Service Manual

EFTC-140F Hot Water Combination Boiler

Advanced Heating
& Hot Water Systems

120 Braley Road, East Freetown, MA 02717 • 1-800-323-9651 • www.htproducts.com

LP-528 REV. 8.01.14

Service Manual

Model

EFTC-140F
(Hot Water Combination Boiler)

- Natural Gas(NG) – Factory Default
- Liquid Propane Gas (LP) – Field-Convertible
  (Refer to the gas conversion manual.)

Heat Exchanger bears the ASME "H" Stamp

⚠ WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury, or death.

– Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
– WHAT TO DO IF YOU SMELL GAS
  · Do not try to light any appliance.
  · Do not touch any electrical switch; do not use any phone in your building.
  · Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  · If you cannot reach your gas supplier, call the fire department.
– Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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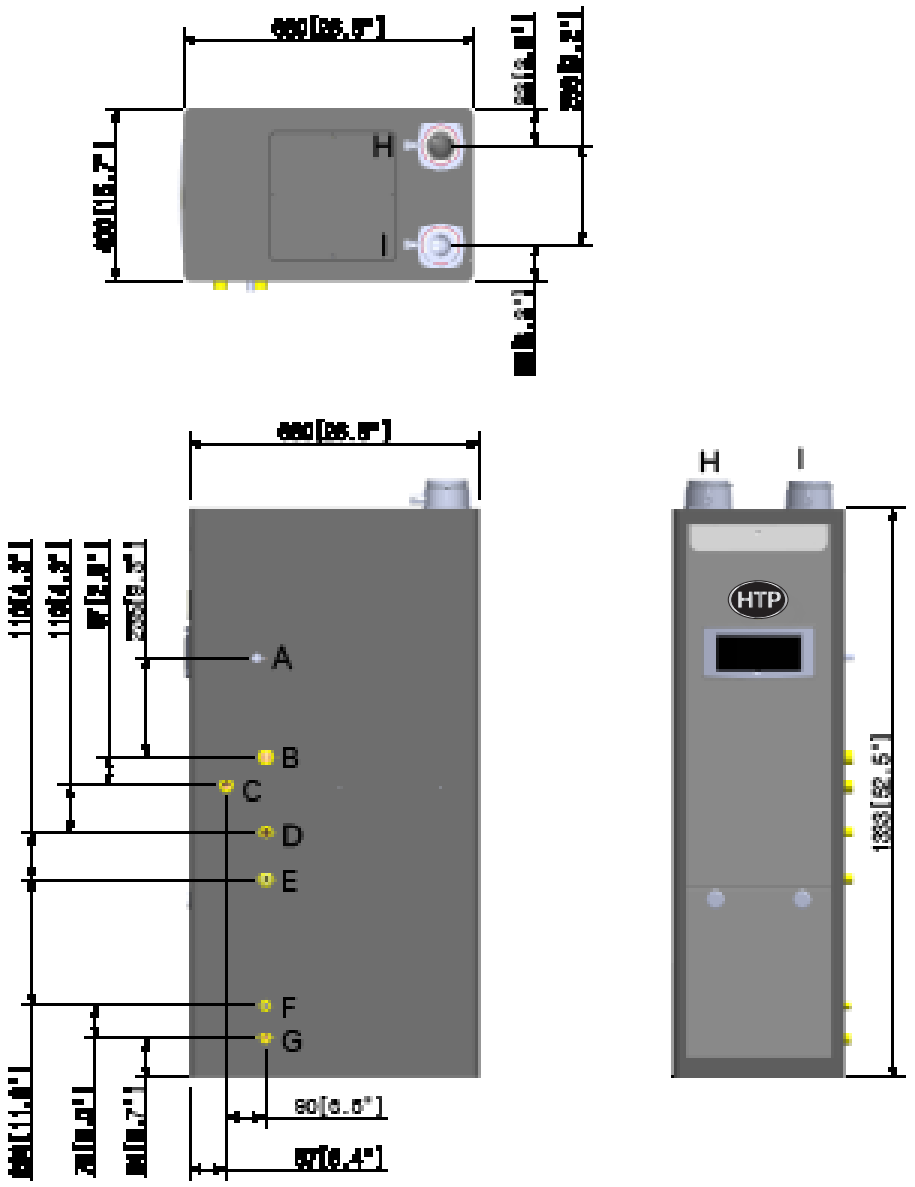
■ Specification

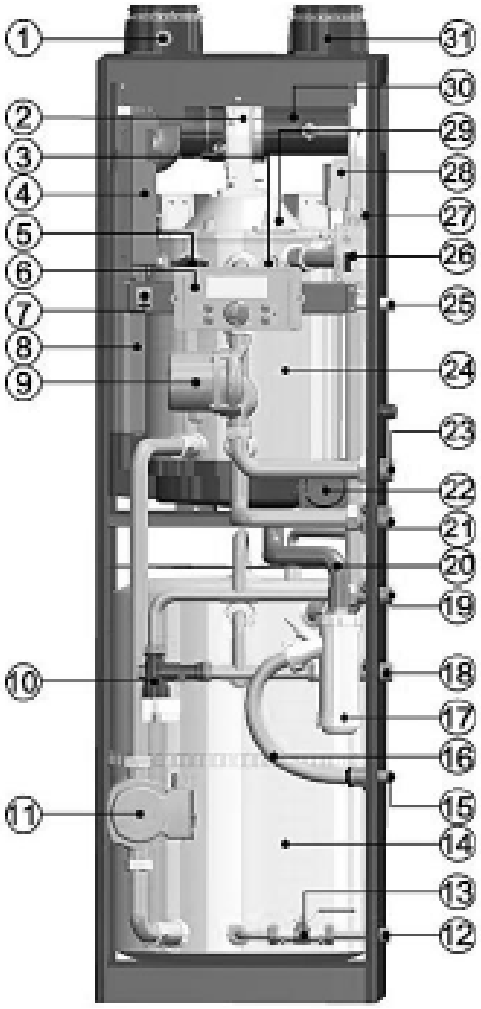
Model Name			EFTC-140F
Gas Input Rate	MAX		140,000 Btu/h
	MIN		28,000 Btu/h
AFUE			93.2%
Hot Water Capacity	35°F Rise		7.1 Gal
	45°F Rise		5.5 Gal
	77°F Rise		3.2 Gal
Installation			Indoor / Floor stand type
Flue System			Sealed Combustion Direct Vent
Vent Run			2″(50ft) , 3″(100ft) Schedule 40 PVC, CPVC, PP, SS
Orifice Size	NG(Orifice/Needle)		0.232″ (5.9 mm)
	LP(Orifice/Needle)		0.185″ (4.7 mm)
Gas Supply Pressure	NG		3.5″ WC to 14″ WC
	LP		3.5″ WC to 14″ WC
Manifold Pressure	Low Fire	2″/3" VENT	NG: -0.0039″ WC / -0.002″ WC
	High Fire	2"/3″ VENT	NG: -0.374″ WC / -0.216″ WC
Power Supply	Main Supply		120V 60Hz / 6A
	Maximum Power Consumption		160W
Ignition System			Direct Electronic Ignition / Automatic Flame Sensing
Burner System			Single Orifice Premixed Fuel Modulation Metal Fiber Infrared
Gas Valve System			Air ratio valve
Minimum Flow Rate			0.5 GPM
Internal Pipe Material			Copper
Dimensions			W15.7″ - H53.0″ – D26.8″
Shipping Weight			250 lbs.
Internal Storage Tank Water Capacity			11 Gallon
Boiler Heat Exchanger Capacity			4 Gallons
Total Water Capacity			15 Gallons
Main Controller / Control Panel			GTX-920C / P-920C_CB-HTP
CH Pressure			Min 15 ~ Max 30 PSI
DHW Pressure			Max 150 PSI
Connection Sizes	DHW Inlet / Hot Water Outlet		3/4″ NPT
	CH Supply/Return		1″NPT
	Gas Inlet		1/2″ NPT (1/2 x 3/4 Bell Coupling Provided to Upsize Gas Line)
Materials	Cabinet		Cold Rolled Carbon Steel
	Heat Exchanger		Primary Heat Exchanger : Stainless Steel Sub Heat Exchanger : Stainless Steel
Safety Devices			Flame Rod, Overheat Cut Off Device, Gas Valve Operation Detector, Exhaust Temperature High Limit Sensor, Water Temperature High Limit Sensor

■ Dimensions



	Description	Diameter
A	Gas Connection Adapter	1/2″ NPT (1/2 x 3/4 Bell Coupling Provided to Upsize Gas Line)
B	‘CH supply’ Adapter	1″
C	‘CH return’ Adapter	1″
D	‘DHW outlet’ Adapter	3/4″
E	‘DHW inlet’ Adapter	3/4″
F	Condensate Adapter	1/2″
G	Drain Adapter	1/2″
H	Exhaust Vent Connection	3″
I	Intake Pipe Connection	3″

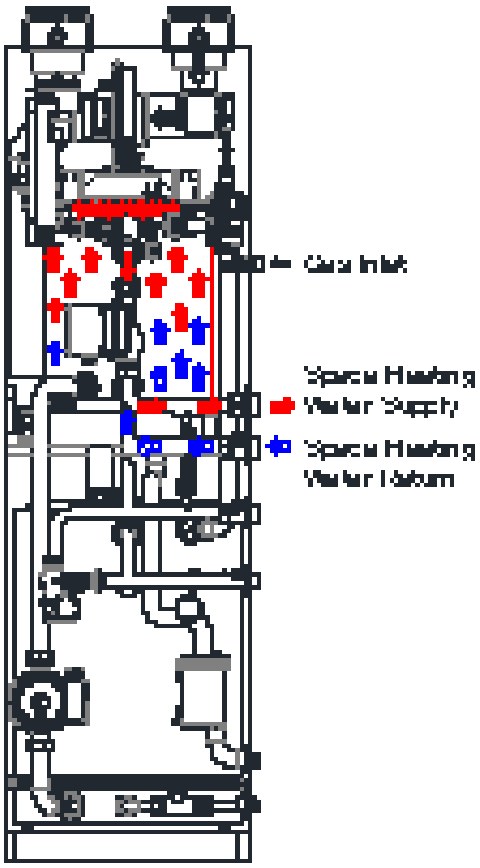
■ Components Description



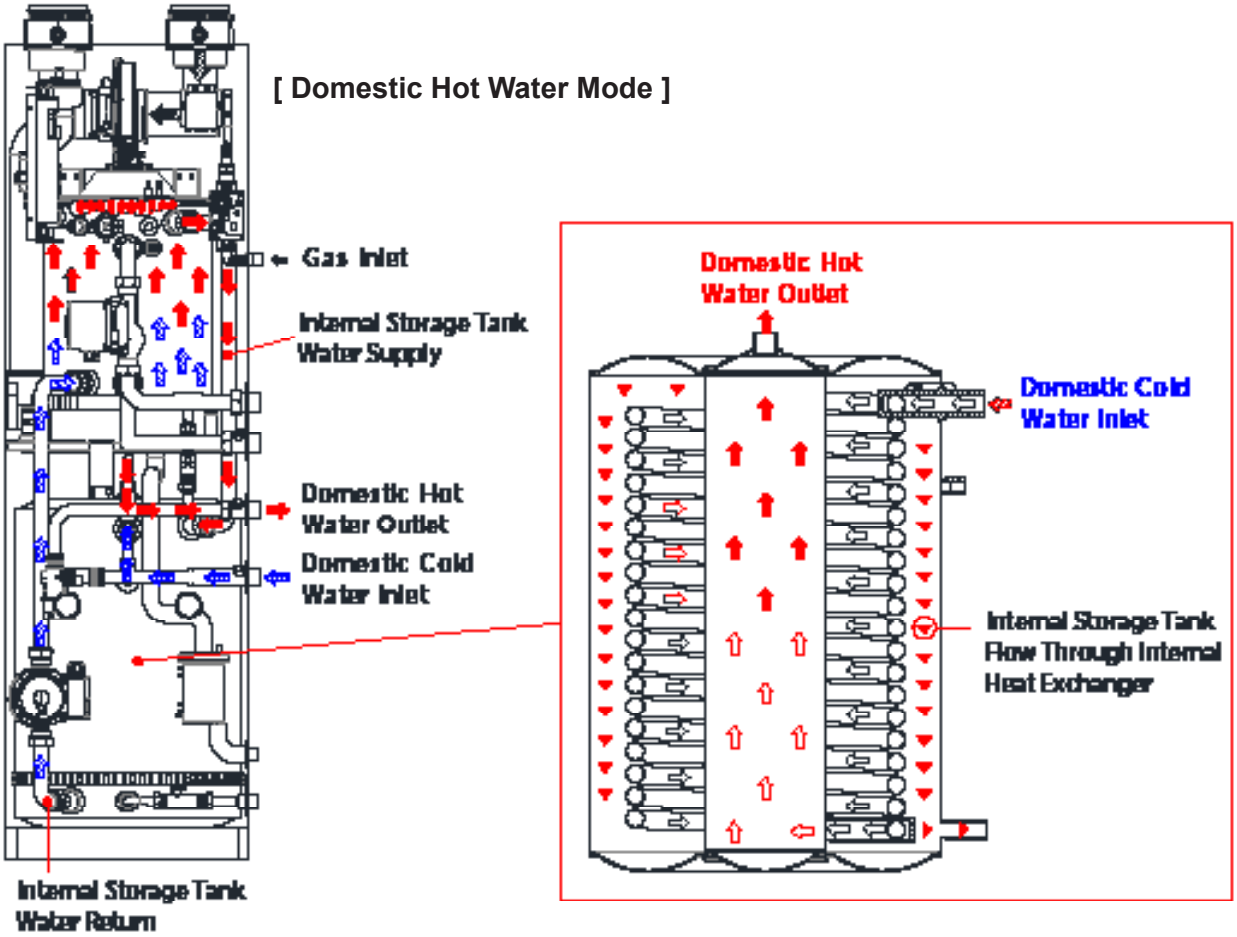
NUMBER	COMPONENT DESCRIPTION	NUMBER	COMPONENT DESCRIPTION
1	Exhaust Vent Adapter	17	Condensate Trap
2	BLDC Fan	18	DHW Inlet Adapter
3	Flame Detection Window	19	DHW Outlet Adapter
4	Main PCB	20	Condensate Hose 2
5	Flame Detection Sensor	21	CH Return Adapter
6	Control Panel	22	APS (Air Pressure Switch)
7	Manual ON/OFF Power Switch	23	CH Supply Adapter
8	Exhaust Pipe	24	Heat Exchanger
9	Internal CH Pump	25	Gas Inlet Adapter
10	Mixing Valve	26	Gas Valve
11	Internal Recirculation Pump (DHW)	27	Air Vent
12	Water Discharge Adapter	28	Ignition Transformer
13	Water Discharge Valve	29	Igniter
14	Internal Storage Tank	30	Air Intake Pipe
15	Condensate Trap Adapter	31	Air Intake Adapter
16	Condensate Hose 1		

■ Flow chart

[Space Heating Mode]

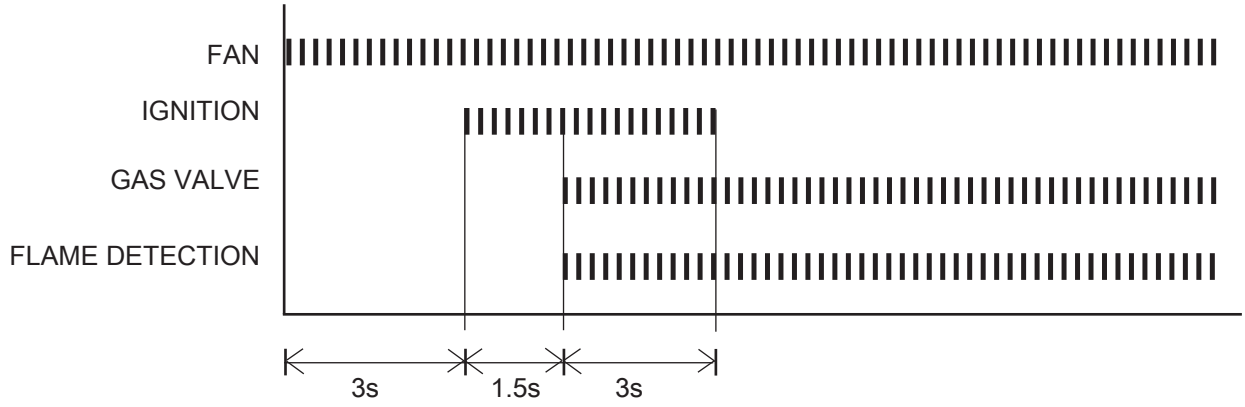


[Domestic Hot Water Mode]

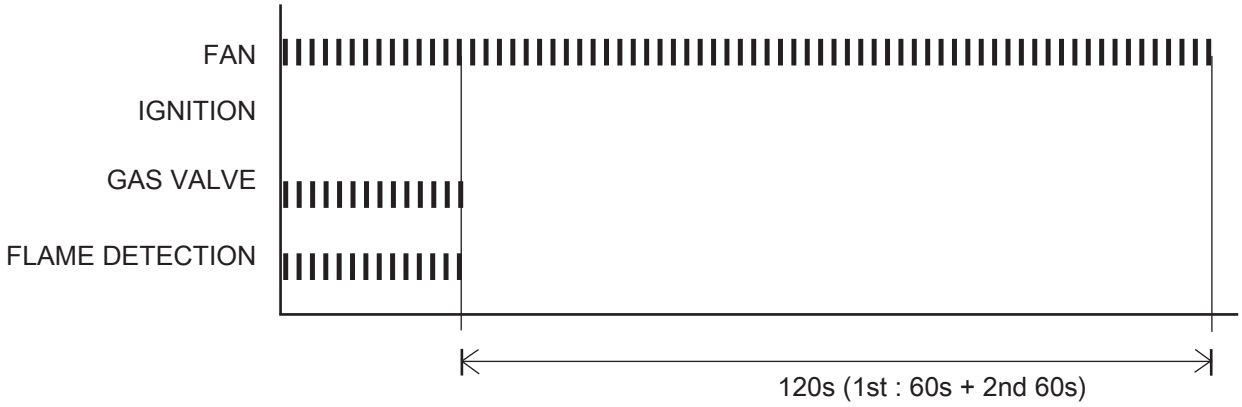


■ Time chart

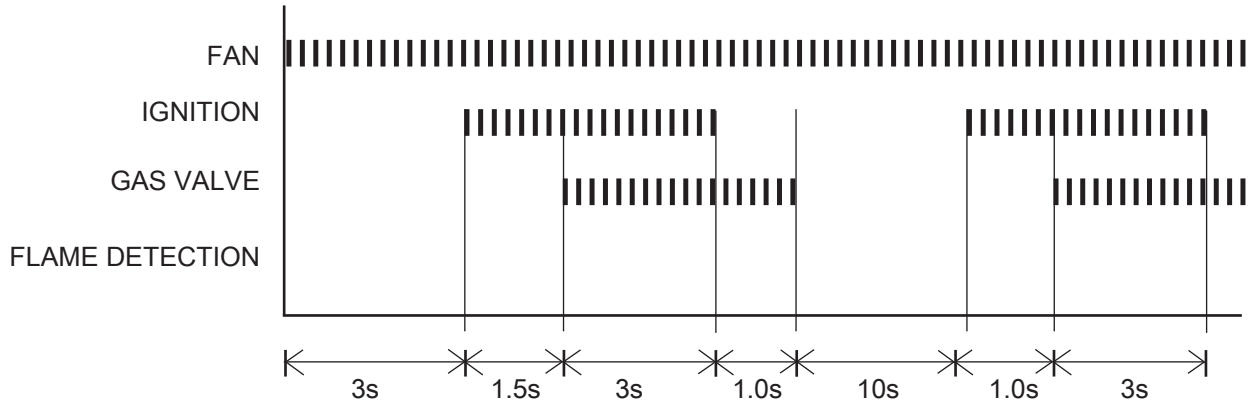
■ If normal ignition



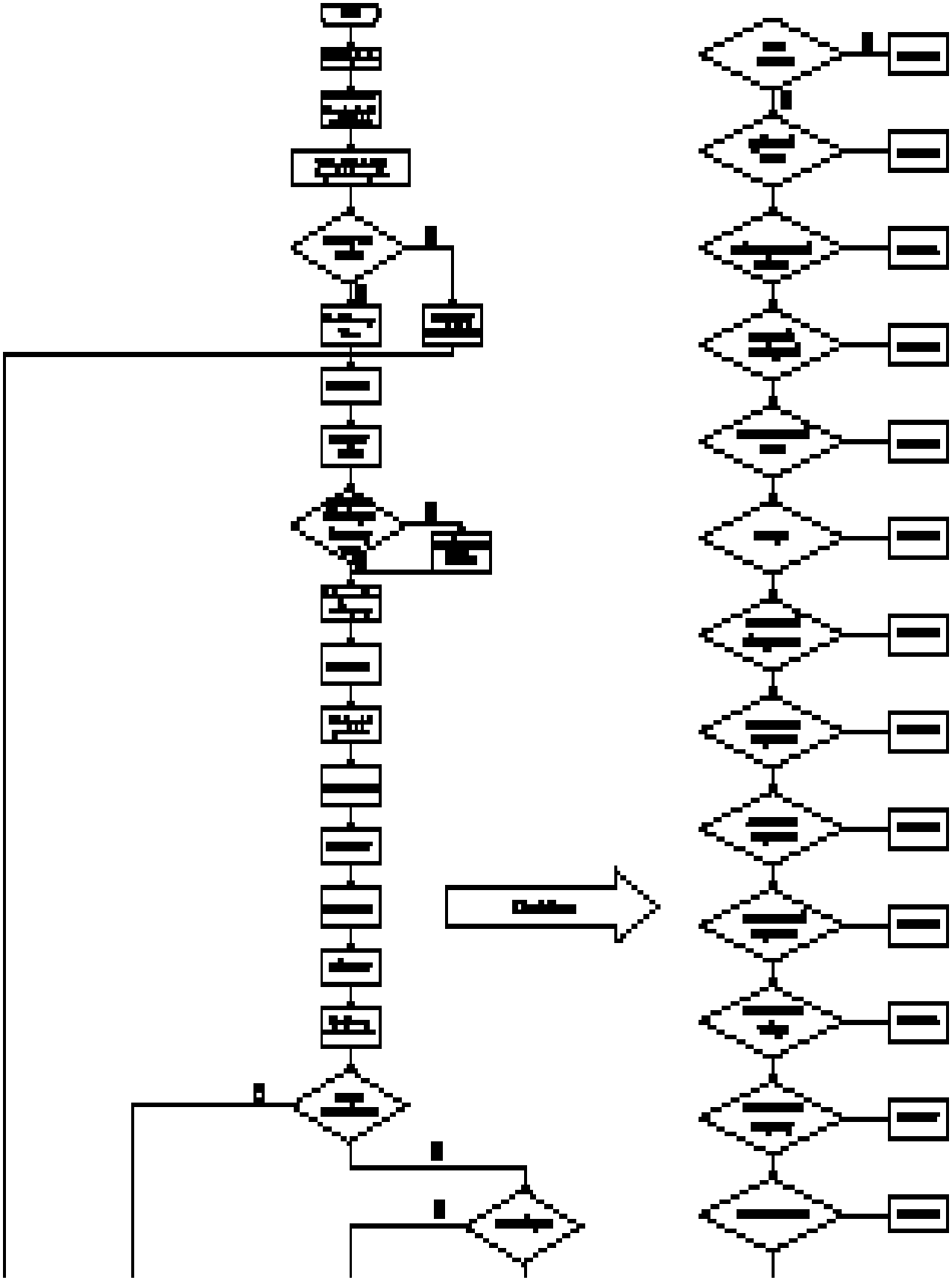
■ If flame extinguishes



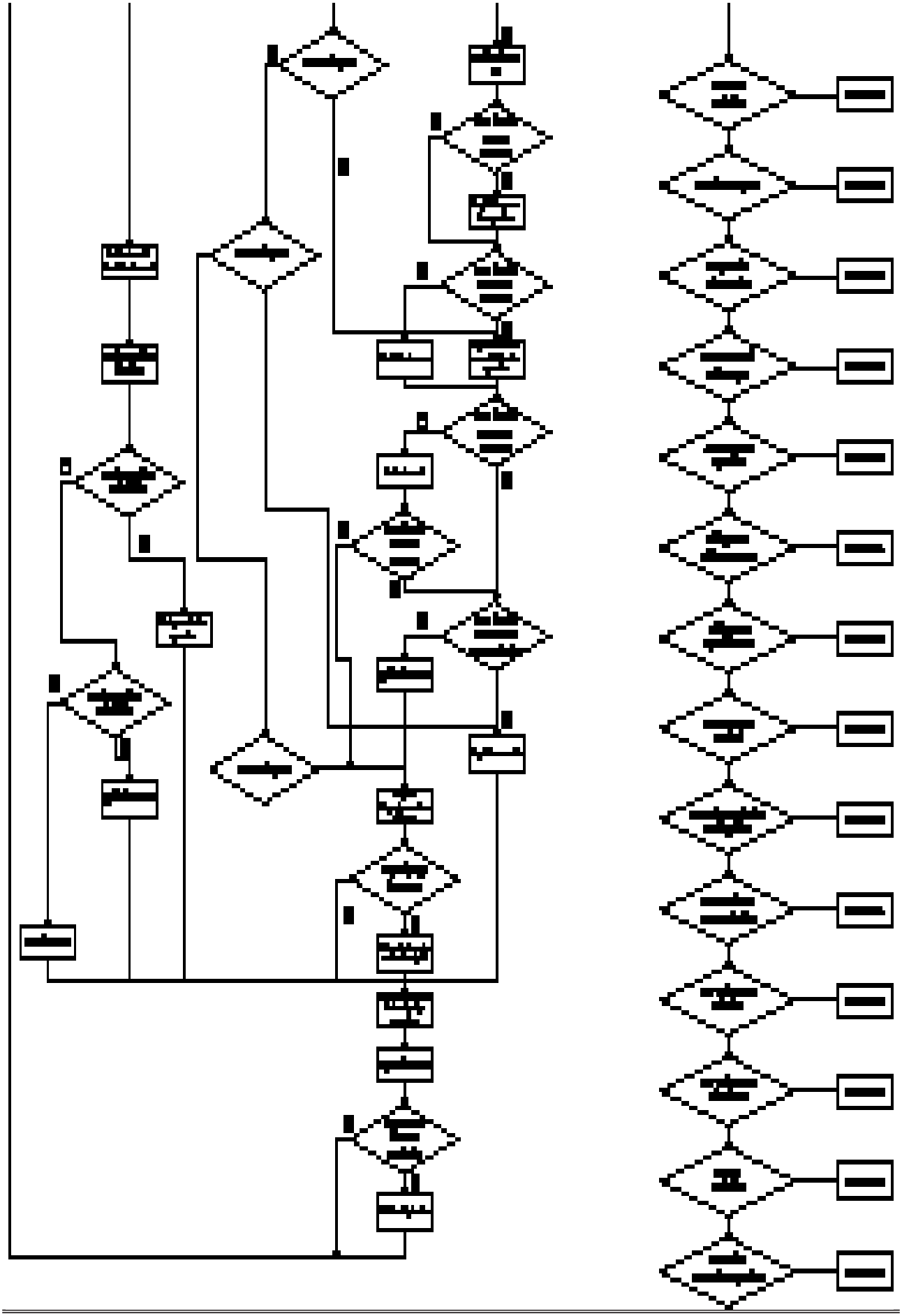
■ If abnormal ignition (Alarm after the 10 trial)



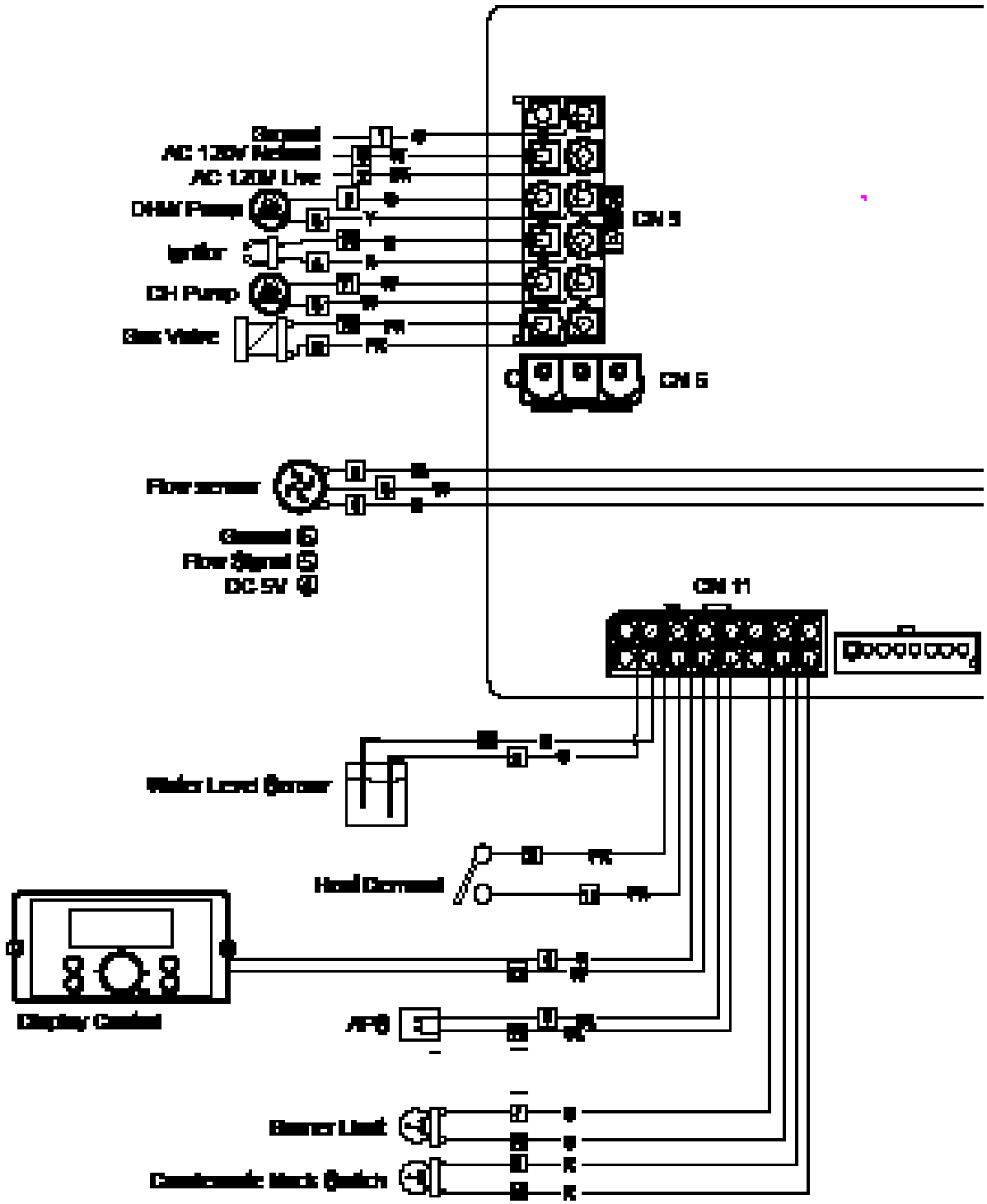
■ Operation flow chart



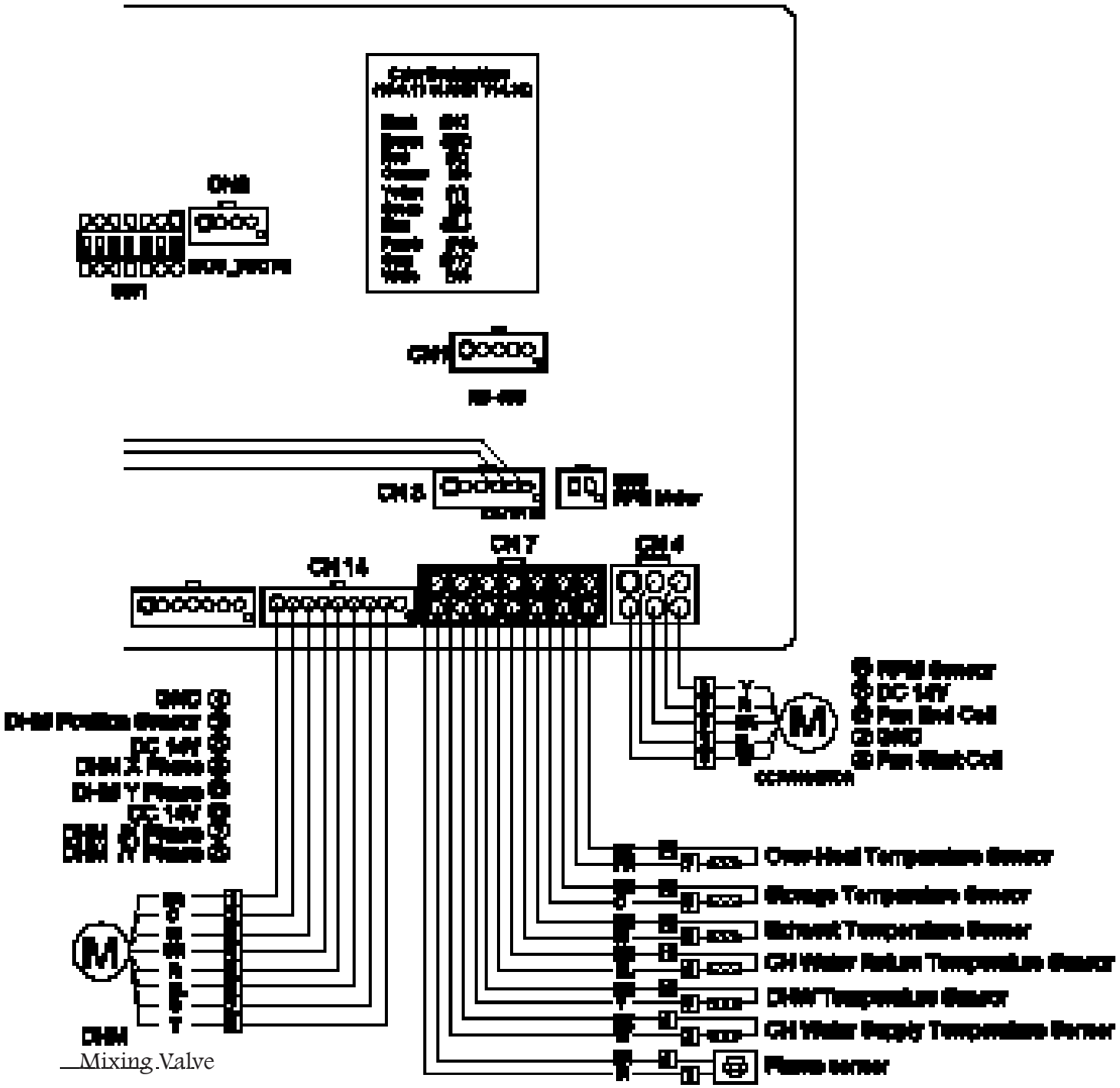
■ Operation flow chart



■ Wiring Diagram



■ Wiring Diagram



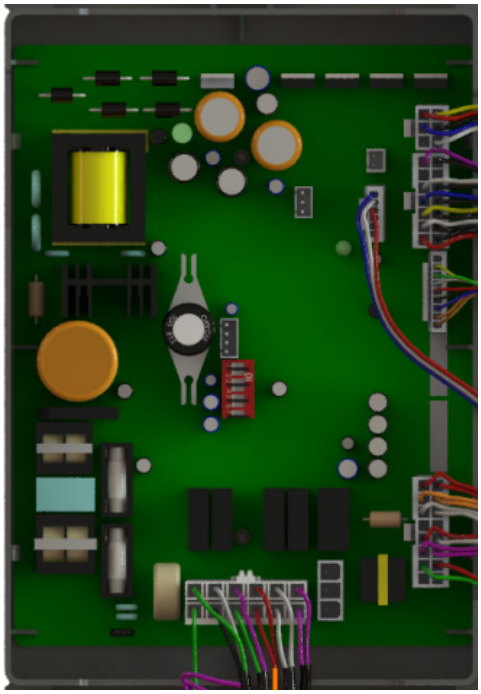
■ Connector function

Connector			Descriptions	HT SELV
no. of location and type	Pin nr.	Board Silk		
CN9 65001WS-12	1	-	GROUND	-
	2	L	Power Supply Line	HT (120VAC)
	3	CP1	Pump 1: DHW Pump	HT (120V~)
	4	IT	Ignitor	HT (120V~)
	5	L(HT)	Pump 2: Central Heating Pump	HT (120V~)
	6	GV	Gas Valve	HT (120V~)
	7	-	-	-
	8	N	Power Supply Neutral	HT (120V~)
	9-12		AC Power COM Line	HT (120V~)
CN1 SMW250-05	1	RS-485	RS485 +	SELV (5VDC)
	2		RS485 -	SELV (5VDC)
	3		GND	-
	4		RS485 +	SELV (5VDC)
	5		RS485 -	SELV (5VDC)
CN4 LWD1140-06	1	FAN	Unuse	-
	2		GND	SELV (26VDC)
	3		VDD	SELV (14VDC)
	4		Fan power(start coil)	SELV (26VDC)
	5		Fan power(end coil)	SELV (26VDC)
	6		Fan speed feedback signal	SELV (14VDC)
CN8 SMW250-04	1	MCU ISP	GND	SELV (5VDC)
	2		ISP /Reset port	SELV (5VDC)
	3		ISP TOOL0 Data port	SELV (5VDC)
	4		VCC	SELV (5VDC)
CN11 LWD1140-16	1	HWL	Unuse	SELV (12V~)
	8			
	2	LWL	Low Water Level Leakage Sensor	SELV (12V~)
	10			
	3	HD	Central Heating Demand	SELV (5V)
	11			
	4	TH	Connect to the Display Control(Thermostat)	SELV (14V)
	12			
	5	APS	Air Pressure Switch	SELV (14V)
	13			
	6	-	Not Used	-
	14			
	7	BL	Burner Limit	SELV (14V)
	15			
	8	HL	Condensate Block	SELV (14V)
	16			

■ Connector function

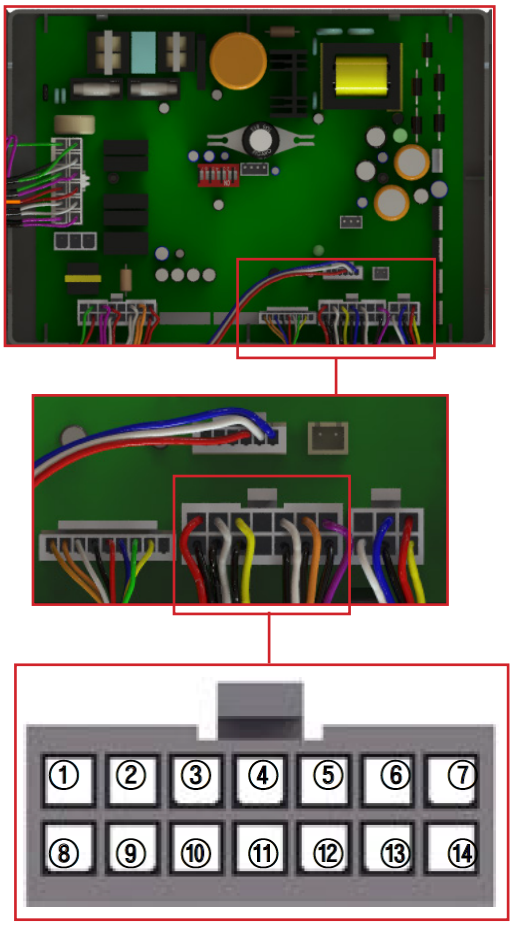
Connector			Description	HT SELV
no. of location and type	Pin nr.	Board Silk		
CN7 LWD1140-14	1	F.S	Flame Detect Sensor	SELV (5VDC)
	8			
	2	OP.S	Operation water temperature sensor	SELV (5VDC)
	9			
	3	DH.S	DHW temperature sensor	SELV (5VDC)
	10			
	4	I.S	Returen water temperature sensor	SELV (5VDC)
	11			
	5	BG.S	Exhaust temperature sensor	SELV (5VDC)
	12			
	6	ST.S	Storage water temperature sensor	SELV (5VDC)
	13			
	7	SP.S	CH Over heat temperature sensor	SELV (5VDC)
	14			
CN14 SMW250-09	1	IWM	GND	SELV (14VDC)
	2		IWM Stepper motor position	SELV (14VDC)
	3		VDD	SELV (14VDC)
	4		IWM Stepper motor coil X phase	SELV (14VDC)
	5		IWM Stepper motor coil Y phase	SELV (14VDC)
	6		VDD	SELV (14VDC)
	7		IWM Stepper motor coil /X phase	SELV (14VDC)
	8		IWM power IWM Stepper motor coil /Y phase	SELV (14VDC)
	9		Not Used	-
CN3 SMW250-06	1	WPS	Not Used	SELV (5VDC)
	2		Not Used	SELV (5VDC)
	3		Not Used	SELV (5VDC)
	4	FLUX1	VCC	SELV (5VDC)
	5		Water Flow Sensor	SELV (5VDC)
	6		GND	SELV (5VDC)
CN5 SMW250-10	1	RPM	FAN RPM Check	SELV (5VDC)
	2		GND	SELV (5VDC)

Description / Part #	Main Control Board / 7855P-008	Check Point	N/A
Function	This part controls all components contained in the combination boiler.		
Failure Event	Abnormal main controller operation.		
Effects	When the main controller has abnormal condition, components may not operate properly.		
Error Code	Er 38, Er 70		
Diagonostic	Check each connection and/or wires damage on the PCB.		
Color / Wire Number	N/A		



Description / Part #	CH Supply Temperature Sensor: 7855P-031 Storage Temperature Sensor: 7855P-057 DHW Temperature Sensor: 7855P-094 Exhaust Temperature Sensor: 7855P-092	Check Point	CN7
Function	The controller compares each sensor with setting temperature then goes to safety shut down when measured temperature is over the setting temperature.		
Failure Event	Sensor malfunction or overheating condition detected.		
Effects	Improper temperature measurement.		
Error Code	Er 16, Er 28, Er 30, Er 32, Er 33, Er 35		
Diagonostic	① Visibly check for breakage of wires and/or each connections ② Check each sensor's resistance range with a multi-meter.		
Color / Wire Number	① CH Water High Limit Sensor (black/purple): Connector ⑭,⑦ ② Storage Temperature Sensor (black/orange): Connector ⑬,⑥ ③ Exhaust Temperature Sensor (black/white): Connector ⑫,⑤ ④ DHW Temperature Sensor (black/yellow): Connector ⑩,③ ⑤ CH Supply Temperature Sensor (black/white): Connector ⑨,②		

NO	Item	Standard	
1	Temperature – Resistance Type Idling Condition	Temperature(℃)	Resistance(kΩ)
		0 ± 0.1 ℃	-10.99
		25 ± 0.1 ℃	-3.906
		85 ± 0.1 ℃	0.552 ± 3%
		( )Blank is for reference measurement	
2	Fixed Number (25/85)	3482.4K ± 2%	
3	Fixed Number of Heat Dissipation	2.5mW/℃ (Min.) (While not boiling)	
4	Fixed Number of Heating	8(15)Sec (Max)(63.2% reaching time while boiling)	
5	Range of Workable Temperature	- 4 ~ 230 °F	



CN7

CH Water High Limit Temperature Sensor

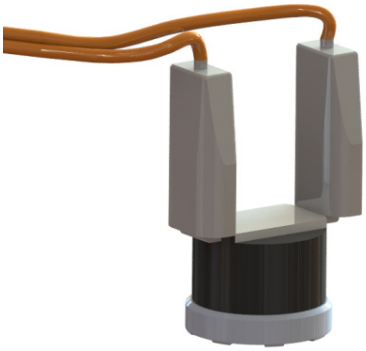
Exhaust Temperature Sensor

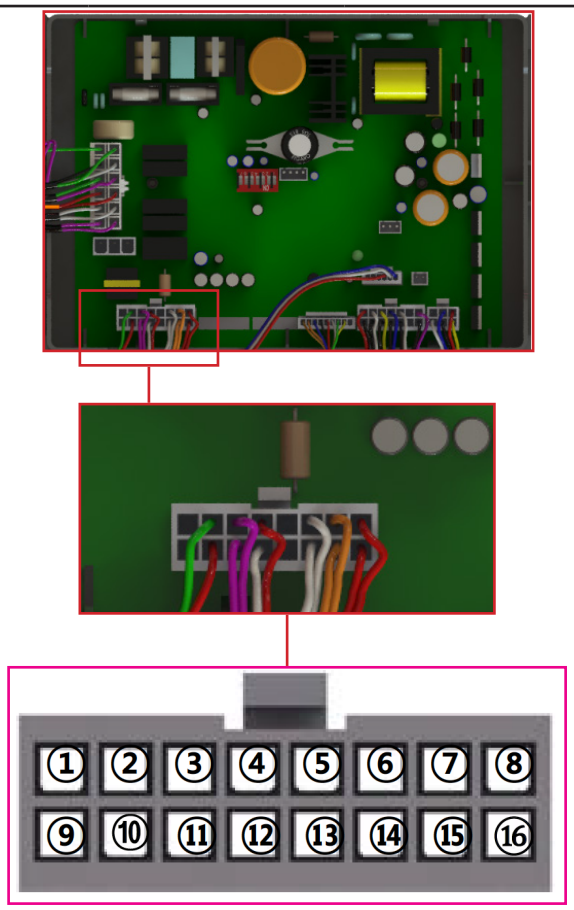
Storage Temperature Sensor

DHW Temperature Sensor

CH Supply Temperature Sensor

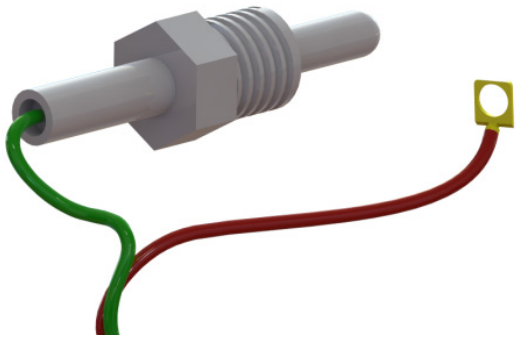
Description / Part #	Burner Overheat Switch: 7855P-066	Check Point	CN11
Function	Burner Overheat limit switch prevents damage to burner plate caused by temperature exceding 392ºF		
Failure Event	Detects overheating temperature if switch has an abnormal condition.		
Effects	Boiler shuts down if burner plate temperature exceeds the setting temperature.		
Error Code	Er 43		
Diagonostic	① Check the connection around the overheat limit switch and use a multi meter to measure resistance. If resistance is 0 Ohm , replace the switch. ② Check the 'Dip Switch' setting on the 'Main PCB'. ③ Check gas orfice 'Nozzles' Size.		
Color / Wire Number	① Temperature switch_burner upper (392℉/200℃ , orange) : Connector ⑦,⑮		

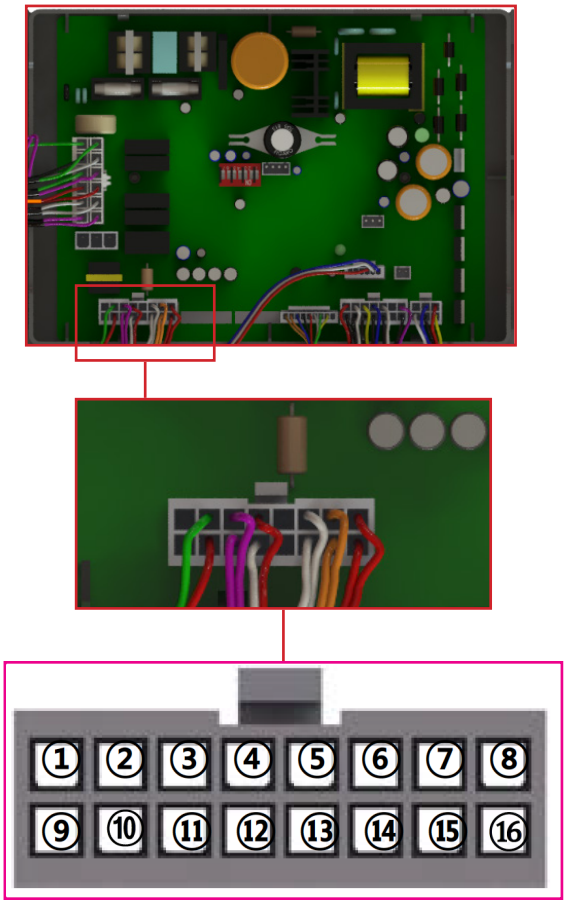




CN11

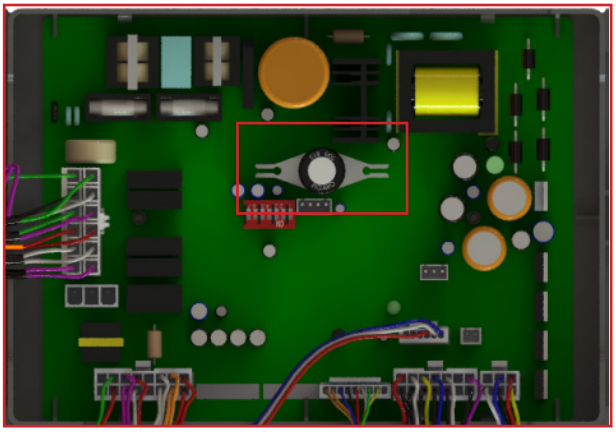
Description / Part #	Water Level Detection Sensor: 7855P-029	Check Point	CN11
Function	This sensor detects water level inside of heat exchanger to prevent dry fire.		
Failure Event	Water is not detected at proper level .		
Effects	Boiler operation is interrupted.		
Error Code	Er 80		
Diagonostic	① Visual inspection : wiring connection ② Check CH pressure gauge (minimum CH pressure is 15 PSI).		
Color / Wire Number	① Water level sensor (red/green) : Connector ②,⑩		



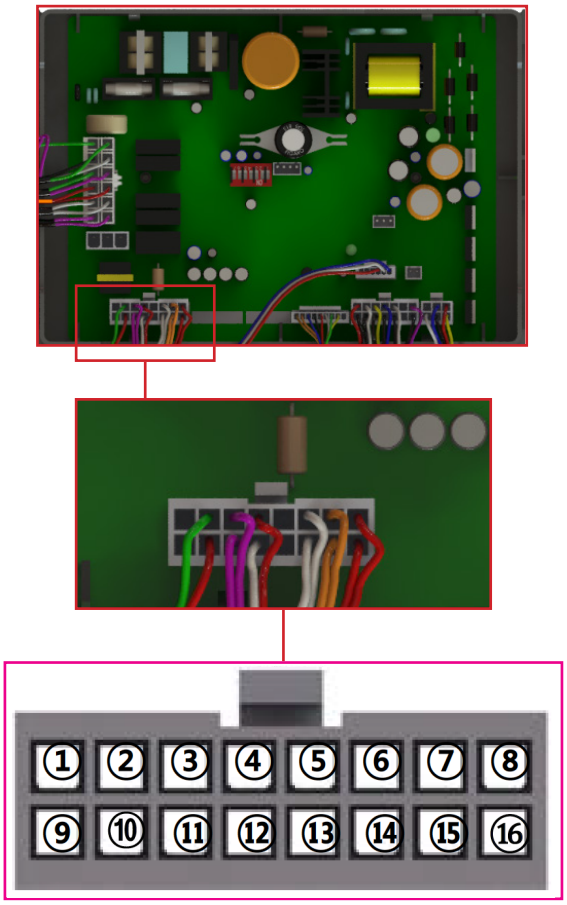


CN11

Description / Part #	Gas Leak Detection Sensor: 7850P-093	Check Point (Main PCB)	N/A
Function	This sensor shutsdown the unit if a gas leak is detected		
Failure Event	Gas leak detection sensor is not operating correctly		
Effects	Risk of explosion and personal injury.		
Error Code	Er 40		
Diagonostic	① Follow instruction on first page of installation manual. Check for leakage around the gas valve and gas piping by using soapy water. ② Check the burner assembly		
Color / Wire Number	N/A		

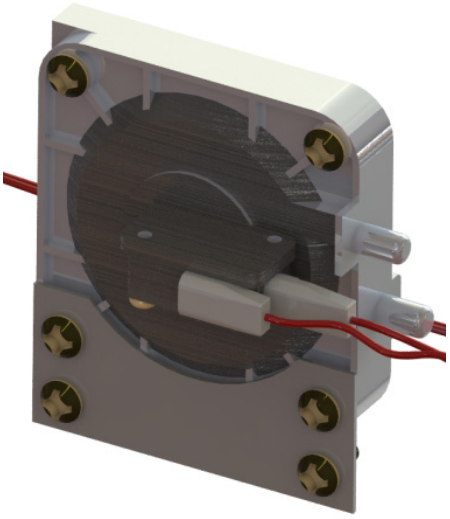


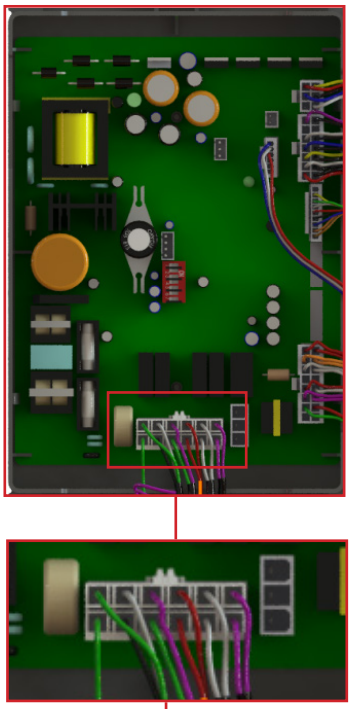
Description / Part #	Jumped Wire Connection: 7850P-096	Check Point (Main PCB)	CN11
Function	This part is used to jump out circuit.		
Failure Event	Jumper is disconected		
Effects	The unit shutsdown		
Error Code	Er 42		
Diagonostic	① Make sure the jumper is properly connected		
Color / Wire Number	Jumped Wire Connection (white): connector ⑥,⑭		

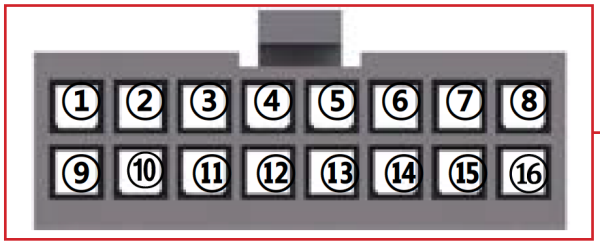


CN11

Description / Part #	APS: Air Pressure Switch: 7855P-017	Check Point (Main PCB)	CN11
Function	This APS monitors the flue for blockage		
Failure Event	① Combustion noise occurs ② Imperfect and lifting flame occurs ③ The unit will not ignite		
Effects	Pressure due to exhaust vent blockage will affect the boiler operation		
Error Code	Er 29		
Diagonostic	① Check APS wiring connection ② Check the hose for blockage or kinking. ③ Check exhaust vent for blockage ④ Check APS resistance using a multi-meter		
Color / Wire Number	Air pressure switch (blue) : connector ⑤, ⑬		

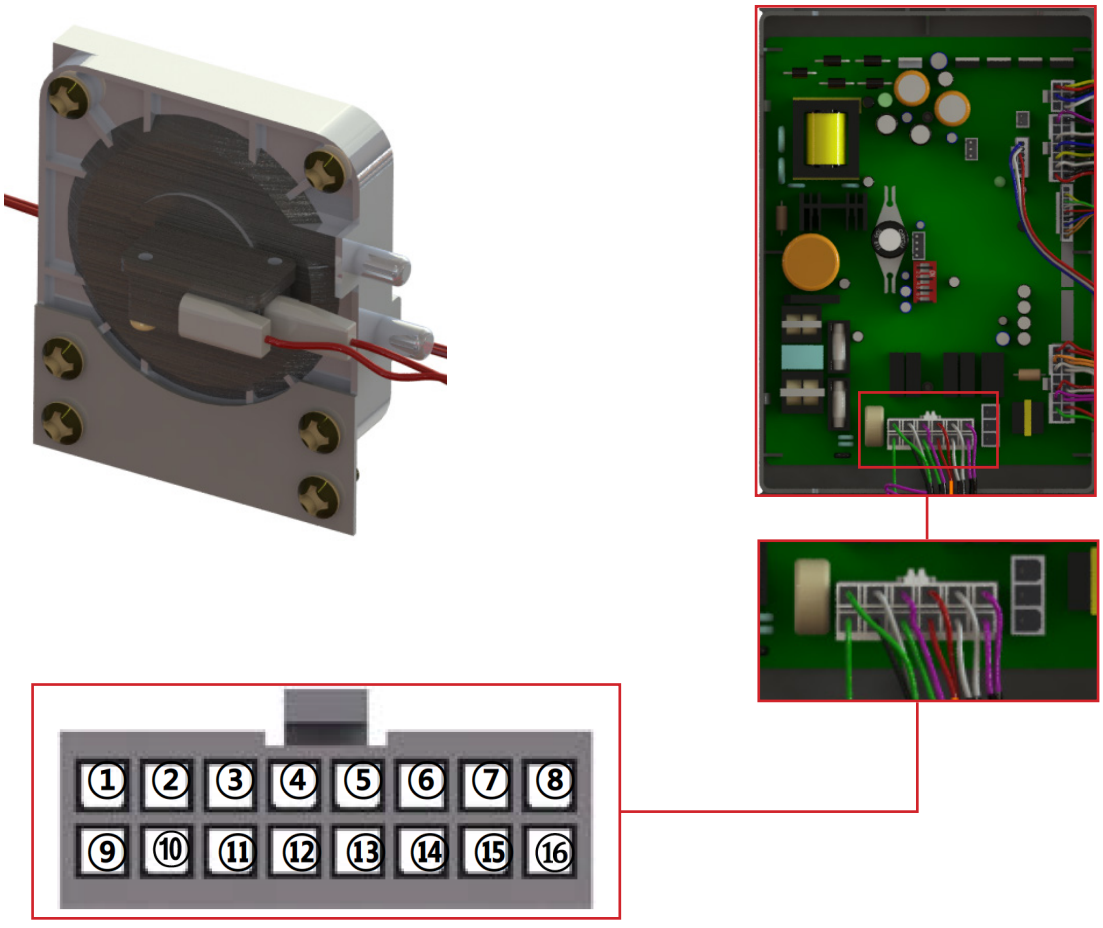






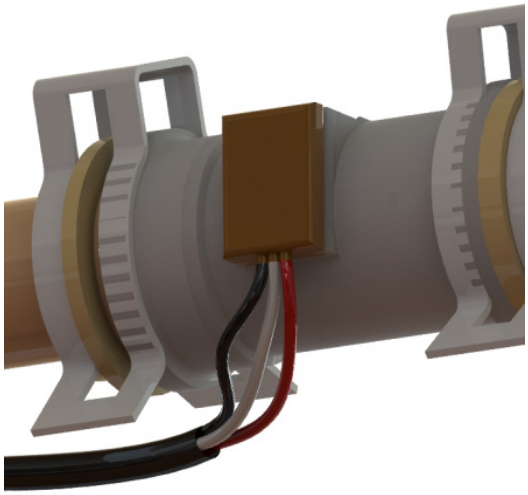
CN11

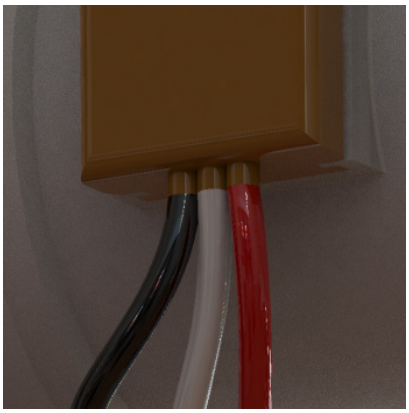
Description / Part #	Condensate Blockage APS: 7855P-017	Check Point (Main PCB)	CN11
Function	This switch monitors the condensate dischage line for blockage		
Failure Event	① The unit will not ignite		
Effects	Pressure due to condensate line blockage will affect the boiler operation		
Error Code	Er 20		
Diagonostic	① Check Condensate Blockage APS wirring connection ② Check the hose for blockage or kinking. ③ Check the condensate discharge line ④ Check Condensate Blockage APS resistance using a multi-meter		
Color / Wire Number	Condensate Blockage Switch (red) : connector ⑧, ⑯		

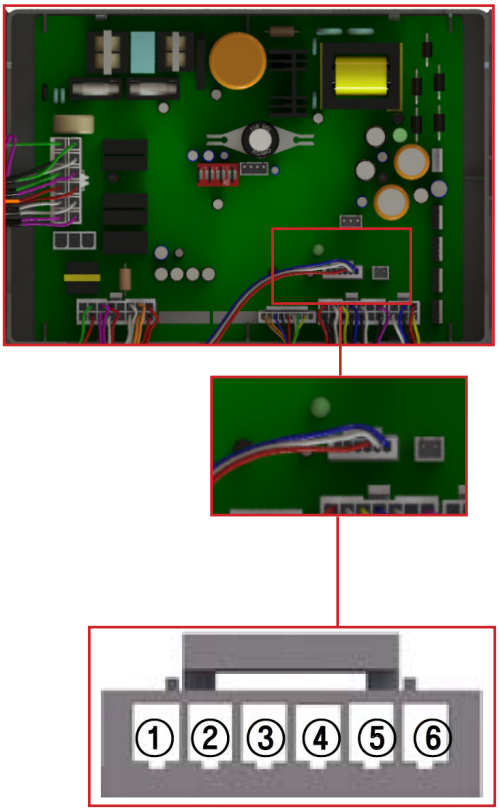


CN11

Description / Part #	DHW Flow Sensor: 7855P-083	Check Point (Main PCB)	CN3
Function	This sensor detects water flow (more than 0.5 GPM) through DHW loop		
Failure Event	Water flow is not detected		
Effects	Domestic hot water set point is not achieved		
Error Code	N/A		
Diagonostic	① Restart the appliance ② Visual inspection : check flow sensor wiring for proper connection		
Color / Wire Number	① Ground (blue) : Connector ⑥ ② Flow Signal (white): Connector ⑤ ③ DC 5V (red) : Connector ④		

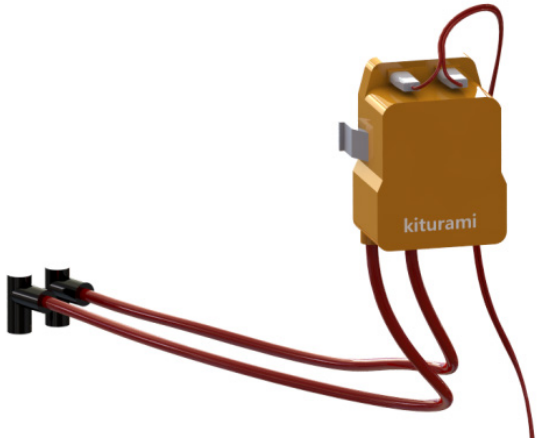


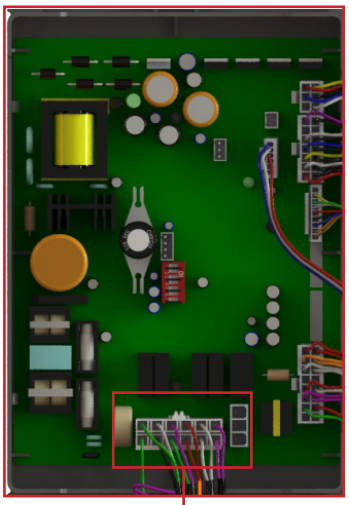


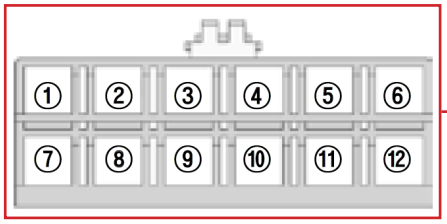


CN3

Description / Part #	Ignition Transfomer: 7855P-007	Check Point (Main PCB)	CN9
Function	Generates sparks energy to ignite the fuel		
Failure Event	sparks energy is not generated		
Effects	The unit does not ignite		
Error Code	Er11		
Diagonostic	① Check wiring for proper connection ② Check range of voltage		
Color / Wire Number	Igniter (red) : connector ④ Igniter (red) : connector ⑩		

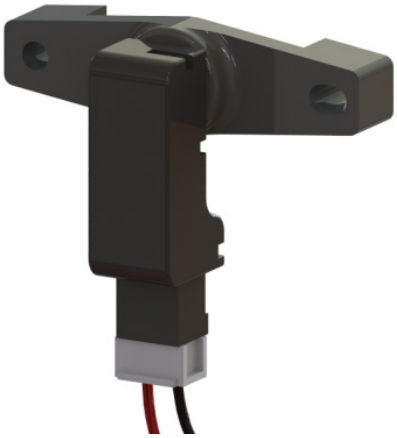


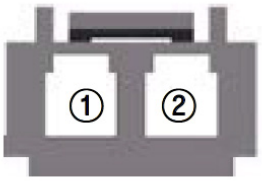


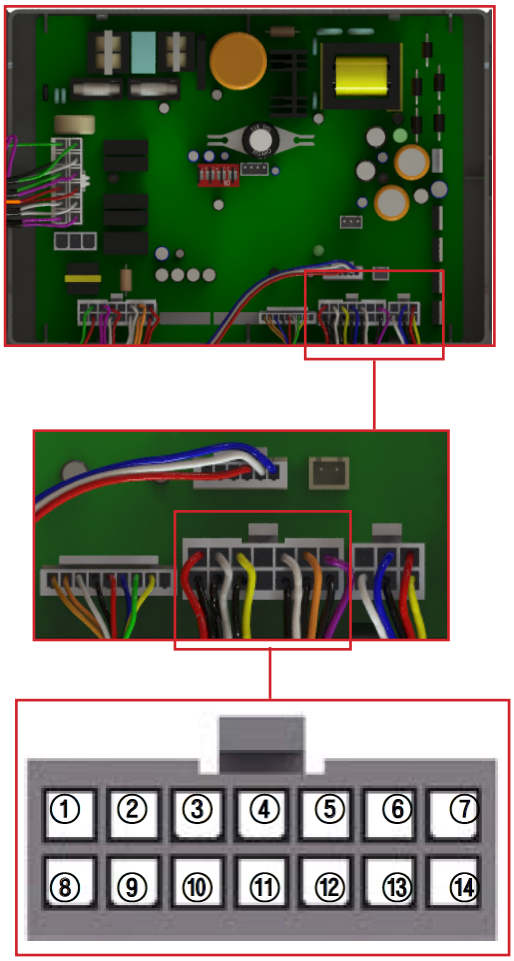


CN9

Description / Part #	Flame Detection Sensor: 7855P-031	Check Point (Main PCB)	CN7
Function	Detects flame during combustion		
Failure Event	Ignition fault		
Effects	Abnormal product operation		
Error Code	Er 11, Er 72		
Diagonostic	① Check the discoloration of flame monitoring window ② Check the connection around the flame detection sensor		
Color / Wire Number	Flame detection sensor (red) ① : connector ① Flame detection sensor (black) ② : connector ⑧		

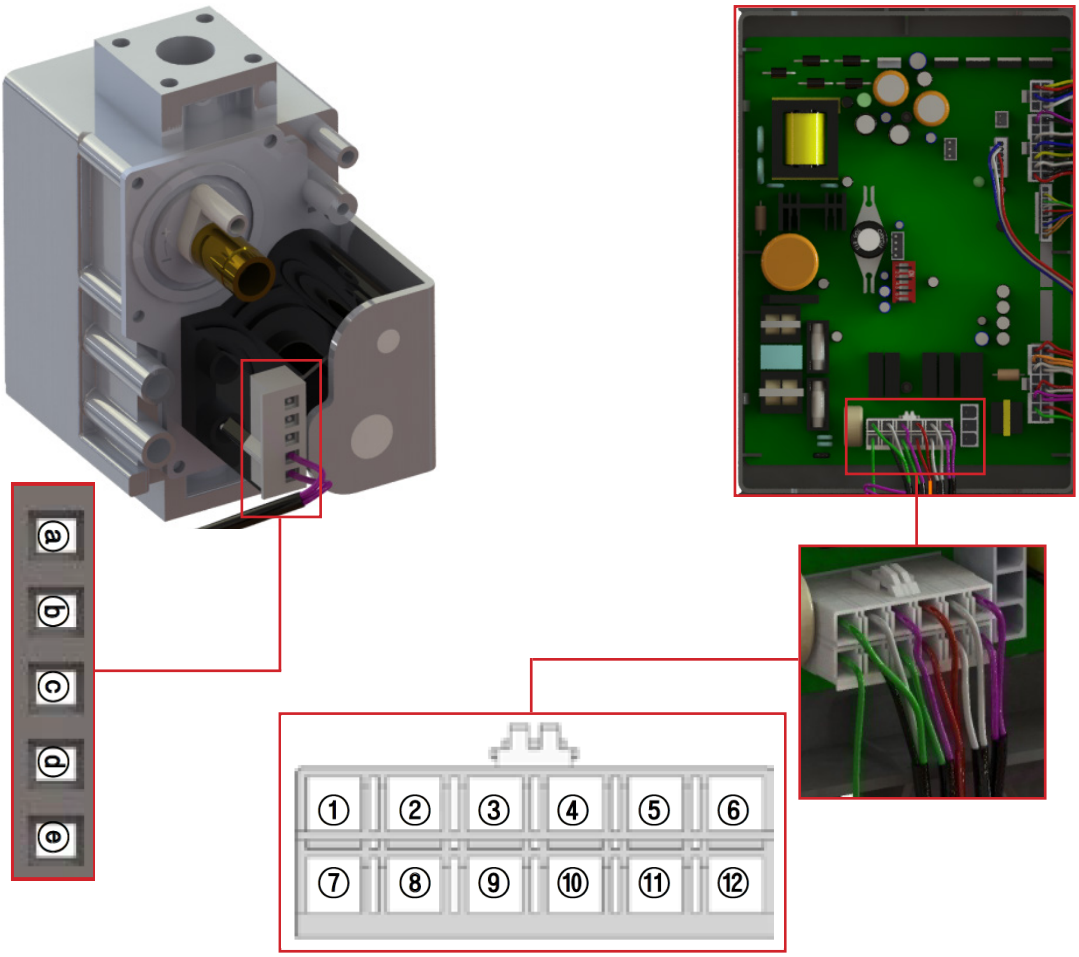






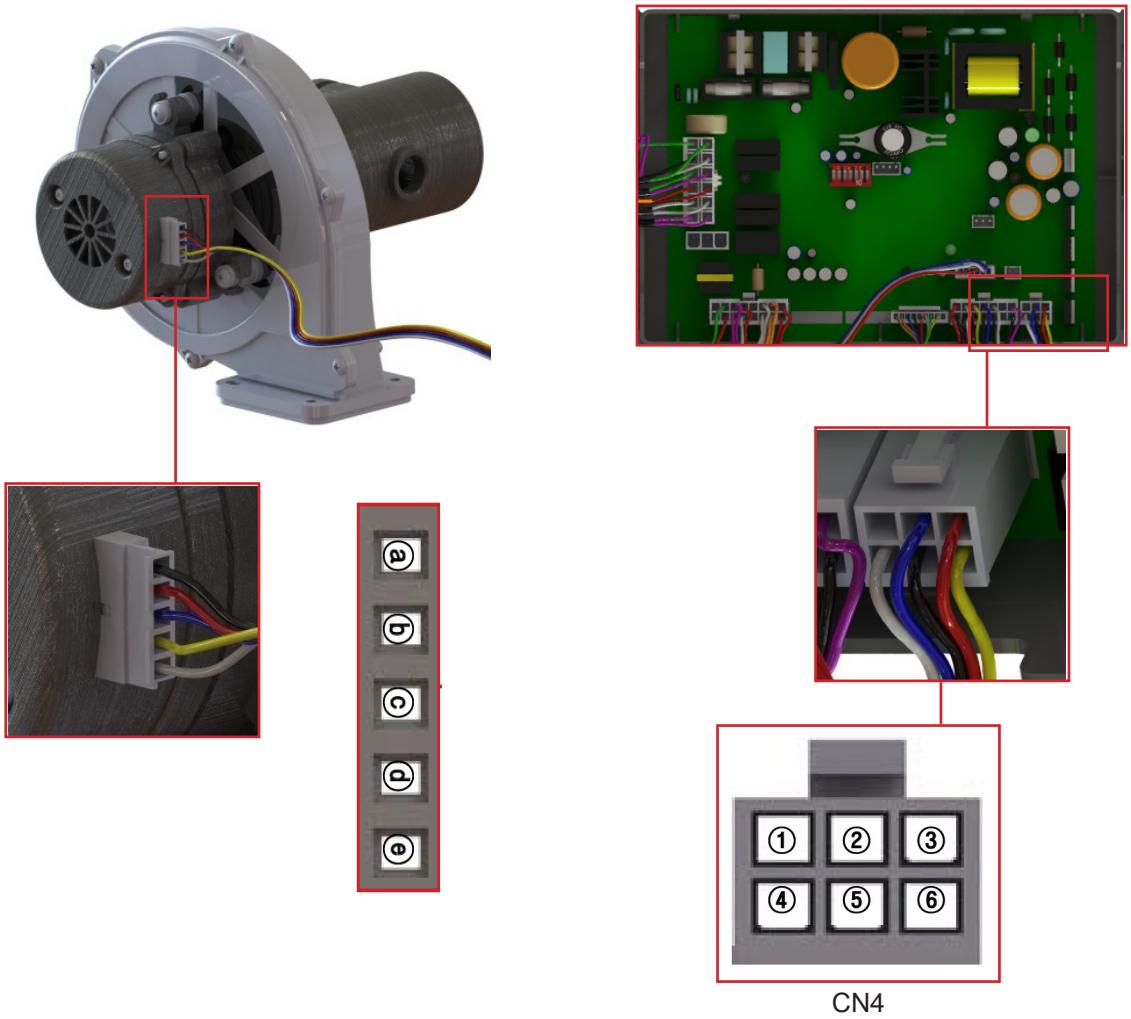
CN7

Description / Part #	Gas Valve: 7855P-034	Check Point (Main PCB)	CN9
Function	Negative gas valve controls the regulation of gas and air imixture in the combustion system		
Failure Event	① Gas leakage occurs ② Gas valve does not operate (Unable to open/close) ③ Gas flow is not modulated (Proportional gas valve)		
Effects	① Spark is not generated. ② Operation of product is stopped ③ Carbon monoxide exceeding the reference is discharged		
Error Code	Er 11		
Diagonostic	① Check wiring for proper connection ② Check the connection and mounting location ③ Check resistance using a multi-meter		
Color / Wire Number	Gas valve (purple) : connector ⑥, ⑫		



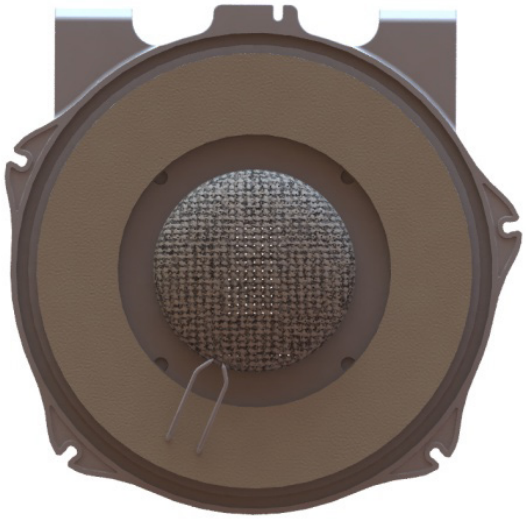
CN9

Description / Part #	BLDC Fan: 7855P-025	Check Point (Main PCB)	CN4
Function	Supplies air and fuel to the burner		
Failure Event	① Abnormal noise occurs at the fan ② Abnormal fan speed(RPM) ③ Poor connection		
Effects	① Abnormal combustion ② Abnormal noise occurs ③ The unit does not operate		
Error Code	Er 41, Er 61		
Diagonostic	① Check vent blockage ② Check BLDC fan wiring for proper connection ③ Check voltage range using a multi meter		
Color / Wire Number	[Blower] GND (blue) ⓒ: connector ②, 30VDC Power(white) ⓔ: connector ④, 30VDC Speed feedback signal(yellow) ⓓ: connector ⑥, 14VDC VDD (red) ⓑ: connector ③, 30VDC		



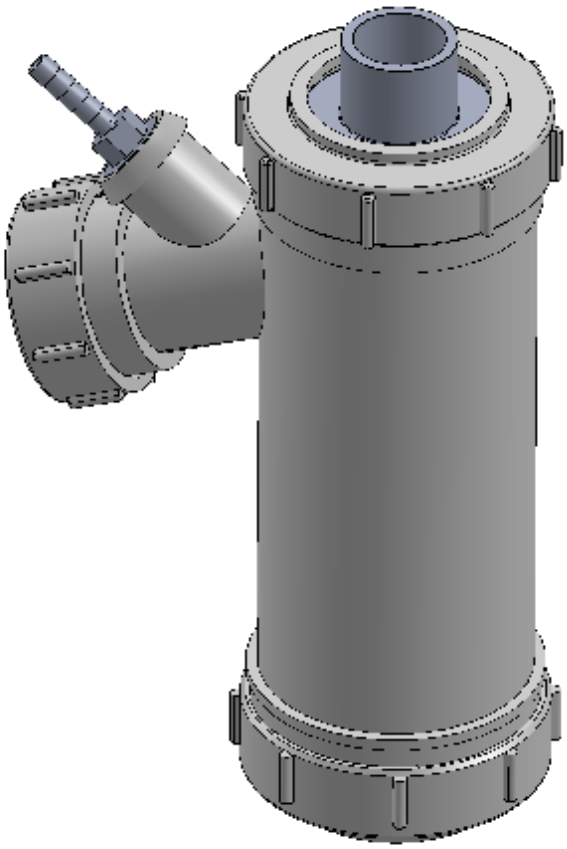
CN4

Description / Part #	Burner Assembly: 7855P-064	Check Point (Main PCB)	N/A
Function	This component provides the heat source by mixing and combusting air and gas.		
Failure Event	① Unable to initialize/sustain combustion ② Soot occurs on the surface of burner ③ Gas leakage occurs from burner		
Effects	① Abnormal combustion ② Unstable flame generation ③ Ignition failure		
Error Code	N/A		
Diagonostic	Visual inspection : Unstable flame conditions during operation.		
Color / Wire Number	N/A		

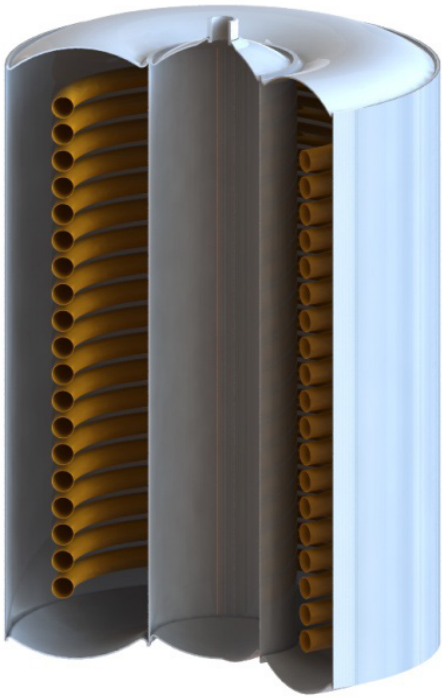


Description / Part #	Fire Tube Heat Exchanger: 7855P-064	Check Point (Main PCB)	N/A
Function	Heats the water by Absorbing the high-temperature heat generated by the burner.		
Failure Event	① Water or exhaust gas leakage through the crack ② Abnormal heat exchange		
Effects	① Operation of product is stopped ② Exhaust gas leakage ③ Abnormal noise occurs		
Error Code	Er33, Er94		
Diagonostic	① Check the crack on the surface of heat exchanger ② Check the boiling sounds inside the heat exchanger		
Color / Wire Number	N/A		

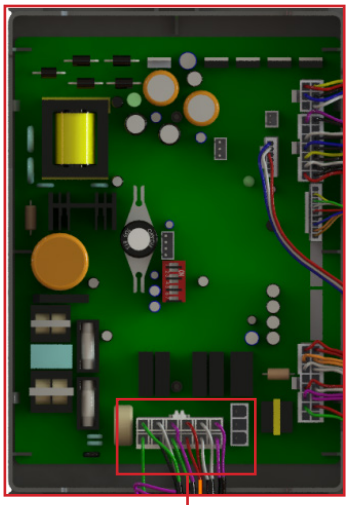
Description / Part #	Condensate Trap: 7855P-053	Check Point (Main PCB)	N/A
Function	This component reliably discharges the condensate generated by the combustion		
Failure Event	Unneutralized condensate is discharged		
Effects	Product corrosion and environmental degradation are caused by the condensate		
Error Code	Er20		
Diagonostic	① Check the hose for blockage or bending		
Color / Wire Number	N/A		

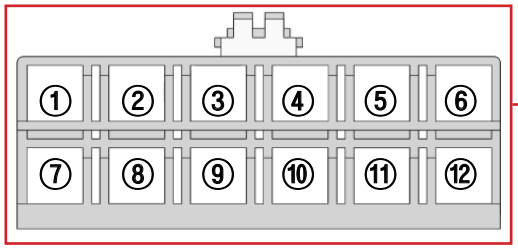


Description / Part #	Internal DHW Storage Tank: 7855P-059	Check Point (Main PCB)	N/A
Function	Transfers energy into DHW to provide stable temperature		
Failure Event	Leakage occurs at DHW storage tank.		
Effects	① Operation of product is stopped ② Domestic hot temperature fluctuation		
Error Code	Er20		
Diagonostic	Replace DHW storage tank		
Color / Wire Number	N/A		



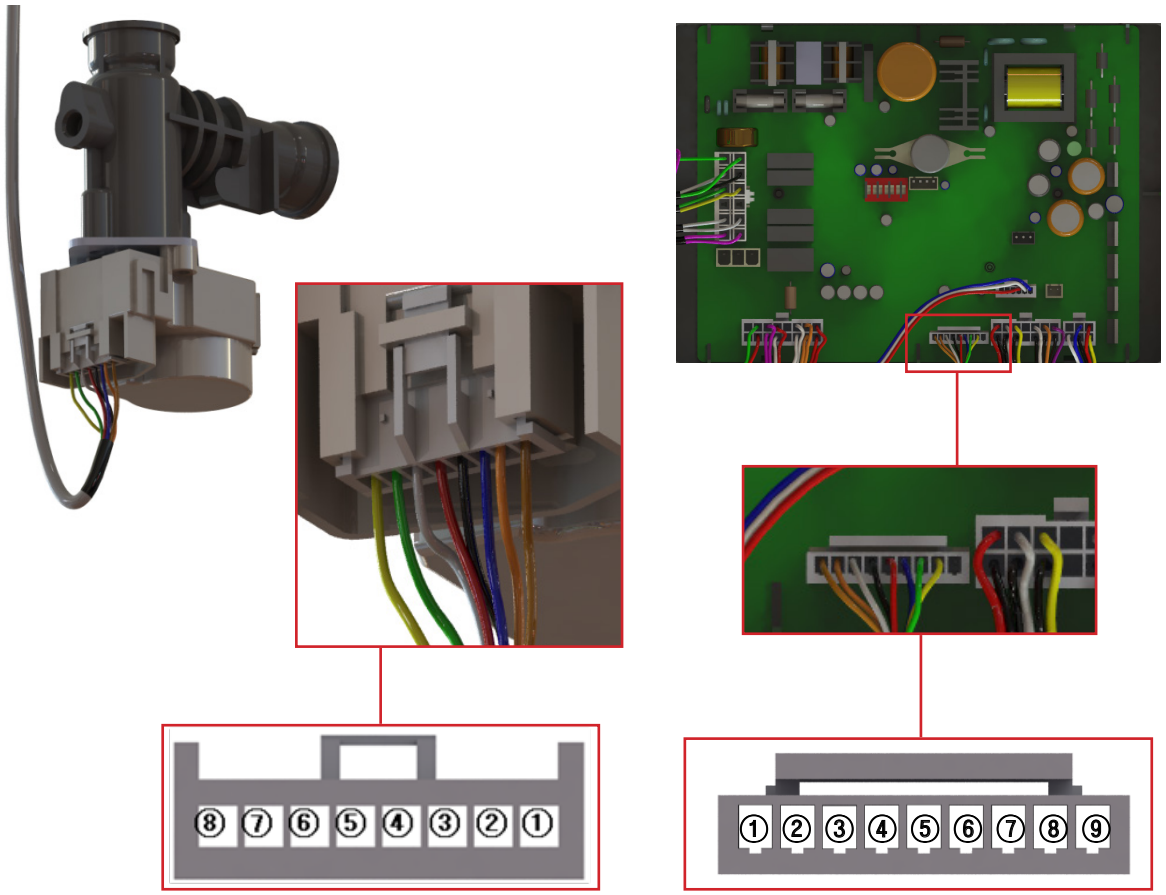
Description / Part #	Internal CH/DHW Recirculation Pumps: 7855P-081	Check Point (Main PCB)	CN9
Function	Provides circulation through the heat exchanger and internal storage tank		
Failure Event	Water flow is not detected.		
Effects	① Unit does not opperate ② Internal CH/DHW circulation pump is not operating		
Error Code	N/A		
Diagonostic	① Visual inspection : check wiring for proper connection ② Check supply voltage		
Color / Wire Number	Internal DHW circulation pump (yellow/green) : Connector ③, ⑨ Internal CH primary circulation pump (white) : Connector ⑤, ⑪		





CN9

Description / Part #	DHW Mixing Valve: 7855P-043	Check Point (Main PCB)	CN14
Function	This component controls DHW outlet temperature by mixing cold and hot water		
Failure Event	Water flow rate is not detected and water leakage occurs around the mixing valve.		
Effects	① Ignition sequence does not start. ② Operation of product is stopped once water leakage is detected.		
Error Code	Er 66, Er 68		
Diagonostic	① Restart the unit ② Check the connection around the mixing valve.		
Color / Wire Number	[IWM (Inlet Water Modulation)] GND (brown) : connector ① DHM Position Sensor (orange) : connector ② DC 14V (white) : connector ③ DHM X phase (black) : connector ④ DHM Y phase (red) : connector ⑤ DC 14V (blue) : connector ⑥ DHM /X phase (green) : connector ⑦ DHM /Y phase (yellow) : connector ⑧		



CN14

■ Function explanation

[illegible]

[illegible]

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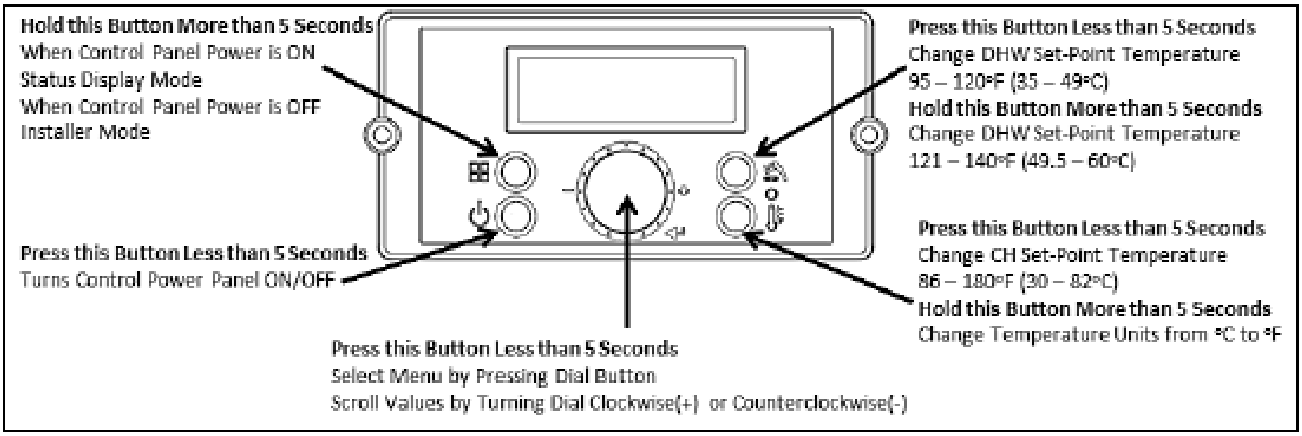
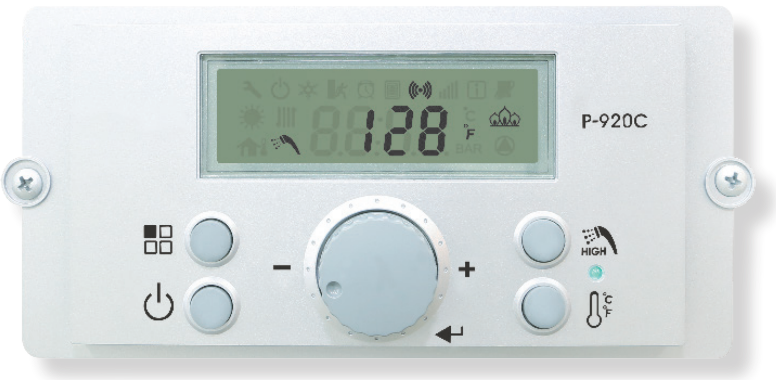
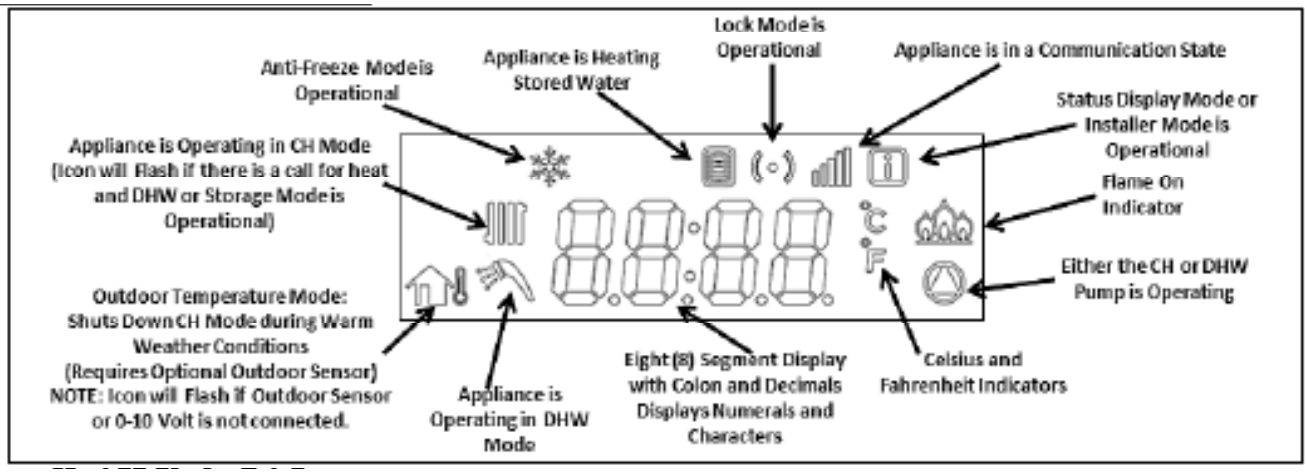
■ Control panel

Customized Temperature Control
Advanced technology used for the flow sensor and heat capacity control makes domestic hot water highly efficient by maintaining constant temperature during usage.





■ LCD Specification



■ Control panel mode

Status display mode

Status Display Mode will activate when the ⊞ button is pressed and held for five seconds when the display panel is powered ON.

Turn the dial ↻ counterclockwise and clockwise to scroll through the displayed parameters. To view parameter details, press the ↵ button at the appropriate screen. Press the ⊞ or ↵ buttons to leave the parameter.

Press the ⊞ button again to return to Operation Mode.

To turn on Lock Mode, press the ↵ button at the dLc parameter. Turn the dial ↻ counterclockwise or clockwise to scroll On or Off. Press the ↵ button to save the selection and return to the parameters.

Press the ⊞ button again to return to Operation Mode.

NOTE: The Control System will not allow the changes if Lock Mode is activated. Lock Mode will have to be turned off before making further changes.

Parameter	Detail	Description
O: ot	Outdoor temperature	Current outdoor sensor temperature
A: Li or A: GA	DHW Water flow rate	Current flow (Li: LPM, GA: GPM)
b: lt	CH return water temperature	Current CH return water temperature
C: Fr	FAN speed (RPM)	Current fan speed (RPM)
d: Lc	Lock function (Lock)	Lock Mode "ON"/"OFF"
E: oP	CH supply temperature (Operating temperature)	Current CH supply temperature
F: dH	DHW outlet temperature	Current DHW outlet temperature
H: Eh	Exhaust temperature	Current exhaust temperature
t: St	Internal storage tank temperature	Current stored water temperature
Parameter	Detail	Description
J: oH	CH water overheat temperature	Current temperature on the overheating sensor.

L: rt	1: PH	Burner Operation Time	Supply power time	L:rt display on sub menu	Unit : 100 hour
	2: rh		Burner operation time		Unit : 1 hour
	3: rH		Burner operation time		Unit : 1,000 hour
	4: It		Ignition cycles		Cycle : 10 times
	5: IH		Ignition cycles		Cycle : 10,000 times

P: Ou	Displays output condition for Internal recirculation pump, and heating pump. ⬭ ⬭ ⬭	Items	1st: Internal DHW Storage pump	2nd: Internal CH Primary Pump	3rd: Not Used
		Stop	⬭	⬭	⬭
		Operation	⬭	⬭	⬭

■ Control panel mode

Installer Setting Mode.

Installer Mode will activate when the ⊞ button is pressed and held for five seconds while the display is powered OFF. If the display is powered on, press the ⏻ button to turn it off before pressing and holding the ⊞ button for five seconds.

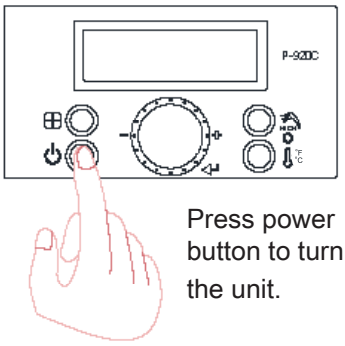
Toggle through items that can be viewed/changed by turning the dial ○. To view/change an item, press the ⏎ button. Some displayed items can be changed by turning the dial ○ counterclockwise to lower and clockwise to raise the displayed value. Press the ⏎ button again to save settings.

To leave Installer Mode, press the ⊞ button again. The display will return to power off mode.

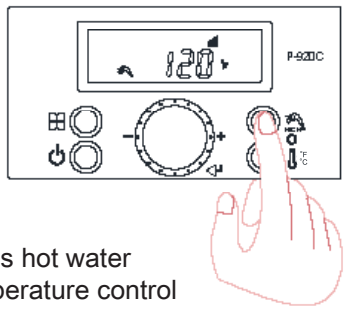
Display	Default	Detail	Description
1: EH	E0:00	Error history up to 10	Check last 10 error codes (E0 – E9)
2: dE	OFF	Delete Error history	Select "ON" to delete error code history Range: ON or OFF
3: In	OFF	Initialized system	Select "ON" to reset to factory setting (Burner operation time, Ignition cycles, and Supply power time will not be reset) Range: ON or OFF
4: Fu	GA	Change unit for water volume	Range: GA or Li
5: St	ON	Stored water heating function "ON", "OFF"	Select "OFF" to turn off this function Range: ON or OFF
6: OH	68 F	Maximum Outdoor Temperature	When used with an outdoor sensor, sets the maximum outdoor design temperature for the system design. Warm weather shut down will disable the appliance if the programmed outdoor temperature is exceeded. Maximum outdoor temperature must be set 9°F above the minimum outdoor temperature. Range: (Minimum Outdoor Temperature + 9°F) to 110°F
7: OL	5 F	Minimum Outdoor Temperature	Sets the minimum outdoor design temperature for the system. Minimum outdoor temperature must be set 9°F below the maximum outdoor temperature. Range: -4°F to (Maximum Outdoor Temperature – 9°F)
8: FH	00	Maximum Fan speed	Adjusts Maximum Fan Speed Range: -30 – +30
9: FL	00	Minimum Fan speed	Adjusts Minimum Fan Speed Range: -30 –+30
10: dr	NO	Initialized burner operation time	Select ON to Initialize burner operation time Range: NO or YES
11: dI	NO	Initialized ignition cycle	Select ON to Initialize ignition cycles Range: NO or YES
12: bt	0	Boost Function	This function boosts CH temperature to the maximum if set point is not reached within the set period of time. Range: 0 - 120 min
13: Ft	1	CH Anti-Frequency time	This function delays burner operation during CH mode Range: 0 – 20 min
14: bo	27 F	Set differential temperature to turn burner "ON"	When set, the appliance will operate to heat CH water when water temperature falls below a differential setting. Example: If setpoint is 180°F and differential is 27°F, the appliance will turn on when CH water temperature falls below 153°F. Range: 9 – 27°F
15: OF	68 F	Warm Weather Shutdown	This warm weather temperature setting will shut down CH Mode Range : 50 – 110°F
16: cH	180 F	Maximum supply temperature	Sets the maximum design supply temperature based on the minimum outdoor design temperature. Maximum supply temperature must be set 9°F above the minimum supply temperature. Range: (Minimum Supply Temperature + 9°F) – 180°F
17: cL	86 F	Minimum supply temperature	Sets the design supply water temperature based on the maximum outdoor design temperature. Minimum supply temperature must be set 9°F below the maximum supply temperature. Range: 86°F to (Maximum Supply Temperature - 9°F)
18: dH	140 F	Maximum DHW set temperature	Sets Maximum DHW Setpoint temperature Range:120 - 140°F
19: cb	100	Heating capacity	Set Heating combustion rate Range: 50 – 100%
20: db	100	DHW capacity	Set DHW combustion rate Range: 50 – 100%

Display	Default		Detail	Description
21: PP	40		Internal CH Pump Post Run Timer, T/T Calling for Heat	When appliance CH setpoint is satisfied, but T/T is calling for heat, the burner will shut OFF and the CH pump will continue to run for this set amount of time Range: 1 – 60 minutes
22: Po	5		Internal CH Pump Overrun Timer (On)	This function runs the Internal CH Pump after the Internal CH Pump Post Run Timer has completed. This will cycle the Internal CH Pump again based on the default programmed Off and On cycles and repeats until the central heating call is satisfied. Range: 1–60 minutes
23: PF	10		Internal CH Pump Overrun Timer (Off)	
24: SF	158 F		Internal DHW Storage Tank Setpoint	Sets the Internal DHW Storage Tank Setpoint Range:140 – 167°F
25: So	27 F		Internal DHW Storage Tank Differential	Sets the Internal DHW Storage Tank Differential Range: 9 – 36°F
26: dt	2		Delay time when switching from DHW mode to CH mode	Range: 0 – 2 minutes
27:PE	1		Internal CH Pump Post-Purge Time, T/T Satisfied	Allows the user to set the appliance pump post purge time once the appliance CH setpoint and thermostat are satisfied. Range: 1-5 minutes
28: NA	NA 0		N/A	N/A
29: AP	AP: dP	5	Internal CH Pump and Internal DHW Storage Pump Test Mode	This function sets the time to run both the Internal CH and Internal DHW Storage pumps to purge air from the system. Range: 1 – 30 minutes
	dP: off or dP: on	OFF	Internal CH Pump and Internal DHW Storage Pump Test Mode	Turn this function on to activate Internal CH and Internal DHW Storage pump testing. Only works in installation mode. Turns off when in normal mode.

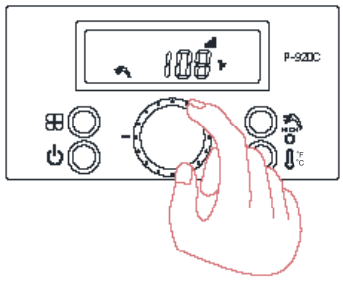
Domestic Hot Water temperature control (Range:95 ~ 120℉)



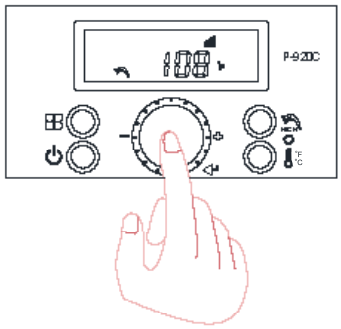
Press power button to turn on the unit.



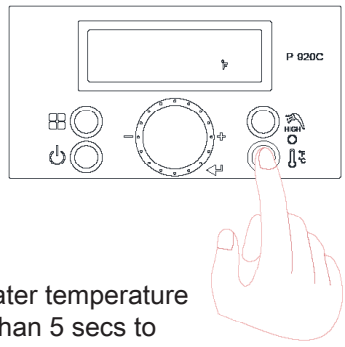
Press hot water temperature control button to enter DHW temperature setting mode. The default temperature is set to 125℉.



Turn the dial to set desired DHW temperature.

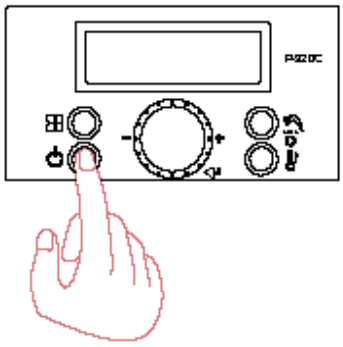


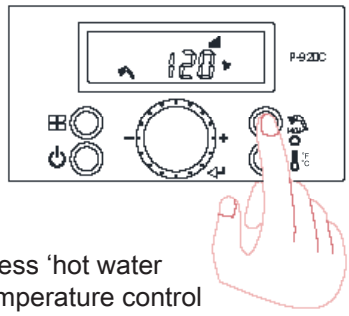
Press dial button to complete setting.



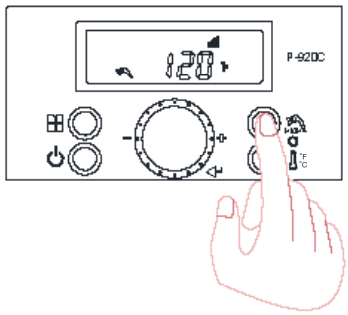
Press ‘heating water temperature button’ for more than 5 secs to convert temperature unit (℉ or ℃)

Domestic Hot Water high temperature control (Range:121℉ ~ 140℉)

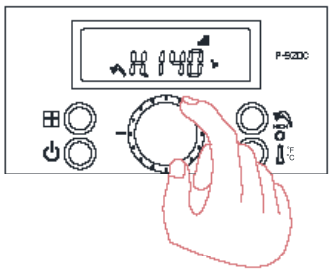




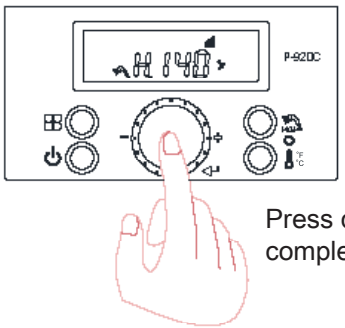
Press ‘hot water temperature control button’ to enter ‘DHW temperature setting mode. The default temperature is set 125℉.



Press ‘hot water temperature button’ for 5 secs to set high temperature.

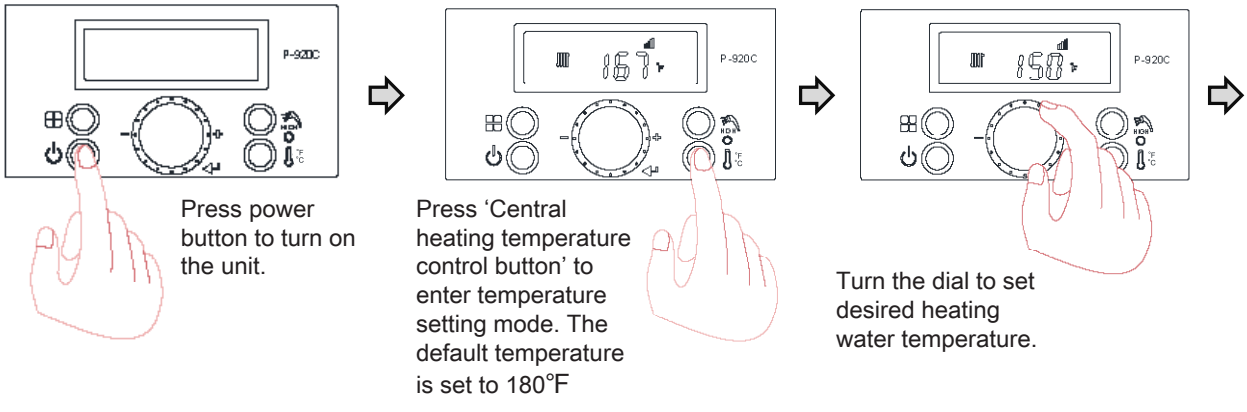


Turn the dial to set desired DHW temperature.



Press dial button to complete setting.

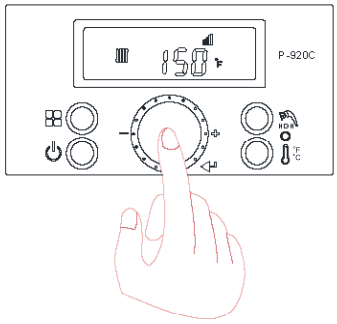
control (Range: 86~ 180°F)



Press power button to turn on the unit.

Press 'Central heating temperature control button' to enter temperature setting mode. The default temperature is set to 180°F

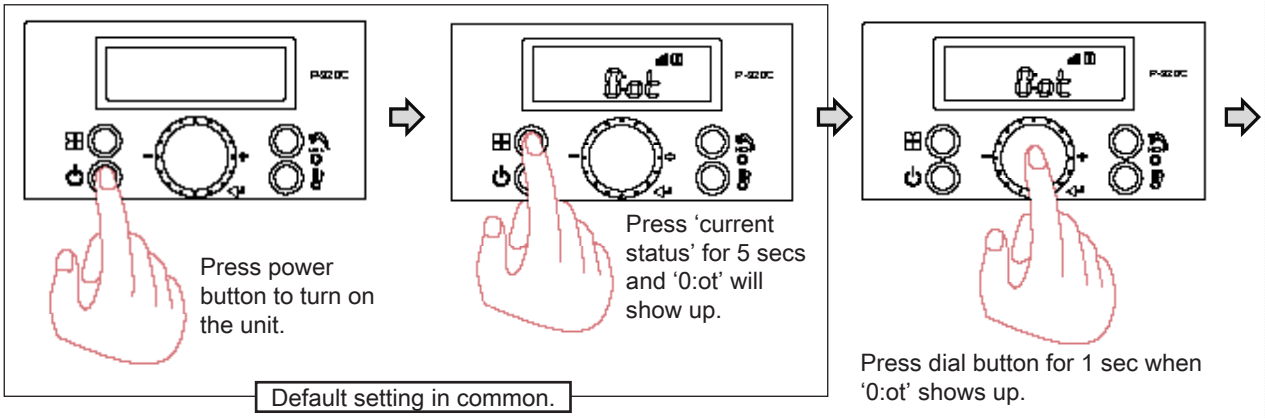
Turn the dial to set desired heating water temperature.



Press dial button to complete setting.

View System Parameters (Status Display Mode)

Outdoor Temperature display

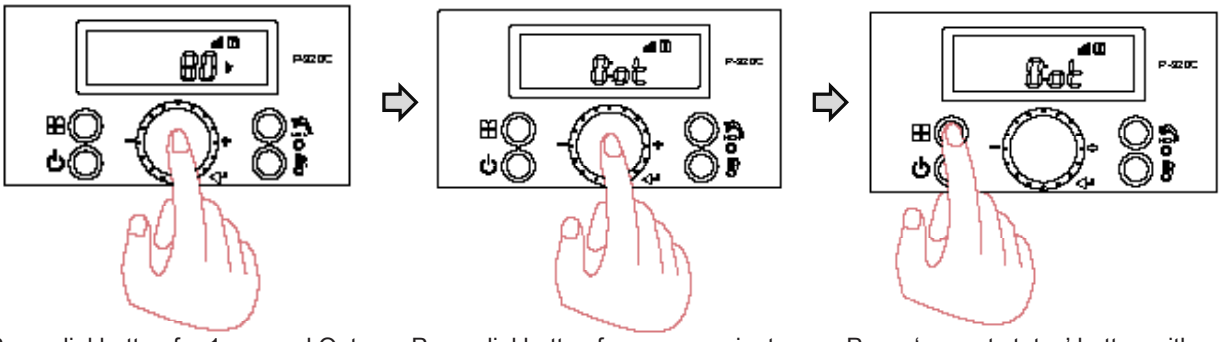


Press power button to turn on the unit.

Press 'current status' for 5 secs and '0:ot' will show up.

Press dial button for 1 sec when '0:ot' shows up.

Default setting in common.

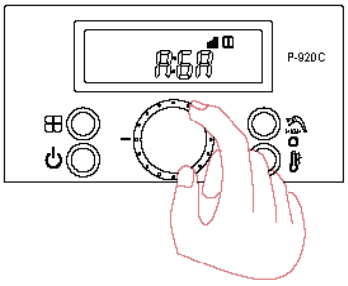


Press dial button for 1 sec and Outdoor Temperature will be displayed.

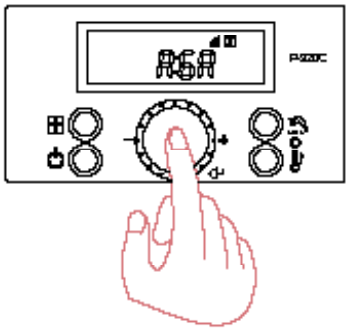
Press dial button for a sec again, to go back to the previous mode.

Press 'current status' button with '0:ot" mode to go back to initial status.

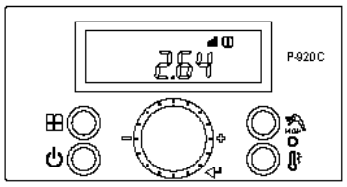
Water flow rate (GPM or LPM)



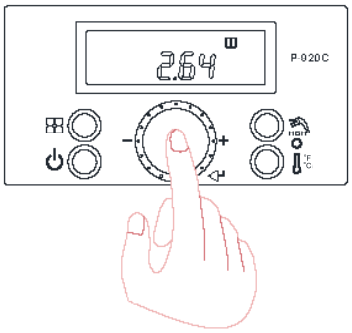
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘A:GA’.



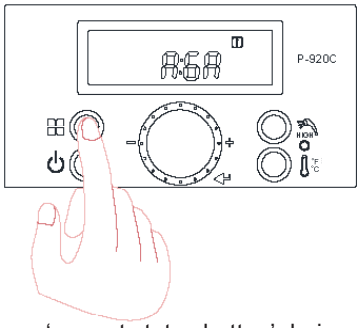
Press dial button for 1 sec when ‘A:GA’ shows up.



Water flow status will be displayed. (ex : 2.64)

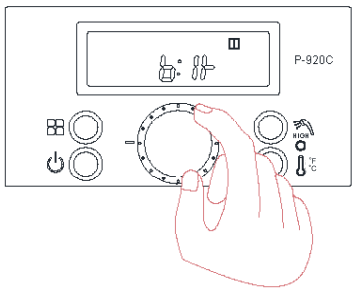


Press dial button for a sec again, to go back to the previous mode.

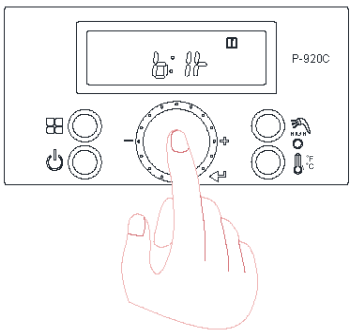


Press ‘current status button’ during ‘A:GA’ mode to go back to the initial status.

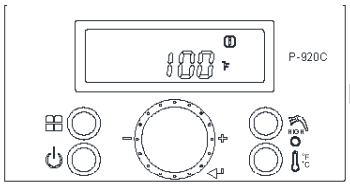
CH Return Water temperature



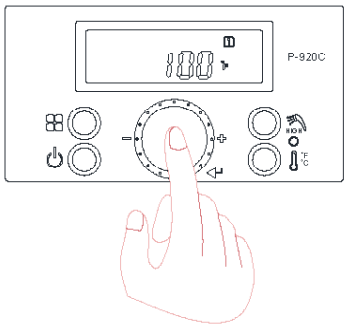
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘b:lt’.



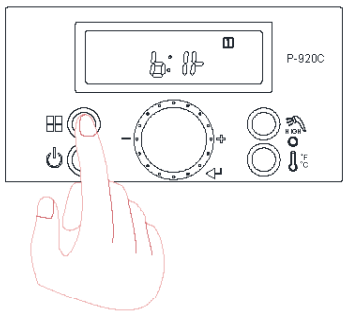
Press dial button for 1 sec when ‘b:lt’ shows up.



Current return water temperature status will be displayed. (ex : 100°F)

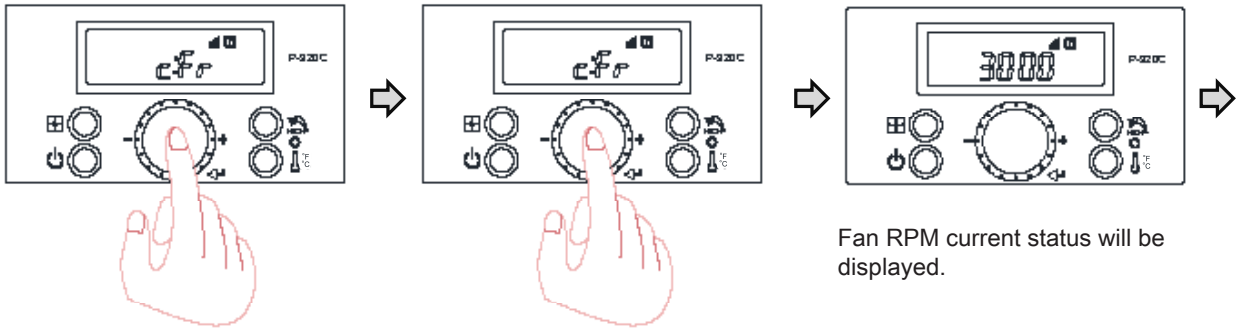


Press dial button for a sec again, to go back to the previous mode.



Press ‘current status button’ during ‘b:lt’ mode to go back to the initial status.

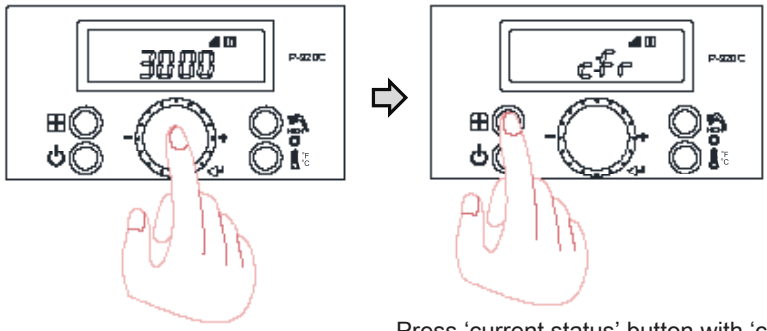
Fan speed (RPM)



After '0:ot' has been displayed by pressing 'current status button' for 5 secs, turn the dial until it shows 'c:Fr'.

Check RPM by pressing 'dial button' for 1 sec when 'c:Fr' shows up

Fan RPM current status will be displayed.

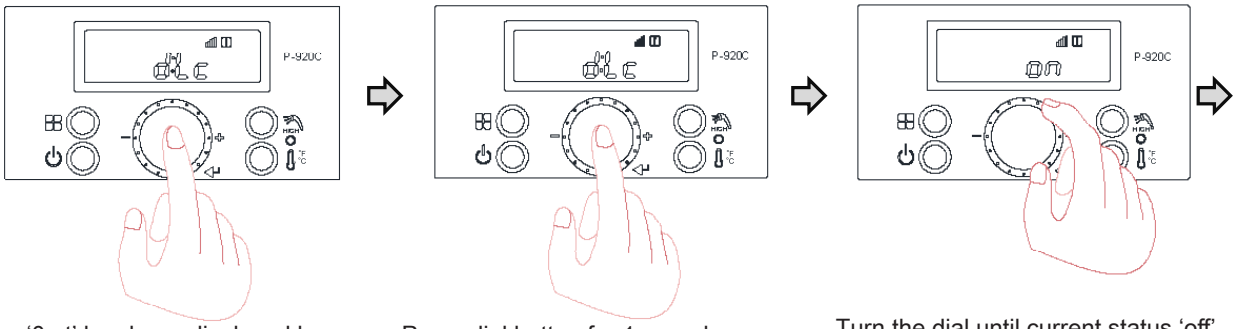


Press dial button for a sec again, to go back to 'c:Fr' mode.

Press 'current status' button with 'c:Fr' mode to go back to the initial status.

Program lock mode

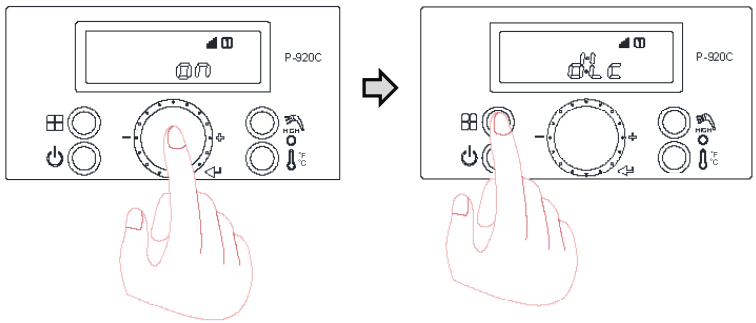
NOTE: The Control System will not allow the changes if Lock Mode is activated. Lock Mode will have to be turned off before making further changes.



After '0:ot' has been displayed by pressing 'current status button' for 5 secs, turn the dial until it shows 'd:Lc'.

Press dial button for 1 sec when 'd:Lc' shows up.

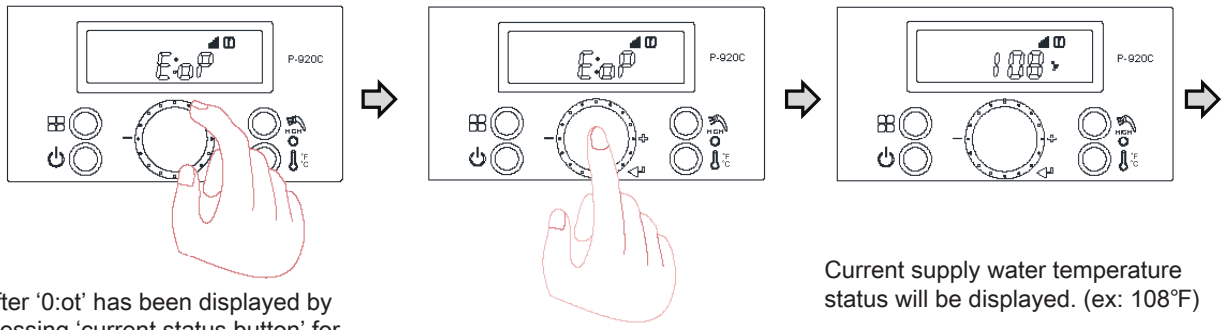
Turn the dial until current status 'off' mode turns into 'on'.



Press dial button for a sec again after setting completion to go back to the previous mode.

Press 'current status button' with 'd:Lc' mode to go back to the initial status.

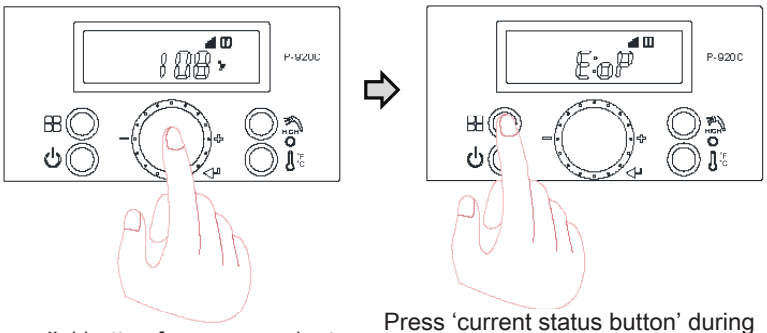
CH Supply water temperature



After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘E:oP’.

Press dial button for 1 sec when ‘E:oP’ shows up

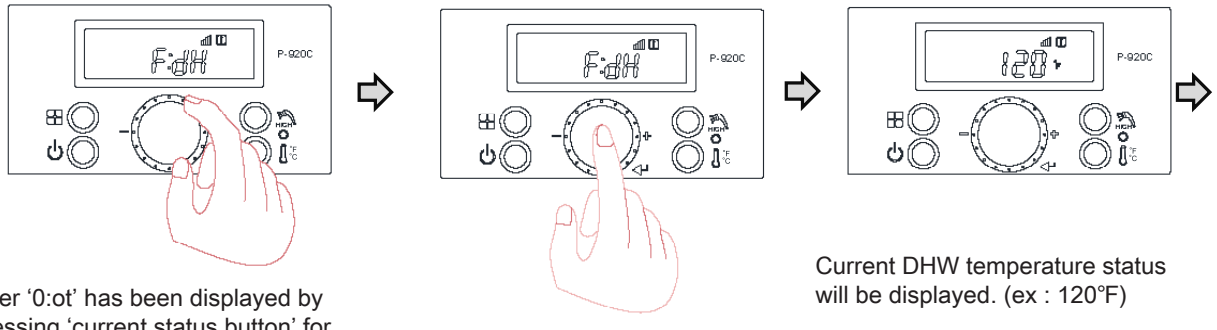
Current supply water temperature status will be displayed. (ex: 108°F)



Press dial button for a sec again, to go back to the previous mode.

Press ‘current status button’ during ‘E:oP’ mode to go back to the initial status.

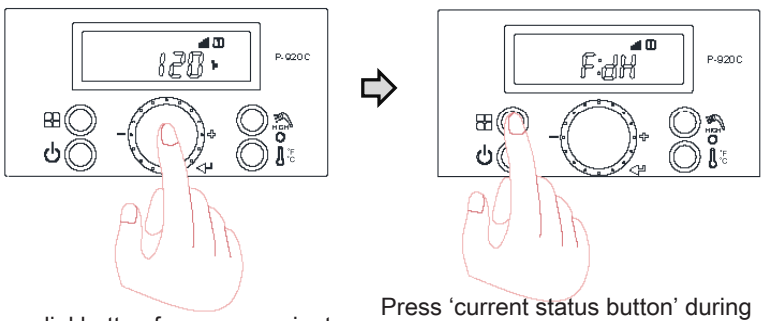
DHW outlet water temperature



After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘F:dH’.

Press dial button for 1 sec when ‘F:dH’ shows up

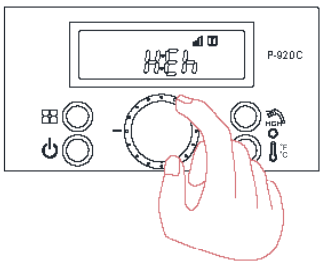
Current DHW temperature status will be displayed. (ex : 120°F)



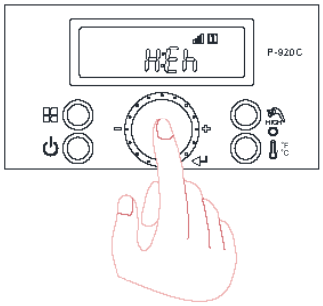
Press dial button for a sec again, to go back to the previous mode.

Press ‘current status button’ during ‘F:dH’ mode to go back to the initial status.

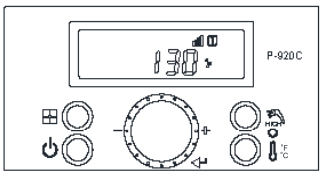
Exhaust gas temperature



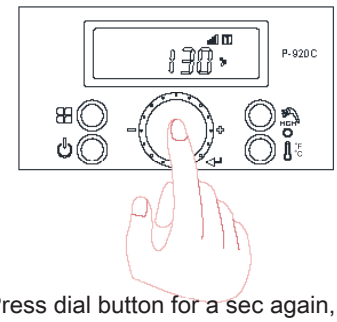
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘H:Eh’.



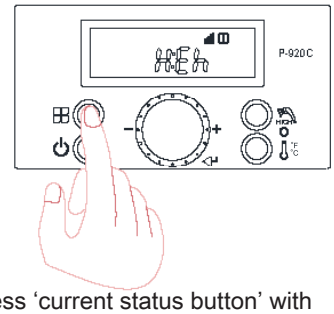
Press dial button for 1 sec when ‘H:Eh’ shows up.



Current exhaust gas temperature status will be displayed. (ex : 130°F)

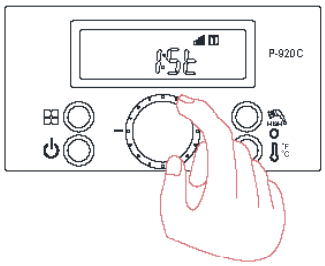


Press dial button for a sec again, to go back to the previous mode.

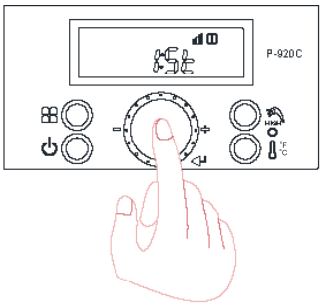


Press ‘current status button’ with ‘H:Eh’ mode to go back to the initial status.

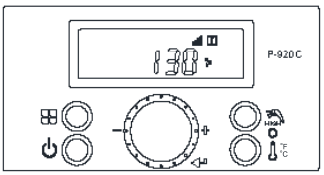
Internal storage tank water temperature.



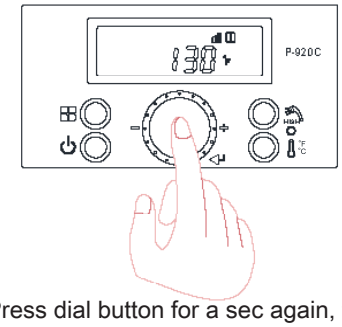
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘I:St’.



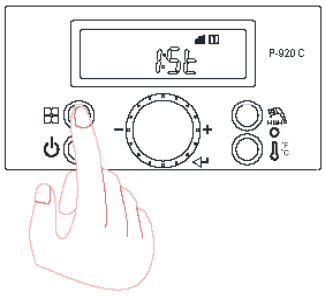
Press dial button for 1 sec when ‘I:St’ shows up.



Current hot water tank temperature status will be displayed. (ex : 130°F)

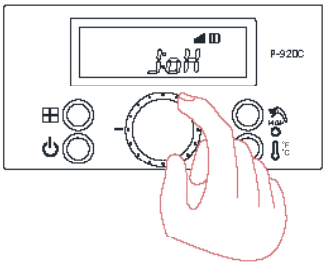


Press dial button for a sec again, to go back to the previous mode.

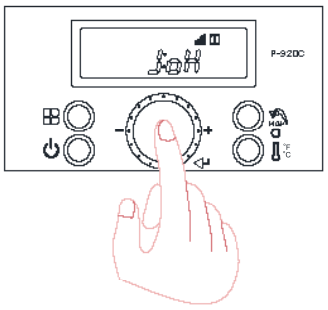


Press ‘current status button’ with ‘I:St’ mode to go back to the initial status.

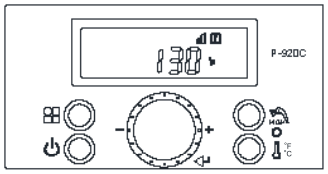
Overheat Temperature Sensor



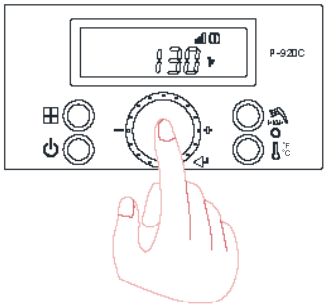
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘J:oH’.



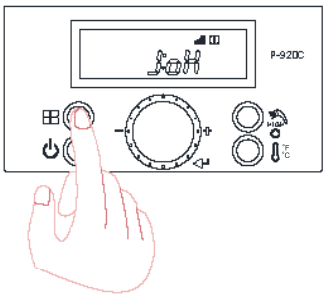
Press dial button for 1 sec when ‘J:oH’ shows up



Current hot overheating sensor temperature status will be displayed. (ex : 130°F)

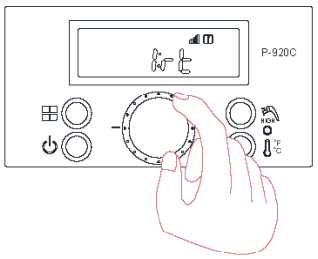


Press dial button for a sec again, to go back to the previous mode.

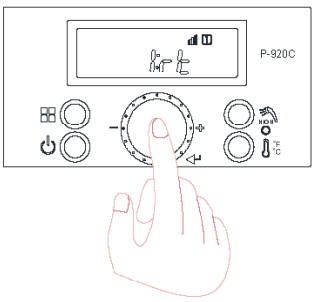


Press ‘current status button’ during ‘J:oH’ mode to go back to the initial status.

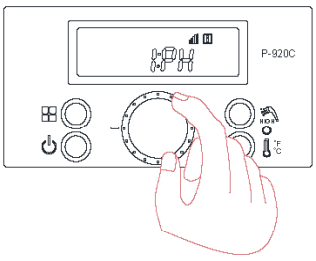
View supply power time (displayed value X 100 hours)



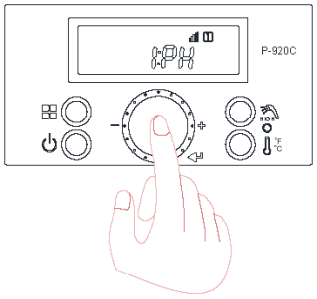
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘I:rt’.



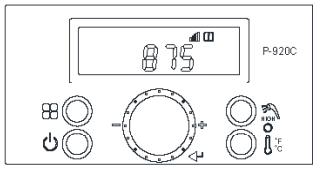
Press dial button for 1 sec when ‘I:rt’ shows up



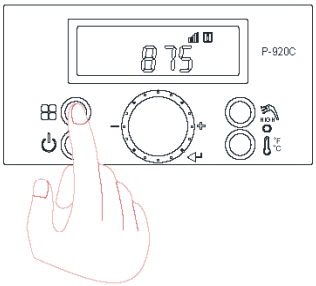
Turn the dial until 1:PH shows up.



Press dial button for a sec again, to go back to the previous mode.

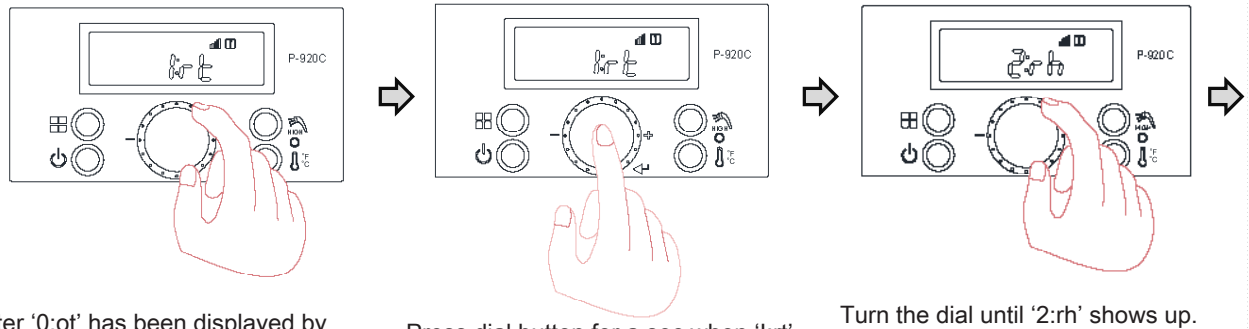


Current power input time will be shown. (ex : 875×100hr)



Press current status button for a sec after confirmation to go back to the initial status.

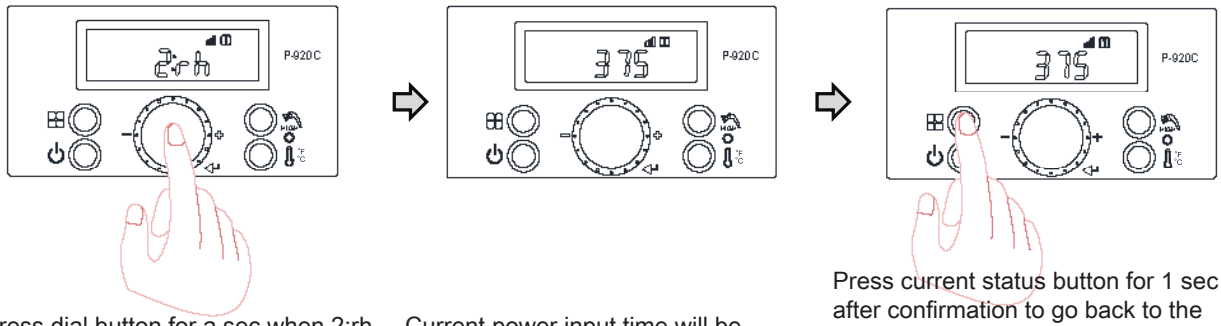
View Burner Operating Time (Unit: 1hr)



After '0:ot' has been displayed by pressing 'current status button' for 5 secs, turn the dial until it shows 'I:rt'.

Press dial button for a sec when 'I:rt' shows up.

Turn the dial until '2:rh' shows up.

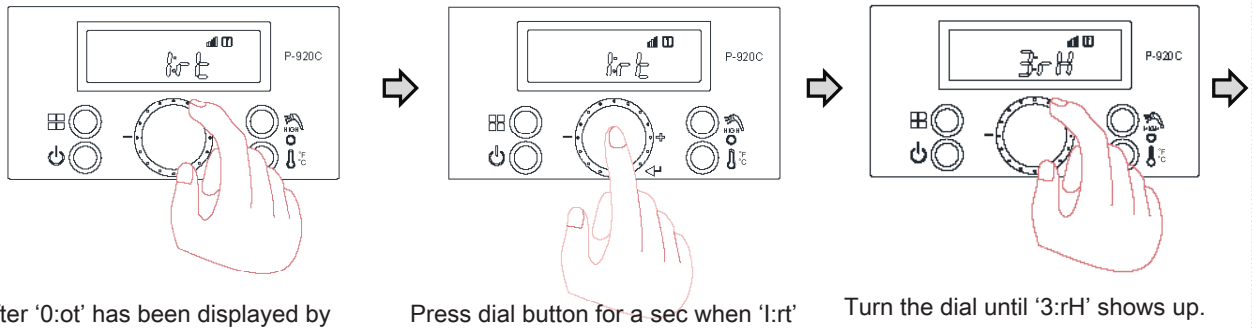


Press dial button for a sec when 2:rh shows up.

Current power input time will be shown. (ex : 375hr)

Press current status button for 1 sec after confirmation to go back to the initial status.

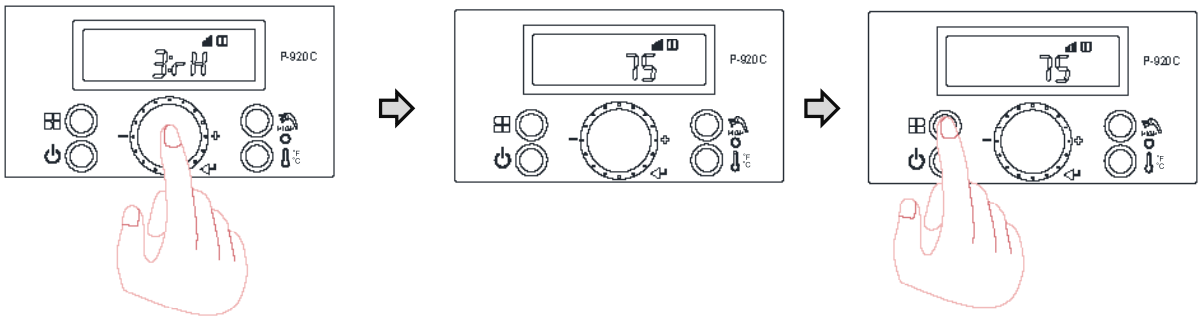
View Burner Operating Time (displayed value X 1000 hours)



After '0:ot' has been displayed by pressing 'current status button' for 5 secs, turn the dial until it shows 'I:rt'.

Press dial button for a sec when 'I:rt' shows up.

Turn the dial until '3:rH' shows up.

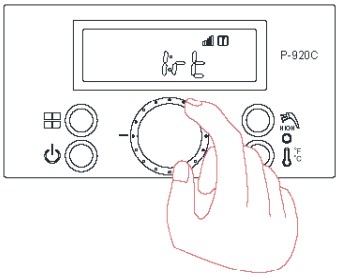


Press dial button for a sec when '3:rh' shows up.

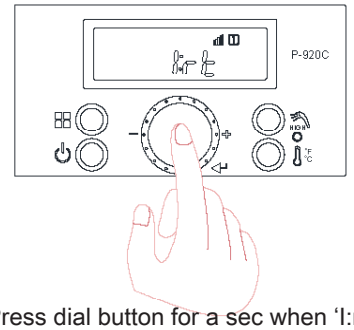
Current power input time will be shown. (ex : 75 ×1000hr=75,000hr)

Press current status button for 1 sec after confirmation to go back to the initial status.

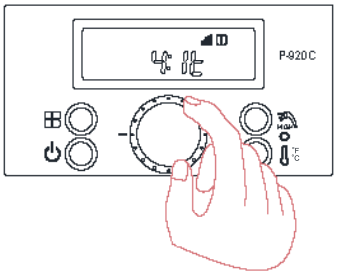
View ignition cycles (displayed value X 10 times)



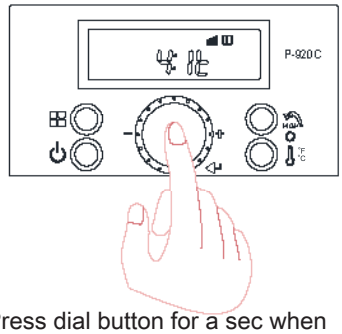
After ‘0:ot’ being displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘I:rt’.



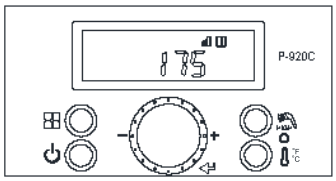
Press dial button for a sec when ‘I:rt’ shows up.



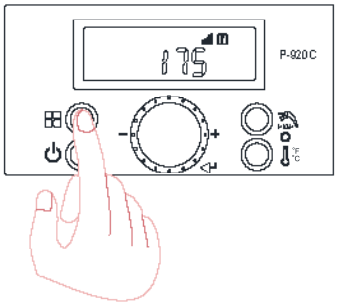
Turn the dial until ‘4:It’ shows up.



Press dial button for a sec when ‘4:It’ shows up.

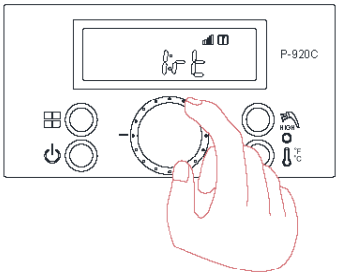


Current ignition attempts number will be shown. (ex : 175 ×10times=-1750times)

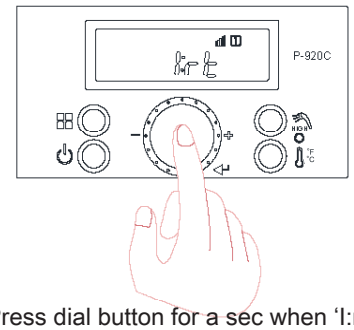


Press current status button for 1 sec after confirmation to go back to the initial status.

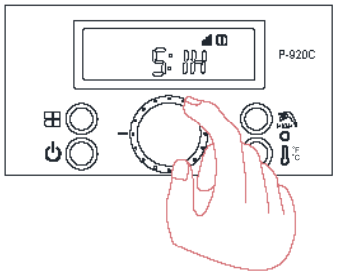
View ignition cycles (displayed value X 10,000 times)



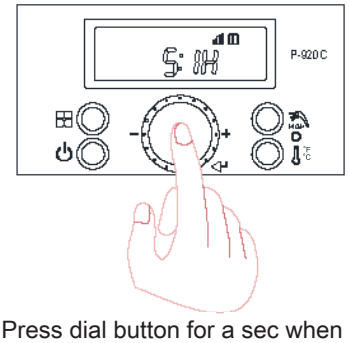
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘I:rt’.



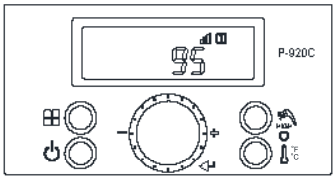
Press dial button for a sec when ‘I:rt’ shows up.



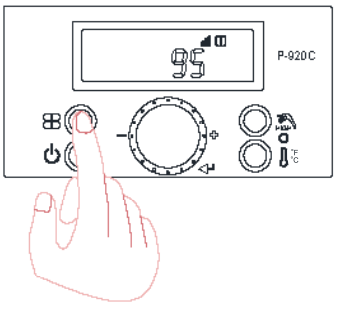
Turn the dial until ‘5:IH’ shows up.



Press dial button for a sec when ‘5:IH’ shows up.

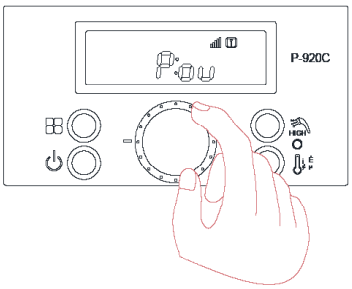


Current ignition attempts number will be shown. (ex : 95 ×10000 times=950,000times)

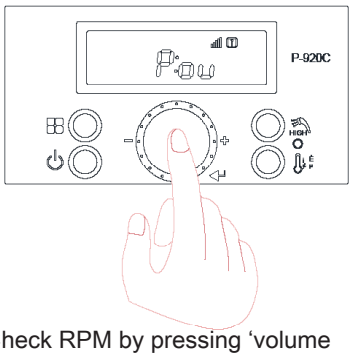


Press current status button for 1 sec after confirmation to go back to the initial status.

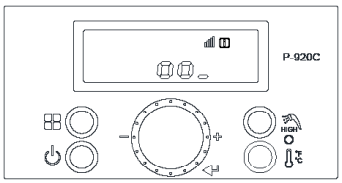
Pump Condition Display



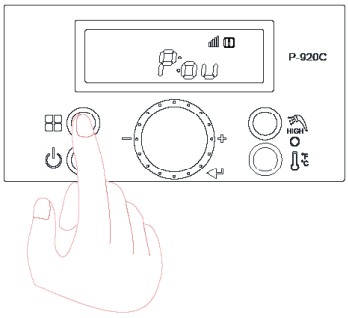
After ‘0:ot’ has been displayed by pressing ‘current status button’ for 5 secs, turn the dial until it shows ‘P:ou‘.



Check RPM by pressing ‘volume button’ for 1 sec when ‘P:ou’ shows up



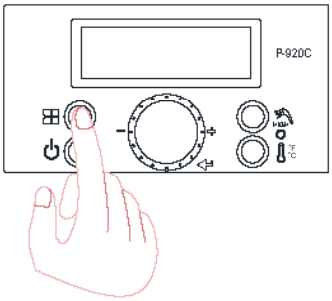
Pump condition current status will be displayed.



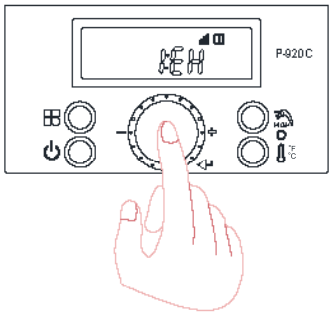
Press ‘current status’ button with ‘P:ou’ mode to go back to the initial status.

Change System Parameters (INSTALLER MODE)

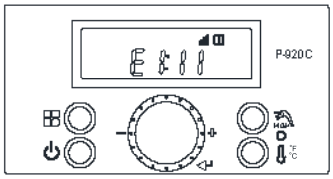
Fault Code history



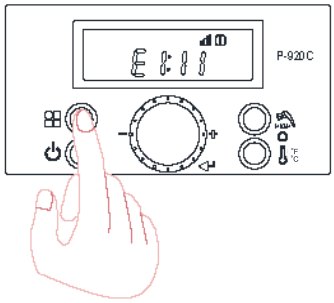
Press ‘current status button’ for 5 secs while display is powered off to enter installer setting mode



Press dial button for a sec to access the codes.

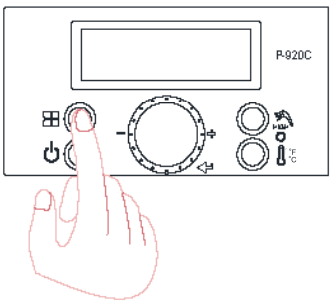


10 recent Fault Codes can be viewed by turning the dial.

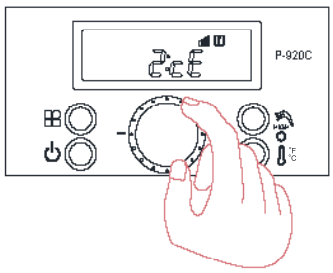


Press ‘current status button’ after confirmation to go back to the initial status.

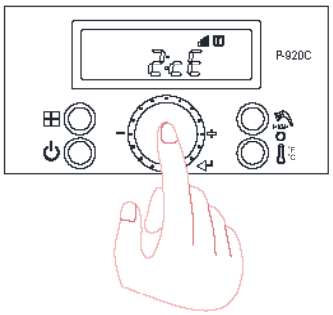
Clear Error Code history



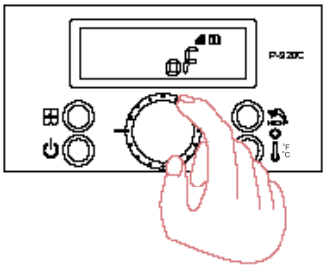
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode



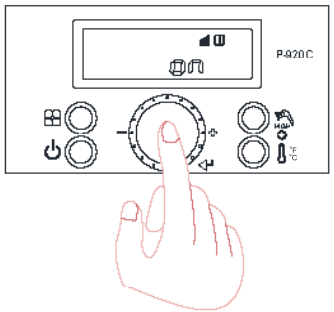
Turn the dial until ‘2:cE’ shows up.



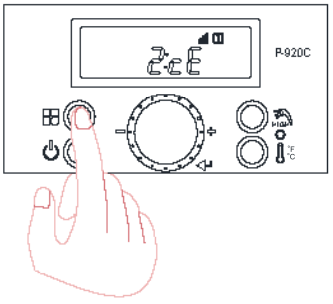
Press dial button for a sec when ‘2:cE’ is displayed



Turn the dial to set ‘on’ status when initial ‘of’ shows up.
(Default : off mode)

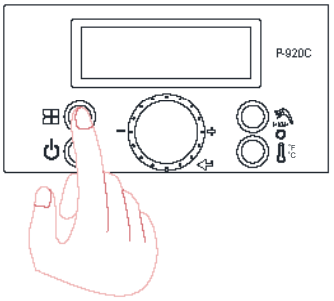


Press dial button during ‘on’ status to save the setting.

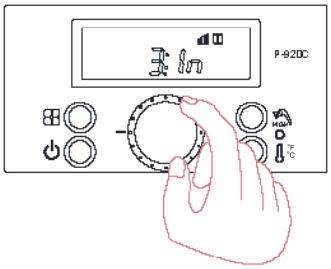


Press ‘current status button’ for a sec to go back to initial status after confirmation.

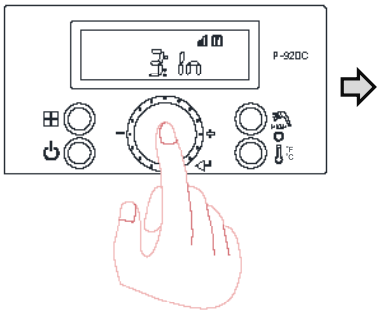
System Reset



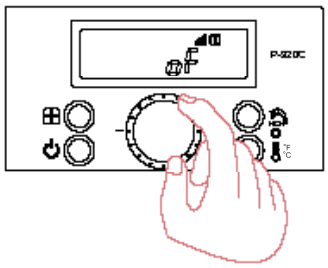
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



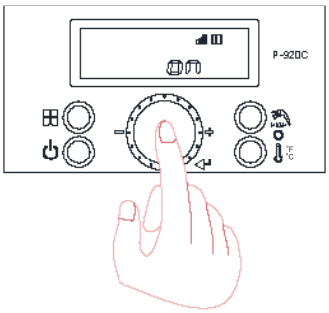
Turn the dial until ‘3:In’ shows up.



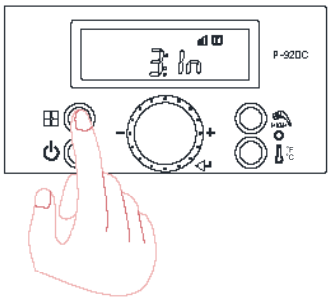
Press dial button for a sec when ‘3:In’ is displayed.



Turn the dial to set ‘on’ status when initial ‘off’ shows up.
(Default : off mode)

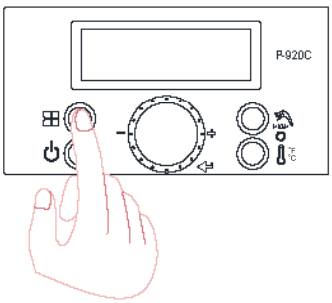


Press dial button during ‘on’ status to save the setting.

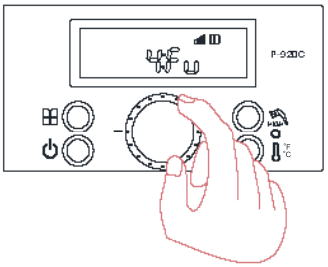


Press ‘current status button’ for a sec to go back to initial status after confirmation.

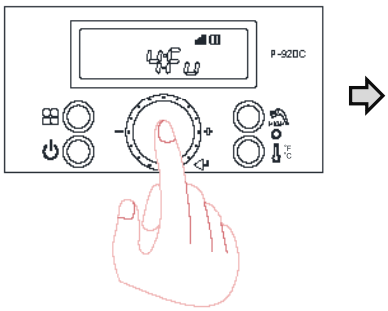
Change DHW flow rate measurement unit (GA_gallon or LI_litter)



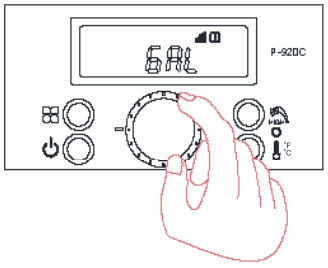
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



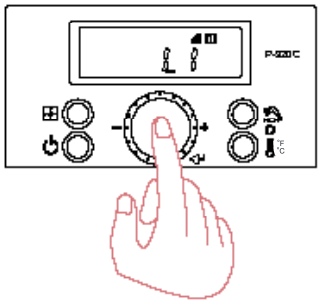
Turn the dial until ‘4:Fu’ shows up.



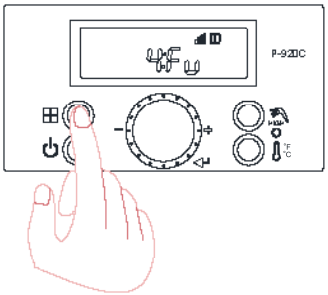
Press dial button for a sec when ‘4:Fu’ is displayed.



Turn the dial to set ‘Li’ when initial ‘GA’ shows. (Convert Liter to Gallon)

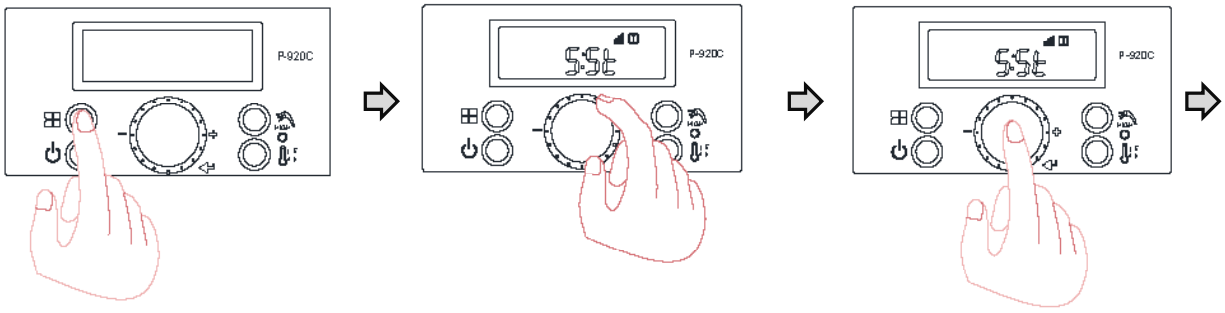


Press dial button to save the setting during ‘Li’ status.



Press ‘current status button’ for a sec to go back to initial status after confirmation.

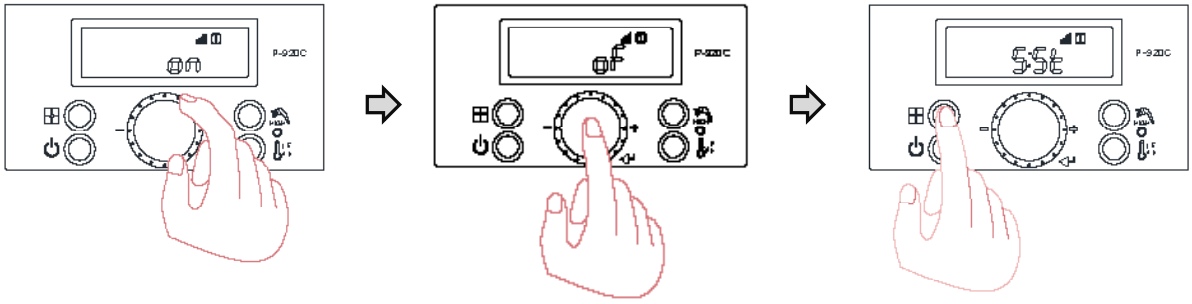
Internal Storage Tank Pre-heating Mode (on or off)



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode

Turn the dial until ‘5:St’ shows up.

Press dial button for a sec when ‘5:St’ is displayed.

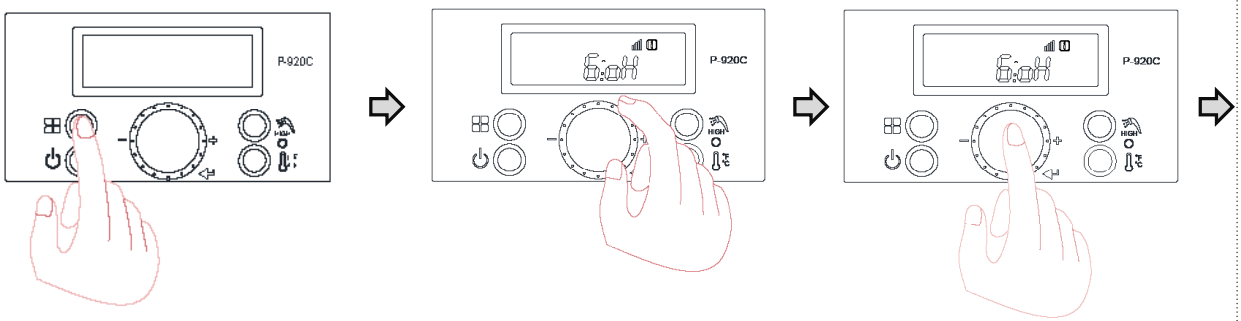


Turn the dial to set ‘off’ status when initial ‘on’ shows up.(Default : on)

Press dial button during ‘off’ status to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

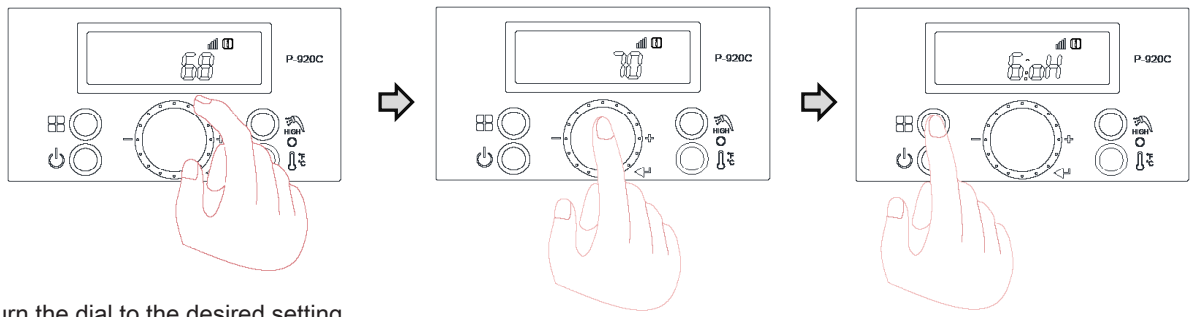
Change maximum outdoor temperature



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘6:oH’ shows up.

Press dial button for a sec when ‘6:oH’ is displayed.

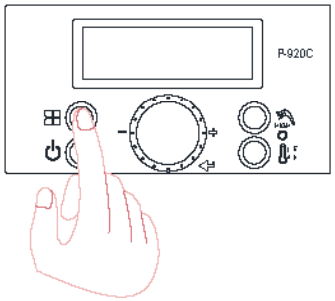


Turn the dial to the desired setting when initial 68 setting is displayed.

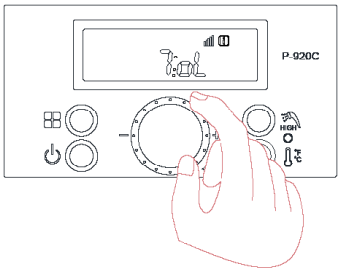
Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

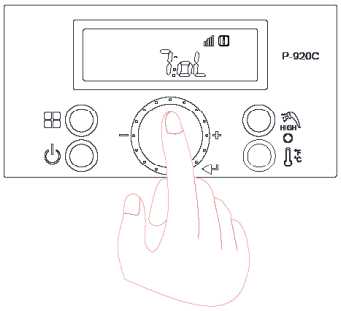
Change minimum outdoor temperature



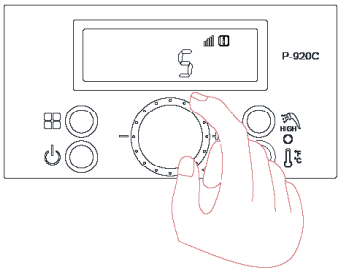
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



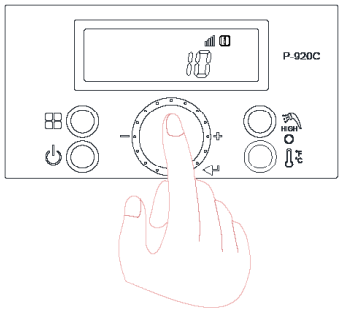
Turn the dial until ‘7:oL’ shows up.



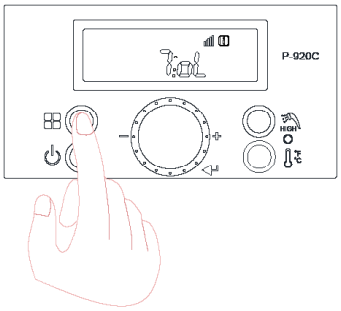
Press dial button for a sec when ‘7:oL’ is displayed.



Turn the dial to the desired setting when initial 5 setting is displayed.

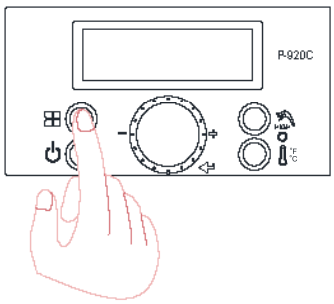


Press dial button to save the setting.

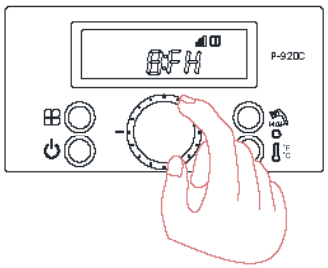


Press ‘current status button’ for a sec to go back to initial status after confirmation.

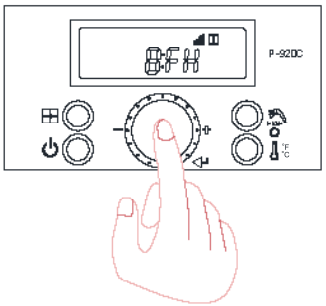
Fan, Max RPM Adjustment.



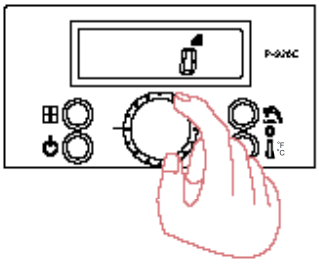
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode
.



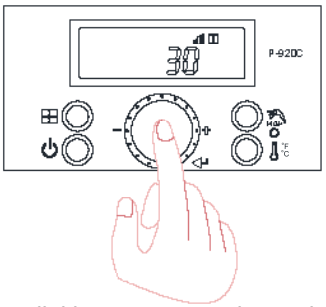
Turn the dial until ‘8:FH’ shows up.



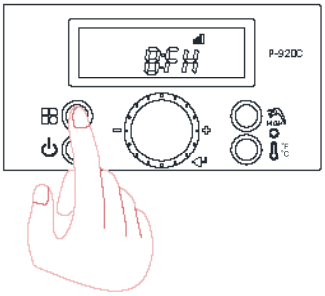
Press dial button for a sec when ‘8:FH’ is displayed



Turn the dial to the desired setting when initial 0 is displayed.
(-30 ~ +30, Default : 0)

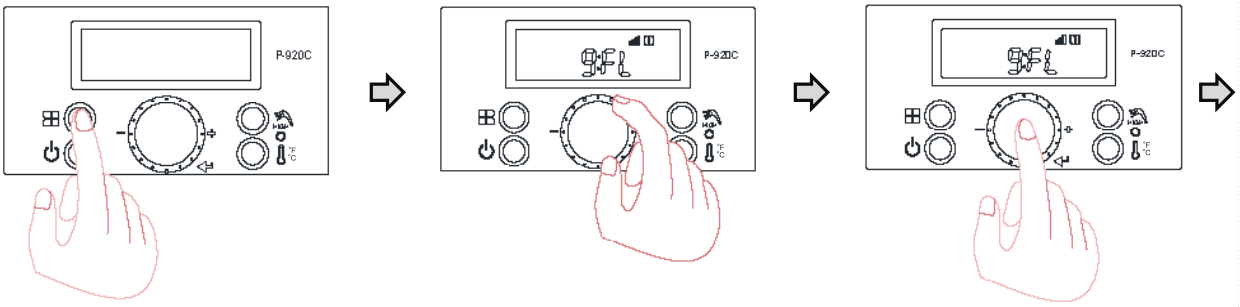


Press dial button to save the setting.



Press ‘current status button’ for a sec to go back to initial status after confirmation.

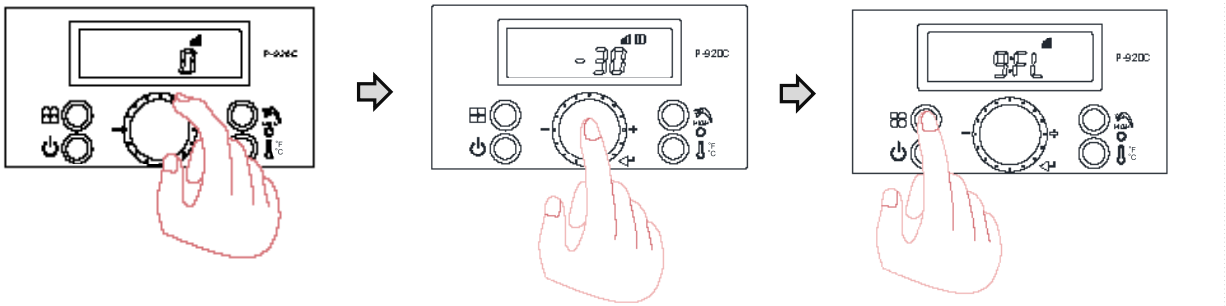
Fan, Min RPM Adjustment.



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘9:FL’ shows up.

Press dial button for a sec when ‘9:FL’ is displayed

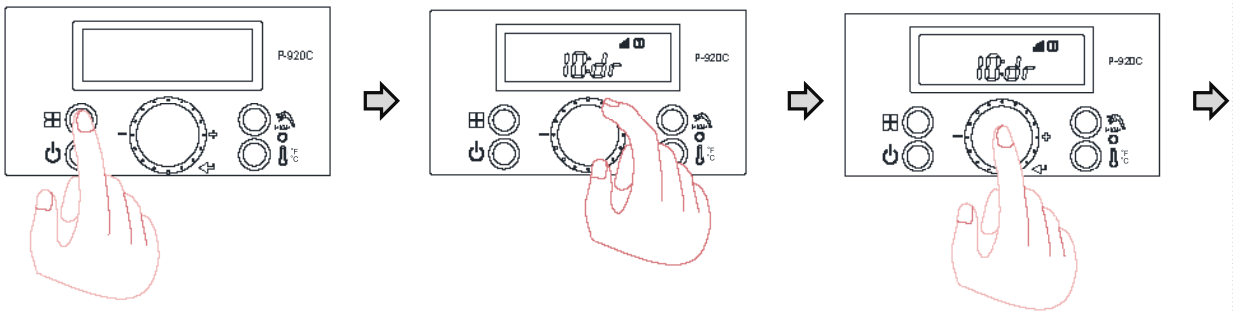


Turn the dial to the desired setting when initial 0 is displayed.
(-30 ~ +30, Default : 0)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

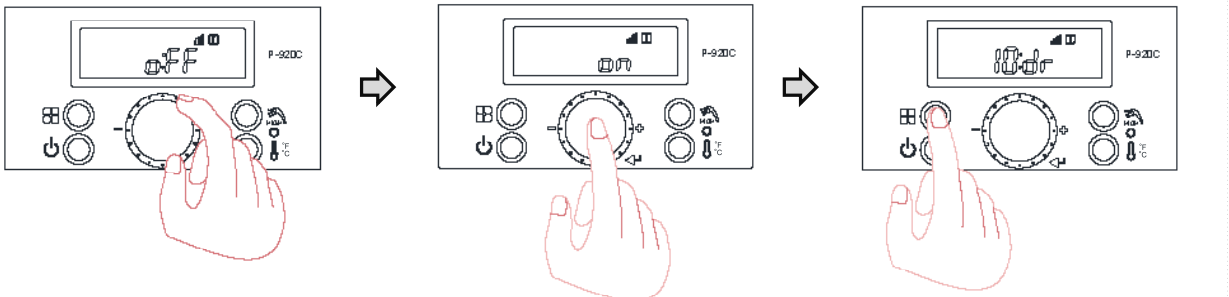
Reset burner operation time



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘10:dr’ shows up.

Press dial button for a sec when ‘10:dr’ is displayed

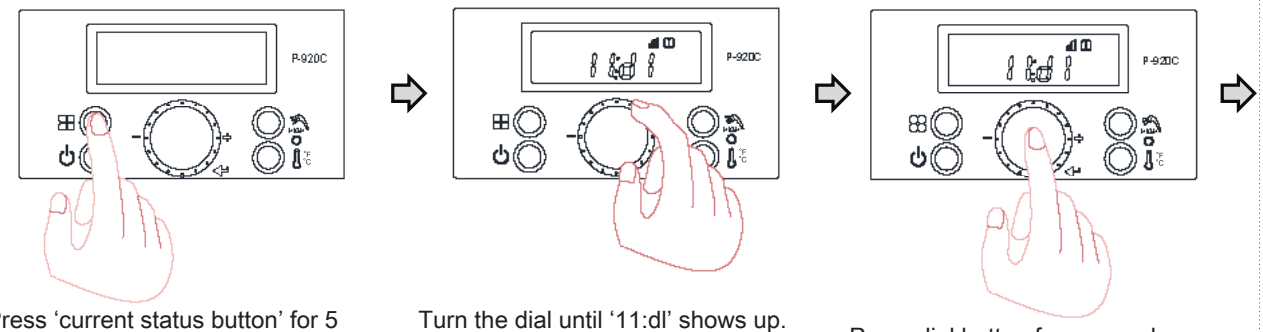


Turn the dial to ‘on’ status when initial ‘off’ shows up. (Default : off)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

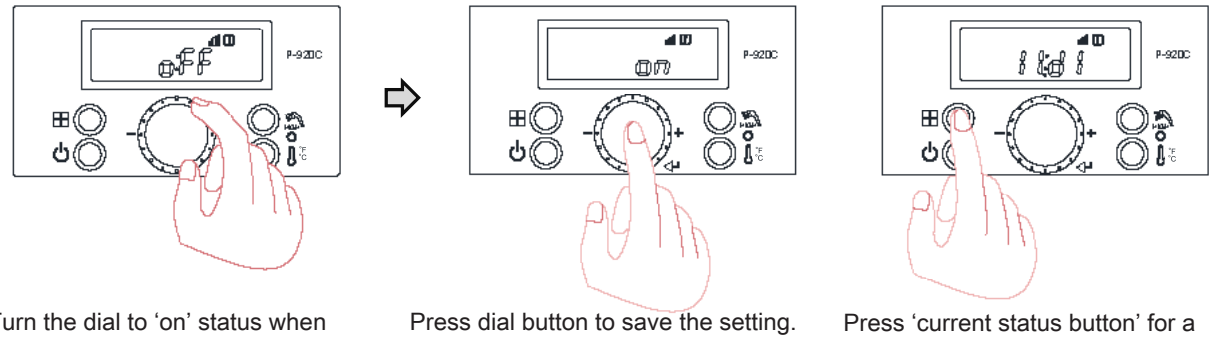
Reset igniting cycles



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘11:dl’ shows up.

Press dial button for a sec when ‘11:dl’ is displayed

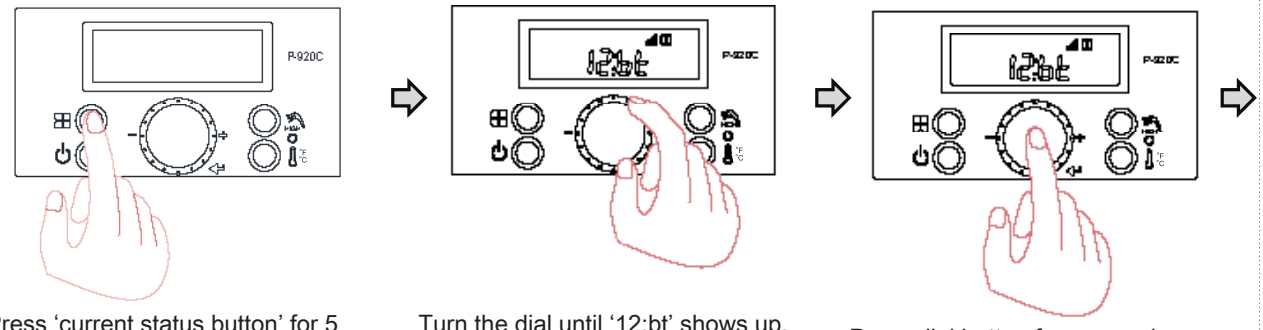


Turn the dial to ‘on’ status when initial ‘off’ shows up.(Default : off)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

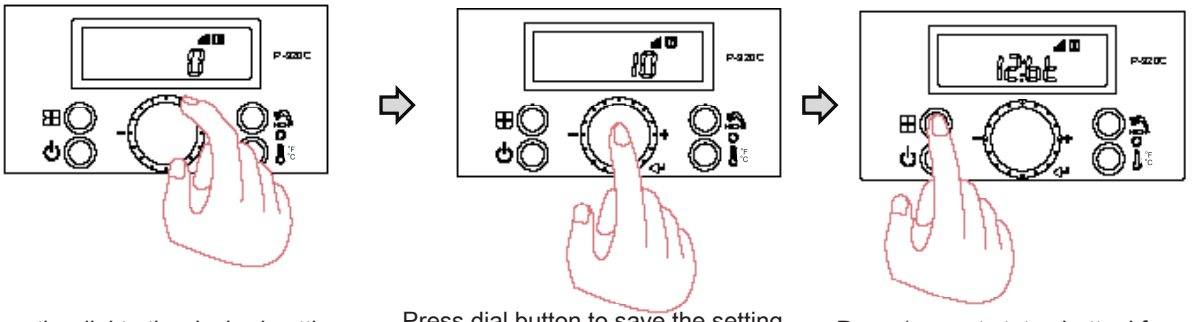
Boost Function



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘12:bt’ shows up.

Press dial button for a sec when ‘12:bt’ is displayed

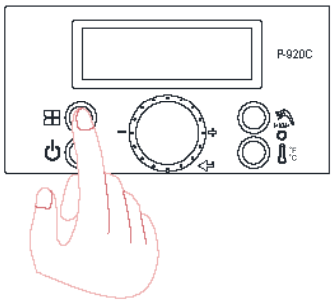


Turn the dial to the desired setting when initial 0 is displayed.
(Range:0~120 min, Default : 0 min)

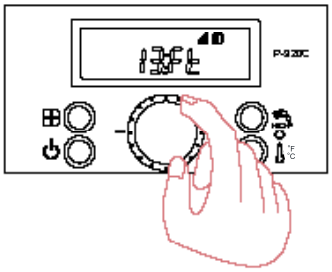
Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

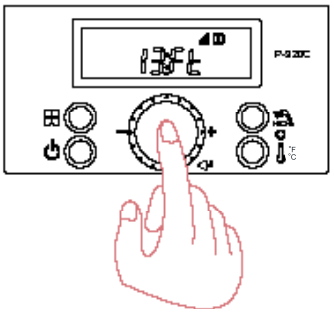
CH anti-cycling time



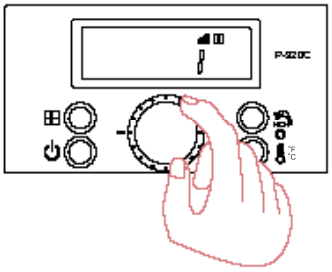
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



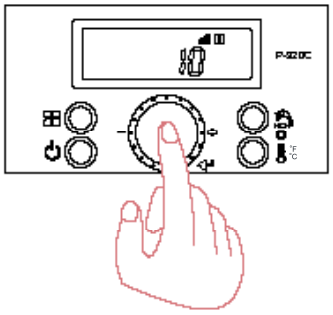
Turn the dial until ‘13:Ft’ shows up.



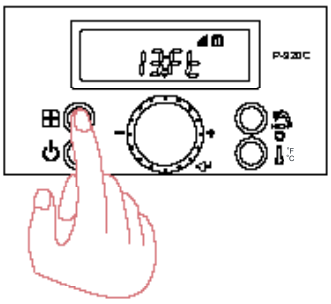
Press dial button for a sec when ‘13:Ft’ is displayed.



Turn the dial to the desired setting when initial setting is displayed.
(Range: 0~20 min, Default : 1 min)

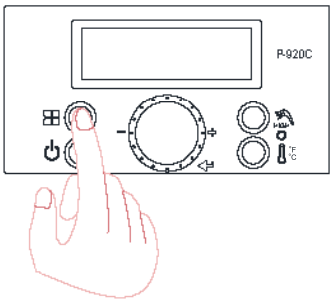


Press dial button to save the setting.

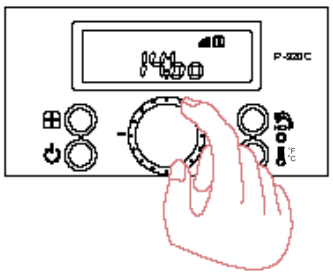


Press ‘current status button’ for a sec to go back to initial status after confirmation.

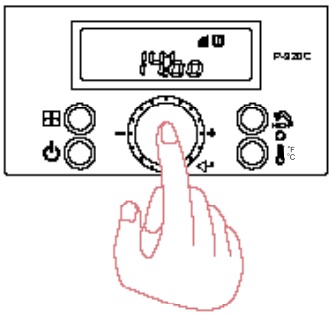
Burner 'ON' differential temperature



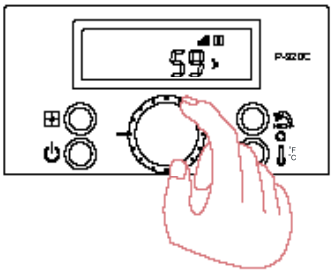
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



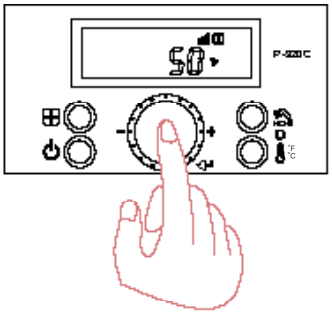
Turn the dial until ‘14:bo’ shows up.



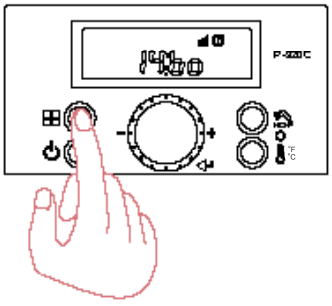
Press dial button for a sec when ‘14:bo’ is displayed.



Turn the dial to the desired setting when initial setting is displayed.
(Range: 9 °F ~ 27°F, Default: 27 °F)

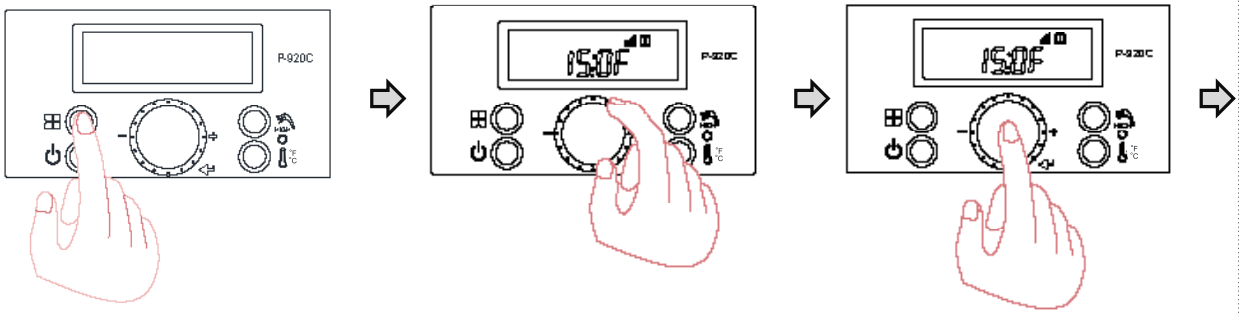


Press dial button to save the setting.



Press ‘current status button’ for a sec to go back to initial status after confirmation.

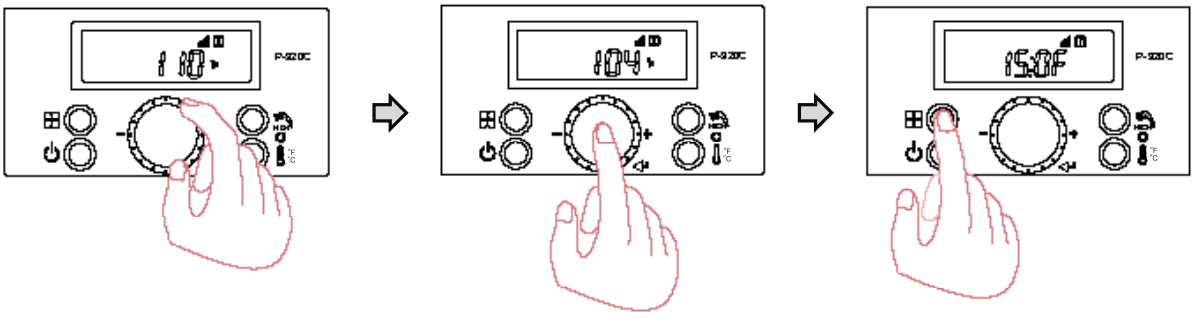
Warm weather shutdown



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘15:OF’ shows up.

Press dial button for a sec when ‘15:OF’ is displayed.

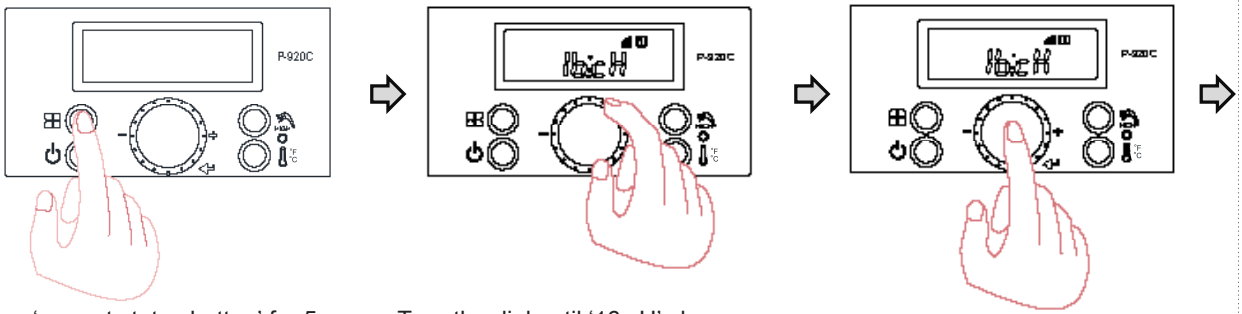


Turn the dial to the desired setting when initial setting is displayed.
(50 ~ 110 ℉, Default : 110℉)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

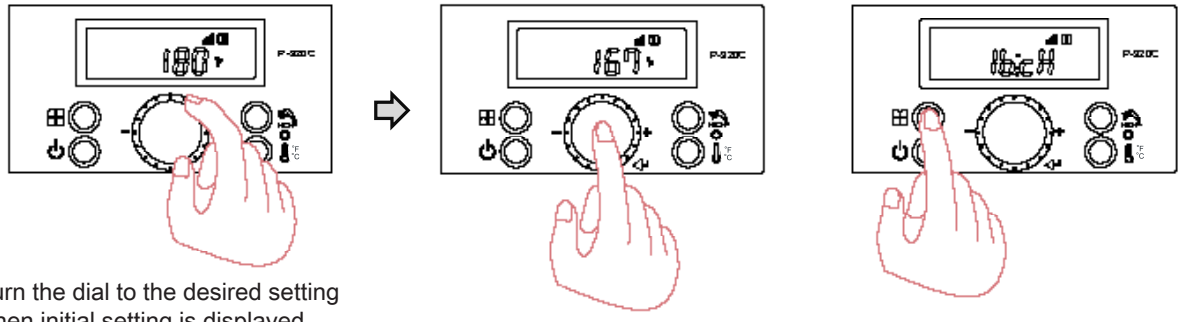
Maximun CH Supply tempature



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘16:cH’ shows up.

Press dial button for a sec when ‘16:cH’ is displayed.

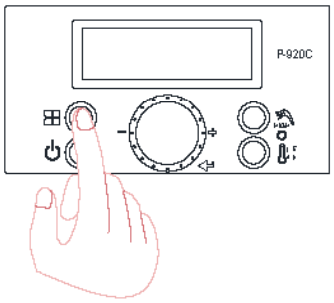


Turn the dial to the desired setting when initial setting is displayed.
(Range: miniimum supply temperature + 9 ℉ ~ 180 ℉) - Default: 180℉

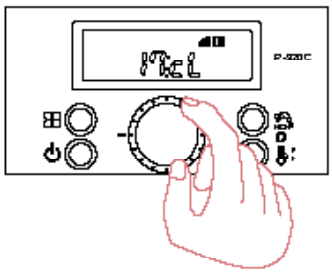
Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

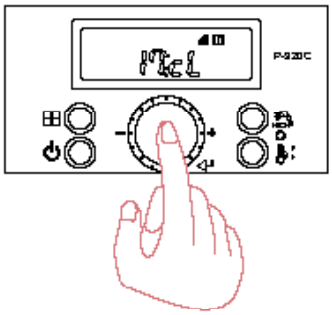
Minimun CH Supply tempature



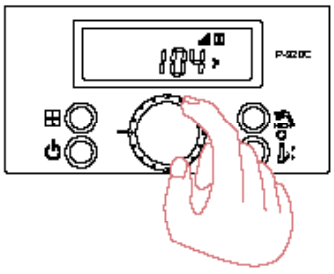
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



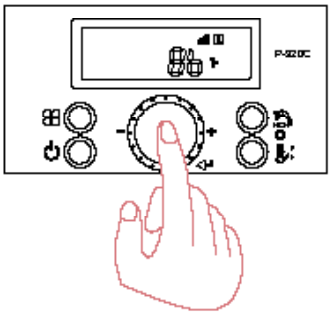
Turn the dial until ‘17:cL’ shows up.



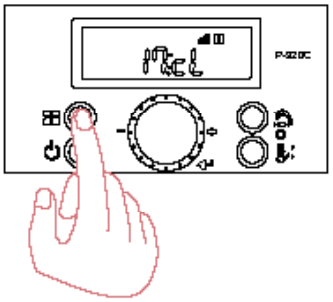
Press dial button for a sec when ‘17:cL’ is displayed.



Turn the dial to the desired setting when initial setting is displayed. (Range: 86 ℉ ~ maximum CH supply temperature - 9 ℉, Default: 86 ℉)

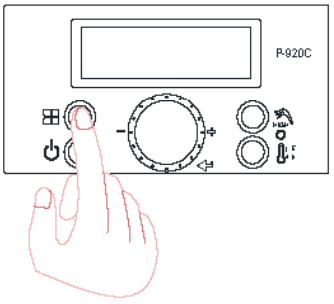


Press dial button to save the setting.

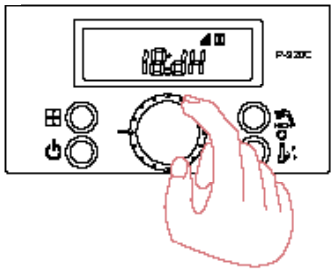


Press ‘current status button’ for a sec to go back to initial status after confirmation.

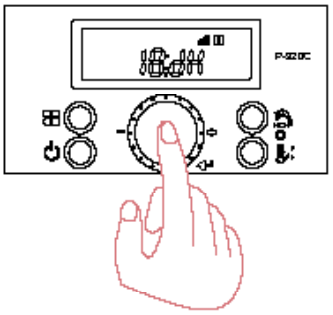
Maximum DHW set temperature



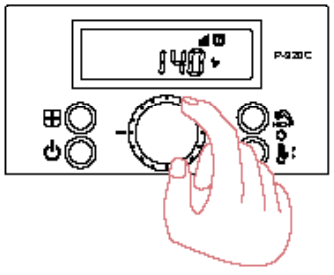
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



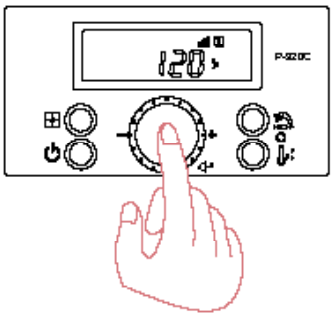
Turn the dial until ‘18:dH’ shows up.



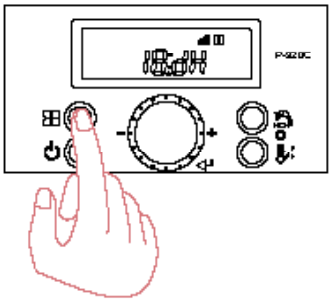
Press dial button for a sec when ‘18:dH’ is displayed.



Turn the dial to the desired setting when initial setting is displayed. (Range: 120℉~140℉, Default : 140℉)

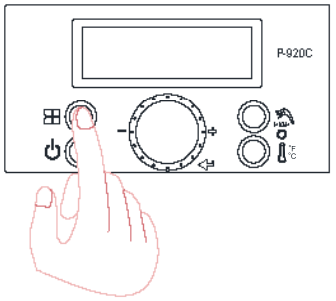


Press dial button to save the setting.

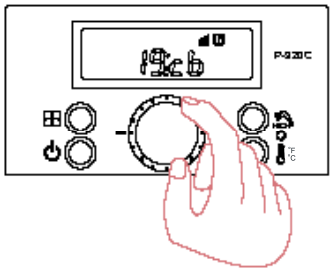


Press ‘current status button’ for a sec to go back to initial status after confirmation.

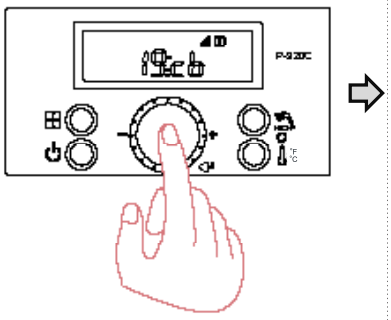
CH capacity



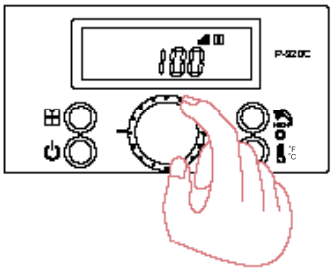
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



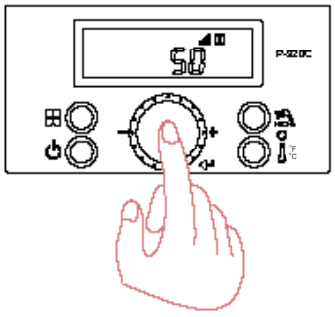
Turn the dial until ‘19:cb’ shows up.



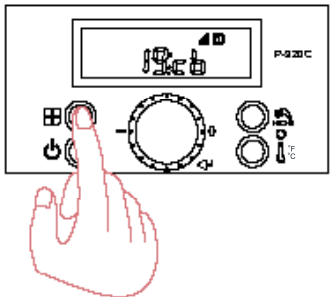
Press dial button for a sec when ‘19:cb’ is displayed.



Turn the dial to the desired setting when initial setting is displayed.
(Range: 50~100%, Default : 100%)

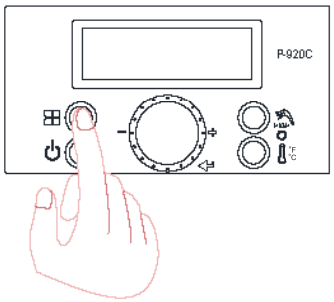


Press dial button to save the setting.

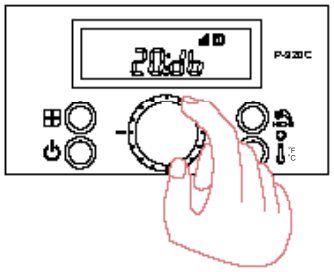


Press ‘current status button’ for a sec to go back to initial status after confirmation.

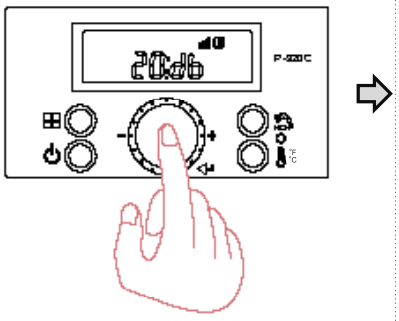
DHW heating capacity



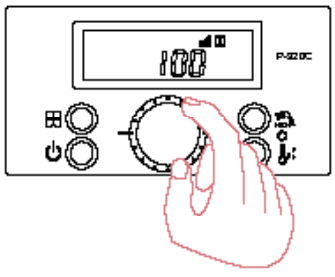
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



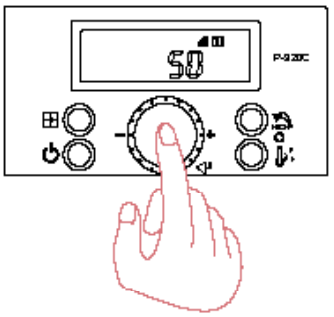
Turn the dial until ‘20:db’ shows up.



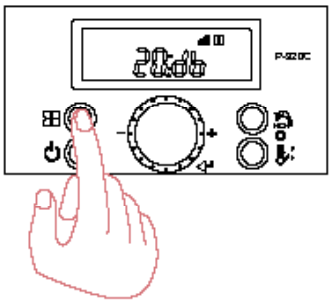
Press dial button for a sec when ‘20:db’ is displayed.



Turn the dial to the desired setting when initial setting is displayed.
(Range: 50~100%, Default : 100%)

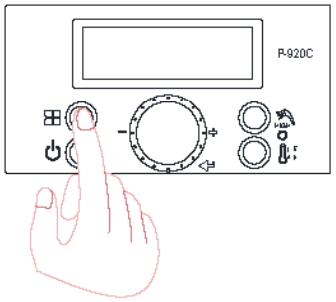


Press dial button to save the setting.

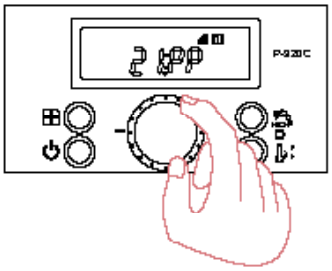


Press ‘current status button’ for a sec to go back to initial status after confirmation.

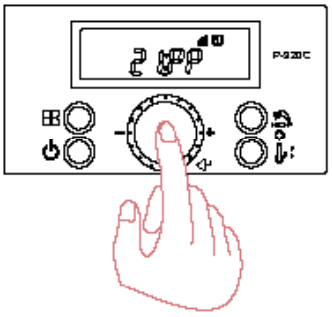
Internal CH primary pump post run timer (T/T calling for heat)



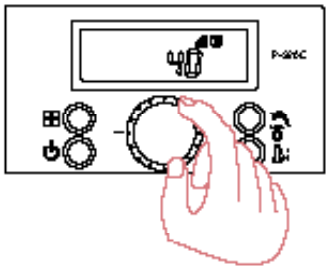
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



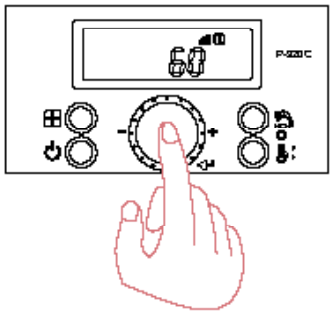
Turn the dial until ‘21:PP’ shows up.



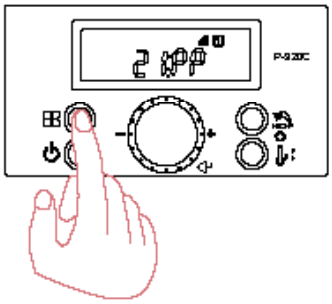
Press dial button for a sec when ‘21:PP’ is displayed.



Turn the dial to the desired setting when initial setting is displayed.
(Range: 1min ~ 60min,
Default: 40min)

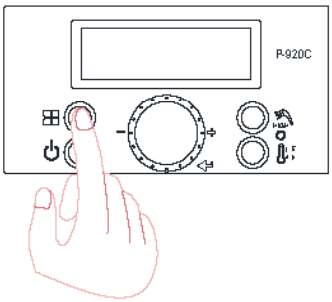


Press dial button to save the setting.

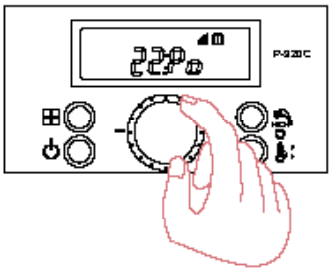


Press ‘current status button’ for a sec to go back to initial status after confirmation.

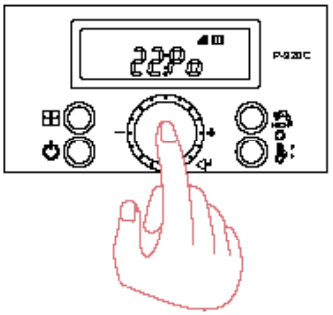
Internal CH pump overrun timer (On)



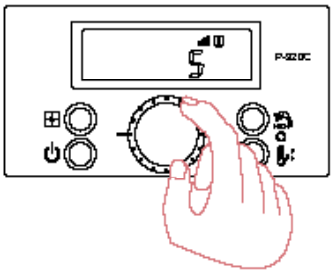
Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.



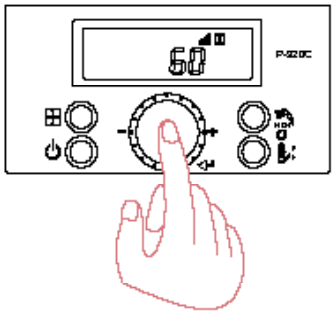
Turn the dial until ‘22:Po’ shows up.



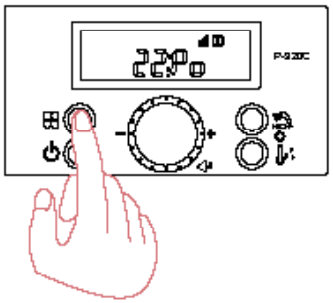
Press dial button for a sec when ‘22:Po’ is displayed.



Turn the dial to the desired setting when initial setting is displayed.
(Range: 1min ~ 60min,
Default: 5min)

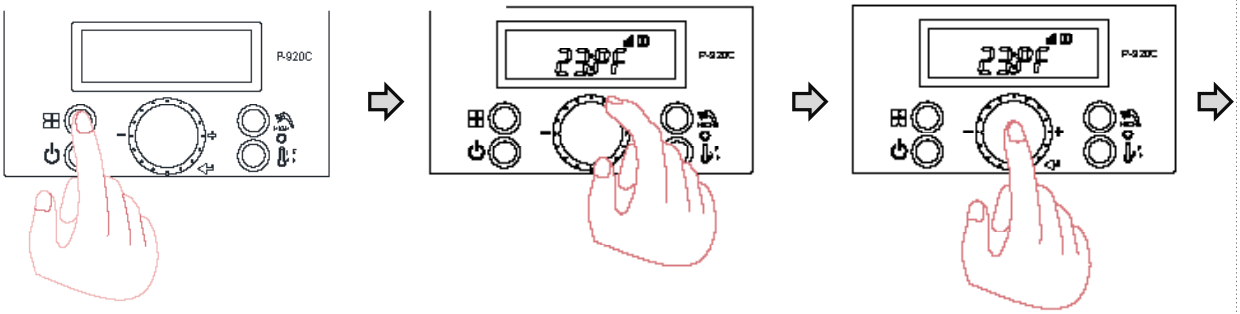


Press dial button to save the setting.



Press ‘current status button’ for a sec to go back to initial status after confirmation.

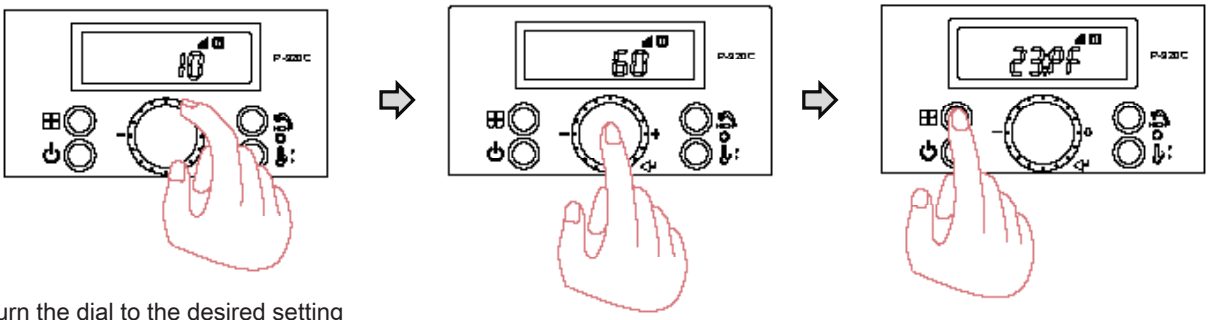
Internal CH pump overrun timer (Off)



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘23:PF’ shows up.

Press dial button for a sec when ‘23:PF’ is displayed.

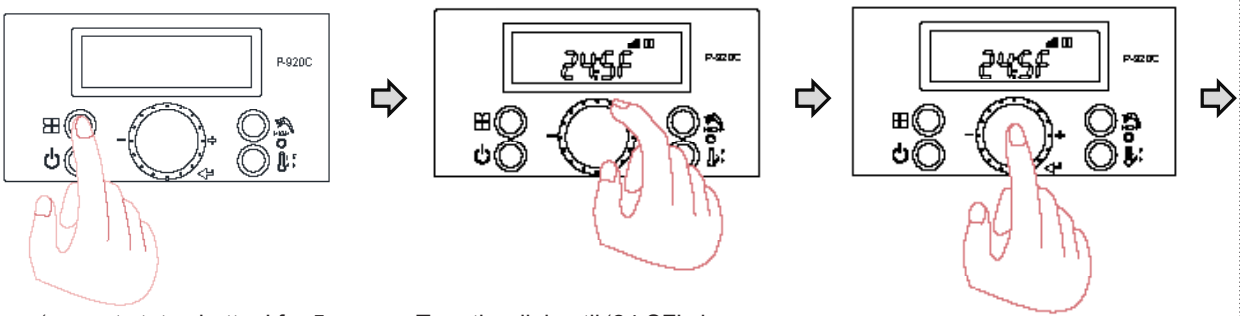


Turn the dial to the desired setting when initial setting is displayed. (Range: 1min ~ 60min, Default : 10min)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

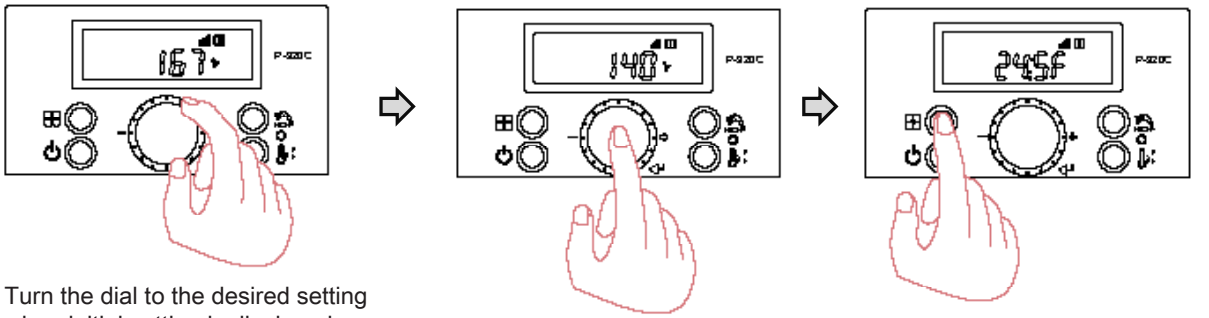
Internal DHW storage tank set point



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘24:SF’ shows up.

Press dial button for a sec when ‘24:SF’ is displayed.

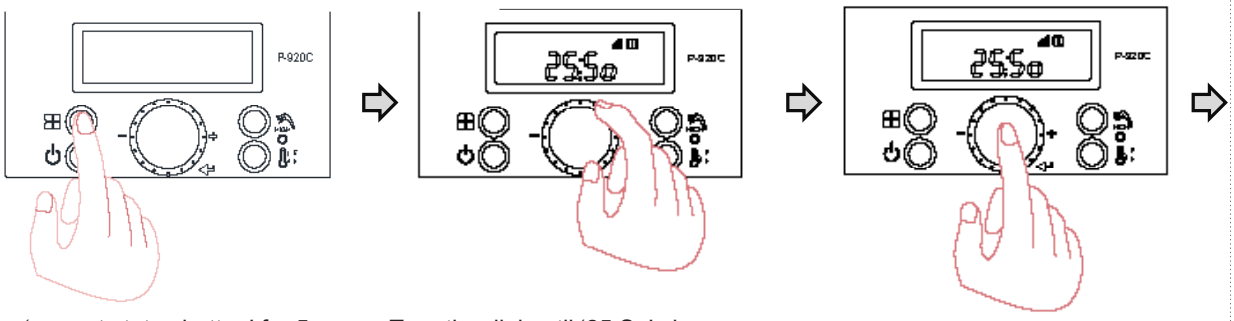


Turn the dial to the desired setting when initial setting is displayed. (Range: 140 °F ~ 167 °F, Default: 158 °F)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

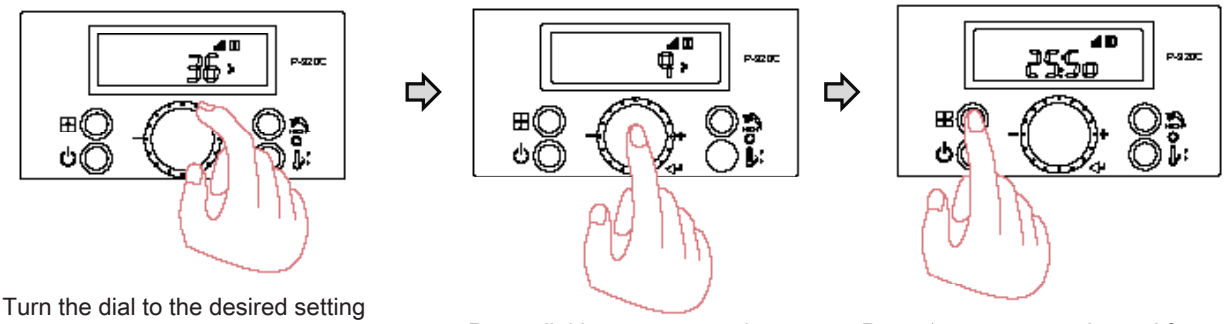
Internal DHW storage tank differential



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘25:So’ shows up.

Press dial button for a sec when ‘25:So’ is displayed.

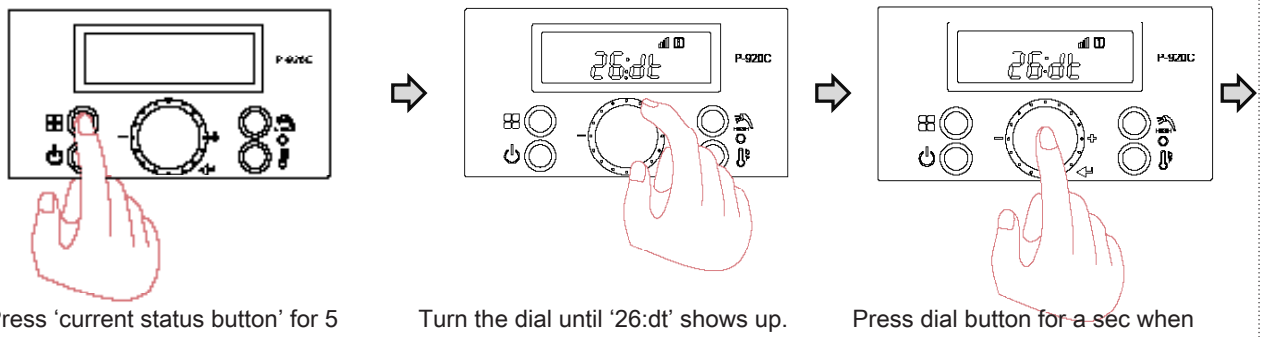


Turn the dial to the desired setting when initial setting is displayed. (Range: 9℉ ~ 36℉, Default: 27℉)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

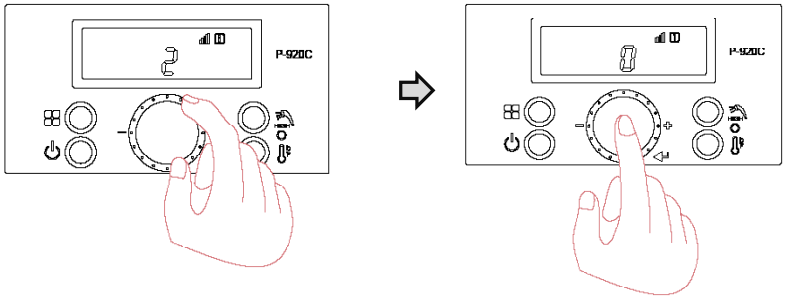
Delay time when switching from DHW to CH mode



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘26:dt’ shows up.

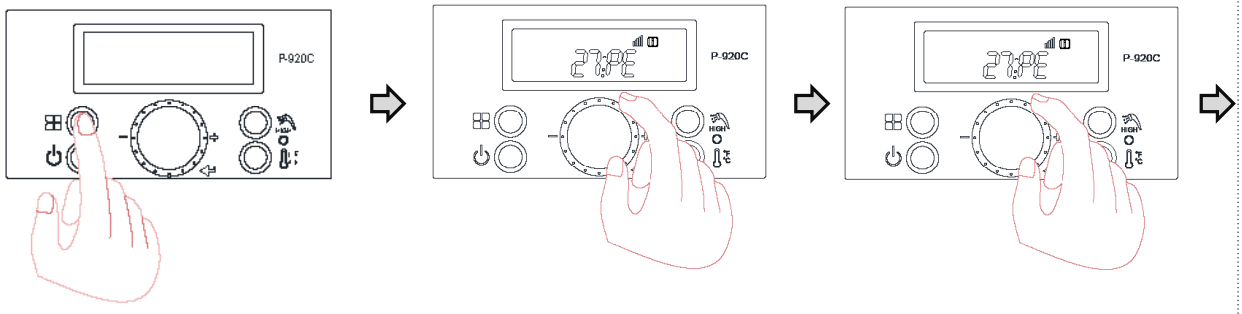
Press dial button for a sec when ‘26:dt’ is displayed.



Turn the dial to the desired setting when initial setting is displayed.

Press ‘current status button’ for a sec to go back to initial status after confirmation..

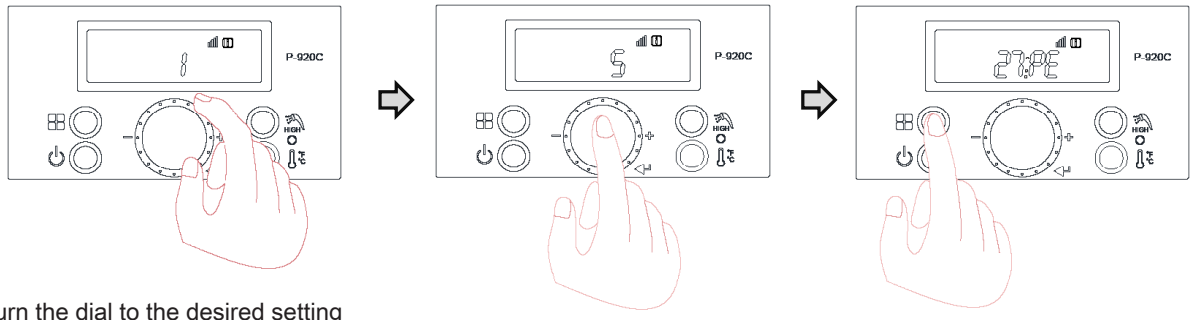
Internal CH primary pump post purge timer (T/T satisfied)



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘27:PE’ shows up.

Press dial button for a sec when ‘27:PE’ is displayed.

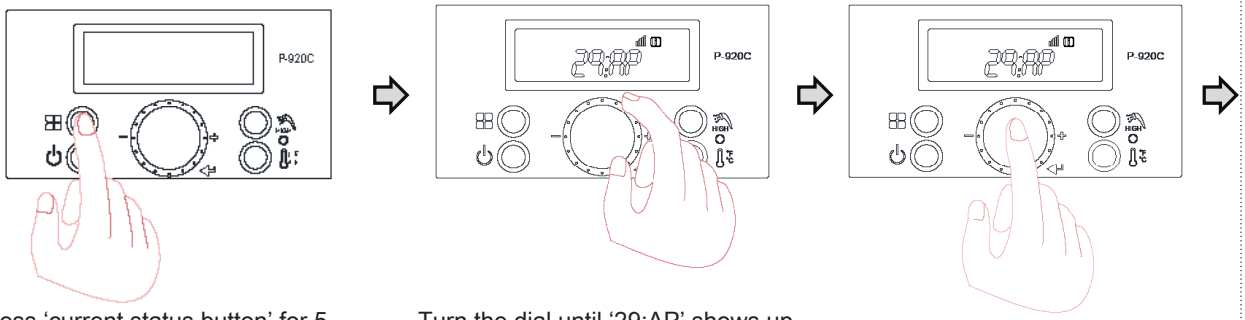


Turn the dial to the desired setting when initial setting is displayed. (Range: 1min ~ 60min, Default : 10min)

Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

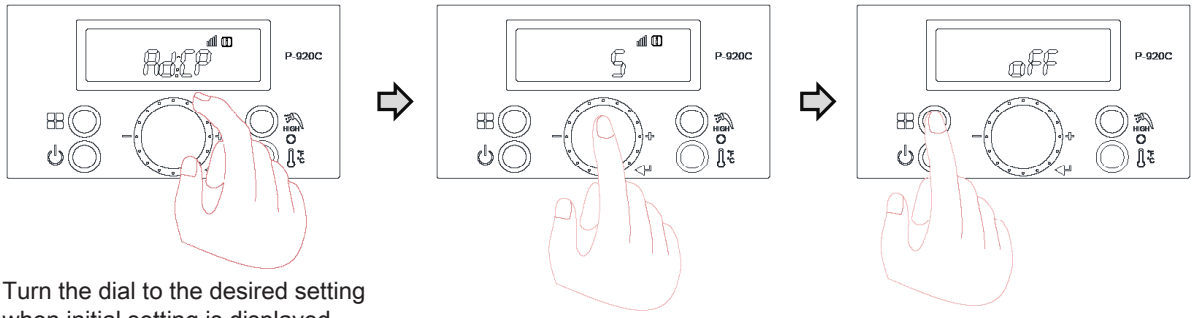
Internal CH and DHW pumps test mode



Press ‘current status button’ for 5 secs while display is powered off to enter into installer setting mode.

Turn the dial until ‘29:AP’ shows up.

Press dial button for a sec when ‘29:AP’ is displayed.

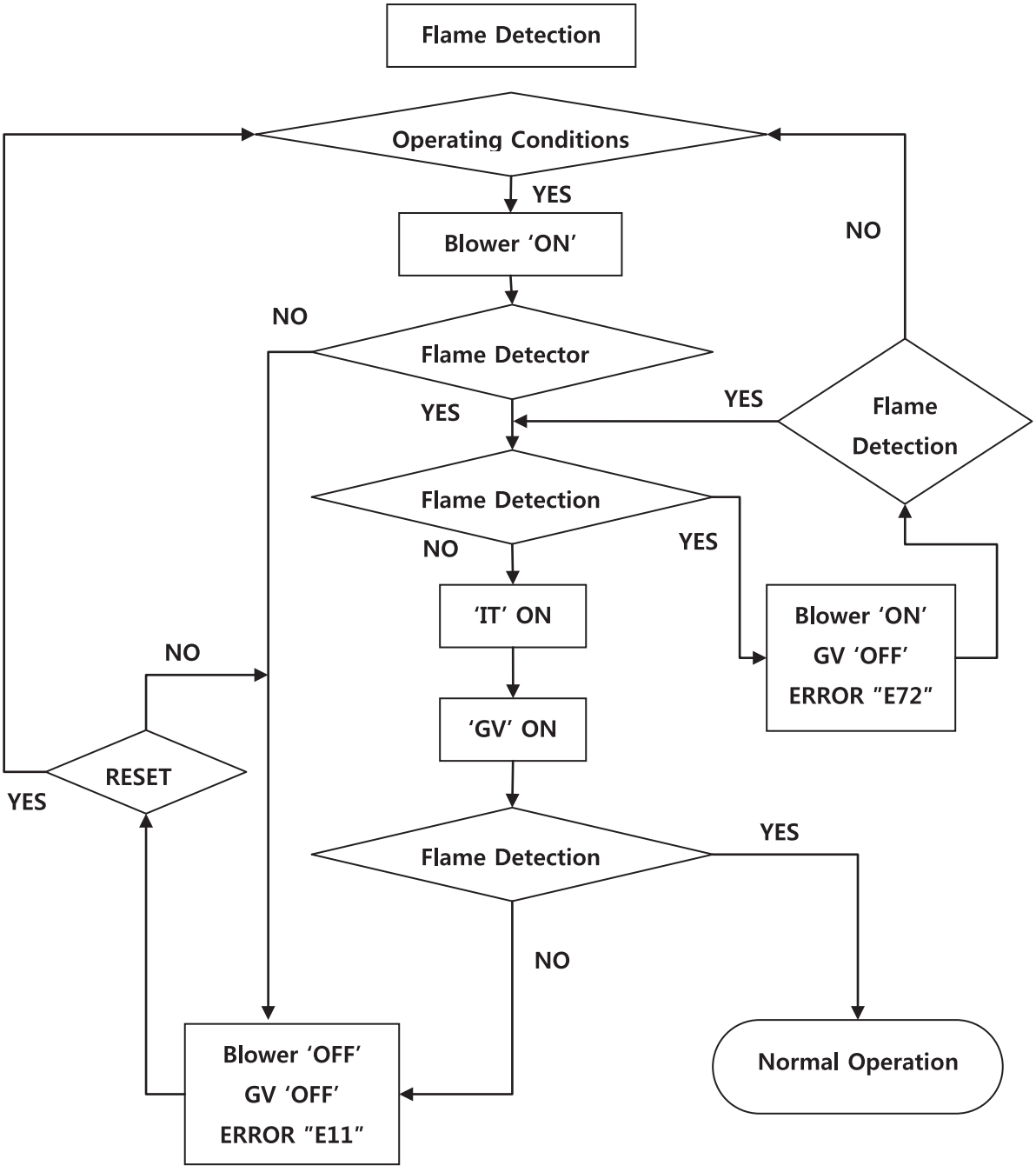


Turn the dial to the desired setting when initial setting is displayed.

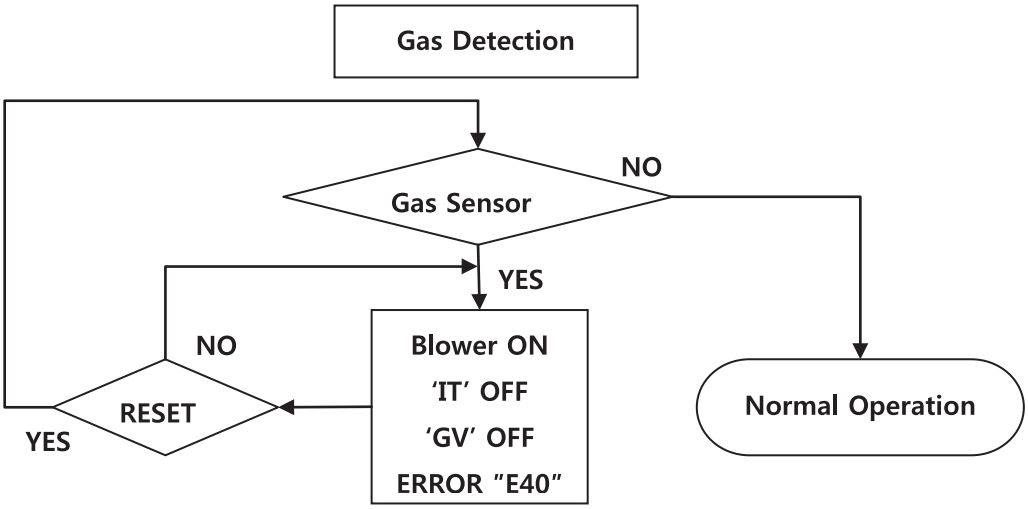
Press dial button to save the setting.

Press ‘current status button’ for a sec to go back to initial status after confirmation.

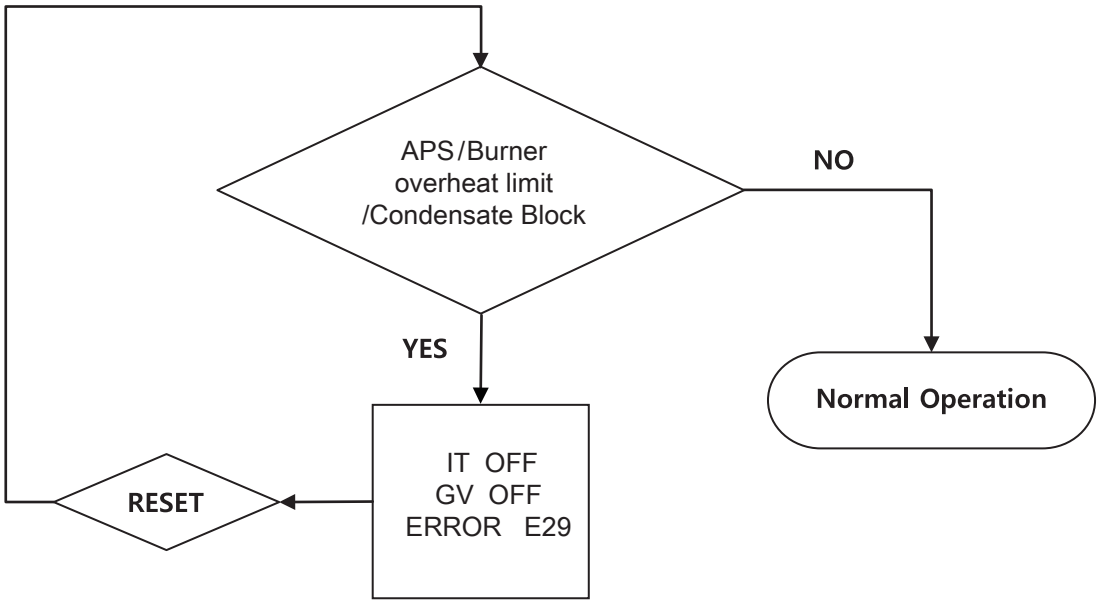
1. Flame Detection



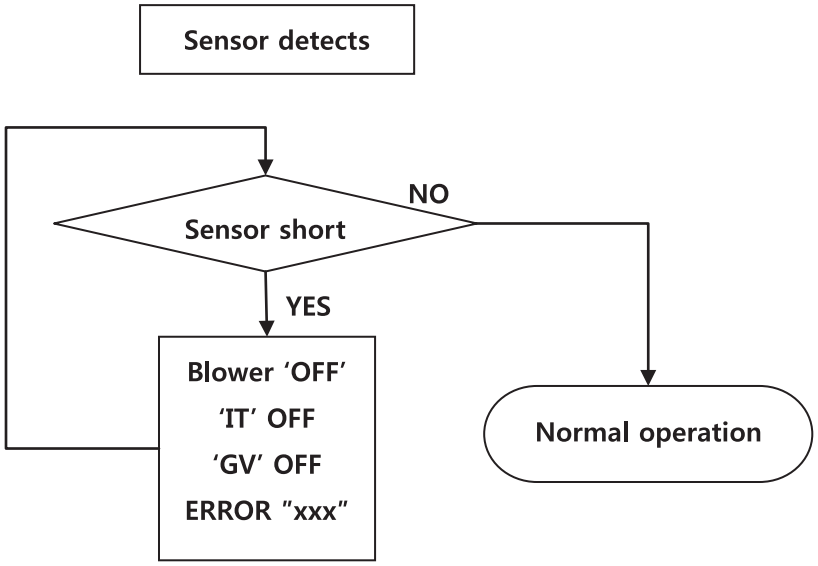
2. Gas Detection



3. APS/Burner overheat limit/Condensate Block switch



4. ‘Storage’, ‘DHW’, ‘OP’, ‘CH Overheat’, ‘Exhaust Overheat’ Sensor



[Error code]

The following screen will display when the appliance encounters an error.

Error Code	Error Code Description	Possible Remedies
Er:10	Flame has Extinguished 8 (Eight) Times	Press the Power button to clear the Error Code. If Error happens again: 1. Monitor the gas pressure to the appliance while in operation. Ensure pressure is between 3.5 and 14" WC. 2. Check gas valve wire. Ensure connection is secure. 3. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 4. Check vent terminations. Ensure there are no blockages. 5. Assure that the flame is stable when lit. 6. If the problem persists, replace the main control.
Er:11	Ignition has Failed 10 (Ten) Times	Press the Power button to clear the Error Code. If Error happens again: 1. Monitor the gas pressure to the appliance while in operation. Ensure pressure is between 3.5 and 14" WC. 2. Check gas valve wire. Ensure connection is secure. 3. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 4. Check Igniter transformer for proper connection. 5. Clean the spark igniter with steel wool to remove oxides. Ensure proper separation (3-4 mm). 6. Replace the spark igniter if damaged. 7. Assure that the flame is stable when lit. 8. If the problem persists, replace the main control.
Er:16	Operating Temperature Sensor detects Water Temperature Greater than 203°F (95°C)	Press the Power button to clear the Error Code. If Error happens again: 1. Check if dip switch High Fire setting is ON. Switches 6 and 7 should be OFF for normal operation. 2. Check if CH inlet pipe is blocked. Ensure there is enough water flowing to the appliance. 3. Check Operating Temperature sensor at CH heat exchanger outlet. If resistance is zero, replace the sensor. 4. If the problem persists, replace the main control.
Er:20	Condensate – Closed is Normal, Open is Fault (Condensate Drain Trap)	Press the Power button to clear the Error Code. 1. Check Condensate and main controller connections. Ensure all are secure. 2. Check Condensate sensor resistance. If resistance is zero, replace the switch. 3. Check Condensate hose. Ensure it is connected and in good condition. 4. Check condensate line and termination for blockages. 5. Check exhaust vent for blockages. 6. If the problem persists, replace the main control.
Er:28	Overheat Sensor Open or Short	This Error Code will go away when CH temperature decreases. If Error happens again: 1. Check overheat temperature sensor. Ensure connections are secure. 2. Check overheat sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.
Er:29	APS Open	1. Check APS and connections. 2. If APS is open, replace the switch. 3. If APS is closed and connections are secure, check switch resistance. If resistance is zero, replace the switch. 4. Check condensate line and termination for blockages. 5. Check exhaust vent for blockages. 6. Press the Power button to clear the Error Code and restart appliance. 7. If the problem persists, replace the main control.
Er:30	DHW Storage Temperature Sensor Open or Short	This Error Code will go away when stored DHW temperature decreases. If Error happens again: 1. Check DHW storage temperature sensor. Ensure connections are secure. 2. Check DHW storage temperature sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.
Er:32	DHW Sensor Open or Short	This Error Code will go away when outlet DHW temperature decreases. If Error happens again: 1. Check DHW outlet temperature sensor. Ensure connections are secure. 2. Check sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.

Error Code	Error Code Description	Possible Remedies
Er:33	CH Temperature Sensor Open or Short	This Error Code will go away when CH temperature decreases. If Error happens again: 1. Check CH temperature sensor. Ensure connections are secure. 2. Check CH sensor resistance. If resistance is zero, replace the sensor. 3. If the problem persists, replace the main control.
Er:35	Exhaust Sensor Open or Short	This Error Code will go away when exhaust temperature decreases. If Error happens again: 1. Check exhaust temperature sensor. Ensure connections are secure. 2. Check sensor resistance. If resistance is zero, replace the sensor. 3. Check exhaust vent for blockage. 4. If the problem persists, replace the main control.
Er:36	Abnormal Supply Voltage	Supply voltage is too low to operate. This Error Code will go away when supply voltage returns to normal operating range. If Error happens again: 1. Ensure appliance is properly wired to a power source meeting the requirements on the rating plate. 2. If problem persists, replace the main control.
Er:37	Abnormal Supply Frequency	Supply frequency is too high to operate. This Error Code will go away when supply frequency returns to normal operating range. If Error happens again: 1. Ensure appliance is properly wired to a power source meeting the requirements on the rating plate. 2. If problem persists, replace the main control.
Er:38	Error Appears When Control Stores Data, but Data is not Saved	Press the Power button to clear the Error Code. Replace the main control.
Er:40	Gas Leakage is Detected for Greater than 5 seconds, or three times within 10 minutes	IMPORTANT: If you smell gas, STOP! Follow the instructions on page 2, this manual, and call a qualified service technician or the fuel gas utility. Press the Power button to clear the Error Code. If Error happens again: 1. Check the appliance cover. Ensure it is secure. 2. Check gas connections for leakage with a soapy solution. Fix any leaks. 3. Check condition of the burner assembly. 4. If the problem persists, replace the main control.
Er:41	Fan Speed too High with Flame On	Press the Power button to clear the Error Code. If Error happens again: 1. Check the vent connections for blockages. 2. Check the burner assembly. 3. Check fan operation. If fan appears to be operating normally but RPMs are too high, replace the fan. 4. If the problem persists, replace the main control.
Er:42	Jumped Wire Disconnected	Press the Power button to clear the Error Code. If Error happens again: 1. Ensure the jumped wire is properly connected. 2. If the problem persists, replace the main control.
Er:43	Burner Overheat Switch Open	Press the Power button to clear the Error Code. If Error happens again: 1. Check burner overheat switch connections. Ensure connections are secure. 2. Check switch resistance. If resistance is zero, replace the switch. 3. If the problem persists, replace the main control.
Er:51	Fan Speed Feedback Signal Abnormal	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check the connections to the fan. Ensure all are secure. 2. If the fan does not rotate during the ignition sequence, check for AC8V–26.5V power at the fan connection. If AC8V–26.5V power is present at the control, replace the fan. If the blower does not have AC8V–26.5V power, check power at the control. If AC8V–26.5V power is not present at the control, replace the control. 3. If the problem persists, replace the main control.
Er:56	Mixing Valve Initial Value Error (Mixing Valve Cannot Return to Initial Position)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Turn power OFF and ON at the main power switch internal to the appliance. 2. Check wiring connections to mixing valve. Ensure all are secure. 3. Replace mixing valve. 4. If the problem persists, replace the main control.
Er:58	Mixing Valve Operation Error (Mixing Valve Stuck in Initial Position)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Turn power OFF and ON at the main power switch internal to the appliance. 2. Check wiring connections to mixing valve. Ensure all are secure. 3. Replace mixing valve. 4. If the problem persists, replace the main control.

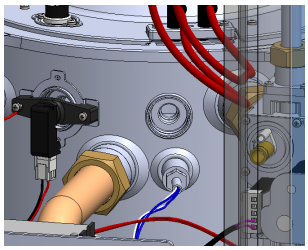
Error Code	Error Code Description	Possible Remedies
Er:70	Register, Ram, Rom, I/O Port, AD Abnormal, Important EPROM Data or Safe Data Abnormal	This Error Code will go away when the condition is remedied. If Error happens again: 1. Turn power OFF and ON at the main power switch internal to the appliance. 2. If the problem persists, replace the main control.
Er:72	Flame Signal Detected before Ignition	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check the appliance cover. Ensure it is secure. Flame detection sensor can detect an external light source. 2. Check flame detection sensor. Ensure connections are secure. Normal operating settings are more than 2.5DC before ignition, less than 2.5DC after ignition. 3. If the problem persists, replace the main control.
Er:76	Poor Communication	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check connections from main control to display panel. 2. If the problem persists, replace the display and/or the main control.
Er:80	Low Water Level Sensor (Low Water Level Detected Four (4) Consecutive times)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Ensure all valves are open to the appliance and there are no leaks. 2. Ensure all air has been purged from the system. 3. Check wiring connections to low water level sensor. Ensure all are secure. 4. Check low water level sensor resistance. If resistance is zero, replace the sensor. 5. If the problem persists, replace the main control.
Er:81	Low Water Level Circuit	This Error Code will go away when the condition is remedied. If Error happens again: 1. Ensure all valves are open to the appliance and there are no leaks. 2. Check wiring connections to low water level sensor. Ensure all are secure. 3. Check low water level sensor resistance. If resistance is zero, replace the sensor. 4. If the problem persists, replace the main control.
Er:85	Freeze Protection (Appliance has detected water temperature below 34°F (1°C)	This Error Code will go away when the freezing condition is remedied. If Error happens again: 1. Ensure appliance is located in a mechanical room protected from freezing conditions. 2. Ensure all valves are open to the appliance, there are no leaks. 2. Check wiring connections to low water level sensor. Ensure all are secure. 3. Check low water level sensor resistance. If resistance is zero, replace the sensor. 4. If the problem persists, replace the main control.
Er:94	Exhaust Sensor detects Vent Temperature is Greater than 190°F (88°C)	This Error Code will go away when the condition is remedied. If Error happens again: 1. Check if dip switch High Fire setting is ON. Switches 6 and 7 should be OFF for normal operation. 2. Check exhaust temperature sensor. Ensure connections are secure. 3. Check sensor resistance. If resistance is zero, replace the sensor. 4. Check exhaust vent for blockage. 5. If the problem persists, replace the control. 6. If the problem persists, replace the heat exchanger.

Error code	Meaning	Cause
	Flame loss (manual reset)	If flame loss issue repeats 8 times while unit is operating, error code 10 will appear.

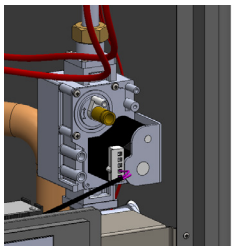
Failure event

If flame is not detected within 1minute after ignition trial, the unit restarts. If ignition trial is repeated eight times in a row, ignition sequence will stop. Error will not disappear until display panel is manually reset.

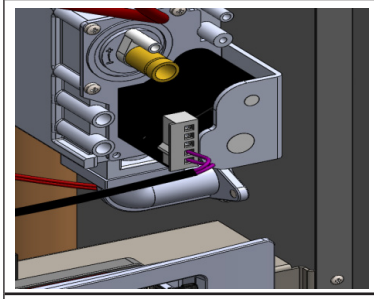
Check point



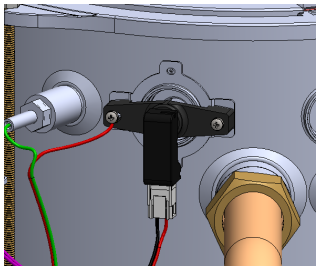
① ▸ If the flame sensing viewing port is excessively discolored, loss of fame will occur.



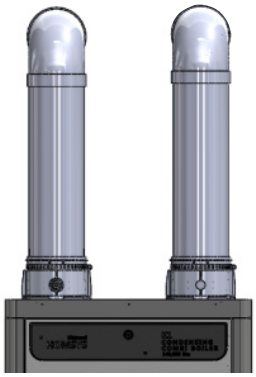
② Ensure gas valve wiring is properly connected.



③ Check Gas Inlet Pressure Range:
NG:
3.5” WC ~ 14” WC
LP:
3.5” WC ~ 14”WC



④ Please check flame detector sensor’s connecting line and ensure correct position as shown.



⑤ Please check the blockage of flue (intake and exhaust pipes).

⑥ If all things are normal, please replace main controller.

WARNING

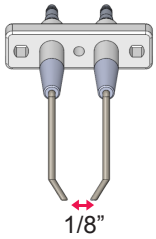
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Ignition failure (manual reset)	During ignition trials, if unit failed to ignite 10 times continuously, error code 11 will appear.

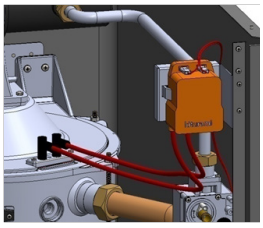
Failure event

If the unit failed to detect flame during ignition sequence pre-purge time will exceed 10 sec, and error code Er 11 will appear.

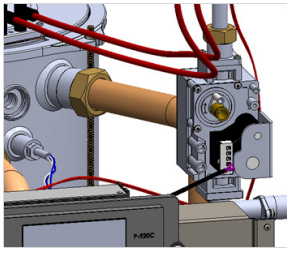
Check point



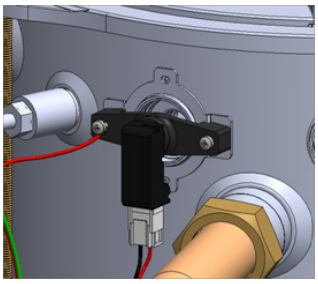
① Check separation distance after removing the flame rod. (separation distance: 1/8”)



② Check ignition transformer and electrical wires for proper connection.



③ Check Gas Inlet Pressure Range:
NG:
3.5” WC ~ 14” WC
LP:
3.5” WC ~ 14”WC



④ Please check flame detector sensor’s connecting line and ensure correct position as shown.

■ From more than DC 2.5V after ignition safety, cut-off will appear
① When setting before ignition is less than DC 2.5V: Replace flame sensor.
② When setting after ignition is more than DC 2.5V: Replace flame sensor.

Flame detector sensor setting
(Please check after closing front cover)

ITEM	Normal operating settings
Before ignition	More than DC 2.5V
After ignition	Less than DC 2.5V

⑤ If the flame sensing viewing port is excessively discolored, loss of fame will occur. To correct this problem, replace the flame viewing glass.

⑥ If all things are normal, please replace main controller.

WARNING

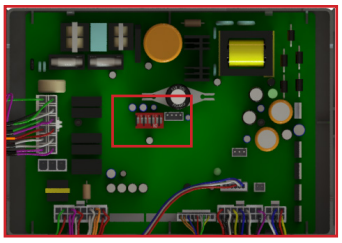
Failure to turn the power off to the appliance before repair could result in serious injury or death.

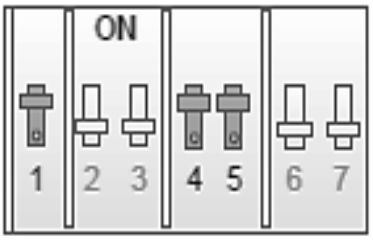
Error code	Meaning	Cause
	CH overheating temperature issue (manual reset)	If temperature on the CH supply temperature sensor (tagged OP on connectors) exceeds 203 °F, error Er 16 will appear

Failure event

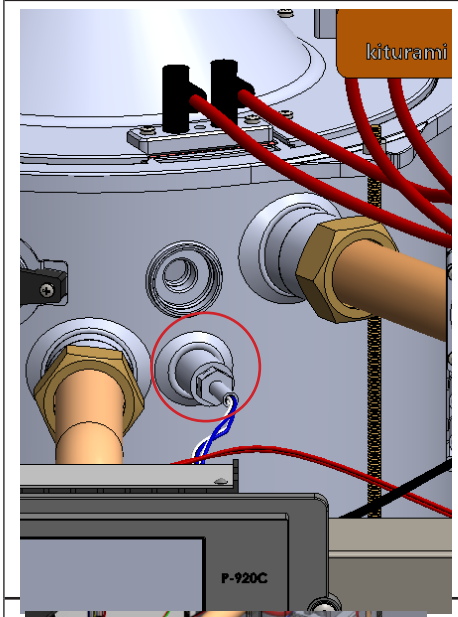
In case that CH supply temperature is more than 203 °F, water temperature overheating fault occurs and all output except for fan post-purge is stopped.

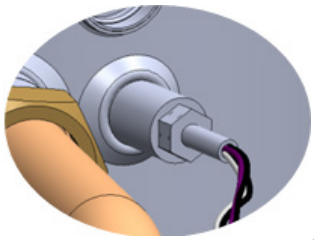
Check point

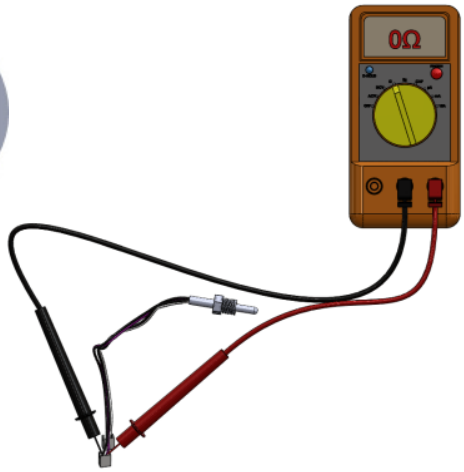




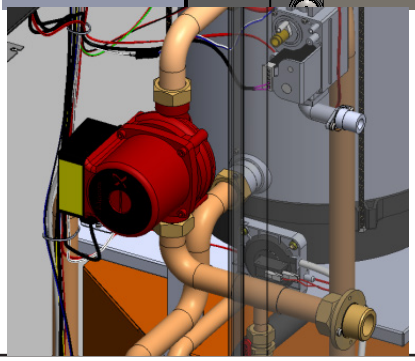
① Check to see if the default DIP SWITCH settings have been changed from the factory settings – assure that default settings are set to correct overheating condition.

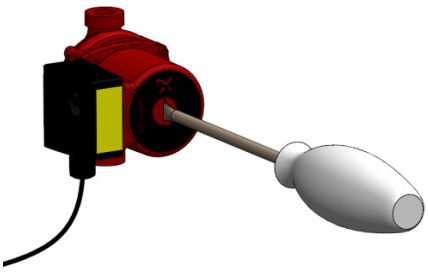






② Please check CH supply temperature sensor (wires are tagged OP). When the value measured with a multi-meter is 0Ω, replace the sensor.





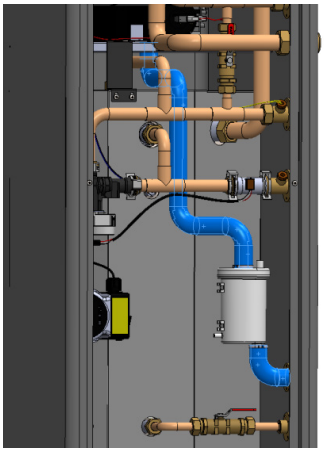
③ Check internal CH pump is operational. Use a flat head screw driver to rotate a screw on the back side of the pump to ensure the pump internal shaft is not stuck. Check pump wiring to ensure proper connection.

④ If all things are normal, please replace main controller

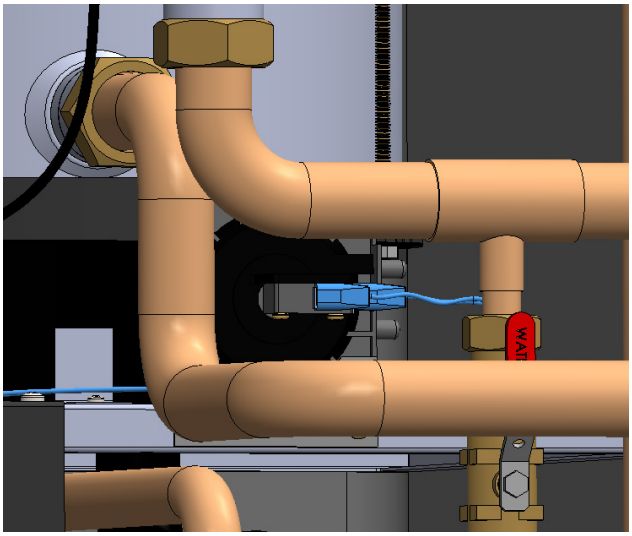
WARNING

Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Condensate air pressure switch is open (manual reset)	When condensate outlet blockages occurs, error code Er 20 will appear
Failure event		
If the condensate drain line is blocked, 'Er 20' will occur		
Check point		



① Check Condensate discharging line



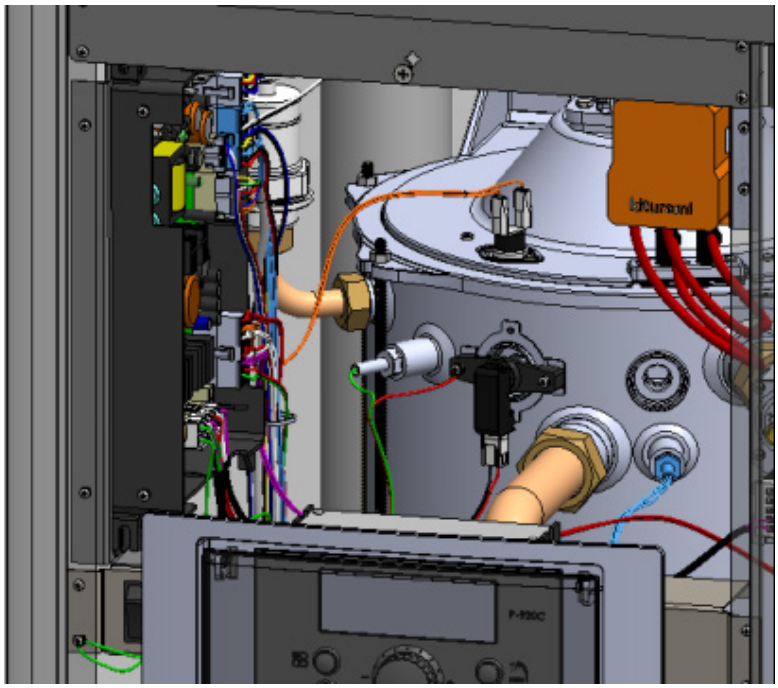
② Check APS line for proper connection

Error code	Meaning	Cause
	CH supply overheating sensor open or short (manual reset)	If CH supply overheating sensor is shorted or disconnected, 'Er 28' is displayed.

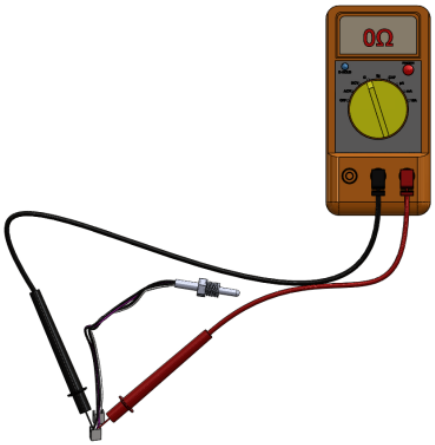
Failure event

If connection of the CH supply over-heating sensor connected to heat exchanger is shorted or disconnected, 'Er 28' is displayed.

Check point



① Check whether over-heating switch is shorted or disconnected.



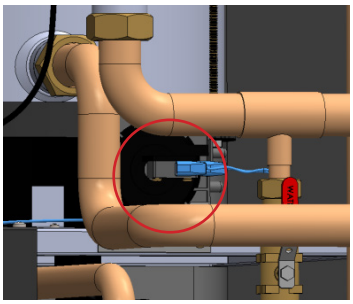
② Check CH supply over-heating sensor condition. Connect multi meter with over-heating switch's socket and measure the value. (If value shows 0Ω it's a sensor's malfunction so replace it)

Error code	Meaning	Cause
	APS open (manual reset)	When exhaust vent blockages occurs, error code 29 will appear

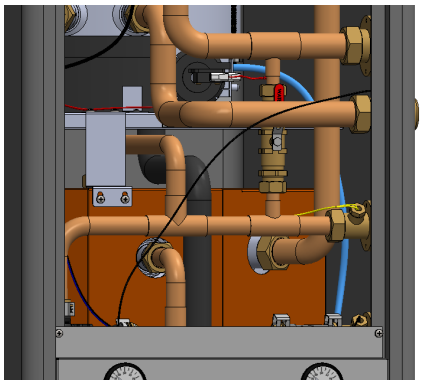
Failure event

In case of vent blockage, the air pressure in the combustion system exceeds tthe APS setting and Er 29 is displayed.

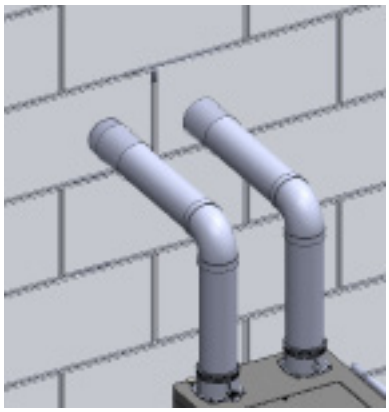
Check point



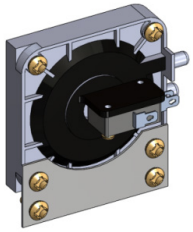
① Check APS wiring to assure proper connection



② Check APS hose. (check hose damages)



③ Please check the blockage of flue (exhaust pipe).



④ If the above conditions are normal, please replace APS.

⑤ If all things are normal, please replace main controller.

WARNING

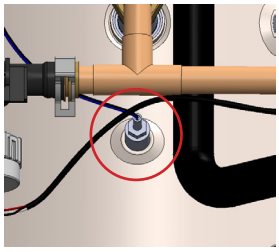
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Storage tank temperature sensor error (automatic reset)	When storage tank temperature sensor malfunctions or gets disconnected, error code Er 30 will appear

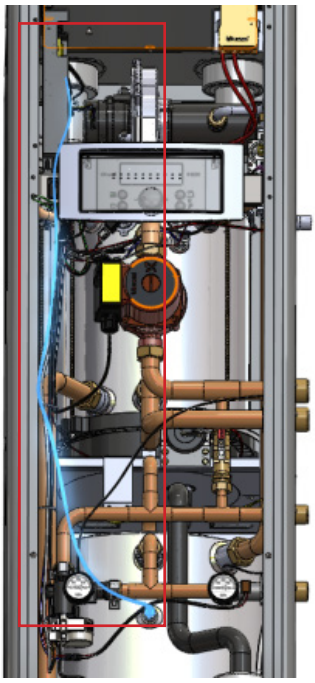
Failure event

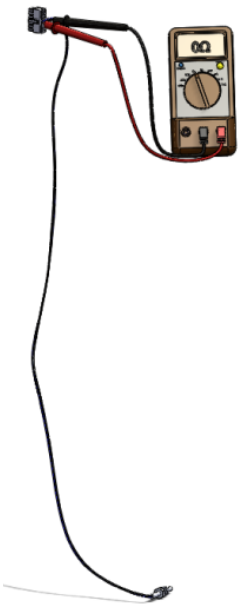
Storage tank temperature sensor malfunction.

Check point



① Ensure the storage tank temperature sensor is properly connected.





② Check storage tank temperature sensor condition.

When the resistance value measured with a multimeter is 0Ω, replace storage tank temperature sensor.

③ If all things are normal, please replace main controller.

WARNING

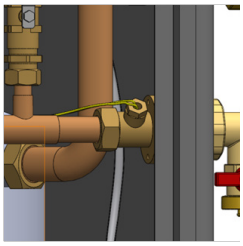
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	DHW outlet temperature sensor error (automatic reset)	When DHW outlet temperature sensor malfunctions or gets disconnected, error code Er 32 will appear.

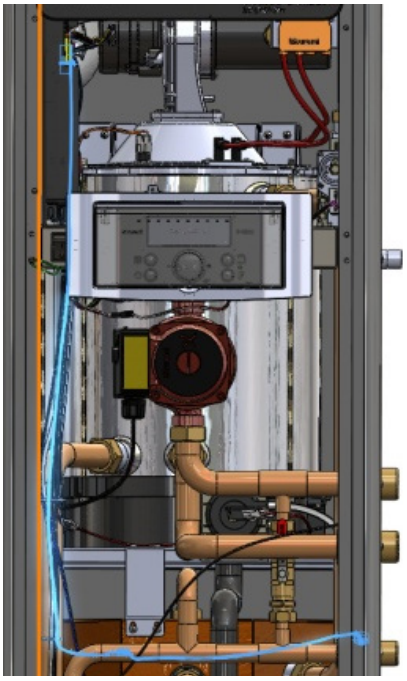
Failure event

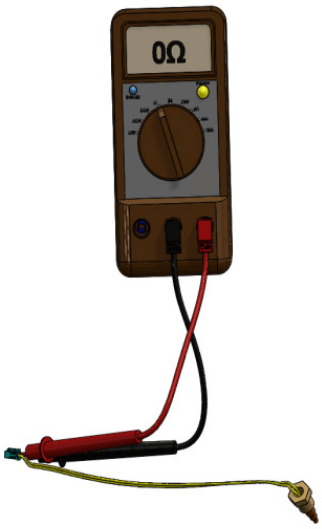
DHW outlet temperature sensor malfunction

Check point



① Ensure the DHW outlet temperature sensor is properly connected.





② Check DHW outlet temperature sensor condition.

When the resistance value measured with a multimeter is 0Ω, replace DHW outlet temperature sensor.

③ If all things are normal, please replace main controller.

WARNING

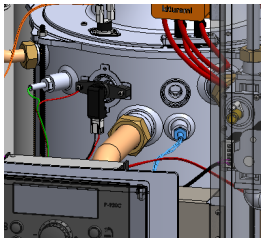
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	CH supply temperature sensor error (automatic reset)	When CH supply temperature sensor malfunctions or gets disconnected, error code Er 33 will appear.

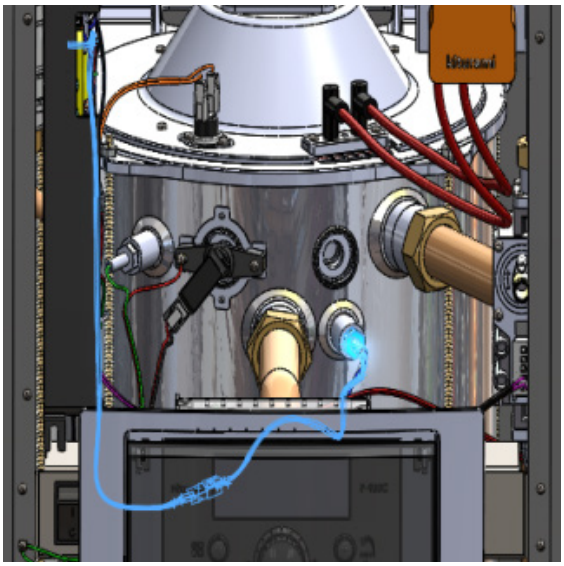
Failure event

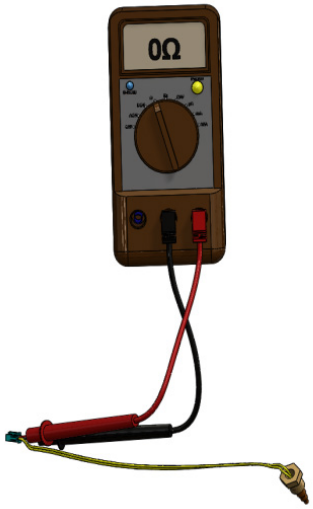
CH supply temperature sensor wiring line disconnected or faulty.

Check point



① Ensure the CH supply temperature sensor is properly connected.





② Check CH supply temperature sensor condition. When the resistance value measured with a multimeter is 0Ω, replace CH supply

③ If all things are normal, please replace main controller.

WARNING

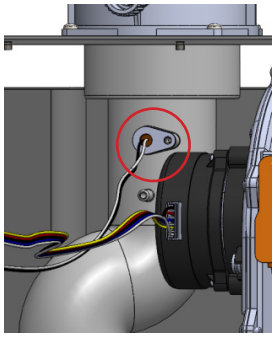
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Exhaust temperature sensor error (automatic reset)	When exhaust temperature sensor malfunctions or gets disconnected, error code Er 35 will appear.

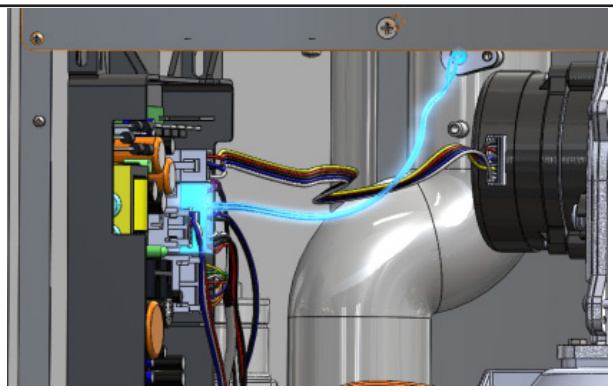
Failure event

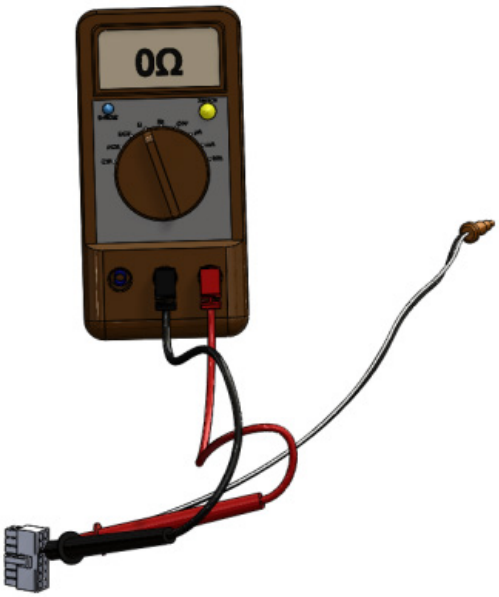
Exhaust temperature sensor malfunction.

Check point



① Ensure the exhaust temperature sensor is properly connected.





② Check exhaust temperature sensor condition.

When the resistance value measured with a multimeter is 0Ω, replace exhaust temperature sensor.

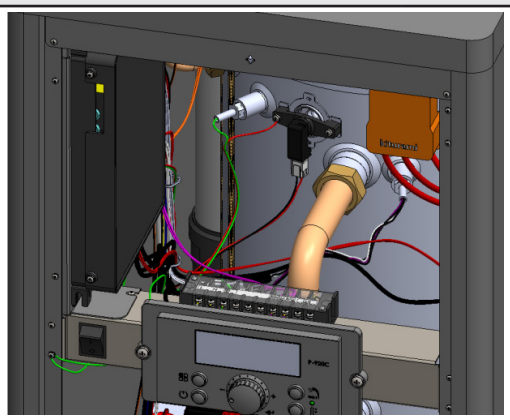
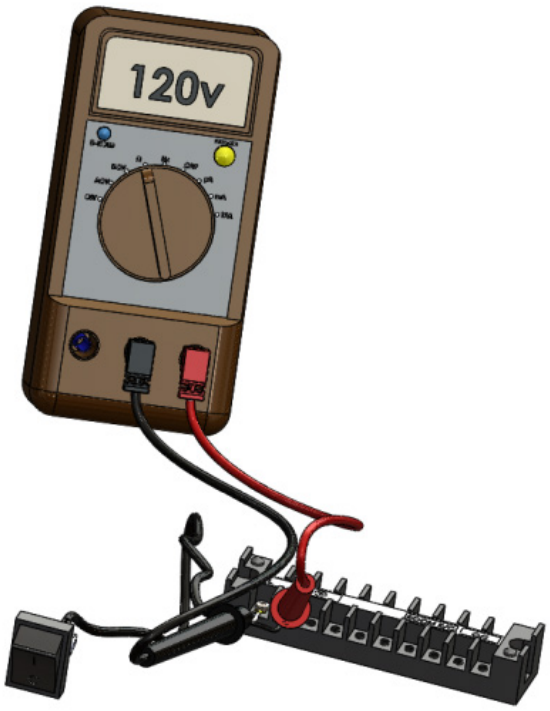
③ If all things are normal, please replace main controller.

WARNING

Failure to turn the power off to the appliance before repair could result in serious injury or death.

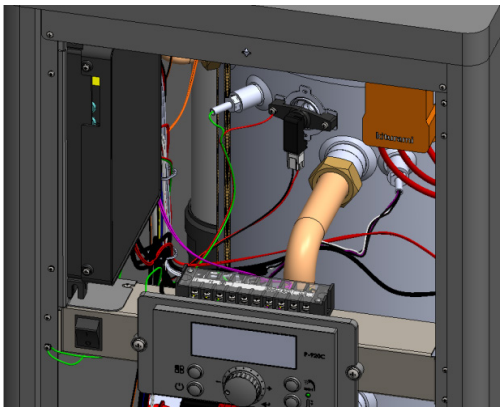
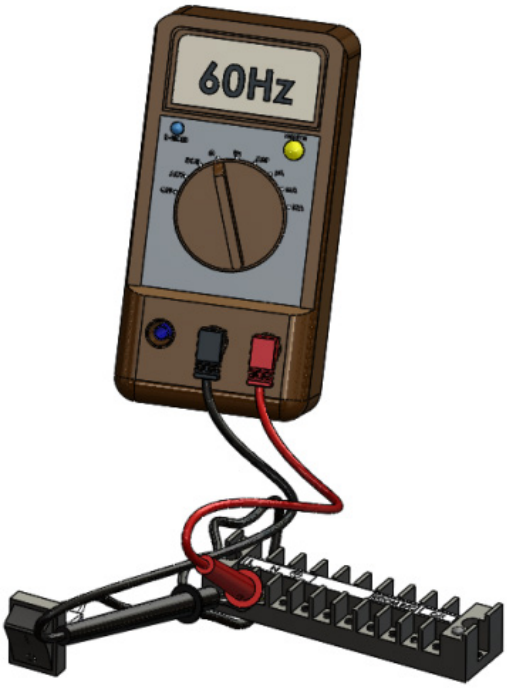
Error code	Meaning	Cause
	Voltage error (Automatic reset)	When input voltage is lower than 90V (+/-3V) for 10 sec then error Er 36 will occur. When Voltage is above 100V then error will automatically reset.

Failure event
Incoming voltage issue.

Check point
 ① Ensure manual power switch is properly connected Check the supply voltage at the manual power switch is within 102V~132 Vac. if so, then it's main controller's malfunction and replace it.   
② Check whether power voltage is within the safety scope 5 seconds after power is supplied.

Error code	Meaning	Cause
	EEPROM error (Manual reset)	If the electrical frequency is not in the range of 50/60 Hz +/-5Hz, all the outputs will malfunction except for the fan post purge.

Failure event
Incoming frequency issue.

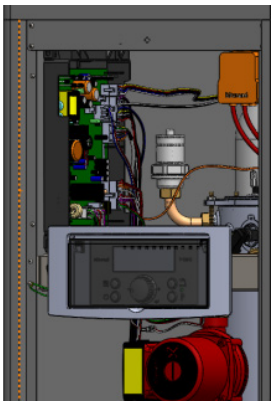
Check point
 ①When operating power frequency is within 50/60 HZ ±5Hz error will automatically reset. 

Error code	Meaning	Cause
	EEPROM error (Manual reset)	When EEPROM malfunctions, error 39 occurs and all of the outputs will stop except fan post-purge.

Failure event

When EEPROM malfunctions, error occurs and all of the outputs will stop except fan post-purge.

Check point



① Replace the main controller.

WARNING

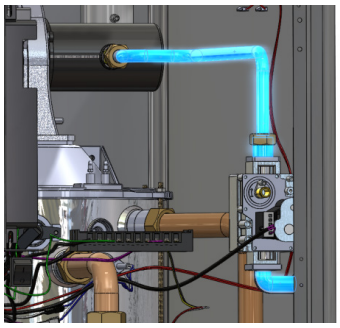
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Gas leakage (Manual reset)	When gas leakage is detected during operation, error code Er 40 will appear.

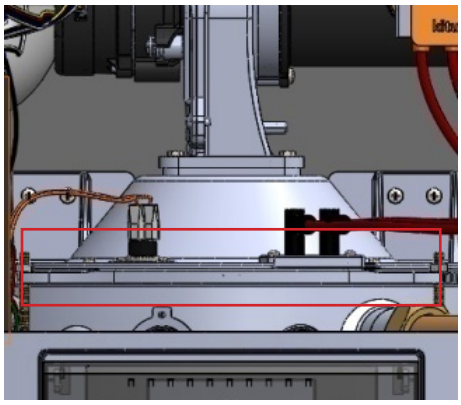
Failure event

When gas leak is detected for more than 10 min continuously or 3 times in a hour, error code will appear.

Check point



① Follow instruction on first page of installation manual.
Check leakage by using soapy water on all related gas pipe connection and gas valve to determine source of leak. Once determined repair leak and reassemble. Check condition of O-rings and gaskets and replace them if damaged.



② If leaks are not present on the gas piping or valve .
Start unit and monitor for leaks around blower assembly and connection to determine source of leaks.

③ If all things are normal, please replace main controller.

WARNING

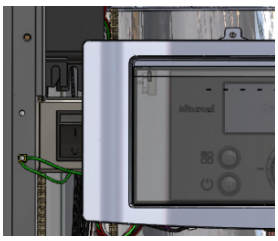
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Excess fan speed detected (Manual reset)	When standard fan speed is exceeded during combustion, error code 41 will appear.

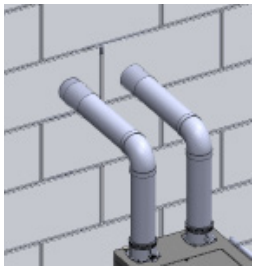
Failure event

Excess fan speed.

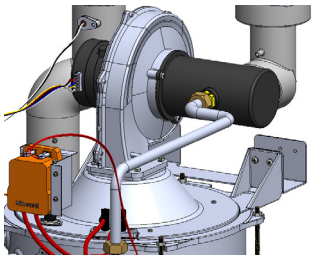
Check point



① Check whether error code disappears after turning OFF and ON the power.



② Check vent blockage.



③ Check whether BLDC fan is operating normally.

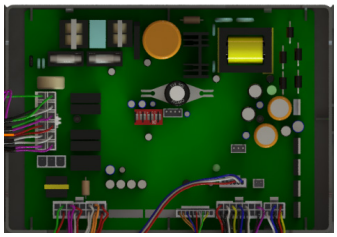
④ If all things are normal, please replace main controller.

WARNING

Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Jumped Wire Disconnected (Manual reset)	Error Er 42 will appear if wire is disconnected.

Failure event
Jumped Wire Disconnected

Check point
 ① Ensure the jumper wire is properly connected on the control board.
② If all things are normal, please replace main controller.

WARNING

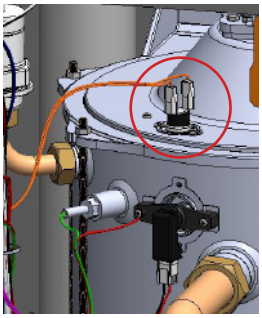
Failure to turn the power off to the appliance before repair could result in serious injury or death.

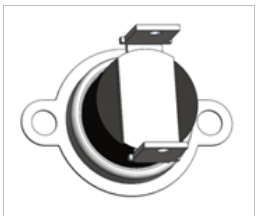
Error code	Meaning	Cause
	Burner Plate overheating protection switch open (Manual reset)	If burner plate temperature is higher than the switch high limit setting (392◦F), error code 43 will appear.

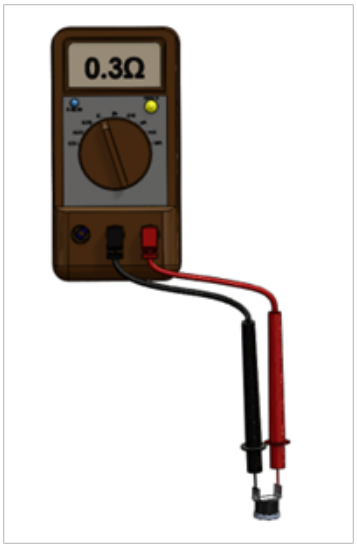
Failure event

When burner overheating switch's temperature exceeds 392 F, error code will appear.

Check point







① Check Burner Plate for distortion or burn marks . If plate shows signs of overheating replace entire burner plate assembly.

② Check burner overheat switch connections. Ensure all wire leads are secure.

After removing the burner overheat switch from the burner plate, measured resistance using multi meter.If the resistance value is 0Ω, replace the switch.

③ If all things are normal, please replace main controller.

WARNING

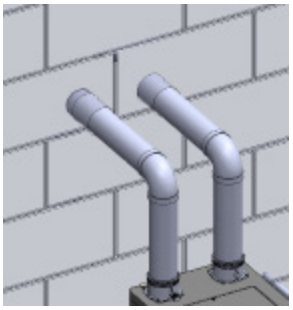
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Blower operation error (automatic reset)	Blower is disconnected or malfunctioning

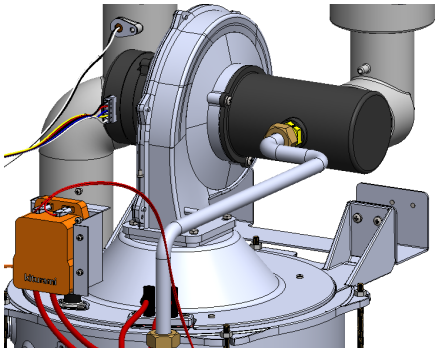
Failure event

Blower operation error.

Check point



① Check vent blockage.



② Check whether BLDC fan is operating normally.
Although fan operation is normal, replace the fan in case the speed is higher than the reference value.

③ If all things are normal, please replace main controller.

WARNING

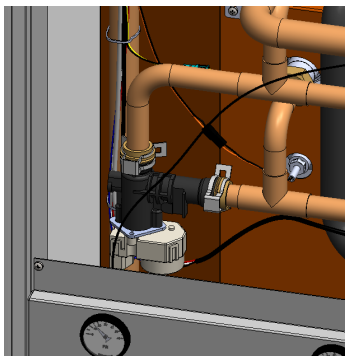
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Mixing valve error (Manual reset)	Mixing valve is unable to detect its zero point (fully opened)

Failure event

Mixing valve unable to detect its zero reference point.

Check point



① Mixing Valve recognizes zero point after turning off and on the power. Check indication of error after basically turning off and on the power. If mixing valve doesn't operate normally, replace the part.

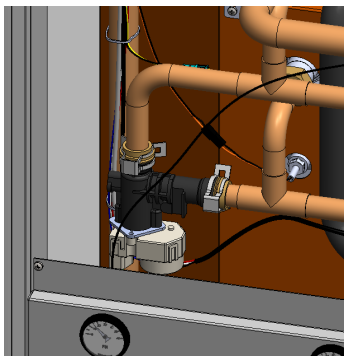
② If all things are normal, please replace main controller.

WARNING

Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Mixing valve operation error (automatic reset)	Mixing valve is controlled by more than 500 steps and blocked when zero point is recognized for 10 secs.

Failure event
Mixing valve operation error

Check point
 ① Mixing Valve recognizes zero point after turning off and on the power. Check indication of error after basically turning off and on the power. If mixing valve doesn't operate normally, replace the part.
②If all things are normal, please replace main controller.

WARNING

Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Flame detector error (Automatic reset)	When flame is detected before ignition error code 72 appears.

Failure event

Flame detector error

Check point

① Ensure the appliance cover is secure.
Flame detection sensor can detect external light source and cause an error code.

Please check flame detector sensor's connecting line and ensure correct position as shown.

■ From more than DC 2.5V after ignition safety cut-off will appear

① When setting before ignition is less than DC 2.5V :
Replace flame sensor

② When setting after ignition is more than DC 2.5V :
Replace flame sensor

Flame detector sensor setting (Please check after closing front cover)

③ If all things are normal, please replace main controller.

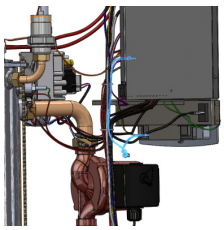
WARNING
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Connection error between LCD display panel and main controller (automatic reset) :	When communication with display panel is not stabilished for 10 minutes, 'Er 76' is displayed.

Failure event

Connection error between LCD display panel and main controller.

Check point



① Ensure proper connection between display panel and main controller.

② If all things are normal, please replace main controller.

WARNING

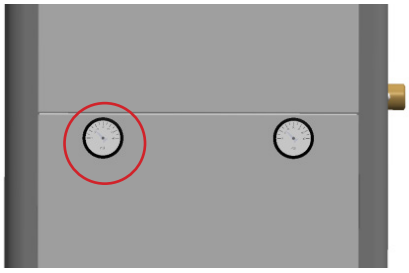
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Low water level error (automatic reset)	If adequate water level is not detected in the Boiler Heat Exchanger, error Er 80 will occur.

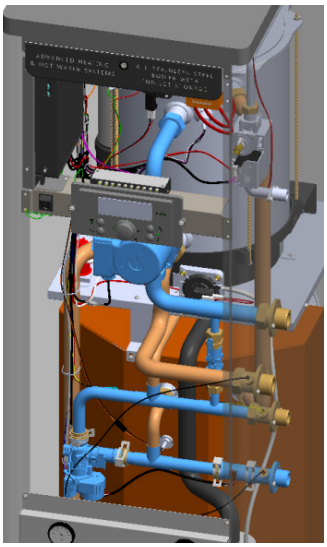
Failure event

Low water level error

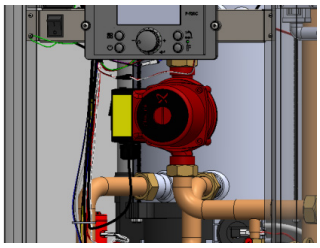
Check point



① If CH pressure is lower than 15 PSI, check automatic Water feed valves to assure they are operating properly . Check to ensure automatic air vent operates properly. Either there is no sufficient water or there is air trapped in the system.



② Check freezing condition of the water replenishment line. Visually check leakage around the internal CH piping then check boiler near piping for leaks .



③ Ensure internal CH and DHW pumps are operational. Use a flat head screw driver to rotate a screw on the back side of the pump to ensure the pump internal shaft is not stuck. Check pump wiring to ensure proper connection.

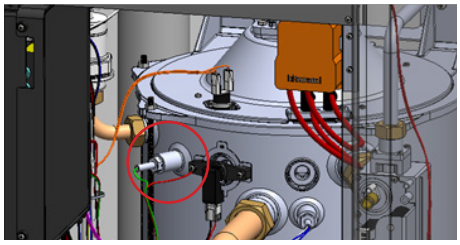
④ If all things are normal, please replace main controller.

WARNING

Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Low water level circuit error (automatic reset)	When low water level circuit malfunctions, error code Er 81 appears

Failure event
Low water level circuit error

Check point
 ① Ensure the low water level sensor is properly connected.
② If all things are normal, please replace main controller.

WARNING

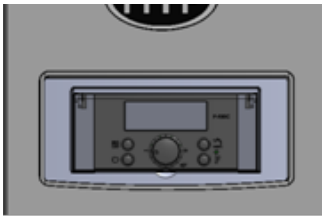
Failure to turn the power off to the appliance before repair could result in serious injury or death.

Error code	Meaning	Cause
	Freeze Protection (automatic restore)	When system detects water temperature below 33◦F, error code 85 appears; The unit runs to increase the temperature to prevent freezing.

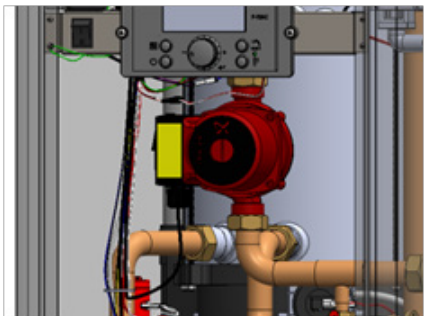
Failure event

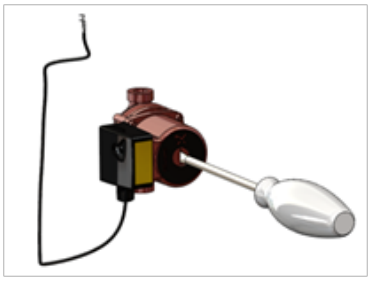
When system detects water temperature below 33◦F, error code 85 appears

Check point

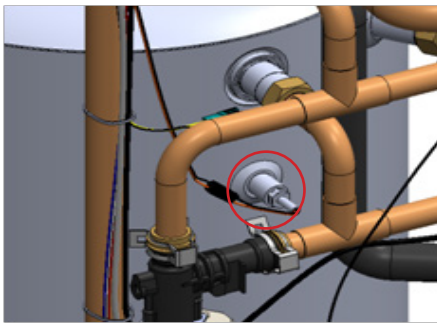


① Check whether operation of boiler is normal after turning display panel off/on.

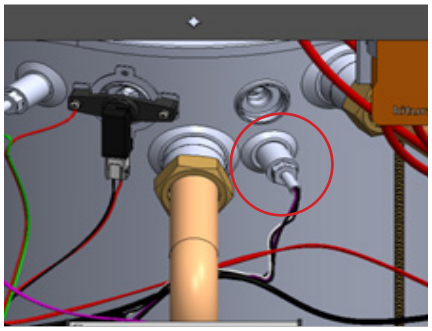




② Check internal CH and DHW pumps are operational. Use a flat head screw driver to rotate a screw on the back side of the pump to ensure the pump internal shaft is not stuck. Check pumps wiring to ensure proper connection.



Storage tank temperature sensor

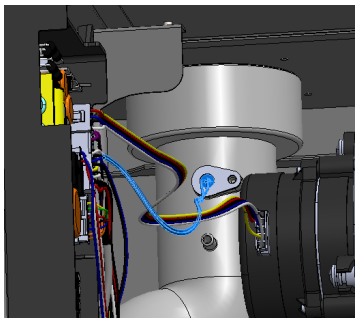
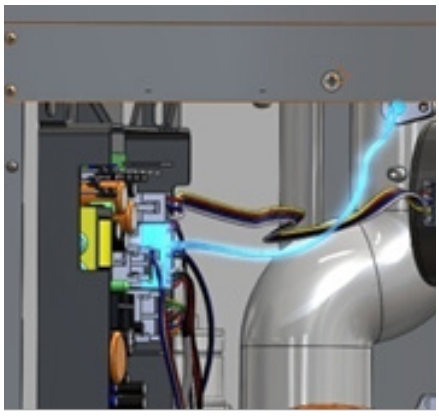
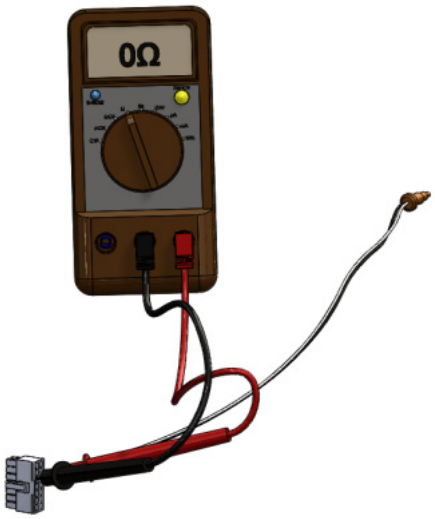


OP sensor

③ ▸ Ensure storage tank and CH supply temperature sensor are properly connected.

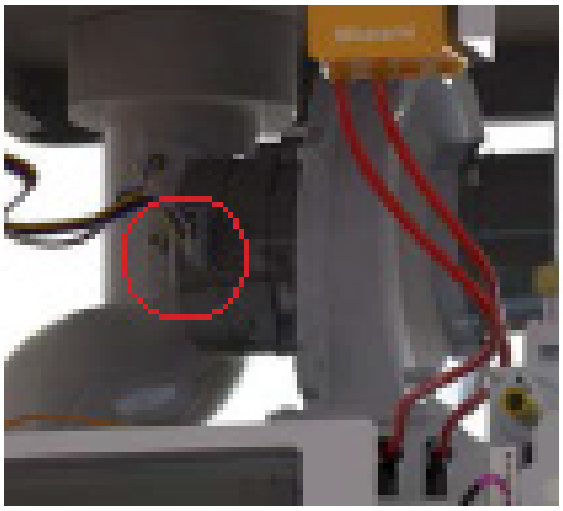
Error code	Meaning	Cause
	Exhaust temperature overheating issue (automatic reset)	When exhaust temperature exceeds190◦F, error code 94 will appear. error will automatically reset when exhaust temperature is below 180◦F.

Failure event
Exhaust temperature overheating issue

Check point
 ① Ensure exhaust temperature sensor is properly connected. Check main controller connection.
  ② Check Exhaust Temperature sensor condition when the resistance value measured with a multimeter is 0Ω, replace exhaust temperature sensor.

Main components Replacement Instructions

[redacted]



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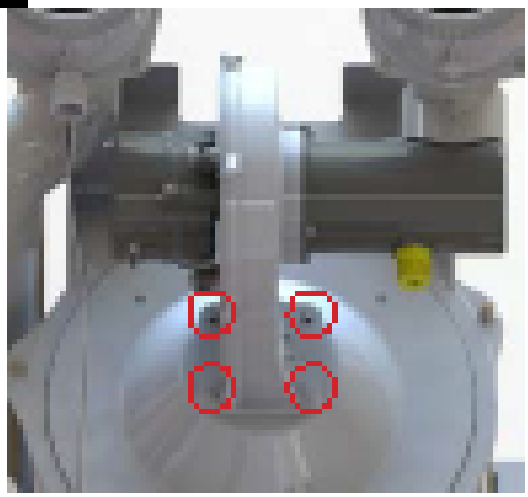

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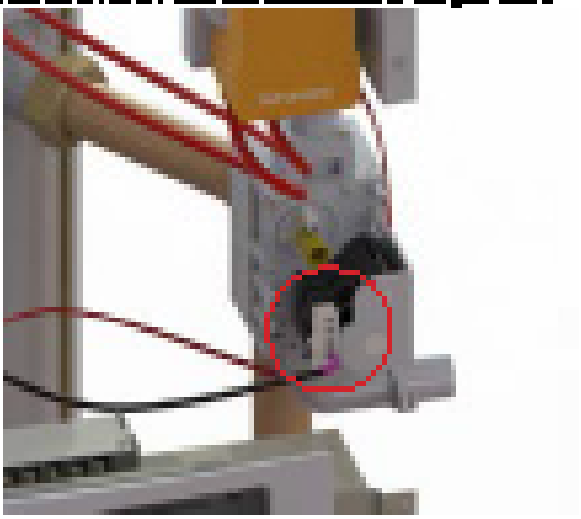
WARNING

Failure to turn the power and gas off to the appliance and ensure the unit is cool before repair could result in serious injury or death.

Main components Replacement Instructions

[redacted]



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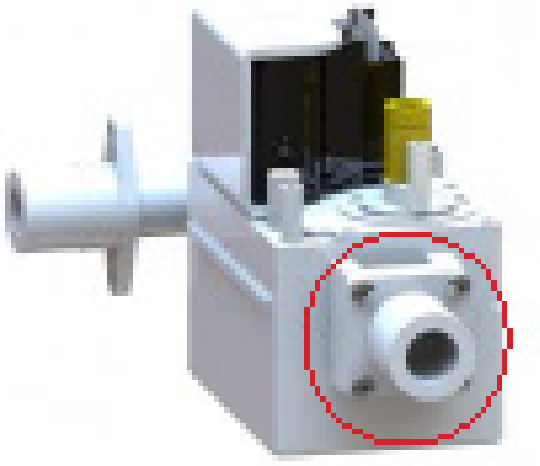

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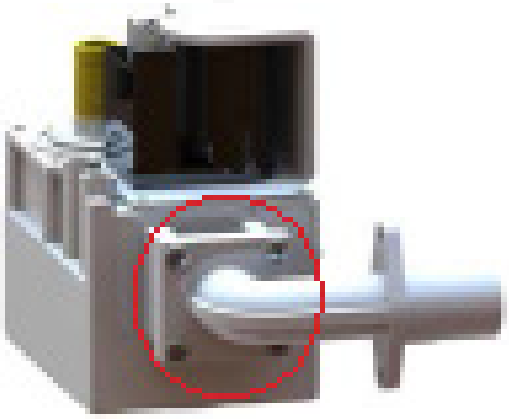

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Main components Replacement Instructions

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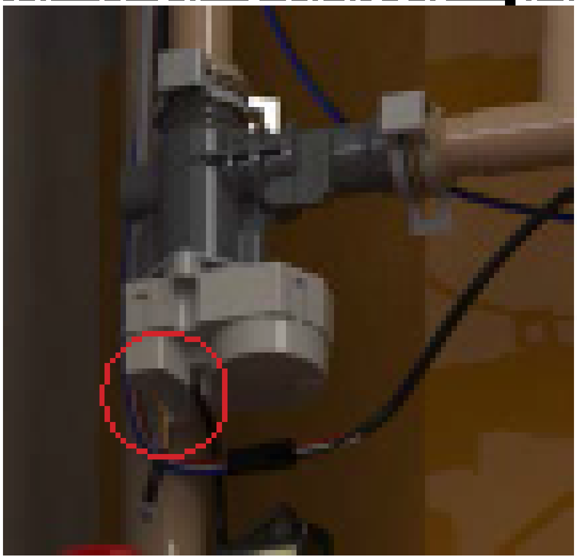

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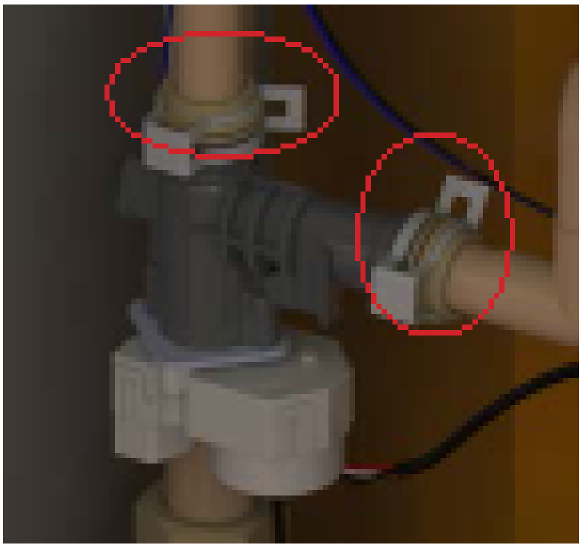

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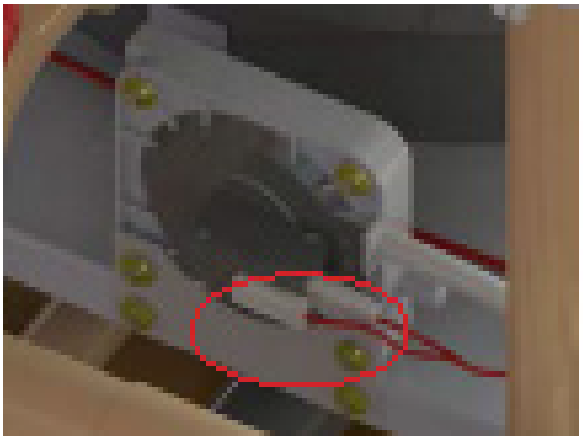
Main components Replacement Instructions

[redacted]



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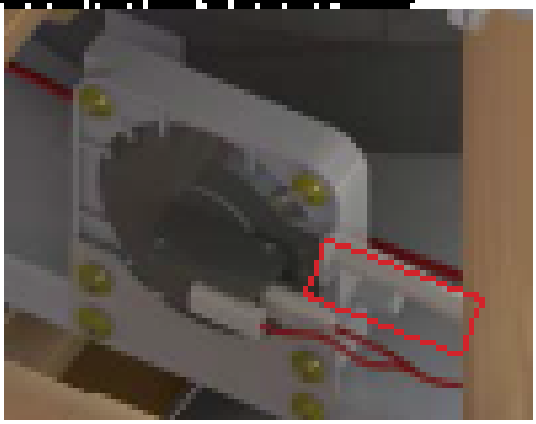

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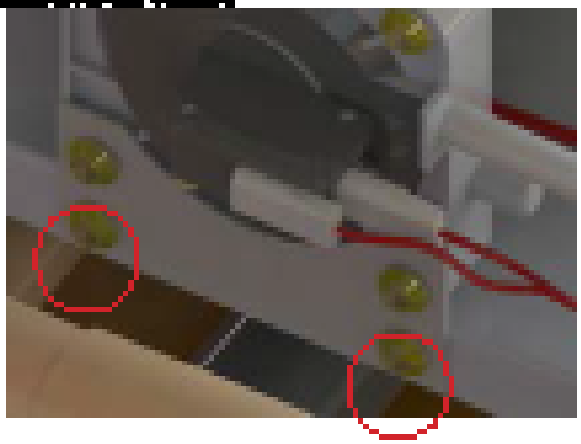

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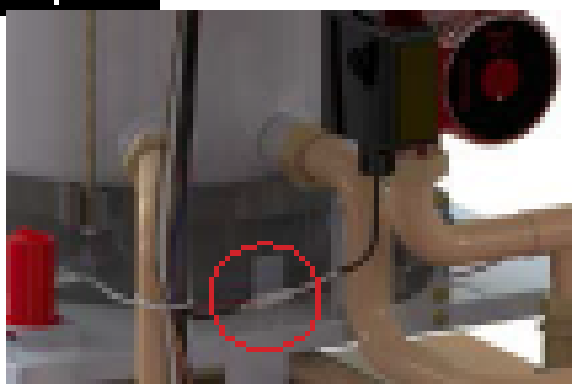

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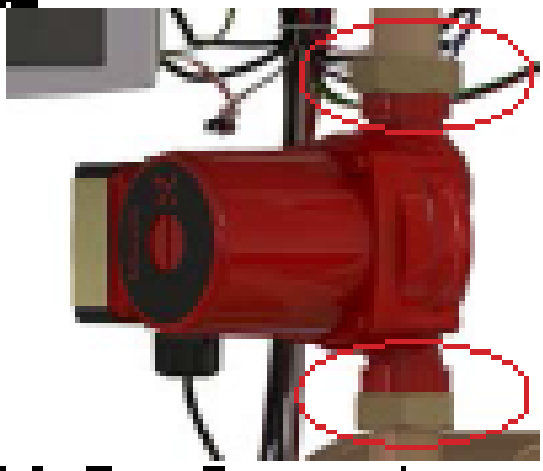

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Main components Replacement Instructions

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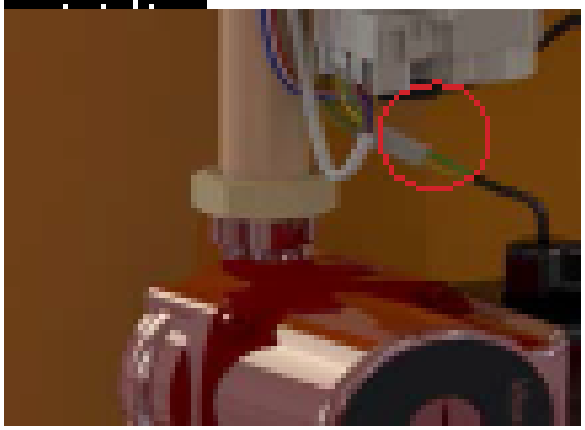
[redacted]



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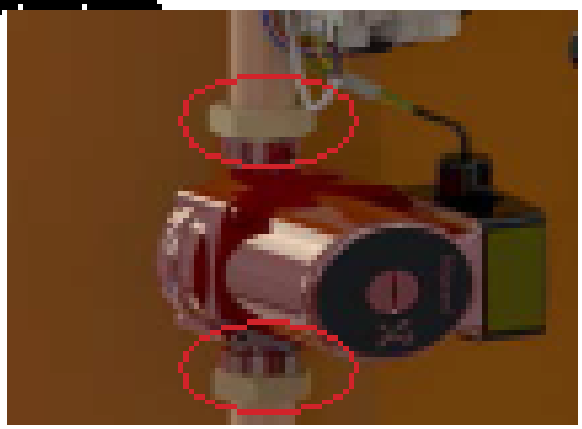

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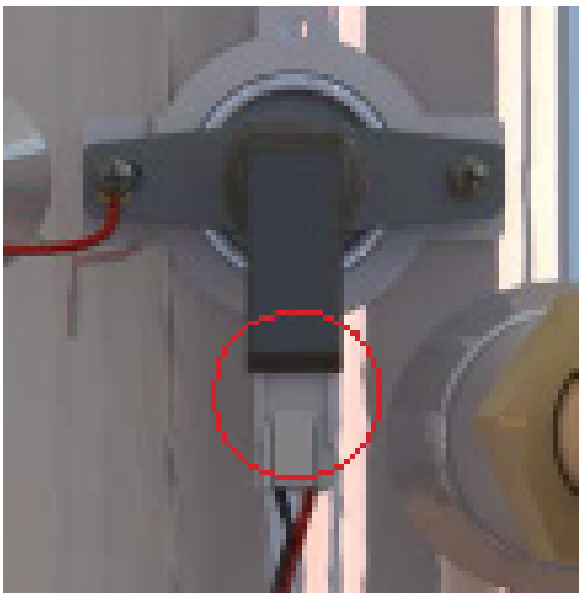

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WARNING
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Main components Replacement Instructions

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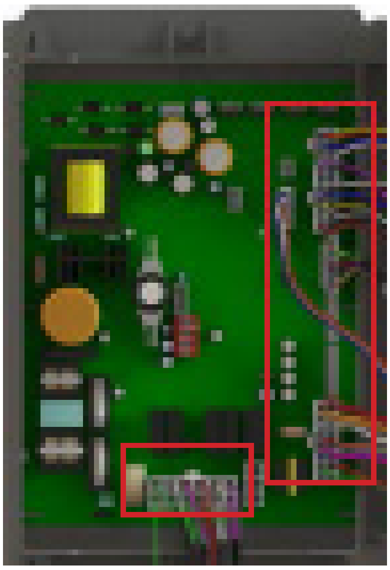

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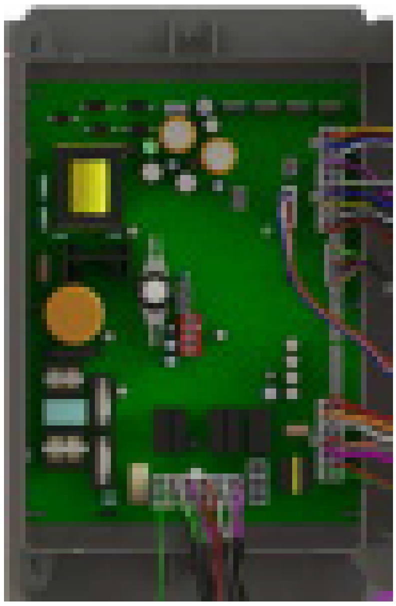

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Main components Replacement Instructions

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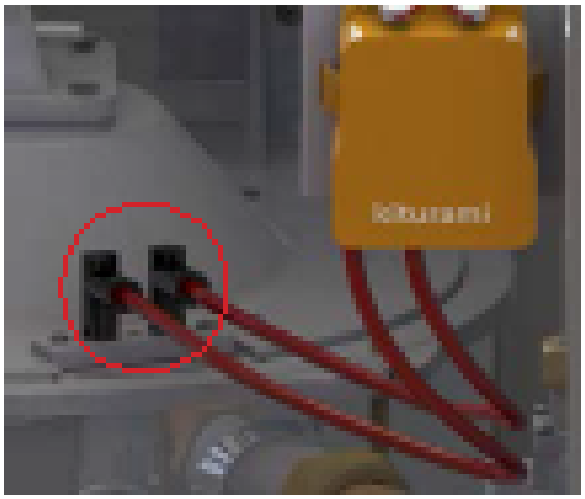

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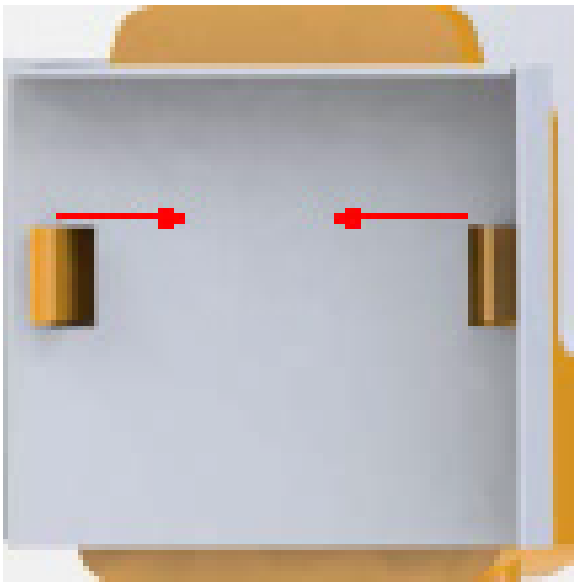

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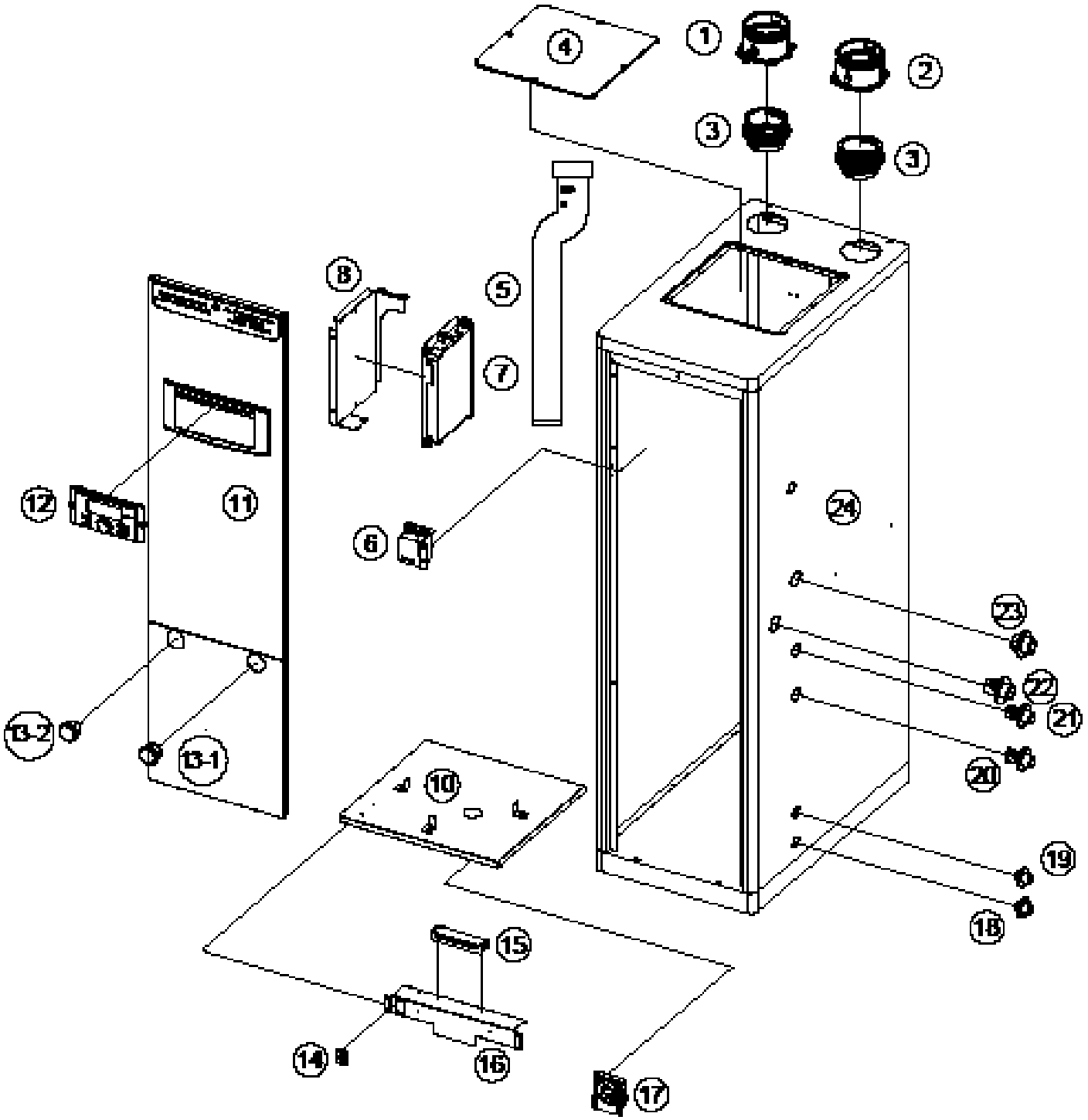
WARNING

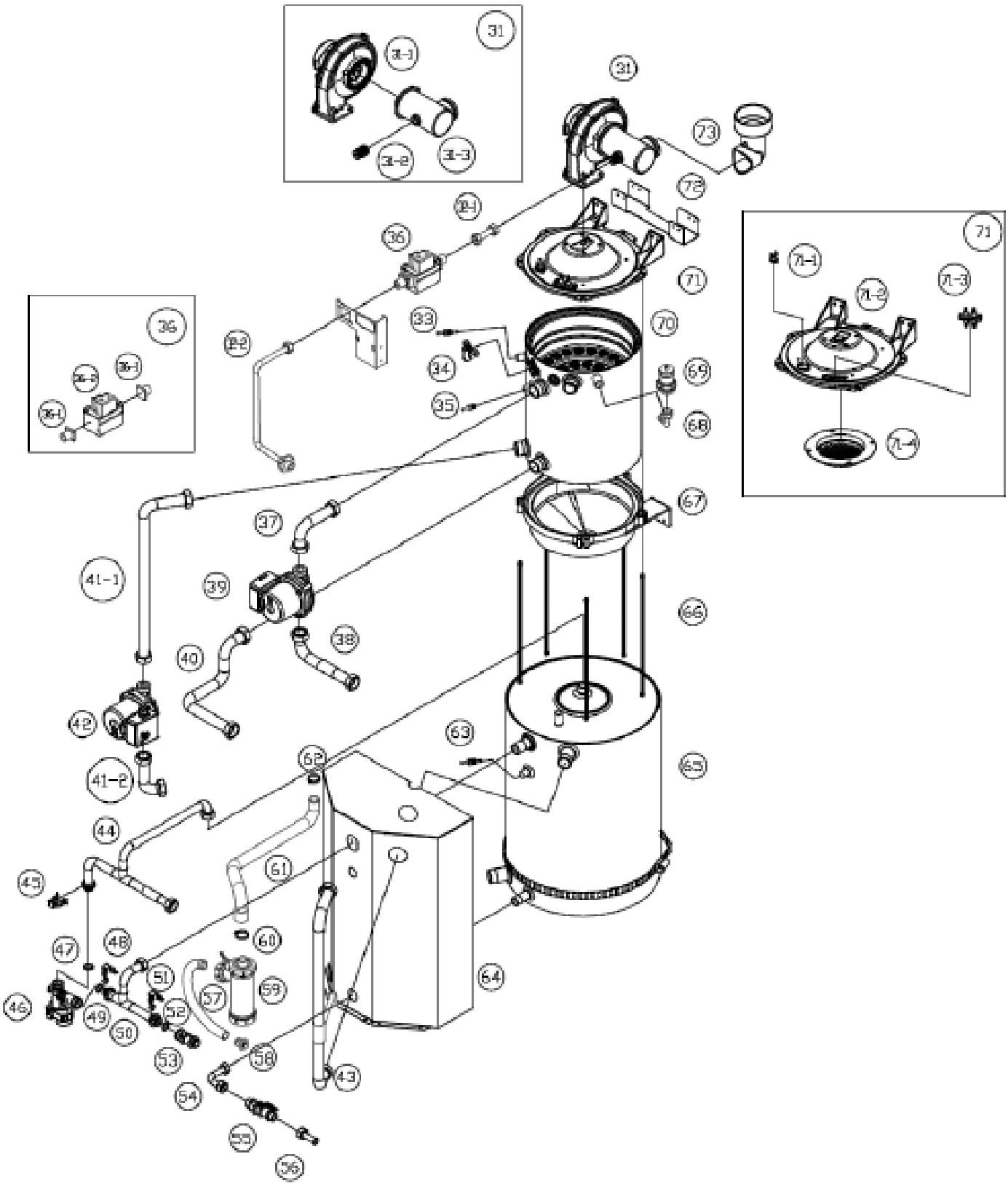
Failure to turn the power and gas off to the appliance and ensure the unit is cool before repair could result in serious injury or death.

1. Cabinet Replacement Parts



NUMBER	DESCRIPTION	PART NUMBER	NUMBER	DESCRIPTION	PART NUMBER
1	Exhaust Duct	7859P-002	13-2	DHW Pressure Gauge (0-150 PSI)	7859P-013
2	Air Intake Cap	7859P-003	14	Manual Power Switch	7859P-014
3	Exhaust and Air Intake Pipe Adapters	7859P-004	15	Terminal Block	7859P-015
4	A/S Cover	7859P-005	16	Front Bracket	7859P-016
5	Exhaust Pipe	7859P-006	17	Air Pressure Switch	7859P-017
6	Ignition Transformer	7859P-007	18	Drain Adapter	7859P-018
7	Main Control Board (PCB)	7859P-008	19	Condensate Adapter	7859P-019
8	Main Control Board (PCB) Bracket	7859P-009	20	DHW Inlet Adapter	7859P-020
9	N/A	N/A	21	DHW Outlet Adapter	7859P-021
10	Boiler Heat Exchanger Bracket	7859P-010	22	CH Return Adapter	7859P-022
11	Front Cover	7859P-011	23	CH Supply Adapter	7859P-023
12	Display Panel	7859P-012	24	Cabinet	7859P-024
13-1	CH Pressure Gauge (0-60 PSI)	7859P-013			

2. Combustion System Replacement Parts



NUMBER	DESCRIPTION	PART NUMBER	NUMBER	DESCRIPTION	PART NUMBER
31	Fan Assembly	-	51	Flow Sensor Clip	7665P-042
31-1	Fan	7665P-025	52	Flow Sensor O-Ring	7665P-047
31-2-A	Gas Orifice Nozzle (NG)	7665P-024	53	DHW Flow Sensor	7665P-053
31-2-B	Gas Orifice Nozzle (LP)	7665P-079	54	Drain Pipe Connector 1	7665P-048
31-3	Air Gas Mixer	7665P-027	55	Drain Valve	7665P-049
32-1	Outlet Gas Pipe	7665P-030	56	Drain Pipe Connector 2	7665P-050
32-2	Inlet Gas pipe	7665P-031	57	Condensate Drain Hose	7665P-051
33	Water Level Detection Sensor (Low water Cutoff)	7665P-029	58	Condensate Outlet Fitting	7665P-052
34	Flame Sensor	7665P-031	59	Condensate Trap ASSY	7665P-053
35	CH Supply Temperature Sensor	7665P-030	60	Condensate Trap Inlet Clamp	7665P-054
36	Gas Valve ASSY	7665P-032	61	Condensate Hose EPDM	7665P-055
36-1	Gas Outlet	7665P-033	62	Condensate Collector Pan Clamp	7665P-056
36-2	Gas Valve	7665P-034	63	Storage Temperature Sensor	7665P-057
37	CH Water Supply 1 (Upper)	7665P-036	64	Water Storage Tank Bracket	7665P-058
38	CH Water Supply 2 (Lower)	7665P-037	65	DHW Tank ASSY	7665P-059
39	Internal Primary CH Pump	7665P-051	66	Heat Exchanger Long Bolt Set (5 Bolts)	7665P-060
40	CH Return Pipe	7665P-038	67	Condensate Collector Pan	7665P-061
41-1	Storage Tank Outlet Pipe (Upper)	7665P-039	68	Air Vent Pipe	7665P-062
41-2	Storage Tank Inlet Pipe (Lower)	7665P-040	69	Air Vent	7665P-063
42	Internal DHW Circulation Pump	7665P-051	70	Heat Exchanger ASSY	7665P-064
43	Storage Tank Outlet Pipe	7665P-032	71	Burner ASSY	7665P-065
44	DHW Outlet Pipe	7665P-041	71-1	Burner Overheat Switch	7665P-066
45	Mixing Valve Outlet Clip	7665P-042	71-2	Burner Body	7665P-067
46	Mixing Valve	7665P-043	71-3	Ignition Rod	7665P-068
47	Mixing Valve Outlet O-Ring	7665P-044	71-4	Ceramic Fiber Burner	7665P-069
48	Mixing Valve Inlet Clip	7665P-042	72	Burner ASSY Bracket	7665P-070
49	Mixing Valve Inlet O-Ring	7665P-045	73	Air intake Pipe	7665P-071
50	DHW Inlet Pipe	7665P-046			