REV. 8 - '89
10M

Supplement to installation, start-up, and maintenance manual

Ground Water Source Heat Pumps

Models "LT" and "HLT" Series
(HLT - Heating Only)

When utilizing ground water with temperatures as low as 40°F as a heat source/sink, special considerations are necessary. In the heating mode, the "LT" or "HLT" heat pump actually becomes an air cooled water chiller, with leaving water temperatures as low as 35°F, and refrigerant evaporating temperatures as low as 25°F. Since water freezes at 32°F, additional safety precautions must be taken so as to avoid the possibility of freeze-up in the water coil should any adverse operating conditions be encountered.

Refrigerant control:
FHP "LT" and "HLT" series heat pumps incorporate a "thermal expansion valve" for refrigerant flow control in the cooling and/or heating modes. By means of a "feeler bulb" and a pressure connection, the expansion valve senses both the pressure and temperature of the refrigerant as it enters the suction port of the compressor. Accordingly, it automatically regulates the flow of refrigerant gas in response to operating conditions, to provide the optimum cooling and/or heating performance.

Each expansion valve has been precisely matched to its' "LT" or "HLT" heat pump and cannot be adjusted. System pressure equalization on shut-down is accomplished thru a "bleed" hole in the expansion valve flange.

Cold Start time delay:
Like all FHP heat pumps, the "LT" and "HLT" series are equipped with low and high pressure safety controls wired thru a lock-out circuit. This system will stop the compressor, and prevent its' automatic restart, in the event of an abnormal refrigerant pressure condition.

However, under certain installation and operating conditions, transient, abnormal pressures can sometimes occur on compressor start-up resulting in unnecessary compressor shut-down and lock-out. To alleviate the possibility of this happening, the "LT" and "HLT" series heat pump control systems incorporate a solid state, interval timer which, on each start-up, temporarily bypasses the low pressure safety control contacts, allowing water flow to be established and refrigerant pressures to normalize.

After a delay of approximately 90 seconds, the timer load circuit will open, putting the low pressure control back in the circuit until the next start-up.

CAUTION

As with any FHP heat pump, in the unlikely event that the "LT" or "HLT" compressor stops running and "locks out," a serious problem could be indicated. The lock-out circuit can be reset, and compressor operation re-established by turning the space thermostat off and back on. If, after a short time, the compressor locks out again, repeat the off-on sequence at the thermostat. Should the compressor lock-out a third time, a serious problem exists which must be determined and corrected.

Compressor start assist:
Although the "LT" and "HLT" heat pump refrigeration systems are self-equalizing, certain conditions can exist, from time to time, whereby additional compressor starting torque may be required on start-up. Each single phase unit may incorporate a solid-state "PTCR" motor starting device to ensure positive starting under all but the most adverse starting conditions.

Crankcase heaters:
Solid state, "PTCR" self-heating crankcase heaters are standard in all "LT" and "HLT" heat pumps, to keep liquid refrigerant out of the compressor crankcase and prevent liquid slugging and/or loss of lubrication on start-up.

Water flow control:
Maximum efficiency is obtained with the "LT" and "HLT" series heat pumps by providing them with maximum design water flow in both the heating and/or cooling modes. Refer to performance tables for water flow requirements and unit performance at various conditions. In most cases it is not necessary to use automatic water flow regulating valves with these units. However, a means of setting the water flow (ball valve, globe valve, etc.) and positively shutting it off during heat pump off periods is required.

Water conservation should always be a prime consideration. In many cases an "LT" or "HLT" heat pump will operate just as dependably with less than maximum water flow, while still providing high efficiency cooling and/or heating. In some cases more water may be required in heating than in cooling, or vice versa, to satisfy particular design conditions. In such cases automatic water flow regulating valves are recommended.
Suitable valves can be obtained from FHP distributors. Each "LT" and "HLT" heat pump is provided with a pressure port to facilitate connecting automatic water regulating valves to the refrigeration system without "dumping" the refrigerant charge. For "LT" units, a pair of valves is usually required, one for cooling and the other for heating. These valves should be adjusted as follows, by competent service personnel only:

1. With gauges attached and the heat pump operating in the heating mode, adjust the heating valve in an opening direction for an increase in suction pressure. Refer to operating pressure tables for normal operating pressure ranges.
2. Next operate the heat pump in cooling ("LT" units only). Adjust the cooling water valve to attain discharge pressure within the range of normal pressures given in the operating pressure table.

Installation:
"LT" and "HLT" heat pumps have been designed for operation with water temperatures as low as 40°F. Water temperatures colder than 40°F are not recommended and could cause malfunction or serious damage to the unit.

The standard water circuit material is copper, and recommended for use with fresh water only. Cupronickel water circuits are available, and should be used with other than fresh water, such as brackish or salt water.

These ground water heat pumps are designed to be installed within the conditioned space, and in no case should they be installed in an area where the surrounding air temperature can fall below 40°F. When installed in an unheated space, an insulating jacket can be installed around the entire unit to minimize heat loss.

Service/maintenance:
When installed, maintained and operated properly, FHP model "LT" and "HLT" heat pumps will provide many years of highly efficient, trouble free heating and cooling. However, like an automobile, periodic service and preventive maintenance is always required for best performance and longest life.

- The owner should be instructed on the operation of the unit, including the space thermostat.
- The owner should be instructed on the location of the air filter and how to change or clean it. During periods of extended heating or cooling operation the filter should be checked once a month, and cleaned or replaced as required. THIS IS THE OWNERS' RESPONSIBILITY.
- The owner should be instructed as to the function and importance of the "lock-out" circuit.

WARNING

Like all air conditioning systems, "LT" and "HLT" heat pumps are electro-mechanical appliances that incorporate a pressurized refrigerant gas in a sealed system. It is not the intent or purpose of this instruction supplement to imply or suggest that anyone but trained and qualified service personnel attempt to service this equipment. Without proper training and knowledge of such equipment, an attempt to service the unit could result in serious injury and even death.

"LT" & "HLT" models

Ground water heat pumps

Operating pressures and temperatures

GENERAL: There are many variables (airflow, air temperatures, water flow and temperatures) in an air-conditioning system that will affect operating refrigerant pressures and temperatures. The chart below shows approximate conditions and is based on air flow at the rated CFM.

For application below 45° EWT refer to supplemental performance tables.

			OPERATING DATA (*)							
			COOLING				HEATING			
MODEL SIZE	ENTERING WATER TEMP., °F	WATER FLOW, GPM	SUCT. PRES., PSIG	DISCH. PRES., PSIG	WATER TEMP. RISE, °F	AIR TEMP. DROP° FDB	SUCT. PRESS., PSIG	DISCH. PRESS., PSIG	WATER TEMP. DROP, °F	AIR TEMP. RISE, °FDB
10	45°	1.5	75-80	142-152	19-22	18-22				
		2.5	74-79	120-130	12-15	18-22	64-68	200-210	5.2-6.8	20-25
		3.5	73-78	111-121	8-11	18-22	65-69	202-212	4.6-6.4	21-26
	50°	1.5	76-81	150-160	19-22	18-22	67-71	208-218	9.1-9.9	19-24
		2.5	75-80	130-140	12-15	18-22	68-72	210-220	5.6-7.4	20-25
		3.5	75-80	120-130	8-11	18-22	68-72	213-223	4.2-6.8	21-26
	55°	1.5	76-81	162-172	19-22	18-22	67-71	216-226	10.1-11.7	23-28
		2.5	76-81	142-152	12-15	18-22	70-74	220-230	6.1-7.9	25-30
		3.5	75-80	131-141	8-11	18-22	73-77	224-234	5.5-7.3	26-31
	60°	1.5	76-81	175-185	18-21	17-21	67-71	216-226	11.4-12.2	28-33
		2.5	76-81	155-165	11-13	17-21	70-74	220-230	7.2-8.6	30-35
		3.5	75-80	146-156	7-10	18-22	73-77	224-234	6.4-7.1	32-37
15	45°	2.0	74-79	129-139	18-21	18-22				
		3.0	74-79	115-125	12-15	18-22	53-57	195-203	5.4-5.9	18-23
		4.0	73-78	106-116	9-12	18-22	55-59	199-207	4.1-4.6	20-25
	50°	2.0	75-80	140-150	18-21	18-22	55-59	202-210	8.7-9.2	20-25
		3.0	75-80	125-135	12-15	18-22	57-61	207-215	6.2-6.7	21-26
		4.0	74-79	115-125	9-12	18-22	58-62	211-219	4.7-5.2	22-27
	55°	2.0	76-81	156-166	17-20	17-21	61-65	210-218	9.6-10.3	22-27
		3.0	76-81	140-150	11-14	18-22	63-67	215-223	6.9-7.4	24-29
		4.0	75-80	130-140	8-11	18-22	64-68	219-227	5.2-5.7	25-30
	60°	2.0	77-82	173-183	16-19	17-21	65-69	218-226	10.5-11.3	24-29
		3.0	77-82	155-165	10-13	17-21	67-71	223-231	7.5-8.0	26-31
		4.0	76-81	145-155	7-10	18-22	69-73	227-235	5.7-6.2	28-33
20	45°	3.0	76-81	140-150	22-25	18-22				
		4.0	77-82	118-128	13-15	18-22	62-66	195-203	5.8-6.3	19-24
		5.0	78-83	109-119	9-11	18-22	63-67	197-205	4.4-4.9	20-25
	50°	3.0	77-82	148-158	22-25	18-22	64-68	200-208	10.6-11.1	20-25
		4.0	77-82	128-138	13-15	18-22	67-71	202-210	6.5-7.0	21-26
		5.0	78-83	119-128	9-11	18-22	67-71	206-214	4.8-5.3	22-27
	55°	3.0	77-82	160-170	22-25	17-21	66-70	204-212	10.5-11.3	21-26
		4.0	78-83	140-150	13-15	18-22	69-73	209-217	7.2-7.7	25-28
		5.0	79-84	129-139	9-11	18-22	72-76	213-221	5.4-5.9	24-29
	60°	3.0	77-82	173-175	23-25	17-21	66-70	210-218	11.4-12.2	27-32
		4.0	78-83	153-163	14-16	17-21	69-73	216-224	7.9-8.4	28-33
		5.0	79-84	144-154	10-12	18-22	72-76	220-228	6.0-6.5	29-34
30	45°	3	72-76	152-160	23-25	18-22				
		5	71-75	124-132	14-16	18-22	49-53	210-218	6.1-6.8	20-25
		7	70-74	122-130	10-11	18-22	50-54	212-220	4.5-5.0	21-26
	50°	3	73-77	165-173	23-25	18-22				
		5	72-76	143-151	14-16	18-22	54-58	218-226	6.9-7.6	22-27
		7	71-75	135-143	10-11	18-22	56-60	221-229	5.1-5.6	23-28
	55°	3	74-78	176-184	23-25	17-21	56-60	222-230	11.5-12.3	23-28
		5	73-77	154-162	14-16	18-22	59-63	227-235	7.7-8.5	25-30
		7	72-76	148-156	10-11	18-22	62-66	230-238	5.6-6.2	26-31
	60°	3	75-79	191-199	23-25	17-21	61-65	231-239	12.6-13.4	25-30
		5	74-78	169-177	14-16	17-21	65-69	235-243	8.4-9.3	27-32
		7	73-77	161-169	10-11	18-22	67-71	239-247	6.2-6.9	28-33
40	45°	5	71-75	135-143	23-25	19-23				
		6.5	70-74	123-131	14-16	19-23	50-54	206-214	5.8-6.3	21-26
		8	69-73	110-118	10-11	19-23	53-57	207-215	4.2-4.7	22-27
	50°	5	71-75	147-155	22-24	19-23	54-58	211-219	8.5-9.3	22-27
		6.5	70-74	129-137	14-16	19-23	56-60	214-222	6.5-7.0	23-28
		8	70-74	121-129	10-11	19-23	58-62	216-224	5.0-5.5	24-29
	55°	5	72-76	158-166	22-24	19-23	55-59	219-227	11.1-11.9	24-29
		6.5	71-75	140-148	13-15	19-23	61-65	223-231	7.3-7.8	25-30
		8	71-75	131-139	10-11	19-23	64-68	225-233	5.4-5.9	26-31
	60°	5	73-77	169-177	22-24	18-22	60-64	226-234	12.1-12.9	26-31
		6.5	72-76	151-159	13-15	18-22	66-70	231-239	8.1-8.6	28-33
		8	72-76	141-149	10-11	19-23	70-74	234-242	6.0-6.5	29-34

			OPERATING DATA (*)							
			COOLING				HEATING			
MODEL SIZE	ENTERING WATER TEMP., °F	WATER FLOW, GPM	SUCT. PRES., PSIG	DISCH. PRES. PSIG	WATER TEMP. RISE, °F	AIR TEMP. DROP, °FDB	SUCT. PRESS., PSIG	DISCH. PRESS., PSIG	WATER TEMP DROP, °F	AIR TEMP RISE, °FDB
50	45°	5	72-76	141-149	23-25	19-23				
		8	71-75	126-134	14-16	19-23	44-48	195-203	5.8-6.3	19-24
		11	70-74	116-124	10-11	19-23	46-50	197-205	4.4-4.9	20-25
	50°	5	73-77	153-161	23-25	19-23				
		8	72-76	138-146	14-16	19-23	49-53	202-210	6.5-7.0	21-26
		11	71-75	128-136	10-11	19-23	52-56	206-214	4.8-5.3	22-27
	55°	5	74-78	165-173	22-24	19-23	51-55	204-212	10.5-11.3	21-26
		8	73-77	150-158	14-16	19-23	54-58	209-217	7.2-7.7	23-28
		11	72-76	140-148	10-11	19-23	58-62	213-221	5.4-5.9	24-29
	60°	5	75-79	178-186	22-24	19-23	56-60	211-219	11.4-12.2	23-28
		8	73-77	162-170	13-15	19-23	61-65	217-225	7.9-8.4	23-28
		11	72-76	152-160	10-11	19-23	63-67	221-229	6.0-6.5	26-31
60	45°	6	71-76	147-155	22-25	17-22				
		9.5	70-75	131-139	15-17	18-23	52-56	202-210	6.4-7.0	22-27
		13	70-75	125-134	11-12	19-24	53-57	205-213	4.8-5.3	22-27
	50°	6	72-77	158-166	21-25	18-23	55-59	204-212	10.9-11.7	23-28
		9.5	71-76	142-150	14-16	18-23	57-61	208-216	6.9-7.6	24-29
		13	71-76	136-144	11-12	19-24	59-63	211-219	5.2-5.7	24-29
	55°	6	72-77	169-177	21-24	17-22	59-63	209-217	11.9-12.7	25-30
		9.5	72-77	153-161	14-16	18-23	62-66	214-222	7.7-8.4	26-31
		13	71-76	147-155	11-12	19-24	65-69	217-225	5.7-6.3	27-32
	60°	6	73-78	181-189	21-24	18-23	64-68	215-233	12.8-13.6	27-32
		9.5	72-77	164-172	13-15	18-23	67-71	219-227	8.3-9.1	28-33
		13	72-77	157-165	10-11	18-23	71-75	223-231	6.2-6.8	29-34
70	45°	8	68-73	140-148	20-23	19-24				
		12	67-72	128-136	14-16	20-25	53-57	200-208	5.7-6.3	22-27
		16	67-72	122-130	11-12	21-26	54-58	202-210	4.4-4.9	22-27
	50°	8	69-74	151-159	20-23	19-24	56-60	206-214	8.9-9.7	23-28
		12	68-73	139-147	14-16	20-25	58-62	210-218	6.7-7.3	24-29
		16	68-73	133-141	11-12	21-26	60-64	213-221	5.2-5.7	25-30
	55°	8	70-75	162-170	20-23	19-24	60-64	215-233	9.9-10.7	24-29
		12	69-74	150-158	14-16	19-24	63-67	220-228	7.0-7.8	26-31
		16	69-74	143-151	10-11	20-25	66-70	224-232	5.4-5.9	27-32
	60°	8	71-76	173-181	19-22	19-24	65-69	224-232	10.9-11.7	26-31
		12	70-75	160-168	13-15	19-24	68-72	230-238	7.7-8.2	28-33
		16	70-75	154-162	10-11	19-24	72-76	235-243	5.9-6.4	29-34
90	45°	10	69-77	145-151	23-25	19-24				
		15	68-73	133-141	14-16	20-25	53-57	200-208	5.8-6.3	22-27
		20	68-73	127-135	10-11	21-26	54-58	202-210	4.4-4.9	22-27
	50°	10	70-75	156-164	23-25	19-24				
		15	69-74	144-152	14-16	20-25	58-62	210-218	6.5-7.0	24-29
		20	69-74	138-146	10-11	21-26	60-64	213-221	4.8-5.3	24-29
	55°	10	71-76	167-175	22-24	19-24	60-64	213-221	10.5-11.5	25-30
		15	70-75	155-163	13-15	19-24	63-67	218-226	7.2-7.7	26-31
		20	70-75	148-156	10-11	20-25	66-70	222-230	5.4-5.9	27-32
	60°	10	72-77	178-186	22-24	19-24	65-69	222-230	11.4-12.2	27-32
		15	71-76	165-173	13-15	19-24	68-72	228-238	7.9-8.4	28-33
		20	71-76	159-167	10-11	19-24	72-76	234-242	6.0-6.5	29-34

*Based on new unit operating with rated SCFM entering air at 80° FDB, 67° FWB in cooling. 70° FDB in heating.
Shaded areas signify operation not recommended at these water flow conditions.

#Applies to "LT", Reverse Cycle Models Only.

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a HARROW company