ecosmart™
simplifying comfort

ES50LVP/ES90LVP/ES120LVP
MODULATING AIR HANDLER

Installation, Operation and Maintenance Manual

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ETL LISTED c US
Intertek

P/N 14000F

Contents

All technical information subject to change without notice.

SAFETY INFORMATION

It is the responsibility of the installer to ensure the installation complies with all national and local building codes and standards, in addition to the instructions outlined in this manual. All applicable codes take precedence over any instructions made in this document.

This symbol indicates safety alerts. When you see this symbol on labels or in this manual, be alert to the potential for personal injury. Understand and pay particular attention to the signal words **DANGER, WARNING,** or **CAUTION.**

DANGER indicates an **imminently** hazardous situation, which if not avoided, **will result in death or serious injury.**

WARNING indicates a **potentially** hazardous situation, which if not avoided, **could result in death or serious injury.**

CAUTION indicates a **potentially** hazardous situation, which if not avoided, **may result in minor or moderate injury.** It is also used to alert against unsafe practices and hazards involving only property damage.

	**WARNING** - Improper installation may create a condition where the operation of the product could cause personal injury or property damage. Only a qualified contractor, installer or service agency should install this product. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance.
	**CAUTION** - This product must be installed in strict compliance with the installation instructions and any applicable local, state, and national codes including, but not limited to; building, electrical, and mechanical codes.
	**WARNING - FIRE OR ELECTRICAL HAZARD**. Failure to follow the safety warnings exactly could result in serious injury, death, or property damage. A fire or electrical hazard may result causing property damage, personal injury or loss of life.
	**WARNING** - Hot water from a boiler used to satisfy heating requirements can be heated to temperatures of 180°F. Parts containing water this hot can scald very quickly. Use extreme caution when servicing or performing maintenance on any parts containing hot water. To avoid severe burns, allow equipment to cool before performing maintenance.

INTRODUCTION

The **ecosmart** hydronic furnace is designed to maximize performance and comfort in residential or light commercial applications. The **ecosmart** can be used with a variety of heat sources such as boilers and water heaters and can be implemented in combo systems that provide domestic hot water as well as space heating.

Smart control systems within the **ecosmart** allow extraction of maximum heat by allowing condensing high efficiency heat sources to work at their maximum efficiency while providing ultimate comfort with unmatched performance.

Simple, independent heat/cool and system parameters can easily be set by the installer to adjust for a wide variety of installations. Various parameters are automatically monitored and fan and pump speeds vary simultaneously. The **ecosmart** has a built-in variable speed pump controller that can vary the speed of a standard single speed AC pump.

MODES OF OPERATION

Three modes of operation are available:

1. Full modulation – full control of fan and pump (requires the supplied outdoor temperature sensor be installed).
2. Step modulation – timed fan and pump sequencing.
3. Single stage – standard furnace emulation.

Modulating Mode (ecosmart outdoor sensor installed)

Water temperature is set at the heat generator by referring to the heat generator performance data. It is best to maintain constant water temperature at the heat generator.

If the heat generator comes with an optional outdoor temperature sensor do **not** install it as it will conflict with the **ecosmart** control.

The fan operates at the speed selected on the HEAT CFM switch during the setup. Fan and pump speed automatically reduce as outdoor temperature rises. Fan CFM may reduce by up to 30% from the HEAT CFM switch setting depending on outdoor temperature.

If the heat generator includes a built-in pump, and it is directly connected to the **ecosmart**, the **ecosmart** will vary the pump automatically. If the system is configured for primary/secondary pumping and the heat generator includes a pump, the secondary pump can be controlled by the **ecosmart**.

Step Modulating Mode (ecosmart outdoor sensor not installed)

Water temperature is set at the heat generator by referring to the heat generator performance data. Fan operates at 50% of the HEAT CFM setting for 5 minutes then increases to 75% for a further 5 minutes, then increases to 100% until the thermostat is satisfied. If the pump is controlled by the **ecosmart**, its speed will be adjusted accordingly as the **ecosmart** goes through its stages. If the pump is controlled by the heat source, it will function according to the heat source control strategy.

Basic Mode (ecosmart outdoor sensor not installed)

Water temperature is set at the heat generator by referring to the heat generator performance data. Fan operates at 100% of selected HEAT CFM and pump operates at maximum speed until the thermostat is satisfied.

PERFORMANCE RATINGS

50LVP

Performance Data - Hot Water Capacities (BTUH) @ 70°F Entering Air Temperature										
		Entering Water Temperature								
CFM	GPM	110°F	120°F	130°F	140°F	150°F	160°F	170°F	180°F	Water PD feet WC @140°F
300	3	10,700	13,400	16,100	18,810	21,520	24,240	26,960	29,680	2.32
	4	10,970	13,730	16,500	19,270	22,050	24,820	27,600	30,380	3.87
	5	11,140	13,940	16,740	19,550	22,360	25,180	27,990	30,810	5.77
400	3	13,260	16,610	19,980	23,350	26,730	30,110	33,500	36,890	2.32
	4	13,730	17,190	20,670	24,150	27,640	31,130	34,620	38,120	3.87
	5	14,020	17,550	21,090	24,640	28,190	31,740	35,300	38,860	5.77
500	3	15,470	19,390	23,330	27,280	31,240	35,210	39,180	43,160	2.32
	4	16,160	20,250	24,360	28,470	32,590	36,710	40,840	44,970	3.87
	5	16,600	20,790	24,990	29,200	33,420	37,640	41,870	46,100	5.77
600	3	17,390	21,820	26,260	30,720	35,180	39,660	44,150	48,640	2.32
	4	18,330	22,980	27,640	32,320	37,000	41,700	46,400	51,100	3.87
	5	18,920	23,710	28,510	33,320	38,150	42,970	47,810	52,650	5.77
700	3	19,090	23,950	28,840	33,740	38,660	43,590	48,530	53,470	2.32
	4	20,270	25,420	30,590	35,770	40,970	46,180	51,390	56,610	3.87
	5	21,030	26,360	31,710	37,070	42,440	47,820	53,210	58,610	5.77
800	3	20,580	25,840	31,120	36,420	41,730	47,070	52,410	57,760	2.32
	4	22,020	27,620	33,250	38,890	44,550	50,220	55,900	61,590	3.87
	5	22,950	28,770	34,620	40,480	46,360	52,250	58,150	64,050	5.77
900	3	21,910	27,510	33,150	38,800	44,480	50,170	55,870	61,590	2.32
	4	23,600	29,610	35,650	41,720	47,800	53,890	60,000	66,110	3.87
	5	24,710	30,990	37,290	43,620	49,960	56,310	62,680	69,050	5.77

90LVP

Performance Data - Hot Water Capacities (BTUH) @ 70°F Entering Air Temperature										
		Entering Water Temperature								
CFM	GPM	110°F	120°F	130°F	140°F	150°F	160°F	170°F	180°F	Water PD feet WC @140°F
600	3	18,930	23,720	28,530	33,350	38,180	43,020	47,860	52,710	1.96
	4	19,890	24,920	29,960	35,010	40,070	45,140	50,210	55,280	3.26
	5	20,500	25,670	30,850	36,040	41,240	46,440	51,650	56,860	4.84
700	3	20,890	26,190	31,510	36,840	42,180	47,540	52,900	58,260	1.96
	4	22,140	27,740	33,360	38,990	44,640	50,290	55,940	61,600	3.26
	5	22,930	28,720	34,520	40,340	46,170	52,000	57,840	63,690	4.84
800	3	22,630	28,380	34,150	39,940	45,750	51,560	57,380	63,210	1.96
	4	24,170	30,300	36,450	42,610	48,790	54,970	61,160	67,360	3.26
	5	25,160	31,520	37,910	44,300	50,710	57,130	63,550	69,980	4.84
900	3	24,180	30,340	36,520	42,720	48,930	55,160	61,400	67,640	1.96
	4	26,030	32,630	39,260	45,910	52,570	59,250	65,930	72,610	3.26
	5	27,220	34,110	41,030	47,960	54,900	61,860	68,820	75,790	4.84
1,000	3	25,580	32,100	38,640	45,210	51,790	58,400	65,000	71,620	1.96
	4	27,720	34,770	41,840	48,930	56,040	63,160	70,290	77,430	3.26
	5	29,120	36,510	43,910	51,340	58,780	66,240	73,700	81,170	4.84
1,100	3	26,830	33,680	40,550	47,450	54,370	61,310	68,260	75,210	1.96
	4	29,270	36,720	44,200	51,700	59,210	66,750	74,290	81,840	3.26
	5	30,880	38,720	46,590	54,480	62,380	70,310	78,240	86,170	4.84
1,200	3	27,970	35,110	42,280	49,480	56,710	63,950	71,200	78,460	1.96
	4	30,700	38,520	46,370	54,240	62,140	70,050	77,980	85,910	3.26
	5	32,520	40,790	49,080	57,400	65,730	74,090	82,450	90,830	4.84
1,300	3	28,990	36,400	43,850	51,320	58,820	66,340	73,860	81,400	1.96
	4	32,020	40,170	48,370	56,590	64,840	73,100	81,380	89,670	3.26
	5	34,050	42,710	51,400	60,120	68,860	77,620	86,380	95,170	4.84

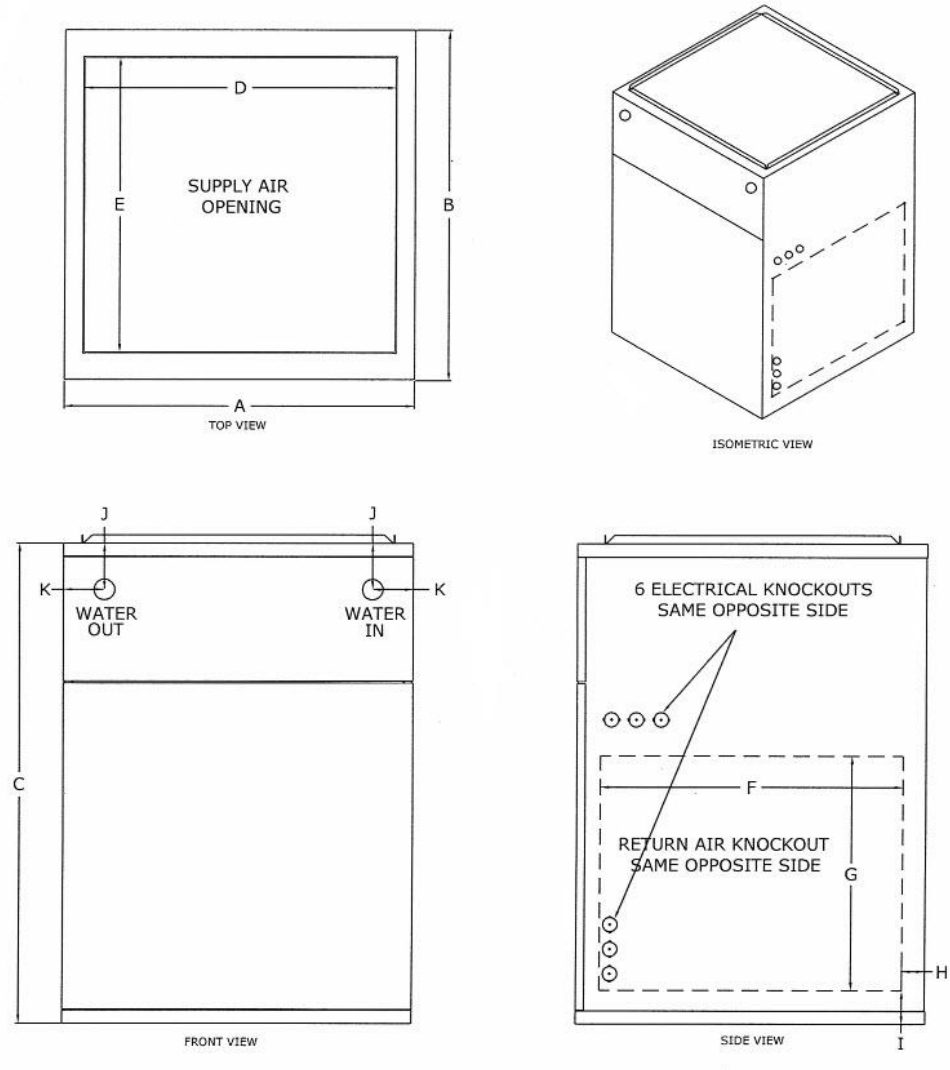
120LVP

Performance Data - Hot Water Capacities (BTUH) @ 70°F Entering Air Temperature										
		Entering Water Temperature								
CFM	GPM	110°F	120°F	130°F	140°F	150°F	160°F	170°F	180°F	Water PD feet WC @140°F
1,300	3	31410	39480	47600	55760	63960	72180	80410	88660	3.13
	4	35030	44000	53020	62070	71160	80280	89420	98570	2.19
	5	37480	47050	56660	66320	76000	85710	95440	105190	3.29
1,400	3	32480	40830	49240	57700	66200	74730	83270	91840	3.13
	4	36360	45670	55050	64460	73910	83390	92890	102410	2.19
	5	39070	49050	59090	69170	79280	89420	99580	109760	3.29
1,500	3	33540	42170	50870	59610	68390	77200	86030	94890	3.13
	4	37580	47220	56920	66660	76440	86260	96090	105940	2.19
	5	40550	50920	61350	71830	82340	92880	103450	114030	3.29
1,600	3	34510	43400	52360	61360	70400	79480	88580	97690	3.13
	4	38700	48640	58640	68690	78780	88900	99040	109210	2.19
	5	41930	52660	63460	74310	85190	96110	107050	118010	3.29
1,700	3	35410	44540	53730	62980	72260	81580	90920	100280	3.13
	4	39740	49950	60230	70560	80940	91350	101780	112230	2.19
	5	43210	54290	65430	76620	87860	99130	110420	121740	3.29
1,800	3	36250	45590	55010	64470	73980	83530	93090	102680	3.13
	4	40700	51170	61710	72620	82970	93670	104390	115140	2.19
	5	44420	55810	67270	78790	90350	101960	113580	125230	3.29
1,900	3	37020	46570	56190	65860	75580	85330	95100	104900	3.13
	4	41750	52510	63340	74230	85170	96160	107170	118210	2.19
	5	45540	57240	69000	80820	92690	104600	116540	128500	3.29
2,000	3	32740	47480	57290	67150	77060	87010	96970	106960	3.13
	4	42750	53770	64870	76030	87240	98490	109780	121090	2.19
	5	46600	58570	70620	82730	94890	107090	119320	131570	3.29

SPECIFICATIONS

PHYSICAL DATA - INCHES											
Model	**Overall Dimensions W x D x H**			**Supply Opening W x D**		**Side Return**				**Piping Location**	
	A	B	C	D	E	F	G	H	I	J	K
50LVP	14.0	21.0	29.0	11.8	17.8	18.3	14.3	1.4	2.0	2.8	2.4
90LVP	21.0	21.0	29.0	18.8	17.8	18.3	14.3	1.4	2.0	2.8	2.4
120LVP*	24.0	21.0	29.0	21.8	17.8	18.3	14.3	1.4	2.0	2.8	2.4

* For sufficient airflow, use dual air returns



MODEL	50LVP	90LVP	120LVP *
DX Cooling Capacity (tons)	1 to 2	1.5 to 3.5	3.5 to 5
Power (Volts/Phase/Hz)	120/1/60	120/1/60	120/1/60
Cabinet Size W x D x H (in)	14 x 21 x 29	21 x 21 x 29	24 x 21 x 29
Supply Air Opening W x D (in)	11.8 X 17.8	18.8 x 17.8	21.8 x 17.8
Side Return Air Opening (in)	18.3 X 14.3	18.3 X 14.3	18.3 x 14.3
Recommended Filter Size (in)	16 x 20	16 x 20	16 x 20
Shipping Weight (lb)	85	95	135
Shipping Dimensions W x D x H (in)	15 x 24 x 30.5	22 x 24 x 30.5	25 x 24 x 30.5

* For sufficient airflow, use dual air returns

50LVP ECM blower performance (CFM/amps)

SWITCH SETTING	0.1" WC	0.2" WC	0.3" WC	0.4" WC	0.5" WC	0.6" WC	0.7" WC	0.8" WC	0.9" WC	1.0" WC
300 CFM	362 0.7	367 0.80	359 0.92	338 1.04	343 1.19	335 1.35	349 1.47	338 1.62	328 1.76	325 1.88
400 CFM	470 1.02	462 1.13	474 1.28	468 1.43	466 1.56	458 1.73	449 1.89	452 2.08	449 2.29	452 2.56
500 CFM	542 1.34	539 1.41	540 1.55	540 1.74	534 1.91	540 2.10	538 2.28	536 2.49	534 2.71	548 2.86
600 CFM	611 1.71	603 1.76	604 1.89	600 2.08	613 2.28	622 2.50	619 2.76	628 2.93	620 3.14	625 3.37
700 CFM	732 2.67	730 2.71	729 2.73	732 2.88	726 3.07	724 3.25	730 3.50	736 3.74	731 3.92	727 4.19
800 CFM	872 4.07	864 4.10	865 4.10	858 4.11	849 4.23	851 4.41	849 4.62	852 4.82	847 5.02	856 5.41
900 CFM	967 5.25	960 5.26	949 5.32	950 5.35	941 5.38	936 5.47	937 5.62	942 5.83	932 6.05	930 6.29

90LVP ECM blower performance (CFM/amps)

SWITCH SETTING	0.1" WC	0.2" WC	0.3" WC	0.4" WC	0.5" WC	0.6" WC	0.7" WC	0.8" WC	0.9" WC	1.0" WC
400 CFM	533 0.80	527 0.94	502 1.10	496 1.26	469 1.44	447 1.61	454 1.77	435 1.96	459 2.11	454 2.26
600 CFM	696 1.19	677 1.37	681 1.53	679 1.74	665 1.96	662 2.17	634 2.43	645 2.62	647 2.86	635 3.22
700 CFM	753 1.35	754 1.59	747 1.82	748 2.04	757 2.29	740 2.58	745 2.80	740 3.02	724 3.28	726 3.41
800 CFM	844 1.73	843 1.99	849 2.23	850 2.49	848 2.77	840 3.02	842 3.26	835 3.50	834 3.80	835 4.02
900 CFM	955 2.20	954 2.47	962 2.76	952 3.04	950 3.31	952 3.58	945 3.86	940 4.10	937 4.40	930 4.71
1000 CFM	1021 2.61	1009 2.86	1018 3.16	1017 3.44	1014 3.76	1017 4.05	1014 4.34	1018 4.73	1018 4.95	1019 5.22
1100 CFM	1139 3.34	1137 3.73	1141 4.01	1142 4.34	1150 4.67	1149 4.98	1144 5.29	1138 5.70	1133 5.93	1137 6.28
1200 CFM	1364 5.37	1361 5.73	1358 6.04	1350 6.43	1319 6.40	1280 6.35	1240 6.28	1200 6.29	1167 6.26	1120 6.23

120LVP ECM blower performance (CFM/amps)

SWITCH SETTING	0.1" WC	0.2" WC	0.3" WC	0.4" WC	0.5" WC	0.6" WC	0.7" WC	0.8" WC	0.9" WC	1.0" WC
1300 CFM	1304 3.38	1300 3.68	1313 4.02	1332 4.49	1347 4.98	1352 5.22	1344 5.64	1341 5.99	1352 6.38	1353 6.74
1400 CFM	1391 4.11	1411 4.41	1417 4.85	1433 5.29	1445 5.70	1446 6.10	1451 6.53	1463 7.10	1462 7.43	1455 7.77
1500 CFM	1518 5.14	1529 5.32	1533 5.80	1538 6.29	1556 6.71	1551 7.22	1560 7.56	1578 8.04	1572 8.46	1557 8.90
1600 CFM	1631 6.38	1639 6.44	1654 6.93	1647 7.55	1666 7.96	1683 8.50	1690 9.02	1669 9.46	1679 9.77	1675 10.17
1700 CFM	1720 7.42	1737 7.64	1783 8.07	1757 8.67	1783 9.22	1763 9.70	1788 10.23	1778 10.59	1781 11.07	1779 11.49
1800 CFM	1797 8.12	1805 8.32	1814 8.68	1813 9.34	1834 9.92	1853 10.35	1830 10.87	1828 11.32	1844 11.72	1797 11.64
1900 CFM	1925 9.90	1928 10.01	1932 10.26	1930 10.78	1953 11.38	1947 11.65	1903 11.66	1860 11.74	1817 11.68	1791 11.52
2000 CFM	2056 11.51	2047 11.69	2045 11.68	2011 11.68	2005 11.69	1958 11.68	1907 11.56	1880 11.52	1863 11.38	1803 11.46

QUICK START-UP PROCEDURES

Refer to the installation instructions before following the start-up procedures.

1. Fill the system with water. Do not start the system.
2. Purge all air from the system. Isolation and purge valves are strongly recommended.
3. Purge all air from the space heating loop by closing the isolation valve on the return leg of the loop and open the drain to purge air. Open the return leg isolation valve and then close the drain valve.
4. Start the hot water generating equipment per the manufacturer's recommendations. Set the design water temperature to deliver the necessary amount of BTUs to the air handler.
5. Once all air has been purged, turn on the power to the **ecosmart** and set the room thermostat to heat and set the temperature high enough to initiate a call for heat. This will energize the air handler and in turn the fan and pump.
6. Once the heat source is supplying hot water, check supply and return pipes for a temperature difference to make sure there is flow. There should be a noticeable difference in temperature between supply and return lines. Use caution when supply water temperature is above 120 F / 49 C.

INSTALLATION

The installer must comply with all local and national code requirements pertaining to the installation of this equipment.

Clearances

The **ecosmart** is approved for up-flow, down-flow, and horizontal configurations. Clearances do not change with orientation. This hydronic furnace is for indoor installation only.

	Clearance from Combustibles (in)	Recommended Service Clearance (in)
Top	0	0
Bottom	0	0
Front	0	24
Back	0	0
Sides	0	0

Freeze Protection

It is not recommended to install the **ecosmart** in an unheated space.
Should the **ecosmart** be installed in an area where the ambient temperature may fall below freezing, ethylene or propylene glycol should be added into the hydronic heating system to protect against damage, which would not be covered under warranty. Make sure the glycol is compatible with all system components and is permitted by local and national codes.

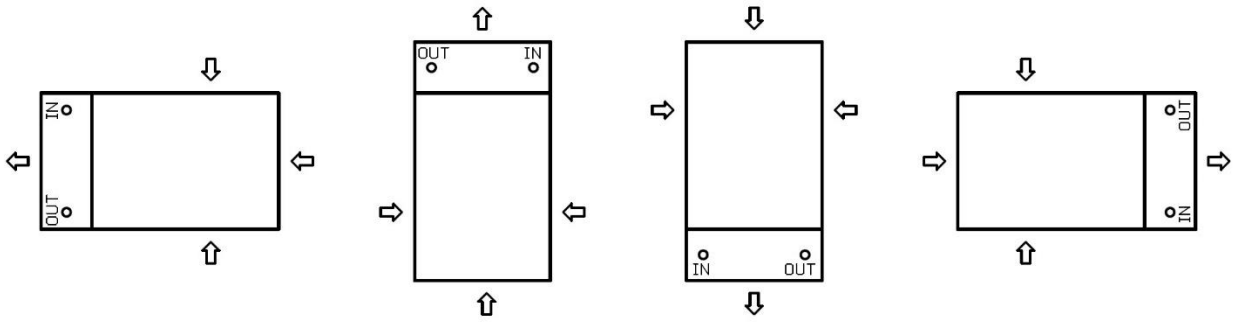
Rear Piping Connections

The heating coil may be reversed to allow rear piping:

- Remove upper door
- Disconnect supply air sensor from extension cable
- Slide out heating coil
- Re-mount supply air sensor and grommet to opposite end of heating coil
- Remove rear knockouts
- Slide in heating coil
- Use plastic plugs (provided) to close up holes on upper door

Ecosmart Mounting

The **ecosmart** can be installed in up flow, down flow and left or right horizontal applications. Install the **ecosmart** with the door in place to make sure the cabinet remains square. Flip the unit for down flow applications so that the top of the unit is now the bottom. No modification is required for any configuration.



MULTIPOSITION INSTALLATION

The **ecosmart** can be suspended from floor joists, rafters or concrete using rods, pipe, angle supports or straps. Units must be hung level to ensure quiet operation. Vibration isolation is strongly recommended.

CAUTION - Use any of the existing screw holes in the cabinet when using straps. If the existing screw is too short for securing a mounting strap, a longer screw should be used provided care is taken not to damage any internal components. Product warranty does not cover any damage or claims resulting from damage from longer screws or from the unit being improperly suspended.

The cabinet is designed so that the return air can be located on either side of the cabinet, or from the bottom of the cabinet. Position a filter rack so that the filter is readily accessible. A filter and filter rack are not included. Sides have pre-cut knockouts for a standard 16 x 20 in filter rack.

WARNING - Special care should be taken in the vicinity of the coil to avoid puncture. Screw into opening flange instead of top of cabinet when fastening the supply air duct.

Plumbing

Install a sediment faucet or ball valve for use as a drain/purge valve. The drain valve must be located downstream of the pump and check valve, and upstream of the isolation valve (if isolation valve is present). With this arrangement, any air trapped in the system can easily be flushed out following the instructions in the Start-up & Troubleshooting sections. Isolation valves are recommended, but not required. Installing isolation valves facilitates easy servicing.

When the space heating loop connections are made to the domestic water connections:

- The heating loop connections should be positioned horizontally in a vertical section of the domestic water line for both inlet and outlet. Refer to the piping schematic for details.
- Connect the heating loop to the domestic water connections as close to the water heater as possible

Avoid sections of pipe in the heating loop that can trap air where possible. It is usually impossible to install a system without having at least one part of the system or heating coil able to trap air. This will not be a problem if the connection to the domestic water lines is made properly, and purge valves and air eliminator devices are installed.

- Following the flushing procedures in the Start-up section will ensure that there is no air in the system after initial set-up.

Follow recommendations supplied by the manufacturer of the heating source being used. **ecosmart** includes a flow switch connection where a flow switch can be connected to allow for domestic water priority. Note: the correct type of flow switch is a normally open (NO) device. The flow switch contacts close when domestic water is flowing.

Check Valve

A check valve may be required for your system to meet local codes and to work effectively. A check valve:

- Protects against back-flow of water to avoid short circuiting around the water heater during domestic use
- Protects against thermal siphoning
- Is required in all potable water systems

Drain Pan

A drain pan is recommended underneath the appliance for all installations in case of heat exchanger failure.

Pump

A pump is not included inside the **ecosmart**. Whether you are using an external pump or an internal built-in pump, it should be sized for the system. Pumps supplied with the heat

generating units can be used as the sole pump provided it meets the needs of the system. This is especially the case in retrofit applications where a much larger pump may have previously been used in the system.
The **ecosmart** includes a built-in variable speed pump controller that can control a standard single speed pump up to 250 watts. Operational modes are as follows:

- When set up in modulating mode, the pump will operate as a continuously variable speed pump
- When set up in step-modulating mode, the pump will operate as a multi-speed pump.
- When set up in basic mode, the pump will operate as a single-speed pump
- The **ecosmart** controller has a built-in pump timer that exercises the pump for 1 minute every 24 hours to prevent the possibility of 'sticking' due to sediment and comply with local codes

Water Heater or Boiler Setup

Follow the manufacturer's installation and start-up instructions of the water heater or boiler. Make sure the equipment is turned off during installation and service. Make certain the equipment has been refilled and all air is purged from the system before turning on the heater.

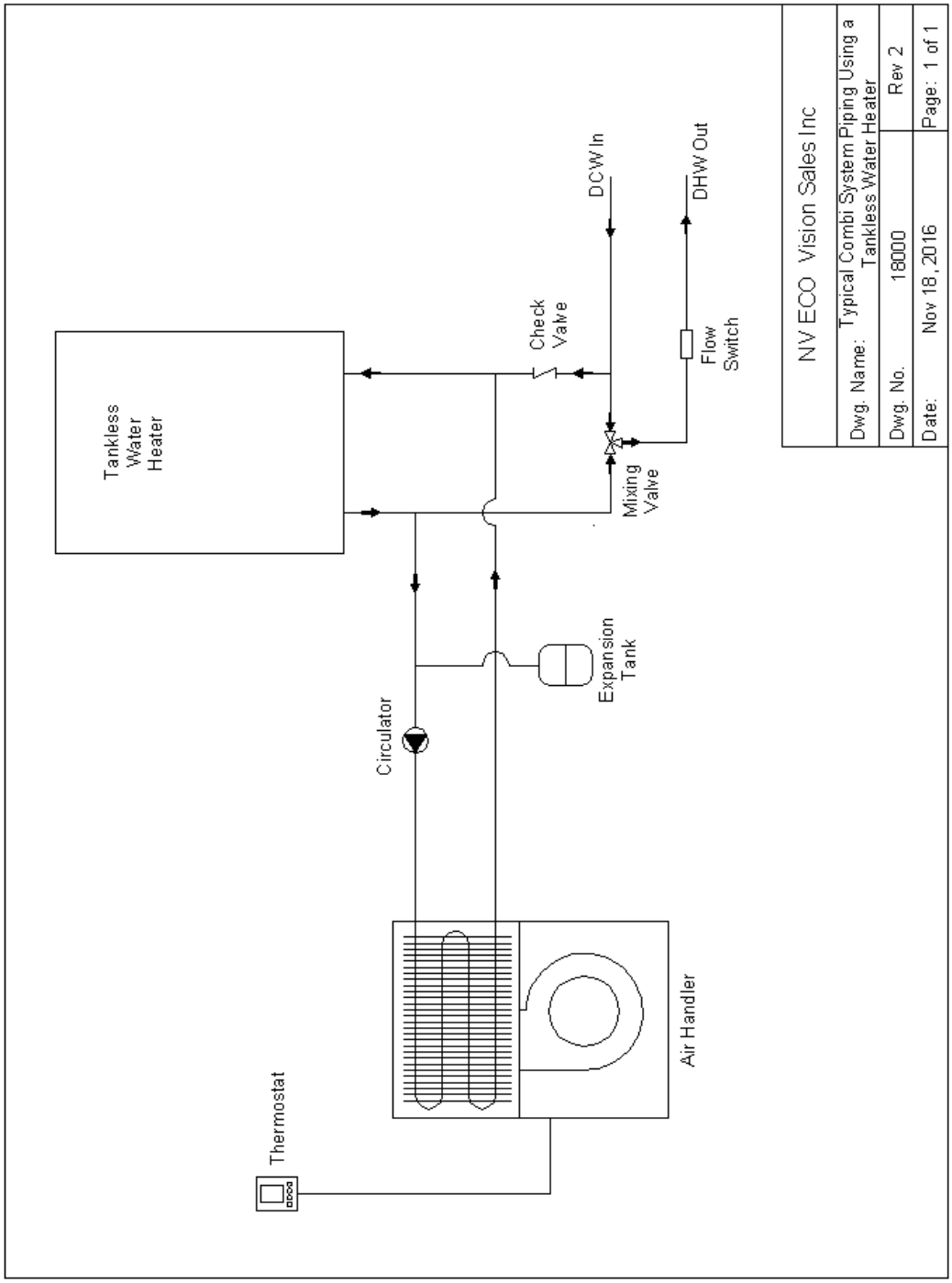
WARNING - When the system requires water temperatures higher than 120F, a mixing valve shall be installed to reduce domestic hot water temperature to safeguard against scalding.

Combo Systems

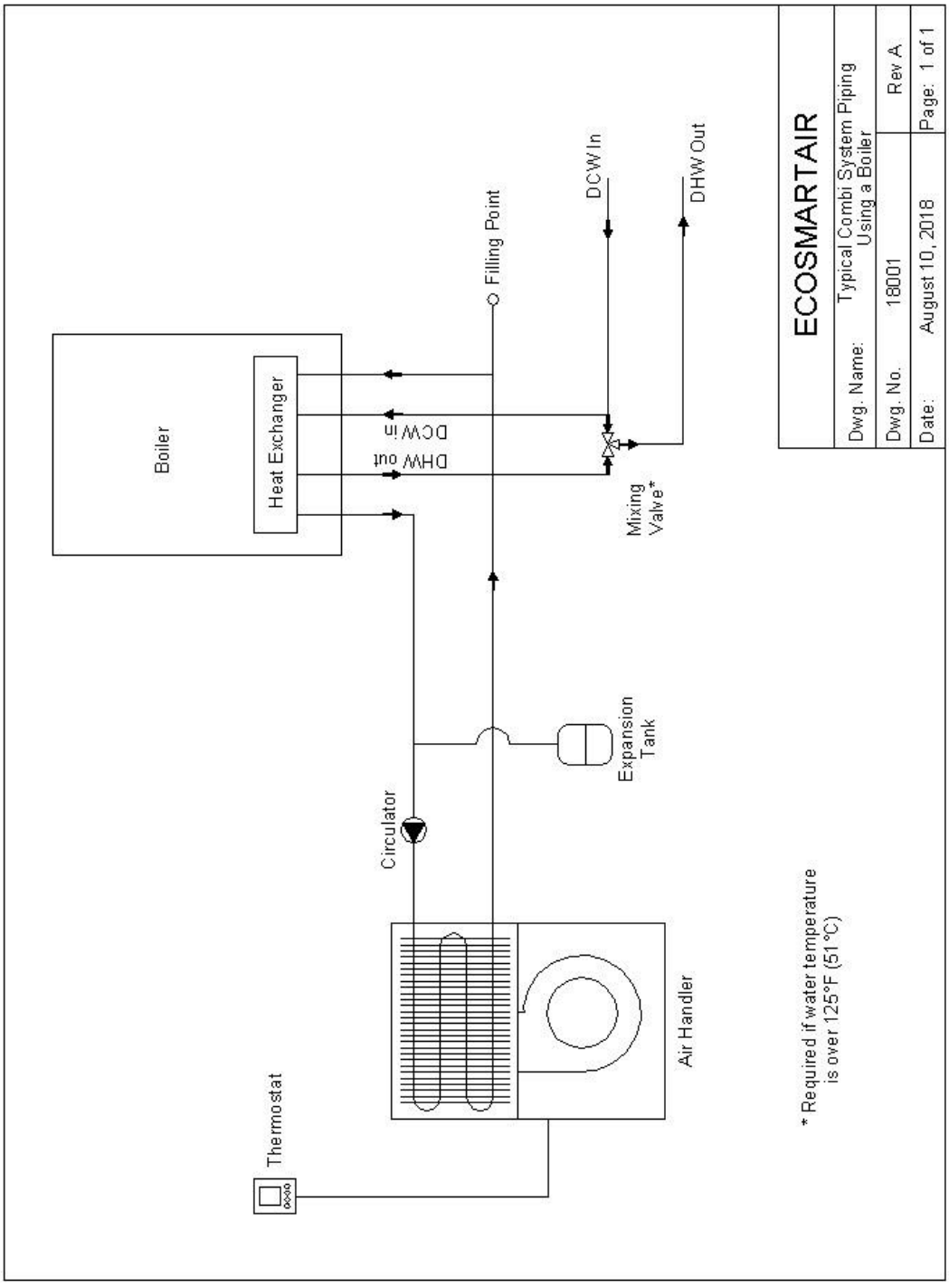
The **ecosmart** is ideal for use in combo systems which provide space heating and domestic hot water from a single heat source. Any properly sized natural gas, propane or oil-fired water heater or boiler will work in a combo system. Make sure any water heater being used is approved for combo applications.

PIPING DIAGRAMS

Tankless Water Heater Piping



Combi-Boiler Piping



ELECTRICAL

WARNING - Make sure the installation meets all national and local electrical codes.

Electrical Information

The ecosmart wiring diagram is located on the cover of the electrical box behind the lower front panel. Ratings data is located on the lower front panel.

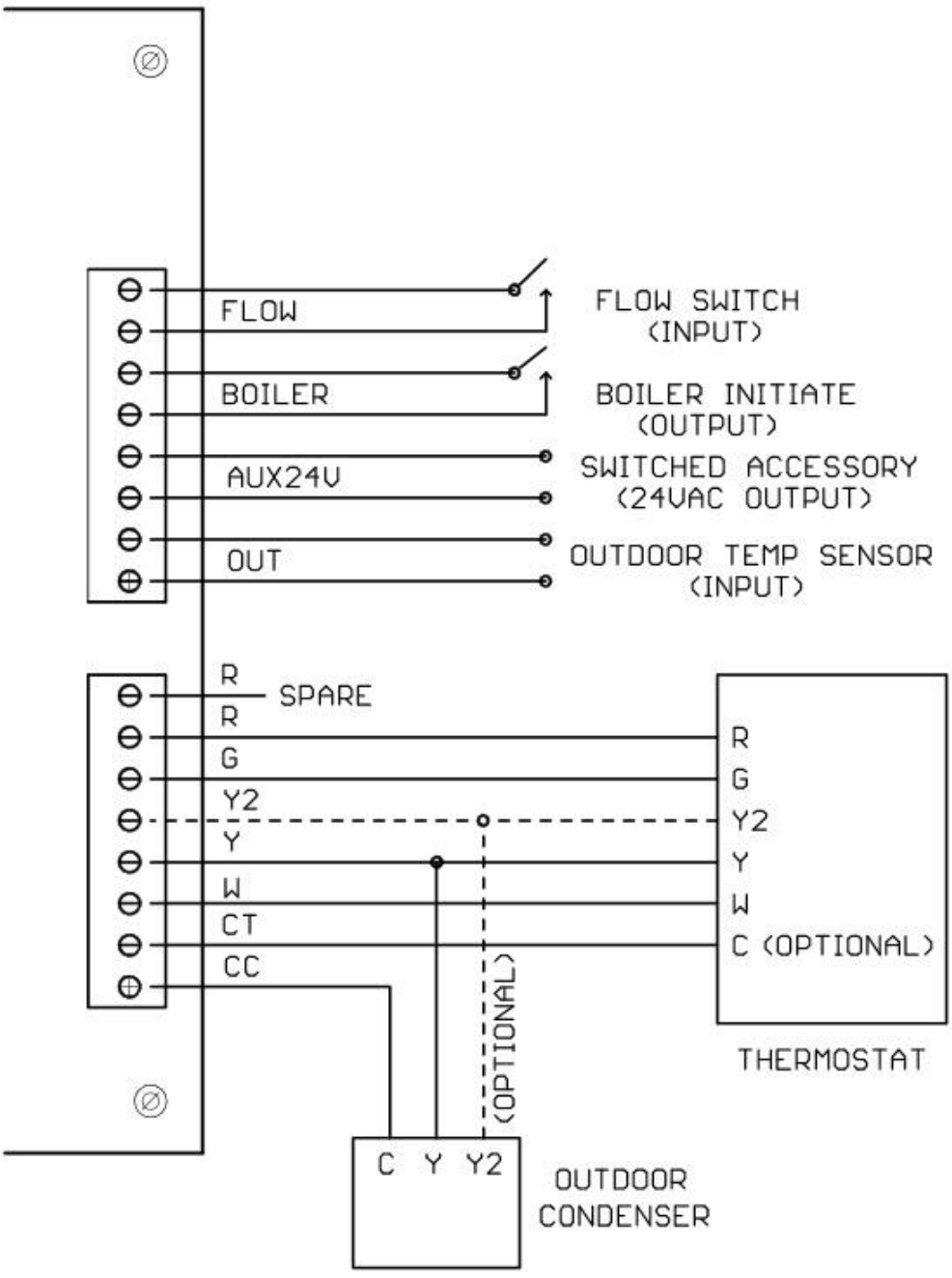
- The ecosmart operates on 120VAC 60Hz single phase line voltage
- All control circuits are standard 24VAC
- **ecosmart** must be grounded via the green wire within the control box

Electrical Connections Made to Quick Connects

- Stranded or solid wire may be used
- Male tab size on control board: 0.250 in x 0.032 in
- Correct female disconnects to mate with male tabs:
    - Wire range: 22-18 AWG (Red) Panduit # DNF18-250 or equivalent
    - Wire range: 16-14 AWG (Blue) Panduit # DNF14-250 or equivalent

Use a quality ratchet crimping tool to ensure reliable connections

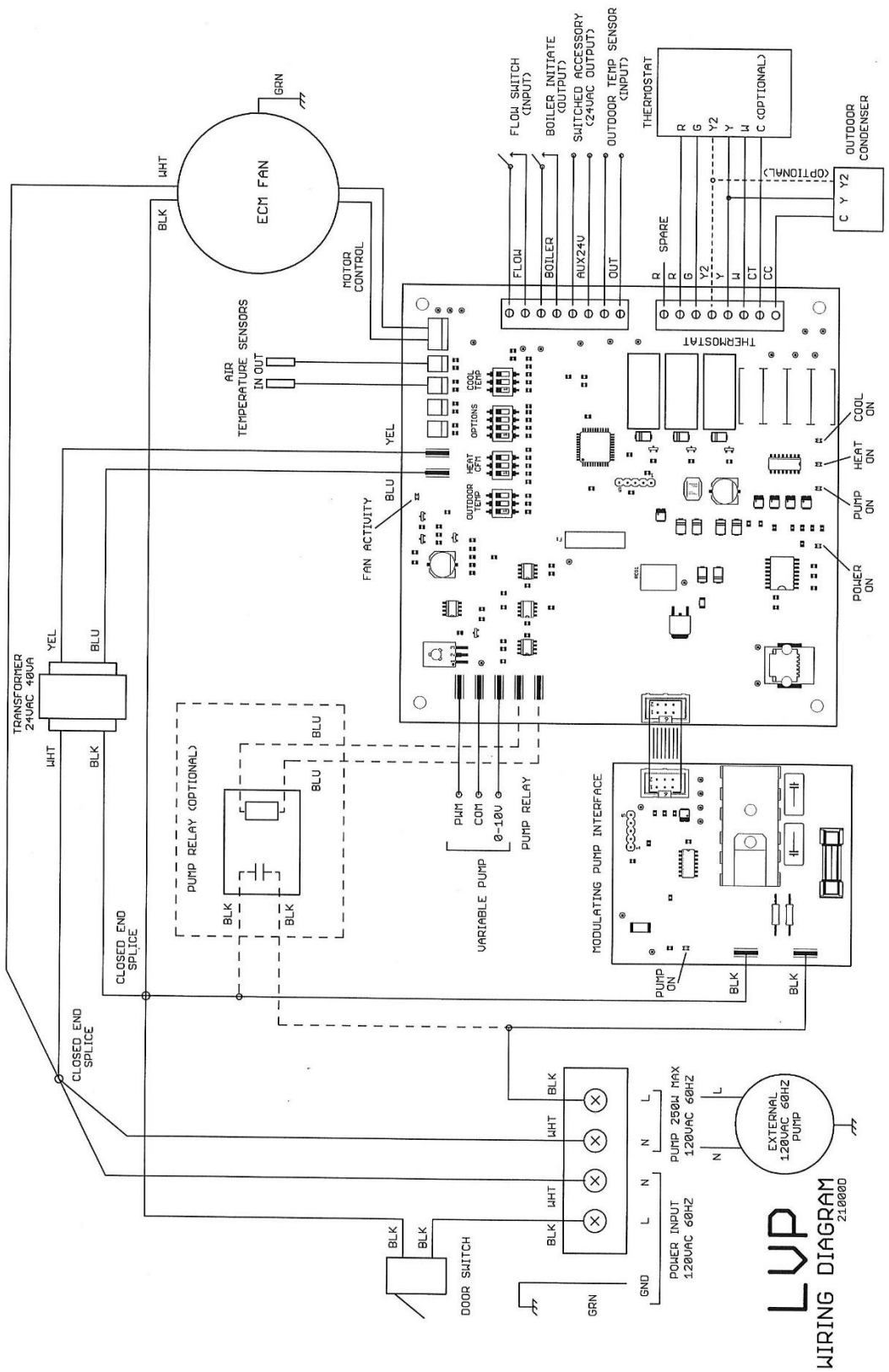
LVP Main Wiring



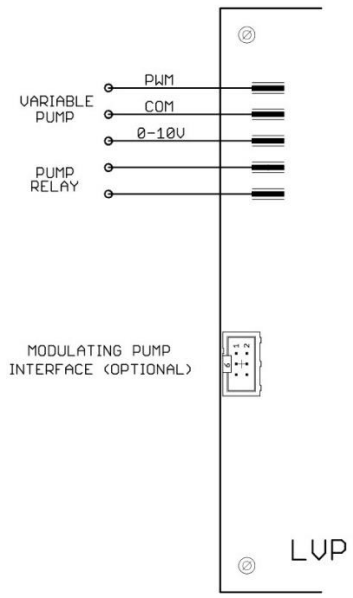
LVP Main Wiring Information

FLOW	When using a water heater and domestic hot water (DHW) priority is required, connect a normally open (NO) flow switch. If there is a call for DHW, fan and pump will shut down after 1 minute. If flow switch is active longer than 30 minutes, fan and pump will resume normal operation.
BOILER	Dry contact to initiate heat source. Active when heating is on.
AUX24V	24VAC output for humidifier or other accessory. Active when heating is on.
OUT	Outdoor temperature sensor connects here. Changes in outdoor temperature causes air handler to modulate fan and pump. If pump drive module P/N 15018 is not installed, and a standard pump relay is used, pump will run at high speed only.
R	Thermostat R connection
R	Thermostat R connection
G	Thermostat G connection
Y2	Thermostat Y2 connection
Y	Thermostat Y connection
W	Thermostat W connection
CT	‘Always On’ C to supply power to ‘Smart’ thermostats.
CC	‘Interrupted’ C for condenser contactor (on when cooling if air out temperature sensor is above 40°F)

LVP Wiring Diagram

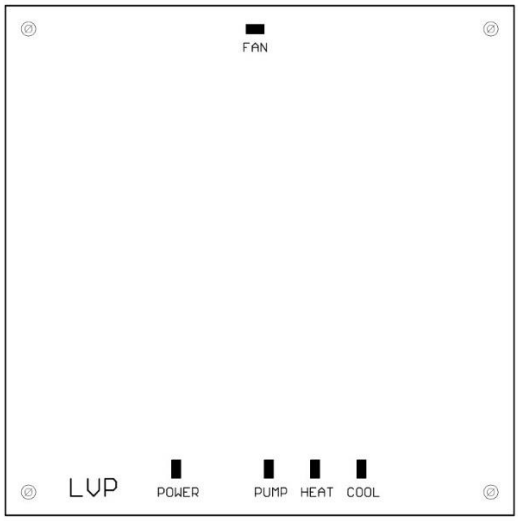


LVP Miscellaneous Wiring



Variable Pump **(additional control interface)**	Output for variable speed pump control. Provides: 0-10V or PWM output. Connect between COM and PWM for PWM output. Connect between COM and 0-10V for variable voltage output. Active when heating.
Pump Relay **(not installed on LVP models)**	24VAC power to activate relay for standard 120VAC pump. Active when heating.
Modulating Pump Module **(standard on LVP models)**	Output for optional pump drive module P/N 15018. Replaces standard pump relay and allows **variable control** of a standard 120VAC pump up to 250W. Active when heating.

LVP Indicator Lights

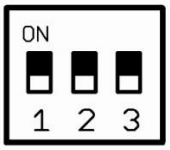


FAN	Lights when fan activity signal is present. Intensity varies with fan speed.
POWER	Lights when 24VAC power is present.
PUMP	Lights when pump is on.
HEAT	Lights when heating.
COOL	Lights when cooling.

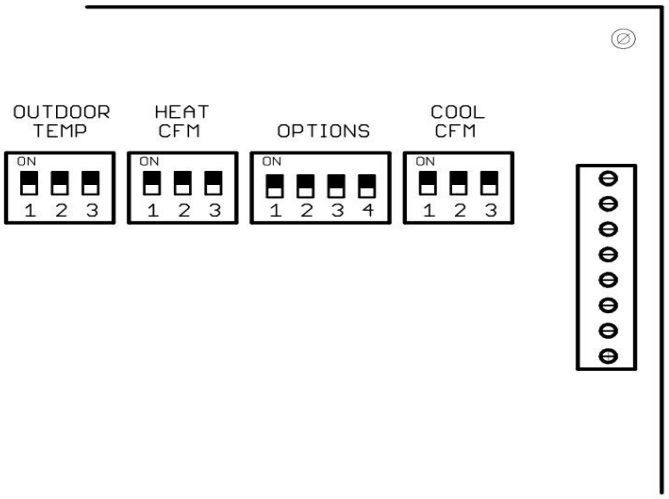
DIP SWITCH OPTIONS

Switch Locations

- Four DIP switches are located on the top, mid-section of the control board.
- WARNING – to prevent damage, use a small screwdriver to change switch position.
- Up is ON as marked on the switch body and are identified with numbers below.



- **OUTDOOR TEMP** – set the lowest outdoor temperature expected
- **HEAT CFM** – set 1 of 8 fan CFM rates for heating
- **OPTIONS** – set various system parameters
- **COOL CFM** – set 1 of 8 fan CFM rates for cooling



Outdoor Temperature Select

Select lowest possible expected outdoor temperature.

DESIGN TEMP °C	DESIGN TEMP °F	SWITCH 1	SWITCH 2	SWITCH 3
< -18	**< 0**	**OFF**	**OFF**	**OFF**
-17 to -10	**1 – 14**	**ON**	**OFF**	**OFF**
-9 to 0	**15 – 32**	**OFF**	**ON**	**OFF**
1 to 10	**33 – 50**	**ON**	**ON**	**OFF**
>10	**>50**	**OFF**	**OFF**	**ON**
NOT USED		**X**	**X**	**X**
NOT USED		**X**	**X**	**X**
NOT USED		**X**	**X**	**X**

Heat CFM (50LVP)

CFM @ 0.5” WC	SWITCH 1	SWITCH 2	SWITCH 3
300	OFF	OFF	OFF
400	ON	OFF	OFF
500	OFF	ON	OFF
600	ON	ON	OFF
700	OFF	OFF	ON
800	ON	OFF	ON
900	OFF	ON	ON

Heat CFM (90LVP)

CFM @ 0.5" WC	SWITCH 1	SWITCH 2	SWITCH 3
400	OFF	OFF	OFF
600	ON	OFF	OFF
700	OFF	ON	OFF
800	ON	ON	OFF
900	OFF	OFF	ON
1000	ON	OFF	ON
1100	OFF	ON	ON
1200	ON	ON	ON

Heat CFM (120LVP)

CFM @ 0.5" WC	SWITCH 1	SWITCH 2	SWITCH 3
1300	OFF	OFF	OFF
1400	ON	OFF	OFF
1500	OFF	ON	OFF
1600	ON	ON	OFF
1700	OFF	OFF	ON
1800	ON	OFF	ON
1900	OFF	ON	ON
2000	ON	ON	ON

Options (50LVP, 90LVP and 120LVP)

Select required system parameters.

Mode	SWITCH 1	SWITCH 2	SWITCH 3	SWITCH 4
Full Modulation	OFF	OFF	X	X
Step Modulation	ON	OFF	X	X
Single Stage	OFF	ON	X	X
Test Mode **(1)**	ON	ON	X	X
Normal Fan Cooling **(2)**	X	X	OFF	X
Dehumidification Fan Cooling **(2)**	X	X	ON	X
Normal Continuous Fan **(3)**	X	X	X	OFF
Low Speed Continuous Fan **(3)**	X	X	X	ON

(1) Test Mode - heat source is brought on, fan runs at HEAT CFM setting and pump runs at full speed irrespective of thermostat setting. Useful for eliminating air in the system during installation.

(2) Normal Fan Cooling runs at rate set by COOL CFM switch.
Dehumidification Fan Cooling runs at 85% of COOL CFM rate for 10 min. ON EACH COOLING CYCLE and then reverts back to rate set by COOL CFM.

(3) Normal Continuous Fan runs at rate set by HEAT CFM switch.
Low speed Continuous Fan runs at 50% of rate set by HEAT CFM switch.

Cool CFM (50LVP)

CFM @ 0.5" WC	SWITCH 1	SWITCH 2	SWITCH 3
300	OFF	OFF	OFF
400	ON	OFF	OFF
500	OFF	ON	OFF
600	ON	ON	OFF
700	OFF	OFF	ON
800	ON	OFF	ON
900	OFF	ON	ON

Cool CFM (90LVP)

CFM @ 0.5" WC	SWITCH 1	SWITCH 2	SWITCH 3
400	OFF	OFF	OFF
600	ON	OFF	OFF
700	OFF	ON	OFF
800	ON	ON	OFF
900	OFF	OFF	ON
1000	ON	OFF	ON
1100	OFF	ON	ON
1200	ON	ON	ON

Cool CFM (120LVP)

CFM @ 0.5" WC	SWITCH 1	SWITCH 2	SWITCH 3
1300	OFF	OFF	OFF
1400	ON	OFF	OFF
1500	OFF	ON	OFF
1600	ON	ON	OFF
1700	OFF	OFF	ON
1800	ON	OFF	ON
1900	OFF	ON	ON
2000	ON	ON	ON

SEQUENCE OF OPERATION

Full Modulation (ecosmart outdoor sensor installed)

Thermostat calls for heat

- R is connected to W
- Heat generator is turned on
- Auxiliary 24VAC power is turned on
- Pump turns on 100%
- After a 15 second delay to allow for system water to heat up coil, fan ramps up to HEAT CFM speed
- **ecosmart** control automatically adjusts fan and pump speeds to meet the outdoor temperature conditions

Thermostat is satisfied

- R is disconnected from W
- Heat generator is turned off
- Auxiliary 24VAC power is turned off
- Pump turns off and fan speed ramps down to zero, extracting any remaining heat in the coil

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Step Modulation (ecosmart outdoor sensor not installed)

Thermostat calls for heat

- R is connected to W
- Heat generator is turned on
- Auxiliary 24VAC power is turned on
- Pump turns on 100%
- After a 15 second delay to allow for system water to heat up coil, fan ramps up to HEAT CFM speed
- **ecosmart** goes through three steps:
    - 50% of HEAT CFM setting for 5 minutes – pump LO
    - 75 % of HEAT CFM for 5 minutes – pump MID
    - 100% of HEAT CFM until thermostat is satisfied – pump HI

Thermostat is satisfied

- R is disconnected from W

- Heat generator is turned off
- Auxiliary 24VAC power is turned off
- Pump turns off and fan speed ramps down to zero, extracting any remaining heat in the coil

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Basic Modulation Mode (ecosmart outdoor sensor not installed)

Thermostat calls for heat

- R is connected to W
- Heat generator is turned on
- Auxiliary 24VAC power is turned on
- Pump turns on at 100%
- After a 15 second delay to allow for system water to heat up coil, fan ramps up to HEAT CFM speed

Thermostat is satisfied

- R is disconnected from W
- Heat generator is turned off
- Auxiliary 24VAC power is turned off
- Pump turns off and fan speed ramps down to zero, extracting any remaining heat in the coil

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Cooling Mode (Modulation, Step and Basic)

(Assumes a condenser and DX coil is installed within the system)

- R is connected to Y or Y2*
- Condenser turns on
- Fan ramps up to COOL CFM setting

* If thermostat and condenser support 2-stage cooling

Thermostat is satisfied

- Condenser turns off
- Fan speed ramps down to zero, extracting any remaining cooling from the DX coil

Dehumidification

When in cooling mode, a dehumidification function can be set using system switch 3 as follows:

- OFF - Normal cooling fan runs at rate set by COOL CFM switch
- ON - fan runs at 85% of COOL CFM rate for 10 min. and then reverts back to rate set by COOL CFM

Fan Mode

- R is connected to G
- If fan is set to "ON" on thermostat, fan runs as follows:
    - If SYSTEM switch 4 is OFF, fan runs at selected HEAT CFM rate
    - If SYSTEM switch 4 is ON, fan runs at 50% of selected HEAT CFM rate
- If fan is set to "OFF" on thermostat, fan runs at HEAT or COOL CFM settings

Constant Low Fan Circulation

Fan may be run at a low rate using system switch 4 as follows:

- OFF – fan runs at rate set by HEAT CFM switch
- ON – fan runs at 50% of rate set by HEAT CFM switch

Condenser Lockout/Freeze Protection

The **ecosmart** is equipped with a condenser lockout/freeze protection sensor to help prevent any damage to the hot water coil from a freeze up. In any mode, heating, cooling or standby, when the outlet air temperature sensor reads a temperature of 40°F or lower the **ecosmart** will bring on the circulating fan and energize the pump. If in cooling mode, the **ecosmart** will also turn on the condenser by breaking the C connection.

Pump Exerciser

- The circulating pump is exercised for 1 min every 24 hr when the **ecosmart** is OFF, COOLING (Y), COOLING2 (Y2) or FAN (G) to prevent the possibility of 'sticking' due to sediment and to meet local codes.
- During the 1 min pump on-time, the fan is turned off and resumes once the pump exercising is completed
- Pump runs continuously if the outlet air temperature drops below 40F to prevent the chance of freezing

SERVICE AND MAINTENANCE

NOTE: The **ecosmart** is not to be used for temporary heat during construction. Use for this purpose will void equipment warranty.

Filter

Inspect the filter monthly and replace, remove and vacuum or rinse as required. A clogged or inadequate filter may void product warranty. Replacement filter size is 16 x 20 x 1.

Coils

Air conditioning and heating coils should not require cleaning if the filter maintenance schedule is adhered to. If a filter is damaged or collapses from plugging, dust may foul the coils. If this happens, replace the filter and carefully vacuum the coils. The coils may need to be removed to gain access to the face of the heating and cooling coils.

Fan and Motor

Check fan for dust once a year. If dirty, vacuum or wash to remove dust. Keeping the fan blades clean will reduce noise and improve capacity and efficiency of the heating system.

TROUBLESHOOTING

Thermostat call error

If the **ecosmart** does not run when the thermostat is calling, remove the thermostat connections at the **ecosmart** and jumper R to W for heating, or R to Y (Y2) to verify if the problem is with the thermostat or **ecosmart** control. Note that some thermostats have a delay (typically five minutes) before they will re-start cooling.

Water heater temperature and pressure relief valve is weeping

A check valve or back-flow preventer may have been installed in the system. Consult water heater manufacturer's instructions. An expansion tank may be required.

Cold water at hot faucet

When the heat source is a water heater, the most probable cause is reverse flow through the heating loop from a stuck check valve - repair or replace valve.

Fan runs for cooling but not for heating

The room thermostat may be connected improperly. Refer to Electrical section or wiring schematic on **ecosmart** for proper installation.

Fan continues to run in cooling mode when thermostat is satisfied

The condenser shuts off but the **ecosmart** fan continues to run. This is often caused by older thermostats that have built-in heat anticipators. When cooling, the heat anticipator, in parallel with the thermostat contacts, allows a small current to flow to the **ecosmart** control board, keeping the fan on. The contactor in the condenser shuts off because it requires more current to stay on. Solution: replace with a modern thermostat which has no heat anticipator.

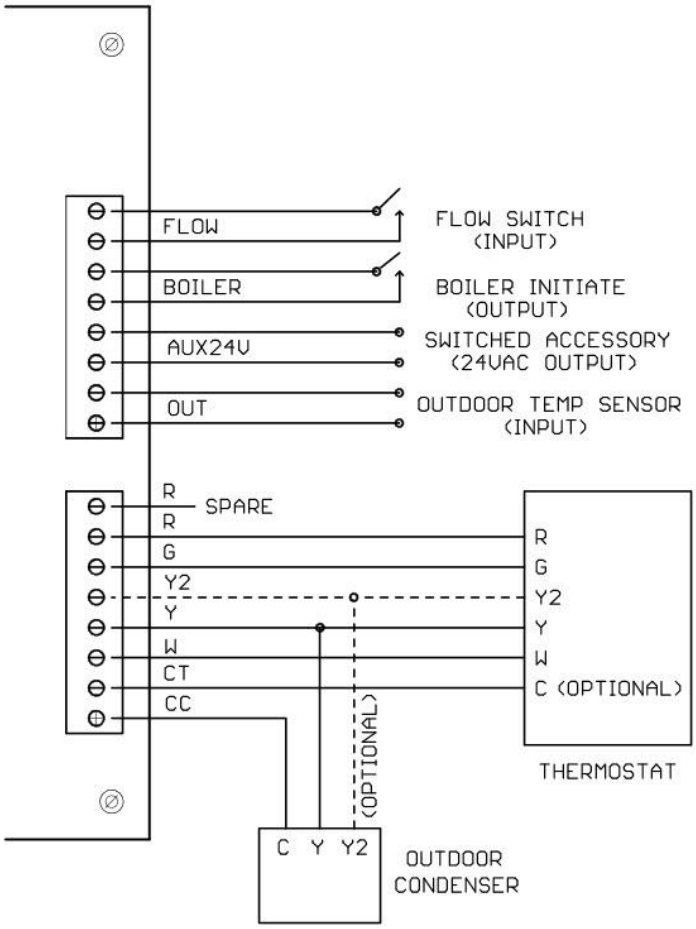
Fan not running

The fan is driven by a variable speed EC motor. The PWM (Pulse Width Modulation) signal generated by the control board at connector has a frequency of 80Hz and an amplitude of 24V and can provide up to 64 speed settings (0 to 100% duty). To determine if the fault is with the control board or the motor, follow these steps:

1. Apply power. POWER indicator should light.
2. No power - check door switch
3. No power – check output of 24VAC transformer.
4. No power – check control board 3A fuse.
5. Jumper R to G to bring on fan
6. Check if FAN indicator lights. Light intensity increases with fan speed. If indicator does not light, replace control board.
7. If fan still does not run, check for 120VAC on power connector at motor.
8. If power is still not present, check continuity of motor power cable.
9. If fan still does not run, check continuity of motor control cable.

Smart/WiFi thermostat not working properly

Standard digital thermostats usually have internal batteries and do not require external power. Smart thermostats may require a constant source of external power for proper operation.
For **thermostat power**, use the **'CT'** connection that is available at all times.
For **condenser contactor power**, use the **'CC'** connection which is on when cooling and the air out temperature sensor is above 40°F.



External pump does not run (sticking issue)

In areas where hard water is present the pump may stick and fail to run. Often, closing the isolation valve on the return leg and opening the drain port so that water flows through the pump can free this. If this fails to free the pump, removal for cleaning or replacement is necessary. The daily pump exerciser will help prevent pump sticking.

External pump does not run (electrical issue)

Standard 120VAC pump not running. Check operation as follows:

1. Jumper R to W or set to test mode: (Options DIP switch 1 and 2 on - fan runs at rate set by HEAT CFM switch and pump runs at full speed).
2. Indicator will light on pump control board and 120VAC should appear on power connector. If pump control indicator does not light, check if cable between main board and pump control board is fully seated.

External pump is noisy at start-up

If sound has not diminished within 1 minute, air may be present in the system and may need re-purging. If the heat source is a water heater, check to make sure branch connections for the heating loop are horizontal to prevent the collecting of air in the loop. Install air eliminating device at high point in system.

Insufficient or no heat

- Check that the heat generator is functioning properly.
- Plugged air filter or coil. Refer to maintenance section for filter care and coil cleaning.
- Air in heating loop - purge system.
- Inlet and outlet connections to **ecosmart** are backwards - reverse connections.
- Supply water temperature set too low or heat generator is not supplying water at the specified setting.
- Restrictions in heating loop - remove restrictions, check if valve is stuck, isolation valves could be too restrictive or left partially closed after purging, or a closed valve.

Heating during standby mode

Probable cause is thermal siphoning.

Pump and fan run continuously (test mode off and no call for heat/cool)

Air out sensor monitors the temperature above the heating coil in the supply airstream and will turn on the pump and fan if temperature goes below 40°F.

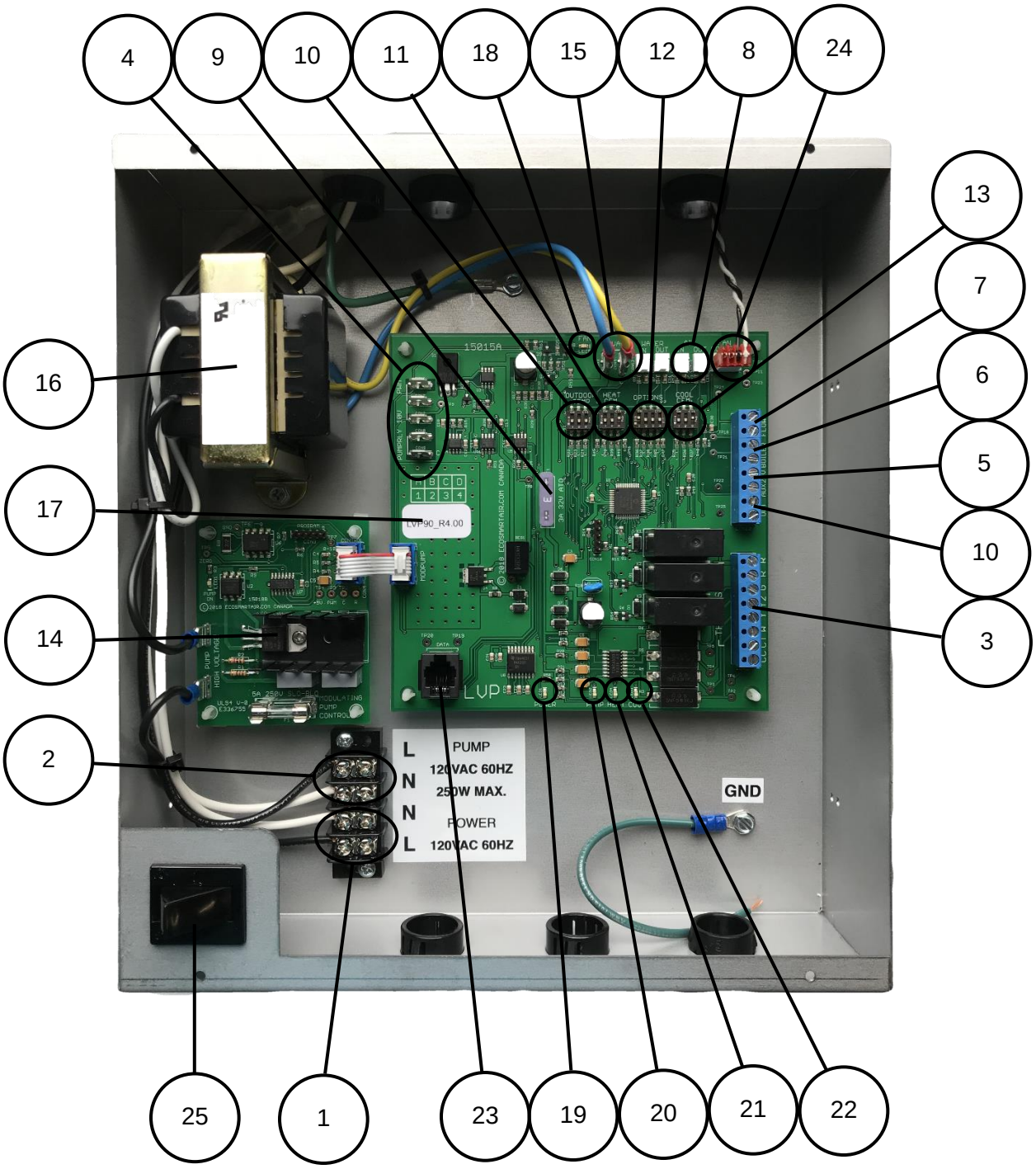
- Make sure Air out temperature sensor plug is properly seated into board connector
- Sensor resistance should be approximately 10K at room temperature

REMOVING BLOWER/CONTROL ASSEMBLY

Blower and control assembly can be removed as a single piece:

- Turn off power to **ecosmart**
- Disconnect AIR OUT temperature sensor (white plug/socket) just above front centre plate and pull up out of the way to prevent damage to the cable when sliding out assembly
- Disconnect power, thermostat and other wiring from within control box
- Undo (Qty. 2) #1/4-20 bolts, lock washers and flat washers
- Slide out blower assembly

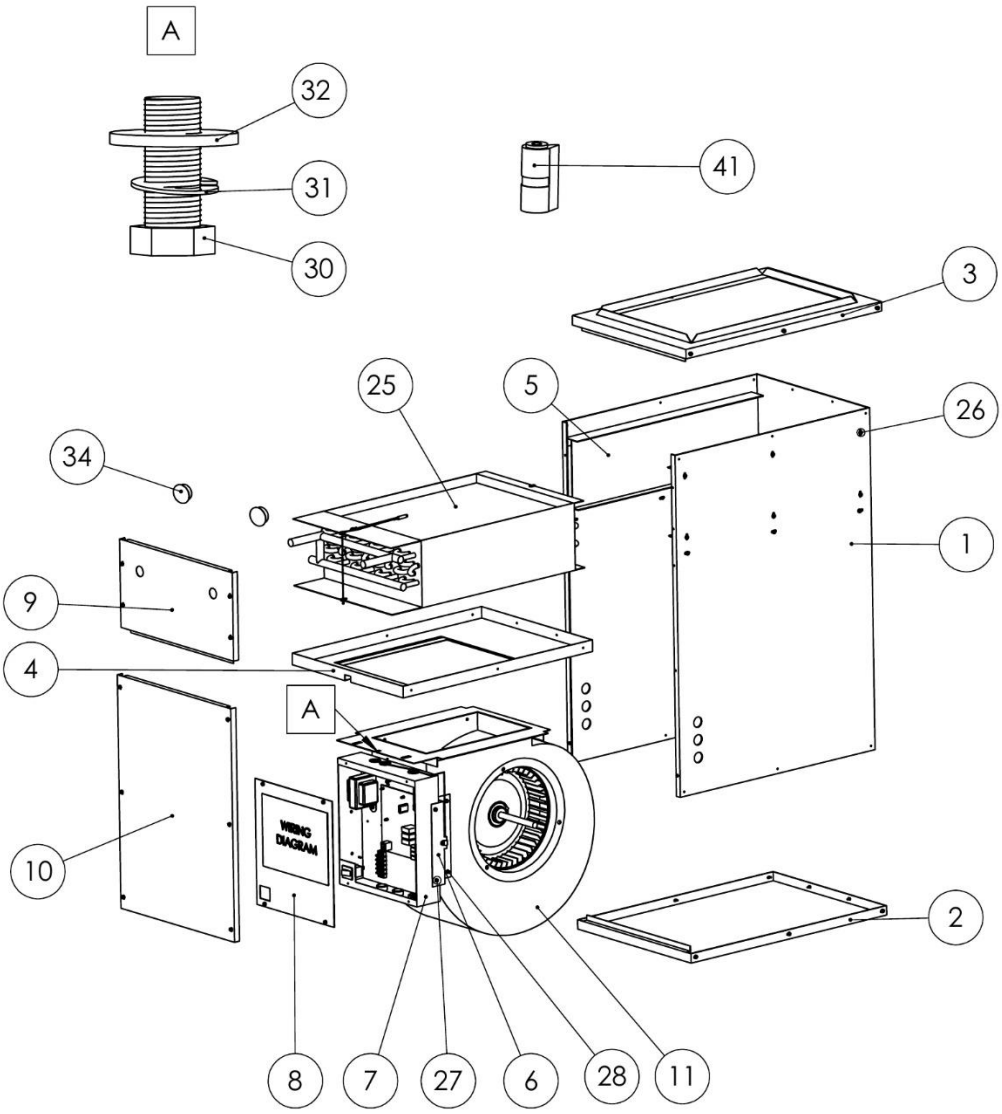
LVP CONTROL ASSEMBLY LAYOUT



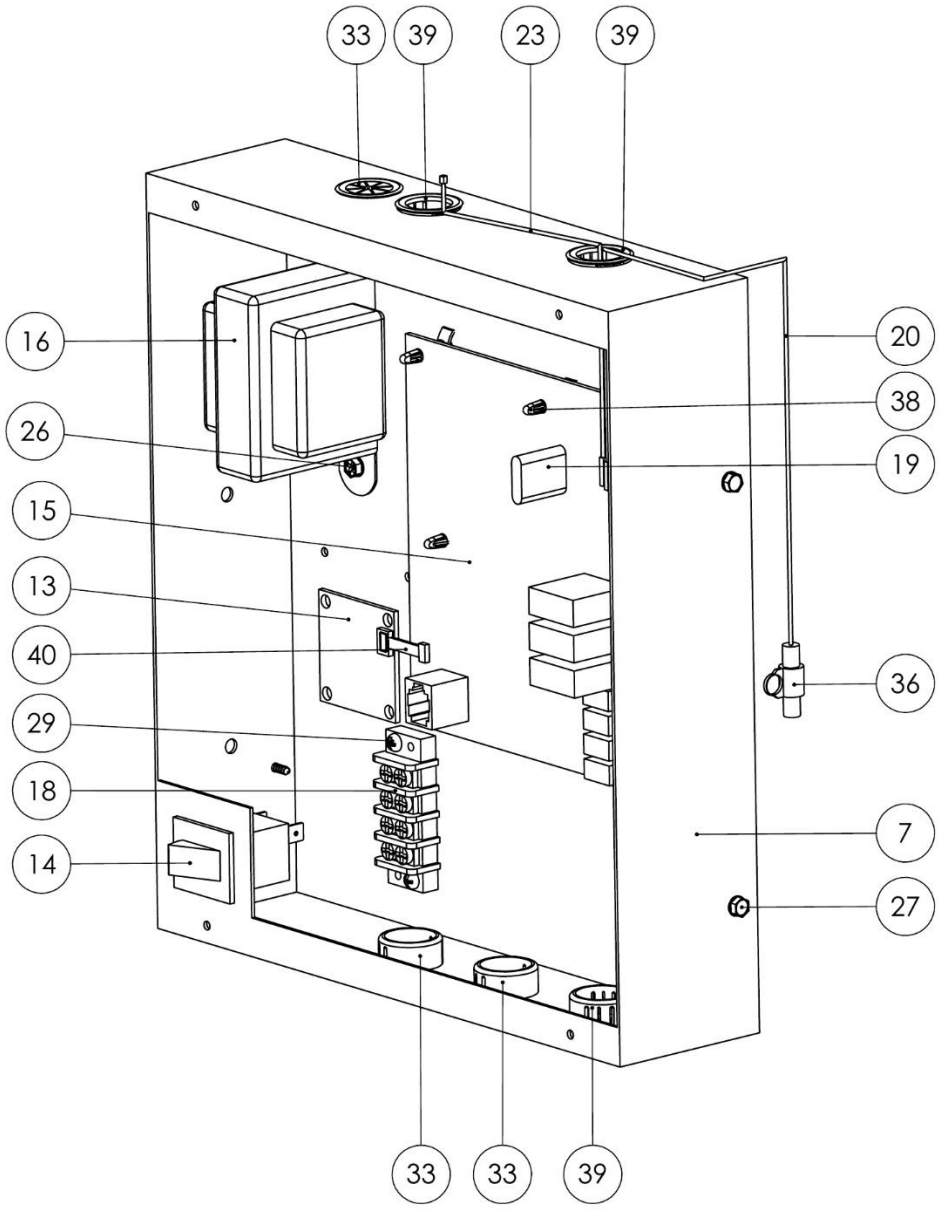
LVP CONTROL ASSEMBLY LEGEND

1	120VAC 60Hz single phase power input
2	120VAC 250W Max. pump output from relay
3	Thermostat connection: R, R, G, Y2, Y, W, CT, CC (R=transformer 24VAC) (CT=thermostat 24VAC com) (CC=interrupted condenser 24VAC com)
4	0-10VDC and PWM output for variable speed pump
5	Auxiliary 24VAC accessory output – active when heating
6	Dry contacts to bring on heat source
7	Flow switch input for domestic hot water priority (active when closed)
8	Air in/out temperature sensors
9	Fuse 3A 32V ATO type
10	Outdoor temperature DIP switch
11	Heat CFM DIP switch
12	Options DIP switch
13	Cool CFM DIP switch
14	Modulating pump control board
15	24VAC input from transformer (Blue = 24VAC, Yellow = 24VAC com)
16	24VAC 40VA transformer
17	Software version identifier
18	Fan operating indicator (Brightness varies with fan speed)
19	Power indicator
20	Pump indicator
21	Heat indicator
22	Cool indicator
23	Diagnostic connector
24	Variable speed output to fan
25	Door switch

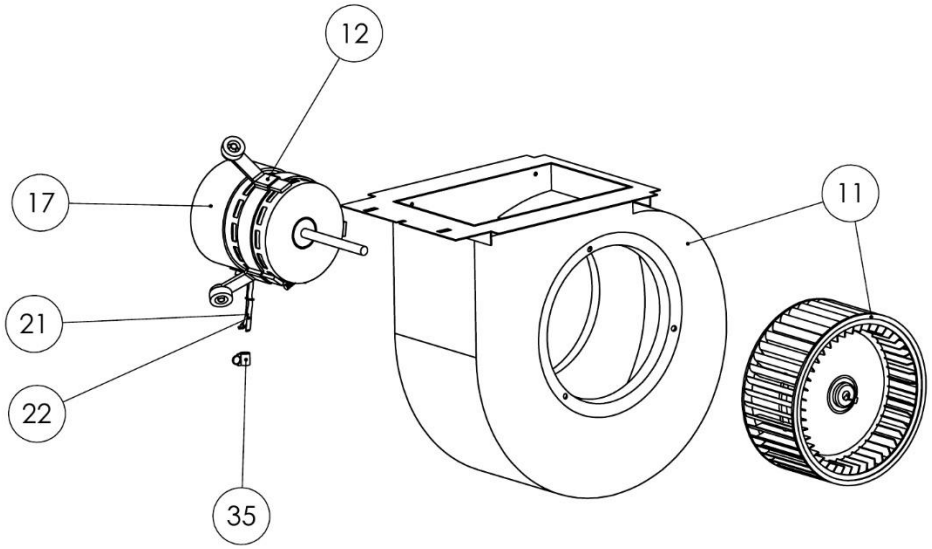
Final Assembly – Exploded View

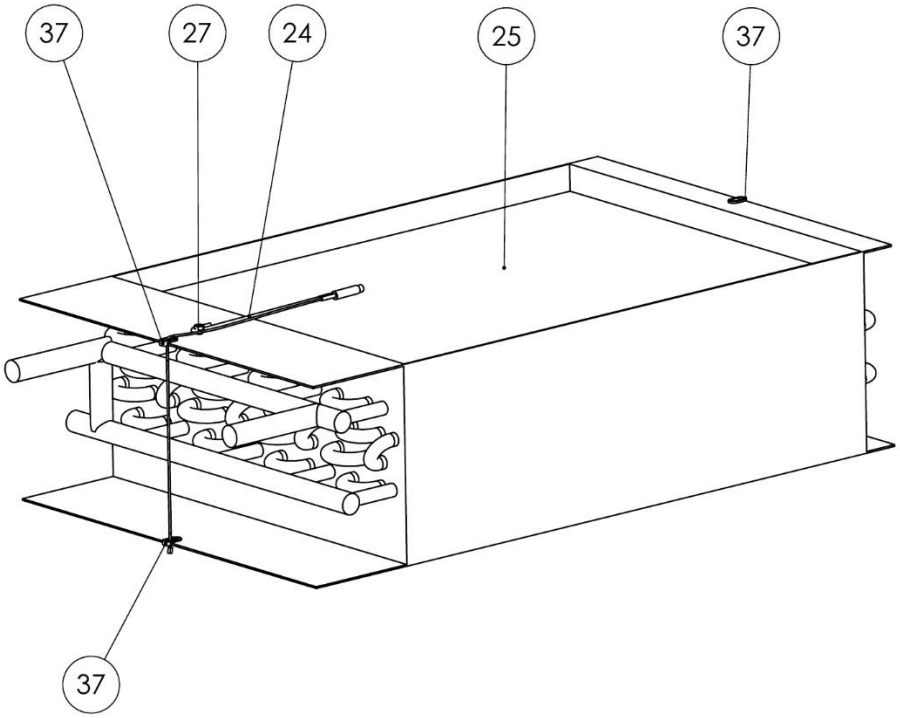


Electrical Box – Exploded View



Blower & Heating Coil – Exploded View





Replacement Parts

Replacement Parts LVP Models					
Item	**Part Number**	**Part Number**	**Part Number**	**Description**	**Qty.**
	50LVP	**90LVP**	**120LVP**		
METALWORK					
1	24041	24042	24043	Wrapper insulated	1
2	24044	24045	24046	Bottom cover insulated	1
3	16015	16002	16049	Top cover	1
4	16016	16003	16056	Centre plate	1
5	16005	16005	16005	Coil rail	2
6	16036	16006	16036	Electrical box support	2
7	16007	16007	16007	Electrical box	1
8	16008	16008	16008	Electrical box cover	1
9	24047	24048	24049	Upper door insulated	1
10	24050	24051	24052	Lower door insulated	1
BLOWER ASSY					
11	16033	16004	16055	Blower assy.	1
12	16035	16035	16035	Motor mount set BB-10-4 (short arm)	1
ELECTRICAL					
13	15018	15018	15018	PCA Ecosmart Pump Controller	1
14	18000	18000	18000	Door Switch	1
15				PCA Ecosmart LVP Controller 24V	1
16	24062	24062	24062	Transformer 120VAC 24VAC 40VA	1
17				Motor EC PerfectSpeed	1
18	18011	18011	18011	Barrier block 20A 4 pos	1
19	18020	18020	18020	Fuse 3A	1
WIRING					
20	20000	20000	20000	Cable assy. temp sensor 10K	1
21	20001	20001	20001	Cable assy. LVP/HVP motor control	1
22	20002	20002	20002	Cable assy. LVP/HVP motor power	1
23	20008	20008	20008	Cable assy. temp sensor extension	1
24	24032	24032	24032	Cable assy. supply temp sensor	1
Heating Coil					
25	17006	17002	17008	Hydronic Heating coil	1

HARDWARE					
26	19000	19000	19000	Screw Selftap #8 x 3/8in Type AB Hex/PHP Zinc	50
27	19001	19001	19001	Screw Selftap #8 x 3/8in Type B Slotted/Hex Serrated Zinc	10
28	19018	19018	19018	Screw Selftap #8 x 3/8in Type Selfdrill Hex Zinc	4
29	19011	19011	19011	Screw Selftap #6 x 1/2in Type A PNP Zinc	2
30	19015	19015	19015	Bolt 1/4 x 20 x 3/4in zinc	2
31	19016	19016	19016	Lockwasher 1/4in zinc	2
32	19017	19017	19017	Washer 1/4in zinc	2
33	19012	19012	19012	Bushing universal 0.875 blk	3
34	19007	19008	19008	Dome plug blk	2
35	19013	19013	19013	Cable clip 7/16in blk	1
36	19014	19014	19014	Cable clip 3/16in blk	1
37	19003	19003	19003	Grommet 0.625OD 0.312ID blk	4
38	19004	19004	19004	Control board support	8
39	19026	19026	19026	Bushing snap 0.875 blk	3
40	24071	24071	24071	Cable assy. Pump Controller	1
41	22000	22000	22000	Outdoor Temp. Sensor 10K	1
MISC					
	14000	14000	14000	Ecosmart LVP Installation, Operation and Maintenance Manual	1
	14003	14003	14003	Ecosmart LVP brochure	1

WARRANTY

Warranty is 3 years' parts. Visit **ecosmartair.com** for full details.