63mm Furnace System

with 380182A 50mm graphite set and 282701A Radiation Shield set

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Introduction

The graphite resistance furnace provides the heat necessary to melt preforms up to 50mm in diameter and draw fibre from its tip over a range of speeds. It is supplied with direct current (DC) from a 3-phase transformer and diode array by semi-flexible copper busbars. The furnace body and transformer are water cooled and the furnace temperature is monitored by an infra-red pyrometer mounted on the side of the furnace body.

Inert gas is supplied through four ports to maintain an oxygen free environment in the heating zone when the furnace is in use. When not in use the furnace is stored under a vacuum. Alarm systems are fitted to both the inert gas and water cooling circuits.

(Drawings 380183A, 284329A, 284330A, 284341A, 288918A, 288929A, 289091A, 380033A, 282701A, 284266A, 285186A, 286001A & 288976A refer).

Description

Furnace Assembly

A furnace assembly of 63 mm (capable of accepting graphite furniture of up to 63mm diameter; for 50mm diameter preforms) is supplied. The furnace is of an electrical resistance type based on a graphite heating element. The furnace has a top and bottom aperture. The top aperture is formed by a disc matched to preform diameter and the bottom aperture, located on the narrow bottom extension assembly, is a small hole formed between two sliding doors.

Inert gas, used to purge the furnace and maintain an oxygen free environment in the heating zone when the furnace is in use, is supplied through four ports. When not in use the furnace may be stored under a vacuum to prevent the graphite element absorbing moisture and reactive gases. The furnace has individual water cooling circuits for the furnace body, the power conductor flanges, top and bottom cover flanges, top ring and the bottom extension. Both the inert gas purging and the cooling

water systems are fitted with alarms which shut down the furnace in the event of a malfunction.

To accommodate a temperature range of 800-2350 deg C with a control range of +/- 1 deg C, the furnace body is screened from the high temperatures produced within the heating zone by an internal radiation shield. The temperature of graphite heating element is monitored by an infrared pyrometer viewing the external surface of heating element through a window at the front of the furnace body and an aperture in the radiation shield.

Electrical Power System

Warning  ***When operating the furnace busbar connectors are electrically 'live'. Ensure the connectors are not shorted to each other or earthed/grounded.***

An electrical Power Supply Unit (PSU) Control Cabinet provides electrical power to the 3-Phase transformer and diode array mounted in an enclosure assembly on a plinth adjacent to the furnace. The diode arrays, which convert the low voltage 3-phase AC current from the transformer to DC current, are connected to the furnace by means of semi-flexible copper busbars. These are of solid copper construction and are cooled by ambient airflow.

Input to the transformer is controlled by a thyristor circuit which responds to inputs from the controlling computer.

Electrical insulation of the main body of the furnace from the furnace conductor flanges/busbar connectors is provided by insulation rings and tie bar insulation bushes.

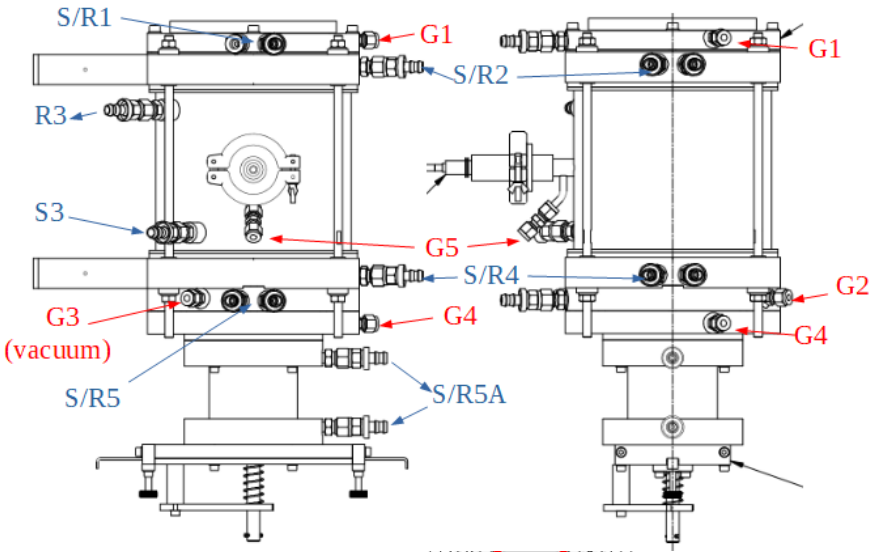
Water, taken from water distribution panel, provides internal cooling for the diodes. Surface cooling of the diodes is provided by a fan.

Water Cooling System (Drawings 288918A, 288919A)

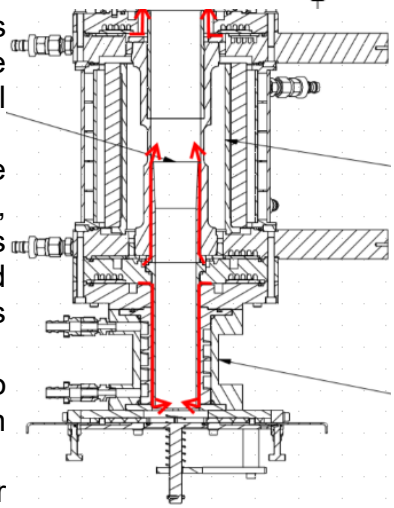
Cooling water is supplied from an external source to two tower water distribution panels. One panel supplies cooling water to the furnace, the other supplies the transformer/diode array. The water supply flow rate to each location is monitored by a flowmeter and a flow switch is installed in each return line. Any failure in the water cooling system activates the flow switch which then stops the electrical supply to the transformer/diode array.

Inert Gas System

Furnace Gas Inlets and Flow Direction



The inert gas, Argon, is used within the furnace to prevent oxidation of the furnace graphite assemblies.



The gas is supplied to the gas control cabinet, located on the tower frame, where it is regulated and filtered. It is then distributed to the furnace in separate channels for the Top Gas Curtain, the Bottom Gas Curtain, the Furnace Chamber and the Pyrometer Window.

Each channel has its own Mass Flow Controller.

A vacuum circuit is used to evacuate the furnace body when not in use to prevent the graphite element absorbing moisture and reactive gases. The remote control box for this circuit is located immediately beneath the gas control cabinet.

The inert gas system also includes a Cussons RGP4 rare gas purifier and a Cussons P9229 ZOX Oxygen analyser. For detailed information regarding the operation of these units please refer to the 3rd party documentation provided.

Top Gas Curtain Channel G1

Gas enters the furnace via the top cover flange (marked G1) and is distributed evenly around the flange circumference through a series of galleries producing a gas curtain across the aperture.

Chamber Channel G2

The chamber channel (marked G2 on the rear of bottom cover flange is for gas, and G3 on the front of bottom cover flange is for vacuum only.) provides a gas flow to the heating element chamber. The gas helps shield the element core from atmospheric oxygen preventing oxidization.

Gas enters the furnace via the bottom cover flange. It is distributed evenly around the flange circumference through a series of galleries and ports entering the furnace chamber through the annulus between the bottom of the graphite element and the bottom sleeve and then exiting the furnace chamber via 4 radial holes in the lower section of the graphite heating element which lead to the zone in which the preform is located.

Bottom Gas Curtain Channel G4

Gas enters the furnace via the bottom gas flange (marked G4) and is distributed evenly around the flange circumference through a series of galleries and ports. The gas then passes down the cylindrical gap between the furnace bottom extension and the graphite bottom sleeve producing a gas curtain across the fibre exit zone above the bottom door.

Pyrometer Channel G5

The pyrometer channel supplies a trickle flow of gas to the space surrounding the graphite element in which the radiation shield is

located. Entering through the pyrometer port (marked G5), the gas keeps the pyrometer viewing window free from dust and deposits and aids in the prevention of oxidisation of the radiation shield and outside surface of the element. It then flows to the furnace chamber via the radial holes in the bottom of the element where it combines with the flow from the chamber gas supply.

Furnace Controls

Limited furnace control is available from the remote control panel located adjacent to the furnace ie. temperature ramping between idle, run and drop temperatures and gas Hi/Lo switching. The remote control panel also gives control of preform feed and X-Y positioning.

Remote Control Box

The remote control box comprises an emergency off button and a touchscreen control panel.

Operation

Safety

The furnace, operated as part of the fibre drawing process, represents an extremely hazardous working environment. Personnel are to comply with the following warnings as well as all local, State or Federal Health and Safety Regulations. Training in the safe operation of the process is to be carried out.

Warning ***The correct Personal Protective Equipment (PPE) is to be worn at all times.***

Warning Working at height and related safety.

- ***Personnel are to remain behind guard rails at all times and/or wear an appropriate safety harness.***
- ***Only personnel of sufficient physical strength are to carry out preform loading/unloading.***
- ***All equipment not immediately required for use on the gantry is to be stored in specifically designed trays or locations.***
- ***Personnel are to practice good housekeeping and methodical working practices to prevent items falling from the tower.***

Warning ***Furnace.***

- ***Ensure there are no loose objects in the vicinity of the power flanges or busbars.***
- ***Ensure all electrical safety covers are correctly fitted prior to applying power.***

Warning ***Water leaks.***

- ***All water pipe connections on and around the tower are to be regularly inspected for leaks.***
- ***If a leak is apparent all electrical systems are to be isolated before the leak is investigated.***

Warning Heat.

- ***Furnace related items, i.e. preform handles, top discs and top disc supports, retain high levels of heat after the furnace has been run.***
- ***Heatproof gloves are to be worn when receiving the preform drop from the furnace. They may be removed when the fibre has thinned sufficiently to dissipate the heat.***
- ***Hot glass waste is to be placed in the designated metal bins.***

Warning Eye Protection – Glare

- ***Personnel are to use welding goggles when***
  a. Viewing the preform entry area into the top disc.
  b. Looking into the furnace from above.
  c. Viewing the furnace from below in conjunction with a mirror.
- ***Under NO circumstances are personnel to look up into the bottom of the furnace as this places them directly below the potential drop zone.***

Furnace Entry Disc

The radial clearance between the preform and the entry disc is typically kept between 1.0 and 2.0mm.

Note: A variety of entry discs in differing size increments will be needed to cover the nominal preform diameters to be drawn and the normal preform to preform diameter variations that occur within any given nominal diameter.

To ensure the preform surface does not come into contact with the entry disc, resulting in preform degradation, during either preform loading or process feeding perform the following steps:

1. Remove all soot deposits from the entry disc after every run and clean with Isopropyl Alcohol.
2. Centre the entry disc on the furnace axis before preform loading.
3. Use the preform X-Y position control to keep it centred in the entry disc throughout the preform loading operation.

Caution To avoid graphite oxidation when operating the furnace operators are to:·

Ensure the top and bottom apertures are NEVER fully opened together whenever the furnace is under power or within 20 minutes of power down. The resultant updraft will entrain sufficient atmospheric oxygen to promote oxidisation of the furnace graphite components.

Ensure furnace gas flows are checked before powering up the furnace or ramping from 'Idle' temperature(1600°C) to 'Run' or 'Drop'.

Ensure preforms are only loaded or unloaded when

- ***a. The furnace is at 'Idle' temperature (1600°C) or below and***
- ***b. The bottom door plug is fitted.***

Place the top cap on the furnace as soon as possible when an old preform has been removed.

Leave the top cap in place until the last moment before lowering a new preform into the furnace.

Ensure the bottom gas curtain is set to 'High' whenever loading or unloading preforms and when carrying out a preform 'Drop'.

Ensure, when carrying out a preform 'Drop' that the bottom doors are closed to their minimum possible aperture for the prevailing conditions.

Ensure bottom doors are fully shut after a preform 'Drop'.

Gas Flows

When determining gas flows ensure that the total gas flow through all 4 gas channels is sufficient to maintain a positive

pressure inside the furnace so that there is ALWAYS a net outflow through the bottom doors.

Caution Failure to maintain positive pressure at all times will drastically shorten graphite life.

Factors such as the nominal preform diameter used, entry sleeve radial clearance and furnace operating temperature affect the gas flows which are finally confirmed by analysis of the resultant fibre quality.

Once a combination of gas flows has been selected, the flow conditions at the bottom door are checked by using a suitable commercial air current test kit, e.g. Drager. To perform this procedure the preform is to be in place centred in the top disc and the furnace is to be at final run temperature with no fibre being drawn.

The bottom gas curtain flow is set to 'low' and a smoke cloud, produced by following the air current test kit manufactures instructions, is introduced to the bottom door area. The total furnace gas flow is adjusted to produce a positive outflow from the, confirmed by the movement of the smoke cloud.

The objective is to maintain pyrometer, chamber and bottom gas curtain flows constant from preform to preform, at settings previously proven to yield acceptable fibre quality i.e. diameter, uniformity and strength, and make the necessary adjustments to total flow using the top gas curtain flow only.

This procedure is to be performed for each nominal preform diameter over the full range of entry sleeve radial clearances to be used.

The following gas flow rates for each channel are initial settings and are finally determined during tower commissioning using the above criteria.

Channel	**Gas Flow Rates (63mm)**
Top Gas Curtain	1 L/Min (same flow in Hi & Lo)
Chamber	5 L/Min (same flow in Hi & Lo)
Bottom Gas Curtain	Low 5 , High 10 L/Min
Pyrometer Purge	1 L/Min (same flow in Hi & Lo)

Note 1: Flow rates are dependent on furnace and preform size and are a guide only. To be finally optimised by the user.

Note 2: Bottom gas curtain Low values used under normal process conditions. High values used whenever the process requires the bottom door to be opened or the top to be open without preform or top cap in place.

Note: Do not set top gas curtain flow to zero. If there is excessive outflow from the bottom door reduce the bottom gas curtain flow or increase entry disc radial clearance until the flow rate from the bottom door is correct

Furnace Purging

The furnace is stored in vacuumed condition and manually purged after exposure to the atmosphere to prevent deterioration of the graphite.

Cyclic Purging

To purge the furnace after exposure to atmosphere and perform the following steps:

After use allow the furnace to cool for a minimum of 20 minutes ensuring that the water and inert gas systems are operating.

1. Remove the top cap and place the top vacuum cover. Insert the bottom vacuum plug and check it is correctly seated.
2. Open the Argon valve. Check gas is flowing to all channels and close the Argon valve
3. Start the vacuum pump and open the vacuum valve.

   Wait until the vacuum gauge falls to below -0.85 bar. And stay for another minute.

Note: If the pressure fails to drop further than approximately -0.2 bar check the vacuum seals in the furnace and repeat.

4. Stop the vacuum pump. Ensure the vacuum gauge remains steady.
5. Open the Argon to let the gas purge the furnace.

Watch the vacuum gauge and close the gas when the gauge has risen to approximately -0.2 bar.

6. Close the Argon and start the vacuum.

7. Repeat the steps 3 – 6 above a minimum of 5 times in total.
8. End cycle purge with vacuum. Stop the vacuum when gauge falls below -0.85 bar. Leave in vacuumed condition until the furnace is used.
9. If the furnace is to be used immediately, then open the Argon and set high flow.
10. Allow the pressure gauge to rise, remove the vacuum cover and place the top cap in position.
11. Remove the bottom vacuum plug. Close the bottom doors inserting the door plug between them.

Auto Cyclic Purging

If the system is fitted with MFCs then it will include an auto cyclic purge function. Navigate to the Furnace Inert Gas Control section of the control screen. Press “Start” to initiate the automatic cyclic purge sequence. Monitor the first cycle to ensure the vacuum caps are fitted correctly so that the correct vacuum is achievable and the cycle is proceeding between the pressure switch points. #

Storage

The furnace can be kept purged with Argon or stored in the vacuumed condition at all times when not in use.

If it is to be stored vacuumed condition, then perform the following steps:

1. Allow the furnace to cool for a minimum of 20 minutes after use ensuring that the water and inert gas systems are operating.
2. Remove the top cap. Place the top vacuum cover. Insert the bottom vacuum plug and check it is correctly seated.
3. Start the vacuum. Wait until the pressure drops below -0.85 bar.

Note: If the pressure fails to drop further than approximately -0.2 bar check the vacuum seals and repeat vacuum.

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4. Switch off the vacuum. Ensure the vacuum gauge remains steady.
5. Monitor the gauge for changes in pressure.

Note: Small daily changes in the reading on the pressure gauge are normal and are a result of changes in atmospheric pressure. A

progressive rise in pressure is indicative of a leak in the furnace seals or the gas delivery system which must be rectified before running the furnace. The gas delivery system may be checked using a helium mass spectrometer leak detector.

Caution ***If the pressure has risen by more than 0.03 bar since the previous use, the furnace is to be cyclically purged before use***

Alarms and Interlocks

Alarms are provided for the following system parameters.

Water Over-temperature

A Resistance Temperature Detection (RTD) probe is fitted in the water return line and trips an alarm and then the furnace is shutdown on high temperature.

Water Flow

Flow switches are fitted in the furnace and diode water return lines and trip an alarm if the water flow falls below 30 lpm in the case of the furnace and 4 lpm for the diodes..

Diode Over-temperature

The water cooled diodes in the transformer are protected by a Resistance Temperature Detection (RTD) probe. If the diodes exceed their normal operating temperature the furnace is automatically shut down.

Pyrometer Over-temperature

High temperature alarm contacts are installed in the temperature controller on the Furnace Temperature Control Panel and connected to the Temp alarm which may be set to any required value. If the set temperature is exceeded an alarm is tripped.

Inert Gas

A pressure switch and a flow switch are fitted to the Argon supply to the furnace. If either drops below a preset value, indicating possible gas starvation, an audible and visual indication on the Furnace Temperature Control Panel is initiated together with a visual alarm indication on the computer monitor alarm status screen. Alarm pressure and flows are approximately 2 bar and 5 litres/min respectively.

If any of the above parameters are exceeded or there is an emergency stop in the process, electrical power to the furnace is automatically tripped off.

Fault Diagnosis

Element Life

Under normal operating conditions element life in excess of 500 hours can be achieved but is determined by the following factors:

a. Reduction of element wall thickness.

   The 50mm graphite heating element wall thickness on hot zone area, when new, is 3.0mm. Oxidation of the inner surface of the element results in the progressive thinning of the element wall thickness and the subsequent increase in electrical resistance. This is shown by a rise in voltage and a corresponding reduction in the current required to maintain a given temperature or power level. Reduction in wall thickness may not affect the drawing process but uneven thinning will produce 'hot' or 'cold spots' and lead to uneven heating of the preform resulting in possible asymmetry of the draw down region and unpredictable effects on fibre quality. Heating elements are to be replaced when a trend of increasing voltage is clearly established and it has physically risen, e.g. over 2v above its starting value when new.

b. Fibre tension value.

   A steady drift from the anticipated value of fibre tension for a given fibre temperature, as a result of local 'hot' or 'cold spots', is indicative of element life expiry.

c. Fibre strength.

   A reduction in fibre strength which is not attributable to any obvious cause is indicative of element life expiry

If a life span of less than 500 hours is being achieved process procedures are to be reviewed as small changes may lead to considerable improvements. Very short element lifespans may be attributed to the following factors:

a. Incorrect operating procedures.

b. Failure within the inert gas system.

c. The entrainment of air caused by incorrect settings

Perform the following steps:

1. Ensure the inert gas system is correctly connected to each furnace channel.
2. Ensure all gas channels within the furnace are operating at the correct flow rates.

3. Ensure the inert gas meets the correct specification.
4. Ensure all precautions to avoid air entry, detailed in the operating procedure, are observed.
6. Monitor the furnace chamber pressure in the stored condition (see storage).

Note: Ensure the furnace vacuum pump is switched off. If it is left operating during any period of storage leakage will go unnoticed and air will be drawn into the system subsequently contaminating the inert gas when the system is refilled ready for operation

Top Sleeve Life

The top sleeve is a removable graphite liner located inside the element immediately above the hot zone. It is designed to prevent deposition of silica on the top section of the element core. Instead these from on the top sleeve itself which can then be removed for routine cleaning without having to disturb the element. Its lifetime is not normally limited by oxidisation but by the excessive build up of hard silica deposits that cannot easily be removed by scraping and which can obstruct the furnace core to a degree which obstructs the gas flow paths or causes contact with the preform. When this is in danger of happening the top sleeve should be replaced. Lifetime is dependent on factors such as drawing conditions, cleaning techniques and regularity, but typically should achieve around 500 hours i.e. a similar lifetime to the element itself.

Bottom Sleeve Life

The bottom sleeve design comprises two sections, the top cap and the lower bottom sleeve section.

The top cap is immediately next to the element and reaches very high temperatures especially at its top end where its wall is thinnest and it is closest to the hot zone. When oxygen is present the top cap will erode quickly, first thinning its wall and then becoming shorter as the top edge is burnt away. Top cap life is dependent on the correct use of operating procedures to avoid air entry into the furnace. The top cap is not an electrical conductor and as electrical parameters cannot be used to measure its condition, replacement is based on visual inspection and length measurement in comparison to a new item.

Replacement is required if:

1. The top edge has become noticeably uneven or lopsided, or if the overall length has reduced significantly, e.g. >3mm.

2. A reduction in fibre strength occurs which is not attributable to any other obvious cause.

Under normal operating conditions a bottom sleeve top cap life of approximately 250 hours can be achieved but this figure will be drastically reduced if the correct operating procedures are not followed. If the top cap life does not approach the above figures the element checks are to be carried out (see Element Life).

The bottom sleeve lower section does not reach sufficient temperature to oxidise significantly and with its large wall thickness and general robustness should last almost indefinitely.

Radiation Shield Life

The radiation shield insulation package is fully protected by the element from air entry into the furnace. Its lifespan is primarily dependant on the quality of the Argon used for the furnace as this is the only route by which oxygen can normally enter this area. Inadequate cyclic purging after furnace maintenance can lead to rapid and extensive oxidation of this package.

The insulation package consists of three components.

a. A graphite inner core.

b. An outer insulation sleeve made of rigid graphite felt covered in a thin sealing layer of graphite 'paint'.

c. A pyrometer port sleeve. This fits through a hole in the side of the insulation sleeve and screws into the inner core linking items a and b above together.

Note: Outer insulation sleeve and graphite inner core are manufactured as a matched unit and must NOT be replaced separately.

The graphite inner core, with its large wall thickness and robust construction, should last almost indefinitely. The pyrometer port sleeve will erode progressively and can be replaced as a precaution whenever the insulation is inspected. This should be carried out every 3 months or 1500 operating hours unless called for as a result of fibre strength problems, after a suspected problem with Argon quality or failure to cyclic purge the furnace after maintenance. The insulation sleeve will gradually deteriorate as a result of handling damage or oxidisation but with proper care in handling, scrupulous cyclic purging after every maintenance session and good quality Argon it should be possible to extend the life to well in excess of 1500 hours.

The insulation sleeve is fragile and prone to accidental damage during handling as the graphite 'paint' layer is very thin and the underlying felt quite soft. During assembly ensure that there is approximately 0.5mm of radial clearance between the outside diameter (OD) of the core and the inside diameter (ID) of the sleeve (1mm diameter difference). This prevents thermal expansion splitting the insulation and shedding particles which can potentially cause fibre strength problems.

Fibre Strength

The following factors can cause reduction in fibre strength.

a. Excessive soot build-up in the furnace.
b. Severe oxidisation of the element and/or bottom sleeve.
c. Contamination of the inert gas.
d. Preform contact with the top entry disc.
e. Fibre contact with the bottom doors.
f Setting combinations of gas flows/temperature/radial clearance that may cause particles deposit onto the preform close to the hot zone.
g Damage to the heat shield "paint"

Perform the following steps:

1. Inspect the furnace in-situ and clean as required (see Routine Maintenance).
2. Check for signs of element oxidation (unusually large quantities of loose graphite powder and excessive erosion rate of the bottom top cap) and heat shield "paint" damage and if present, carry out Fault Diagnosis Element Life checks.
3. Ensure any chosen deviations from the recommended initial gas flow and aperture clearances are made in small increments. Check, at each increment change, that fibre properties are unaffected and no air has entered at the bottom door.

Note: Failure to do this may result in excessive oxidation of the graphite (see item 2 above), excessive fibre diameter deviations and/or particulate deposition onto the preform surface above or within the hot zone and which can lead to a reduction in fibre strength.

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4. Ensure correct maintenance of the system to prevent particle contamination of the gas.

Note: A sub-micron filter is installed in the inert gas system to protect the furnace under normal operating conditions (Figure 13). Excessive contamination of the gas could cause the filter to block.

5. Review procedures for centring entry sleeve and preform during preform loading and subsequent movement of the preform due to adjustment of preform clamp motorised X-Y stages during thread up and ramping of line speed.
6. Inspect preform clearance at all stages and if necessary reposition the entry sleeve to avoid risk of contact.
7. Check the fibre is central in the bottom doors and the bare fibre diameter gauge measurement window. If not check bare fibre tension against the clean air flow (see item 6 above) and if correct review tower alignment.

Maintenance

Warning ***The correct Personal Protective Equipment (PPE) is to be worn at all times.***

Warning ***Working at height and related safety.***

- ***Personnel are to remain behind guard rails at all times and/or wear an appropriate safety harness.***
- ***Personnel are to practice good housekeeping and methodical working practices to prevent items falling from the tower.***

General

The furnace graphite and gas system filters require on-condition servicing at intervals dependant on the results of routine maintenance inspections. Graphite life is dependent on the quality of the inert gas used and the operating conditions. The gas filter life should exceed one year under normal operating conditions but is dependent on the cleanliness of the source gas.

The furnace graphite is to be replaced if it is physically damaged, burnt or approaching burn out. A worn heating element will require less current and more voltage to attain a given temperature compared to a good element and may produce a weaker fibre (see Fault Diagnosis and Element Life).

Inability of the element to pass current is usually caused by a bad contact between the power flanges and the element split rings. In this situation remove the element, clean the contact areas of the power flanges with a mildly abrasive polishing pad, e.g. Scotchbrite, and replace the element ensuring that both split rings are fully tightened. Other non-current carrying graphite components should be inspected for wear and replaced if necessary (see Element Replacement).

Routine Maintenance

The servicing requirements depend on tower usage, the working environment and the results of routine maintenance inspections.

Before every operation

1. Check the furnace graphite for signs of contamination, wear or physical damage and clean or replace if required.
2. Check the graphite top sleeve and water cooled top ring for soot build-up. Remove and clean if necessary.
3. Select the appropriate size entry sleeve and clean per item 2 above.

Weekly

Check the furnace system water and gas flow interlocks (see Alarms and Interlocks).

Monthly

Check the furnace bottom doors for distortion or damage and replace if required.

3 monthly or every 1500 operating hours

1. Check the furnace pyrometer alignment and window cleanliness.
2. Check the graphite insulation for signs of wear or damage and replace if required.

6 monthly or every 3000 operating hours

1. Check the overlap joints in the busbar system for tightness.
2. Check the alignment of all equipment on the tower using a plumb line (see Alignment).
3. Check the cleanliness of the vacuum pump filter.

Radiation Shield – Installation/Cleaning/Inspection/Replacement

The radiation insulation shield assembly 282701A comprises a graphite cylinder surrounded by a cylinder of insulating carbon felt covered in a thin sealing layer of graphite ‘paint’.

Warning ***The correct Personal Protective Equipment (PPE) is to be worn at all times.***

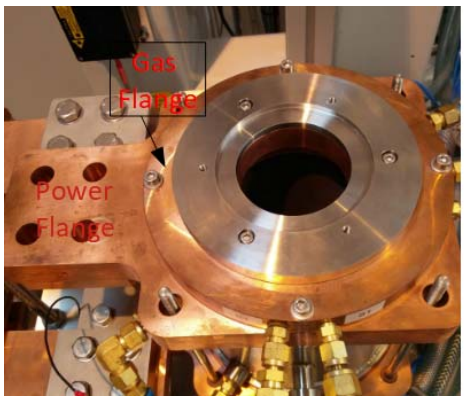
Warning ***Ensure the furnace is completely cold before starting any maintenance.***

Warning ***Ensure electrical power is isolated at the PSU cabinet.***

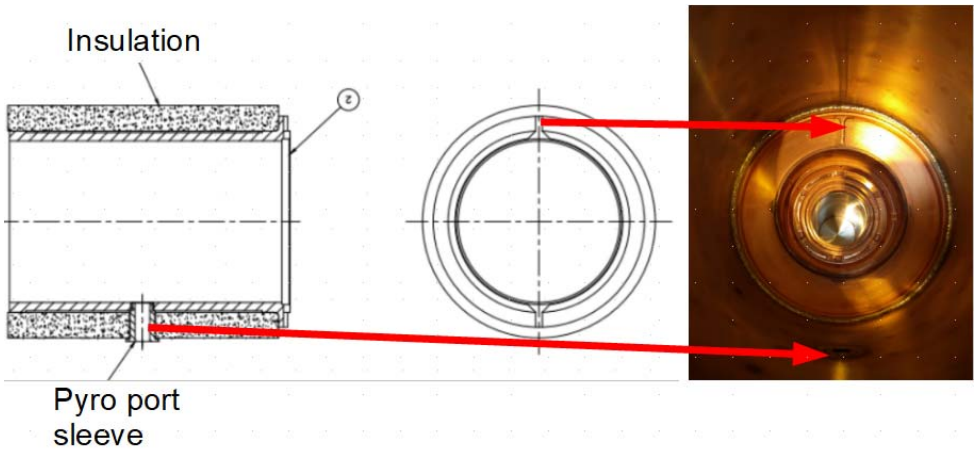
Caution ***Physical damage will shorten the insulation life. Care is to be taken when handling the insulation. Always wear powder free clean room gloves when handling graphite components.***

Installation

1. Remove the top Power Conductor Flange and carefully place it behind of furnace body. 2 people required for this job. Clean out the furnace cavity using soft bristle brush, vacuum cleaner. Use lint free wipes and Isopropyl Alcohol if required.



2. Assemble Radiation Shield and fit in the furnace cavity. Check the radiation shield alignment from the pyrometer port. The viewing path should be circular and unobstructed . If it is irregular, elliptical or blocked completely, recheck installation of insulation package.



3. Fit the Power Flange back and remove water cooled Top Gas Flange to fit graphite elements.

Note: Care is to be taken to ensure that the location pin is not damaged as the flange is lowered into place.

Cleaning/Inspection/Replacement

1. Carry out graphite element replacement procedure.
2. Remove the top power flange
3. Carefully remove the Radiation Shield assembly.
4. Clean out the furnace cavity.
5. Inspect the inner and outer surface of the radiation shield and the pyrometer port sleeve for damage or erosion.

Note: We do not recommend separating the insulator sleeve from the inner core as this can cause wear and damage to the "painted" graphite surfaces which in turn can result in dust generation during use. However the pyrometer port sleeve can be unscrewed for inspection/replacement.

6. Replace parts as required and reassemble.

Note 1: See Radiation Shield Life, clearance between inner core and insulation sleeve.

Note 2: The pyrometer port sleeve tends to erode at its face where the pyrometer port purge gas enters the furnace. This part is to be replaced if it is not in pristine condition.

Note3: Radiation Shield outer insulation sleeve and graphite inner core are manufactured as a matched unit. If replacement is required both parts MUST be replaced. The pyrometer port sleeve can be replaced separately.

7. Remove the pyrometer fibre bundle adapter and inspect the window for cleanliness by using a viewing aid inside the furnace.

Note: If necessary, remove the window by unscrewing the window nut and withdrawing the window from the window socket. Clean the window with methanol. Inspect the O-ring seal for damage or deterioration and install in the base of the window socket. Install window, spacer and nut.

Graphite Element - Installation/Cleaning/Inspection/Replacement

Warning ***The correct Personal Protective Equipment (PPE) is to be worn at all times.***

Warning ***Ensure the furnace is completely cold before starting any maintenance.***

Warning ***Ensure electrical power is isolated at the PSU cabinet***

Caution ***The element and associated components are constructed from high purity graphite. Keep away from all sources of contamination and always use powder free disposable clean room gloves when handling.***

Tools and graphite elements (from the left in the picture)

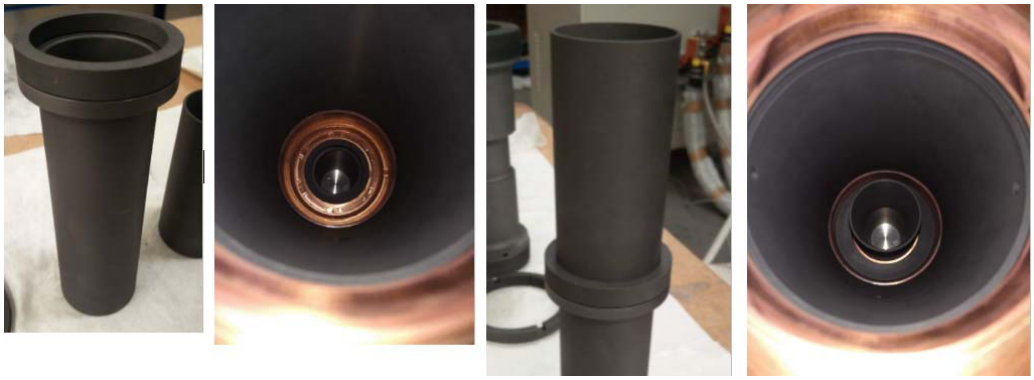
- Bottom Split Ring tool, Top Split Ring tool, Heating Element tool,
- Assembly drawing 380182A
- Bottom Spacer, Bottom Sleeve (3 pieces – lower section, ring, upper section), Bottom Split Ring, Heating Element, Top Split Ring, Top Spacer, Top Sleeve.

Top / Bottom Split Rings and Spacers compared ; Top parts are larger than bottom parts.

Installation

Caution Correct assembly location is critical

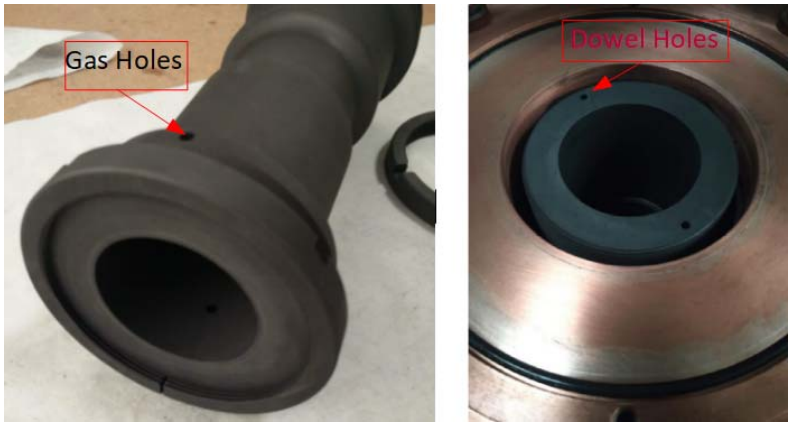
1.Assemble Bottom Sleeve lower section and Ring and fit into bottom extension of the furnace. Fit Bottom Sleeve upper section. Thicker part downside.



2. Screw Bottom Split Ring (4 notched face upward) on the lower end of the Heating Element for 2 or 3 turns. And fit the element above the Bottom Spacer in the furnace.

Note 1: The lower end of the Heating Element has 4 gas holes above the threaded portion. The upper face has dowel 2 holes to fit the tool.

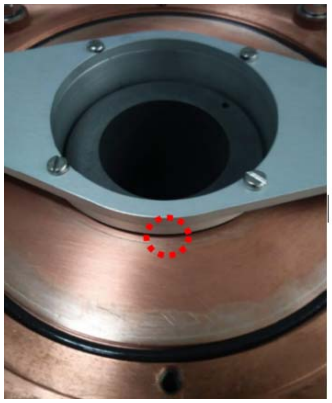
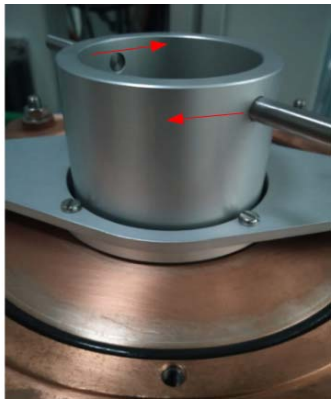
Note 2: The Split Ring and H Element both have tapered threads. Care must be taken to ensure the lower and upper graphite split rings are not reversed. If they are reversed neither can be correctly assembled to the element.



Note: Ensure the H Element is firmly seated on the Bottom Spacer.

3. Fit Bottom Split Ring tool. Carefully adjust the tool's position so that it is seated in the notches of the split ring. No gap between the tool and the power flange. Place Heating Element tool fitting 2 dowels into 2 holes. Hold the split ring tool firmly but not press too hard. Turn H Element tool clockwise until it stops. Remove tools

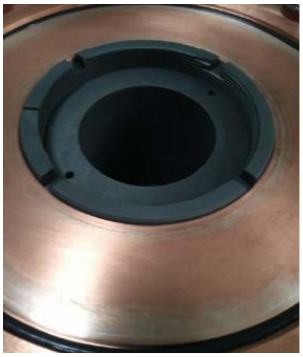
and check Heating Element is secure in the furnace and cannot be rotated or swayed easily.

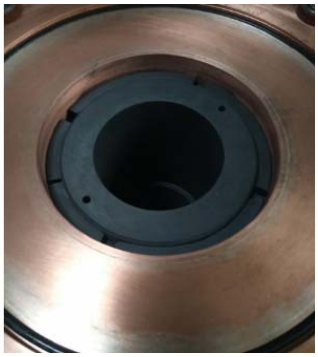



Note: Split Rings are power conductors between the copper Power Flanges and the Heating Element.

Caution The use of extreme torque when tightening can damage the graphite.

4. Place Top Split Ring (notched face upward) and hand screw for a couple of turns onto the Heating Element. Fit Top Split Ring tool and H Element tool. Hold HE tool firmly but not too hard. Rotate Top Split Ring tool clockwise until it tightened sufficiently to ensure a good contact with the top power flange.





5. Place Top Spacer. Fit Top Gas Flange. Insert Top Sleeve.

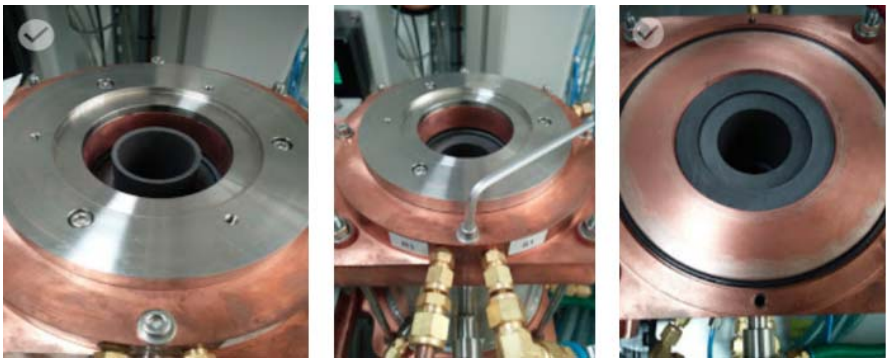
Note: Clean top flanges before fitting. Inspect O-ring seals and replace if required.

6. Place the Top Seal Plate and Preform Entry Disc Support (stainless steel parts in the photo) and the Vacuum Cover. Fit the vacuum plug.

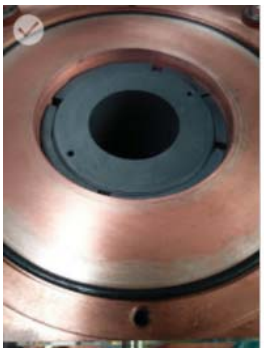
7. Do the cyclic vacuum purge.

Cleaning/Inspection/Replacement

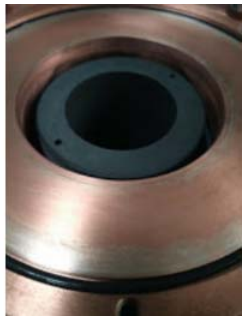
1. Remove the Preform Entry Support, graphite Top Sleeve, water cooled Top Gas Flange (stainless steel plate attached). Remove graphite Top Spacer.



2. Locate Top Split Ring tool in the 4 notches of TSR tool. Fit Heating Element tool matching dowels and holes.



3. Hold the element tool firmly and rotate the upper split ring tool anti-clockwise until the split ring is free from the element. Remove tools and the split ring.

Note: If the split ring will not turn and both rotate together, fit a short length, e.g. 100mm, of ½" O/D stainless steel tube over one of the split ring tool 'T' bar handles. Rotate the assembly clockwise until the extension tube locks against one of the four furnace tie bar nuts, then continue to rotate the element tool bar clockwise. After one or two turns the split ring will be sufficiently loose for the extension tube to be removed and the normal procedure to be followed.

4. Locate the Bottom Split Ring tool and Heating Element tool. Hold the BSR tool firmly and rotate the HE tool anti-clockwise 4 to 6 half turns. Then the Heating Element will be loose enough to slide upwards with the BSR attached.

   Remove tools and graphites.

Note: If the element will not turn and both rotate together fit an extension tube as in note above. Rotate the assembly anti-clockwise until the extension tube locks against one of the four furnace tie bar nuts, then continue to rotate the element tool bar anti-clockwise. After one or two turns the element will be sufficiently loose for the extension tube to be removed and the normal procedure to be followed.

5. Remove Bottom Sleeve upper section, Bottom Spacer, and Bottom Sleeve lower section and ring.

6. 

Clean out the furnace cavity from above and below using soft bristle brush and a vacuum cleaner.

7. Clean the graphite components in an extracted enclosure using a soft brush, and a lint free wipes followed by a filtered nitrogen blast to remove any residual dust.

Note: A scraper blade, a coarse half-round file or a grinding wheel can be very carefully used for removal of the thickest encrustation from the top sleeve.

8. Inspect the graphite components for damage or erosion. Replace as required.
9. Inspect the copper contact areas of the Power Flanges for contamination or damage.

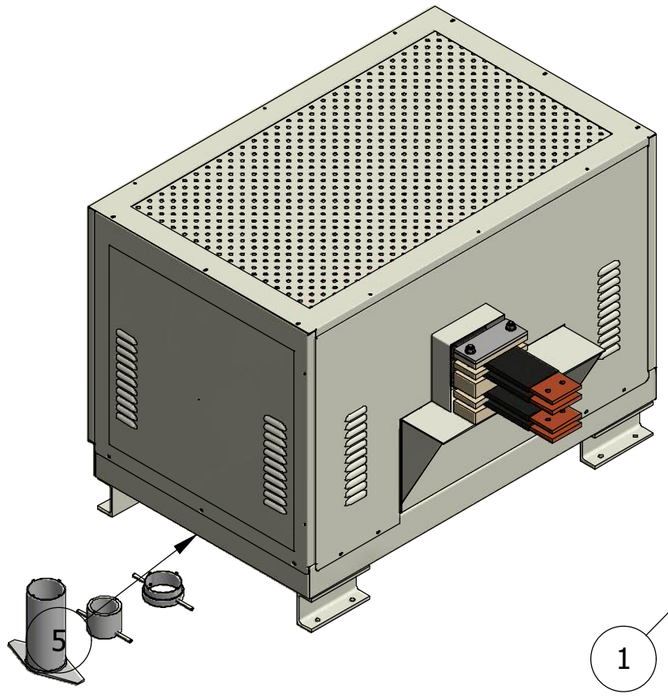
Note 1: A thin, smooth coating of graphite is normal and not a cause for cleaning.

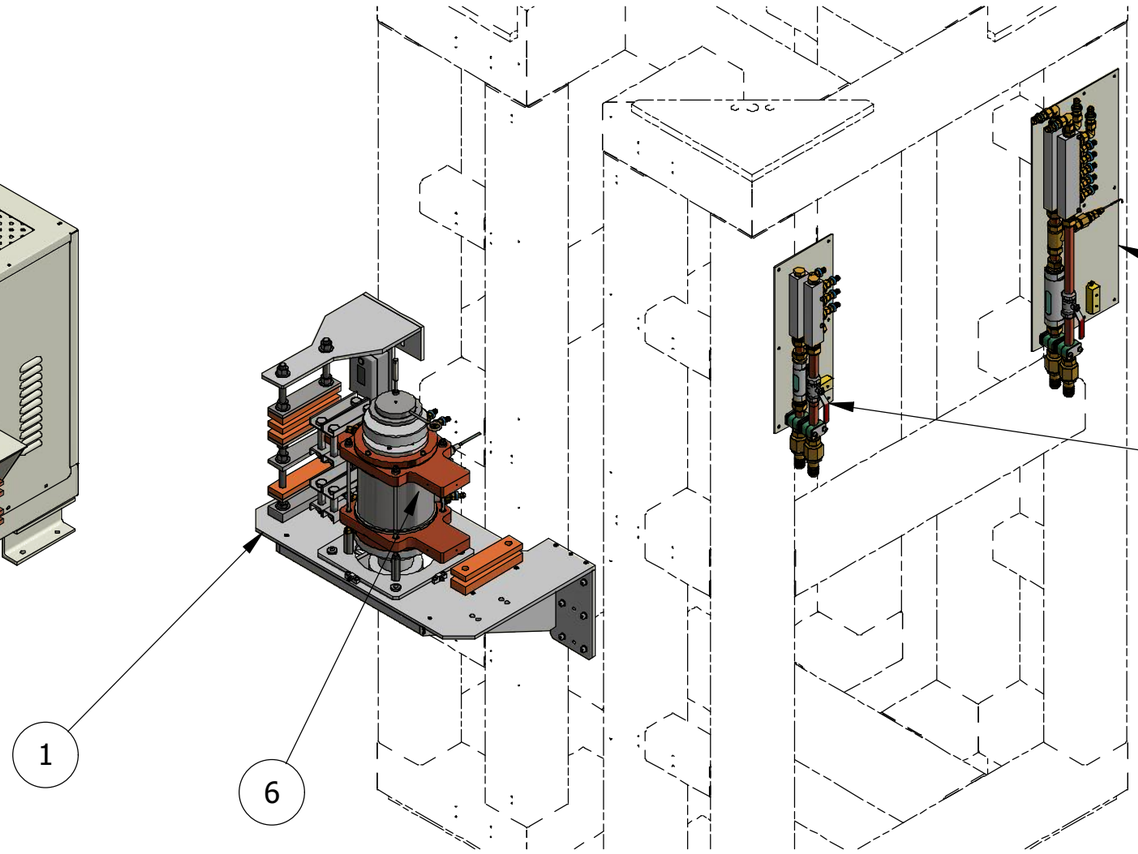
Note 2: Contamination may be removed by using a very fine polishing pad, e.g. Scotchbrite No. 7447. DO NOT USE POLISHING PAD ON THE "PAINTED" SURFACES OF THE RADIATION SHIELD.

Caution Do NOT use coarse abrasive cleaning materials.

10. Inspect the inner surface of the Radiation Shield assembly for damage. Note is is not possible to inspect the outer surface unless the furnace is further disassembled. Replace if required.

REVISION HISTORY				
REV	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		04/02/19	LAR





ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	284329A	FURNACE MOUNTING KIT
2	1	285245A	FURNACE TOOL KIT 63mm ID GRAPHITE SET
3	1	288918A	WATER PANEL ASSEMBLY - 38 & 63mm FURNACE
4	1	288919A	WATER PANEL ASSEMBLY - 63mm TRANSFORMER
5	1	289091A	4000A TRANSFORMER ASSY
6	1	380033A	63mm FURNACE ASSY

SG Controls Limited

DRAWN LAR | DATE 04/02/2019

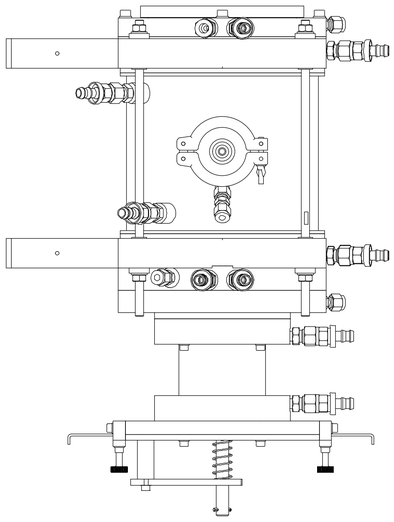
DO NOT SCALE
IF IN DOUBT ASK
UNLESS OTHERWISE STATED
DIMENSIONS ARE IN mm
DIM TOL' 0 ± 0.3
0.0 ± 0.1
ANGULAR TOL ± 0.5
SURFACE FINISH: 1.6 µm
REMOVE ALL SHARP EDGES

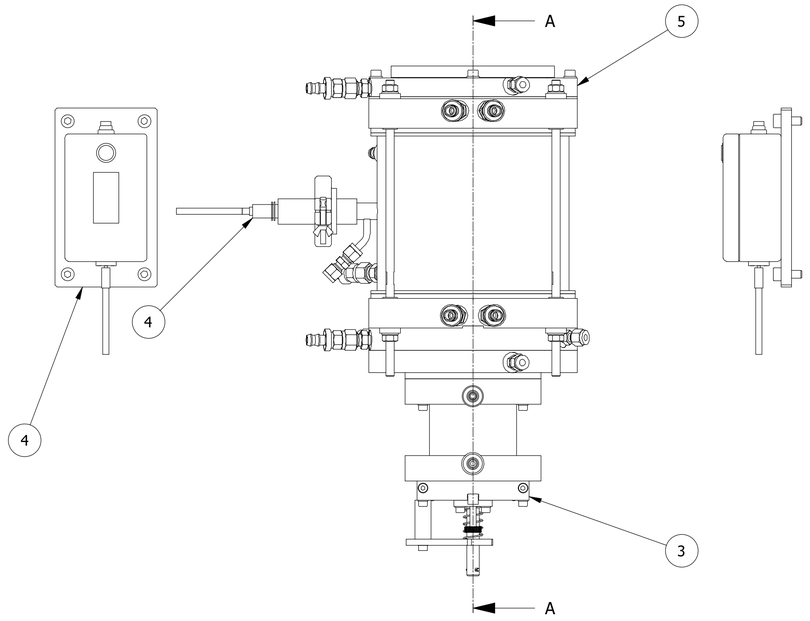
TITLE
63mm FURNACE SYSTEM - SOREQ TOWER

USED ON	DRG No.	SHEET	REV
380001A	380183A	1 OF 1	1
	MATERIAL: -	ORIG SCALE	1:15
	FINISH:	ORIG SHEET	A3

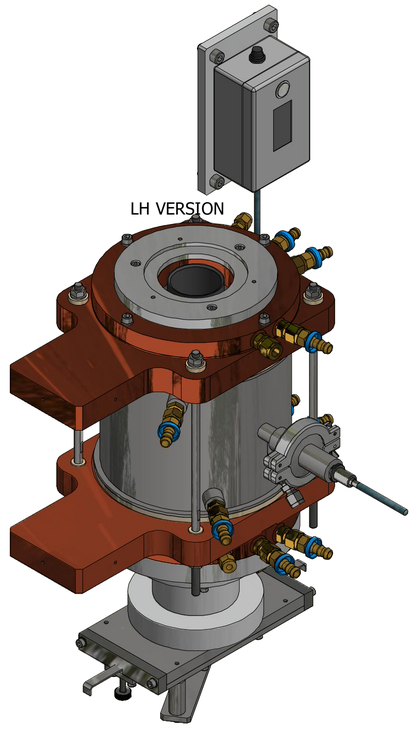
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	282701A	RADIATION SHIELD ASSY
2	1	284266A	WATER COOLED OUTLET
3	1	285186A	FURNACE DOOR ASSEMBLY FOR 63MM FURNACE
4	1	286001A	PYROMETER ASSY
5	1	288976A	FURNACE BODY ASSY - 4 HOLES
6	1	380182A	50mm GRAPHITE SET

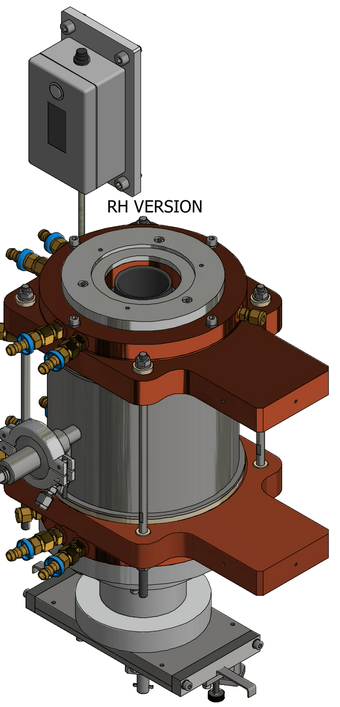
REVISION HISTORY				
REV	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		03.11.17	JG

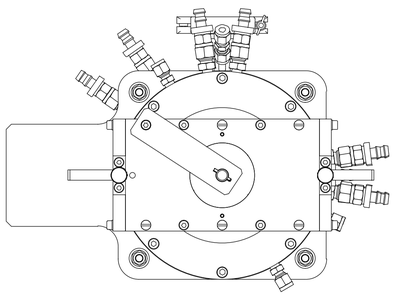




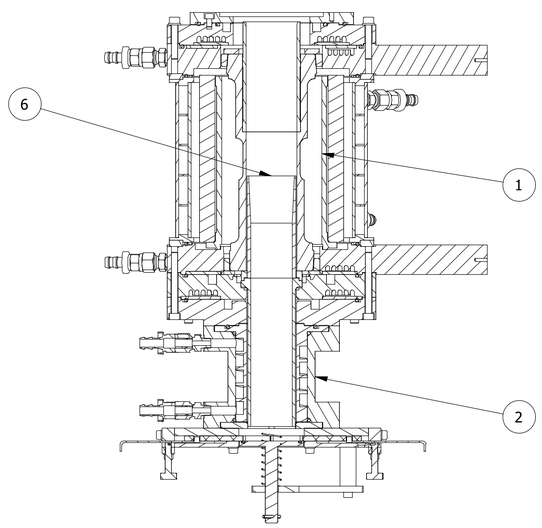
LH VERSION







SECTION A-A



NOTE:

THE PYROMETER SHOWN IS FOR REFERENCE PURPOSES ONLY AND IS NOT PART OF THE FURNACE ASSEMBLY.

POSITION CHANGES WHEN LH OR RH VERSION.

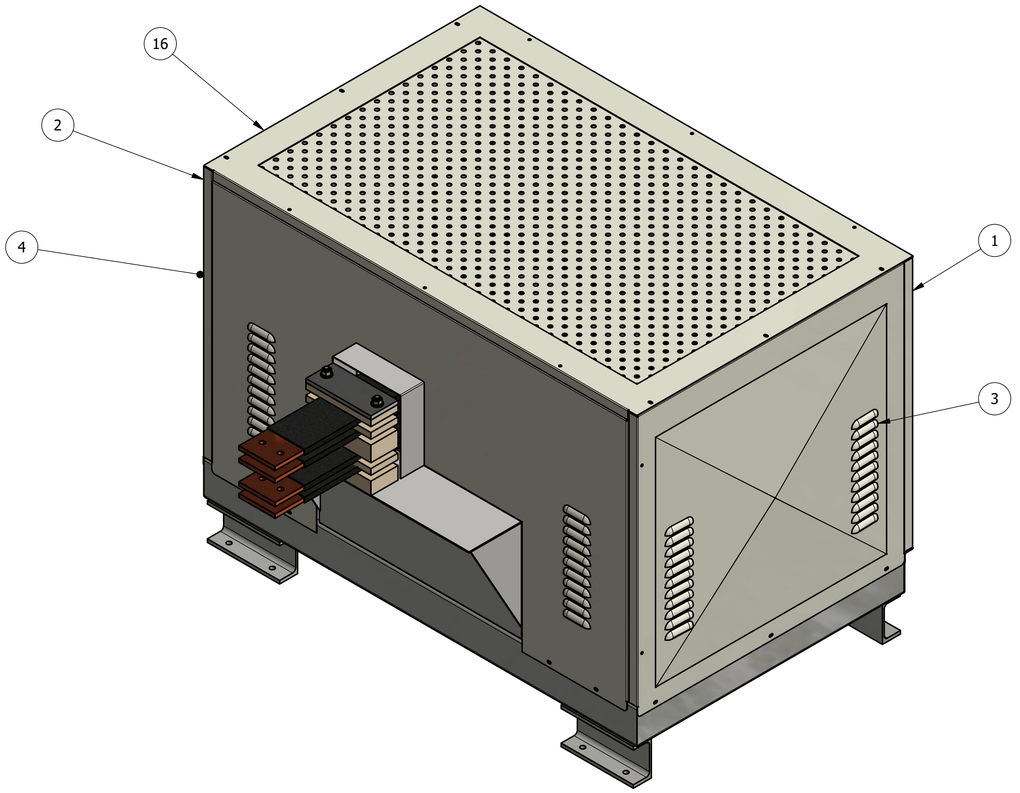
SG Controls Limited

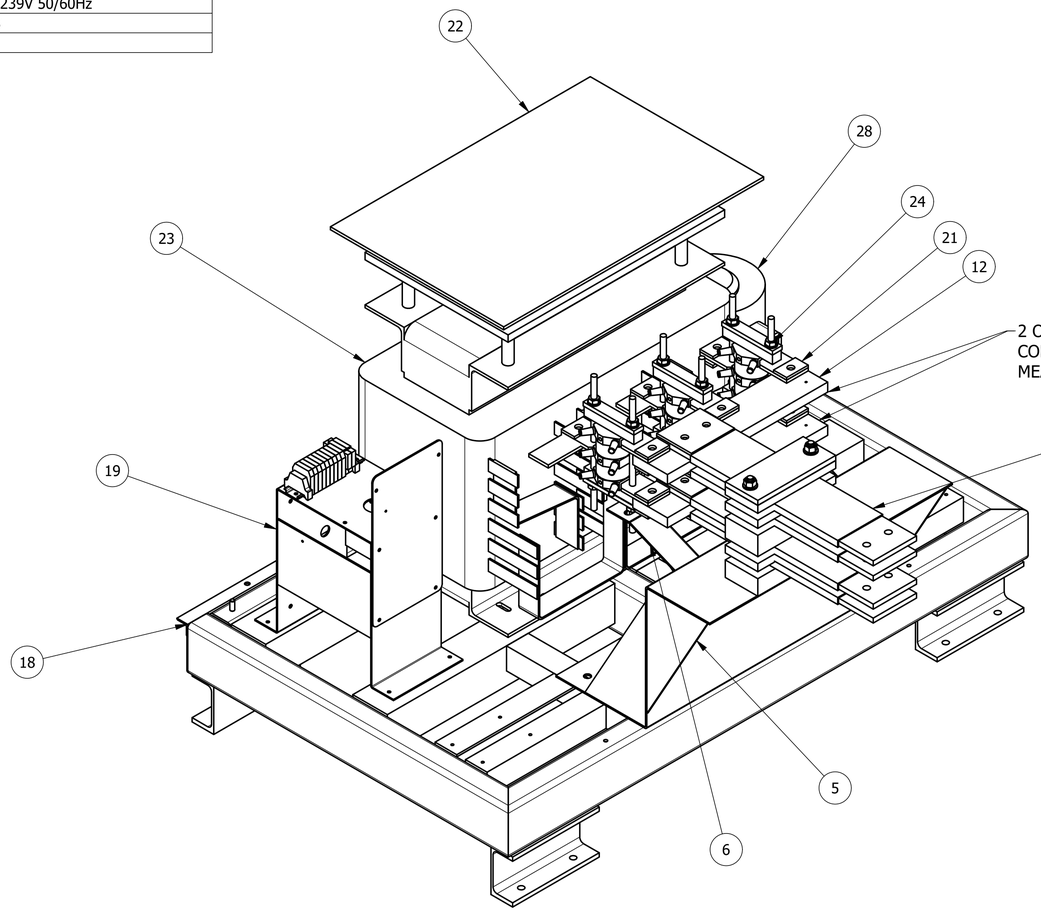
3rdcopy	03/11/2017
DO NOT SCALE	
IF IN DOUBT ASK	
UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm	
DIM TOL 0 ± 0.3	
0.0 ± 0.1	
ANGULAR TOL ± 0.5	
SURFACE FINISH - um 1.6	
REMOVE ALL SHARP EDGES	

TITLE: 63MM FURNACE ASSY.

USED ON	DRG No. 380033A	SHEET 1 OF 1	REV 1
	MATERIAL:	ORIG SCALE	1:3
	FINISH:	ORIG SHEET	A1

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	284363	REAR PANEL
2	1	284364	LH PANEL
3	1	284365	RH PANEL
4	1	284366	FRONT PANEL
5	1	284367	DIODE ASSY SUPP BRKT
6	3	284368	DIODE SUPPORT BRACKET
7	1	284369	BUSBAR CLAMP PLATE
8	3	284370	CLAMP BLOCK 16mm
9	1	284371	CLAMP BLOCK 42.5mm
10	1	284372	CLAMP BLOCK 35mm
11	2	284373	M12 x 230 LONG STUD SS
12	2	284374	CONNECTOR - DIODE
13	4	284375	CLAMP WASHER
14	4	284376	BUSBAR - 100x10mm x2M
15	1	284378	35mm DIN RAIL 150 LONG
16	1	284672	TOP PANEL
17	1	284844	FAN MOUNTING BRACKET
18	1	286109	TRANSFORMER DIODE MO
19	1	286491	CONDUIT BRACKET
20	1	286524	MTG PLATE - CURRENT SENSOR
21	18	288139	DIODE CLAMP PLATE
22	1	289325	CLEAR EXTRUDED ACRYLIC SHEET
23	1	EE031166	TRANSFORMER - SIMPLIFICATION MODEL
24	3	EE058187	DIODE PAIR ASSY 6000
25	2	EE060060	END STOP - ENTRELEC
26	9	EE060063.EE060064	TERMINAL M4/6 GREY & END COVER
27	2	EE060958	TERMINAL FUSED M4/8.SF
28	1	EL82610	AIR BLOWER 150CFM 239V 50/60Hz
29	4	K00508	Washer 12mm Std S/S
30	4	K00509	HxNut M12 S/S





2 OFF M3 TAPPINGS TO ALLOW CONNECTION OF THE VOLTAGE MEASUREMENT WIRES

14 BUSBARS SHOWN TRUNCATED FOR CLARITY

SG Controls Limited

DRAWN mtofts | DATE 30/06/2016

DO NOT SCALE
IF IN DOUBT ASK

UNLESS OTHERWISE STATED
DIMENSIONS ARE IN mm
DIM TOL 0 ± 0.3
0.0 ± 0.1
ANGULAR TOL ±0.5
SURFACE FINISH 1.6 µm
REMOVE ALL SHARP EDGES

TITLE: 4000A TRANSFORMER ASSY

USED ON

DRG No. 289091A

SHEET 1 OF 3 | REV 1

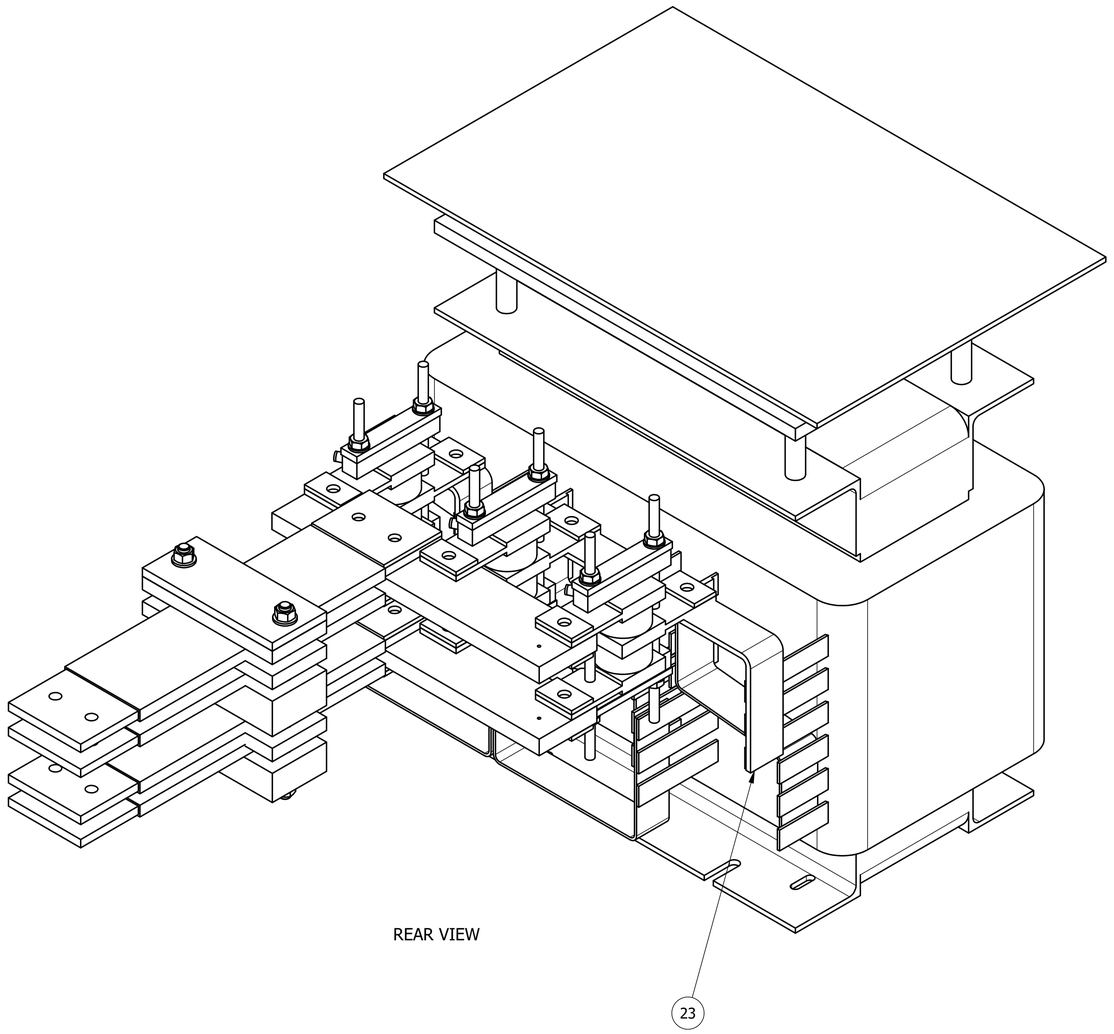
MATERIAL:

FINISH:

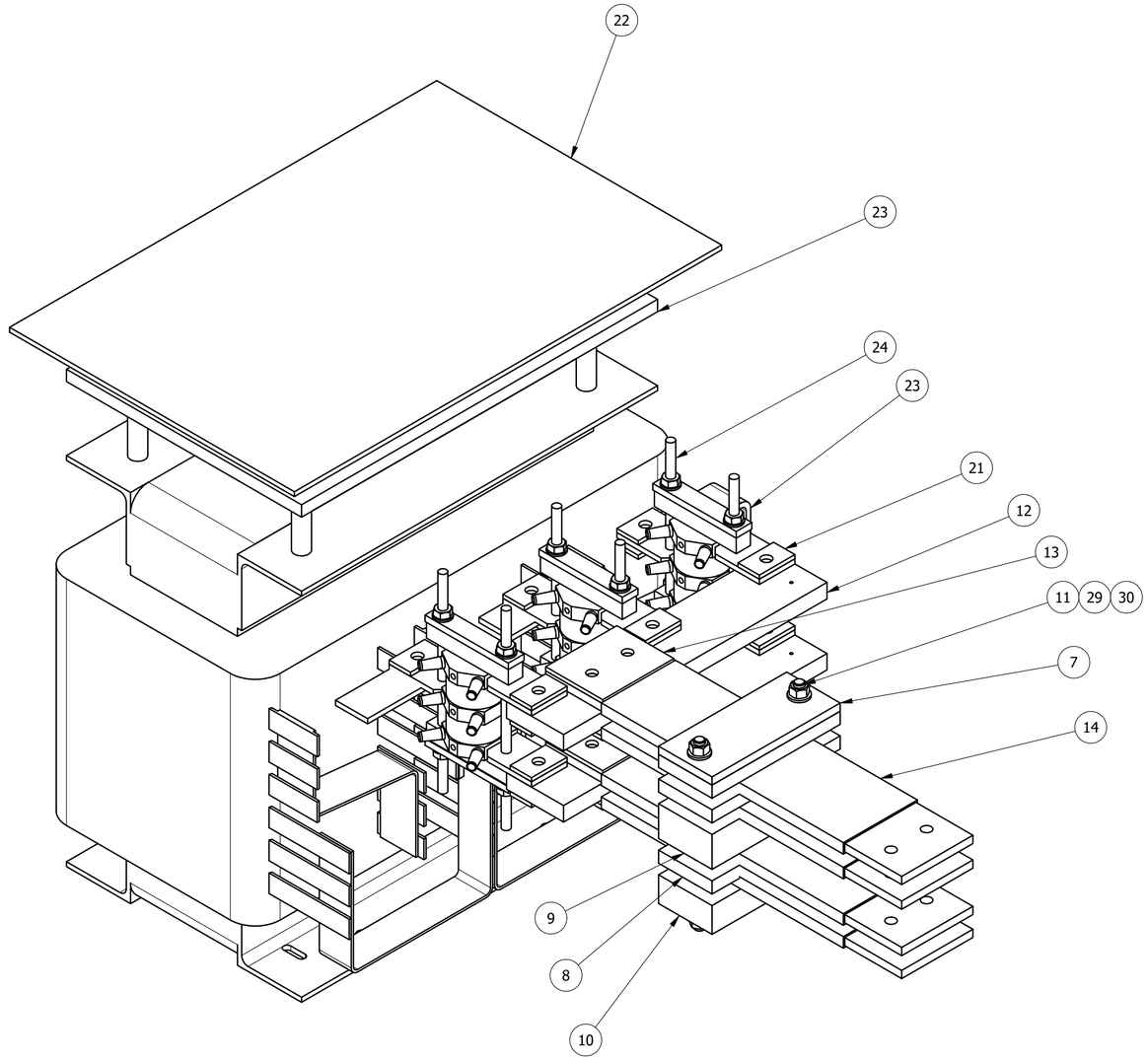
ORIG SCALE 1:6

ORIG SHEET A1

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
7	1	284369	BUSBAR CLAMP PLATE
8	3	284370	CLAMP BLOCK 16mm
9	1	284371	CLAMP BLOCK 42.5mm
10	1	284372	CLAMP BLOCK 35mm
11	2	284373	M12 x 230 LONG STUD SS
12	2	284374	CONNECTOR - DIODE
13	4	284375	CLAMP WASHER
14	4	284376	BUSBAR - 100x10mm x2M
21	18	288139	DIODE CLAMP PLATE
22	1	289325	CLEAR EXTRUDED ACRYLIC SHEET
23	1	EE031166	TRANSFORMER - SIMPLIFICATION MODEL
24	3	EE058187	DIODE PAIR ASSY 6000
29	4	K00508	Washer 12mm Std S/S
30	4	K00509	HxNut M12 S/S



REAR VIEW



SG Controls Limited

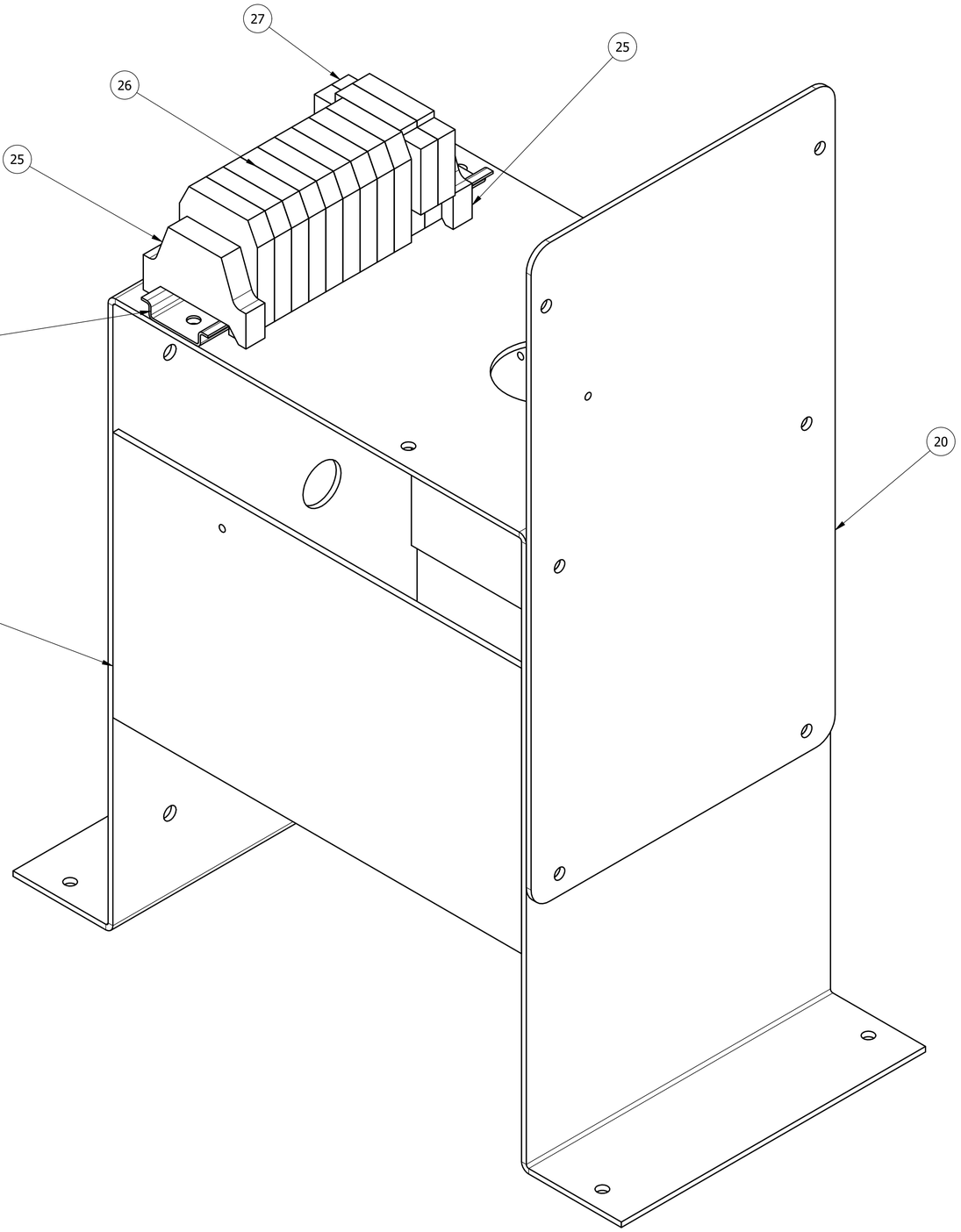
DRAWN	mtofts
DATE	30/06/2016
	DO NOT SCALE
	IF IN DOUBT ASK
	UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
	DIM TOL 0 ± 0.3
	0.0 ± 0.1
	ANGULAR TOL ±0.5
	SURFACE FINISH 1.6 µm
	REMOVE ALL SHARP EDGES

TITLE: 4000A TRANSFORMER ASSY

USED ON	DRG No. 289091A	SHEET 2 OF 3	REV 1
	MATERIAL:	ORIG SCALE 1:6	
	FINISH:	ORIG SHEET A1	

PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
15	1	284378	35mm DIN RAIL 150 LONG
19	1	286491	CONDUIT BRACKET
20	1	286524	MTG PLATE - CURRENT SENSOR
25	2	EE060060	END STOP - ENTRELEC
26	9	EE060063.EE060064	TERMINAL M4/6 GREY & END COVER
27	2	EE060958	TERMINAL FUSED M4/8.SF



SG Controls Limited

DRAWN: mtofts
DATE: 30/06/2016

DO NOT SCALE
IF IN DOUBT ASK

UNLESS OTHERWISE STATED
DIMENSIONS ARE IN mm
DIM TOL 0 ± 0.3
0.0 ± 0.1
ANGULAR TOL ±0.5
SURFACE FINISH 1.6 µm
REMOVE ALL SHARP EDGES

TITLE
4000A TRANSFORMER ASSY

USED ON

DRG No. 289091A

SHEET 3 OF 3

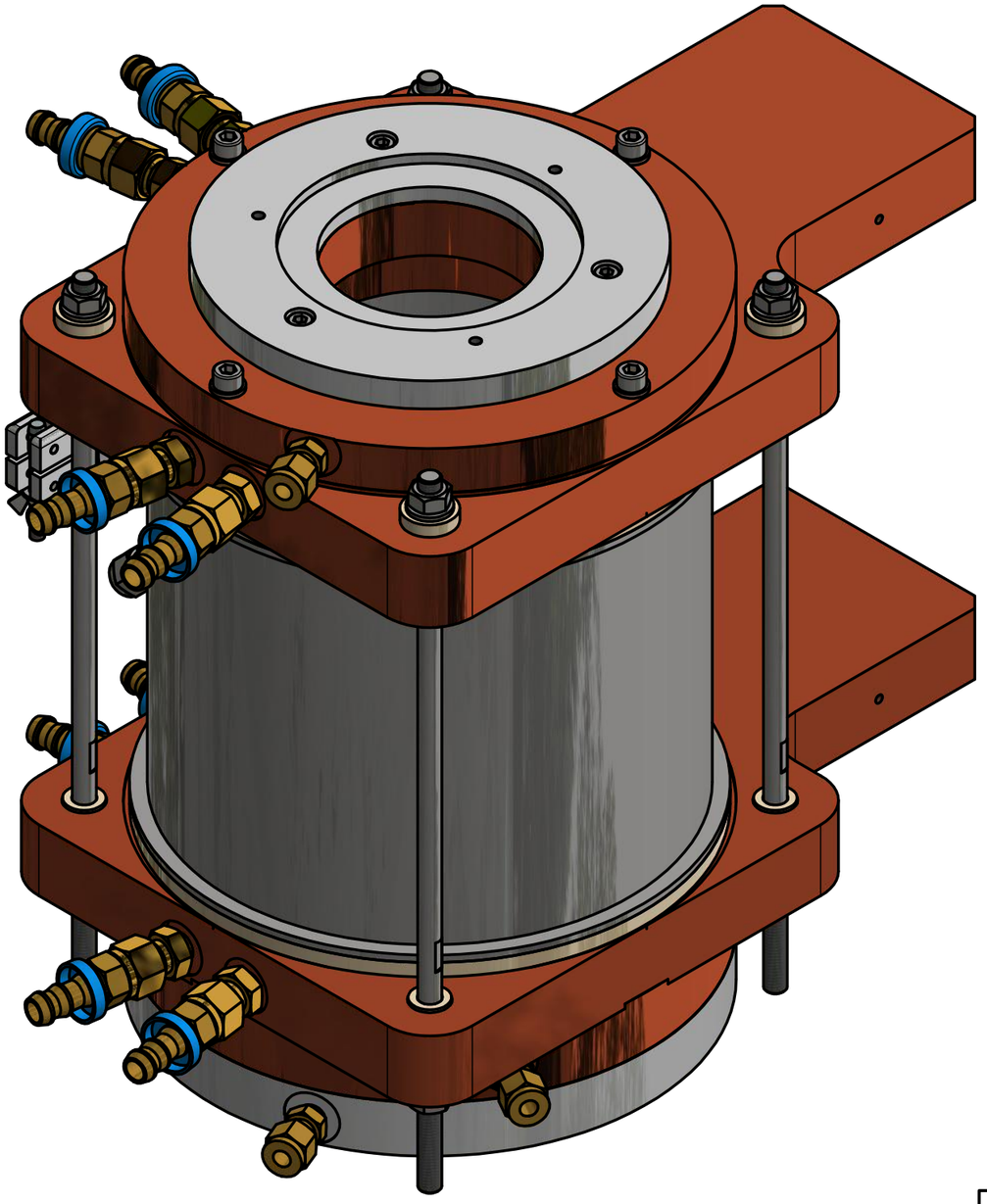
REV 1

MATERIAL:

FINISH:

ORIG SCALE 1:6

ORIG SHEET A1



REVISION HISTORY				
REV	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		13/07/16	MT

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	185027	O-RING CARRIER
2	1	185028	O-RING RETAINER BUSH
3	1	185029	WINDOW PYROMETER
4	1	185030	PYRO WINDOW SPACER
5	8	185091	TIE BAR INSULATION B
6	2	185094	INNER INSULATION RING
7	2	186332	OUTER INSULATION RING
8	1	186705	GAS CURTAIN FLANGE
9	1	186708	FURNACE BODY
13	1	188404	BOTTOM COVER FLANGE
16	4	282740	TIE BAR
18	1	285190	TOP SEAL PLATE
19	1	285191	TOP COVER FLANGE
20	1	288974	LOWER CONDUCT FLANGE - NO HOLES
21	1	288975	UPPER CONDUCT FLANGE - NO HOLES
24	8	K00065	Washer 8mm Std S/S
25	3	K00162	HxCpHd M5x8 S/S
26	4	K00279	HxCpHd M6x35 S/S
27	4	K00313	Washer 6mm Std S/S
28	8	K00345	HxNut M8 S/S
29	8	K00494	HxCpHd M6x60 S/S
30	1	P01961	UNION 1/4"
31	4	P01962	CONNECTOR 1/8" BSPT 1/4"
33	10	P02956	CONNECTOR 3/8" - 1/8" BSPT
34	10	P03243	3/8" HOSE x 3/8" TUBE
35	4	S00052	O-RING VITON
40	1	P00636	PYROMETER CLAMP
41	1	S00054	O RING 200-261-9775
42	1	S00202	O RING 200-112-9775
43	2	S00324	O RING 200-254-9775
44	1	S00372	O RING 200-242-9775

SG Controls Limited

DRAWN: mtofts DATE: 13/07/2016

DO NOT SCALE
IF IN DOUBT ASK
UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM TOL 0 ± 0.3
0.0 ± 0.1
ANGULAR TOL ±0.5
SURFACE FINISH 1.6 µm
REMOVE ALL SHARP EDGES

TITLE: FURNACE BODY ASSY - NO HOLES

USED ON

DRG No. 288976A

SHEET 1 OF 2

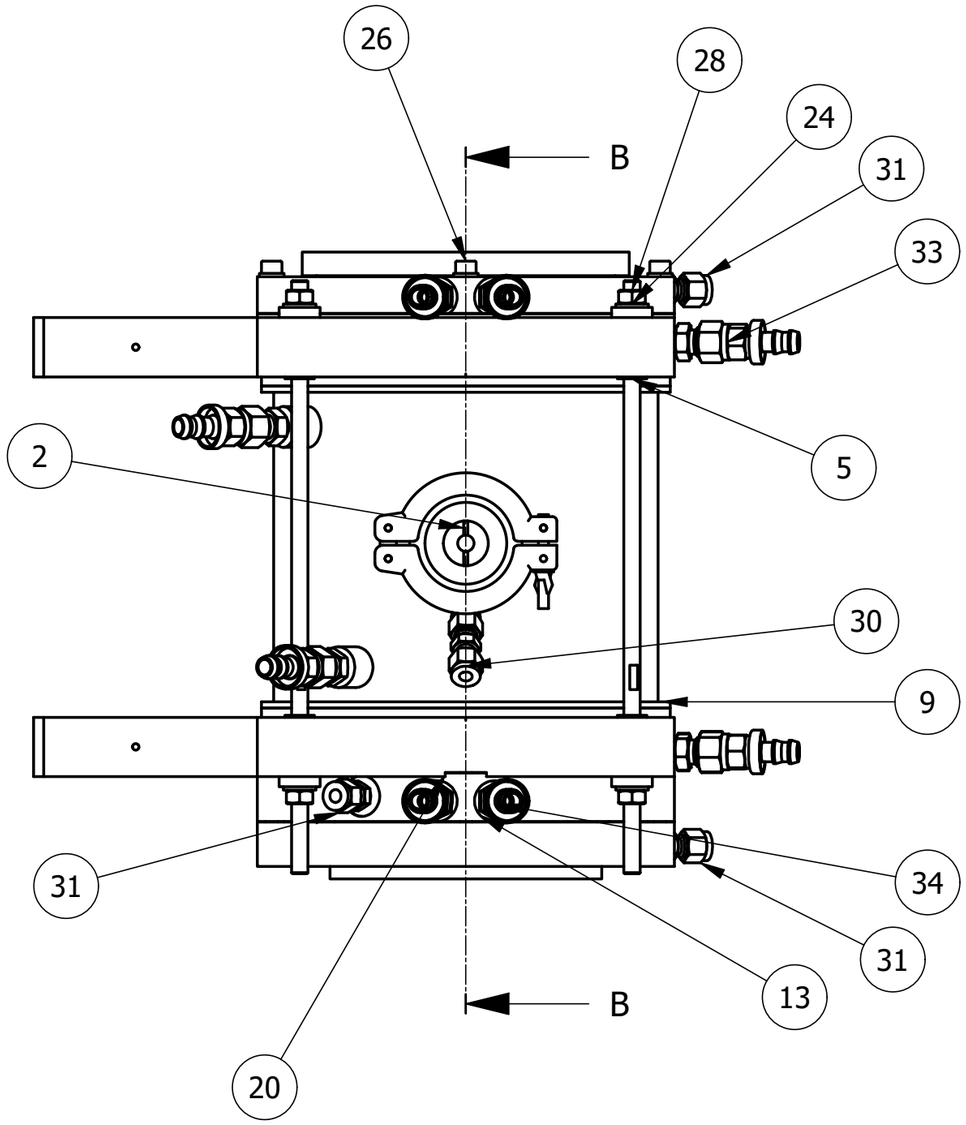
REV 1

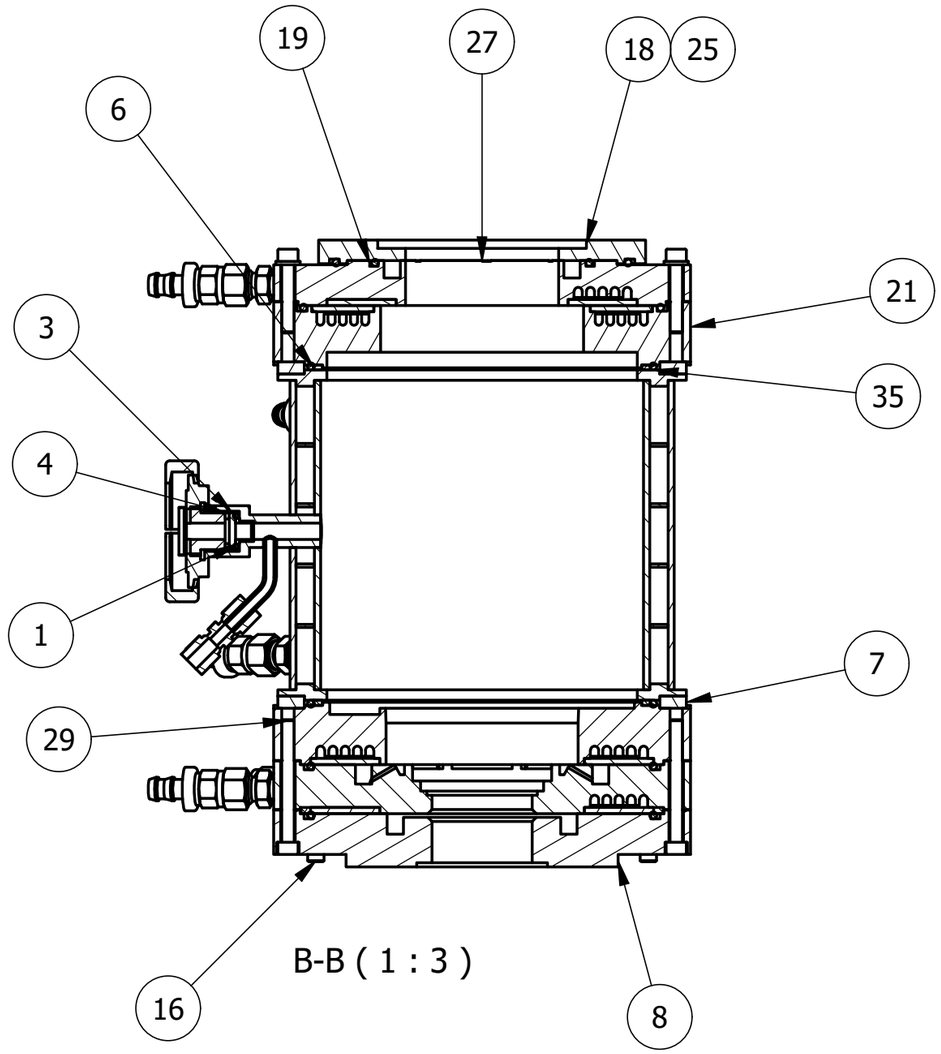
MATERIAL:

FINISH:

ORIG SCALE 1:2

ORIG SHEET A3





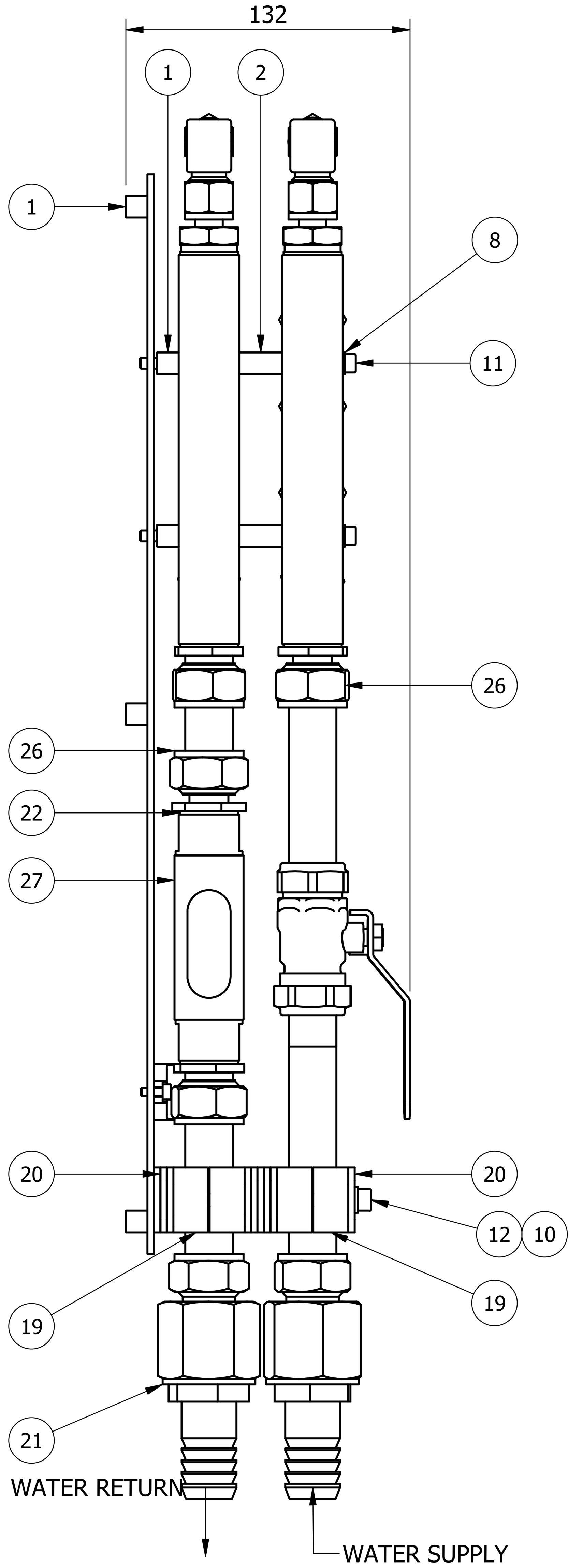
B-B (1 : 3)

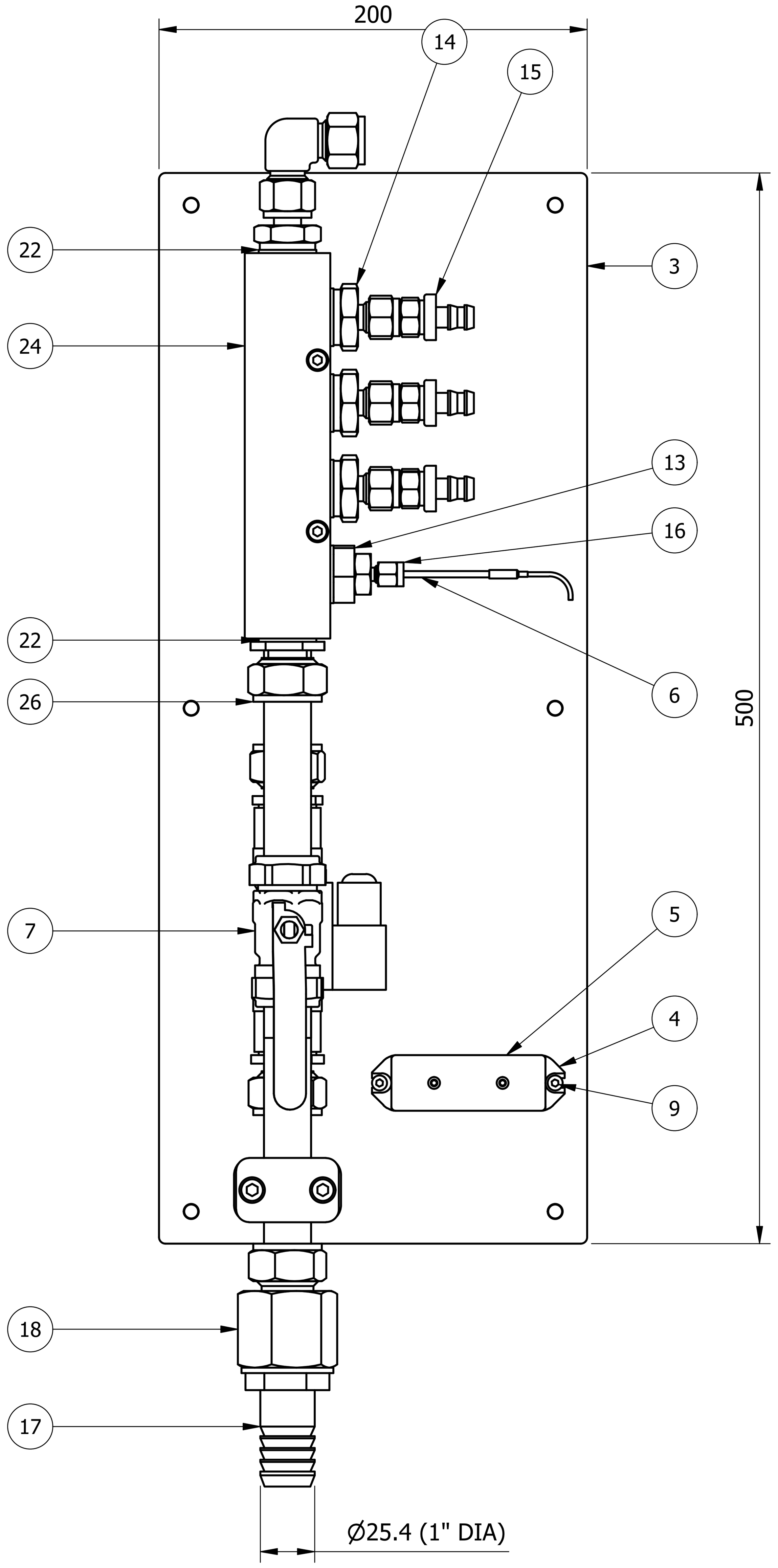
SG Controls Limited

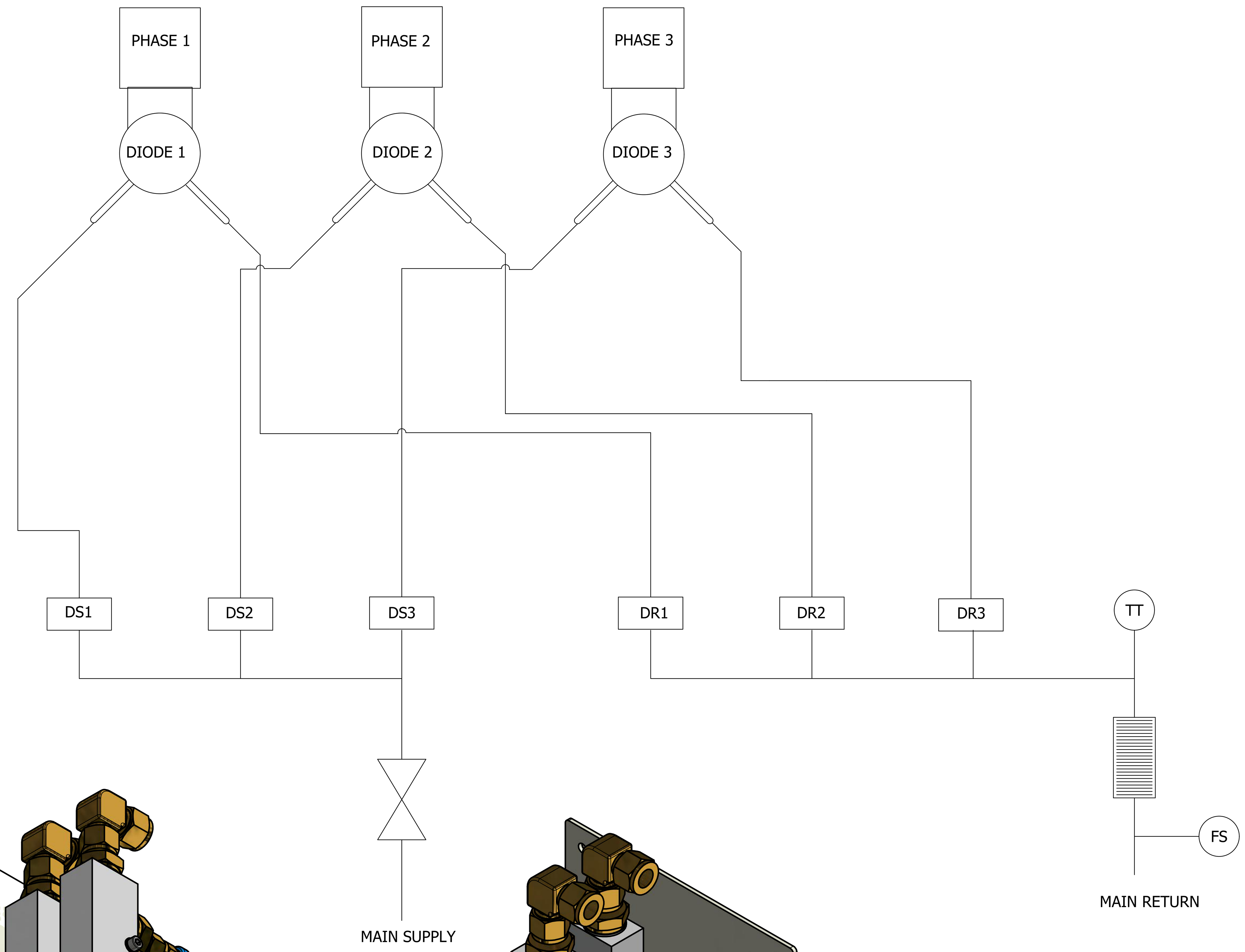
DRAWN mtofts	DATE 13/07/2016	TITLE: FURNACE BODY ASSY - NO HOLES	
DO NOT SCALE IF IN DOUBT ASK UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm DIM TOL 0 ± 0.3 0.0 ± 0.1 ANGULAR TOL ±0.5 SURFACE FINISH 1.6 µm REMOVE ALL SHARP EDGES	USED ON	DRG No. 288976A	SHEET 2 OF 2 / REV 1
		MATERIAL:	ORIG SCALE 1:2
		FINISH:	ORIG SHEET A3

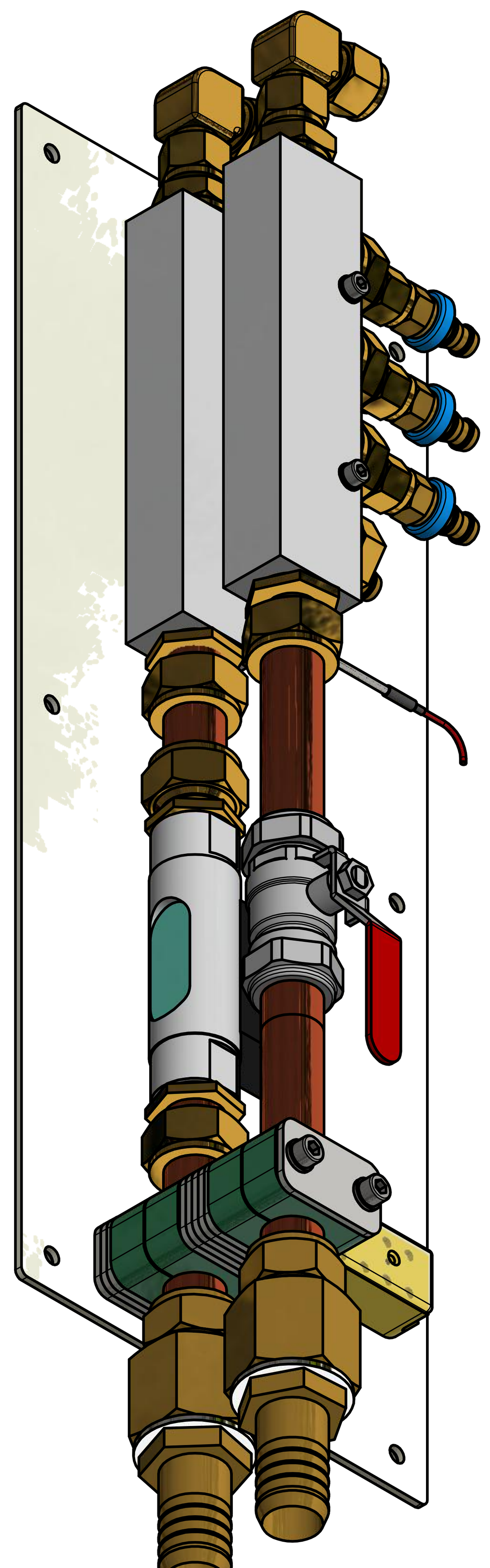
REVISION HISTORY

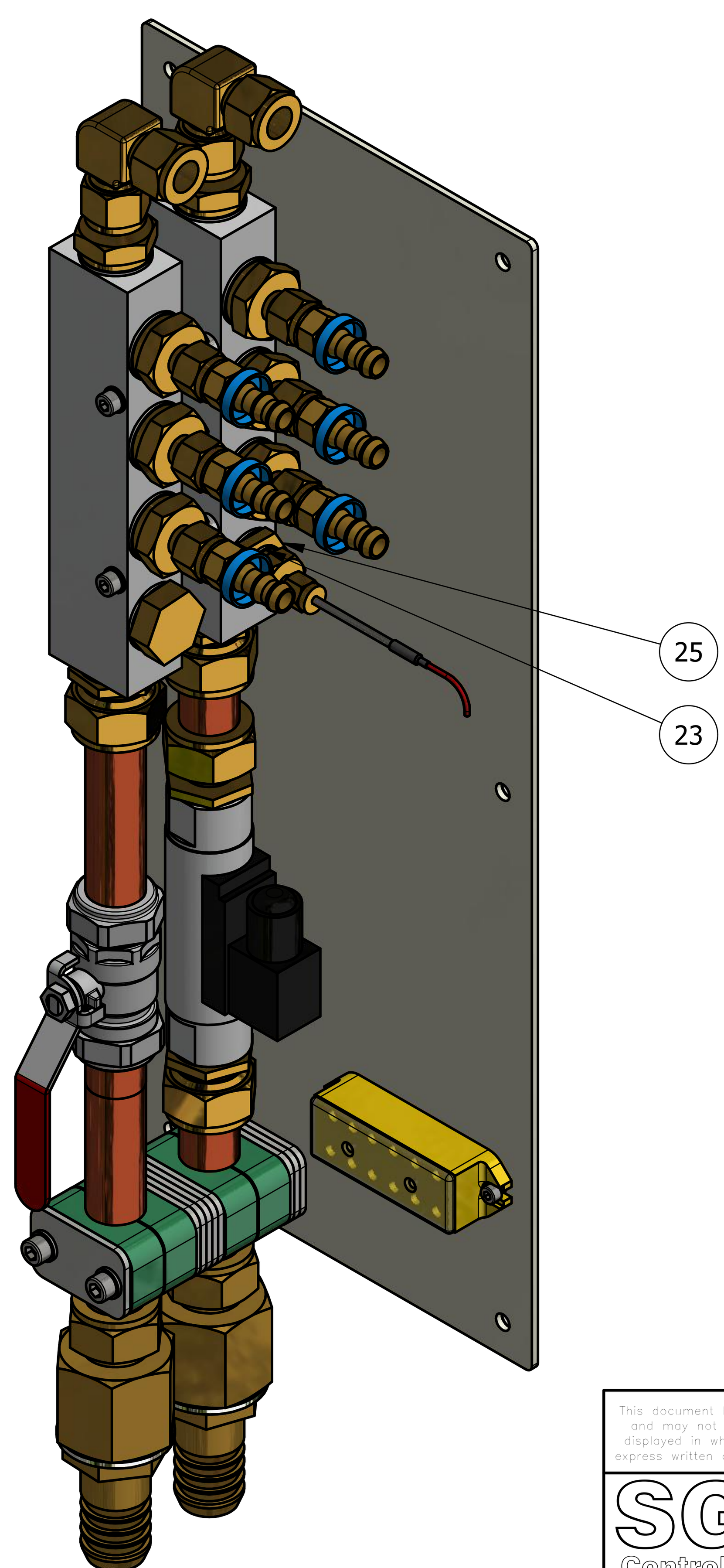
REV	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		26.4.16	AJW
2	replace P03197 with P03126. delete 6x P04072	25472	25/10/19	LAR











APPROXIMATE MASS = 10 kg

PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
1	8	287894	10mm PIPE SPACER
2	2	287903	20mm PIPE SPACER
3	1	288920	PANEL - TRANSFORMER WATER MANIFOLDS
4	1	EE060216	6 WAY TERMINAL BLOCK
5	1	EE060217	COVER - 6 WAY TERMINAL BLOCK
6	1	EL82911	RTD SENSOR DIA.3 x 100 LONG
7	1	H05146	22MM COMPRESSION BALL VALVE
8	2	K00061	5mm PLAIN WASHER - STD, S/S
9	2	K00284	HxCpHd M4x10 S/S
10	2	K00313	Washer 6mm Std S/S
11	2	K03044	M5x95 SKT CAP SCREW S/S
12	2	K03263	HxCpHd M6x90 S/S
13	3	P03120	1/2" BSP BLANKING PLUG
14	2	P02608	1/2" OD TUBE UNION ELBOW BRASS
15	6	P03243	3/8" HOSE x 3/8" TUBE
16	1	P03780	1/8" TUBE TO 1/4" BSP MALE CONNECTOR
17	2	P04006	1" BSP HOSETAIL
18	2	P04014	1" BSP FEMALE TO 22mm COUPLING
19	2	P04069	22mm STANJDARD CLAMP PP
20	9	P04070	COVER PLATE DP3 W3
21	2	P04071	BONDED SEAL FOR 1" BSP
22	14	P04072	BONDED SEAL FOR 1/2" BSP
23	1	P04073	BONDED SEAL FOR 1/4" BSP
24	2	P04074	4 WAY MANIFOLD - 1/2" BSP PORTS
25	1	P04075	1/2" TO 1/4" BSP PL REDUCING BUSH
26	4	P04076	22mm TO 1/2" BSP MALE COUPLER
27	1	V01552	FLOW SWITCH 6 - 15 l/min 1/2" BSP
14	6	P03197	MALE CONNECTOR 3/8"
51	2	P03046	1/2" G Female to 1/2" tube

SG Controls Limited

DRAWN: aweise | DATE: 26/04/2016

DO NOT SCALE
IF IN DOUBT ASK
UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM TOL 0 ± 0.3
0.0 ± 0.1
ANGULAR TOL ± 0.5
SURFACE FINISH -1.6 µm
REMOVE ALL SHARP EDGES

TITLE: WATER PANEL ASSEMBLY - 63mm TRANSFORMER

USED ON

DRG No. 288919A

SHEET 1 OF 1

REV 2

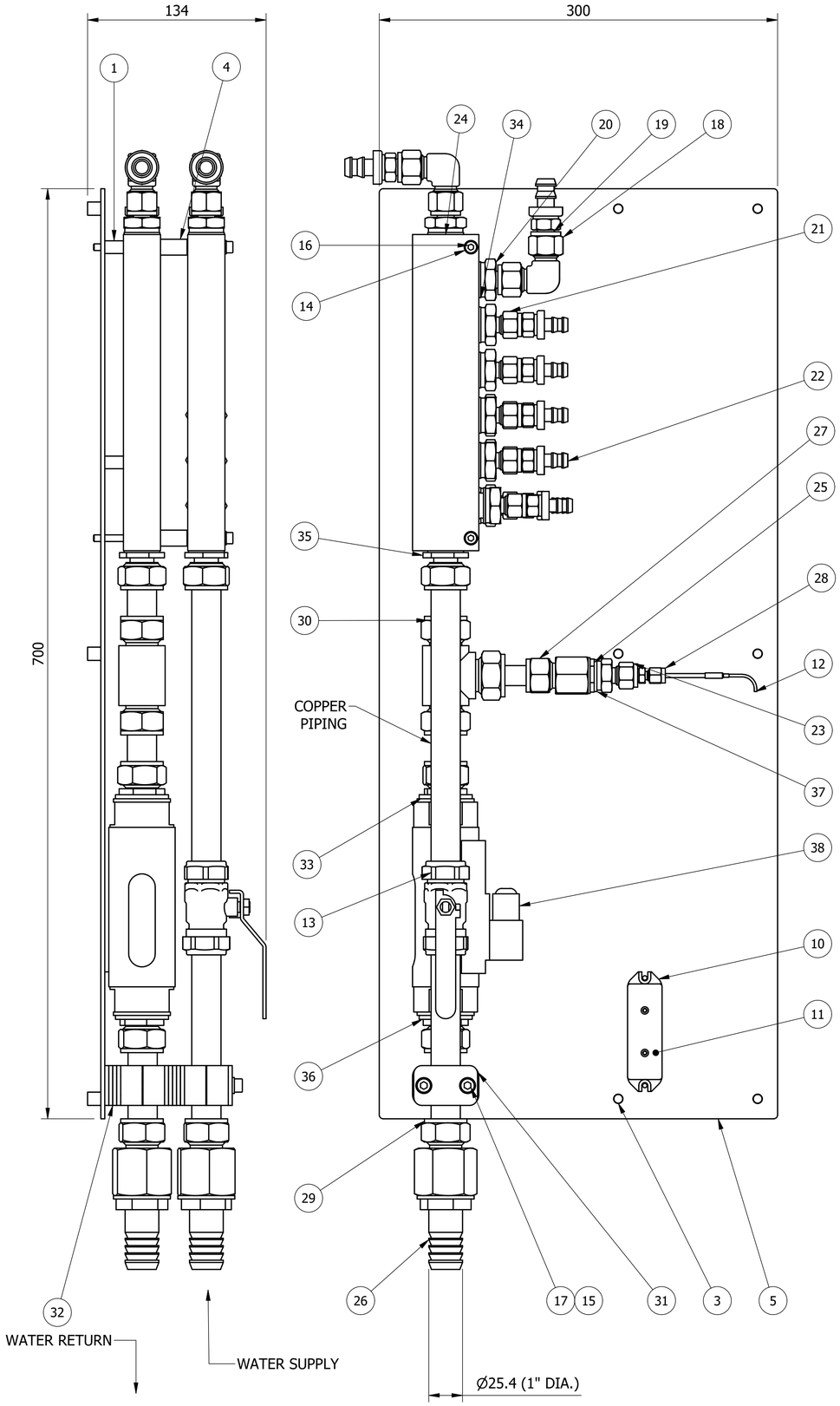
MATERIAL:

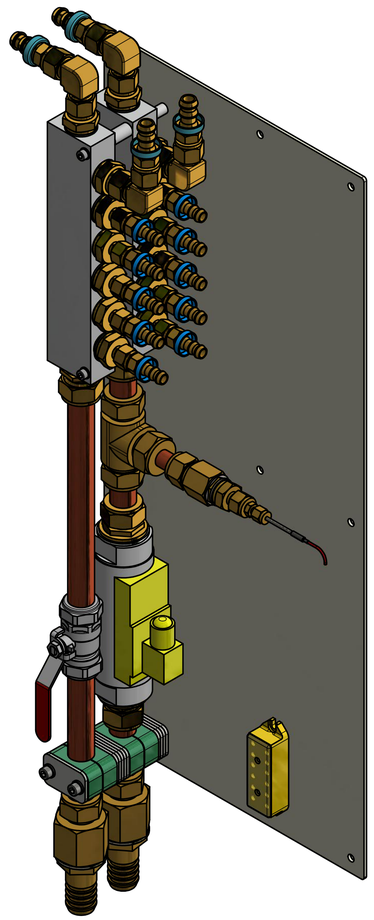
FINISH:

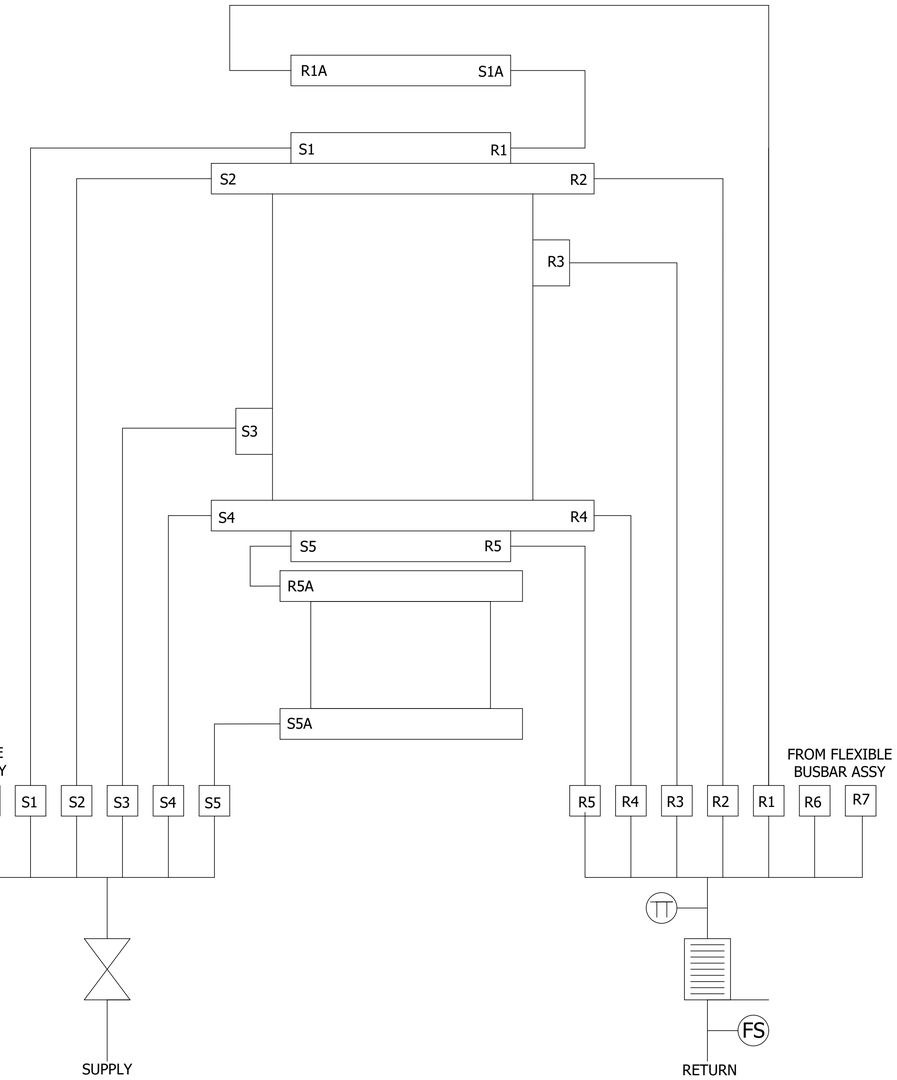
ORIG SCALE 1:2

ORIG SHEET A1

REVISION HISTORY				
REV	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		xx.xx.xx	
2	ADDED SPACERS FOR MANIFOLDS		30/09/2016	MT







NOTE:

ENSURE THAT THERE IS EXTRA PIPE LENGTH
ON PIPES S1A & R1A SO THAT THE CAP CAN BE
REMOVED SUFFICIENTLY SO THAT IT DOESN'T
INTERFERE WHEN FITTING THE GRAPHITE

IF FLEXIBLE BUSBARS ARE NOT USED THEN FIT PLUGS IN PORTS 6 & 7

PORTS 6 OR 7 CAN BE ALSO BE USED FOR COOLING TUBE (IF FITTED)

APPROXIMATE MASS = 15 kg

DO NOT SCALE
IF IN DOUBT ASK
UNLESS OTHERWISE STATED
DIMENSIONS ARE IN mm
TIM TOL ± 0.5
0.0 ± 0.1
ANGULAR TOL ± 0.5°
SURFACE FINISH 1.6
REMOVE ALL SHARP EDGES

SG Controls Limited

TITLE: WATER PANEL ASSEMBLY - 38 & 63mm FURNACE

USED ON | DRG No. 288918A | SHEET 1 OF 2 | REV 2

MATERIAL: | FINISH: | DRG SCALE 1:2 | DRG SHEET A1

PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	125886	SPACER (14mm)
3	6	287894	10mm PIPE SPACER
4	2	288643	SPACER 20MM
5	1	288928	PANEL - 38mm FURNACE WATER
10	1	EE060216	6 WAY TERMINAL BLOCK
11	1	EE060217	COVER - 6 WAY TERMINAL BLOCK
12	1	EL82876	RTD SENSOR DIA.3 x 200 LONG
13	1	H05146	22MM COMPRESSION BALL VALVE
14	2	K00061	5mm PLAIN WASHER - STD, S/S
15	2	K00313	Washer 6mm Std S/S
16	2	K03090	HxCpHd M5x100 S/S
17	2	K03263	HxCpHd M6x100 S/S
18	4	P02608	1/2" OD TUBE UNION ELBOW BRASS
19	4	P02910	HOSE CONNECTOR 1/2" BARB to 1/2" TUBE
20	4	P03046	1/2" G Female to 1/2" tube
21	10	P03197	MALE CONNECTOR 3/8"
22	10	P03243	3/8" HOSE x 3/8" TUBE
23	1	P03309	3/8" BSP TO 3/8" SWAGELOK
24	2	P04000	6 WAY MANIFOLD - 1/2" BSP
25	1	P04001	3/8" TO 1/4" BSP REDUCING BUSH
26	2	P04006	1" BSP HOSETAIL
27	1	P04009	FEMALE COUPLER 15mm TO 1/2" BSPT
28	1	P04010	3/8" TO 1/8" REDUCER
29	2	P04014	1" BSP FEMALE TO 22mm COUPLING
30	1	P04016	REDUCING TEE 22 x 22 x 15
31	2	P04069	22mm STANJDARD CLAMP PP
32	10	P04070	COVER PLATE DP3 W3
33	4	P04071	BONDED SEAL FOR 1" BSP
34	18	P04072	BONDED SEAL FOR 1/2" BSP
35	2	P04076	22mm TO 1/2" BSP MALE COUPLER
36	2	P04077	22mm TO 1" BSP MALE COUPLER
37	1	S00184	BONDED SEAL 3/8
38	1	V01559	FLOW SWITCH 30 - 90 l/min

VIEW5 (1:5)

SG Controls Limited

dwg: aweise | date: 28/04/2016

DO NOT SCALE
IF IN DOUBT ASK
UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM TOL 0 ± 0.3
0.0 ± 0.1
ANGULAR TOL ±0.5
SURFACE FINISH 1.6 µm
REMOVE ALL SHARP EDGES

TITLE: WATER PANEL ASSEMBLY - 38 & 63mm FURNACE

USED ON

DRG No. 288918A

SHEET 2 OF 2

REV 2

MATERIAL:

FINISH:

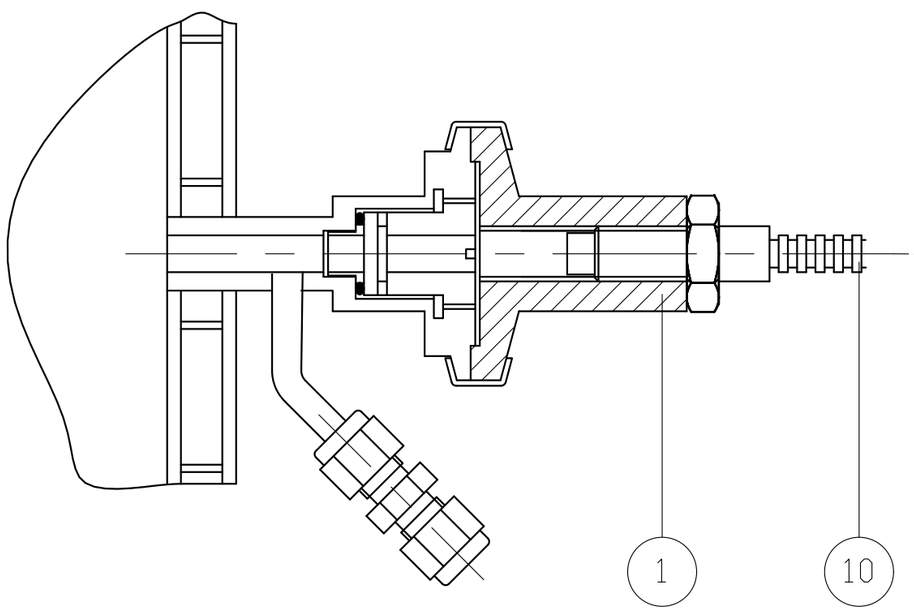
ORIG SCALE 1:2

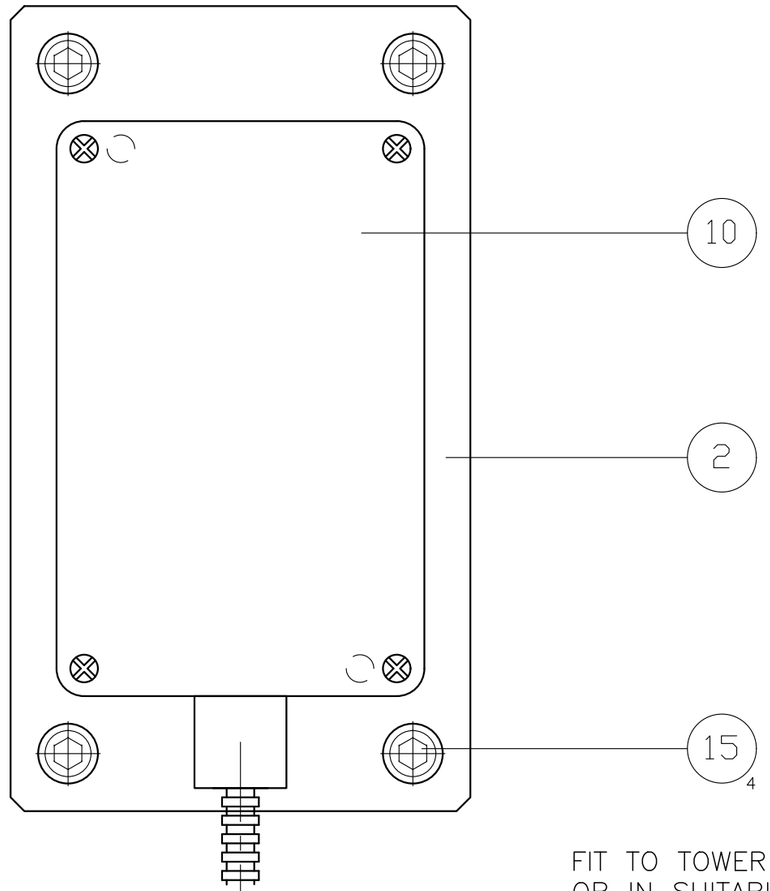
ORIG SHEET A3

DWG. No.	DO NOT SCALE	DRAWING TO BS308	DO NOT SCALE
286001A			

REVISION HISTORY				
REV.	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		12.8.10	AJW

PYROMETER PORT
ON FURNACE BODY





FIT TO TOWER MATRUX PLATE,
OR IN SUITABLE POSITION ON
TOWER

DRAWN	AJW	12.8.10
CHECKED		DATE
APPROVED		DATE

SG controls — **SG Controls Limited**

UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM. TOL. 0 ±
0.0 ±
ANGULAR TOL. ±
SURFACE FIN. –
REMOVE ALL SHARP EDGES

THIRD ANGLE PROJECTION

TITLE: PYROMETER ASSEMBLY
FURNACE BODY

USED ON	DWG. No.	SHEET	REV
285991A	286001A	1 OF 1	1
	MATERIAL	ORIG. SCALE	1:1
	FINISH	ORIG. SHEET	A2

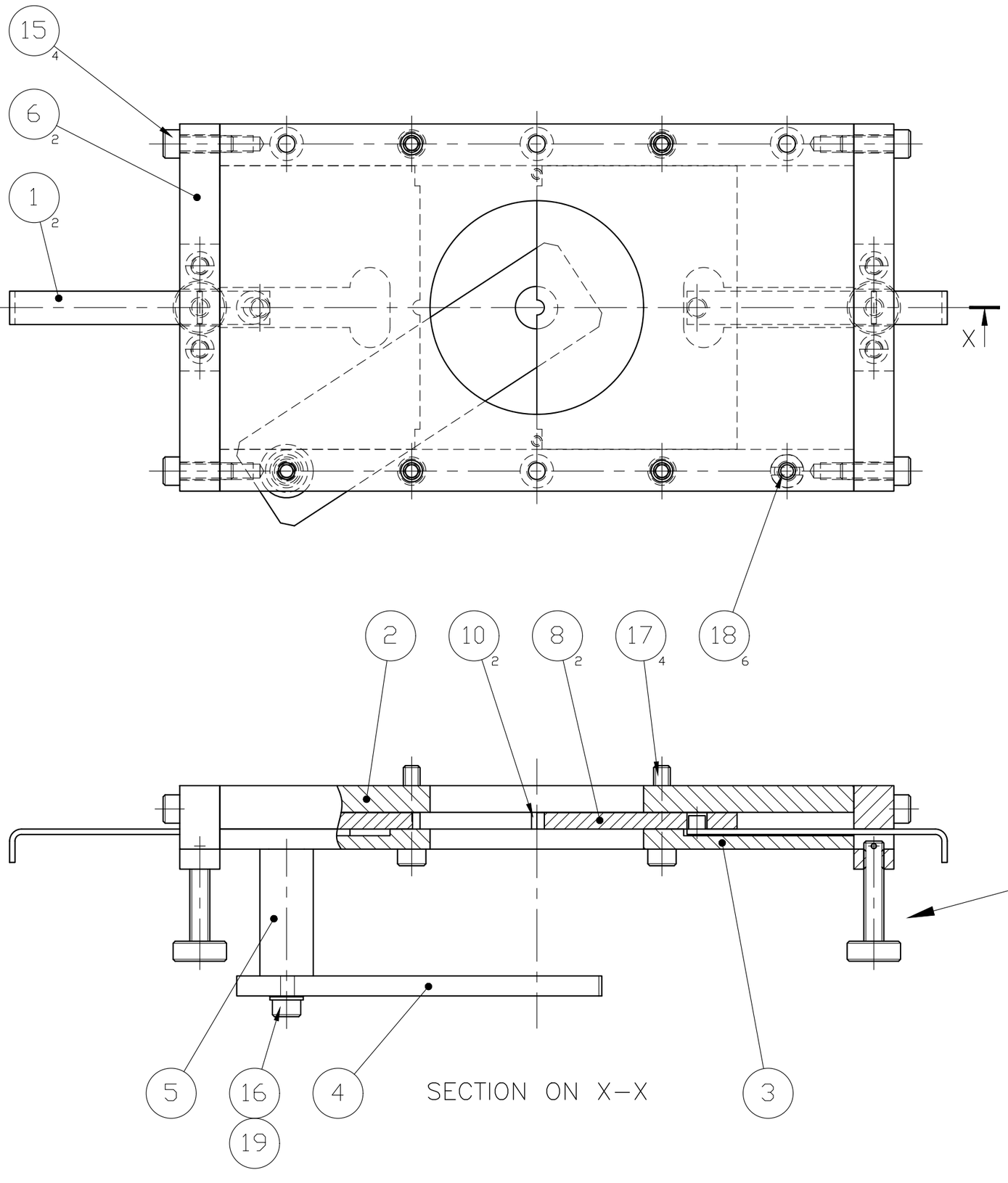
DWG. No. 285186A

DO NOT SCALE

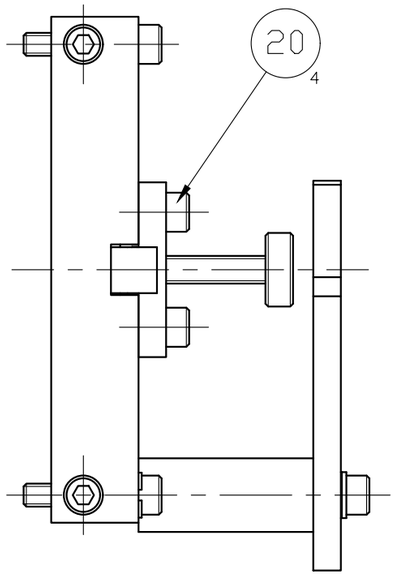
DRAWING TO BS308

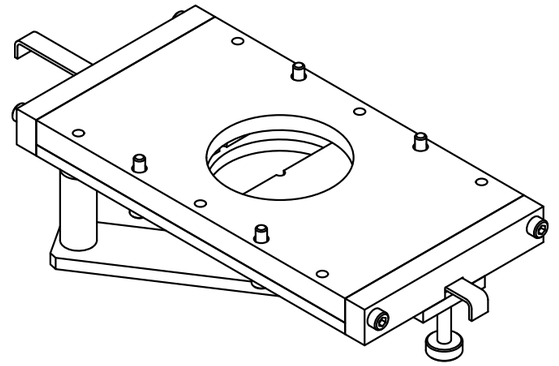
DO NOT SCALE

REVISION HISTORY				
REV.	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE	N/A	15.5.09	RL
2	SECOND SET OF DOORS ADDED @ 6.0 DIA		30.11.17	AJW

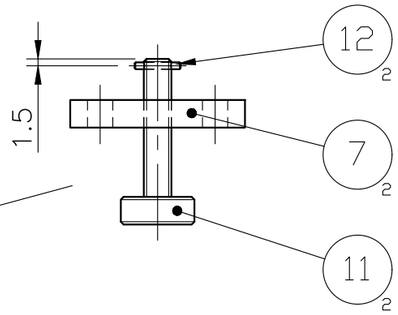


SECTION ON X–X





ISOMETRIC VIEW
(SCALE 1:2)



FIT ITEM 11 INTO ITEM 7 & DRILL ø1.5 THRO AT DIMN SHOWN. FIT ITEM 12 BEFORE ASSEMBLY TO DOOR

FOR GRAPHITE DOOR LEAF VERSION SEE 189911A

DRAWN	RL	DATE 15–MAY–09
CHECKED		DATE
APPROVED		DATE

SG controls — SG Controls Limited

UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM. TOL. 0 ± 0.0 ±
ANGULAR TOL. ±
SURFACE FIN. –
REMOVE ALL SHARP EDGES

TITLE: FURNACE DOOR ASSEMBLY – ST STEEL LEAF FOR 63mm DIA FURNACE ASSEMBLY

USED ON	DWG. No.	SHEET	REV
285162A	285186A	1 OF 1	2
THIRD ANGLE PROJECTION	MATERIAL SEE UNIPLAN BOM	ORIG. SCALE	1:1
	FINISH	ORIG. SHEET	A2

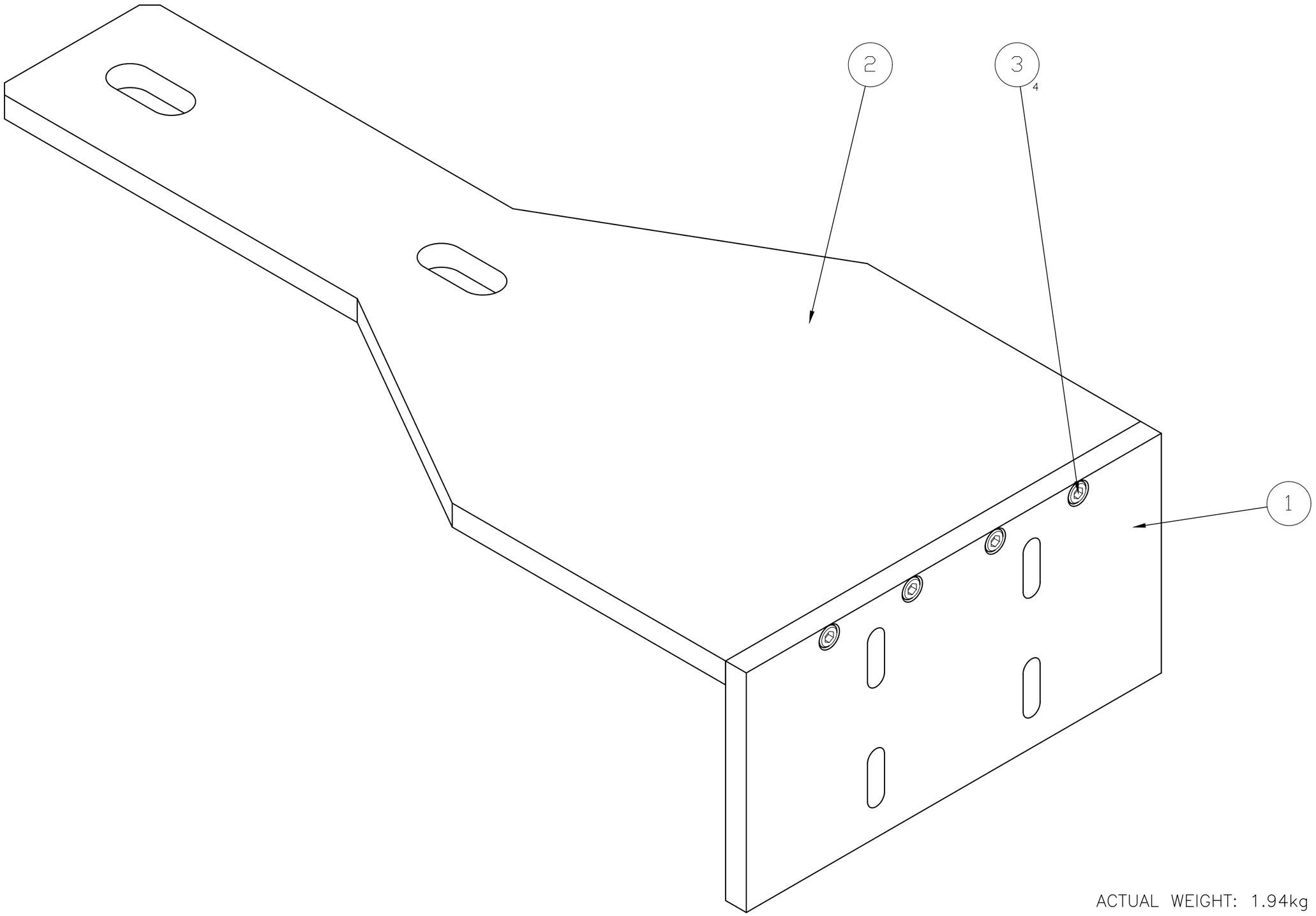
DWG. No. 284341A

DO NOT SCALE

DRAWING TO BS308

DO NOT SCALE

REVISION HISTORY				
REV.	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE	N/A	11.2.08	RL
2	BACK PLATE LOWERED TO MINIMISE HEIGHT		25.2.11	RL



ACTUAL WEIGHT: 1.94kg (4.3lbs)

DRAWN	RL	DATE 11-FEB-08
CHECKED		DATE
APPROVED		DATE

TITLE: STUD SUPPORT PLATE ASSEMBLY FOR 63MM DIA FURNACE ASSY

SG controls — SG Controls Limited

UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM. TOL. 0 ± N/A, 0.0 ± N/A
ANGULAR TOL. ± N/A
SURFACE FIN. – N/A (µm)
REMOVE ALL SHARP EDGES

THIRD ANGLE PROJECTION

USED ON 284329A	DWG. No. 284341A	SHEET 1 OF 1	REV 2
	MATERIAL SEE UNIPLAN BOM	ORIG. SCALE	1:1
	FINISH N/A	ORIG. SHEET	A2

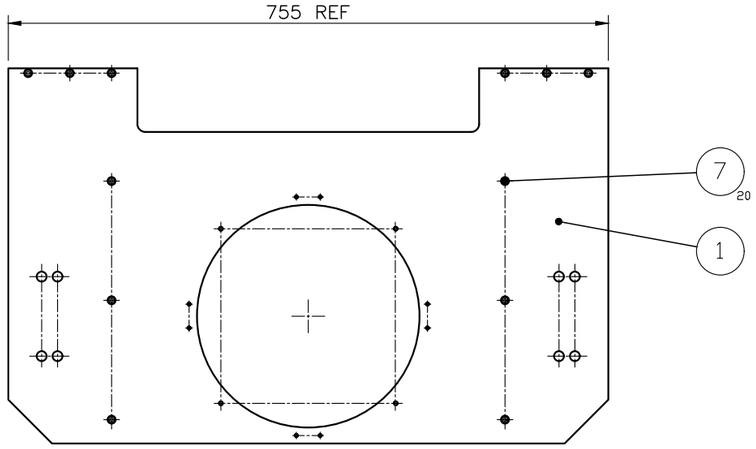
DWG. No. 284330A

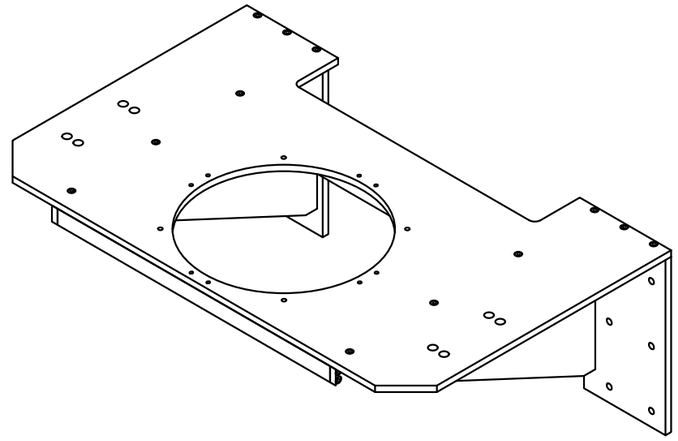
DO NOT SCALE

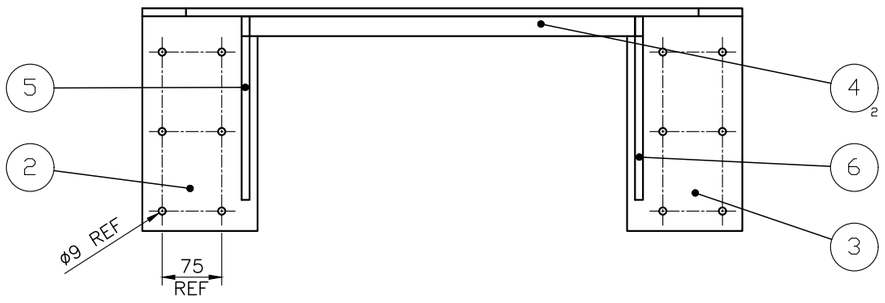
DRAWING TO BS308

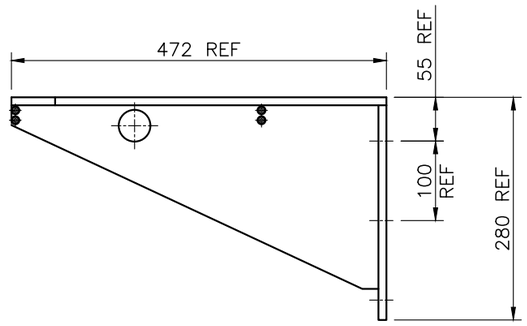
IF IN DOUBT ASK

REVISION HISTORY				
REV.	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE	N/A	5.2.08	RL
2	2 OFF HOLES ADDED AT LHS OF PLATE	22011	10.4.08	RL
3	BRKT SHORTENED BY 100mm	22511	18.5.09	RL
4	NOTCH ADDED AT REAR OF BRACKET	22574	24.8.09	RL









DRAWN	RL	DATE 5-FEB-08
CHECKED	?	DATE ?
APPROVED	?	DATE ?

SG controls

SG Controls Limited

UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm

DIM. TOL. 0 ± N/A
0.0 ± N/A
ANGULAR TOL. ± N/A
SURFACE FIN. – N/A √(µm)

REMOVE ALL SHARP EDGES

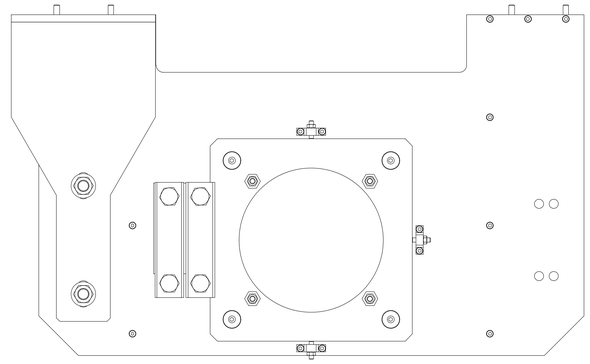
TITLE

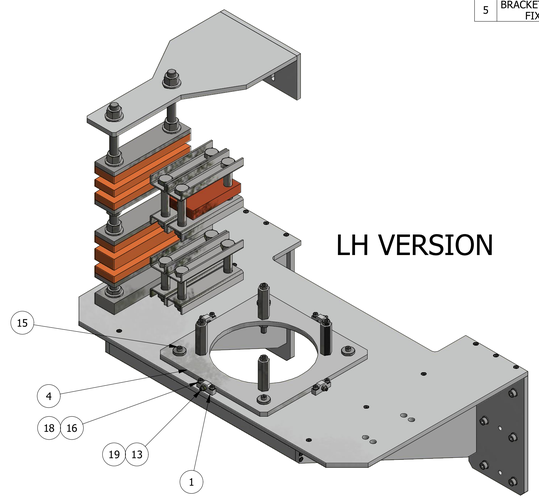
FURNACE MOUNTING KIT FOR 63MM DIA FURNACE ASSY

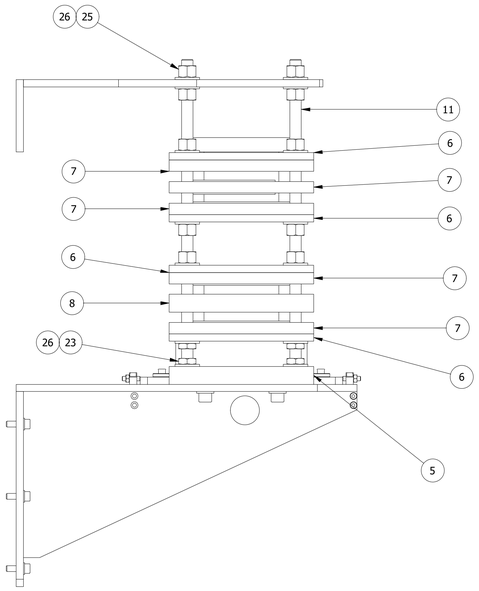
USED ON 284329A	DWG. No. 284330A	SHEET 1 OF 1	REV 4
THIRD ANGLE PROJECTION	MATERIAL SEE UNIPLAN BOM	ORIG. SCALE	1:4
	FINISH N/A	ORIG. SHEET	A1

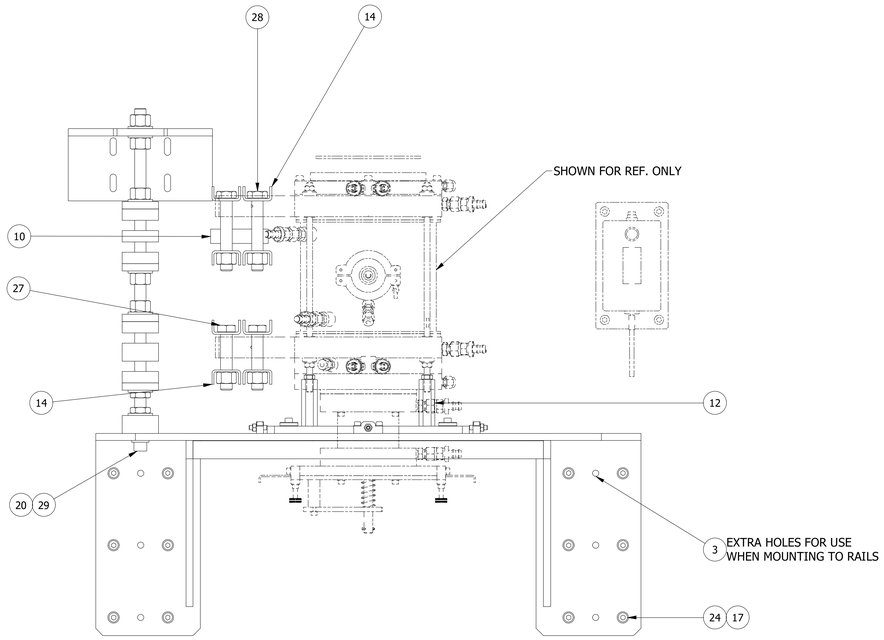
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	283852	STOP/ADJUSTER BLOCK
2	4	283938	CLAMP WASHER
3	1	284330A	SUPPORT PLT ASSY 63 FURNACE
4	1	284336	ADJUSTER PLATE 63MM
5	1	284337	BUSBAR SUPPORT BLOCK
6	4	284338	BUSBAR CLAMP PLATE
7	5	284339	CLAMP BLOCK 16mm
8	1	284340	CLAMP BLOCK 25mm
9	1	284341A	STUD SUPPORT PLATE ASSY
10	1	284345	COPPER SPACER BLOCK
11	2	284360	M16 x 450 STUD
12	4	284706	SUPPORT STUD - 64.5mm
13	4	H04380	StScr-M6x25 S/S
14	8	H04535	BUSBAR CLAMP 100mm
15	4	K00030	HxCpHd M6x25 S/S
16	8	K00061	Washer 5mm Std S/S
17	12	K00065	Washer 8mm Std S/S
18	8	K00293	HxCpHd M5x20 S/S
19	4	K00312	HxNut M6 S/S
20	2	K00508	Washer 12mm Std S/S
21	4	K00513	Washer M10 (Form A) S/S
22	4	K00549	HxNut M10 S/S
23	4	K00864	HxNut M16 Half S/S
24	12	K00882	HxCpHd M8x25 S/S
25	18	K00902	HxNut Full M16 S/S
26	14	K00903	Washer M16 (Form C) S/S
27	4	K03202	HxHd Bolt M16 x 80 S/S
28	4	K03203	HxHd Bolt M16x100 S/S
29	2	K03285	HxCpHd M12x30 HTS 12.9

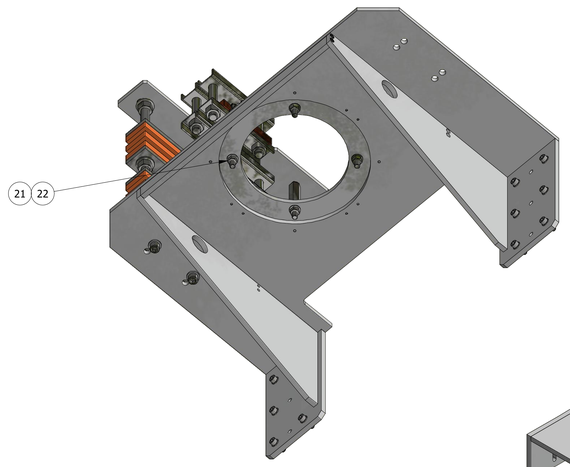
REVISION HISTORY				
REV	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		13.2.08	RL
2	UPDATED WITH CLAMP & FITTING MOD'S		27/11/08	RL
3	BRACKET HEIGHT SHORTENED BY 100mm		15/05/09	RL
4	430 X 80 NOTCH ADDED AT REAR OF BRKT		24/05/09	RL
5	BRACKETS MODED TO ALLOW FIXING ONTO RAILS		2/11/17	CK

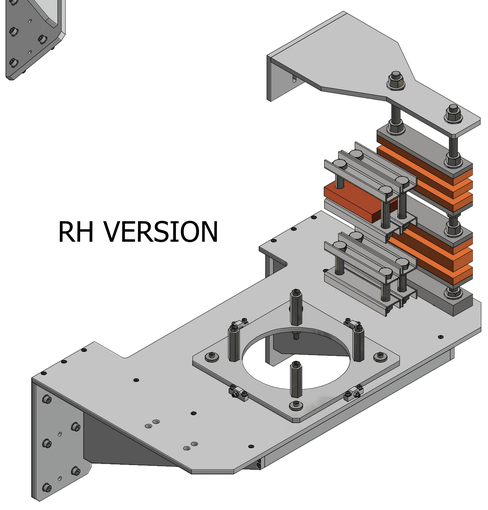












NOTES

1) EXTRA HOLES IN SUPPORT BRACKET ARE FOR USE WHEN MOUNTING TO RAILS.

2) FACES OF BUSBAR FURNACE FLANGES AND COPPER SPACER BLOCK MUST BE FLAT AND UN DAMAGED. THE SURFACES MUST BE CLEAN AND DE GREASED. JOINT PASTE MUST NOT BE USED.

SG Controls Limited

UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm TOLERANCE ± 0.5 SURFACE FINISH 3.2 BREAK ALL SHARP EDGES

DO NOT SCALE IF IN DOUBT ASK

TITLE: FURNACE MOUNTING KIT

DRG No.: 284329A

SHEET 1 OF 1

REV 5

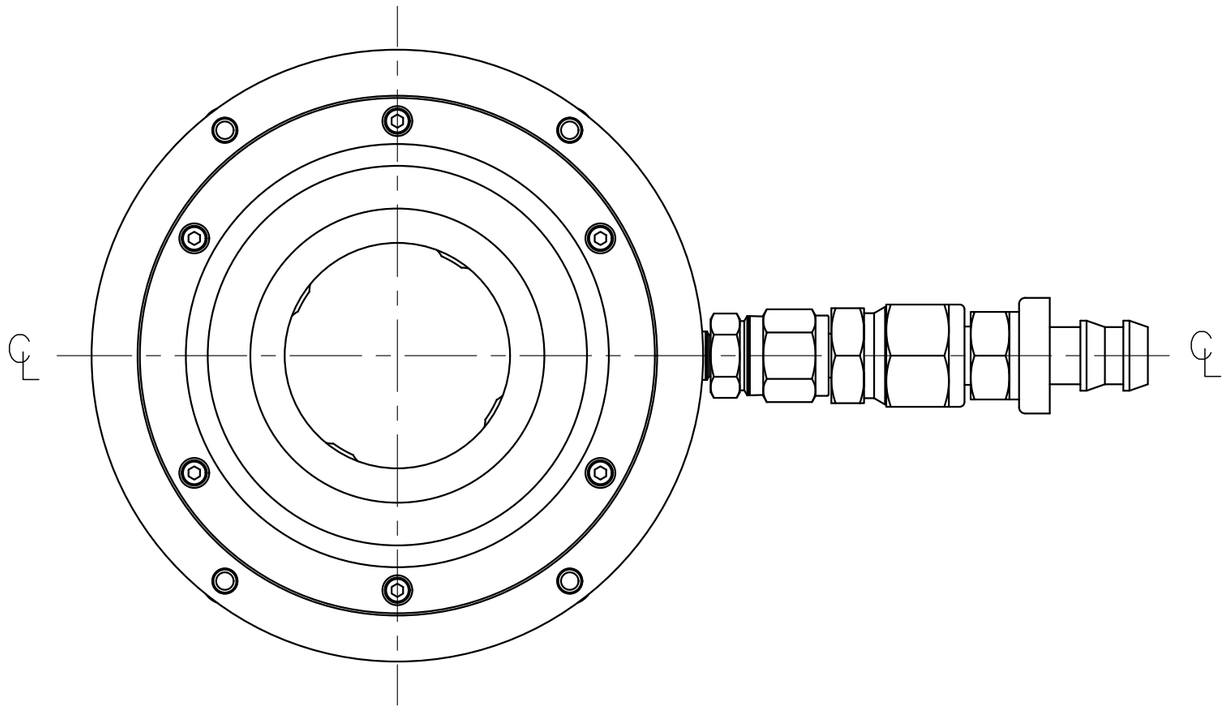
MATERIAL:

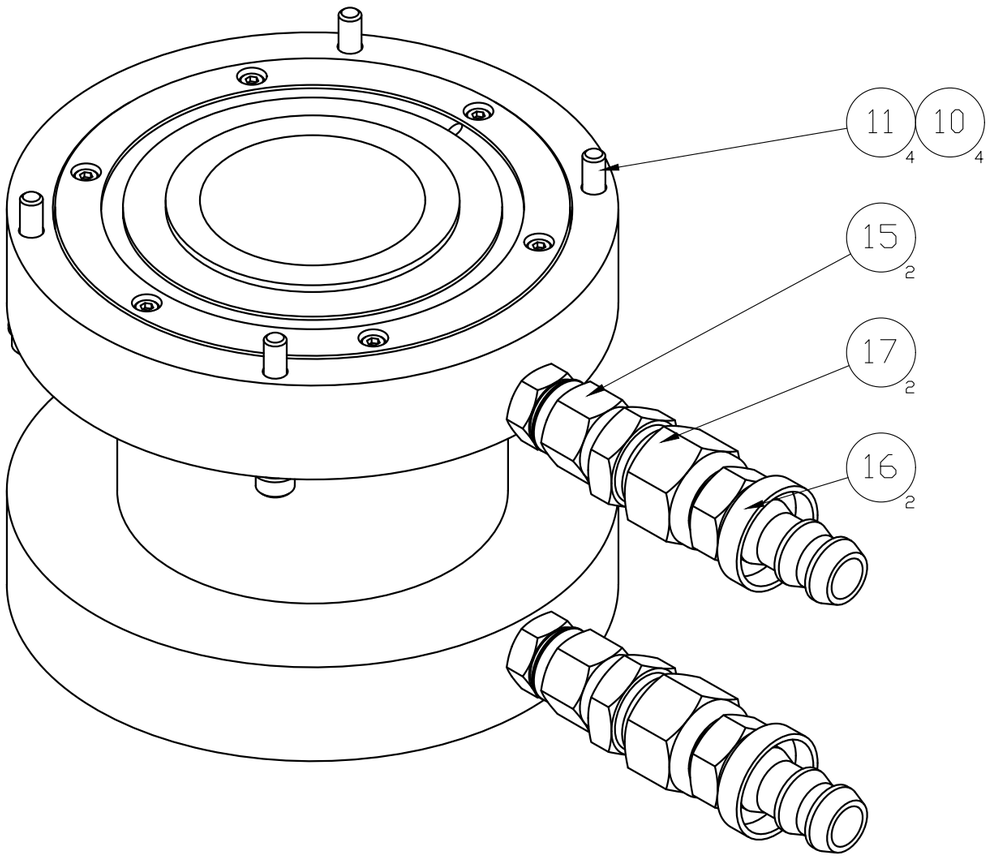
DRG SCALE NA

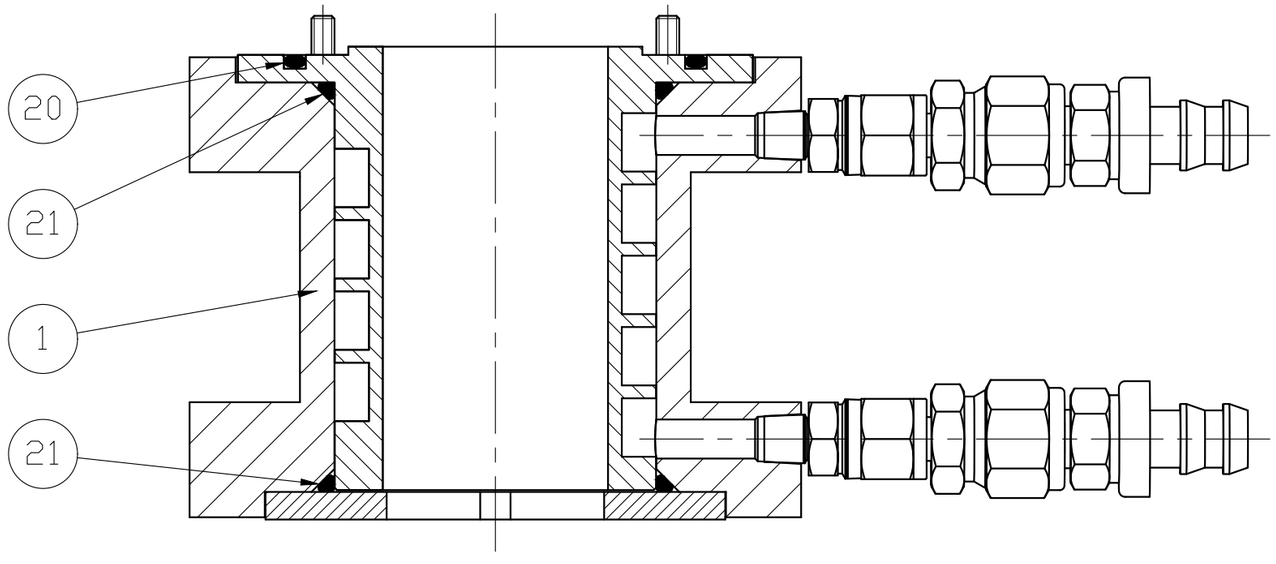
DRG SHEET A3

DWG. No.	DO NOT SCALE	DRAWING TO BS308	DO NOT SCALE
284266A			

REVISION HISTORY				
REV.	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE	N/A	22.11.07	RL
2	2 OFF ITEM 21 ADDED	22122	2.7.08	RL
3	1/2" WATER CONNS WERE 3/8"	22181	28.7.08	RL







PART SECTION ON ℄

ACTUAL WEIGHT: 1.75kg (3.8lbs)

DRAWN	RL	DATE 22-NOV-07
CHECKED		DATE
APPROVED		DATE

SG controls — **SG Controls Limited**

UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM. TOL. 0 ± N/A, 0.0 ± N/A
ANGULAR TOL. ± N/A
SURFACE FIN. – N/A
REMOVE ALL SHARP EDGES

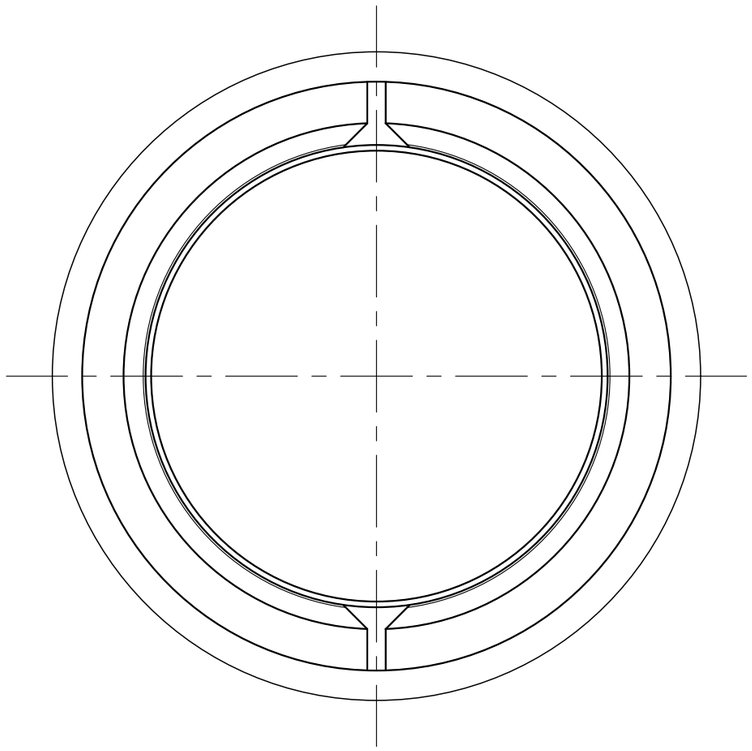
TITLE: WATER COOLED OUTLET ASSEMBLY FOR 63MM DIA FURNACE

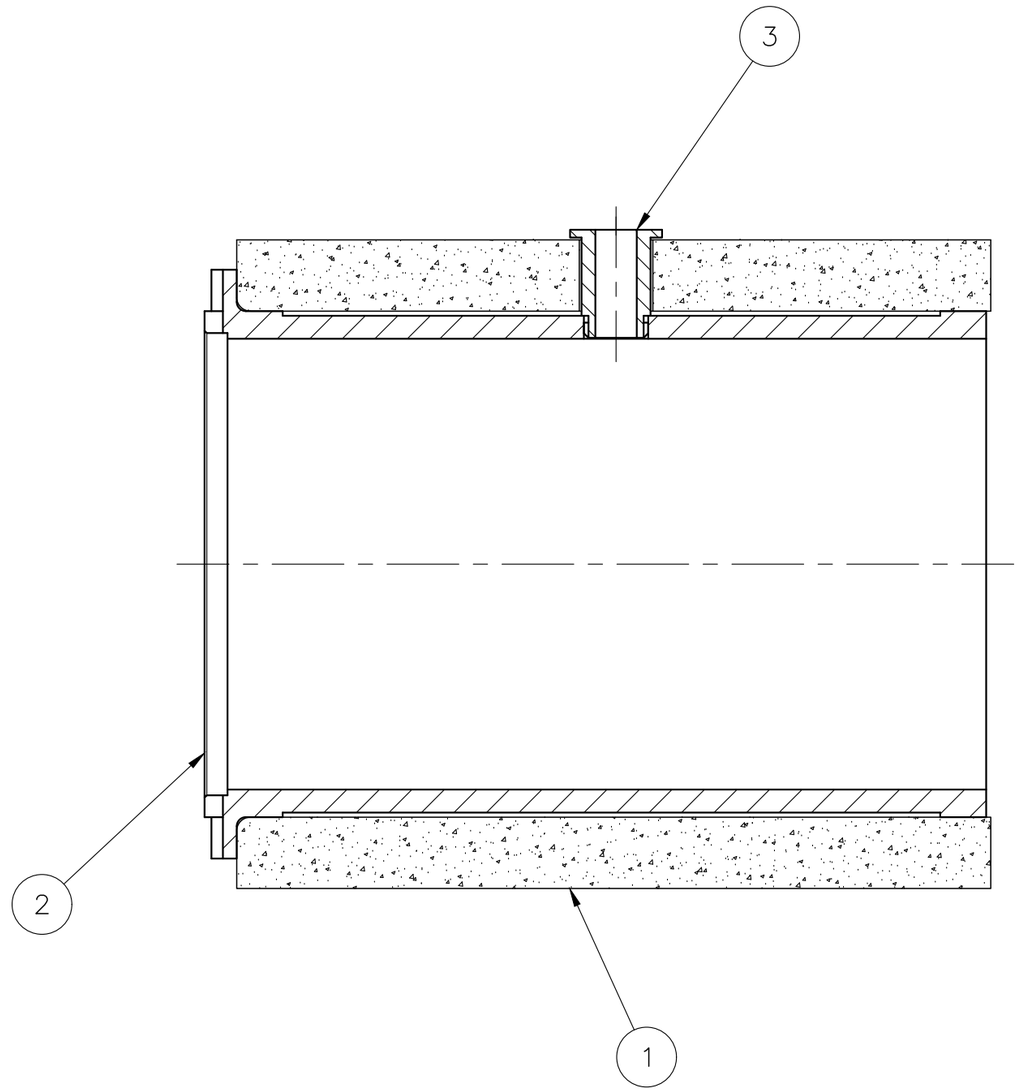
USED ON	DWG. No.	SHEET	REV
284262A	284266A	1 OF 1	3
THIRD ANGLE PROJECTION	MATERIAL SEE UNIPLAN BOM	ORIG. SCALE	1:1
	FINISH N/A	ORIG. SHEET	A2

DWG. No.	DO NOT SCALE	DRAWING TO BS308	DO NOT SCALE
282701A			

REVISION HISTORY

REV.	DESCRIPTION	DCR No.	DATE	APPROVED
1	FIRST ISSUE		04.09.01	T.H.





DRAWN	DATE
T.Hedger	04–09–01
CHECKED	DATE
APPROVED	DATE

SG controls

SG Controls Limited

UNLESS OTHERWISE STATED DIMENSIONS ARE IN mm
DIM. TOL. 0 ±
0.0 ±
ANGULAR TOL. ±
SURFACE FIN. –
REMOVE ALL SHARP EDGES

TITLE: RADIATION SHIELD ASSEMBLY (ø63mm FURNACE)

USED ON	DWG. No.	SHEET	REV
282700A	282701A	1 OF 1	1
THIRD ANGLE PROJECTION	MATERIAL	ORIG. SCALE	1–1
	FINISH	ORIG. SHEET	A2