Hazardous Area Electric Process Heat & Control Systems
COMPANY PROFILE

EXHEAT is recognised as one of the world leaders in the design and manufacture of electric process heaters and control systems for both hazardous and non-hazardous area equipment. EXHEAT has extensive global experience in electrical, mechanical and thermal design.

From harsh offshore locations where anti-corrosion properties are of paramount importance, to desert locations where high and low ambient temperatures must be considered, EXHEAT has the expertise you require. Equipment can be supplied to meet both IEC and NEC requirements. Where it is to be installed within a hazardous area, product certification can be supplied from all certification bodies.

For both onshore and offshore applications, EXHEAT has the knowledge and expertise to design and manufacture electric process heating equipment suitable for installation within the extreme environments commonly found in the oil, gas and petrochemical industries.

In 2014, EXHEAT expanded its manufacturing area to 3,250m², resulting in three separate premises dedicated to bespoke heaters, standard heaters and control system manufacturing. This expansion is in line with EXHEAT’s goals of achieving sustainable growth and providing industry leading solutions.

INDUSTRIES SERVED

Oil and gas  Petrochemical
Processing plants  Refineries
Chemical  Pharmaceutical
Marine  Food processing
Power generation  Construction
Medical  General manufacturers
Utilities

PRODUCT APPLICATIONS

EXHEAT is a world leader in the design and manufacture of engineered electric process heaters for hazardous areas. Typical applications include:

Fuel gas  Oxygen
Glycol regeneration (TEG)  Process gas
Crude oil  Heat transfer liquids
Hydrocarbon liquids  Water
Sea water  Hot water calorifiers
Nitrogen / air  HVAC

250kW Ex d  Removable Core Heaters
300kW Ex d  Fuel Gas Heaters
1000kW Ex d  Fuel Gas Heater Bundles
2530kW Ex e  Natural Gas Heaters
Ex e Air Duct Heaters
400kW Ex e  Heater Bundles
Ex p Control Panels
Ex d Control Panels
Hazardous Area Submerged L-Heaters
Ex d Cast Line Heaters
MISSION STATEMENT

EXHEAT endeavors to lead the global hazardous area electric heaters and control systems industry. We aim to achieve this through core focus on:

- Embracing new technologies and continuous improvement in our product range
- Offering innovative solutions and delivering the best quality
- Offering globally approved equipment certified for hazardous areas
- Serving customers with a high level of service in design, detailed engineering and project management
- Supporting customers worldwide with a team of support / service engineers

QUALITY ASSURANCE

EXHEAT is a Total Quality Environment committed to continuous improvement to ensure that customers’ requirements are met and backed up by a level of service necessary to operate in today’s global market place.

EXHEAT operates a Quality Management System in accordance with the internationally recognised benchmark standard ISO 9001:2008, which additionally meets the Quality Assurance requirements of both the European ATEX Equipment Directive (94/9/EC) and Pressure Equipment Directive (97/23/EC), as well as the international IECEx scheme. Products manufactured for the European market are CE marked and meet the requirements of the European Low Voltage, EMC and Machinery Directives. EXHEAT is also registered with both Achilles and Achilles FPAL, ensuring total quality in its products and systems.

CERTIFICATION

EXHEAT holds approvals from North America, Europe, China, India, Korea, Russia and globally through the IECEx scheme for the manufacture of electrical heating equipment for use in potentially explosive atmospheres:
Design and Manufacturing Capabilities

MANUFACTURING TECHNIQUES

EXHEAT meets the stringent requirements of design codes, international standards and client specifications. Our design features allow us to provide heating solutions for extreme processes — from cryogenic service to gas regeneration — and for pressures in excess of 500 barg.

We manufacture heaters with element to tubesheet sealing using bite coupling design or automated orbital welding. Alternatively, we are also able to provide heaters with cartridge elements inserted in pockets to facilitate withdrawal of the elements without the need to drain the system.

ELEMENTS

Elements are manufactured from 80/20 nickel chrome resistance wire with high-purity compacted magnesium oxide powder sheathed within corrosion / erosion resistant tube, selected in line with process, eg:

- Incoloy 800/825
- Inconel 600/625
- Titanium
- Stainless steel 316/316L
- Stainless steel 321
- Monel

ROD TYPE

Metal sheathed with mineral insulated rod elements are the most versatile and cost effective method of electric heating.

CORE TYPE

Withdrawable ceramic core type elements are designed for use in heating large tanks — the advantage being that maintenance can be done without the need to drain the tank.

CARTRIDGE TYPE

Cartridge elements are similar in construction to rod elements, except both terminations are made at a single end. This allows elements to be installed in a withdrawable construction.
DESIGN

Our unique design approach and extensive range of certification offers simple solutions to complex requirements. EXHEAT design teams support customers from conceptual, FEED to EPC, and throughout the life cycle of the equipment.

Our in-house design capabilities include:

- Single heaters up to 5MW
- 3D modeling (Pro Engineer)
- Thermal design
- Electrical design
- Process design verification
- Mechanical design
- Instrumentation requirements

ADVANTAGES OF ELECTRIC HEATING

Compared to other types of industrial heating such as fuel and gas fired heating systems or indirect heat exchangers, electric heating offers many advantages:

- **Efficiency:** Without the need for regular tuning or additional heat sources, electric heating boasts virtually 100% efficiency, since almost all of the electricity is converted to heat.

- **Precision:** Being a direct heating solution, electric heating boasts fast reaction times, offering superior temperature control and the flexibility to deal with varying process conditions.

- **Environmental:** Without the production of pollutants as a by-product, electric heating avoids the monitoring and control measures necessary to meet environmental regulations. Furthermore, with minimal moving parts, noise regulations are not a concern either.

- **Physical size:** Electric heating boasts a small footprint, without the need for additional piping and supports, thereby saving valuable space.

- **Costs:** Being physically smaller in size, not only are initial costs considerably less with electric heating, but without the need for frequent and complex maintenance activities and their associated down times or expensive performance monitoring, operating costs are less too.

- **Maintenance:** With minimal moving parts, electric heating requires less maintenance.

- **Installation:** Electric heating boasts a simpler means of operation with faster setup times.
Ex d and Ex e Hazardous Area Process Heaters

EXHEAT Ex d flameproof / explosionproof and Ex e hazardous area electric heaters comprise a large range of process flow heaters, certified for use in a Zone 1 or Class I, Div 1 or Div 2 hazardous area, custom built to meet client specifications.

VESSEL MATERIALS
- Carbon steel
- Low temperature steel
- Stainless steel
- Duplex
- Titanium

VESSEL DESIGN CODES
- PED compliant
- PD 5500: Cat 1
- ASME VIII Div 1 or 2
- Stoomwezen
- CODAP
- AD Merkblätter
- AS 1210
### TYPICAL APPLICATIONS

- Fuel gas
- Natural gas
- Molecular sieve regeneration
- Industrial gases
- Heat transfer oils
- Fuel oils
- Water
- Crude oil
- Hydrocarbon liquids
- Heating medium
- Cleaners
- Lubricating oils
- Vapour degreasing
- Steam
- Dye solutions

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<table>
<thead>
<tr>
<th><strong>Ex d Explosionproof Process Heaters</strong></th>
<th><strong>Ex e Hazardous Area Process Heaters</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1400kW (larger ratings achieved by a combination of enclosures)</td>
<td>Up to 5000kW</td>
</tr>
<tr>
<td>Certified to ATEX / IECEx II 2 G, CU TR (formerly GOST), CCOE, CNEx and Inmetro standards</td>
<td>Certified to ATEX / IECEx II 2 G/D, CSA, CU TR (formerly GOST), CCOE, CNEx and Inmetro standards</td>
</tr>
<tr>
<td>Ex d, Zone 1, Gas Group II A, B, C</td>
<td>Ex e, Zone 1, Gas Group II</td>
</tr>
<tr>
<td>Class I, Div 1, Gas Group A, B, C, D</td>
<td>Class I, Div 2, Gas Group A, B, C, D</td>
</tr>
<tr>
<td>Terminal box certified weatherproof to IP66</td>
<td>Terminal box certified weatherproof to IP67 or NEMA 4x</td>
</tr>
<tr>
<td>Lightweight stainless steel construction terminal box</td>
<td></td>
</tr>
<tr>
<td>Temperature class T1 to T6 (T450 to T85°C)</td>
<td></td>
</tr>
<tr>
<td>Elements specially sealed to prevent moisture ingress</td>
<td></td>
</tr>
<tr>
<td>Elements individually replaceable on site without the need for special tools</td>
<td></td>
</tr>
<tr>
<td>Suitable and certified for use in ambient temperatures -60 to +60°C</td>
<td></td>
</tr>
<tr>
<td>Anti-condensation heaters fitted if required</td>
<td></td>
</tr>
</tbody>
</table>
Ex d and Ex e Hazardous Area Immersion Heaters

EXHEAT Ex d flameproof / explosionproof and Ex e hazardous area electric heaters comprise a large range of process immersion heaters, certified for use in Zone 1 or Class I, Div 1 or Div 2 hazardous areas, custom built to meet client specifications.
<table>
<thead>
<tr>
<th>Ex d Explosionproof Immersion Heater</th>
<th>Ex e Hazardous Area Immersion Heater</th>
<th>Hazardous Area L Immersion Heater</th>
</tr>
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<tbody>
<tr>
<td>Up to 1400kW (larger ratings achieved by a combination of enclosures)</td>
<td>Up to 5000kW</td>
<td>Up to 300kW</td>
</tr>
<tr>
<td>Certified to ATEX / IECEx II 2 G/D, CSA CU TR (formerly GOST), CCOE, CNEx and Inmetro standards</td>
<td>Certified to ATEX / IECEx II 2 G, CSA CU TR (formerly GOST), CCOE, CNEx and Inmetro standards</td>
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</tr>
<tr>
<td>Ex d, Zone 1, Gas Group II A, B, C</td>
<td>Ex e, Zone 1, Gas Group II</td>
<td>Ex e, Zone 1, Gas Group II</td>
</tr>
<tr>
<td>Class I, Div 1, Gas Group A, B, C, D</td>
<td>Class I, Div 2, Gas Group A, B, C, D</td>
<td>Terminal box certified weatherproof to IP66/67 or NEMA 4x</td>
</tr>
<tr>
<td>Terminal box certified weatherproof to IP66</td>
<td>Terminal box certified weatherproof to IP67 or NEMA 4x</td>
<td>Durable stainless steel enclosure with removable cable entry gland plates</td>
</tr>
<tr>
<td>Lightweight stainless steel construction terminal box</td>
<td>Cable entries cut to suit incoming cable requirements</td>
<td></td>
</tr>
<tr>
<td>Temperature class T1 to T6 (T450 to T85°C)</td>
<td>Elements specially sealed to prevent moisture ingress</td>
<td>External and internal earth stud</td>
</tr>
<tr>
<td>Elements individually replaceable on site without the need for special tools</td>
<td>Suitable and certified for use in ambient temperatures -60 to +60°C</td>
<td>Anti-condensation heaters fitted if required</td>
</tr>
</tbody>
</table>

**TYPICAL APPLICATIONS**

- Crude oil
- Hydrocarbon liquids
- Glycol (TEG and MEG) reboilers
- Molecular sieve regeneration
- Heat transfer oils
- Heating medium
- Industrial gases
- Tank heating
- KO drums
- Fuel gas
- Fuel oils
- Water
- Synthetic oils
- Butane / propane vaporisers
- Molten salt baths
EXHEAT's range of Ex e duct heaters are custom built to meet client specifications and are suitable for use in Zone 1 or Zone 2 hazardous areas.

The range of air duct heaters are certified for use in heating, ventilation and air conditioning (HVAC) systems.

**TYPICAL APPLICATIONS**

- Air handling units
- Space heating
- HVAC heating
- Drying ovens
- Furnace heating
- Anti-icing heaters
- Reheating
- Core drying
- Air pre-heating
- Annealing

**FEATURES**

Certified to ATEX / IECEx II 2 G and CU TR (formerly GOST) standards

Elements certified Ex e for use in Zone 1 hazardous areas

Terminal box is certified weatherproof to IP66 and IP67

Temperature class T2 to T6

Elements are specially sealed to prevent moisture ingress

Elements are individually replaceable on site without the need for special tools

Various types of over-temperature cut-outs available (eg) certified thermostats, RTDs or thermocouples

Anti-condensation heaters fitted if required
EXHEAT’s range of cast aluminium line heaters provide a compact and efficient heating solution for constant flow liquids or gases. Cast heaters are increasingly being selected over traditional pressure vessel type heaters for the following reasons:

- Cost effective
- Uniform heat distribution
- Available on shorter lead times
- Resistant to any internal vibrations
- Compact size with a reduced footprint
- Increased safety due to the encasement
- Suitable for high process design pressures
- High reliability and increased service life
- Excellent heat transfer and residual heating from the aluminium casting

The design incorporates electric heating elements and an indirect process heating coil embedded within marine grade cast aluminium. This provides excellent heat transfer properties combined with low surface temperatures.

**FEATURES**

Certified to ATEX Equipment Directive, IECEx, CSA and CU TR (formerly GOST) standards

Certified under EN/IEC 60079-0, 60079-1, 60079-7 and 60079-31

Flameproof IP66 rated terminal enclosure

Cellular Glass insulated with stainless steel cladding

Maximum design pressure and temperature of 660 barg at up to 400°C

Process control and over-temperature protection sensors: RTD Pt100, thermocouple type K or thermostats

Wall or floor, vertical or horizontal mounting

Multiple heating elements allow for step control; alternatively, solid state relay or thyristor control can be employed

Coil materials: stainless steel 316L, duplex S31803, super duplex S32760 (others, including nickel alloys available on request)

Process connections available using standard flanged or compression joints

**TYPICAL APPLICATIONS**

- Natural gas
- Paint heating
- CO₂
- Instrument air
- Pasteurisation
- Air
- Steam generation
- Nitrogen
- Solvent
- Annealing
EXHEAT’s control systems are manufactured at our factory in the United Kingdom to comply with each and every standard demanded by our clients. The operation of an electric heater is only as good as the system which controls it. EXHEAT specialises in the control of electric heaters and heating systems. The systems can range from the simple on / off control, to the most sophisticated burst fire / single cycle thyristor control.

EXHEAT has extensive experience in the design of large heater control systems and requirements for ‘load splitting’. Loads can also be divided into stages to give multi-thyristor control. In addition, combinations of thyristor and contactor control can be supplied to provide a fully synchronised system and limit the impact on the power generation system.

Control systems can be certified to UL standards 508A and 698A, for Class I, II and III, Division 1 and 2 hazardous locations and safe areas.

**CONTROL SYSTEM SERVICES**

- Thyristor control system design
- Step contactor sequence control
- PLC programming
- Engineering planning
- Manufacture

**IN-HOUSE TESTING**

- Factory testing and quality control
- On-site commissioning
- Spares and after sales service
- SIL level reports / verification
- Full load / heat soak testing
- Harmonic analysis
- RF interference testing
- Waveform recording
HAZARDOUS AREA PURGED PANELS

EXHEAT can provide hazardous area purged Ex p control panels to IEC/EN60079-2.

Ex p control panels are ideal for heating systems where the heater is controlled locally via a skid mounted control system.

FLAMEPROOF CONTROL PANELS

Heater control and instrument display panels can be engineered and supplied to enable local control of EXHEAT hazardous area heating products and the local visual display of process temperatures; these control panels provide an effective solution.

For applications with large electrical power requirements, we advise that the control system be installed in a safe area. However, for small step or thyristor controlled loads, the use of a flameproof control system can reduce installation costs.

<table>
<thead>
<tr>
<th>Hazardous Area Purged Panels</th>
<th>Flameproof Control Panels</th>
</tr>
</thead>
</table>
| ATEX certified Ex px suitable for Zones 1 and 21  
  CSA certified Class I and II, Div 1 | ATEX approved  II 2 G |
| ATEX certified Ex py and Ex pz, Zones 2 and 22  
  CSA certified Class I and II, Div 2 | CENELEC, IECEx, CSA |
| Where thyristor control is deployed, the forced fan cooling system is replaced by vortex coolers | Ex d or Ex de IIB or IIC T1 to T6 |
| EXHEAT has a range of purge kits suitable for pressurizing enclosures with volume up to 12.7m³ | Suitable for Zones 1 and 2 |
| Stainless steel 316 or painted mild steel IP66 (Type 4X) enclosures are available | Certified weatherproof to IP66 |
| | Ambient temperatures from -20°C to +40°C |
| | Marine grade aluminium cast alloy or stainless steel |
FUEL GAS

Fuel gas is commonly used in the power generating industry as an energy source for turbines. Before the fuel gas is burned in the turbines, it needs to be treated to ensure the removal of solid, liquid and gas contaminants. A fuel gas conditioning system commonly consists of the following components: a pre-heater, a pressure regulation valve, two high efficiency coalescing filter elements and a superheater.

The pre-heater is used to prevent the formation of hydrate due to a pressure and temperature drop across the pressure regulator.

The pressure regulating valve is then used to maintain a constant gas pressure to the turbine in the event that the gas supply pressure exceeds an acceptable level, while a coalescing filter is then used to remove the solids and liquids. The system will commonly include two such filters so that one can be replaced without shutting down the fuel gas conditioning system.

Finally a superheater is used to ensure that superheated gas enters the turbine at the correct temperature.

SEAL GAS

Dry gas seals are used in process gas centrifugal compressors. It is necessary to have shaft sealing to prevent the process gas from escaping to the atmosphere. Dry gas seals can be applied to accomplish the required shaft sealing and although available in a variety of configurations, a tandem style seal is typically applied within a process gas service.

Tandem seals consist of a primary seal and a secondary seal. During normal operation, the primary seal absorbs the total pressure drop to a vent system and the secondary seal acts as a back-up should the primary seal fail. Dry seals are basically mechanical face seals, consisting of a mating (rotating) ring and a primary (stationary) ring. During operation, grooves in the mating ring generate a fluid-dynamic force causing the primary ring to separate from the mating ring and create a running gap between the two rings. A sealing gas is injected into the seal, providing the working fluid for the running gap and the seal between the atmosphere or flare system and the compressor internal process gas.

It is necessary for the high pressure seal gas to be heated to ensure the removal of moisture and prevent condensation within the seal. EXHEAT heaters are typically used within this generally high pressure application.
**BIOGAS**

Biogas is the result of biological breakdown of organic matter in the absence of oxygen. Comprising mainly of methane and carbon dioxide, the gas is produced by the anaerobic digestion of biodegradable materials. Biogas captured from landfill and sewage plants is either used to generate electricity with gas powered engines or upgraded to be injected into national grids.

Captured biogas in its unrefined state is heavily contaminated with siloxanes. These siloxanes convert into silicon dioxide on combustion.

The silicon dioxide combines with other elements in the gas and lubrication oils, forming a hard compound that accumulates on the combustion surfaces. As a result, engine efficiency is compromised and unburned fuel contaminates the exhaust gases increasing emissions. This also causes severe damage to valves, pistons, piston rings, liners, cylinder heads, spark plugs and turbochargers of gas engines.

The solution is to use a siloxane removal system. An integral part of the process is an electric process heater to provide a clean, efficient and controllable solution for process heating.

**HEATING MEDIUM**

Heating medium is any solid or fluid (such as water, steam, air, or flue gas) which is used to convey heat from a heat source (such as an electric immersion heater) to a process or space being heated. Electric heat is often used as a temporary or permanent solution to heat the medium which is then used in various types of heat exchangers throughout the plant.

When electric heat is used permanently to heat the medium which in turn is used in a process, we ask our customers: “Could you use electric heaters directly in the process?” The positive answer usually reduces the overall cost of the process design.
CONTINUOUS CATALYST REGENERATION

The Continuous Catalyst Regeneration (CCR) process is part of a process used in the petroleum and petrochemical industries, which produces aromatics from naphthenes and paraffins commonly used as motor fuel.

In this process, hydrotreated naptha is combined with recycled hydrogen gas, heated to the desired reaction temperature (496°C to 524°C) and sent through a series of reactors (vertical or side by side). Because the reaction is endothermic, interstage heaters are required between each reactor section to attain the required reaction temperature. In order to attain the desired reactions and high product yield, a metal catalyst such as platinum is used. The catalyst moves from reactor to reactor and the feed mixture flows radially across the catalyst beds.

MOLECULAR SIEVE REGENERATION

A molecular sieve is a material containing tiny pores of a precise and uniform size that is used as an adsorbent for gases and liquids. Molecules small enough to pass through the pores are adsorbed while larger molecules are not. A molecular sieve can adsorb water up to 22% of its own weight.

Often they consist of aluminosilicate minerals, clays, porous glasses, microporous chars, zeolites, active carbons or synthetic compounds that have open structures through which small molecules, such as nitrogen and water can diffuse.

Molecular sieves are often utilised in the petroleum industry, especially for the purification of gas streams and in the chemistry laboratory for separating compounds and drying reaction starting materials. Due to the mercury content of natural gas being extremely harmful to the aluminium piping and other parts of the liquefaction apparatus, silica gel is used in this case.

Methods for regeneration of molecular sieves include pressure change (as in oxygen concentrators), heating and purging with a carrier gas (as used in ethanol dehydration), or heating under high vacuum. EXHEAT electric heaters are commonly used to heat the carrier gas, for example nitrogen, that is used to regenerate the molecular sieve bed.
**KO DRUMS**

A vapour-liquid separator is a vertical vessel used in several industrial applications to separate a vapour-liquid mixture. Gravity causes the liquid to settle to the bottom of the vessel, where it is withdrawn. The vapour travels upward at a designed velocity which minimizes the entrainment of any liquid droplets in the vapour as it exits the top of the vessel.

The feed to a vapour-liquid separator may also be a liquid that is being partially or totally flashed into vapour and liquid as it enters the separator.

A vapour-liquid separator may also be referred to as a flare KO drum, flash drum, knock-out drum, knock-out pot, compressor suction drum or compressor inlet drum.

When used to remove suspended water droplets from streams of air, a vapour-liquid separator is often called a demister.

EXHEAT electric heaters are used as a means of increasing the temperature of the liquid which has been separated. EXHEAT core heater elements allow for the removal and replacement of the elements without the need to drain the process; a feature which is particularly useful in this application.

**CRUDE OIL**

Heavy crude oil or extra heavy crude oil is any type of crude oil which does not flow easily. Heavy crude oil has been defined as any liquid petroleum with an API gravity less than 20°API, meaning that its specific gravity is greater than 0.933 (g/ml).

Production, transportation, and refining of heavy crude oil presents special challenges compared to light crude oil.

Physical properties that distinguish heavy crudes from lighter ones include higher viscosity and specific gravity as well as heavier molecular composition. Generally a diluent is added at regular distances in a pipeline carrying heavy crude to facilitate its flow. EXHEAT electric heaters can be used to reduce viscosity in order to improve flow of heavy oils in a pipeline or within a storage tank.
GLYCOL REBOILERS

Lean, water-free glycol (purity >99%) is fed to the top of an absorber where it is contacted with the wet natural gas stream. The glycol removes water from the natural gas by physical absorption and is carried out the bottom of the column. Upon exiting the absorber, the glycol stream is often referred to as “rich glycol”. The dry natural gas leaves the top of the absorption column and is fed either to a pipeline system or to a gas plant.

After leaving the absorber, the rich glycol is fed to a flash vessel where hydrocarbon vapours are removed and any liquid hydrocarbons are skimmed from the glycol. This step is necessary as the absorber is typically operated at high pressure and the pressure must be reduced before the regeneration step. Due to the composition of the rich glycol, a vapour phase will form when the pressure is lowered having a high hydrocarbon content.

After leaving the flash vessel, the rich glycol is heated in a cross-exchanger and fed to the stripper (also known as a regenerator). The glycol stripper consists of a column, an overhead condenser and a reboiler. The glycol is thermally regenerated to remove excess water and regain the high glycol purity.

The hot, lean glycol is cooled by cross-exchange with rich glycol entering the stripper. It is then fed to a lean pump where its pressure is elevated to that of the glycol absorber. After raising the pressure, the lean solvent is cooled again with a trim cooler before being fed back into the absorber. This trim cooler can either be a cross-exchanger with the dry gas leaving the absorber or an aerial type cooler.

EXHEAT electric heaters can be used within the reboiler to thermally regenerate the glycol, providing a clean, efficient controllable heat source with controlled sheath temperatures so as not to burn the glycol.
NATURAL GAS

Natural gas is transmitted through long distance pipe lines under high pressure. However, this pressure is not suitable for local gas distribution networks supplying customers for use in domestic and industrial gas appliances. Usually, a pressure reduction valve (PRV), ie a throttle valve (also known as Joule-Thomson valve) is used at Pressure Reduction Stations (PRS) to reduce natural gas pressure before supply to a local gas distribution network. This pressure reduction in a PRS by a throttle valve results in reduction of both pressure and temperature of natural gas.

For example, natural gas throttled from 25 barg and 10°C to 3 barg would be cooled by about 6.5°C (ie will be at about 3.5°C) after pressure reduction. It is a normal practice to have provision for heating natural gas at PRS, preferably before throttling, so that its temperature is maintained at an acceptable level after throttling to avoid operational and material integrity problems in local gas distribution network that can be caused by low gas temperature. It is estimated that 22kJ of heat would be required per kg of natural gas to preheat it to 16.5°C before throttling which will leave the gas at 3 barg and 10°C after throttling.
HIGH TEMP / LARGE DELTA T APPLICATIONS

EXHEAT, with its knowledge gained over the years, uses variable watt densities to achieve different heat transfer in various stages of the heater. This ensures the elements are at the correct temperature and will not exceed the thermal cracking temperature of the media flowing through.

Multiple heaters are connected in a series of vessels for optimal heat transfer and allow for varying heat input across the required load. Our design includes heat shields and insulation discs for terminal box temperature protection and the use of rod-type baffles to meet heat transfer requirements, whilst ensuring a very low pressure drop.

This system can be used for many processes such as;

- Catalyst reduction, hot H2 stripping, oxidation and reactivation
- Continuous catalyst regeneration
- Reactivation burning
- Gas regeneration

TANK HEATERS

EXHEAT core and cartridge element immersion heaters are used in many applications requiring tank heating, and with precision control of liquid temperature and virtually 100% energy efficiency they are ideal in industries requiring a reliable and fast heat up time.

EXHEAT’s preferred method for tank heating is pocketed elements to allow maintenance without tank draining. Tank heating is used for heating liquids in large tanks where low levels are commonly experienced. It is also used to heat materials such as water, solvents, molasses, syrups and many petroleum products.
AIR SEPARATION

Air separation is a common process used to extract gases from atmospheric air. The main gases extracted are nitrogen and oxygen.

Cryogenic air separation units (ASU) utilise the varying condensing / boiling points to enable separation by distillation at cryogenic temperatures. Liquefying and distilling air provides a process to successfully separate the nitrogen and oxygen.

Modern ASUs utilise a Prepurifier Unit (PPU), which removes moisture, CO2 and most hydrocarbons from the air to prevent ice and dry ice forming later in the process. A PPU is typically made up of a chiller to cool the air to 40 to 55°F, a condensate separator to remove free water and two vessels filled with desiccant and mole sieve material which adsorbs the contaminants while allowing the air to pass through. The desiccant and molecular sieve bed is regenerated by passing heated waste nitrogen to remove accumulated contaminants. Electric heaters are used to heat the waste nitrogen.
Major Project Experiences

NORTH AMERICA
- WHITE ROSE OIL FIELD DEVELOPMENT
- TERRA NOVA FIELD DEVELOPMENT
- WHITING REFINERY NORTHWEST INDIANA
- HIBERNIA GAS FIELD DEVELOPMENT

SOUTH AMERICA
- PEREGRINO FPSO
- UFN III – PETROBRAS FERTILIZER PLANT
- CAMPOS BASIN DEVELOPMENT – P56, P58, P62 & P63
- BALEIA AZUL FIELD DEVELOPMENT
- LULA OIL FIELD DEVELOPMENT
- MACUETA GAS COMPRESSION PLANT
- PERU LNG
- FPSO ILHA BELA
- TUPI 7 & TUPI 8
- TUPI ALPHA & TUPI BETA
- CESSÃO ONEROSA P74

EUROPE
- ADRIATIC LNG
- NYHAMNA/ORMEN LANGE
- GJOA
- PAZFLO SRU
- SKARV & IDUN DEVELOPMENT
- MILFORD HAVEN REFINERY
- BUZZARD FIELD
- SULLOM VOE OIL AND GAS TERMINAL
- HOLFORD GAS STORAGE
- LEMAN PLATFORM
- HOLE HOUSE II GAS STORAGE FACILITY
- JASMINE DEVELOPMENT
- REVOLUTION GAS STORAGE
- MARINER
- AASTA HANSTEEN
- IVAR AASEN

AFRICA
- IN SALAH GAS FIELD
- HUNGO AND CHOCALHO DEEPWATER OIL FIELDS – KIZOMBA FPSOS
- ANGOLA LNG
- OLOWI DEEPWATER OIL FIELD
- WESTERN LIBYA GAS PROJECT (WLGP)
- NIGERIA LNG (BONNY ISLAND DEVELOPMENT)
- DIFFRA FPF AND FLOWLINES
- MELUT BASIN OIL
RUSSIA/CIS
MOSCOW/SALAVAT REFINERIES
TUAPS/KUBYSHEV/SYRZAN REFINERIES
STAVROLEN/NIZHEGORODNOC
SHAH-DENIZ AND AZERI PROJECTS
CHIRAG PLATFORM
ATYRAU REFINERY
AGT PIPELINES PROJECT
KARACHAGANAK FIELD DEVELOPMENT
KASHAGAN FIELD DEVELOPMENT
KASHAGAN BARGES
KHARYAGA FIELD DEVELOPMENT
SAKHALIN
TURKEMENISTAN BLOCK 1 GAS DEVELOPMENT

ASIA
BRUNEI LNG
WEST EAST PIPELINE
AMPA FAIRLEY RATIONALISATION
GUANGZHOU REFINERY
HUIZHOU 21-18 GAS PROJECT
SUMBAGSEL
TANGGUH LNG
USAN FPSO
RESAK DEVELOPMENT
TANGGA BARAT DEVELOPMENT
MALAMPAYA DEBOTTLENECKING
HELIOS TERMINAL
SONGKHLA GAS SEPARATION PLANT
NAM CON SON - LAN TAY PLATFORM
NINGXIA HUI REFINERY

AUSTRALASIA
LAMINARIA FIELD
BUFFALO FPSO
BASSGAS OFFSHORE DEVELOPMENT
OTWAY OFFSHORE GAS
QUEENSLAND CURTIS LNG
GREATER GORGON GAS
AUSTRALIA PACIFIC LNG
GLADSTONE LNG
WHEATSTONE LNG
PRELUDE FLNG
ICHTHYS

MIDDLE EAST & INDIA
KHUFF GAS DEVELOPMENT
BOROUGE 2
EMIRATES ALUMINIUM SMELTER COMPLEX
SOUTH PARS
ESFAHAN GASOLINE PRODUCTION PLANT
AROMATICS COMPLEX KUWAIT
OMAN LNG
SAIH RAWL OILFIELD
MUKHAIZNA POWER PLANT
HARWEEL CLUSTER DEVELOPMENT
AL-SHAHEEN

YANBU REFINERY
HAWIYAH LNG
5K OLEFIN PLANT
RIYADH POWER PLANT
HABSHAN GAS COMPLEX
YEMEN LNG
AMAL
GAOU ALAM
JUBAIL EXPORT REFINERY
SAHIL & SHAH FIELD DEVELOPMENT
SHAYBAH NGL

PEARL GTL
BHATINDA REFINERY
TISCO JAMSHEDPUR
ICP-R PROCESS PLATFORM
ZAMZAMA GAS FIELD
VEDANTA ALUMINIUM
JAMNAGAR REFINERY
UCH GAS FIELD
SANGU DEVELOPMENT
EX Services, backed with 20 years of experience serving Operators and EPC contractors in the design and manufacture of hazardous area electric process heaters and control systems, gives us the expertise to ensure your systems are maintained by highly qualified and experienced engineers.

EX Services delivers services designed to lower costs, reduce risk and improve product longevity by eliminating problems before they arise. Dedicated teams in strategic global positions allow EX Services to offer fast technical support or emergency site visits anywhere in the world.

Whether you require training, technical support or fully comprehensive preventive maintenance service contracts, EX Services is here to maintain and keep your heating and control systems running.

SERVICES

SERVICE CONTRACTS

Our maintenance solutions help you maximise the performance of your heating system.

Correctly maintained equipment helps ensure performance is improved to — and sustained at — design specifications.

The best way to ensure proper maintenance is through an EX Services contract. We offer several service contract options that are tailored to suit your business and maintenance needs.

Available service contract options include:

- 6 month routine maintenance
- 12 month routine maintenance inclusive of heater terminal enclosure inspection
- Spares discount
- Labour discount
- Spares stock check
- Site survey
- 24hr telephone technical support
- Maintenance days included
- Inclusive repairs spares
- Bundle removal and inspection

TRAINING

EX Services is able to provide structured training covering operation, basic maintenance and problem solving for your EXHEAT equipment.

Tailored to suit your staffing needs and providing your team with the knowledge to get the best performance from your equipment daily. This certified training can be conducted on site or at our training facilities in the UK.

TECHNICAL SUPPORT

EX Services is proud to provide a comprehensive technical support service.

This service is provided via our main offices in the UK and Singapore, ensuring support is available when it is needed most.

With access to the design, manufacturing and site services team, you can be assured of a prompt and appropriate response to assist you with your technical enquiry.
COMMISSIONING AND START UP COVER

Guaranteeing your EXHEAT equipment is installed right the first time can be vital to ensuring timely completion of a critical project and providing a stable base for equipment performance.

EX Services can supply on and off shore commissioning engineers to complete all commissioning and start-up checks; giving you the confidence that your equipment has been installed correctly and is operating within its design parameters.

Using EX Service engineers to commission your EXHEAT equipment will also provide instant validation of the EXHEAT warranty.

ON AND OFFSITE REPAIRS

EX Services is able to provide ongoing engineering support through our internationally based team of EX Services technicians.

With many years of experience our team can provide remote support, on site / off shore and return-to-base repairs on all EXHEAT systems, ensuring the right solution for our customers.

SITE SURVEYS AND CONDITION REPORTS

Our team of engineers will conduct a full site survey and provide condition reports for all EXHEAT equipment. The site survey also includes a review of customer training needs; spares stock levels and onsite documentation ensuring you are perfectly equipped to get the most from your heating equipment.

We can also carry out thermal imaging studies to safely detect otherwise invisible symptoms of imminent failure at an early stage, allowing you to fix issues before they disrupt your production process and help your company save both time and money.

For more information about EX Services:
Email: contact@exservices.com
Telephone: +44 (0)1953 886200
Website: www.exservices.com

PREVENTATIVE MAINTENANCE

In any stream of life, prevention is always better than cure. Never has this been more prevalent than within a process or production environment.

Our preventative maintenance programmes provide the foundations for optimum performance and asset longevity. Each preventative maintenance programme is tailored to suit the customer.

Part of the preventative maintenance schedule includes ongoing diagnostics performance monitoring of your equipment to ensure optimum performance at all times throughout the lifecycle of your heater.
EXHEAT Industrial Products

EXHEAT Industrial offers fast track solutions to the industry's wide and varied requirements for electrical heating systems. All heaters manufactured by EXHEAT Industrial for use in hazardous areas are supplied fully certified to meet the latest requirements of the IECEx scheme, CSA, Inmetro, CU TR (formerly GOST), CCOE, CNEx, KGS or the European ATEX Equipment Directive, as appropriate.

All heaters are manufactured and stocked in the UK; a selection of stock is also kept at our regional office in Singapore to facilitate faster delivery time.

Air Heaters

- Hazardous area Ex e air warmers and convector heaters, 250W to 3kW
- Flameproof Ex d air warmers, 500W to 2kW
- FLR radiator style Ex d heaters designed for dust environments, 1kW, 2kW, 3kW
- Ex d and Ex e anti-condensation and frost protection enclosure heaters, 30W to 500W
- Flameproof Ex d fan assisted unit heaters, 9kW to 30kW
- Industrial safe area CE approved convector heaters, 1kW to 3kW
- Industrial safe area CE approved IP66 fan heaters, 3kW to 30kW

- A selection of air heaters are currently in stock and available for despatch within 2 to 3 working days.
- Our heaters can be controlled from the EXHEAT Industrial range of thermostats listed below.

Line Heaters

- Flameproof and industrial safe area line heaters are available from 500W to 150kW (subject to the application and medium).
- An indirect method of efficient heating for bulk liquid flow applications.
- Alternative materials available and designed for a variety of mediums such as water, oil, air and corrosive materials.

Immersion Heaters

- A standard range of flameproof immersion and tank heaters are available on short lead times, and can be designed to meet your specific requirements.
- Selection of heating elements including low watts density standard rod / hairpin type and withdrawable ceramic core and cartridge type. Our robust Ex d terminal enclosure protects the connections, and is fitted with a process control thermostat and over-temperature protection.
- Duties from 100W to 150kW subject to process requirement within the design parameters.
- Any electrical supply up to 690V.
- Industry flange connections or a threaded boss in a variety of materials.

Thermostat / Transmitter Enclosures

- Dual certified flameproof air sensing thermostats and a safe area equivalent all available ex stock.
- The HFT is a tamperproof 316L stainless steel construction or the AFT with its externally adjustable design made from cast aluminium.
- The HIH flameproof transmitter / instrument 316L stainless steel enclosure designed to accommodate most makes of head mounted transmitters such as WIKA, Siemens and Rosemount.

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Experience List

- ABB LUMMUS GLOBAL (CB&I)
- ADCO
- ADGAS
- ADMA-OPCO
- ADNOC
- AGIP
- AIBEL
- AIR LIQUIDE
- AIR PRODUCTS
- KVAERNER (AKER)
- AKER SOLUTIONS
- ALFA LAVAL
- ALSTOM
- AMEC
- HESS (AMERADA)
- ARCO
- AXENS
- BASF
- BAYER
- BCPL
- BECHTEL
- BEMCO
- BHP
- BLUEWATER
- BOC
- BOUYGUES
- BP
- BRITISH GAS
- BUMI ARMADA
- BW OFFSHORE
- CAMERON
- CB & I
- CHEVRON
- CHIYODA
- CLOUGH
- CNOOC
- CONOCO
- COSTAIN ENGINEERING
- CPCL
- CPECC
- CREST
- CTCI
- FLOWSERVE
- CUEL
- CUULONG
- DAEILIM
- DOW
- DRESSER-RAND
- DSME
- EIL
- ENCA
- ENI
- ENPP1
- ESSAR
- ESSO
- EXXONMOBIL
- FLUOR
- FORMOSA PLASTIC
- FOSTER WHEELER
- GAIL
- GASCO
- GAZPROM
- GE INTERNATIONAL
- GNOPC
- GSPC
- HALLIBURTON
- HHI
- HITACHI
- HYUNDAI ENGINEERING
- IKPT
- INDIAN OIL CORP
- J RAY MCDERMOTT
- JACOBS COMPRIMO
- JGC
- JOHN CRANE
- KAZMUNAIGAZ
- KBR
- KENCANA HL
- KOBELCO
- KOC
- KOGAS
- LARSEN & TOUBRO (L&T)
- LINDE
- LPEC
- LUKOIL
- ROSNEFT
- MAERSK OIL & GAS
- METKA
- MITSUBISHI
- MITSUI
- MMHE
- MODEC
- MOSS GAS
- MURPHY OIL
- MW KELLOGG
- NALCO
- NAM
- NEWFIELD
- NEXEN
- NIGC
- NORSK HYDRO
- OCCIDENTAL
- ODEBRECHT
- OGC
- OMV
- ONGC
- OPWPC
- ORIGIN
- PAE
- PARSONS
- PDO
- PERTAMINA
- PETRECO
- PETROBRAS
- PETROCHINA
- PETROFAC
- PETROJET
- PETROKEMYA
- PETROM SA
- PETRONAS
- PHILLIPS PETROLEUM
- POSCO
- PRAXAIR
- PROSAFE
- PTSC
- PTT
- PTTEP
- PUNJ LLYOD
- SIBUR
- QATAR GAS
- QATAR PETROLEUM
- RAMUNIA
- REKAYASA
- RELIANCE
- REPSOL
- ROMPETROL
- S.M.O.E
- SABIC
- SAIPEM
- SAMSUNG ENGINEERING
- SATORP
- SAUDI ARAMCO
- SBM
- SDE
- SEI
- SHAW GROUP
- SHELL
- SHI
- SINOPEC
- SK ENGINEERING
- SNAMPROGETTI (SAIPEM)
- SNC LAVALIN
- SOLAR TURBINES
- STATOIL
- TALISMAN
- TANKER PACIFIC
- TECHINT
- TECHNIP
- TECNICAS REUNIDAS
- TEXACO
- TOTAL
- TOYO
- TRANSCO
- TURKMENGAZ
- UHDE SHEDDEN
- UOP
- VEDANTA
- WINTERSHALL
- WOOD GROUP
- WOODSIDE
- WORLEY PARSONS
- PKN ORLEN