

Clyde

Clyde CK40

Carnot Consult

Natural gas
Class D oil
Dual Fuel

Cast Iron Boiler

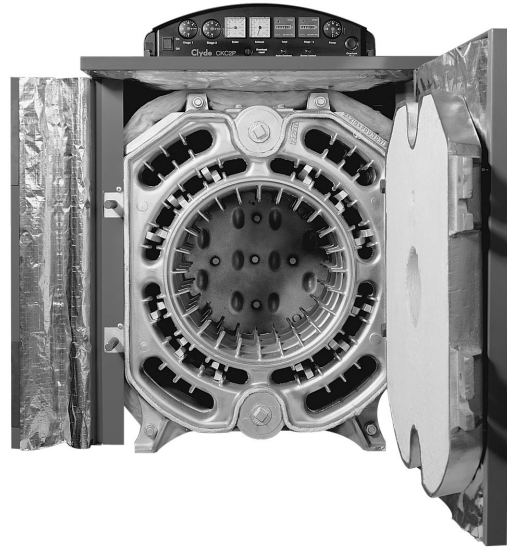
350 kW
to
500 kW



Contents	Page
General information	2
Dimensions	3
Technical data	3
Installation requirements	4 & 5
Boiler control panel	6
Wiring diagrams	7 & 8

- **Seasonal efficiency of over 84% gives compliance with ADL2B 2013 for gas fired boilers without the need for additional heating credits**
- **Compact heat exchanger gives small footprint relative to output**
- **Delivered in loose sections for easy site access, or as a ready-assembled block if preferred**
- **Wide range of 2-stage gas and oil, dual-fuel and modulating gas burners available**

General information



Description

CK40 cast iron sectional boilers are designed for use in either open vented or pressurised heating systems up to 8 bar working pressure with gas, oil or dual fuel burners. There are four models in the range 336 kW to 500 kW. The boiler has a pressurised combustion chamber and burners offered are all capable of overcoming the boiler resistance without the assistance of the chimney.

These are 3-pass boilers, ensuring that they comply with the efficiency requirements of ADL2B of The Building Regulations Part L 2013.

Application

CK40 boilers are made from Grade GG20 cast iron and conform with the requirements of EN 303-1. The boilers are suitable for use in LTHW heating systems with a maximum operating pressure of 8 bar. Maximum system operating temperatures are 90°C for LTHW systems and 105°C for MTHW systems.

CK40 boilers may be fired by Natural gas, Class D oil or dual fuel burners with 2-stage control. Modulating burners are optionally available.

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 potable water is required, a matching calorifier or plate heat exchanger must be provided in the system.

Statutory requirements

CK40 boilers are CE marked and must be fired by a compatible burner certified to EN267 (oil firing) or EN676 (gas firing) to comply with the Boiler (Efficiency) Directive 1993.

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

Gas supplies and gas burners must be installed and commissioned by a qualified person, eg. a Gas Safe registered engineer.

Materials & boiler assembling

The boiler is supplied as standard with the cast iron sections loose for site assembling. The boiler blocks can be assembled and tested at works to special order. Each section is tested hydraulically for soundness in accordance with EN303-1. Conical nipples are used to join the sections. The insulation around the assembled boiler block is 50mm thick and the steel jacket is finished in two-tone enamel. The jacket, insulation, boiler control panel and burner are packed separately for fitting on site.

Site assembling should only be undertaken by Carnot or their authorised engineer. All insulating and refractory materials are included, with ceramic sealing ropes for all access doors.

Handling

Offloading, dry storing and placing of equipment in the boiler room is the responsibility of the installer.

Equipment must be dry stored and protected from frost. Cartons must not be crushed or otherwise damaged.

Commissioning

Carnot undertake commissioning of boilers. Commissioning charges do not include servicing during the guarantee period. This may be carried out under service contract or to specific order.

Boiler log book

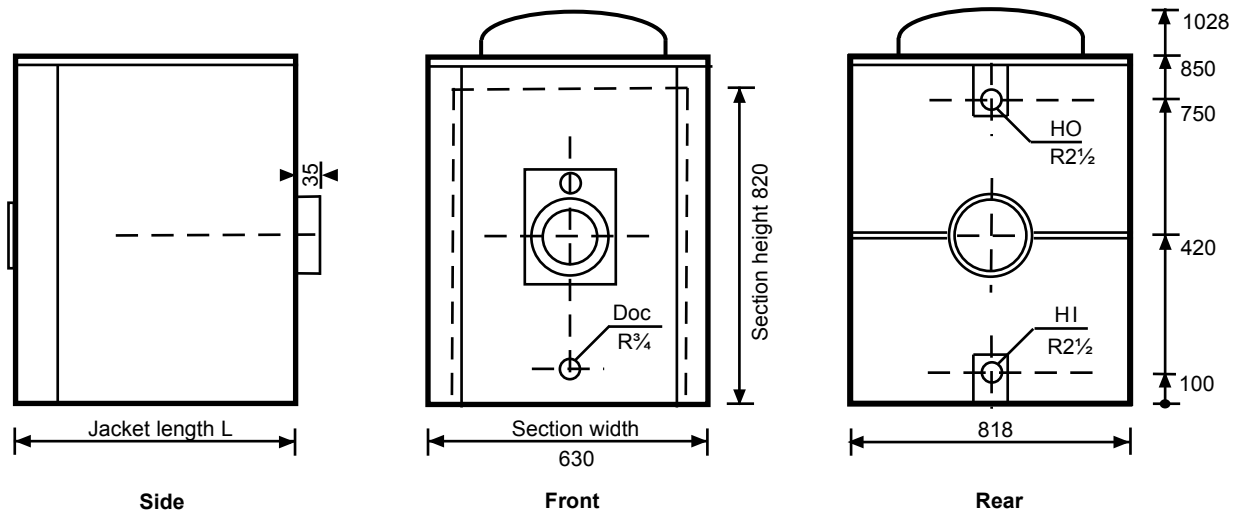
A permanent record of commissioning and servicing data and measurements should be kept in the building log book. It should be kept safe and updated whenever routine or emergency work is performed on the boiler.

Guarantee

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

The guarantee is not valid if the boiler is subjected to thermal stress, 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.

Dimensions and technical data



Dimensions

Boiler model		350	400	450	500
Output	kW	336	401	454	500
No. sections		8	9	10	11
Overall length	L mm	1264	1397	1530	1663
Combustion chamber length	mm	981	1114	1247	1380
Combustion chamber diameter	mm	370	370	370	370
Boiler door thickness	mm	130			
Boiler flow connection	HO	R ² / ₁ / ₂			
Boiler return connection	HI	R ² / ₁ / ₂			
Boiler drain connection	Doc	R ³ / ₄			
Flue spigot diameter	mm	250	250	300	300

Technical data

Nominal heat output (full load) ncv	kW	336	401	454	500	
Nominal heat input (full load) ncv	kW	368	437	496	545	
Efficiency at 100% load (ncv)	%	91.2	91.7	91.5	91.7	
Efficiency at 30% load (ncv)	%	94.2	94.7	94.5	94.7	
Boiler seasonal efficiency(1)	%	84.43	84.88	84.7	84.88	
Natural gas consumption (gcv)	m ³ /h	37.9	45	51.1	56.1	
Oil consumption (ncv)	kg/h	31.5	37.3	42.4	46.6	
Dry weight (excludes burner)	kg	835	919	1003	1087	
Water volume	litres	97	109	121	133	
Flue gas mass flow @3% oxygen	kg/s	0.15	0.18	0.21	0.23	
Chimney draught	Pa	4 (min) 25 (max)				
Gas side resistance	mbar	1.7	2.3	2.9	3.6	
Flue gas temperature rise @3% oxygen	Nat gas (2)	°C	157	154	152	150
	Class D oil	°C	187	185	183	181
Maximum working temperature	°C	90 LTHW				
Maximum hydraulic working pressure	bar	8				
CE-Registration number		CE-0617/97				

Water flow rates and hydraulic resistances

Water flow rate at 11°C temp. rise	l/s	7.27	8.68	9.83	10.82
Hydraulic resistance at 11°C temp. rise	kPa	27.1	38.3	48.6	58.8
Water flow rate at 20°C temp. rise	l/s	4	4.77	5.4	5.95
Hydraulic resistance at 20°C temp. rise	kPa	8.2	11.6	14.7	17.8
Water flow rate at 30°C temp. rise	l/s	2.67	3.18	3.6	3.97
Hydraulic resistance at 30°C temp. rise	kPa	3.6	5.2	6.5	7.9

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

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

(2) BS 7190:1989

Installation requirements

Boiler location (Refer Figs 1 & 2)

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 assembling and servicing.

Boilers must not be installed in areas where inflammable vapours are likely to be present. To avoid damage to the boilers, contamination of the combustion air by high levels of dust or halogenated hydrocarbons (eg. Solvents, spray can propellants, cleaning agents, adhesives, etc) must be avoided.

Boilers should be installed on a plinth which is at least 50mm high and is smooth and level. Mild steel inserts to support the boiler should be positioned in the partially set concrete, made level and the concrete allowed to set. (NB : For some burners with acoustic shrouds the plinth may need to be higher - refer Sales Office).

An uneven plinth will prevent correct assembling of the boiler sections, cause damage to sections and assembling tools and may give rise to leaks. It can also inhibit freedom for expansion and contraction of the boiler during operation.

Burners

Boilers can be supplied with two stage Natural gas, Class D oil or Dual fuel burners. Modulating burners are also available with load-matching control equipment. A choice of burner makes is available.

Fuel specification

Natural gas (GCV 38.76 MJ/m³) with a minimum gas inlet pressure according to the burner model specified.

BS2869 Class D oil (35 sec). Advice should be sought from the oil supplier regarding the storage of Class D oil.

Fuel supply pipework

Install gas or oil supply pipe(s) and service valve(s) 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 gas supply pipework and components must be carried out by a qualified person, eg. a Gas Safe registered engineer. The gas meter and supply must be sited in accordance with the requirements of BS6400.

Plant room layout (Refer Fig 1)

When planning the layout of the boiler room, allowance must be made for opening the boiler door, boiler assembling, boiler cleaning and maintenance. The boiler door may be hinged from the right (as illustrated) or the left. A ceiling height of at least 2.3m is recommended. Wall clearances:

- W1 Minimum 100mm
- W2 Burner length A + 100mm, to a min of 400mm
- W3 Jacket length + 200mm in front of boiler for cleaning
- W4 Min 850mm behind boiler to allow 500mm of horizontal flue before any bends or tees

Plinth dimensions (Refer Fig 2)

Plinth height - at least 50mm, smooth and level

Steel inserts - 100mm x 5mm steel strip or 100mm x 55mm x 5mm steel angles

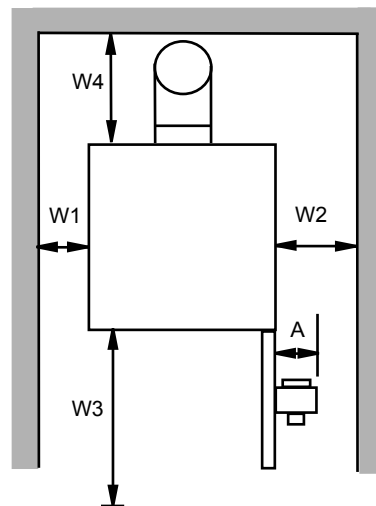


Fig 1 Wall clearances

Boiler	L1 mm	L2 mm
CK40-350	1264	934
CK40-400	1397	1067
CK40-450	1530	1200
CK40-500	1663	1333

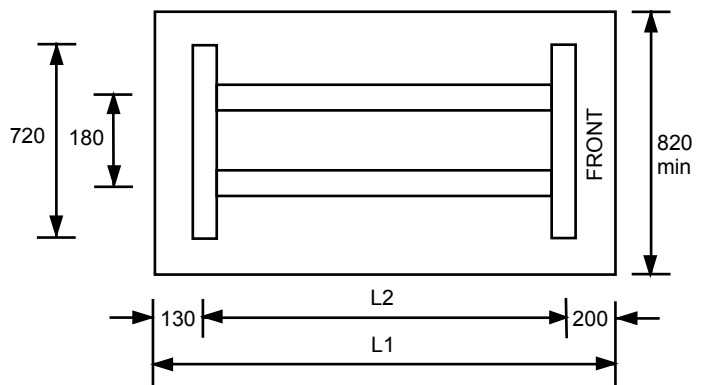


Fig 2 Plinth dimensions

Installation requirements

Air supply

Air for ventilation and combustion must be provided for gas fired boilers in accordance with either BS 6644:2011 or IGE/UP/10. Air supply for oil fired boilers must conform to BS 5410 : Part 2.

Chimney design

The CK40 boiler is designed to operate with a pressurised combustion chamber and the chimney is not required to assist the burner in overcoming the boiler resistance. The chimney must cater for the total internal resistance of the flue system from each boiler outlet and not impose an additional load on the burner.

Water circulation (Refer Fig 3)

The flow water temperature from the boiler must reach 60°C (gas firing) or 50°C (oil firing) within 10 minutes of the boiler being brought into operation. Thereafter, water circulation should be maintained through the boiler such that the boiler flow water temperature is always above 60°C (gas firing) or 50°C (oil firing). A pump overrun facility is necessary to ensure that water circulation is maintained for at least three minutes after the boiler is switched off.

There are several ways of providing boiler protection, eg shunt pumps, primary loops, etc. A typical boiler pump and 3-port valve arrangement is shown in Fig 3.

For multi-boiler systems a 'reverse return' pipework configuration is required to ensure equal distribution of water flow through the boilers.

Water treatment

Whenever a new boiler is connected to an existing system, the pipework must be thoroughly cleaned and flushed. 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. Long term water treatment is essential to the economic operation and life of both new and refurbished heating systems.

For full information on cleaning, flushing and protecting hot water systems, refer to BSRIA Application Guide AG 1/2001.

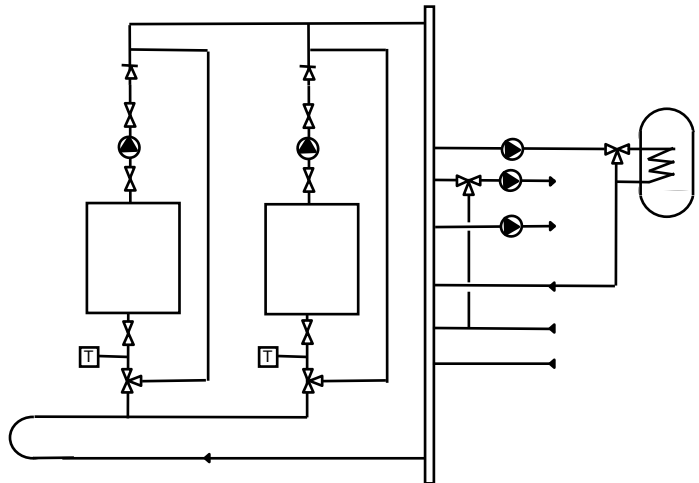


Fig 3 Multiple boilers with individual pumps

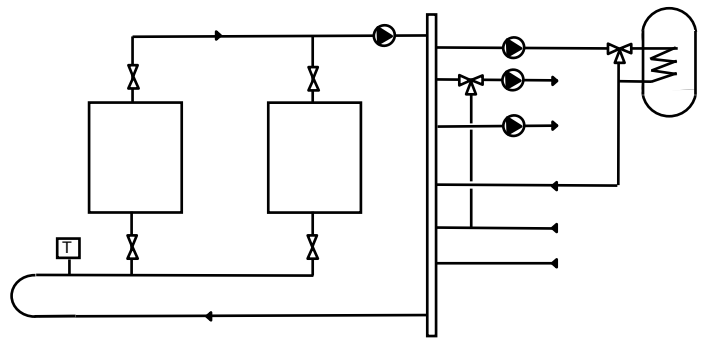


Fig 3a Alternative arrangement for boiler protection with a primary loop

Electrical supply (Refer Fig 4)

A 400V 3PH supply is required for some of the standard burners offered, and the connection details are shown opposite. The boiler control panel requires an additional 230V 1PH supply.

If a 230V 1PH burner is being used, the fused supply (max 15A) should be taken to the control panel only. The harness and connector supplied 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 4 is only diagrammatic. Double pole switches with a minimum separation of at least 3 mm must always be used.

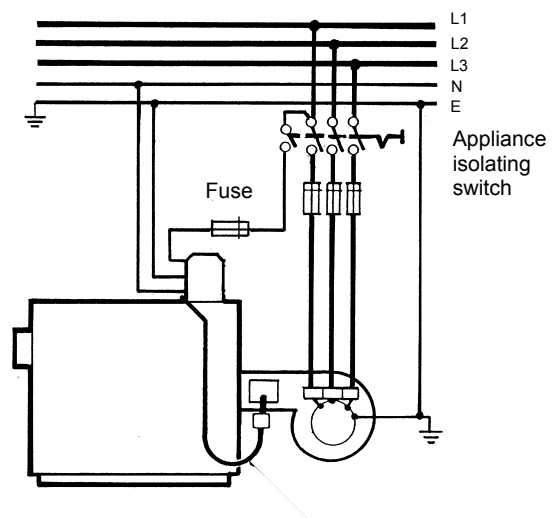


Fig 4 - Electricity supply

Boiler control panel

Control panel CKC2P provides 2-stage burner control for high/low operation whilst panel CKC1P provides 1-stage burner control for on/off, modulating or LFS operation.

Within the control panel the minimum essential control items are enhanced with extra indicators and terminal facilities to meet the majority of foreseeable needs.

A pump overrun thermostat is provided as standard to facilitate the dissipation of residual heat from the boiler via a system pump or a dedicated boiler pump.

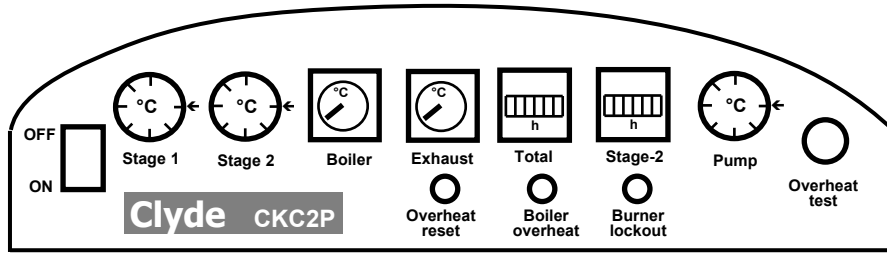
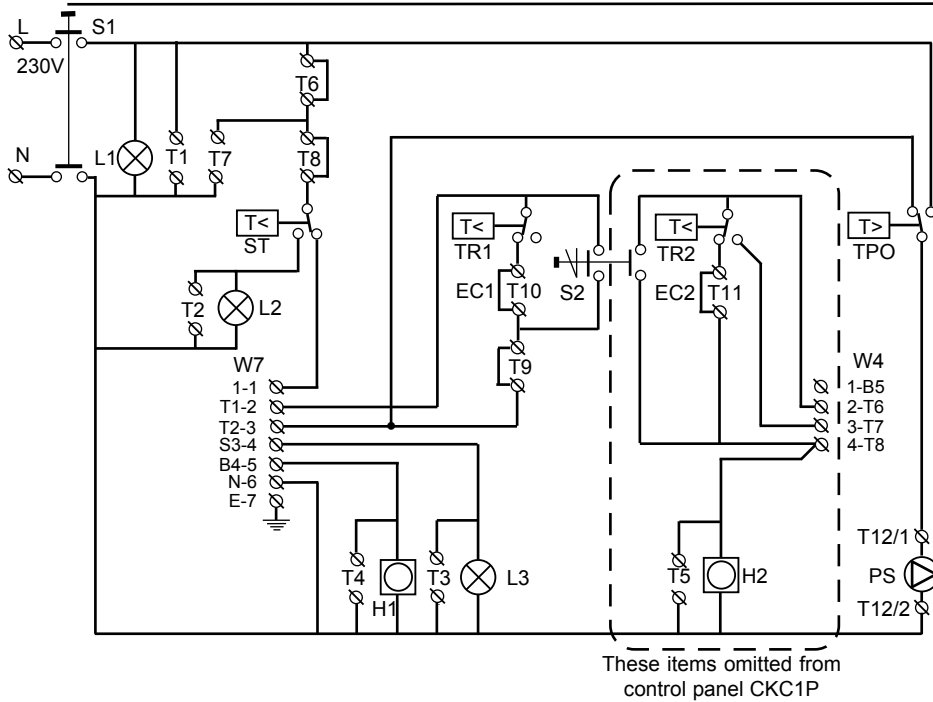


Fig.5

Components supplied in control panel (refer Fig 5)

	CKC1P	CKC2P
Boiler on/off switch	X	X
Boiler ON lamp (green)	X	X
Boiler thermostat adjustable 40°C ... 90°C - stage 1, on/off or LFS	X	X
Boiler thermostat adjustable 40°C ... 90°C - stage 2, high/low		X
Hours run meter - total	X	X
Hours run meter - stage 2		X
Boiler thermometer, °C	X	X
Exhaust gas thermometer, °C	X	X
Boiler overheating thermostat, LTHW 100°C	X	X
Boiler overheating thermostat manual reset button	X	X
Boiler overheating warning lamp (red)	X	X
Boiler overheating test switch	X	X
Burner lockout warning lamp (red)	X	X
Pump overrun thermostat adjustable 40°C ... 90°C	X	X

Schematic wiring diagram - control panels CKC1P and CKC2P



Components

EC1	External control, stage-1
EC2	External control, stage-2
H1	Hours run, total
H2	Hours run, stage-2
L1	Boiler run lamp (green)
L2	Boiler overheath warning (red)
L3	Burner lockout warning (red)
PS	Boiler or system pump (10A max)
S1	Panel On/Off switch
S2	Overheath test switch
ST	Overheath thermostat
TPO	Thermostat, pump overrun
TR1	Thermostat, stage-1
TR2	Thermostat, stage-2

Terminals

T1	External indicator, power ON
T2	External warning, boiler overheath
T3	External warning, burner lockout
T4	External indicator, total hours run
T5	External indicator, stage-2 hours run
T6	Plant room safety link
T7	Plant room ventilation fan
T8	Ventilation fan proving link
T9	Flue fan proving link
T10	External energy control, stage-1
T11	External energy control, stage-2
T12	Boiler or system pump (10A max)

7-wire loom

1	Line to burner control
T1	Control loop, stage-1, out
T2	Control loop, stage-1, return
S3	Total hours run signal
B4	Burner lockout signal
N	Neutral
E	Earth

4-wire loom

B5	Not used
T6	Control loop, stage-2 out
T7	Stage-2 damper close signal
T8	Stage-2 damper open signal

These items omitted from control panel CKC1P

Control circuit description

System integrity

Switch S1 provides the ON/OFF facility for the control panel and burner control box. When ON, the lamp L1 is green, external 230V indication is available via terminals T1/1&2.

A plant room fire link, smoke detector or similar safety device may be connected at terminals T6/1&2. An output signal for a plant room ventilator or similar device, which must be in operation whilst the boiler is switched on, is provided at terminals T7/1&2. The proving link for this device is between terminals T8/1&2. If the plant room fire link (safety device) is broken, the ventilation fan supply signal is switched off.

A boiler overheath signal is indicated by lamp L2 in response to the boiler overheath thermostat ST and is available as an external 230V signal at terminals T2/1&2. If system integrity is proved, a power supply is provided for the burner control system via terminal W7-1 of the 7-wire burner loom.

Boiler pump overrun

Pump overrun thermostat TPO enables the boiler or system pump, PS, which is connected between terminals T12/1&2 once a demand for heat is made by the external control EC1 and the boiler thermostat TR1. When the boiler flow water temperature exceeds a pre-selected temperature, recommended as 60°C, thermostat TPO transfers the pump run directly to the power supply. At the end of the heating cycle when burner firing is terminated by either EC1 or TR1, the pump continues to run until the flow temperature falls to the set point to dissipate residual heat from the boiler.

Stage 1 control loop (CKC1P & CKC2P)

The control loop of the burner control box is provided via the 7-wire loom on terminals W7-T1/T2. The boiler stage-1 thermostat TR1 is in series with terminals T10/1&2 which provides facilities for connecting a space heating thermostat, frost thermostat, timeswitch and/or external building management system, EC1. If a flue (chimney) fan or flue dilution system is installed, the run signal should be taken from T9/1 and the proving link made between T9/1&2. (NB Fan overrun facility must be provided after the burner has switched off to purge the boiler of exhaust gases). Burner lockout warning is signalled by red lamp L3 and total hours run are displayed in meter H1. External 230V indicators are provided for burner lockout warning on terminals T3/1&2 and total hours run on terminals T4/1&2.

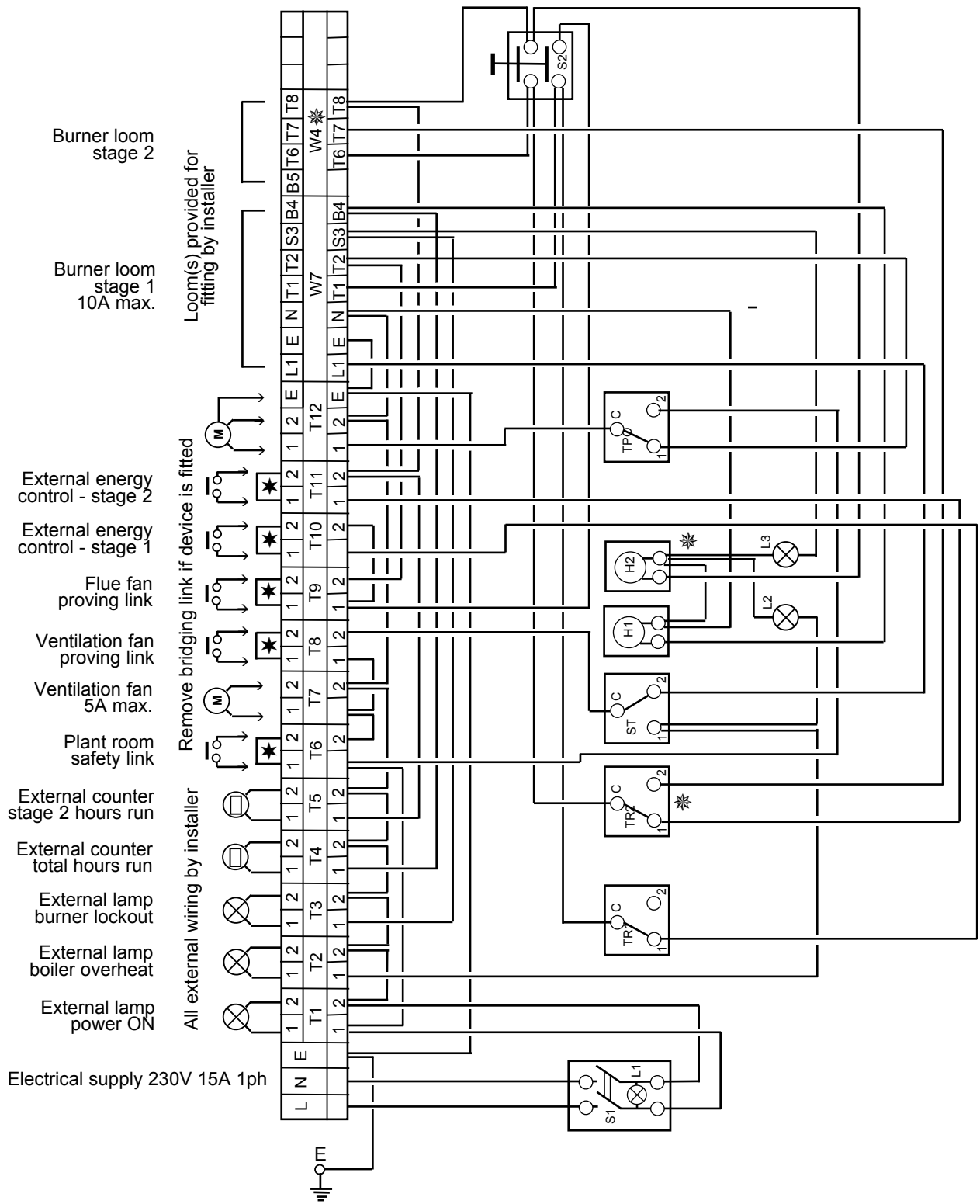
Stage 2 control loop : (CKC2P only)

The stage-2 burner control is provided by the 4-wire loom on terminals W4/1-4. Boiler thermostat TR2 is in series with terminal T11/1&2 which provides connection for the external building management system EC2. Meter H2 displays stage-2 hours run and an external 230V signal is available on terminals T5/1&2.

Boiler overheath test switch

A 'push & hold' boiler overheath test switch S2 is provided for commissioning and for service engineers to test the boiler overheath thermostat ST. This switch bridges the boiler thermostats TR1/TR2 and when held in puts boiler temperature control under the boiler overheath thermostat.

Wiring diagram for control modules CKC1P and CKC2P



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