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Unical XC-K

Carnot Consult

Oil

Condensing oil stainless steel boiler

90 kW

to

1550 kW



- **Separate high and low temperature return connections increase efficiency by keeping the boiler in condensing mode for longer**
- **Third pass exhaust gas tubes have aluminium fins for increased heat transfer**
- **Very low stand-by losses**
- **Wide range of modulating and 2-stage oil burners available**
- **Integrated controls package for single or multiple boiler installations**
- **ErP Class A seasonal efficiency for relevant models**

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General information

Operating principles

XC-K are a range of reverse-flame condensing boilers manufactured from AISI 316L stainless steel. The third pass of exhaust gases is through stainless steel tubes fitted with aluminium fins to maximise heat exchange (see fig 2 below). The boiler includes low temperature (Rbt) and high temperature (Rat) connections to keep return water temperatures as low as possible to maximise condensing benefit. Together with very low standby and chimney losses, efficiencies of up to 104% net are obtained.

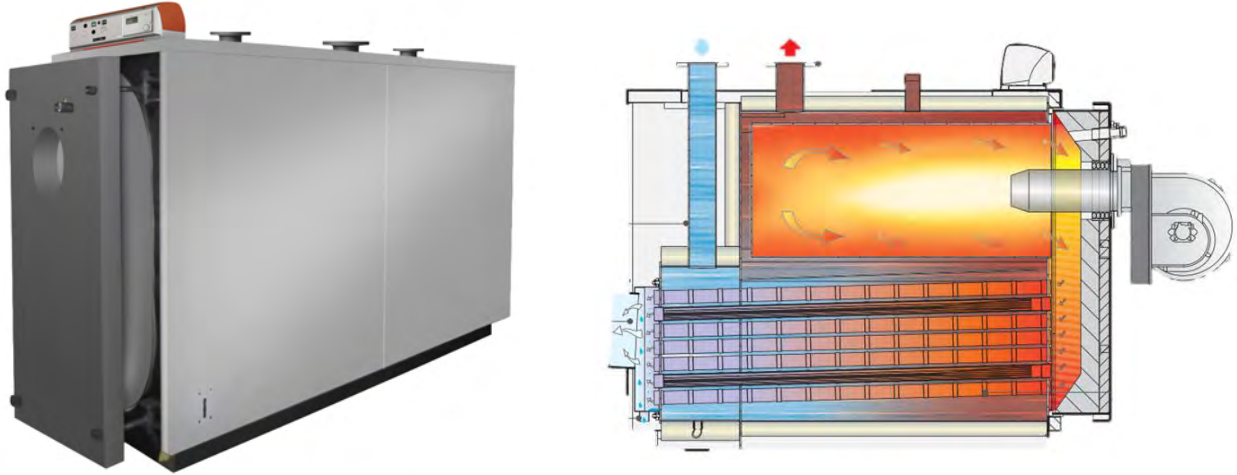


Fig 1 XC-K boiler

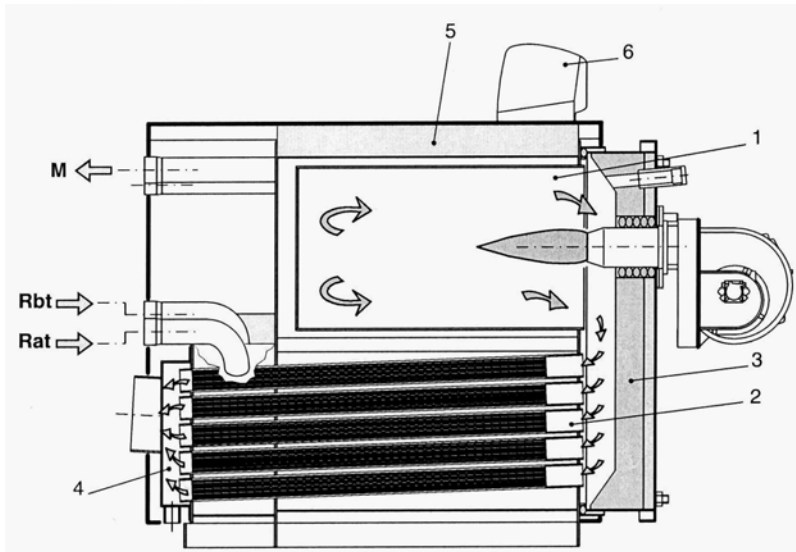


Fig 2a Passage of flue gases



Fig 2b Third pass exhaust gas tube

Key to fig 2

- | | |
|---------------------------------|-----------------------------|
| 1 Combustion chamber | 6 Boiler control panel |
| 2. Third pass exhaust gas tubes | M Flow connection |
| 3 Door | Rbt Low temperature return |
| 4 Third pass collection chamber | Rat High temperature return |
| 5 100 mm insulation (see below) | |

Standby loss and operating loss

Standby losses are the sum of heat losses by radiation and convection from the boiler when the burner is not operating. Reducing these losses makes a significant contribution to high seasonal efficiencies. XC-K boilers have 100 mm of glass wool insulation mattress with mineral fibre backing to minimise these losses, which are only 0.12% (at 50/30°C) for most models.

General information

Application

The XC-K range are stainless steel condensing boilers, manufactured and tested in accordance with EN 303 -1. The combustion chamber and shell is manufactured from AISI 316L stainless steel. The third pass exhaust gas tubes are 316L stainless steel tubes with aluminium fins. XC-K are tested in accordance with the Boiler Efficiency Directive 92/42/CE. They are suitable for use in LTHW heating systems with a maximum operating pressure of 6.0 bar (see Technical data). Maximum system operating temperature is 90°C for LTHW systems.

XC-K boilers are suitable for low sulphur oil and supplied with modulating burners or 2-stage burners.

The boiler is suitable for use in either open vented or pressurised heating systems. It is not suitable for use as a direct water heater. Where wholesome water is required, a matching calorifier or plate heat exchanger must be provided in the system.

Statutory requirements

XC-K boilers are CE marked and must be fired by a compatible burner certified to EN 267 (oil firing) to comply with the Boiler (Efficiency) Directive 1993 where applicable.

The installation and commissioning of the boiler must be carried out by a qualified engineer in accordance with the instructions provided.

Oil supplies and oil burners must be installed and commissioned by a qualified person, eg. an OFTEC registered engineer.

Handling

Offloading, dry storing and placing of equipment in the boiler room is the responsibility of the installer. Lifting hooks are attached to the boiler. Equipment must be dry stored and protected from frost and damage.

Commissioning

Cannot undertake commissioning of boilers. Commissioning charges do not include servicing during the guarantee period, although this may be carried out under service contract or to specific order. Boilers should be commissioned in line with CIBSE Commissioning Code B and burner manufacturer's instructions.

Servicing

The importance of regular maintenance cannot be over-emphasised if maximum efficiency is to be maintained. Customers are strongly advised to place the equipment under service contract immediately commissioning is complete.

Guarantee

Subject to correct handling, installation and operation, all equipment is guaranteed for twelve months from the date of despatch. Boiler heat exchangers are guaranteed for a period of two years from the date of despatch.

The guarantee is not valid if the boiler is not installed in accordance with these instructions, becomes blocked with debris and/or carbonate deposits from the system water and/or there is no documented evidence of commissioning by a competent engineer.

Boiler Log book

A permanent record of commissioning and servicing data and measurements should be kept in the building log book. It is recommended that the owner ensures that this log book is kept safe and brought up to date on every occasion that routine or emergency work is carried out on the boiler.

Installation requirements

Electrical supply (Refer Fig 3)

A 400V 3PH supply is required for most standard burners offered. The boiler control panel requires an additional 230V 1PH supply.

If a 230V 1PH burner is being used, the fused supply should be taken to the boiler control panel only. The harness and connector supplied by Clyde will feed the burner.

The electricity supplies to the burner and boiler control panel must be wired in accordance with IEE Regulations. A separate supply and isolating switch is required for each boiler in the plant room.

All isolating switches and fuses must be provided by the installer. Burner start/run currents for fuse specification are available on request. Burner wiring diagrams and technical data are also available on request.

All connections between the boiler control panel and the burner are made through harnesses with matching plugs and sockets, supplied as standard.

Note: Fig 3 is only diagrammatic. Double pole switches with the required minimum separation must always be used.

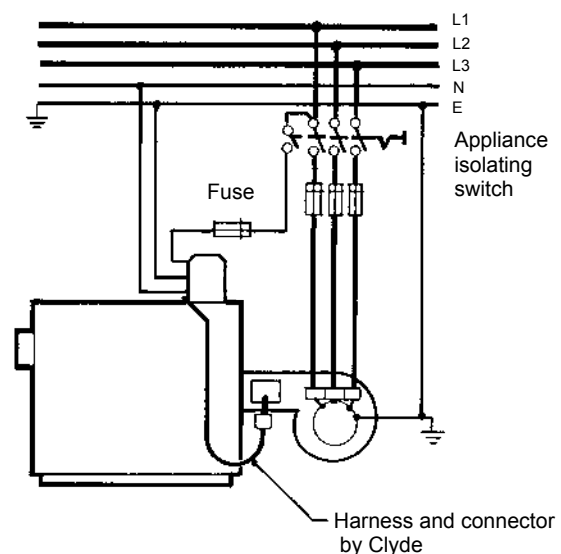
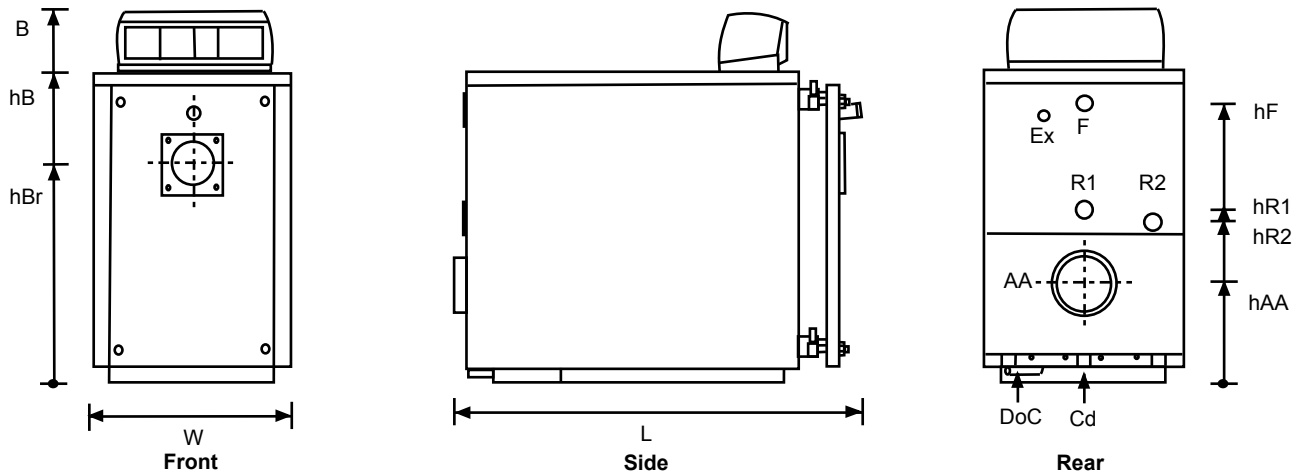


Fig 3 - Electricity supply

Dimensions and Technical data



Dimensions

Boiler model			XC-K 100
Overall length	L	mm	1342
Overall width	W	mm	650
Overall height	B	mm	1222
Boiler height	hB	mm	1032
Combustion chamber size	Dia x length	mm	390 x 700
Burner height	hBr	mm	730
Boiler flow connection	F	Rp	2
Boiler return connections	R1 / R2	Rp	2
Expansion vessel connection	Ex	Rp	1 1/4
Condensate connection	Cd	mm	40
Return 2 connection height	hR2	mm	528
Return 1 connection height	hR1	mm	570
Flow connection height	hF	mm	922
Flue spigot (inside dimension)	AA	DN	182
Flue spigot height	hAA	mm	329
Drain off cock	Doc	Rp	3/4

Technical data

Nominal heat output (full load) 50 / 30°C	kW	90
Nominal heat output (full load) 80 / 60°C	kW	85
Nominal heat input (full load) ncv	kW	88
Efficiency at 100% load (ncv) 50 / 30°C	%	102
Efficiency at 30% load (ncv)	%	104
Boiler seasonal efficiency (1)	%	97.9
Gross Oil consumption (2)	kg/h	7.4
Dry weight	kg	365
Water content	l	140
Gas side resistance	Pa	57
Flue gas temperature rise oil	°C	32
Flue gas mass flow (Max)	kg/h	136.2
CO ₂ in flue gas oil	%	12.7
Maximum volume of condensate	l/h	5.5
Maximum hydraulic working pressure	bar	6

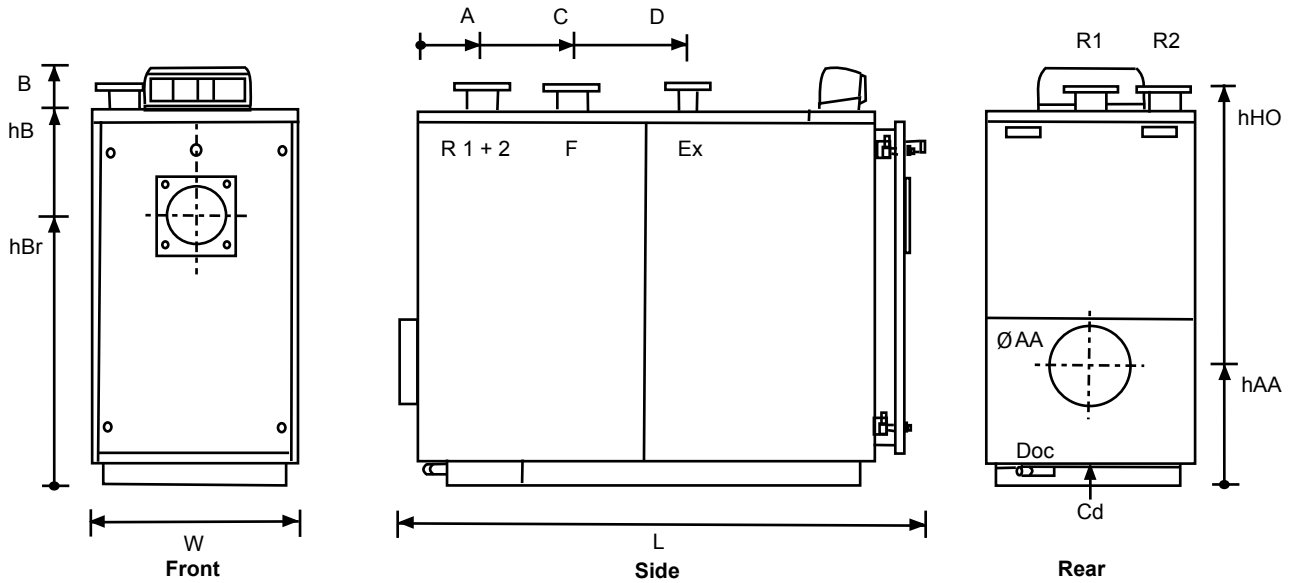
Notes: (1) Calculated from the non-domestic heating and cooling compliance guide for conformance with ADL2A and ADL2B 2013 using the formula $n_{seasonal} = 0.81n_{30\%} + 0.19n_{100\%}$

(2) Class D oil GCV 45.5 MJ/kg NCV 42.7 MJ/kg

Water flow rates and hydraulic resistances

Water flow rate at 15°C temp. rise	l/s	1.43
Hydraulic resistance at 15°C temp. rise	kPa	1.5

Dimensions and Technical data



Dimensions

Boiler model			XC-K 150	XC-K 230	XC-K 300	XC-K 350	XC-K 400
Overall length	L	mm	1703	1755	2055	2107	2277
Overall width	W	mm	720	790	790	854	854
Overall height	B	mm	1322	1472	1472	1662	1662
Boiler height	hB	mm	1132	1282	1282	1472	1472
Combustion chamber size	Dia x length	mm	430 x 930	480 x 970	510 x 1220	540 x 1220	568 x 1390
Burner height	hBr	mm	790	900	900	1062	1062
Boiler flow connection	F	DN	65	80	80	100	100
Boiler return connections	R1 / R2	DN	65	80	80	100	100
Expansion vessel connection	Ex	Rp	1 1/2	2	2	2	2
Condensate drain connection	Cd	mm	40	40	40	40	40
Connection height	hHO	mm	1248	1385	1385	1585	1585
F centre from rear	C	mm	575	590	650	664	664
Ex centre from rear	D	mm	825	840	1100	1164	1164
R centre from rear	A	mm	255	231	271	306	306
Flue spigot (inside dimension)	AA	DN	202	252	252	302	302
Flue spigot height	hAA	mm	374	402	402	494	494
Drain off cock	Doc	Rp	¾	1	1	1	1

Technical data

Nominal heat output (full load) 50 / 30°C	kW	140	210	290	340	400
Nominal heat output (full load) 80 / 60°C	kW	133	199	275	322	379
Nominal heat input (full load) ncv	kW	137	206	284	333	392
Efficiency at 100% load (ncv) 50 / 30°C	%	102	102	102	102	102
Efficiency at 30% load (ncv)	%	104	104	104	104	104
Boiler seasonal efficiency (1)	%	97.1	97.1	97.1	97.1	97.1
Gross Oil consumption (2)	kg/h	11.6	17.4	24	28.1	33.1
Dry weight	kg	525	660	800	1007	1137
Water content	l	260	305	332	544	515
Gas side resistance	Pa	108	127	243	289	360
Flue gas temperature rise oil	°C	32	32	32	32	32
Flue gas mass flow (Max)	kg/h	211.8	317.7	438.7	514.3	605.1
CO ₂ in flue gas oil	%	12.7	12.7	12.7	12.7	12.7
Casing losses 50 / 30°C	%	0.34	0.21	0.15	0.12	0.12
Chimney losses with burner firing 50 / 30°C	%	1.03	1.03	1.03	1.03	1.03
Chimney losses with burner off	%	0.05	0.05	0.05	0.05	0.05
Maximum volume of condensate	l/h	8.6	12.8	17.7	20.8	24.4
Maximum hydraulic working pressure	bar	6				

Notes: (1) Calculated from the non-domestic heating and cooling compliance guide for conformance with ADL2A and

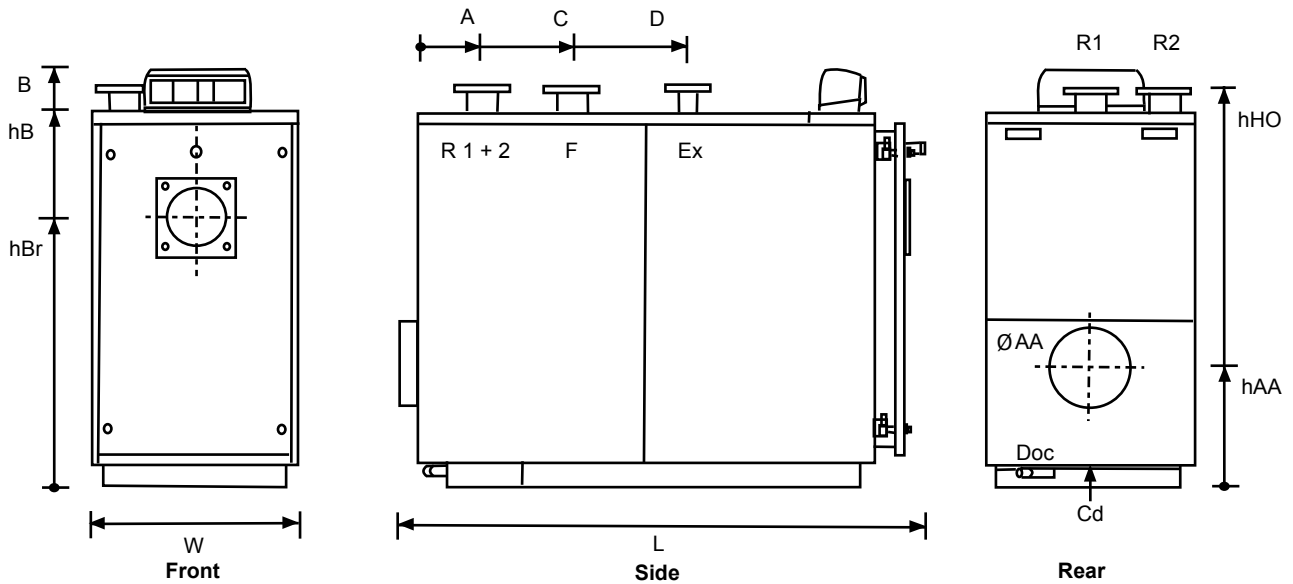
ADL2B 2013 using the formula $n_{seasonal} = 0.81n_{30\%} + 0.19n_{100\%}$

(2) Class D oil GCV 45.5 MJ/kg NCV 42.7 MJ/kg

Water flow rates and hydraulic resistances

Water flow rate at 15°C temp. rise	l/s	2.2	3.3	4.6	5.4	6
Hydraulic resistance at 15°C temp. rise	kPa	3.8	2.5	3.2	2	2.9

Dimensions and Technical data



Dimensions

Boiler model			XC-K 500	XC-K 650	XC-K 850	XC-K 1000	XC-K 1300	XC-K 1550
Overall length	L	mm	2327	2697	2734	3114	3320	3645
Overall width	W	mm	894	894	1064	1064	1204	1204
Overall height	B	mm	1802	1802	1992	1992	2242	2242
Boiler height	hB	mm	1612	1612	1802	1802	2052	2052
Combustion chamber size	Da x length	mm	608 x 1380	636 x 1620	704 x 1720	734 x 1913	790 x 2125	830 x 2330
Burner height	hBr	mm	1161	1161	1287	1287	1493	1493
Boiler flow connection	F	DN	125	125	150	150	200	200
Boiler return connections	R1 / R2	DN	125	125	150	150	200	200
Expansion vessel connection	Ex	DN	65	65	80	80	100	100
Condensate drain connection	Cd	mm	40	40	40	40	40	40
Connection height	hHO	mm	1715	1715	1911	1911	2165	2165
F centre from rear	C	mm	663	793	913	1083	935	934
Ex centre from rear	D	mm	1163	1293	1813	1983	1720	1944
R centre from rear	A	mm	275	405	289	459	372	371
Flue spigot (inside dimension)	AA	DN	352	352	402	402	452	452
Flue spigot height	hAA	mm	523	523	551	552	681	681
Drain off cock	Doc	Rp	1	1	1 1/2	1 1/2	1 1/2	1 1/2

Technical data

Nominal heat output (full load) 50 / 30°C	kW	500	650	820	1000	1300	1550
Nominal heat output (full load) 80 / 60°C	kW	475	617	778	948	1233	1470
Nominal heat input (full load) ncv	kW	491	637	804	980	1275	1520
Efficiency at 100% load (ncv) 50 / 30°C	%	102	102	102	102	102	102
Efficiency at 30% load (ncv)	%	104	104	104	104	104	104
Boiler seasonal efficiency (1)	%	97.1	97.1	97.1	97.1	97.1	97.1
Gross oil consumption (2)	kg/h	41.5	53.8	67.9	82.7	107.7	128.3
Dry weight	kg	1376	1613	2158	2443	3458	3765
Water content	l	625	664	1107	1157	1936	1904
Gas side resistance	Pa	418	491	556	612	685	734
Flue gas temperature rise oil	°C	32	32	32	32	32	32
Flue gas mass flow (M _{bx})	kg/h	757.1	983.3	1240.5	1512.8	1966.6	2344.8
CO ₂ in flue gas oil	%	12.7	12.7	12.7	12.7	12.7	12.7
Maximum volume of condensate	l/h	30.6	39.7	59.1	61.1	79.5	94.7
Maximum hydraulic working pressure	bar	6					

Notes: (1) Calculated from the non-domestic heating and cooling compliance guide for conformance with ADL2A and

ADL2B 2013 using the formula $n_{\text{seasonal}} = 0.81n_{30\%} + 0.19n_{100\%}$

(2) Class D oil GCV 45.5 MJ/kg NCV 42.7 MJ/kg

Water flow rates and hydraulic resistances

Water flow rate at 15°C temp. rise	l/s	7.9	10.3	13	15.9	20.6	24.6
Hydraulic resistance at 15°C temp. rise	kPa	3	3.7	3.5	4	3.9	5.5

Installation requirements

General

XC-K boilers should be installed in accordance with all prevailing regulations and codes of practice, including the Building Regulations, Health and Safety Regulations PM5, Water Bylaws and the current OFTEC guidance. Detailed relevant guidance will also be found in:

BS 5410-2 Code of practice for Oil firing Part 2

CIBSE Guides B and C, AM14:2010 Non-domestic hot water heating systems and Commissioning Code B.

Boiler location (See fig 4)

The location chosen for the boiler(s) must be frost free, provide for a satisfactory flue system and an adequate air supply for combustion and ventilation. Adequate access is necessary for boiler and burner servicing.

Boilers should be installed on a plinth which is at least 50mm high and is smooth and level. The plinth must support the entire boiler base, eg minimum dimensions will be W x L from pages 4 to 6.

Burners

Boilers are supplied with modulating or two stage gas burners. A choice of burner makes is available.

Fuel specification

Class D oil to BS 2869 and FAME to EN 14214:2008 as specified by the burner manufacturer.

Fuel supply pipework

Install oil supply pipe and filter so as to allow free access to the boiler and full opening of the furnace door without removing the burner from the boiler door (see below).

Commissioning of the oil supply pipework and fire valves must be carried out by a qualified person, eg, an OFTEC registered engineer.

Water treatment

XC-K boilers have a stainless steel heat exchanger and care must be exercised to ensure that the system water and any water treatment is compatible.

Whenever a new boiler is connected to an existing system, the pipework must be thoroughly cleaned and flushed with a neutral pH product. This is to remove debris, rust particles, carbonate deposits and any existing water treatment that might be incompatible with the heat exchanger. New systems must also be thoroughly flushed to remove debris and flux deposits. Cannot recommend that a permanent means of filtration be fitted into the return pipework, such as a sludge trap, hydrocyclone or full flow duplex filters. The boiler guarantee will be invalid if waterways are blocked by debris or carbonate deposits.

The pH value of the system water should be between 6.5 and 8.5. Use a neutral pH corrosion and scale inhibitor, such as Sentinel X100. Temporary hardness (calcium carbonate and magnesium carbonate) can be removed by boiling and its effects limited by preventing ingress of fresh, untreated water. The boiler guarantee will be invalidated by the use of incorrect or incompatible water treatment. Specialist advice should be obtained, eg from;

Sentinel Tel. 01928 588330

For full information on cleaning, flushing and protecting hot water systems, refer to BSRIA Application Guide AG 1/2001.1

Boiler condensate

XC-K boilers have a 40 mm condensate drain connection that is compatible with standard plastic waste pipe. Do not use other materials, as they will corrode. A running trap must be fitted close to the outlet. The pipe size must not be reduced and there must be a continuous fall to drain. As a further precaution against freezing, condensate pipes should be run internally whenever possible and lagged when run externally.

Oil boiler condensate contains nitric and sulphuric acid and will require neutralisation before disposal.

Plant room layout

When planning the layout of the boiler room, allowance must be made for opening the boiler door, boiler cleaning and maintenance. The boiler door may be hinged from the right (as illustrated) or the left.

The table below shows the minimum clearances around the boiler.

Dimension W2 = length of burner + 200mm.

Dimension L1 = length of boiler (recommended) for cleaning

Dimension W1 = 1000mm for access to rear of boiler

Dimension W3 = minimum 600mm

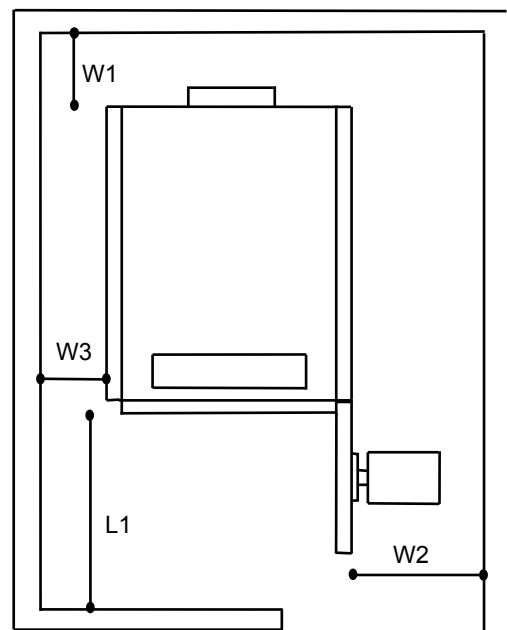


Fig 4 Boiler clearances

Installation requirements

Water circulation

Fig 5a illustrates how low temperature returns (60°C or less) can be separated from the common return and connected to Rbt. Keeping the lower and higher temperature returns separate (and consequently not raising the mean return temperature) will ensure the boiler remains in condensing mode for longer.

If the system return is a common one (as shown in fig 5b), only the high temperature return connection (Rat) should be used.

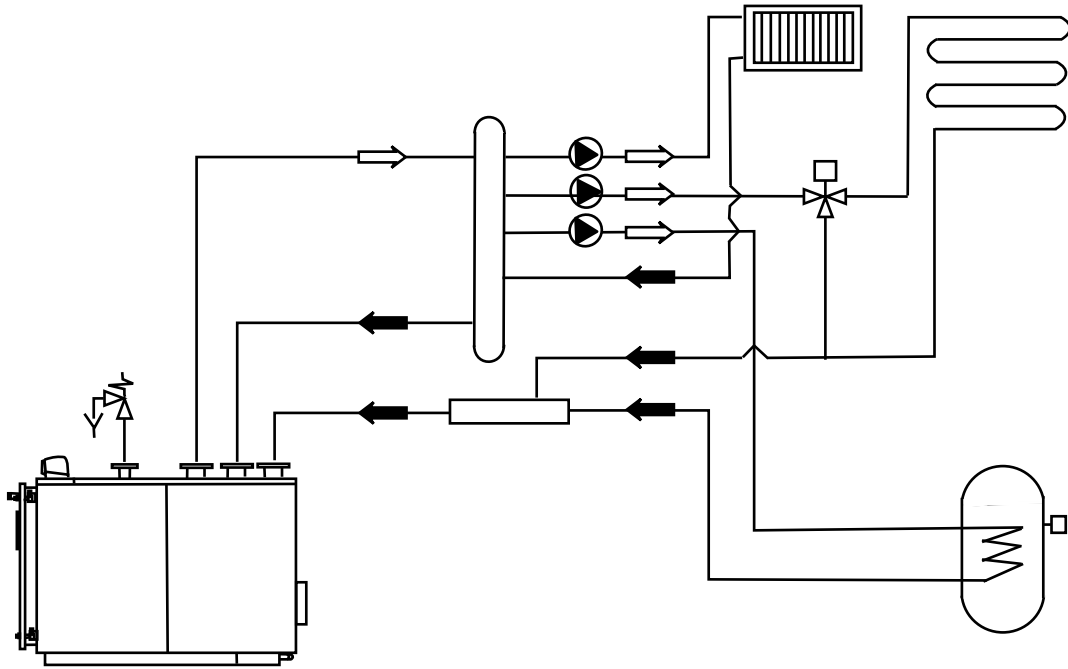


Fig 5a Boiler with separated low and high temperature returns (Rbt and Rat)

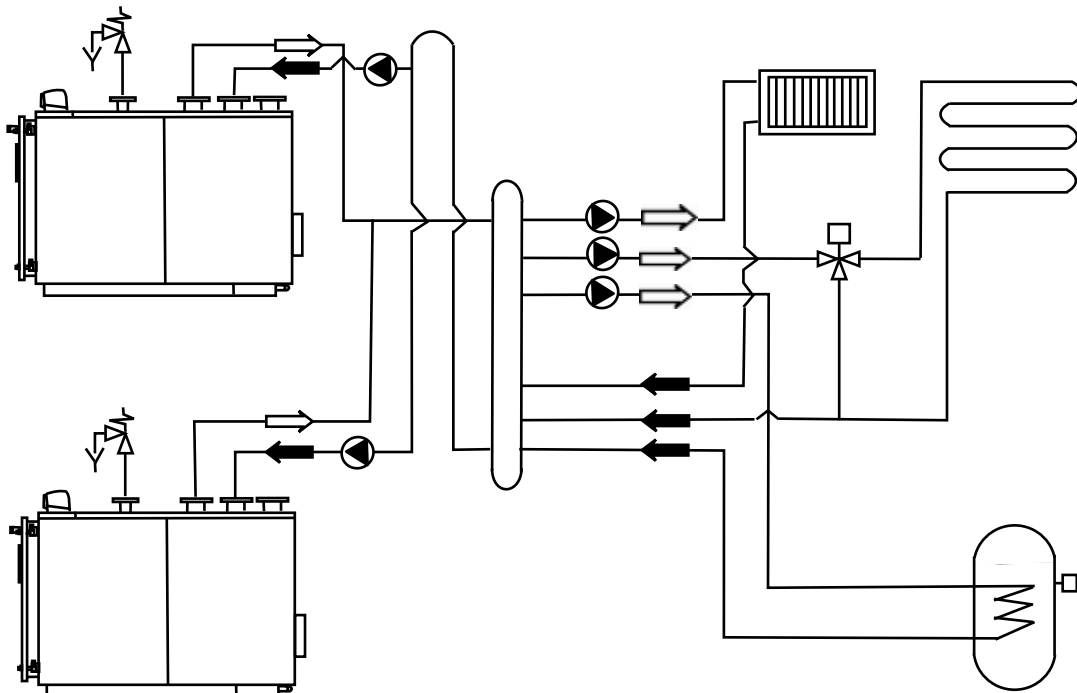


Fig 5b Boilers with common return (use Rat only) and reverse return pipework

Boiler control panels

Control panels 37892 and 38778 (see fig 6) provide either modulating 2-stage burner control for a single boiler installation, or act as the master control panel for a multiple boiler installation. It incorporates the E8 controller (on the right of the module) that provides weather compensation control and cascade control of additional boilers. The Lago Basic controller (in the centre) provides the local control for the individual boiler. Only one E8 controller is required for the entire system, but a Lago Basic controller is necessary for each boiler. Therefore, a Lago Basic controller is part of the slave panel (see fig 7). A 4-wire bus connects each panel in series.

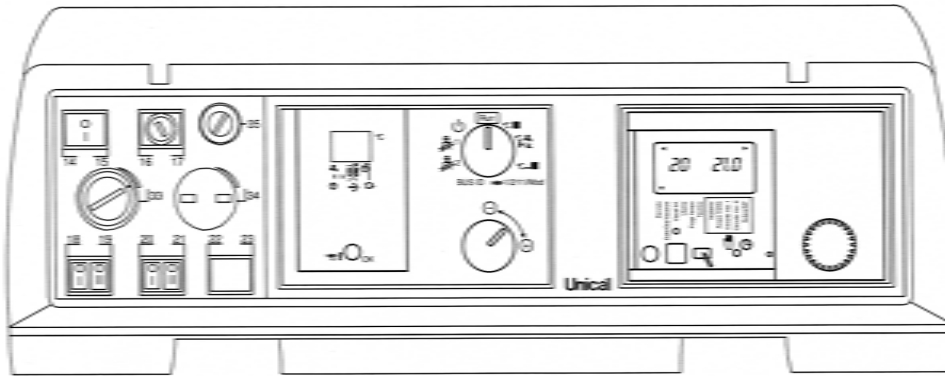


Fig 6 Boiler master control panels 37892 (Modulating burner) and 38778 (2-stage burner)

Control panel 37892 and 38778 standard components

Illuminated on/off switch	E8 controller
4A fuse	Control thermostat (range 60°C to 90°C)
Overheat limit thermostat and manual reset	Lago Basic controller
Boiler on/off switch	

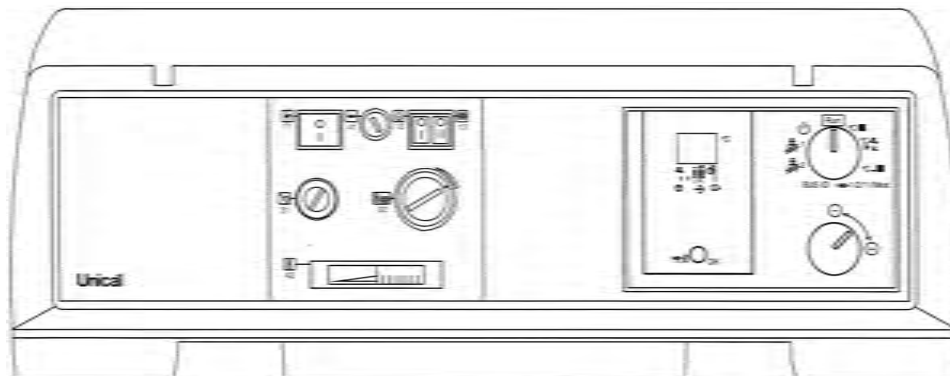


Fig 7 Boiler slave control panel 37900

Control panel 37900 standard components

Illuminated on/off switch	Boiler thermometer
4A fuse	Control thermostat (range 60°C to 90°C)
Overheat limit thermostat and manual reset	Lago Basic controller
Boiler on/off switch	

	Boiler 1	Boiler 2	Boiler 3	Boiler 4
Modulating burner(s)	37892	37900	37900	37900
2-stage burner(s)	38778	37900	37900	37900

Table 1 Boiler module selection

Boiler master control panel

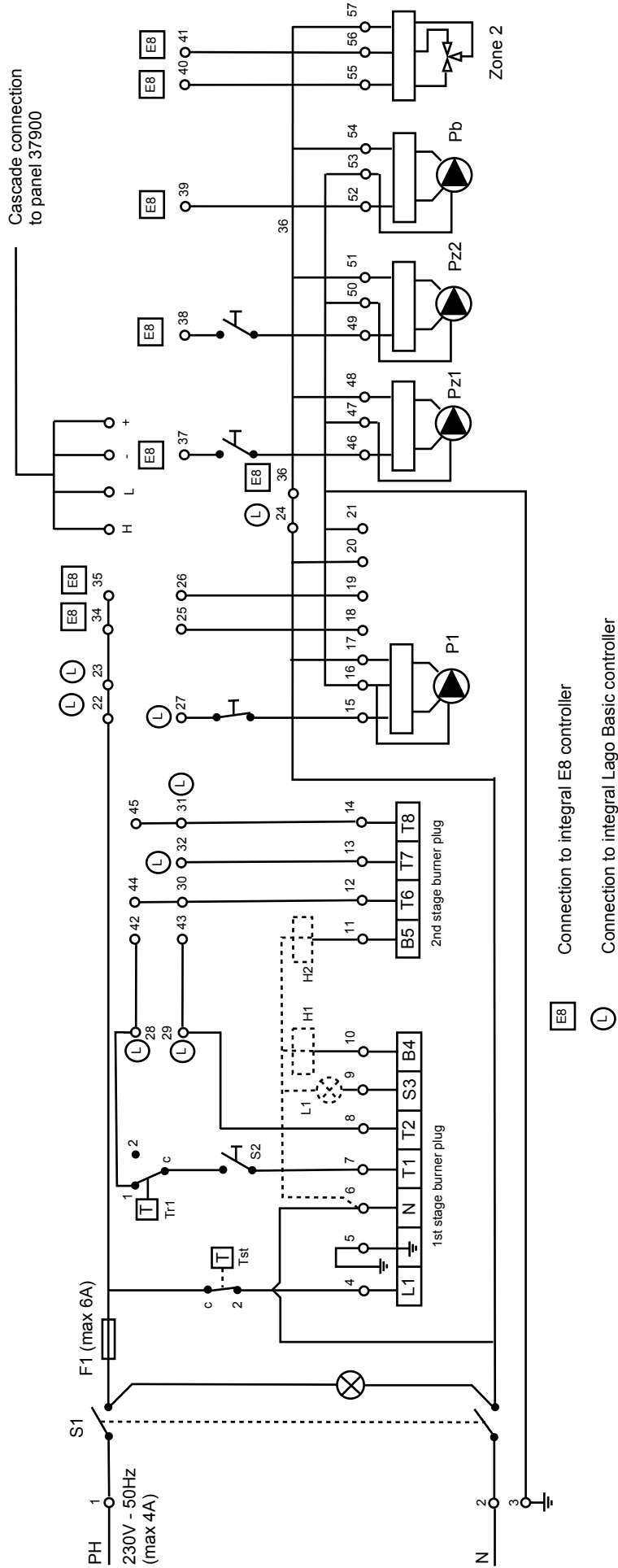
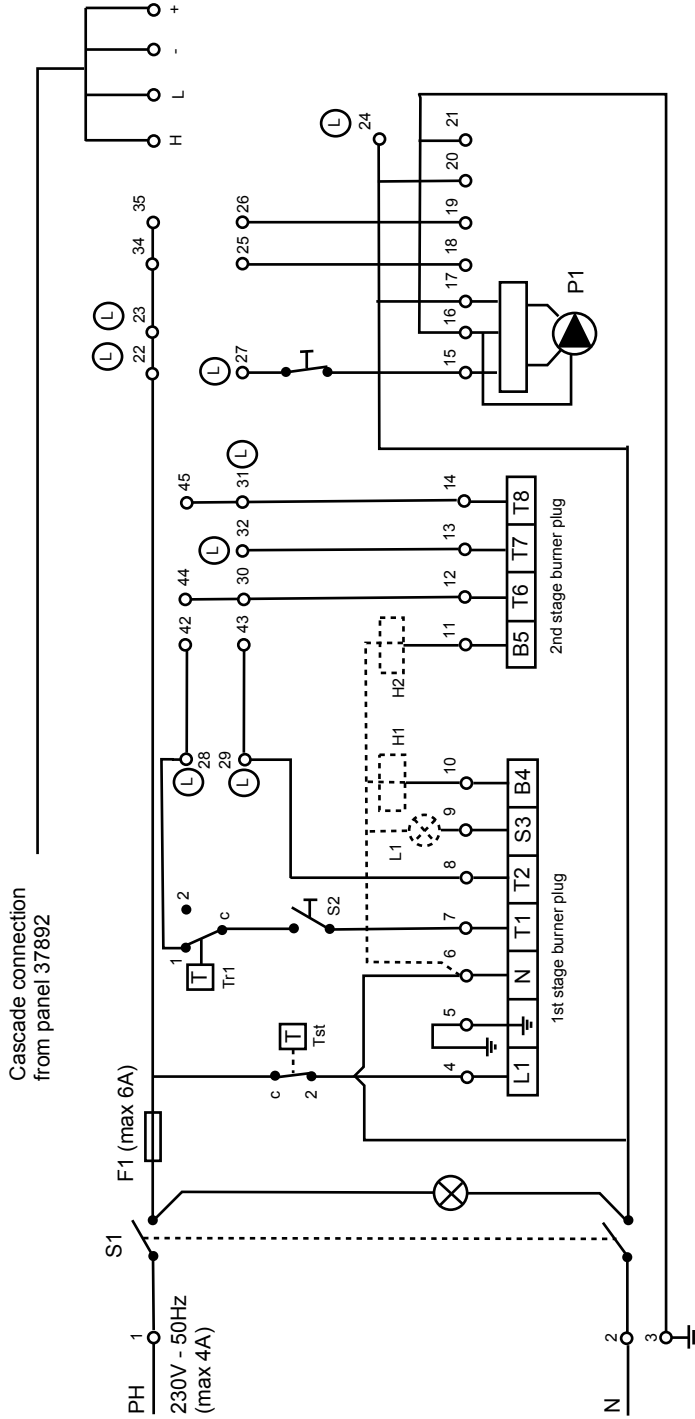


Fig 8 wiring schematic

Key to fig 8 wiring schematic

- H1 External stage 1 hours run counter
- H2 External stage 2 hours run counter
- L1 External remote lock-out lamp
- P1 Boiler primary pump
- S1 Panel on/off switch
- S2 Burner on/off switch
- Pz1 Pump zone 1
- Pz2 Pump zone 2
- Pb HWS loading pump
- Tst Boiler overheat thermostat (100°C)
- Tr1 Stage 1 thermostat (60°C to 90°C)

- Connection to integral E8 controller
- Connection to integral Lago Basic controller



Boiler E8 controller

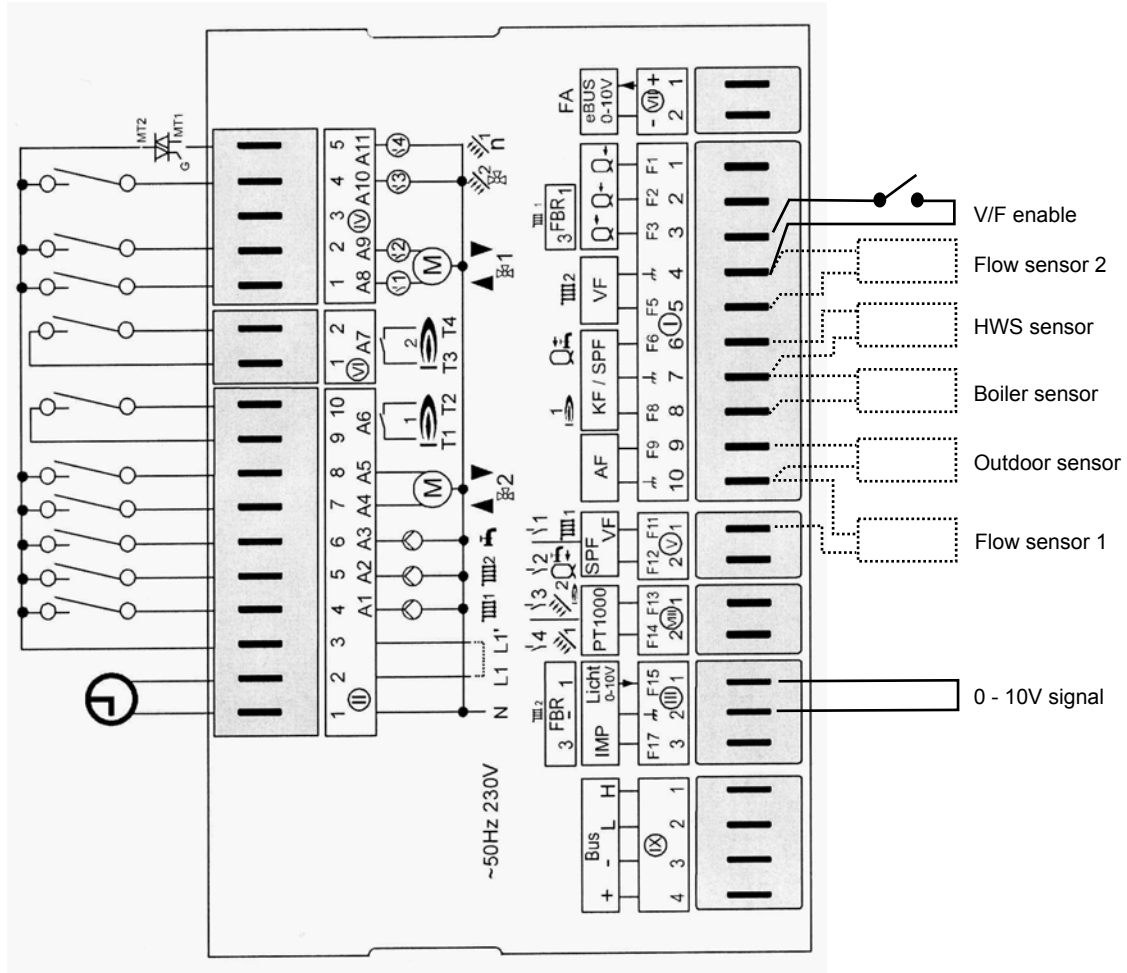


Fig 10 E8 controller in master control panel

E8 Controller

The E8 controller is a system controller rather than an individual boiler controller. Alternative connections for either 0-10V control or a volt-free on/off enable signal are shown on fig 10 above.

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