

EJECTOR SOLUTIONS

for the

OIL & GAS INDUSTRY

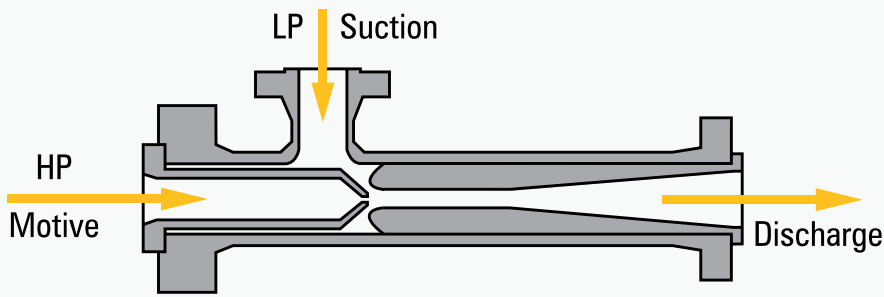
Flare Gas Recovery

Production Boosting

Subsea Processing

Sand Slurry Pumping

How an Ejector works



“Ejectors use high pressure (HP) fluid to compress low pressure (LP) fluid to an intermediate level”

Patented Design

Transvac's patented 'Universal Design' allows for a new Nozzle and Diffuser to be fitted into the existing shell to match the new operating conditions (as the Well depletes over time) and so maintains production at optimum levels with the minimum downtime and cost.

Why use Ejectors?

- ✓ Environmentally friendly - zero emissions
- ✓ No maintenance
- ✓ No moving parts
- ✓ Proven reliability
- ✓ Easy to install
- ✓ Simple to control
- ✓ Performance easily modified to suit depleting Well conditions
- ✓ Operating conditions controlled by standard techniques
- ✓ Low cost & weight
- ✓ Short pay-back
- ✓ Low noise levels
- ✓ Safe to operate
- ✓ Can be installed in tight spaces
- ✓ Handles solids, two phase flow and liquid slugs without damage
- ✓ Project cost significantly less than mechanical pumps / compressors
- ✓ Top-side, sub-sea, FPSO or onshore installation

Free to operate!

The simple principle behind Ejector technology makes it an ideal solution for Oil & Gas applications. Existing energy sources are widely available to 'motivate' Transvac Ejectors.

This generates significant cost and environmental benefits, as no 'new energy' is required to run an Ejector. In many cases it eliminates the need for expensive, troublesome, and environmentally damaging mechanical Pumps / Compressors.

Typical 'motive' HP fluids:

- HP Wells
- Gas Compression & Recycle
- Export Oil or Gas
- Fuel Gas
- Injection Water
- Gas or Liquid from 1st or 2nd stage Separator
- Injection or Lift Gas

Flare Gas Recovery

Recover Flare Gas to Production

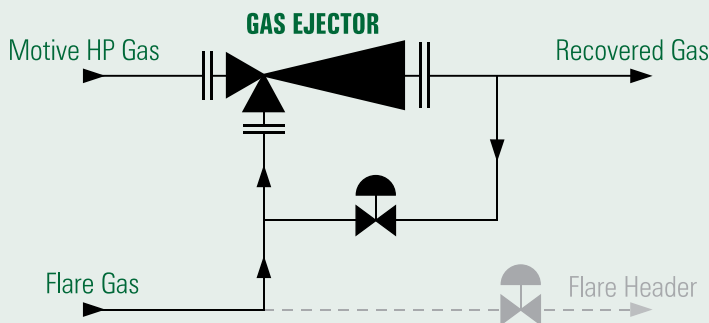
Traditionally in the Oil & Gas industry, waste and surplus gas has been disposed of by flaring to atmosphere. Today this process is becoming increasingly unacceptable as the industry progresses towards eliminating the emission of greenhouse gases into the atmosphere whilst simultaneously conserving energy.

Therefore, the demand for equipment that can safely and economically compress waste and surplus gas back into the production process is rapidly increasing.

Transvac Ejectors are ideally suited to this application because they employ high-pressure gas or liquid energy to entrain and compress waste and surplus gas to a pressure where the gas can be recovered into production or used as fuel gas.



Flare Gas Ejector for Cairn, India



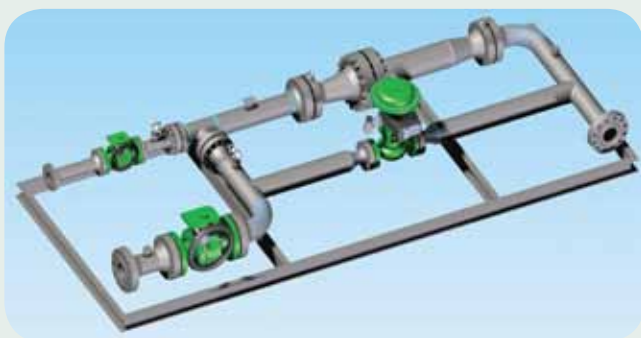
“...the flaring stopped, we recovered gas back into production and it costs nothing to run... why isn't everyone doing this?”



Flare Gas Ejector, complete with Motive Gas control system for Conoco-Phillips, Indonesia



Flare Gas Ejector for BP, Norway



Skid Mounted Flare Gas Ejector Systems for Chevron Angola

Control of Flare Gas Ejectors

It is not uncommon for the flowrate of flare gas to vary and; if not controlled, the suction pressure created by the Gas Ejector will also vary.

In order to maintain the desired flare gas operating pressure, a number of standard control techniques are available. These include:-

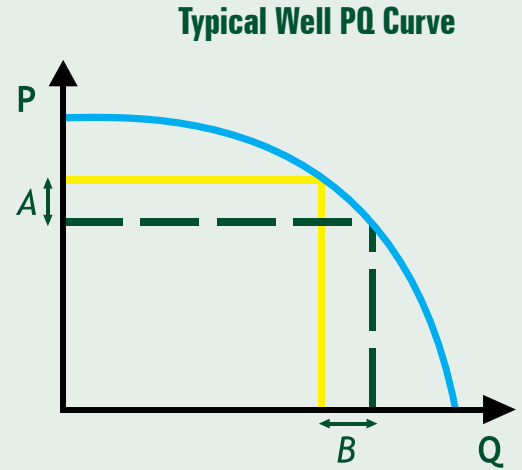
- Recycling of gas from the discharge side of the Gas Ejector back into the suction (low pressure) side
- Incorporation of an integral HP gas regulating assembly which varies the motive fluid consumed.

Production Boosting

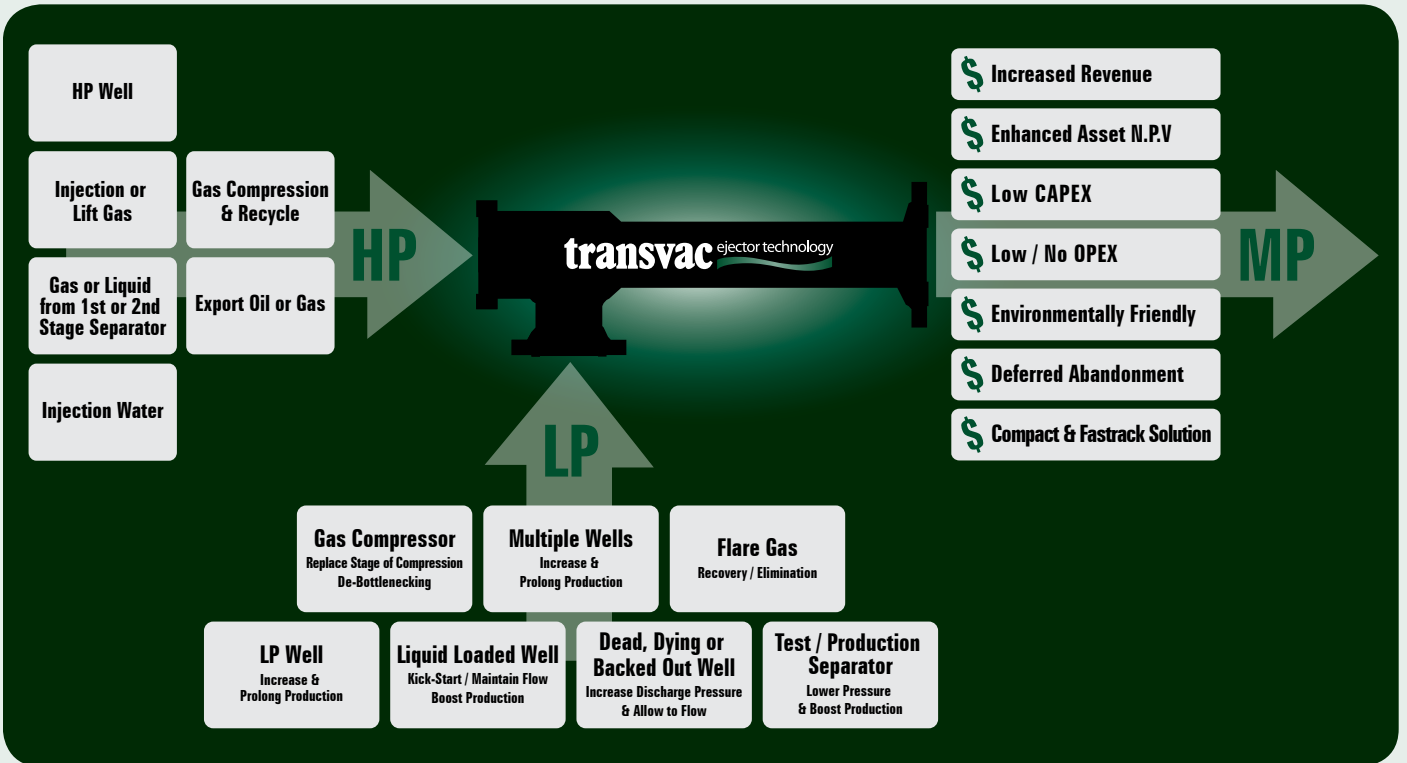
The diagram shows the P-Q curve from a typical LP Well. The yellow line represents the operating conditions before the fitting of an Ejector (also called Jet Pump). Using energy from a suitable high pressure source (a choked HP Well for example) an Ejector can be used to lower the FTHP of the LP Well.

If the pressure reduction achieved by the Ejector at the Well head is 'A' on the diagram, then the increased production from the LP Well will be represented by 'B'.

In the case of nearly and fully shut-in Wells, the increase in production rates can be significant since the P-Q curves are at their flattest in this region. (Small drop in pressure causes large increase in production). In many cases 'dead' or shut-in Wells can be restarted by lowering the Well Head pressure.



Production Boosting Options

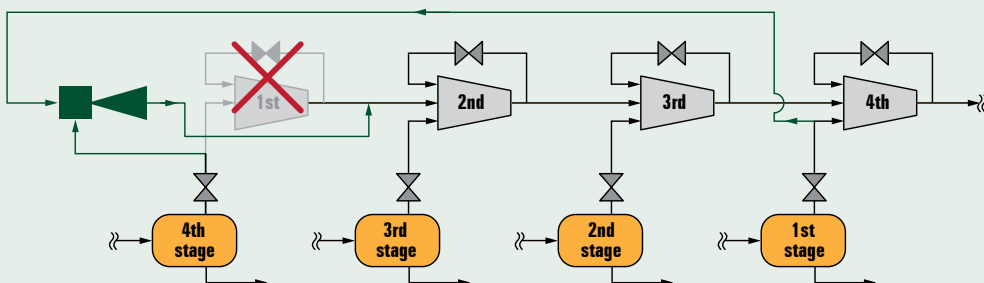


Compressor Replacement

Transvac Gas Ejectors can be used to replace existing mechanical Compressors. With no maintenance and utilising available energy, Ejector technology can be justified on lower CAPEX and OPEX.



Gas Ejector used to replace Mechanical Compressor



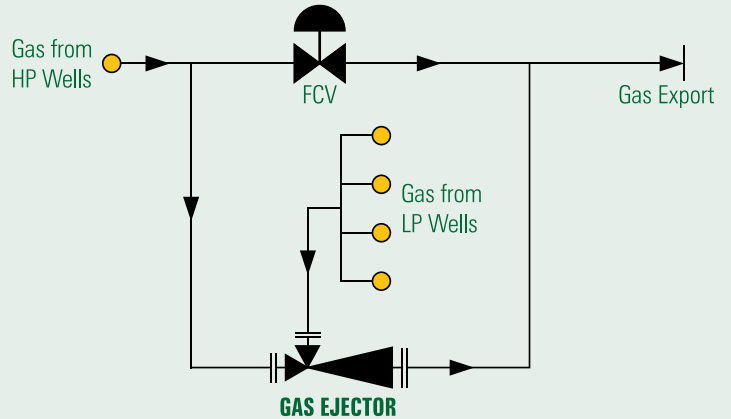
Production Boosting

Production Boosting using Gas from HP Wells

If a suitable HP Well is available nearby, the pressure energy that is normally wasted across a choke can be used to drive an Ejector.



This 630 Barg rated Production Boosting Ejector recovered £127,000 per day of extra gas from a Well that had been shut in for 2 years



“ The Gas Ejector gave us about a 15% increase in gas production, plus we didn't need to install the extra compressor - wow! ”



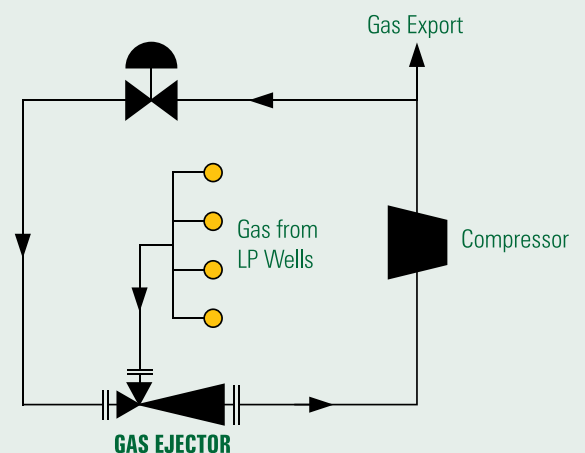
Installation of Production Boosting Ejector for Shell, Southern North Sea



Transvac Patented Ejector boosted production by 15% using Compressor recycle gas

Production Boosting using Compressor Recycle Gas

Many existing Compressors are being maintained within their operating envelope by employing a constant recycle. Transvac Gas Ejector technology can utilise motive gas energy normally wasted across the Compressor recycle valve to lower the FTHP of LP Wells and thereby boost production.



“ The Ejector is showing excellent performance to date, generating up to 34.2 mscfd of 'extra gas' from shut in wells. The Ejector will pay for itself in less than a month! We were all surprised to see production kicking in so easily ”

Subsea Processing

Beneath the Surface

With no moving parts and no maintenance Transvac's Ejector technology is an ideal solution for subsea processing. Transvac subsea Ejectors are designed, manufactured, tested and performance mapped in-house.



Super Duplex Sand Slurry Ejector for Statoil (TORDIS), Norway

Mechanical equipment installed subsea requires huge amounts of energy, often megawatts of power. Also special mechanical equipment designs are required subsea, whereas Ejector designs change very little whether installed subsea or topside.

Ejector technology will provide reliable performance at a fraction of the capital and operating costs of alternative rotating mechanical equipment. In many cases an Ejector can eliminate the need for rotating mechanical equipment if sufficient fluid energy is available from the Wells.

Transvac offers proven wear resistant components for abrasive subsea applications.

Subsea Ejector Applications:

- Pumping slurry as part of a solids handling / separation system
- Flow boosting for separator flushing applications
- Gas compression for production boosting
- Well unloading
- Micro-bubble generation for separation systems
- Recovery of LP Gas
- Entrainment of multi phase liquids



TORDIS - The world's first full field subsea separations system

Sand Slurry Pumping



Sand Slurry Ejector complete with ceramic Nozzle and Diffuser

Transvac Sand Slurry Ejectors (also called Liquid Jet Pumps) 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 Eductor. The motive fluid can be Produced Water or sea water.

Transvac Sand Slurry Ejectors are manufactured as standard with ceramic components to resist abrasion.



Super Duplex Sand Slurry Ejector for Statoil, Norway



Duplex Sand Slurry Ejector for Conoco-Phillips, Indonesia

Our Experience

transvac
the world's leading
supplier of innovative,
custom designed,
ejector based solutions

Transvac has over 40 years experience supplying Ejector solutions. This knowledge and experience is invaluable because it enables Transvac to produce Ejectors using the very latest Ejector design and construction techniques.

As a fully integrated modern in-house Ejector manufacturer, Transvac maintains full control over process and mechanical design, supply of raw materials, manufacturing, scheduling and testing.

Each Ejector is custom designed specifically to suit each customers individual process requirements to ensure maximum operating efficiency. Transvac can also undertake a design study to assess the viability of using an Ejector for a specific application.

Mechanical Design Standards

Transvac Ejectors are designed and manufactured in accordance with recognised national and international design codes such as ASME VIII Div.1, PD5500, ASME B31.3, RTOD etc. supported by in-house FE analysis and full non-destructive testing.

Transvac has dedicated facilities to work with Duplex, Super Duplex, Stainless Steel and Carbon Steel to NORSOK and NACE standards.

Quality

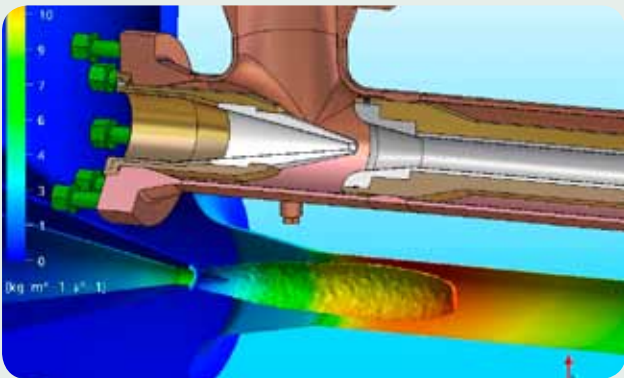
All Transvac's design and manufacturing processes are quality assured and certified to BS EN 9001 and module H of the PED (Pressure Equipment Directive - EU Standard). Transvac is also registered with Achilles and FPAL

R&D Facility

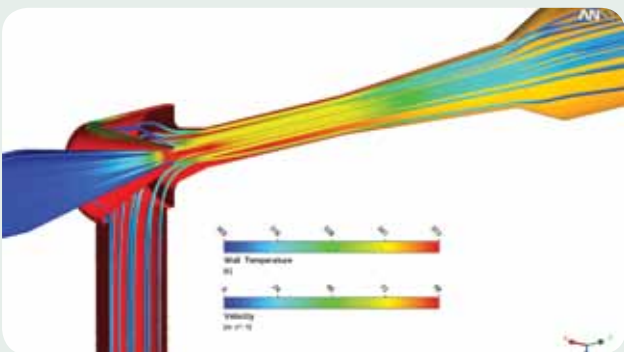
Transvac's new R&D test facility includes high and low pressure equipment for handling water, oil, gas, multi-phase and slurry. Test programmes are supported by CFD studies and fundamental University research.

Test facilities include liquid flow lines for high (in excess of 100 barg), medium & low pressure testing, as well as solids handling systems.

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



Sand Slurry Subsea Ejector CFD Modelling



CFD Ejector Modeling



Transvac's new Research & Development Facility

Flare Gas Recovery

Production Boosting

Subsea Processing

Sand Slurry Pumping

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