

ACER

**WALL-HUNG CONDENSING
PREMIX GAS FIRED BOILER
60 – 180 kW**



DESIGN MANUAL



DESIGN MANUAL

General

This Design Manual has been written with the building design consultant in mind and contains all the necessary information to enable the consultant to specify the Acer boiler in a wide variety of applications.

Installation Instructions and Commissioning & Servicing Instructions are available separately and User Instructions are supplied on delivery of the boiler.

If you have any queries relating to the contents of this manual or questions regarding the Beeston Acer boilers or any of our other products, please contact Beeston using the details below.

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Beeston Heating Ltd operates a policy of continual product development and improvement. Specification and literature may therefore change without notice. Please check our web site for product updates.

1 Product description & specification

1.1 General description

The Beeston Acer boiler is a fully modulating high-efficiency condensing boiler employing a 100% pre-mixed combustion system and a high quality stainless steel heat exchanger.



The internal components comprise:

- Gas control valve
- Fully modulating combustion air fan
- Air/gas mixing assembly
- Specially designed stainless steel heat exchanger
- Internal Boiler pump
- Control panel
- Gas & water connection points
- Electrical power & control signal connection points
- Wall mounting bracket

1.2 Method & scope of supply

The Acer boiler is delivered to site in a fully assembled state, complete with mounting bracket, requiring no site assembly.

1.3 Approval and certification

The Acer is fully CE approved for use in UK installation (GB & IE) under CE-Certificate CE0063 BP3254

1.4 Compliance

The boiler complies with all European Directives.

- Boiler efficiency directive.
- Gas appliance directive.
- Electro magnetic compatibility.
- Low voltage equipment directive.

1.5 Efficiency

The Acer boiler can be operated in fully condensing mode. Under the European method for calculating efficiency (where nett calorific value of fuel is used), the Acer boiler can achieve efficiencies of 109%. The appliance fully complies with **Part L** of the Building Regulations.

1.6 Nox emissions

The appliance Nox emissions extremely low – Class 5.

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1.7 Flue classification

The design and approval of the Acer boiler allows it to be operated as a room-sealed appliance or with combustion air being taken from the boiler room. When combustion air is taken from outside, the air inlet does not have to be in the same location as the flue exhaust point, thus providing for maximum flexibility of flueing.

Due to the very low temperature of the flue gases discharged by the Acer boiler, suitable plastic or stainless steel flue systems can be used. **Aluminium flue systems must not be fitted.** The boiler is designed such that a positive flue pressure is available at the exhaust of the boiler. The surplus fan pressure, along with the natural (thermal) draft that is available from the flue installation, can be used to overcome the resistance of the flue system. A wide range of flue system components are available, including separate air and flue gas systems and concentric systems in certain sizes.

1.8 Electrical power supply

The boiler requires single-phase 230V 50Hz supply, via a fused isolation switch, rated at 6A. The on/off isolator should be accessible to the end user to permit isolating the power supply to the appliance if required. All wiring must comply with IEE Wiring regulations (BS7671) and HSE document 635, and the local and national regulations. **(This appliance must be earthed).**

1.9 Controls

The Acer boiler is designed with simple but very flexible control options to permit operation in a wide range of installations and applications.

The boiler automatically adjusts its operation to the demand for heat, by regulating the burner modulation range of 25% to 100% of the boiler's maximum output.

1.9.1 Control inputs

There are a variety of input signal devices that can be connected to the boiler.

- On-off thermostat with or without timer.
- BMS or Energy management system.
- External temperature sensor for weather compensation.
- Remote modulation room temperature and timecontrol.
- 0-10V DC signal from an external controller.

1.9.2 Control outputs

- Remote lockout and boiler On signals.
- Domestic hot water temperature sensor or thermostat.
- 230V power supply for calorifier pump or 3-way diverter valve.
- Full control for secondary heating circuit with 3-way.

1.9.3 Built in Cascade control facility to link up to 8 boilers.

1.9.4 Frost protection

The appliance has built-in frost protection, automatically activating the internal pump when the boiler water temperature drops below 7°C. When the boiler water temperature subsequently falls to 5°C, the burner is also ignited. The burner will switch off as soon as the water temperature has reached 10°C.

1.10 Service & maintenance

When installed and operated correctly, The Acer boilers are designed to provide long trouble-free operation. Inspection and service is required on an **annual** basis. Maintenance and servicing is dependent on the application and use of the appliance and will be determined through inspection carried out by a qualified (CAS) Corgi registered engineer.

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1.11 General design considerations

The installation of Acer boilers must be in accordance with the following:

- Local & National Building Regulations.
- Local Water Byelaws.

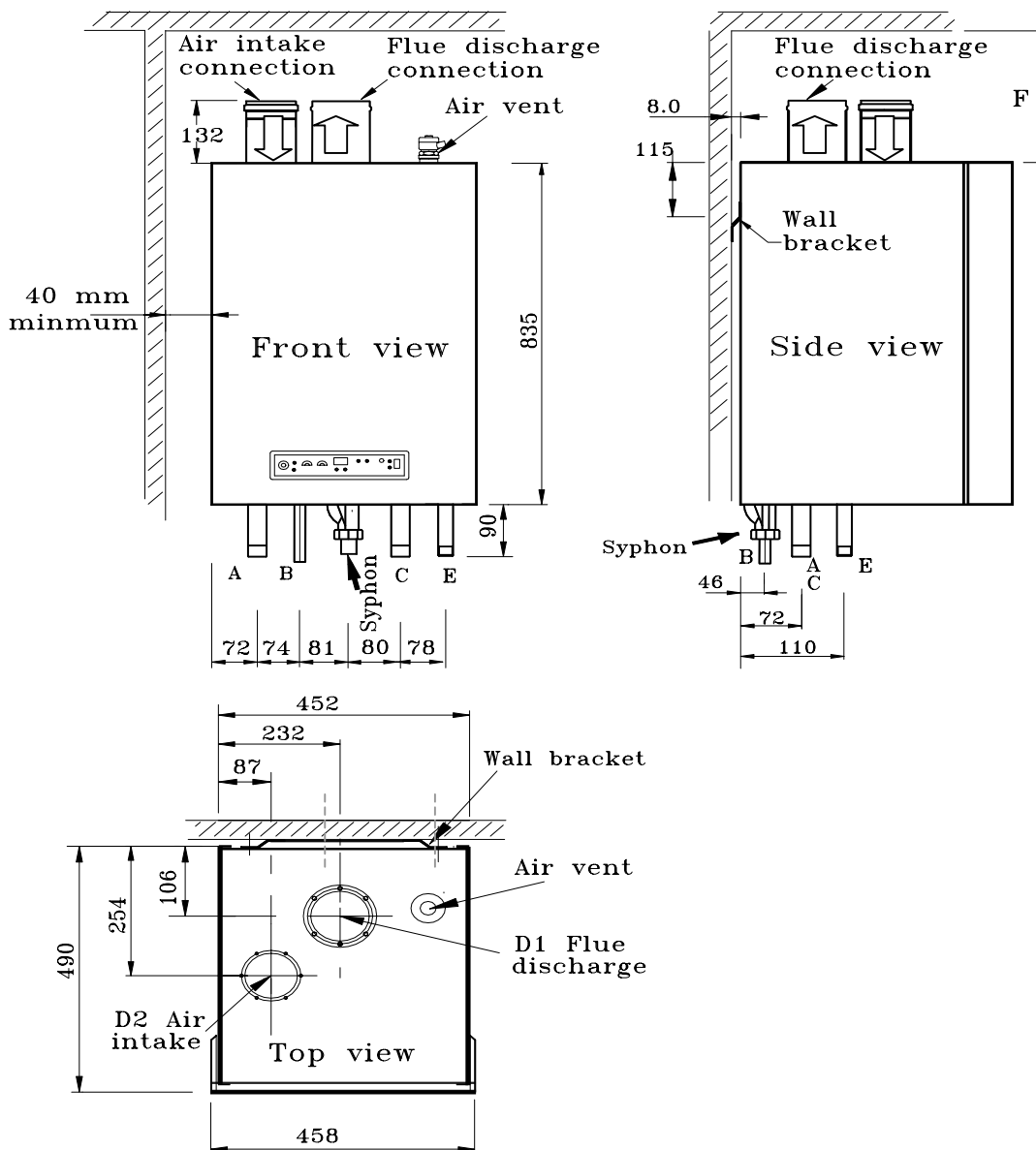
- Local Authority recommendations.
- BS 6644, BS 5440 Part 1 & 2 Flues.
- CIBSE Guidelines.
- British Gas Publications IM/11, IM5 and IM16.

2 General dimensions

2.1 Acer 60, Acer 80, Acer 100 and Acer 120 general dimensions

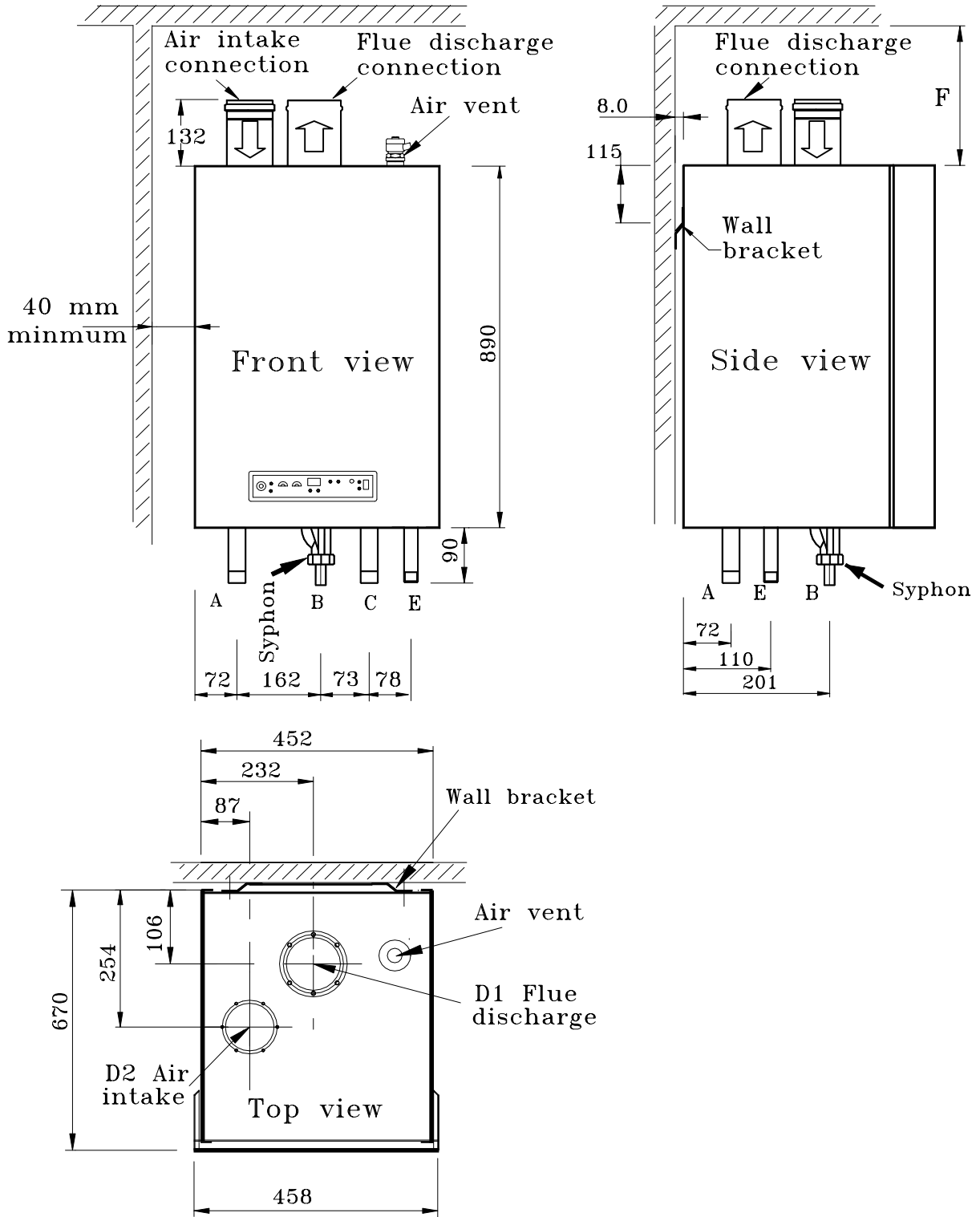
With two-pipe flue system, combustion air intake and flue gas discharge connections.

- For the Acer 60, Acer 80 and Acer 100 available as optional extra, by means of a flue conversion kit available from Beeston see section 6.1.2
- For the Acer 120 supplied as standard.



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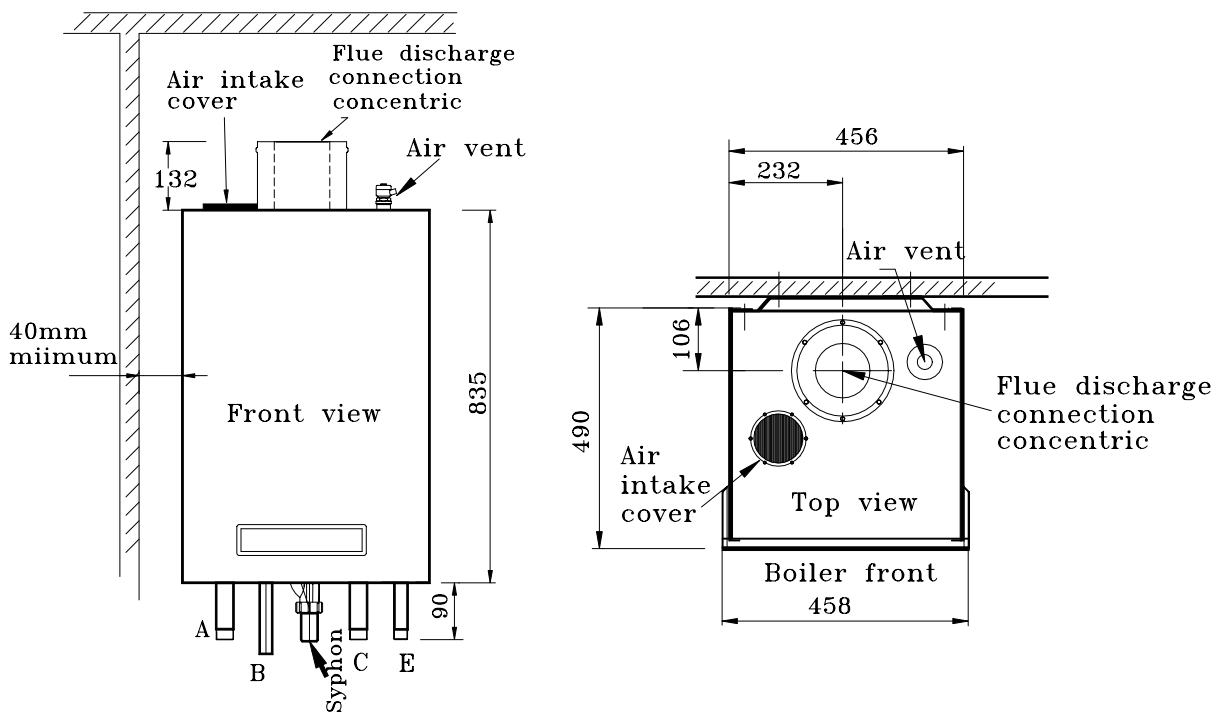
2.2 Acer 150 and Acer 180 general dimensions



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2.3 Acer 60, Acer 80 and Acer 100 general dimensions

The Acer 60, Acer 80 and Acer 100 supplied as standard with a concentric flue connection.



3 Dimensional data

Boiler model		Acer 60	Acer 80	Acer 100	Acer 120	Acer 150	Acer 180	
Flue system								
D1 (Flue discharge)	mm	80	100	100	130	130	130	
D2 (Air intake))	mm	80	100	100	130	130	130	
Concentric flue system size	mm	80/125	100/150	100/150	N/A	N/A	N/A	
Boiler connections								
A (Flow)		R 1½ "	R 1½ "	R 1½ "	R 1½ "	R 2"	R 2"	
B (Condense pipe)	mm	22	22	22	22	22	22	
C (Return)		R 1½ "	R 1½ "	R 1½ "	R 1½ "	R 2"	R 2"	
E (Gas)		R ¾"	R ¾"	R ¾"	R ¾"	R 1"	R 1"	
Clearances	Top	Two pipe flue system F	mm	300	410	410	410	410
		Concentric flue system F	mm	340	360	360	N/A	N/A
	Side	mm	40					
	Front	mm	500	500	500	500	680	680
Safety valve size required			¾"					

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4.0 Technical data

Model			Acer 60	Acer 80	Acer 100	Acer 120	Acer 150	Acer 180	
Performance data	Nominal output at 80/60°C	kW	55	73	90	109	136	163	
	Nominal output at 50/30°C	kW	15-60	20-80	25-100	30-120	36-150	45-180	
	Nominal input (nett)	kW	14-55	18-74	23-92	27-111	34-138	43-166	
	Nominal input (gross)	kW	15-61	20-82	25-102	30-123	38-154	48-184	
	Efficiency (gross)	%	98	98	98	98	98	98	
	Efficiency (nett)	%	109	109	109	109	109	109	
Gas data	Maximum Gas firing rate natural gas	m³/h	5.9	7.9	9.8	11.8	14.7	17.6	
	Minimum Gas inlet pressure natural gas	mbar	20						
	Maximum Gas firing rate propane	m³/h	2.3	3.05	3.8	4.6	5.73	6.84	
	Minimum gas inlet pressure propane	mbar	35						
Hydraulic data	Maximum flow temperature	°C	90						
	Maximum operating pressure	bar	6						
	Cold fill pressure	bar	1.5						
	Safety valve size required		¾"	¾"	¾"	¾"	¾"	¾"	
	Weight (empty)	kg	46	73	78	83	92	101	
	Water content	l	3.9	5	6.5	8.3	10.4	12.9	
Flue gas data	Permissible flue system classifications		B23, C13X, C23X, C33X, C43X, C53X, C63X, C83X						
	CO ₂	%	9						
	CO	ppm	<50	<50	<50	<50	<50	<50	
	NOx emissions max	ppm	<15	<15	<15	<15	<15	<15	
	NOx Class		5						
	Flue gas temperature (at 20°C ambient)	°C	85						
	Dew point temperature	°C	53						
	Condensate pH		4 – 5.5						
Surplus flue pressure	Pa	150	200	250	250	300	300		
Electrical data	Power supply	V	230V / 50Hz / 1ph via on/off Isolator fused at 6 Amp						
	Power consumption	W	375	375	375	375	460	460	
	Protection class		IP44						
Noise level	Measured at 1 metre away from boiler	Maximum	dBA	45	45	50	50	50	50
		Minimum	dBA	35	35	35	35	35	35

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5.0 Hydraulic system

5.1 Internal pump

5.1.1 The appliance pump is factory set at maximum speed (3) **and should not be adjusted**. The boiler control has a built in pump overrun timer preset at 3-minutes, that delays switching off the pump at the end of the heat demand. The overrun time can be adjusted via the control panel.

5.1.2 Where connected, the external pump and the diverter valve / hot water pump are also activated for one minute every 24 hours. The 24-hour cycle starts as soon as power is supplied to the appliance.

5.2 System pump

The boiler pump is designed to overcome the boiler resistance. It is recommended to install an external pump to suite the hydraulic system. In some systems, a transfer pump between the boilers and the low-loss header (manifold) may be required.

5.3 Water treatment

5.3.1 Prior to filling, systems should be flushed to remove debris (and sludge from existing systems) and to ensure that solder flux is not present in the system. It is also recommended that an effective air and dirt separator or filter is fitted for the permanent protection of the boiler.

5.3.2 It is essential for the correct and lasting operation of the Acer boilers, in particular the stainless steel heat exchanger, that suitable and adequate water treatment is applied to the hydraulic system, in accordance with the manufacturer's recommendation to prevent the build up of scale and corrosion products. Sentinel X100, available from Betz Dearborn has been shown to be suitable for this type of heat exchanger.

However, it is the responsibility of the installer or contractor to ensure that the selection of water treatment products takes account of all of the materials included in the hydraulic system.

5.4 Pipe-work & system materials

Where the boiler is connected to an under-floor heating system or any other system where plastic pipework is utilised, such plastic pipework must include an oxygen diffusion barrier to prevent oxygen entering the system

water and thereby causing corrosion within the system.

If the pipework does not include such a barrier then the system water must be separated from the primary water circulating around the boiler via a plate heat exchanger. **Failure to provide this separation will render the boiler warranty void.**

5.5 Other hydraulic system design considerations

5.5.1 Suitable safety pressure relief valve or valves must be installed on the hydraulic system. Valves of the correct size, type and relief pressure must be fitted at the point in the system where the maximum temperature occurs, usually as close to the flow connection on the boiler as possible.

5.5.2 Where thermostatic valves are installed in the system, then a suitable bypass arrangement is required to allow sufficient flow through the boiler, even when all valves are closed.

5.5.3 It is necessary to install an expansion vessel of the correct capacity and pressure setting to suit the system and the static pressure.

6.0 Flue and ventilation

6.1 Flue system

6.1.1 The ACER boiler is a room sealed appliance. The boiler has two connections: one for the flue gas discharge and the other for the fresh air supply into the boiler for combustion. Contamination of the air supply from external sources must be avoided, with particular reference to dust, insulation debris, flue products, fluorides and chlorides.

6.1.2 The ACER Boiler can be installed with different flue options.

1- Two pipe system terminating through the wall or through the roof, one pipe for flue gas and the other for fresh air intake from outside.

2- One pipe system for flue gas discharge. Fresh air is taken from the plant room, **(plant room must have adequate ventilation at high and low level).**

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3- Concentric flue system can be horizontal through the wall or vertical through the roof, **available in two flue system sizes, 80/125 system for the Acer60 and 100/150 system for Acer 80 and Acer 100 only.**

The Acer models 60, 80 and 100 are supplied as standard with concentric flue connection, when other flue systems arrangement are required, conversion kits must be specified and are available from Beeston as optional extra.

Flue conversion kits part numbers are:

- ACERFCK1, for Acer 60.
- ACERFCK2, for Acer 80 and Acer 100.

4- Multiples of boilers (two or more) can be connected to a suitable horizontal common header and a vertical flue stack. Fresh air for combustion can be taken from the plant room, where the plant room has adequate ventilation, or from the outside by means of a suitable air duct connected to the boilers.

6.2 Flue length requirements

6.2.1 The maximum stated pipe length in metres for both the air supply and flue gas discharge ducts is the distance between the boiler connection and the roof or wall terminal. The table below is a guide for single boiler installation only.

6.2.2 Flue length requirement for single boiler

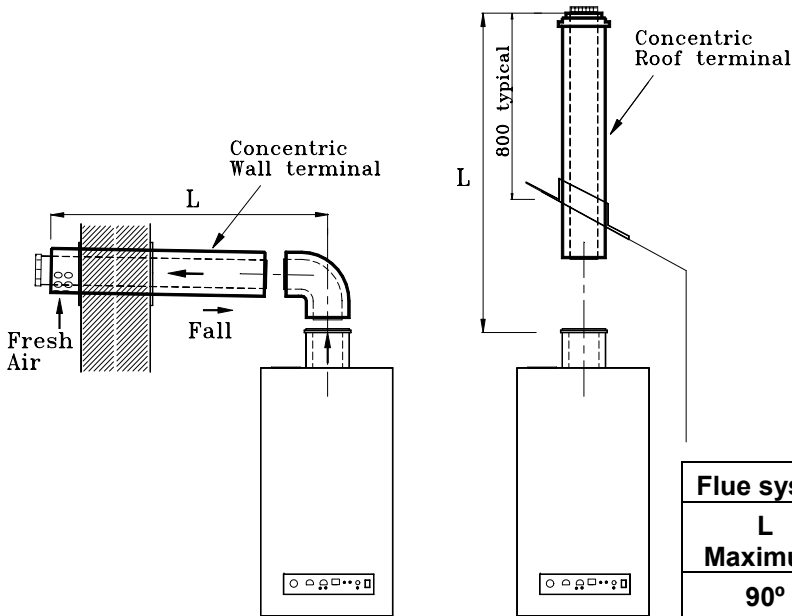
Appliance Model	Maximum pipe length in metres for flue system 80 mm diameter	Maximum pipe Length in metres for flue system 100 mm diameter	Maximum pipe length in metres for flue system 130 mm diameter	Maximum pipe length in metres for flue system 150 mm dia.
ACER 60	7.0 m	21.5 m	38.0 m	N/A
ACER 80	3.5 m	13.5 m	30.0 m	N/A
ACER100	N/A	11.0 m	24.5 m	38.0 m
ACER 120	N/A	N/A	20.0 m	32.5 m
ACER 150	N/A	N/A	16.0 m	27.0 m
ACER 180	N/A	N/A	13.0 m	20.5 m
<p>The above pipe length does not include the number of bends used in the flue and the air supply system. The equivalent length stated below for each bend must be added to the total pipe length. Example: ACER80 with 8 metres flue duct 100 mm diameter and 2 X 90 deg Bends this means:- The total flue system length = 8 metres + 2 X 1.5 metres = 11.0 metres.</p>				
Elbows Equivalent length in metres				
90 degrees	1.25 m	1.5 m	2.0 m	2.5 m
45 deg	1.0 m	1.25 m	1.75 m	2.0 m

Note: see typical flue installations section 6.3

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6.3 Typical flue systems

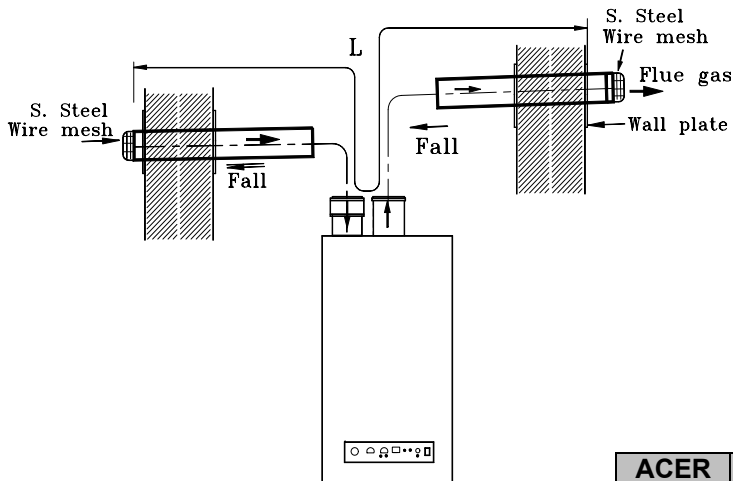
6.3.1 Concentric flue systems



- The maximum length L does not include the number of elbows.
- Flue horizontal run should be installed sloping back to the boiler.

		ACER 60	ACER 80	ACER 100
Flue system size		80/125	100/150	100/150
L Maximum	mm	8.0	13.5	11.0
90° equivalent	m	1.5	2.0	2.0
45° equivalent	m	1.25	1.5	1.5

6.3.2 Two pipe system through the wall, flue gas discharge and fresh air from outside

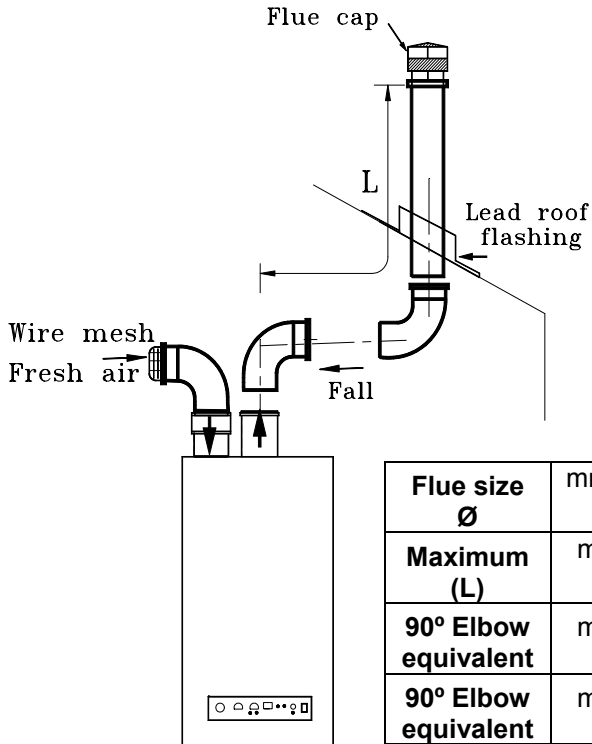


- The maximum length L does not include the number of elbows.
- Flue horizontal run should be installed sloping back to the boiler.
- This system can be vertical through the roof if required.

		ACER 60	ACER 80	ACER 100	ACER 120	ACER 150	ACER 180
Flue size Ø	mm	80	100	100	130	130	130
Maximum (L)	m	16	27	22	40	32	26
90° Elbow equivalent	m	1.25	1.5		2.0		
45° Elbow equivalent	m	1.0	1.25		1.75		

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6.3.2 Vertical conventional flue system, fresh air from the plant room



- The maximum length L does not include the number of elbows.
- Flue horizontal run should be installed sloping back to the boiler.
- Plant room must have adequate ventilation at high and low.

		ACER 60	ACER 80	ACER 100	ACER 120	ACER 150	ACER 180
Flue size Ø	mm	80	100	100	130	130	130
Maximum (L)	m	14	27	22	40	32	
90° Elbow equivalent	m	1.25	1.5		2.0		
90° Elbow equivalent	m	1.0	1.25		1.75		

6.4 Ventilation

6.4.1 If the appliance is installed in a cupboard, compartment or in a room that is suspect then permanent air vents must be provided at both high and low level, and these vents must communicate with outside air.

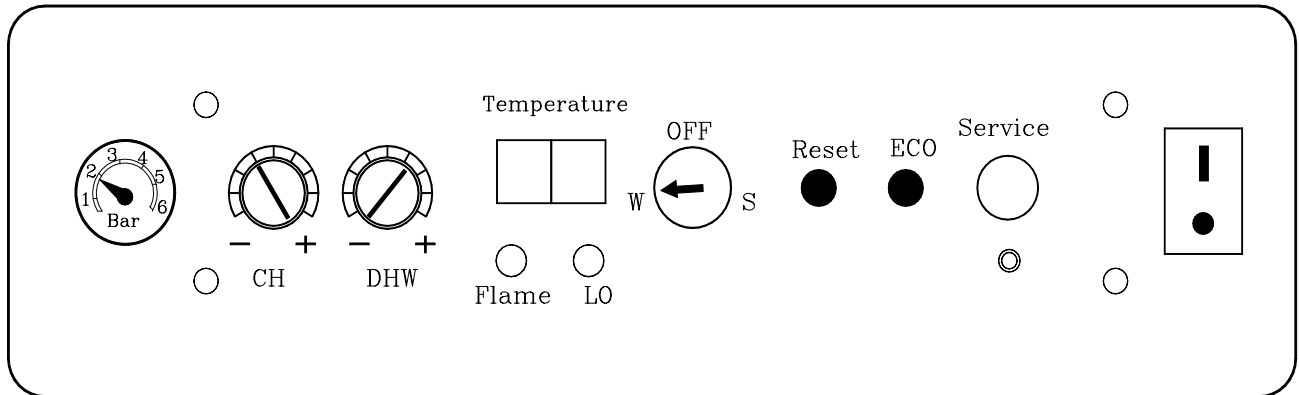
6.4.2 Installations where the fresh air intake for combustion is taken from the plant room, adequate ventilation at low and high level must be provided, and it should be in accordance with BSEN6644.

Ventilation requirements

Appliance	Natural		Mechanical	
	Low Level cm ²	High Level cm ²	Inlet l/s	Extract l/s
ACER 60	576	288	56.5	37.2
ACER 80	676	338	74.7	58.2
ACER 100	730	365	93.6	62.4
ACER 120	884	442	112.5	75.0
ACER 150	1040	520	140.6	93.8
ACER 180	1080	540	168.8	112.5

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7 Boiler control panel & system control options



The Boiler control Panel Display and function key

7.1 Boiler control panel display

7.1.1 The Acer boilers have a comprehensive control panel.

- Double pole on/off switch.
- Indication lamps: green for burner On and red for lockout.
- CH setting knob, for setting the maximum flow temp for heating.
- DHW setting knob for setting the temperature of domestic hot water.
- Reset key.
- ECO key and ECO green lamp, when a calorifier is connected, and the lamp is on the domestic hot water is active, by pressing the ECO button the lamp will go out and DHW will be set in night setback or holiday mode.
- Two display screens, one screen displays the appliance flow temperature. The other displays the current status of the appliance.
- Summer/ Winter and Off switch.
 - 1- Winter, (W) Position heating and domestic hot water (DHW) active.
 - 2- Summer (S) position, heating is off domestic hot water (DHW) is active.
 - 3- Off position the appliance is off.

7.1.2 The appliance has built in frost protection, when the boiler temperature drops below 7°C it activates the pump and if the temperature drops to 5°C, the burner is ignited, when the flow reaches 10 °C the burner will cut out.

7.2 Step control

This feature allows the increase of the flow temperature by steps at the beginning of the heating process. This happens in such a manner that during the heating process the boiler has the lowest possible return temperature and condenses continuously and has therefore the optimum efficiency.

7.2.1 There are 6 steps, the first step is after the boiler fires, the boiler output is increased by 50%, in the second step the appliance output is increased by 10% in 60 seconds, and so on. Thus the boiler output is increased by 10% in every step, the program stops once the maximum output or the required room temperature has been reached.

7.2.2 If an On-Off room thermostat is connected to the boiler and the heat demand has been met (the thermostat is 'off'), the programme will step down with similar time intervals until demand returns.

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7.3 Terminal block connections

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
Outside Sensor	Flow sensor high temp circuit	Flow sensor low temp heating circuit			DHW Sensor			Room thermos. Low temp heating circuit		+ 0-10 V DC	-	Room Thermos high temp heating circuit.		Cascade Connection link						
	18	19	20	21	22	23		24	25	26	27	28	29	30	31	32	33	34	35	36
	C	ON	LO	L1	N	L2		L1	N	L2	L1	N	L2					L	N	E
	Remote signals			Calorifier pump or valve ----- Or low temp htg. Cct pump.				3 way mixing valve low temp heating cct.			Heating system pump 27 & 28 ----- or Calorifier pump 28 & 29							Main 230V 50 Hz 6A		

The ACER control panel terminal block showing the inputs and outputs connections

7.4 Inputs and outputs connections

- Remote signals are available, lockout terminal-20 and boiler on terminal-19. Volt free.
- Terminals 21, 22, and 23 for a calorifier 3-way valve or a calorifier primary pump if low temperature heating circuit pump is not used.
- Terminals 24, 25 and 26 for 3-way mixing valve heating circuit.
- Terminals 27, 28 and 29 Heating system pump. If it is not used for heating circuit then a calorifier pump.
- Terminals 34, 35 and 36, 230 volts 50 Hz external supply via on/off (spur) Isolator fused at 6 Amps.
- Terminals 15 and 16, these are the cascade link control, between two boilers or more (**up to 8 boilers maximum**).
- Terminals 13 and 14 room stat connection for high temperature heating circuit.
- Terminals 11 and 12, the boiler can be controlled by an external controller trough a **0 to 10 Volts dc signal**.
- Terminals 10 and 9 Room thermostat with or without timer, for low temperature heating circuit.
- Terminals 8 and 7 Domestic hot water sensor or thermostat.
- Terminals 6 and 5 flow sensor for low temperature heating circuit.

- Terminals 4 and 3 flow sensor for high temperature heating circuit.
- Terminals 1 and 2 external temperature sensor.

7.5 Electrical load

7.5.1 Acer 60, Acer 80, Acer 100 and Acer 120 total outputs electrical power 345 Watts maximum, load current 1.45 Amp maximum available, Valves and Pumps connected to the boiler terminal block and exceed this load **they must be wired via relays**.

7.5.2 Acer 150 and Acer 180, total outputs electrical power 255 Watts maximum, total load current 1.1 Amp available, Valves and Pumps connected to the boiler terminal block and exceed this load **they must be wired via relays**.

7.6 Cascade control

7.6.1 The Acer boiler has a cascade function built in the boiler control. A total of 8 boilers can be linked by a bus-system, so that all burner controls will act as one boiler, one boiler will be designated as a master and the other boilers as slaves see fig sections 7.6.2, 7.6.3 and 7.6.4, all the required Parameters and settings are entered into the boilers control at commissioning.

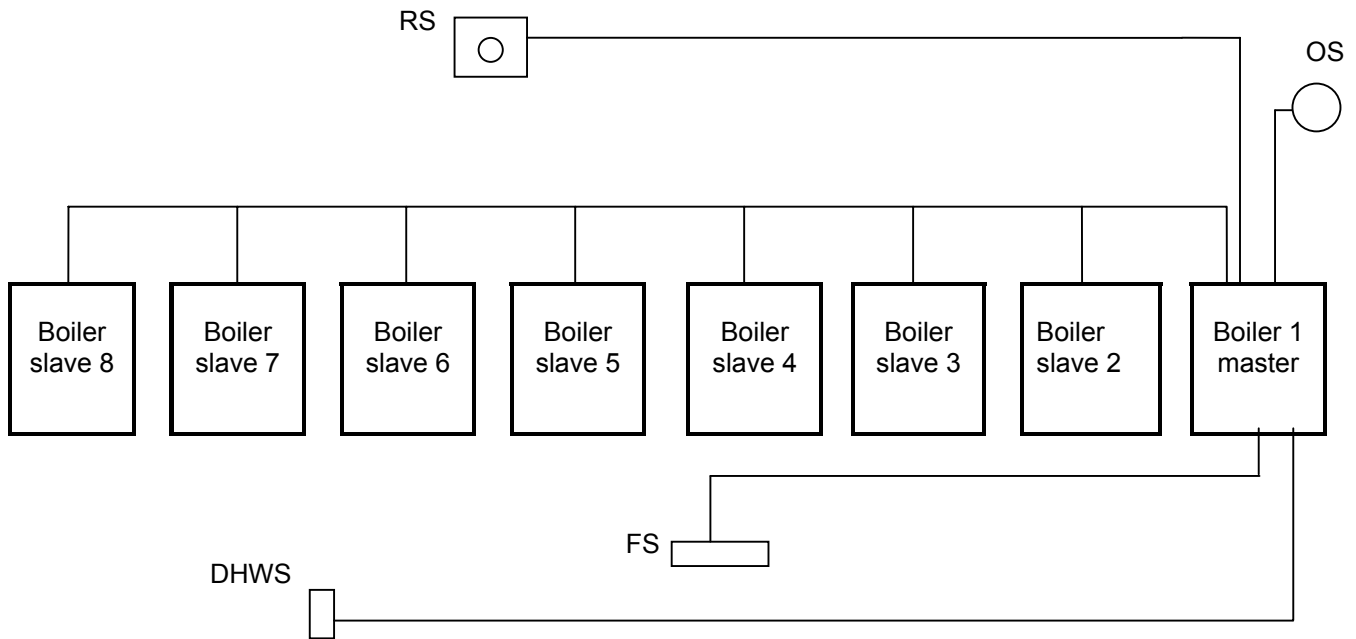
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7.6.2 Cascade working principle

The cascade will work switching on and off the master boiler and the slaves in a sequence that will normally vary every 24 hours as follows, On heating or hot water demand boiler X will fire, when the desired flow temperature is reached after a preset waiting time, then the master will start to control, if the desired flow temperature has not been reached, then another boiler will fire

and so on until all boilers will fire at the minimum output. If the temperature still has not been reached all boilers will modulate up until reaching the maximum output. And when the desired temperature finally is going to be reached the boilers will modulate down until reaching equilibrium, eventually switching off when all are at minimum load.

7.6.3 Cascade schematic diagram



- OS Outside sensor.
- RS Room stat with timer.
- FS Flow sensor.
- DHWS Domestic hot water sensor

7.6.4 Cascade operation sequence for 8 boilers

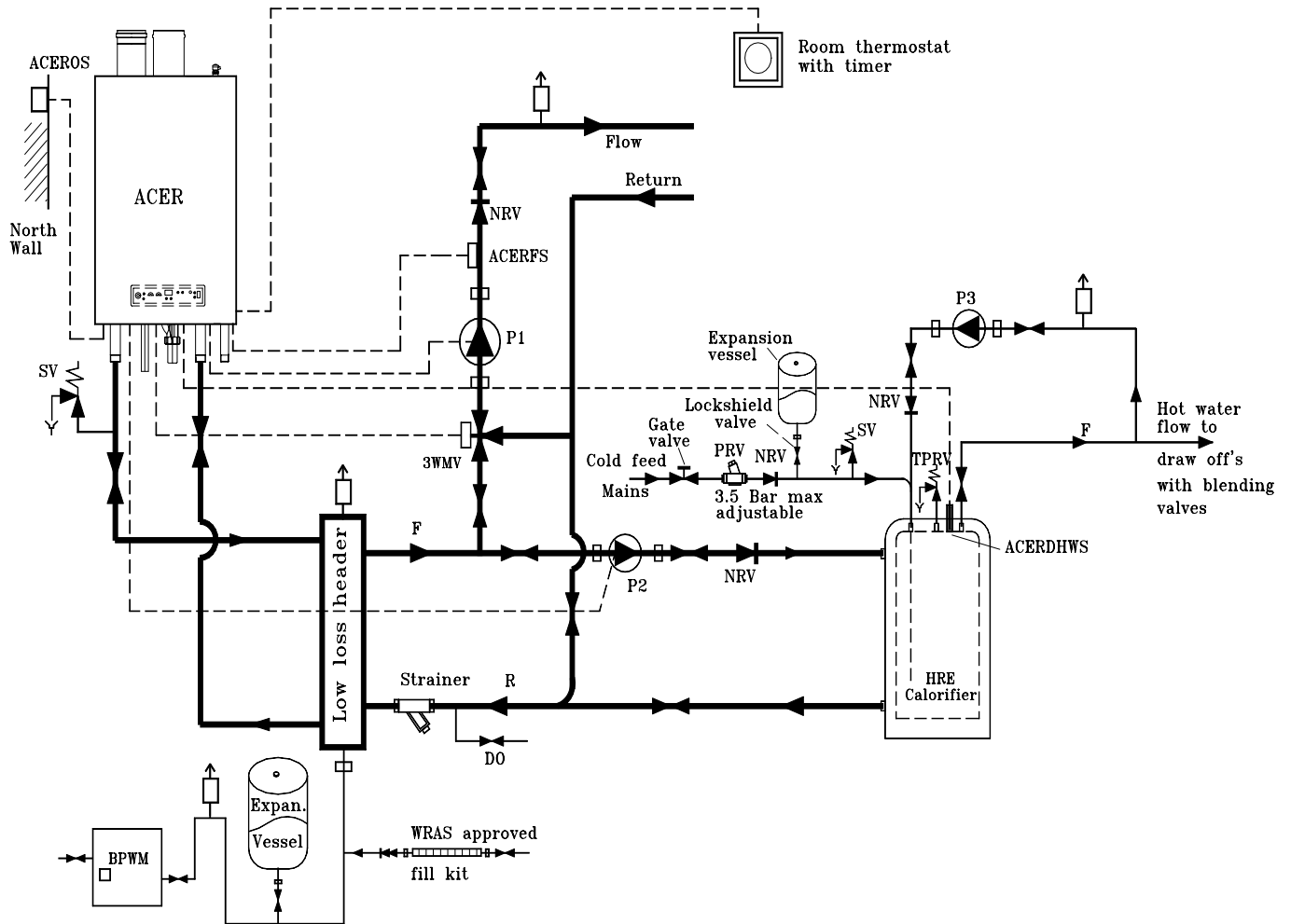
Day	Switching on sequence	Switching off sequence
Day 1	Master – Slave 1 – Slave 2 – Slave 3 - Slave 4 – Slave 5 – Slave 6 – Slave 7	Slave 7 – Slave 6– Slave 5 – Slave 4 - Slave 3 – Slave 2 – Slave 1 – Master
Day 2	Slave 7 – Master – Slave 1 – Slave 2 – Slave 3 – Slave 4 – Slave 5 – Slave 6	Slave 6– Slave 5 – Slave 4 – Slave 3 – Slave 2 – Master – Slave 7
Day 3	Slave 6 – Slave 7 – Master – Slave 1 – Slave 2 – Slave 3 – Slave 4 – Slave 5	Slave 5– Slave 4 – Slave 3 – Slave 2 – Slave 1 – Master – Slave 7 – Slave 6
Etc.	Etc.	Etc.

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8.0 Typical schematic diagrams

8.1 Example 1

ACER boiler serving variable temperature fully compensating heating circuit and domestic hot water calorifier.

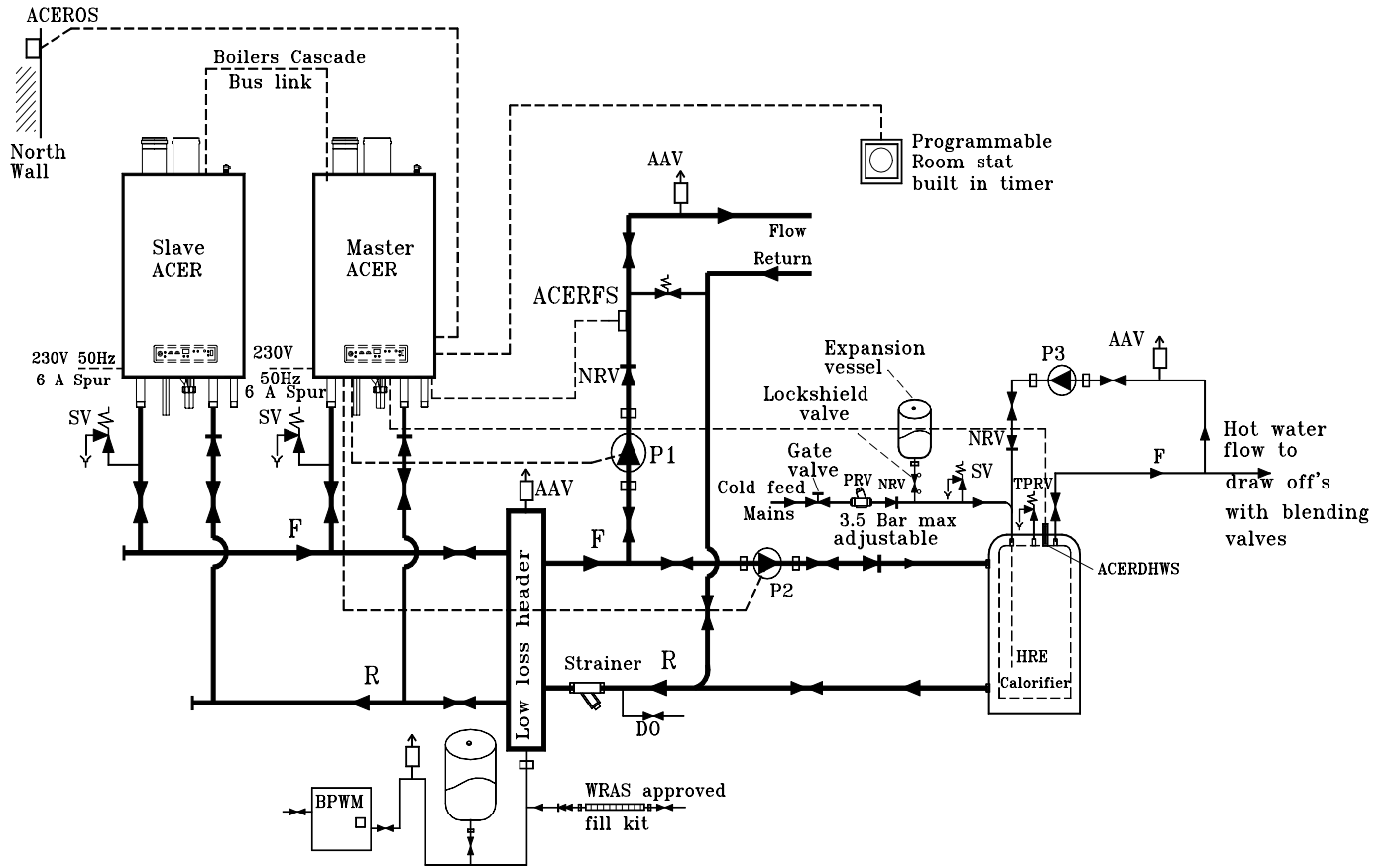


ACEROS	Acer outside sensor
ACERFS	Acer flow sensor, heating
ACERDHW	Acer domestic hot water sensor
P1	Heating zone pump
P2	Calorifier primary pump
P3	Hot water recirculation pump
3MV	3 way mixing valve heating zone
NRV	Non return valve
SV	Safety relief valve
TRPV	Temperature & pressure relief valve
BPWM	Beeston pressurisation wall mounted unit

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8.2 Example 2

Two Acer boilers in cascade serving a heating circuit and domestic hot water calorifier

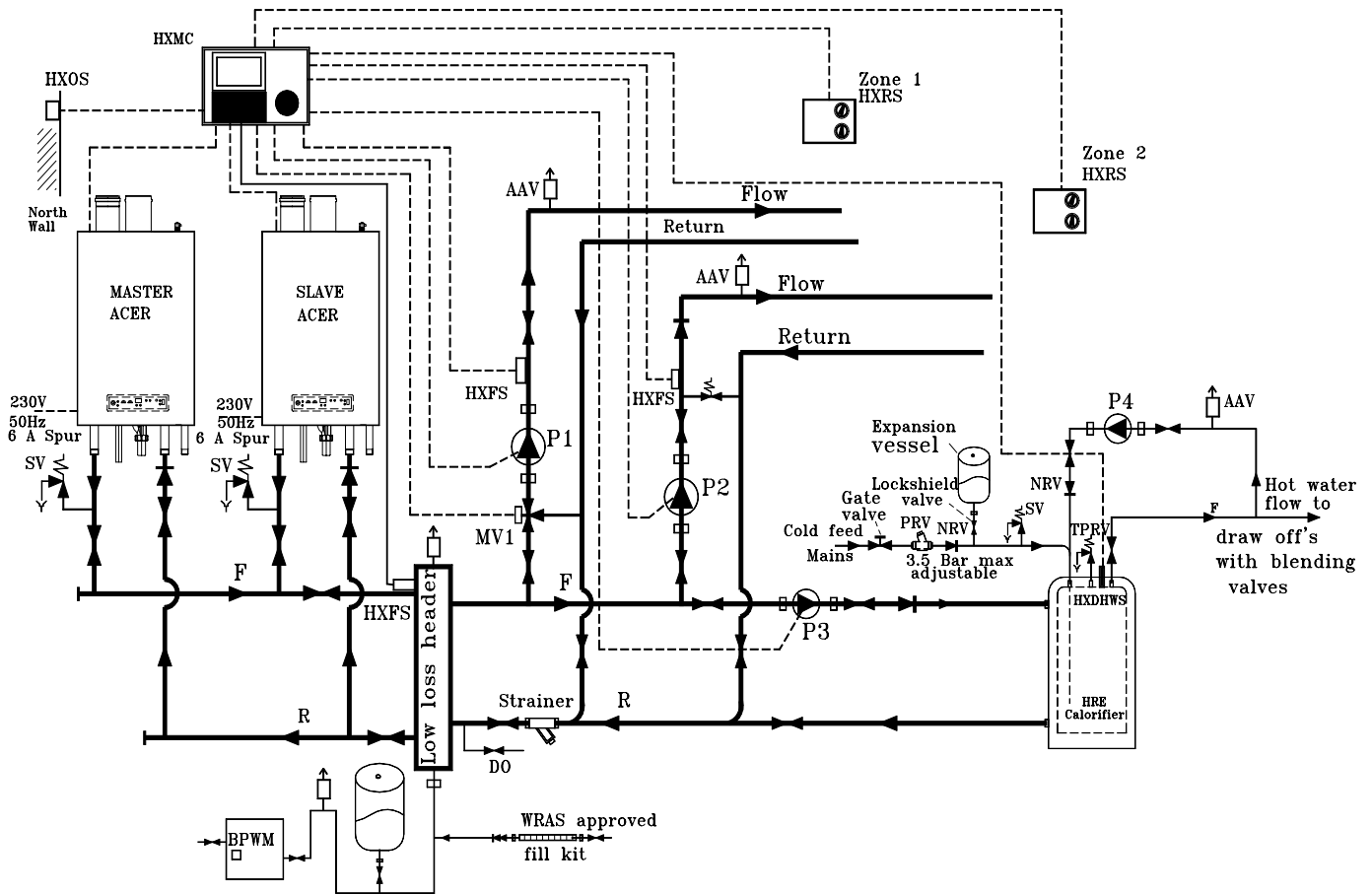


ACEROS	Acer outside sensor
ACERFS	Acer flow sensor, heating
ACERDHS	Acer domestic hot water sensor
P1	Heating zone pump
P2	Calorifier primary pump
P3	Hot water recirculation pump
NRV	Non return valve
SV	Safety relief valve
TRPV	Temperature & pressure relief valve
BPWM	Beeston pressurisation wall mounted unit

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8.3 Example 3

ACER boilers serving two heating circuits. A variable temperature fully compensating circuit, a constant heating circuit and a domestic hot water calorifier using the Beeston Helix control package.

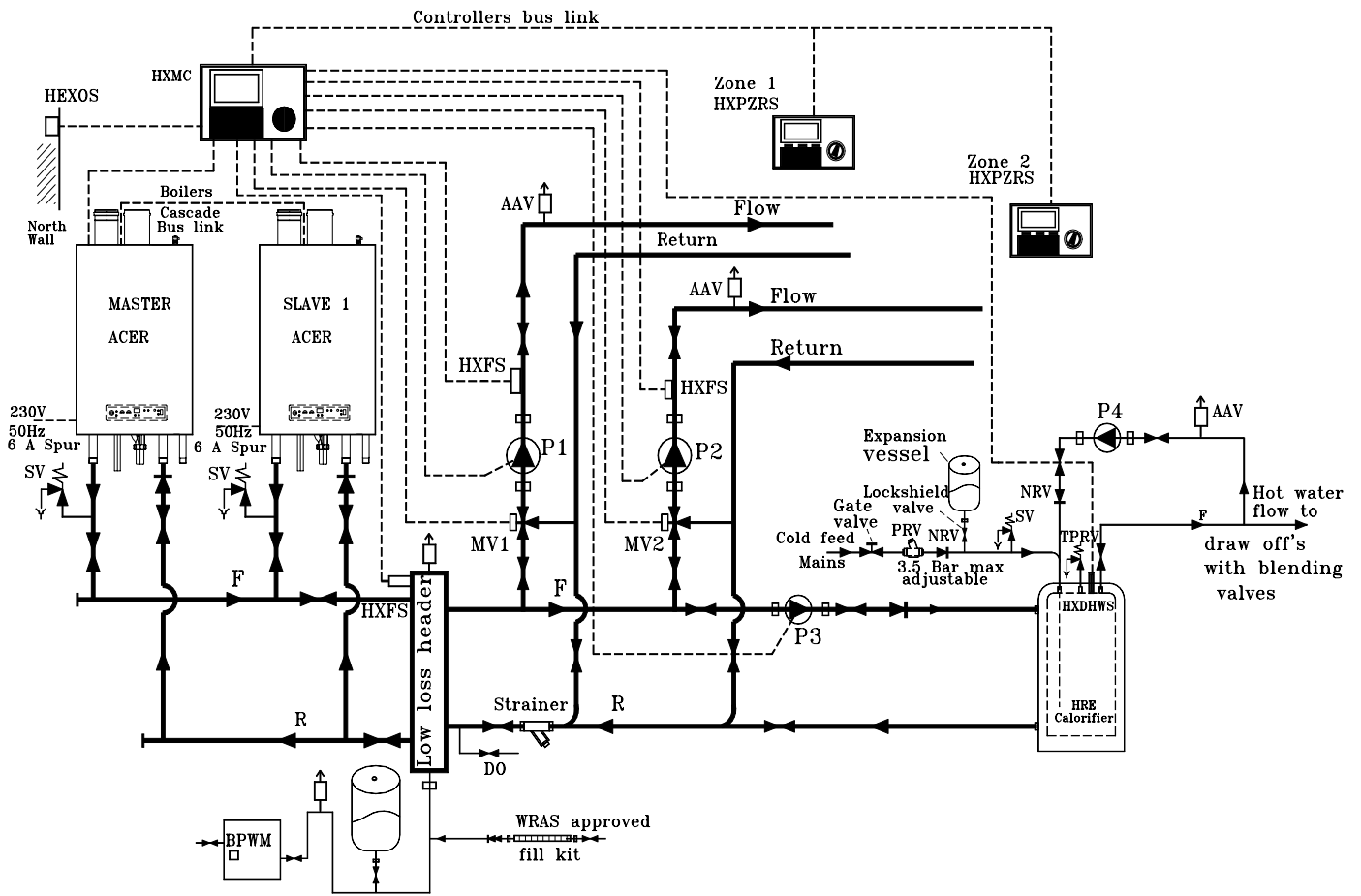


HXMC	Helix main controller
HXRS	Helix remote room sensor, heating zone 1
HXRS	Helix remote room sensor, heating zone 2
HXOS	Outside sensor
HXFS	Helix flow sensor
HXFS	Helix flow sensor, heating zone 1
HXFS	Helix flow sensor, heating zone 2
HXDHWS	Helix domestic hot water sensor
NRV	Non return valve
SV	Safety relief valve
TPRV	Temperature & pressure relief valve
AAV	Air vent
P1	Heating zone 1 pump
P2	Heating zone 2 pump
P3	Calorifier primary pump
MV1	Heating zone 1, 3 way mixing valve

DESIGN MANUAL

8.4 Example 4

Two ACER boilers serving two variable temperature fully compensating heating zones, each zone fully controlled independent of the other, using the Beeston Helix control package.



HXMC	Helix main controller
HXPZRS	Helix remote room sensor, heating zone 1
HXPZRS	Helix remote room sensor, heating zone 2
HXOS	Outside sensor
HXFS	Helix flow sensor
HXFS	Helix flow sensor, heating zone 1
HXFS	Helix flow sensor, heating zone 2
HXDHWS	Helix domestic hot water sensor
NRV	Non return valve
SV	Safety relief valve
TPRV	Temperature & pressure relief valve
AAV	Air vent
P1	Heating zone 1 pump
P2	Heating zone 2 pump
P3	Calorifier primary pump
MV1	Heating zone 1, 3 way mixing valve
MV2	Heating zone 2, 3 way mixing valve



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