The Application of Ejector Technology to Subsea Fields of the Future

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What are Ejectors?

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An Ejector is a simple device which uses the energy within a high pressure fluid to entrain and compress a low pressure fluid to an intermediate pressure.
What are Ejectors?

Ejectors are also known as Eductors or Jet Pumps.
Why choose Ejectors?

- No moving parts
- No maintenance
- Requires no electrical power
Why choose Ejectors?

- No moving parts
- No maintenance
- Requires no electrical power
- Often no operating costs
- Proven in service
- Simple construction
- Compact size / small footprint
Why choose Ejectors?

- Zero emissions
- Environmentally friendly
- Resistant to erosion
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- Resistant to erosion
- Handles liquid and gas slugs without damage
- Simple to start-up, operate & shut down
- Suitable for use with gasses and liquid
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... ideal features for use subsea!
Possible Sources of HP Energy

- HP gas well
- Compressor gas, recycled / discharged
- HP production separator gas
- Lift / Injection gas
Possible Sources of HP Energy

HP Gas
- HP gas well
- Compressor gas, recycled / discharged
- HP production separator gas
- Lift / Injection gas

HP Liquid
- HP oil well
- Injection water
- HP production separator liquid
- Pumped liquids, oil, water or mixture
Potential Subsea Applications

- Production Boosting
- Subsea Processing
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- Production Boosting
- Subsea Processing
Example - Production Boosting

Duplex - Holland (10,000lb rated)
Example - Production Boosting

This Ejector increased production by 31.6mm scfd, by bringing two shut-in wells back into production.
Example - Production Boosting

The Ejector lowers pressures at the well head to:

- Boost production
- Reduce condensate loading
- Prevent wells becoming shut-in
- Extend field life
- Maximise recovery
Example - Production Boosting

Duplex - Holland (10,000lb rated)

Subsea field of the future!
Example - Production Boosting

Subsea field of the future!
Example - Production Boosting
This Ejector boosted production by \(~15\%\)
using wasted energy across the anti-surge valve
and eliminated the need for 2\textsuperscript{nd} stage compression.
Example - Production Boosting

- Lowered arrival pressure at the platform by 200 psi, enabling loaded wells to produce consistently.

- Higher gas velocities swept most of the liquids accumulated in the pipeline, causing a further 140 psi pressure drop at the wellhead.
Example - Production Boosting

- Production increased by 24%, due to wellhead pressure reduction and lower pipeline loss.
- 2.5 Bscf of otherwise lost reserves recovered.
- Flow delivered at higher compressor suction pressure increased compressor throughput.

Subsea field of today!
Example - Gas Lift Boosting

- Lower well back-pressure
- Increase production
- Deliver to export pressure
- Less lift gas required
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Subsea field of the future!
Potential Subsea Applications

- Production Boosting
- Subsea Processing
Potential Subsea Applications

- Production Boosting
- Subsea Processing
Subsea Processing with Ejectors

- Hydrocyclone pressure boosting
- Separator flushing
- Sand slurry pumping
- Sand cleaning

TORDIS - The World’s First Full-Field Separation System, Offshore Norway
Subsea Processing with Ejectors

- Hydrocyclone pressure boosting
- Separator flushing
- Sand slurry pumping
- Sand cleaning
- Multi-phase fluid pumping
- Micro-bubble generation for conditioning process water
- Flow Restrictor / Pressure let-down

TORDIS - The World’s First Full-Field Separation System, Offshore Norway
Sand Slurry Pumping

Separator

Sand Slurry

Fluidising Jets

Sand Slurry

Motive Liquid

Ejector

Pressure Boosting to Hydrocyclones / cleaning system
Subsea Processing - Marlim

Transvac Ejector
Subsea Processing - Marlim Ejector 1

Patented Multi-Nozzle Subsea Ejector supplied for boosting flow as part of the separator flushing operation.
Subsea Ejector supplied for boosting the pressure lost over hydrocyclones.
Subsea Processing - Marlim Flow Restrictor

Flow restrictors supplied for destroying excess pressure in the reject line of the multi-phase desander module.
Transvac carried out full performance mapping/validation for each of the Ejectors and flow restrictors supplied for the Marlim Project at our R&D facility.
Transvac R&D Test Facility

- 8 Liquid flow loops
- Pressures up to 250 bar
- Flows up to 700m³/h
- Sand slurry test rig
- Multi-phase flow loop
...for your fields of the future, consider Ejectors.
Who we are...

- Based in the United Kingdom
- Privately owned company
- Over 40 years experience
- Custom designed products, across many industries
- Transvac’s own patented designs
- In-house control over design, manufacture & non destructive testing
- R&D Test Facility
Thank you.

Please visit us on stand B43 in the exhibition hall.
Current R&D Projects

- Micro-bubble generating device
- High pressure liquid Ejectors compressing gas
- Gas motivated Ejectors entraining liquids
Subsea Ejectors for Multi-Phase Handling

Transvac has performance tested Ejectors for multi-phase applications for subsea processing.

Ejector technology is now proven to be a reliable and robust alternative to mechanical multi-phase pumps.
Universal Design

Removable Nozzle

Removable Diffuser / Throat

Ejector & Silencers
QUALITY ASSURANCE

- Transvac has a good reputation as a supplier of high quality custom design products
- Accredited to BS EN ISO 9001 : 2008
- Qualified on both FPAL No. 44491 & Achilles No. 25938
- Accredited to Module H of the Pressure Equipment Directive
- Promatomnadzor Permission of Belarus - Mozry Refinery
MECHANICAL DESIGN

- Design codes: PD5500, ASME VIII, ASME B31.3, RTOD and other standards
- Client Specs: NORSOK / Shell DEP
- Others: NACE (materials)
- In-house FEA capability
R&D Test Facility

CFD Ejector Modelling

High pressure performance mapping with gas injection

Sand Slurry Ejector CFD Modelling
Why choose Ejectors? What is the alternative?

- Special designs & construction
- Maintenance issues
- Heavy construction
- Huge energy costs
- High capex cost
- Large footprint
Transvac R&D Test Facility
Example - Production Boosting

Subsea field of the future!