

STEAM GENERATING PLANT

John Thompson Containerised Dual Fuel (Diesel/Gas) Fired Boiler



General Information: Thompson Redipac Package Steam Boiler

Dimensions LxWxH (mm) (Containerised):	1 x 20 foot and 1 x 10 foot, high cube containers
	Steamboiler: 6060 x 2500 X 2896 (excluding chimney stack)
	Water treatment: 3207 x 2440 x 2959
Mass (Dry) (kg) (Containerised, Empty Weight)	Steamboiler: 9600
NB: Must be transported empty of water & fuel:	Water treatment: 2900
Mass (Wet - Ready to operate) (kg) (Containerised):	Steamboiler: 13200 (Operating) ; 13900 (Fully flooded)
	Water treatment: 5400 (Operating); 6700 (Fully flooded)
Number of Boilers:	One
Nominal Rating:	3000 kg/h (from and at 100°C)
Actual Evaporation:	2511 kg/h (with feedwater at 20°C)
Working Pressure:	10 Bar
Design Pressure:	11 Bar
Fuel Specification (Relative Density):	Natural Gas 0,55 to 0,7 OR Light Fuel Oil (LFO):
Gross Calorific Value:	41,3 MJ/Nm ³
Fuel Specification (Kinetic Viscosity):	Diesel (LFO Light Fuel Oil) 1,5 to 5,5 mm ³ /s at 50°C
Gross Calorific Value:	45,476 MJ/kg
Fuel Consumption	LFO Fuel Burnt: 182,5Kg/h OR Natural Gas Fuel Burnt 200 Nm ³ /h
Health & Safety Standard:	EN12953 (Current Edition and Revision)

Boiler is supplied with the following:

3 Pass fire-tube pressure part comprising horizontal reverse flame fully wetback furnace and one convection spiral tube pass	Boiler mounted control panel complete with Lamtec BT340 burner controller for dual fuel firing
Front & rear smokebox door with heat shield covers	Boiler lagging grade 430 Finish 2B stainless steel cladding
Modulating pressure jet burner unit including gas control train, oil filter and oil flow meter	Set boiler valves and mountings with variable speed pump controls & screw down non-return valve
Automatic TDS Controller with water sample cooler	One boiler mounted feedwater pump complete with isolation valves and strainer
VSD modulating feedwater level controls	Feedwater flow meter
Boiler integral pipework	Cable trays fitted on boiler
Set of boiler tools and spares	Burner refractories
JT quality control data book and standard documentation	

Rand Air South Africa (Pty) Ltd

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General Information: Pressure Jet Dual Fuel Burner Unit

Number of Burners per Boiler:	One per Boiler
Burner Manufacturer:	FBR
Burner Type:	Modulating Pressure Jet
Fuel to be Fired:	Natural Gas (NG) and Light Fuel Oil (LFO or Diesel)
Inlet Fuel Pressure (Gas):	60-500mbar
Inlet Fuel Pressure (LFO/Diesel):	0,4 to 5 bar

Each Burner is supplied complete with the following:

Lamtec BT340 combustion control unit, air damper actuator & flame scanner	Direct spark ignition system and photo-electric cell
Integrated FD fan and wind box	Duel fuel firing head
Burner Manual	

LFO firing equipment comprising of the following:

Set of Nozzles and 2 sets of stainless steel braided fuel hoses (2,2m long)	Oil fuel filter & Burner head gasket
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One Natural Gas train comprising of the following:

One gas isolating valve	One gas filter unit
One turbine gas flow meter	Two gas pressure guages complete with isolation valves
One Dungs gas pressure regulator/over pressure slam shut valve	One pressure relief valve
Dungs valve block & Dungs VPS (valve proving system)	Low and high gas pressure switches

Control Panel

The combustion system control equipment is microcontroller based and mounted integral with the burner. The boiler control equipment is housed in a boiler mounted IP40 control panel which includes water level control circuits, feedwater pump variable speed drives and controls for boiler mounted feedwater pumps. Variable speed drives and controls for remote mounted pumps are not included in the panel. These can be provided in a separate panel for mounting local to the pumps as an option.

The control panel is rated IP40 and suitable for placement inside a boiler-house. The mild steel enclosure is epoxy powder coated Siemens Grey. Control is affected with labelled mounted control elements. The control panel is fitted with a terminal strip for interconnection to external equipment.

Switchgear used is Schneider or equivalent with WEG Inverters. Switchgear is supplied for the burner and feedwater pump. A PR pressure controller is used for steam pressure control and a Honeywell pressure stat is used for high-pressure cut-out. The boiler feedwater pump is driven by three phase Inverter.

The burner and feedwater pump have start/stop selectors and running and fault light indicators. Low and extra low water levels use sirens for audible alarms with pilot lights identifying these alarms.

Water level interlocking is based upon the use of a high integrity self-checking level probe and controller unit to provide the hardwired extra low water safety interlock. Water level regulation is based upon the use of a capacitance level probe and Shinko PID controller.

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A 2kVA uninterruptable power supply (UPS) is fitted in the panel to protect the sensitive electronic instrumentation such as:

- BT340 burner controller
- High integrity self checking extra low-level probe and controller
- High pressure cut-out switch
- TDS transmitter, conductivity sensor and analyser
- Capacity water level probe and pre-amplifier
- High pressure cut-out switch
- Boiler pressure transmitter

The control panel is boiler mounted as standard. Wiring between the control panel and the combustion equipment and boiler mounted controls is run in cable trays fixed to the boiler cladding. A remote mounting panel is available as an option in which case boiler wiring terminates in a boiler mounted junction box. Site wiring between the control panel and the junction box is not provided as standard.

One cross ventilated boiler/burner control panel houses:

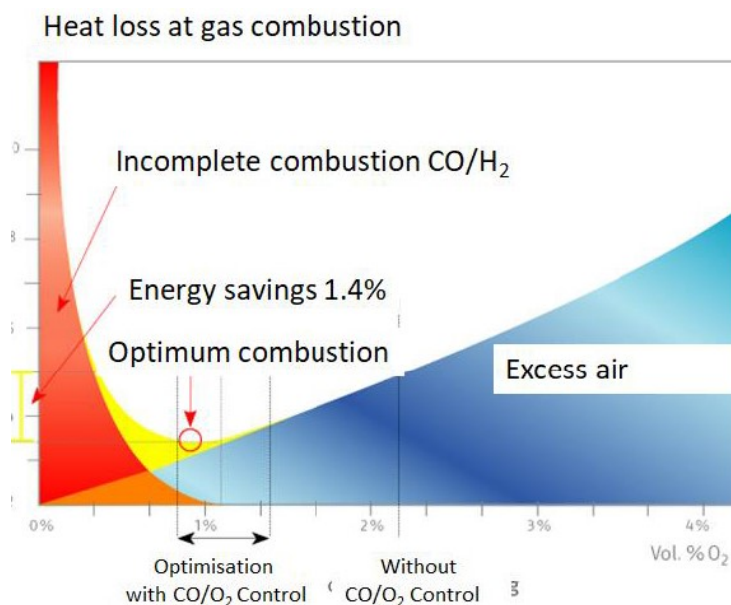
- Control switches
- VSD Drives
- Control and interlocking equipment
- Switchgear
- UPS
- Terminal rail

The Boiler Control Panel is designed to a fault level of less than 10kA and as is supplied with a Panel Test Certificate and an Electrical Certificate of Compliance (COC). The site voltage stipulated shall not vary greater than +/-10% with a frequency deviation of less than 2% and a phase-to-phase imbalance less than 3%.

The panel earth provided shall be certified to be less than 10 Ohms.

High efficiency and economical fuel usage

The Thompson Redipac boiler is of sturdy all welded construction with a robust design to achieve a typical life expectancy in the order of 25 years. The fuel usage over this period and associated running costs exceeds the capital investment by a large percentage and should be considered in the overall boiler selection. Lamtec combustion control equipment is utilised on the burner maintaining the lowest oxygen levels in combustion resulting in the highest heat value per kg of fuel burnt with the highest efficiency accuracy and repeatability.



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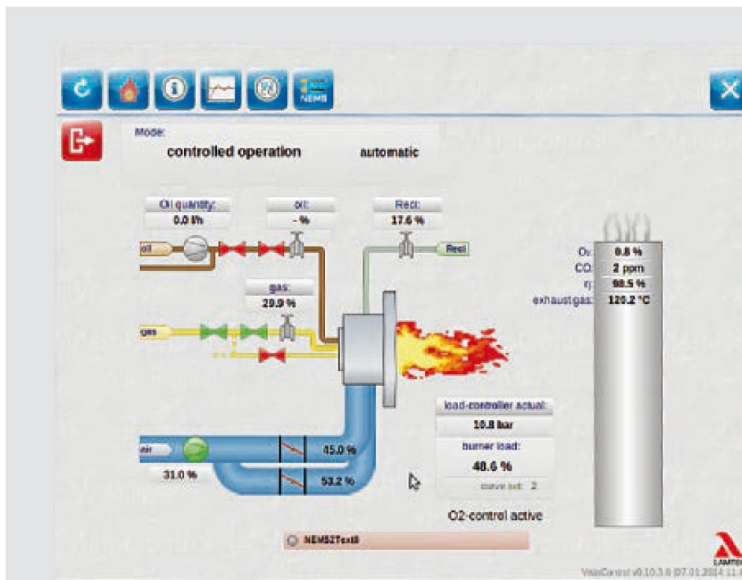
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HMI interface—Lamtec GKI300

The control panel fascia plate is fitted with a LAMTEC GKI300 10-inch touchscreen panel, through which the burner can be controlled (see example below)

Remote Monitoring Data Module

We have included a Modbus TCP/IP data module on the Lamtec controller for monitoring burner data. We have also provided the below signals and potential free contacts for your use.

Additional 4-20 mA signals provided:

Boiler water level sensor & pressure sensor

Additional potential free contracts provided:

All boiler common alarms

The touch screen has the advantages of all relevant information about the combustion system is displayed. At the same time, set point curves can be read and firing rate values pre-selected. The burner itself can be switched on or shut down by the GKI300. In the fault history list, the last 10 faults are saved and can be displayed. After start-up, a graphical representation of the burner is displayed for the user to visualize.

The following menus are available for users:

- Refresh
- Fuel-air ratio curves
- Close application
- Fault history
- Burner operation
- Firing rate controller
- Data setting

NEMS—Fault identification process indicator system

The identification of lock out conditions after the boiler has stopped is not always obvious. The failure of flame monitoring, boiler water level, oil temperatures or gas pressures are some common faults. In some instances, the offending controller or sensor may have a knock-on effect to other units in the control philosophy which makes determining the exact cause time consuming. To identify the cause of the problem may not be possible if the condition has corrected itself over time and may reoccur at a later time effecting steam production.

The NEMS fault identification indicator can be freely programmable to up to 16 various inputs. The indicator will identify which of the inputs has failed first eliminating the guess work resulting in the fastest remedy time by your service technician ensuring your boiler is returned to a safe and normal operating condition.

Remote Monitoring Data Module

We have included a Modbus TCP/IP data module on the Lamtec controller for monitoring burner data. We have also provided the below signals and potential free contacts for your use.

Additional 4-20 mA signals provided:

Boiler water level sensor & pressure sensor

Additional potential free contracts provided:

All boiler common alarms

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Boiler valves and mountings: Each boiler is provided with the following valves:

- | | |
|---|--|
| • One main steam isolating valve | • One main steam screw down non-return valve |
| • One safety valve | • One feedwater pump |
| • One feedwater check valve | • One air release valve |
| • One blowdown valve with key | • One water guage with protectors |
| • One inspector's test cock | • One rear spyglass isolating valve |
| • One set feedwater suction isolation valve(butterfly) & strainer | • Strainer |

All valves are flanged EN1092 where relevant, connections are screwed BSP. The valves are of ARI manufacture or equal, at our option unless otherwise stated.

Standard Instrumentation: Each boiler is provided with the following instrumentation:

- | | |
|--|--|
| • One high pressure cut-out switch complete with cooling tower & isolation valve | • One capacitance water level probe c/w water level chamber, isolating & drain valves |
| • One high integrity self-checking extra low-level alarm probe & controller | • One TDS transmitter c/w conductivity sensor, analyser, water sample cooler, strainer & isolation valves. |
| • One boiler pressure transmitter | • One boiler pressure guage with isolating valve & test cock |
| • One boiler flue gas temperature guage | • One water flow meter complete with pulsing unit |

Automatic extra low water hardwired interlock

Safety Requirements:

To comply with the European Standard EN 12953-1, the extra low water limiter employed in the John Thompson EN series of boilers is a top-mounted high integrity self-checking probe used along with a controller for automation of this function.

Operation:

An automatic cyclic test of the probe, probe cable, and controller is carried out every few seconds by internally simulating a fault in the probe. A test button is fitted so that a full test of the probe, controller, and associated circuits can be carried out by a competent person.

The controller is normally configured to lockout the boiler when the level is outside predetermined limits.

The controller compares the resistance to earth from the probe, through the water, to the boiler shell. If a change in water level causes this resistance to change beyond a set limit, a timer is engaged which alters the state of internal relays after a pre-set delay. This signal is normally used to trigger an alarm and lock-out the boiler.

Variable speed feed water pump control

The advantage of the variable speed pump control is that it maintains a more constant water level which reduces the pressure variation associated with "on - off" control reducing fatigue which would lengthen the operating life of the boiler. The constant feed of water into the boiler in relation to the steam produced reduces steam pressure fluctuations which minimizes the firing rate changes resulting in a more constant air/fuel ratio and reduced fuel consumption.

Auto TDS Control Equipment

The conductivity controller samples the boiler water at regular intervals. When the TDS level rises above the pre-set level the solenoid valve remains open and bleeds off the high conductivity water reducing the TDS to the desired level. This control system minimises water, chemical and heat wastage. This equipment is supplied with a water sampling cooler for safe and accurate water sampling.

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Auto TDS Control Equipment (Continued)

The TDS control equipment comprises the following:

- Conductivity controller & conductivity probe
- 24V solenoid valve
- Manifold & fittings
- Water sampling cooler
- Isolating valves
- Installation and electrical connection to the boiler

Blowdown vessel

Number of Vessels:	One
Vessel Model:	BDV 10—32
Code of Construction:	BS EN 13445-3: 2014+A4:2018
Design Pressure:	700 kPa
Test Pressure:	1250 kPa
Capacity:	2262 ℓ (flooded)
Operating Pressure:	Less than 40 kPa
Maximum temperature under normal operation:	40°C

The blowdown vessel is of all welded construction with inlet, drain and vent connections

Note: Prolonged boiler blowdown will raise the temperature of the overflow water in the blowdown vessel or blowdown sump which may damage the effluent system. The effluent pipework should be of baked clay or metal construction. The use of PVC or similar materials should be avoided.

Chimney Stack

Stack Type:	Guyed, incl. stack sections, 3 sets of Galvanised guy wires & fittings.
Nominal Diameter:	400 mm
Nominal Height:	10,4 m from floor level
Mounting:	Boiler
Construction Material:	Mild Steel
Lagging:	None
Cladding:	None
Stack:	BS EN 1993-3-2:2006

Pre- Boiler Plant: Water Softener

Softener Type:	Duplex
Number of Softeners:	2 (One duty & one standby)
Make-up Capacity:	3000 ℓ/h
Hours of Operation & Condensate return:	24 hrs/day & 0%
Total Make-Up Hardness:	150 mg/ℓ as CaCO ₃
Make-Up Supply Pressure:	2,5 to 5,5 bar

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Pre– Boiler Plant: Water Softener (2)

Each water softener is supplied complete with the following:

Skid Frame, ion exchanger & brine tank	Make-up water pressure relief valve, pressure guage & flow meter
Interconnecting, bypass and drain pipework	50 5g Salt
Electrical plug connections (220V) to be supplied by customer for electrical connection of water softener and chemical dosing units.	

Chemical Dosing Unit: For the chemical treatment of the boiler make-up water we offer the following:

Number of Units:	Two
Dosing Capacity:	2,1 l/hr @ 700kPa
Dosing Control:	Proportional to make-up
Dosing Point:	Feedwater tank

Each chemical dosing unit is supplied complete with the following:

- Chemical dosing pump with dosing line, water impulse meter and electronic dosing controls
- Chemical mixing tank with bundwall

The meters are located in the make-up line to the feed tank and the feed line to the boilers effects dosage proportional to make-up and feed by initiating the dosing pump operation through the electronic control. Start-up chemicals comprising:

- 25 kg anti corrosion
- 25 kg oxygen scavenger

Feed Water Storage Tank:

Number of tanks:	One
Nominal Vessel Storage Capacity:	2750 l
Construction Material:	Mild Steel
Stand Height:	1,4m
Lagging and Cladding:	None

Each feedwater storage tank is supplied complete with the following:

Storage vessel with connections as follows:

- Make-up water inlet, feedwater outlet and condensate return complete with sparge pipe
- Drain and overflow
- Temperature guage
- Standard float operated level control valve
- Floor support

Containerised Boiler & Ancillaries:

Number of Containers:	Two
Container Sizes:	1 x 20Foot & 1 x 10Foot, high cube containers
Construction Material:	Mild Steel
End Access Doors:	Full open on both sides

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Containerised Boiler & Ancillaries: (Continued)

Side Access:	Sliding door, single access door (main container) & Single access door (ancillary container)
Louvres:	On both containers
Top Access:	On main container for access to boiler valves
Colour: Undercoat & Topcoat	One coat spray application each

Containers: Electrical & Lighting

Distribution Board:	One
Electrical Switchgear:	1 x 63A 3ph main, 1 x 50A 3ph boiler control, 1 x 20A single phase plug circuit & 1 x 16A single phase light circuit
Double Industrial Plug Outlets:	Three
Inside Lighting:	Six (5ft double vapour proof fittings with LED Tubes)
Outside Lighting:	Eight (20w LED flood lights on outside corners)
CoC for Electrical Installation:	Provided

Terminal Points:

Gas - Mains gas inlet flange on gas train at wall of main container

Oil - Inlet and return connections at wall of main container

Feedwater - Potable water inlet connection on water softener in ancillary container

Main steam - Discharge flange on main steam line at the wall of the main container

Blowdown - Discharge flange of blowdown pipework from the boiler at the wall of the main container

Blowdown - Inlet flange of blowdown pipework to blowdown vessel at the wall of the ancillary container

Boiler Drains - Discharge of drain header pipework at the wall of the main container Inlet of drain pipework to blowdown vessel at the wall of the ancillary container

Boiler Drains - Discharge of drain pipework from the blowdown vessel at the wall of the ancillary container, to effluent

Safety Valve Escape - Discharge of safety valve escape pipework protruding from the side of the main container

Flue Gas - Discharge flange on boiler rear smokebox

Flue Gas - Inlet and outlet flanges of stack section

Electrics - Mains supply connection in distribution board in main container

Site Conditions:

The equipment offered is designed to operate under the site conditions as follows:

Site Location:	South Africa
Site Altitude:	Sea level to 1800 m.a.s.l.
Power Supply:	400 Volt/3 Phase or 50 Hz / 4 Wire
Control Voltage:	230 Volt

Our boiler and control panels are designed for indoor use in a safe non-hazardous area.

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Exclusions:

Our offer does not include for any equipment or service not specifically mentioned and for your guidance we highlight the following exclusions in particular:

- Mains gas storage and supply system prior to gas train inlet flange at main container wall
- Fuel oil storage and supply system (ie. ringmain consisting of oil meter/s, oil filter/s, oil heater/s, oil pump/s) prior to oil inlet and outlet connections at main container wall
- Mains electrical connection into the distribution panel in the main container and electrical earthing
- Foundations, civil works, stack anchor points, civil design
- Transport of containers and equipment to site
- Off-loading from transport vehicle/s and placing of containers
- All services pipework, main steam pipework and condensate return pipework connected to the various points at/in the containers
- Lagging and cladding of stack, feedtank and pipework other than the main steam line in the main container
- Cost of commissioning outside of RSA (air fare, accommodation, transport, duties, visas, taxes, permits etc.)
- Employment of Authorised Inspection Authority as required by the Pressure Equipment Regulation covering inspections before, during and after the site hydraulic test
- Preparation and performance of regulation site hydraulic test for the Authorised Inspection Authority
- Training of maintenance or boiler operating staff other than informal site instruction during commissioning
- Fuel, water, power, chemicals, and operating labour required for commissioning
- Specialised equipment testing (Efficiency, Emissions etc.)
- Permanent site safety officer, site offices, notice boards, Gantt charts, weekly progress reports, etc.
- Compliance with Construction Regulations
- Boiler registration with the Department of Labour
- Permissions required under the NEM-AQA or involvement in any EIA application (we will provide all the process data for the boiler/s as required for any application)
- Any item of equipment or services not specifically offered

Feedwater Specifications:

The required water specifications to the water treatment plant should be as follows:

- Make-up supply water pressure between 2.5 and 5.5 bar (max)
- pH between 8,5 and 9,5.

We highly recommend the use of softened water to ensure optimum performance and extended life of the boiler. The boiler and feedwater should be within the recommendations of EN12953-10.

A copy of the recommended boiler and feedwater specifications is attached.

Chimney Height Acceptance:

All users of fuel burning appliances must comply with the Government Regulations concerning the National Environmental Management Act: Air Quality Act, 2004 (Act no 39 of 2004) before installing and operating boiler-plant. The height of the chimney must therefore be accepted by the local Air Quality Officer and in view of this, the nominal height quoted may be subject to price alteration depending upon the final accepted height and design.

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Noise Levels:

When the REDIPAC boiler is installed in a large boiler-house where the multiple reflection is small, the noise level from the boiler at a 3 m reference radius complies with the requirements of the Occupational Health and Safety Act, 1993. (85 dBA). When the REDIPAC boiler is installed in a small boiler-house where the multiple reflection is high, the customer is advised to consult an acoustics expert for recommendations on damping these reflections.

If an authority, in whose area the boiler is to be installed, requires a reduction in the noise level specified in the above Act, the customer must establish what this additional requirement is in order to ensure that the complete boiler-plant installation, including the boiler-house, complies with these requirements.

In all cases it is the customer's responsibility to ensure that the boiler-house is acoustically treated, when necessary, to meet the requirements of the authorities.

Safety, Health & Environmental Compliance (SHE):

All equipment manufactured and supplied by John Thompson fully complies with South African Legislation, in particular the Pressure Equipment Regulations (PER), SANS 329 and SANS 347. Every boiler is classified as a Category IV vessel and AIA (Lloyds Register) verification and inspection during manufacture is included as standard.

The Occupational Health and Safety Management System of John Thompson is accredited to ISO 45001:2018 and listed accordingly. The scope of which includes the design and manufacture of industrial watertube boilers, fire-tube boilers and pressure vessels.

The boiler itself is built to the most modern health and safety standard available, EN 12953. This standard specifies safety devices in excess of the norm. Please refer to our specification for full details.

Our design, service and commissioning engineers are all Registered Gas Practitioners in terms of the PER.

Sites, where we erect and commission plant, are run in accordance with the Occupational Health and Safety Act. Site specific SHE requirements can also be accommodated.

Quality Assurance:

The quality management system of John Thompson is accredited to ISO 9001:2015 by DQS and listed accordingly. The scope of which includes the design and manufacture of industrial watertube boilers, fire-tube boilers, and pressure vessels. John Thompson is also accredited to ISO 14001:2015 for its Environmental Management System.

John Thompson has designed and built equipment in accordance with a number of international standards and specifications. These include AD Merkblatter, ASME, British Standard Specification, ANCC (Italian), and TRD. All boilers and pressure vessels manufactured at our premises are inspected and approved by Lloyds Register of Industrial Services as an approved manufacturer for Class I fusion welded pressure vessels.

Main Steam Pipework:

To comply with the Pressure Equipment Regulations and SANS 347 all steam pipework with an operating pressure of 0.5 bar and above is to be designed in accordance with BS EN 13480-3:2017 and is to be submitted to an Approved Inspection Authority (AIA) for approval. The AIA for this project will be Lloyds Register.

Should the scope of supply be revised to include the main steam pipework John Thompson will supply for approval by your AIA the following documents in order for the Pressurized System to be certified:

- | | |
|--------------------------------|---|
| • Material certificates | • Welder Qualifications |
| • Design drawing and site plan | • Approval of drawing and calculations by AIA |

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