

Zero Net Energy Retrofit Project at The Domes: Interim Performance Assessment & Verification

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EXECUTIVE SUMMARY

In 2012, the University of California, Davis (UC Davis), Energy Institute initiated a project funded by the Pacific Gas and Electric Company (PG&E) Emerging Technologies Program to retrofit existing residential structures through energy efficiency improvements and with ground source heating and cooling systems to achieve zero net energy (ZNE) performance goals. The project team hoped to identify scalable, deployment-ready technologies that could hasten the transition to zero net energy homes in PG&E territory. In addition, it was a project goal that the technologies selected would be both leading-edge as well as readily available, reliable, and proven. This is exemplified in the selection of technologies such as LED lights, heat pumps, and basic envelope improvements.

Architectural Energy Corporation, now NORESKO, was part of the project team to inform the choices of retrofit equipment, accurately estimate the potential energy savings, and later monitor the energy performance of installed systems. Initially, computer generated whole-house energy simulations were generated and compared to the metered utility information for the site. Analysis of the energy model showed that the greatest opportunities for energy savings would be to reduce the heating and cooling energy used, which led to the selection of the specific technologies.

Four out of the fourteen residences at The Domes project site have been retrofitted with the selected technologies. One of these four domes did not receive the HVAC retrofit and is a partial baseline. Energy monitoring equipment has been installed at these four retrofitted Domes along with two other "baseline" Domes that did not receive any retrofit to improved envelope, lighting, shared DHW system, and heating/cooling equipment. The performance of the retrofitted Domes was ultimately compared to the performance of the three "baseline" Domes.

As of the writing of the interim report, NORESKO has collected nine months of monitored performance data, including the full summer, which has provided insight into the performance of the heat pump technologies. It has also highlighted a number of potential performance issues. The heat pumps have proven to be effective at cooling the retrofitted Domes and all three are operating efficiently. However, the shared Domestic hot water system is using significantly more energy than the existing baseline Domestic water heaters and is causing the overall energy use of the retrofitted Domes to be much higher than the baseline. Once outdoor air temperatures begin to drop and the final three months of data is collected, the project team will update the performance analysis, revise the conclusions, and release a final report.

INTRODUCTION

The Domes site in Davis, CA, consists of 14 detached Dome structure homes originally constructed in the 1970s. The Domes are located near the intersection of Orchard Park Cir and Orchard Park Dr near the UC Davis campus and are occupied by a diverse group of UC Davis students. The residents of the Domes generally embrace a sense of community and share resources such as a garden, some livestock, and frequently make use of "The Commons" area and the community Yurt. These structures are served by electricity only, from PG&E, and are all connected to one master site meter. The homes each have an approximate 450 ft² floor plan on concrete slabs, with fiberglass and polyurethane wall construction, double-pane aluminum-framed windows, and wooden doors. The overall R- value of the envelope, including walls, doors, and windows, is between 20-23 (ft²·°F·Hour/BTU). The equipment in the homes prior to any retrofits include refrigerators, electric ovens & ranges, electric Domestic hot water heaters, and general lighting. The Domes have electric space heaters and no cooling. As part of this project, Domes 13, 14, and 15 were retrofitted with slab insulation, new doors, skylights, LED lighting, and a central air-to-water heat pump water heater. Domes 14 and 15 were retrofitted with ground source heat pumps for heating and cooling, and Dome 13 was retrofitted with an air source heat pump. Dome 8 was retrofitted as well with the exception of HVAC equipment.

NORESCO installed comprehensive monitoring equipment on site in order to quantify the energy performance of the retrofitted Domes (13-15). The performance of the retrofitted Domes will then be compared to three "baseline" Domes. Domes 6 and 10 did not receive any retrofits to improve the envelope, lighting, and heating/cooling equipment. Dome 8 is a partial baseline which did receive all of the retrofit technologies with the exception of HVAC. Dome 8 was also retrofitted with a separate air source heat pump water heater. Table 1 provides of a summary of the retrofit and baseline domes.

TABLE 1: SUMMARY OF BASELINE AND RETROFIT DOMES.

DOME #	RETROFITS			
	SLAB INSULATION, DOORS, SKYLIGHTS, LED LIGHTING	CENTRAL AIR-TO-WATER HEAT PUMP WATER HEATER	GSHP FOR HEATING AND COOLING	STANDALONE AIR SOURCE HEAT PUMP WATER HEATER
6 (Baseline)				
8 (Partial Baseline)	X			X
10 (Baseline)				
13 (Retrofitted)	X	X	X	
14 (Retrofitted)	X	X	X	
15 (Retrofitted)	X	X	X	



FIGURE 1. OVERVIEW OF THE DOMES AT BAGGINS END.



FIGURE 2. DOME EXTERIOR.

DOMES RETROFIT PROCESS

The verification and assessment of the retrofit technologies installed in the Domes was completed by NORESO and UC Davis at the following:

- The Domes
 - 3 retrofitted homes
 - 1 partial retrofitted/partial baseline home
 - 2 baseline homes

ENERGY ANALYSIS

At the beginning of the project, in order to inform the choices of retrofit equipment and accurately estimate the potential energy savings, computer generated whole-house energy simulations were created by NORESO using REM/Rate and compared to the metered utility information. Model inputs were taken from drawings where possible, otherwise assumptions were made and adjusted to reflect historical energy bills. Note that there is only one meter for the entire Domes site, so calibration of the energy model is approximate. These models estimated the as-built total annual load energy performance of the homes based on the heating and cooling requirements for Sacramento, CA (Climate zone 3B). The estimated annual energy use for each Dome is approximately 6,000 kWh.

The results of the energy models indicated that there was a substantial opportunity to improve the performance of the Domes during the heating season by addressing the thermal efficiency of multiple building components. Insulating the slab floor, replacing the windows & skylights, and improving the thermal properties of the door should all contribute to reduced energy consumption.

During the cooling season, the largest controllable opportunity to save energy was determined to be replacing the windows and skylights, to reduce solar heat gain, and to increase the overall insulation of the Dome.

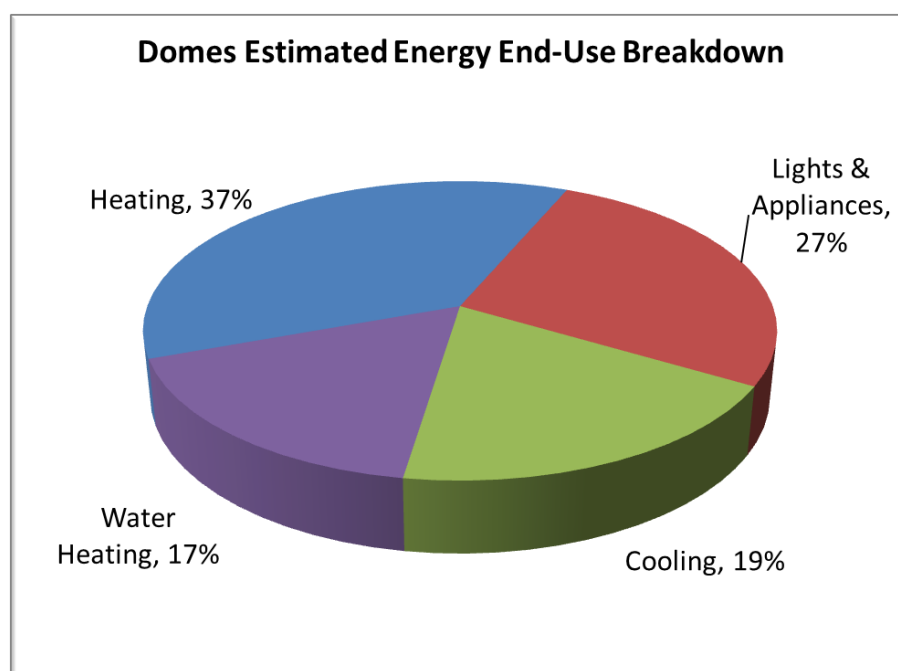


FIGURE 3. ENERGY END-USE BREAKDOWN.

RETROFIT TECHNOLOGIES

Based on the energy analysis results, technologies were selected and implemented in four of the Domes, but only three of the Domes received HVAC retrofits. Details of the specific envelope, lighting, space conditioning, and water heating technologies installed are described in the following sections.

ENVELOPE AND LIGHTING IMPROVEMENTS

During the summer of 2013, Domes 8 and 13, 14, and 15 were retrofitted with insulation around the concrete slab edge, new insulated entry doors, and skylights in place of exhaust fans. LED lighting was also installed in each of the retrofitted Domes.

DHW IMPROVEMENTS

An air-to-water AO Smith hybrid electric heat pump water heater was installed in a newly constructed enclosure adjacent to Dome 14 to serve each of the three retrofitted Domes. This system has a recirculating loop that runs through the ground to maintain Domestic hot water temperatures for Domes 13 and 15. Because it is immediately adjacent to the water heater, the hot water supply to Dome 14 is piped separately and is not part of the recirculation loop.

A separate 50 gallon Geospring air-to-water heat pump was installed adjacent to Dome 8 and serves that Dome only with no recirculation loop.

HVAC IMPROVEMENTS

An air-to-air AMANA PTH123 packaged terminal heat pump was installed in Dome 15 for heating and cooling. This same model of heat pump was modified by Enertech to function as a ground source water-to-air heat pump and installed in Domes 13 and 14.

ENERGY PERFORMANCE VERIFICATION

The assessment methods used at The Domes included sub-metered end-use monitoring, monitoring of space temperature, outside air temperature, flow rates and temperatures of ground loop water, as well as power monitoring, and subsequent analysis of the energy performance of the systems.

The verification of the actual energy savings of the implemented retrofits was accomplished by comparing the sub-metered residences to the baseline residences. The baseline Domes (6 and 10) are similar to the retrofitted Domes but did not receive retrofit technologies. Dome 8 is a partial baseline which did receive all of the retrofit technologies with the exception of HVAC. The baseline Domes were sub-metered in the same fashion as the retrofitted Domes.

MONITORING EQUIPMENT

The monitoring equipment utilized was installed by NORESKO, has been in place since February 7, 2014, and will remain through the end of 2014. Equipment and data collection devices include the following equipment:

■ Hobo U30 Remote Monitoring Stations

- Combination temperature/relative humidity sensors for indoor environmental monitoring
- Split-core current transformers for measuring circuit current
- Wattnode power meters for total energy use, PTAC/GTAC energy use, and water heater energy use
- Surface mounted temperature sensors for hot water and ground loop supply and return temperatures
- Seametrics flow meters for measuring ground water and hot water flow

The Hobo U30 station serves as a data collection hub for the various sensors in the dome. Using GSM transmissions, the Hobo U30 uploads all of its data daily to the “hobolink” website where it can be accessed remotely with a username and password.

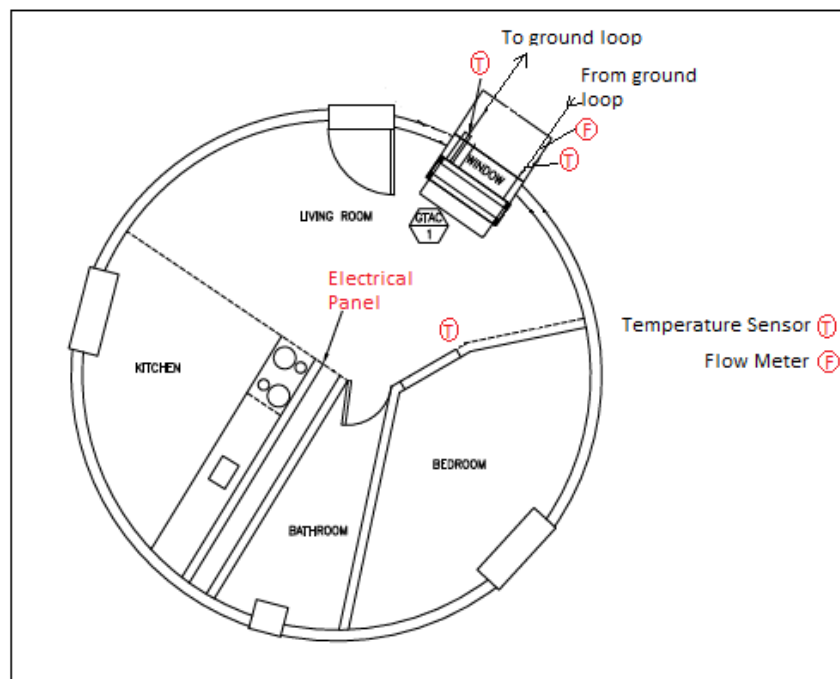


FIGURE 4. DOME MONITORING POINTS SCHEMATIC

Figure 4 above shows approximate locations of the various sensors within the Domes. All of the Split-core current transformers and Wattnode power meters are located in or immediately adjacent to the electrical panel. This schematic applies to Domes 13 and 14; for Dome 15 the difference is that there is no ground loop and instead a temperature sensor for discharge air from the PTAC.

**FIGURE 5. INSIDE A TYPICAL INSTALLATION****FIGURE 6. GROUND LOOP TEMPERATURE SENSOR (INSULATION REMOVED TO SHOW MOUNTING)**

ENERGY PERFORMANCE MONITORING PERIOD

The scope of services performed by NORESCO began in December 2013 and will continue through the end of 2014. Due to changes in the project scope, the baseline Dome monitoring equipment was not installed until February 7, 2014. During the monitoring period, there were quarterly summary reports which highlighted significant findings, data collection or analysis issues, and presented opportunities for additional energy savings.

MONITORING PLAN

Table 2 outlines the monitoring points that were used to accomplish the verification tasks.

General metering was performed at the panel level, where the loads were classified as either HVAC, appliance, lighting, or plug loads. The retrofits that were identified for monitoring were presented categorically which is not necessarily representative of the field monitoring setup. For example, while the lighting was an individual retrofit, lighting is not isolated on its own separate circuit and thus lighting and plug loads are monitored together as one load.

THE DOMES MONITORING POINTS

TABLE 2. THE DOMES MONITORING POINTS

MONITORED ATTRIBUTE	TREND POINT	TREND INTERVAL	UNITS	DOME 6 (BASE)	DOME 10 (BASE)	DOME 8 (PARTIAL BASE)	DOME 13 (RETRO)	DOME 14 (RETRO)	DOME 15 (RETRO)
Total Dome Electric	Main service power (Wattnode)	5 min	kWh	x	x	x	x	x	x
Lighting/Plugs	Lighting/Plugs circuit current	5 min	Amps	x	x	x	x	x	x
GSHP (Dome 13, 14 Heat/Cool)	Total unit power (Wattnode)	5 min	kWh						
	Heat pump ground water flow	5 min	Gallons				x	x	
	Ground water supply temperature	5 min	Degrees F						
	Ground water return temperature	5 min	Degrees F						
PTAC HP (Dome 15 Heat/Cool)	Total power (Wattnode)	5 min	kWh						
	Supply air temperature	5 min	Degrees F						x
Space Heater (Baseline Domes)	Total current	5 min	Amps	x	x	x			
Envelope	Indoor air temperature	5 min	Degrees F						
	Indoor relative humidity	5 min	%						
	Outdoor air temperature	5 min	Degrees F	x	x	x	x	x	x
	Outdoor relative humidity	5 min	%						
Appliances	Range current	5 min	Amps	x	x	x	x	x	x
Heat Pump Water Heater	Total power (Wattnode)	5 min	kWh						
	Hot water supply temperature	5 min	Degrees F						
	Hot water return temperature	5 min	Degrees F			x	x	x	x
	Total system water flow	5 min	Gallons						

Electric Water Heater (Baseline Domes)	Total unit current	5 min	Amps	x	x				
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DATA ANALYSIS AND RESULTS

The goals of this data analysis were to determine the impact of the retrofit technologies on the energy performance of the Domes, normalizing for any extraneous circumstances between the baseline and retrofitted residences, and to evaluate the performance of the installed heating/cooling and water heating systems.

HEATING PERFORMANCE EQUATIONS

A critical aspect of the energy performance analysis for this project is the heating performance of the heat pumps in the retrofitted Domes. Heat pump heating performance is typically quantified using the Coefficient of Performance (COP). COP is defined as the dimensionless ratio of useable thermal energy to the energy used to operate the system. Specifically, COP is calculated using the following equations:

EQUATION 1. COEFFICIENT OF PERFORMANCE

$$COP = HC / (3.412 \cdot DMD)$$

Where

EQUATION 2. HEATING CAPACITY

$$HC = HE + (3.412 \cdot DMD)$$

EQUATION 3. HEAT OF EXTRATION

$$HE = 500 \cdot GPM \cdot \Delta T$$

DMD is the electrical demand of the heat pump as measured by the Wattnode on each unit. GPM is the ground water flow as measured by the flow meter.

ΔT is the temperature difference between the ground water supply and return.

For the air source heat pump in Dome 15 the calculation is the same except that:

$$HE = 1.08 \times CFM \times \Delta T$$

CFM is the rated air flow of the unit.

ΔT is the temperature difference between the return air and the supply air.

COOLING PERFORMANCE EQUATIONS

Determining the cooling performance of the heat pumps in the retrofitted Domes is also a vital component of the overall energy performance analysis. Heat pump cooling performance is typically quantified using the Energy Efficiency Rating (EER). EER is defined as the dimensionless ratio of useable thermal energy to the energy used to operate the system. Specifically, EER is calculated using the following equations:

EQUATION 4. ENERGY EFFICIENCY RATING

$$EER = COP \cdot 3.412$$

Where

$$COP = HC / (3.412 \cdot DMD)$$

For cooling applications

$$HC = HE$$

$$HE = 500 \cdot GPM \cdot \Delta T$$

DMD is the electrical demand of the heat pump as measured by the Wattnode on each unit. GPM is the ground water flow as measured by the flow meter.

ΔT is the temperature difference between the ground water supply and return.

For the packaged terminal heat pump in Dome 15 the calculation is the same except that:

$$HE = 1.08 \times CFM \times \Delta T$$

CFM is the rated air flow of the unit.

ΔT is the temperature difference between the return air and the supply air.

It should be noted that the cooling and heating performance equations are only meaningful when the heat pumps are actively cooling and/or heating. In other words, the compressor and fan should be running. During this analysis, the raw data are filtered for times when the compressor is actually running before any efficiency calculations are made.

HEATING PERFORMANCE RESULTS AND DISCUSSION

Because of data quality issues during the first quarter of the study, the heating performance data for the year is not yet available. Specifically, there were issues with the location of the ground loop temperature sensors in both Domes 13 and 14 as well as the supply air temperature sensor in Dome 15. The sensors appeared to be picking up heat from the compressor motors and skewing the data. This issue was identified and corrected on May 22, 2014. Fortunately, electrical consumption data from that time period is still valid and is presented in the Overall Energy Use Comparison section of this report. Once data from the final three months of 2014 is available, NORESO will issue a revised, final report including updated heating COP analysis.

COOLING PERFORMANCE RESULTS AND DISCUSSION

Using the EER equations, the average EER (when the unit is actively cooling) between February 7th and September 30th was calculated with the following results:

Dome 13 Q2 Ground Source HP Cooling EER=11.9

Dome 14 Q2 Ground Source HP Cooling EER =12.1

Dome 15 Q2 Packaged Terminal HP Cooling EER =10.6

These numbers indicate decent cooling efficiency although potentially not as efficient as expected. For reference, the rated EER for both of the ground source heat pumps was 18.8 as estimated by bench testing performed by Enertech. It is important to note that the rated EER is estimated unit performance at rated conditions, which are not the conditions the unit actually operates in during the year. The packaged terminal heat pump came from the manufacturer with a rated EER of 10.7. The following figures show the performance of each heat pump during different times of the summer:

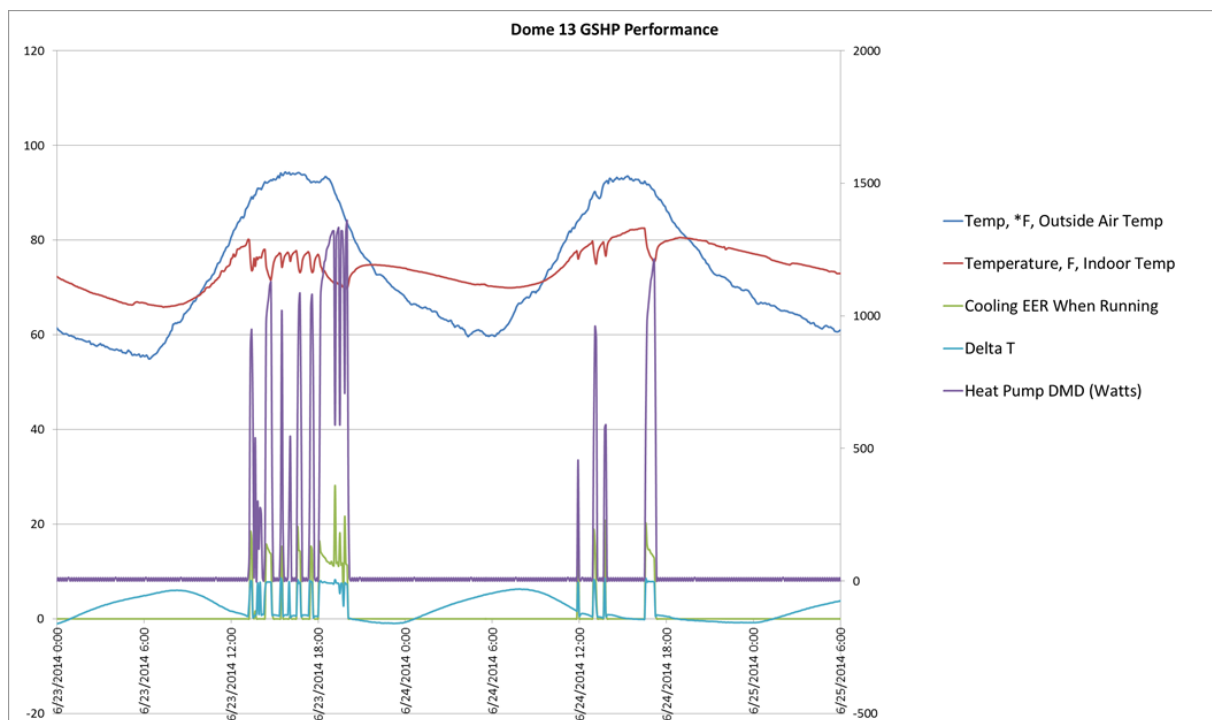


FIGURE 7. DOME 13 GSHP PERFORMANCE



FIGURE 8. DOME 13 GSHP PERFORMANCE

Figures 4 and 5 show the performance of the Dome 13 ground source heat pump during different times of the summer. Looking at the indoor air temperature (red line) reveals that the unit is effective at cooling the indoor space even with outside air temperatures well over 100 degrees. As soon as the unit comes on (purple line) the indoor air temperature drops quickly. Ground water Delta T's are averaging around 8 F and the Cooling EER remains fairly constant. This represents a properly operating ground loop heat pump. It is interesting to note that the temperature set point is relatively high, between 75-80F resulting in reduced overall cooling energy and higher unit efficiency.

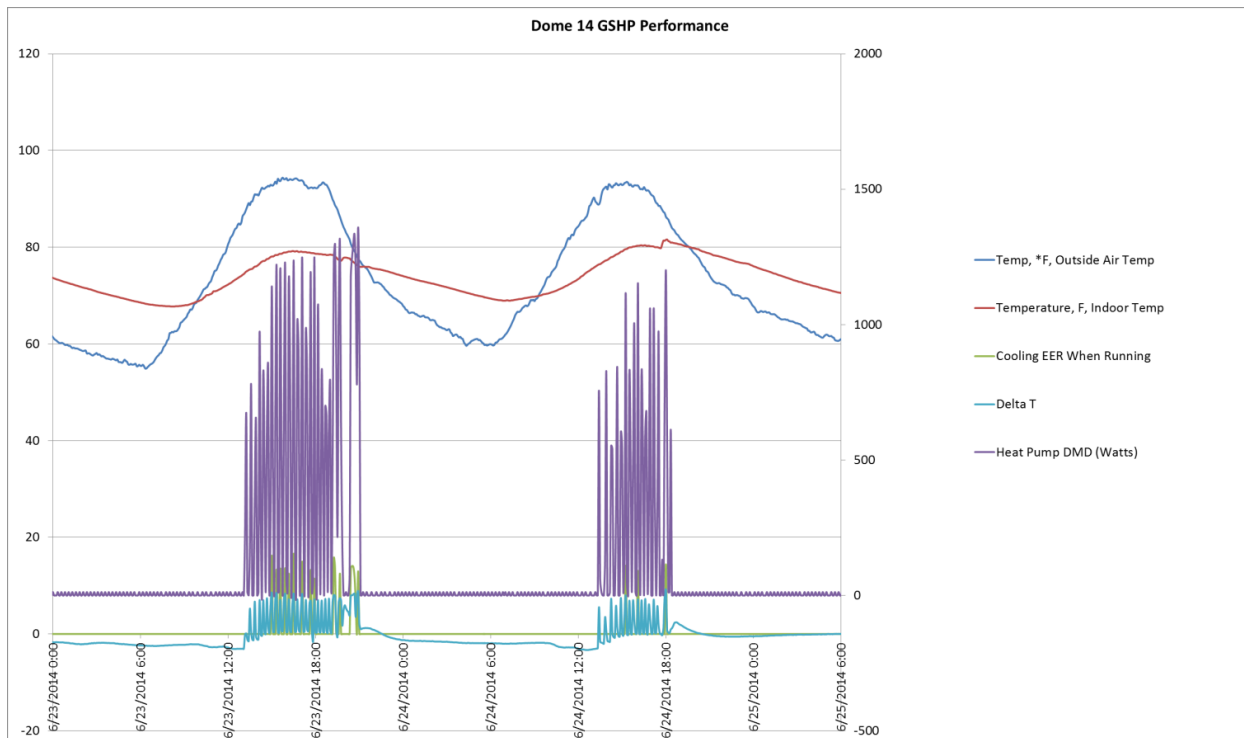


FIGURE 9. DOME 14 GSHP PERFORMANCE

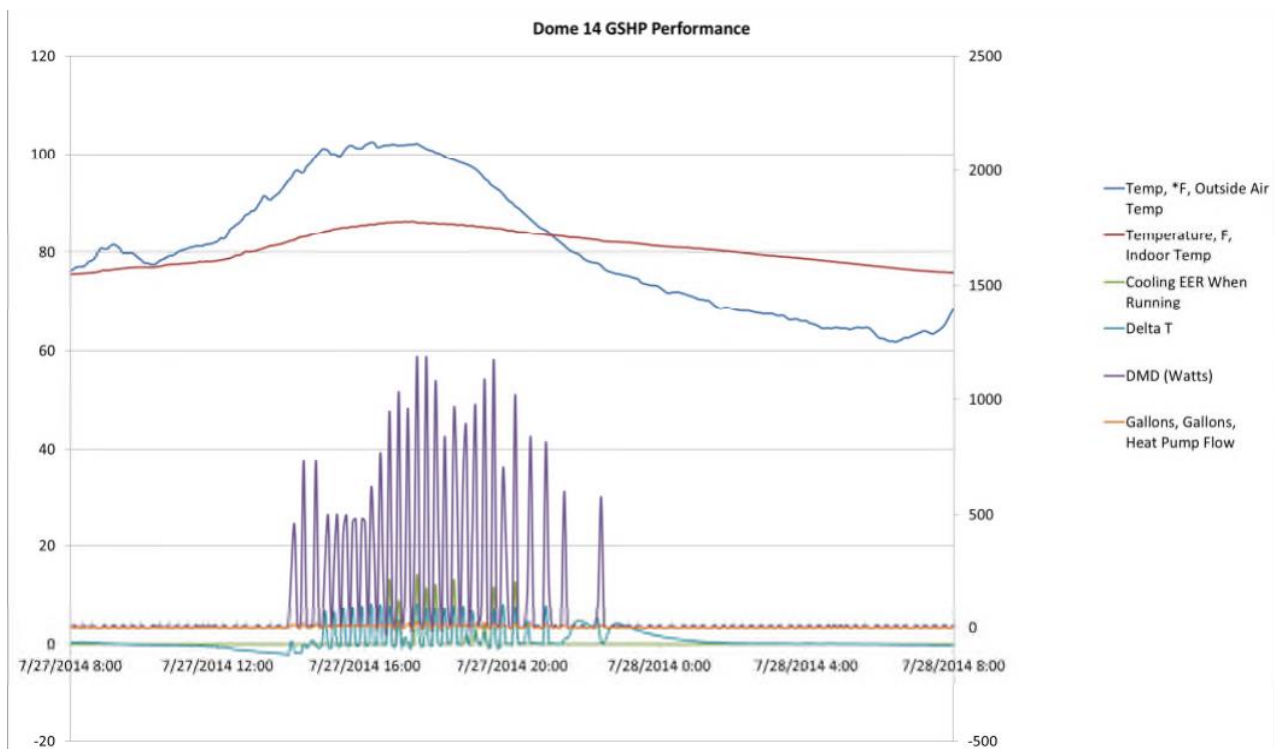


FIGURE 10. DOME 14 GSHP PERFORMANCE

Figures 6 and 7 show the performance of the Dome 14 heat pump during different time periods of the summer. Different days are shown for this unit than in the previous figures because the residents do not always use their cooling on the same days and these days are good examples of the unit running for much of the day. Compared to the heat pump in Dome 13, the unit does not appear to be affecting indoor

temperature very effectively. This is evident by looking the indoor air temperature (red line); there are not significant reductions in temperature when the unit comes on (purple line). Additionally, the heat pump does not remain on for long periods. The most likely explanation for this behavior is that the location of the thermostat is such that the heat pump discharge blows directly on to the thermostat. This would cause the short cycling while preventing the actual space temperature from being affected. That said, the measured space temperature is in fact cooler than the indoor temperature recorded in the baseline Domes during the same time period as evidenced in Figure 10.

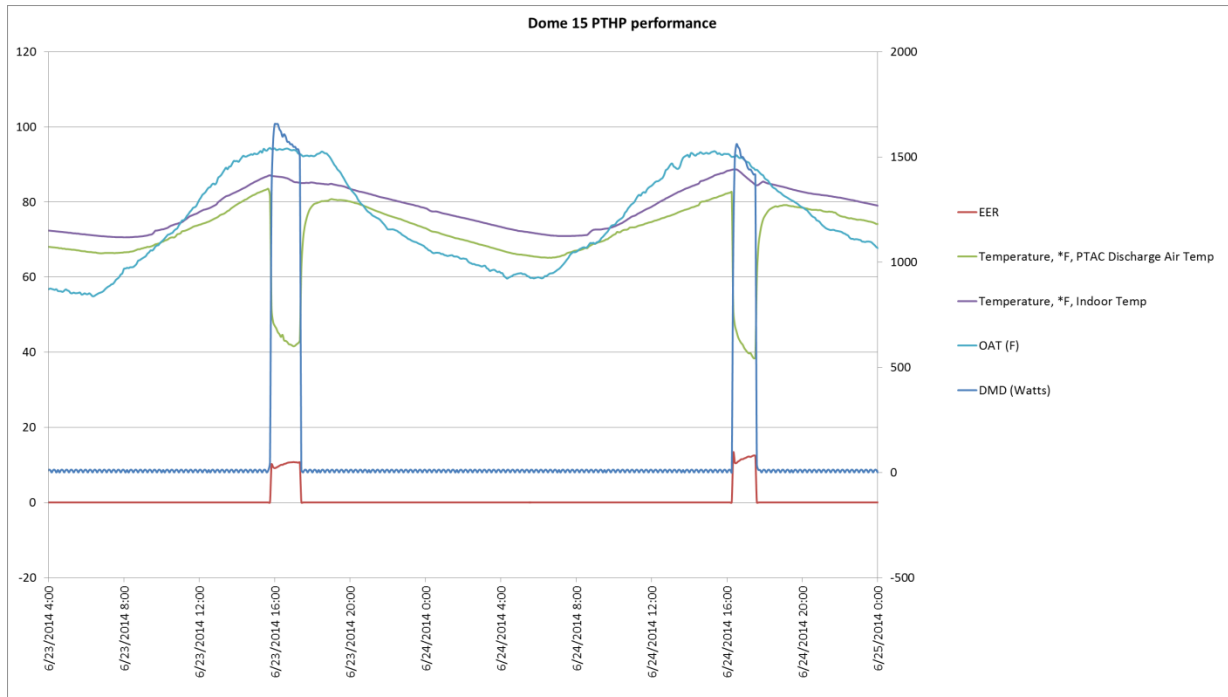


FIGURE 11. DOME 15 GSHP PERFORMANCE

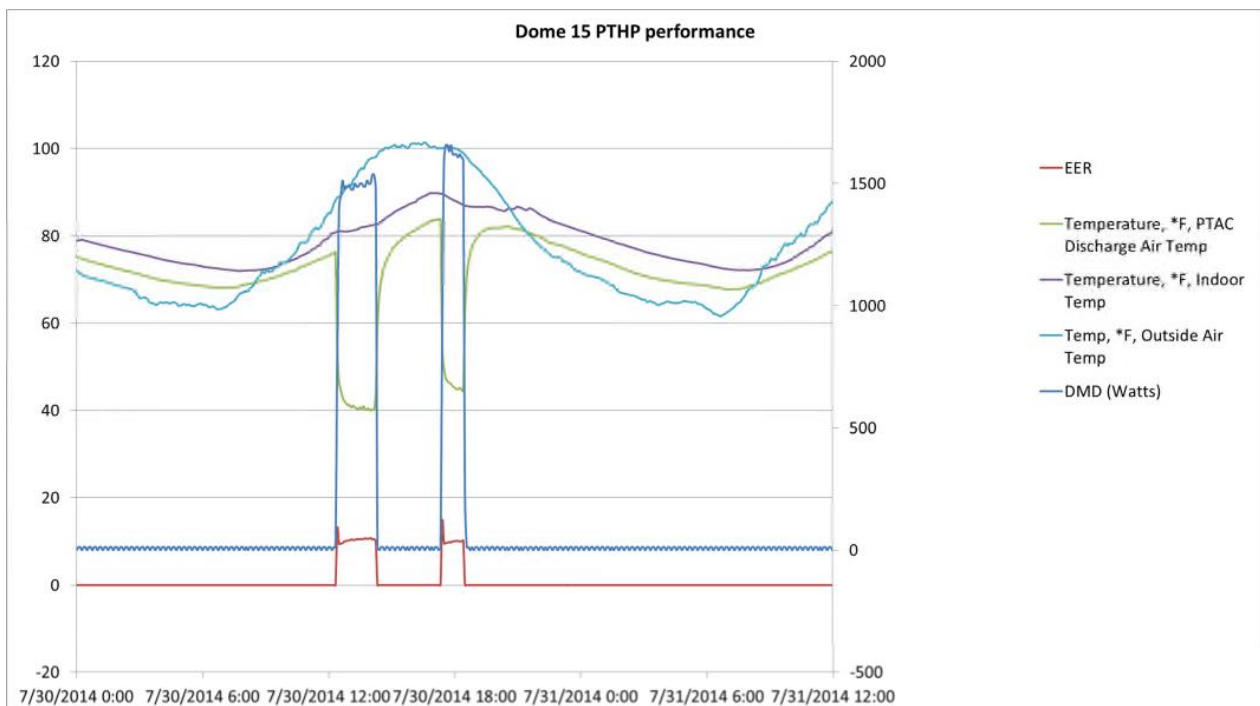


FIGURE 12. DOME 15 GSHP PERFORMANCE

Figures 11 and 12 show the performance of the Dome 15 packaged terminal heat pump, again for different time periods over the summer. The operating behavior of this unit is different from the ground loop heat pumps in that the unit remains on for one entire cooling period and does not cycle as often. This may be due to furniture or other items blocking the discharge of the unit preventing the cool air from circulating throughout the Dome. Regardless of the fact that the heat pump is not cycling, the unit appears to be working correctly and efficiently. Indoor air temperatures appear to be reduced when the unit runs and the EER value is consistently around 10.

OVERALL ENERGY USE COMPARISON

The following tables provide an interesting energy use comparison spanning from February 2 through September 30, 2014.

TABLE 3. HEATING ENERGY (kWh) USE COMPARISON

	JAN	FEB (PERIOD STARTING 2/7)	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Dome 6 (Space Heater)	N/A	278	225	28	0	0	0	0	0	N/A	N/A	N/A	531
Dome 8 (Space Heater)	N/A	18	26	5	0	0	0	0	0	N/A	N/A	N/A	50
Dome 10 (Space Heater)	N/A	2	2	43	2	1	0	0	0	N/A	N/A	N/A	51
Dome 13 (GSHP)	N/A	9	8	25	13	0	0	0	0	N/A	N/A	N/A	55
Dome 14 (GSHP)	N/A	84	103	49	7	2	1	1	5	N/A	N/A	N/A	252
Dome 15 (PTHP)	N/A	77	85	24	0	0	0	0	0	N/A	N/A	N/A	186

Table 3 shows that heating energy consumption is very diverse and is mostly dependent on occupant behavior more than any other factor. This is supported by the fact that Dome 6 uses more than 10 times the amount of heating energy of the other two baseline Domes which each have roughly equal heating performance. Also, Dome 8, which did receive insulation retrofits, used the same amount of heating energy as Dome 10 which had no retrofits. Energy consumption between the three baseline Domes varies greatly and is largely a matter of thermostat setpoints.

TABLE 4. COOLING ENERGY (kWh) USE COMPARISON

	JAN	FEB (PERIOD STARTING 2/7)	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Dome 6 (No Cooling)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
Dome 8 (No Cooling)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
Dome 10 (No Cooling)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
Dome 13 (GSHP)	N/A	0	0	2	5	47	42	24	22	N/A	N/A	N/A	141
Dome 14 (GSHP)	N/A	0	1	3	27	111	55	47	50	N/A	N/A	N/A	294

Dome 15 (PTHP)	N/A	3	5	11	33	57	77	62	40	N/A	N/A	N/A	288
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Table 4 shows the cooling energy consumption in each Dome by month. Of course, because the baseline Domes do not have any mechanical cooling, no meaningful comparison can be made. Like heating, the cooling energy consumption is more affected by occupant behavior than any other factor.

TABLE 5. PLUGS/LIGHTS ENERGY (kWh) USE COMPARISON

	JAN	FEB (PERIOD STARTING 2/7)	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Dome 6 (Baseline)	N/A	33	37	26	20	28	40	30	13	N/A	N/A	N/A	228
Dome 8 (Partial Baseline)	N/A	22	32	30	25	44	60	60	46	N/A	N/A	N/A	319
Dome 10 (Baseline)	N/A	48	53	54	45	42	31	30	38	N/A	N/A	N/A	342
Dome 13 (Retrofitted)	N/A	22	27	44	45	48	39	56	28	N/A	N/A	N/A	310
Dome 14 (Retrofitted)	N/A	49	73	57	65	56	55	47	41	N/A	N/A	N/A	443
Dome 15 (Retrofitted)	N/A	38	53	44	41	64	73	67	51	N/A	N/A	N/A	432

Table 5 compares plug load and lighting energy for each of the 6 Domes. The retrofitted Domes have upgraded lighting which helps to reduce lighting energy use. However those savings are overshadowed by plug load energy use. Yet again, plug loads are entirely dependent on occupant behavior and there is little difference between the baseline and retrofitted Domes.

TABLE 6. RANGE ENERGY (kWh) USE COMPARISON

	JAN	FEB (PERIOD STARTING 2/7)	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Dome 6	N/A	27	36	27	17	20	13	30	7	N/A	N/A	N/A	176
Dome 8	N/A	22	26	24	17	17	14	19	11	N/A	N/A	N/A	152
Dome 10	N/A	39	46	38	22	17	1	1	10	N/A	N/A	N/A	176
Dome 13	N/A	56	90	91	66	56	59	60	25	N/A	N/A	N/A	504
Dome 14	N/A	22	26	34	20	18	16	15	17	N/A	N/A	N/A	168
Dome 15	N/A	27	31	32	26	30	28	22	31	N/A	N/A	N/A	227

TABLE 7. DHW ENERGY (kWh) USE COMPARISON

	JAN	FEB (PERIOD STARTING 2/7)	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Dome 6 (Electric WH)	N/A	113	147	86	54	55	60	51	57	N/A	N/A	N/A	623
Dome 10 (Electric WH)	N/A	101	150	153	121	86	51	68	117	N/A	N/A	N/A	848
Dome 8	N/A	48	63	50	49	44	38	36	33	N/A	N/A	N/A	361

(Standalone Heat Pump)													
Dome 13 (Shared Heat Pump)	N/A	110	215	296	221	207	280	248	181	N/A	N/A	N/A	1757
Dome 14 (Shared Heat Pump)	N/A	110	215	296	221	207	280	248	181	N/A	N/A	N/A	1757
Dome 15 (Shared Heat Pump)	N/A	110	215	296	221	207	280	248	181	N/A	N/A	N/A	1757

Table 7 compares domestic hot water energy usage between the six Domes. The retrofitted Domes have a shared hot water system, so individual Dome energy use is estimated as one third of the total energy usage for the whole system. These numbers show a significant increase in energy use for DHW in the retrofitted Domes which is disappointing given the system design which should theoretically be much more efficient. A more in-depth discussion of this result is provided in the Overall Energy Use Comparison section of this report. Interestingly, the Dome 8 standalone hot water heat pump appears to be the best performer using about half of the energy use of the two other baseline Domes.

TABLE 8. TOTAL ENERGY (kWh) USE COMPARISON

	JAN	FEB (PERIOD STARTING 2/7)	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Dome 6 (Baseline)	N/A	452	445	167	90	103	113	111	77	N/A	N/A	N/A	1558
Dome 10 (Baseline)	N/A	190	252	288	190	147	83	99	166	N/A	N/A	N/A	1415
Dome 8 (Partial Baseline)	N/A	110	148	109	91	106	112	115	91	N/A	N/A	N/A	881
Dome 13 (Retrofitted)	N/A	198	340	458	349	359	419	387	257	N/A	N/A	N/A	2767
Dome 14 (Retrofitted)	N/A	265	419	437	360	394	407	357	294	N/A	N/A	N/A	2914
Dome 15 (Retrofitted)	N/A	255	390	405	321	358	458	399	304	N/A	N/A	N/A	2890

Table 8 is a total of the monthly energy use in each Dome. The most surprising result this table reveals is that the retrofitted Domes together used significantly more energy than the baseline Domes. This is somewhat alarming; however it can be explained by a careful examination of the monitored performance data.

One of the major contributors to the retrofitted Dome energy use is cooling energy. Because the baseline Domes do not have any mechanical cooling, it is expected that the retrofitted Domes would use more HVAC energy during the summer. However, as the following figure illustrates, the retrofitted Domes do generally stay cooler inside and peak temperatures were lower. During this period the baseline Domes reach indoor temperatures well over 90 degrees F which is of course outside the generally accepted comfort ranges. So while mechanical cooling does increase energy use, it is justifiable as it provides a more comfortable and reasonable living space.

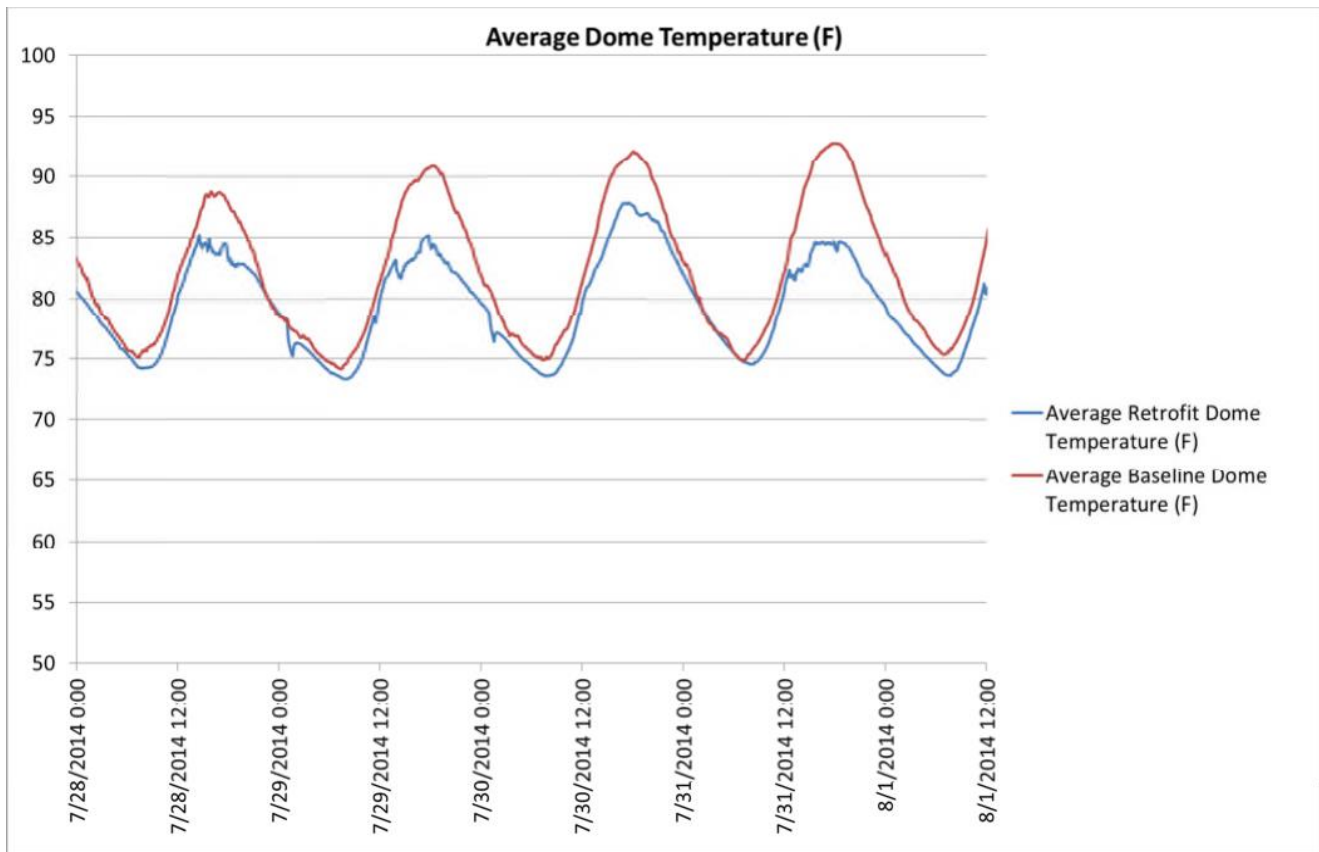


FIGURE 13. AVERAGE INDOOR TEMPERATURES

A second important observation is that the domestic hot water energy usage in the retrofitted Domes is much higher than the baseline Domes. This is unexpected, since the baseline Domes have basic electric resistance water heaters compared with the shared DHW system which is a heat pump with a rated COP of up to 3.0 (3 times more efficient than the baseline.) However, as the following discussion concludes, there may be a way to correct this issue and improve the energy performance of the shared DHW system.

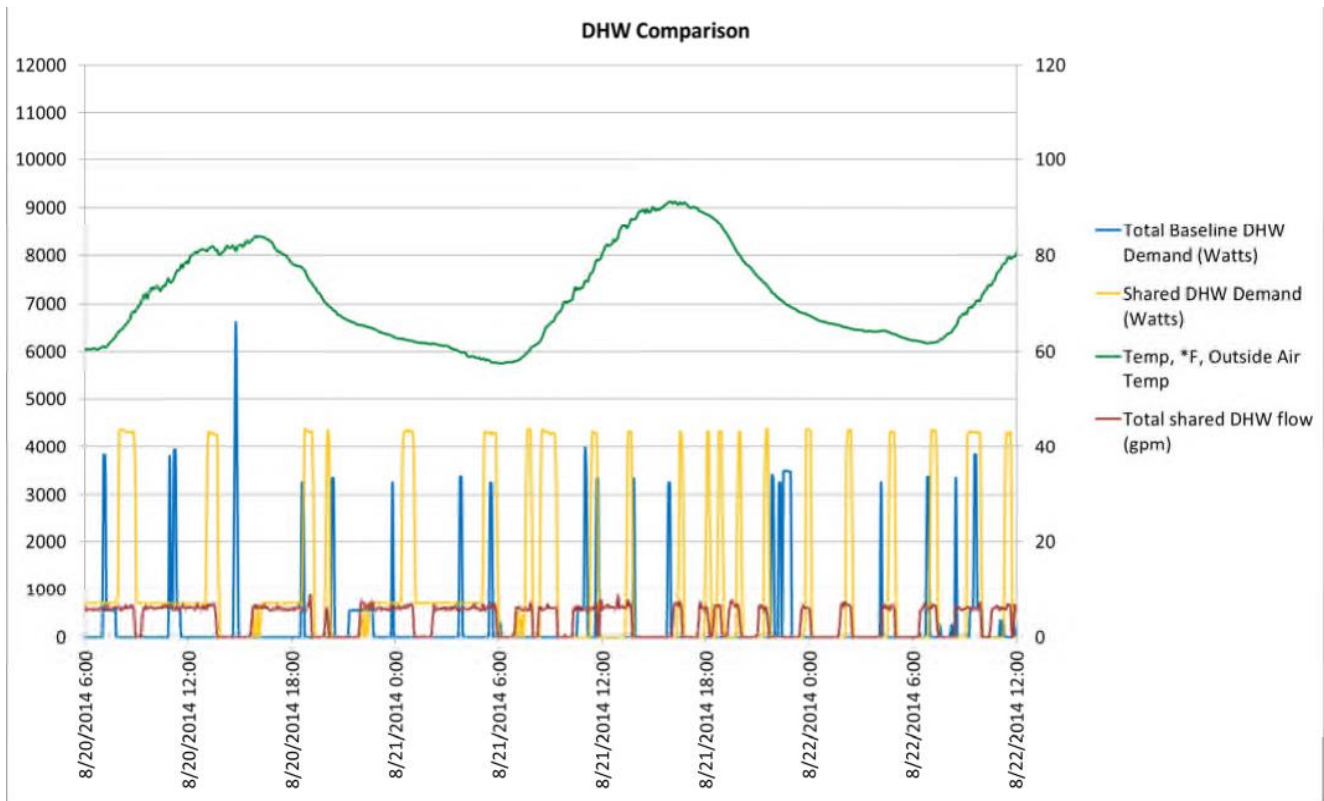


FIGURE 14. DOMESTIC HOT WATER COMPARISON

Figure 11 highlights an important factor in the DHW energy consumption. The water heaters in the baseline Domes (blue line) typically cycle on and off for very short periods throughout the day, while the shared DHW system (yellow line) stays on for much longer periods and has more frequent spikes on top of that. The spikes in energy use are from the electric resistance backup supplementing the heat pump. Looking at the data between 8/21-8/22, there are multiple instances where the heat pump operates as an electric resistance heater whenever any water flows at all. This is a feature of the heat pump operation which provides a faster recovery time at the expense of efficiency.

Part of the reason for the unexpectedly high energy use is that the shared system for the retrofitted Domes has a recirculation loop running underground which, despite having some insulation, is constantly losing heat to the ground. On average, the water is returning from the recirculation loop around 0.5-1 degree F cooler than the supply temperature even when no hot water is being used. The cooler return water temperature causes the heat pump to run in order to bring the water back to set point which results in the heat pump operating for much of the day.

The other major factor is that the electric resistance backup often turns on. Whenever hot water is used, cold makeup water is mixed into the return line and the water heater employs the backup heater to recover more quickly. In the third quarter of 2014, the extra energy used by the backup heating element accounted for approximately 45% of the total hot water energy use.

Fortunately, there are controls provided with the DHW heat pump which may help alleviate the current high energy usage. Specifically, the operating mode can be changed to eliminate the electric resistance backup. This particular water heater has four operating modes: Efficiency, Hybrid, Electric, and Vacation mode. The unit is currently in Hybrid mode, which has shown itself to use the backup electric heat more frequently than desirable. On October 29, 2014 the heat pump operating mode was changed to "Efficiency" mode, which should eliminate the backup electric resistance heater. Given that the backup heating element accounted for 45% of the energy use between June and September, this change may help by saving at least that much energy going forward. The results of this change will be available at the end of the year and will be presented in the final project report.

CONCLUSION

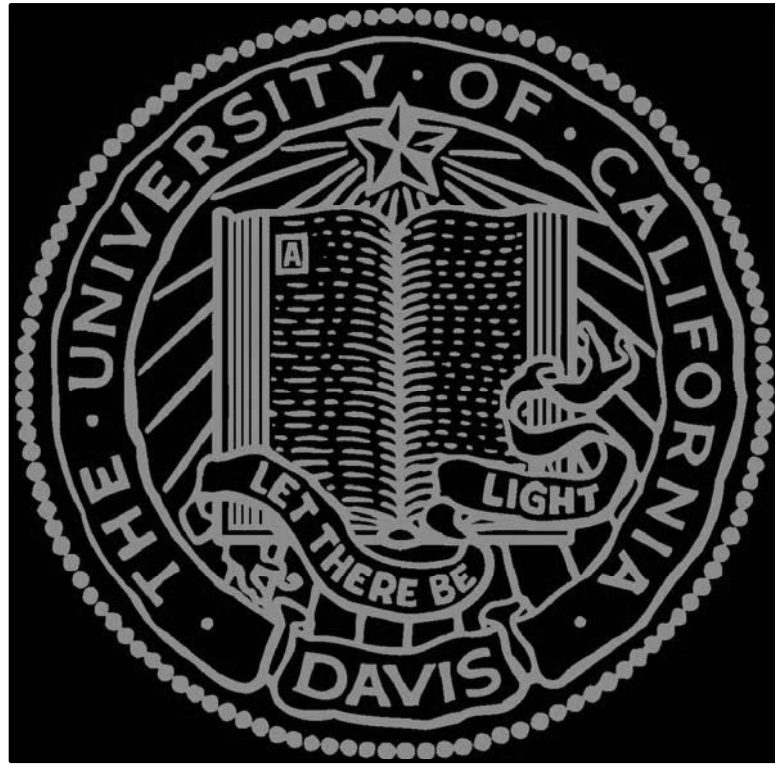
Over the course of the year it has become clear that the new mechanical equipment installed for the retrofitted Domes has resulted in significantly increased energy usage. However, further investigation and analysis has revealed reasonable explanations and possible solutions. The majority of this energy is attributed to the shared DHW system which may be partially addressable by changing the operating mode to "Efficiency" as described in the user manual. The results of this change will be available once all of the year end data becomes available.

The additional cooling energy in the retrofitted Domes is also a contributing factor which cannot be compared to the baseline Domes, which have no form of mechanical cooling. Of course, it should be noted that the increased cooling energy provides increased comfort and a more appropriate living space. Additionally, the average cooling efficiency has shown to be relatively good and the cooling energy use is not beyond what would reasonably be expected for any comparable air conditioning system.

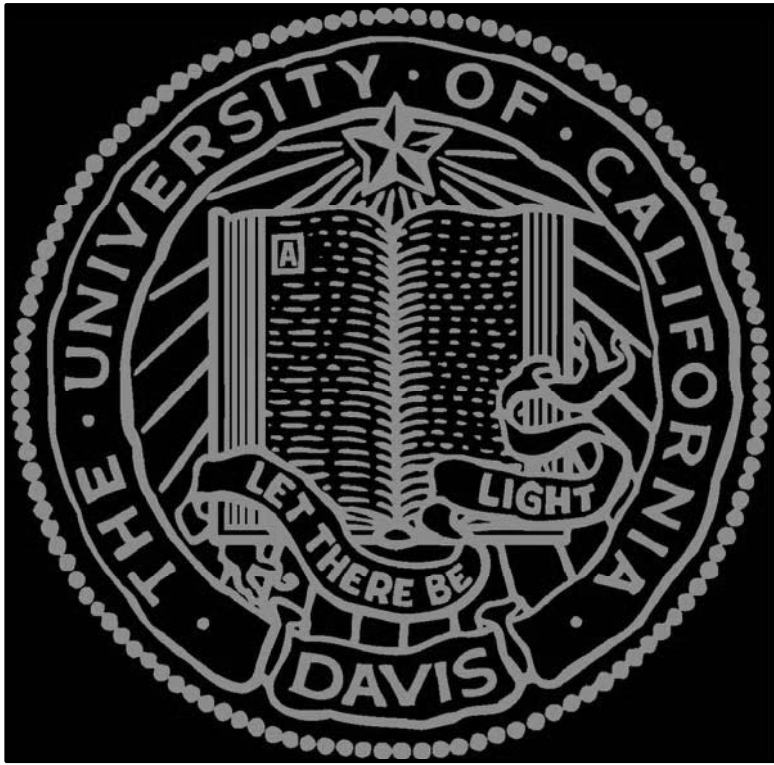
Finally, the heating season data has yet to be received and analyzed. Once the actual end of year data is available and heating energy use is determined, a more meaningful HVAC comparison will be possible.

APPENDIX A.

DRAWINGS AND PRODUCT INFORMATION



DOMES MECHANICAL UPDGRADE/HEAT PUMP RETROFIT PROJECT NO. 2502400



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







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ABBREVIATIONS		SYMBOL LEGEND		DRAWING INDEX			PROJECT DESCRIPTION		DEFERRED APPROVALS		PROJECT INFORMATION	
GWS	GROUND LOOP WATER SUPPLY (TO HEAT PUMP)		AIR VENT, AUTOMATIC	ID	NAME	PUBLISHED	THE INTENT OF THIS PROJECT IS TO RETROFIT TWO DOME BUILDINGS WITH A HORIZONTALLY DRILLED GEOTHERMAL HEAT PUMP SYSTEM FOR SPACE HEATING AND COOLING. THE THIRD DOME SHALL BE HAVE A STANDARD PTAC HEAT PUMP INSTALLED AS A PROJECT CONTROL FOR DATA COLLECTION. THE GROUND HEAT EXCHANGER WILL CONSIST OF (2) 1" HORIZONTALLY DRILLED AND GROUTED LOOPS X 175 FEET LONG. <u>ADDITIVE BID ITEM:</u> REFERENCE SHEET P1.0. REMOVE THE EXISTING ELECTRIC WATER HEATERS IN DOMES 13, 14, AND 15. PROVIDE A NEW CENTRAL AIR-TO-WATER HEAT PUMP WITH HOT WATER RECIRCULATION SYSTEM TO ALL THREE DOMES. WATER HEATER ENCLOSURE SHALL BE PROVIDED BY THE UNIVERSITY.	NONE		BUILDING NAME: DOMES AT BAGGINS END YEAR CONSTRUCTED: 1970+- ZONE: 12 OCCUPANCY TYPE: R1 CONSTRUCTION TYPE: R1 AREA: 450 SQ. FT.	APPLICABLE CODES: 2010 CBC, CMC, CPC, 2011 ICSPPA DESIGN AND INSTALLATION STANDARDS AND 2008 BUILDING ENERGY EFFICIENCY STANDARDS.	
GWR	GROUND LOOP WATER RETURN (TO GROUND LOOP)		BALL VALVE	G0.0	COVER SHEET	<input type="checkbox"/>						
CFM	CUBIC FEET PER MINUTE		CHECK VALVE, SPRING	M0.0	MECHANICAL SCHEDULES & NOTES	<input type="checkbox"/>						
CD	CONDENSATE DRAIN		CHECK, SWING GATE	M1.0	MECHANICAL SITE PLAN	<input type="checkbox"/>						
DIA	DIAMETER		FLEXIBLE PIPE CONNECTION	M2.0	MECHANICAL FLOOR PLAN	<input type="checkbox"/>						
(E)	EXISTING		GATE OR GLOBE VALVE	P1.0	ADDITIVE BID ITEM: PLUMBING SITE PLAN	<input type="checkbox"/>						
EER	ENERGY EFFICIENCY RATIO		PRESSURE GAUGE			<input type="checkbox"/>						
ESP	EXTERNAL STATIC PRESSURE		PRESSURE REDUCING VALVE			<input type="checkbox"/>						
FC	FLEX CONNECTION		PUMP			<input type="checkbox"/>						
GTAC	GEOTHERMAL TERMINAL AIR CONDITIONER W/ HEAT		P/T PORT			<input type="checkbox"/>						
LBS	POUNDS		REDUCER			<input type="checkbox"/>						
LRA	LOCKED ROTOR AMPS		STRAINER									
MBH	THOUSAND BTU'S PER HOUR		TEMPERATURE AND PRESSURE RELIEF VALVE (T&PR)									
MCA	MINIMUM CIRCUIT AMPS		UNION									
MOCP	MAXIMUM OVERCURRENT PROTECTION		AIR SEPARATOR									
P	PUMP		EXPANSION TANK									
PD	PRESSURE DROP (FEET OF WATER)		HOSE BIBB									
PTAC	PACKAGED TERMINAL AIR CONDITIONER W/ HEAT											
RLA	RATED LOAD AMPS											
REQD	REQUIRED											
TYP	TYPICAL											
UCD	UNDERCUT DOOR											

VICINITY MAP / SITE PLAN

VICINITY MAP

NORTH

SITE PLAN

NORTH

RELEASE STATUS: DATE:

☐ PLANNING APPROVAL

☐ CLIENT REVIEW

☐ BIDDING

☒ PLAN CHECK 7/31/13

REVISIONS:

DOMES MECHANICAL
UPGRADE/HEAT PUMP RETROFIT
NO. 2502400
DAVIS, CA

COVER SHEET

SCALE: NOTED

G0.0

PROJECT NO. ME645

MECHANICAL NOTES	
1.	THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE ALL BUILDING PERMITS FROM THE UC DAVIS DESIGN AND CONSTRUCTION TEAM.
2.	ALL MATERIALS AND INSTALLATION SHALL COMPLY WITH THE LATEST EDITIONS OF ALL APPLICABLE LOCAL, STATE AND NATIONAL CODES AND ORDINANCES. IN CASE OF CONFLICT BETWEEN REFERENCED CODES AND ORDINANCES, THE MORE STRINGENT REQUIREMENTS SHALL GOVERN.
3.	PROGRAMMABLE THERMOSTATIC CONTROL INTEGRATED WITH THE GTAC AND PTAC UNITS CHALL HAVE MANUAL OVERRIDE AND SETBACK CAPABILITIES. WALL MOUNTED THERMOSTATS SHALL BE MOUNTED 4'-0" ABOVE FINISHED FLOOR.
4.	ELECTRICAL RECEPTACLE IS REQUIRED WITHIN 25 FEET OF EQUIPMENT FOR SERVICE PER CMC 308.
5.	IDENTIFY HVAC EQUIPMENT AS TO THE AREA BEING SERVED PER CMC 303.6.
6.	ALL EXTERIOR WALL PENETRATIONS SHALL BE FLASHED AND COUNTERFLASHED AS REQUIRED TO SEAL WEATHER TIGHT.
7.	COORDINATE WITH ELECTRICAL INSTALLATION OF MOTOR STARTERS, DISCONNECTS AND ALL ELECTRICAL CONNECTIONS.
8.	LOW VOLTAGE WIRING FOR HVAC SYSTEMS SHALL BE FURNISHED AND INSTALLED AS PART OF THE MECHANICAL WORK. PROVIDE ALL WIRE PER MANUFACTURER'S INSTRUCTIONS FOR A COMPLETE OPERATING SYSTEM.
9.	ALL EQUIPMENT AND DUCTWORK SHALL BE LATERALLY RESTRAINED ACCORDING TO THE REQUIREMENTS OF CHAPTER 16 OF THE LATEST EDITION OF THE UNIFORM BUILDING CODE, THE LATEST EDITION OF THE SMACNA GUIDELINES FOR THE SEISMIC RESTRAINT OF MECHANICAL EQUIPMENT AND PIPING SYSTEMS, WHICHEVER IS MOST STRINGENT SHALL GOVERN.
10.	HVAC UNITS SHALL BE ACCESSIBLE FOR INSPECTION, SERVICE, REPAIR AND REPLACEMENT WITHOUT REMOVING PERMANENT CONSTRUCTION PER CMC 304.0.
11.	CONDENSATE SHALL BE COLLECTED AND DISCHARGED TO AN APPROVED PLUMBING FIXTURE OR DISPOSAL AREA. IF DISCHARGED INTO THE DRAINAGE SYSTEM THE EQUIPMENT SHALL DRAIN BY MEANS OF AN INDIRECT WASTE PIPE. THE WASTE PIPE SHALL HAVE A SLOPE OF NOT LESS THAN 1/8 INCH PER FOOT OR ONE PERCENT SLOPE AND SHALL BE OF APPROVED CORROSION RESISTANT MATERIAL. CONDENSATE OR WASTE SHALL NOT DRAIN OVER A PUBLIC WAY PER CMC309.1.
12.	THE PIPING FOR ALL SPACE-CONDITIONING AND SERVICE WATER-HEATING SYSTEMS WITH FLUID TEMPERATURES LISTED IN TABLE 123-A OF THE 2008 CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS SHALL HAVE THE AMOUNT OF INSULATION SPECIFIED IN SECTION 123 OF THE 2008 CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS.

WATER TO AIR HEAT PUMP SCHEDULE(GTAC)																				
TAG	MANUFACTURER	MODEL	ELECTRICAL				COMPRESSOR		WATER FLOW			COOLING LOAD (MBH)		CFM	HEATING LOAD (MBH)	EER	COP	WEIGHT	LOCATION	NOTES
			VOLTAGE	TOTAL FLA	MCA	MOCP	RLA	LRA	GPM	WATER CONN.	PD (FT.)									
												SENSIBLE	TOTAL							
GTAC 1	PROVIDED BY UNIVERSITY	HEAT PUMP	208-230/60/1	-	6.8	15	4.9	25	3	¾"	6.0	-	12.0	340	11.3	18.8	3.8	115	SEE M2.0	
GTAC 2	PROVIDED BY UNIVERSITY	HEAT PUMP	208-230/60/1	-	6.8	15	4.9	25	3	¾"	6.0	-	12.0	340	11.3	18.8	3.8	115	SEE M2.0	
NOTES: 1. EER ESTIMATED FOR 90°F ENTERING WATER TEMPERATURE. 2. COP ESTIMATED FOR 45°F ENTERING WATER TEMPERATURE. 3. UNIT TO COME WITH INTEGRAL GROUND LOOP CIRCULATION PUMP. ELECTRICAL SCHEDULE INCLUDES PUMP LOAD. 4. UNIT TO COME WITH PROGRAMMABLE WALL THERMOSTAT.																				

PACKAGED TERMINAL HEAT PUMP															
TAG	MANUFACTURER	MODEL	ELECTRICAL				COOLING LOAD (MBH)		CFM	HEATING LOAD (MBH)	EER	COP	WEIGHT	LOCATION	NOTES
			VOLTAGE	TOTAL FLA	MCA	MOCP	SENSIBLE	TOTAL							
<div>PTAC1</div>	PROVIDED BY UNIVERSITY	AMANA PTH123G25AXXX	208-230/60/1	-	14.1	15	-	12.0	340	11.3	10.7	3.2	115	SEE M2.0	
NOTES: 1. INSTALL AS PER MANUFACTURER RECOMMENDATIONS. 2. UNIT TO COME WITH PROGRAMMABLE THERMOSTAT.															

PUMP SCHEDULE								
TAG	GPM	TDH	ELECTRICAL				WEIGHT (LBS.)	NOTES
			VOLTAGE	AMPS	WATTS	HP		
<div>P1</div>	3	12	230/60/1	0.75	87	0.12	6	GROUND LOOP CIRCULATION PUMP
<div>P2</div>	3	12	230/60/1	0.75	87	0.12	6	GROUND LOOP CIRCULATION PUMP
NOTES: 1. PUMPS ARE INTEGRAL TO THE GTAC UNITS.								

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REGISTERED PROFESSIONAL MECHANICAL ENGINEER

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☐ PLANNING APPROVAL

☐ CLIENT REVIEW

☐ BIDDING

☒ PLAN CHECK

7/31/13

REVISIONS:	
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DOMES MECHANICAL

UPGRADE/HEAT PUMP RETROFIT

NO. 2502400

DAVIS, CA

MECHANICAL SCHEDULES & NOTES

SCALE: NOTED

GROUND LOOP INSTALLATION SPECIFICATIONS

SPECIFICATIONS WRITTEN WITH REFERENCE TO CLOSED-LOOP/GEOHERMAL HEAT PUMP SYSTEMS
DESIGN AND INSTALLATION STANDARDS 2011 PUBLISHED BY IGSHA

1. THE GROUND LOOP DESIGN FOR THIS PROJECT IS BASED UPON THE FOLLOWING PROPERTIES
- A. SOIL THERMAL CONDUCTIVITY:

0.88 BTU/HR-FT-F
- B. SOIL THERMAL DIFFUSIVITY:

0.56 FT²/DAY
- C. GROUND TEMPERATURE:

68°F
- D. HORIZONTAL BOREHOLE LENGTH:

175 FT
2. COORDINATION AND WARRANTY
- A. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TRENCHING AND BACKFILLING OF TRENCHES, INCLUDING ANY TRENCHES BETWEEN THE HEADERING PIT AND DOMES 13, AND 14.

B. CONTRACTOR SHALL BE EXPERIENCED IN LOOP DESIGN AND INSTALLATION AND SHALL BE CERTIFIED BY IGSHA. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PERMITS AND INSPECTION OF THE LOOP FIELD.

C. AS-BUILT DRAWINGS OF THE LOOP FIELD SHALL BE PROVIDED BY THE CONTRACTOR TO THE OWNER.

D. THE GROUND LOOP SHALL BE WARRANTED AGAINST LEAKS FOR 25 YEARS BY THE PIPING MANUFACTURER, INCLUDING ALL PARTS AND LABOR.
3. BOREHOLE DRILLING
- A. HORIZONTAL BOREHOLES SHALL BE DRILLED BY A CS7 LICENSED DRILLER EXPERIENCED IN GROUND LOOP DRILLING AND GROUTING PROCEDURES.

B. HEADERING AND ALL OTHER GROUND LOOP PIPE CONNECTIONS SHALL BE COMPLETED BY AN IGSHA CERTIFIED CONTRACTOR EXPERIENCED IN THE CONSTRUCTION OF GROUND LOOPS.

C. CONTAIN, MANAGE, AND DISPOSE OF DRILL CUTTINGS IN ACCORDANCE WITH LOCAL REGULATIONS.

D. AFTER THE LOOP INSTALLATION, BOREHOLES ARE TO BE IMMEDIATELY BACKFILLED WITH THERMALLY ENHANCED BENTONITE GROUT (CONDUCTIVITY, K = 0.88 BTU/HR-FT-F MINIMUM).

E. HORIZONTAL DRILLING CONTRACTOR TO GUARANTEE THAT THE BOREHOLES ARE COMPLETELY BACKFILLED.
4. GROUND LOOP (HEAT EXCHANGER AND HEADER) MATERIALS:
- F. PIPING MATERIAL SHALL BE HIGH DENSITY POLYETHYLENE (HDPE) PE3408 OR PE3408/PE4710.

G. PIPE WITH A DIAMETER OF 2" OR LESS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM D-3035 WITH A MAXIMUM DIMENSION RATIO (DR) OF 11.
5. PIPE FUSION AND CONFIGURATION
- A. ALL BURIED PIPE SHALL BE HEAT FUSED BY BUTT, SOCKET OR ELECTROFUSION IN ACCORDANCE WITH THE PIPE MANUFACTURER'S PROCEDURES. ALL JOINING TO BE PERFORMED BY FACTORY-TRAINED INSTALLERS WITH CURRENT IGSHA FUSION CERTIFICATION DOCUMENTS.

B. HORIZONTAL LOOP PIPES SHALL BE FUSED TO EACH DOME HEADER FOUR (4) FEET BELOW FINISHED GRADE, MINIMUM.

C. SUPPLY AND RETURN PIPING FROM THE LOOP FIELD TO THE DOMES SHALL BE AT THREE (3) FEET BELOW FINISHED GRADE MINIMUM.

D. PIPING OUTSIDE OF A BUILDING OR IN AN EXTERIOR WALL SHALL BE PROTECTED FROM FREEZING.

E. SHUT-OFF VALVES AND FUSED CONNECTING FLANGES TO BE PROVIDED AT THE SUPPLY AND RETURN LINE TERMINATION POINTS OUTSIDE THE DOMES.
6. GROUND LOOP TESTING
- A. ALL FUSION JOINTS AND LOOP LENGTHS SHALL BE CHECKED TO VERIFY THAT NO LEAKS HAVE OCCURRED DUE TO FUSION JOINING OR SHIPPING DAMAGE.

B. ALL LOOPS WILL BE PRESSURE TESTED BEFORE INSTALLATION INTO THE BOREHOLE. EACH SUPPLY AND RETURN CIRCUIT SHALL BE FLUSHED AND PURGED IN THE FORWARD AND REVERSE DIRECTIONS WITH WATER AT A MINIMUM VELOCITY OF 2 FT./SEC. THROUGH EACH PIPING SECTION. FLUSH PUMP SHALL BE CAPABLE 6 GPM AT 12 FEET OF HEAD. FLOW MUST BE MAINTAINED FOR A MINIMUM OF 15 MINUTES IN EACH DIRECTION TO REMOVE ALL DEBRIS AND AIR. TO VERIFY THAT ALL AIR IS REMOVED FROM THE SYSTEM, THE RETURN WATER VALVE TO THE TANK SHALL BE CLOSED. A CHANGE IN THE LEVEL OF FLUID IN THE PURGE PUMP TANK DURING PRESSURIZATION INDICATES AIR STILL TRAPPED IN THE SYSTEM. THE HEAT EXCHANGER SYSTEM PURGING SYSTEM SHALL BE COMPLETED SEPARATELY FROM THE BUILDING SYSTEM.

C. FLOW RATES AND PRESSURE DROPS WILL BE COMPARED TO CALCULATED VALUES TO ASSURE THAT THERE IS NO BLOCKAGE OR KINKING OF ANY PIPE. IF ACTUAL FLOW RATE OR PRESSURE DROP VALUES DIFFER FROM CALCULATED DESIGN VALUES BY MORE THAN 10 PERCENT, THE PROBLEM SHALL BE IDENTIFIED AND CORRECTED.

D. BEFORE CONECTION (HEADERS) TRENCHES ARE BACKFILLED, HEAT EXCHANGERS SHALL BE PRESSURE TESTED WITH WATER AT 100 PSI FOR 1 HOUR WITH NO OBSERVED DROP IN PRESSURE (GREATER THAN 10 PSI OR ±10%).

E. AFTER THE CONCLUSION OF THE GROUND HEAT EXCHANGER PRESSURE TEST, THE GROUND HEAT EXCHANGER SHALL BE FILLED WITH CLEAN WATER AND MAINTAINED UNDER PRESSURE UNTIL FINAL CONNECTION TO THE BUILDING SYSTEM. SEE WATER QUALITY SPECIFICATION BELOW.
7. INDOOR LOOP PIPING
- A. PIPING TO BE HIGH DENSITY POLYETHYLENE (HDPE) PE3408, PE3408/PE4710 OR COPPER TYPE L.

B. TRANSITION FITTINGS BETWEEN DISSIMILAR MATERIAL SHALL BE INSIDE OR ACCESSIBLE.

C. ALL INDOOR PIPING SHALL BE INSULATED WHERE CONDENSATE MAY CAUSE DAMAGE ABOVE CEILING IN CONDITIONED SPACES.

D. ALL PIPES THROUGH WALLS SHALL BE SLEEVED AND SEALED WITH NON-HARDENING CAULKING MATERIAL. PARTICULATE CONTAMINANTS SHALL BE REMOVED FROM THE PIPING SYSTEM PRIOR TO INITIAL START-UP; ALL Y-STRAINERS TO BE CLEANED.

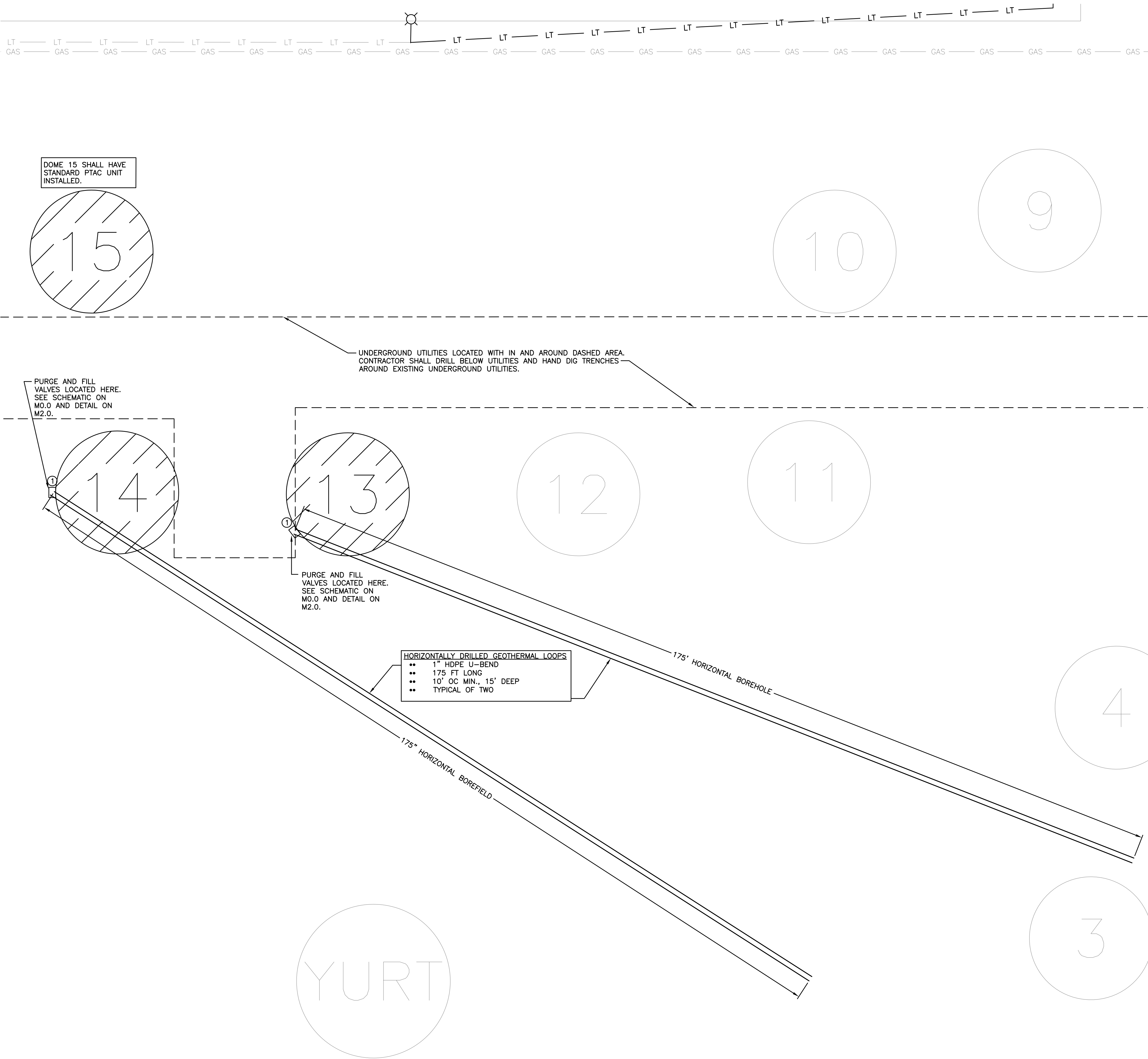
F. START-UP PRESSURIZATION OF THE CIRCUIT TO BE 20-30 PSI WHEN INSTALLED IN THE SUMMER WITH CIRCULATING TEMPERATURE OF 70-90 DEGREES F AND 40-50 PSI WHEN INSTALLED IN THE WINTER WITH CIRCULATING WATER TEMPERATURE OF 40-50 DEGREES F IS REQUIRED.

G. THE CIRCULATION SYSTEM SHALL INCORPORATE PROVISIONS FOR FLOW AND TEMPERATURE-SENSING CAPABILITY FOR TESTING THE PERFORMANCE OF THE WATER-SIDE OF THE HEAT PUMP SYSTEM. PRESSURE AND TEMPERATURE-SENSING PORTS MUST BE WITHIN 2 FEET OF THE HEAT PUMP.
8. WATER QUALITY AND TREATMENT.
- NOTE: SYSTEM VOLUME FOR EACH DOME ESTIMATED AT 17 GALLONS.

A. WATER QUALITY FOR GEOHERMAL HEAT PUMPS SYSTEMS SHALL MINIMIZE CORROSION, SCALE BUILDUP, AND BIOLOGICAL GROWTH FOR OPTIMUM EFFICIENCY OF HVAC EQUIPMENT WITHOUT CREATING A HAZARD TO OPERATING PERSONNEL OR THE ENVIRONMENT. HEAT PUMP MANUFACTURER RECOMMENDS THE FOLLOWING MINIMUM WATER QUALITY:

HARDNESS: <300 PPM
IRON OXIDES: LOW LEVELS ONLY
pH=7-9
HYDROGEN SULFIDE: <10 PPM
CO2: <50 PPM
CHLORIDE: <300 PPM
TOTAL DISSOLVED SOLIDS: 1000 PPM

B. GEOHERMAL HEAT PUMP SYSTEM WATER TREATMENT SHALL BE BASED ON QUALITY OF WATER AVAILABLE AT PROJECT SITE, GEOHERMAL HEAT PUMP SYSTEM MATERIAL CHARACTERISTICS, IGSHA, AND THE REQUIREMENTS AND GUIDELINES OF THE AUTHORITY HAVING JURISDICTION.
9. THE CONTRACTOR SHALL PROVIDE A CERTIFICATE DESCRIBING THE SPECIFICATIONS AND THE START-UP PERFORMANCE TEST RESULTS OF THE SYSTEM AS REQUIRED BY IGSHA AND SYSTEM COMMISSIONING.



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DESIGN AND CONSTRUCTION
MANAGEMENT

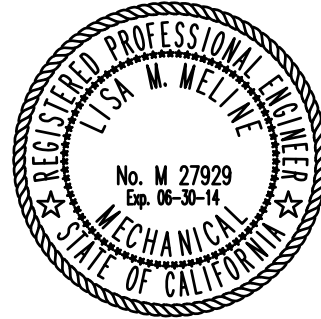
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REVISIONS:

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2	
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DOMES MECHANICAL
UPGRADE/HEAT PUMP RETROFIT
NO. 2502400
DAVIS, CA

MECHANICAL
SITE PLAN

SCALE: NOTED

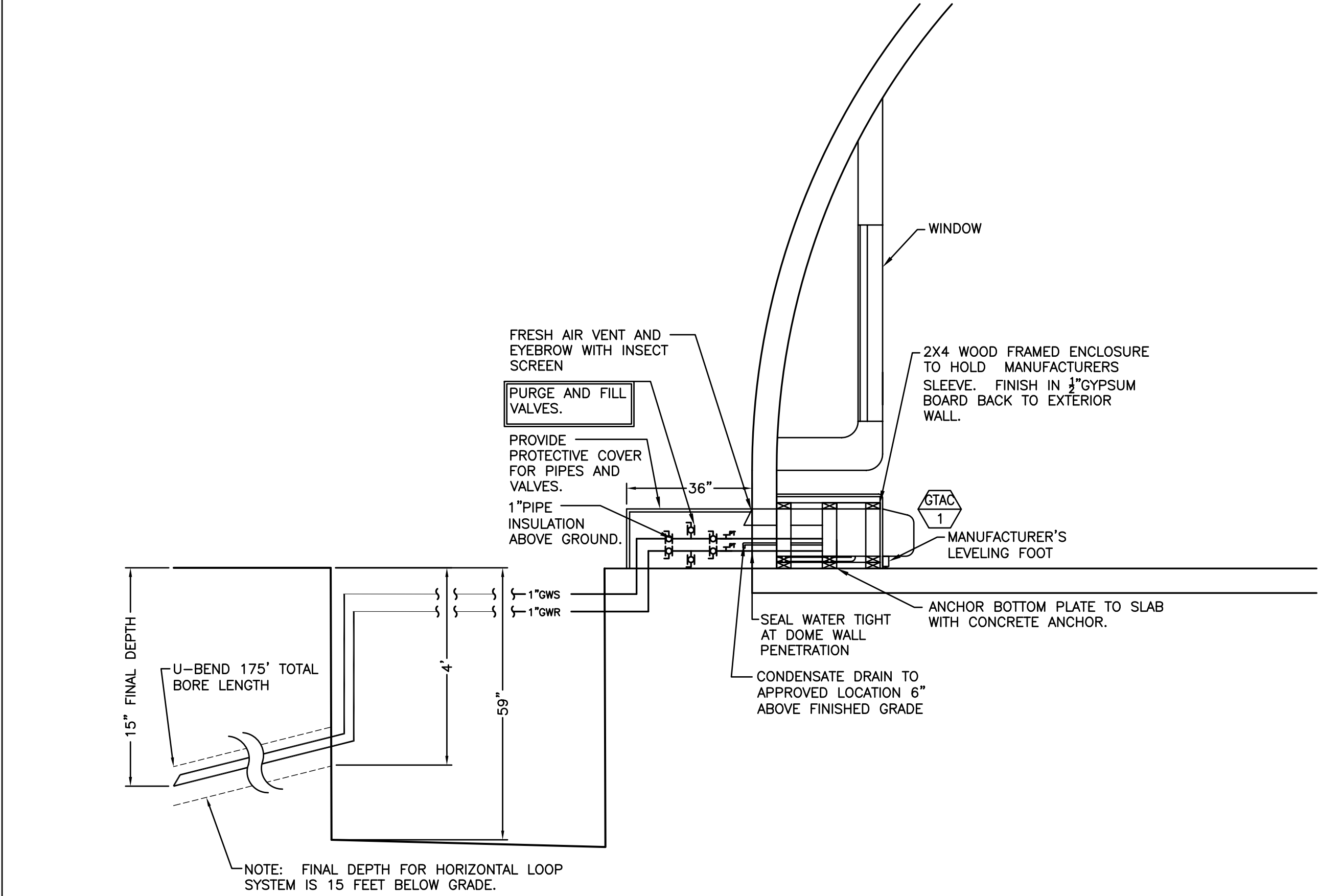
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PROJECT NO. ME645



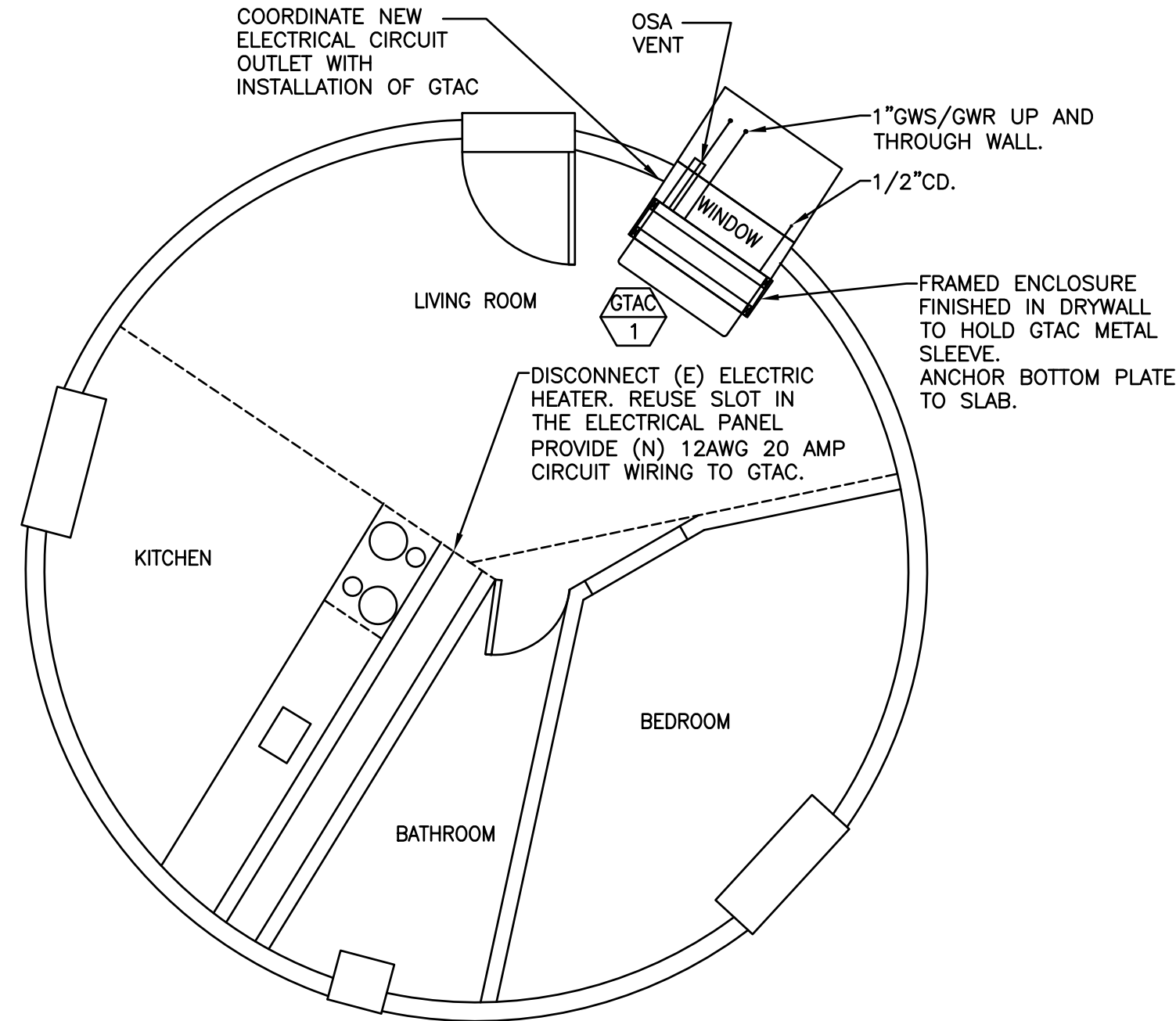
MECHANICAL SITE PLAN

SCALE: 1"=10'

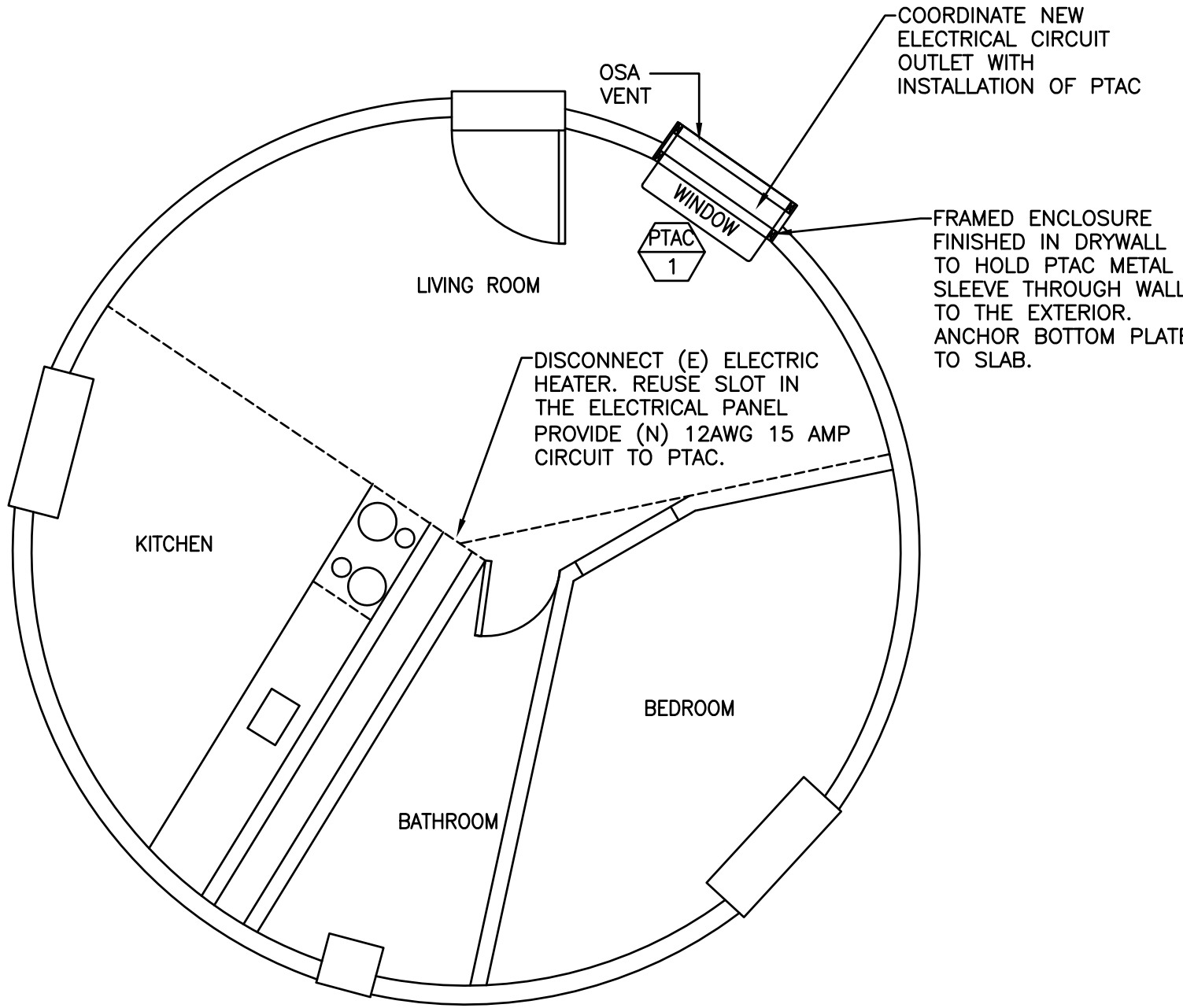


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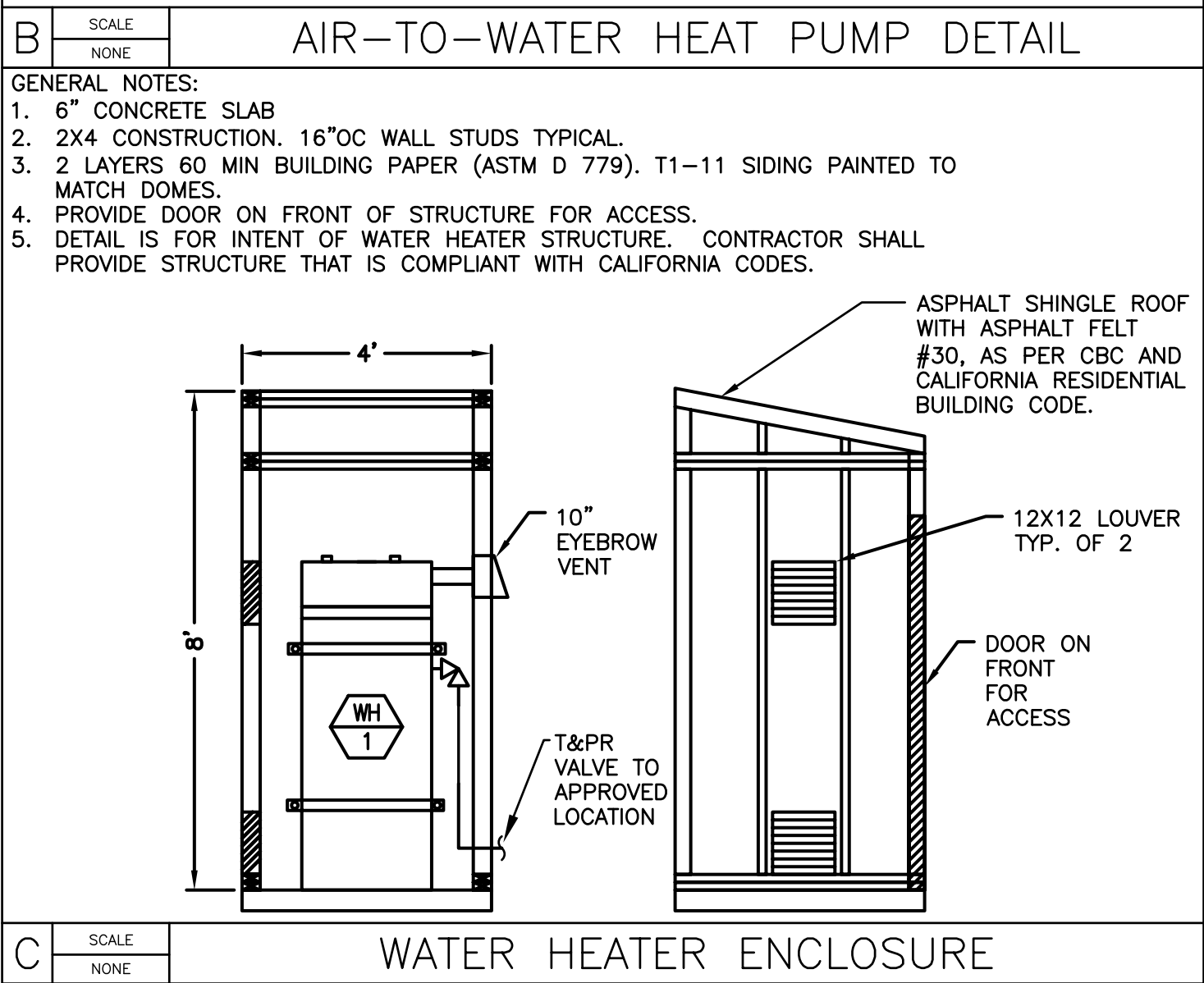
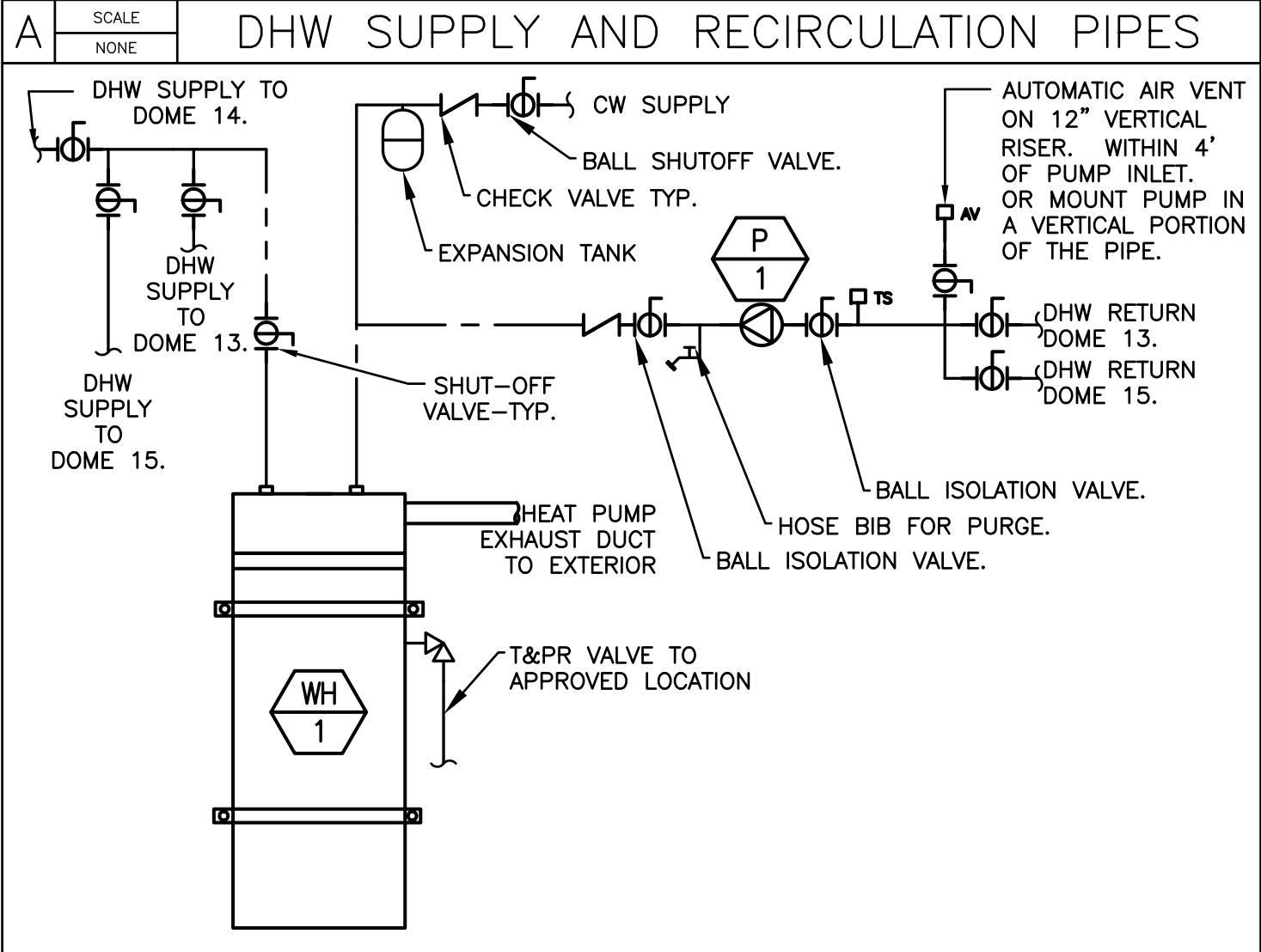
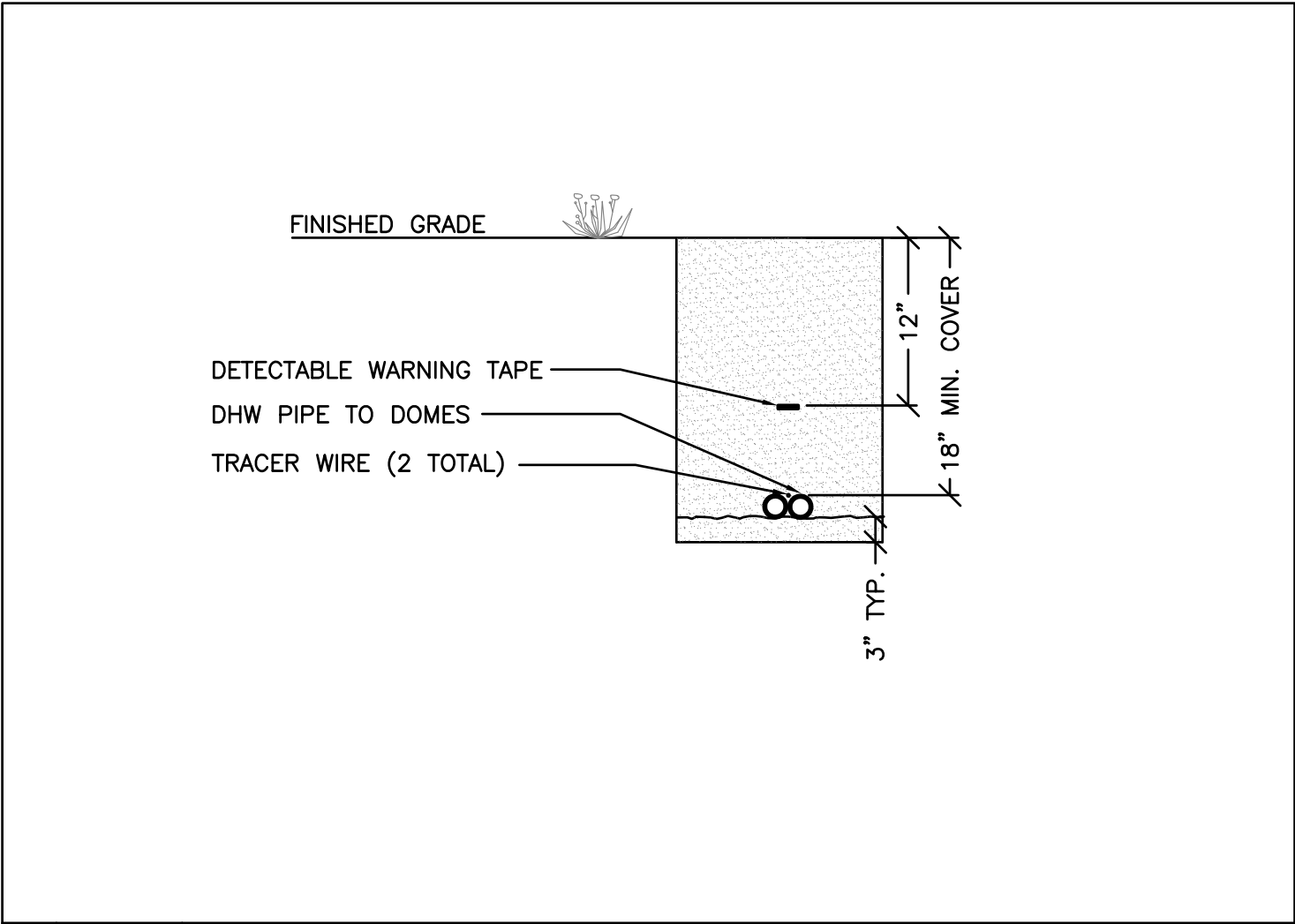
GTAC INSTALLATION



DOME 13 & 14 FLOOR PLAN
SCALE: 1/4"=1'

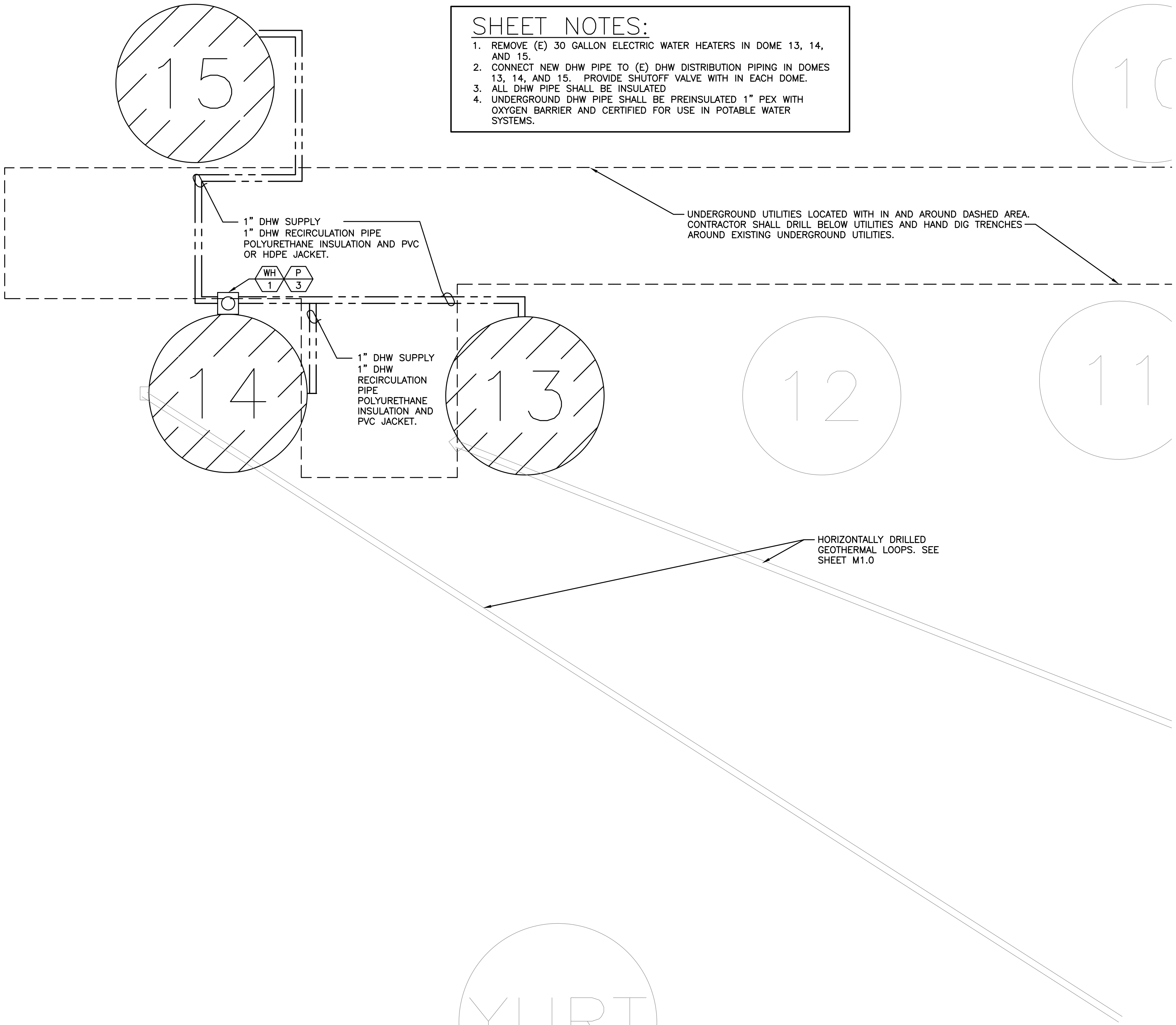


DOME 15 FLOOR PLAN
SCALE: 1/4"=1'



WATER HEATER SCHEDULE(AIR-TO-WATER HEAT PUMP)										
TAG	MANUFACTURER	MODEL	GAL.	VOLT/HZ/PH	MOCP	ENERGY FACTOR	DIA.	HEIGHT	WT (LBS.)	LOCATION
WH 1	AOSMITH	PHPT-80	80	240/60/1	25	2.30	25.5"	81.5"	410	WATER HEATER ENCLOSURE
NOTES: 1. INSTALL AS PER MANUFACTURER RECOMMENDATIONS. 2. PROVIDE STRUCTURE TO PROTECT WATER HEATER FROM THE ELEMENTS. STRUCTURE SHALL HAVE A WATER PROOF ROOF OR ASPHALT SHINGLES, AND PAINTED T1-11 SIDING. 3. PROVIDE LOUVERED OPENING IN STRUCTURE AND EXHAUST DUCT WORK FOR PROPER OPERATION OF HEAT PUMP.										

RECIRCULATION PUMP SCHEDULE									
TAG	MANUFACTURER	MANUFACTURER	GPM	TDH	ELECTRICAL				NOTES
					VOLTAGE	AMPS	WATTS	HP	
P 3	TACO	006-BC4-5PNP	2	8	115/60/1	0.52	-	1/40	DHW RECIRCULATION PUMP
NOTES: 1. UNIT SHALL OPERATE ON TIMER AND TEMPERATURE SENSOR ON RETURN LINE AT PUMP INLET.									



- SHEET NOTES:**
1. REMOVE (E) 30 GALLON ELECTRIC WATER HEATERS IN DOME 13, 14, AND 15.
 2. CONNECT NEW DHW PIPE TO (E) DHW DISTRIBUTION PIPING IN DOMES 13, 14, AND 15. PROVIDE SHUTOFF VALVE WITH IN EACH DOME.
 3. ALL DHW PIPE SHALL BE INSULATED
 4. UNDERGROUND DHW PIPE SHALL BE PREINSULATED 1" PEX WITH OXYGEN BARRIER AND CERTIFIED FOR USE IN POTABLE WATER SYSTEMS.

UC DAVIS

DESIGN AND CONSTRUCTION MANAGEMENT

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RELEASE STATUS: DATE:	
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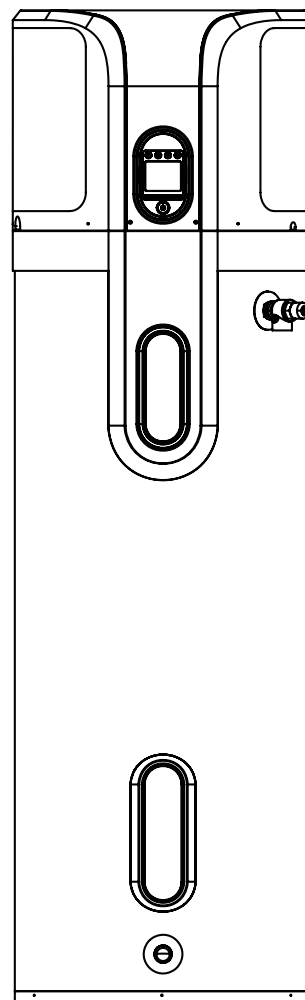
DOMES MECHANICAL
UPGRADE/HEAT PUMP RETROFIT
NO. 2502400
DAVIS, CA

ADDITIVE BID ITEM:
PLUMBING SITE
PLAN (DHW)

SCALE: NOTED

P1.0

PROJECT NO. ME645



A.O. Smith – Voltex™ Hybrid Electric Heat Pump Water Heater Installation Instructions and Use & Care Guide

To obtain technical, warranty or service assistance during or after the installation of this water heater, call toll free
1-800-527-1953

When calling for assistance, please have the following information ready:

1. Model number
2. 7 Digit product number
3. Serial number
4. Date of installation
5. Place of Purchase

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WATER HEATER SAFETY

Your safety and the safety of others are very important.

We have provided many important safety messages in this manual and on your appliance. Always read and obey all safety messages.



This is the safety alert symbol.

This symbol alerts you to potential hazards that can kill or hurt you and others.

All safety messages will follow the safety alert symbol and either the word “DANGER” or “WARNING.” These words mean:

⚠ DANGER

You can be killed or seriously injured if you don't immediately follow instructions.

⚠ WARNING

You can be killed or seriously injured if you don't follow instructions.

All safety messages will tell you what the potential hazard is, tell you how to reduce the chance of injury, and tell you what can happen if the instructions are not followed.

Important Safety Instructions

CAUTION: Hydrogen gas is produced in a hot water system served by this heater that has not been used for a long period of time (2 weeks or more). Hydrogen gas is extremely flammable. To reduce the risk of injury under these conditions, it is recommended that the hot water faucet be opened for several minutes at the kitchen sink before using any electrical appliance connected to the hot water system. When hydrogen is present, there will probably be an unusual sound such as air escaping through the pipe as the water begins to flow. There should be no smoking or open flame near the faucet at the time it is open.

The California Safe Drinking Water and Toxic Enforcement Act requires the Governor of California to publish a list of substances known to the State of California to cause cancer, birth defects, or other reproductive harm, and requires businesses to warn of potential exposure to such substances.

WARNING: This product contains a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm.

This appliance can cause low-level exposure to some of the substances included in the Act.

IMPORTANT: The heat pump portion of this water heater uses R-134a refrigerant. See the data plate on the heat pump jacket for the charge level.

INSTALLING YOUR WATER HEATER

Consumer Information

This water heater should be installed in accordance with the local code authority having jurisdiction, the power company or electric utility, and this installation manual. In the absence of local code requirements, follow the regulations set forth in the latest edition of The National Electric Code, NFPA 70. This is available from the following:

National Fire Protection Association

1 Batterymarch Park

Quincy, MA 02269

American National Standards Institute

1430 Broadway

New York, NY 10018

Check your phone listings for the local authorities having jurisdiction over your installation.

Consumer Responsibilities

This manual has been prepared to acquaint you with the installation, operation and maintenance of your electric heat pump water heater and to provide important safety information in these areas.

We urge you to read all of the instructions thoroughly before attempting the installation or operation of this water heater. This manual should be kept for future reference.

The manufacturer of this water heater will not be liable for any damages caused by failure to comply with the installation and operating instructions outlined in this manual.

If you lack the necessary skills required to properly install this water heater or you have difficulty following the directions, you should not proceed but have a qualified person perform the installation of this water heater.

Examples of a qualified person include: licensed plumbers, authorized electric company personnel, and authorized service personnel.

Massachusetts code requires this water heater to be installed in accordance with Massachusetts 248-CMR 2.00: State Plumbing Code and 248-CMR 5.00.

A data plate identifying your water heater can be found adjacent to the upper element door. When referring to your water heater always have the information listed on the data plate readily available, to include the model and serial number. Retain your original receipt as proof of purchase.

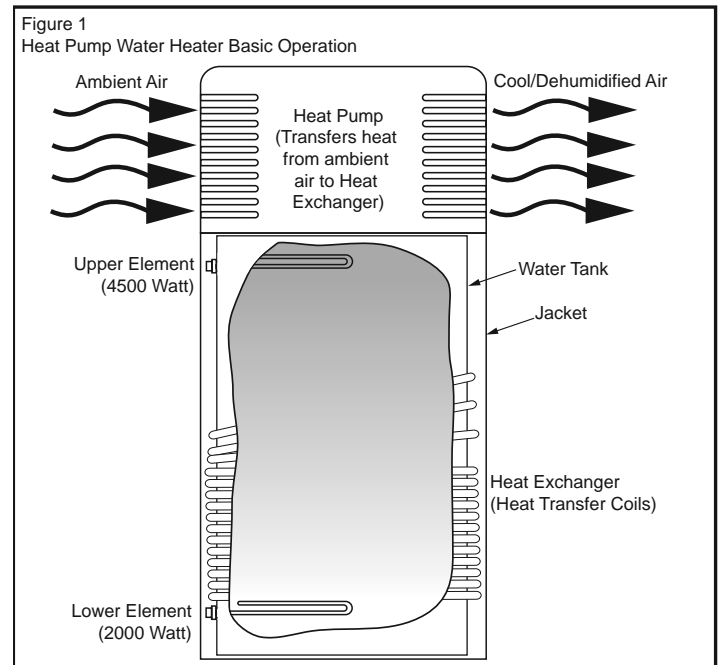
Basic Operation Fundamentals

The Heat Pump Water Heater (HPWH) is an integrated heat pump water heater unit, having an 850 watt compressor and external coil heat exchanger with backup electric elements (See Figure 1). When in Efficiency Mode the heat pump draws heat from the ambient air in the room and transfers it to the water in the tank through the coil heat exchanger. While in Electric Mode the water heater functions like a standard electric water heater, relying on the electric elements to heat the water. A Hybrid Mode is available that relies primarily on the heat pump to heat

the water while the electric elements only function during high demand periods. (See "Adjusting the User Interface Module/ Operational Mode" section). The more often the unit operates using the heat pump, rather than the elements, the more efficient the unit will be.

The tank capacity of this heat pump water heater is sized to maximize the use of the heat pump to deliver hot water at a lower cost as compared to heat pump waters with lower tank capacities (50 gallons or less.)

The HPWH uses about half the electricity of a comparably sized conventional electric water heater when operating in the Efficiency Mode, and provides up to ½ ton cooling capacity and dehumidification. It is designed for indoor, residential applications for installation in a basement, garage or utility room (See "Location Requirements" section).



Unpacking the Water Heater

⚠ WARNING

Excessive Weight Hazard

Use two or more people to move and install water heater.

Failure to do so can result in back or other injury.

Removing Packaging Materials

IMPORTANT: Do not remove, cover or deface any permanent instructions, labels, or the data label from either the outside of the water heater or on the inside of water heater panels.

- The water heater must NOT be placed on its side. It should be transported and stored in an upright position.
- Remove exterior packaging and place installation components aside.
- Inspect all parts for damage prior to installation and start-up.
- Completely read all instructions before attempting to assemble and install this product.
- After installation, dispose of/recycle all packaging materials.

Location Requirements

Site location

Select a location near the center of the water piping system. The unit must be installed indoors and in a vertical position on a level surface. The flooring beneath the water heater must be able to support the weight of the water heater when filled with water (See Table 1).

IMPORTANT: The water heater must have unrestricted airflow and requires a minimum installation space of 750 cubic feet. As an example, a room that has an eight foot tall ceiling and is 10 feet long by 9-1/2 feet wide would contain 760 cubic feet. See The Confined Space Installation section of this manual for installing the water heater in spaces of less than 750 cubic feet.

NOTE: To ensure optimal performance and efficiency a minimum clearance of six (6) inches from the back, left and right sides of the water heater must be maintained. A minimum of 12 inches from the front of the unit should be maintained for control access. Service clearances of three (3) feet from the left and right sides are recommended as a best installation practice.

The water heater should be located in an area not subject to freezing temperatures. Water heaters located in unconditioned spaces (i.e., garages, basements, etc.) may require the water piping, condensate piping, and drain piping to be insulated to shelter against freezing. The drain and controls must be easily accessible for operation and service.

The site location must be free from any corrosive elements in the atmosphere such as sulfur, fluorine, and chlorine. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, air fresheners, paint, and varnish removers, refrigerants, and many other commercial and household products. In addition, excessive dust and lint may affect the operation of the unit (See "Cleaning the Filter" section).

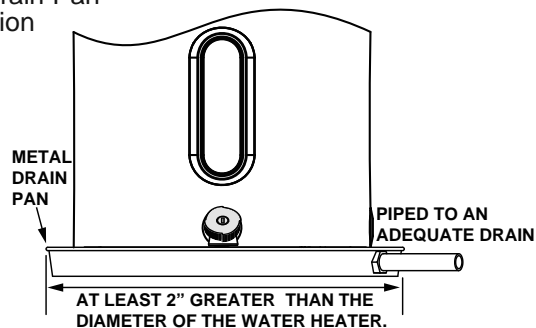
The ambient air temperature must also be considered when installing this unit. In Efficiency Mode the ambient air temperature must be above 45°F and below 109°F. If the ambient air temperature falls outside these upper and lower limits the electrical elements will activate to meet the hot water demand and the heat pump does not operate.

NOTE: Local codes and requirements in your area may require the installation of your water heater be accomplished in a way that the bottom element is elevated from the floor at least 18 inches. Ensure that a platform capable of supporting the combined weight of the water heater and water is used.

Table 1	
Capacity	Weight (lbs)
60 Gallon	760
80 Gallon	967

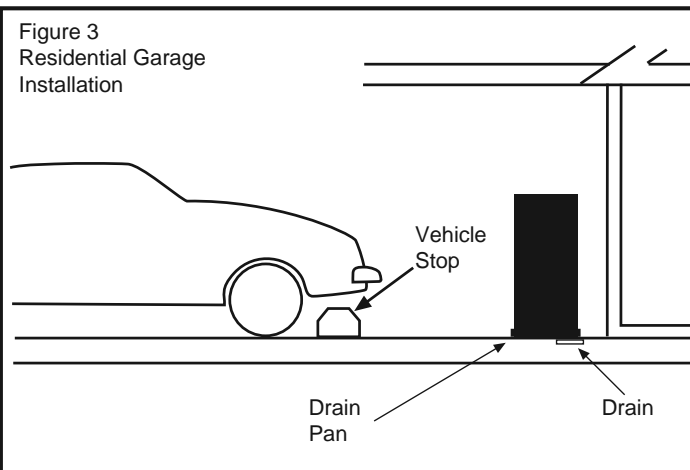
IMPORTANT: The water heater should be located in an area where leakage of the tank, connections, condensate lines or condensate will not result in damage to the area adjacent to the water heater or to lower floors of the structure. Due to the normal corrosive action of the water, the tank will eventually leak after an extended period of time. Also, any external plumbing leak, including those from improper installation, may cause early failure of the tank due to corrosion if not repaired. If the homeowner is uncomfortable with making the repair a qualified person should be contacted. A suitable metal drain pan should be installed under the water heater as shown below, to help protect the property from damage which may occur from condensate formation or leaks in the piping connections or tank. The pan must limit the water level to a maximum depth of 2-1/2 inches and be two inches wider than the heater and piped to an adequate drain. Locate the water heater near a suitable indoor drain. Outside drains are subject to freezing temperatures which can obstruct the drain line. The piping should be at least 3/4" ID and sloped for proper drainage. Under no circumstance will the manufacturer or seller of this water heater be held liable for any water damage which is caused by your failure to follow these instructions.

Figure 2
Metal Drain Pan
Installation



NOTE: The water heater shall be located so it is not subject to physical damage by moving vehicles or area flooding.

Figure 3
Residential Garage
Installation



State of California

NOTE: The water heater must be braced, anchored, or strapped to avoid moving during an earthquake. Contact local utilities for code requirements in your area, visit <http://www.dsa.dgs.ca.gov>, or call 1-916-445-8100 and request instructions.

Confined Space Installation

The heat pump water heaters covered in this manual require a minimum of 750 cubic feet of installation space. When a space meeting this minimum requirement is not available these units may be installed in spaces with less than 750 cubic feet (confined spaces) when provisions are made by installing an accessory Outlet Duct Kit and/or louvered grills as described in this section.

Inlet air will be derived from an alternate location inside the building structure through one or more louvered grills or through a fully louvered door leading into the confined space. The alternate location from where inlet air will be derived must provide a minimum of 750 cubic feet of space when using this installation method. When the Outlet Duct Kit is installed outlet air from the unit is redirected to an alternate location. The alternate location to where outlet air will be redirected must also provide a minimum of 750 cubic feet of space.

Other configurations are possible when using the Outlet Duct Kit (PN 9910006000) and/or the Inlet Duct Kit (PN 9910005000) with these water heaters. Consult the installation instructions included with the duct kits for additional information. These instructions are also available on the manufacturer's web site. Contact the distributor where the water heater was purchased for information on ordering these duct kits.

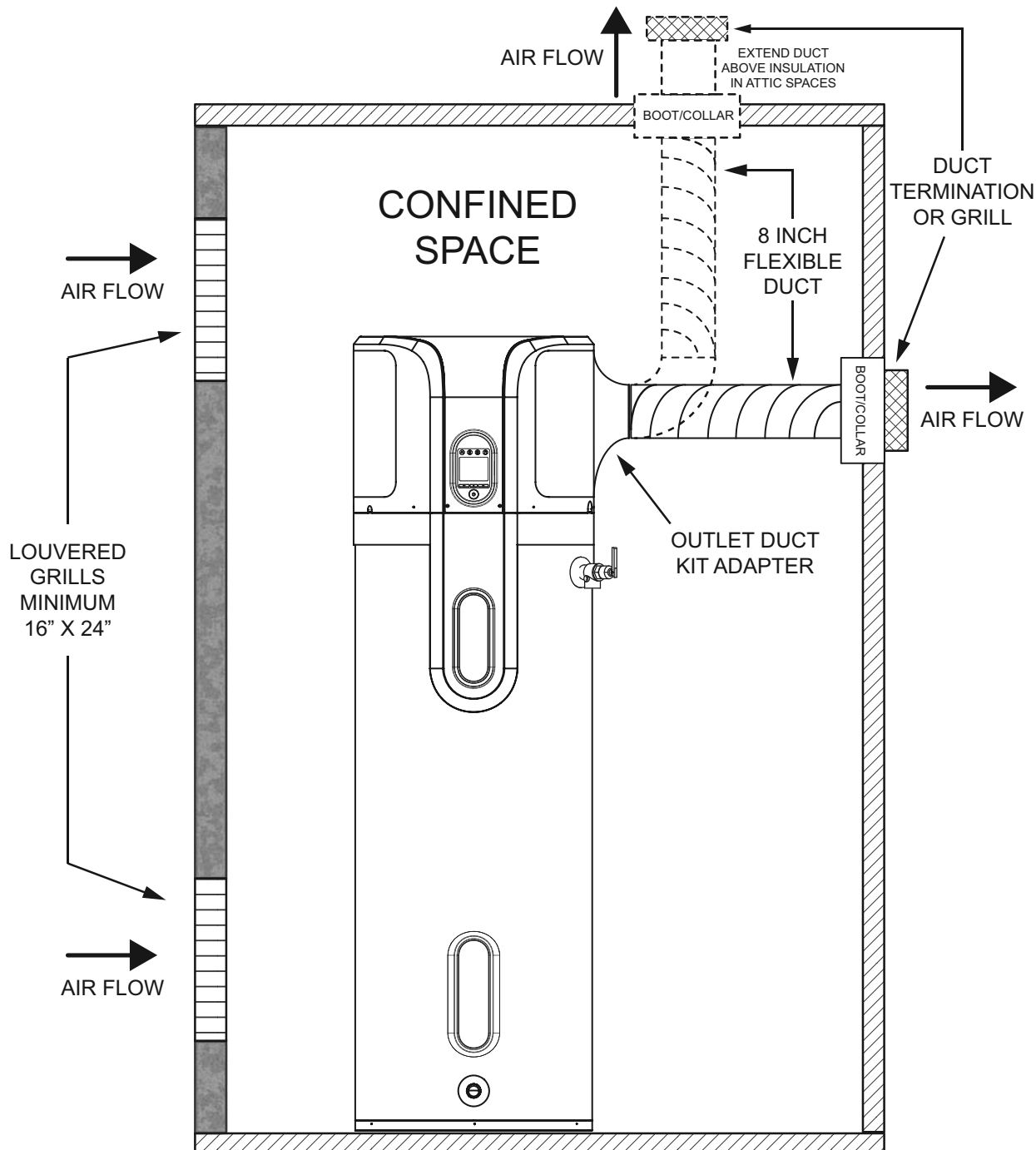
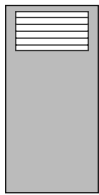
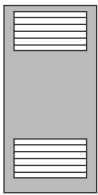
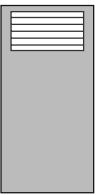
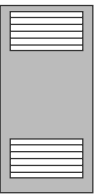


FIGURE 4

Table 2

ITEM	WITHOUT DUCTWORK		WITH 8 INCH FLEXIBLE DUCT AND OUTLET DUCT KIT	
LOUVERED GRILL CONFINED SPACE CONFIGURATION (door or wall)				
MINIMUM SPACE (cubic feet)	610	460	400	128
EXAMPLE ROOM SIZE H X L X W (feet)	8' x 7.6' x 10'	8' x 5.75' x 10'	8' x 10' x 5'	8' x 4' x 4'

Installation

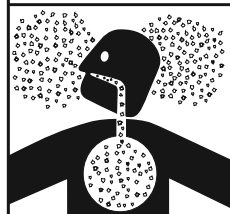
Installation requires ability equivalent to that of a qualified HVAC installer. Installation skills such as air supply, venting, and duct installation are required. If you are not qualified and licensed or certified as required by the authority having jurisdiction to perform a given task do not attempt installation. Contact a local HVAC contractor to perform the installation.

Installation must comply with all national, state and local building codes and agencies having jurisdiction. Check with your local building code authority if you have any questions regarding code compliance.

1. Inlet air is derived through louvered grill(s) installed in a door or wall between the installation space and another space inside the building structure. The space from where inlet air is derived must be a minimum of 750 cubic feet. See Figure 4.
2. Installation is permitted in confined spaces between 750 and 610 cubic feet of space using one louvered grill or in spaces between 610 and 460 cubic feet using two louvered grills. See Figure 4 and Table 2.
3. For installation in confined spaces of less than 460 cubic feet the accessory Outlet Duct Kit (PN 9910006000) is required. With this kit installation is permitted in confined spaces between 460 and 400 cubic feet with one louvered grill or in spaces between 400 and 128 cubic feet with two louvered grills. See Figure 4 and Table 2.
4. Minimum louvered grill size is 16" x 24" for each grill installed. Fully louvered doors are an acceptable substitute for louvered grill(s) if the louvered area of the door is not less than the total required area the grill(s) would provide.
5. Follow the instructions included with the Outlet Duct Kit for the included duct adapter and ductwork.
6. Eight (8) inch flexible ducting is required but not supplied in the Outlet Duct Kit. Suitable ducting is readily available at home centers or HVAC supplies.
7. Duct collars and boots may also be required but are not supplied with the Outlet Duct Kit. Suitable collars and boots are readily available from home centers or HVAC supplies.
8. The maximum length of duct allowed is 10 feet. This maximum length must not be exceeded under any circumstances.
9. Ducting should be installed as straightly as possible; there must be no kinks or flattening of the ductwork.
10. The Outlet Duct Kit and connected ductwork must redirect outlet air from the unit to a location other than the confined installation space. The alternate location to where the outlet air is redirected must be a minimum of 750 cubic feet.

⚠ WARNING

Breathing Hazard - Carbon Monoxide Gas



- Do not duct air from a garage or other space where potentially harmful fumes from solvents, chemicals or exhaust from automobiles are present into any other space in the building structure.
- Gas and carbon monoxide detectors are available.

Breathing carbon monoxide can cause brain damage or death. Always read and understand instruction manual.

11. The outlet air from a unit installed in a garage or drawing inlet air from a garage or any area where solvents or other chemicals that emit potentially harmful fumes are stored or automobiles are located must never be ducted to any other space inside the building structure. This would include all occupied and unoccupied spaces such as attics or basements. Potentially harmful fumes and vapors could be introduced into living spaces.
12. A duct termination or grill is required at the end of the duct run but not supplied with the Outlet Duct Kit. Suitable duct terminations and grills are readily available from home centers or HVAC supplies. Terminations must be fitted with screens or designed to prevent rodents, other pests and debris from entering the ductwork. If terminated outdoors or to another space where water or moisture may enter the ductwork, terminations designed to prevent water or moisture infiltration must be used.
13. If outlet ductwork is terminated through a ceiling into an attic space provision must be made to ensure the ductwork terminates well above the insulation line in the attic to prevent insulation from entering the ductwork. A short section of 8 inch round metal duct may be used with a suitable duct termination. Overall duct length, including flexible and metal duct must not exceed 10 feet.
14. Ductwork that transitions through walls or ceilings must be properly sealed to prevent rodent, other pests or moisture infiltration.

Water System Piping

Piping, fittings, and valves should be installed according to the installation drawing (Figure 5). If the indoor installation area is subject to freezing temperatures, the water piping must be properly insulated.

Water supply pressure should be 50-60 PSIG and not exceed the maximum 80 PSIG. If the supply line pressure exceeds 80 PSIG, a pressure reducing valve (PRV) with a bypass should be installed in the cold water supply line. This should be placed on the supply to the entire house in order to maintain equal hot and cold water pressures.

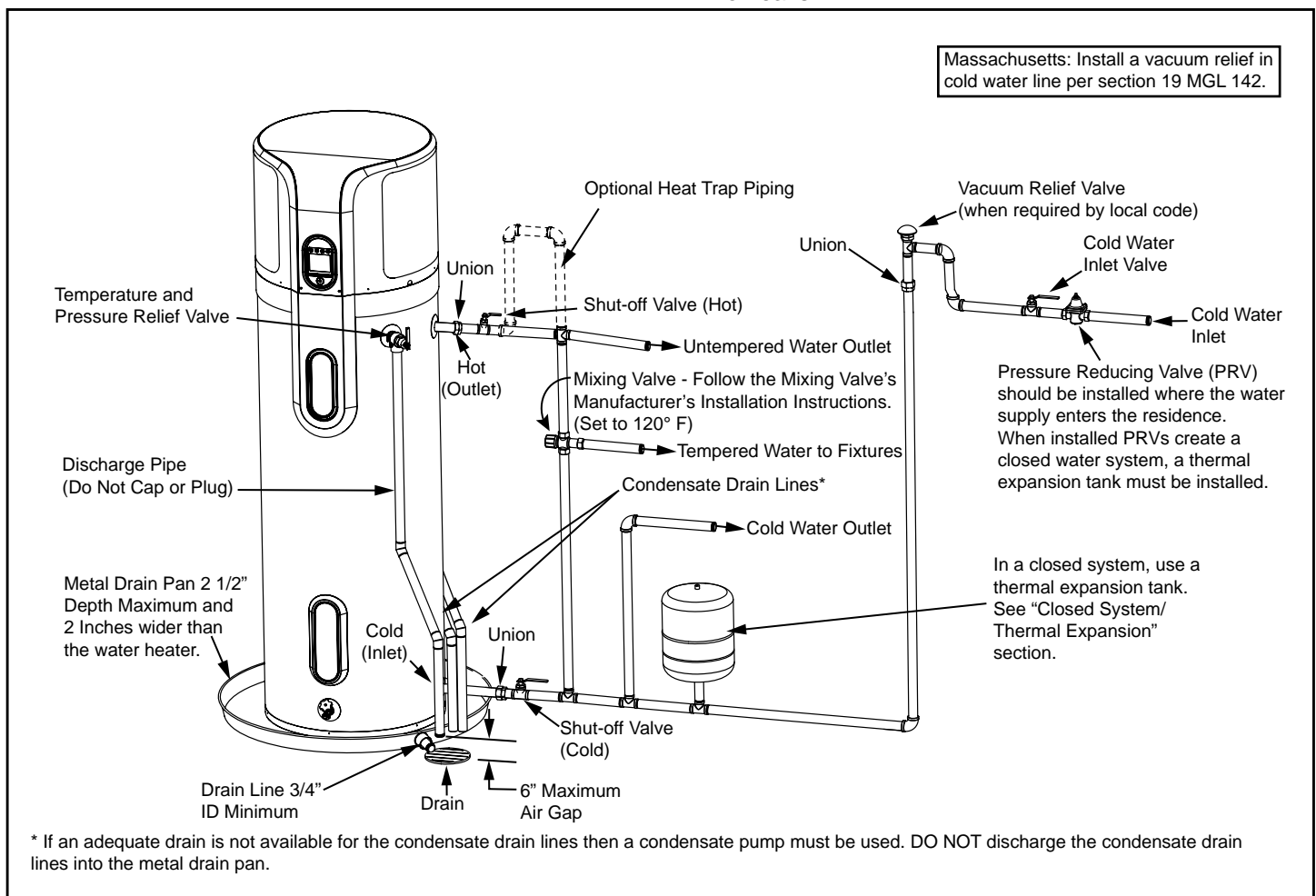
IMPORTANT:

- **Heat must not be applied to the water fittings on the heater as they may contain nonmetallic parts. If solder connections are used, solder the pipe to the adapter before attaching the adapter to the hot and cold water fittings.**
- Always use a good grade of joint compound and be certain that all fittings are tight.

IMPORTANT: DO NOT over apply joint compound.

Piping Installation

1. Install the water piping and fittings as shown in Figure 4. Connect the cold water supply (3/4" NPT) to the fitting marked "Cold". Connect the hot water supply (3/4" NPT) to the fitting marked "Hot".
2. The installation of unions in both the hot and cold water supply lines are recommended for ease of removing the water heater for service or replacement.
3. Some local codes may require, and the manufacturer of this water heater recommends, installing a mixing valve or an anti-scald device in the domestic hot water line as shown in Figure 5. These valves reduce the point-of-use temperature of the hot water by mixing cold and hot water and are readily available. Contact a licensed plumber or the local plumbing authority for more information.
4. Some local codes may require, and the manufacturer of this water heater recommends, installing a pressure reducing valve (PRV) in the cold water inlet line where it enters the residence as shown in Figure 5.
5. If installing the water heater in a closed water system, install an expansion tank in the cold water line as specified under "Closed System/Thermal Expansion."
6. Install a shut off valve in the cold water inlet line. It should be located close to the water heater and be easily accessible. Know the location of this valve and how to shut off the water to the heater.
7. Install a discharge line from the temperature and pressure relief valve in the opening marked "T & P RELIEF VALVE". See Figure 5 and the "Temperature and Pressure Relief Valve" section.)
8. After piping has been properly connected to the water heater, open the nearest hot water faucet. Then open the cold water shut off valve and allow the tank to completely fill with water. To purge the lines of any excess air and sediment, keep the hot water faucet open for 3 minutes after a constant flow of water is obtained. Close the faucet and check all connections for leaks.



Please note the following:

- The system should be installed only with piping that is suitable for potable (drinkable) water such as copper, CPVC, or polybutylene. This water heater must not be installed using iron piping or PVC water piping.
- Use only pumps, valves, or fittings that are compatible with potable water.
- Use only full flow ball or gate valves. The use of valves that may cause excessive restriction to water flow is not recommended.
- Use only 95/5 tin-antimony or other equivalent solder. Any lead based solder must not be used.
- Piping that has been treated with chromates, boiler seal, or other chemicals must not be used.
- Chemicals that may contaminate the potable water supply must not be added to the piping system.

Condensate Drain Line Installation

Install two 1/2" PVC discharge lines from the condensate drains (located on the right side near the back). The lines should terminate a maximum of six inches above an adequate drain. Do not discharge the condensate drain lines into the metal drain pan. If no floor drain is available or the drain is above the level of the condensate line, a condensate pump should be installed. These pumps are available from local distributors.

When installing the drain line, note the following:

- Plastic pipe or tubing must be used to connect the condensate drain to a suitable drain or condensate pump.
- Condensate drain lines should be installed in conditioned areas only. Install approved insulation on the condensate drain lines to prevent condensation from forming on the outside of the drain lines. Condensation drain lines installed in areas that are subject to freezing temperatures should be wrapped with a nationally recognized/listed heat tape. Install per manufacturer's instructions.
- Do not connect condensate drain lines with other drain or discharge lines into a single (common) pipe or line. Each line (condensate drain line, temperature and pressure relief valve discharge pipe, etc) should be independently run to an adequate drain.
- Slope the condensate drain lines toward the inside floor drain or condensate pump.
- The condensate drain lines and connections to the drain piping must comply with all local codes.
- Use appropriate primer and glue to cement the condensate drain lines to the heat pump drain pan.
NOTE: The heat pump drain pan is ABS and the two condensate drain pipes should be PVC.
- If a condensate pump is installed it should shut off the heat pump in the event the condensate pump fails or the float switch in the pump activates (See "Condensate Pump Installation" section.)

Closed System/Thermal Expansion

WARNING



Explosion Hazard

If the temperature and pressure relief valve is dripping or leaking, have a qualified person replace it.

Examples of a qualified person include: licensed plumbers, authorized electric company personnel, and authorized service personnel.

Do not plug valve.

Do not remove valve.

Failure to follow these instructions can result in death or explosion.

Most public water systems in North America are required to prevent water flowing from points of use (residences, businesses, etc.) back into the supply system in order to maintain water quality. To accomplish this, back flow preventers such as check valves, are installed in the water line going to each point of use. Typically the back flow preventer will be installed at the water meter or inside a building where the supply line enters the building. This device allows water to flow into the residence but does not allow it to flow back into the water supply. This creates what is known as a "Closed System". As water is heated by the water heater, the water in the system attempts to expand, but has nowhere to go resulting in an increase in pressure. This increase in pressure in the system may cause the temperature-pressure relief valve to open to relieve the pressure. Water will drip from the temperature and pressure relief valve. Premature tank failure will result if this condition is not corrected. To prevent this condition, a properly-sized thermal expansion tank should be installed in the cold water supply to the water heater as shown in Figure 4. Failure to install a properly sized expansion tank in a closed system will void the warranty on the water heater in the event of tank failure. It is important to follow the thermal expansion tank manufacturers' installation instructions and to adjust the expansion tank pressure to match the water supply pressure. Contact a plumbing service agency or your retail supplier regarding the installation of a thermal expansion tank.

Temperature and Pressure Relief Valve

⚠ WARNING



Explosion Hazard

If the temperature and pressure relief valve is dripping or leaking, have a qualified person replace it.

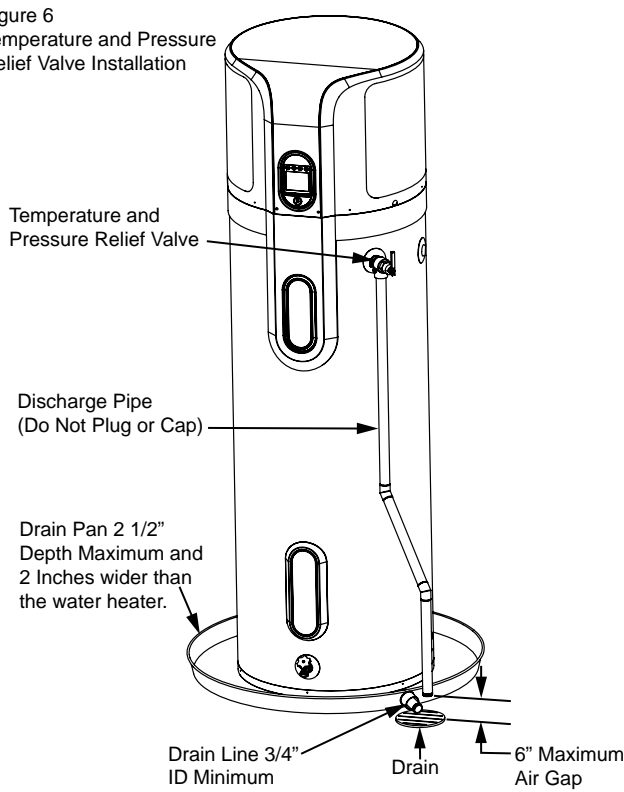
Examples of a qualified person include: licensed plumbers, authorized electric company personnel, and authorized service personnel.

Do not plug valve.

Do not remove valve.

Failure to follow these instructions can result in death or explosion.

Figure 6
Temperature and Pressure
Relief Valve Installation



For protection against excessive pressures and temperatures, a temperature and pressure relief valve must be installed in the opening marked "T & P RELIEF VALVE" (See Figure 5).

To reduce the risk of excessive pressures and temperatures in this water heater, install temperature and pressure relief protective equipment required by local codes, but no less than a combination temperature and pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of the production of listed equipment or materials, as meeting the requirements for Relief Valves and Automatic Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22 - latest edition. This valve must be marked with the maximum set pressure not to exceed the marked maximum working pressure of the water heater. Install the valve into an opening provided and marked for this purpose in the water heater, and orient it or provide tubing so that any discharge from the valve exits only within 6 inches above drain, or at any distance below, the structural floor, and does not contact any live electrical part. The discharge opening must not be blocked or reduced in size under any circumstance.

IMPORTANT: Only a new temperature and pressure relief valve should be used with your water heater. Do not use an old or existing valve as it may be damaged or not adequate for the working pressure of the new water heater. Do not place any valve between the relief valve and the tank.

The Temperature & Pressure Relief Valve:

- Shall not be in contact with any electrical part.
- Shall be connected to an adequate discharge line.
- Shall not be rated higher than the working pressure shown on the data plate of the water heater.

The Discharge Line:

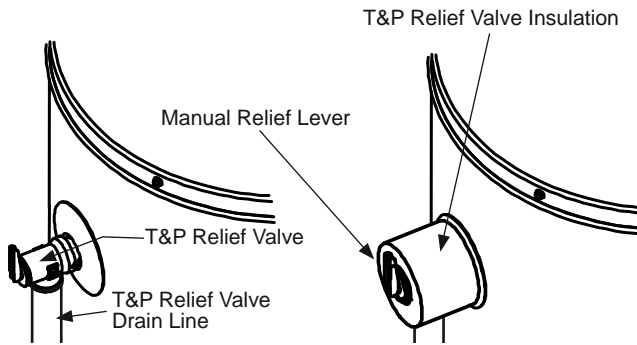
- Shall not be smaller than the pipe size of the relief valve or have any reducing coupling installed in the discharge line.
- Shall not be capped, blocked, plugged or contain any valve between the relief valve and the end of the discharge line.
- Shall terminate a maximum of six inches above a floor drain or external to the building. In cold climates, it is recommended that the discharge pipe be terminated at an adequate drain inside the building.
- Shall be of material listed for hot water distribution.
- Shall be installed to allow complete drainage of both the valve and discharge line.

Temperature/Pressure Relief Valve and Pipe Insulation

1. Locate the temperature and pressure relief valve on the water heater (also known as a T&P relief valve). See Figure 6.
2. Locate the slit running the length of the T&P relief valve insulation.
3. Spread the slit open and fit the insulation over the T&P relief valve. See Figure 7. Apply gentle pressure to the insulation to ensure that it is fully seated on the T&P Relief Valve. Once seated, secure the insulation with duct tape, electrical tape, or equivalent.

IMPORTANT: The insulation and tape must not block the discharge opening or hinder access to the manual relief lever (Figure 7). Ensure a discharge pipe is installed into the T&P valve discharge opening per the instructions in this manual.

Figure 7
T&P Relief Valve Insulation



4. Locate the hot water (outlet) & cold water (inlet) pipes to the water heater.
5. Locate the slit running the length of a section of pipe insulation.
6. Spread the slit open and slip the insulation over the cold water (inlet) pipe. Apply gentle pressure along the length of the insulation to ensure that it is fully seated around the pipe. Also, ensure that the base of the insulation is flush with the water heater. Once seated, secure the insulation with duct tape, electrical tape, or equivalent.
7. Repeat steps 5 and 6 for the hot water (outlet) pipe.
8. Add additional sections of pipe insulation as needed.

Electrical Requirements

⚠ WARNING



Electric Shock Hazard

Disconnect power before servicing.

Replace all parts and panels before operating.

Failure to do so can result in death or electrical shock.

⚠ WARNING



Fire Hazard

Use 10 gauge solid copper wire.

Use a UL listed or CSA approved strain relief.

Connect ground wire to green ground wire.

Failure to do so can result in death, fire, or electrical shock.

If you lack the necessary skills required to properly install the electrical wiring to this water heater, do not proceed but have a qualified electrician perform the installation.

When making the electrical connections, always make sure:

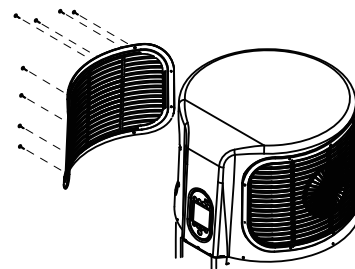
- The electrical service provides 240 VAC to the water heater for proper operation. DO NOT use 208 VAC.
- Wire sizes and connections comply with all applicable codes or in the absence of local or state codes follow NFPA-70, the National Electrical Code-current edition.
- Wiring enclosed in approved conduit (if required by local codes).
- The water heater and electrical supply are properly grounded.
- The electrical supply has the proper overload fuse or breaker protection.

Figures 9A, 9B & 10 are provided as reference drawings. Always reference the wiring diagram located on the water heater for the correct electrical connections and connect the electrical supply to the water heater in accordance with local utility requirements and codes.

When installing the electrical wiring to the water heater:

1. Although this water heater is equipped with "Dry Fire" protection circuitry, be sure tank is completely filled with water, and all air is purged from the tank before making any electrical connections. See "Draining and Flushing Section".
2. Turn off power to the electrical wiring for the water heater at the circuit breaker/fuse box.
3. Remove the left louvered access panel (when facing the water heater) by loosening the screws securing it to the water heater. See figure 8.
4. Loosen the screws securing the electrical junction box cover to the water heater and set aside.

Figure 8
Louvered Panel



5. Connect the electrical supply to the water heater. A standard 1/2 inch opening has been made in the junction box for conduit connections.
6. Connect ground wire to green ground wire in the electrical junction box of the water heater.
7. Reinstall the junction box cover.
8. Reattach the left louvered access panel to the water heater and secure it using the screws loosened earlier.
9. Turn on electrical power to the water heater.
10. Press the power button to turn the water heater on, then press the Efficiency button to set the operating mode.
NOTE: The water heater will conduct a system diagnostic (approximately 8 minutes) prior to returning to operation.
11. Once the diagnostic sequence has finished, the fan should turn on.
NOTE: The heat pump's fan will not turn on if the incoming water temperature is less than 59 °F and/or the ambient air temperature is above 109 °F or below 45 °F. Should the internal diagnostics detect a problem with the heat pump, an error message will be displayed.
12. Set the operational mode. For standard installation, the Hybrid Mode offers the best combination of efficiency and hot water delivery. For detailed descriptions of all operational modes see "Adjusting the User Interface Module/Operational Modes" section.

Figure 9A
Junction Box

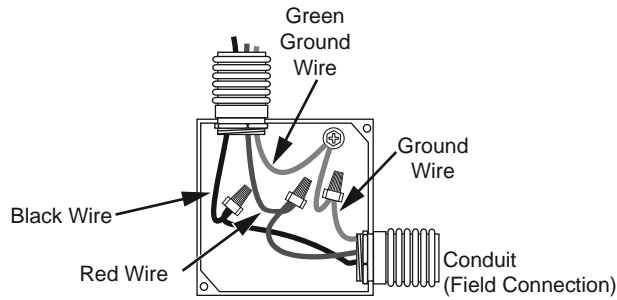


Figure 9B
Condensate Pump Wiring

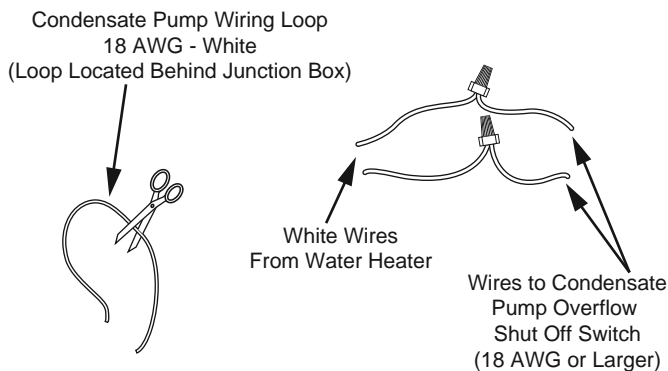
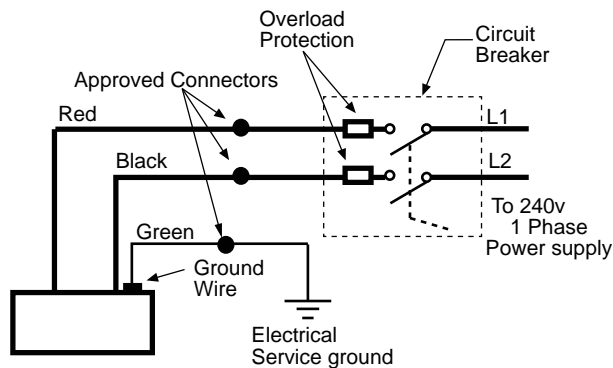


Figure 10
Wiring Diagram



Connecting the Condensate Pump Overflow Shut Off Switch

1. Turn off power to the electrical wiring for the water heater at the circuit breaker/fuse box.
2. Locate the white 18 AWG wire loop behind the field wiring junction box. See Figure 9B.
3. Cut the loop and strip insulation off of the two ends.
4. Measure the distance from the field wiring junction box to the condensate pump, and cut two 18 AWG or larger wires to correct length and strip the insulation at both ends of each wire. See Figure 9B.

5. Connect these two wires to the two wires on the water heater using wire nuts or other connectors.
6. Connect the free ends of the two wires to the shut off switch on the condensate pump in accordance with the manufacturers recommendations.
7. Turn on electrical power to the water heater.
8. Press the power button to turn the water heater on and select the desired operational mode. After about 8 minutes, the heat pump will turn on.
9. Test the operation of the shut off switch by unplugging the condensate pump and filling the condensate reservoir with water until the float switch opens the circuit.
10. The heat pump should turn off and the error code "CONDENSATE DRAIN ALARM "will appear on the user interface screen.
11. Plug the condensate pump in and verify that the pump operates and pumps the water out of the condensate reservoir.
12. The error on the user interface should clear and the heat pump should operate after 8 minutes.

Insulation Blankets

The use of an insulation blanket on this water heater is not needed or recommended. The purpose of an insulation blanket is to reduce the standby heat loss encountered with storage tank heaters. Your water heater meets or exceeds the National Appliance Energy Conservation Act standards with respect to insulation and standby loss requirements, making an insulation blanket unnecessary.

INSTALLATION CHECKLIST

Water Heater Location

- ❑ Centrally located with the water piping system.
- ❑ The flooring beneath the water heater must be able to support the weight of the water heater when filled with water (See Table 1).
- ❑ Located indoors (such as a basement or garage) and in a vertical position. Sheltered from freezing temperatures.
- ❑ Provisions made to shelter the area from water damage. Metal drain pan installed and piped to an adequate drain.
- ❑ Sufficient room to service the water heater.
- ❑ The water heater must have unrestricted airflow and requires a minimum installation space of 750 cubic feet. As an example, a room that has an eight foot tall ceiling and is 10 feet long by 9-1/2 feet wide would contain 760 cubic feet. See The Confined Space Installation section of this manual for installing the water heater in spaces of less than 750 cubic feet.
NOTE: This Heat Pump Water Heater may be located within a required minimum of 6" clearance from a wall on the inlet or outlet side, however for future service considerations a minimum clearance of 3 feet from any obstruction on the left and right side (air inlet and outlet) is recommended.
- ❑ The unit cannot be placed into any type of closet or small enclosure.
- ❑ The site location must be free from any corrosive elements in the atmosphere such as sulfur, fluorine, and chlorine. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, air fresheners, paint, and varnish removers, refrigerants, and many other commercial and household products. In addition excessive dust and lint may affect the operation of the unit and require more frequent cleaning (See "Cleaning the Heat Pump" section).
- ❑ Ambient air temperature must be above 45°F and below 109°F. If the ambient air temperature falls outside these upper and lower limits the electrical elements will activate to meet the hot water demand.

Water System Piping

- ❑ Temperature and pressure relief valve properly installed with a discharge pipe run to an adequate drain and sheltered from freezing (See Figure 5).
- ❑ All piping properly installed and free of leaks.
- ❑ Heater completely filled with water (See "Water Piping System" section).
- ❑ Closed system pressure buildup precautions installed (See "Closed System/Thermal Expansion" section).

- ❑ Mixing valve (when applicable) installed per manufacturer's instructions (See "Water Temperature Regulation" section).

Condensate Drain Line Installation

- ❑ Must be located with access to an adequate drain or condensate pump.
- ❑ Condensate drain lines installed and piped to an adequate drain or condensate pump (See Figure 4).

Electrical Connections

- ❑ This water heater requires a 240 VAC single phase 25 amp power supply. DO NOT use a 208 VAC service.
- ❑ Wiring size and connections comply with all applicable codes or in the absence of local or state codes follow NFPA-70, the National Electrical Code-current edition.
- ❑ Water heater and electrical supply are properly grounded.
- ❑ Wiring enclosed in approved conduit (if required by local codes).
- ❑ Proper overload fuse or circuit breaker protection installed.

Post Installation Review

- ❑ Understand how to use the User Interface Module to set the various modes and functions (See "Adjusting the User Interface Module/Operating Modes" section).
- ❑ Hybrid Mode is the recommended Operating Mode. Understand the various Operating Modes and which mode may be best based on season, ambient temperature, and usage (See "Operating Mode Description" section).
NOTE: It may be necessary to temporarily change modes if for example filling a spa or hot tub.
- ❑ Understand the importance of routine inspection/maintenance of the condensate drain pan and lines (See "Inspection/Cleaning of the Condensate Drain Pan & Condensate Drain Lines" section). This is to help prevent any possible drain line blockage resulting in the condensate drain pan overflowing.
IMPORTANT: Water coming from the plastic shroud is an indicator that both condensation drain lines may be blocked. Immediate action is required.
- ❑ To maintain optimal operation check, remove and clean the air filter (See "Air Filter Cleaning/Replacement" section).
- ❑ The Installation Instructions and Use & Care Guide should be kept with the water heater for reference.

OPERATING YOUR WATER HEATER

Before Using

1. Make sure the water heater has been properly installed. See “Installing Your Water Heater” section.
2. Make sure the air filter is correctly seated, as it may shift during shipping or installation. See “Repair Parts Illustration” section.
3. Completely fill the tank with water (See “Water Piping” section).
4. After the water heater tank is completely filled with water, connect electrical power to the water heater.
5. Read the “Water Temperature Regulation” section of this manual. If you do not fully understand these instructions, contact a qualified person.
6. Press the power button (See Figure 11) to turn the water heater on and allow it to run a system diagnostic. This typically takes eight minutes. Once complete, proceed to the next step.
NOTE: If the system diagnostic yields any codes, reference the Diagnostic Code section in this manual.
7. Adjust the thermostat to the desired temperature setting as described under “Adjusting the User Interface Module/Operational Modes” section.

IMPORTANT: Do not attempt to operate this water heater if the unit has been submerged, subjected to flooding, or surrounding insulation has been exposed to water in any way.

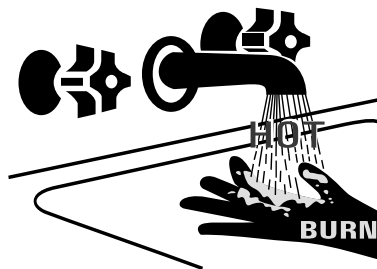
Do not attempt to repair a unit subjected to flood conditions. Water heaters subjected to flood conditions or any time the unit has been submerged in water require replacement of the entire water heater.

Safety Shut-off (ECO)

This water heater is designed to automatically shut-off in the event that the water temperature exceeds 190°F or 87.8°C. A temperature limit switch or ECO (Energy Cut Off) is used to shut off the power to the system if the water temperature exceeds 190°F or 87.8°C (See “Water Temperature Regulation” section). To reset the ECO disconnect power at the circuit breaker/fuse box then remove the upper access panel. Reset the ECO by firmly pushing in the red reset button located on the ECO block. If the ECO continues to shut-off the water heater contact a qualified person for service.

Water Temperature Regulation

⚠ WARNING



Water temperature over 125°F can cause severe burns instantly or death from scalds.

Children, disabled and elderly are at highest risk of being scalded.

Feel water before bathing or showering.

Temperature limiting valves are available.

The water heater is adjusted to a temperature setting of no higher than 120°F when it is shipped from the factory. Water temperature can be regulated by adjusting the User Interface Module to the preferred setting as shown in “Adjusting the User Interface Module/Operational Mode”. The preferred starting point is 120°F. There is a hot water scald potential if the temperature set point is set too high.

IMPORTANT: Adjusting the set point above 120°F on the User Interface Module will increase the risk of scald injury in the times shown below.

Table 3

Water Temperature °F	Time for 1st Degree Burn (Less Severe Burns)	Time for Permanent Burns 2nd & 3rd Degree (Most Severe Burns)
110	(normal shower temp.)	
116	(pain threshold)	
116	35 minutes	45 minutes
122	1 minute	5 minutes
131	5 seconds	25 seconds
140	2 seconds	5 seconds
149	1 second	2 seconds
154	instantaneous	1 seconds

(U.S. Government Memorandum, C.P.S.C., Peter L. Armstrong, Sept. 15, 1978)



NOTE: During low demand periods when hot water is not being used, a lower temperature set point will reduce energy losses and may satisfy your normal hot water needs. If hot water use is expected to be more than normal, a higher temperature set point may be required to meet the increased demand.

When leaving your home for extended periods (vacations, etc.) set the water heater to Vacation Mode. See “Adjusting the User Interface Module/Operational Modes” section. This will maintain the water at low temperatures with minimum energy losses and prevent the tank from freezing during cold weather.

NOTE: When returning from an extended stay remember to set the water heater back to the desired Operational Mode.

Adjusting the User Interface Module/Operational Modes

Water Temperature Adjustment

The water temperature can be adjusted from 95°F to 150°F. Use the Up and Down Buttons   on the front panel to set the desired temperature.

IMPORTANT: Before attempting to adjust the thermostat, read the “Water Temperature Regulation” section. If the instructions are not clear, contact a qualified person.

IMPORTANT: Filling a spa or hot tub from this water heater may result in extended recovery/re-heat time. Switching (temporarily) to Hybrid Mode or Electric Mode will decrease the recovery/re-heat time. Be sure to switch back to the desired operational mode when finished.

Operating Mode Descriptions

The operating modes can be changed by touching the desired mode icon on the User Interface Module (see Figure 11.)

NOTE: All buttons on the User Interface are touch sensitive and require only a light touch to actuate.



Hybrid Mode - This is the default, recommended setting. Combining high energy efficiency with reduced recovery time. This mode uses the heat pump as the primary heating source. The heating element will heat water if demand exceeds a predetermined level so that the set point temperature can be recovered more quickly.



Efficiency Mode - Is the most energy efficient mode. This mode uses the heat pump to heat water in the tank. The elements are not used unless the ambient operating temperature is below 45°F or above 109°F. If hot water demands are not met in Efficiency Mode it may be necessary to switch to Hybrid Mode.



Electric Mode - The water heater functions as a conventional electric unit, relying totally on the elements to heat the water in the tank. This mode may be useful in winter to eliminate the output of cold air from the unit.



Vacation Mode - The controller adjusts the water temperature to approximately 60°F. This mode is recommended when the water heater is not in use for a long period of time. This mode minimizes energy consumption and prevents the water heater from freezing during cold weather.

NOTE: To activate the Vacation Mode touch the vacation button. To deactivate Vacation Mode touch the vacation button. **IMPORTANT:** The anode protecting the tank requires power to the unit to operate. Do not shut off power to the unit for extended periods of time. If power must be turned off for an extended period of time, drain the tank completely.

Other Controls

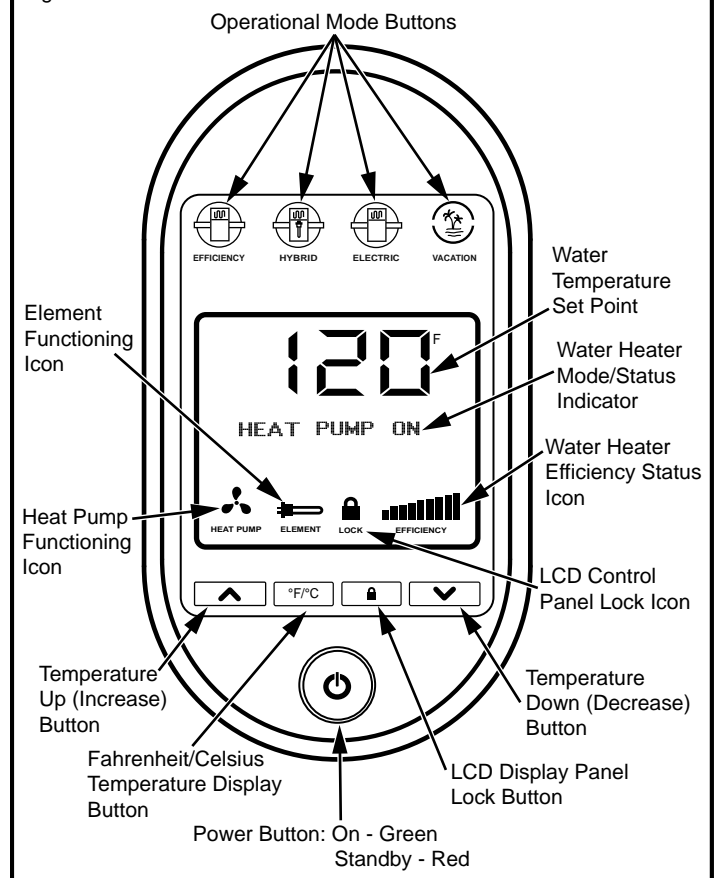


Lock - Holding this button for more than 3 seconds switches the lock mode on or off. When the User Interface Module is locked a symbol and “Lock” text will be visible on the display (see Figure 11).



°F/°C - The button switches the display to show the set temperature in Fahrenheit or Celsius.

Figure 11 User Interface Module



Operational Conditions

Powered Anode Operation

To shelter the glass-lined water tank from corrosion through electrolysis, this water heater is equipped with a non-sacrificial powered anode which should not need to be replaced under normal operating conditions. NOTE: The powered anode operates only when electrical power is applied.

If the powered anode malfunctions it should be replaced by a qualified technician.

IMPORTANT: If a faulty powered anode is not repaired or has been removed permanently, then all warranties are void.

Water Heater Sounds

During the normal operation of the water heater, sounds or noises may be heard. These noises are common and may result from the following:

1. Normal expansion and contraction of metal parts during periods of heat-up and cool-down.
2. Sediment buildup on or around the elements could create varying amounts of noise and may cause premature tank failure. Drain and flush the tank as directed under the "Draining and Flushing" section.
3. The heat pump compressor or fan running.

Stacking

Stacking occurs when a series of short draws of hot water (3 gallons or less) are taken from the water heater tank. This causes increased cycling of the heat pump and/or heater elements and can result in increased water temperatures at the hot water outlet. An anti-scald device is recommended in the hot water supply line to reduce the risk of scald injury.

MAINTENANCE OF YOUR WATER HEATER

Temperature and Pressure Relief Valve

⚠ WARNING



Explosion Hazard

If the temperature and pressure relief valve is dripping or leaking, have a qualified person replace it.

Examples of a qualified person include: licensed plumbers, authorized electric company personnel, and authorized service personnel.

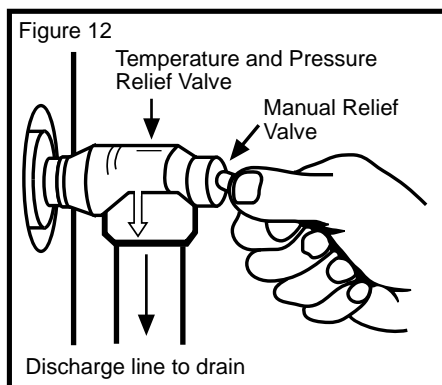
Do not plug valve.

Do not remove valve.

Failure to follow these instructions can result in death or explosion.

Manually operate the temperature and pressure relief valve at least once a year to make sure it is working properly.

To prevent water damage, the valve must be properly connected to a discharge line which terminates at an adequate drain. Standing clear of the outlet (discharged water may be hot), slowly lift and release the lever handle on the temperature and pressure relief valve to allow the valve to operate freely and return to its closed position. If the valve fails to completely reset and continues to release water, immediately disconnect the electrical power, close the cold water inlet valve and call a qualified person.



Draining and Flushing

It is recommended that the tank be drained and flushed every 6 months to remove sediment which may build up during operation. The water heater should be drained if being shut down during freezing temperatures. To drain the tank, perform the following steps:

1. Place the water heater in Standby Mode by pressing the power button on the user interface module.
2. Turn off the power to the water heater at the circuit breaker/fuse box.
3. Open a nearby hot water faucet until the water is no longer hot.
4. Close the cold water inlet valve.
5. Connect a hose to the drain valve and terminate it to an adequate drain or external to the building.
6. Open the water heater drain valve and allow all of the water to drain from the tank. Flush the tank with water as needed to remove sediment.
7. Close the drain valve, refill the tank (open the cold water inlet valve), and restart the heater as directed in this manual.
IMPORTANT: Do not turn on power to the water heater unless it is completely filled with water. To ensure that the tank is full, open a hot water faucet and allow the water to run until the air is purged and the water flows uninterrupted from the faucet.
8. Press the power button to turn the water heater on.
NOTE: The water heater will conduct a system diagnostic prior to operation.

If the water heater is going to be shut down for an extended period, the drain valve should be left open.

Heating Element Replacement

⚠ WARNING



Electric Shock Hazard

Disconnect power before servicing.

Replace all parts and panels before operating.

Failure to do so can result in death or electrical shock.

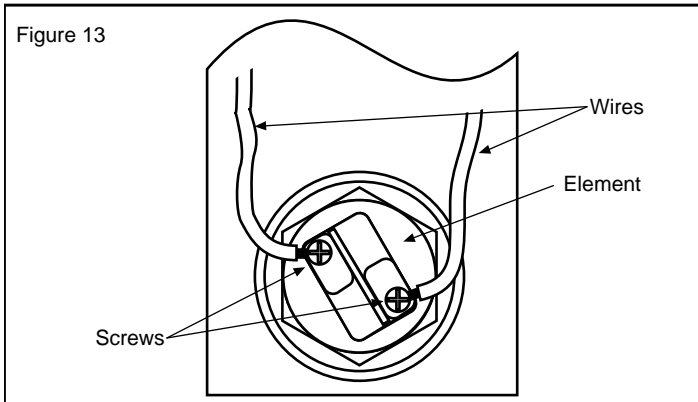
Replacement heating elements must be of the same style and voltage/wattage rating as the ones originally in the water heater. This information can be found on the flange or terminal block of the element or on the water heater data plate.

IMPORTANT: Before replacing any element confirm that you have the correct replacement element (wattage). This water heater has a 4500 watt upper element and a 2000 watt lower element. DO NOT replace the element(s) with a wattage different than the ones specified for the upper and/or lower element.

IMPORTANT: Using an element greater than 2000 watts in place of the lower element will damage the water heater and void the warranty.

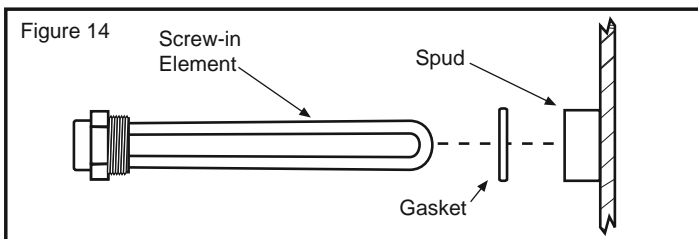
1. Press the power button on the user interface module to place the water heater in Standby Mode.
2. Turn off the power to the water heater.
3. Drain the water heater as directed in the "Draining and Flushing" section.

Figure 13



4. Remove the access cover(s), then remove the foam insulation block.
 5. Remove the protective plastic cover(s) over the elements from their attachment point.
 6. Disconnect the electrical wires from the heating element(s) by loosening the screws (Figure 13). Remove the screw-in element(s) by turning the element(s) counterclockwise with a 1-1/2 inch socket wrench. Remove the existing gasket(s).
 7. Clean the area where the gasket(s) fits to the tank and internal threads. If you are replacing the bottom element, remove any accumulated sediment on the bottom of the tank.
 8. Make sure the replacement element(s) has the correct voltage and wattage rating by matching it to the rating plate on the water heater. Position the new gasket(s) on the element and insert it into the water heater tank (Figure 14).
- NOTE:** Apply a light coat of hand dishwashing soap and water to the gasket. Tighten the element by turning it clockwise until secure.
9. Close the drain valve and open the nearest hot water faucet. Then open the cold water shut off valve and allow the tank to fill completely with water. To purge the lines of any excess air and sediment, keep the hot water faucet open for 3 minutes after a constant flow of water is obtained.

Figure 14



10. Check for leaks around the element(s).
 11. Reconnect the electrical wires to the element and securely tighten the screws (See Figure 13).
 12. Replace the protective plastic cover(s) removed earlier. Make sure the cover(s) are securely engaged on the attachment point(s).
 13. Replace the foam block(s) and access cover(s).
 14. Although this water heater is equipped with "Dry Fire" protection circuitry, be sure tank is completely filled with water before applying electrical power to the water heater.
 15. Reconnect electrical power to the water heater at the circuit breaker/fuse box.
 16. Press the power button to turn the water heater on. Set the desired water temperature and operating mode.
- NOTE:** The water heater will conduct a system diagnostic (approximately 8 minutes) prior to operation.

Routine Preventive Maintenance

At least monthly, a visual inspection should be made of the following:

- Air Filter (Remove and inspect, clean if needed, and reinstall).
- Condensate drain pan and condensate lines.
- The lower metal drain pan for standing water which may indicate a clogged condensate drain pan, condensate lines, or plumbing leak.
- Leaking or damaged water piping.
- Presence of corrosive materials in the installation area.
- Presence of combustible materials near the water heater.
- After servicing this water heater, check to make sure it is working properly. (See "Operating Your Water Heater" section of this manual.)

IMPORTANT: If you lack the necessary skills required to properly perform this visual inspection, you should not proceed, but get help from a qualified person.

Cleaning the Heat Pump

Air Filter Cleaning/Replacement

IMPORTANT: Before attempting to clean or replace the air filter press the power button to place the water heater in Standby Mode and turn-off power to the water heater at the circuit breaker/fuse box.

1. Locate the screw securing the filter panel to the heat pump shroud and loosening it.
2. Remove (slide) the filter from the unit.
3. If you are replacing the filter skip to step 4. To clean the filter use a vacuum with a hose attachment to remove any dust or debris.
4. Place the new or cleaned filter into the water heater and secure the filter to the shroud with the screw loosened earlier.

NOTE: The guides/slots when inserting the filter into the water heater.

5. Restore power to the water heater and press the power button to turn the water heater on. **NOTE:** the water heater will conduct a system diagnostic prior to operation.

Inspection/Cleaning of the Condensate Drain Pan & Condensate Drain Lines

IMPORTANT: Before attempting to clean or replace the condensate drain pan or lines press the power button to place the water heater in Standby Mode and shut-off power to the water heater at the circuit breaker/fuse box.

1. Remove the access panel (fan side) by loosening the screws securing it to the unit.
2. Check the condensate drain pan and drain lines for any dirt or debris that might interfere with proper drainage. Wipe out any dirt or debris with a damp cloth.
3. Once the condensate drain pan and lines have been inspected/cleaned, secure the access panel to the water heater.
4. Restore power to the water heater and press the power button to turn the water heater on.

NOTE: The water heater will conduct a system diagnostic prior to operation.

DIAGNOSTIC CODES

DISPLAY SHOWS	INDICATES	CORRECTIVE ACTION
UPPER ELEMENT CONNECT FAULT	1. Upper element is not functioning	1. Turn off power at the circuit breaker/fuse box and check for a loose connection at the element. For access directions see "Heating Element Replacement" section. If error persists proceed to the next step. 2. Replace non-functioning element. See "Heating Element Replacement" section.
LOWER ELEMENT CONNECT FAULT	1. Lower element is not functioning	1. Turn off power at the circuit breaker/fuse box and check for a loose connection at the element. For access directions see "Heating Element Replacement" section. If error persists proceed to the next step. 2. Replace non-functioning element. See "Heating Element Replacement" section. IMPORTANT: Using an element greater than 2000 watts in place of the lower element will damage the water heater and void the warranty.
HEAT PUMP CONNECT FAULT	1. Heat Pump compressor is not functioning.	1. Contact a qualified person to service the heat pump.
FAN CONNECT FAULT	1. Heat Pump fan is not functioning.	1. Contact a qualified person to service the unit.
AMBIENT TEMP SENSOR SHORT OR OPEN OR AD ERROR	1. Ambient Temperature Sensor is not functioning.	1. Contact a qualified person to service the unit.
UPPER TEMP SENSOR SHORT OR OPEN OR AD ERROR	1. Upper Temperature Sensor is not functioning.	1. Contact a qualified person to service the unit.
LOWER TEMP SENSOR SHORT OR OPEN OR AD ERROR	1. Lower Temperature Sensor is not functioning.	1. Contact a qualified person to service the unit.
DISCHARGE TEMP SENSOR SHORT OR OPEN OR AD ERROR	1. Discharge Temperature Sensor is not functioning.	1. Contact a qualified person to service the unit.
COIL TEMP SENSOR FAULT OR AD ERROR	1. Coil Temperature Sensor is not functioning.	1. Contact a qualified person to service the unit.
MAIN CIRCUIT BOARD FAULT	1. Main Circuit Board is not functioning.	1. Contact a qualified person to service the unit.
HIGH TEMP LOCKOUT	1. Water temperature in unit has exceeded 190° F.	1. See "Safety Shut-off" section.
CONDENSATE DRAIN ALARM (If Accessory Condensate Pump is Installed)	1. Condensate pump failure.	1. Check to see if accessory condensate pump is plugged in and has power. Also check circuit breaker/fuse box and GFCI (if used). If error persists proceed to the next step. 2. Check condensate pump outlet tube for blockage. If error persists proceed to the next step. 3. Check control wire connections to condensate pump. If error persists proceed to the next step. 4. Replace accessory condensate pump. If error persists contact a Qualified Person.
LOW WATER LEVEL ALARM	1. Not enough water in the tank. (Tank not full)	1. Fill Completely - Open all hot water taps in home and run until water (uninterrupted by air) flows from all open hot water taps.
COMMUNICATION ERROR	1. No communication between mainboard and user interface board.	1. Contact a qualified person to service the unit.

DIAGNOSTIC CODES

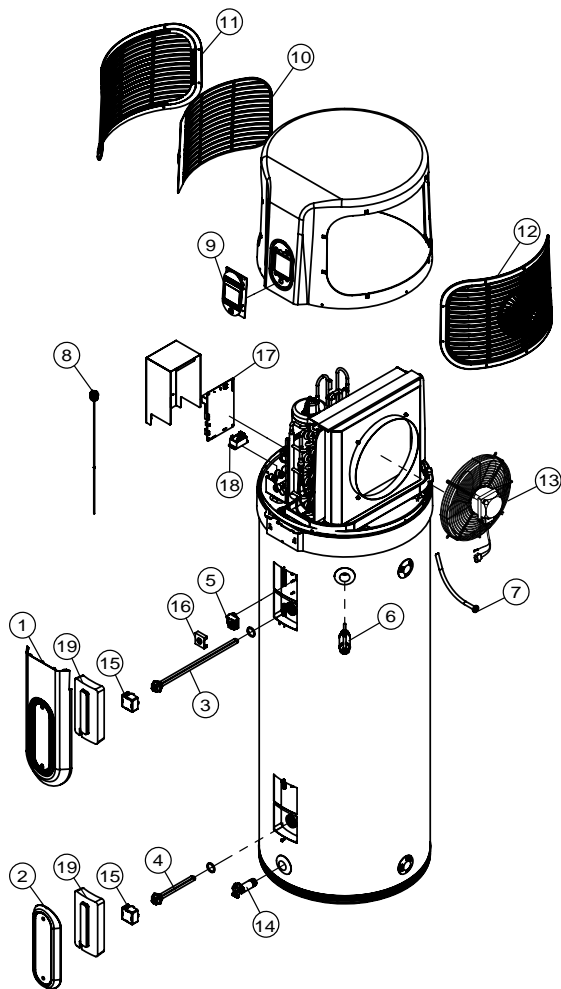
ELECTRONIC POWER ANODE ERROR #0-9 (# CAN BE 0-9)	1. Indicates the power anode is not operating properly	1. Contact a qualified person to service the unit.
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NOTE: The diagnostic codes listed above are the most common. If a diagnostic code not listed above is displayed, contact Residential Technical Assistance referencing the number on the front of this manual.

TROUBLESHOOTING CHART

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
NO HOT WATER	<ol style="list-style-type: none"> No power to the water heater (power button not lit) Unit in standby (power button RED) Unit in Vacation mode High temperature limit switch open Hot water usage pattern exceeds the capability of the water heater in current mode Non-functioning upper temperature sensor 	<ol style="list-style-type: none"> Check for blown fuse or tripped breaker. Restore power to unit then press power button. Press the power button to turn the unit on (power button GREEN) Press Vacation Mode Button to exit Vacation mode and return to desired operating mode. Reset the high temperature limit switch; see "Safety shut-off" section for more information Change to different mode or modify usage patterns Contact a qualified person for service
INSUFFICIENT HOT WATER/ SLOW HOT WATER RECOVERY	<ol style="list-style-type: none"> Temperature set-point too low Air filter dirty Hot water usage pattern exceeds the capability of the water heater in current mode Water connections to unit reversed Heat lost through long run of exposed pipe Hot water leak at faucet or piping Non-functioning heating element Sediment or scale build up in tank 	<ol style="list-style-type: none"> Increase set point temperature; see "Adjusting the User Interface Module" section Clean air filter Change to different mode or modify usage patterns (For example if in Efficiency Mode switch to Hybrid Mode) Ensure the cold connection is at the bottom and that the hot connection is at the top Insulate exposed piping Repair hot water leaks Call qualified person for service Drain and flush tank. Water conditioning may be necessary to minimize build up
HIGH OPERATION COSTS	<ol style="list-style-type: none"> Temperature set-point too high Air filter dirty Electric mode selected Water connections to unit reversed Heat lost thru long run of exposed pipe Hot water leak at faucet or piping Sediment or scale build up in tank 	<ol style="list-style-type: none"> Decrease set point temperature; see "Adjusting the User Interface Module" Clean air filter Change to Efficiency or Hybrid mode for reduced energy costs Ensure the cold connection is at the bottom and that the hot connection is at the top Insulate exposed piping Repair hot water leaks Drain and flush tank. Water conditioning may be required to minimize build up
DRIP FROM TEMPERATURE & PRESSURE RELIEF VALVE (Warning: Do not plug or cap T&P discharge pipe.)	<ol style="list-style-type: none"> Excessive water pressure Add or service a thermal expansion tank. Non-functioning Temperature & Pressure Relief Valve 	<ol style="list-style-type: none"> Check water supply inlet pressure. If higher than 80 PSIG, install a pressure reducing valve (50-60 PSIG is the recommended pressure.) See "Closed System/Thermal Expansion" section Replace the Temperature & Pressure Relief Valve
OTHER	<ol style="list-style-type: none"> The water heater does not immediately start The heat pump does not run in Efficiency mode. 	<ol style="list-style-type: none"> When first started the water heater takes about 8 minutes to complete a diagnostic routine Contact a qualified person for service

REPAIR PART ILLUSTRATION



REPAIR PARTS LIST

ITEM NO.	PARTS DESCRIPTION
1	Upper Access Cover
2	Lower Access Cover
3	Upper Element (4500 Watts)
4	Lower Element (2000 Watts)
5	Energy Cut-Off (ECO) Switch
6	Temperature & Pressure Relief Valve (T&P)
7	Dip Tube (at hot water outlet)
8	Powered Anode Rod
9	User Interface Module
10	Air Filter
11	Air Inlet Side Panel
12	Air Outlet Side Panel
13	Fan Assembly
14	Drain Valve
15	Element Terminal Cover
16	ECO Cover
17	Control Board
18	Compressor ECO Relay
19	EPS Cover
20*	Ambient / Coil / Discharge Temperature Sensor
21*	Upper / Lower Tank Temperature Sensor
22*	Run Capacitor
23*	Control Board Module Fuses

REPAIR PARTS

Repair parts may be ordered through your plumber, local distributor, home improvement center, or by calling 1-800-527-1953. When ordering repair parts always give the following information:

1. Model, serial and product number
2. Item number
3. Parts description

* NOT SHOWN

NOTES

GEH50DEEDSR

GeoSpring™ hybrid electric water heater

Dimensions and Installation Information (in inches)

Local Installation Regulations: This water heater must be installed in accordance with these instructions, local codes, utility codes, utility company requirements or, in the absence of local codes, the latest edition of the National Electrical Code. It is available from some local libraries or can be purchased from the National Fire Prevention Association, Batterymarch park, Quincy, MA 02169 as booklet ANSI/NFPA 70.

Installation Information: For complete information, see installation instructions packed with your water heater.

Power Requirements: Check the markings on the rating plate of the water heater to be certain the power supply corresponds to the water heater requirements.

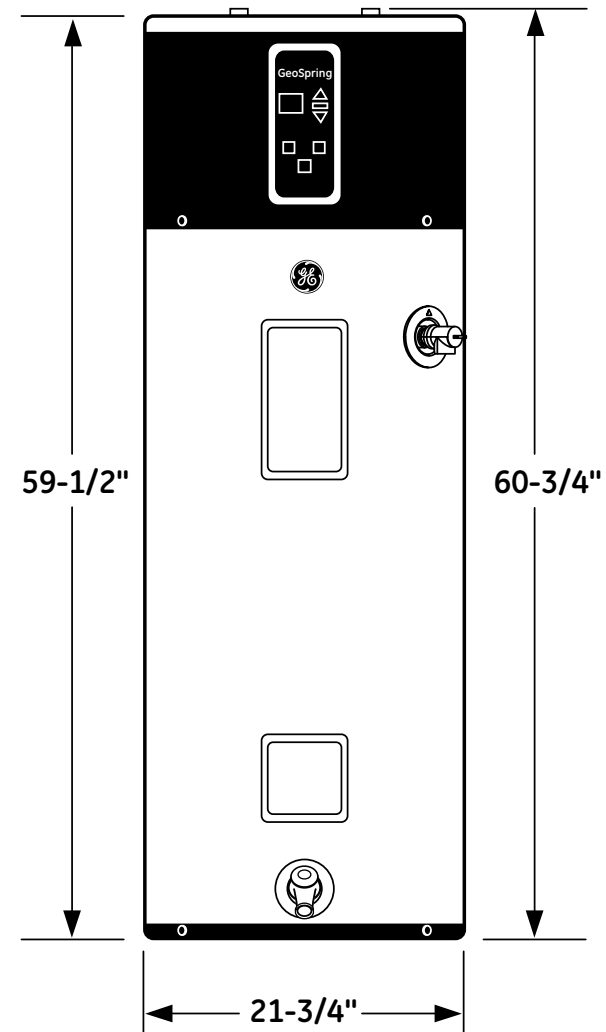
Location: Locate the water heater in a clean dry area as near as practical to the area of greatest heated water demand. Long uninsulated hot water lines can waste energy and water.

Note: Because this unit draws in air from the room to heat the water, the room must be at least 10' x 10' x 7' (700 cubic feet) or larger. If the room is smaller, there must be a louvered door. Louvers should be 240 square inches (0.15m²) or greater. If two louvers are used, one should be near the top of the door. Place the water heater in such a manner that the air filter, cover and front panels can be removed to permit inspection and servicing, such as removal of elements or cleaning of the filter. The water heater and water lines should be protected from freezing temperatures and high-corrosive atmospheres. Do not install the water heater in outdoor, unprotected areas.

For answers to your Monogram®, GE Profile™ or GE® appliance questions, visit our website at geappliances.com or call GE Answer Center® service, 800.626.2000.



imagination at work



Above illustration intended for dimensional reference only.
Refer to photograph for actual product appearance.

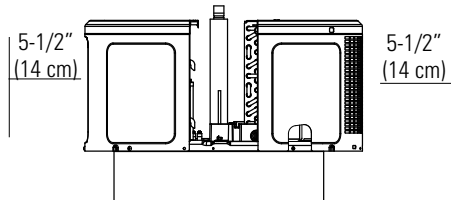
Specification Revised 7/14

GEH50DEEDSR

GeoSpring™ hybrid electric water heater

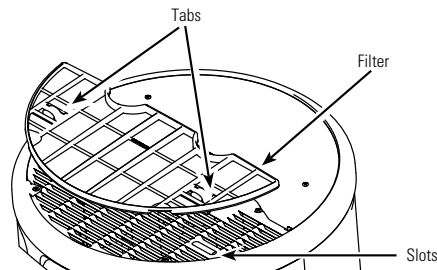
Dimensions and Installation Information (in inches)

Front & back clearance requirements: A 7" clearance is recommended with a minimum of 5-1/2" air space between any object and the front and back of the water heater and 7" on each side. Clearance is needed to allow for removal of the front and back covers in the event service is needed.



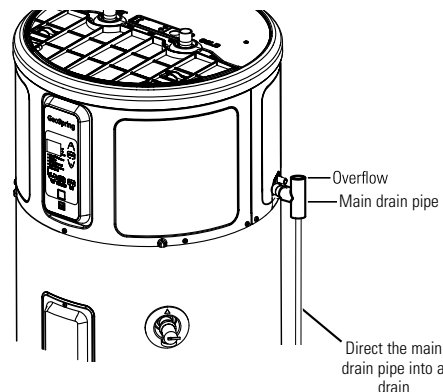
Top filter removal clearance requirements:

A minimum 6" clearance is required at the top of the water heater to pull the filter up and remove it for cleaning. It is critical that the hot and cold water plumbing and the electrical connections do not interfere with the removal of the filter.



Condensate drain required: A primary drain pipe must be installed at the top right side of the water heater. The primary drain is intended to carry all condensate away.

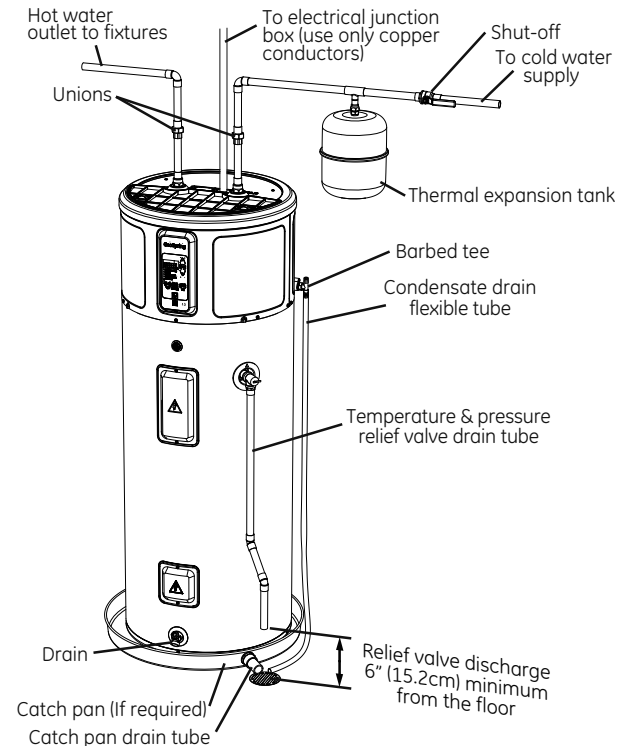
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Water Supply Connections: Refer to the illustration below for suggested typical installation. The installation of unions or flexible copper connectors is recommended on the hot and cold water connections so that the water heater may be easily disconnected for servicing if necessary. The HOT and COLD water connections are clearly marked and are 3/4" NPT on all models.

Note: Install a shut-off valve in the cold water line near the water heater. This will enable easier service or maintenance of the unit later.

IMPORTANT: Do not apply heat to the HOT or COLD water connections. If sweat connections are used, sweat tubing to adapter before fitting the adapter to the cold water connections on heater. Any heat applied to the hot or cold water connection will permanently damage the dip tube.



Above illustration intended for dimensional reference only. Refer to photograph for actual product appearance.



imagination at work

GEH50DEEDSR

GeoSpring™ hybrid electric water heater

Verification Checklist:

<input type="checkbox"/>	1 Tank location: - Is room size less than 10x10x7 (700 cu. ft.)? If yes, Louvered door or similar ventilation is needed. - Back of unit away from wall by 7 inches. - Front of unit is free and clear. - Is the water heater level ? If no, add shims under the base of the unit.
<input type="checkbox"/>	2 Plumbing connections: - Do not prevent air filter removal. - No leaks after filling the tank with water, either when water is flowing or not.
<input type="checkbox"/>	3 Condensate lines are in place: - Longer PVC pipe on lower drain nozzle and directed into a floor drain or a condensate pump.
<input type="checkbox"/>	4 T & P valve is working and drain line completed per local code.
<input type="checkbox"/>	5 Electrical connection does not prevent air filter removal.
<input type="checkbox"/>	6 Verify control panel displays 120°F (49°C) Hybrid Mode.
<input type="checkbox"/>	7 Verify filter is in place.

Normal startup—what to expect after pressing the POWER button

Elapsed time	Hybrid water heater actions	Comments
:00 to 2:00 minutes	Unit will go through self-check	This 2 minute off-time prevents compressor from being “short cycled” (improved reliability).
2:00 to 10:00 minutes	Compressor and fan turn on and run for 8 minutes	This 8 minute period is used to ensure tank is full of water (dry fire prevention algorithm).
10:00 to 30:00 minutes	Compressor and fan turn off, heating elements turn on for approximately 20 minutes.	Quickly provides initial amount of hot water for user (~25 gallons).
30 minutes and beyond	Upper element turns off, and compressor turns back on.	Uses efficient heat pump for majority of heating.

NOTE: Heat pump operating range is 45°F to 120°F.

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GEH50DEEDSR

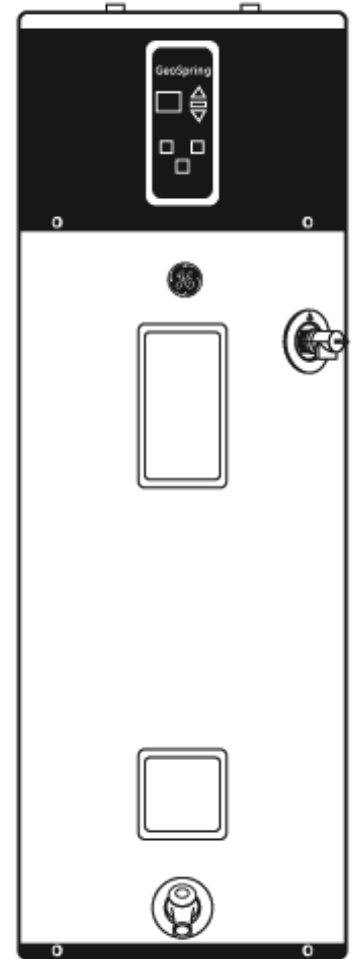
GeoSpring™ hybrid electric water heater

Features and Benefits

- 62% more efficient than a standard electric 50-gallon water heater
- Saves the average household \$365 every year* in water heating expenses - that's \$3,650 savings over a 10-year period
- Provides the same amount of hot water as a traditional 50-gallon standard electric water heater with 65 gallons first-hour delivery
- Installs like a standard electric water heater with the same top water and electrical connections, making replacing your old standard water heater quick and easy
- Electronic controls with 4 operating modes plus a vacation setting make it simple to select the temperature and optimal energy savings performance
- Utilizes heat pump technology to absorb the heat in ambient air and transfers it into water, making GeoSpring an efficient and environmentally friendly water heater
- Qualifies for state and local utility rebates and tax credits
- Designed for common indoor installation in areas such as: basement, garage, closet, utility room, attic, etc.
- Limited 10 year warranty provides peace of mind and dependability
- Proudly Made in America
- GEH50DEEDSR - Red

*Based on DOE test procedures and comparison of 50-gallon standard electric tank water heaters using 4879 kWh per year vs. the GeoSpring hybrid water heater using 1830 kWh per year and national average electricity rate of 12 cents per kWh

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PACKAGED TERMINAL AIR CONDITIONERS AND HEAT PUMPS

WITH OUR DigiSmart® CONTROL BOARD & EMS

DigiSmart PTAC SPECIFICATIONS AND ACCESSORIES CATALOG



- First-Year Warranty: Parts & Labor
 - Second through Fifth Year: Parts & Labor on certain sealed system components
 - Second through Fifth Year: on certain functional parts only
- * Complete warranty details available from your local dealer or at www.amana-ptac.com.



Assembled in the USA for 30 years:
Units are 100% run-tested and
triple-tested for leakage.

STANDARD FEATURES

- **Energy Efficiencies:** With EERs up to 11.7 and COPs up to 3.4, our unit's high efficiencies may qualify you for many of the rebates offered by electrical power companies.
- **Quiet Operation:** Our PTAC has been redesigned to be the quietest PTAC we've ever built. The unit's state-of-the-art design and construction provide a quiet environment, allowing guests to enjoy peaceful, sleep-filled nights.
 - Two fan motors (indoor/outdoor)
 - Indoor tangential fan for quiet operation
 - STC of 28
- **Assembled in the USA for 30 years:** assembled at our plant in Fayetteville, TN, using Goodman resources including engineering, production, and testing.
- **Increased Dehumidification Capacity:** Maintain lower humidity levels in rooms while cooling them without the need for expensive add-ons. As a result, guests feel more comfortable at higher temperatures, thus reducing cooling costs.
- **Seven-Button Touch Pad:** Provides complete control to guests for in-room comfort while maintaining energy efficiency.
- **Five-Year Limited Warranty:** Enjoy one of the most comprehensive warranties in the industry: First Year: parts & labor; Second through fifth years: parts & labor on certain sealed system components; second through fifth years: on certain functional parts only. For complete warranty details, visit www.amana-ptac.com.
- **100% Run Tested:** All units are 100% run tested at our plant in Fayetteville, TN, including leak checks during manufacturing and again prior to shipment at the warehouse.
- **7 $\frac{3}{8}$ " Unit Front Depth:** Enhance valuable room space with our slim unit front, which has a sleek 7 $\frac{3}{8}$ " depth, one of the shallowest silhouettes in the industry today. In addition, to inhibit guest-tampering, the front can be secured to the chassis with a hidden screw.
- **Removable Condenser Shroud:** Allows easy access to enable regular cleaning of coils, which is essential to maintain unit efficiency and protect the compressor for long unit life.
- **Easy Pull-Out Filters:** Our filters are washable and easy to maintain.
- **Filter Dryer for Sealed System Refrigerant:** Standard in all units to protect the compressor and lengthen the life of the unit by removing moisture and preventing acid formation.

 **DigiSmart** CONTROL BOARD



STANDARD FEATURES (CONT.)

- **Condensate Dispersion System:** Our condensate dispersion system removes condensate from indoor cooling operation by throwing water directly on to the outdoor coil for rapid evaporation and increased cooling efficiencies. The slinger ring on the new, enhanced fan draws water up and into the fan blades. This water is then atomized and evaporated into the atmosphere through the condenser. Increased surface area from the coil allows more water to be evaporated on the sides of the coils and helps to minimize condensate run-off.
- **Front Desk Control:** Each unit comes equipped with the DigiSmart™ control and energy management software. With Digi-Smart™ using the optional RF Antennae, all units can be wirelessly connected to a central hub for enhanced energy savings and diagnostics. Amana brand PTACs also have a low-voltage interface capability with a field-supplied front-desk ON/OFF switch. (See Page 4.)
- **Room Freeze Protection:** When the unit senses temperatures of 40°F or below, the unit activates the fan motor and either the electric resistance heater or the hydronic heater.
- **Easy-to-use Controls:** No complex controls to confuse your guests and create phone calls for your manager. Controls are easy to read, understand, and activate. Our new 7-button control panel provides guests with complete control of the unit for their in-room comfort while maintaining overall energy efficiency.
- **Easy to Service with On-Board LED Diagnostics:** The main components are easily serviced and there is no guessing to determine the problem with our easy-to-read diagnostics.
- **Stonewood Room Front:** Our Stonewood room front strikes the balance between attractive styling and practical design. Distinctive contours and a modern appearance enhance the character of even the most luxurious room, while the sleek 7 $\frac{3}{8}$ " depth maximizes usable space for your guests.
- **Remote Thermostat Control:** When the DigiSmart™ wireless remote thermostat (DS01E, sold separately) is set up, both the remote thermostat and unit control panel continue to control the unit, providing flexibility and home-like system control. Installation requires no more than pressing two buttons. No need to run wires or make electrical connections.
- **Remote Temperature Sensing:** Guests enjoy ultimate comfort with consistent climate control. When the field-installed thermistor (RTS03) is used, the unit-mounted thermostat is overridden to allow more accurate, internal wall-sensing of room ambient temperature.
- **Extended Heat Pump Heating:** Heat pump models will operate in the heating mode down to as low as 24°F outdoor ambient temperature.
- **Zero Floor Clearance:** The unit can be installed flush to a finished floor, if desired. (Some accessories do not have zero clearance).
- **30-Second Fan-Off Delay:** The fan continues to run 30 seconds after the compressor has stopped in either cooling or heat pump mode and after electric heat has been turned off. This improves efficiency by dispersing the conditioned air on the coils into the room.
- **Compressor Lock-In:** This feature helps prolong the life of the compressor by preventing short-cycling. When the compressor is switched from Off to On because room temperature has risen or fallen below the specified limit, it will remain on for at least 4 minutes. If the temperature set-point is changed during this 4 minutes, the lock-in feature is overridden.
- **Automatic Emergency Heat:** No more "my unit is not heating" complaints during the middle of the night. Heat pump units will automatically switch over to electric resistance heat if the heat pump compressor system fails or if the heating load is greater than the unit capacity.
- **Constant Fan Mode:** Take advantage of each unit's dual options — select continuous fan operation or cycle the fan ON and OFF with the thermostat. Our new 7-button design allows guests to select fan performance while allowing the owner to have the unit revert to the desired program of continuous fan or cycle with conditioning.
- **Hidden Ventilation Control:** The ventilation control lever is hidden from the occupant's view to allow you to manage ventilation requirements.
- **High-Pressure Switch:** Protects the unit from high pressure and damage to the unit, helping to ensure long unit life.



brings together our best PTAC ever with our best Energy Management Software and now integration with Property Management and Front Desk Management Software. Reduce PTAC energy consumption by 35% OR MORE* through the power of the in-unit Energy Management System, programmable temperature set-back and limits combined. Reduce PTAC maintenance cost through our automated maintenance notification system. Improved maintenance sustains energy efficiency (EER) and prolongs PTAC life, keeping equipment running at its designed efficiency level and room guests more comfortable.

THE AMANA BRAND DIGISMART SOLUTION

IN-ROOM: “SELF-INSTALLABLE” WIRELESS PERIPHERALS



The DigiSmart Occupancy Sensor completes the in-room equipment. This infrared sensor can determine if the room is occupied or empty, and when empty signals the PTAC to adjust the temperature to save energy based on programmable setbacks.

The DigiSmart Wireless Remote Thermostat can mount on the wall anywhere in the guest room. Battery powered and with its own wireless ability to communicate with the PTAC to maintain room temperature. Best of all, no wires to run. The PTAC and Thermostat connect at the press of a button and are permanently linked. The thermostat and PTAC work in-sync to display accurate temperature.

The DigiSmart Wireless Antenna installs inside the PTAC with a snap-in connector. Installing the antenna allows the PTAC to communicate wirelessly with other devices in the room and to the DigiSmart network.

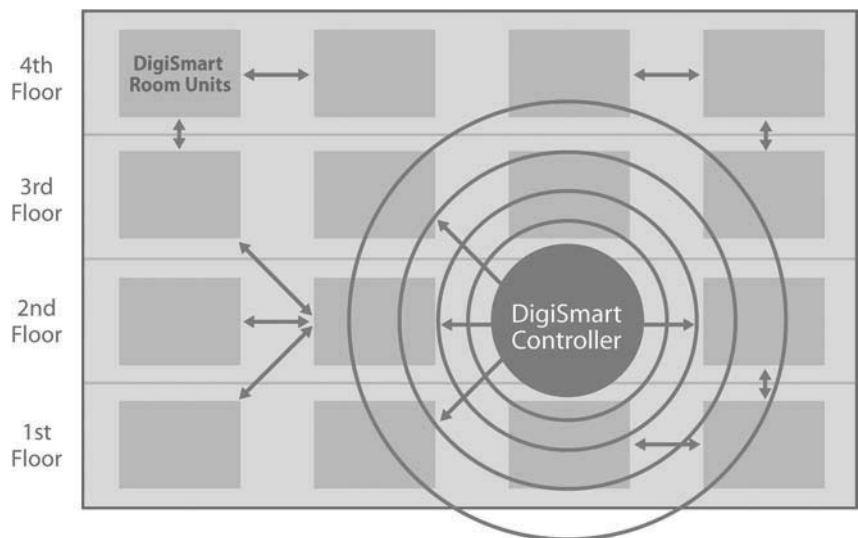
- > 45,000+ rooms have had wireless installations since 2005
- > Total wireless devices deployed to date: 120,000+

The Amana brand DigiSmart PTAC with antenna, combined with the self-installable, wireless Thermostat and Occupancy Sensor give the property owner complete control over the equipment settings and can reduce PTAC energy usage by 35% OR MORE.*

SITE-LEVEL —

CENTRAL WIRELESS CONTROLLER

- > Site-wide PTAC Configuration
- > Site-wide PTAC Diagnostics
- > Front Desk System Interface
- > Email Reporting
- > Internet Accessible Web User Interface Enterprise

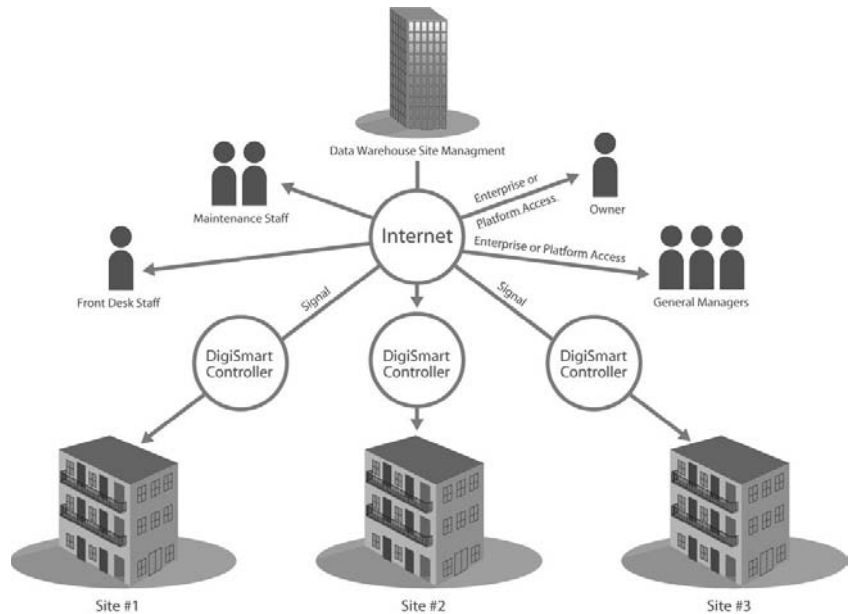


* These savings represent estimated savings over time as compared to the same PTAC model without the DigiSmart EMS System installed and were generated using general assumptions including energy loads, local weather averages and use of occupancy controls. Actual savings will vary according to actual use habits, room square footage, and how the unit is installed.

ENTERPRISE — MULTIPLE WIRELESS CONTROLLERS

CENTRAL MONITORING AND CONTROL OF MULTIPLE PROPERTIES

- > Data Warehousing
- > Savings Analysis
- > Email Reporting
- > Virtual Metering
- > Load Shedding



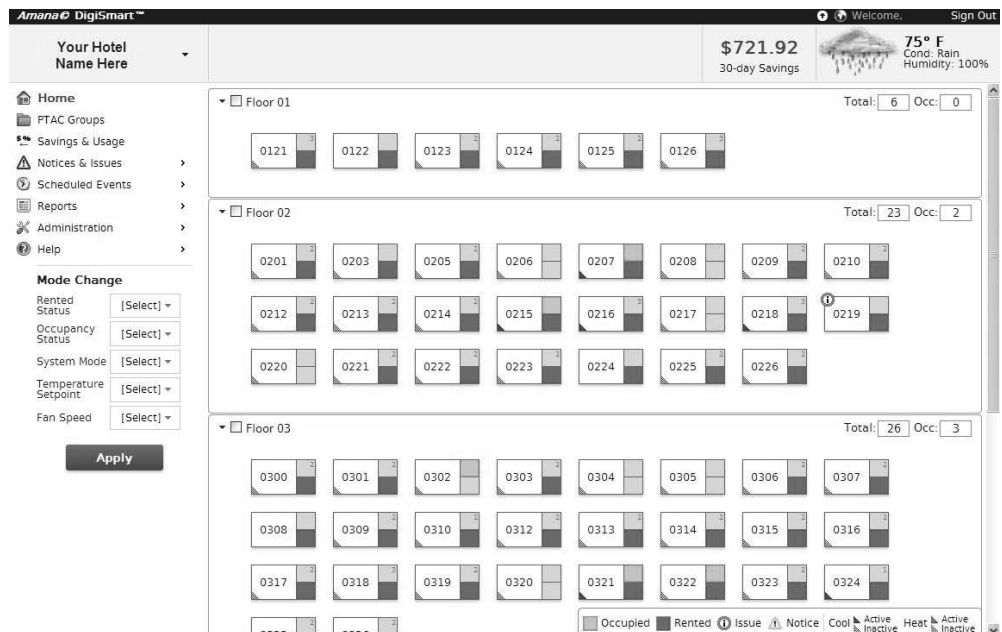
WEB-BASED, REAL-TIME MONITORING

AMANA® BRAND DIGISMART™ CONTROLLER:

All of the PTACs in the building can be managed through a single interface on a PC.

FEATURES INCLUDE: Full unit details for every PTAC, visible from the front desk or home office, automatic emails for PTAC maintenance, ability to change all settings on the unit, and enhanced diagnostics. Monitor up to 170 PTACs, WIRELESSLY, with one controller. Additional controllers can expand the network for additional rooms/properties.

- > System Verification
- > Global Setbacks
- > EMS Configuration
- > Site Statistics
- > Battery Notices
- > Email Reporting
- > Unit Health
- > Unit Code Alerts



Temp Limiting – Each PTAC can be configured with a heating and cooling temperature set-point limit.

Setbacks – Once a room is declared unoccupied by the occupancy sensor, the PTAC progresses through three different temperature setbacks, configured as three degree and time pairs (An example configuration is listed below).

1st: 2°, 30 mins – Setback the temp 2 degrees after 30 minutes

2nd: 4°, 1 hr – Setback the temp 2 more degrees after 30 more minutes

3rd: 8°, 3 hrs – Setback the temp 4 more degrees after 2 more hours

Unrented Set-Points – By integrating with your property's Front Desk System, the PTACs will adjust to specific set-points when no longer identified as rented in the system.

NOMENCLATURE

		PTC	07	3	G	35	AXXX	AA
		1,2,3	4	5	6	7,8,9	10,11,12,13	14
Basic Model Type								Engineering
PTC	Standard Cooler PTAC							Major & Minor Revisions
PTH	Standard Heat Pump PTHP							
DRY	Dehumid Cooler PTAC							Features Code
Cooling Capacity								A Standard Model
07	7000 BTU/h	60 Hz						
09	9000 BTU/h	60 Hz						
10	10000 BTU/h	50 Hz						
12	12000 BTU/h	50 or 60 Hz						
15	14000 BTU/h	60 Hz						
Rated Voltage								C Corrosion Protection (Seacoast)
2	115V, 60 Hz, 1 Ph							D Power Door
3	230/208V, 60 Hz, 1 Ph							F Fuse Holder (230/208 Only)
4	265V, 60 Hz, 1 Ph							H Hydronic Heat-Capable
5	240/220V, 50 Hz, 1 Ph							P Condensate Pump (PTH Only)
Design Series								Q Quiet STC 31 Chassis
G	R-410A							R RF Antenna
Heater Size								V Power Vent
00	No Electric Heat	35	3.5 kW (230/208V)					
15	1.5 kW		3.7 kW (265V)					
25	2.5 kW	50	5.0 kW					

- A Standard Model
- C Corrosion Protection (Seacoast)
- D Power Door
- F Fuse Holder (230/208 Only)
- H Hydronic Heat-Capable
- P Condensate Pump (PTH Only)
- Q Quiet STC 31 Chassis
- R RF Antenna
- V Power Vent
- X placeholder
- W Hard-Wired (PTQC)

Use up to 4 as needed in alphabetical order

Examples:

PTC123E50AXXX

PTC073E35CRXX

PTC123E50CXXX

PTC073E25CQRW

POWER CORD CONFIGURATION

Power Cord Plugs		Power Receptacle Configuration	
<p>250V Rating Power Cord Plugs with LCDI Device NEMA 6 Configuration</p> <p>15 amp 20 amp 30 amp</p>		<p>NEMA6-15R; 250V receptacle used on 230/208V units NEMA6-20R; 250V receptacle used on 230/208V units NEMA6-30R; 250V receptacle used on 230/208V units</p>	
<p>277V Rating Power Cord Plugs NEMA 7 Configuration</p> <p>20 amp 30 amp</p>		<p>NEMA7-20R; 277V receptacle used on 265V units NEMA7-30R; 277V receptacle used on 265V units</p>	
		<p>All units come with factory-installed power cords. All units less than 250 volts come with LCDI device.</p>	

PRODUCT SPECIFICATIONS: PTC MODELS — COOLING/ELECTRIC HEAT

230/208 Volts



MODEL ^{6, 8, 9}		PTC 073G***XXX	PTC 093G***XXX	PTC 123G***XXX	PTC 153G***XXX
Voltage ³		230 / 208	230 / 208	230 / 208	230 / 208
Capacity (BTU/h)		7,700	9,000	11,700 / 11,500	15,000 / 14,700
Amps ¹⁰		3.5	4.1	5.6	7.0
Watts ¹⁰		670/660	805/785	1135/1105	1500/1470
EER		11.5	11.2/11.5	10.3/10.4	10.0/10.0
UNIT WITHOUT ELECTRIC HEATER					
Min. Circuit Amps ^{2, 4, 10}		4.2	4.9	6.8	8.5
CFM (Cool/Wet Coil)	High	290	290	290	340
	Low	264	264	264	314
CFM (Dry Coil)	High	310	310	310	360
	Low	282	282	282	332
Ventilated Air, CFM (Fan Only)*		65*	65*	65*	65*
Dehumidification (Pints/Hr.)		1.7	2.2	3.6	4.4
Net Weight (lbs.)		98	102	102	113
Ship Weight (lbs.)		113	117	119	130

265/277 Volts

Model ^{1, 6, 8}		PTC 074G***XXX	PTC 094G***XXX	PTC 124G***XXX	PTC 154G***XXX
Voltage ^{1, 3}		265	265	265	265
Capacity (BTU/h)		7,700	9,000	12,000	14,800
Amps ¹⁰		3.0	3.6	4.8	6.0
Watts ¹⁰		670	795	1,165	1,480
EER		11.5	11.3	10.3	10.0
UNIT WITHOUT ELECTRIC HEATER					
Min. Circuit Amps ^{2, 4, 10}		3.6	4.4	5.9	7.4
CFM (Cool/Wet Coil)	High	290	290	290	340
	Low	264	264	264	314
CFM (Dry Coil)	High	310	310	310	360
	Low	282	282	282	332
Ventilated Air, CFM (Fan Only)*		65*	65*	65*	65*
Dehumidification (Pints/Hr.)		1.7	2.2	3.6	4.4
Net Weight (lbs.)		98	102	102	113
Ship Weight (lbs.)		113	117	119	130

* Actual vent CFM performance will vary due to application and installation conditions.

NOTES

- ¹ All 265-volt models must use an Amana® brand sub-base (PTSB4**E) or an Amana® brand hard-wire kit PTPWHWK4 and disconnect switch PSHW04A.
- ² Minimum Circuit Ampacity (MCA) ratings conform to the National Electric Code; however, local codes should apply.
- ³ Minimum voltage on 230/208-volt models is 197 volts; maximum is 253 volts. Minimum voltage on 265-volt models is 239 volts; maximum is 292 volts.
- ⁴ Overcurrent protection for all units without electric heaters is 15 amps. Overcurrent protection on 265-volt models must be cartridge-style time-delay fuses (included and factory-installed on all Amana® brand 265-volt chassis). See heater performance.
- ⁵ Heating capacity and efficiency based on unit operation without condensate pump; unit automatically switches to electric heat at approximately 24°F outdoor ambient.
- ⁶ Specify two-digit heater kW size to complete model number.
- ⁷ R-410A refrigerant used in all systems.
- ⁸ All units meet or exceed ASHRAE 90.1 standards.
- ⁹ All units less than 250 volts have a Leak Current Detector Interrupter (LCDI) power cord and meet UL 484 standards.
- ¹⁰ Refer to electric heat performance data for total MCA and recommended overcurrent protection. Amps and Watts notation refers to compressor only.

PRODUCT SPECIFICATIONS: PTH MODELS — COOLING/HEAT PUMP/ELECTRIC HEAT



MODEL ^{1, 6, 8, 9}	PTH073G **AXXX	PTH093G **AXXX	PTH123G **AXXX	PTH153G **AXXX	PTH074G **AXXX	PTH094G **AXXX	PTH124G **AXXX	PTH154G **AXXX
Voltage ^{1, 3}	230 / 208	230 / 208	230 / 208	230 / 208	265	265	265	265
Capacity (BTU/h)	7,600	9,000	12,000	14,200	7,600	9,100	12,000	14,200
Amps ¹⁰	3.9	4.2	5.8	7.0	3.1	3.7	5.0	6.1
Watts ¹⁰	650	785	1,125 / 1,100	1,465 / 1,445	650	790	1,120	1,465
EER	11.7	11.5	10.7	9.7	11.7	11.5	10.7	9.7

UNIT WITHOUT ELECTRIC HEATER

Min. Circuit Amps ^{2, 4, 10}		4.7	5.1	7.1	8.5	3.8	4.5	6.1	7.4
CFM (Cool/Wet Coil)	High	340	330	340	390	340	330	340	390
	Low	245	245	245	340	245	245	245	340
CFM (Dry Coil)	High	370	360	370	410	370	360	370	410
	Low	270	270	270	370	270	270	270	370
Ventilated Air, CFM (Fan Only)*		65*	65*	65*	65*	65*	65*	65*	65*
Ventilated Air, CFM (Comp & Fan)*		40*	40*	40*	40*	40*	40*	40*	40*
Dehumidification (Pints/Hr.)		1.7	2.2	3.6	4.4	1.7	2.2	3.6	4.4
Net Weight (lbs.)		108	112	115	126	108	112	115	125
Ship Weight (lbs.)		123	127	132	143	123	127	132	142

* Actual vent CFM performance will vary due to application and installation conditions.

NOTES

¹ All 265-volt models must use an Amana® brand sub-base (PTSB4**E) or an Amana® brand hard-wire kit (PTPWHWK4).

² Minimum Circuit Ampacity (MCA) ratings conform to the National Electric Code; however, local codes should apply.

Minimum voltage on 230/208-volt models is 197 volts; maximum is 253 volts.

³ Minimum voltage on 265-volt models is 239 volts; maximum is 292 volts.

⁴ Overcurrent protection for all units without electric heaters is 15 amps. Overcurrent protection on 265-volt models must be cartridge-style time-delay fuses (included and factory-installed on all Amana® brand 265-volt chassis).

⁵ Heating capacity and efficiency based on unit operation without condensate pump; unit automatically switches to electric heat at approximately 24°F outdoor ambient.

⁶ Specify two-digit heater kW size to complete model number.

⁷ R-410A refrigerant used in all systems.

⁸ All units meet or exceed ASHRAE 90.1 standards.

⁹ All units less than 250 volts have a Leak Current Detector Interrupter (LCDI) power cord and meet UL 484 standards.

¹⁰ Refer to electric heat performance data for total MCA and recommended overcurrent protection. Amps and Watts notation refers to compressor only.



PRODUCT SPECIFICATIONS: PTC / PTH MODELS — ELECTRIC HEAT PERFORMANCE

(Primary Heating for PTC Models; Auxiliary Heating for PTH Models; See below for Power Cord Configuration)

VOLTAGE	ELECTRIC HEATER SIZE (kW)	NO. OF STAGES	NOMINAL HEATING (BTU/h)			TOTAL WATTS ⁶	TOTAL AMPS	MIN. CIRCUIT AMPACITY ²	MOD ⁴ (AMPS)	POWER CORD
			@ 230V	@ 208V	@ 265V					
230/208V	2.5	1	8,500	6,800	--	2,570 / 2,115	11.2 / 10.1	14.1	15	6-15 P
230/208V	3.5	1	12,000	9,900	--	3,570 / 2,935	15.5 / 14.1	19.5	20	6-20 P
230/208V	5	1	17,100	14,000	--	5,070 / 4,160	22.1 / 20.0	27.6	30	6-30 P
265V	2.5	1	--	--	8,500	2,570	9.7	12.2	15	7-20 P
265V	3.7	1	--	--	12,600	3,770	14.2	17.9	20	7-20 P
265V	5	1	--	--	17,100	5,070	19.2	23.9	25	7-30 P

NOTES

¹ All 265-volt models must use an Amana® brand sub-base (PTSB4**E) or an Amana® brand hard-wire kit (PTPWHWK4).

² Minimum branch circuit ampacity ratings conform to the National Electric Code; however, local codes should apply.

³ Minimum voltage on 230/208-volt models is 197 volts; maximum is 253 volts. Minimum voltage on 265-volt models is 239 volts; maximum is 292 volts.

⁴ Overcurrent protection for all units without electric heaters is 15 amps. Overcurrent protection on 265-volt models must be cartridge-style time-delay fuses (included and factory-installed on all Amana® brand 265-volt chassis).

⁵ Heating capacity and efficiency based on unit operation without condensate pump; unit automatically switches to electric heat at approximately 24°F outdoor ambient.

⁶ Total watts for 15,000 BTU/h models; subtract 20 watts for PT07/09/12

⁷ Specify two-digit heater kW size to complete model number.

⁸ R-410A refrigerant used in all systems.

⁹ All units meet or exceed ASHRAE 90.1 standards.

¹⁰ All units less than 250 volts have a Leak Current Detector Interrupter (LCDI) power cord and meet UL 484 standards.

PRODUCT SPECIFICATIONS: PTH MODELS — REVERSE-CYCLE HEATING PERFORMANCE



HEATING CAPACITY ¹	PTH073G **AXXX	PTH093G **AXXX	PTH123G **AXXX	PTH153G **AXXX	PTH074G **AXXX	PTH094G **AXXX	PTH124G **AXXX	PTH154G **AXXX
Voltage ^{1, 3}	230 / 208	230 / 208	230 / 208	230 / 208	265	265	265	265
BTU/h ⁵	6,800	8,300 / 8,100	11,500 / 11,300	13,800 / 13,600	6,800	8,300	11,400	13,700
Amps ¹⁰	3.9	4.2	5.8	7.0	3.1	3.7	5.0	6.1
Watts ¹⁰	585 / 570	715 / 700	1085 / 1035	1350 / 1330	570	715	1080	1340
COP ⁵	3.4 / 3.5	3.4	3.1 / 3.2	3.0	3.5	3.4	3.1	3.0
CFM (Dry)	370	360	370	410	370	360	370	410

COP = Coefficient of Performance; per AHRI Test Procedures, units are rated for capacities and efficiencies.

NOTES

¹ All 265-volt models must use an Amana® brand sub-base (PTSB4**E) or an Amana® brand hard-wire kit (PTPWHWK4).

² Minimum branch circuit ampacity ratings conform to the National Electric Code; however, local codes should apply.

³ Minimum voltage on 230/208-volt models is 197 volts; maximum is 253 volts.

Minimum voltage on 265-volt models is 239 volts; maximum is 292 volts.

⁴ Overcurrent protection for all units without electric heaters is 15 amps. Overcurrent protection on 265-volt models must be cartridge-style time-delay fuses (included and factory-installed on all Amana® brand 265-volt chassis).

⁵ Heating capacity and efficiency based on unit operation without condensate pump; unit automatically switches to electric heat at approximately 24°F outdoor ambient.

⁶ Specify two-digit heater kW size to complete model number.

⁷ R-410A refrigerant used in all systems.

⁸ All units meet or exceed ASHRAE 90.1 standards.

⁹ All units less than 250 volts have a Leak Current Detector Interrupter (LCDI) power cord and meet UL 484 standards.

¹⁰ Refer to electric heat performance data for total MCA and recommended overcurrent protection. Amps and Watts notation refers to compressor only.

ACCESSORIES

WALL SLEEVES

All our wall sleeves have industry standard dimensions of 42" wide x 16 1/4" high. All Stonewood Beige G-90 metal wall sleeves are thermally insulated and include a weather board for use during construction. The WS900D, SC and INTERNAL 14 1/2" depth is the industry standard. Sleeves may be shipped separately to allow for installation during construction.

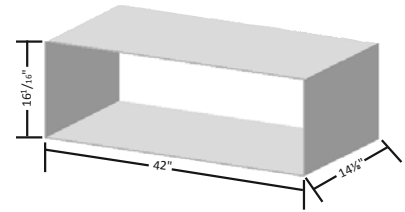
STANDARD DEPTH SLEEVES

WS900E	Standard PTAC sleeve
WS900SC	Seacoast triple protected
WS900D-INTERNAL	Internal drain only for window-wall installations (DK900D sold separately)

EXTRA DEEP SLEEVES

We offer sleeves in several depths for thicker wall installations or special room configurations

WS9xxD1	16" to 24" in 1" increments
WS928D1	Extra deep 28"
WS930D1	Extra deep 30"
WS936D1	Extra deep 36"



OUTDOOR GRILLES

Available in stamped-aluminum or architecturally louvered for application with an Amana brand WS900D wall sleeve.

AGK—Extruded aluminum architectural grille available with anodized aluminum finish or a baked-on paint finish for durability. Choose from 3 stock colors or a custom color to blend with your building's exterior color scheme. Colors include:

CB (Clear Anodized), DB (Dark Brown/Bronze), TB (Stonewood Beige), WB (White), SB (Special/Custom Colors)

PGK—One-piece injection molded grille using a polymer blend of engineered thermoplastic high-impact strength material with chemical resistance and an exterior UV protective coating.

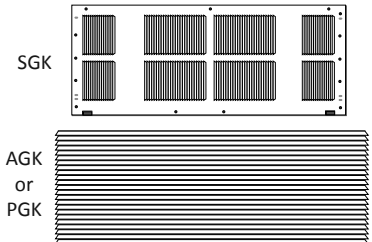
Choose from 3 stock colors:
DB (Dark Brown/Bronze), TB (Stonewood Beige), WB (White)

STANDARD OUTDOOR GRILLE

SGK01B	Single Pack
SGK01TB	Stonewood Beige

ARCHITECTURAL OUTDOOR GRILLE

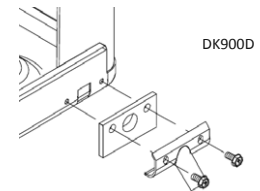
AGK01CB	Anodized Aluminum (Silver)
AGK01DB	Dark Bronze/Brown
AGK01TB	Stonewood Beige
AGK01WB	Amana White
AGK01SB	Custom Colors
PGK01DB	Dark Bronze/Brown
PGK01TB	Stonewood Beige
PGK01TB	Amana White



CONDENSATE DRAIN KIT

Attaches to the wall sleeve base pan for controlled internal or external disposal of condensate.

DK900D	Condensate Drain Kit (use with WS900E)
DK9001D	Condensate Drain Kit (use with WS900B)



LOW-VOLTAGE WIRE HARNESS KIT

For quick connections of the remote, or wired, thermostats, wired EMS, or front desk with jumpers and connectors.

PWHK01C	Wire Harness Kit
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REMOTE ESCUTCHEON KIT (NOT SHOWN)

Optional kit for use with units controlled via a wired, remote thermostat. Covers control touch-pad for wired thermostat installations.

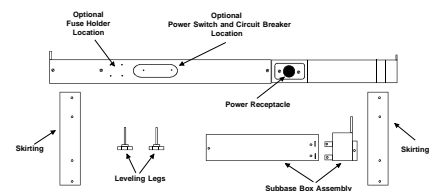
REK10B	Remote Escutcheon Kit (10-pack)
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Each kit contains 80 wires and wire nuts, enough to attach a thermostat and one additional accessory to 10 PTAC units. Wires come in assorted colors for easy attachment.

SUB-BASE KIT

The fully skirted sub-base conceals wiring while providing strong support, if needed. Plug-in receptacle and field-wiring access speeds installation. Electrical accessories, such as fuse holders, circuit breakers and disconnect switches, meet N.E.C. requirements.

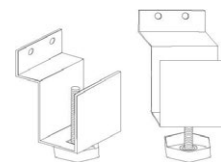
PTSB320E	230/208V 15/20A
PTSB330E	230/208V 30A
PTSB420E	265V 15/20A
PTSB430E	265V 25A
PTSB000E	Non-electrical



LEVELING LEGS

Gives wall sleeve front support and helps to level the unit for installation.

LL2B	Leveling legs for WS9** sleeves
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HARD-WIRE KITS

Used to permanently wire to the chassis when a standard sub-base and power cord are not used.

PTPWHWK4	Armored Cable - all voltages
PTQC03A	Quick Connect - 230/208 V
PTQC04A	Quick Connect - 265 & 115 V



ACCESSORIES (CONT.)

POWER DISCONNECT SWITCH

The PSHW**A power disconnect switch can be used for 265-volt or 230/208-volt physical disconnect, where required by local codes. The switch is rated at 30-amp capacity. The switch is for use with and Amana® brand standard sub-bases or PTPWHWK4 Hard Wire Kit.

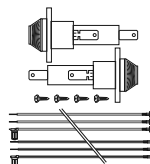
PSHW03A	230/208V
PSHW04A	265V



FUSE HOLDER KIT

Cartridge-style fuses can be installed in the fuse holder for use in the sub-base or chassis. Available in 15, 20 and 30 amp (included on 265-volt unit).

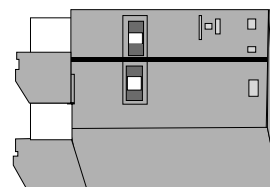
FHK315C	230/208V 15A
FHK315E	230/208V 15A (R-410A)
FHK320C	230/208V 20A
FHK320E	230/208V 20A (R-410A)
FHK330C	230/208V 30A
FHK330E	230/208V 30A (R-410A)



CIRCUIT BREAKER KIT (230/208V ONLY)

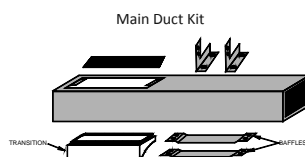
The circuit breaker kit, available in 15, 20 or 30 amp, can be used with Amana brand sub-bases. It gives overcurrent protection, and its location allows you to turn the unit on or off without tools.

CBK3**C	Circuit Breaker Kit
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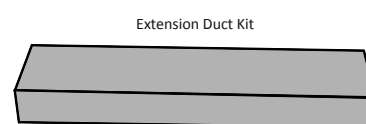


DUCT EXTENSION KIT

Extends air distribution to an adjoining room. Consists of a main duct for the room of origin and an extension duct to reach the adjoining room and terminal duct. PTDK01A allows for the new "B" series unit to work with the "A" series duct kits.



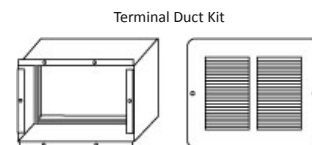
Main Duct Kit



Extension Duct Kit

MDK02B	Main Duct – R-22
MDK01E	Main Duct – R-410A
EDK02B	Extension Duct

TDK02B	Terminal Duct
PTDK01A	Transition Duct Only – R-22
PTDK01E	Transition Duct Only – R-410A



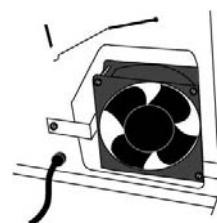
Terminal Duct Kit

POWER VENT KIT

Installation of Power Vent increases CFM up to approximately 95. Vent door will automatically close when unit fan is off.

R-410A models must have these kits installed at the factory.

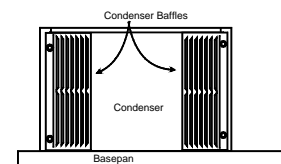
PVK3A	230/208V – R-22
PVK4A	265V – R-22



CONDENSER BAFFLE KIT

For use on non-baffled grilles. These deflectors direct the air in toward the center and away from the inlet to prevent recirculation of the hot condenser air.

DGK1B	Condenser Baffle Kit
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Condenser Baffles

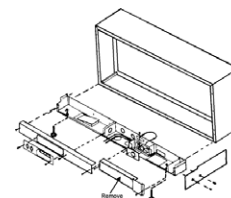
Condenser

Basepan

SUB-BASE EXTENSION COVER KIT

Converts older 30-amp sub-bases to allow for installation of the larger 30-amp LCDI power cord and plugs.

SBEC10A	10 Pack
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CONDENSATE REMOVAL PUMP

Can be field-installed. Assists in removing condensate developed by heat pump operation and transfers it to indoor coil to dissipate into room while adding humidity to the room.

CDP302	230/208V – R-22
CDP402	265V – R-22
CDP302E	230/208V – R-410A



ACCESSORIES (CONT.)

SECURITY KEY LOCKS

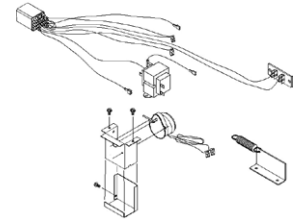
In conjunction with the tamper-resistant front, the installation of Amana® brand security key locks prevents tampering of the controls used to set temperature, heating and cooling functions. UL approved for institutional use only.

POWER DOOR KIT

Vent door will automatically open when unit fan is on.






KL03B	Security Key Lock (R-22)
KL03E	Security Key Lock (R-410A)

PDK3A	230/208V – R-22
PDK4A	265V – R-22
PDK3E	230/208V – R-410A
PDK4E	265V – R-410A



THERMOSTATS

The following thermostats offer remote control. Any thermostat other than those listed must be submitted to Goodman Company, L.P., for approval prior to use.

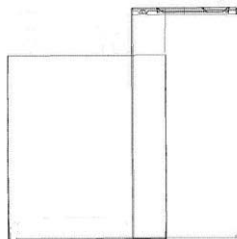
MODEL #		HEAT STAGES	COOL STAGES	FAN SPEED	# OF WIRES REQUIRED	TEMP LIMITING	BACKLIT	DISPLAY	TYPE	SHAPE & ORIENTATION	CONNECTION
2246002		1	1	1	5	No	Yes	Digital	Manual	Rect./Horiz.	Wired
2246003		2	2	2	7	Yes	Yes	Digital	Manual	Rect./Horiz.	Wired
2246007		2	2	2	7	Yes	Yes	Digital	Auto-Change	Rect./Horiz.	Wired
2246008		2	2	2	7	Yes	Yes	Digital	Programmable	Rect./Horiz.	Wired
DS01E		2	2	2	0	Yes	Yes	Digital	Manual	Rect./Horiz.	Wireless

HYDRONIC HEAT KIT

Add-on kits fit all units allowing the addition of hydronic water or hydronic steam heat to cooling and heating units. The kits feature left- or right-hand piping. Unit retains complete service access with a kit installed. Unit must be connected to and operated by a wall thermostat.

HWK03B	Hydronic Water Kit – R-22
HVK03B	Hydronic Steam Kit – R-22
HWK03E	Hydronic Water Kit – R-410A
HVK03E	Hydronic Steam Kit – R-410A

Hydronic Heat Kit-Side View



Hydronic Heat Kit-Top View



Hydronic Heat Kit-Right View



HYDRONIC VALVES

Water and steam valves are available for use with the HWK03 (water) and HVK03 (steam) heat kits.

VS2WNCA*	2-way/24V/NC/Steam
VS2WNOA*	2-way/24V/NO/Steam
VW2WNCA*	2-way/24V/NC/End Switch
VW2WNOA*	2-way/24V/NO/End Switch
VW3WNC2B*	3-way/24V/NC/NO/End Switch

* Pop-top Actuator

WIRELESS RF (RADIO FREQUENCY) CONTROLS

All DigiSmart PTACs come factory-ready to be controlled via wireless RF devices. 2.4 Ghz 802.15.4 protocol assures robust communications and response.

DS01E	Thermostat: 2-way communications
DD01E	Occupancy Sensor: EMS activation
DT01A	Antennae / Router
GT01A	Generic Radio Antenna / Router
DD01F	Door Switch: EMS Activation
DP01E	Web-enabled Platform Server
DL01E	Web-enabled Platform Server Link



REMOTE TEMPERATURE SENSOR

Unit can be wired to sense room temperature away from the PTAC to have accurate readings.

RTS03	Remote wall-mounted sensor
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ACCESSORIES (CONT.)

WIRED ENERGY MANAGEMENT CONTROL

Includes PIR occupancy sensor power from the DigiSmart control and door switch; cannot be used with a remote wired thermostat.

WEMR01W	Recess-mounted door switch
WEMS01B	Surface-mounted door switch (Brown)
WEMS01W	Surface-mounted door switch (White)

WALL SLEEVE EXTENSION ADAPTER KITS

Room-side extension kits to increase the depth of the existing sleeve to allow for an industry-standard PTAC to be installed.

SECM1001A	Climate Master 12½" Sleeve Extension (10 Pack)
SEZA0501A	Zone Aire 11½" Sleeve Extension (5 Pack)

CURTAIN BAFFLE KIT

The color-matched polymer curtain baffles help to prevent curtains from falling into the discharge air stream and causing recirculation, reducing efficiencies and shortening compressor life.

PTCB10B	10 Pack for R-22 units
PTCB10E	10 Pack for R-410A units

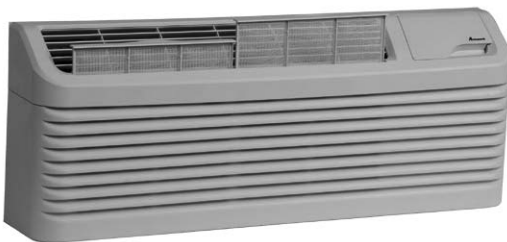
MONTHLY MAINTENANCE

INTAKE AIR FILTERS

It is extremely important to clean the inlet air filters once a month (or more often if operated in dusty or dirty locations or conditions) to properly maintain the operational performance of the PTAC unit. The two intake air filters (constructed of durable polypropylene) can be easily inserted into the cabinet front using the cabinet filter guides. Before cleaning the intake filters, turn the unit off by setting the mode switch to the OFF position. Filters should be cleaned as required. The following procedure is used to remove the intake filters:

1. Facing the unit, pull up on the filter handles located at the front top of the unit.
2. Pull each filter upward and remove.
3. Clean filters with vacuum or with running water. Reverse this procedure to reinstall the filters.

Note: Accessory filter kits are available from your sales person. All filters are permanent and cleanable. Consult your I&O Manual for other monthly cleaning instructions.



SPARE FILTERS

Helps keep dirt and lint out of the air and off the coil, thus increasing the unit's efficiency. Amana® brand filters are easy to remove, wash and replace.

FK10A	10-PACK - A SERIES
FK10B	10-PACK - B, C & D SERIES
FK10E	10-PACK - E SERIES (THIS MODEL REQUIRES 2 FILTERS PER CHANGE.)

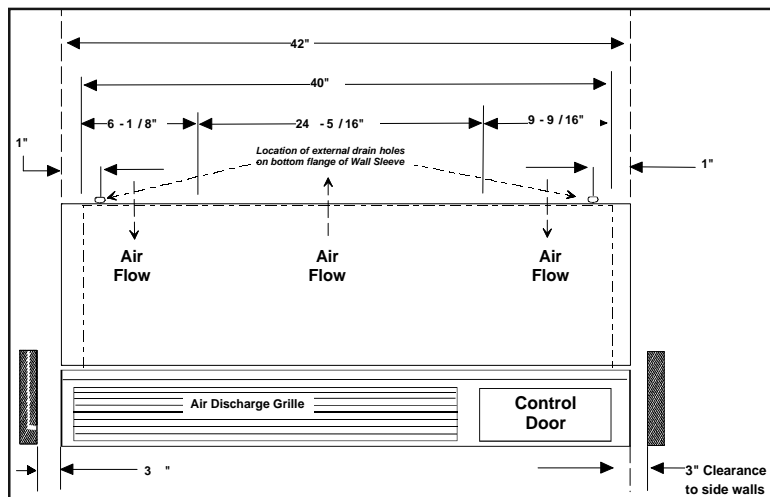
REPLACEMENT CHARCOAL FILTER KIT

Absorbs airborne odors caused by cigarette, pipe or cigar smoke and odors caused by mold, mildew, etc. Filters are made of polyester fibers coated with activated charcoal and are individually wrapped. These filters are permanent and can be washed or cleaned. Call your Amana® brand PTAC sales person for details. 10 filters per pack.

CFK10A	10-PACK - A SERIES (R-22)
CFK10B	10-PACK - B, C & D SERIES (R-22)

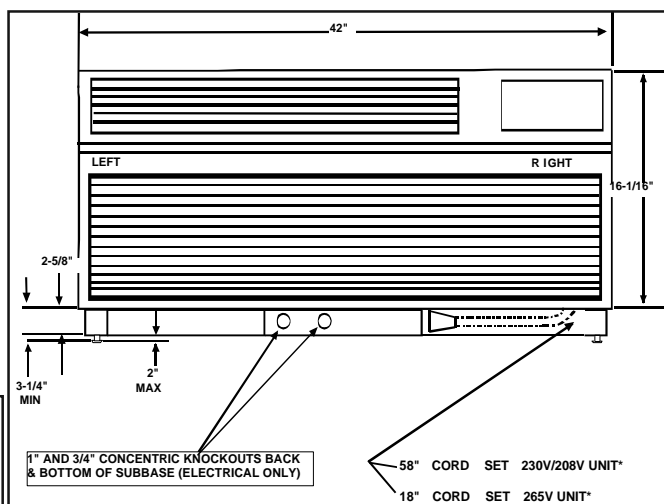
UNIT WITH ACCESSORY WALL SLEEVE AND SUB-BASE ACCESSORY

TOP VIEW

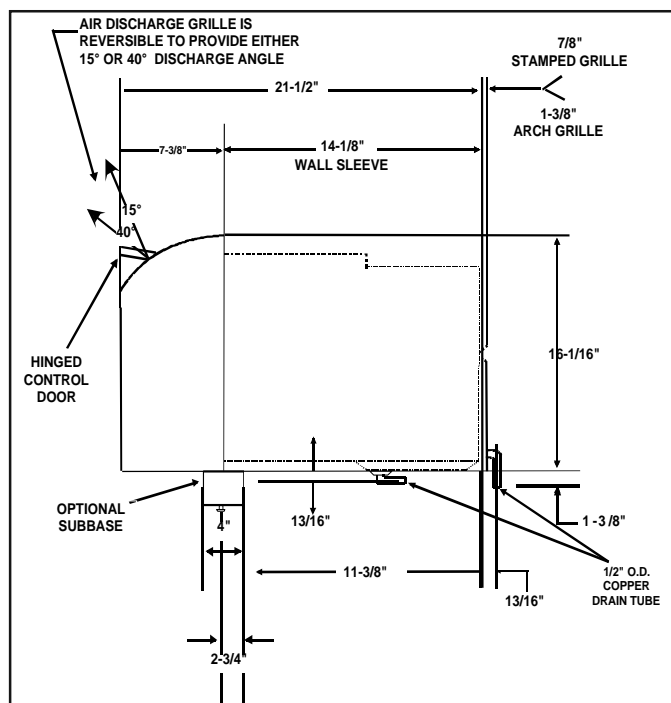


FRONT VIEW

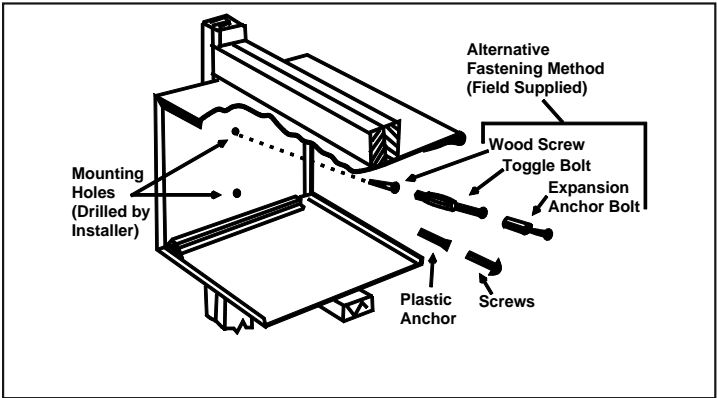
58" LCDI CORD SET — 230V/208V UNIT*



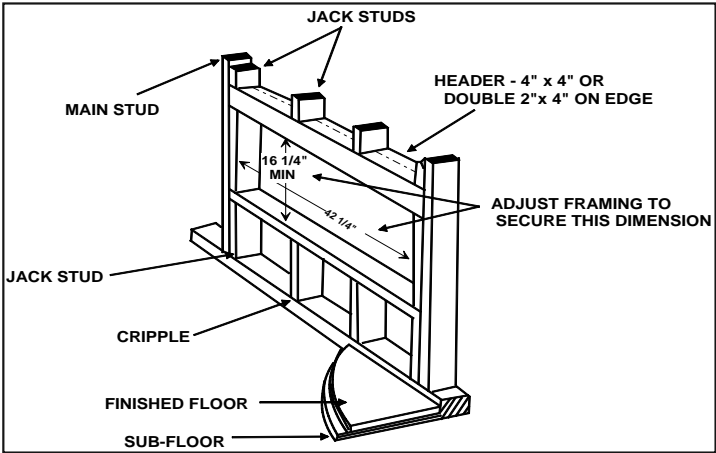
RIGHT VIEW



FRAMING FOR ACCESSORY WALL SLEEVE (WS9XX)



Wall Sleeve must extend a minimum of 3/4" beyond outside wall to allow for proper caulking.



Wall sleeve opening height should be squared with wall sleeve opening width.	H = 16 1/4"
	W = 42 1/4"

FASTENING WALL SLEEVE

When installed in an opening, the Wall Sleeve must be horizontally level (side-to-side) and pitched 1/4" bubble to the outside.

(NOTE: To ensure unit's maximum efficiency, **DO NOT** over- or under-pitch.)

INSTALLATION NOTES

1. If **Sub-base** (PTSB***E) is installed, allow minimum 3 3/4" height clearance and maximum 5" height clearance between wall sleeve and floor; allow minimum 2 3/4" protrusion from a finished wall. *See Note 4 if using hydronic units.*
2. **Drain Kit** (DK900D) shipped separately. Can be mounted either right side, left side or bottom of sleeve. If mounted to bottom of sleeve, allow 2" height clearance from floor to bottom of sleeve.
3. For UL approval, 265V units must use Amana® brand **Sub-base** (PTSB***E) or Amana® brand **Hard Wire Kit** (PSHW04A). Overcurrent protection on 265V units must be by cartridge-style time delay fuses, **which are included and factory-installed on the Amana® brand 265V chassis.**
4. If **Hydronic Kit** (HWK03 or HVK03) is installed, **Wall Sleeve** must extend exactly 3" into the room from the finished interior wall. If using the Amana® brand **Sub-base** (PTSB***E), only the minimum 3 3/4" height clearance between wall sleeve and floor is permissible. Unit must also be operated with a remote-mounted thermostat.
5. If **Duct Kit** (MDK***E) is installed, allow a minimum of 2 3/4" into the room from the finished interior wall.



PACKAGED TERMINAL AIR CONDITIONERS AND HEAT PUMPS

WITH **DigiSmart** CONTROL BOARD



7-Button Control Pad

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- Total Fan Control
- Easy-to-Read Display



Assembled in the USA for 30 years:
Units are 100% run-tested and
triple-tested for leakage.



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Second through Fifth Year: Parts & Labor on certain sealed system components
Second through Fifth Year: on certain functional parts only

* Complete warranty details available from your local dealer or
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