFF again. After 5 – 15 seconds elapse, then LED configuration is among those listed below.

Table 4.9.3 LED Status

LED	STATUS	DESCRIPTION
GREEN	ON	Vision 2020i controller is synchronized with all the other DBLAN nodes. The node is working correctly.
	OFF	Vision 2020i controller is not network connected or it doesn't receive any signal from the DBLAN
YELLOW	BLINKING	Vision 2020i controller is transmitting data to other network nodes.
	OFF	Vision 2020i controller is not transmitting messages.
RED	OFF	No hardware and software problem.
	ON	Vision 2020i controller software not compatible or variables database not correct, contact Dunham-Bush Service Personnel.
	BLINKING	Vision 2020i hardware is not compatible - Ram is smaller than 32 KB. The Vision 2020i controller is just for working in stand-alone mode.

5.0 MAINTENANCE

5.1 GENERAL

As with all mechanical equipment, a program of regular inspection, cleaning and preventive maintenance by trained personnel will contribute greatly to the long satisfactory service life of this product.

5.2 PERIODIC INSPECTION

Read essential temperatures and pressures periodically to see that they indicate normal operation. It is a good idea to record these readings on a log sheet. If any abnormal operation is observed, try to remedy it. See Trouble Shooting Guide Section.

5.3 MONTHLY INSPECTION

Remote dirt and debris from condenser coil. Shut unit down, open main disconnect, inspect control panel, checking for loose wires, burned contacts, signs of overheated wires, etc. Restart unit and check performance of controls. Check sight glasses for proper refrigerant charge, see charging.

5.4 VESSEL MAINTENANCE

5.4.1 GENERAL

The efficient performance of the evaporator and condenser heat transfer surfaces is essential for efficient performance of your packaged water cooling machine. If these surfaces accumulate a film of dirt, scale or slime, their performance efficiency will degrade substantially. The refrigerant side of heat transfer surfaces does not foul since refrigerant is a good solvent and it is in a closed, filtered cycle. Water side surfaces can foul from the water system. A program of water treatment can slow the rate of fouling on heat transfer surfaces, but not eliminate it.

5.4.2 WATER SIDE CLEANING OF EVAPORATOR

The effects of fouling of the evaporator heat transfer surfaces can be detected by recording full load performance data on the log sheet. The best measure of performance of evaporator is approach, which is the difference between leaving water temperature and saturated refrigerant temperature at the pressure in the vessel. At full load, read evaporator pressure and leaving chilled water temperature on the computer. Then use Table 5.4.2 to find saturated temp. in evaporator. Then calculate approaches as follows:

Evaporator Approach = T lvg chilled water - T sat evaporator

If the approach increases by more than 2°F [1.1°C] above the approach recorded at clean conditions, the tubes should be cleaned. It is generally advisable to clean the water side surfaces at least annually and more often if severely foul water is used. In chemical cleaning, a caustic solution is pumped through the heat exchanger, which attacks dirt, slime and mineral deposits and flushes then away. Chemicals can be recommended by water treatment specialists, but it is important to rinse the system thoroughly after cleaning to remove the chemicals before they attack the metal surfaces.

5.5 AIR COOLED CONDENSER CLEANING

The face of the condenser should be cleaned at least once month during operation. If conditions are bad and condensers pick up dirt very quickly, it is suggested that they can be cleaned more frequently. If the condenser is allowed to get too dirty, the unit will run at high head pressure and will not give satisfactory performance.

Dirty coils can be cleaned using a soft brush or by flushing with cool water or commercially available coil cleaners. DO NOT USE HOT WATER OR STEAM. To do so will cause excessive pressure in the system. The face of the condenser should be cleaned at the beginning of the season and periodically thereafter if conditions require.

5.6 ELECTRICAL MALFUNCTION

The unit has four devices designed to protect compressor motors and manual motor controllers from electrical malfunctions: Circuit breakers. starter overload relays, under voltage relay, and motor over temperature protectors (optional).

If the under voltage relay trips, it is a sign of trouble in incoming power. If it trips again after resetting, call your electric utility to investigate the problem. If circuit breaker or motor overload relay or motor over temperature protectors trip, this is a sign of possible motor trouble. DO NOT reset and try to run compressor again. Call authorized service representative to check for motor trouble. Resetting these safety devices and repeated starting could turn a minor motor problem into a costly major motor burnout.

5.7 REFRIGERANT CHARGE

All packaged chiller units are given a complete charge of refrigerant at the factory. The type and amount of refrigerant required is in Physical Specifications. The total refrigerant shown is for the entire system. Since these units have separate circuits, each circuit should be considered separately for charging.

In order to check proper refrigerant charge, look in each liquid line sight glass with the aid of a flashlight during system operation. At all operating conditions, the sight glass should be clear. If bubbles are visible at any operating condition, the circuit is short of charge.

Be careful not to overcharge the machine. overcharging will result in considerable liquid logging in the condenser, and excessive condensing pressure.

To add refrigerant, connect a refrigerant vessel to the 1/4"[6mm] back seating port of the suction valve. Purge the air from the tube with refrigerant gas before connecting. With the unit running, open the refrigerant vessel vapor connection slightly. If the refrigerant vessel is warmer than the cooler, refrigerant will more readily flow from the vessel into the unit.

5.0 MAINTENANCE

TABLE 5.4.2 R134a PRESSURE/TEMPERATURE PROPERTIES

PRESS		TEMP.		PRESS		TEMP.		PRESS		TEMP.		PRESS		TEMP.		PRESS		TEMP.	
PSIG	KPA	°F	°C	PSIG	KPA	°F	°C	PSIG	KPA	°F	°C	PSIG	KPA	°F	°C	PSIG	KPA	°F	°C
0.00	101.38	-14.70	-25.94	53.00	466.90	56.90	13.83	106.00	832.41	90.90	32.72	159.00	1197.93	115.00	46.11	212.00	1563.45	134.10	56.72
1.00	108.28	-12.00	-24.44	54.00	473.79	57.70	14.28	107.00	839.31	91.50	33.06	160.00	1204.83	115.40	46.33	213.00	1570.34	134.40	56.89
2.00	115.17	-9.50	-23.06	55.00	480.69	58.50	14.72	108.00	846.21	92.00	33.33	161.00	1211.72	115.80	46.56	214.00	1577.24	134.70	57.06
3.00	122.07	-7.10	-21.72	56.00	487.59	59.30	15.17	109.00	853.10	92.50	33.61	162.00	1218.62	116.20	46.78	215.00	1584.14	135.10	57.28
4.00	128.97	-4.80	-20.44	57.00	494.48	60.10	15.61	110.00	860.00	93.00	33.89	163.00	1225.52	116.60	47.00	216.00	1591.03	135.40	57.44
5.00	135.86	-2.60	-19.22	58.00	501.38	60.90	16.06	111.00	866.90	93.50	34.17	164.00	1232.41	117.00	47.22	217.00	1597.93	135.70	57.61
6.00	142.76	-0.50	-18.06	59.00	508.28	61.60	16.44	112.00	873.79	94.00	34.44	165.00	1239.31	117.40	47.44	218.00	1604.83	136.00	57.78
7.00	149.66	1.50	-16.94	60.00	515.17	62.40	16.89	113.00	880.69	94.50	34.72	166.00	1246.21	117.70	47.61	219.00	1611.72	136.40	58.00
8.00	156.55	3.50	-15.83	61.00	522.07	63.10	17.28	114.00	887.59	95.00	35.00	167.00	1253.10	118.10	47.83	220.00	1618.62	136.70	58.17
9.00	163.45	5.30	-14.83	62.00	528.97	63.90	17.72	115.00	894.48	95.50	35.28	168.00	1260.00	118.50	48.06	221.00	1625.52	137.00	58.33
10.00	170.34	7.20	-13.78	63.00	535.86	64.60	18.11	116.00	901.38	96.00	35.56	169.00	1266.90	118.90	48.28	222.00	1632.41	137.30	58.50
11.00	177.24	8.90	-12.83	64.00	542.76	65.30	18.50	117.00	908.28	96.50	35.83	170.00	1273.79	119.30	48.50	223.00	1639.31	137.60	58.67
12.00	184.14	10.60	-11.89	65.00	549.66	66.00	18.89	118.00	915.17	97.00	36.11	171.00	1280.69	119.70	48.72	224.00	1646.21	138.00	58.89
13.00	191.03	12.30	-10.94	66.00	556.55	66.80	19.33	119.00	922.07	97.50	36.39	172.00	1287.59	120.00	48.89	225.00	1653.10	138.30	59.06
14.00	197.93	13.90	-10.06	67.00	563.45	67.50	19.72	120.00	928.97	98.00	36.67	173.00	1294.48	120.40	49.11	226.00	1660.00	138.60	59.22
15.00	204.83	15.50	-9.17	68.00	570.34	68.20	20.11	121.00	935.86	98.40	36.89	174.00	1301.38	120.80	49.33	227.00	1666.90	138.90	59.39
16.00	211.72	17.00	-8.33	69.00	577.24	68.90	20.50	122.00	942.76	98.90	37.17	175.00	1308.28	121.20	49.56	228.00	1673.79	139.20	59.56
17.00	218.62	17.50	-8.06	70.00	584.14	69.50	20.83	123.00	949.66	99.40	37.44	176.00	1315.17	121.50	49.72	229.00	1680.69	139.50	59.72
18.00	225.52	20.00	-6.67	71.00	591.03	70.20	21.22	124.00	956.55	99.90	37.72	177.00	1322.07	121.90	49.94	230.00	1687.59	139.80	59.89
19.00	232.41	21.40	-5.89	72.00	597.93	70.90	21.61	125.00	963.45	100.30	37.94	178.00	1328.97	122.30	50.17	231.00	1694.48	140.10	60.06
20.00	239.31	22.80	-5.11	73.00	604.83	71.60	22.00	126.00	970.34	100.80	38.22	179.00	1335.86	122.60	50.33	232.00	1701.38	140.40	60.22
21.00	246.21	24.10	-4.39	74.00	611.72	72.20	22.33	127.00	977.24	101.30	38.50	180.00	1342.76	123.00	50.56	233.00	1708.28	140.80	60.44
22.00	253.10	25.40	-3.67	75.00	618.62	72.90	22.72	128.00	984.14	101.70	38.72	181.00	1349.66	123.40	50.78	234.00	1715.17	141.10	60.61
23.00	260.00	26.70	-2.94	76.00	625.52	73.50	23.06	129.00	991.03	102.20	39.00	182.00	1356.55	123.70	50.94	235.00	1722.07	141.40	60.78
24.00	266.90	28.00	-2.22	77.00	632.41	74.20	23.44	130.00	997.93	102.70	39.28	183.00	1363.45	124.10	51.17	236.00	1728.97	141.70	60.94
25.00	273.79	29.20	-1.56	78.00	639.31	74.80	23.78	131.00	1004.83	103.10	39.50	184.00	1370.34	124.50	51.39	237.00	1735.86	142.00	61.11
26.00	280.69	30.50	-0.83	79.00	646.21	75.50	24.17	132.00	1011.72	103.60	39.78	185.00	1377.24	124.80	51.56	238.00	1742.76	142.30	61.28
27.00	287.59	31.70	-0.17	80.00	653.10	76.10	24.50	133.00	1018.62	104.00	40.00	186.00	1384.14	125.20	51.78	239.00	1749.66	142.60	61.44
28.00	294.48	32.80	0.44	81.00	660.00	76.70	24.83	134.00	1025.52	104.50	40.28	187.00	1391.03	125.50	51.94	240.00	1756.55	142.90	61.61
29.00	301.38	34.00	1.11	82.00	666.90	77.30	25.17	135.00	1032.41	104.90	40.50	188.00	1397.93	125.90	52.17	241.00	1763.45	143.20	61.78
30.00	308.28	35.10	1.72	83.00	673.79	78.00	25.56	136.00	1039.31	105.30	40.72	189.00	1404.83	126.30	52.39	242.00	1770.34	143.50	61.94
31.00	315.17	36.20	2.33	84.00	680.69	78.60	25.89	137.00	1046.21	105.80	41.00	190.00	1411.72	126.60	52.56	243.00	1777.24	143.80	62.11
32.00	322.07	37.30	2.94	85.00	687.59	79.20	26.22	138.00	1053.10	106.20	41.22	191.00	1418.62	127.00	52.78	244.00	1784.14	144.10	62.28
33.00	328.97	38.40	3.56	86.00	694.48	79.80	26.56	139.00	1060.00	106.70	41.50	192.00	1425.52	127.30	52.94	245.00	1791.03	144.40	62.44
34.00	335.86	39.50	4.17	87.00	701.38	80.40	26.89	140.00	1066.90	107.10	41.72	193.00	1432.41	127.70	53.17	246.00	1797.93	144.70	62.61
35.00	342.76	40.50	4.72	88.00	708.28	81.00	27.22	141.00	1073.79	107.50	41.94	194.00	1439.31	128.00	53.33	247.00	1804.83	145.00	62.78
36.00	349.66	41.50	5.28	89.00	715.17	81.50	27.50	142.00	1080.69	108.00	42.22	195.00	1446.21	128.40	53.56	248.00	1811.72	145.30	62.94
37.00	356.55	42.50	5.83	90.00	722.07	82.10	27.83	143.00	1087.59	108.40	42.44	196.00	1453.10	128.70	53.72	249.00	1818.62	145.60	63.11
38.00	363.45	43.50	6.39	91.00	728.97	82.70	28.17	144.00	1094.48	108.80	42.67	197.00	1460.00	129.10	53.94	250.00	1825.52	145.90	63.28
39.00	370.34	44.50	6.94	92.00	735.86	83.30	28.50	145.00	1101.38	109.20	42.89	198.00	1466.90	129.40	54.11	251.00	1832.41	145.20	62.89
40.00	377.24	45.50	7.50	93.00	742.76	83.90	28.83	146.00	1108.28	109.70	43.17	199.00	1473.79	129.70	54.28	252.00	1839.31	146.40	63.56
41.00	384.14	46.40	8.00	94.00	749.66	84.40	29.11	147.00	1115.17	110.10	43.39	200.00	1480.69	130.10	54.50	253.00	1846.21	146.70	63.72
42.00	391.03	47.40	8.56	95.00	756.55	85.00	29.44	148.00	1122.07	110.50	43.61	201.00	1487.59	130.40	54.67	254.00	1853.10	147.00	63.89
43.00	397.93	48.30	9.06	96.00	763.45	85.60	29.78	149.00	1128.97	110.90	43.83	202.00	1494.48	130.80	54.89	255.00	1860.00	147.30	64.06
44.00	404.83	49.20	9.56	97.00	770.34	86.10	30.06	150.00	1135.86	111.30	44.06	203.00	1501.38	131.10	55.06	256.00	1866.90	147.60	64.22
45.00	411.72	50.10	10.06	98.00	777.24	86.70	30.39	151.00	1142.76	111.80	44.33	204.00	1508.28	131.40	55.22	257.00	1873.79	147.90	64.39
46.00	418.62	51.00	10.56	99.00	784.14	87.20	30.67	152.00	1149.66	112.20	44.56	205.00	1515.17	131.80	55.44	258.00	1880.69	148.20	64.56
47.00	425.52	51.90	11.06	100.00	791.03	87.80	31.00	153.00	1156.55	112.60	44.78	206.00	1522.07	132.10	55.61	259.00	1887.59	148.50	64.72
48.00	432.41	52.70	11.50	101.00	797.93	88.30	31.28	154.00	1163.45	113.00	45.00	207.00	1528.97	132.40	55.78	260.00	1894.48	148.70	64.83
49.00	439.31	53.60	12.00	102.00	804.83	88.80	31.56	155.00	1170.34	113.40	45.22	208.00	1535.86	132.80	56.00	261.00	1901.38	149.00	65.00
50.00	446.21	54.40	12.44	103.00	811.72	89.40	31.89	156.00	1177.24	113.80	45.44	209.00	1542.76	133.10	56.17	262.00	1908.28	149.30	65.17
51.00	453.10	55.30	12.94	104.00	818.62	89.90	32.17	157.00	1184.14	114.20	45.67	210.00	1549.66	133.40	56.33	263.00	1915.17	149.60	65.33
52.00	460.00	56.10	13.39	105.00	825.52	90.40	32.44	158.00	1191.03	114.60	45.89	211.00	1556.55	133.80	56.56	264.00	1922.07	149.90	65.50

NOTE : PRESSURE AND TEMPERATURE ARE STATED IN PSIA(KPA) AND °F(°C) RESPECTIVELY.

5.0 MAINTENANCE

5.8 OIL CHARGE

The proper oil charge is in the unit as supplied from the factory. Any operating compressor should show oil return and oil overflow at all time. If for some reason, a compressor runs low on oil, a low oil level switch in the compressor will shut it down before any damage is done. In the event of a low oil shutdown, call a D/B authorized service agent to correct the problem. **DO NOT ADD OIL TO THE SYSTEM.**

Note: Only DB 09 oil may be used in this package. Use of other oil is not approved by Dunham-Bush, and will result in poor performance of the package. **It is recommended to change oil after the first year of operation. Oil analysis is required for the subsequent years to ensure the oil is within its characteristics limit.**

5.9 TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	REMEDY
1. Unit will not start.	a.) Power off. b.) No control power. c.) Compressor circuit breakers open. d.) Undervoltage relay open. e.) Flow Switch open. f.) Compressor switch open. g.) Controller shutdown not reset.	a.) Check main disconnect switch and main line fuses. b.) Check control transformer fusing. c.) Close circuit breakers. If trip, check compressor. d.) Check for power supply problems (low voltage, phase imbalance). When corrected, press reset button. e.) Start pumps, check flow switch. f.) Turn switch on. Check alarm status. Correct problem. g.) Press reset button.
2. Compressor hums but does not start.	a.) Low voltage. b.) No power on one phase of 3 phase unit. c.) Faulty starter or contactor.	a.) Check at main entrance and at unit. Consult power company if voltage is low and increase wire size to the unit if voltage is normal at main and low at unit. Voltage must be within 10% of motor nameplate rating. b.) Check fuses and wiring. c.) Check the contacts and time delay on part wind start.
3. Compressor will not start when reset button is pushed. Check light: None	a.) Cooling not required. b.) Computer's time delay active. c.) Undervoltage relay open. d.) Flow switch open. e.) Compressor switch open. f.) Burned out signal light. i.) Wiring problem	a.) Apply load. b.) Wait 15 minutes max. c.) See 1.(d.) above. d.) See 1.(e.) above. e.) See 1.(f.) above. f.) Check signal light bulbs. i.) Check wiring against drawing.
4. Compressor overload.	a.) Compressor drawing high amps.	a.) Check motor megohms. Reset overloads, run com- presssor an check amps. Do not exceed RL x 1.25. Call D/B serviceman.
5. High oil temperature	a.) Motor windings failing. b.) Insufficient motor cooling.	a.) Check megohms. b.) Open liquid injection valve slightly.
6. High motor temperature	a.) Motor windings failing.	a.) Check megohms. Reset by turning compressor switch off and then on.
7. Low suction	a.) Inadequate feed to cooler. b.) Inadequate refrigerant charge. c.) Fouling of water side of evaporator. d.) Inadequate chilled water flow. e.) Too much oil in system.	a.) Check to see that main expansion valve superheat. b.) See information on charging in Section 5.7. c.) At high load, check evaporator approach (See Section 5.4). If approach is more than 2°F [1.1°C] above clean valve, fouling is probably the trouble. Clean tube. d.) Measure pressure drop across vessel and determine flowrate from Figure 3.3. If flowrate is low, check chilled water pump, valves and strainers. e.) If all oil level sight glasses are full at all times, remove oil until oil level shows at top of glass on a compressor.
8. High discharge pressure.	a.) Inadequate air flow across condenser	a.) Check condenser fan operation and condenser coil for clogging.
9. Oil low in sump.	a.) Low oil level in compressor.	a.) Low oil level in compressor sight glass is acceptable.
10. Low oil shutdown.	a.) Low oil in compressor.	a.) See Section 5.8.
11. Freeze warning.	a.) Operating setpoint too low. b.) Load changing too rapidly.	a.) Check leaving water setpoint on controller. b.) Load on package must drop at reasonable rate for automatic control to work properly.
12. Improper capacity control.	a.) Ramp rate incorrect.	a.) See Section 4.4.6.5.

5.0 MAINTENANCE

5.10 SAMPLE LOG SHEET

SHEET NO.....

DUNHAM-BUSH SCREW COMPRESSOR PACKAGED CHILLER

NAMEPLATE DATA:

UNIT MODEL NO. .....**UNIT NO.** .....**VOLTS:** ..... **Hz** .....

UNIT SERIAL NO. .....**COMPRESSOR MODEL NOS.** .....

START UP : DATE.....**TIME**.....

DATE									
TIME									
ELAPSED TIME METERS									
COMP. NO.									
SUCTION PRESSURE	1.								
	2.								
	3.								
	4.								
DISCHARGE PRESSURE	1.								
	2.								
	3.								
	4.								
DISCHARGE TEMPERATURE	1.								
	2.								
	3.								
	4.								
DISCHARGE SUPERHEAT (DISC. TEMP.-SAT. DISCH.)*	1.								
	2.								
	3.								
	4.								
DISCHARGE SUPERHEAT (DISC. TEMP.-SAT. SUCT.)*	1.								
	2.								
	3.								
	4.								
EVAPORATOR WATER TEMPERATURE-IN									
EVAPORATOR WATER TEMPERATURE-OUT									
EVAPORATOR PRESSURE DROP FTWG [KPA]									
EVAPORATOR WATER FLOW GPM[M³/HR]									
CONDENSER AIR TEMPERATURE-IN(AMBIENT) AC ONLY									
ACTUAL VOLTAGE COMPRESSOR AMPS	1.								
	2.								
	3.								
	4.								
FAN AMPS									
VOLTS									

*USE TABLE 5.4.2 FOR OBTAINING SATURATED TEMPERATURE

THIS LOG SHEET IS PROVIDED AS A RECOMMENDATION OF THE READINGS THAT SHOULD BE TAKEN ON A PERIODIC BASIS. THE ACTUAL READINGS TAKEN AND THE FREQUENCY WILL DEPEND UPON THE UNITS APPLICATION, HOURS OF USE, ETC. THIS TYPE OF INFORMATION CAN PROVE VERY USEFUL IN PREVENTING AND/ OR SOLVING PROBLEMS THAT MIGHT OCCUR DURING THE LIFE OF THE UNIT.

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