

## Submittal Data

# GAHP Line AR Series

## Reversible Gas Fired Absorption Heat Pump

### Heating and Cooling

GAHP is the acronym for Gas Absorption Heat Pump. The GAHP-AR is a High Efficiency Reversible Air-Water Heat Pump, utilizing a water-ammonia absorption cycle that is designed for outdoor use. The GAHP-AR is capable of chilling water down to a temperature of 37.4 °F, or

heating water up to 140 °F in the heat pump mode with a nominal efficiency of 126% in nominal conditions (external ambient temperature 44.6 °F, inlet water temperature 122 °F). Obtaining efficiencies up to 141% are possible depending on operating conditions. The cycle of the GAHP-AR is

driven by thermal energy provided by a gas burner. Therefore, the required electric energy is limited to driving the fan, pump motors and low voltage components. The GAHP-AR is fed by natural gas or LPG, and supplied with 208-230 V - 60 Hz SINGLE PHASE electrical power.



#### Operating mode

- **Cooling mode** (summer). The appliance operates as an absorption chiller, and the heat, taken away from the cooled environment via the hydronic circuit, is dissipated to the outside via the air-cooled finned coil.
- **Heating mode** (winter). The appliance uses the absorption cooling cycle to recover heat from the outside environment via the finned coil, which, when combined with the heat produced by the combustion of natural/LPG gas, is transferred into the exchanger and then into the environment to be heated, ensuring efficiency of 126 %

- (under nominal conditions). The GAHP-AR is equipped with the following devices:
- steel sealed circuit, externally coated with epoxy paint;
  - premixed multigas burner with ignition and flame sensing device managed by an electronic control box;
  - steel tube air exchanger with single-row coil and aluminum fins;
  - titanium stainless steel tube bundle water heat exchanger, with external insulation;
  - reversing valve on the refrigerant circuit; which switches the unit between heating and chilling mode;
  - two-way automatic defrosting valve, controlled

- by the microprocessor, allows for fin coil defrosting;
- variable speed condenser fan, controlled by the microprocessor.

#### Control and safety devices

- The GAHP-AR is controlled and monitored by the S60 control board through the peripheral AR10 card. These cards and other components compose the control and safeties of the GAHP-AR, listed below:
- S60 Electronic Control Board with integrated microprocessor, LCD display and encoder located inside the electric box; it is programmable and it controls and monitors the

- operation of the heat pump;
- water flow switch; located on the return chilled water line; monitors the water flow and helps prevent the freezing of the evaporator (cooling mode) or overheating of the condenser-absorber (heating mode);
- sealed circuit high temperature limit; located on the external wall of the generator; helps prevent overheating of the generator;
- hot water high temperature limit switch; located on the outlet water line; prevents water circuit from overheating;
- differential air pressure switch; located inside the

<p>electric box; it helps manage the combustion system by monitoring the air flowing into the air-gas mixing chamber and stopping the burner if the air flow is too low;</p> <ul style="list-style-type: none"> <li>flue gas temperature limit switch; located inside the rear portion of the combustion chamber; helps</li> </ul>	<p>prevent overheating of the generator;</p> <ul style="list-style-type: none"> <li>sealed circuit safety relief valve;</li> <li>safety by-pass valve; located inside the sealed system; prevents over pressurizing of the sealed system;</li> <li>antifreeze function for hydronic system; together</li> </ul>	<p>with the flow switch, this electronic function programmed into the microprocessor, helps prevent the freezing of water in the heat exchanger;</p> <ul style="list-style-type: none"> <li>ignition control box; located inside the electric box; it manages the combustion system controlling the burner ignition, the gas</li> </ul>	<p>valve, the air pressure switch, the air blower and the flame sensor;</p> <ul style="list-style-type: none"> <li>dual gas valve;</li> <li>temperature probes; located both on the sealed system and on the water lines; they monitor functional parameters of the unit.</li> </ul>
--	---	---	--

PERFORMANCE RATINGS - HEATING <sup>(1)</sup>			GAHP-AR
Heating capacity <sup>(2)</sup>		BTU/h	120,400
Gas input (HHV)		BTU/h	95,500
Ambient operating temperature	maximum	°F	95
	minimum	°F	-20
Hot water temperature	maximum outlet (to hydronic system)	°F	140
	maximum inlet (to unit)	°F	122
Hot water flow	nominal	GPM	13.4
Internal pressure drop at nominal hot water flow		Feet of Head	9.8
		psi <sub>g</sub>	4.2

PERFORMANCE RATINGS - COOLING <sup>(1)</sup>			
Cooling capacity <sup>(3)</sup>		BTU/h	57,700
Gas input (HHV)		BTU/h	95,500
Ambient operating temperature	maximum	°F	120
	minimum	°F	32
Chilled water temperature	minimum outlet (to hydronic system)	°F	37.4
	maximum inlet (to unit)	°F	113
Chilled water flow	nominal	GPM	12.8
Internal pressure drop at nominal chilled water flow		Feet of Head	10.5
		psi <sub>g</sub>	4.5

ELECTRICAL RATINGS			
Required voltage, 60 Hz, single phase <sup>(4)</sup>		V	208 - 230
Operating consumption <sup>(5)</sup>		kW	0.75

PHYSICAL DATA			
Operating weight		pounds	838
Dimensions	width	inches	33 1/2
	length	inches	48 1/2
	height	inches	50 3/4

<sup>(1)</sup> All illustrations and specifications contained herein are based on the latest information available at the time of publication.

<sup>(2)</sup> Heating capacity at standard conditions of 44.6 °F ambient temperature. Hot water outlet temperature 122 °F, hot water inlet temperature 104 °F.

<sup>(3)</sup> Cooling capacity at standard conditions of 95 °F ambient temperature. Chilled water outlet temperature 44.6 °F, chilled water inlet temperature 53.6 °F.

<sup>(4)</sup> Units are factory-wired for 208-230 volts operation.

<sup>(5)</sup> May vary by ± 10% as function of both power supply and electrical motor input tolerance.

**Due to continuous product innovation and development, Robur reserves the right to change product specifications without prior notice.**

**HEATING MODE CAPACITY (BTU/h)**

External ambient operating temperature (dry bulb)	Outlet (to plant) hot water temperature			
	86 °F	113 °F	122 °F	140 °F
	$\Delta\Delta T = 18\text{ °F}$			$\Delta\Delta T = 27\text{ °F}$
-20.0 °F	91,100	82,900	82,900	80,900
-13.0 °F	92,100	83,900	83,900	81,900
-4.0 °F	93,200	85,000	85,000	82,900
5.0 °F	97,200	89,400	88,000	85,600
14.0 °F	105,400	94,500	92,100	90,100
19.4 °F	111,900	100,300	96,900	95,500
35.6 °F	123,900	118,700	109,900	102,400
44.6 °F	129,300	128,000	<b>120,400</b>	112,600
50.0 °F	131,700	131,000	124,200	117,700
59.0 °F	134,100	133,400	128,300	122,200
68.0 °F	134,800	134,400	129,300	123,900
77.0 °F	134,800	134,400	129,700	126,200

Nominal value in bold type.

$\Delta T$  is the difference between outlet and inlet temperature.

**COOLING MODE CAPACITY (BTU/h)**

External ambient operating temperature (dry bulb)	Outlet (to plant) chilled water temperature		
	37.4 °F	44.6 °F	50.0 °F
	$\Delta\Delta T = 9\text{ °F}$		
59.0 °F	64,800	63,800	64,800
68.0 °F	63,500	63,500	64,100
77.0 °F	60,100	62,400	63,300
86.0 °F	54,300	60,700	61,800
95.0 °F	44,000	<b>57,700</b>	59,400
104.0 °F	--	51,200	54,600
113.0 °F	--	--	46,100

Nominal value in bold type.

$\Delta T$  is the difference between outlet and inlet temperature.

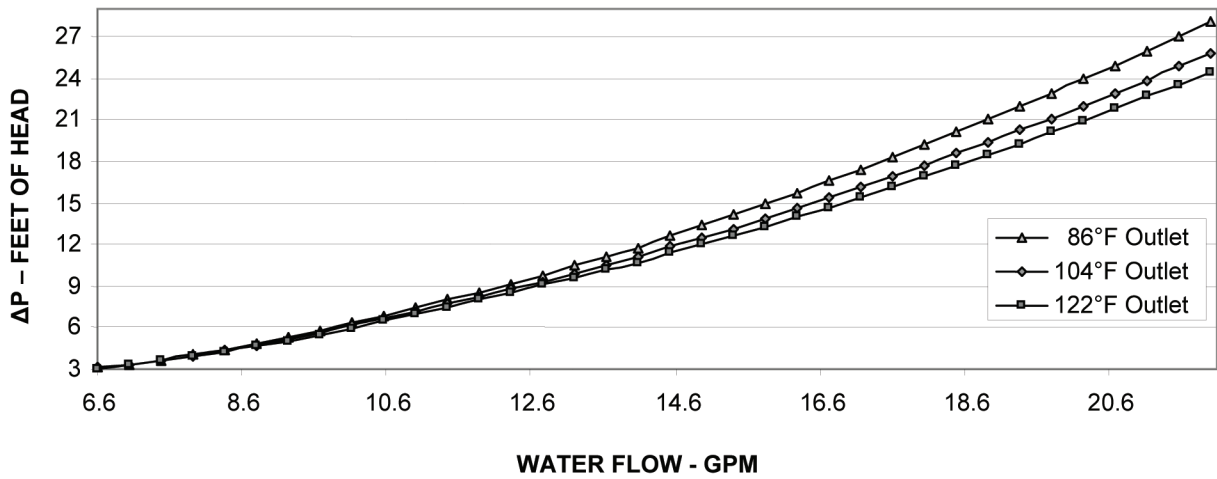
**PRESSURE DROP - Heating mode ( $\Delta P$  condenser / absorber)**

Hot water flow	Outlet water temperature		
	122.0 °F	104.0 °F	86.0 °F
GPM	$\Delta\Delta P$ (Feet of Head)		
6.60	3.05	3.08	3.15
7.04	3.30	3.32	3.35
7.48	3.58	3.62	3.65
7.93	3.89	3.98	4.05
8.37	4.25	4.35	4.42
8.81	4.64	4.76	4.86
9.25	5.05	5.19	5.28
9.69	5.50	5.66	5.77
10.13	5.96	6.18	6.29
10.57	6.45	6.66	6.83
11.01	6.95	7.16	7.39
11.45	7.47	7.68	7.97
11.89	7.99	8.21	8.57
12.33	8.52	8.76	9.18
12.77	9.06	9.32	9.80
13.21	9.59	9.90	10.43
13.65	10.12	10.50	11.07
14.09	10.64	11.11	11.72
14.53	11.36	11.81	12.60
14.97	11.98	12.48	13.35
15.41	12.63	13.17	14.12
15.85	13.29	13.87	14.91
16.29	13.97	14.60	15.72
16.73	14.67	15.35	16.55
17.17	15.39	16.11	17.40
17.61	16.13	16.90	18.27
18.05	16.88	17.70	19.16
18.49	17.65	18.53	20.07
18.93	18.44	19.37	21.00
19.37	19.25	20.23	21.94
19.81	20.08	21.11	22.91
20.25	20.92	22.01	23.90
20.69	21.78	22.93	24.90
21.13	22.66	23.87	25.93
21.57	23.56	24.82	26.97
22.01	24.48	25.80	28.03

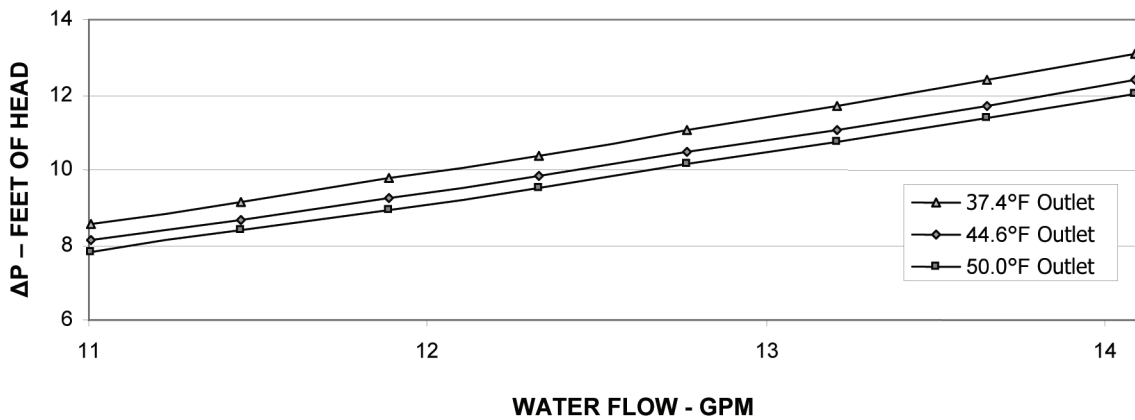
**PRESSURE DROP - Cooling mode ( $\Delta P$  evaporator)**

Chilled water flow	Outlet water temperature		
	37.4 °F	44.6 °F	50.0 °F
GPM	$\Delta\Delta P$ (Feet of Head)		
11.01	8.55	8.11	7.84
11.45	9.15	8.67	8.39
11.89	9.77	9.25	8.96
12.33	10.40	9.85	9.54
12.77	11.05	10.46	10.15
13.21	11.71	11.08	10.76
13.65	12.38	11.72	11.40
14.09	13.07	12.38	12.04

**PRESSURE DROP – HEATING MODE**



**PRESSURE DROP – CHILLING MODE**

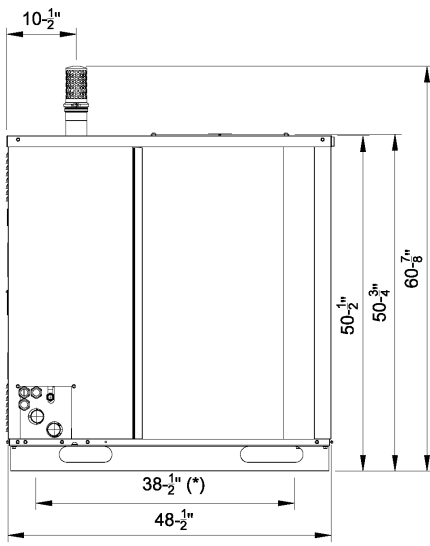


**APPROXIMATE WATER FREEZING POINT TEMPERATURE**

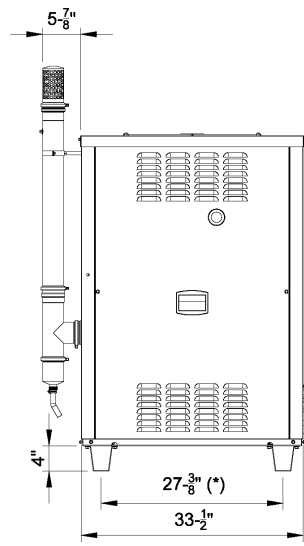
Percentage of monoethylene glycol	10	15	20	25	30	35	40
Water freezing point temperature (°F)	26.6	23.0	17.6	10.4	5.0	-4.0	-13.0
Percentage of increase in pressure drop	--	6	8	10	12	14	16
Loss of efficiency of unit	--	0.5	1	2	2.5	3	4

The numbers provided in this table are approximate and you must refer to the glycol manufacturer's instructions for additional instructions and amount of glycol required based on expected ambient conditions.

**GAHP-AR DIMENSIONS**

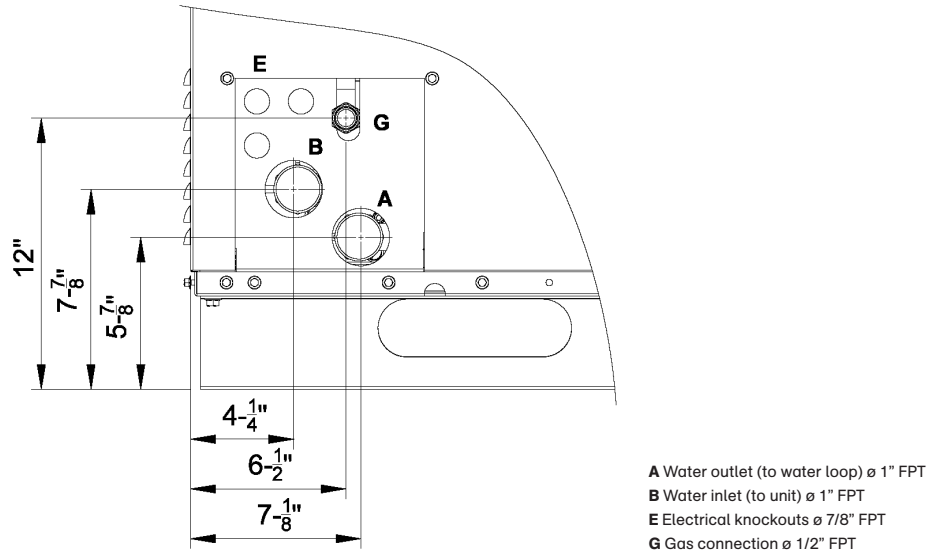


Side View

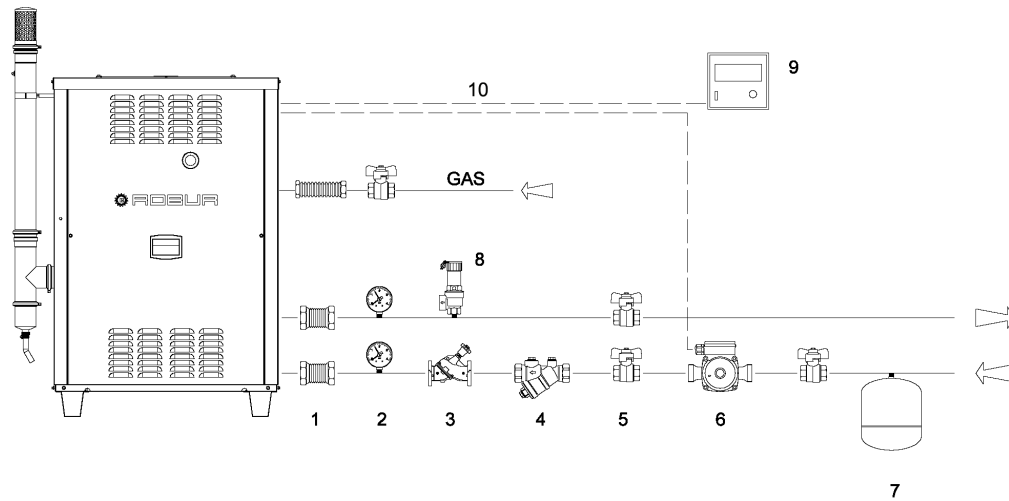


Front View

**GAHP-AR SERVICE PLATE DIMENSIONS**



**GAHP-AR HYDRONIC SYSTEM: Typical Installation Arrangement (External Components not included with Robur Unit)**



- |                                |  |
|--------------------------------|--|
| 1 Antivibration flexible hoses | 6 Circulating water pump               |
| 2 Pressure gauge               | 7 Expansion tank                       |
| 3 Flow regulating valve        | 8 Safety valve                         |
| 4 Water filter                 | 9 DDC (optional from Robur)            |
| 5 Shut-off valve               | 10 Can Bus cable (optional from Robur) |

**Clearances**

Position the appliance so that minimum clearances from combustible surfaces and constructions (walls and other equipment) are maintained, as shown in the figure below.

The appliance may be installed directly on wood flooring.

Minimum clearances are

necessary for operating performance, and in order to be able to carry out maintenance operations and to ensure the correct airflow required for proper heat exchange with the finned coil.

There must not be any obstructions or structural overhangs (roof edges, balconies) over the top of

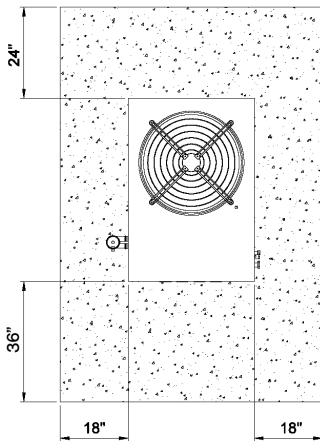
the unit. The re-circulation of the air discharged from the condenser results in poor unit performance.

When the unit is installed in close proximity to buildings, keep the unit away from the roof edge drip line.

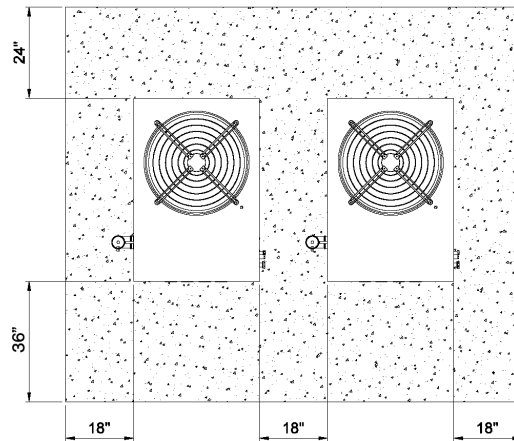
In no case should the unit be placed within 6 feet of any external air intakes of the building. For installations on

balconies or roofs, the unit must not be located within 8 feet from chimney flues, outlets and other such vents. It is important that the unit is located so that hot or contaminated air is not drawn into the air intakes of the unit.

**Observe all local and State codes.**



Single unit



Multiple units



## Submittal Data

# GA Line ACF - RTCF HR Series

## Gas Fired Absorption Chillers

### Cooling with Heat Recovery

The High Efficiency Chillers ACF HR and RTCF HR series are water chillers, equipped with an air-cooled condenser and designed for outdoor installation. The absorption cooling cycle is based upon a solution of water and

ammonia for the production of chilled water. The chilling system is fed by thermal energy provided by a gas burner, therefore the required electric energy is limited to driving the fan and pump motors.

The evacuation of combustion gases occurs by mixing them with condenser air using the axial fan of the appliance; no flue is needed. The combustion fuel is natural gas or LPG.



#### Version

The ACF and RTCF HR models are standard chillers with a heat recovery system capable of providing from 60,500 to 302,500 BTU/h (it is possible to link up to 5 chillers to obtain RTCF groups) of nominal cooling capacity when operating without the heat recovery system.

With the heat recovery system, it can obtain a cooling capacity from 61,240 to 306,200 BTU/h and, at the same time, provide from 86,400 to 432,000 BTU/h of heating capacity. Capable of producing hot water up to 180 °F and available in a 4-pipe configuration only.

#### Control and safety devices

The ACF and RTCF HR series units are equipped with the following components and safety devices:

- steel sealed circuit, painted with external epoxy paint;
- steel tube air exchanger with single-row coil and aluminum fins;
- titanium stainless steel tube bundle water heat exchanger, with external insulation;
- variable speed condenser fan, microprocessor controlled;
- S60 Electronic Control Board with integrated microprocessor, LCD display and encoder located inside the electric box; it is programmable and it controls and monitors the operation of the chiller;
- sealed circuit high temperature limit; located on the external wall of the generator; helps prevent overheating of the generator;
- hot water high temperature switch; located on the hot water outlet line; helps prevent overheating of the water circuit;
- flue gas temperature limit switch; located inside the rear portion of the combustion chamber; helps prevent overheating of the generator;
- sealed circuit safety relief valve;
- premixed multigas burner with ignition and flame sensing device managed by an electronic control box;
- differential air pressure switch; located inside the electric box; it helps manage the combustion system by monitoring the air flowing into the air-gas mixing chamber and stopping the burner if the air flow is too low;
- ignition control box; located inside the electric box; it manages the combustion system controlling the

- burner ignition, the gas valve, the air pressure switch, the air blower and the flame sensor;
- dual gas valve;
- chilled water flow sensor; located on the return chilled water line; it monitors the water flow and helps prevent freezing of the evaporator;
- safety by-pass valve; located inside the sealed system; prevents over pressurizing the sealed system;
- antifreeze function for hydronic system; together with the flow switch, this electronic function, programmed into the microprocessor, helps prevent freezing of the evaporator;
- temperature probes; located both on the sealed system and on the water lines; they monitor functional parameters of the unit.



PERFORMANCE RATINGS <sup>(1)</sup>			ACF60	RTCF120	RTCF180	RTCF240	RTCF300
Cooling capacity (no recovery) <sup>(2)</sup>	BTU/h		60,500	121,000	181,500	242,000	302,500
Cooling capacity (with recovery) <sup>(3)</sup>	BTU/h		61,240	122,500	183,700	245,000	306,200
Heating capacity <sup>(3)</sup>	BTU/h		86,400	172,800	259,200	345,600	432,000
Gas input (HHV)	BTU/h		94,900	189,800	284,700	379,600	474,500
Ambient operating temperature	maximum	°F		120			
	minimum	°F		32			
Chilled water temperature	minimum outlet	°F		37.4			
	maximum inlet	°F		113			
Maximum hot water outlet temperature		°F		176			
Chilled water flow	nominal	GPM	12.2	24.4	36.6	48.8	61.0
	nominal	GPM	9.6	19.2	28.8	38.4	48.0
Recovery system hot water flow	minimum	GPM	0	0	0	0	0
	maximum	GPM	11.0	22.0	33.0	44.0	55.0
Internal pressure drop at nominal chilled water flow		Feet of Head		9.5			
		psi <sub>g</sub>		4.0			
Pressure drop inside recovery system		Feet of Head		4.34			
		psi <sub>g</sub>		3.0			
<b>ELECTRICAL RATINGS <sup>(1)</sup></b>							
Required voltage, 60 Hz, single phase <sup>(4)</sup>		V		208 - 230			
Operating consumption <sup>(5)</sup>		kW		0.75			
<b>PHYSICAL DATA <sup>(1)</sup></b>							
Operating weight		pounds	750	2,040	3,075	4,115	5,127
Chilled / hot water entering and leaving connections		FPT	1"	1 1/2"		2"	
Gas inlet connections		FPT	1/2"	1"		1 1/4"	
Dimensions	width	inches	33 1/2	49 1/2			
	length	inches	48 1/2	93	144	195	246
	height	inches	50 3/4	53 1/4			

<sup>(1)</sup> All illustrations and specifications contained herein are based on the latest information available at the time of publication.  
<sup>(2)</sup> Cooling capacity at standard conditions (no recovery): ambient temperature 95 °F. Chilled water outlet temperature 45 °F, chilled water inlet temperature 55 °F.  
<sup>(3)</sup> Cooling capacity at standard conditions (with recovery): ambient temperature 95 °F. Chilled water outlet temperature 45 °F, heat recovery system water temperature - delivery 122 °F - return 104 °F.

<sup>(4)</sup> Units are factory-wired for 208-230 volts operation.  
<sup>(5)</sup> May vary by ± 10% as function of both power supply and electrical motor input tolerance.

**Due to continuous product innovation and development, Robur reserves the right to change product specifications without prior notice.**

**COOLING CAPACITY (BTU/h) - Cooling Only**

External ambient operating temperature	Outlet chilled water temperature			
	37.4 °F	41.0 °F	44.6 °F	48.2 °F
32 °F	59,290	59,895	61,105	62,315
41 °F	59,290	59,895	61,105	62,315
50 °F	59,290	59,895	61,105	62,315
59 °F	59,290	59,895	61,105	62,315
68 °F	59,290	59,895	61,105	62,315
77 °F	58,685	59,895	61,105	62,315
86 °F	54,450	59,290	61,105	62,315
95 °F	40,535	52,635	60,500	61,710
104 °F	--	--	53,240	56,265
113 °F	--	--	40,535	47,190

**COOLING CAPACITY (BTU/h) - Cooling + Recovery**

External ambient operating temperature	Outlet chilled water temperature			
	37.4 °F	41.0 °F	44.6 °F	48.2 °F
32 °F	59,403	60,015	61,240	62,465
41 °F	59,403	60,015	61,240	62,465
50 °F	59,403	60,015	61,240	62,465
59 °F	59,403	60,015	61,240	62,465
68 °F	59,403	60,015	61,240	62,465
77 °F	58,790	60,015	61,240	62,465
86 °F	54,504	59,403	61,240	62,465
95 °F	44,705	55,728	61,240	62,465
104 °F	--	54,504	58,178	58,790
113 °F	--	--	48,992	52,054

**HEATING CAPACITY OF THE HEAT RECOVERY UNIT (BTU/h)**

Heat capacity - Output = 2.2 GPM (BTU/h)							
Recovery system hot water return temperature	External air temperature						
	59 °F	68 °F	77 °F	86 °F	95 °F	104 °F	113 °F
50 °F	92,210	92,893	93,576	93,917	95,283	96,308	97,333
68 °F	72,743	75,134	76,978	78,549	80,188	83,330	85,379
86 °F	52,628	55,667	58,570	61,644	65,162	68,577	72,231
104 °F	35,859	39,275	42,007	46,071	50,954	55,667	61,507
122 °F	21,857	24,248	27,356	31,761	37,567	43,714	50,818
140 °F	9,563	12,226	15,368	18,783	25,033	31,420	40,982
158 °F	--	--	8,196	8,982	13,831	21,003	30,395

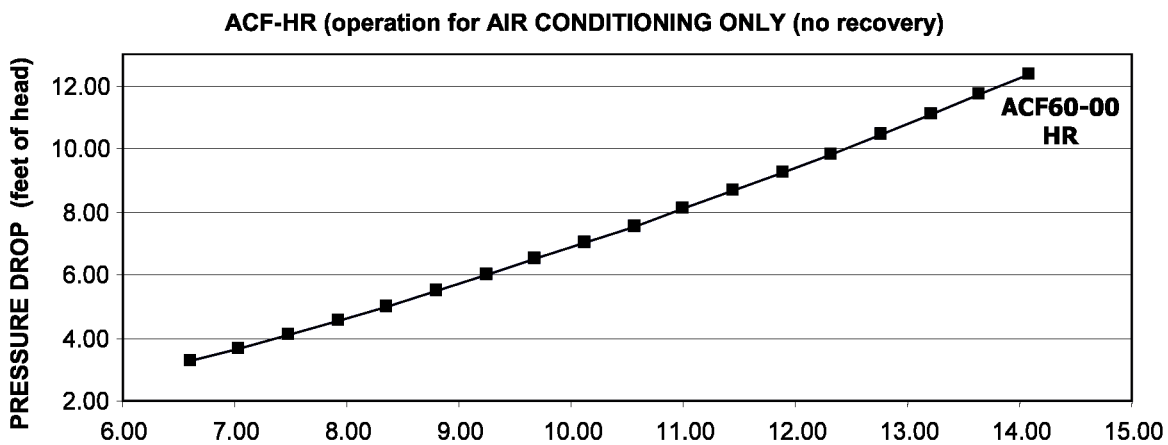
Heat capacity - Output = 4.4 GPM (BTU/h)							
Recovery system hot water return temperature	External air temperature						
	59 °F	68 °F	77 °F	86 °F	95 °F	104 °F	113 °F
68 °F	92,210	99,040	102,797	106,895	109,286	--	--
86 °F	71,719	78,208	83,604	85,755	89,546	95,625	102,455
104 °F	47,983	54,643	61,473	65,162	71,719	78,549	85,584
122 °F	27,765	34,083	41,426	45,149	53,004	59,868	65,640
140 °F	10,246	16,051	21,447	25,682	34,152	40,299	46,105
158 °F	--	--	8,538	11,953	19,330	23,906	31,078

Heat capacity - Output = 6.6 GPM (BTU/h)							
Recovery system hot water return temperature	External air temperature						
	59 °F	68 °F	77 °F	86 °F	95 °F	104 °F	113 °F
68 °F	96,991	102,455	109,286	--	--	--	--
86 °F	75,134	81,964	88,795	93,269	100,406	105,871	110,993
104 °F	50,886	60,107	66,596	72,368	80,257	87,429	93,917
122 °F	30,224	38,592	44,295	50,203	56,931	64,137	71,377
140 °F	10,929	17,076	22,779	28,346	34,152	40,982	47,813
158 °F	--	--	10,587	14,344	21,174	23,029	33,469

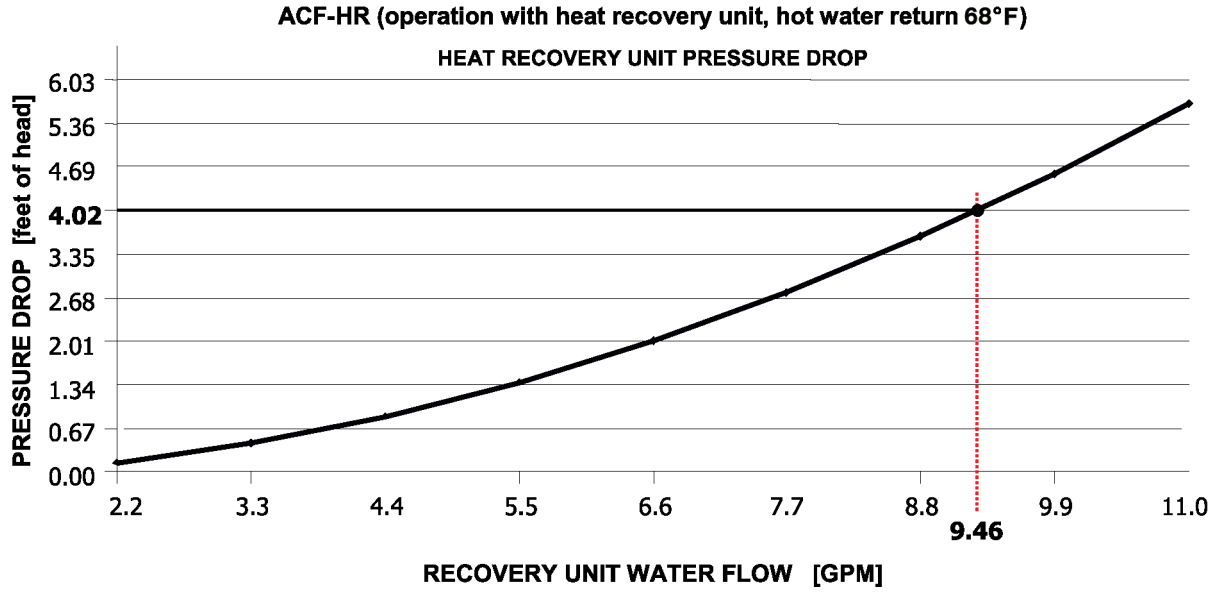
Heat capacity - Output = 8.8 GPM (BTU/h)							
Recovery system hot water return temperature	External air temperature						
	59 °F	68 °F	77 °F	86 °F	95 °F	104 °F	113 °F
68 °F	97,333	104,709	110,993	--	--	--	--
86 °F	76,158	83,399	91,868	97,333	--	--	--
104 °F	51,228	61,302	72,094	78,549	85,106	92,210	99,040
122 °F	30,258	39,275	47,813	54,643	59,902	66,596	76,158
140 °F	14,022	17,144	24,111	29,678	35,859	42,690	49,520
158 °F	--	--	12,704	17,076	22,882	29,712	35,859

Heat capacity - Output = 11.0 GPM (BTU/h)							
Recovery system hot water return temperature	External air temperature						
	59 °F	68 °F	77 °F	86 °F	95 °F	104 °F	113 °F
68 °F	103,924	--	--	--	--	--	--
86 °F	81,281	88,795	102,455	--	--	--	--
104 °F	57,033	64,888	76,295	82,613	88,795	97,572	102,455
122 °F	36,884	41,255	49,520	58,058	63,454	71,104	79,061
140 °F	17,452	21,345	26,331	31,112	38,113	45,798	55,736
158 °F	--	--	13,285	18,100	23,906	30,737	39,275

ACF-RTCF HR COOLING ONLY PRESSURE DROP



**ACF-RTCF HR HEAT RECOVERY PRESSURE DROP**

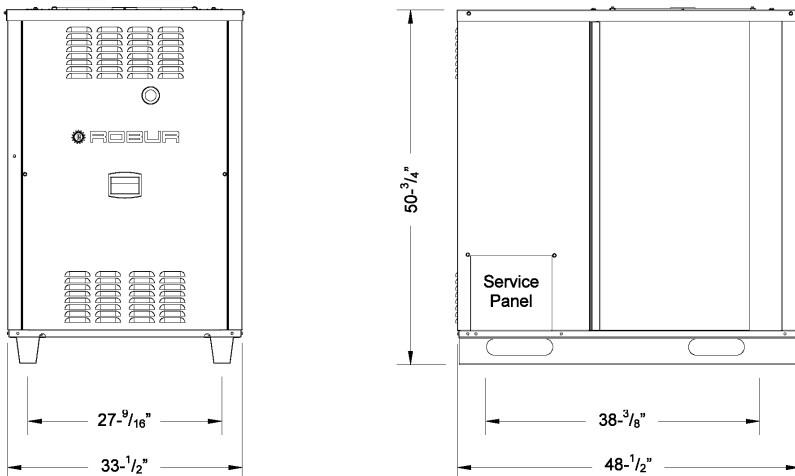


**APPROXIMATE WATER FREEZING POINT TEMPERATURE**

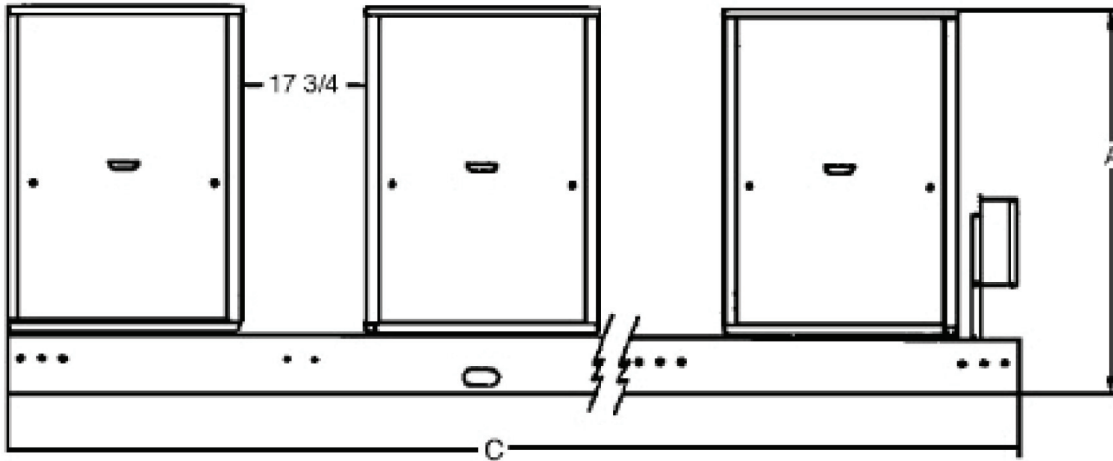
Percentage of monoethylene glycol	10	15	20	25	30	35	40
Water freezing point temperature (°F)	26.6	23.0	17.6	10.4	5.0	-4.0	-13.0
Percentage of increase in pressure drop	--	6	8	10	12	14	16
Loss of efficiency of unit	--	0.5	1	2	2.5	3	4

The numbers provided in this table are approximate and you must refer to the glycol manufacturer's instructions for additional instructions and amount of glycol required based on expected ambient conditions.

**ACF HR DIMENSIONS**

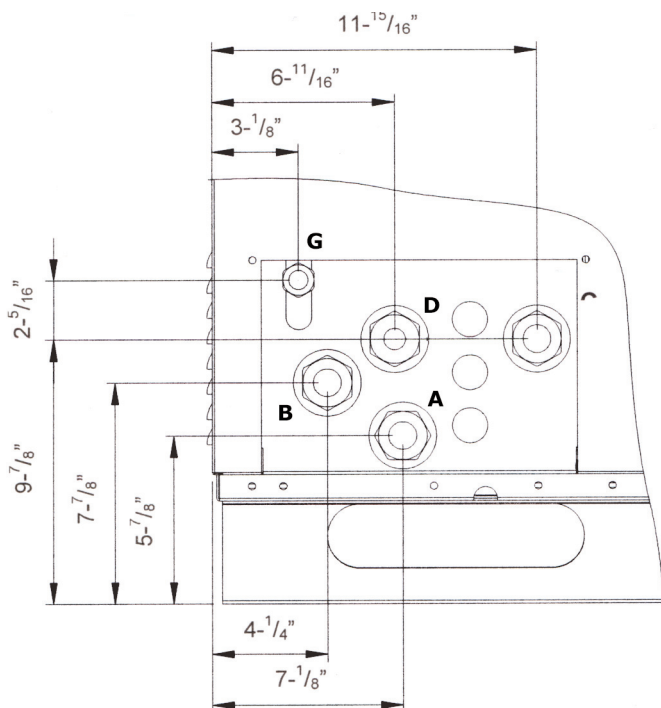


**RTCF HR DIMENSIONS (ALL VERSIONS)**



MODEL	A	B depth (not shown)	C	Approximate Weight (lb)	
				shipping	operating
RTCF120	53.25	49.0	93.0	1,870	1,910
RTCF180	53.25	49.0	144.0	2,825	2,880
RTCF240	55.25	49.0	195.0	3,765	3,855
RTCF300	55.25	49.0	246.0	4,690	4,802

**ACF HR SERVICE PLATE DIMENSIONS**



**G** Gas connection ø 1/2" FPT

Chiller - CHILLED WATER

**A** Water delivery to appliance ø 1" FPT

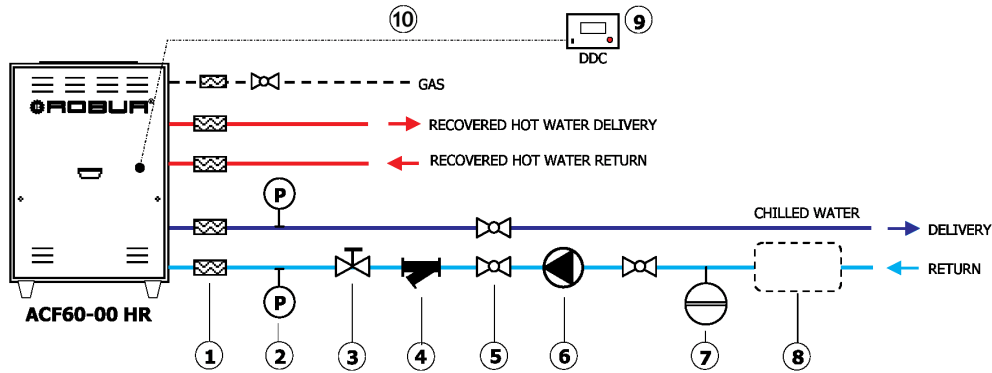
**B** Water return to unit ø 1" FPT

Recovery unit - HOT WATER

**C** Water delivery to appliance ø 1" FPT

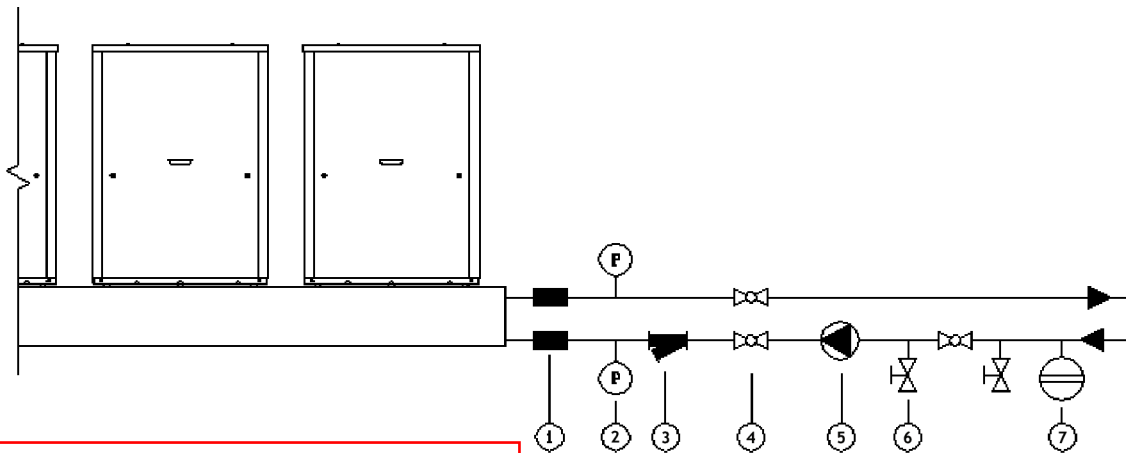
**D** Water return to unit ø 1" FPT

**ACF HR HYDRONIC SYSTEM: Typical Installation Arrangement (External Components not included with Robur Unit)**



- |                                |  |
|--------------------------------|--|
| 1 Antivibration flexible hoses | 7 Expansion tank                       |
| 2 Pressure gauge               | 8 Water storage                        |
| 3 Flow regulating valve        | 9 DDC (optional from Robur)            |
| 4 Water filter                 | 10 Can Bus cable (optional from Robur) |
| 5 Shut-off valve               |  |
| 6 Circulating water pump       |  |

**RTCF HYDRONIC SYSTEM: Typical Installation Arrangement (External Components not included with Robur Unit)**



- |                                |                          |
|--------------------------------|--------------------------|
| 1 Antivibration flexible hoses | 5 Circulating water pump |
| 2 Pressure gauge               | 6 Fill/drain valve       |
| 3 Water filter                 | 7 Expansion tank         |
| 4 Shut-off valve               |                          |

**Location**

The ACF and RTCF HR systems must be installed outdoors in an area of free natural air circulation. The installation inside a room or a building is not allowed. There must be a minimum clearance of 4 feet horizontally from electric meters, gas meters, regulators and relief

equipment and in no case located above or below these items unless a 4 foot horizontal distance is maintained. The noise generated by the condenser fan during unit operation is not excessive.

However, avoid locating the unit in an area adjacent to bedrooms or neighboring

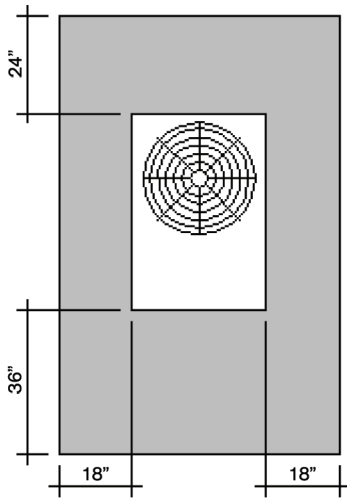
buildings. Also, avoid installing the unit in building corners, where air turbulence can take place or the unit noise (reverberation) can be amplified.

**Clearances**

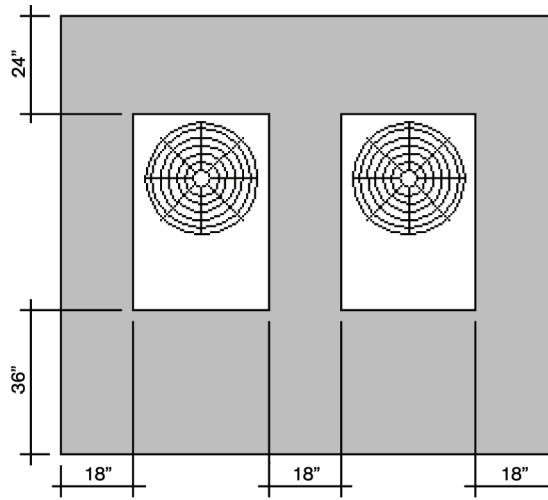
A free space is to be provided around the unit to allow for proper unit operation and for

servicing. The minimum clearance from walls, obstructions and other units must be as follows:  
- right / left side: 18 inches;  
- rear side: 24 inches;  
- front side: 36 inches.

**Observe all local and State codes.**

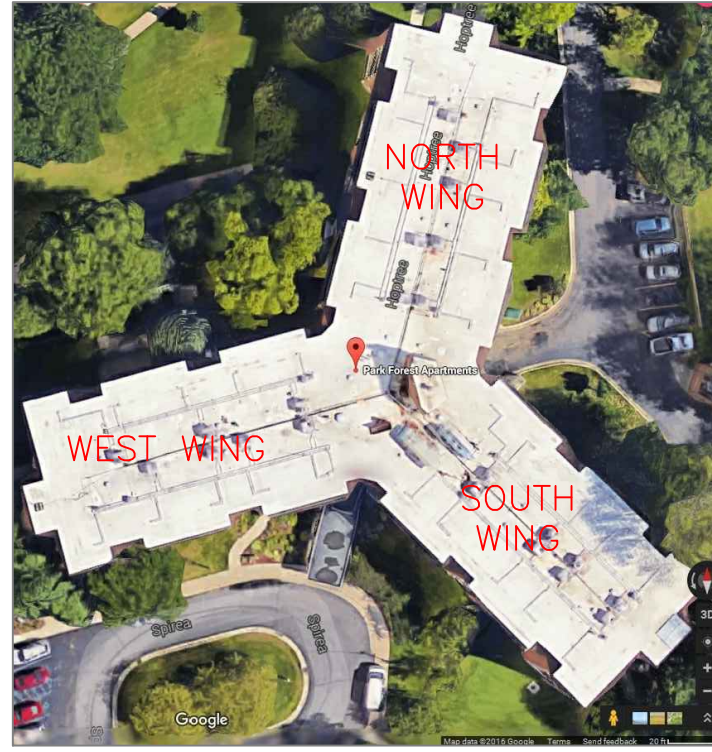


Single unit



Multiple units



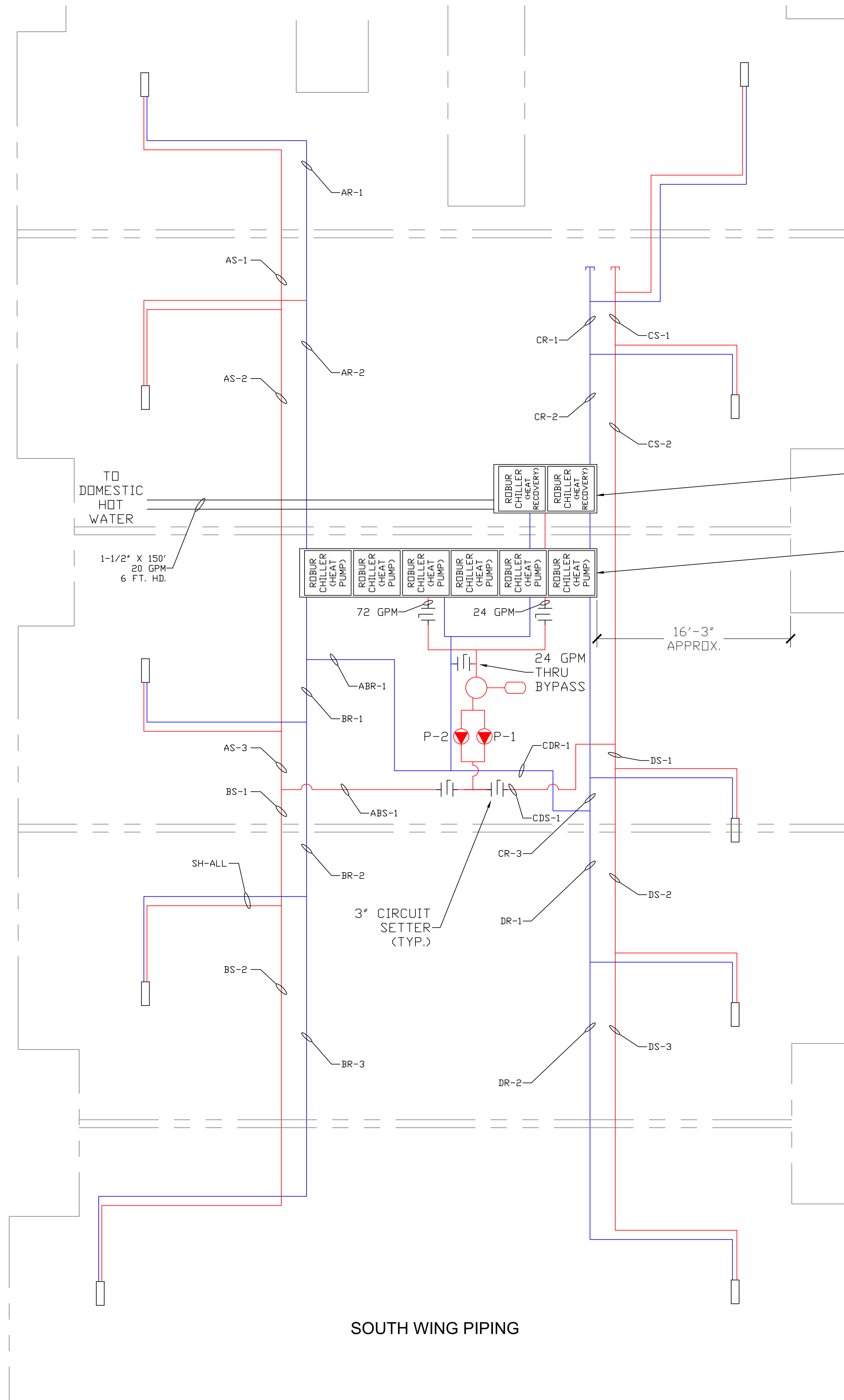


**MAINS AND RISERS**

120 GPM SYSTEM TOTAL  
 60 GPM PER SIDE  
 12.92 FT. OF HD. COMMON W/RISER  
 1.81 FT. HD. 3" NEAR CHILLER  
 9 FT. HD. CHILLERS  
 3 FT. HD. FITTINGS

PUMP: 120 GPM @ 27 FT. HD.

CHILLER SKID(S) (GAL.) 28.0  
 RISER CAPACITY (GAL.) 100.0  
 SYSTEM PIPING CAP. (GAL.) 72.0  
 TOTAL : 200.0



ROBUR 2 UNIT RACK  
 UNITS WEIGHT 1928 LBS.  
 RAIL AND PIPING 600 LBS.

ROBUR 6 UNIT RACK  
 UNITS WEIGHT 5783 LBS.  
 RAIL AND PIPING 1000 LBS.

TOTAL LOAD : 9311 LBS.

South Wing Piping Schedule					
Pipe Section	Pipe Size (Inch)	Length (Ft)	GPM	Velocity (Ft/Sec)	PD (Ft)
ABS-1	2.5	16	60	4.05	0.39
AS-1	1.25	14	12	3.07	0.47
AS-2	1.25	36	24	6.15	4.19
AS-3	1.5	5	36	6.52	0.52
AR-1	1.5	14	12	2.17	0.21
AR-2	1.5	30	24	4.35	1.52
ABR-1	2.5	22	60	4.05	0.54
SH-ALL	1.5	150	12	3.07	5.09
NEAR CHILLER	3	50	120	5.68	1.81
CHILLERS					9.00
FITTINGS					3.00
				<b>TOTAL</b>	<b>26.73</b>
ABS-1	2.5	16	60	4.05	0.39
BS-1	1.5	10	24	4.35	0.51
BS-2	1.5	25	12	2.17	0.37
BR-1	1.5	6	36	6.52	0.63
BR-2	1.5	15	24	4.35	0.76
BR-3	1.5	25	12	2.17	0.37
ABR-1	2.5	22	60	4.05	0.54
SH-ALL	1.5	150	12	3.07	5.09
NEAR CHILLER	3	50	120	5.68	1.81
CHILLERS					9.00
FITTINGS					3.00
				<b>TOTAL</b>	<b>22.46</b>
CDS-1	2.5	16	60	4.05	0.39
CS-1	1.5	5	12	2.17	0.07
CS-2	1.5	34	24	4.35	1.72
CR-1	1.5	5	12	2.17	0.07
CR-2	1.5	36	24	4.35	1.83
CR-3	1.5	3	36	6.52	0.31
CDR-1	2.5	15	60	4.05	0.37
SH-ALL	1.5	150	12	3.07	5.09
NEAR CHILLER	3	50	120	5.68	1.81
CHILLERS					9.00
FITTINGS					3.00
				<b>TOTAL</b>	<b>23.67</b>
CDS-1	2.5	16	60	4.05	0.39
DS-1	1.5	2	36	6.52	0.21
DS-2	1.5	16	24	4.35	0.81
DS-3	1.5	24	12	2.17	0.36
DR-1	1.5	13	24	4.35	0.66
DR-2	1.5	24	12	2.17	0.36
CDR-1	2.5	15	60	4.05	0.37
SH-ALL	1.5	150	12	3.07	5.09
NEAR CHILLER	3	50	120	5.68	1.81
CHILLERS					9.00
FITTINGS					3.00
				<b>TOTAL</b>	<b>22.05</b>

**PIPING PLAN**

SCALE: 3/16" = 1'-0" (APPROX.)

**PIPING SYMBOLS LEGEND**

MIXING VALVE		EXPANSION TANK	
DIVERTING VALVE		BY-PASS VALVE	
PRESSURE REDUCE VALVE		DRAIN VALVE	
PUMP		THERMOMETER	
CHECK VALVE		GAUGE	
UNIONS		BALL VALVE	
CIRCUIT SETTER		AIR SEPARATOR	
ZONE VALVE		BACK FLOW PREVENTER	
FLOWGARD VALVE		AIR VENT	

**NOTES:**

\* MAX PIPE SPACING TO BE 12 INCHES OR 4 PIPE DIAMETERS APART OR WHICHEVER IS LESS.

**SOUTH WING PIPING**

CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN

THAWPAK DISTRIBUTOR:  
**PERFORMANCE**  
 engineering group

DRAWN BY:  
 Gordon Faustich  
 REVIEWED BY:  
 AD  
 APPROVED BY:  
 AD  
 ISSUED FOR

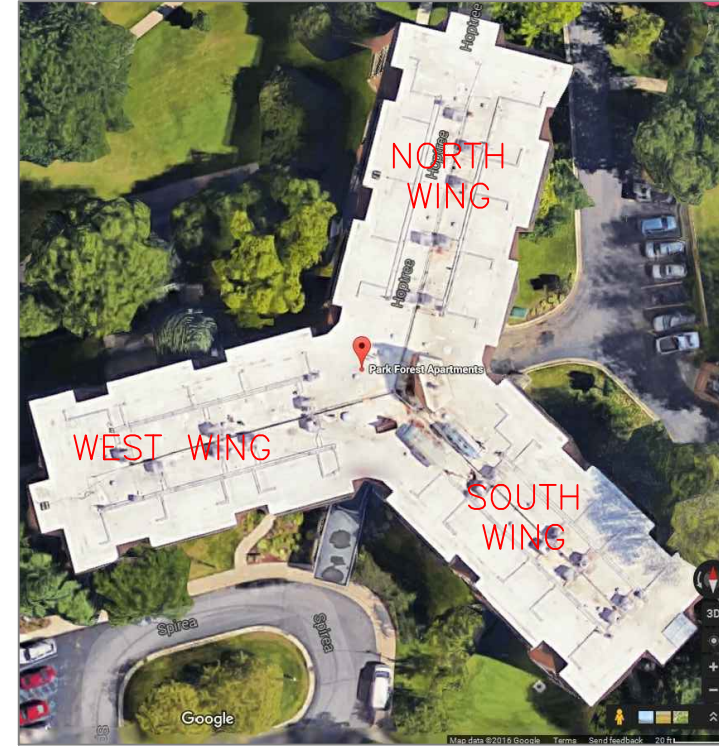
09/15/16	SUBMITTAL
09/22/16	REARRANGED
09/27/16	FIELD CHANGE
10/06/16	REMOVED REV SET
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAWPAK  
 This drawing is the property of THAWPAK. It has been prepared for use in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
**PARK FOREST**

SHEET NO.  
**P1**





**MAINS AND RISERS**

120 GPM SYSTEM TOTAL  
 60 GPM PER SIDE  
 12.96 FT. OF HD. COMMON W/RISER  
 1.3 FT. HD. 3" NEAR CHILLER  
 9 FT. HD. CHILLERS  
 3 FT. HD. FITTINGS

PUMP: 120 GPM @ 27 FT. HD.

CHILLER SKID(S) (GAL.) 21.0  
 RISER CAPACITY (GAL.) 100.0  
 SYSTEM PIPING CAP. (GAL.) 82.0  
 TOTAL : 203.0

**PIPING PLAN**

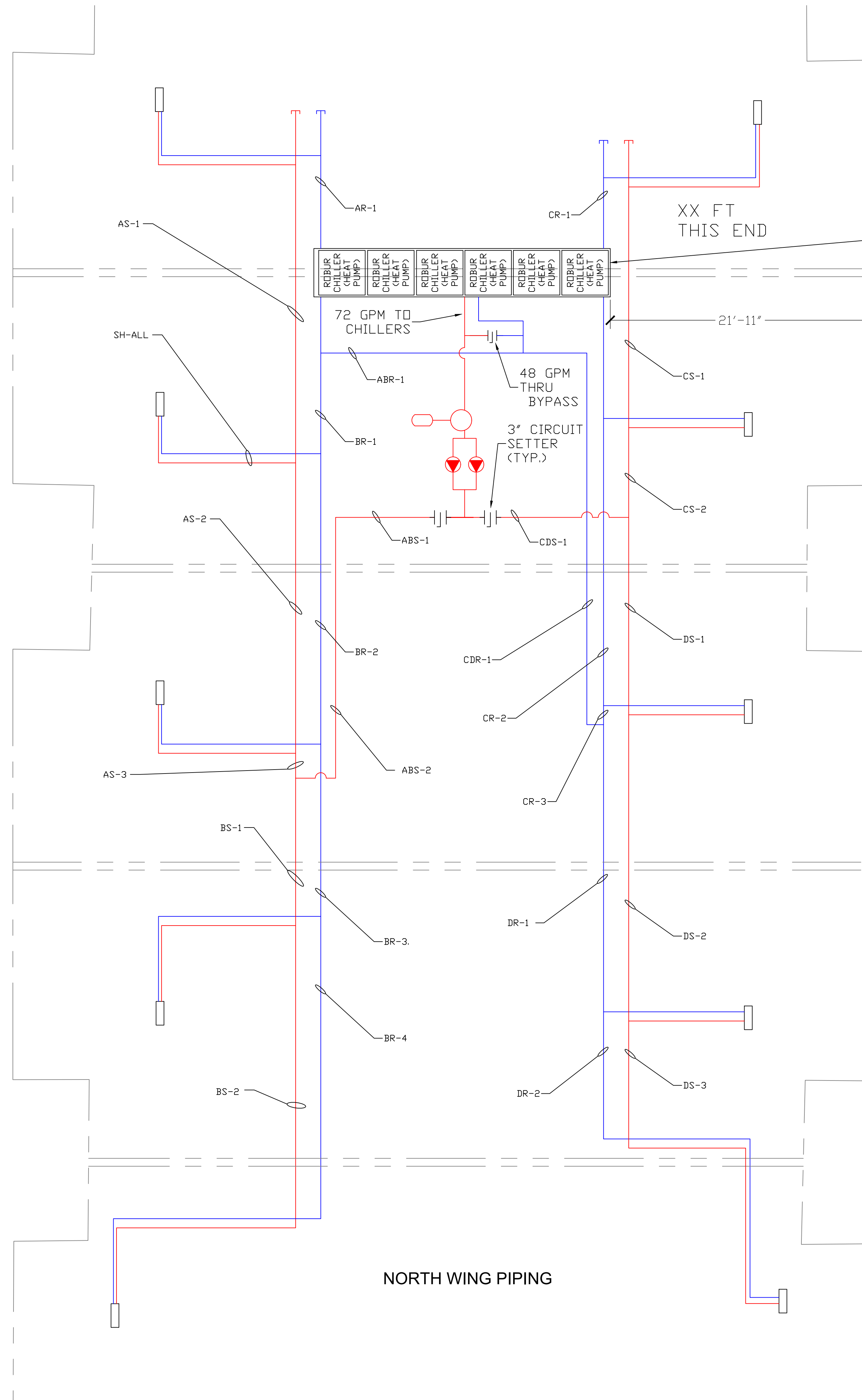
SCALE: 3/16" = 1'-0" (APPROX.)

**PIPING SYMBOLS LEGEND**

MIXING VALVE		EXPANSION TANK	
DIVERTING VALVE		BY-PASS VALVE	
PRESSURE REDUCE VALVE		DRAIN VALVE	
PUMP		THERMOMETER	
CHECK VALVE		GAUGE	
UNIONS		BALL VALVE	
CIRCUIT SETTER		AIR SEPARATOR	
ZONE VALVE		BACK FLOW PREVENTER	
FLOWGARD VALVE		AIR VENT	

**NOTES:**

\* MAX PIPE SPACING TO BE 12 INCHES OR 4 PIPE DIAMETERS APART OR WHICHEVER IS LESS.



ROBUR 6 UNIT RACK  
 UNITS WEIGHT 5783 LBS.  
 RAIL AND PIPING 1000 LBS.  
 TOTAL LOAD : 6783 LBS.

North Wing Piping Schedule					
Pipe Section	Pipe Size (Inch)	Length (Ft)	GPM	Velocity (Ft/Sec)	PD (Ft)
ABS-1	2.5	12	60	4.05	0.29
ABS-2	2	25	60	6.28	1.74
AS-1	1.25	25	12	3.07	0.85
AS-2	1.25	25	24	6.15	2.91
AS-3	1.5	3	36	6.52	0.31
AR-1	2	17	12	1.26	0.07
ABR-1	2.5	17	60	4.05	0.41
SH-ALL	1.25	150	12	3.07	5.09
NEAR CHILLER	3	35	120	5.68	1.26
CHILLERS					9.00
FITTINGS					3.00
<b>TOTAL</b>					<b>24.94</b>
ABS-1	2.5	12	60	4.05	0.29
ABS-2	2	25	60	6.28	1.74
BS-1	1.5	15	24	4.35	0.76
BS-2	1.5	25	12	2.17	0.37
BR-1	2	9	48	5.02	0.42
BR-2	2	25	36	3.77	0.70
BR-3	2	15	24	2.51	0.20
BR-4	2	25	12	1.26	0.10
ABR-1	2.5	17	60	4.05	0.41
SH-ALL	1.25	150	12	3.07	5.09
NEAR CHILLER	3	35	120	5.68	1.26
CHILLERS					9.00
FITTINGS					3.00
<b>TOTAL</b>					<b>23.35</b>
CDS-1	2.5	12	60	4.05	0.29
CS-1	1.5	25	12	2.17	0.37
CS-2	1.5	8	24	4.35	0.41
CR-1	1.5	2	36	6.52	0.21
CR-2	1.25	24	24	6.15	2.79
CR-3	1.5	2	24	6.15	0.23
CDR-1	2	30	60	6.28	2.09
SH-ALL	1.25	150	12	3.07	5.09
NEAR CHILLER	3	35	120	5.68	1.26
CHILLERS					9.00
FITTINGS					3.00
<b>TOTAL</b>					<b>24.74</b>
CDS-1	2.5	12	60	4.05	0.29
DS-1	1.5	17	36	6.52	1.78
DS-2	1.5	25	24	4.35	1.27
DS-3	1.5	12	12	2.17	0.18
DR-1	1.5	20	36	6.52	2.09
DR-2	1.5	12	12	2.17	0.18
CDR-1	2	30	60	6.28	2.09
SH-ALL	1.25	150	12	3.07	5.09
NEAR CHILLER	3	35	120	5.68	1.26
CHILLERS					9.00
FITTINGS					3.00
<b>TOTAL</b>					<b>26.22</b>

CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
 engineering group

DRAWN BY:  
 Gordon Faustich  
 REVIEWED BY:  
 AD  
 APPROVED BY:  
 AD

ISSUED FOR

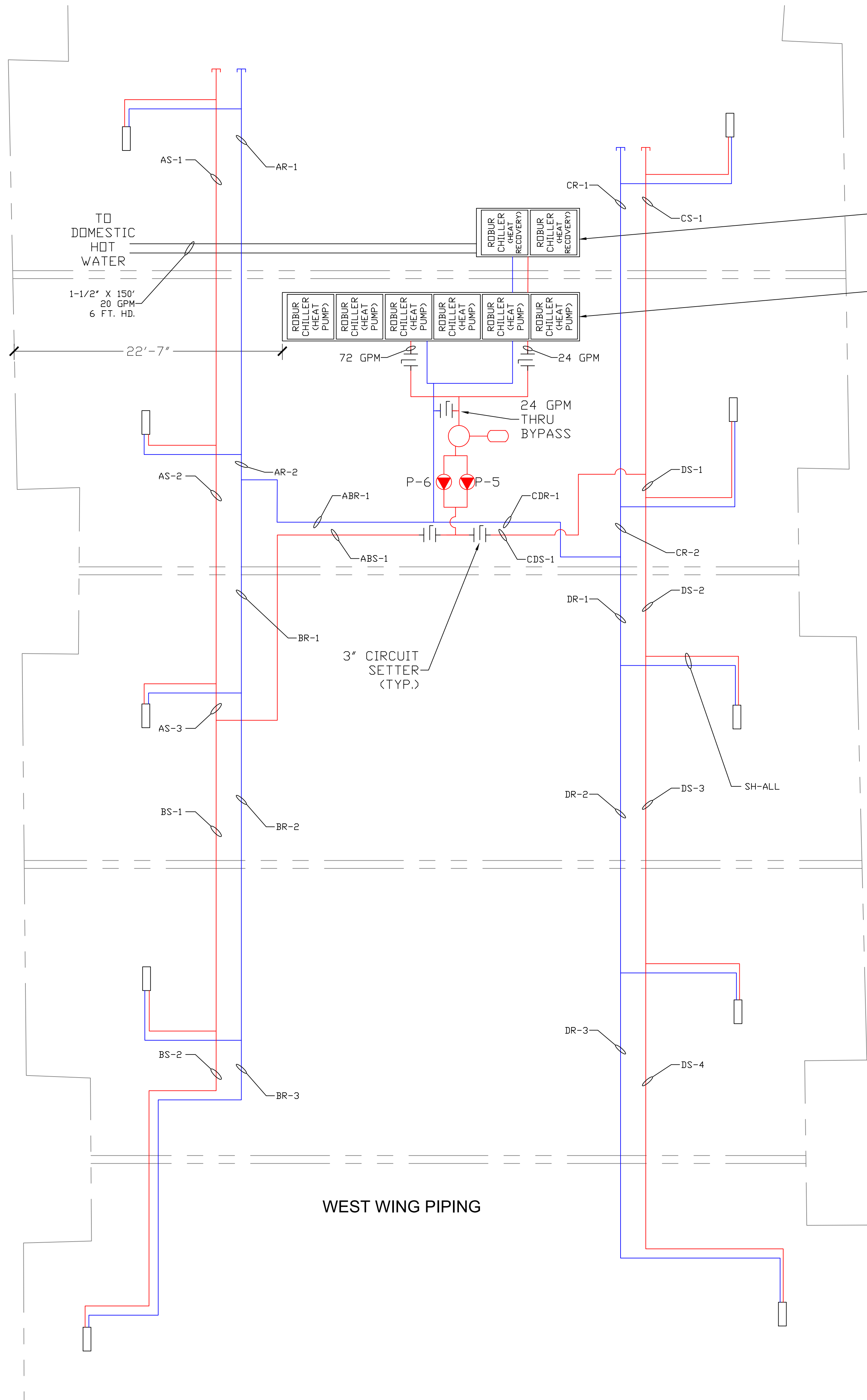
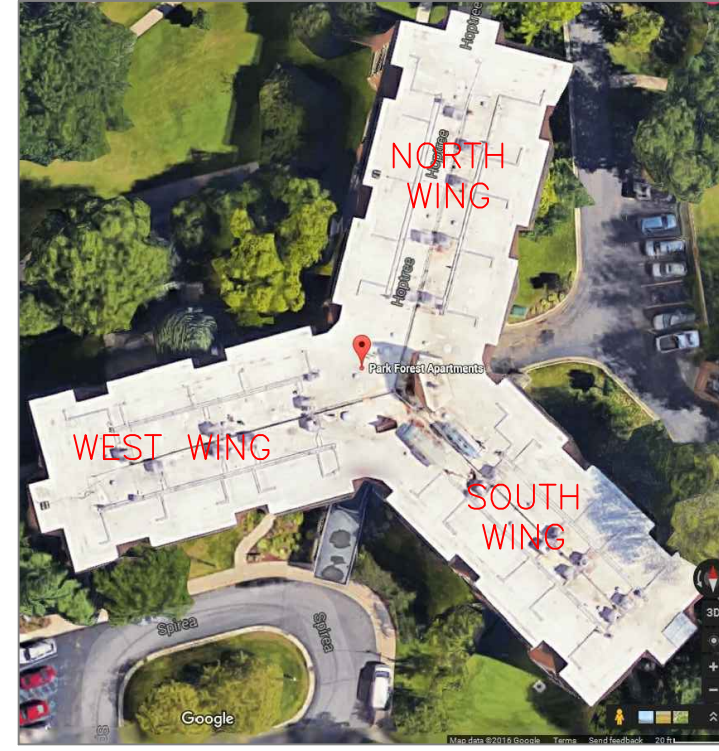
09/15/16	SUBMITTAL
09/22/16	REARRANGED PERMITS
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV SET SUPPLY PIPING
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAW-PAK  
 This drawing is the property of THAW-PAK, it has been prepared to assist in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
**PARK FOREST**

SHEET NO.  
**P2**





ROBUR 2 UNIT RACK  
UNITS WEIGHT 1928 LBS.  
RAIL AND PIPING 600 LBS.

ROBUR 6 UNIT RACK  
UNITS WEIGHT 5783 LBS.  
RAIL AND PIPING 1000 LBS.

TOTAL LOAD : 9311 LBS.

**MAINS AND RISERS**

120 GPM SYSTEM TOTAL  
60 GPM PER SIDE  
13.36 FT. DF HD. COMMON W/RISER  
1.81 FT. HD. 3" NEAR CHILLER  
9 FT. HD. CHILLERS  
3 FT. HD. FITTINGS

PUMP: 120 GPM @ 27 FT. HD.

CHILLER SKID(S) (GAL.) 28.0  
RISER CAPACITY (GAL.) 100.0  
SYSTEM PIPING CAP. (GAL.) 97.0  
TOTAL : 225.0

West Wing Piping Schedule						
Pipe Section	Pipe Size (Inch)	Length (Ft)	GPM	Velocity (Ft/Sec)	PD (Ft)	
ABS-1	2.5	33	60	4.05	0.85	
AS-1	1.25	30	12	3.07	1.02	
AS-2	1.25	20	24	6.15	2.33	
AS-3	1.5	3	36	6.52	0.31	
AR-1	1.5	30	12	2.17	0.44	
AR-2	1.5	3	24	4.35	0.15	
ABR-1	2.5	20	60	4.05	0.49	
SH-ALL	1.5	150	12	3.07	5.09	
NEAR CHILLER	3	50	120	5.68	1.81	
CHILLERS					9.00	
FITTINGS					3.00	
				<b>TOTAL</b>	<b>24.49</b>	
ABS-1	2.5	33	60	4.05	0.85	
BS-1	1.5	26	24	4.35	1.32	
BS-2	1.5	5	12	2.17	0.07	
BR-1	1.5	18	36	6.52	1.88	
BR-2	1.25	30	24	6.15	3.49	
BR-3	1.25	5	12	3.07	0.17	
ABR-1	2.5	20	60	4.05	0.49	
SH-ALL	1.5	150	12	3.07	5.09	
NEAR CHILLER	3	50	120	5.68	1.81	
CHILLERS					9.00	
FITTINGS					3.00	
				<b>TOTAL</b>	<b>27.17</b>	
CDS-1	2.5	23	60	4.05	0.56	
CS-1	2	25	12	1.26	0.10	
CR-1	2	27	12	1.26	0.11	
CR-2	2	4	24	2.51	0.05	
CDR-1	2.5	19	60	4.05	0.46	
SH-ALL	1.5	150	12	3.07	5.09	
NEAR CHILLER	3	50	120	5.68	1.81	
CHILLERS					9.00	
FITTINGS					3.00	
				<b>TOTAL</b>	<b>20.19</b>	
CDS-1	2.5	23	60	4.05	0.56	
DS-1	2	2	48	5.02	0.01	
DS-2	2	14	36	3.77	0.39	
DS-3	2	26	24	2.51	0.35	
DS-4	2	24	12	1.26	0.10	
DR-1	2	9	36	3.77	0.25	
DR-2	2	26	24	2.51	0.35	
DR-3	2	24	12	1.26	0.10	
CDR-1	2.5	19	60	4.05	0.46	
SH-ALL	1.5	150	12	3.07	5.09	
NEAR CHILLER	3	50	120	5.68	1.81	
CHILLERS					9.00	
FITTINGS					3.00	
				<b>TOTAL</b>	<b>21.47</b>	

# PIPING PLAN

SCALE: 3/16" = 1'-0" (APPROX.)

PIPING SYMBOLS LEGEND			
MIXING VALVE		EXPANSION TANK	
DIVERTING VALVE		BY-PASS VALVE	
PRESSURE REDUCE VALVE		DRAIN VALVE	
PUMP		THERMOMETER	
CHECK VALVE		GAUGE	
UNIONS		BALL VALVE	
CIRCUIT SETTER		AIR SEPARATOR	
ZONE VALVE		BACK FLOW PREVENTER	
FLOWGARD VALVE		AIR VENT	

**NOTES:**  
\* MAX PIPE SPACING TO BE 12 INCHES OR 4 PIPE DIAMETERS APART OR WHICH EVER IS LESS.

CONSULTANTS:  
**WILLIAM E. WALTER**  
1917 HOWARD AVE  
FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
3300 SPIREA COURT  
JACKSON MICHIGAN

THAWPAK DISTRIBUTOR:  
**PERFORMANCE**  
engineering group

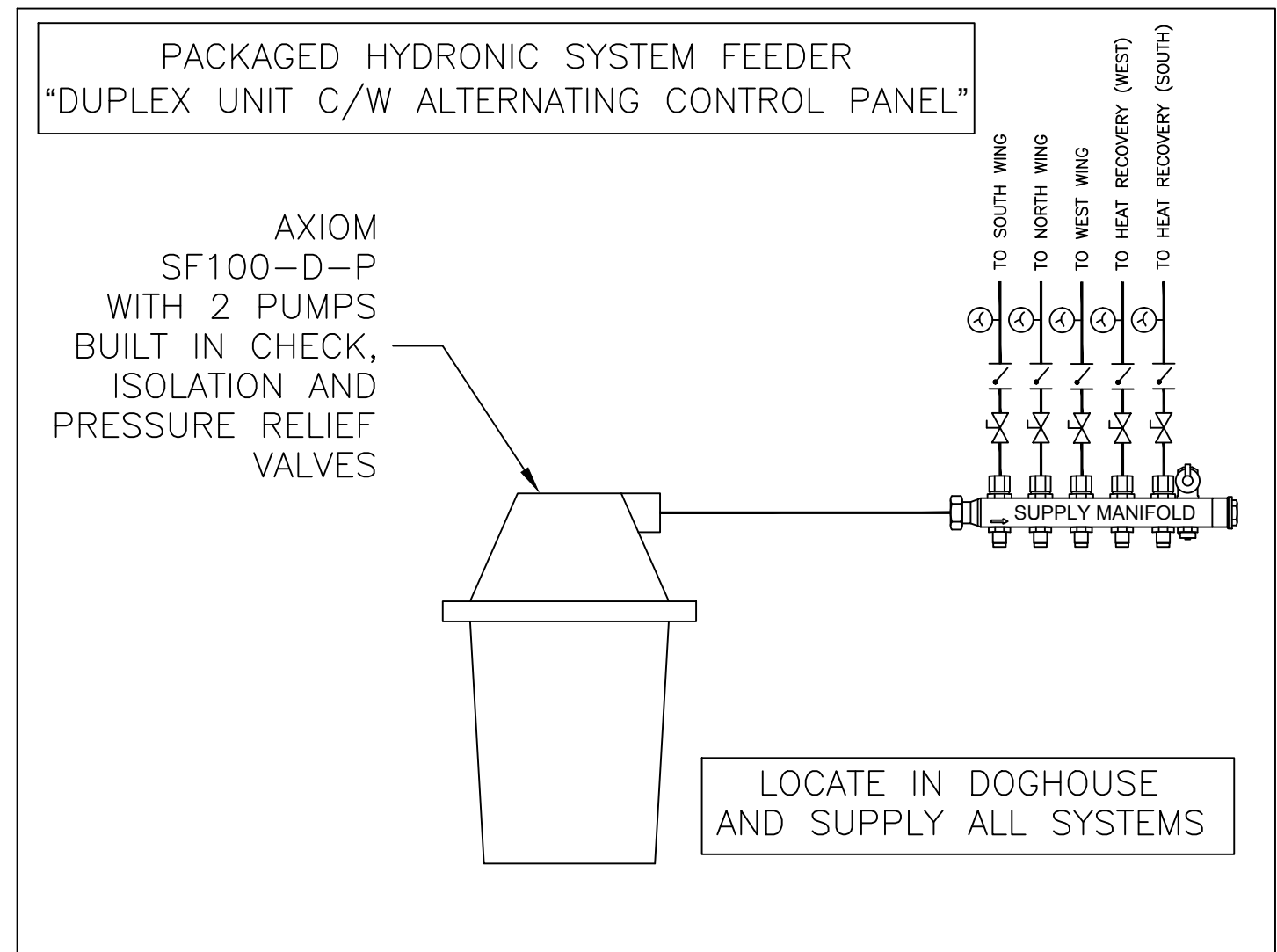
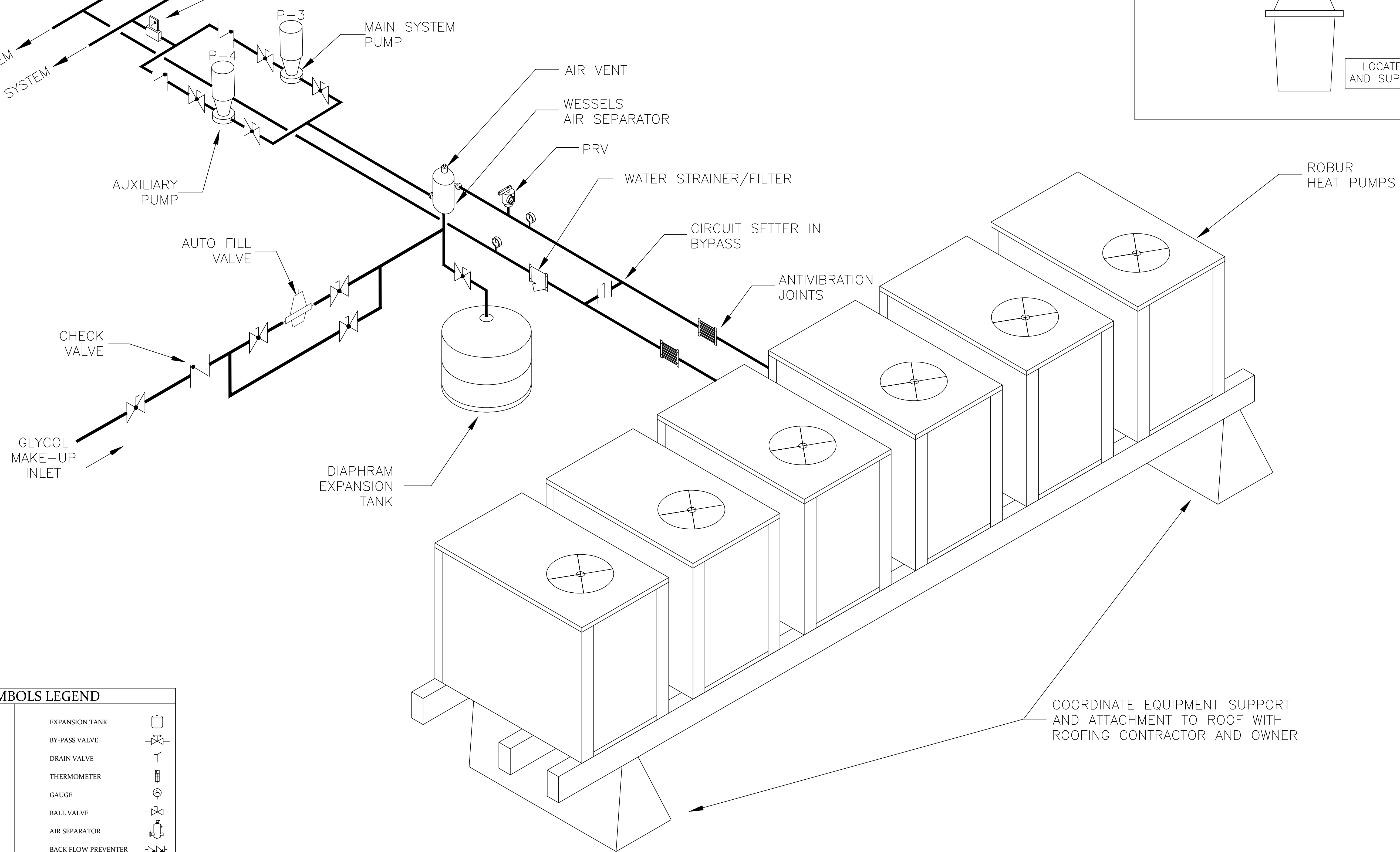
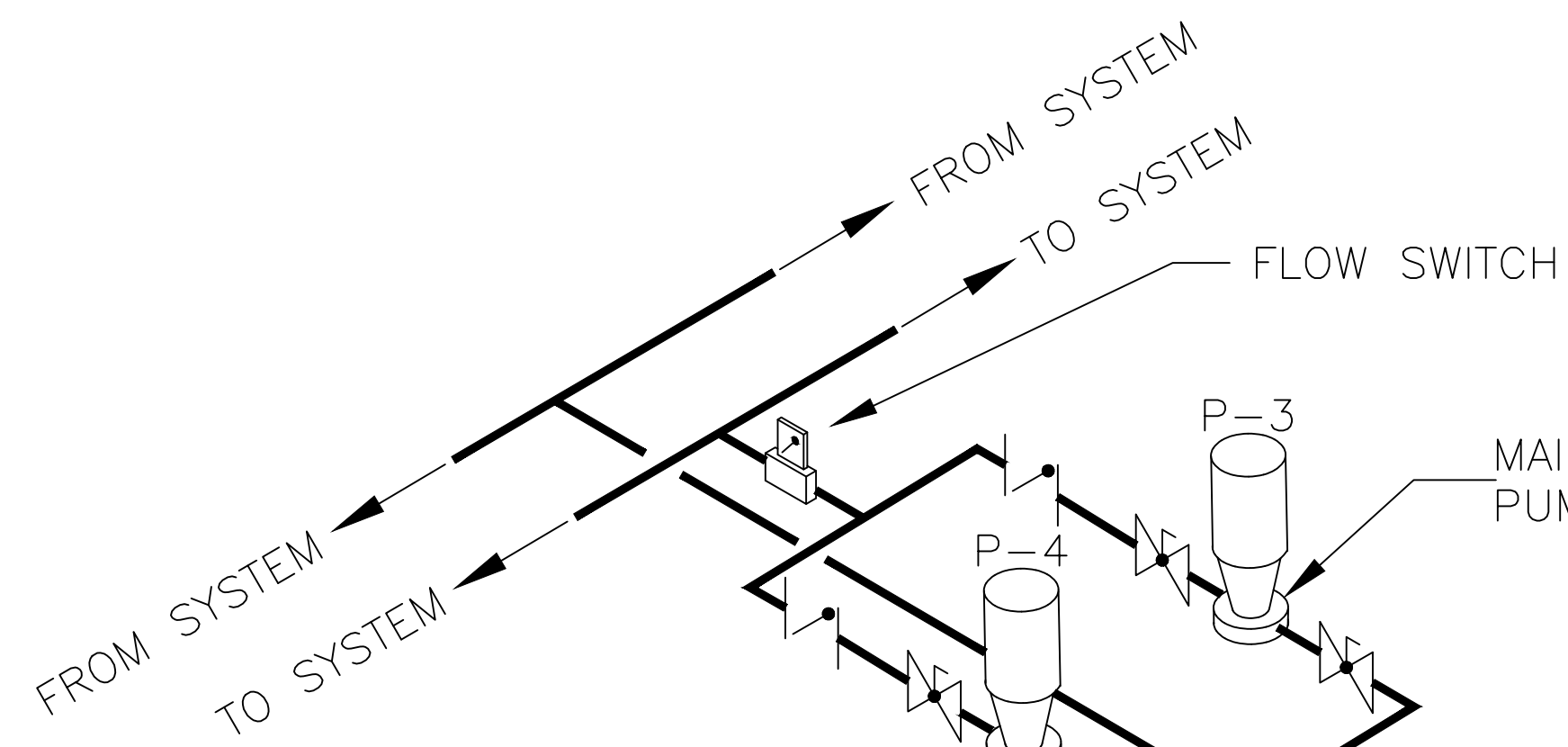
DRAWN BY:  
Gordon Faustich  
REVIEWED BY:  
AD  
APPROVED BY:  
AD  
ISSUED FOR

09/15/16	SUBMITTAL
09/22/16	REARRANGED PIPING
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV SET SUPPLY PIPING
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAWPAK  
This drawing is the property of THAWPAK, it has been prepared to assist in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
**PARK FOREST**

SHEET NO.  
**P3**



PIPING SYMBOLS LEGEND	
MIXING VALVE	EXPANSION TANK
DIVERTING VALVE	BY-PASS VALVE
PRESSURE REDUCE VALVE	DRAIN VALVE
PUMP	THERMOMETER
CHECK VALVE	GAUGE
UNIONS	BALL VALVE
CIRCUIT SETTER	AIR SEPARATOR
ZONE VALVE	BACK FLOW PREVENTER
FLOWGARD VALVE	AIR VENT

**NOTES:**  
 \* MAX PIPE SPACING TO BE 12 INCHES OR 4 PIPE DIAMETERS APART OR WHICH EVER IS LESS.

# NEAR CHILLER PIPING SINGLE SKID NORTH WING

SCALE: NONE

CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
 engineering group

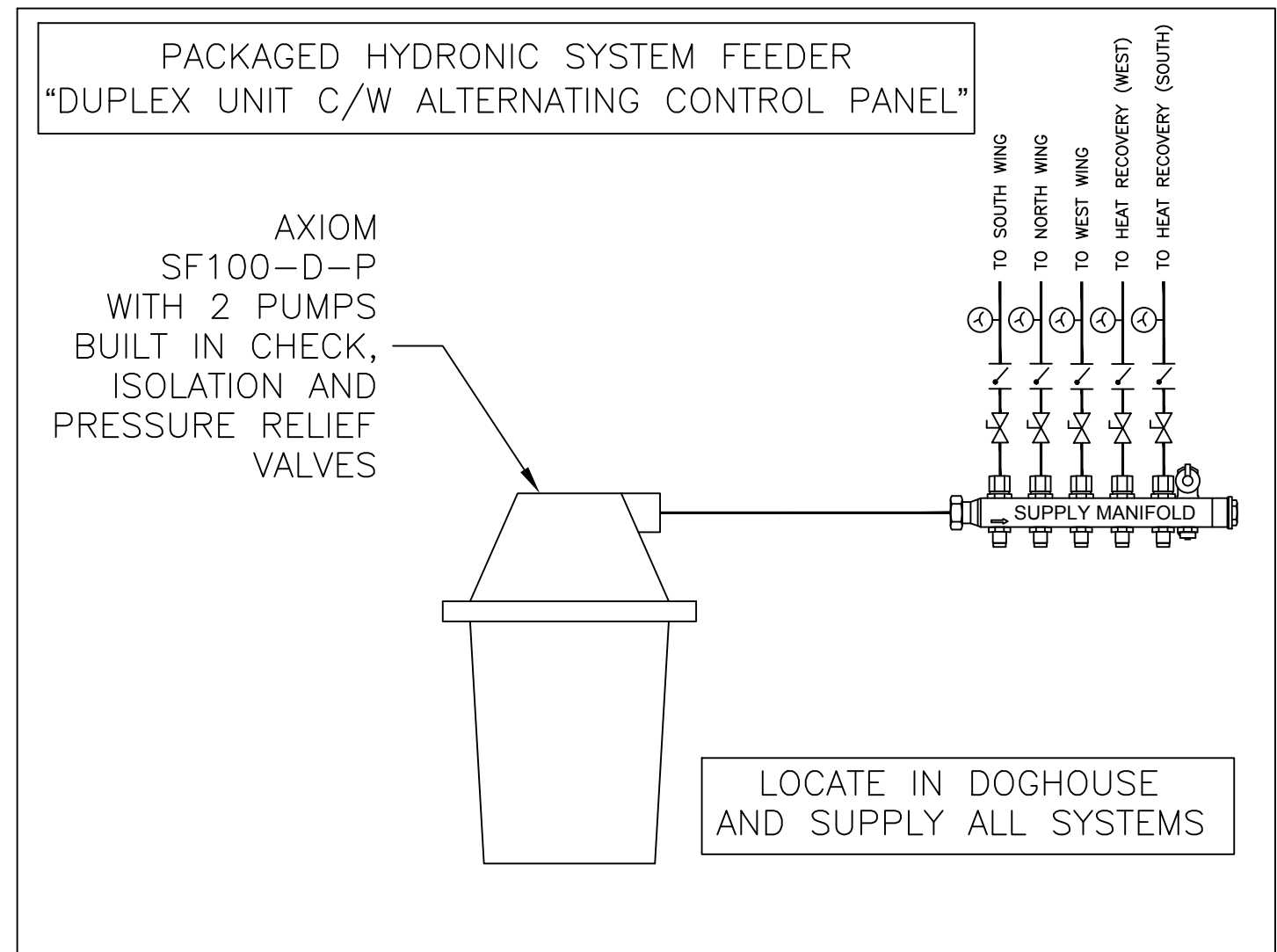
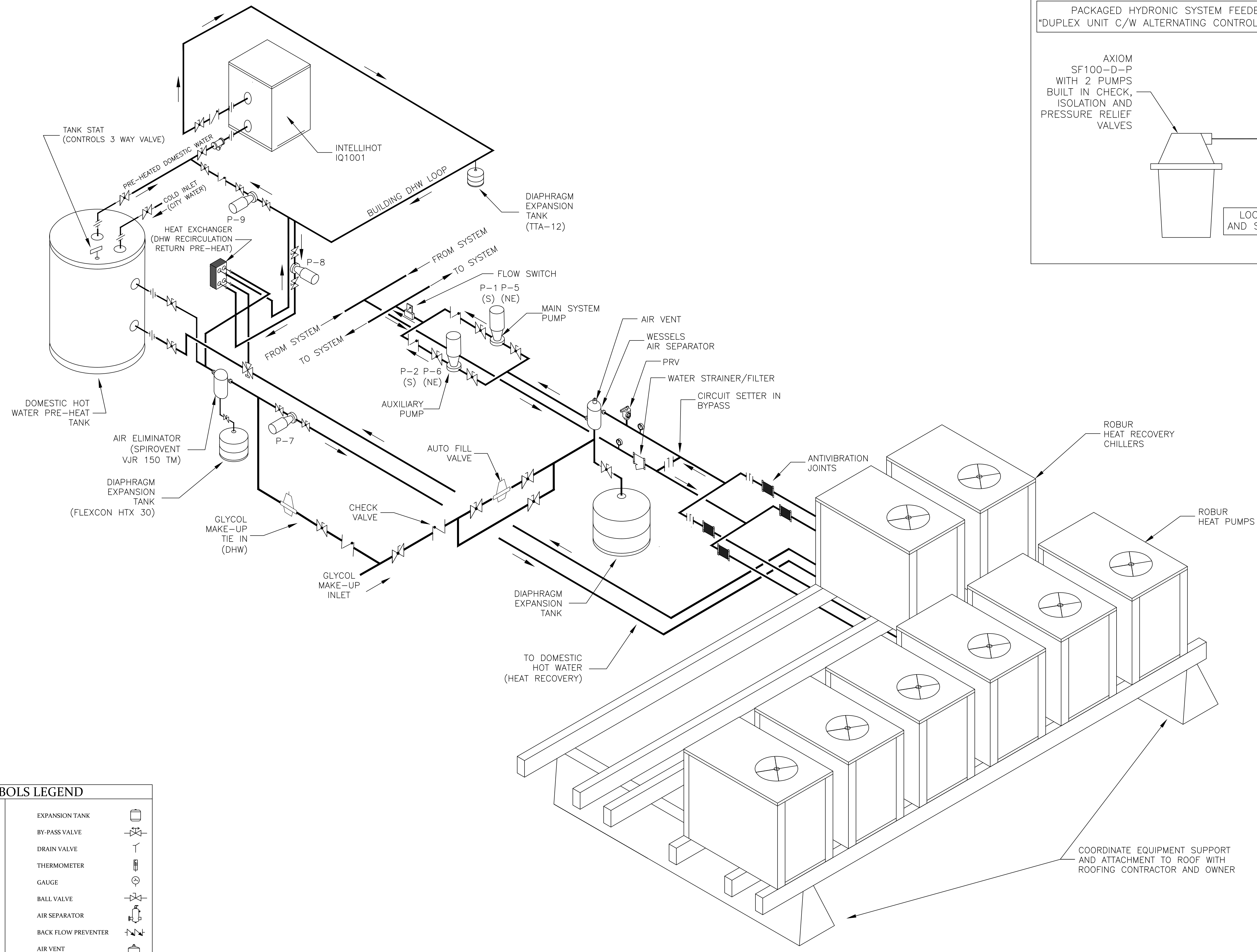
DRAWN BY: Gordon Faustich	
REVIEWED BY: AD	
APPROVED BY: AD	
ISSUED FOR	
09/15/16	SUBMITTAL
09/22/16	REARRANGED PIPING
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV RET SUPPLY PIPING
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

**PROPERTY OF THAW-PAK**  
 This drawing is the property of THAW-PAK, it has been prepared for use in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
 PARK FOREST

SHEET NO.  
**P4**





PIPING SYMBOLS LEGEND	
MIXING VALVE	EXPANSION TANK
DIVERTING VALVE	BY-PASS VALVE
PRESSURE REDUCE VALVE	DRAIN VALVE
PUMP	THERMOMETER
CHECK VALVE	GAUGE
UNIONS	BALL VALVE
CIRCUIT SETTER	AIR SEPARATOR
ZONE VALVE	BACK FLOW PREVENTER
FLOWGARD VALVE	AIR VENT

NOTES:  
 \* MAX PIPE SPACING TO BE 12 INCHES OR 4 PIPE DIAMETERS APART OR WHICH EVER IS LESS.

# NEAR CHILLER PIPING DUAL SKID (SOUTH AND WEST WING)

SCALE: NONE

COORDINATE EQUIPMENT SUPPORT AND ATTACHMENT TO ROOF WITH ROOFING CONTRACTOR AND OWNER

CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN

THAWPAK DISTRIBUTOR:  
**PERFORMANCE**  
 engineering group

DRAWN BY: Gordon Faustich	
REVIEWED BY: AD	
APPROVED BY: AD	
ISSUED FOR	
09/15/16	SUBMITTAL
09/22/16	REARRANGED PIPING
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV SET SUPPLY PIPING
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAWPAK  
 This drawing is the property of THAWPAK, it has been prepared for use in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
 PARK FOREST

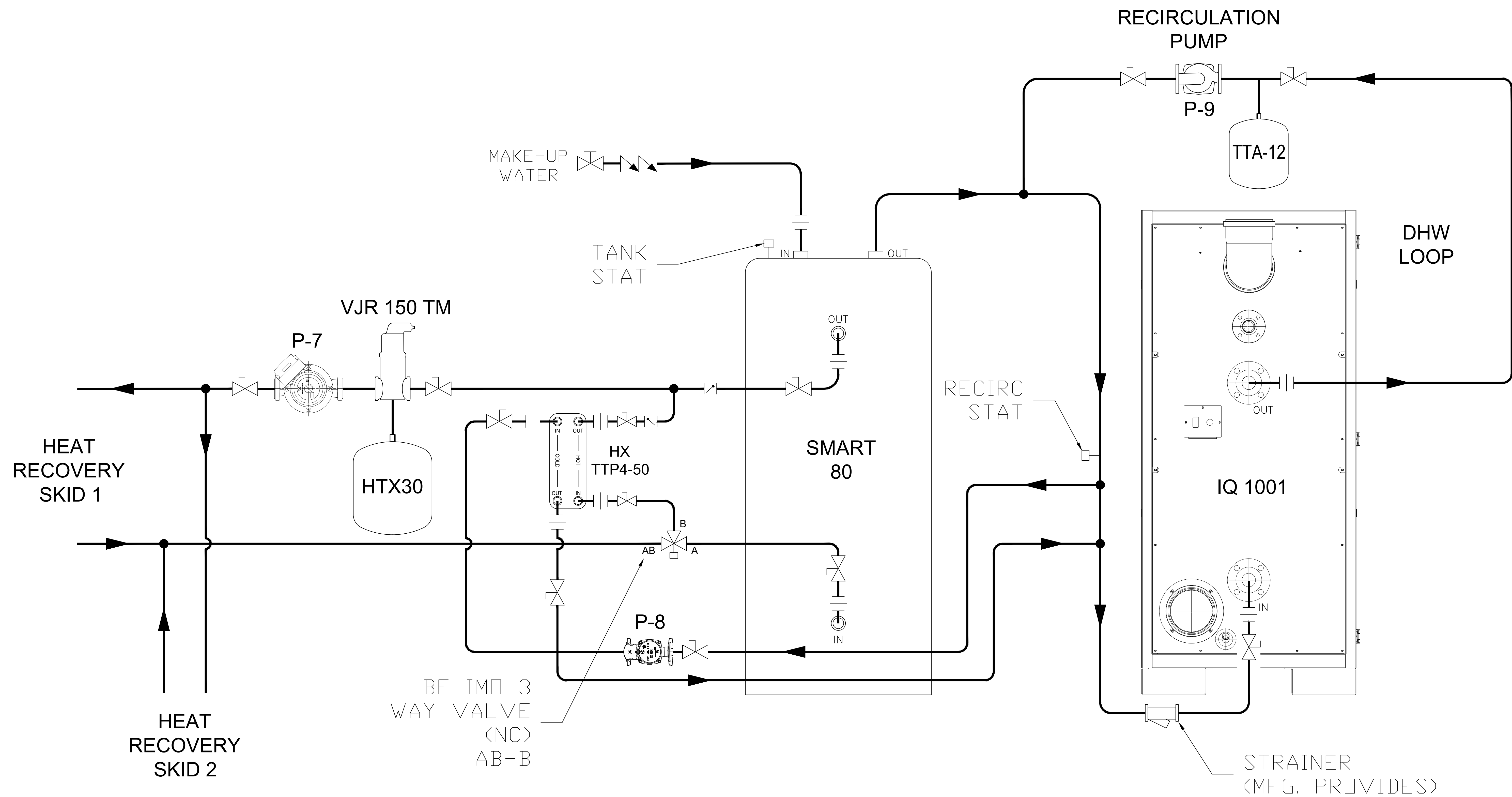
SHEET NO.  
**P5**

PIPING SYMBOLS LEGEND			
MIXING VALVE		EXPANSION TANK	
DIVERTING VALVE		BY-PASS VALVE	
PRESSURE REDUCE VALVE		DRAIN VALVE	
PUMP		THERMOMETER	
CHECK VALVE		GAUGE	
UNIONS		BALL VALVE	
CIRCUIT SETTER		AIR SEPARATOR	
ZONE VALVE		BACK FLOW PREVENTER	
FLOWGARD VALVE		AIR VENT	

NOTES:  
 \* MAX PIPE SPACING TO BE 12 INCHES OR  
 4 PIPE DIAMETERS APART OR WHICH EVER IS LESS.

# HEAT RECOVERY PIPING (SOUTH AND WEST WING)

SCALE: 1-1/2"=1' (APPROX.)



CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
 engineering group

DRAWN BY:  
 Gordon Faustich  
 REVIEWED BY:  
 AD  
 APPROVED BY:  
 AD

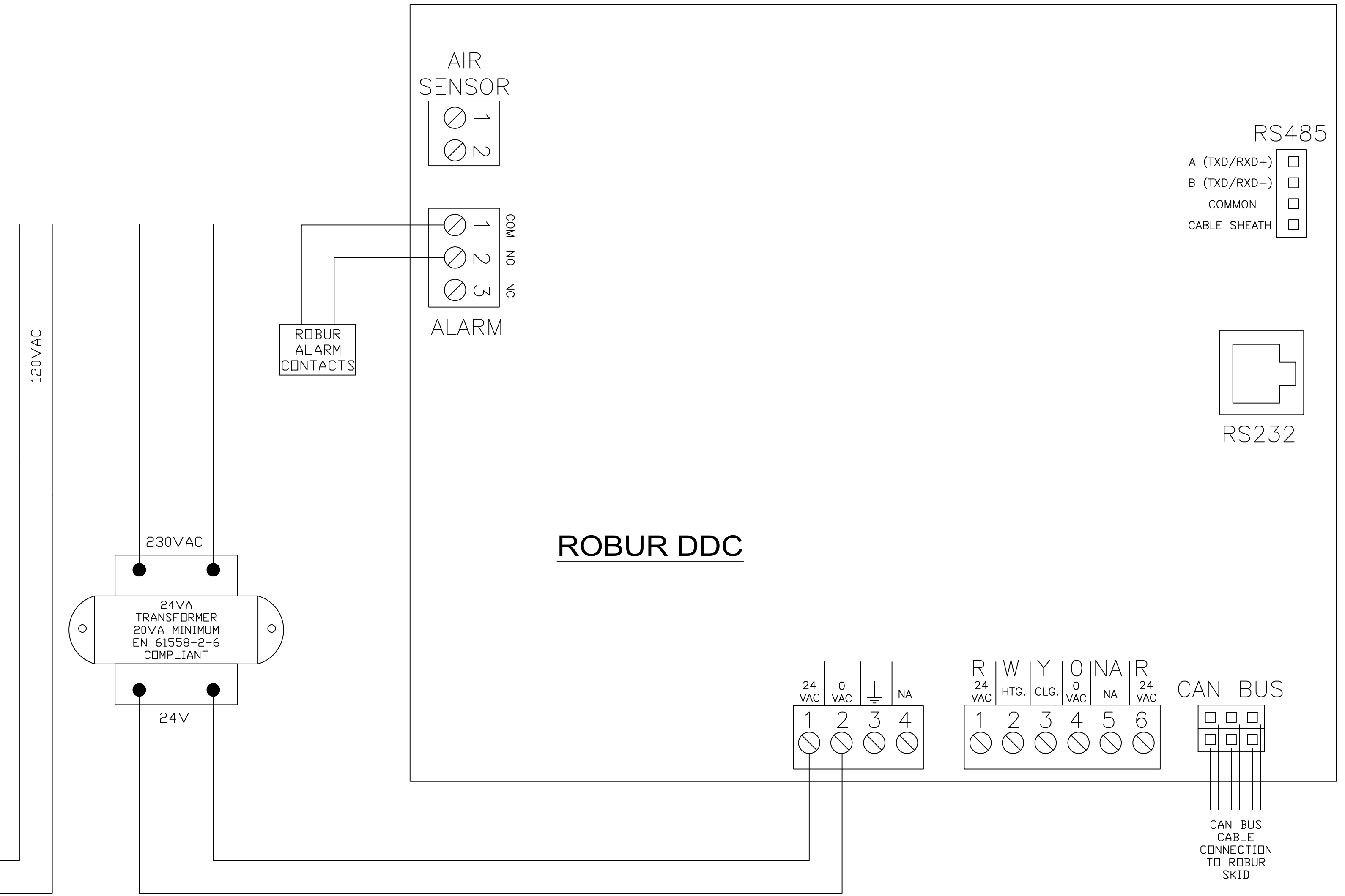
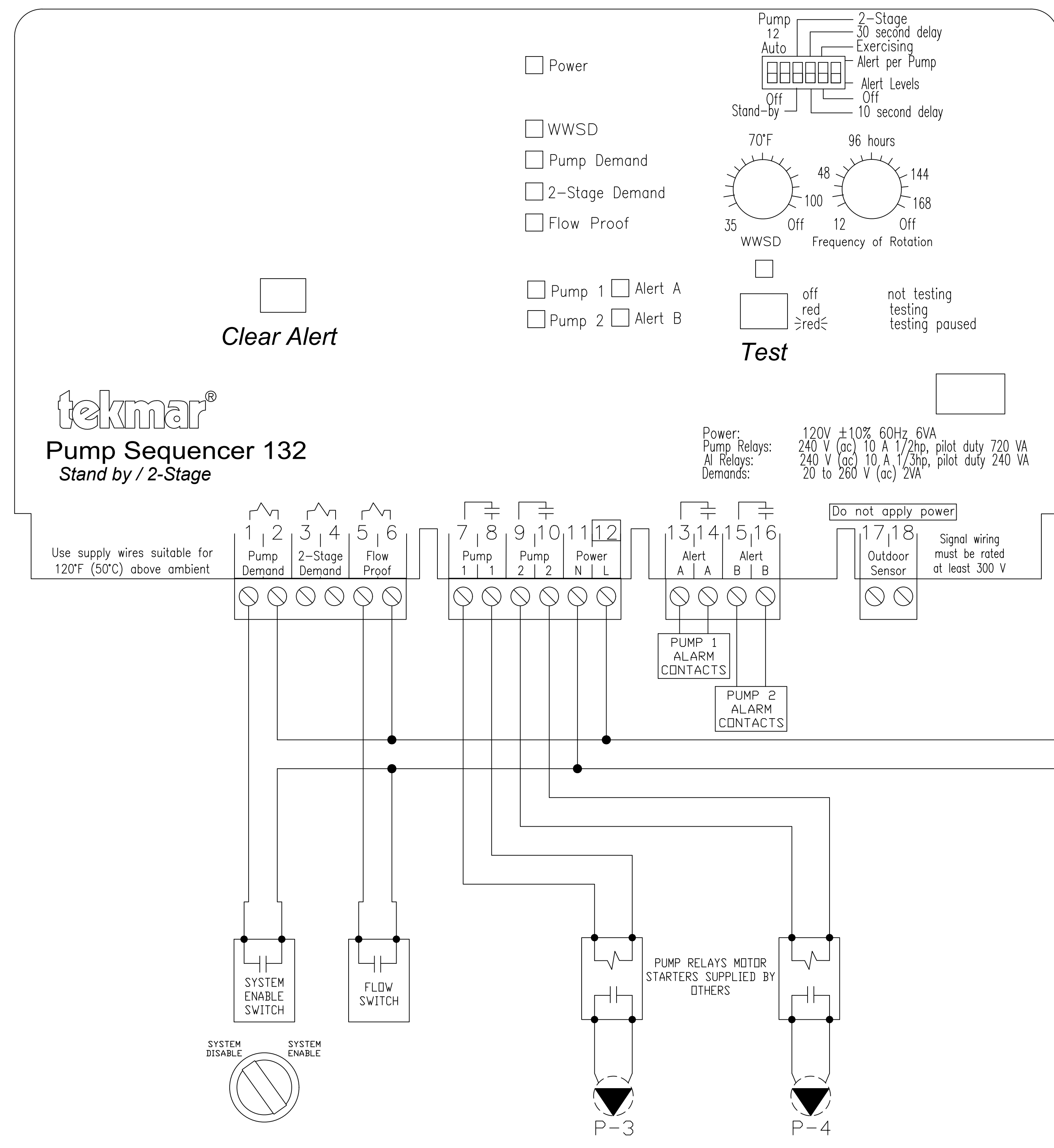
ISSUED FOR	
09/15/16	SUBMITTAL
09/22/16	REARRANGED PER
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV SET SUPPLY PIPING
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAW-PAK  
 This drawing is the property of THAW-PAK, it has been prepared in aid of the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
 PARK FOREST

SHEET NO.  
**P6**





# WIRING DIAGRAM HEAT PUMPS

SCALE: NONE

CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
 engineering group

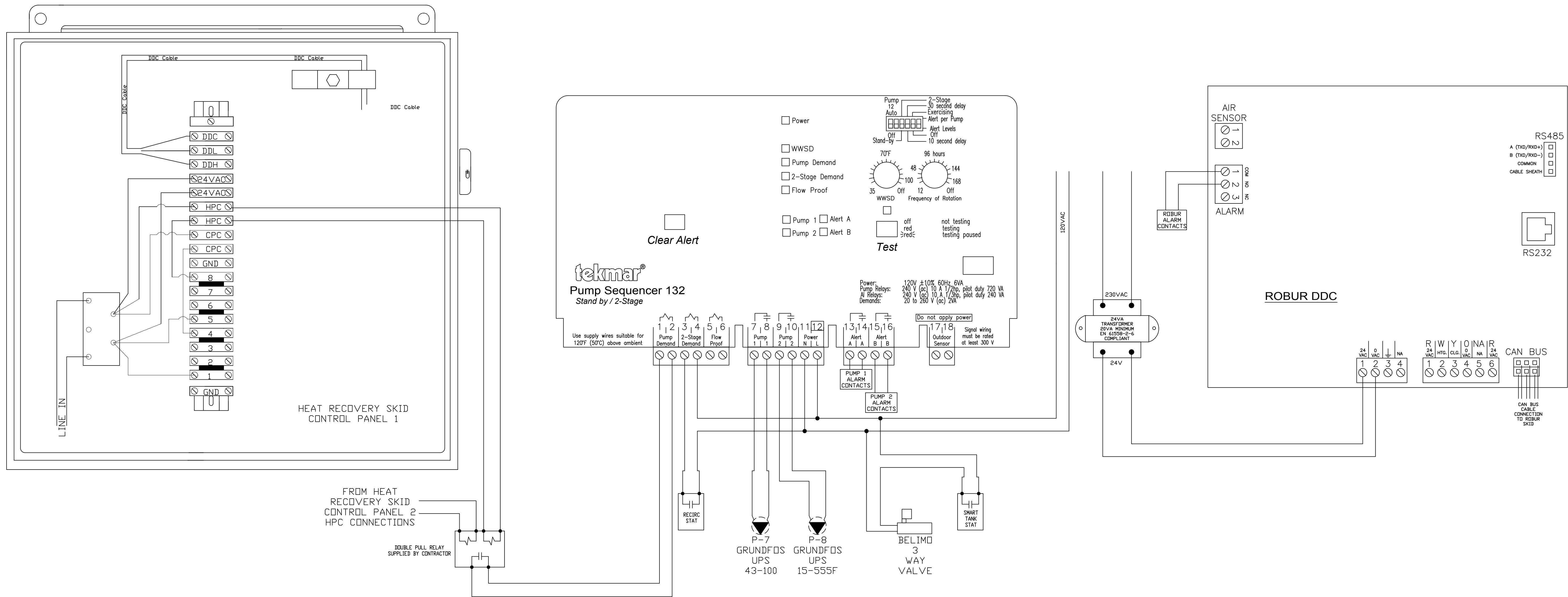
DRAWN BY:  
 Gordon Faustich  
 REVIEWED BY:  
 AD  
 APPROVED BY:  
 AD

ISSUED FOR	
09/15/16	SUBMITTAL
09/22/16	REARRANGED PERM
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV RET SUPPLY PRINC.
11/03/16	REVISED PRINC.
11/08/16	REVISED CONTROLS

PROPERTY OF THAW-PAK  
 This drawing is the property of THAW-PAK, it has been prepared to assist in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
 PARK FOREST

SHEET NO.  
**E1**



SEQUENCE OF OPERATION:

- 1) UNITS MUST BE IN THE SEASONAL COOLING MODE (SUMMER) FOR HEAT RECOVERY TO FUNCTION AND THE DDC SHOULD BE POWERING REQUIRED UNITS (HEAT RECOVERY CHILLERS).
- 2) HEAT RECOVERY PUMP P7 GETS ENERGIZED VIA THE HPC CONTACTS IN THE HEAT RECOVERY SKID CONTROL PANELS. THE PUMP RUNS CONTINUOUSLY AS LONG AS A SIGNAL IS PRESENT.
- 3) PUMP P7 SUPPLIES HOT WATER TO THE HEAT EXCHANGER IN THE SMART TANK UNTIL IT'S HEAT REQUIREMENTS ARE SATISFIED. AT THIS POINT THE TANK STAT OPENS AND REMOVES POWER TO THE BELIMO DIVERTING VALVE TO DIVERT HOT WATER THRU THE BRAZED PLATE HEAT EXCHANGER.
- 4) IF THE RE-CIRCULATION LOOP NEEDS HEAT THE RE-CIRC STAT WILL SEND A SIGNAL THAT WILL POWER PUMP P8 AND INJECT HOT WATER TO PRE-HEAT THE RETURN WATER ENTERING THE iQ1001
- 5) IF THE DDC SAYS NO HEAT AVAILABLE (HEAT RECOVERY IS OFF). NO PUMPS WILL OPERATE

**WIRING DIAGRAM HEAT RECOVERY (FOR DOMESTIC HW)**

SCALE: NONE

CONSULTANTS:  
**WILLIAM E. WALTER**  
1917 HOWARD AVE  
FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
3300 SPIREA COURT  
JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
engineering group

DRAWN BY:  
Gordon Faustich  
REVIEWED BY:  
AD  
APPROVED BY:  
AD  
ISSUED FOR

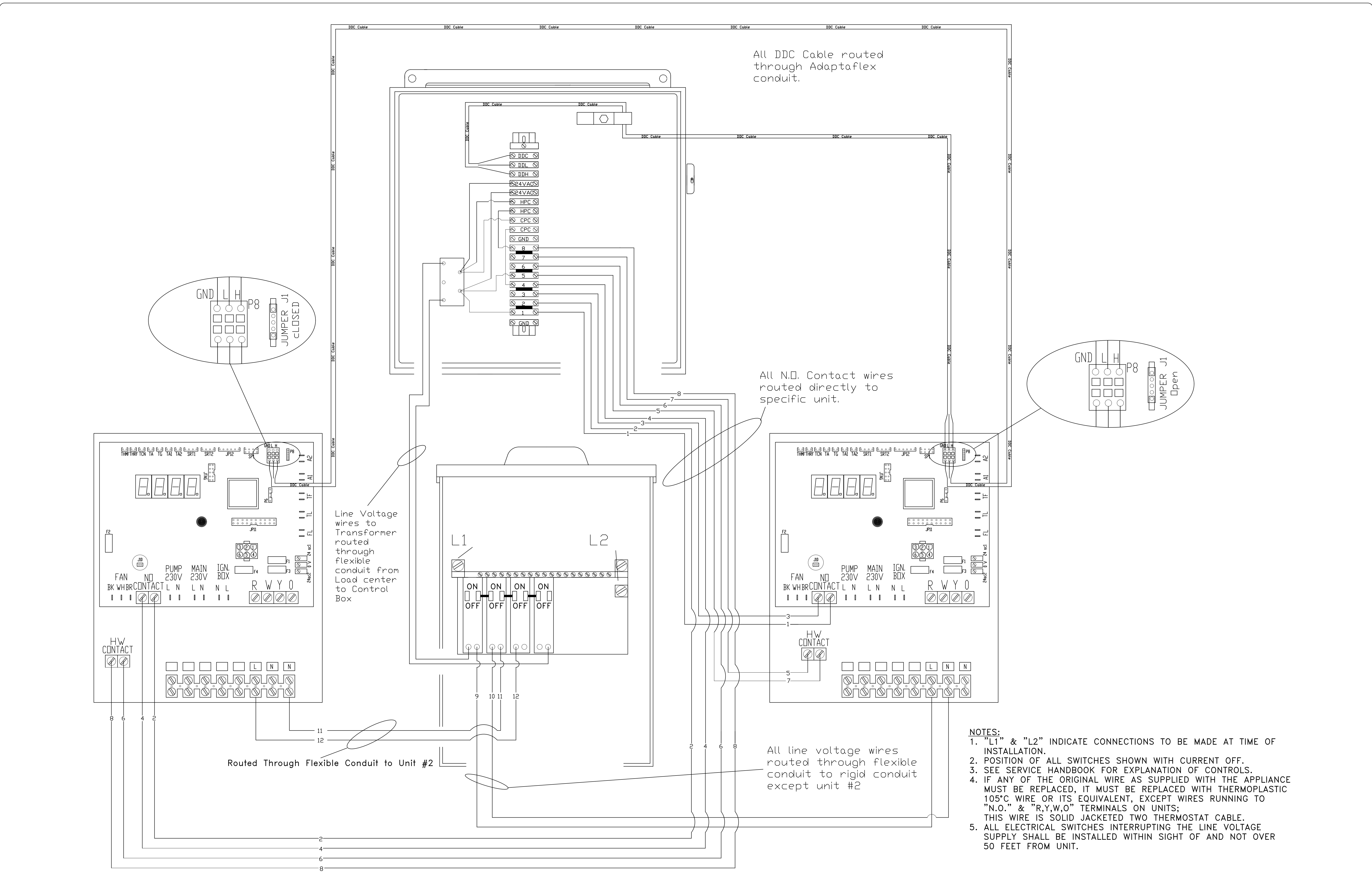
09/15/16	SUBMITTAL
09/22/16	REARRANGED PERM
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV SET SUPPLY PUMPING
11/03/16	REVISED PUMPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAW-PAK  
This drawing is the property of THAW-PAK, it has been prepared in aid of the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
PARK FOREST

SHEET NO.  
**E2**





All DDC Cable routed through Adaptaflex conduit.

All N.O. Contact wires routed directly to specific unit.

Line Voltage wires to Transformer routed through flexible conduit from Load center to Control Box

Routed Through Flexible Conduit to Unit #2

All line voltage wires routed through flexible conduit to rigid conduit except unit #2

- NOTES:
1. "L1" & "L2" INDICATE CONNECTIONS TO BE MADE AT TIME OF INSTALLATION.
  2. POSITION OF ALL SWITCHES SHOWN WITH CURRENT OFF.
  3. SEE SERVICE HANDBOOK FOR EXPLANATION OF CONTROLS.
  4. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH THERMOPLASTIC 105°C WIRE OR ITS EQUIVALENT, EXCEPT WIRES RUNNING TO "N.O." & "R,Y,W,O" TERMINALS ON UNITS; THIS WIRE IS SOLID JACKETED TWO THERMOSTAT CABLE.
  5. ALL ELECTRICAL SWITCHES INTERRUPTING THE LINE VOLTAGE SUPPLY SHALL BE INSTALLED WITHIN SIGHT OF AND NOT OVER 50 FEET FROM UNIT.

# HEAT RECOVERY SKID WIRING

SCALE: NONE

CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
 engineering group

DRAWN BY:  
Gordon Faustich

REVIEWED BY:  
AD

APPROVED BY:  
AD

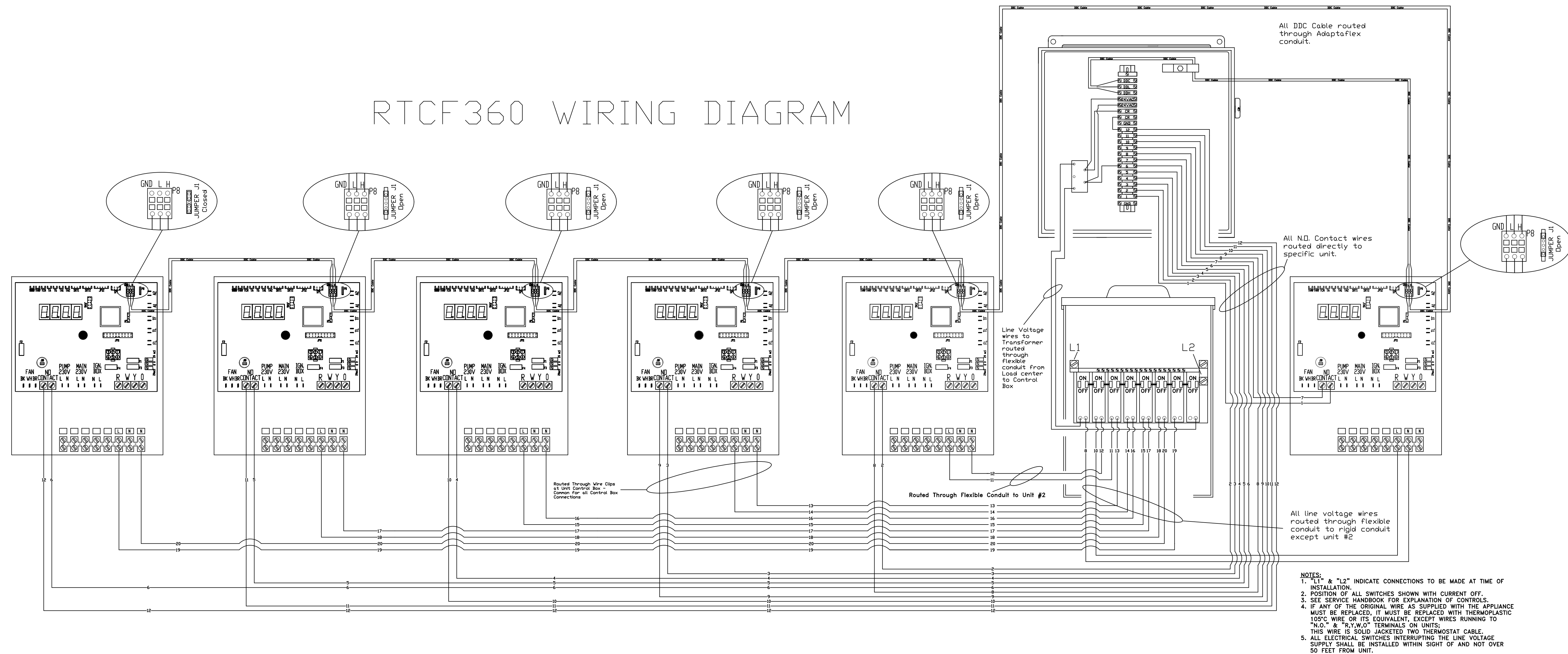
ISSUED FOR	
09/15/16	SUBMITTAL
09/22/16	REARRANGED PERMITS
09/27/16	UPDATED TO FIELD CHANGES
10/06/16	REMOVED REV RET SUPPLY LISTING
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAW-PAK  
 This drawing is the property of THAW-PAK, it has been prepared for use in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
**PARK FOREST**

SHEET NO.  
**E3**

# RTCF360 WIRING DIAGRAM



- NOTES:**
1. "L1" & "L2" INDICATE CONNECTIONS TO BE MADE AT TIME OF INSTALLATION.
  2. POSITION OF ALL SWITCHES SHOWN WITH CURRENT OFF.
  3. SEE SERVICE HANDBOOK FOR EXPLANATION OF CONTROLS.
  4. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH THERMOPLASTIC 105°C WIRE OR ITS EQUIVALENT, EXCEPT WIRES RUNNING TO "N.O." & "R,Y,W,O" TERMINALS ON UNITS; THIS WIRE IS SOLID JACKETED TWO THERMOSTAT CABLE.
  5. ALL ELECTRICAL SWITCHES INTERRUPTING THE LINE VOLTAGE SUPPLY SHALL BE INSTALLED WITHIN SIGHT OF AND NOT OVER 50 FEET FROM UNIT.

## 18/2 LOW VOLTAGE WIRE LENGTHS

Unit #	Wire Length
#1	161"
#2	83"
#3	158"
#4	205"
#5	248"
#6	300"
500'spool =	Part# 88301606

## 14 AWG LINE VOLTAGE WIRE LENGTHS

Unit #	Wire #	Wire Length
#1	8 & 10	130"
#2	11 & 12	54"
#3	13 & 14	119"
#4	15 & 16	171"
#5	17 & 18	229"
#6	19 & 20	278"
500' Spool =	P# 88284592	

## DDC CABLE LENGTHS

Between Unit #'s	Wire Length
#1 & Control Box	140"
#1 & #2	161-1/2"
#2 & #3	161-1/2"
#3 & #4	161-1/2"
#4 & #5	161-1/2"
#5 & #6	161-1/2"
P# M-CVO008	

## ADAPTA FLEX CONDUIT LENGTHS

Between Unit #'s	Conduit Length
#1 & Control Box	91"
#1 & #2	114"
#2 & #3	114"
#3 & #4	114"
#4 & #5	114"
#5 & #6	114"
P# = PAFS21/BL1 =	100' COIL

# HEAT PUMP SKID WIRING

SCALE: NONE

CONSULTANTS:  
**WILLIAM E. WALTER**  
1917 HOWARD AVE  
FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
3300 SPIREA COURT  
JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
engineering group

DRAWN BY:  
Gordon Faustich

REVIEWED BY:  
AD

APPROVED BY:  
AD

ISSUED FOR

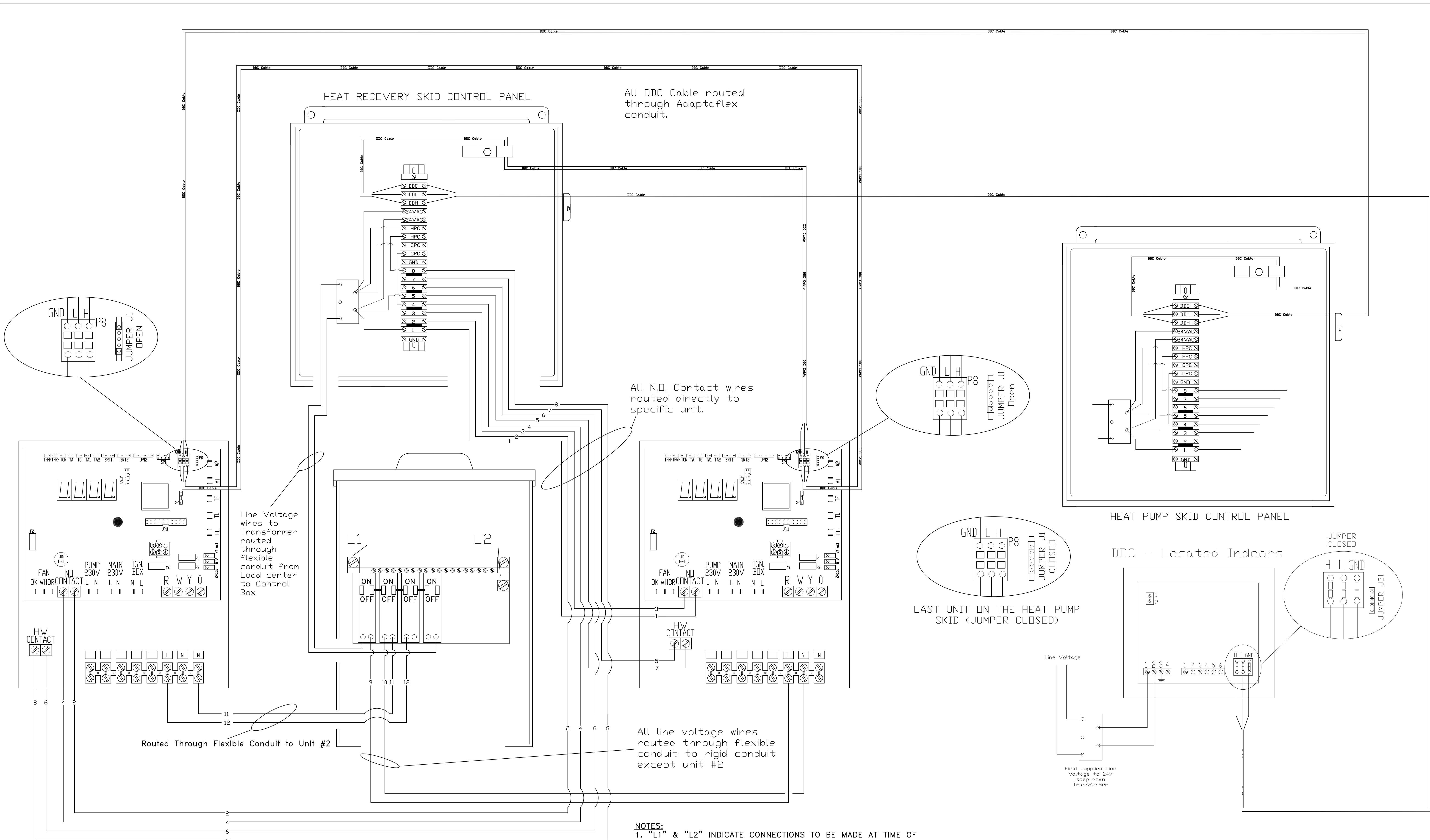
DATE	DESCRIPTION
09/15/16	SUBMITTAL
09/22/16	REARRANGED
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV RET SUPPLY LISTING
11/03/16	REVISED WIRING
11/08/16	REVISED CONTROLS

PROPERTY OF THAW-PAK  
This drawing is the property of THAW-PAK, it has been prepared to assist in the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
16-009P\_E\_  
PARK FOREST

SHEET NO.  
**E4**





All DDC Cable routed through Adaptaflex conduit.

All N.O. Contact wires routed directly to specific unit.

Line Voltage wires to Transformer routed through flexible conduit from Load center to Control Box

Routed Through Flexible Conduit to Unit #2

All line voltage wires routed through flexible conduit to rigid conduit except unit #2

- NOTES:**
- "L1" & "L2" INDICATE CONNECTIONS TO BE MADE AT TIME OF INSTALLATION.
  - POSITION OF ALL SWITCHES SHOWN WITH CURRENT OFF.
  - SEE SERVICE HANDBOOK FOR EXPLANATION OF CONTROLS.
  - IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH THERMOPLASTIC 105°C WIRE OR ITS EQUIVALENT, EXCEPT WIRES RUNNING TO "N.O." & "R.Y.W.O" TERMINALS ON UNITS; THIS WIRE IS SOLID JACKETED TWO THERMOSTAT CABLE.
  - ALL ELECTRICAL SWITCHES INTERRUPTING THE LINE VOLTAGE SUPPLY SHALL BE INSTALLED WITHIN SIGHT OF AND NOT OVER 50 FEET FROM UNIT.

# SKID TIE IN WIRING (HEAT PUMP TO HEAT RECOVERY SKID)

SCALE: NONE

CONSULTANTS:  
**WILLIAM E. WALTER**  
1917 HOWARD AVE  
FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
3300 SPIREA COURT  
JACKSON MICHIGAN

THAW-PAK DISTRIBUTOR:  
**PERFORMANCE**  
engineering group

DRAWN BY:  
Gordon Faustich

REVIEWED BY:  
AD

APPROVED BY:  
AD

ISSUED FOR

09/15/16	SUBMITTAL
09/22/16	REARRANGED PER PINS
09/27/16	UPDATED TO FIELD CHANGE
10/06/16	REMOVED REV RET SUPPLY PIPING
11/03/16	REVISED PIPING
11/08/16	REVISED CONTROLS

PROPERTY OF THAW-PAK  
This drawing is the property of THAW-PAK, it has been prepared in aid of the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
**16-009P\_E\_**  
PARK FOREST

SHEET NO.  
**E5**

# HEATING AND COOLING

System Name	Robur (Skid)	QTY.	Heating 5° Ambient 122° Water Temp	Cooling 95° Ambient 44.6° Water Temp	Heat Recovery @ 86° Water Return Temp	Robur Voltage	Gas Connection	Water Connection	Weight (Lbs)	Length (Inches)	Width (Inches)
Park Forest South Wing (Skid 1)	RTAR360-720	1.00	528,000	346,200	N/A	208-230/1/60	1.25"	2"	5,500	306	49
Park Forest South Wing (Skid 2)	ACF-RTCF120 HR	1.00	N/A	122,480	182,236	208-230/1/60	1.0"	1.5"	2,040	93	49
Park Forest North Wing	RTAR360-720	1.00	528,000	346,200	N/A	208-230/1/60	1.25"	2"	5,500	306	49
Park Forest West Wing (Skid 1)	RTAR360-720	1.00	528,000	346,200	N/A	208-230/1/60	1.25"	2"	5,500	306	49
Park Forest West Wing (Skid 2)	ACF-RTCF120 HR	1.00	N/A	122,480	182,236	208-230/1/60	1.0"	1.5"	2,040	93	49
		Total	1,584,000	1,283,560	364,472						

# CURRENT BUILDING FAN COILS

System Name	Square Feet	2 Pipe Fan Coil Units			Fan Coil Capacity (MBH)		Total Capacity (MBH)	
		W-602	W-302X	W-202	Cooling	Heating	Cooling	Heating
Park Forest South Wing	56,316							
South East	28,158	4	19	10	415	449	830	898
South West	28,158	4	19	10	415	449		
Park Forest North Wing	56,316						678	738
East	28,158		20	10	339	369		
West	28,158		20	10	339	369		
Park Forest West Wing	56,316						370	437
North West	28,158		20	5	185	219		
South West	28,158		20	5	185	219		
Total		8	118	50	1,878	2,073	1,878	2,073

# PUMPS

Pump No.	System Name	Pump Model Number	Pump Qty.	Pump HP	Pump Voltage	System Flow (GPM)	System Head (FT.)
P1	Park Forest South Wing	Paco 20709 VL	1	2.00	208-230/3/60	120	27
P2	Park Forest South Wing	Paco 20709 VL	1	2.00	208-230/3/60	120	27
P3	Park Forest North Wing	Paco 20709 VL	1	2.00	208-230/3/60	120	27
P4	Park Forest North Wing	Paco 20709 VL	1	2.00	208-230/3/60	120	27
P5	Park Forest West Wing	Paco 20709 VL	1	2.00	208-230/3/60	120	26
P6	Park Forest West Wing	Paco 20709 VL	1	2.00	208-230/3/60	120	26
P7	Domestic Hot Water Pump (From Chillers)	Grundfos UPS 43-100	1	0.50	208-230/1/60	40	15
P8	Heat Recovery Pump	Grundfos 15-55SF	1	0.06	115-120/1/60	10	3
P9	Recirculation Pump (Existing)	Grundfos UP26-99B	1	0.16	115-120/1/60	10	

# SYSTEM CAPACITIES

System Name	System Volume (Gal.)	Expansion Tank	Total Volume (Gal.)	Max Accept. (Gal.)	System Connection	Air Separator	Pipe Size
Park Forest South Wing	200.00	Flexcon SXHT 40	20	8	1"	Wessels SPA-3	3"
Park Forest North Wing	203.00	Flexcon SXHT 40	20	8	1"	Wessels SPA-3	3"
Park Forest West Wing	225.00	Flexcon SXHT 40	20	8	1"	Wessels SPA-3	3"
Park Forest (DHW) Recirculation		Wessels TTA 12	5	3.3	3/4"		
Park Forest (DHW) Heat Recovery		Flexcon SXHT 30	4.5	2.5	1/2"	Spirovent VJR 150 TM	1-1/2"

Glycol Makeup Unit	Glycol Makeup (Gal.)	Total System Volume (Gal.)
SF100-D-P	61.00	834.00

# DOMESTIC HOT WATER

Boiler	Maximum Output (BTU/Hr)	Turn Down Ratio (TDR)	GPM 75° F Rise
Intellihot iQ 1001	940,940	33:1	25

# CONTROLS

Alternating Pump Control Relay	Chiller Control
Tekmar Pump Sequencer C 132	Robur DDC

# HYDRONIC SPECIALTIES

Indirect Hot Water Tank	Domestic Capacity (Gal.)	Boiler output BTU/Hr	1st Hour Recovery (Gal.)	Heat Exchanger	Qty.	Hot Side Temps		Cold Side Temps		Hot Side		Cold Side	
						In / Out (F°) 30% Glycol	In / Out (F°) Water	GPM	Pressure Drop (PSI)	GPM	Pressure Drop (PSI)		
Triangle Tube Smart 80	70	300,000	460	Triangle Tube TTP4-50	1	130/119.6	100/120	16	1.5	10	0.5		

# SCHEDULES

CONSULTANTS:  
**WILLIAM E. WALTER**  
 1917 HOWARD AVE  
 FLINT MICHIGAN

PROJECT NAME:  
**PARK FOREST APT'S.**  
 3300 SPIREA COURT  
 JACKSON MICHIGAN



DRAWN BY:  
 Gordon Faustich  
 REVIEWED BY:  
 AD  
 APPROVED BY:  
 AD  
 ISSUED FOR  
 09/15/16 SUBMITTAL  
 09/22/16 REARRANGED PIPING  
 09/27/16 UPDATED TO FIELD CHANGES  
 10/06/16 REMOVED REV RET SUPPLY PIPING  
 11/03/16 REVISED PIPING  
 11/08/16 REVISED CONTROLS

PROPERTY OF THAW-PAK  
 This drawing is the property of THAW-PAK, it has been prepared in aid of the installation of our system. Customer agrees to keep confidential and not disclose this drawing or copies thereof without our written consent.

DRAWING NO.  
 16-009P\_E\_  
 PARK FOREST

SHEET NO.  
**S1**