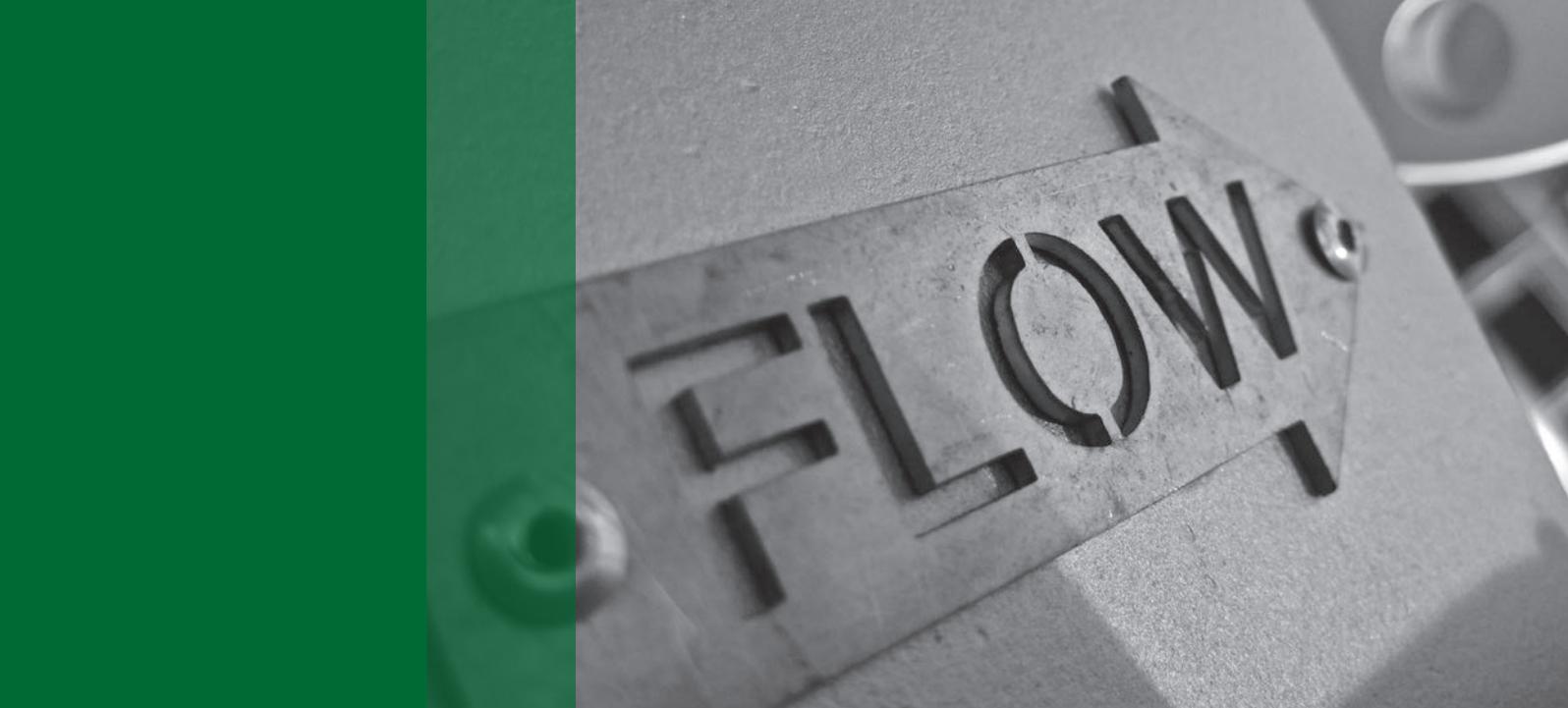


Produced Water & Sand Management





How Ejectors Work

Sand Slurry Ejectors (also referred to as Jet Pumps or Eductors) provide a simple, robust and reliable method of pumping and pressure boosting sand slurry entrained from Separators. With no moving parts and no maintenance they are increasingly being used instead of mechanical pumps.

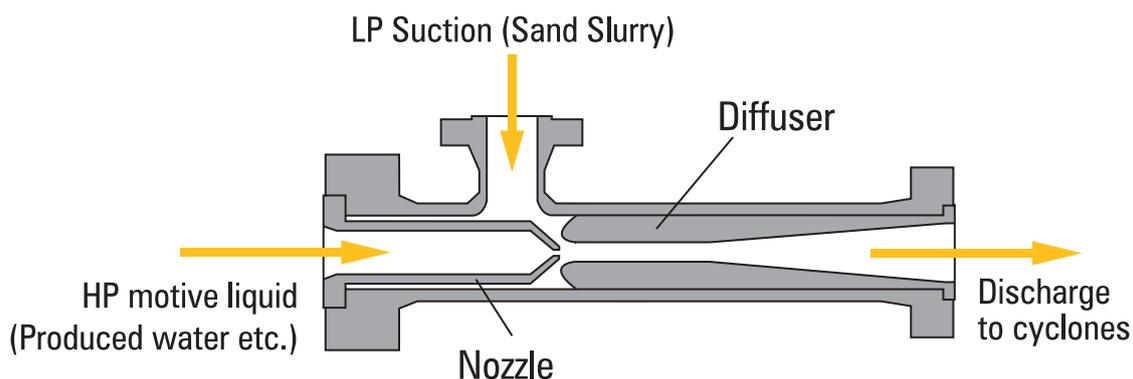
In operation Sand Slurry Ejectors utilise the energy available from high pressure motive liquid (such as produced water) to entrain sand slurry from a Separator and then pump and pressure boost the resulting mixture to a cyclone separator or scrubbing system.

Vigorous mixing as the two streams contact within the Ejector makes them an important part of a sand washing / scrubbing system.

They are also being used to dilute sand slurry to improve slurry transportation and as flushing devices.

Transvac has the in-house facilities to performance tests Sand Slurry Ejectors to ensure they meet the required design and off-design operating requirements.

Transvac has supplied literally hundreds of Sand Slurry Ejectors over many years, working with different types of Separator sand fluidising systems. Each Ejector includes a ceramic nozzle and Diffuser (throat) insert to resist abrasion.





Why choose Ejectors?

- ▶ Environmentally friendly - zero emissions
- ▶ No maintenance
- ▶ No moving parts
- ▶ Proven reliability
- ▶ Easy to install
- ▶ Simple to control
- ▶ Controlled by standard techniques
- ▶ Low cost & weight
- ▶ Robust construction
- ▶ ATEX not applicable
- ▶ Can be installed in tight spaces
- ▶ Handles sand without damage
- ▶ Top-side, sub-sea, FPSO or onshore installation
- ▶ Can be performance tested prior to despatch

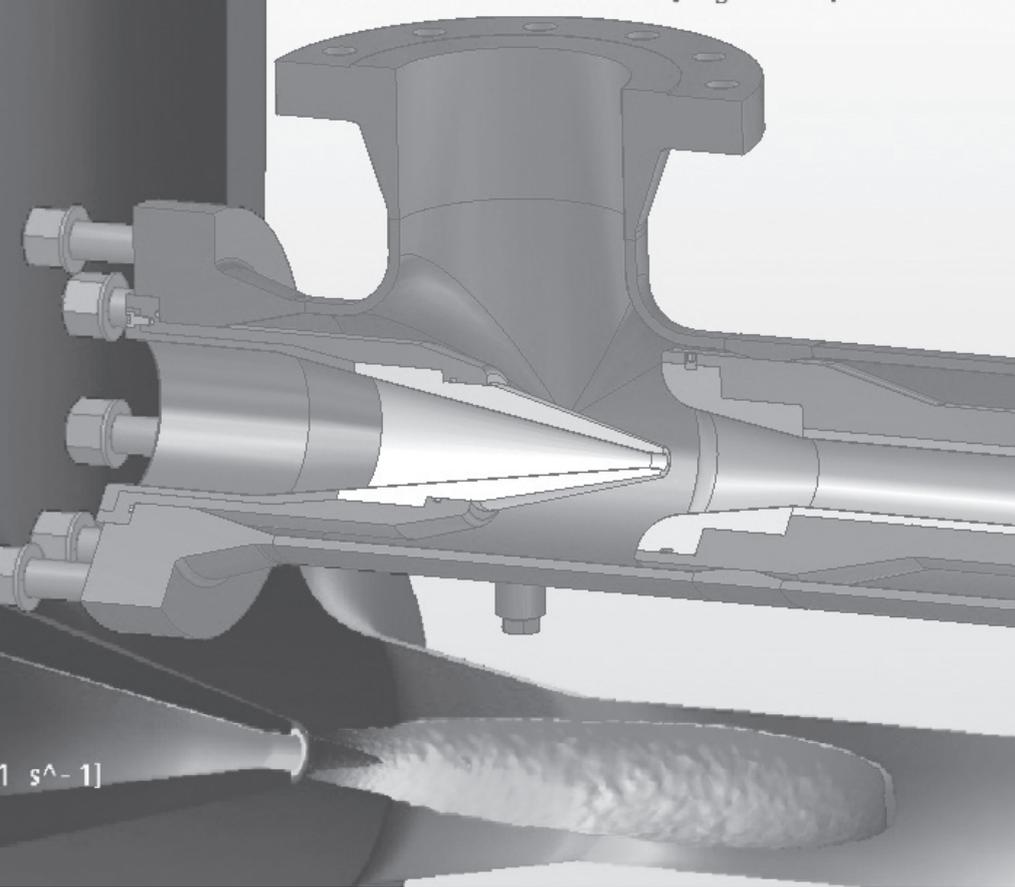


“ when it comes to moving sand around, ejectors offer unrivalled reliability.

- David Hoon, Technical Director

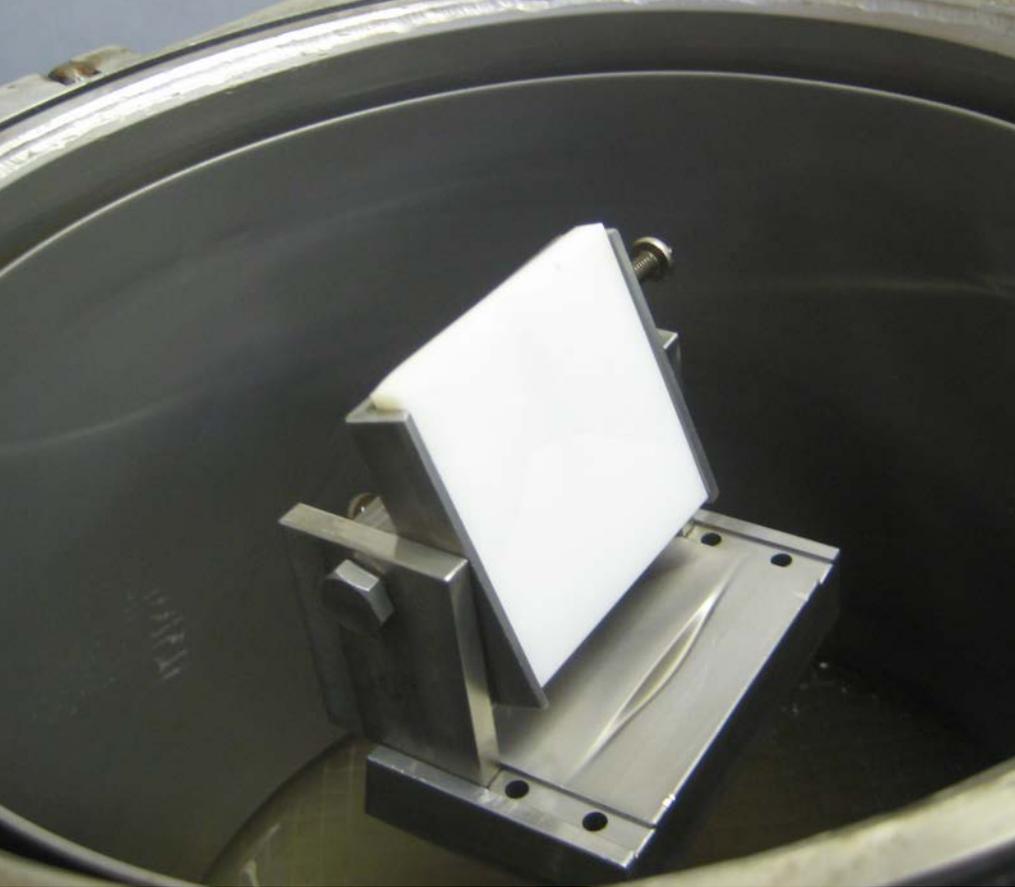


Super Duplex Sand Slurry Ejector
for Statoil, Norway



Produced water & sand management solutions

- ▶ Pressure boosting after hydro-cyclones
- ▶ Pumping slurry as part of a solids handling / separation system
- ▶ Flow boosting for separator flushing applications
- ▶ Desanding for gas flotation unit
- ▶ Desanding for produced water desanders
- ▶ Sand cleaning / scrubbing
- ▶ Flushing slurry lines following sand removal



Abrasion Resistance

Where sand is present in the process, special consideration needs to be given to material choice. All of Transvac's sand handling Ejectors are supplied with special-grade ceramic internal parts (nozzle and diffuser section) to resist abrasion.

As a result, Transvac has never been required to supply replacement parts due to wear from sand or solids.



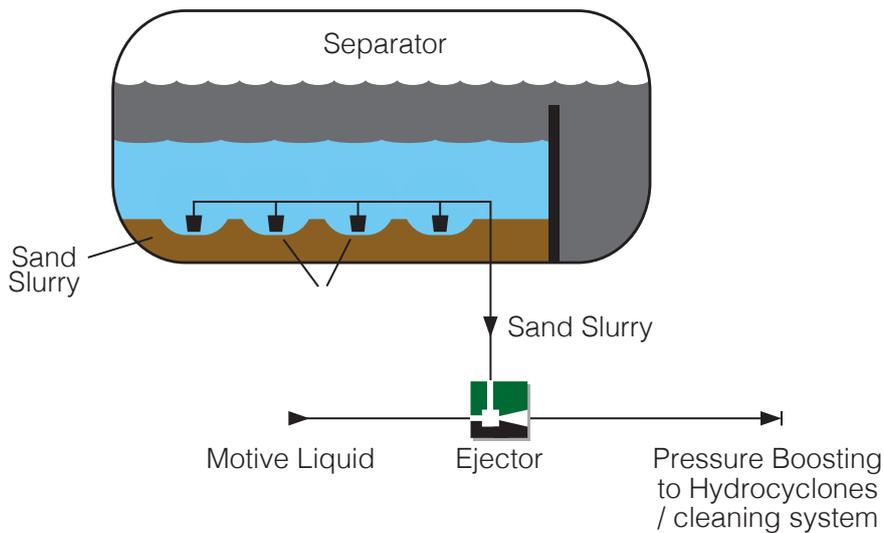
Sand Slurry Ejector complete with ceramic Nozzle and Diffuser



Slurry pumping from separators

Transvac Sand Slurry Ejectors are an ideal method of transporting sand slurries from Separators or Cyclones as part of a de-sanding / sand washing system.

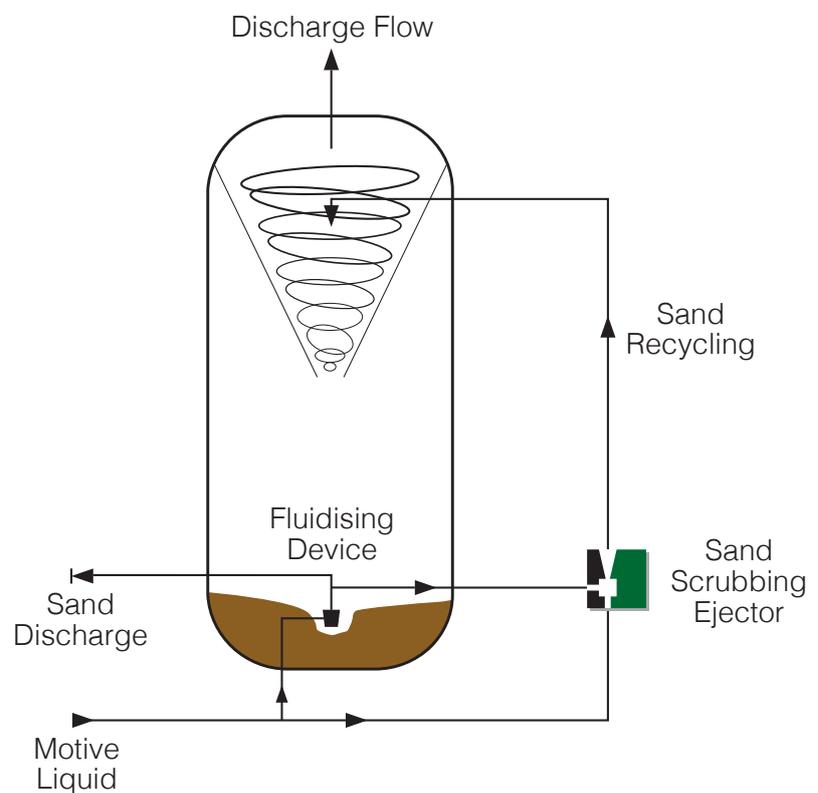
Accumulated sand is normally fluidised to ensure it will flow, prior to entering the suction port of the Ejector. The motive fluid can be Produced Water or pressurised water sources.





Sand Cleaning & Water Recycle

Ejectors provide high-shear pumping, which can be used effectively in the sand cleaning process. Any oil which remains attached to the sand is successfully separated from it as it passes through the high-velocity section of the ejector. This is then pumped into the separator / cleaning vessel for continued processing.

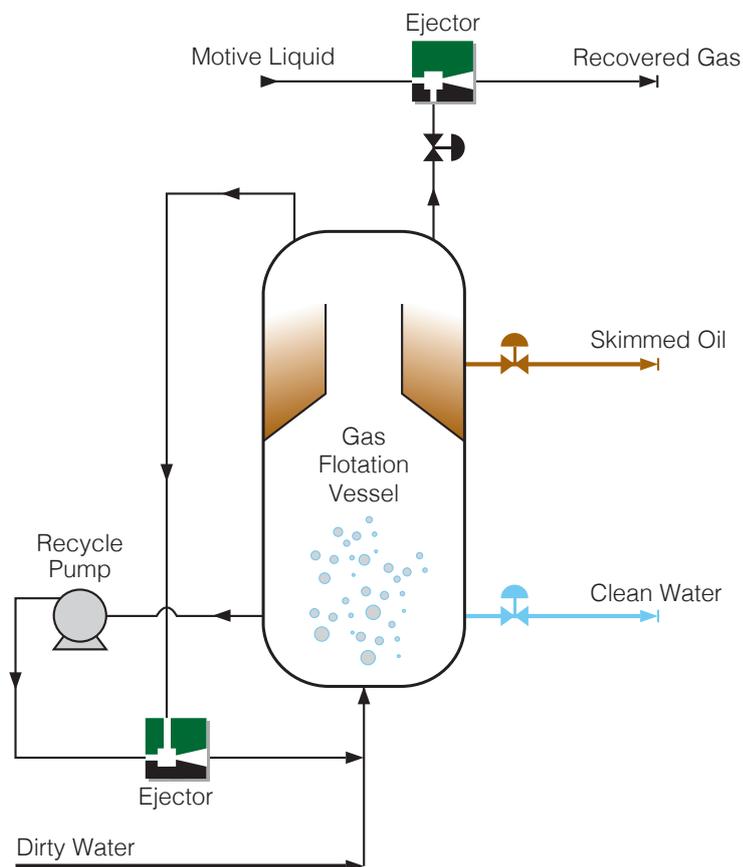




Micro-bubble generation & gas recovery

Ejectors can be used to perform a number of duties in the oil flotation process. Transvac has developed a special 'micro-bubble generating' ejector device capable of producing ultra-fine bubbles. With a huge surface area created, a more efficient flotation process is observed.

Where excess gas needs to be recovered from the flotation vessel, a second ejector is available to compress and recover this gas. To maintain gas efficiency, minimal 'new' gas is introduced to the process with this recycle method.



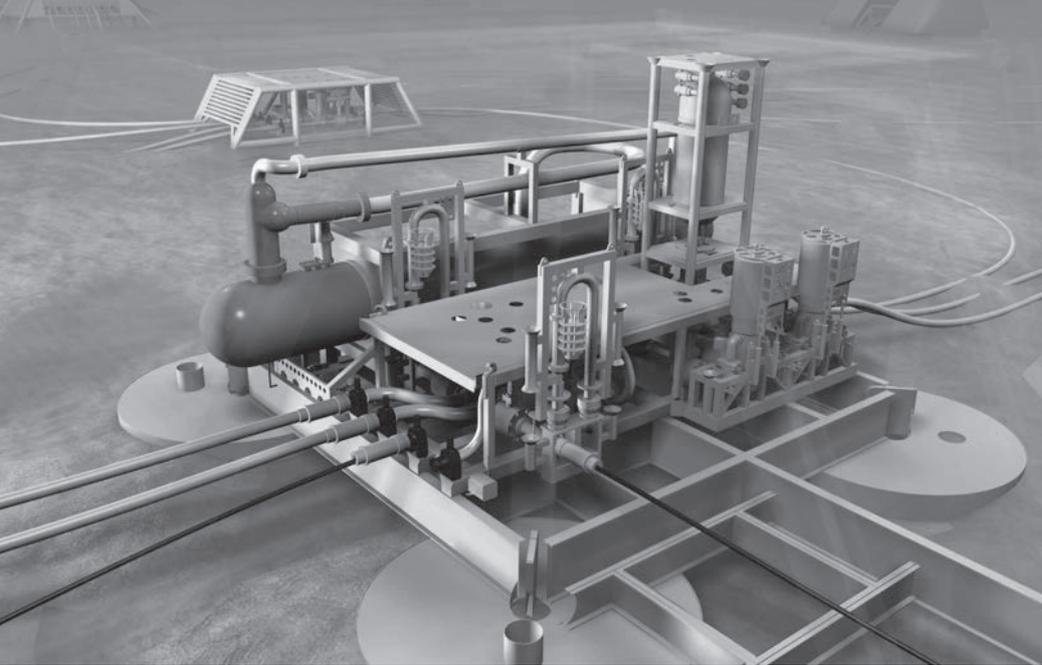


topside

“ as the industry pushes for more processing to be done subsea, many technologies fall by the wayside. With no moving parts or power requirements, ejectors are ideally suited to this challenging environment.

- Philip Ainge, Technical Sales Director

subsea



Subsea Processing

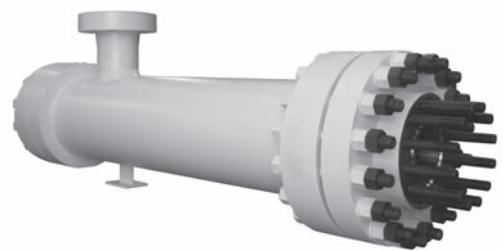
With no moving parts and no maintenance Transvac's Ejector technology is an ideal solution for subsea processing. To ensure trouble-free operation, all Transvac subsea Ejectors are designed, manufactured and tested in-house.

Operating rotating mechanical equipment subsea requires huge amounts of energy, often megawatts of power. Ejector technology can operate using existing energy and therefore operating costs can be negligible. Rotating mechanical equipment also requires special designs for performing subsea. Ejector designs change very little whether subsea or topside.

In some applications, Ejector flows can be simply calculated using pressure drop data across the Ejector, thereby negating the need for flow metering instrumentation.

Materials of construction and mechanical design meet project specific subsea piping standards and are fully qualified. Transvac also provides ceramic nozzle and diffuser components for abrasive applications which have been proven over many years on topside applications.

Transvac supplied the world's first subsea processing Ejector on the TORDIS project for Statoil.



*Subsea Ejector for Petrobras - Marlim Field
Mechanical Design: 345 bar(g)*



*Subsea Ejector for Statoil - Tordis Project
Mechanical Design: 200 bar(g)*



“ we are focused on
turning innovative designs
into proven solutions.

- Gary Short, R&D Director



R&D Test Facility

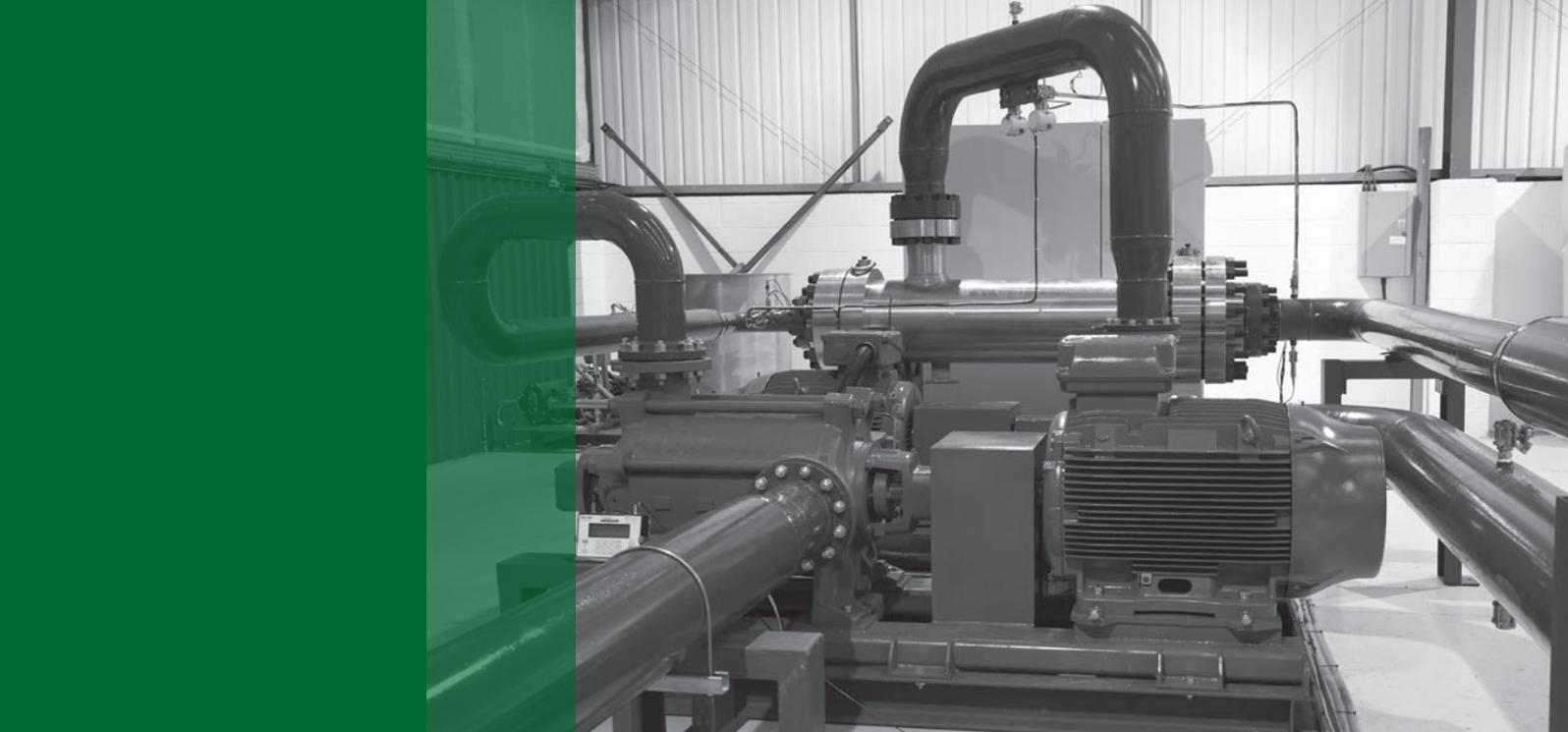
Transvac officially opened its R&D Test facility in April 2010. The state-of-the-art test facility primarily develops new oil & gas Ejector technology for subsea processing, flare gas recovery, sand slurry pumping and production boosting.

Ejector applications for the nuclear, bio-fuel, chemical and wastewater industries are also under development.

The R&D test facility includes high and low pressure equipment for handling water, oil, gas, multi-phase and slurry. Test programmes are supported by CFD studies and include fundamental University research.

The Transvac facilities include liquid flow lines for high, medium & low pressure testing (in excess of 250 bar(g)) and solids handling systems.

Transvac performs functional validation tests for Ejectors used in the oil & gas, nuclear and process industries.



Test Facilities

- ▶ 9 x flow loops
- ▶ 9 x VSD water pumps
- ▶ Pump pressure up to 300 bar
- ▶ Liquid flows up to 700 m³/h
- ▶ Sand slurry flows up to 60 m³/h [up to 60% SVF]
- ▶ Nitrogen 100 bar(g) @ 200 kg/h
- ▶ Air 12.5 bar(g) @ 70 Am³/h
- ▶ 400 kVA stand alone generator
- ▶ 150 kVA mains supply
- ▶ 2 x 9 m³ clean water tanks
- ▶ 1 x 35 m³ slurry / water tank
- ▶ 1 x 6 m³ calibrated weigh tank
- ▶ 7 x Coriolis meters (liquid / gas)
- ▶ 1 x 16 m³ 27.5 bar(g) pressure vessel for closed loop multi-phase testing
- ▶ High pressure in-line solids / phase separator [150 bar(g) and 100 m³/h]
- ▶ Fully automatic control and data acquisition system using ASi field bus system (LabView)
- ▶ Flow assurance : flow accuracy 0.1 - <1.0 % FS / Pressure Accuracy 0.1% or better



About Us

Transvac Systems Limited is a privately owned Ejector Solutions provider formed in 1973.

As both a designer and a manufacturer of Ejectors, Transvac has full in-house control over process and mechanical design, supply of raw materials, manufacturing, scheduling and testing. With all of our procedures certified to BS EN ISO 9001:2015 the quality of the final product is assured.

Transvac is accredited to Module H of the Pressure Equipment Directive (PED) and our products are CE marked where appropriate. We are also 1st Point Assessment (FPAL) and Achilles registered.

All products are custom designed to suit the process and mechanical requirements of each application to ensure maximum operating efficiency. Transvac offers standard and exotic materials of construction including Hastelloy, Duplex, Super Duplex, Titanium etc.





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