

Forceflow - LST Fan Convector

Installation, Servicing and Maintenance Instructions

(Issue 3 – 05/02/07)



Description

The Low Surface Temperature (LST) Forceflow Fan Convactor uses active control to maintain the surface temperatures of the unit within the 43°C limit indicated by NHS Estates document "Health Guidance Note – 'Safe' hot water and surface temperatures".

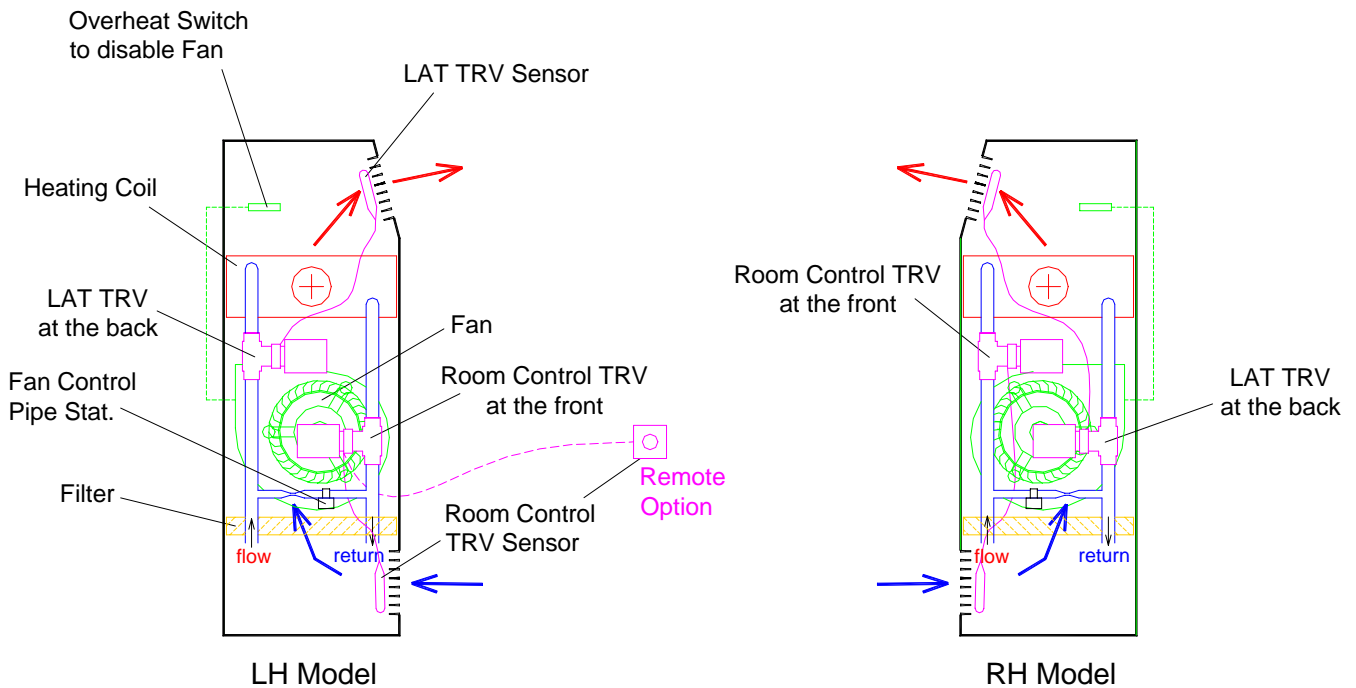


Figure 1 – Forceflow LST Fan Convectors

In common with a typical fan convector the unit has a motorised fan, heating coil and air filter housed within a painted sheet steel casing. Room air is entrained into the bottom return grille and a heated stream of air is discharged from the top grille to heat the conditioned space.

Figure 1 shows the basic components of the unit. A Leaving Air Temperature, Thermostatic Radiator Valve (LAT TRV) with control head sensor located in the air discharge of the unit is fitted in the heating coil pipework. By automatically adjusting the flow rate of the water through the heating coil the temperature of the air that blows out of the unit is controlled so the casing will not go above 43°C. This LAT TRV is pre-set by Biddle in its factory and then locked so it cannot be reset by the end user or persons on site.

A Room Control, Thermostatic Radiator Valve (Room Control TRV), with control head sensor located within the air inlet of the unit (or located remotely in the conditioned space as an option) is also fitted in the heating coil pipework. By adjusting the water flow rate the temperature of the

air in the conditioned space that the LST fan convector serves is automatically controlled. This Room Control TRV can be adjusted by the installer at the time of commissioning, or by the end user (if remote option), to achieve a satisfactory room air temperature for comfort heating. The Room Control TRV will not compromise the action of the LAT TRV in maintaining surface temperatures to no more than 43°C.

To ensure the low surface temperature safety of the unit a overheat switch is located in the air discharge and will disable the fan if the LAT TRV should fail and not control the surface temperature. In this situation, without the fan operating, surface temperatures will not go above 43°C and the unit will operate as a natural convector giving approximately 10% of maximum catalogue heating output. The overheat switch is a manual reset device and requires a Technician using tools to reset the switch and investigate why it tripped.

The fan switches on when the integral Fan Control Pipe Thermostat, fitted on the by-pass pipe, detects hot water at above 45°C at the start of an occupied period (e.g. heating system starting up early morning). The fan will switch off when the heating system has turned off at the end of an occupied period and the water in the heating system has cooled below 35°C (approximately 30 minutes lag). This "global" switching system means that turning the heating system on and off controls the fan On/Off for all the LST fan convectors in the building. The fan will be on continuously when the fan control pipe thermostat detects hot water, this is quite normal. The fan speed can be set to one of three fan speeds at the time of commissioning.

Design Considerations

LPHW water flow temperatures can vary between 70°C and 90°C and the Biddle LST Active Control "patent applied for" will maintain safe surface temperatures and provide the maximum heat outputs as given in Table 1. Water flow temperatures below 70°C will still provide heat output but below that given in Table 1.

NB. If using the LST Forceflow on compensated water circuits this should not present a problem as lower heat output in this situation is then desirable. A water flow temperature of 60°C will provide c.65% of Table 1 heat output and a water flow temperature of 50°C will provide 45% of Table 1 heat output.

A permanent electrical supply must be made to the unit via a local isolator with 3mm contact separation on both live and neutral poles. The unit must be earthed. The unit **must not** be controlled on and off via a timed or manual switched electrical supply as this will start and stop the unnecessarily. Fan On/Off must only be via the integral fan control pipe thermostat when it detects hot water at above approximately 45°C. The electrical supply to the unit must be left permanently energised except in the case of an emergency or for servicing the unit. A sticker with the wording "To be left on during normal operation" is included with the unit and must be affixed to the local electrical isolator by the installer. The Biddle remote switch box cannot be used with the Forceflow LST Fan Convector.

The maximum heat outputs and corresponding water flow rates for 80°C water flow temperature shown in Table 1, are for when the Room Control TRV is fully open, i.e. the design day condition. Higher water flow rates will not produce higher heat outputs, just higher pressure drops. This is because the leaving air temperature is fixed by the LAT TRV to achieve a safe low surface temperature. Only an increase in fan speed and/or a decrease in return air temperature to the unit below 20°C will give higher heat outputs than those shown in Table 1.

Size	Fan Speed	Air Volume (l/s)	Max. Heat Output @ Flow/Return temp. and 20°C EAT (kW)	Water Flow Rate @ 80°C flow temp. (l/s)	Hydraulic Pressure Drop (kPa)
915	high	118	2.83 @ 80/63°C	0.041	1.6
	medium	87	2.09 @ 80/62°C	0.028	0.8
	low	59	1.42 @ 80/61°C	0.018	0.3
930	high	190	4.56 @ 80/59°C	0.051	2.4
	medium	176	4.22 @ 80/60°C	0.047	2.2
	low	104	2.50 @ 80/60°C	0.028	0.8
935	high	254	6.40 @ 80/57°C	0.068	4.5
	medium	202	5.10 @ 80/58°C	0.057	3.2
	low	136	3.43 @ 80/59°C	0.040	1.6
940	high	318	8.01 @ 80/52°C	0.070	5.0
	medium	249	6.28 @ 80/54°C	0.059	3.4
	low	164	4.13 @ 80/56°C	0.042	1.8
975	high	465	11.72 @ 80/55°C	0.114	9.8
	medium	408	10.28 @ 80/55°C	0.100	7.7
	low	250	6.30 @ 80/55°C	0.062	3.0

Table 1

Please note that the water flow rates, water return temperatures and hydraulic pressure drops are shown above for a water flow temperature of 80°C. This is with the unit operating at maximum output (i.e. with the Room Control TRV fully open). Design water flow rates, water return temperatures and hydraulic pressure drops will be different for other water flow temperatures, i.e. 70°C or 90°C. Contact the Biddle Sales office for details.

To explain this it must be understood that the maximum heat output is determined solely by the airside equation with the Room Control TRV fully open and the LAT TRV controlling the Leaving Air Temperature (LAT) so that maximum case temperatures are 43°C, i.e.

$$\text{Air Volume} \times 1.2 \times \text{Increase in Air Temp} = \text{Heat Output}$$

For a 930 size unit at medium fan speed this would be :-

$$0.176 \times 1.2 \times (40^\circ\text{C LAT} - 20^\circ\text{C EAT}) = 4.22 \text{ kW}$$

Where 40°C LAT is the mean off coil temperature to ensure that no part of the casework of the unit is hotter than 43°C and 20°C EAT is the entering air temperature of room air back into the unit.

The hydraulic pressure drop in column 6 of Table 1 refers to the pressure drop across all the components within the unit, i.e. LAT TRV + Heating Coil + Room Control TRV at the water flow rate given in column 5.

To achieve this maximum heat output with 80°C water flow temperature the flow rate of the water has to be set as per that shown in Table 1 and this results in the water return temperatures in column 4. Whilst these water temperature differentials are somewhat higher than normally seen they should not present a problem to the designer, on the contrary it can be argued that they benefit boiler efficiency.

Do not use a pump more powerful than is required to achieve the design water flow rates with the hydraulic pressure drops given. The differential pressure over the thermostatic valves must not exceed 20kPa (0.2 bar) even if the valves have shut down or the valve seat will lift compromising the LST performance of the unit, whereon the manual reset overheat switch will turn off the fan. If it is believed that high differential pressures will occur in the partial load condition (i.e. TRV head throttling down) a suitable differential pressure regulating device must be fitted across the flow and return pipework to each unit.

For design of the electrical installation the full load current and starting current for the unit are as shown in Table 2.

Size	Full Load Current (Amps)	Start Current (Amps)
915	0.33	0.47
930	0.49	0.68
935	0.45	0.67
940	0.50	0.68
975	1.70	3.55

Table 2

It is important to note that the unit may not operate as a low surface temperature heat emitter until approximately 30 minutes after first turning on from cold via the integral fan control pipe thermostat and should not be relied upon as being LST until then. A slight over temperature could occur during this initial warm-up period, which would usually be when the building is unoccupied. If the unit is operated continuously, such as is typical in hospitals, retirement homes, etc. it will always be LST as demonstrated during its trials at the BSRIA Test House.

Installation

Decide on the best location for the fan convector. This is often adjacent to a cold zone in the room such as under a window or against an external wall.

Remove protective cardboard outer packaging and any polystyrene padding. You should have received the fan convector in perfect condition. Please advise us within 5 days of receipt if it is damaged in any way whatsoever.

Remove the front access panel (2 screws or 2 key locks) and offer the unit up to its intended location and mark where the flow and return water pipes will enter the unit through the rectangular entry hole in the base of the casing. Electrical connection is made to the unit at the opposite end of the casing to the pipe connections. This can be done via the cable entry point at the bottom of the side panel, using the cable gland supplied, or the rectangular hole in the base of the unit

NB. The unit can be manufactured with RH or LH pipe connections at the factory to suit the installation. It is not possible to change pipework handing once the unit is on site.

Fix the unit to the wall using four suitable fixings via the keyhole slots in the rear panel and connect water and electrical connections. The flow (inlet) pipe must be connected to the 22mm copper pipe connection marked "FLOW" or the unit will be non-LST and unsafe (See Figure 1 on front page). The return (outlet) pipe must then be connected to the 22mm copper pipe connection marked "RETURN". Ensure the direction of flow of site pipework is correct or the unit will be non-LST and unsafe. For units with LH pipe connections (viewed from the front) the flow pipe is at the rear, for units with RH connections the flow pipe is at the front. A double check should be carried out using the direction of flow arrows engraved on the TRV Valve bodies. 22mm compression fittings should be used to connect to the flow and return connections. Do not use heat in this area when connecting pipework.

A permanent electrical supply must be made to the unit via a local isolator with 3mm contact separation on both live and neutral poles. The unit must be earthed. See Wiring Diagram – Figure 3. A sticker entitled "To be left on during normal operation" is included with the unit and must be affixed to the local electrical isolator by the installer.

If a Remote Room Control TRV, Sensor Head is being used the sensor head should be positioned in a suitable location within the room in accordance with the instructions that accompany the sensor head. The capillary should then be fed back to the fan convector via the square entry hole in the base of the casing and connected onto the Room Control TRV (front TRV). See Figure 2 below. Ensure the large chrome knurled fixing nut that holds the sensor capillary head to the valve body is tight. Using pump pliers, or equivalent, "nip up" the fixing nut just past hand tight, no tighter.

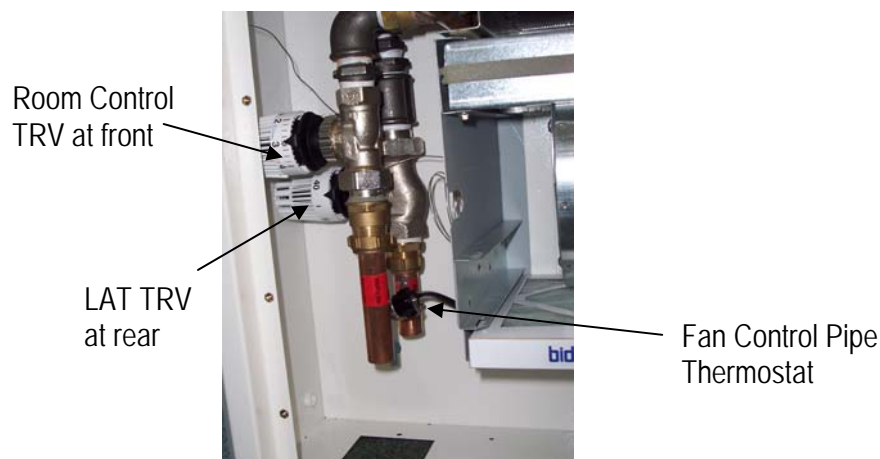


Figure 2 – (LH Pipe Connections shown)

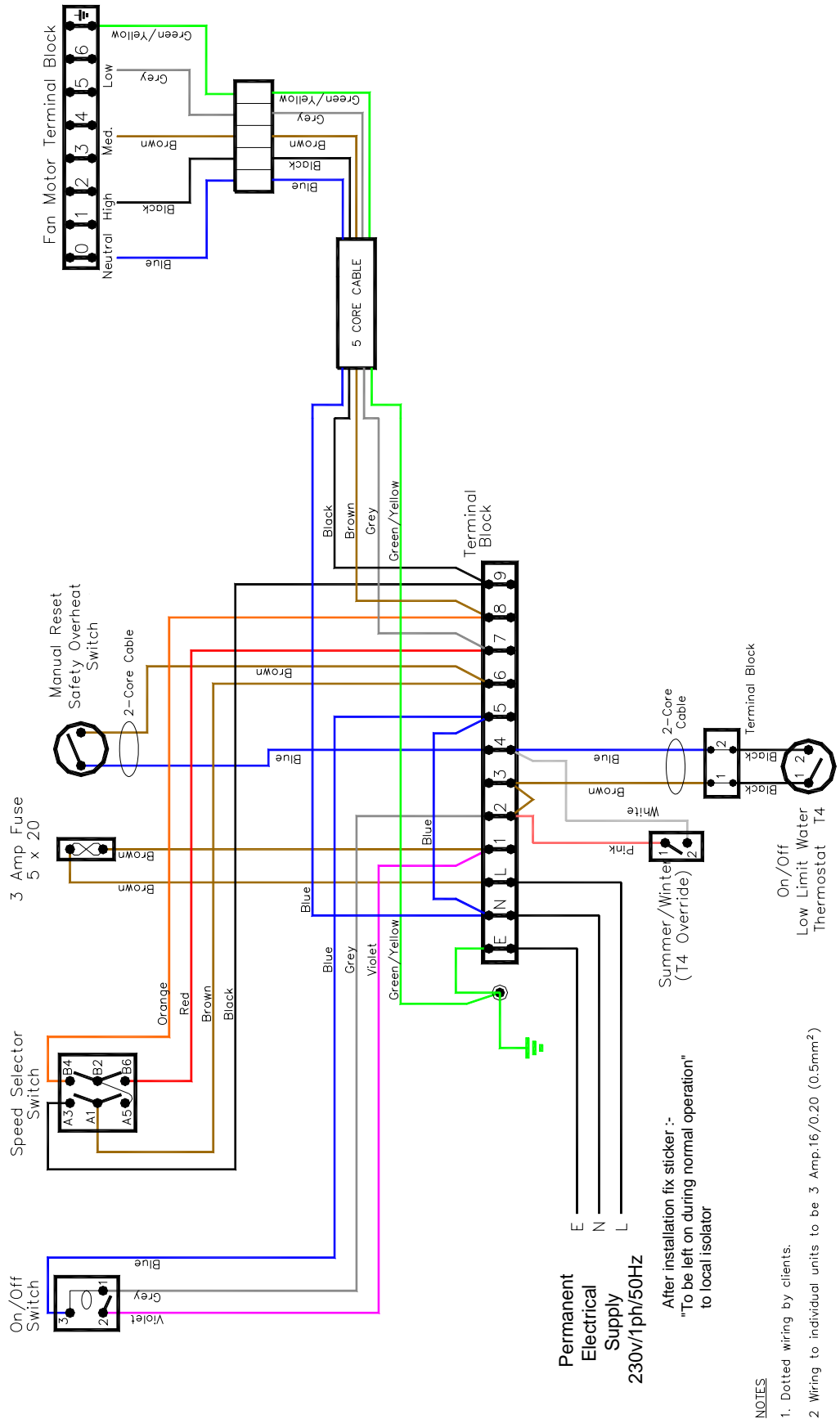


Figure 3 – Wiring Diagram

Commissioning

Remove front access panel (2 screws or 2 key locks). Switch on electrical power to unit.

On the integral control panel (See Figure 4) set the Summer/Winter Switch to summer and the On/Off Switch to On and the fan should operate. Switch the fan through all three speeds with the fan speed selector switch (High, Medium and Low) and check fan speeds correspond. Set the fan speed to Low or Medium or High, this will be the speed the unit is then permanently set to run on.

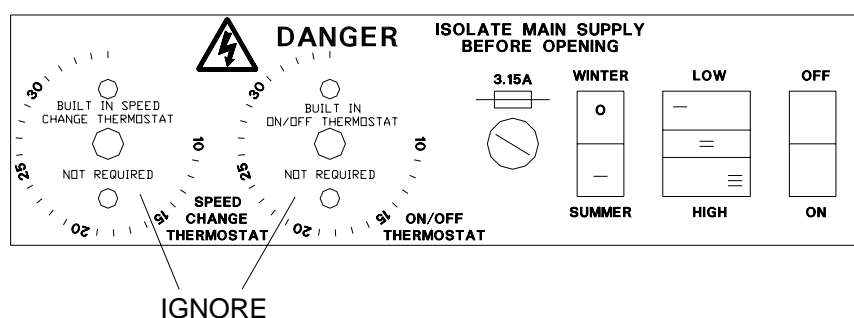


Figure 4 – Integral Control Panel

If the Room Control TRV (front TRV, see Figures 1 & 2) has the room sensor head pre-fitted inside the unit adjust this to the required temperature setting, see Table 3. Check that the large chrome knurled fixing nut that holds the sensor head to the valve body is still tight. Using pump pliers, or equivalent, check the fixing nut is “nipped up” just past hand tight, no tighter.

Setting Position	1		2		3		4	5
Approx. Room Temperature	12	14	16	18	20	22	24	28

Table 3 – Room Control TRV Settings

The LAT TRV (rear TRV, see Figures 1 & 2) is factory set and locked at the correct setting. It must not be tampered with under any circumstances. The valve head should be fixed tight onto the valve body at the factory. Check that the large chrome knurled fixing nut that holds the valve head to the valve body is still tight. Using pump pliers, or equivalent, check the fixing nut is “nipped up” just past hand tight, no tighter.

Set the Summer/Winter Switch to the winter position and the fan should turn off.

With the heating system operating ensure the by-pass pipe gets hot and the fan operates after a short delay. If fan does not operate check that the overheat switch has not tripped, reset if necessary via reset button on underside of switch. Replace the front access panel.

Servicing

Before carrying out any service work isolate the unit from the power supply and ensure it cannot be accidentally restored by unauthorised personnel. Remove front access panel (2 screws or 2 key locks).

The standard cardboard frame panel filter is not designed to be cleaned and should be replaced at appropriate intervals, which will vary from site to site. Clean the coil and fans by vacuuming. Carry out the checks as described above in "Commissioning" and replace the front access panel.

Repair and Maintenance

Short list of spare parts relevant to the Forceflow LST Fan Convecter is shown in Table 4 :-

Part Name	Biddle Part No.
Room Control TRV or LAT TRV – Valve Body 1 in.	0308101
Room Control TRV – Head	0308102
optional Remote Room Control TRV - Head	0308104
LAT TRV – Head	0308103
Overheat Switch	0803100
Fan Control Pipe Thermostat	0307001

Table 4

Because of the critical nature of the unit operating within LST constraints it is very important that if components should fail they are replaced correctly. We therefore recommend that Biddle Air Systems carry out such work unless a fully qualified Technician is available.

Copyright and trademarks

All the information and drawings in these instructions are the property of Biddle and may not be used (other than for the actual operation of the device), photocopied, duplicated, translated and/or be brought to the attention of third parties without Biddle's written permission.

The name Biddle is a registered trademark.

Guarantee

The guarantee conditions form part of the terms of delivery.

Delivery of Units

If any items of the delivery have sustained damage through transit or otherwise please contact us at the address below within 5 days

Liability for the contents of this guide:

Care has been taken in compiling these instructions to ensure they are correct, although Biddle disclaims all liability for damage resulting from any inaccuracies and/or deficiencies in this documentation.

Should you find any errors or ambiguities in these instructions we would be pleased to hear from you as it helps us to improve our documentation further.

Biddle retains the right to change the specifications stated in these instructions.

Biddle Air Systems Ltd.
St. Mary's Road, Nuneaton
Warwickshire. CV11 5AU
United Kingdom
Tel: 024 7638 4233
Fax: 024 7637 3621
Email: sales@biddle-air.co.uk
Web Site: www.biddle-air.co.uk