Specification

Technical Specification – Waste Gas Burner Installations

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Revision details

Version No.	Clause	Description of revision
7	General	Reformatted, references updated, numerous minor amendments.
	2	Points 9 and 10 added
	3, 4	Turn down ratio amended from “infinite” to “120 to 1”.
	6	Points 28, 29, 30 added
	Appendix 1	Reference drawings included in appendix.
6	All	Format update
5	All	General update
4	All	General update
3	All	General update
2	All	General update
1	All	New document

Introduction

This Specification is for waste gas burner installations for Sydney Water assets.

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Acronyms

Acronym	Definition
AGA	Australian Gas Association
API	American Petroleum Institute
AS	Australian Standards
BMS	Burner Management System

Acronym	Definition
BTU	British Thermal Unit
CFR	Code of Federal Regulations (US EPA)
DC	Direct current
DIN	Digital Input
EEHA	Electrical Equipment in Hazardous Areas
EN	European Standards
EPA	Environmental Protection Authority
EPL	Environmental Protection License
IEC	International Electrotechnical Commission
I/O	Input / Output
IP	International (Ingress) Protection Marking
LPG	Liquefied Petroleum Gas
PLC	Programmable Logic Controller
POEO Act	Protection of the Environment Operations Act
RTD	Resistance Temperature Detector
SCADA	Supervisory Control and Data Acquisition
SPDT	Single Pole Double Throw
SS316	Stainless Steel 316
UL	Underwriters Laboratories
UPS	Uninterruptible Power Supply
UV	Ultraviolet
WHS	Work, Health and Safety

1. General

1.1 Scope

Sydney Water uses waste gas burners (specifically designed flares) to combust any excess digester biogas not utilised by co-generation, heaters, or other biogas users. The waste gas burners minimise the possibility of digester gas venting at the digester pressure relief valves, preventing odours, health hazards or gas explosions in extreme cases.

This Specification covers the general requirements for the supply, installation, testing and commissioning of waste gas burners in Sydney Water's wastewater treatment and water recycling plants. This Specification applies to both open (candlestick) and enclosed burners that are installed in Sydney Water's plants.

This Specification sets out requirements for waste gas burner components located within the waste gas burner compounds including the burner unit and stack, pilot and ignition system, pipework, condensate removal equipment, safety accessories, valves, instrumentation, and power backup.

1.2 Exclusions

Steam and gas assisted burners are excluded from the scope of this Specification. These types of burners are generally not installed at Sydney Water's plants. This Specification is not intended to be used to set out requirements for other components, gas pipework and elements related to the digesters.

1.3 Objective

The objective of this Specification is to provide technical specifications and criteria for standardisation of waste gas burner installations in Sydney Water's wastewater treatment and water recycling plants. The intention is to ensure that a robust, yet simple solution is implemented with the required operational information provided to the plant production officers. This will reduce the risk of venting of un-combusted biogas to the atmosphere and minimise non-compliance with legislative requirements, community complaints, personnel health, and safety issues.

1.4 Legislative requirements

The Protection of the Environment Operations Act 1997 (POEO Act) is the governing statutory legislation for managing air emissions in NSW and is administered by the Environment Protection Authority (EPA) in NSW. Under this Act is the Protection of the Environment Operations (Clean Air) Regulation 2021, which sets limits on air pollution emissions and specifies the requirements for plant and equipment for the control of air pollution.

All waste gas burner installations must meet the relevant requirements of the above Act and Regulation. With relation to the requirements of the Regulation, it is noted that waste gas burner installations in Sydney Water plants do not treat landfill gas and are not designed to be enclosed in relation to combustion requirements.

Part 5 of the Regulation deals specifically with air emissions from plant and scheduled activities. The Regulation classifies waste gas burner installations as a "Group 6" activity on scheduled premises; and defines the air emissions standards and operational requirements flares must meet.

The emissions requirements are detailed in Schedule 2 Standards of concentration for scheduled premises: afterburners, flares, and vapour recovery units, and include (for Group 6):

Air impurity	Plant	Standard of concentration
Smoke	Any flare	No visible emission other than for a total period of no more than 5 minutes in any 2 hours

Detailed in Clause 49, additional operational requirements include:

a) any flare operated for the treatment of air impurities is operated in such a way that a flame is always present while air impurities are required to be treated.

Clauses relating specifically to landfill gas do not apply to Sydney Water installations as the waste gas burners do not treat landfill gas. Any other relevant requirements in the Act and Regulation must be complied with.

No emissions monitoring and requirements are stipulated within Sydney Water environmental protection licenses (EPL) for Waste Gas Burners.

2. General requirements

1) Waste gas burner installations must be located such that in the event of unburnt gas being vented it will not cause a hazard or risk of explosion
2) Separation distances from sources of ignition for instrumentation and electrical components must comply with the requirements of AS/NZS IEC 60079.10.1.
3) All waste gas burner components and elements (including skid components) within the waste gas burner compound must utilise materials which are corrosion resistant to H_2S and suitable for use in coastal environments regardless of site location. Any components that will be or potentially will be exposed to elevated temperatures must be appropriately heat resistant rated.
4) Electrical installations associated with the waste gas burner system must comply with AS/NZS 3000.
5) Waste gas burners must meet the regulatory smoke opacity requirements: achieving smokeless operation as stipulated.
6) All fasteners must be SS316.
7) All waste gas burner installations must have a 100 % standby capability in a duty / standby arrangement unless otherwise stated in the project-specific technical specification.
8) The waste gas burner installation must be wired to the plant PLC UPS, with dedicated and appropriately rated circuit breaker/s on the UPS distribution board. The plant PLC and the duty waste gas burner(s) must be able to operate for a minimum of 4 hours on UPS power supply.
9) If the treatment plant has a cogeneration plant, where other PLCs are available, the waste gas burners shall not be wired and controlled by the same PLC as the cogeneration system. This allows for the biogas path to be treated by the waste gas burners in the event of a cogeneration plant PLC CPU failure.
10) The waste gas burners shall be wired to separate PLCs where possible, to ensure that upon a PLC CPU failure, the other waste gas burner can operate in full automatic mode. If this cannot be achieved, it shall be escalated for approval by Sydney Water.
11) Waste gas burners must be installed within a security fenced compound with appropriate access and signage.
12) Lightning protection must be provided on the waste gas burner stack(s) in accordance with AS 1768.
13) Cables must be appropriately protected (insulated) or located at a suitable distance away from any heat source(s).
14) Provide radiation plots with isopleths as required by the project-specific technical specifications.

3. Candlestick burners (open flares)

Candlestick burners (open flares) are the typical type of flare used in most Sydney Water treatment plants. The candlestick burner generally consists of a gas burner head, gas pipework, valves, safety accessories, pilot with the ignition system mounted on a support pedestal and a cylindrical flame shield around the pilot tip/main flame. The candlestick burners have simple combustion controls limited to operation of automatic valves.

Candlestick burners are capable of meeting 40 CFR Part 60.18, which requires the flare to operate with no visible emissions except for periods not exceeding 5 minutes during any 2 consecutive hours. Typical destruction efficiencies are in the 90 - 95 % range. The destruction efficiency is typically not measured in this type of burner as there is no practical way to monitor the exhaust.

With candlestick burners, the risk of explosion due to unburnt gas is relatively lower compared to an enclosed burner as there is no combustion chamber and combustion occurs in the open.

1) The waste gas burner must be self-supporting for winds up to 177 km/hr or wind speeds according to AS/NZS 1170.2, whichever is the more stringent. A stable pilot and main flames must be maintained, and blowout must not occur at these design conditions.
2) The pilot must be a continuous pilot and always lit when the burner is available. Therefore, the pilot flame must be a continuous low-pressure pilot which must stay alight whether the main stack is flaring biogas or not.
3) The burner tip must be designed to prevent flame lift off under the specified operating conditions.
4) The waste gas burner and stack must be of stainless steel 316 construction including the pilot piping, nozzles, and type K thermocouples. The thermocouples must be provided with 4 - 20 mA signal conditioners for monitoring of the pilot. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.
5) Each waste gas burner must have pilot flame detection capability. When a pilot flame is not detected, the vendor specified re-ignition cycles must be attempted by the pilot controller. The waste gas burner must shut-off and create a fault to enable the standby burner to automatically take-over if the pilot does not ignite after the specified number of re-ignition cycles. An alarm condition must be raised in the plant PLC/SCADA to indicate that the faulted burner needs to be investigated for faults.
6) A wind shroud must be provided around the pilot flame to protect the flame from the wind and allow more reliable ignition.
7) Design heat radiation levels must be in accordance with API Standard 521 Pressure-relieving and depressurising systems.
8) The waste gas burners must be designed to provide a minimum of 120 to 1 turn down ratio.
9) Stack elevation and spacing must be designed such that permissible heat densities for personnel on ground level or platforms (where present) are not exceeded at maximum heat release conditions. The stack height must be a minimum of 5 m high unless otherwise approved by Sydney Water.
10) Stack location and height must meet all the EPA regulatory requirements for noise levels.
11) The upstream control system of the waste gas burner will control digester pressure and flow rates to the burners by adjusting the position of the butterfly valves. The butterfly valves must be spring to close type suitable for position control and is controlled by the SCADA PLC. Note: A mechanical regulator is not required on the waste gas burner supply line.

12) Pressure gauges must be provided for both the main burners and pilot flame.

13) A correctly sized flame arrestor prior to the stack on the horizontal main gas supply must be installed on each burner. The flame arrestor must produce maximum flame blow-back protection at the minimum pressure loss across the unit. The internal cassettes must be of grade 316 stainless steel and the flame arrestor housing of grade 316 stainless steel for maximum ease of cassette removal. Specific approval must be obtained from Sydney Water if any other materials are offered by the vendor.

14) The main flame arrestor must be fitted with an IEC Ex AUS compliant RTD temperature transmitter or K-Type Thermocouple on the stack end of the flame arrestor housing to detect any blow-back. The blow-back detection must raise a fault condition in the burner control panel and instantly shutdown the burner if the “High Temperature” setpoint within the controller is reached. The flame arrestor temperature transmitter must be fitted with 4 - 20 mA signal conditioners for monitoring of burner flashbacks. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.

15) The control panel must also be constructed from SS316, mounted on SS316 supports and meet a minimum rating of IP54 as per CPDMS0022. There should also be a SS316 weather hood above the control panel to allow for maintenance/operation in wet weather with enough lighting provided under the hood for operating the burner and troubleshooting the controls at night.

16) Skid mounted units must be manufactured from SS316 with locating bolt-down holes, but not caged. The waste gas burners must be open to the environment as the burners will be located within fenced off purpose-built compounds.

17) The valve and piping arrangement must be mounted on pipe supports for coupling to the burner pilot skid unit to the burner stack. Allowance must be made for thermal expansion in the design of the mechanical installation of pipework and other relevant components.

18) Skid mounted units must be transportable in NSW roadways in accordance with the relevant NSW Transport Legislation. Each component may be mounted on its own skid if required. For example, one for the main burner, and one for the pilot system & control panel.

19) The skid must be designed in accordance with Sydney Water Technical Specifications - Civil and Mechanical, respectively, for walkway access. The safety in design process must be undertaken to evaluate clearances, access/egress, and safe access to operable and maintainable assets on the skid. Evidence of this must be provided with the technical datasheets.

20) The Rural Fire Service (RFS) must be consulted in situations where a candlestick waste gas burner is near a bush fire prone area due to the presence of an open flame. An enclosed burner type or additional flame shielding may be required subject to the advice of the RFS. Sydney Water may undertake a bush fire risk assessment as part of the project works.

21) The waste gas burner compound must have flood lighting installed with light switches at the main entry gate of the compound.

22) The waste gas burner compound must have two entries and exit points with lockable gates for safety of staff and emergency needs.

4. Enclosed burners

Enclosed burners are used on Sydney Water plants where candlestick burners are not suitable due to site specific conditions. The open flame present in candlestick burners may be an issue for sensitive community sites where the flame is visible to nearby residences or poses a risk to a bush fire sensitive area.

In enclosed burners, combustion occurs entirely within the enclosed shell. As a result, there is less luminosity, heat radiation and greater wind protection compared to a candlestick burner. Combustion is also more uniform, and emissions are low with destruction efficiencies of greater than 98 %.

Unlike candlestick flares, the performance of enclosed flares can be measured, and a sampling port can be provided on the enclosure to measure the quality of the exhaust prior to discharge into the ambient air. This is an important feature in relation to carbon credits or emissions trading schemes.

1) The waste gas burner must be self-supporting for winds up to 177 km/hr or wind speeds according to AS/NZS 1170.2, whichever is the more stringent. A stable pilot and main flames must be maintained, and blowout must not occur at these design conditions.
2) Enclosed burners must consist of a suitable combustion stack assembly to permit the proper influx of air regardless of gas flow.
3) The burners must be of a broad flame design to ensure proper exit velocities of the gas.
4) The waste gas burners must be designed to provide a minimum of 120 to 1 turn down ratio.
5) The waste gas burner design must provide complete combustion based on a naturally aspirated process without the need for dampers or complex control of process parameters.
6) The combustion stack height must be of sufficient height to create the natural draft for smokeless combustion and dispersion of the thermal plume.
7) The combustion stack must be of SS316 construction. Specific approval must be obtained from Sydney Water if any other materials are offered by the vendor.
8) Guaranteed contaminant destruction rates of 99 % are not required for Sydney Water sites. The burners performance must meet the EPA regulatory requirements including smokeless combustion.
9) Pilot venturi nozzles, thermocouples, and thermowells must be SS316. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.
10) The burner air intake must provide adequate cooling so that the combustion stack does not require refractory lining or insulation. The heat radiation from the stack structure must be low enough for personnel to be working for extended periods (more than 4 hours) near the burner at ground level without special protective clothing.
11) The burner flame must not be visible above the top of the stack. This is a requirement for minimisation of community complaints.
12) Safe access to the main flame internal nozzles and components must be provided by easily removable covers and robust hinging/support system for covers/access hatches. These covers and access hatches must be designed to last for the 25-year lifecycle of the burner. Removable covers must be either lockable or require tools to remove / open.
13) The burner must minimise noise as much as possible and comply with the EPA industrial noise policy, plant operating licence, development approval conditions and workplace health and safety requirements.

14) Each burner must be provided with a pilot and main flame detection (on enclosed burners) for monitoring the facility. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature(s).

15) When a pilot flame is not detected, the vendor specified re-ignition cycles must be attempted by the pilot controller. The waste gas burner must shut-off and create a fault to enable the standby burner to automatically take-over if the pilot does not ignite after the specified number of re-ignition cycles. An alarm condition must be raised in the plant PLC/SCADA to indicate that the faulted burner needs to be investigated for faults.

16) The upstream control system of the waste gas burner will control digester pressure and flow rates to the burners by adjusting the position of the butterfly valves. The butterfly valves must be spring to close type suitable for position control and is controlled by the SCADA PLC. Note: A mechanical regulator is not required on the waste gas burner supply line.

17) Each burner must be provided with sampling test ports.

18) Pressure gauges must be provided for both the main burners and pilot flame.

19) A correctly sized flame arrestor prior to the stack on the horizontal main gas supply must be installed on each burner. The flame arrestor must produce maximum flame blow-back protection at the minimum pressure loss across the unit. The internal cassettes must be of grade 316 stainless steel and the flame arrestor housing of grade 316 stainless steel for maximum ease of cassette removal. Specific approval must be obtained from Sydney Water if any other materials are offered by the vendor.

20) The main flame arrestor must be fitted with an IEC Ex AUS compliant RTD temperature transmitter or K-Type Thermocouple on the stack end of the flame arrestor housing to detect any blow-back. The blow-back detection must raise a fault condition in the burner control panel and instantly shutdown the burner if the “High Temperature” setpoint within the controller is reached. The flame arrestor temperature transmitter must be fitted with 4 - 20 mA signal conditioners for monitoring of burner flashbacks. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.

21) The control panel must also be constructed from SS316, mounted on SS316 supports and meet a minimum rating of IP54 as per CPDMS0022. There should also be a SS316 weather hood above the control panel to allow for maintenance/operation in wet weather with enough lighting provided under the hood for operating the burner and troubleshooting the controls at night.

22) All equipment must be securely fixed down on the concrete slab using correctly sized anchor bolts.

23) Skid mounted units must be manufactured from SS316 with locating bolt-down holes, but not caged. The waste gas burners must be open to the environment as the burners are located within fenced off purpose-built compounds.

24) The valve and piping arrangement must be mounted on pipe supports for coupling to the burner pilot skid unit to the burner stack. Allowance must be made for thermal expansion in the design of the mechanical installation.

25) Skid mounted unit must be transportable in NSW roadways in accordance with the relevant NSW Transport Legislation. Each component may be mounted on its own skid if required. For example, one for the main burner, and one for the pilot system and control panel.

26) The skid must be designed in accordance with Sydney Water Technical Specifications - Civil and Mechanical, respectively for walkway access. The safety in design process must be undertaken to evaluate clearances, access/egress, and safe access to operable and maintainable assets on the skid. Evidence of this must be provided with the technical datasheets.

27) The waste gas burner compound must have flood lighting installed with light switches at the main entry gate of the compound.

28) The waste gas burner compound must have two entries and exit points with lockable gates for safety of staff and emergency needs.

5. Pilot burners (candlestick and enclosed burners)

Pilot burners provide the required ignition to flare the main waste gas supply. There are several pilot types available: flame front generator, high energy ignition and ignition rods are among some of the available technologies. Most of the existing Sydney Water installations use the flame front technology. The pilot burners need to be reliable as the main combustion process relies on the operation of the pilot burner. Continuous pilots are now mandatory due to EPA compliance requirements and the reliability issues experienced with the pilot ignition when operated on demand. The use of biogas pilots eliminates the running costs associated with continuous LPG pilots.

1) The waste gas burners must have a continuous pilot burner flame. The pilot must be permanently lit whether the main gas supply is actively flaring or not. Pilot must be always ON when placed in AUTO.
2) The pilot must be designed to provide reliable ignition (robust against fluctuations in gas composition), pilot flame stability and flame resilience against wind and other operating conditions. The pilot system must be designed for a pilot supply gas pressure that varies between 1.0 and 3.5 kPa.
3) The continuous pilot flame nozzle must be mounted integral to the burner and must have a long profile flame. The pilot flame must extend through waste gas flow profile to ensure ignition of waste gas regardless of the flow rate.
4) Unprotected pilots must withstand winds up to 177 km/h or wind speeds according to AS/NZS 1170.2, whichever is the more stringent. The pilot must be able to operate on biogas continuously, whether the main flame is lit or extinguished.
5) The pilot gas supply must be a minimum of 1” diameter SS316 pipe and drawn from the top of the incoming main waste gas supply with a vertical incline, then directed at a downward slope through to the pilot mixture system and continued to the main pilot line. A condensate drain valve and tube must be tapped into all low points of the pilot system and pilot pipework, avoiding all condensate from collecting/pooling within the pilot gas supply pipe from the draw-off point to the pilot tip.
6) The pilot gas piping and appurtenances must be installed at an incline to maximize air-gas mixing unless an alternative design is recommended by the vendor or manufacturer. Specific approval must be obtained from Sydney Water for alternative designs.
7) Pressure regulator(s) must be provided on the pilot supply pipe to control pilot fuel pressure to the flare and maintain the reliability of the continuous pilot flame.
8) Pilot gas and air must be premixed and ignited at ground level, remote from the combustion stack assembly and delivered to the pilot tip for combustion. Exclusions apply for alternative ignition systems accepted by Sydney Water with demonstrated advantages and reliability (such as HEI ignition tips).
9) All components of the ignition system must be protected from the heat of combustion to provide safe, reliable, and effective ignition in all-weather scenarios.
10) The pilot ignition system must utilise flame front technology OR other reliable technology with proven track record which is recommended by the waste gas burner supplier. This will be subject to Sydney Water’s approval.

11) Any pilot gas control components must be mounted on a SS316 plate with weather hood and supported by SS316 steel supports. The lighting provided under the weather hood must be sufficient to allow maintenance of the pilot components during night time conditions.

12) A suitable flame check valve must be installed on the continuous pilot retention pipe; at least 2 meters downstream of the ignition chamber and at an adequate distance to protect upstream critical components of the pilot system and from flame ignition of the main gas supply via the pilot pipe.

13) The pilot must always be designed to run continuously on digester biogas as its ONLY fuel source and maintain a reliable control function to keep the fuel mixture at the ideal ignition air/fuel ratio.

14) In case of a pilot flame failure, the pilot system must stop after a safe nominated re-ignition cycle and raise an alarm sent to the SCADA PLC. The SCADA PLC will then immediately shut-off the main gas control valves associated with that burner.

15) If the pilot gas components require the following components: solenoid valves must have SS316 steel inserts, pressure gauges, isolation valves, (the blower is aluminium body), all tubing and threaded fittings must also be in SS316.

16) Type K thermocouple with 4 - 20 mA signal must be provided for monitoring of the pilot flame.

6. Pipework and valves

1) All main biogas piping must be schedule 10S SS316 pipe, manufactured in accordance with the requirements set out in AS 4041 for class 3 piping or other agreed manufacturers' standards.
2) The biogas pipework and valves must be configured primarily for the waste gas burners to operate in a duty / standby arrangement. The arrangement must also allow the burners to operate in a duty / assist configuration when required.
3) Biogas pipework must have a 1:50 minimum slope to provide moisture drainage towards the nearest moisture-removing device or barometric loop.
4) Where a gas flow meter is installed in the horizontal pipe run, the biogas pipework must have a minimum slope of 1:40. Alternatively, the flow meter may be installed in a vertical pipe leg.
5) Maximum velocity of biogas in any new pipework must not exceed 3.7 m/s under normal duty flows to minimise the risk of liquid and solid carry-over resulting in damage to instrumentation and equipment.
6) The design of the biogas delivery pipework must minimise the number of pipe bends and piping length to reduce pressure losses in the system.
7) Pipe bends must be 1.5D radius bends. Biogas pilot piping and condensate drain piping must also be provided in SS316 tubing or pipe with flange or threaded connections to isolation valves where required.
8) The main gas line control and isolation valves for the waste gas burner installation must be butterfly valves unless otherwise stated in the project specific technical requirements.
9) Butterfly valves must be lugged to Table D and constructed from SS316 body, disc, shaft and handles (for manual operation). No gearboxes will be accepted without Sydney Water approval, and the valves must be compliant with BS EN 593 Industrial valves, Metallic butterfly valves or approved equivalent.
10) All manual isolation valves (DN50 or smaller, i.e. on biogas pilot lines) on the gas train must be ball type valves constructed from SS316 and conform to BS EN: 331 Manually operated ball valves and closed bottom taper plug valves for gas installations for buildings or approved equivalent.
11) Two pneumatically operated control valves (spring loaded close valves) must be provided on each waste gas burner biogas pipe train.
12) Digital positioners must be provided for the control valves. Positioners using bellows are not acceptable.
13) All manual, auto on/off and modulating valves (DN80mm or greater) on the main gas train must resilient seated butterfly valves suitable for digester biogas service.
14) Actuators must be suitably sized for the required duties. Pneumatic actuation is the preferred method of actuation.
15) Pneumatic actuators must be constructed of corrosion resistant materials suitable for biogas applications. This must include resistance to corrosion attack from Hydrogen Sulphide gas (H_2S). The actuators must be suitable for use with the plant's existing compressed air supply. The actuators must be of spring-return type fitted with 4 - 20 mA positioners for process flow control and with a SS316 hood to protect the positioner displays from environmental elements.

16) Pneumatic cylinders must have aluminium / Rislan coated bodies, SS316 shafts with suitable shaft extensions in SS316 trim and fastenings. They must be suitable for operation from a compressed air system ranging between 450 and 1000 kPa. The cylinder must be of the spring return type with the direction of operation determined by a digital controller mounted on the cylinder.

17) All pneumatic valve actuators must be supplied with digital open and close proximity switches. These switches may be integral with the digital controller module.

18) Solenoid operated valves on compressed air lines must be specially constructed for non-lubricated air service. All valves must be equipped with a manual means to operate the valve in the case of power failure. Valve body must be stainless steel 316.

19) SS316 expansion bellows must be provided between the valves for dismantling purposes where required. The bellows must be constructed by SS316 flanges to AS 4087 and SS316 bellows or UV resistant rubber (single bellows).

20) Valves must be installed so that they are easily and safely accessible for operating and maintenance purposes.

21) Pipework supports must be provided as required. The arrangements and locations of the supports must allow for disassembly of the equipment and piping.

22) All drains must be directed to dedicated drains located within the perimeter of the waste gas burners compound.

23) All gas pipework and valves must comply with the relevant requirements of the AS/AGA codes.

24) Pressure testing of the new pipeline must be to AS 2885.

25) All anchor bolts and fixings must be SS316.

26) All instrumentation tubing must be manufactured from SS316 seamless tube and fittings suitable for use with compression fittings.

27) The pipework must include purge and test points at the appropriate locations. DN25 full bore ball valves must be provided for isolation of the test points.

28) Main biogas pipework gaskets on the "cold side" upstream of the waste gas burner flame arrestor shall be NBR gaskets (nitrile butadiene rubber) which is suitable for petroleum, organics and resistant to other compounds found in biogas.

29) Gaskets either side of the main flame arrestor shall be compressed fibre which is heat resistant and shall be provided by the waste gas burner supplier. The gasket details shall be documented within the Operations and Maintenance manual (O&M manual) provided by the waste gas burner supplier.

30) The waste gas burner units shall have gaskets already installed by the supplier which are normally metal gaskets that meet the required heat ratings. The gasket details shall be documented within the Operations and Maintenance manual (O&M manual) provided by the waste gas burner supplier.

7. Electrical and instrumentation

7.1 Local control panel

A local control panel must be provided with the waste gas burner installation. The panel must comply with the following requirements:

1) The panel must be IP56 or greater in 316 SS construction with a rain and sun hood/shade.
2) Any pilot gas control components must be mounted on a SS316 plate with weather hood and supported by SS316 supports. Lighting under the hood must be provided for evening works.
3) The local control panel must have the following components and functionality:
   a) Pilot Control: Selector for OFF/MANUAL (Only if BMS has manual function) /AUTO modes; the selector position must be displayed on SCADA.

      Note: Thermocouple control must always be in AUTO. No “Off” function is permitted. The BMS start permissive from the plant PLC will start the pilot automatically while the BMS is powered on from its selector switch. If the default or existing BMS has “Thermocouple Control - AUTO / OFF”, the BMS must be modified to remove this function, allowing only an “AUTO” mode permanently. If a “Remote Start Simulation” switch is installed by the vendor, this switch must also have its position signal fed back to the plant SCADA PLC. The SCADA PLC must create an alarm indicating that this switch is ON and that the panel may attempt to light the burner, even when the remote permissive is OFF. Interlock logic must be provided in the SCADA PLC for this interlock.
   b) Start permissive from Plant PLC: When ACTIVE - the burner must start its start-up cycle to light the pilot. When start permissive is removed, the pilot must shut-off and no ignition takes place (burner waits for SCADA PLC permissive). Consider 0 V DC for Run Permissive from Plant PLC, and 24 V DC for Stopping the Pilot System. Upon PLC failure, at 0 V DC, the run permissive will keep the pilot ON and the 240 V AC must be maintained to the local control panel of the burner.
   c) Pilot flame monitoring must be provided with K-Type Thermocouple or better. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.
   d) Flame blow-back monitoring must be provided with an RTD or K-Type Thermocouple installed on the flame side of the main flame arrestor/outlet pipe and parallel feedback is required for alarm and 4 - 20 mA signal to local panel and plant PLC. No digital thermal switches must be provided for this function. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.
   e) Enclosed Burners must have a main flame monitoring by a K-Type thermocouple. Terminal must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.
   f) Status indicators for “Pilot On”, “Pilot Off”, “Spark”, “RSSS On”, “BMS On”, Retention Valve On (where fitted) etc. must be fed back to the SCADA
   g) Adjustable thermocouple set point
   h) Manual ignition button
   i) Remote Ignition Provision

j) Remote Reset from Plant PLC/SCADA: When activated, the burner must reset to the start of its internal starting cycle (Pilot Valve Open, Blower Run, Timer Expired, Ignition, Awaiting Thermocouple for Pilot ON status etc.)

k) SPDT contacts for remote indication of pilot on/off and pilot flame failure functions

l) Capability for AUTO repeated ignition cycle up to a settable maximum count.

4) 24 V DC power supply is preferred for all pilot system components, including the air fan/blower and ignitor. Alternate voltages are subject to approval by Sydney Water

5) The control panel installation must be adequately grounded neutral.

6) The control panel must include necessary pilot controls to provide automatic re-ignition of the pilot flame. It will provide flame sensing and re-ignition sequence in case the pilot flame is extinguished.

7) The local control panel must allow for extra DIN rail capacity for several plant field instruments and controllers. This allows for a marshalling section for the site's equipment and the multicore connection to the SCADA PLC can be used for a neater installation.

8) The waste gas burner panel and components must be connected to the plant's backup UPS supply so that the waste gas burners must continue to operate as normal during a power outage.

9) The 240 V AC supply to the Local Control Panel must be protected by an appropriately rated surge protection device mounted within the Local Control Panel

10) The Local Control Panel must have an externally accessible isolator that can be locked in the OFF position to allow for the isolation of the 240 V AC supply to the panel.

7.2 Connections to plant PLC

1) All control and indication signals must be wired to the plant control system. A PLC panel will be nominated for connection of all instrumentation and control signals.

2) All installed instrumentation and waste gas burner signals (I/O) must be maintained by the PLC UPS system, allowing for inputs and outputs to SCADA PLC.

3) Vendor supplied package items must be controlled via the BMS (Burner Management System) within the local control panel. Individual alarms generated from any of the package supplied items must be provided back to the onsite SCADA system.

4) The burner control panel must have the ability to transmit and receive the following I/O's to and from the local control panel. As a minimum, the following signals must be connected back to the plant SCADA system.

Digital Inputs (24 V DC)

- System start (stop = 0) Run permissive from plant
- Remote reset input from plant PLC - BMS starts from "starting sequence"

Digital Outputs (Volt Free)

- Panel Fault - 1 input per Fault Type.
- Pilot Control Mode feedback (controls: Auto, OFF etc.)
- Pilot flame detection (alarm out on flame failure)
- Any other key failure conditions (Flame Blow-back etc.)
- Status Signals

"Igniting"

- Pilot ON Signal
- Pilot OFF Signal
- RSSS ON Signal (where fitted)
- BMS Power ON Signal
- Retention Valve ON Signal (where fitted)
- Low Gas Pressure (field instrument)
- Condensate Traps Low Level (field instrument)
- Sediment Trap High level (field instrument).

Analogue Outputs (4 - 20 mA)

- Pilot flame temperature (degrees C)
- Flame Arrestor Blow-back Temperature (degrees C)
- Biogas Pressure (kPa) (field instrument)
- Biogas Train(s) Flow Rate (Nm3/h) (field instrument)
- Compressed Air Pressure (kPa) (field instrument)
- Control Valves Positions (%) (field instrument).

7.3 Flow measurement

For duty / standby burner arrangements, one flow transmitter must be provided on the combined gas inlet pipework. The flow meter must be installed at a location to ensure accurate measurement (as per the recommendations in the installation manual of the flow meter) and where flow to either burner can be measured when the other is isolated.

For burner systems with multiple duty burners (i.e. duty / duty / standby), one flow transmitter must be provided on each waste gas burner train. If the upstream pipeline straight length is limited due to site specific conditions, a flow transmitter on the combined gas inlet pipework with insertion type flow meters for wet biogas on the main gas supply must be used.

Krohne Optisonic 7300C flowmeters are the preferred flow measurement solution for Sydney Water waste gas burners installations. Alternative solutions must be subject to Sydney Water approval. Note: The Krohne Optisonic 7300C flow meter should be sized to ensure that the gas flow velocity is in the allowable range (0.3 to 30 m/s), for the range of flow conditions specified in the scope of work.

Flow measurement instruments within the waste gas burner installation must be rated for IEC Ex-d / Ex-e / Ex-i Zone 1 and power supply to the instrument must be 24 V DC with field fitted surge protection. The supplied instrument must comply with the requirements of the Sydney Water I&C Standards.

7.4 Pressure management

A pressure transmitter must be provided on the combined gas inlet pipework at or near the waste gas burner(s) fenced compound. Krohne Optibar 5060C or equivalent products from Foxboro or Yokogawa are the preferred pressure measurement solution for Sydney Water waste gas burner installations. Alternative solutions must be subject to Sydney Water approval.

Pressure measurement instruments for biogas must be rated for IEC Ex-d / Ex-e / Ex-i Zone 1 and power supply to the instrument must be 24 V DC with field fitted surge protection. The supplied instrument must comply with the requirements of the Sydney Water I&C standards.

8. Safety accessories and other equipment

8.1 Flame arrestors

Flame arrestors or flame traps are designed to stop the propagation of flame by absorbing and dissipating heat through the increased surface area provided by the banks within the arrestors. The reduction of energy through this process lowers the temperature of the gas below its ignition point and puts out the flame.

1) The flame arrestor must have a minimum of three times the net free area of the corresponding pipe size.
2) Main gas flame arrestor must be of SS316 casing and insert cassette with a flash-back temperature transmitter on the flame arrestor burner side for detection of flash-back and ensuring supply shut-off command interlocked within the burner control panel. Terminals must be provided for the 4 - 20 mA to be relayed back to the plant PLC/SCADA for monitoring temperature.
3) The banks within the arrestors must be able to be inspected and replaced without removal of the arrestor body from the pipework.
4) The pressure-drop across the flame arrestor must not exceed 6.9 kPa (1 PSI).
5) The flame arrestor must be leak proof to 69 kPa (10 PSI) or better.
6) Pipework upstream and downstream of the main flame arrestor must have SS316 drain ball valves installed to allow draining of condensate and prevent accumulation of condensate in the flame arrestor.
7) The flame arrestor must be installed within 4.6 meters of the waste gas burner stack in accordance with UL recommendations.

8.2 Thermal shut off valve

Not used.

8.3 Pressure relief valves

Not used.

8.4 Barometric loops and condensate traps

1) Condensate traps or barometric legs with condensate pots must be provided at suitable locations to drain any condensate trapped in the system. The design of the pipework must minimise the number of condensate removal points required. Construction of the pots and pipework must be from SS316.
2) Low level switches must be provided for all condensate traps and pots. If switches are of an electronic type, field surge protection must be fitted.
3) Barometric loops are the preferred solution in lieu of condensate and sediment traps. If a condensate/sediment trap is unavoidable due to relative levels, minimum storage capacities of condensate and sediment must be subject to prior approval by Sydney Water. A level switch must be

provided to monitor the water level from the SCADA system. This is to only serve as a SCADA alarm only and NOT to shut down the waste gas burner. If switches are of an electronic type, field surge protection must be fitted.

4) A removable top cover for interior access with an integral inspection pipe for sediment level measurement must be provided for condensate traps. The main gas inlet and outlet pipes must be arranged so that the trap can be bypassed. Stainless-steel butterfly valves must be installed at the inlet and outlet of the trap and on the bypass pipe. This allows for bypass and maintenance of the trap when required.

8.5 Compressed air receiver

A dedicated compressed air receiver must be provided for the waste gas burner installation unless a dedicated supply is available. Generally, the plant service air supply line must be connected to the dedicated air receiver to provide continuity of compressed air pressure during a power failure.

1) The new compressed air receiver must be fitted with a pressure gauge, auto drain, relief and safety valves and bypass valve arrangement for servicing. The receiver must be sized to ensure that the waste gas burner installation's pneumatic control valves can operate for a minimum of 20 complete cycles (per duty burner) during a power failure.
2) A 24 DC motorised ball valve (fail close during power failure) or suitable non-return valve must be provided on the inlet of the air receiver to prevent the air receiver from being depleted by other users connected to the compressed air system. The motorised ball valve must be connected to the UPS backup for the waste gas burners.
3) The air receiver must be supplied with any certification required by the relevant WHS legislation or pressure vessels codes.
4) The air receiver must be located within the waste gas burner fenced compound.
5) A pressure transmitter (Krohne, Yokogawa, VEGA, IFM or Sydney Water approved equivalent) must be provided on the compressed air receiver or supply line downstream of the control valve / non-return valve to monitor the compressed air supply available to the waste gas burner installation. Field Surge protection must be fitted to the pressure transmitter.

9. Hazardous area requirements

1) The Contractor must ensure all waste gas burner installations within the classified gas hazardous areas comply with the relevant Australian Standards, legislative requirements, and power supply distributor requirements.
2) Circuits connecting to instruments and control equipment located in hazardous areas must incorporate fail-safe intrinsic safety barriers or be of flameproof type installation in accordance with requirements of AS/NZS 60079.14. Area classifications must be included on layout diagrams, schematic diagrams, and block cable diagrams.
3) Before the commencement of work, the Contractor must confirm with Sydney Water the current hazardous area classification of existing installations.
4) The Contractor must supply a "dossier" of the hazardous area installation, including all equipment, wiring methods and fittings as well as a drawing delineating the various hazardous areas. A sample of the hazardous area drawing is included in Appendix 1 - drawings WGB-9 and WGB-10.
5) The dossier must be prepared in accordance with AS/NZS 60079.14, AS/NZS 60079.17 and other relevant Australian Standards. The dossier and related documentation must be prepared by a suitably qualified and competent person. Competency may be demonstrated in accordance with AS/NZS 4761 or equivalent training and assessment frameworks.
6) Where an existing hazardous area dossier is already available, the Contractor must update the existing dossier to reflect the new installation and include any additional information required.
7) The dossier must contain the following documentation where applicable:
    a) Relevant site information
    b) Hazardous area classification report
    c) Hazardous area mapping drawings
    d) Hazardous area equipment registers and certificates of conformity
    e) Relevant electrical datasheets and drawings
    f) Relevant documentation from manufacturer
    g) Relevant inspection and test records
    h) Relevant installation and maintenance documentation
    i) Any other required documentation.

9.1 Electrical equipment, instrumentation and installation requirements

All electrical equipment and instrumentation installed within the classified Hazardous Areas must meet the following requirements:

1) Have its own individual and current IECEx or AUSEx certificate (this includes one for the device and another certificate for components that interface with the device such as glands, stopping plugs and other components)

2) If the devices are Exd rated, all glands entering field devices should utilise an IECEx or AUSEx rated “barrier gland” to prevent any gas migration along the cable.
3) If the devices are Exd rated, a steel wire Armoured cable will need to be used from the device to the cabinet.
4) Where possible, consideration should be made so that any conduits or sleeving over the cables do not pass from a classified hazardous area to a non-hazardous area. This may lead to gas migration along the conduit to the non-hazardous area.

If any device does not have IECEx or AUSEx certification and cannot be exchanged (proprietary device), then it will need to have a Conformity Assessment Document (CAD) completed for each device. This must be completed by a local test house (Test Safe, SIMTARS or TRA) and be submitted to Sydney Water for approval prior to installation. Anything that cannot be IECEx or AUSEx rated or cannot achieve a CAD must be relocated outside of the hazardous area where possible (e.g., air blower).

10. Reference standards and specifications

All standards referred to in this specification relate to the latest editions.

API Standard 521: Pressure-relieving and Depressuring Systems

AS 1375: Industrial fuel-fired appliances

AS 1768: Lightning protection

AS 2885: Pipelines - Gas and Liquid Petroleum

AS 4041: Pressure piping

AS 4087: Metallic flanges for waterworks purposes

AS/NZS 1170.0: Structural Design Actions - General Principles

AS/NZS 1170.2: Structural Design Actions

AS/NZS 3000: Electrical Installations

AS/NZS 4761: Competencies for working with electrical equipment for hazardous areas (EEHA).

AS/NZS IEC 60079.10.1: Explosive atmospheres - Classification of Areas - Explosive gas atmospheres

AS/NZS 60079.14: Explosive atmospheres - Electrical installations design, selection, erection and initial inspection

AS/NZS 60079.17: Explosive atmospheres - Electrical installations inspection and maintenance

BS EN 593 Industrial valves, Metallic butterfly valves

Draft Sydney Water Process Functional Description - Waste Gas Burners

EN: 331 Manually operated ball valves and closed bottom taper plug valves for gas installations for buildings

WEF Manual of Practice 8: ASCE Manuals and Reports on Engineering Practice, No. 76

USEPA New Source Performance Standards (NSPS)

Sydney Water Standards

Health and Safety Procedure HSP-058: Risk Assessment in Design

Safety in Design Procedure (D0000653)

Technical Specification – Commissioning - transitioning assets into operation (D0001440)

Asset Creation Operational Readiness Guideline (D0000256)

Instrumentation and Control Standards TOG_TS01

Treatment Plant SCADA Standards

Technical Specification – Civil (CPDMS0023)

Technical Specification – Mechanical (BMIS0209)

Technical Specification – Electrical (CPDMS0022)

Sydney Water Procedure: TG0502 Classification and Management of Flammable Gas Hazard Areas

11. Reference drawings (refer Appendix 1)

1) WGB-1 Open / Candlestick Burner (Duty / Standby) P&ID
2) WGB-2 Enclosed Burner (Duty / Standby) P&ID
3) WGB-3 Candlestick Burner (Duty / Duty / Standby) P&ID
4) WGB-4 Enclosed Burner (Duty / Duty / Standby) P&ID
5) WGB-5 Open / Candlestick Burner General Arrangement - Plan
6) WGB-6 Open / Candlestick Burner General Arrangement - Elevation
7) WGB-7 Enclosed Burner General Arrangement - Plan
8) WGB-8 Enclosed Burner General Arrangement - Elevation
9) WGB-9 Open / Candlestick Burner Sample Hazardous Area - Plan
10) WGB-10 Open / Candlestick Burner Sample Hazardous Area - Elevation

12. Site specific technical specifications

Reference example waste gas burner data sheets in Appendices 2 and 3.

Ownership

Ownership

Role	Title
Group	Engineering and Technical Solutions (ETS)
Owner	Norbert Schaeper, Engineering Manager, Engineering and Technical Solutions
Author	Jason Smith, ETS – Senior Mechanical Engineer

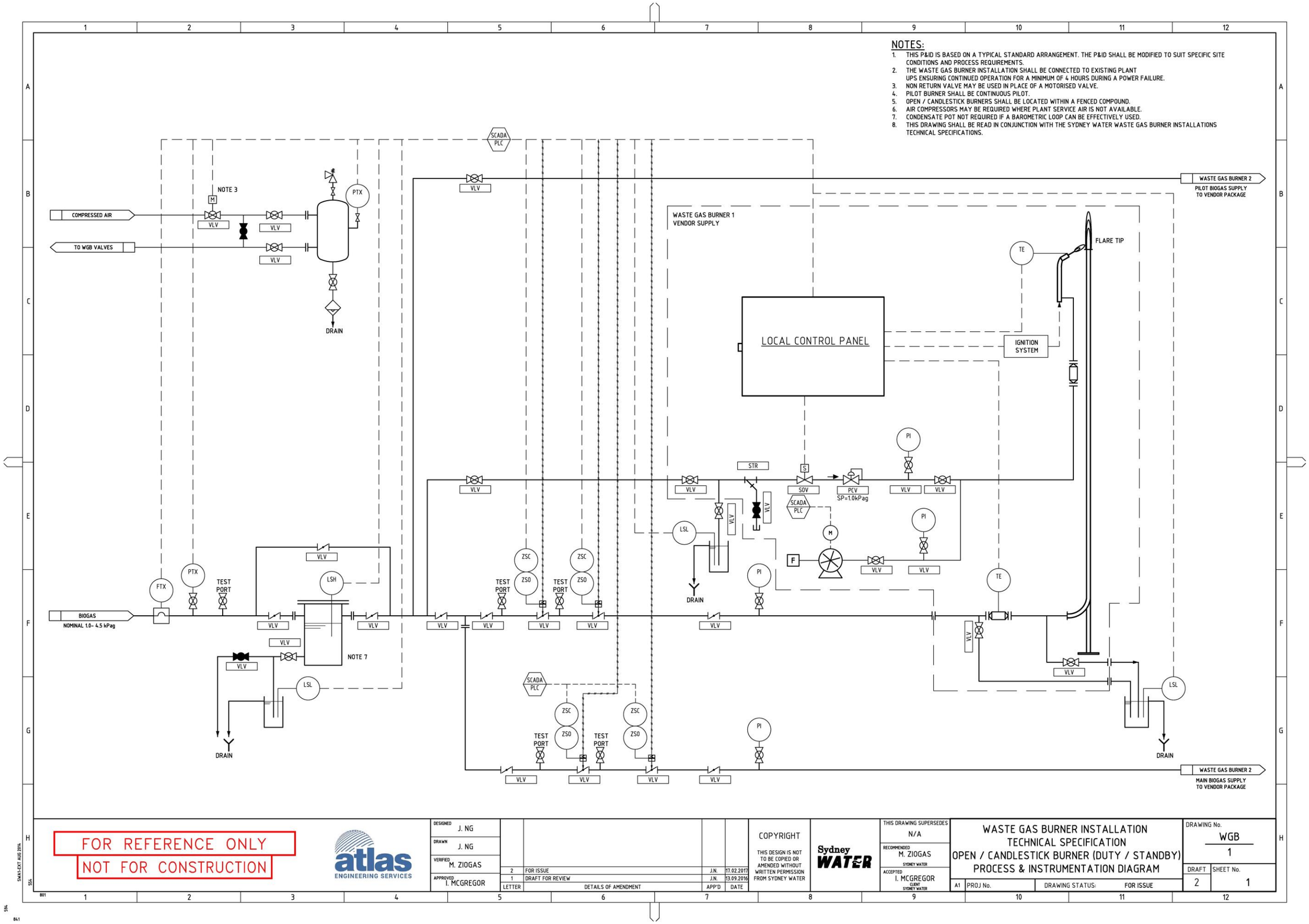
Change history

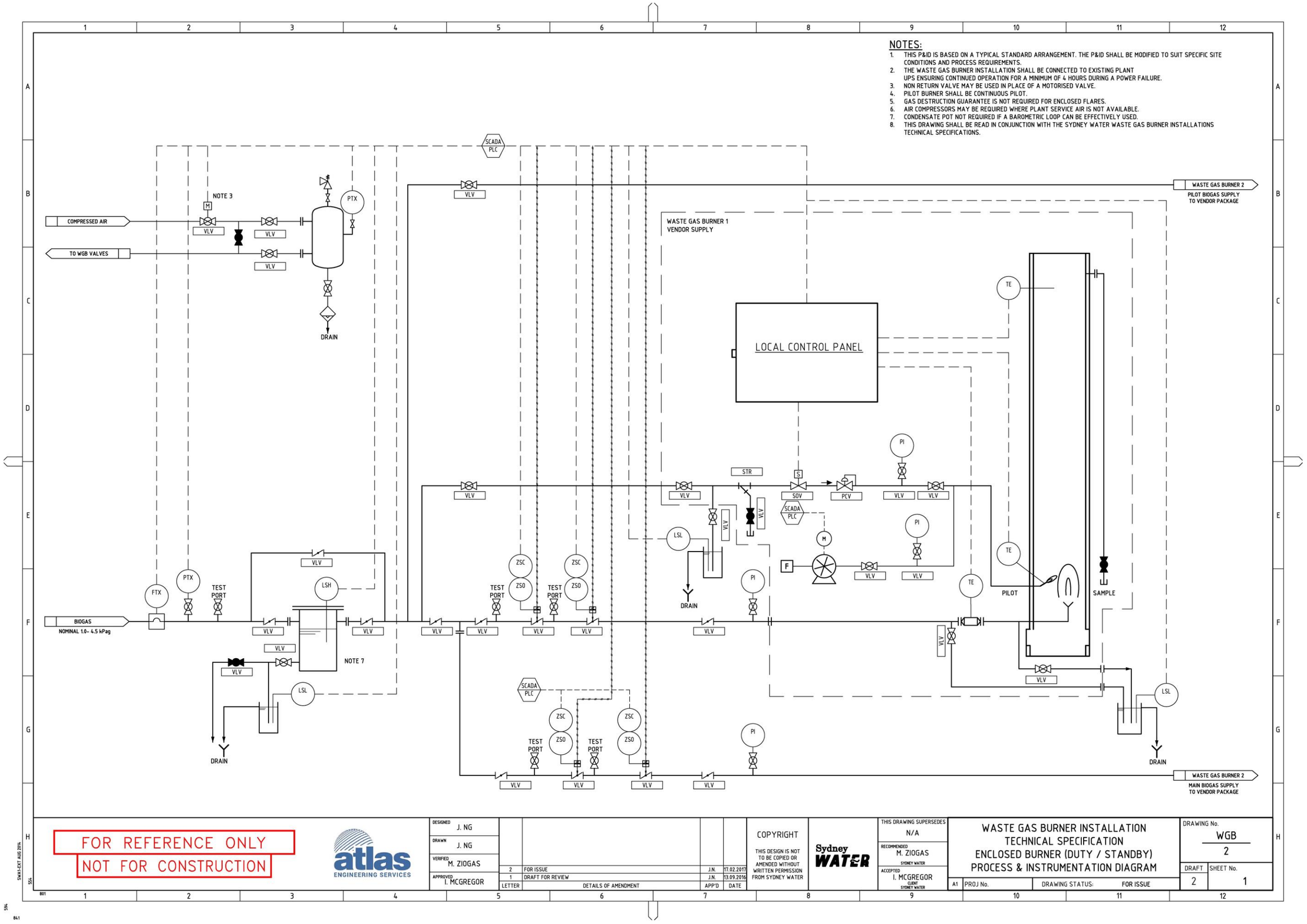
Version No.	Prepared by	Date	Approved by	Issue date
1	Jason Ng	22/12/2016	Mark Ziogas	22/12/2016
2	Jason Ng	13/02/2017	Mark Ziogas	13/02/2017
3	Jason Ng	17/02/2017	Mark Ziogas	17/02/2017
4	Mark Ziogas	02/03/2019	Jason Ng	02/03/2019
5	Mark Ziogas	12/09/2019	Jason Ng	12/09/2019
6	Mark Ziogas, Jason Smith	10/06/2021	Norbert Schaeper	10/06/2021
7	Jason Smith	21/09/2022	Norbert Schaeper	21/09/2022

Appendices

Attachment	Title
1	Reference Drawings
2	Candlestick (Open) Waste Gas Burner Example Data Sheet
3	Enclosed (Closed) Waste Gas Burner Example Data Sheet

Appendix 1 Reference Drawings

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1. THIS P&ID IS BASED ON A TYPICAL STANDARD ARRANGEMENT. THE P&ID SHALL BE MODIFIED TO SUIT SPECIFIC SITE CONDITIONS AND PROCESS REQUIREMENTS.
2. THE WASTE GAS BURNER INSTALLATION SHALL BE CONNECTED TO EXISTING PLANT UPS ENSURING CONTINUED OPERATION FOR A MINIMUM OF 4 HOURS DURING A POWER FAILURE.
3. NON RETURN VALVE MAY BE USED IN PLACE OF A MOTORISED VALVE.
4. PILOT BURNER SHALL BE CONTINUOUS PILOT.
5. GAS DESTRUCTION GUARANTEE IS NOT REQUIRED FOR ENCLOSED FLARES.
6. AIR COMPRESSORS MAY BE REQUIRED WHERE PLANT SERVICE AIR IS NOT AVAILABLE.
7. CONDENSATE POT NOT REQUIRED IF A BAROMETRIC LOOP CAN BE EFFECTIVELY USED.
8. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SYDNEY WATER WASTE GAS BURNER INSTALLATIONS TECHNICAL SPECIFICATIONS.
WASTE GAS BURNER 1
VENDOR SUPPLY
LOCAL CONTROL PANEL
SCADA PLC
COMPRESSED AIR
TO WGB VALVES
NOTE 3
PTX
DRAIN
VLV
WASTE GAS BURNER 2
PILOT BIOGAS SUPPLY
TO VENDOR PACKAGE
TE
PI
STR
SOV
PCV
LSL
M
F
PILOT
SAMPLE
BIOGAS
NOMINAL 1.0- 4.5 kPag
FTX
TEST PORT
LSH
NOTE 7
ZSC
ZSO
WASTE GAS BURNER 2
MAIN BIOGAS SUPPLY
TO VENDOR PACKAGE
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WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
ENCLOSED BURNER (DUTY / STANDBY)
PROCESS & INSTRUMENTATION DIAGRAM
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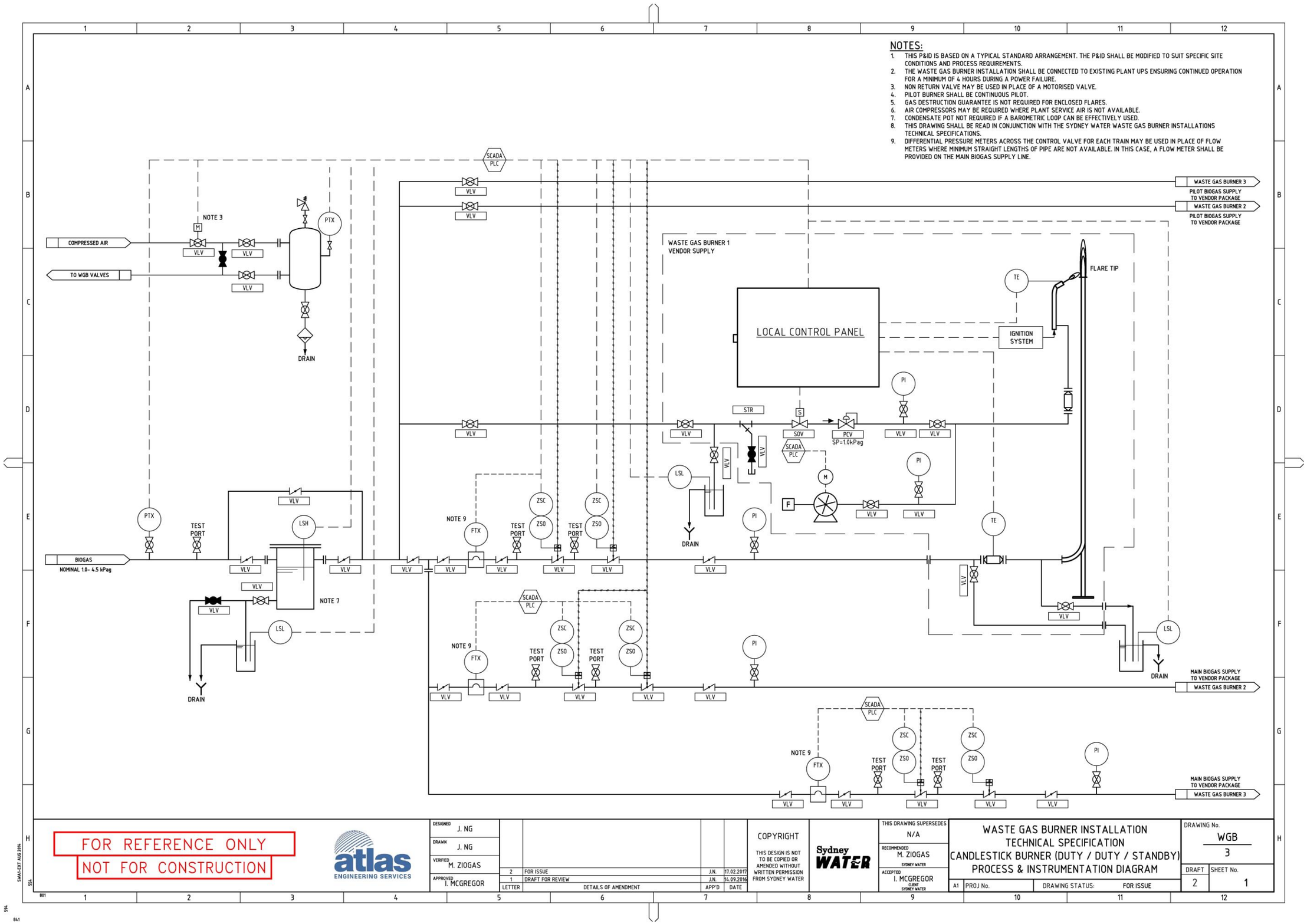
DRAWING No. WGB 2
DRAFT 2 SHEET No. 1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9. DIFFERENTIAL PRESSURE METERS ACROSS THE CONTROL VALVE FOR EACH TRAIN MAY BE USED IN PLACE OF FLOW METERS WHERE MINIMUM STRAIGHT LENGTHS OF PIPE ARE NOT AVAILABLE. IN THIS CASE, A FLOW METER SHALL BE PROVIDED ON THE MAIN BIOGAS SUPPLY LINE.
WASTE GAS BURNER 3
PILOT BIOGAS SUPPLY TO VENDOR PACKAGE
WASTE GAS BURNER 2
PILOT BIOGAS SUPPLY TO VENDOR PACKAGE
WASTE GAS BURNER 1 VENDOR SUPPLY
LOCAL CONTROL PANEL
IGNITION SYSTEM
FLARE TIP
COMPRESSED AIR
TO WGB VALVES
NOTE 3
DRAIN
BIOGAS
NOMINAL 1.0 - 4.5 kPag
NOTE 7
NOTE 9
MAIN BIOGAS SUPPLY TO VENDOR PACKAGE
WASTE GAS BURNER 2
MAIN BIOGAS SUPPLY TO VENDOR PACKAGE
WASTE GAS BURNER 3
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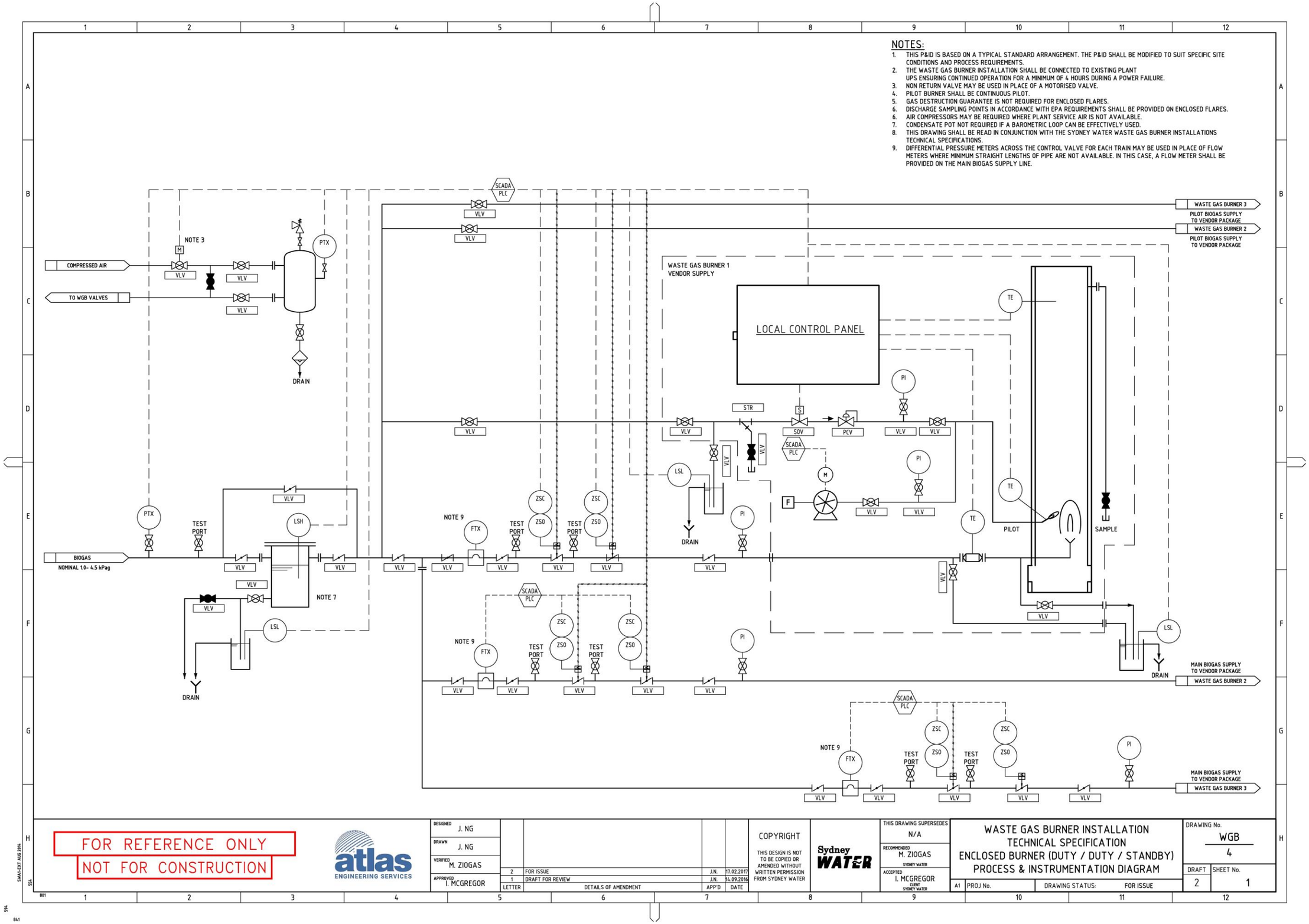
TECHNICAL SPECIFICATION
CANDLESTICK BURNER (DUTY / DUTY / STANDBY)
PROCESS & INSTRUMENTATION DIAGRAM
A1 PROJ No. DRAWING STATUS: FOR ISSUE
DRAWING No. WGB 3
DRAFT 2 SHEET No. 1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3. NON RETURN VALVE MAY BE USED IN PLACE OF A MOTORISED VALVE.
4. PILOT BURNER SHALL BE CONTINUOUS PILOT.
5. GAS DESTRUCTION GUARANTEE IS NOT REQUIRED FOR ENCLOSED FLARES.
6. DISCHARGE SAMPLING POINTS IN ACCORDANCE WITH EPA REQUIREMENTS SHALL BE PROVIDED ON ENCLOSED FLARES.
6. AIR COMPRESSORS MAY BE REQUIRED WHERE PLANT SERVICE AIR IS NOT AVAILABLE.
7. CONDENSATE POT NOT REQUIRED IF A BAROMETRIC LOOP CAN BE EFFECTIVELY USED.
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TEST PORT
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NOTE 7
BIOGAS
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PILOT
SAMPLE
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WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
ENCLOSED BURNER (DUTY / DUTY / STANDBY)
PROCESS & INSTRUMENTATION DIAGRAM
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NOTES:

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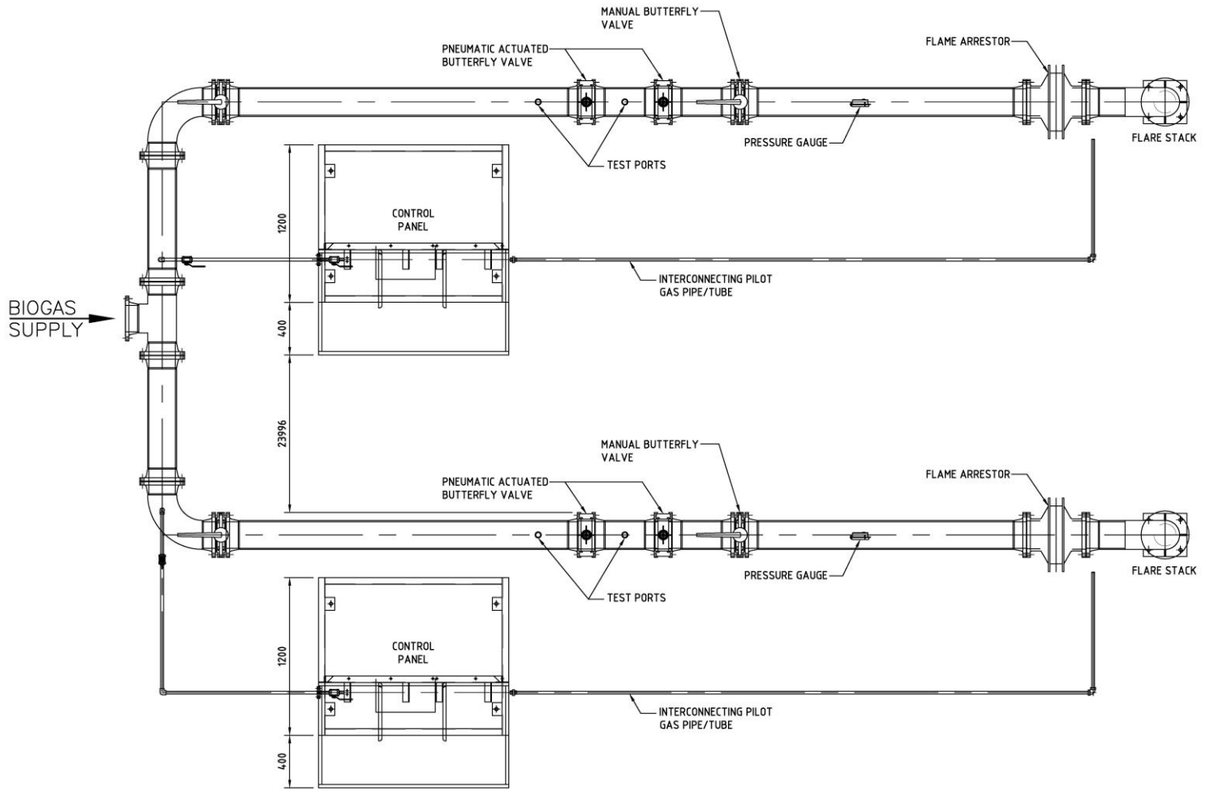
2. AUXILIARIES REQUIRED FOR THE INSTALLATION ARE NOT SHOWN AS THE REQUIREMENT AND LOCATION WILL BE SITE SPECIFIC, I.E. COMPRESSED AIR VESSEL, CONDENSATE POT.
3. MINIMUM CLEARANCE FOR MAINTENANCE AND OPERATION OF THE WASTE GAS BURNER AND IT'S COMPONENTS SHALL BE 1200mm. FOR RENEWAL OR MODIFICATION OF EXISTING INSTALLATIONS, 1000mm CLEARANCE MAY BE ACCEPTABLE SUBJECT TO SYDNEY WATER APPROVAL.
4. CONDENSATE POT NOT REQUIRED IF A BAROMETRIC LOOP CAN BE EFFECTIVELY USED.
5. MINOR PIPEWORK SUCH AS CONNECTING DRAWINGS NOT SHOWN FOR CLARITY.
6. PILOT PIPEWORK IS NOT SHOW IN ITS ENTIRETY. THE PILOT ARRANGEMENT MAY VARY DEPENDING ON VENDOR AND IGNITION TECHNOLOGY USED.
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SYDNEY WATER WASTE GAS BURNER INSTALLATIONS TECHNICAL SPECIFICATIONS.



OPEN/CANDLESTICK BURNER - PLAN
SCALE 1:20

0 200 400 600 800 1000 1200 1400 1600 1800 2000mm
SCALE 1:20 AT ORIGINAL SIZE

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WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
OPEN / CANDLESTICK BURNER
GENERAL ARRANGEMENT - PLAN

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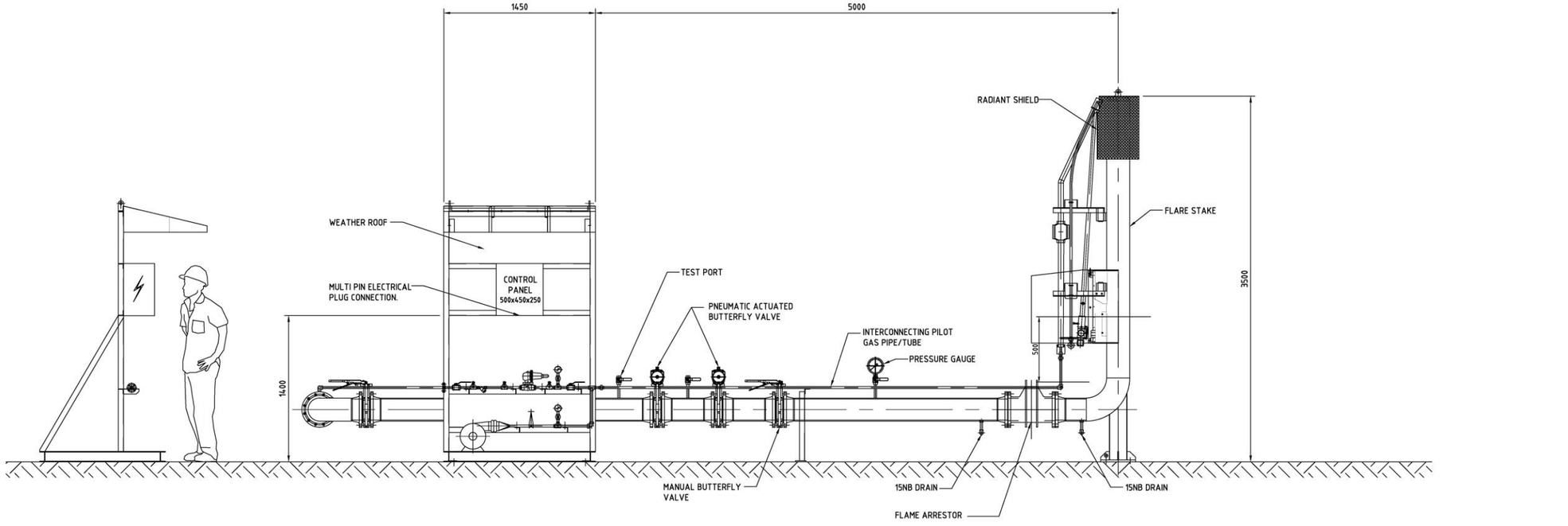
6. PILOT PIPEWORK IS NOT SHOW IN ITS ENTIRETY. THE PILOT ARRANGEMENT MAY VARY DEPENDING ON VENDOR AND IGNITION TECHNOLOGY USED.
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SYDNEY WATER WASTE GAS BURNER INSTALLATIONS TECHNICAL SPECIFICATIONS.
8. CANDLESTICK BURNERS SHALL BE INSTALLED WITHIN A SECURITY FENCED COMPOUND.



OPEN/CANDLESTICK BURNER - ELEVATION
SCALE 1:20

0 200 400 600 800 1000 1200 1400 1600 1800 2000mm
SCALE 1:20 AT ORIGINAL SIZE

FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

atlas ENGINEERING SERVICES

DESIGNED	J. NG
DRAWN	S.CALE
VERIFIED	M. ZIOGAS
APPROVED	I. MCGREGOR

LETTER	DETAILS OF AMENDMENT	APP'D	DATE
2	FOR ISSUE	J.N.	17.02.2017
1	DRAFT FOR REVIEW	J.N.	14.09.2016

Sydney WATER

THIS DRAWING SUPERSEDES: N/A
RECOMMENDED: M. ZIOGAS, SYDNEY WATER
ACCEPTED: I. MCGREGOR, CLIENT, SYDNEY WATER

WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
OPEN / CANDLESTICK BURNER
GENERAL ARRANGEMENT - ELEVATION

A1 | PROJ No. | DRAWING STATUS: FOR ISSUE

DRAWING No. WGB 6
DRAFT 2 | SHEET No. 1

SWA:EXT AUG 2014

NOTES:

1. THIS GENERAL ARRANGEMENT IS A ARRANGEMENT FOR A TYPICAL DUTY/STANDBY ENCLOSED WASTE GAS BURNER INSTALLATION. THIS ARRANGEMENT SHOWN IN THIS DRAWING SHALL BE MODIFIED AS REQUIRED TO SUIT SITE SPECIFIC INSTALLATIONS.
2. AUXILIARIES REQUIRED FOR THE INSTALLATION ARE NOT SHOWN AS THE REQUIREMENT AND LOCATION WILL BE SITE SPECIFIC, I.E. COMPRESSED AIR VESSEL, CONDENSATE POT.
3. MINIMUM CLEARANCE FOR MAINTENANCE AND OPERATION OF THE WASTE GAS BURNER AND IT'S COMPONENTS SHALL BE 1200mm. FOR RENEWAL OR MODIFICATION OF EXISTING INSTALLATIONS, 1000mm CLEARANCE MAY BE ACCEPTABLE SUBJECT TO SYDNEY WATER APPROVAL.
4. CONDENSATE POT NOT REQUIRED IF A BAROMETRIC LOOP CAN BE EFFECTIVELY USED.
5. MINOR PIPEWORK SUCH AS CONNECTING DRAWINGS NOT SHOWN FOR CLARITY.
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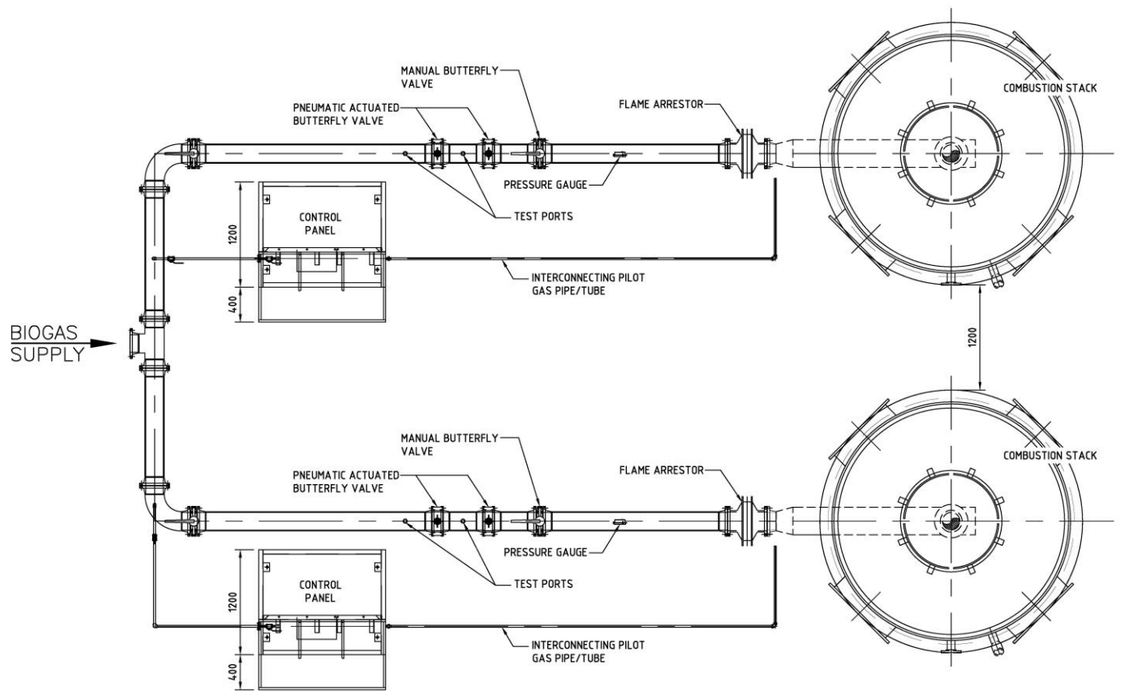
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SYDNEY WATER WASTE GAS BURNER INSTALLATIONS TECHNICAL SPECIFICATIONS.
8. COMBUSTION STACK SIZE AND HEIGHT WILL VARY DEPENDING ON PROCESS REQUIREMENTS AND EQUIPMENT VENDOR. ANY DIMENSIONS SHOWN ARE INDICATIVE ONLY.
9. 99% CONTAMINANT DESTRUCTION GUARANTEE IS NOT REQUIRED FOR SWC SITES.



ENCLOSED BURNER – PLAN
SCALE 1:30

0 300 600 900 1200 1500 1800 2100 2400 2700 3000mm
SCALE 1:30 AT ORIGINAL SIZE

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RECOMMENDED: M. ZIOGAS, SYDNEY WATER
ACCEPTED: I. MCGREGOR, CLIENT, SYDNEY WATER

WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
ENCLOSED BURNER
GENERAL ARRANGEMENT – PLAN

A1 | PROJ No. | DRAWING STATUS: FOR ISSUE

DRAWING No. WGB 7
DRAFT 2 | SHEET No. 1

NOTES:

1. THIS GENERAL ARRANGEMENT IS A ARRANGEMENT FOR A TYPICAL DUTY/STANDBY ENCLOSED WASTE GAS BURNER INSTALLATION. THIS ARRANGEMENT SHOWN IN THIS DRAWING SHALL BE MODIFIED AS REQUIRED TO SUIT SITE SPECIFIC INSTALLATIONS.
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4. CONDENSATE POT NOT REQUIRED IF A BAROMETRIC LOOP CAN BE EFFECTIVELY USED.
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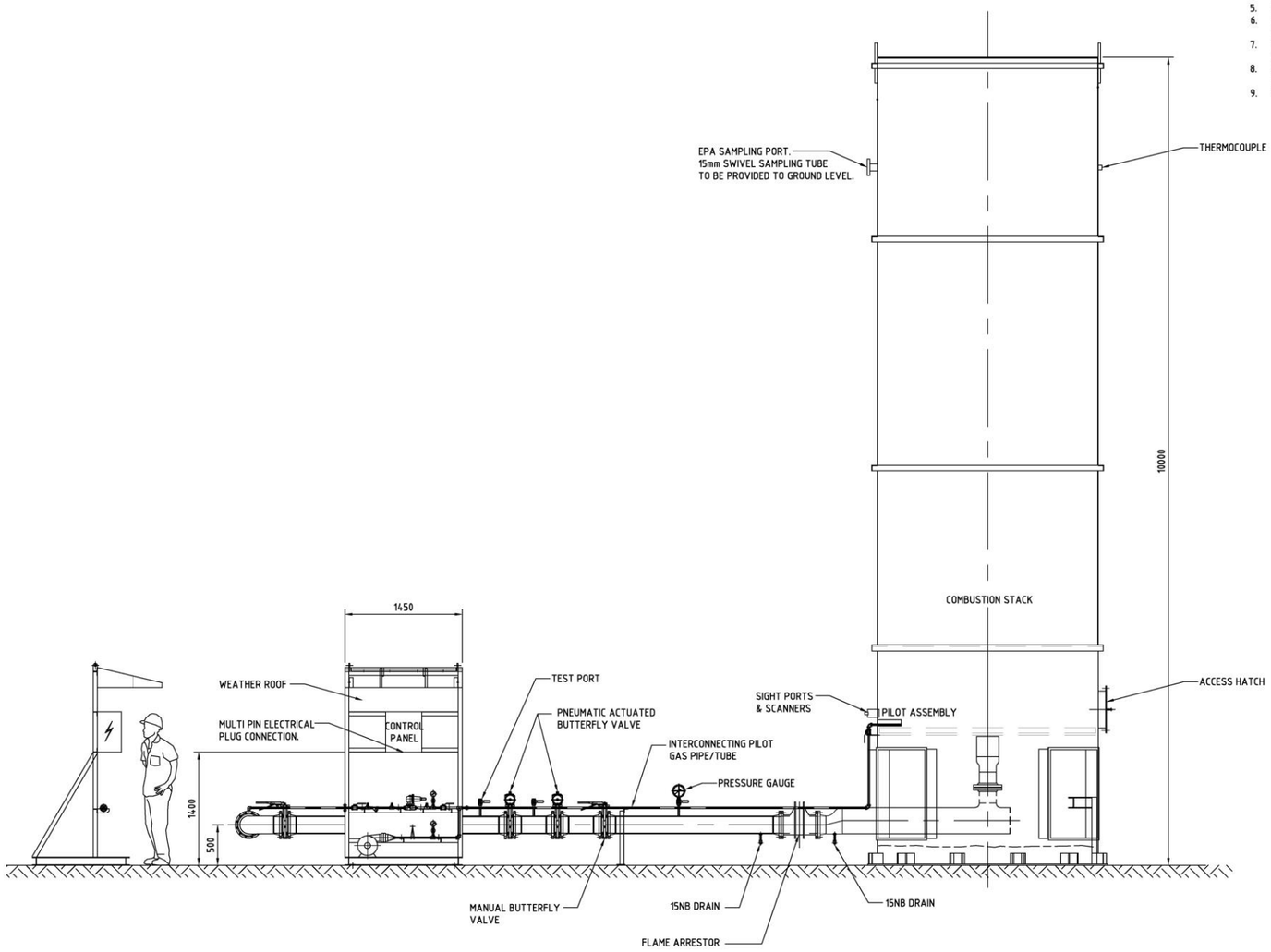
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SYDNEY WATER WASTE GAS BURNER INSTALLATIONS TECHNICAL SPECIFICATIONS.
8. COMBUSTION STACK SIZE AND HEIGHT WILL VARY DEPENDING ON PROCESS REQUIREMENTS AND EQUIPMENT VENDOR. ANY DIMENSIONS SHOWN ARE INDICATIVE ONLY.
9. 99% CONTAMINANT DESTRUCTION GUARANTEE IS NOT REQUIRED FOR SWC SITES.



ENCLOSED BURNER - ELEVATION
SCALE 1:30

0 300 600 900 1200 1500 1800 2100 2400 2700 3000mm
SCALE 1:30 AT ORIGINAL SIZE

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NOT FOR CONSTRUCTION

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DESIGNED	J. NG	
DRAWN	S.CALE	
VERIFIED	M. ZIOGAS	
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Sydney WATER

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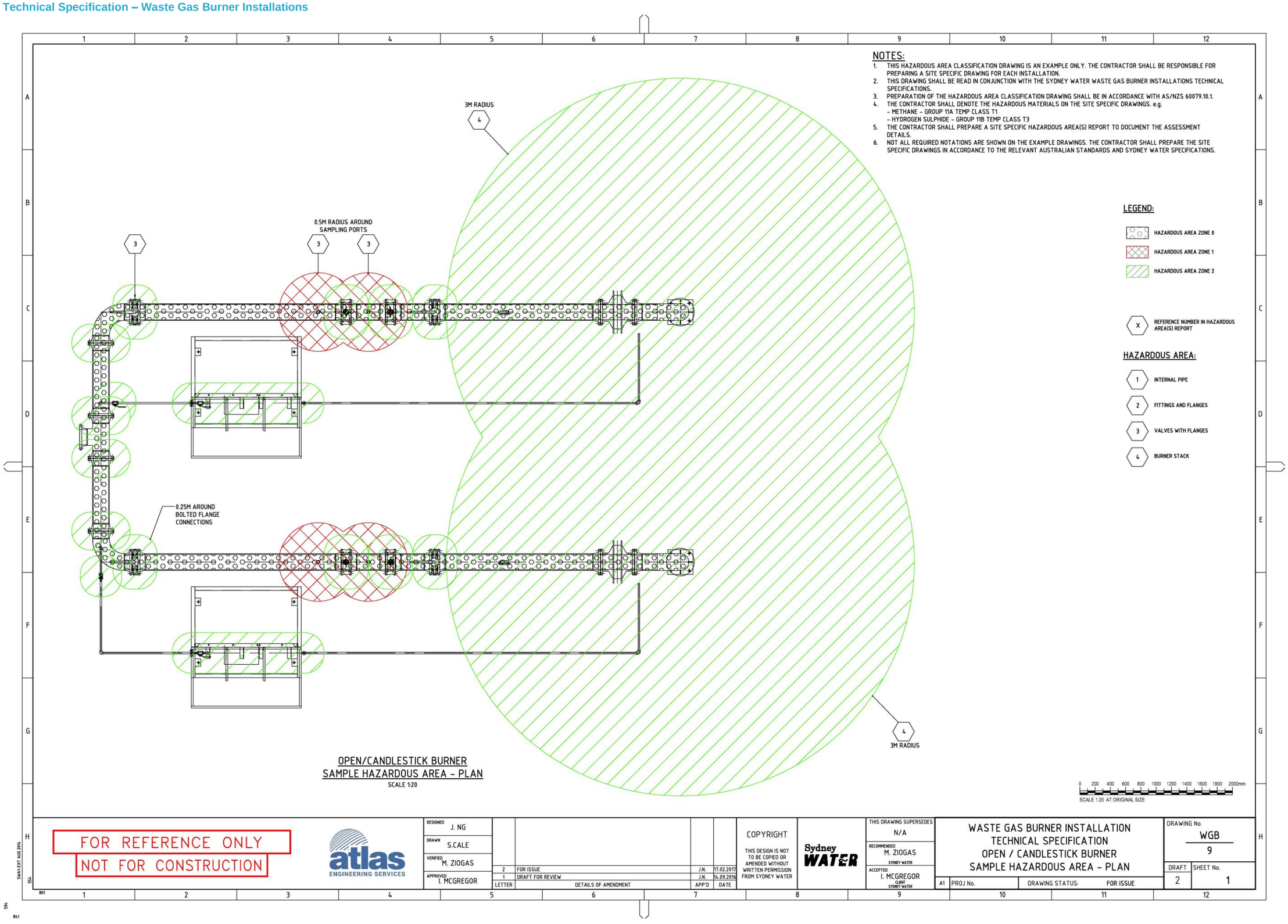
RECOMMENDED	M. ZIOGAS, SYDNEY WATER
ACCEPTED	I. MCGREGOR, CLIENT, SYDNEY WATER

WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
ENCLOSED BURNER
GENERAL ARRANGEMENT - SECTION

A1	PROJ No.	DRAWING STATUS:	FOR ISSUE

DRAWING No.	
WGB 8	
DRAFT 2	SHEET No. 1

SWA1-EXT AUG 2016


NOTES:
1. THIS HAZARDOUS AREA CLASSIFICATION DRAWING IS AN EXAMPLE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARING A SITE SPECIFIC DRAWING FOR EACH INSTALLATION.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SYDNEY WATER WASTE GAS BURNER INSTALLATIONS TECHNICAL SPECIFICATIONS.
3. PREPARATION OF THE HAZARDOUS AREA CLASSIFICATION DRAWING SHALL BE IN ACCORDANCE WITH AS/NZS 60079.10.1.
4. THE CONTRACTOR SHALL DENOTE THE HAZARDOUS MATERIALS ON THE SITE SPECIFIC DRAWINGS. e.g.
– METHANE – GROUP 11A TEMP CLASS T1
– HYDROGEN SULPHIDE – GROUP 11B TEMP CLASS T3
5. THE CONTRACTOR SHALL PREPARE A SITE SPECIFIC HAZARDOUS AREA(S) REPORT TO DOCUMENT THE ASSESSMENT DETAILS.
6. NOT ALL REQUIRED NOTATIONS ARE SHOWN ON THE EXAMPLE DRAWINGS. THE CONTRACTOR SHALL PREPARE THE SITE SPECIFIC DRAWINGS IN ACCORDANCE TO THE RELEVANT AUSTRALIAN STANDARDS AND SYDNEY WATER SPECIFICATIONS.
LEGEND:
HAZARDOUS AREA ZONE 0
HAZARDOUS AREA ZONE 1
HAZARDOUS AREA ZONE 2
X REFERENCE NUMBER IN HAZARDOUS AREA(S) REPORT
HAZARDOUS AREA:
1 INTERNAL PIPE
2 FITTINGS AND FLANGES
3 VALVES WITH FLANGES
4 BURNER STACK
3M RADIUS
0.5M RADIUS AROUND SAMPLING PORTS
0.25M AROUND BOLTED FLANGE CONNECTIONS
OPEN/CANDLESTICK BURNER
SAMPLE HAZARDOUS AREA – PLAN
SCALE 1:20
0 200 400 600 800 1000 1200 1400 1600 1800 2000mm
SCALE 1:20 AT ORIGINAL SIZE
FOR REFERENCE ONLY
NOT FOR CONSTRUCTION
atlas ENGINEERING SERVICES
DESIGNED J. NG
DRAWN S.CALE
VERIFIED M. ZIOGAS
APPROVED I. MCGREGOR
2 FOR ISSUE J.N. 17.02.2017
1 DRAFT FOR REVIEW J.N. 14.09.2016
LETTER DETAILS OF AMENDMENT APP'D DATE
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RECOMMENDED M. ZIOGAS SYDNEY WATER
ACCEPTED I. MCGREGOR CLIENT SYDNEY WATER
WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
OPEN / CANDLESTICK BURNER
SAMPLE HAZARDOUS AREA – PLAN
A1 PROJ No. DRAWING STATUS: FOR ISSUE
DRAWING No. WGB 9
DRAFT 2 SHEET No. 1

NOTES:

1. THIS HAZARDOUS AREA CLASSIFICATION DRAWING IS AN EXAMPLE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARING A SITE SPECIFIC DRAWING FOR EACH INSTALLATION.
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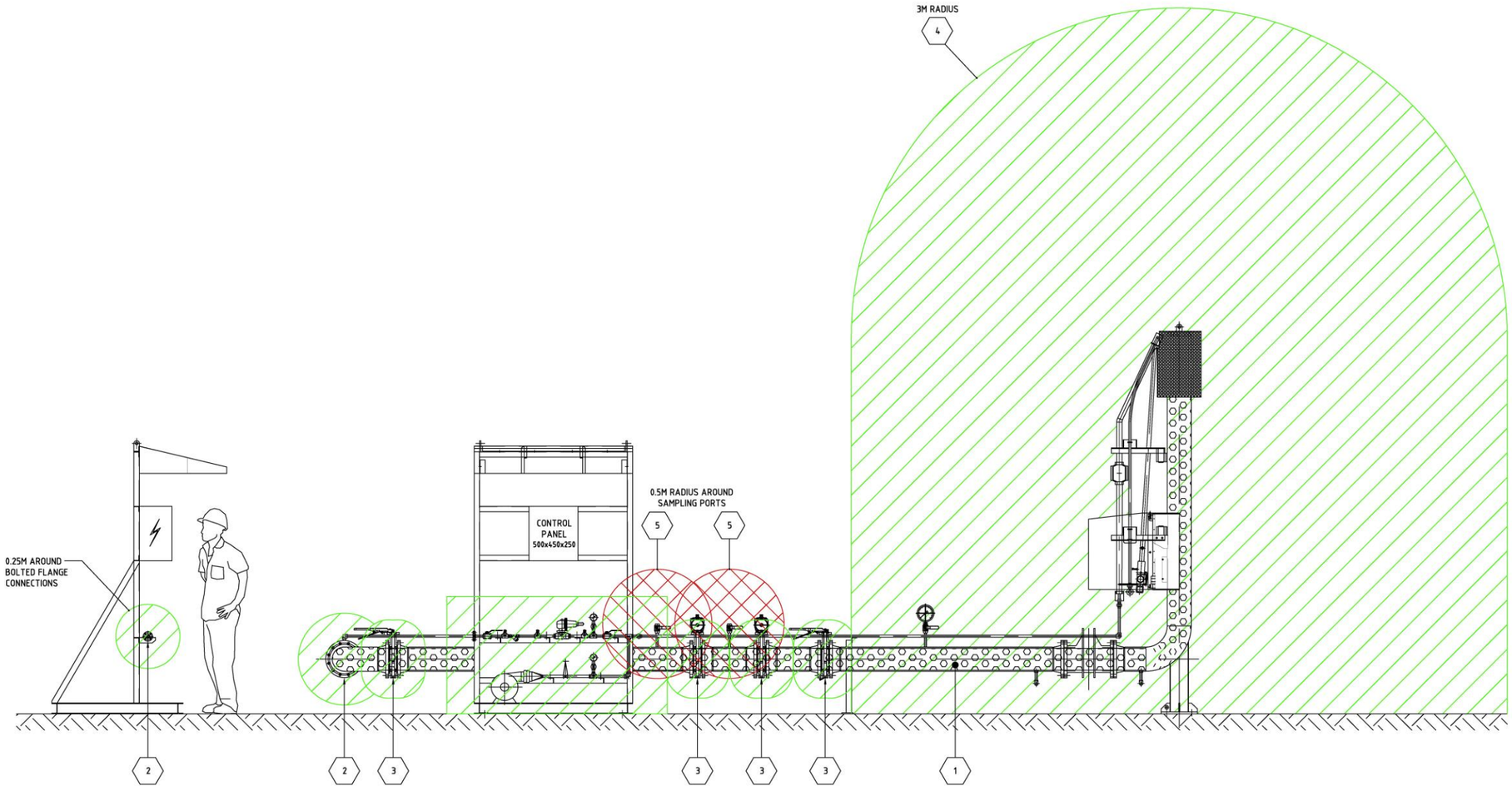

OPEN/CANDLESTICK BURNER
SAMPLE HAZARDOUS AREA – ELEVATION
SCALE 1:20

LEGEND:

- HAZARDOUS AREA ZONE 0
- HAZARDOUS AREA ZONE 1
- HAZARDOUS AREA ZONE 2
- X — REFERENCE NUMBER IN HAZARDOUS AREA(S) REPORT

HAZARDOUS AREA:

1. INTERNAL PIPE
2. FITTINGS AND FLANGES
3. VALVES WITH FLANGES
4. BURNER STACK

0 200 400 600 800 1000 1200 1400 1600 1800 2000mm
SCALE 1:20 AT ORIGINAL SIZE

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ACCEPTED	I. MCGREGOR, CLIENT, SYDNEY WATER

WASTE GAS BURNER INSTALLATION
TECHNICAL SPECIFICATION
OPEN / CANDLESTICK BURNER
SAMPLE HAZARDOUS AREA – ELEVATION

A1	PROJ No.	DRAWING STATUS:	FOR ISSUE

DRAWING No.	
WGB	10
DRAFT	SHEET No.
2	1

SWA-EXT AUG 2014

Appendix 2 Candlestick (Open) Waste Gas Burner Example Data Sheet

Project	
Item	
Tag Number (s)	
Quantity Required	

Specifications
Sydney Water Technical Specification – Civil (CPDMS0023)
Sydney Water Technical Specification – Mechanical (BMIS0209)
Sydney Water Technical Specification – Electrical (CPDMS0022)
Sydney Water Technical Specification - Commissioning - transitioning assets into operation
Sydney Water Technical Specification - Maintenance
Sydney Water Technical Specification - Waste Gas Burner Installations
WSA 201 - Manual for Selection and Application of Protective Coatings

Scope of supply
Two waste gas burner flares including pilot burner, ignition system, BMS (Burner Management System), control panel, main flame arrestor, pilot gas flame arrestor and combustion air fan(s) for pilot burner.
Delivery to site Witnessed testing at supplier's works Test documentation, drawings and manuals in accordance with Sydney Water Specifications Commissioning assistance and operator training. Note: Civil works, installation and tie-ins are excluded from Scope.

Item	Units	Requirement	Suppliers offer
VENDOR INFORMATION			
Function	-	Combustion of excess digester biogas	
Type	-	Candlestick - Open Flare	
Supplier	-	Supplier to advise	
Manufacturer	-	Supplier to advise	
Model	-	Supplier to advise	
Country of Manufacture	-	Supplier to advise	
DESIGN LIFE			
Years (before equipment replacement)	Years	25	
Duty	-	Duty / Standby, Duty / Assist, Duty / Duty / Standby, Duty / Duty / Assist	
AMBIENT CONDITIONS			
Ambient Environment	-	Inland	
Ambient Temperature Range	°C	0 to 45	
Ambient Humidity Range	% RH	5 to 95	
Maximum Design Temperature	°C	45	
Design Wind Speeds	km/h	177 or as per AS/NZS 1170.2:2011; whichever is more stringent	
Site Elevation	mAhD	20-100	
Solar Radiation	kW/m^2	1.0	
Installation Location	-	Outdoors	
Site Hazardous Zone	-	Class 1 Zone 1/2	
OPERATING CONDITIONS			
Process Medium	-	Digester Biogas	
Composition	-	60 % - CH_4, 36 % - CO_2, 0.1 % - H_2S, 1 % - H^2, 1 % - N_2	
Specific Gravity	-	0.9	
Moisture Content	-	100 % Saturated	
Pressure	kPaG	1.0 - 4.0	
Temperature	°C	35	
Density	Kg/m^3	1.087	
Dynamic Viscosity	cP	0.01305	
Service	-	Intermittent	
Flare System	-	Low Pressure	
Pressure Assisted	-	No	
Operation mode	-	Automatic Continuous Pilot	

PIPEWORK AND INSTALLATION			
Installation Location	-	Waste gas burner compound	
Duck Foot Stack Support	Yes / No	Yes	
Duck Foot Support Height	mm	Supplier to advise	
Main Gas Termination	mm	Supplier to advise	
Termination Connection Standard	-	Supplier to advise (i.e. ANSI 150#)	
Main Gas Supply Thermocouple	Yes / No	Yes, Type K	
Main Gas Flame Arrestor / Model	Yes / No	Supplier to advise	
Main Gas Flame Arrestor Size	mm	Supplier to advise	
Net free area available	m^2	Supplier to advise	
Pressure Drop across flame arrestor at design flow	kPa	Supplier to advise	
Flame arrestor Thermocouple	Yes / No	Yes, Type K	
Purge Reduction Seal	Yes / No	Supplier to advise	
Drain Connections	-	Supplier to advise	
Overall Skid Dimension (for transportation)	mm (W x L x H)	Supplier to advise NOTE: Skid must ensure walkway areas around the burner skid comply with minimum distances specified in Sydney Water Technical Specification - Civil (CPDMS0023) Sydney Water Technical Specification - Mechanical (BMIS0209)	
Weights			
Stack	kg	Supplier to advise	
Control Panel	kg	Supplier to advise	
Flame Arrestor	kg	Supplier to advise	
Skid Assembly (if Skid Mounted)	kg	Supplier to advise	
Overall Shipping Weight	kg	Supplier to advise	
PERFORMANCE			
Design Flow Capacity	Nm^3/h @ (1atm, 0°C)	300	
Turndown Capacity	1: X or unlimited	Supplier to advise / TBC	
Sterile Radius (4.73 kW/m^2)	m	Supplier to advise	
Sterile Radius (1.58 kW/m^2)	m	Supplier to advise	
Sound Pressure Level (SPL) at Stack Base	dB(A)	Supplier to advise	
Sound Pressure Level (SPL) at Sterile Radius	dB(A)	Supplier to advise	
Peak Radiation at Ground Level	kW/m^2	Supplier to advise	
Peak Radiation at Sterile Radius	kW/m^2	Supplier to advise	
Peak Exit Velocity	m/s	Supplier to advise	
PILOT SYSTEM			

Operation Type	-	Continuous	
No of allowable reignition cycles	-	Supplier to advise	
Supply Fuel	-	Digester Biogas	
Pilot line connection	mm	Supplier to advise (min 1” required)	
Mixing	Yes / No	Yes, Air Blower No, Venturi System	
Design Pressure Range	kPa	1-4.5	
Ignition System	-	Flame Front / High Energy Ignition / Other	
Pilot Flame Arrestor	Yes / No	Yes	
Pilot Flame Arrestor Size	mm	Supplier to advise	
Pilot Thermocouple	Yes / No	Yes, Type K	
Flame Trap Thermocouple	Yes / No	Yes, Type K	
Flame Check	Yes / No	Yes	
Flame Check Size	mm	Supplier to advise	
Air Blower			
Capacity	m^3/min	Supplier to advise	
Pressure	mBar	Supplier to advise	
Power Supply	V DC / V AC	24 / 240	
STACK			
Overall Height from Ground Level	m	Supplier to advise	
Stack Height	m	Supplier to advise, minimum of 5 meters	
Stack Diameter	mm	Supplier to advise	
Tip Diameter	mm	Supplier to advise	
Inlet Nozzle Size	mm	Supplier to advise	
Wind Shroud	Yes / No	Supplier to advise	
Nozzle Connection Standard	-	Supplier to advise (i.e. ANSI 150#)	
Support Method	-	Self-Supported	
Enclosure Thermocouple	Yes / No	Type K	
CONTROL PANEL			
Rain Canopy	Yes / No	Yes	
Canopy Lighting	Yes	Supplier to advise	
IP Rating	-	IP56	
Dimensions	mm (WxLxH)	Supplier to advise	
Power Supply	-	230 V AC 50 Hz	
CONSTRUCTION (as per Sydney Water Technical Specifications or better)			
Stack	-	SS316 / SS310	
Stack Wall Thickness	-	Supplier to advise	
Wind Shroud	-	SS316L	
Clips	-	SS316	

Flame Arrestor Body	-	SS316	
Flame Arrestor Inserts	-	SS316	
Piping	-	Schedule 10 SS316	
Flanges	-	SS316	
Gaskets (if applicable)	-	SS316	
Base Plate	-	SS316	
Fittings	-	SS316	
Isolation Valves	-	SS316	
Fasteners	-	SS316	
Skid Base	-	SS316	
Control Panel	-	SS316	
Supports	-	SS316	
Air Blower Body and Fan	-	Supplier to advise	
ACCESSORIES			
Ladder / Platform	-	Supplier to advise	
Personnel Shielding	-	Supplier to advise	
Thermal Insulation	Yes / No	Supplier to advise	
Insulation type and thickness	mm	Supplier to advise	
Awning Light	Yes / No	Supplier to advise	
EQUIPMENT LABELLING			
Label Material	-	Stainless Steel 316	
Information Required	-	As per Sydney Water Technical Specification – Mechanical	
Fixing Method	-	Oval Head Stainless Steel Screws	
Lubrication Label	-	Required	
PROTECTIVE COATINGS			
Requirements	-	As per WSA 201	
SPARE PARTS			
Years (Recommendation List)	Years	5	
Availability	-	Supplier to advise	
Warehouse location	-	Supplier to advise	
Pricing	-	Supplier to advise	
DOCUMENTATION & CERTIFICATION			
Drawings	-	Drawings to be provided in AutoCAD dwg format	
Radiation plot and isopleth map	Yes / No	Project specific	
Operation and Maintenance Manuals	-	As per Sydney Water Technical Specification – Commissioning – transitioning assets into operation, Sydney Water Technical Specification – Maintenance	
Reference Drawings	-	Project specific	

Reference Sydney Water Plants with similar equipment	-	Supplier to advise	
INSPECTION & TEST REQUIREMENTS			
Shop Inspection During Performance	-	Required (non-witnessed)	
Inspection and Test Plan	-	Required	
Radiation Plots			
1.58 kW/m^2	Yes / No	Required	
3.15 kW/m^2	Yes / No	Project specific	
4.73 kW/m^2	Yes / No	Required	
9.46 kW/m^2	Yes / No	Project specific	
On site commissioning assistance	-	Required	
Operator training	-	Required	
PERFORMANCE TESTING			
• As per Sydney Water Technical Specification – Commissioning – transitioning assets into operation • As per Sydney Water approved vendor Inspection Test Plan • As per project-specific Scope of Works			
GENERAL REQUIREMENTS			
• FAT test report shall be provided.			
SPECIFIC REQUIREMENTS			
• N/A			

Appendix 3 Enclosed (Closed) Waste Gas Burner Example Data Sheet

Project	
Item	
Tag number (s)	
Quantity required	

Specifications
Sydney Water Technical Specification - Civil (CPDMS0023) Sydney Water Technical Specification - Mechanical (BMIS0209) Sydney Water Technical Specification - Electrical (CPDMS0022) Sydney Water Technical Specification - Maintenance Sydney Water Technical Specification - Commissioning – transitioning assets into operation Sydney Water Technical Specification - Waste Gas Burner Installations WSA 201 - Manual for Selection and Application of Protective Coatings

Scope of supply
Two waste gas burner flares including pilot burner, ignition system, BMS (Burner Management System), control panel, main flame arrestor, pilot gas flame arrestor and combustion air fan(s) for pilot burner. Delivery to Site. Witnessed testing at supplier's works. Test documentation, drawings and manuals in accordance with Sydney Water Specifications. Commissioning assistance and operator training. Note: Civil works, installation and tie-ins are excluded from scope.

Item	Units	Requirement	Suppliers offer
VENDOR INFORMATION			
Function	-	Combustion of excess digester biogas	
Type	-	Enclosed - closed flare	
Supplier	-	Supplier to advise	
Manufacturer	-	Supplier to advise	
Model	-	Supplier to advise	
Country of manufacturer	-	Supplier to advise	
DESIGN LIFE			
Years (before equipment replacement)	Years	25	
Duty	-	Duty / Standby, Duty / Duty, Duty / Duty / Standby, Duty / Duty / Duty	
AMBIENT CONDITIONS			
Ambient environment		Inland	
Ambient temperature range	°C	0 to 45	
Ambient humidity range	%RH	5 to 95	
Maximum design temperature	°C	45	
Design wind speeds	km/h	177 or AS/NZS 1170.2:2011; whichever is more stringent	
Site elevation	mAhD	20 - 100	
Solar radiation	kW/m^2	1.0	
Installation location	-	Outdoors	
Site hazardous zone	-	Class 1 Zone 1/2	
OPERATING CONDITIONS			
Process medium	-	Digester biogas	
Composition	-	60 % - CH_4, 36 % - CO_2, 0.1 % - H_2S, 1 % - H_2, 1 % - N_2	
Specific gravity	-	0.9	
Moisture content	-	100 % Saturated	
Pressure	kPa G	1.0 - 4.0	
Temperature	°C	35	
Density	Kg/m^3	1.087	
Dynamic viscosity	cP	0.01305	
Service	-	Intermittent	
Flare system	-	Low pressure	
Pressure assisted	-	No	
Operation mode	-	Automatic Continuous Pilot	
PIPEWORK AND INSTALLATION			
Installation location	-	Waste gas burner compound	

Item	Units	Requirement	Suppliers offer
Burner assembly support	-	Supplier to advise support type	
Burner assembly support height	mm	Supplier to advise	
Main gas termination	mm	Supplier to advise	
Termination connection standard	-	Supplier to advise (i.e. ANSI 150#)	
Main gas supply thermocouple	Yes/No	Yes, Type K	
Main gas flame arrestor/model	Yes/No	Supplier to advise	
Main gas flame arrestor size	mm	Supplier to advise	
Net free area available	m^2	Supplier to advise	
Pressure drop across flame arrestor at design flow	kPa	Supplier to advise	
Flame arrestor thermocouple	Yes/No	Yes, Type K	
Purge reduction seal	Yes/No	Supplier to advise	
Drain connections	-	Supplier to advise	
Overall skid dimension (for transportation)	mm (WxLxH)	Supplier to advise NOTE: Skid must ensure walkway areas around the burner skid comply with minimum distances specified in Sydney Water Technical Specification - Civil (CPDMS0023) Sydney Water Technical Specification - Mechanical (BMIS0209)	
Weights			
Combustion chamber shell	kg	Supplier to advise	
Burner base	kg	Supplier to advise	
Control panel	kg	Supplier to advise	
Flame arrestor	kg	Supplier to advise	
Skid assembly (if skid mounted)	kg	Supplier to advise	
Overall shipping weight	kg	Supplier to advise	
PERFORMANCE			
Design flow capacity	Sm^3/h @ (kPa, ^0C)	300 @ (1.0, 35)	
Turndown capacity	1: X	Supplier to advise / TBC	
Sterile Radius (4.73 kW/m^2)	m	Supplier to advise	
Sterile Radius (1.58 kW/m^2)	m	Supplier to advise	
Sound Pressure Level (SPL) at Burner Base	dB(A)	Supplier to advise	
Sound Pressure Level (SPL) at Sterile Radius	dB(A)	Supplier to advise	
Peak Radiation at Ground Level	kW/m^2	Supplier to advise	
Peak Radiation at Sterile Radius	kW/m^2		

Item	Units	Requirement	Suppliers offer
Peak Exit Velocity	m/s		
PILOT SYSTEM			
Operation type	-	Continuous	
No of allowable reignition cycles	-	Supplier to advise	
Supply fuel	-	Digester biogas	
Pilot line connection	mm	Supplier to advise (min 1”required)	
Mixing	Yes/No	Yes, air blower. No, venturi system	
Design pressure range	kPa	1 - 4.5	
Ignition system	-	Flame front/High energy ignition	
Pilot flame arrestor	Yes/No	Yes	
Pilot flame arrestor size	Mm	Supplier to advise	
Pilot thermocouple	Yes/No	Yes, type K	
Flame trap thermocouple	Yes/No	Yes, type K	
Flame check	Yes/No	Yes	
Flame check size	mm	Supplier to advise	
Air blower			
Capacity	m^3/min	Supplier to advise	
Pressure	mBar	Supplier to advise	
Power supply	V DC / V AC	24/240	
COMBUSTION ASSEMBLY			
Burner head type	-	Supplier to advise	
No. of burner nozzles	-	Supplier to advise	
Nozzle type	-	Supplier to advise	
Burner orientation	-	Vertical/Horizontal	
Combustion chamber purging required	-	No. supplier to confirm	
Overall height from ground level	m	Supplier to advise	
Combustion chamber height	m	Supplier to advise	
Combustion chamber diameter	mm	Supplier to advise	
Trip Diameter	mm	Supplier to advise	
Inlet nozzle size	mm	Supplier to advise	
Wind shroud	Yes/No	Supplier to advise	
Nozzle connection standard	-	Supplier to advise (i.e ANSI 150#)	
Support method	-	Self-supported	
Enclosure thermocouple	Yes/No	Type-K	
CONTROL PANEL			
Rain canopy	Yes/No	Yes	

Item	Units	Requirement	Suppliers offer
Canopy lighting	-	Yes	
IP rating	-	IP56	
Dimensions	mm (WxLxH)	Supplier to advise	
Power supply	-	230 V AC 50 Hz	
CONSTRUCTION (as per Sydney Water Technical Specifications or better)			
Combustion chamber	-	SS316/SS310	
Combustion chamber thickness	-	Supplier to advise	
Burner base/pedestal/inlet manifold	-	SS316	
Clips	-	SS316	
Flame arrestor body	-	SS316	
Flame arrestor inserts	-	SS316	
Piping	-	Schedule 10 SS316	
Flanges	-	SS316	
Gaskets (if applicable)	-	SS316	
Base plate	-	SS316	
Fittings	-	SS316	
Isolation valves	-	SS316	
Fasteners	-	SS316	
Skid base	-	SS316	
Control panel	-	SS316	
Supports	-	SS316	
Air blower body and fan	-	Supplier to advise	
Air dampers (if applicable)	-	SS316	
Hatches	-	SS316	
Sigh port	-	Supplier to advise	
Refractory lining	-	N/A. Not accepted by SW	
ACCESSORIES			
Ladder/platform	-	Supplier to advise	
Personnel shielding	-	Supplier to advise	
Thermal insulation	Yes/No	Supplier to advise	
Insulation type and thickness	mm	Supplier to advise	
Awning light	Yes/No	Supplier to advise	
EPA sample ports	Yes (Number of ports)/no	Supplier to advise	
Sampling drop pipes	Yes/No	Supplier to advise	
Access hatches	Nos and type	Supplier to advise, hinged/bolted/others	
UV flame scanner	Yes/No	Supplier to advise,	
Air dampers	Yes (Number) /No	Supplier to advise,	

Item	Units	Requirement	Suppliers offer
Sight ports	Yes (Number) /No	Supplier to advise,	
EQUIPMENT LABELLING			
Label material	-	Stainless steel 316	
Information required	-	As per Sydney Water Technical Specification - Mechanical	
Fixing method	-	Oval head stainless steel screws	
Lubrication label	-	Required	
PROTECTIVE COATINGS			
Requirements	-	As per WSA 201	
SPARE PARTS			
Years (recommendation list)	Years	5	
Availability	-	Supplier to advise	
Warehouse location	-	Supplier to advise	
Pricing	-	Supplier to advise	
DOCUMENTATION & CERTIFICATION			
Drawings	-	Drawings to be provided in AutoCAD dwg format	
Radiation plot and isopleth map	Yes/No	TBC	
Operation and maintenance manuals	-	As per Sydney Water Technical Specification – Commissioning – transitioning assets into operation, Sydney Water Technical Specification – Maintenance	
Reference drawings	-	TBC	
Reference Sydney Water Plants with similar equipment	-	Supplier to advise	
INSPECTION & TEST REQUIREMENTS			
Shop inspection during performance	-	Required (non-witnessed)	
Inspection and test plan	-	Required	
Radiation plots			
1.58 kW/m^2	Yes/No	Required	
3.15 kW/m^2	Yes/No	TBC	
4.73 kW/m^2	Yes/No	Required	
9.46 kW/m^2	Yes/No	TBC	
On site commissioning assistance	-	Required	
Operator training	-	Required	
PERFORMANCE TESTING			
• As per Sydney Water Technical Specification – Commissioning – transitioning assets into operation • As per Sydney Water approved vendor Inspection Test Plan (ITP)			
GENERAL REQUIREMENTS			

Item	Units	Requirement	Suppliers offer
• FAT test report shall be provided			
SPECIFIC REQUIREMENTS			
• N/A			