Installation, Operation & Maintenance Instructions Manual

4.2 Edition (June 2024)

Refer to EXHEAT website for latest edition. (www.exheat.com/iom)

Contents

EXHEAT has provided versions of this manual in German, French, Italian, Spanish, Portuguese, Polish, Chinese and Russian. The foreign language versions can also be found at www.exheat.com/iom.

****EXHEAT IOM in foreign languages are auto translated and English version is precedent****

To maintain the equipment warranty, the instructions contained within this manual must be complied with in full.

To maintain the equipment Ex hazardous area certification, the instructions in this IOM must be fully complied with, in addition to the "Appendix X: IOM Ex heater Annex".

Fitting any other device invalidates the hazardous area certification.

1. Contact Details

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2. Description of equipment

Please refer to the Contract Manufacturing Data Book.

3. Safety

General

Electrical equipment must be designed, tested and installed such that, when it is used correctly, health and safety risks are kept to a minimum. The client must be provided with information about any necessary safety conditions, warned of any possible hazards that may arise during normal operation and told how to avoid them.

The client must ensure that:

- any employees working on the equipment are authorized & competent in the proper working procedures in order to ensure their safety. The plant must be maintained in a safe condition.
- safety interlocks are provided and maintained to ensure that the heater may only be energised when the design flow rate through the heater is attained, and that the heater is de-energised should this flow rate be reduced or stopped.
- heater terminal enclosure covers are not removed whilst any precipitation, airborne dust or moisture is in the vicinity or when grinding, welding or similar activities are taking place nearby.

Provided the above conditions are adhered to, the equipment should be safe for use under normal operating conditions.

Safety hazards may arise when authorised and competent persons need to open doors or remove covers on control cubicles to carry out maintenance, testing or setting up to work. In the majority of these cases the equipment cannot be completely isolated before working on it.

It is virtually impossible to achieve conditions which are completely hazard-free when working on energised circuits. Responsibility for safe conduct of the competent person or persons operating on the equipment rests with those under whose authority they act.

Where the equipment is subject to the *Pressure Equipment Directive* (2014/68/EU):

- Prior to putting the equipment into service, the client must comply with the Essential Safety Requirements as stipulated by the directive.
- Refer to the Manufacturing Data Book for further details.

Installation

Should deviation from original design parameters occur, or change of original design structure be required, please refer back to EXHEAT for consultation prior installation.

Ensure that the equipment is correctly installed in a suitable location by technically qualified and competent persons.

Before operating the equipment, have the installation approved by a supervisor to ensure that the system is safe for operation.

Ensure compliance with any instructions and information provided in this manual and on the drawings supplied.

It is the client's responsibility to ensure that safe systems of work are used by all personnel operating and maintaining the equipment, including testing when 'live'.

Normal use

Observing the following points will minimise the risk of accidents to personnel using electrical equipment:

- Ensure that all persons operating the equipment are fully trained. This includes training in emergency shutdown procedures.
- Train operators to recognise signs of maloperation of the equipment and to know what actions to take in these circumstances.
- Keep all control cubicle doors closed and locked whilst the equipment is in operation and comply with any safety warning notices.
- Restrict access to heater terminal enclosures and keys for control cubicle doors to competent authorised personnel. Issue them only as part of a written safe system of work to ensure doors and terminal enclosure covers are:
  - not unlocked until electrical supplies are isolated
  - locked before electrical supplies are restored for normal operation of equipment.

Maintenance and testing

The client must ensure that maintenance, set up and testing of the equipment is only carried out by authorised and competent persons.

The following rules must be adhered to:

- Before starting maintenance work, isolate the equipment completely where possible.
- Comply with safe working conditions.
- Do not work alone on the equipment when it is energised.

- Be aware of hazards which may arise when working on energised equipment and take all necessary precautions.
- Familiarise all persons working on the equipment with the instructions and information provided in the manual.

4. Preservation and storage instructions

Where specified in the contract, the equipment is supplied by EXHEAT suitably packed for storage.

Receipt of goods

Follow the guidelines below when goods are received:

- Use all design lifting points whenever moving the equipment from one area to another.

Lifting eyes fitted in the Element Support Plate of immersion heater bundles are designed for supporting only the bundle during removal and re-fitting, in conjunction with slings. They are not designed for the combined weight of the fitted heater in the vessel. The same is true for lifting points on the terminal enclosures of air duct heaters – use these for bundle lift only. Lift the package using the lift points on the duct section.

- Take care at all times to ensure that the equipment is moved safely and that no out of balance occurs during movement.
- On receipt of the equipment into the storage area:
  - Examine the equipment against the packing list to check that goods received match the packing list.
  - Check for any damage that may have occurred in transit. Any damage must be logged and reported to the site manager and EXHEAT within seven (7) days of receipt of goods.
  - Unless otherwise agreed in writing, store the equipment in an inside location that is dry, clean and well ventilated. Please refer to Post Despatch & Storage.
  - Ensure that equipment is not stacked and observe any ‘This Way Up’ markings.

Preservation materials

Further preservation instructions can be found in Section 12.

Suitable preservation materials, such as silica gel bags, have been placed inside the packaging is only for transportation purpose.

It is the client’s responsibility to ensure that these silica gel bags be checked, replaced if necessary and replenished with sufficient amount for preservation purposes.

For heaters, the preservation materials have been placed inside the main heater terminal enclosure and the auxiliary instrument junction box, if fitted. It is the client’s responsibility to ensure that, if the terminal enclosure is opened prior to installation, these bags are checked and replaced if necessary.

Post Despatch & Storage

Ensure the equipment is stored in a proper manner in order to minimise the risk of accidental damage.

The following preservation instructions must be adhered to. Failure to do so could result in the equipment warranty being invalidated:

- Store the equipment at between 0°C and +50°C.
- Ensure that the equipment is not subjected to direct sunlight at ambient temperatures above 30°C.
- Protect the equipment against external sources of vibration and/or impact.
- Do not store the equipment for more than 3 months unless packed for long term storage.
- For long term storage packed equipment, leave the equipment in its original sealed packaging until required for installation. Moisture indicators may have been fitted to this type of packaging. These indicators should be checked every three months, the preservation materials replaced if necessary, and the packaging resealed.
- Where provided, anti-condensation heaters should be temporarily energised during storage and prior to installation. The temporary supply must be disconnected following the equipment being put into full operation.
- Should it be necessary to open a packing/heater terminal enclosure, for example to cable in an anti-condensation heater:
    - check the preservation materials and replace them if necessary.
    - replace the terminal enclosure cover immediately after the work has been carried out.
    - reseal the packaging.
- The contractor must carry out periodic inspections of the equipment during storage in order to:
    - detect any signs of deterioration.
    - check on limitations of time in storage.
    - ensure maintenance of proper conditions.
    - determine the current state of materials.
- For equipment supplied with vessel, refer to the Manufacturing Data Book or contact EXHEAT for recommendations.
- When the periodic inspections are complete, complete the Storage Preservation Check Record in Appendix B.

Should it be necessary to open the main heater terminal enclosure, replace the preservation materials and update the preservation record (found in the main heater terminal enclosure) accordingly.

5. Erection and installation instructions

Overview

This section covers the erection and installation requirements for most of the range of EXHEAT equipment, such as non-hazardous areas/locations.

Compliance with these instructions is a warranty requirement and documented evidence must be maintained in the form of signed checklist and records as contained in Appendix B. Copies of completed checklists and records will be required in the event of a warranty claim.

Refer to the relevant code of practice for the equipment.

Over-temperature trip devices

It is a mandatory requirement that the over-temperature devices (excluding spares) are connected back to the dedicated trip system to shut down electrical power to the heater in the event of over-temperature.

Be aware of the following important points:

Thermocouple

Note the polarity of the circuit for the sensor to operate correctly.

Ensure that the correct compensating cable is used for the type of thermocouple fitted, as detailed on the schedule drawings.

RTD

Note the correct connections to ensure that they operate as detailed on the schedule drawings.

Temperature transmitters

Note the polarity of each device to ensure that it functions correctly within the control loop.

Thermostats

Note the connections shown in the drawing to ensure the correct operation.

- Where thermostats have been pre-set at EXHEAT they require no further adjustment.
- Adjust thermostats that have been supplied un-set to meet process requirements.

If there is any uncertainty about these points, contact EXHEAT for advice.

Scope

The extent of equipment to be erected/installed is detailed in the drawing schedule specific to each contract.

Responsibilities

This section outlines the erection contractor's responsibility for the erection and installation of the equipment supplied by EXHEAT:

- Install the equipment under the surveillance of the client's site engineers, in accordance with these instructions. In addition, check Flow direction indication.
- Carry out the installation in complete accordance with this document, which shall be read as complimentary to all associated contract documents (such as site conditions, contract specifications and drawings) and national legislation/regulations.
- Ensure that all employees are fully trained and supervised in the appropriate site working procedures in order to ensure their safety. The site must be maintained in a safe condition at all times.
- Ensure that all site installation personnel are issued with copies of all relevant drawings, material schedules and specifications necessary to fulfil their obligations.
- Provide all tools and equipment necessary to carry out the installation as required on the schedule drawings for that contract.

Pre-installation inspection

Before installation, inspect the equipment to ensure that all items are available and that all crates and/or packaging are in good condition and undamaged. Any damage must be reported to the site manager and to EXHEAT.

Moving the equipment into position

Follow the steps below to safely move the equipment into position:

Ensure that the equipment is moved and installed by technically qualified and competent persons experienced in the class of work involved.

- Carefully remove the packaging from each item and check for damage. Report any damage to the site construction manager immediately and to EXHEAT.
- Move the equipment by either crane or fork lift truck, using suitable lifting chains/slings to prevent damage to the heating elements. Observe the following safety points:
  - All lifting tackle/equipment must have a safe working load (SWL) capacity in excess of that of the equipment weight and include for snatch factors etc.

Certain equipment configurations may require a lifting beam to achieve a safe lift.

  - The slings or ropes must be long enough to keep the angle between the slings/ropes and the top of the equipment greater than 45°.

If the sling/rope is too short it will reduce this angle and lead to unacceptably high stresses on the eyebolts/lifting lugs.

- Additional support should be provided when lifting, as necessary, to counteract any out of balance that may be present.
- Use a suitable method to prevent or reduce the swing of the suspended load.

Lifting eyes fitted in the Element Support Plate of immersion heater bundles are designed for supporting only the bundle during removal and re-fitting, in conjunction with slings. They are not designed for the combined weight of the fitted heater in the vessel. The same is true for lifting points on the terminal enclosures of air duct heaters – use these for bundle lift only. Lift the package using the lift points on the duct section.

- Only use a forklift truck to move equipment if absolutely necessary, particularly at the assembly site and on uneven ground. Use a crane whenever possible.
- If a forklift must be used, space the arms as far apart as the equipment allows and ensure they are long enough to go completely under the equipment.
- Ensure that the destination position is free from obstructions.
- Move the equipment into position and set the load down carefully and without bumping.
- Check the alignment prior to bolting it in position.

Installing the heater

Follow the steps below to install the heater:

- In the case of non-installed immersion heater bundles:
  - Inspect the gasket face prior to installation.
  - Inspect the immersed part of the heater bundle for any damage.
  - Check that the heating elements are not touching. This can lead to localised over-heating and premature element failure. Pay particular attention to the element ends furthest from the heater flange.
  - Report any damage or discrepancies to the site manager and EXHEAT.
- The equipment should be installed using industry recognised torqueing/ Tensioning Procedure.
- Check the insulation resistance of heater per stage. Use a 500VDC calibrated megohmmeter to take a reading between each phase terminal with reference to ground/earth. The reading should be taken for 60 seconds and to achieve greater than 2 megohm. If any of heater stages is lower than 2 megohm, contact EXHEAT for advice.
- Ensure that the equipment is suitably supported, both internally and externally, and not subjected to undue stress or vibration.
- If a heater bundle is supplied without housing, the immersed part must be adequately supported within the respective vessel, tank or duct.
- Ensure that there is sufficient room around the heater to remove the heater bundle for maintenance.
- Each heater is fitted with safety devices as detailed on the drawing schedule for that contract. These safety devices **must** be kept in good working order and connected

into the dedicated trip system as stated on the schedule drawings.

- Safety interlocks must be installed to ensure that the heater may only be energised when the design flow rate through the heater is attained, and that the heater is de-energised should this flow rate be reduced or stopped.
- Ensure that the supply cable is of the correct type and is sized for the current being carried. Consider:
  - maximum ambient temperatures
  - cable routing method
  - volt drops due to cable runs.
- Ensure that the supply cables are suitably supported to prevent undue force/stress on the terminal points.
- Check that the voltage on the heater nameplate is compatible with the mains supply being used.
- Under no circumstances interfere with any EXHEAT internal cabling or connections. This includes re-routing and 'bunching' cables, which can have a serious adverse effect on the heat build-up generated within the terminal enclosure.

Terminal Points

The terminal points for each heater are as follows:

- Power terminals and cable gland plates (or cable entries) for heater power supply.
- Control terminals and cable gland plates (or cable entries) for heater trip/alarms.
- Equipment earth terminals.

Earth-fault protection

For safety reasons, it is essential to limit the magnitude and duration of earth-fault currents. It is impractical to cover all possible systems, however note that, regardless of which system is used, the heater must be protected by a suitable device wired to shut down the heater in the event that a heater element fails to earth. Suitable devices include a residual current device (RCD) – this is the preferred method and should be used whenever possible – or an insulation monitoring device.

- EXHEAT recommended setting for RCDs: Instantaneous trip at 100mA. The maximum duration time setting of 10ms (ten milliseconds) ensures that any fault is detected within a single cycle of a thyristor system (where applicable).
- Maximum recommended setting for the insulation monitoring device: Insulation resistance is not greater than 50 ohms per volt of rated voltage.

Ensure that the equipment is earthed in accordance with the plant earthing philosophy.

If fitted, an anti-condensation heater must be protected by a 30mA earth leakage circuit breaker. Recommended systems are available from EXHEAT upon request.

Before commissioning the equipment, the completed installation should be approved by a qualified supervisor to ensure that it has been carried out correctly and that the system is safe for commissioning.

Heaters must only be immersed in the fluid they are designed to heat. Introducing alternative

fluids even in small concentrations for purposes such as sterilising may cause serious damage to the heater and will invalidate the warranty.

Before switching the heater on, check that the heater elements and temperature sensors are fully immersed and that the rated process flow is passing over the heating elements.

Ensure that the terminal enclosure is not subjected to direct sunlight at ambient temperatures above 30°C.

Installing the control panel

Follow the guidelines below when installing a control panel:

- Ensure that there is sufficient room around the panel to open the panel door for maintenance.
- Ensure that all cables to be connected into the panel are of the correct type and are sized for the current being carried.
- Consider the:
  - maximum ambient temperatures
  - cable routing method
  - volt drop due to cable runs.
- Check that the voltage on the control panel nameplate is compatible with the mains supply being used.
- Following installation remove the lifting eyebolts, where fitted, and replace them with suitable plugs.
- Before commissioning the equipment, have the completed installation approved by a qualified supervisor to ensure that it has been carried out correctly and the system is safe for commissioning.
- Note that the gland plates, on both the control panel and the heater, may be drilled to fit the cable gland as directed by the gland manufacturer's instructions, taking care to preserve the IP rating of the enclosure

Terminal points

The terminal points for each control panel are as follows:

- The input terminals and cable gland plates (or cable entries) for control panel power supply.
- The output terminals and cable gland plates (or cable entries) for heater power supply and trip/alarms.
- Equipment earth terminals.

Earth-fault protection

The heater must be protected by a suitable earth-fault protection device wired to shut down the heater in the event a heater element fails to earth. The reason for any trip condition initiated by the earth-fault protection device must be fully investigated and rectified before the system is reset and the heater switched on.

Where they have not been included in the control panel, recommended systems are available from EXHEAT upon request.

6. Pre-commissioning/commissioning instructions

Pre-commissioning

The following checks should be carried out prior to commissioning and the equipment should not be energised until all the checks have been completed.

Heaters

The pre-commissioning checks below should be carried out before installing heaters:

- Check the overall physical condition of the heater for any signs of damage.
- Ensure the layout of the installation is neat in appearance.
- Check for any loose components and tighten as required.
- Remove all debris from enclosures.
- Ensure that any preservation items, such as silica gel bags, are removed.
- Disconnect the main electrical supply cable and check the overall insulation resistance of the heater per stage. Use a 500VDC calibrated megohmeter to take a reading between each phase terminal with reference to ground/earth. The reading should be taken for 60 seconds and to achieve greater than 2 megohm. if any of the heater stages is lower than 2 Megohm, contact EXHEAT for advice.
- Reconnect the cable ensuring terminations are secure.
- Ensure both the heater and instrument enclosure covers are closed and all fastenings are tight but not over-tight.

Where the enclosure is of sheet metal fabrication and uses a 6mm thick silicone sponge sealing gasket, the recommended torque for the M6 fasteners (on the cover, gland plate and back plate) is 6 Newton metre.

- For flameproof or EX d enclosure heaters, take extreme care when removing/re-fitting the covers to maintain the integrity of the flame-paths. Clean the flame-paths thoroughly and re-coat with an approved Ex d corrosion inhibitor before refitting the cover.
- Ensure all trip devices are functioning correctly (including over-temperature/low flow/no flow and over-pressure safety interlocks).
- Check that labels and tags are secure and correct.

Compliance with the points listed above is a warranty requirement. Documented evidence must be maintained in the form of signed checklist and records as contained in Appendix B. Copies of completed checklists and records will be required in the event of a warranty claim.

Control panels

The following pre-commissioning checks must be performed:

- The control panel is mounted correctly, in particular that it is square, rigid and there is no bowing of doors.
- The doors close and lock easily. Lubricate noisy hinges as required.
- The layout of the installation is neat in appearance.
- There are no loose components and connections.
- There is no debris in enclosures.
- Any preservation items, such as silica gel bags, are removed.
- Filters on fan intakes and filter outlets, where fitted, are not blocked.
- Shrouds/covers are fitted over incoming and outgoing terminals.
- All incoming and outgoing cables are terminated in the proper manner.
- Correct lamps and coloured lenses are fitted.
- Labels and tags secure and correct.
- Overall physical condition – no signs of damage. Paintwork should be intact.

Electrical checks

The pre-commissioning electrical checks below should be carried out before installing equipment:

Before carrying out the following checks, take all electronic components in the panel out of circuit. Do this by removing control fuses or by physically disconnecting the electronic components.

- Disconnect the main supply cable and check the insulation resistance of the mains cable within the panel. Use a 1000VDC calibrated megohmeter (for 3 phase)/ 500Vdc (for Single phase) to take reading between per phase with reference to ground/earth. The reading should be taken for 60 seconds and to achieve greater than 300 Megohm. If it is lower than this, contact EXHEAT for advice.
- Reconnect the main supply cable ensuring terminations are secure.
- Ensure all emergency stops and safety interlocks are working correctly. All isolating devices should be open before work commences and only closed as the plant is put progressively into service.
- Before switching on the incoming feed to the control panel, ensure that the supply conform to the specified voltage on the control panel and/or heater nameplate at a nominal variance of +/- 5% of the specified voltage.

Submit relevant marked up drawings of EXHEAT approved modification performed on the equipment (if any) for as building of relevant drawings.

Compliance with these instructions is a warranty requirement. Documented evidence must be maintained in the form of signed checklist and records as contained in Appendix B. Copies of completed checklists and records will be required in the event of any warranty claim.

Commissioning

The procedures in this section should be carried out after completion of all the pre-commissioning checks. All prevailing site safety regulations should be adhered to at all times.

Control panel

These steps apply to heaters and panels with thermocouples or RTDs and heaters and panels with adjustable control thermostats.

- Isolate the heater then energise the control panel.
- Carry out the relevant test procedure as described in the Data Book for that equipment.

Heater

These steps apply to:

- Heaters with thermocouples or RTDs
- Heaters with adjustable control thermostats
- Heaters and panels with thermocouples or RTDs
- Heaters and panels with adjustable control thermostats.

The steps are as follows:

- Before switching the heater on, check that the heater elements and temperature devices are fully immersed and that the correct process flow is passing over the heating elements.

Low flow and low level protection must be provided elsewhere in the system so as not to be solely reliant the over-temperature trips from the heater, which have not expressly been provided for low flow and low level protection.

- Set the control device to approximately the required temperature.
- Switch on the power supply to the heater.
- Ensure all temperature sensing instruments are monitored and show rising temperature.
- Allow the process temperature to stabilise.
- Check the temperature and adjust the control devices to the required temperature.

Temperature controller (if installed)

- Configure and tune the temperature controller, if fitted, in accordance with the component data sheets in the Data Book.

Trip amplifier (if installed)

- Refer to EXHEAT procedure *WI/09/131* in Appendix C for trip amplifier set-up.

Refer also to the relevant component data sheets in the Data Book for that equipment.

7. Operating instructions

General

This section describes the operating procedures for various pieces of equipment supplied by EXHEAT. Many of them contain information vital for ensuring the safe operation of the equipment and should be read by all operators/end users of the equipment.

Normal start-up

Before starting the equipment

- Ensure that each piece of equipment has an approved Initial Equipment Start Up Certificate by EXHEAT.
- Ensure process flow direction and conditions are correct.
- Provided that the controls are set correctly, the heating and temperature control is automatic.

Operation

Regardless of the heater type, it is vital to ensure correct operation so you should also refer to the Manufacturing Data Book for:

- Drawings
- Data sheets
- Any Essential Safety Requirements as stipulated by the *Pressure Equipment* Directive (2014/68/EU) (where applicable).

Heater types where the heating elements are in direct contact with the process fluid

When operated correctly, these types of heaters are not considered overly susceptible to perforation failure where the process fluid is able to permeate through the heating element into the terminal enclosure. However, this type of failure can be caused by extreme conditions, such as overheating, excessive thermal cycling, or vibration, either flow-induced or externally by other means.

Temperature control – heaters with adjustable control thermostats

The control temperature set points can only be changed by adjusting the thermostat inside the heater terminal enclosure cover.

If an increase in the process operating temperature of more than 10°C is required, contact EXHEAT to verify the resultant element surface temperature is acceptable.

Temperature control – panel

The control temperature set points can only be changed by adjusting the temperature controller at the panel. This can be done while the system is in operation.

Over-temperature trip – control panel

The following applies to both EXHEAT and client-supplied control panels:

- A trip can only be reset at the control panel when the temperature at the sensor has fallen below the trip temperature set point.
- Investigate the reason for the trip before resetting the system.
- Only an authorised person is permitted to reset the trip using the key switch or special tool provided.

Over-temperature trip – heater

The following points apply to heater trips:

- The trip device will only operate if there is an over-temperature fault.
- Investigate the reason for the trip before resetting the system.
- A trip can only be reset at the heater. The trip device and reset button are inside the main heater terminal enclosure. It can only be reset when the temperature at the sensor has fallen below the trip temperature set point.

The above applies only to heaters where the latching trip (over-temperature or Hi-Hi thermostat) is located inside the heater terminal enclosure.

Normal shut down

To shut down the heater, press the Off button, either at the control panel or locally where this facility is provided.

Emergency shut down

Where the control panel is supplied by EXHEAT and the emergency shutdown facility is available, see the control panel operation information contained in the Data Book for the equipment.

8. Maintenance instructions

General Safety Precautions

- All prevailing site safety regulations shall be adhered to at all times.
- Before removing the terminal enclosure, allow sufficient time for the internal components to cool down after electrical isolation.
- Fully isolate the equipment from the electrical supply before and whilst any work is being carried out.

Heater

The following preventative maintenance should be carried out at the intervals shown below.

Any replacement parts, please contact EXHEAT

Compliance with these maintenance instructions is a mandatory requirement. Documented evidence must be maintained in the form of a signed checklist and the records in Appendix B. Copies of completed checklists and records will be required in the event of a warranty claim.

If heaters are not in used for a period of 3 months, they must be tested for insulation Resistance.

Three-monthly checks

Carry out a general inspection of the equipment to check for external damage. Notify EXHEAT immediately of any defects and do not return the heater to service until authorised.

Six-monthly checks

The following checks should be carried every six months:

- Isolate the electrical supply and remove the terminal enclosure cover, taking care not to damage the flame paths. Notify EXHEAT immediately of any defects and do not return the heater to service until authorised.

Do not remove the terminal enclosure cover during wet or humid conditions as this will lead to a reduction in insulation resistance of the heater.

- Ensure that internals are clean, dry and free from debris.
- Ensure that electrical terminations are undamaged and tight.
- Measure the overall insulation resistance of the heater per stage. Use a 500VDC megohmeter to take a reading between per phase with reference to ground/earth. The reading should be taken for 60 seconds and to achieve greater than 2megohm. If it is not, contact EXHEAT.
- Ensure that the gasket or ‘o’-ring, as applicable, is in good condition and carefully

refit the cover.

- Ensure that earth conductors are correctly fitted between all earth points and main structure.
- Ensure all trip devices are working properly (including over-temperature/low flow/no flow and over-pressure safety interlocks). Notify EXHEAT immediately of any defects and do not return the heater to service until authorised.

Annual checks

Ensure that the following checks are carried out annually. This include equipment that is in storage:

- Check for element failure by comparing phase resistance values. On a healthy three phase system these values should be equal. If there is an element failure or low insulation resistance, contact EXHEAT for further advice.

Only EXHEAT or EXHEAT approved Services Representative are authorised to replace elements and/or heater related components.

- Notify EXHEAT immediately of any defects and do not return the heater to service until authorised.
- Where capillary thermostats require replacement, contact EXHEAT for advice.

24-monthly checks

If necessary, carry out the following checks every two years:

- For heaters immersed in an electrically non-conductive process, carry out a hydrostatic test of the vessel with the heater installed. Record the insulation resistance of each element, including any spares, before and after this test. Follow the instructions set out in Section 13.
- Remove the heater bundle from immersion heaters and thoroughly inspect the condition of immersed parts, in particular the elements, for signs of abrasion or distortion. It is recommended that EXHEAT is employed for this purpose.
- Notify EXHEAT immediately of any defects and do not return the heater to service until authorised.

If Section 13 specifies additional requirements for all or some of the heaters, both of the 24-monthly preventative maintenance checks included on the *Routine Maintenance Check Record* must be carried out.

Control Panel

This section describes the regular maintenance checks that should be carried out on control panels.

Three-monthly checks

Generally inspect the equipment for external damage.

Six-monthly checks

The following checks should be carried every six months:

- Isolate the incoming electrical supply and open the panel door.
- Clean out any dust or debris that may have accumulated inside the enclosure.
- Check the electrical connections for tightness.
- Clean out fan intake and outlet filters, where fitted and check correct operation of cooling fans.
- Check the component mountings for tightness.
- Ensure that all earth conductors are correctly fitted between all earth points and main structure.
- Check that lamps are working properly.
- Check that all external glands and connections are complete, tight and conform to the correct specification.

Annual checks

Ensure that the following checks are carried out annually. This include equipment that is in storage:

- Check contactors for internal contact points
- Check MCCB functions
- Test ACBs Electronic Trip Unit (ETU) for correct function (if applicable)
- Check stock level of critical operational spares availability

9. Fault finding and correction

All air heaters

See Maintenance instructions for procedures relating to these faults.

Fault	Check	Resolution
Heater fails to achieve required design air temperature	• Isolate power supply. • Supply fuses. • Temperature control device set points are correct. • All elements still operative. Take load resistance reading. Resistance between phases should be equal. • Air flow not greater than design rating.	Contact EXHEAT for advice.
Air temperature too high	• Temperature control device set points correct. • Air flow not less than design rating.	
Heater trips	• Air flow not less than design rating and evenly distributed across duct cross section. • Supply voltage is correct. • All trip devices functioning correctly and sensors not failed. • Ambient temperature within design limits.	Refer to Appendix A.
Earth leakage trip	Limiting earth-fault currents (magnitude and/or duration) is essential for safety. The earth-fault protection device is intended to provide critical safety protection if there is current leakage to earth. Fully investigate and rectify any trip condition **before** resetting the system and operating the heater. In addition, where process is gas, de-pressurise system during investigation.	Where an earth leakage trip has occurred, isolate the heater and: • Check insulation resistance is according to Section 8. • Check settings of earth leakage protection device are according to Section 5. Where a heating element has failed, remove and replace it before returning the heater to service. If this is not possible it may be acceptable to disconnect the failed element and suitably isolate it, provided that: • EXHEAT agrees to and approves proposed remedial action prior to work commencing. • Refer also to additional requirements in Section 13.

All immersion heaters

See Maintenance Instructions for procedures relating to these faults.

Fault	Check	Resolution
Heater fails to achieve required design process temperature	• Isolate power supply • Supply fuses. • Temperature control device set points correct. • All elements still operative by taking load resistance reading. Resistance between phases should be equal. • Process flow not greater than the design rating	Contact EXHEAT for advice.
Process temperature too high	• Temperature control device set points are correct. • Process flow within design limits	
Heater trips	• Process flow not less than design rating and within design limits • Supply voltage is correct. • All trip devices functioning correctly and sensors not failed. • Ambient temperature is within design limits.	Contact EXHEAT for advice Refer to Appendix A.
Earth leakage trip	Limiting earth-fault currents (magnitude and/or duration) is essential for safety. The earth-fault protection device is intended to provide critical safety protection if there is current leakage to earth. Fully investigate any trip condition and rectify prior to resetting the system and operating the heater. Where the process is gas, de-pressurise system during investigation.	Where an earth leakage trip has occurred, isolate the heater and: • Check insulation resistance is according to Section 8. • Check the settings of the earth leakage protection device are correct according to Section 5. Where a heating element has failed, remove and replace it before returning the heater to service. If this is not possible it may be acceptable to disconnect the failed element and suitably isolate it, provided that: • EXHEAT agrees to and approves proposed remedial action prior to work commencing. • Refer also to additional requirements in Section 13.

All control panels

See Maintenance instructions for procedures relating to these faults.

Fault	Check	Resolution
No controls operating and no lamps lit	• Check that main incoming switch is turned on. • Check control supply fuses are healthy.	Replace fuses as required with identical fuses.
Any heater fault lamp lit	• Check control devices are set correctly. If control devices are set correctly then check the heater. • Check all remote interlocks.	Reset control devices in accordance with project documentation. Reset interlocks.
Panel over-temperature lamp lit	• Check operation of cooling fans. • Check control devices are set correctly. • Check for dust in panel filters.	Remove any objects fouling the blades. Reset control devices in accordance with project documentation. Clean out any dust from panel filters.
Any thyristor fault lamp lit	• Check control devices on the thyristor unit.	Remove any objects fouling the blades.
No heater output control	• Check all remote interlocks and control devices. • Check there are no faults present.	Reset control devices in accordance with project documentation.
Earth leakage trip	Limiting earth-fault currents (magnitude and/or duration) is essential for safety. The earth-fault protection device is intended to provide critical safety protection if there is current leakage to earth. Fully investigate any trip condition and rectify prior to resetting the system and operating the heater. Where the process is gas, de-pressurise system during investigation.	Where an earth leakage trip has occurred, isolate the heater and: • Check the insulation resistance in accordance with Section 8. • Check the settings of the earth leakage protection device are correct in accordance with Section 5.

10. COSHH statement

Health and safety information

There are no chemical, hazardous or toxic substances applied with this order as defined in COSHH (control of substances hazardous to health) regulations (2002).

11. Control panel operation

Because each EXHEAT control panel is individually designed, the control panel procedures are tailored to suit the requirements of the individual product. These procedures are delivered as part of the Data Book.

For details of the control panel operation for a particular product, refer to the corresponding Data Book.

12. Electrical heater insulation resistance

Introduction

This procedure shall be read in conjunction with any procedures that have been supplied with the equipment. Any contradictions or conflicts must be brought to the attention of EXHEAT for clarification.

Warranty

All EXHEAT warranties are subject to EXHEAT Guarantee Terms and Conditions.

EXHEAT guarantees that the insulation resistance (IR) of the heater is at an acceptable level when the heater is dispatched from our factory. Evidence of this can be found on the test certificate provided with the equipment.

As EXHEAT has no control over the storage or initial or ongoing preservation of the heater, EXHEAT does not provide any warranty (inferred or otherwise) for minimum IR of the electrical heater.

Overview

The internal insulation of the element is constructed from compressed magnesium oxide powder (MgO). This powder is highly hygroscopic (it attracts moisture from the atmosphere).

Additionally, many heaters are shipped with a very high IR value which may reduce significantly over time. This time period is dependent on a number of factors but mainly on how stringently preservation procedures are followed during storage, installation, commissioning and ongoing maintenance/operation.

Heaters have many individual elements connected together in parallel. Whilst all the individual elements have an acceptable IR value, once they are connected in parallel this reduces significantly, ie $1/R_{total} = 1/R_1 + 1/R_2 + ...$ etc

- Example 1 - 50 elements each with an individual IR value of 100 megohm will have a connected value of 2 megohm.
- Example 2 - 70 elements each with an individual IR value of 10 megohm will have a connected value of 0.143 megohm.
- Example 3 - 48 elements each with an individual IR Value of 100 megohm plus 2 individual elements with an IR value of 2 megohm will have a connected value of 0.676 megohm.
- Example 4 - 48 elements each with an individual IR Value of 100 megohm plus 2 individual elements with an IR value of 0.1 megohm will have a connected value of 0.0488 megohm.

Construction

During manufacture of the individual elements, each element is dried in a high-temperature oven and subsequently sealed using a very strict procedure. However, this is a manual procedure and the final results are dependent on a variety of factors and produce varying IR values. These factors include:

Drying oven

How long the heater elements were baked in the oven. EXHEAT has no stipulated maximum time. This can mean that some elements are left in the oven much longer than others and will hence be dryer and have higher IR values than others.

Sealing of elements

The elements are sealed after they have been dried in the ovens. The length of time before the elements have their first seal applied determines how much atmospheric moisture they absorb. This varies depending on how many elements are in the ovens at any time, atmospheric humidity and so on. After sealing the elements are tested and, provided the IR is above the minimum acceptable value, they are passed regardless of the variations in the upper levels of IR. Electric elements only have to have a minimum IR value.

Terminal enclosure seal

EXHEAT heaters have terminal enclosures that are completely sealed against ingress of moisture when dispatched from the factory. However, it is the client's responsibility to ensure that this seal is maintained once the equipment leaves our factory to ensure there is no ingress of moisture into the terminal enclosure which can be absorbed by the elements.

Poor preservation

Once the equipment is dispatched to site, EXHEAT have no control on how it is preserved. Strict preservation procedures are issued to clients by EXHEAT. However, in our experience, clients/operators do not adhere to them eg:

- on many occasions the terminal enclosure covers are removed for long periods.
- silica gel is not replaced and/or the amount not sufficient.
- terminal enclosure covers are removed for cabling and left off during periods of rain or high atmospheric humidity. All this will cause moisture to enter the terminal enclosure and ultimately degrade the IR levels.

IR level after use

Once the elements are switched on, any microscopic amounts of moisture inside the elements migrate along the hot portion of the element and accumulate at the hot/cold intersection of the element. This can cause a drop in overall IR value.

All elements are tested after sealing to ensure they meet our minimum criteria before assembly into the heater bundle.

Every heater that is shipped from EXHEAT has a terminal enclosure that is sealed from moisture present in the atmosphere. However, every time the terminal enclosure is opened, moist and/or humid air enters the terminal enclosure. This then condenses on the terminals and/or internal wires or at worst can even be absorbed into the element insulation MgO.

Preservation

EXHEAT recommend the following to ensure that there is no significant reduction in IR values that could prevent the heater from being operated satisfactorily:

Pre-installation /storage

When the heater is dispatched from our factory, the terminal enclosure has silica gel (or equivalent) inside. The terminal enclosure has also been sealed from atmospheric moisture and pressure tested to ensure it is pressure/air/moisture tight. Do not remove the terminal enclosure cover, gland plates or any other opening that may breach the integrity of the terminal enclosure until it is time to carry out the cabling and installation. This will allow moisture inside the terminal enclosure which will cause reduction of IR levels.

During cabling/installation

It is not necessary to remove the terminal enclosure cover to install the heater into the vessel/pipe work. Cable installation shall be done as quickly as possible and shall never be carried out during wet weather conditions. Under no circumstances shall water/moisture be allowed to enter the terminal enclosure. Keep the terminal enclosure gland plates and other openings sealed at all times unless it is critical to the installation that they are removed.

Once the cables have been installed and tested:

- check the terminal enclosure for any foreign objects, eg strands of amour cable, strands of copper cable/wire, tools or other objects that cause short circuits
- put fresh silica gel into the terminal enclosure and document the date of installation.
- re-fit the terminal enclosure cover
- tighten all terminal enclosure and gland plate bolts to ensure the weatherproof integrity of the terminal enclosure.

Post installation preservation

If the heater is not to be used for a significant period of time after installation, the following is recommended to ensure the inside of the terminal enclosure does not contain moisture that could reduce the IR value of the heating elements.

- Put fresh silica gel inside the terminal enclosure and write the date on the cover.
- Reduce or remove trapped moist air after refitting the terminal enclosure cover as follows:
    - Purge the terminal enclosure with clean, dry air after fitting/replacing and sealing the terminal enclosure cover, gland plates and any other openings.
    - Purge for approximately 10- 20 minutes by means of a temporary air hose connection. Please contact EXHEAT for further instructions.
    - It is critical that the terminal enclosure is never pressurized: isolate the air supply first and close the vent 10/20 seconds later.
    - Disconnect the air hose and seal the connections.

On occasion, the heater is not to be used for a long period of time but regular IR values are required to ensure the integrity of the heater at start-up.

In this case, EXHEAT recommends that a small core cable be attached to each phase bus-bar/main cable connection point and brought outside the terminal enclosure so that IR

values can be taken without opening the terminal enclosure cover and allowing moisture to enter the terminal enclosure.

This can be done with a small diameter multi-core instrument cable and brought out of the terminal enclosure via a weatherproof gland in the gland plate.

Mark the individual cables so that accurate records can be taken and maintained.

Remove this cable and plug the cable entry hole with a suitably certified blanking plug before any power is applied to the heater.

Recovering insulation resistance

Once the IR value has reduced, there are no procedures that can guarantee to bring it back up to the levels that were present before despatch from EXHEAT. However, following the steps in the post installation preservation procedure can prevent further reduction of IR values and may in many cases increase the IR value of the heater. Invariably, the final IR value, will dependant on whether the moisture is in the terminal enclosure or inside the heating elements.

Failure to increase IR values

If the IR value continues to reduce, or does not increase to an acceptable level, we recommend the following tests are carried out:

- Conduct a full inspection of the heater terminal enclosure to ensure that the terminal enclosure is now sealed from atmospheric humidity. If not, seal the enclosure and follow the steps in the post installation preservation procedure.
- If it is considered that the enclosure is sealed, measure the IR level of each element. If any are found to be excessively low these can be disconnected, spares fitted and, if they are at a higher level, connected into the circuit.

There is a ceramic insulator fitted to the end of each element. Take extreme care to ensure that it is not disturbed, cracked or broken during this process. When replacing wires or connections to the ends of elements, fully tighten the ceramic retaining nut to prevent localised heating. Do not over tighten the nut as this can overstress the ceramic and cause it to break or crack.

All the above procedures can be carried out by EXHEAT site personnel if required. Relevant chargeable site rates prevail and can be provided upon request.

If the client elects to carry out the above procedures using other than EXHEAT personnel, it is the client's responsibility, and they shall ensure that all safety requirements and regulations are fully complied with.

13. Additional requirements

'Dry' Process Fluids

The points contained in this section apply to heaters with 'dry' process fluids. They are important requirements that are additional to the other sections of this manual.

Some process fluids are considered 'dry', meaning that they are electrically inert and non-conductive. A dry fluid leaking through a perforation in the element sheath will not necessarily initiate an earth-fault trip or show as low insulation resistance in the heating element.

For this reason, it is very important that you check the integrity of the element sheath as part of your routine maintenance checks. Refer to the maintenance instructions for more details. This procedure can be carried out by EXHEAT site personnel if required. Relevant chargeable site rates prevail and can be provided upon request.

Where possible, remove and replace a failed element before returning the heater to service. If this is not possible it may be acceptable to disconnect the failed element and suitably isolate it, provided that:

- EXHEAT agrees to and approves the proposed remedial action **prior** to carrying out the work.

Where the process fluid is gas:

- Take routine samples to check for leakage inside the terminal enclosure
- Sample the gas using an appropriate certified reducer and stop end fitted to the terminal enclosure to assist with access.
- Follow all approved site operating procedures during sampling.

Corrosive Environment

The environment can be both the external environment and/or the process.

It is important any corrosive substance is removed from the heater when not in use.

High chromium steels, whilst having good corrosion resistance, require the surface to be free from contamination and washed with clean water in order to maintain the self-passivating chromium rich oxide layer.

Appendix A. Heater datasheet

See Heater Manufacturing Data Book.

Appendix B. Check reports/certificates

Instructions for completing and submitting check reports and certificates

Complete and sign off all *Pre-Commissioning Check Records* as pre-commissioning progresses; one check report must be completed for each piece of equipment supplied. When pre-commissioning is complete, submit all *Pre-Commissioning Check Records* to EXHEAT for acceptance.

Check all load resistance, insulation resistance and trip settings at the commissioning stage. Record the results on the appropriate *Commissioning Check Record*. When commissioning is complete, submit all *Commissioning Check Records* to EXHEAT for acceptance.

If the equipment is to be stored between completion of commissioning activities and start-up, refer to the appropriate preservation and requirements in this manual. Record all test results on the appropriate *Storage Preservation Check Record*.

When the equipment is ready for start-up, complete the *Equipment Start-Up Certificate* and submit it to EXHEAT for acceptance.

If Section 13 specifies additional requirements for all or some of the heaters, carry out the additional preventative maintenance checks included on the Routine Maintenance Check Record.

Carry out all routine maintenance activities at the intervals determined by the *Routine Maintenance Check Record*. These records must be completed, signed off and submitted to EXHEAT for acceptance if requested.

Check records/certificates, can either be e-mailed to **commissioning@exheat.com** marked for the attention of the After Sales Department.

Forms shall be completed and registered with EXHEAT to continue the equipment warranty. Failure to do so may potentially result in warranty becoming void.

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www.exheat.com

CHECK RECORD

Insulation Resistance Control Panel

Tag No	
Description	
PO No	
Reference No	

	Insulation Resistance M.ohm											**Comments**
	Stage to Stage								**Phase to Earth**			
Stage	1	2	3	4	5	6	7	8	L1	L2	L3	
1												
2												
3												
4												
5												
6												
7												
8												

Megger Test Date:

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
Name			
Signature			
Date			
CompEX Certificate No.			

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CHECK RECORD
Load Resistance
Electric Heater

Tag No	
Description	
PO No	
Reference No	

	Load Resistance (ohm)						**Comments**
Stage	L1-L2	L1-L3	L2-L3	L1-N	L2-N	L3-N	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Multimeter Test Date:

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

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Signature			
Date			
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COMMISSIONING CHECK RECORD

Control Panel

Tag No	
Description	
PO No	
Reference No	

Inspection Checklist		**Status Codes**	**Name**	**Date**	**Comment**
01	Ensure all pre-commissioning checks have been carried out.				
02	Carry out a full function test on the control panel; in accordance with the Control Panel Test Procedure (PTP) provided within the manufacturing data book OR listed in Appendix A of the contract IOM) List drawings and document revisions used in Comment column. **A completed Control Panel Test Procedure must be returned with the check lists/ forms.**				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Commissioning / Start-Up Contractor**	**EXHEAT Ltd**	
Name			
Signature			
Date			
CompEX Certificate No.			

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COMMISSIONING CHECK RECORD

Trip Settings

Tag No	
Description	
PO No	
Reference No	

See IOM: **Appendix C for Overtemperature Trip Setting Procedure.**

	Inspection Checklist	Tag Number	Status / Verified Trip Setpoint	Name	Date	Comment
01	Check all temperature sensors and transmitters are correctly located, undamaged and functioning correctly.					
02	Check temperature trip set points and record details below.					
03	Check earth leakage trip time and record details below:					
04	Item Description:					
05	Item Description:					
06	Item Description:					
07	Item Description:					
08	Item Description:					
09	Item Description:					
10	Item Description:					
11	Item Description:					
12	Item Description:					
13	Item Description:					

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Commissioning / Start-Up Contractor**	**EXHEAT Ltd**	
Name			
Signature			
Date			
CompEX Certificate No.			

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INITIAL EQUIPMENT START-UP CERTIFICATE

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	**Sign**	**Name**	**Date**	**Comment**
01	Pre-commissioning & Commissioning records as per Appendix B of the Installation, Operation and Maintenance Manual completed and submitted to EXHEAT Limited for acceptance no later than 21 days after completion of commissioning.				Date of commissioning Completion to be recorded below:
02	Storage Preservation Check Records as per Appendix B of the Installation, Operation and Maintenance Manual completed and submitted to EXHEAT Limited for acceptance no later than 21 days after completion of commissioning.				
03	Routine Maintenance records as required under Section 8 of the Installation, Operation and Maintenance Manual are complete and available (to be submitted to EXHEAT upon request).				
04	Any Post-Installation Preservation checks as required by EXHEAT Installation, Operation and Maintenance Manual between completion of commissioning and Start-up has been completed and recorded (to be submitted to EXHEAT upon request).				Date of Installation to be recorded below:
05	All equipment checked to ensure that all applicable Special Conditions for Safe Use have been complied with.				
06	Confirm that the correct process flow medium, flowrate or level (whatever is applicable) at flow direction				
07	Equipment ready for Start-Up				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

A completed certificate is required for each piece of equipment

It is a warranty requirement that all commissioning check lists and test reports are completed by Contractor and signed off during commissioning and e-mailed to commissioning@exheat.com for acceptance.

No claim under the equipment warranty will be accepted if Commissioning & Preservation Forms and this Equipment Start-Up Certificate have not been provided and accepted by EXHEAT Ltd prior to any claim.

Verified	**Commissioning / Start-Up Contractor**	**EXHEAT Ltd**
Name		
Signature		
Date		
CompEX Certificate No.		

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ROUTINE MAINTENANCE CHECK RECORD

Electric Heater

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	Status Codes	Name	Date	Comment
	3 Monthly Checks				
01	Check equipment for external damage				
	6 Monthly Checks (in addition to 3 Monthly Checks)				
01	Check that there is no dirt, debris, loose items or moisture within the terminal enclosure				
02	Check that all electrical connections are undamaged and tight including any spare unused terminals.				
03	Check the heater insulation resistance and record readings on form EXS-FORM-000043-REV2				
04	Check that enclosure gaskets are undamaged and fit correctly				
05	Check flame paths are undamaged				
06	Check that earth conductors are correctly fitted and undamaged				
07	Check heater and instrument enclosure covers are closed and all fasteners are fitted, tight and of the correct type				
08	Check all trip devices are set and functioning correctly; record set-points on form EXS-FORM-000048				
	12 Monthly Checks (in addition to 3 & 6 Monthly Checks)				
01	Check heater load resistance values and record on form EXS-FORM-000046				
02	Check stock level of critical operational spares availability				
	24 Monthly Checks (in addition to 3, 6 & 12 Monthly Checks)				
01	Removal of heater bundle to conduct visual inspection on immersed section of the equipment				
02	If Equipment falls within Section 13 of the IOM, under the 'Dry' fluid process immersion Heater, please contact EXHEAT Ltd for recommended procedures for maintenance check.				

NOTE: Routine Maintenance Check Record is necessary to be completed as part of Post-Installation Preservation Check where the equipment is not put into service 3 months between from the Date of Installation and/or commissioning.

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
Name			
Signature			
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ROUTINE MAINTENANCE CHECK RECORD

Control Panel

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	**Status Codes**	**Name**	**Date**	**Comment**
	3 Monthly Checks				
01	Check equipment for external damage				
01	**6 Monthly Checks (in addition to 3 Monthly Checks)**				
02	Check that there is no dirt, debris, loose items or moisture within the control panel enclosure.				
03	Clean out dirt from filters where fitted and check correct operation of cooling fans.				
04	Check for 50% of the main electrical connections are at the specific torque value of the contract document. If any are found to be loose, then a further 100% should be checked				
05	Check the control panel insulation resistance and record readings on form EXS-FORM-000045				
06	Check flame paths are undamaged.				
07	Check that enclosure gaskets are undamaged and fit correctly				
08	Check that earth conductors are correctly fitted and undamaged				
09	Check all trip devices including internal thermostats are set and functioning correctly; record set-points on EXS-FORM-000048				
10	check that all external glands and connections are complete, tight and conform to the correct specification for use in a hazardous area (if applicable)				
01	**12th Monthly Check (In addition to 3 monthly and 6 monthly checks)**				
02	Contactors to be checked for flamepath contact points				
03	Check MCCB functions (if applicable)				
04	ACBs Electronic Trip Unit (ETU) be tested yearly for correct function (if applicable)				
05	Check stock level of critical operational spares availability				

NOTE: Routine Maintenance Check Record is necessary to be completed as part of Post-Installation Preservation Check where the equipment is not put into service 3 months between from the Date of Installation and/or commissioning.

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
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STORAGE / PRESERVATION CHECK RECORD

Electric Heater/ Control Panel

Tag No	
Description	
PO No	
Reference No	
Goods Despatch date:	
Expected Installed Date:	
Expected Commissioning Date:	

Date	Storage Temp	Storage Humidity	Check Form EXS-FORM-000041 completed?	ACH Energised Date	Dessicant Bags Changed Date	Signed	Print
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				
			(YES/NO)				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	Fabrication/ Construction	Hook-Up/ Commissioning	EXHEAT Ltd
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STORAGE / PRESERVATION CHECK

Electric Heater/ Control Panel

Tag No	
Description	
PO No	
Reference No	
Goods Despatch date:	
Expected Installed Date:	
Expected Commissioning Date:	

	Inspection Checklist	Status Codes	Name	Date	Comment
	ELECTRIC HEATER				
01	Ensure the heater is not stored in direct sunlight				
02	Ensure the heater is stored indoors in a regulated environment				
03	Check overall physical condition of the heater/packaging for any sign of damage.				
04	Check that Terminal enclosures are undamaged				
05	Review any previous documentation. If any recommendations were noted on the previous documentation, have they been implemented?				
06	Check the storage environment and record the details on the Storage / Preservation Check Record ((EXS-FORM-000040)				
07	Check the ACH Status and record details on the Storage / Preservation Check Record (EXS-FORM-000040)				
08	If desiccant bags have been changed, record the date on the Storage / Preservation Check Record (EXS-FORM-000040)				
09	Check the heater insulation resistance and record readings on EXS-FORM-000044				
10	Check Heater load resistance values and record on form EXS-FORM-000046				
	CONTROL PANEL Note! If Control Panel is supplied with Heater, ensure Panel is in the same storage condition as the heater,				
01	Ensure the Panel is not stored in direct sunlight				
02	Ensure the Panel is stored indoors in a regulated environment				
03	Check overall physical condition of the panel/packaging for any sign of damage.				
04	Check that enclosures are undamaged				
05	Review any previous documentation. If any recommendations were noted on the previous documentation, have they been implemented?				
06	Check the storage environment and record the details on the Storage / Preservation Check Record (EXS-FORM-000040)				
07	Check the ACH Status and record details on the Storage / Preservation Check Record (EXS-FORM-000040)				
08	If desiccant bags have been changed, record the date on the Storage / Preservation Check Record (EXS-FORM-000040)				
09	Check the control panel insulation resistance and record readings on Form EXS-FORM-000045				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
Name			
Signature			
Date			
CompEX Certificate No.			

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commissioning@exheat.com
www.exheat.com

PRE-COMMISSIONING CHECK RECORD

Control Panel

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	Status Codes	Name	Date	Comment
01	Check the control panel for any signs of damage.				
02	Check that the control panel has been mounted correctly in particular that it is square, rigid and there is no bowing of doors. Doors should close and lock easily. Oil noisy hinges as required.				
03	Check that the control panel conforms to contract drawings (refer to the schedule provided within Appendix A of the contract IOM) List drawings and revisions used in Comment column.				
04	check that all external glands and connections are complete, tight and conform to the correct specification for use in a hazardous area (if applicable)				
05	Check that where any interconnections have been made between cubicles during installation that no cables have become trapped or damaged.				
06	Check that there is no dirt, debris, loose items or moisture within the control panel enclosure				
07	Check that earthing is complete and satisfactory				
08	Check that enclosure gaskets are undamaged and fit correctly				
09	Check for 50% of the main electrical connections are at the specific torque value of the contract document. If any are found to be loose, then a further 100% should be checked				
10	Check that creepage and clearance distances are correct.				
11	Check that there is no obvious damage to internal wiring.				
12	Check that any fans and filters are free of debris and that the fans can spin freely.				
13	Check flame paths are undamaged.				
14	Check that guards, where fitted, are present and correctly located				
15	Check all door locks operate correctly and any isolation interlocks with the panel doors operate.				
16	Check the control panel insulation resistance and record readings on EXS-FORM-000045				
17	Check all labels and tags present, secure and correctly marked				
18	Check all trip devices including internal thermostats are set and functioning correctly; record set-points on form EXS-FORM-000048				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	Fabrication/ Construction	Hook-Up/ Commissioning	EXHEAT Ltd
Name			
Signature			
Date			
CompEX Certificate No.			

EXHEAT Ltd
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Watton, Thetford, Norfolk
IP25 6NG, United Kingdom
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www.exheat.com

PRE-COMMISSIONING CHECK RECORD

Electric Heater

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	Status Codes	Name	Date	Comment
01	Check overall physical condition of the heater for any signs of damage.				
02	Check that terminal enclosures are undamaged				
03	Check that the heater conforms to contract drawings, to also include indication of flow direction (refer to the schedule provided within Appendix A of the contract IOM)				
04	Check that all fasteners, glands and stoppers are complete, tight and conform to the correct specification for use in a hazardous area (if applicable).				
05	Check that there is no dirt, debris, loose items or moisture within the terminal enclosure.				
06	Check that earthing is complete and satisfactory				
07	Check that enclosure gaskets are undamaged and fit correctly				
08	Check that all electrical connections are tight including any spare unused terminals				
09	Check that creepage and clearance distances are correct.				
10	Check that there is no obvious damage to internal wiring.				
11	Check that the apparatus is adequately protected against corrosion, the weather, vibration and any other adverse factors.				
12	Check that guards, where required, are present and correctly located.				
13	Check flame paths are undamaged.				
14	Check the heater insulation resistance and record readings on form EXS-FORM-000044				
15	Check all labels and tags are present, secure and correctly marked.				
16	Check heater and instrument enclosure covers are closed and all fasteners are fitted, tight and of the correct type				
17	Check all trip devices are set and functioning correctly; (record set-points on form EXS-FORM-000048)				
18	Earth leakage system in place and set points checked (record set-points on form EXS-FORM-000048)				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
Name			
Signature			
Date			
CompEX Certificate No.			

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www.exheat.com

CHECK RECORD
Insulation Resistance
Electric Heater

Description	
PO No	
Reference No	

	Insulation Resistance M.ohm											**Comments**
	Stage to Stage								**Phase to Earth**			
Stage	1	2	3	4	5	6	7	8	L1	L2	L3	
1												
2												
3												
4												
5												
6												
7												
8												

Megger Test Date:

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
Name			
Signature			
Date			
CompEX Certificate No.			

Appendix C. Setting Over-temperature Trip Devices (WI/09/131)

Scope

This procedure applies to setting over-temperature trip devices used in protection circuits of all Ex e heaters manufactured by the company. It is also recommended for all other types of heaters.

Failure to comply with this procedure will nullify all certification supplied and issued for use of equipment in hazardous areas.

Procedure

- Ensure that all test equipment is within its calibration period prior to use.
- Ensure that all over-temperature sensors and transmitters (where fitted) are correctly located, undamaged and functional.
- Adjust the trip controller device upscale well above the required trip temperature.
- Using a sensor signal simulator/injector connected in place of the over-temperature sensor, increase the output to correspond to the required trip temperature.
- Adjust the trip controller device downscale until it just trips.
- Verify the setting by adjusting the simulator/injector output well below the trip temperature and then gradually increase the output until the trip controller device operates.
- If this trip occurs outside a tolerance band of +5ºC, adjust as necessary and repeat the previous step to check.
- When the verification is successful, re-connect the over-temperature sensor.
- Repeat the procedure for each over-temperature trip controller device.
- When all over-temperature trip controller devices are set, ensure that the terminal enclosure covers are re-fitted.
- Ensure that enclosures containing trip controller devices are locked using a key or special tool.

Note: Due to ATEX / UKEX certification requirement, all EXHEAT certified heaters (new/repeat bundle) will require the trip amplifier of the Flange Overtemperature Sensor (TE1) to be in compliance with EN50495. Hence, it is necessary for the client to ensure that the originally installed trip amp in the associated Control Panel meet this new requirement.

Appendix G/G1. PED/PE(S)R Essential Safety Requirements

See Heater Manufacturing Data Book.

Appendix H/H1. PED/PE(S)R Design Criteria

See Heater Manufacturing Data Book

Appendix X. IOM Ex Heater Annex

See Next Page

Installation, Operation & Maintenance Instructions Manual

Appendix X

IOM Ex Heater Annex

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Refer to EXHEAT website for latest edition (www.exheat.com)

www.exheat.com/iom

Contents

To maintain the equipment warranty and the Ex hazardous area certification, the instructions contained within this Appendix must be complied with in full and in conjunction with the IOM. In the event of any conflict, the instructions contained within this Appendix take precedence and EXHEAT must be informed.

Section 1 Contact Details

Sales Enquiries

UK, Europe & USA

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Watton, Thetford
Norfolk, IP25 6NG, UK

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Fax: +44 (0) 1953 886 222

Email: sales@exheat.com

Website: www.exheat.com

Rest of the World

EXHEAT Ltd c/o Ex Services Pte Ltd
8 Jalan Kilang Barat
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Tel: +65 6496 4628

Fax: +65 6496 4601

Technical Support

UK, Europe & USA

Ex Services
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Email: contact@exservices.com

Website: www.exservices.com

Rest of the World

Ex Services Pte Ltd
8 Jalan Kilang Barat
Central Link #03-07
Singapore 159351

Tel: +65 6496 4628

Fax: +65 6496 4601

Section 2 Description of Equipment

Please refer to the Contract Manufacturing Data Book.

Markings

ATEX/IECEX/UKEX:

FP range	ISE range
II 2 G D (ATEX & UKEX only)	II 2 G (ATEX & UKEX only)
Ex db *or* Ex db eb IIC T6…T1 Gb	Ex eb *or* Ex db eb IIC T6…T1 Gb
Ex tb IIIC T80°C… T450°C Db	Tamb. -60°C to +60°C
Tamb. -60°C to +60°C	IP66 *or* IP67
IP66	DO NOT OPEN WHILST ENERGISED IF PAINTED – ELECTROSTATIC CHARGING HAZARD SEE INSTRUCTIONS
WARNING: DO NOT OPEN WHILST ENERGISED DO NOT OPEN IN THE PRESENCE OF EXPLOSIVE ATMOSPHERE SEE INSTRUCTIONS FOR CABLE ENTRY SIZE FIELD CABLE SPECIFICATION SHALL BE SUITABLE FOR THE TEMPERATURE OVERPROTECTION LIMIT OF THE ENCLOSURE WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD SEE INSTRUCTIONS	

For all other Ex certifications refer to the Contract Manufacturing Data Book.

Special Conditions of Use

Please refer to the Ex certification included in the Contract Manufacturing Data Book.

Section 3 Safety

Normal use

Observing the following points will minimise the risk of accidents to personnel using electrical equipment:

- Keep all control cubicle doors closed and locked whilst the equipment is in operation and comply with any safety warning notices.
- Restrict access to heater terminal enclosures and keys for control cubicle doors to competent authorised personnel. Issue them only as part of a written safe system of work to ensure doors and terminal enclosure covers are:
    - not unlocked until electrical supplies are isolated,
    - locked before electrical supplies are restored for normal operation of equipment.

Maintenance and testing

The client must ensure that maintenance, set up and testing of the equipment is only carried out by authorised and competent persons.

The following rules must be adhered to:

- Before starting maintenance work, isolate the equipment completely where possible.
- Familiarise all persons working on the equipment with the instructions and information provided in the manual.

Section 4 Preservation & Storage Instructions

Where specified in the contract, the equipment is supplied by EXHEAT suitably packed for storage.

Receipt of goods

Follow the guidelines below when goods are received:

- Use all design lifting points whenever moving the equipment from one area to another.

Lifting eyes fitted in the Element Support Plate of immersion heater bundles are designed for supporting only the bundle during removal and re-fitting, in conjunction with slings. They are not designed for the combined weight of the fitted heater in the vessel. The same is true for lifting points on the terminal enclosures of air duct heaters – use these for bundle lift only. Lift the package using the lift points on the duct section.

- Take care at all times to ensure that the equipment is moved safely and that no out of balance occurs during movement.
- On receipt of the equipment into the storage area:
    - Check for any damage that may have occurred in transit. Any damage must be logged and reported to the site manager and EXHEAT within seven (7) days of receipt of goods.
    - Ensure that equipment is not stacked and observe any ‘This Way Up’ markings.

Post Despatch & Storage

Ensure the equipment is stored in a proper manner in order to minimise the risk of accidental damage.
The following preservation instructions must be adhered to:

- Protect the equipment against external sources of vibration and/or impact.

Section 5 Erection & Installation Instructions

Overview

Refer to the relevant code of practice for the equipment:

IEC/EN 60079-14 for selection and installation
IEC/EN 60079-17 for inspection and maintenance of electric apparatus for use in potentially explosive atmospheres.

When installing these types of equipment, the installation contractor/operator shall be both familiar with and abide by the “Special conditions for safe use” on the Hazardous Area Certificate/s in the Data Book.

Compliance with these instructions is a warranty requirement and documented evidence must be maintained in the form of signed checklist and records as contained in Appendix XB.

Over-temperature trip devices

It is a mandatory requirement that the over-temperature devices (excluding spares) are connected back to the dedicated trip system to shut down electrical power to the heater in the event of over-temperature.

Be aware of the following important points:

Thermocouple

Note the polarity of the circuit for the sensor to operate correctly.

Ensure that the correct compensating cable is used for the type of thermocouple fitted.

RTD

Note the correct connections to ensure that they operate as detailed on the schedule drawings.

Temperature transmitters

Note the polarity of each device to ensure that it functions correctly within the control loop.

Thermostats

Note the connections shown in the drawing to ensure the correct operation.

Where thermostats have been pre-set at EXHEAT they require no further adjustment.

Adjust thermostats that have been supplied un-set to meet process requirements.

If there is any uncertainty about these points, contact EXHEAT for advice.

Over-temperature trip devices in protection circuits of Ex e heaters

Protective devices, such as PT100 resistance thermometers (also known as resistance temperature detectors or RTDs) and thermocouples with or without 4-20mA transmitters, **must** be set up in accordance with EXHEAT procedure in Appendix C.

Failure to comply could result in the Hazardous Area Certificate being invalidated.

Moving the equipment into position

Lifting eyes fitted in the Element Support Plate of immersion heater bundles are designed for supporting only the bundle during removal and re-fitting, in conjunction with slings. They are not designed for the combined weight of the fitted heater in the vessel. The same is true for lifting points on the terminal enclosures of air duct heaters – use these for bundle lift only. Lift the package using the lift points on the duct section.

Installing the heater

Follow the steps below to install the heater:

- Ensure that the equipment is suitably supported, both internally and externally, and not subjected to undue stress or vibration.
- If a heater bundle is supplied without housing, the immersed part must be adequately supported within the respective vessel, tank or duct.
- Ensure that there is sufficient room around the heater to remove the heater bundle for maintenance.
- Each heater is fitted with safety devices as detailed on the drawing for that contract. These safety devices **must** be kept in good working order and connected into the dedicated trip system as stated on the drawings.
- Safety interlocks must be installed to ensure that the heater may only be energised when the design flow rate through the heater is attained and that the heater is de-energised should this flow rate be reduced or stopped.
- Ensure that the supply cable is of the correct type and is sized for the current being carried. Consider:
    - maximum ambient temperatures
    - cable routing method
    - volt drops due to cable runs.
- Ensure that the supply cables are suitably supported to prevent undue force/stress on the terminal points.
- Check that the voltage on the heater nameplate is compatible with the mains supply being used.
- Under no circumstances interfere with any EXHEAT internal cabling or connections. This includes re-routing and ‘bunching’ cables, which can have a serious adverse effect on the heat build-up generated within the terminal enclosure.

Cable Entries

For cable entry details of FP range heater refer to the Contract Manufacturing Data Book.

For ISE range heaters not supplied ready with cable entries, the below procedure applies to the drilling of the necessary entries:

- Refer to the Contract Manufacturing Data Book for details of the intended field connections.
- 10mm minimum shall be maintained between edge of entry holes and edge of aperture/enclosure wall.
- Suitable cable glands, conduit hubs and thread adaptors shall be installed in accordance with the manufacturer's instructions.
- Where taper threads are used the entry shall be tapped ensuring that a minimum of 3 fully engaged threads are used.
- Care must be taken not to damage any sealing gasket of the enclosure during field wiring installation and to remove all sharp edges/burrs after forming entry holes.

Terminal points

Refer to the Contract Manufacturing Data Book for details of field wiring terminal points.

The following apply to Ex e circuits of ISE & FP range heaters:

- Field wire crimps/ferrules shall be suitable for the cross section.
- Only 1 field wire shall be connected to each terminal point.
- Busbar connections shall be made using the bolt, nut and washer assemblies provided.
- Busbar connections shall be torqued in accordance with ISO 898:

M	N.m
5	6.1
6	10.4
8	25.4
10	50
12	88
14	141
16	218
20	426

Earth-fault protection

For safety reasons, it is essential to limit the magnitude and duration of earth-fault currents. It is impractical to cover all possible systems, however note that, regardless of which system is used, the heater must be protected by a suitable device wired to shut down the heater in the event that a heater element fails to earth. Suitable devices include a residual current device (RCD) – this is the preferred method and should be used whenever possible – or an insulation monitoring device.

- EXHEAT recommended setting for RCDs: Instantaneous trip at 100mA. The maximum duration time setting of 10ms (ten milliseconds) ensures that any fault is detected within a single cycle of a thyristor system (where applicable).
- Maximum recommended setting for the insulation monitoring device: Insulation resistance is not greater than 50 ohms per volt of rated voltage.

Ensure that the equipment is earthed in accordance with the plant earthing philosophy.

If fitted, an anti-condensation heater must be protected by a 30mA earth leakage circuit breaker. Recommended systems are available from EXHEAT upon request.

Before commissioning the equipment, the completed installation should be approved by a qualified supervisor to ensure that it has been carried out correctly and that the system is safe for commissioning.

Heaters must only be immersed in the fluid they are designed to heat. Introducing alternative fluids even in small concentrations for purposes such as sterilising may cause serious damage to the heater and will invalidate the warranty.

Before switching the heater on, check that the heater elements and temperature sensors are fully immersed and that the rated process flow is passing over the heating elements.

Ensure that the terminal enclosure is not subjected to direct sunlight at ambient temperatures above 30°C.

Section 6 Pre-Commissioning/Commissioning Instructions

Pre-commissioning

The following checks should be carried out prior to commissioning and the equipment should not be energised until all the checks have been completed.

Heaters

The following pre-commissioning checks must be performed:

- Ensure that any preservation items, such as silica gel bags, are removed.

Where the enclosure is of sheet metal fabrication and uses a 6mm thick silicone sponge sealing gasket, the recommended torque for the M6 fasteners (on the cover, gland plate and back plate) is 6 Newton metre.

Commissioning

The procedures in this section should be carried out after completion of all the pre-commissioning checks. All prevailing site safety regulations should be adhered to at all times.

Heater

These steps apply to:

- Heaters with thermocouples or RTDs
- Heaters with adjustable control thermostats
- Heaters and panels with thermocouples or RTDs
- Heaters and panels with adjustable control thermostats.

The steps are as follows:

- Before switching the heater on, check that the heater elements and temperature devices are fully immersed and that the correct process flow is passing over the heating elements.
-

Low flow and low level protection must be provided elsewhere in the system so as not to be solely reliant the over-temperature trips from the heater, which have not expressly been provided for low flow and low level protection.

- Set the control device to approximately the required temperature.
- Switch on the power supply to the heater.
- Ensure all temperature sensing instruments are monitored and show rising temperature.
- Allow the process temperature to stabilise.
- Check the temperature and adjust the control devices to the required temperature.

Temperature controller (if installed)

- Refer to the relevant component data sheets in the Data Book for that equipment.

Section 7 Operating Instructions

General

This section describes the operating procedures for various pieces of equipment supplied by EXHEAT. Many of them contain information vital for ensuring the safe operation of the equipment and should be read by all operators/end users of the equipment.

Normal start-up

Before starting the equipment

- Ensure process flow direction and conditions are correct

Operation

Temperature control – heaters with adjustable control thermostats

The control temperature set points can only be changed by adjusting the thermostat inside the heater terminal enclosure cover. The certification device temperature set points must not be adjusted above the max setting for the respective T Class. Refer to the Data Book.

If an increase in the process operating temperature of more than 10°C is required, contact EXHEAT to verify the resultant element surface temperature is acceptable.

Check for hazardous gases and isolate the electrical supply before removing the terminal enclosure cover.

If adjusting the thermostat for FP range heaters:

- Take extreme care when removing/re-fitting enclosure covers to maintain the integrity of the flame-paths.
- Clean the flame-paths thoroughly and re-coat with an approved Ex d corrosion inhibitor before refitting the cover.

Over-temperature trip – heater

The following points apply to heater trips:

- The trip device will only operate if there is an over-temperature fault.
- Investigate the reason for the trip before resetting the system.

Check for hazardous gases and isolate the electrical supply before removing the terminal enclosure cover.

- A trip can only be reset at the heater. The trip device and reset button are inside the main heater terminal enclosure. It can only be reset when the temperature at the sensor has fallen below the trip temperature set point.

The above applies only to heaters where the latching trip (over-temperature or Hi-Hi thermostat) is located inside the heater terminal enclosure.

- For trips on FP range heaters:
  - When removing/re-fitting enclosure covers, take extreme care to ensure that the integrity of the flame-paths is maintained.
  - Clean the flame-paths thoroughly and re-coat with an approved Ex d corrosion inhibitor before refitting the cover.
  - Refer to the relevant code of practice for selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres.

Normal shut down

To shut down the heater, press the Off button, either at the control panel or locally where this facility is provided.

Emergency shut down

Where the control panel is supplied by EXHEAT and the emergency shutdown facility is available, see the control panel operation information contained in the Data Book for the equipment.

Section 8 Maintenance Instructions

For FP range heaters, ensure that the flame path surfaces are in good condition. Report any damage to EXHEAT as flame paths are not intended to be repaired.

Compliance with these maintenance instructions is a mandatory requirement. Documented evidence must be maintained in the form of a signed checklist and the records in Appendix XB.

Section 9 Fault Finding & Correction

All air heaters

See Maintenance instructions for procedures relating to these faults.

Fault	Check	Resolution
Heater fails to achieve required design air temperature	• Isolate power supply. • Supply fuses. • Temperature control device set points are correct. • All elements still operative. Take load resistance reading. Resistance between phases should be equal. • Air flow not greater than design rating.	Contact EXHEAT for advice.
Air temperature too high	• Temperature control device set points correct. • Air flow not less than design rating.	
Heater trips	• Air flow not less than design rating and evenly distributed across duct cross section. • Supply voltage is correct. • All trip devices functioning correctly and sensors not failed. • Ambient temperature within design limits.	Refer to Appendix A.
Earth leakage trip	Limiting earth-fault currents (magnitude and/or duration) is essential for safety. The earth-fault protection device is intended to provide critical safety protection if there is current leakage to earth. Fully investigate and rectify any trip condition **before** resetting the system and operating the heater. In addition, where process is gas, de-pressurise system during investigation.	Where an earth leakage trip has occurred, isolate the heater and: • Check insulation resistance is according to Section 8. • Check settings of earth leakage protection device are according to Section 5. Where a heating element has failed, remove and replace it before returning the heater to service. If this is not possible it may be acceptable to disconnect the failed element and suitably isolate it, provided that: • EXHEAT agrees to and approves proposed remedial action prior to work commencing. • The failed element has been capped to an EXHEAT approved procedure.

All immersion heaters

See Maintenance Instructions for procedures relating to these faults.

Fault	Check	Resolution
Heater fails to achieve required design process temperature	• Isolate power supply • Supply fuses. • Temperature control device set points correct. • All elements still operative by taking load resistance reading. Resistance between phases should be equal. • Air flow not greater than the design rating	Contact EXHEAT for advice.
Process temperature too high	• Temperature control device set points are correct. • Process flow within design limits	
Heater trips	• Process flow not less than design rating and within design limits • Supply voltage is correct. • All trip devices functioning correctly and sensors not failed. • Ambient temperature is within design limits.	Contact EXHEAT for advice. Refer to Appendix A.
Earth leakage trip	Limiting earth-fault currents (magnitude and/or duration) is essential for safety. The earth-fault protection device is intended to provide critical safety protection if there is current leakage to earth. Fully investigate any trip condition and rectify prior to resetting the system and operating the heater. Where the process is gas, de-pressurise system during investigation.	Where an earth leakage trip has occurred, isolate the heater and: • Check insulation resistance is according to Section 8. • Check the settings of the earth leakage protection device are correct according to Section 5. Where a heating element has failed, remove and replace it before returning the heater to service. If this is not possible it may be acceptable to disconnect the failed element and suitably isolate it, provided that: • EXHEAT agrees to and approves proposed remedial action prior to work commencing. • The failed element has been capped to an EXHEAT approved procedure.

Appendix XB Check Reports/Certificates

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COMMISSIONING CHECK RECORD

Trip Settings

Tag No	
Description	
PO No	
Reference No	

See IOM: **Appendix C for Overtemperature Trip Setting Procedure.**

	Inspection Checklist	Tag Number	Status / Verified Trip Setpoint	Name	Date	Comment
01	Check all temperature sensors and transmitters are correctly located, undamaged and functioning correctly.					
02	Check temperature trip set points and record details below.					
03	Check earth leakage trip time and record details below:					
04	Item Description:					
05	Item Description:					
06	Item Description:					
07	Item Description:					
08	Item Description:					
09	Item Description:					
10	Item Description:					
11	Item Description:					
12	Item Description:					
13	Item Description:					

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Commissioning / Start-Up Contractor**	**EXHEAT Ltd**
Name		
Signature		
Date		
CompEX Certificate No.		

INITIAL EQUIPMENT START-UP CERTIFICATE

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	**Sign**	**Name**	**Date**	**Comment**
01	Pre-commissioning & Commissioning records as per Appendix B of the Installation, Operation and Maintenance Manual completed and submitted to EXHEAT Limited for acceptance no later than 21 days after completion of commissioning.				Date of commissioning Completion to be recorded below:
02	Storage Preservation Check Records as per Appendix B of the Installation, Operation and Maintenance Manual completed and submitted to EXHEAT Limited for acceptance no later than 21 days after completion of commissioning.				
03	Routine Maintenance records as required under Section 8 of the Installation, Operation and Maintenance Manual are complete and available (to be submitted to EXHEAT upon request).				
04	Any Post-Installation Preservation checks as required by EXHEAT Installation, Operation and Maintenance Manual between completion of commissioning and Start-up has been completed and recorded (to be submitted to EXHEAT upon request).				Date of Installation to be recorded below:
05	All equipment checked to ensure that all applicable Special Conditions for Safe Use have been complied with.				
06	Confirm that the correct process flow medium, flowrate or level (whatever is applicable) at flow direction				
07	Equipment ready for Start-Up				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

A completed certificate is required for each piece of equipment

It is a warranty requirement that all commissioning check lists and test reports are completed by Contractor and signed off during commissioning and e-mailed to commissioning@exheat.com for acceptance.

No claim under the equipment warranty will be accepted if Commissioning & Preservation Forms and this Equipment Start-Up Certificate have not been provided and accepted by EXHEAT Ltd prior to any claim.

Verified	**Commissioning / Start-Up Contractor**	**EXHEAT Ltd**
Name		
Signature		
Date		
CompEX Certificate No.		

ROUTINE MAINTENANCE CHECK RECORD

Electric Heater

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	Status Codes	Name	Date	Comment
	3 Monthly Checks				
01	Check equipment for external damage				
	6 Monthly Checks (in addition to 3 Monthly Checks)				
01	Check that there is no dirt, debris, loose items or moisture within the terminal enclosure				
02	Check that all electrical connections are undamaged and tight including any spare unused terminals.				
03	Check the heater insulation resistance and record readings on form IR-H01				
04	Check that enclosure gaskets are undamaged and fit correctly				
05	Check flame paths are undamaged				
06	Check that earth conductors are correctly fitted and undamaged				
07	Check heater and instrument enclosure covers are closed and all fasteners are fitted, tight and of the correct type				
08	Check all trip devices are set and functioning correctly; record set-points on form TR-02				
	12 Monthly Checks (in addition to 3 & 6 Monthly Checks)				
01	Check heater load resistance values and record on form LR-02				
02	If Equipment falls within Section 13 of the IOM, under the 'Dry' fluid process immersion Heater, please contact EXHEAT Ltd for recommended procedures for maintenance check.				
03	Check stock level of critical operational spares availability				
	24 Monthly Checks (in addition to 3, 6 & 12 Monthly Checks)				
01	Removal of heater bundle to conduct visual inspection on immersed section of the equipment				

NOTE: Routine Maintenance Check Record is necessary to be completed as part of Post-Installation Preservation Check where the equipment is not put into service 3 months between from the Date of Installation and/or commissioning.

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
Name			
Signature			
Date			
CompEX Certificate No.			

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PRE-COMMISSIONING CHECK RECORD

Electric Heater

Tag No	
Description	
PO No	
Reference No	

	Inspection Checklist	**Status Codes**	**Name**	**Date**	**Comment**
01	Check overall physical condition of the heater for any signs of damage.				
02	Check that terminal enclosures are undamaged				
03	Check that the heater conforms to contract drawings, to also include indication of flow direction (refer to the schedule provided within Appendix A of the contract IOM)				
04	Check that all fasteners, glands and stoppers are complete, tight and conform to the correct specification for use in a hazardous area (if applicable).				
05	Check that there is no dirt, debris, loose items or moisture within the terminal enclosure.				
06	Check that earthing is complete and satisfactory				
07	Check that enclosure gaskets are undamaged and fit correctly				
08	Check that all electrical connections are tight including any spare unused terminals				
09	Check that creepage and clearance distances are correct.				
10	Check that there is no obvious damage to internal wiring.				
11	Check that the apparatus is adequately protected against corrosion, the weather, vibration and any other adverse factors.				
12	Check that guards, where required, are present and correctly located.				
13	Check flame paths are undamaged.				
14	Check the heater insulation resistance and record readings on form EXS-FORM-000044				
15	Check all labels and tags are present, secure and correctly marked.				
16	Check heater and instrument enclosure covers are closed and all fasteners are fitted, tight and of the correct type				
17	Check all trip devices are set and functioning correctly; (record set-points on form EXS-FORM-000048)				
18	Earth leakage system in place and set points checked (record set-points on form EXS-FORM-000048)				

Carry out these activities in accordance with relevant codes of practice concerning inspection and maintenance of electrical installations in non-hazardous or hazardous areas whichever is applicable.

Verified	**Fabrication/ Construction**	**Hook-Up/ Commissioning**	**EXHEAT Ltd**
Name			
Signature			
Date			
CompEX Certificate No.			

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4.2 Edition (June 2024)

Refer to EXHEAT website for latest edition