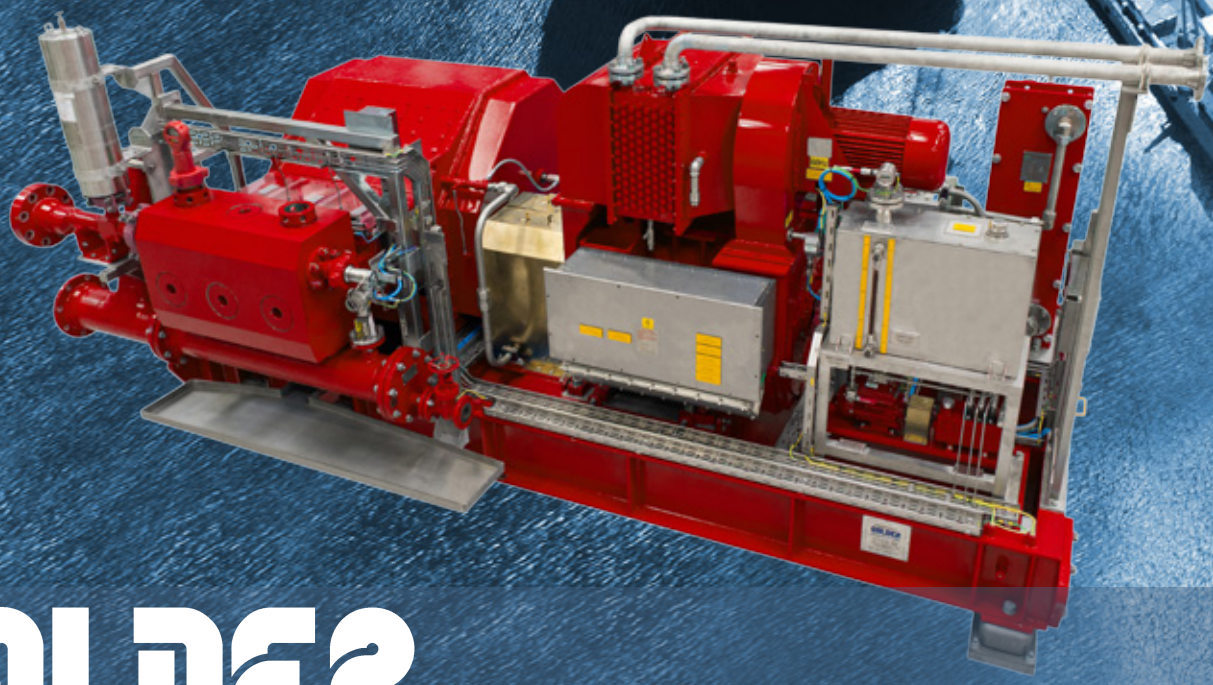
# High Pressure Multi-Purpose Pumping Solutions

**For the HP pumping of:**

- Drill Cuttings (CRI)
- Waste Fluids
- Slurries
- Drilling Fluids
- Deck Drainage
- Treatment Fluids
- Workover Fluids
- Completion Fluids
- Hydrostatic Test Water
- NORM



CALDER

# A Proven Calder Design

## Designed from the ground up…
## …with the customer in mind

Established more than 40 years ago, Calder has built an excellent reputation worldwide as a leading designer and manufacturer of high pressure pump packages for hazardous area Waste Injection and Multi-purpose Pumping applications within the Oil & Gas industry.

Due to the variety of high pressure pumping applications, and their wide range of requirements in terms of legislation, standards and specifications, Calder pump packages are typically of a bespoke design, and custom built to order.

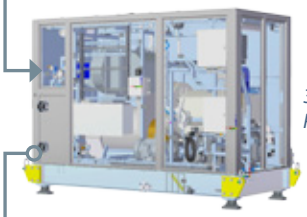
Every pump package is then comprehensively tested and proven within Calder's state-of-the-art test facility.



### 3D Engineering Design

Each new pump package design starts with the creation of a detailed 3D solid model. Calder uses Solid Edge 3D CAD software to create this 3D model and to generate all engineering drawings for the pump package, including general assembly, manufacturing and fabrication drawings.





*3D Model of Pump Package.*

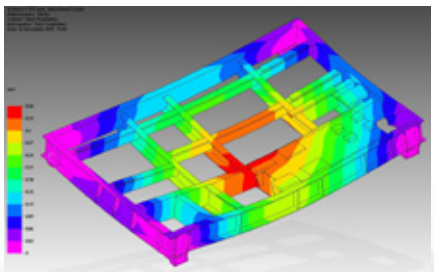


*Manufactured Pump Package.*

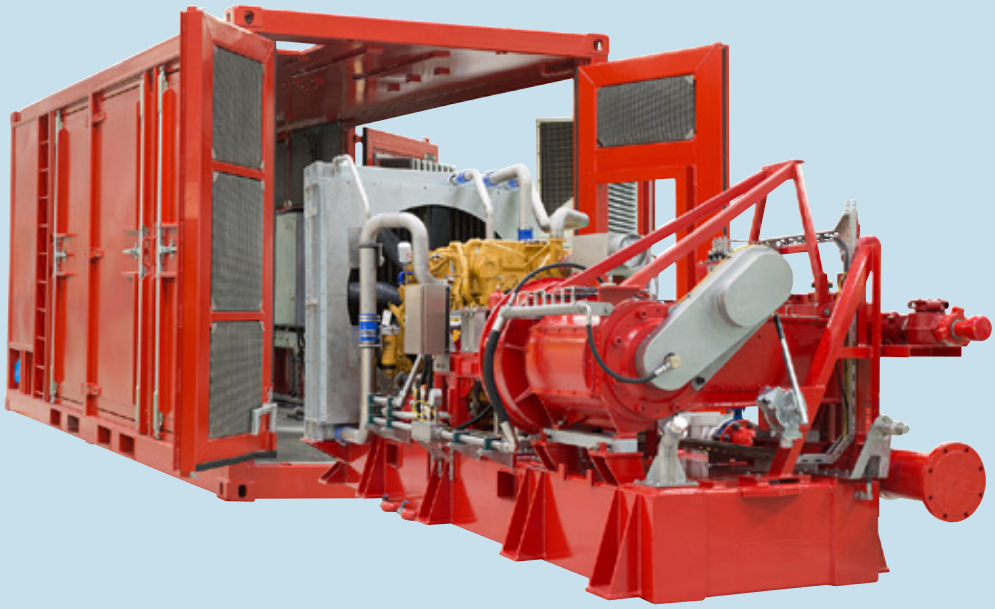
### Finite Element Analysis Capability

The 3D model is also used as the basis for a variety of Finite Element Analysis (FEA) techniques. Calder use these techniques to verify that the design meets the various customer requirements relating to lifting cases, seismic loads, torsion loads, 'blast cases' etc.

Calder also uses FEA to develop their designs to achieve valuable space and weight-saving benefits for their customers. For instance, the example (left) shows a typical analysis of a pump package baseframe under lifting case conditions. Calder use this type of analysis to optimise the baseframe design by determining exactly where to locate the supporting framework for maximum strength, whilst also reducing material where possible to save weight.



*Finite Element Analysis of Baseframe.*



Contact our team to discuss your pumping requirements:

**Call +44 (0) 1905 759090**

**Email sales@calder.co.uk**



## Configurations and Options

Pump packages can be configured to include an electric motor with Variable Speed Drive (VSD) control, capable of providing a variable flowrate from 10% to 100% at the required duty pressure. Alternatively, diesel-driven systems are available with six-speed transmission. Additional configurations such as diesel/electro hydraulic drives are also available.

Calder offer a range of options, e.g. noise hoods which provide noise attenuation and weather protection, local and remote operator controls etc. See page 6 for further examples of the options and configurations available.

## Hazardous Areas and Harsh Environments

Calder equipment is designed and built to operate in some of the harshest environments on the planet. The pump packages typically operate offshore in hazardous area environments, designed to meet the requirements of ATEX Zone 1, Zone 2, NORSOK and other industry standards.

## High Pressure Pumps

At the heart of every Calder Waste Injection and Multi-purpose Pump package is a triplex reciprocating plunger pump. These proven and robust Calder pumps, which conform generally to API674, are selected and configured to suit the customer's exact duty requirements.

The pump fluid ends are manufactured from forged steel, and are designed with easy maintenance in mind, offering fast access to valves, packings and plungers. In addition, the internal suction and discharge valves are designed specifically for aggressive slurry injection processes. These valves have clear flow-ways with specially formulated polyurethane replacement inserts for resistance to acids and abrasives.

## Reliability & Ease of Maintenance

Calder recognise that designing equipment which is reliable and easy to maintain is vital to its customers. To achieve this, Calder works with a range of trusted suppliers to ensure that all components and equipment incorporated within Calder pump packages are highly reliable. Calder's design engineers have extensive experience designing pump packages to be easily maintainable, with the high pressure pump itself designed to provide quick and easy access to the main fluid end components (valves, packings and plungers).



## Spares & On-Site Service Support

Calder is committed to supporting its customers throughout the entire service life of their pump packages. A spare parts function is on hand to assist with the supply of commissioning spares and ongoing operational spares. Our team of experienced commissioning and service engineers are there for all your on-site support requirements.

# The Total Package

## Pump Discharge Manifold

**1 Discharge Manifold Interface:** Various connections available to suit project specifications, such as a 6BX flange (as shown).

**2 Discharge Pulsation Damper:** Sized to reduce pressure pulsation from the reciprocating plunger pump.

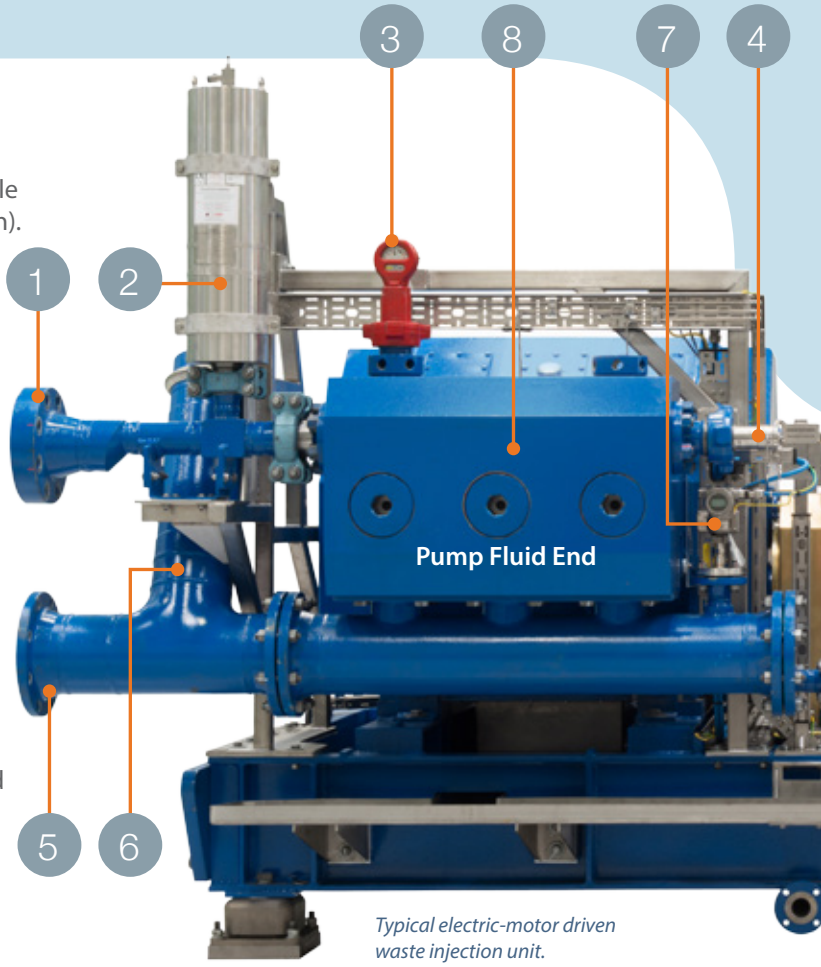
**3 & 4 Discharge Pressure Gauge and Transmitter:** Pressure gauge for local pressure measurement, plus a discharge pressure transmitter to provide high level pressure alarm and shut-down signals.

## Pump Suction Manifold

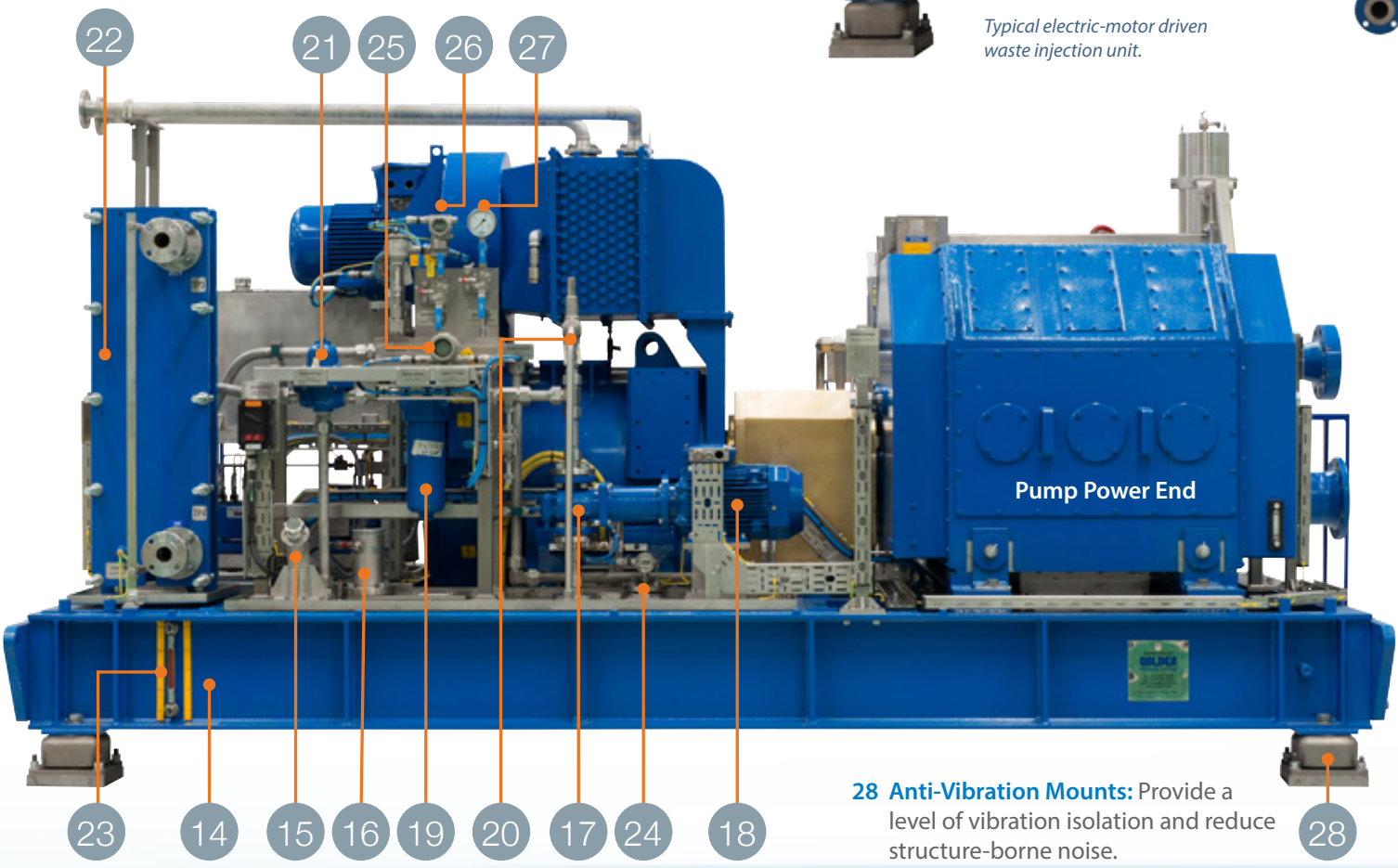
**5 Suction Manifold Interface:** Suction manifold designed to suit the process requirements. Typical suction manifold interfaces include ANSI 150lb RF 6", 8" or 10" flanges.

**6 Suction Pulsation Damper:** Sized to optimise pump suction conditions.

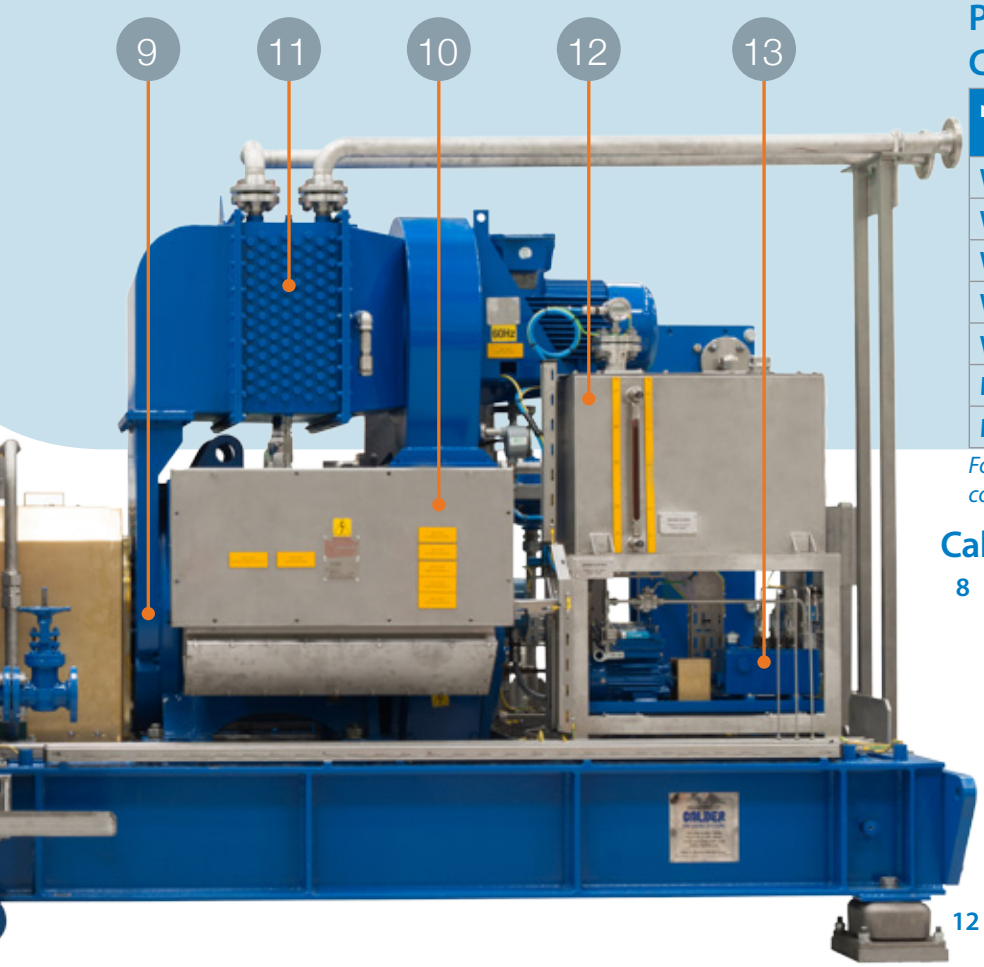
**7 Suction Pressure Transmitter:** Provides low-level alarm and shut-down signals.




*Typical electric-motor driven waste injection unit.*




**28 Anti-Vibration Mounts:** Provide a level of vibration isolation and reduce structure-borne noise.




## Primary Calder Well Service and CRI Pumps

| model | max. flow lpm | max. pressure bar | power kW |
|---|---|---|---|
| WS/CRI 150 | 1,390 | 690 | 140 |
| WS/CRI 250 | 1,390 | 690 | 250 |
| WS/CRI 450 | 2,608 | 1,161 | 450 |
| WS/CRI 750 | 3,668 | 1,147 | 750 |
| WS/CRI 1800 | 5,734 | 1,373 | 1,800 |
| Mud 562 | 2,120 | 345 | 562 |
| Mud 750 | 2,120 | 448 | 750 |

*For performance requirements outside this range please contact us.*

## Calder High Pressure Pump & Motor

**8 High Pressure Pump:** Selected and configured to suit the application, these robust and well-proven reciprocating plunger pumps are perfectly suited for aggressive waste-injection processes.

**9 & 10 Main Pump Motor and Junction Box:** Sized to meet duty requirements.

**11 Motor Cooling System:** Options include air-cooled, or water-cooled systems.

**12 & 13 Packing Oil Lubrication Tank and Motor/ Pump:** The packing sets of the high pressure pump are lubricated by a packing oil system which provides a precise rate of lubrication.

## Power End Lubrication System

**14 & 15 Lube Oil Tank with Filler/Breather Cap:** A lube oil tank is integral to the baseframe, thus saving weight and space, which is filled conveniently via a filler/breather cap located at the skid edge.

**16 Tank Heater:** A thermostatically-controlled lube oil heater element is located within the tank to ensure optimum lube oil temperature and viscosity, particularly in cold ambient temperatures and during start-up operations.

**17 & 18 Pump and Motor:** An intelligent, electrically driven lubrication gear pump provides a constant oil feed to all critical components within the power end of the high pressure pump.

**19 Filter:** The lube oil is filtered to 25 microns to offer maximum protection to the bearing and gear surfaces within the power end of the high pressure pump.

**20 Safety Relief Valve:** The lube oil pipework and components are protected by a safety relief valve which discharges back to the lube oil tank.

**21 Pressure Control Valve:** Lube oil pressure is maintained by a pressure control valve, with spill-back function to the lube oil tank.

**22 Plate Heat Exchanger Oil Cooler:** Lube oil cooling is achieved by a heat exchanger, correctly sized for the duty requirements, cooling medium and ambient conditions. Shell and tube cooling, or blast-air cooling options are available.

## Power End Lubrication System Monitoring and Instrumentation

**23 Tank Level Gauge:** Convenient indication of lube oil level within the tank.

**24 Tank Level Transmitter:** Provides low-level lube oil alarm and shut-down signals.

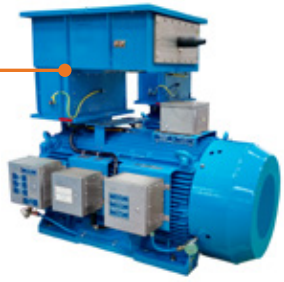
**25 & 26 Oil Temperature and Oil Pressure Transmitters:** Provides low-level lube oil alarm and shut-down signals.

**27 Oil Pressure Gauge:** For local visual measurement of lube oil pressure.

# Package Options

## THE CHOICE IS YOURS

**Calder's design engineers have extensive experience combining a range of equipment options and configurations into their hazardous area pump packages, to suit the customer's exact requirements. Here are just a few examples of the choices on offer.**





### Drive Options, and Motor/Engine Cooling Options

Electric motor with fixed speed, or Variable Speed Drive (VSD) control.

Diesel engine drive, through semi-automatic transmission.

Cooling options include plate heat exchangers, shell and tube heat exchangers, and blast air coolers.





### Control Options

VSD Variable Speed Drive (VSD) control, capable of providing a variable flowrate from 10% to 100% at the required duty pressure. Safe area or Zone I.

On skid control panel to enable basic local control.





### Enclosure Options

Crash frame, offering basic protection and lightweight handling.

Enclosure offering noise attenuation and protection from the environment, with removable panels for ease of maintenance.

DNV-certified containerised packages offering maximum protection and noise attenuation with large doors for maintenance access.

Additional enclosure/container options include:

- *Maintenance crane to lift heavier objects.*
- *Space heaters to maintain optimum operating temperatures within the package.*
- *Fire and gas detection and suppression systems.*

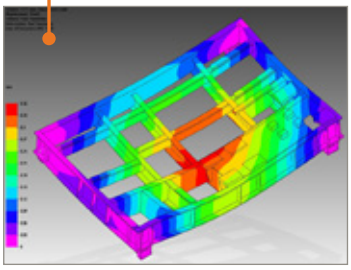


### Analysis and Testing

Calder offers a range of Finite Element Analysis (FEA) techniques to suit project design requirements.

All packages undergo thorough, full performance, Factory Acceptance Testing (FAT) at Calder's state-of-the-art test facility. Additionally, further test procedures can be selected:

- *Load testing of lifting frames.*
- *Load testing of complete pump packages.*
- *Noise and vibration testing.*
- *Control System Interface testing.*
- *Main component witness testing.*





### Preservation

Pump packages can be delivered fully prepared for long-term storage.

All components and pipework can be treated with the appropriate preservation techniques and the pump head can be expertly dissembled and packed for commissioning at a later date.





# Special Applications

## MODULAR TO MOBILE




### Heliportable Units

For a remote location accessible only by helicopter, Calder was tasked with the design and build of two modular pump packages – each section to weigh a maximum of 3,500 kg.




Using creative techniques of design and manufacture, two 18-tonne pump units were built and delivered in a configuration that allows separate helicopter lifts but can be easily and quickly assembled on the remote jobsite ensuring swift deployment.

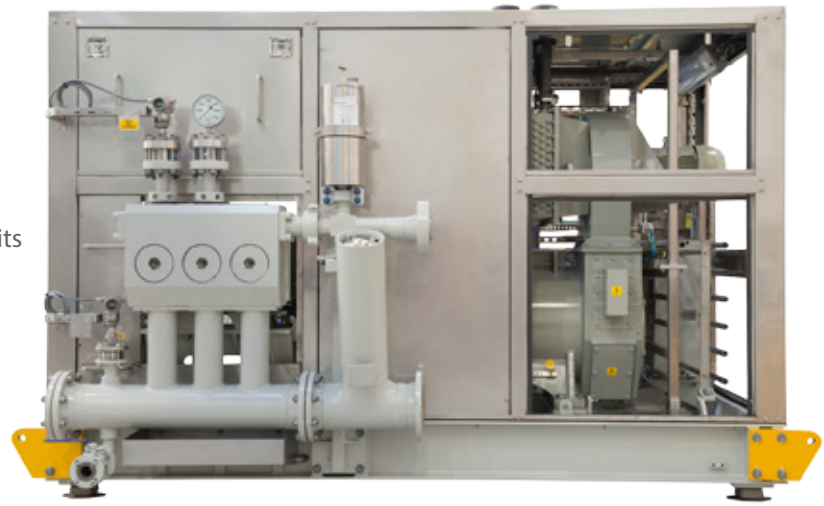
Contact our team to discuss your special application requirements:

**Call +44 (0) 1905 759090**
**Email sales@calder.co.uk**



### Compact Units

With very little offshore platform space available, these units were designed to have a small footprint. To suit site noise restrictions the units have noise hoods which attenuate the noise levels to within 85 dBa, are easily removable and offer excellent protection from the elements. Destined for Newfoundland these units comply with Canadian CSA regulations for electrical equipment





### Mobile Unit

This versatile, road-going trailer-mounted waste injection package was designed to allow the operator to easily move the unit to various land-based operations.

The compact design and two-storey configuration, allow the control station, mixing tank, and storage for suction and delivery hoses to be part of the trailer unit thus allowing the unit to be self-contained.

# | Standards & Specifications:

Calder pump packages can comply with most international standards and specifications including:
**ATEX | IEC | GOST | EN | DNV | API | ANSI | PED | AS/NZ | NORSOK | NACE | CE | PED**

| **ISO 9001** Quality standard has been practised by Calder since 1987 with award of certification in 1999. Our rigorous application of this highly respected International Quality Standard has ensured that we consistently meet and exceed our customers' most demanding expectations for both quality and reliability.

| **ISO 14001** Environmental Standard has been held by Calder since 1999. Careful and judicious management of our working environment with the application of sound and well informed design applications utilising the latest and most efficient technologies helps us to produce equipment which minimises the environmental footprint of our production facility and the operating equipment in the field.

| **OHSAS 18001** We at Calder pride ourselves on our safety record. As members of the British Safety Council we practise the strictest safety procedures within our factory and working environments, applying rigorous risk assessments to all activities and equipment which we design and build.

Calder Ltd reserve the right to alter specifications and data to incorporate improvements in design.



Ideally situated for both Heathrow and Birmingham international airports, Calder's Worcester premises are a modern facility where our equipment is designed, built and tested by our skilled workforce.


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