UltraNOx Types S&T

Low NOx Modulating Dual Fuel Pressure Jet Burner

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UltraNOx Types S&T Burner

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UltraNOx General Description

General Description

The UltraNOx burner is the result of an ongoing and continual development programme for our range of pressure jet burners. The focus of this development work is to achieve minimum emission levels, particularly on gas firing, whilst maintaining excellent combustion performance across the operating range of the burner.

The combustion head assembly of the burner in conjunction with the annular arrangement for fuel inlet are key features in how the combustion performance of the UltraNOx burner has been optimised.

On the smaller range of burners, the design uses a range of 'Wee Warrior' gas jets, custom designed and profiled to promote gas flow into the centre of the combustion process. These, along with Radial Gas Jets, are sized to promote gas flow from the gas manifold into the into the centre of the combustion zone.

Forward facing gas jets, are also used to promote gas introduction into the front face of the combustion zone, encouraging further mixing and propagation of the combustion process.

The burner is suitable for firing on natural gas, LPG, hydrogen or distillate fuel oils.

The burner is a compact unit complete with forced draught FD fan and motor. Close coupled air casing with integral air damper arrangement.

Gas Firing

An integral air damper is fitted to the outlet of the forced draught fan assembly. The combustion control system reacts to boiler pressure (or temperature as applicable) and controls the opening and closing of the air damper using a direct drive servo motor. The combustion control system also controls the gas control valve using an independent direct drive servo motor to allow the gas to be introduced to the combustion head at the required flow rate.

Oil Firing

As standard the Types S&T UltraNOx burners are stage firing on oil. The smaller sizes are two stage with the larger sizes three stage. The opening and closing of the oil flow to the oil nozzles is controlled via solenoid valves by the combustion control system.

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Specification

Burner Assembly

The burner assembly incorporates the following:

Air Silencer: The air inlet is fitted with a air intake silencer which is acoustic lined and incorporates a suitable opening for the air inlet. This promotes air flow over the FD fan motor which is housed within the silencer, providing additional cooling to the motor.

FD Fan Impeller: A forced draught (FD) fan is mounted directly on the FD fan motor shaft. The fan is sized and selected in combination with the bespoke air casing volute design to ensure adequate provision of combustion air to the combustion head at the required volume and pressure.

FD Fan Drive Motor: A totally enclosed, fan-cooled, electrically operated drive motor is flange mounted, bolted to the fan casing. The burner FD fan can be provided with a variable speed drive to help reduce operational costs, whilst maintaining adequate air flow and delivery across the firing range of the burner.

Air Damper: The main air damper is mounted on the outlet of the fan assembly. A bladed damper controls the air supply to the burner head.

The primary air flow is used for initiating the aerodynamic flow pattern necessary for flame stability.

The secondary air flow, which represents the bulk of the total air requirements, is used for flame shaping and reinforcing flame front stability patterns.

A servo motor mounted on the fan casing serves to operate the main air damper.

Air Pressure Switch/Sensor: The switch is set to monitor the air pressure in the casing at both low and high fire. If the fan stops or will not start, the burner will lockout due to insufficient air pressure.

Gas Manifold: A gas manifold is mounted to the air casing and is flange connected to the gas train pipework.

The gas manifold provides an annular path for the main gas flows into the burner head. The gas passes to the combustion head through sized nozzles and jets and is distributed evenly over the front of the burner head, finally emerging into the combustion zone, where it combines with the combustion air. The mixture is ignited automatically by the pilot flame.

The pilot gas line is tapped from the main gas line upstream of the main gas isolating valve. The pilot line terminates in the combustion head assembly and is ignited by means of a spark across the electrode and pilot line.

Gas Train: The gas train allows the gas supply to the burner to be regulated correctly at all load conditions, isolated automatically as demanded by the control system and manually on shutdown on changeover to the alternative fuel. An integrity check of the main supply automatic shut-off valves is automatically carried out prior to ignition of the main gas flame.

Gas passes through the main isolating valve (manual). This valve is fitted with a microswitch to provide a signal interlocked in the control system which allows the burner to fire only if the valve is in the open position.

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Front and Rear Casings, continued

Gas Train, continued: The gas train is fitted with a double block control valve this in conjunction with the two SKP hydromotors fitted provides regulation of the incoming gas pressure to the burner. The gas flow is then controlled by the servo driven gas control valve. The hydromotors use an electro-hydraulic sealed system providing maintenance free operation. The electric motor driven pump applies hydraulic pressure to a rolling diaphragm and a piston connected to the actuator stem, operating the valve disc plug and thus opening the valve downward against the lower return spring. The oil pump is switched off when the valve reaches full travel, and an electro-magnetic relief valve prevents the valve from closing. In the event of current interruption on failure, the relief valve releases hydraulic pressure and the valve returns to the original closed position.

Gas Pressure Switches: The gas train is fitted with 3 pressure switches, each one performs a specific function. At the inlet to the double block gas valve there is a low gas pressure switch which is activated on low incoming gas supply pressure.

On the discharge of the double block gas valve there is a high pressure switch which is activated if the gas pressure after regulation is higher than required limit.

In between the two SKP valves on the double block valve the gas proving switch is fitted. This switch is used in conjunction with the other two switches and the combustion control system to perform the gas proving (leak) test carried out prior to ignition of the burner. This mandatory safety check is carried out each time, pre ignition to ensure that there is no leakage of combustible materials into the gas side of the boiler prior to ignition.

If any of the switches detect a pressure out with normal operating safety limits the burner would be locked out.

Gas Proving Safety System: The combustion control system performs a gas safety proving routine during the ignition sequence of the burner. Should a leak be detected during the light up sequence, interlocks in the panel ensure that the burner goes to lockout.

Pilot Gas Line: Pilot gas for ignition is taken from a point upstream of the main gas isolating valve. This gas passes by way of the multifunction pilot gas valve to the burner head.

Gas Main Isolating Valve Interlock: On Dual fuel applications a micro-switch is fitted to the main isolating valve to ensure that the valve is fully closed before the burner will start.

Burner Head Assembly: This comprises of the pilot gas line, ignition electrode and high tension leads, electrode carrier, air swirler/director assembly, burner lance, primary air tube, primary air damper.

The burner combustion head assembly contains multiple 'Wee Warrior' gas jets and plain jets.

The combustion head assembly is designed to ensure that the fuel supply to the combustion process is achieved to allow for Ultra Low NOx combustion.

Ignition: The burner is designed to operate on pilot gas ignition on gas firing and direct spark ignition on oil firing.

On gas firing the gas is ignited by the gas flame from the ignitor. The gas pilot is automatically lighted each time the burner starts by an electric spark, produced by an electrode and a high voltage transformer. When the burner flame is established the ignition gas is automatically switched off.

For oil firing ignition is by direct spark ignition from the ignitors.

Flame Scanner: The burner can be upgraded with a high integrity flame scanner, which continually monitors the combustion process and locks out the burner on any sign of flame failure. This detector monitors both pilot flame and main flame.

Oil Control: The fuel oil is supplied to the combustion head at pressure by a constant discharge geared pump. The pump is driven by an electrical drive motor. The motor and fuel oil pump are mounted directly onto the burner casing on a pedestal.

Oil firing is a staged firing process, where each oil nozzle has its dedicated solenoid valve which is opened/closed by the combustion control system in response to the load demand.

The type and configuration of the oil circulating system is dependent on the burner output required. Modulation on oil firing is available as an upgrade.

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UltraNOx Burner Function Natural Gas – Emission Reduction

The combustion head assembly of the burner in conjunction with the annular arrangement provided for fuel inlet from the gas manifold are key features in how the combustion performance of the UltraNOx burner has been optimised to minimise NOx emissions whilst maximising combustion performance and efficiency.

Key features are the 'Wee Warrior' gas jets which are sized to match the required performance from the burner. Providing gas flow into the combustion zone at the required rate and position.

Forward facing gas jets, these are used to promote gas introduction into the front face of the combustion zone, encouraging further mixing and propagation of the combustion process.

The combined effect of all of these methods of fuel introduction along with the optimised air flow characteristics of the burner result in excellent combustion with low emissions across the burner load range.

The burner achieves improved combustion performance, increased turndown, reduced noise levels and general trouble free operation, whilst minimising emissions.

The burner size makes is suitable for retrofitting onto Wee Chieftain style of boilers, either as a full burner upgrade or as a combustion system upgrade with modified combustion head assembly and associated controls systems.

UltraNOx Burner Control Systems

The UltraNOx uses high integrity combustion control systems, these are all compatible with Cochran's Eclipse and Synergy boiler control systems.

As standard the Types S&T UltraNOx is fully modulating on Gas or staged firing on Distillate fuel oil.

As standard the Type S&T UltraNOx uses the Siemens LMV2/3 system, but options are available to use other suppliers, e.g. LMV5, all leading combustion control systems and potentially others with development work.

The combustion control system is housed on a burner mounted control panel.

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UltraNOx Types S and T 1000-5600 kg/hr

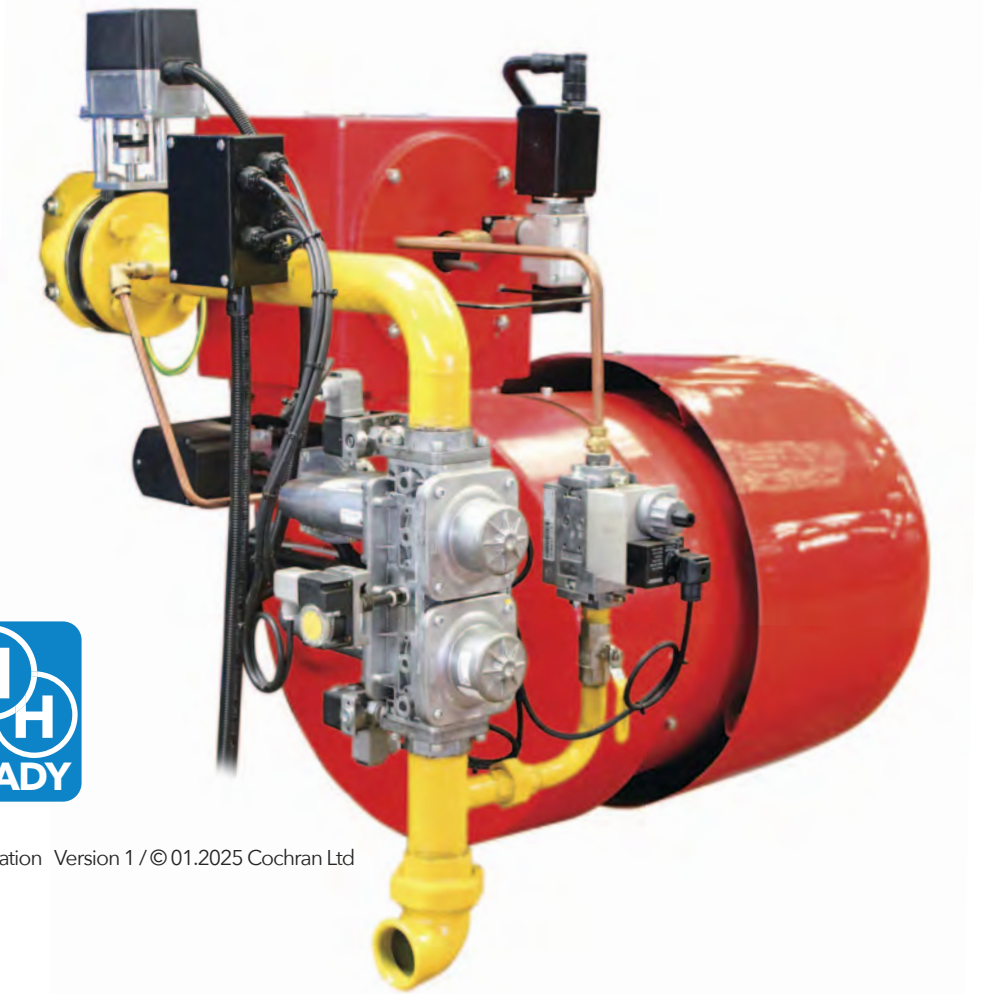
Cochran is a leading provider of fully engineered heat and energy solutions across the globe. Operating worldwide, the Cochran brand is a globally recognised benchmark for British engineering and manufacturing; a name that stands for unrivalled quality, dependability, durability and premium performance.

Now, developed from its well-respected and fully proven burner platform, Cochran have launched the new 40 mg/Nm^3 NOx UltraNOx burner range. Fully MCPD Compliant and Hydrogen ready, this benchmark standard has been achieved without the need for Flue Gas Recirculation (FGR). FGR can be offered to further reduce NOx emissions, where we have achieved results down to 20 mg/Nm^3.*

Delivering low operational noise and excellent fuel efficiency across the 700KW to 4 MW burner net heat output range, the new 40 mg/Nm^3 NOx UltraNOx has been rigorously tested in the field. For maximum efficiency and flexibility, the UltraNOx can be offered with all leading combustion control systems.

Cochran's UltraNOx Types S and T burners offer the following key features:

- Fully MCPD compliant and 100% Hydrogen ready burners delivering from 700KW to 4 MW burner net heat output. Suitable for firing oil or gaseous fuels including Hydrogen or for triple fuel firing, providing maximum flexibility.
- Minimum turndown for Type S and T burners 4.5:1 gas and 3:1 on fuel oil.
- From 40 mg/Nm^3 NOx @3% O_2, without the need for FGR*. For maximum efficiency and flexibility, the UltraNOx can be offered with all leading combustion control systems.
- Digital combustion systems can be incorporated into the burner control package.
- Available with integrated modular options, VSD, O_2 trim, sequencing, remote monitoring.
- Available as a rapid combustion head upgrade retrofit to existing boiler plant - significantly cutting NOx emissions and reducing CAPEX.
- Low operational noise, featuring a muffler and air intake silencer as standard.
- Proven design with extensive real-world testing in the field and supported by Cochran's network of highly experienced UK-based service engineers. Cochran's famous build quality, designed, developed, manufactured and tested in-house at our UK factory, with a powder coated finish for maximum durability. Bespoke design solutions and applications available.



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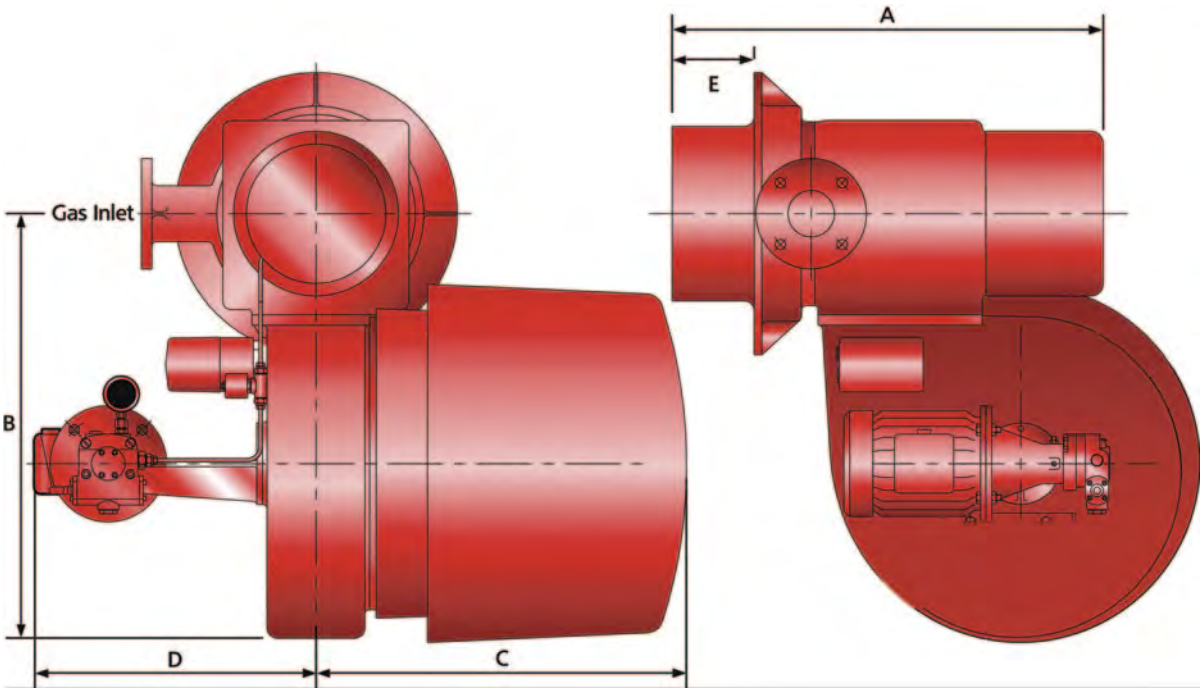
UltraNOx Types S and T 1000-5600 kg/hr



UltraNOx Gas and Dual Fired Types S and T Burners

Boiler Duty		Kg/Hr	1000	1500	2000	2500	3000	3500	4000	4500	5000	5600
Burner Heat Output for all applications		KW	716	1075	1433	1791	2149	2507	2866	3224	3582	4012
Gas Firing Dimensions	A	mm	827	876	876	876	876	907	1074	1074	1074	1074
	B	mm	684	727	727	727	727	737	932	932	932	932
	C	mm	592	617	617	617	617	678	853	853	853	853
	D	mm	285	285	285	300	300	300	361	361	361	361
	E	mm	166	166	166	141	141	141	141	141	141	141
Oil/Dual Firing Dimensions	A	mm	827	876	876	876	876	907	1074	1074	1074	1074
	B	mm	684	729	729	729	729	737	932	932	932	932
	C	mm	592	617	617	617	617	678	853	853	853	853
	D	mm	260	262	262	262	262	483	388	388	388	388
	E	mm	166	166	166	141	141	141	141	141	141	141
Turndown - Natural Gas Firing			4 : 1	4 : 1	4 : 1	4 : 1	4 : 1	4.5 : 1	4.5 : 1	4.5 : 1	4.5 : 1	4.5 : 1
Turndown - Distilate Oil Firing			2 : 1	2 : 1	2 : 1	2 : 1	2 : 1	3 : 1	3 : 1	3 : 1	3 : 1	3: 1
NOx based on ST28 type furnace		mg/Nm^3	40-70	40-70	40-70	40-70	40-70	40-70	40-70	40-70	40-70	40-70

Options: Remote monitoring and data logging - accessible via Internet; O_2 Trim; Exhaust Gas Monitoring; and Integral Gas Leak testing.

Note: All performance figures anticipated and based on a conventionally fired three pass wet back steam boiler with a normal operating pressure of 10 barg.

* Information based on standard test application in test conditions and may vary depending on your application.

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Burner Data Set

UltraNOx Type S & T Data Set

Boiler Duty KG/HR		1000	1500	2000	2500	3000	3500	4000	4500	5000	5600
Equiv. Burner Net Heat Input to Boiler KW		716	1075	1433	1791	2149	2507	2866	3224	3582	4012
Dimensions, Gas Firing	A	827	876	876	876	876	907	1074	1074	1074	1074
	B	684	727	727	727	727	737	932	932	932	932
	C	592	617	617	617	617	678	853	853	853	853
	D	285	285	285	300	300	300	361	361	361	361
	E	166	166	166	141	141	141	141	141	141	141
Dimensions, Gas Firing	A	827	876	876	876	876	907	1074	1074	1074	1074
	B	684	729	729	729	729	737	932	932	932	932
	C	592	617	617	617	617	678	853	853	853	853
	D	260	262	262	262	262	483	388	388	388	388
	E	166	166	166	141	141	141	141	141	141	141
Gas Train inlet	NB	40	50	50	50	50	80	80	80	80	80
Gas Manifold Size	NB	50	50	50	80	80	80	80	80	80	80
Gas Butterfly Control Valve	NB/PN	40	50	50	50	50	65	65	65	65	65
Max. Inlet Gas Pressure Req.	mBar	<200 preferred pmax 300									
Min. Inlet Gas Pressure Req.	mBar	65	65	65	65	75	65	65	65	65	70
Gas Manifold Pressure High Fire	mBar	Dependant upon incoming gas pressure - fine tuned at commissioning stage									
Air Casing Head Pressure	mBar	29	29	31	32	30	34	29	30	28	30
Turndown - Natural Gas Firing		4	4	4	4	4	4.5	4.5	4.5	4.5	4.5
Turndown - Distillate Oil Firing		2	2	2	2	2	3	3	3	3	3
FD Fan Motor Size	KW	4	5.5	5.5	7.5	7.5	11	11	11	15	15
Ambient Air Temperature	°C	25	25	25	25	25	25	25	25	25	25
Max. Altitude above sea level	m	300	300	300	300	300	300	300	300	300	300
Approximate Burner Mass	kg	185	195	195	225	225	230	250	250	255	255

Emission Levels Natural Gas Firing (all based on 100% load)

O_2	% Dry by volume	3	3	3	3	3	3	3	3	3	3
CO_2	% Dry by volume	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25
H_2O	% wet by mass	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75
CO	PPM	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
NOx using ST23 type furnace	mg/Nm^3	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80
NOx using ST23E type furnace	mg/Nm^3	50-80	50-80	50-80	50-80	50-80	50-80	50-80	50-80	50-80	50-80
NOx using ST28 type furnace	mg/Nm^3	40-70	40-70	40-70	40-70	40-70	40-70	40-70	40-70	40-70	40-70
Maximum Gas Side Resistance	mBar	14	14	15	14	14	14	15	15	15	15

All performance figures anticipated and based on a conventionally fired three pass wet back steam boiler with a normal operating pressure of 10 BarG.

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Burner Data Set, continued

Oil Firing

Boiler Duty KG/HR		1000	1500	2000	2500	3000	3500	4000	4500	5000	5600
Oil Atomisation Pressure	Bar	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Oil Pump Motor Size	KW	0.25	0.25	0.25	0.25	0.25	1.1	1.1	1.1	1.1	1.1
Low Fire Oil Jets	U.S.Gal.	6	8	12	16	18	17	18	20	21.5	24
Mid Fire Oil Jets	U.S.Gal.	N/A	N/A	N/A	N/A	N/A	13.5	18	18	20	22
High Fire Oil Jets	U.S.Gal.	7	11	13.5	18	20	13.5	18	18	20	22

Emission Levels Oil Firing (all based on 100% load)

O_2	% Dry by volume	3	3	3	3	3	3	3	3	3	3
CO_2	% Dry by volume	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25
H_2O	% wet by mass	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9
CO	PPM	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
NOx using ST23/28 type furnace	mg/Nm^3	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200

All performance figures anticipated and based on a conventionally fired three pass wet back steam boiler with a normal operating pressure of 10 BarG.

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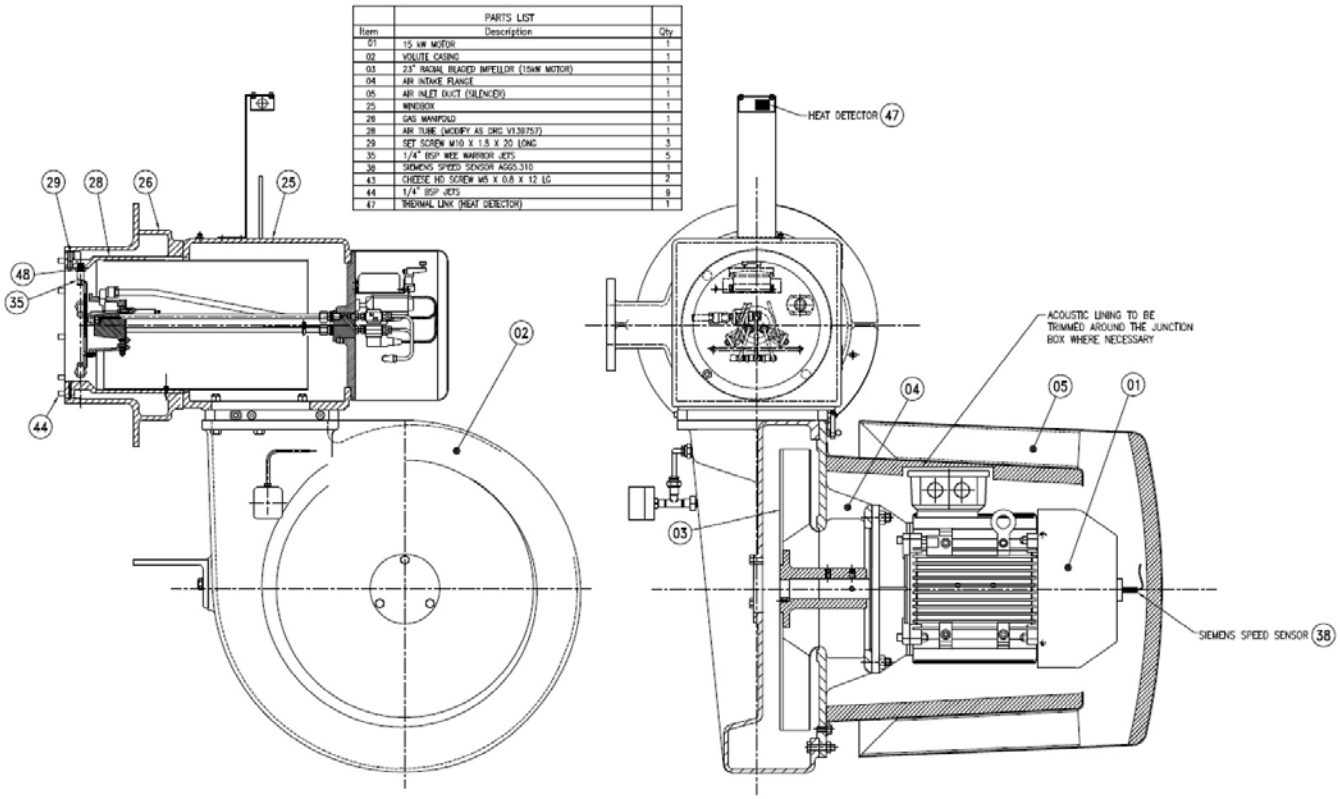
Typical Combustion Head Assembly – Dual Fuel Burner



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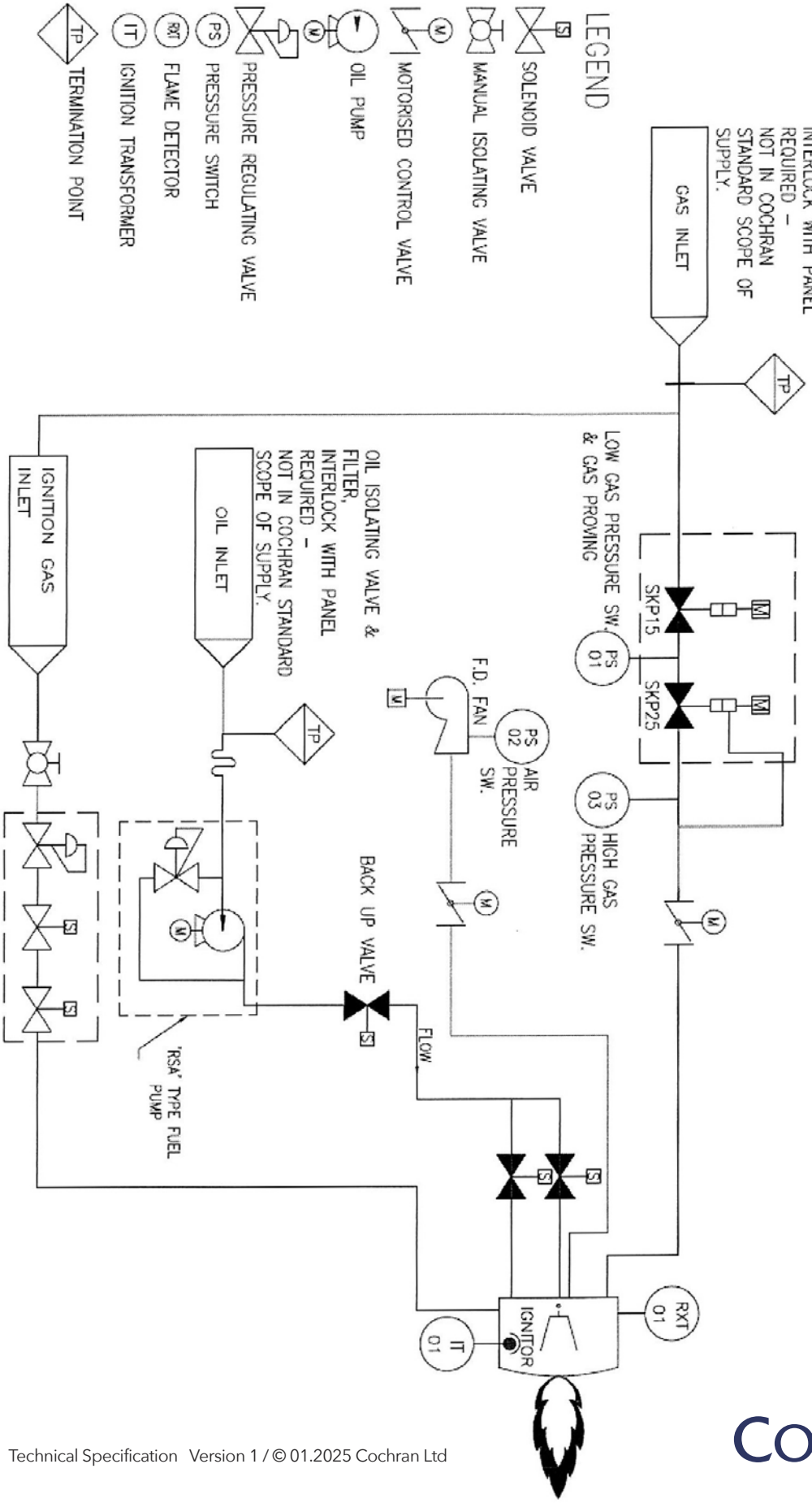
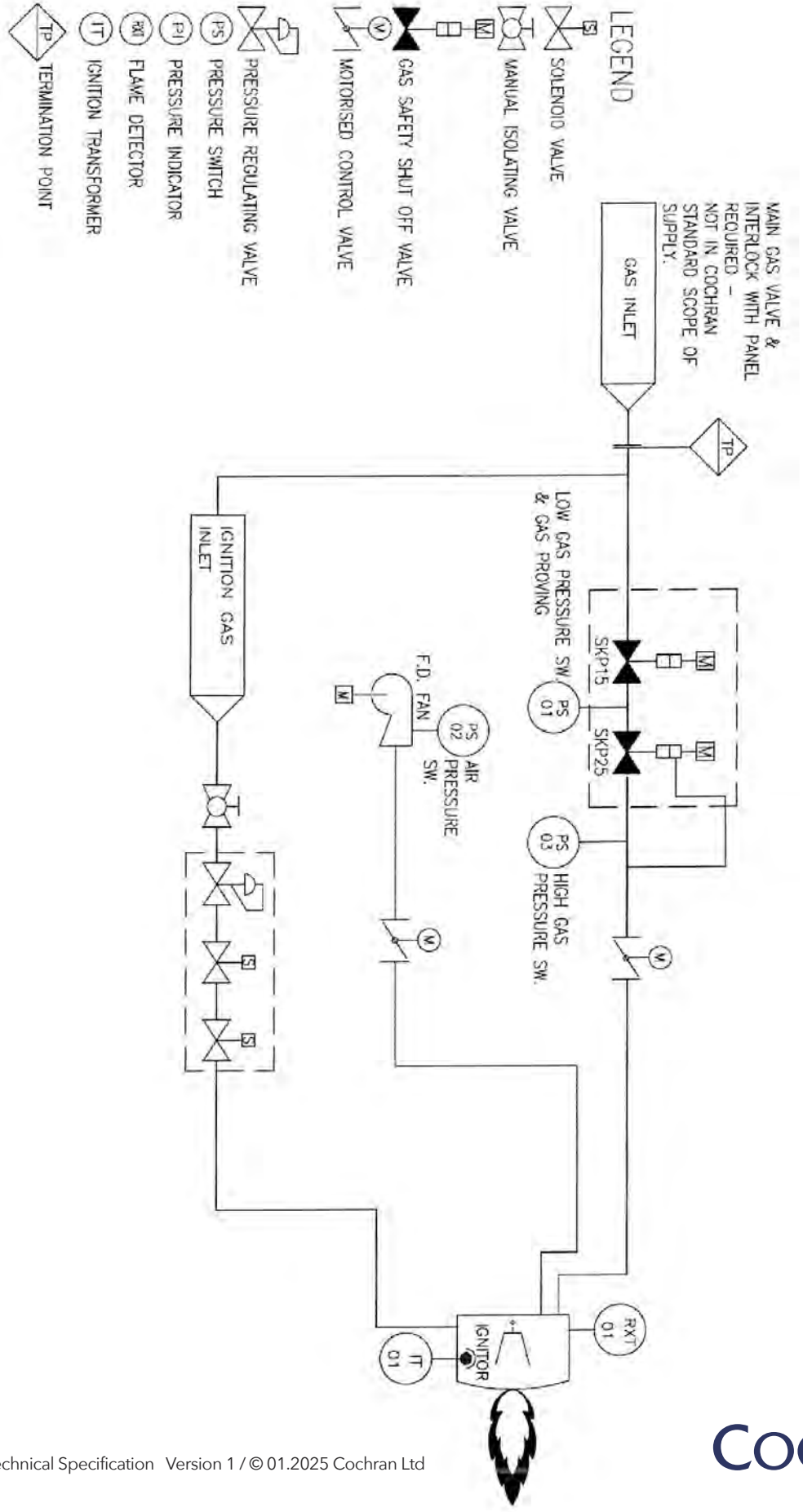
Natural Gas/Distillate Oil Burner P&IDs

P&ID - LMV26 2 Stage on Oil.



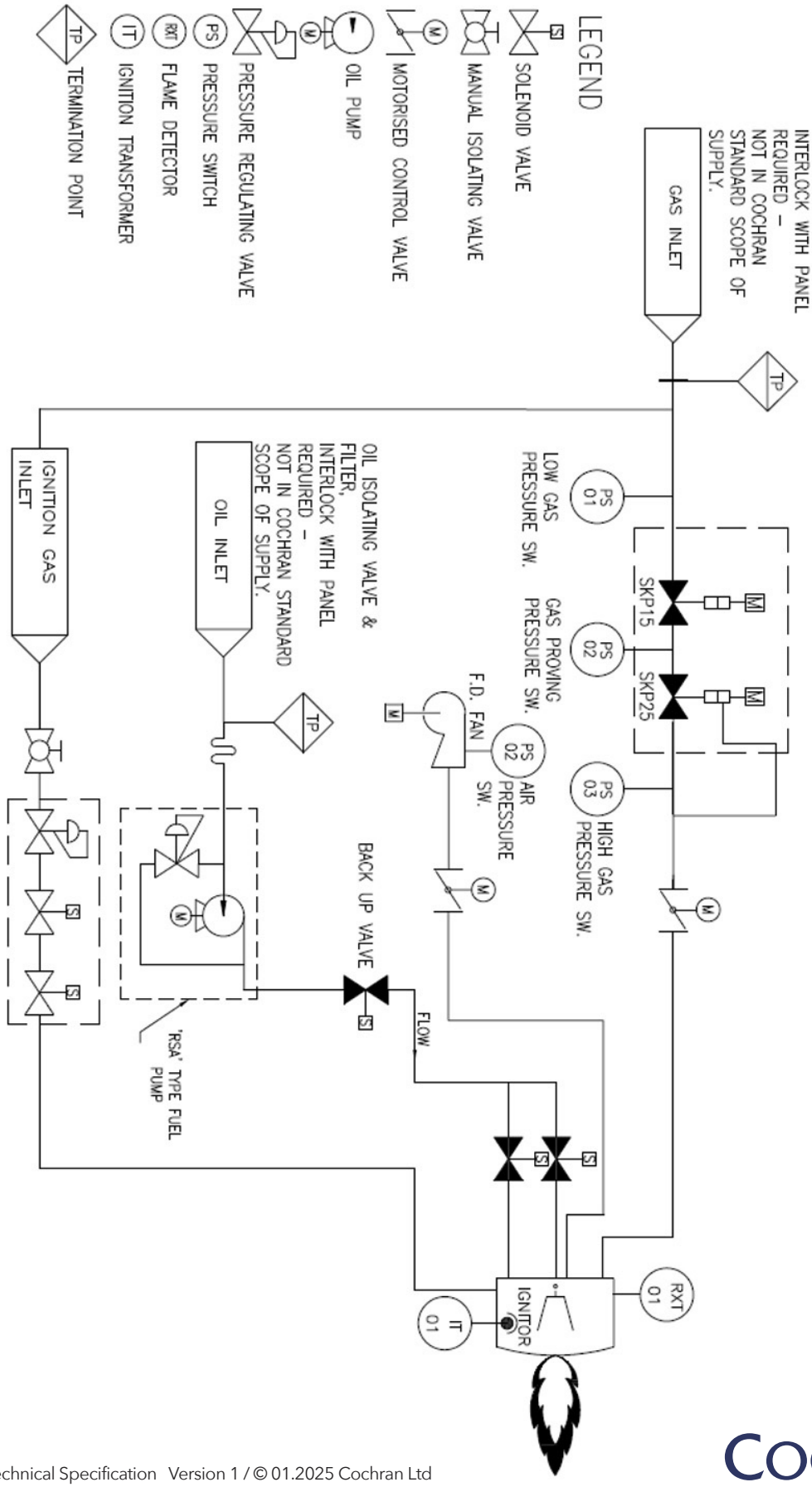
Natural Gas Burner P&ID

P&ID - LMV27-37 system.



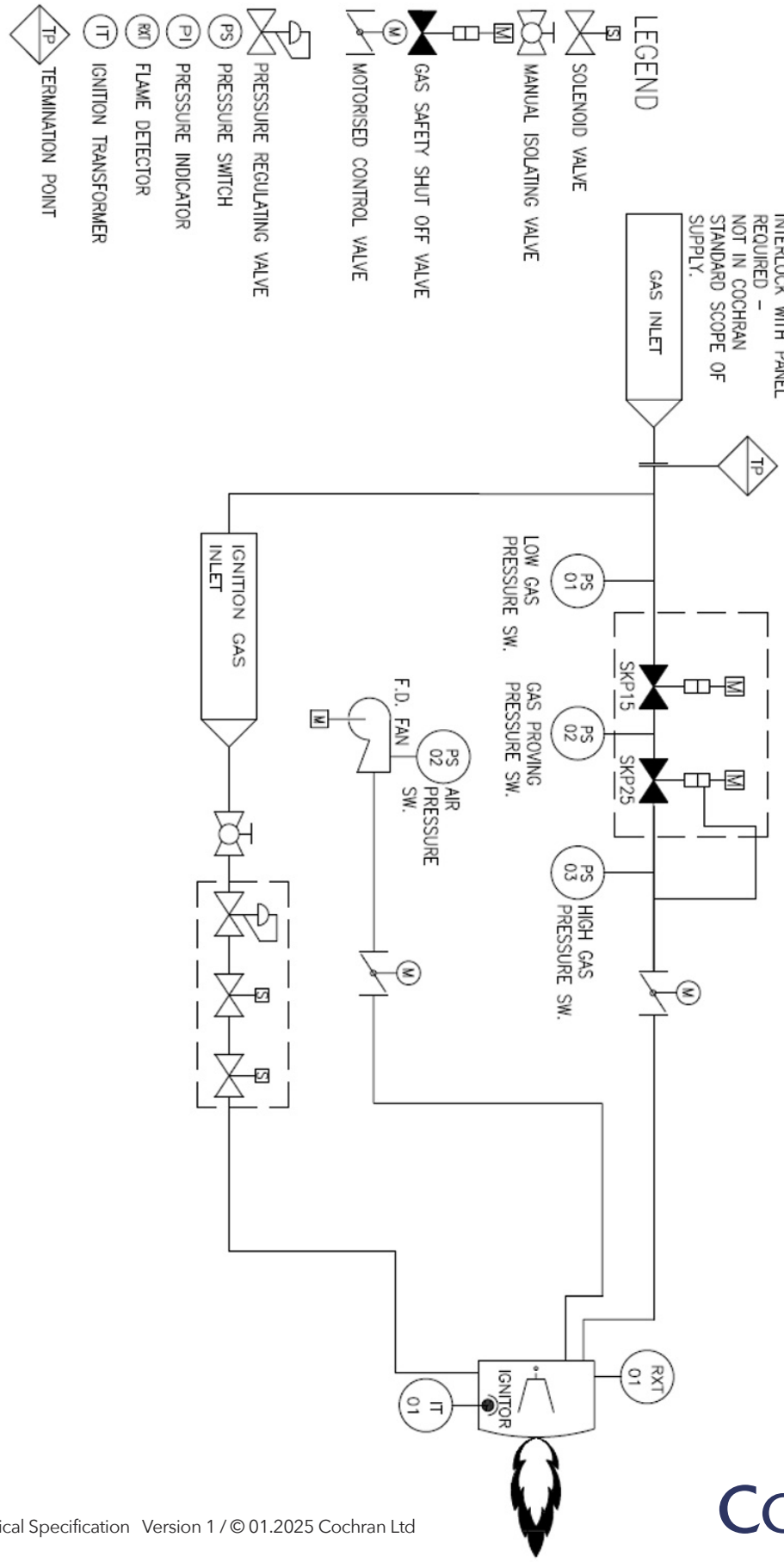
Natural Gas/Distillate Oil Burner P&IDs

P&ID - LMV5 2 Stage on Oil.



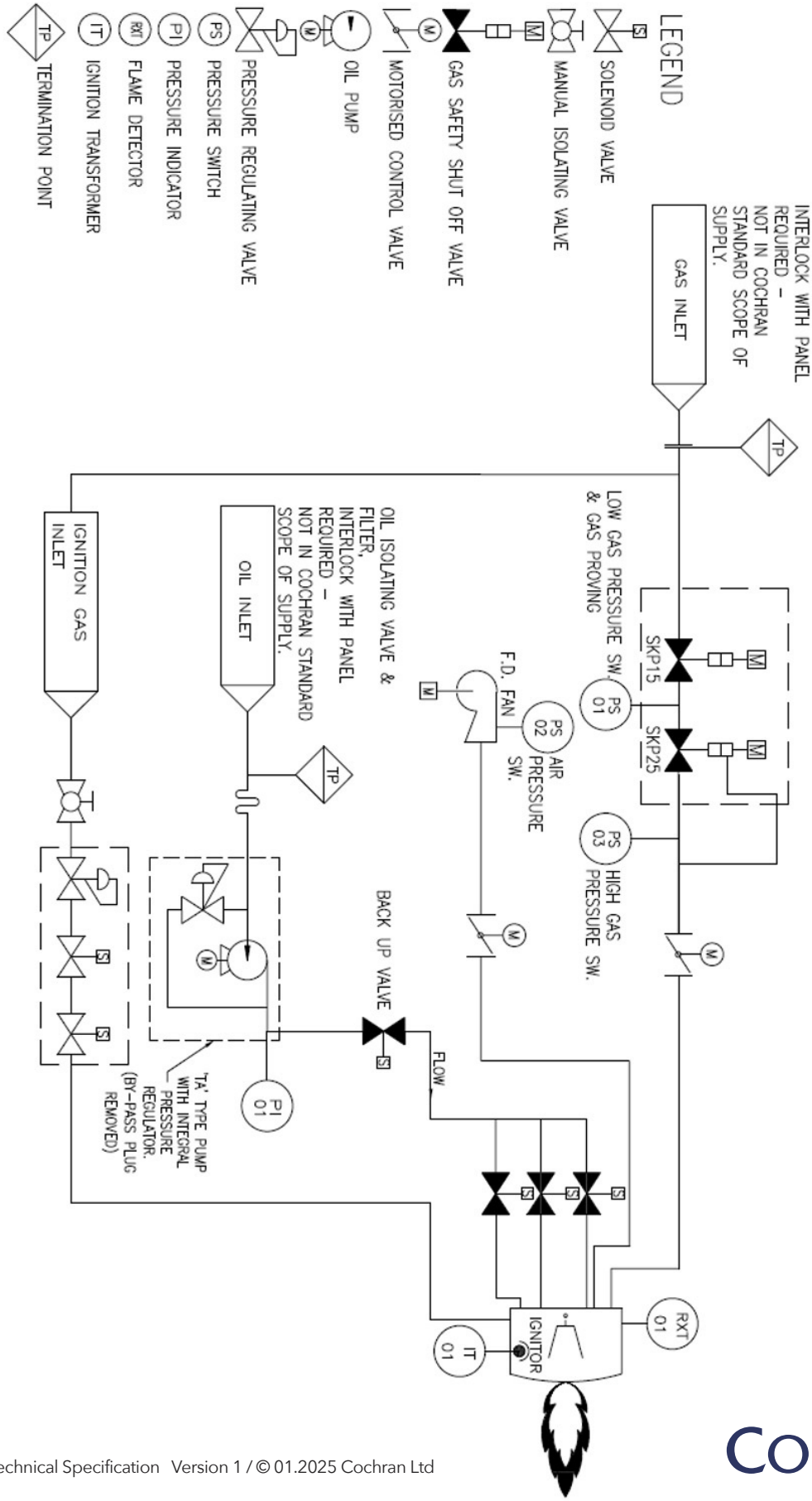
Natural Gas Burner P&ID

P&ID - LMV5 system.



Natural Gas/Distillate Oil Burner P&IDs

P&ID - LMV26 3 Stage on Oil.



UltraNOx Types S&T Technical Specification

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