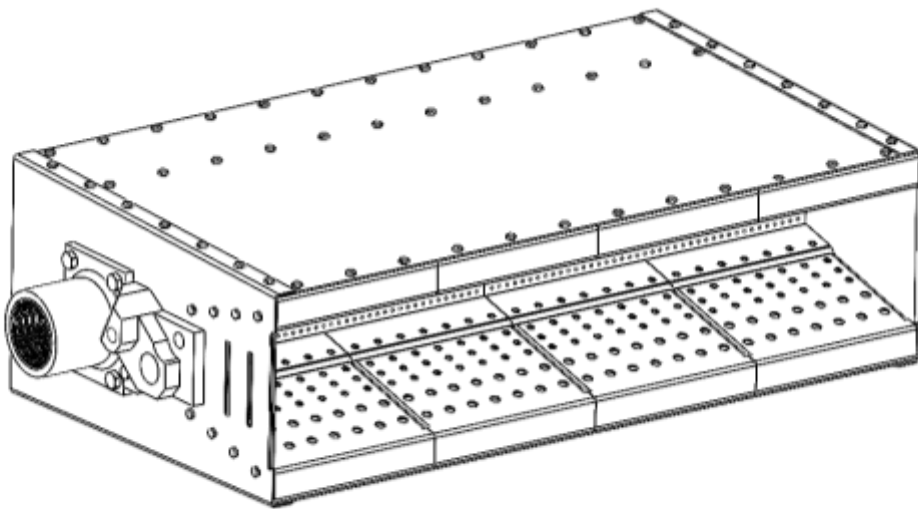




Burners, Heaters & Combustion Systems

# Installation & Maintenance Manual

## PH Burner



# PH Burner Instruction Manual

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## General Specification

The Comtherm 'PH' and 'PHC' series of gas burners are designed for applications where fresh or recirculated air is to be heated up to plant requirements. The burners can be installed in air systems where it is not possible to construct a combustion chamber and install a conventional type of burner assembly. The burners can be supplied for gap firing or flange mounted in-line combustion head.

All the air required for combustion can be supplied by an integral combustion air fan mounted on the burner head or provided that the process air has sufficient oxygen by developing sufficient pressure drop through profile plates on an "open back" design.

Typical applications; Industrial Dryers, Preheaters, Industrial Spray Booths, Direct Fired ARP and AHU, Drying and Curing Rooms

The PH and PHC burner is modular with each 300mm section rated at 300kW whilst the PHC is rated at 600 kW per 300mm section.

The burners are available in 'straight', 'T' and 'X' sections which enable the burner to be constructed to suit the appliance layout and in theory limitless in maximum output.

Typical Flame Lengths at Maximum Duty - 600mm

All valve assemblies on the burners are sized to suit an inlet gas pressure of 17.5 mbar (natural gas) or 30mbar (LP gases) unless otherwise specified. Burners can be supplied to suit other gas types and supply pressures.

Combustion air Pressure Drop across burner air wings;

PH – 200 Pascals

PHC – 300 Pascals

The nozzle mix design of the burner and the progressive air mixing feature of the combustion head ensure that burners can operate with high turn down capability; turndown ratios up to 40:1 are possible depending on burner applications and selection.

The PH burner range is designed to always operate with approximately 30% excess combustion air.

For high - low and modulating gas only burners with fixed combustion air.

The PH burner is not available with modulating gas and air control.

## General Description

The burner consists of a gas manifold assembly having fuel and air jets designed to produce effective mixing of the fuel and combustion air hence providing good flame stability.

The manifold assembly is fitted with integral ignition and flame sensor facilities. The unit comes complete with all the valves and controls required; forming a fully packed, safe burner assembly.

The valves and controls are pre-piped and mounted on the burner side plate, as illustrated diagrammatically in document M4. Pressure test points are fitted between valves where necessary.

The physical arrangement of the burner is shown in diagram form in document M3 (where applicable).

All the electrical equipment on the unit is pre-wired to a terminal enclosure on the assembly, as detailed in the burner wiring diagram in document M5.

### **The electrical operation of the burner is as follows:**

When the electrical supply is switched on to the burner and all the control circuits are closed, the burner light up sequence is initiated.

The burner flame safety sequence control unit (unit A1) receives the electrical start signal and begins to cycle through an air pre-purge and light up sequence.

The air pre-purge is for a specified, preset time and allows for dilution of any fuel leakage; to safeguard against the possibility of explosive fuel/air mixture being present in the burner duct when the ignition is energized.

After the completion of the pre-purge, the ignition and flame proving period take place.

When the flame signal is proven, the burner sequence control remains in the operating position until any of the control circuit interlocks are broken or a flame failure (lockout) condition occurs.

Complete details of the burner light-up sequence including the flame safety control unit (item A1) will be found in the component data sheet, enclosed. For details on installation and commissioning, refer to pages 3-9.

**NOTE:** - See pages 16 for key to items referred to throughout this manual. Refer to documents M1, M3, M4, M5, M9 sent with your contract for specific component manufacturers used on this equipment.

# Installation

Before proceeding with the installation of the burner, inspect the burner for any physical damage that may have occurred during transit, storage or off-loading. Any damage should be reported immediately.

The pipe work or gas valves on the burner should not be used for lifting under any circumstances, as this tends to pull fittings loose or damage valves, causing leaks during later operation.

Mount the burner in the firing position, making sure that adequate space is allowed around the burner for ventilation and that the combustion air inlet is not blocked. Ensure that an adequate fresh air supply is available for combustion and general ventilation.

Situations where gas from valve and pipe work leaks can collect and form pockets of combustible gas/air must be avoided.

Ensure that adequate space is allowed around the burner for easy access to all burner components, pressure switches, control operators etc.

The burner should be securely fixed and the transmission of vibration and heat should be minimised.

## GAS SUPPLY:

Gas piping to the burner should be of sufficient size to provide the correct gas pressure at the burner valve assembly inlet (see specification on page M1).

If in any doubt concerning the size and design of the gas supply pipe work, consult the gas supply company.

The pressure loss in the gas supply pipe work should be such that the following pipeline velocities are not exceeded:

**Unfiltered supply**                      20M/s (65.6ft.sec)

**Filtered supply (250microns)** 45M/s (148ft.sec)

The above stated velocities are based on the avoidance of excessive noise pollution and erosion.

For low-pressure supplies up to 25 mbar (10 w.c), the pressure drop between the meter and the burner inlet should normally not exceed 1mbar (0.4 w.c). For high-pressure supplies, this pressure drop should not exceed 10% of the available gas pressure.

## Installation (Continued)

A manual shut off valve followed by a union or flanged joint should be incorporated in the Gas supply pipe adjacent to the burner, this valve permits isolation of the supply and removal of the burner assembly for maintenance purposes.

The manual shut off valve should be easily accessible.

Do not use the burner valve assembly to support the gas supply pipe work. Suitable brackets or hangers should be used for this purpose.

Before connecting the gas supply check that the available gas pressure is correct (see specification in document M1).

Check that the gas supply system has been designed and installed to ensure that during fault conditions, pressures in excess of the maximum design rating of the equipment can not be reached.

If the burner is installed in a confined space consideration should be taken for the fitting of a vent pipe to the breather holes of governors.

Vents from governors must not be manifolded and should terminate in a safe place, preferably above roof level.

Any additional vent pipes that are required will be shown in document M4.

The gas supply pipe will be full of air and will require purging.

This purging should only be carried out by a suitably qualified gas engineer.

With regard to the soundness (leak) testing and purging of the supply pipe work ensure that a certificate exists stating that this work has been completed in accordance with technical publications EN 746-2.

After completion of the installation work, the procedure for testing for gas leaks on the burner detailed in the manual section pages 10-15, should be completed and any leaks repaired.

The burner should be left with the manual shut off valve (item V1) in the closed position until the plant is commissioned by a suitably qualified gas engineer.

## Installation (Continued)

### ELECTRICAL SUPPLY:

Burners can be supplied to suit almost all types of electrical power supply; including all common industrial three phase (50 or 60Hz) power supplies and with 110/120v or 220/240v control circuits. Burners to suit other electrical supply voltages can be supplied specially to suit specific application requirements.

All wiring on the burner should comply with the requirements of the local electrical codes of practice.

All conduits should be kept clear of heat zones.

Local means of electrical isolation should be installed close to the burner.

Ensure that the electrical voltage does not vary from the specified by more than 6%.

High temperature wire (tri-rated or better) should be used for all electrical connections.

The electrical connections to the burner shown on diagram M5 should be strictly adhered to.

Gas pipe work should not be used as an electrical earth.

# Initial Light Up (Commissioning)

## PLEASE NOTE:

Without exception, burners should only be commissioned by suitably qualified personnel. The following notes are intended as guidance and in no way negate the need for the equipment to be commissioned by suitably qualified personnel.

1. Examine the burner for physical damage.
2. Close all manual fuel valves.
3. Check that the electrical supply is switched off.
4. Check all electrical connections to ensure that the combustion air pressure switch (item P1) and the safety shut off valve (item S1) are wired to the correct terminals in the burner safety control unit (see electrical diagram in document M5)
5. Check the incoming gas pressure (at V1) and verify that the inlet gas pressure is as specified (see document M1). Generally speaking, the inlet gas pressure, without the burner operating, will be somewhat higher than when the burner is in operation.
6. Ensure that the burner on/off switch is in the `off' position.
7. Switch the electrical supply on.
8. Check for gas leaks on the burner as follows:
  - (a) Close the manual valve V1 and pilot manual valve V6.
  - (b) Vent burner pipe work downstream of V1 by opening a suitably positioned test nipple.
  - (c) Use a manometer test pressure downstream of V1 for 1.5 minutes. If no pressure builds up, valve V1 is not leaking.
  - (d) Open valve V1.
  - (e) Check for external leakage using a soap solution or gas detector on pipe work and valves, rectifying any leaks before proceeding.
  - (f) Put temporary electrical supply onto valve S1. This will pressurise the space between S1 and S2. Open the test point downstream of S2 and connect the manometer (valve V2 must be closed); if no pressure builds up within 1.5 minutes then valve S2 is sound.



## Initial Light Up (Commissioning)

- (g) Disconnect the electrical supply to valve S1 and vent the space between valve S1 and S2, using the pressure test nipple. Using the manometer, check that no pressure builds up between the two valves; if no pressure is detected then valve S1 is sound
- (h) Open pilot manual valve V6 and check by using the test nipple downstream of V1 that there is no pressure drop at this point. If no pressure drop is detected in 1.5 minutes then valve S3 is not leaking.
- (i) Finally, check downstream of V2 and V3 with soap solution or gas detector (with burner running).

In cases where burners are fitted with main multi-block / combination safety valve units, the above procedure will vary; the valve should be energised to check for downstream pipe leakages and de-energised followed by venting of downstream pipe space to check for valve seat leakages.

9. Release the spring pressure on the gas governor (item G2).
10. Set the combustion air pressure switch (item P1) 25% below the specified air pressure required.
11. Start the fan supplying the combustion air and ensure that the fan rotation direction is correct.  
  
Check the running current of the motor and crosscheck this with the data on the Motor label. Ensure that the motor overload protection is correctly set.
12. Ensure that valves V2 and V6 are closed.
13. Check that all pressure switches associated with the burner are in the correct position. Note that the burner combustion air pressure switch (item P1) should be in the 'no air' position and should only switch over after the combustion air fan has started
14. Check that all pressure switches associated with the burner are in the 'on' position calling for **heat** and switch the burner on. It may be necessary to reset the burner lockout fault button.

## Initial Light Up (Commissioning)

15. Allow the flame safety control unit (item A1) to cycle through the start up sequence; check that the pressure switch (P1) has changed over from the 'no air' to the air proved position. If it **hasn't**, adjust the combustion air supply so as to provide satisfactory burner air pressure. Check that the ignition and pilot solenoid valves are electrically energised at the correct time and in the correct sequence. The burner flame safety control unit should then lockout.
16. Open the manual pilot valve (item V6)
17. Fit Micro-ammeter into circuit with the flame sensor.
18. Reset the burner lockout button; the burner will cycle and the pilot flame should light. It maybe necessary to start the light up sequence (reset) several times so as to remove air from the pilot line and to adjust the pilot flame to the correct size. Check the pilot flame signal on the micro-ammeter.
19. Note that the burner will go to lockout after each attempt to light the pilot.
20. Half open the manual test valve (item V2). Reset the burner lockout button. The burner should cycle and light up onto the main flame.
21. Slowly open up the manual test valve (item V2) to the full position and adjust the main gas governor (item G2) to produce the required flame size. With the burner on full fire (temperature control calling heat) check that the gas pressure at the nozzle is as specified for the required thermal/fuel rating, this will be indicated on the burner data label and can also be established from the nozzle flow graph included with this manual.
22. Check the main flame signal on the micro-ammeter.
23. Turn the combustion air pressure switch (item P1) upwards so that the burner shuts down. Note the adjustments in air pressure and reduce the switch setting by 25%.
24. Whilst the burner is operating remove the electrical connections from the flame sensor. Check that the burner flame safety control locks out immediately and that the gas supply is automatically shut off.
25. Whilst the burner is operating, block the combustion air supply so that the pressure switch P1 switches to the 'no air' position, checking that the burner shuts down.

## Initial Light Up (Commissioning)

26. Check the operation of all control and safety devices in the burner control circuits. In addition ensure that the burner operates correctly. Make a note of all control settings.
27. The low fire setting of the burner should be made in line with the process requirements whilst still maintaining a steady flame signal.

### NOTE;-

Once correctly commissioned the burner settings should only be altered by suitably qualified personnel, and only when changes to the process requirements deem it necessary. At no point should the settings of any safety device be altered to overcome changes in process conditions without the burner again being fully commissioned in line with those process conditions.

## Fault Finding Guide

FIND FAULT	POSSIBLE CAUSES	SOLUTION
Burner light up sequence does not start	No electrical supply	<ul style="list-style-type: none"> <li>❖ Check electrical supply at local isolator.</li> <li>❖ Check the control fuse</li> </ul>
	Burner electrical control circuits are not in 'start up' condition	<ul style="list-style-type: none"> <li>❖ Check controls and switches in control circuit</li> <li>❖ Check all pressure switches and micro-switches</li> </ul>
	Airflow pressure switch not made	Check setting on switch, if this is correct check airflow
	Low gas pressure switch not made	Check setting on switch if this is correct check the gas pressure
Start cycle begins but the burner locks out or shuts down before initiating the ignition sequence	Low combustion air pressure differential	<ul style="list-style-type: none"> <li>❖ Reset burner pressure switch (P1)</li> <li>❖ If pressure switch P1 is set correctly open the air damper on the combustion air fan</li> <li>❖ Check that the combustion air fan motor is rotating in the correct direction</li> <li>❖ Check that the combustion air fan is running, if not check the overload or circuit breakers</li> </ul>

## Fault Finding Guide

FIND FAULT	POSSIBLE CAUSES	SOLUTION
Pilot does not light	No spark	<ul style="list-style-type: none"> <li>❖ Check electrical supply to ignition transformer</li> <li>❖ Check electrical connection to spark plug</li> <li>❖ Check operation of ignition transformer</li> <li>❖ Check condition of spark plug and clean, reset or replace</li> </ul>
	No pilot gas	<ul style="list-style-type: none"> <li>❖ Check manual valve is open</li> <li>❖ Check that pilot solenoid valve opens</li> <li>❖ Ensure gas is available at burner</li> </ul>
	Not enough pilot gas	Check pilot gas flow adjuster and pilot gas regulator
	Pilot blown out	<ul style="list-style-type: none"> <li>❖ Reduce process air flow if possible</li> <li>❖ Increase pilot gas rate</li> </ul>
<b>Pilot lights but locks out when ignition de-energised</b>	Pilot gas rate too low	Adjust pilot gas rate
Pilot lights but the burner locks out before the main valves are energised	Flame sensor not detecting the flame Or Faulty sensor	<ul style="list-style-type: none"> <li>❖ Check sensor for damage or moisture</li> <li>❖ Clean flame sensor</li> <li>❖ Check flame sensor installation and position</li> <li>❖ Replace sensor</li> </ul>

## Fault Finding Guide

FIND FAULT	POSSIBLE CAUSES	SOLUTION
Main flame does not light and burner locks out at the end of the pilot phase	Faulty main shut off valve	<ul style="list-style-type: none"> <li>❖ Check electrical supply to valve</li> <li>❖ Check condition of the valve, if faulty, replaces</li> </ul>
	No main gas	<ul style="list-style-type: none"> <li>❖ Check manual valve open</li> <li>❖ Check the adjustment of the gas control valve</li> <li>❖ Ensure gas is available at burner</li> </ul>
	Not enough main gas	Check main gas flow adjuster and main gas regulator
Main flame lights but shuts down after a short period of time	Pilot gas rate too high	<ul style="list-style-type: none"> <li>❖ Adjust pilot gas rate</li> </ul>
	Control circuit operating	Check control circuit, over temperature limits etc.
	Burner gas or air ports blocked	<ul style="list-style-type: none"> <li>❖ Check and Clean</li> <li>❖ Identify source of blockage and rectify</li> </ul>
	Flame sensor not detecting the flame	<ul style="list-style-type: none"> <li>❖ Over firing and flame is <b>'lifting off'</b> reset main flame firing rate</li> <li>❖ Check flame sensor installation and position</li> <li>❖ Check the main gas pressure governor</li> </ul>

## Fault Finding Guide

FIND FAULT	POSSIBLE CAUSES	SOLUTION
Flame failure (lockout) during normal main flame operation	Faulty main shut off valve	<ul style="list-style-type: none"> <li>❖ Check electrical supply to valve</li> <li>❖ Check condition of the valve if faulty, replace</li> </ul>
	No main gas	<ul style="list-style-type: none"> <li>❖ Check manual valve is open</li> <li>❖ Check the adjustment of the gas control valve</li> <li>❖ Ensure gas is available at burner</li> </ul>
	Not enough main gas	Check main gas flow adjuster and main gas regulator
	Low fire set too low	❖ Check and adjust
	Control circuit operating	Check control circuit, over temperature limits etc.
	Burner gas or air ports blocked	<ul style="list-style-type: none"> <li>❖ Check and Clean</li> <li>❖ Identify source of blockage and rectify</li> </ul>
	Flame sensor not detecting the flame  Combustion air failure	<ul style="list-style-type: none"> <li>❖ Over firing and flame is <b>'lifting off'</b> reset main flame firing rate</li> <li>❖ Check flame sensor installation and position</li> <li>❖ Inspect combustion air fan for damage</li> <li>❖ Check fan overloads</li> <li>❖ Check air filter (if fitted) and clean if necessary</li> </ul>

## Fault Finding Guide

FIND FAULT	POSSIBLE CAUSES	SOLUTION
Flame failure (lockout) at low fire	Faulty low fire bypass valve (high low burners only)	<ul style="list-style-type: none"> <li>❖ Low fire flame set too low</li> <li>❖ Check electrical supply to valve</li> <li>❖ Check condition of the valve if faulty, replace</li> </ul>
	Low fire flame set too low	<ul style="list-style-type: none"> <li>❖ Check the adjustment of the gas control valve</li> <li>❖ Ensure gas is available at burner</li> </ul>
	Too much air	Check and reset air at high and low fire
	Low fire air set too low (modulating gas and air burners only)	Check and adjust
	Control circuit operating due to <b>temperature 'creep'</b>	Check control circuit, over temperature limits and low fire settings
	Flame sensor not detecting Flame	Check flame sensor installation and position
	Main flame too long	Too much gas
	Combustion air set too low	Check air dampers, linkages and air filter (where fitted)



## Fault Finding Guide (Indirect Heaters)

FIND FAULT	POSSIBLE CAUSES	SOLUTION
<b>Comb' chamber Glows Red.</b>	Low process airflow.	Reset air.
	Main flame too long.	Check the adjustment of the gas control valve.
	Combustion air set too low.	Check air dampers, linkages and air filter (where fitted).
<b>Unit will not achieve temperature.</b>	Too much process air.	Check and reset air.
	Burner input setting too low.	Check and reset Burner.
	Leakage of cold air into system.	Source and rectify.
<b>Burner shuts down (see also sheets M8.1 to M8.4b).</b>	Control circuit operating.	Check control circuit, process airflow switch, over temperature limits and low fire settings.
	Flame sensor not detecting the flame.	Check flame sensor installation and position.
	Too much pressure in chamber.	Check Flue.
<b>Unit Produces condensation.</b>	Burner turned down too low.	Check the adjustment of the gas control valve.
	Low process air volume.	Check and reset air.

# Parts List (Key)

A1: Flame control unit	L6: Indication light – burner fan failure
A2: Flame electrode	L7: Indication light – burner fan run
A3: U.V. flame sensor	L9: indication light – process fan run
A4: Valve proving unit	L10: indication light – exhaust fan run
B1: Burner combustion head	MF: Burner fan
B2: Peep sight	M1: Burner fan motor
B3: Viewing window	M2: Burner fan impellor
B4: Inspection plate	P1: Burner fan pressure switch
C1: Burner fan contactor/overload	P2: Process air pressure switch
C2: Process air fan contactor/overload	P3: Low gas pressure switch
E1: Ignition transformer	P4: High gas pressure switch
E2: Ignition plug	P5: Valve proving pressure switch
E3: Burner on-off switch	P8: Gas pressure gauge
E4: Low fire position micro switch	P9: Air pressure gauge
E5: High fire position micro switch	R: Electrical relay
E6: Closed position indicator switch	S1: First safety shut off valve
E7: Isolator	S2: Second safety shut off valve
E8: Terminal box	S3: First pilot/start gas solenoid valve
E9: Purge timer	S4: Second pilot/start gas solenoid valve
ET: 24v Control transformer	S5: Vent valve (normal open)
EB: Alarm Bell	S6: Three way solenoid valve -burner air
EFS: Exhaust flow switch	SM: Solenoid/governor multi-bloc valve
FC: Control circuit fuse	TC: Control instrument
FB: Burner control fuse	TL: High limit thermostat or sensor
F1: Burner motor fuse	T3: Valve positioner
F2: Process air fan fuse	T4: Valve actuator
G1: Primary gas regulator (high pressure)	T5: Control supply transformer
G2: Main gas governor	V1: Manual inlet valve
G3: Primary pilot gas governor (high pressure)	V2: Manual test valve
G5: Over pressure slam shut valve	V3: Gas filter
G6: Pressure relief valve	V4: Vent cock
K1: Push button – burner start	V5: Gas control valve
K2: Push button – burner stop	V6: Pilot manual gas valve
K3: Push button – lockout reset	V7: Pilot gas adjustment
K4: Push button – fault reset	V8: Gauge cock
K5: Push button – alarm mute	V9: Air flow control valve
K6: Push button – valve proving fault reset	V10: Gas flow adjustment
K7: Push button – Flame signal test	V11: Air flow adjustment
L1: Indication light – burner lockout	V12: Air filter
L2: Indication light – burner run	V13: Oil filter
L3: Indication light – valve fault	V14: Oil control valve
L4: Indication light – power on	V15: Gas orifice plate
L5: Indication light – instruments on	

## Suggested Service Program

The exact timing of service work to the “PH” burners can only be determined based on the ambient working environment of each specific installation; as a minimum however we would suggest that the following service points are covered at least on a half yearly basis and should only be carried out by a suitably qualified or experienced person;

- ❖ 1. Remove spark electrode, clean with wire brush and check plug gap setting of 2.5 to 3mm. Inspect plug ceramic for any cracks or damage.
- ❖ 2. a. Remove flame sensing electrode, clean electrode with emery paper and inspect plug ceramic for any cracks or damage.  
Or  
b. Remove U.V. cell and clean bulb with clean cloth; taking care to not touch the bulb itself.
- ❖ 3. Remove combustion fan motor and impellor, clear impellor blades of any blockage or build-up of material drawn in by the fan.
- ❖ 4. Clear fan inlet guard of any blockage or restriction, if the combustion air is ducted to the fan assembly then the duct should be removed to check for any blockage.
- ❖ 5. Clear burner body of any dirt or debris which has been drawn in by the combustion fan.
- ❖ 6. Condition of the burner air wings can be accessed from inside the combustion chamber /duct, if access to the inside of the oven or combustion chamber is restricted then the burner should be removed from its fixings to inspect for serious damage to the burner air wings, small cracks and fishers or very slight distortion in the air wings would not be detrimental to the operation of the burner.
- ❖ 7. In the event that the burner air wings are found to be severely damaged then the burner head will need to be completely broken down to fit replacements.

## Suggested Service Program

- 8. All pressure switch impulse lines should be removed and checked for any blockage.
- 9. This down time with the burner should also be used to check the integrity and correct operation of safety pressure switches and solenoids.
- 10. The burner valve assembly should also be checked at this time for gas leaks.
- 11. Finally all burner gas and air settings should be checked against the last recorded commissioning or service settings. The burner should not be put back into operation until test firing has been carried out by the engineer performing the service.

Under no circumstances should the settings of any safety devices be changed from those recorded in the last commissioning data unless this is being carried out as a complete re-commissioning of the burner to facilitate changes in process requirements; **the re-commissioning of the burner should only be carried out by suitably qualified personnel.**

If the ambient conditions are particularly dirty then we would suggest carrying out a full service on a quarterly basis.

# Burner Service Program

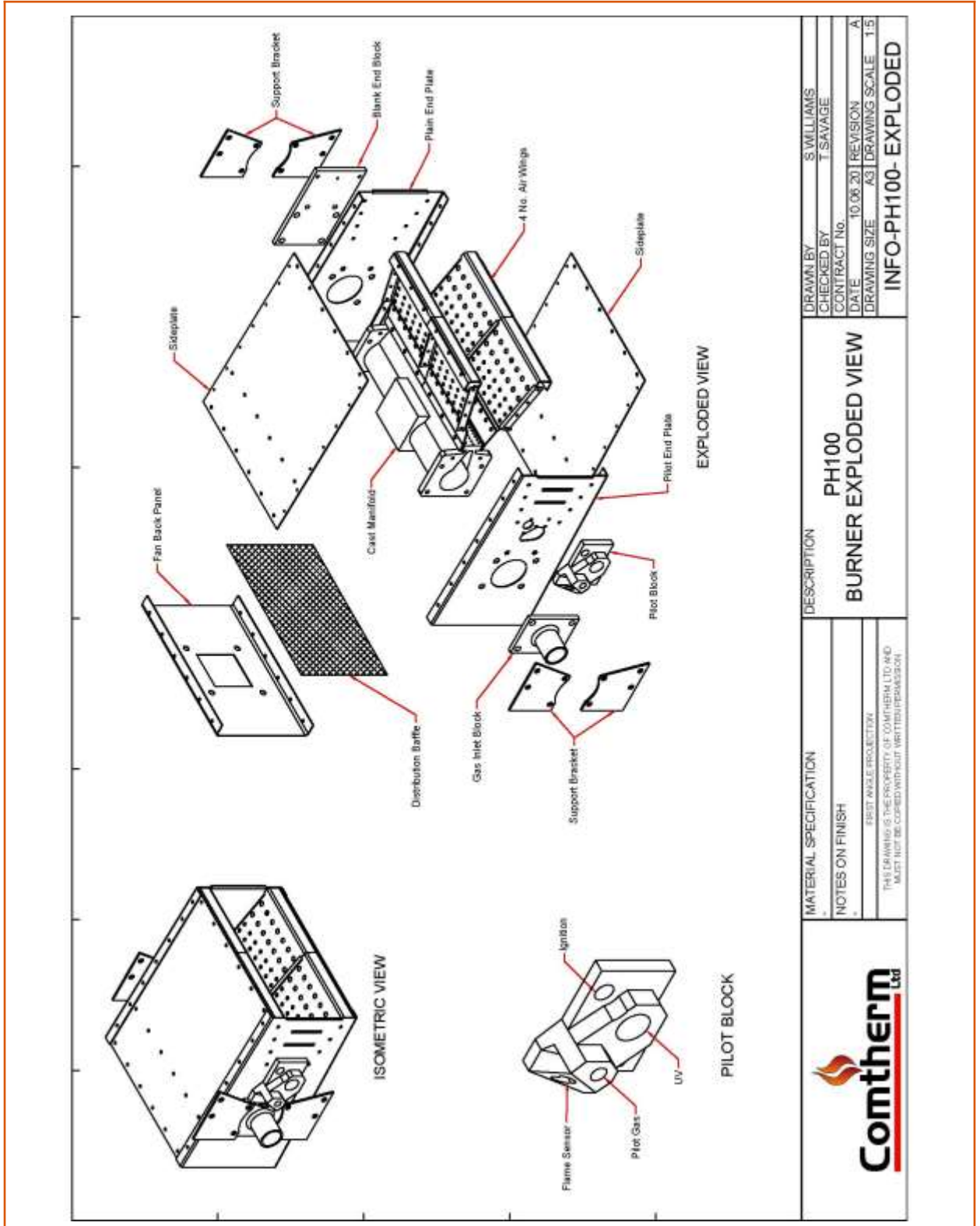
Date of Service	Service Company	Engineer Name	Date of Next Service

# Burner Commissioning Record

Burner Commissioning Data								
	Burner 1		Burner 2		Burner 3		Burner 4	
Burner Location								
Burner Manufacture								
Burner type								
Burner Serial No.								
Fuel Type								
Gas Supply Pressure								
Control Voltage								
Comb. Fan voltage								
Flame Control unit								
Flame Sensor								
Safety Pressure Switch Operation								
	Set	Off	Set	Off	Set	Off	Set	Off
Combustion Fan p/sw								
Process Air p/sw								
High Gas p/sw								
Low Gas p/sw								
Valve Providing p/sw								
Exhaust p/sw								
Combustion Analysis – (where applicable)								
O <sub>2</sub>								
CO <sub>2</sub>								
CO.								
CO:CO <sub>2</sub> .v								
Fuel Temperature								

# Additional Commissioning Notes

# PH Burner Exploded Diagram







Burners, Heaters & Combustion Systems

Comtherm Ltd  
Installation & Maintenance Manual



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