PRODUCT SERIES 75

kentintrol

SUBSEA CHOKES AND CONTROL VALVES FOR WELL CONTROL AND SEAFLOOR PROCESSING APPLICATIONS



KOSO

KOSO KENT INTROL PROVIDES SUBSEA CHOKE AND CONTROL VALVE PACKAGES TO CUSTOMERS AROUND THE WORLD

Our Subsea service includes project engineering, management, life of field support and tooling packages.

Since 1985, Koso Kent Introl (KKI) has supplied almost 800 subsea valves to the industry from its UK facility in Brighouse, Yorkshire. As well as subsea choke and control valves for standard applications, our dedicated engineering team produces solutions for bespoke Subsea project applications.

The product range brings together high technology proprietary equipment from reputable suppliers with over 30 years' experience in the subsea industry. Recent qualification programmes have been executed to ensure the subsea product range meets with current international standards, specifications and legislation.

All programmes have been fully surveyed by Lloyds Register EMEA.

A HISTORY OF THE COMPANY

Introl – 1967 the company was founded

Kent Introl – 1971 joined the George Kent Group

Kent Process Control – 1974 the Kent Group was acquired by Brown Boveri of Switzerland

ABB Control Valves – 1985 transferred into ABB

Koso Kent Introl – 2005 acquired by the Koso Group

KOSO KENT INTROL SUBSEA CENTRE OF EXCELLENCE – BRIGHOUSE







QUALITY MANUFACTURING
Maintaining the highest standards of quality in design, production and customer service are fundamental aspects of the Koso Kent Introl philosophy.

Our facility is accredited in accordance with Quality Management System ISO 9001, Environmental Management System ISO 14001 and Oil and Gas System ISO 29001. In addition all products, where applicable, conform to ATEX, PED and all other applicable EU Directives and are CE marked accordingly.

The company's standard manufacturing experience includes NACE MR01.75, NORSOK, ISO-13628 and API specifications as well as individual customer specifications. Our in-house inspection and testing facilities include hardness testing, NDE, PMI, gas and flow testing.

Safety is paramount in everything we do, with all employees undergoing regular general and specific Health & Safety training.

FPAL empowered by Achilles

SUBSEA PRODUCT PORTFOLIO



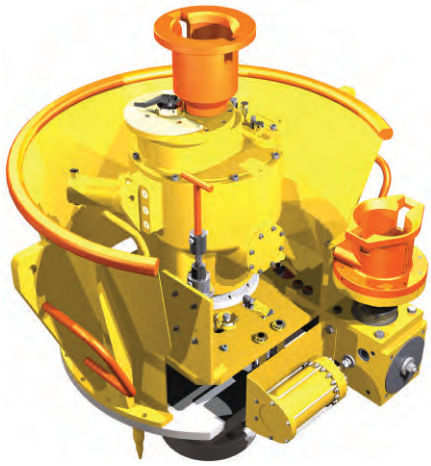
8” DEEP WATER CONTROL VALVE

SUBSEA CONTROL VALVES

With advances in seafloor processing technology comes an increasing requirement for subsea control valves as a system solution. Koso Kent Introl’s knowledge of surface control valves, combined with our experience of subsea chokes allows us to create world-class engineered solutions for subsea control applications.

A subsea control valve is a more suitable solution than a subsea stepping choke for applications such as seawater injection, seafloor pumping/boosting, separator level control and anti-surge applications.

Available subsea hydraulic power can be a challenge for control valve actuators; therefore three actuator options can be considered:
- Hydraulic actuator with surface located supply
- Hydraulic actuator with local subsea supply
- Electric actuator.



ROV TOP ACCESS ONLY INTERFACES ON DEEP WATER CHOKE

SUBSEA CHOKES

Koso Kent Introl’s subsea choke product range covers a wide range of applications, including single or multi-phase production, water/chemical/gas injection and artificial gas lift. Advancing offshore production and injection technologies require subsea chokes to meet market demands. We have products to suit the complete range of conditions, including high-pressure, high-temperature HPHT, Joule-Thomson effect, water depth, temperature and shut-in pressure.

Operators consistently demand a discrete stepping actuator to ensure accurate well control. Additionally, in emergency conditions an additional fast-acting feature is required to ensure the integrity of the system. Both these features form part of our actuator product range.

When the required subsea well chemical injection flow rates or pressure drops are greater than the capacity of traditional chemical injection metering valves (CIMVs), our subsea chokes are an ideal alternative, and can be provided as non-retrievable or insert retrievable designs.



CHOKE INSERT WITHIN CHOKE INSERT RUNNING TOOL (CIRT)

INTERVENTION WORK OVER SYSTEMS (IWOS)

The KKI deep water retrievable equipment can be provided with ISO-13628 compliant interfaces in the event third party equipment is selected, alternatively the KKI intervention work over system can be provided.

The KKI intervention work over system is an innovative design for subsea chokes and control valves. The tooling package is modular, providing installation contractors with all the tools they require during an offshore campaign.

The IWOS Choke Insert Running Tool (CIRT) is a simple, cost effective design suitable for even the most onerous offshore conditions. It is adaptable to installation contractor demands including variable offshore conditions; shallow or deep water. Our range of shipping, handling, testing and protection equipment complements the CIRT to ensure offshore interventions are executed as quickly and safely as possible.

TRIM TECHNOLOGY

ALL KOSO KENT INTROL SERIES 75 CHOKE AND CONTROL VALVES UTILISE THE LOW-PRESSURE RECOVERY TRIM DESIGN. FIRST INTRODUCED IN 1967, THE TRIM PHILOSOPHY IS THAT THE HIGH ENERGY, VELOCITY AND TURBULENCE LEVELS ARE DISSIPATED AND CONTROLLED WITHIN THE CONFINES OF THE TRIM, AVOIDING EROSION DAMAGE TO THE PRESSURE-CONTAINING BOUNDARIES.

FEATURES OF THE CARTRIDGE TRIM DESIGN

- Divides the main flow into a large number of small streams, increasing the turbulence/noise peak frequency and maximising the pipe wall transmission loss
- High energy levels, pressure, velocity and turbulence intensity are dissipated within the confines of the trim, avoiding erosion damage to the pressure-containing boundaries
- Design of last stage ensures low velocity non-interacting jets, avoiding unnecessary generation of noise in the choke outlet
- Various trim sizes can be used in different choke body sizes, to ideally suit the process parameters
- Specially characterised trims can be provided
- The inner tungsten carbide control elements are protected from impact damage by the outer cartridge sleeve (verified by testing)
- The trim design has an inherently high capacity and rangeability
- All seals are resilient and do not suffer from explosive decompression.



MULTI-STAGE SPLINE TRIM



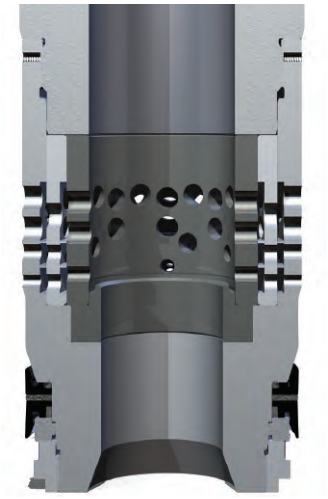
SOLID TUNGSTEN CARBIDE VECTOR TRIM DESIGN



NON-COLLAPSIBLE TRIM DESIGN C/W METALLIC “BRICK-STOPPER”

TRIM TECHNOLOGY

HFT TRIM DESIGN

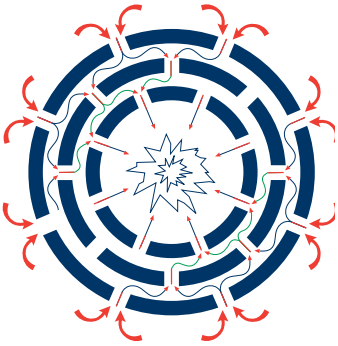


KOSO KENT INTROL HAS A NUMBER OF TRIM OPTIONS TO SUIT A VARIETY OF OIL AND GAS APPLICATIONS.

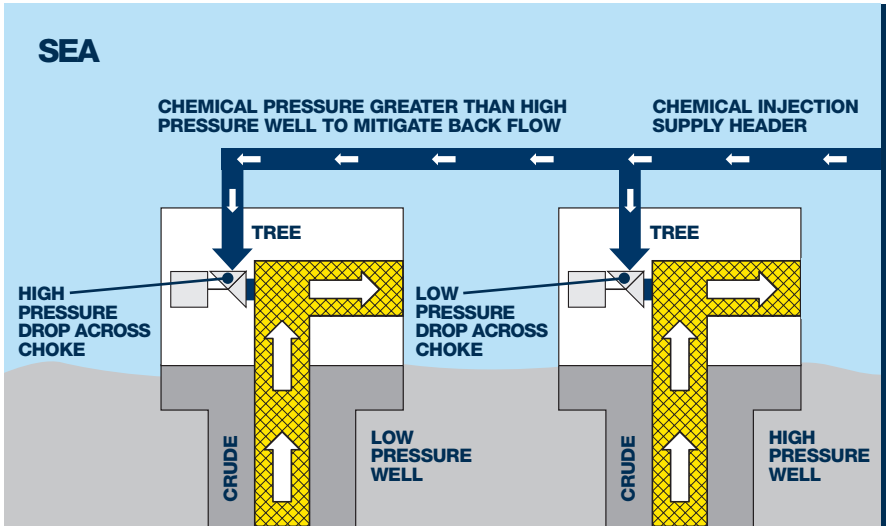
HIGH FRICTION (HF) CARTRIDGE TRIM DESIGN
- Utilised on most standard production type applications
- Solid tungsten carbide trim control/throttling elements
- Inherent built-in 'brick-stopper'
- Full bi-directional trim option.

HIGH FRICTION TRIPLE (HFT) STAGE TRIM DESIGN
- Utilised on most high pressure water injection applications
- Low noise anti-cavitation solution
- A variable stage trim option is available to accommodate high pressure drops at low flow openings.

MICRO/MULTI-SPLINE TRIM DESIGN
- Utilised on most MEG/methanol and chemical injection applications
- Design CV range from 5 down to 0.0013
- Pressure drops in excess of 500 bar can be accommodated.



FLOW PATH FOR HFT TRIM



TYPICAL SEVERE CHEMICAL INJECTION APPLICATION

A typical severe chemical injection application may occur when new production wells are tied back to an existing subsea system. In this event low and high pressure production wells will likely share the same chemical injection header. Topside recycling and re-injection of chemicals also adds to the risk of particle contamination.

High flow, high pressure drop and particle contamination in chemical injection applications requires special trim technology. KKI's multi-stage spline trim can be utilised for improved resistance to erosion, cavitation and vibration.

PLANT ACHIEVEMENTS IN SUBSEA

An unrivalled blend of proven expertise, innovative design technology and skilled engineering is the motivating force behind the development of the Koso Kent Introl range of high quality subsea control valves and chokes.

Our facility in Brighouse, UK, has delivered many successful subsea projects over the last 25 years, achieving the following milestones and industry firsts:
- 1985 non-retrievable subsea chokes developed
- 1989 shallow water retrievable chokes developed
- 1991 deep water retrievable chokes developed
- 1992 deep water retrievable chokes developed using collet type connectors – AN INDUSTRY FIRST
- 1995 deep water retrievable chokes developed using clamp connectors
- 1997 lightweight choke insert developed, weighing <200kg – AN INDUSTRY FIRST
- 2001 choke million step test carried out – AN INDUSTRY FIRST
- 2006 8" CV650 deep water retrievable control valve developed using clamp connector – AN INDUSTRY FIRST

SUBSEA PROCESS CONTROL VALVES

WHY SUBSEA PROCESS CONTROL VALVES?

- Fast acting
- Level and flow control
- Recirculation and pressure control
- Severe service solutions
- Closed-loop control systems.

For over 40 years Koso Kent Introl has been a proven provider of specialist control valves for both process and severe service applications and we have an enviable track record in that time. Our core business is specialist control valve applications and we consider ourselves one of the market leaders in this field.

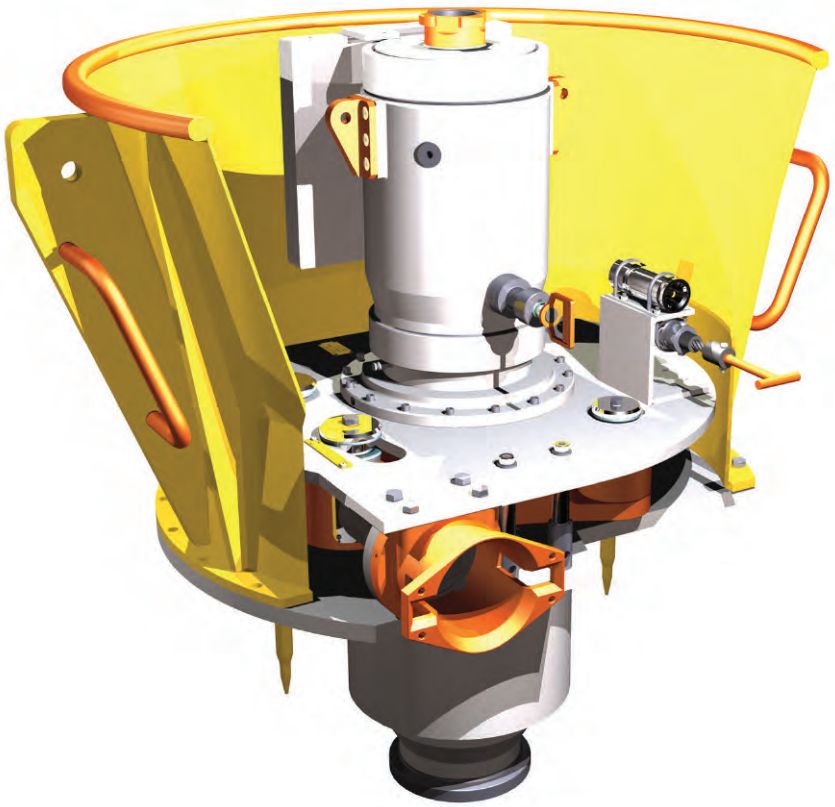
Our skills and experience in surface valve technology transfer into subsea applications such as:

- Anti-surge – compressor recycle
- Pipeline surge relief control
- Separator level control
- Seawater injection
- Recirculation and flushing loops
- Single or multi-phase production
- High pressure high temperature (HPHT).

In order to keep up with worldwide oil and gas demand, operators are focused on extracting more out of their reservoirs and on exploiting resources in harsher environments. Over the last 10 years, seafloor processing systems have become an established technology and many systems require process control valves (PCVs) for various applications.

In many cases, operators continue to use a subsea choke for process control; an ill-fitting product for the task. For seafloor processing, subsea control valves with modulating actuators provide the operator with greater control over their boosting, separation or compression systems.

8” RETRIEVABLE SUBSEA CONTROL VALVE WITH SINGLE ACTING HYDRAULIC ACTUATOR AND 14” REMOTE CLAMP



SUBSEA CONTROL VALVE HISTORY

The Brighouse plant has been involved in two separate subsea control valve development projects starting in the 1980s.

The original development project in the late 1980s involved the study and design of the first subsea control, choke and high performance butterfly valves including actuation for one of the first subsea separator systems in the industry. Extensive site integration testing (SIT) including the subsea valves, control system and umbilical was carried out at the Brighouse Plant. The equipment later went onto subsea trials where the valves and system were further verified.

The second project in early 2000 consisted of a collaboration to provide hydrocarbon facility capability on the sea floor. In an attempt to qualify for the worst conditions envisaged, the largest valve size (8”), fastest response actuation (two seconds) and fully retrievable control valve were selected. The project was successfully completed and included PR2, hyperbaric and million cycle ‘yozzle’ endurance testing.

PROCESS APPLICATIONS

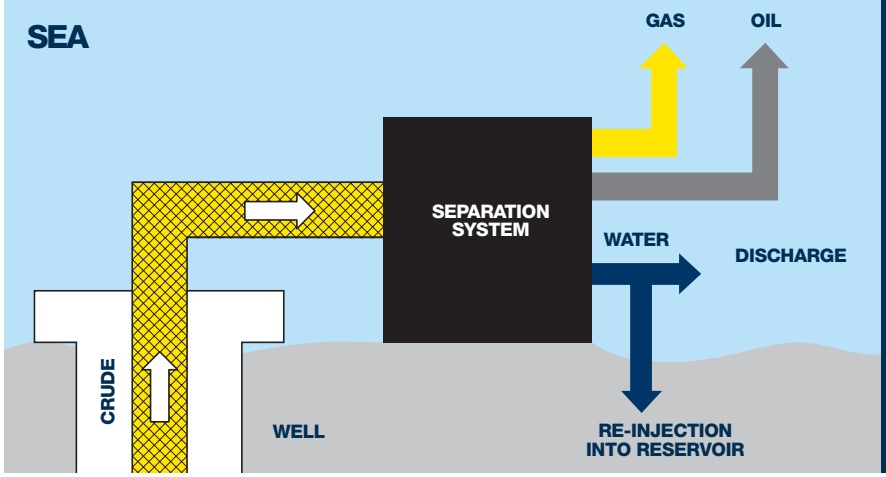
SUBSEA PROCESSING BACKGROUND

Throughout the oil and gas industry, new reserves are becoming more challenging to access and existing brown-field facilities are reaching maturity, being operated beyond their original cost effective production life. As a result, it is more difficult to keep well production at acceptable levels using existing topside infrastructure, due to factors like increased water production.

This means that older and marginal fields require a more cost effective solution than the building of new topside facilities. Subsea processing provides increased well yield and plateau production, and allows marginal fields to be cost effective as they can be linked to existing infrastructure. For green-field applications, subsea processing allows a cost effective solution for ultra-deep fields as well as long step-out applications.

KKI has over 40 years' experience in providing control valve technology for key processing applications. The main subsea processing system components are separation, boosting and injection.

Figure 1: a simplified subsea processing model



IN GENERAL
Valve sizes in the range of 6" – 10" are expected to cover most level and flow control applications while most circulation and pressure control valves are of a smaller size in the range of 2" – 6".

The scope of supply for a process control valve system typically comprises of the following:
- Control valve assembly
- Actuator assembly
- Valve to override interface
- Override to actuator interface
- Local valve controllers
- Local electronics

PROCESSING APPLICATION VALVE SELECTION CONSIDERATIONS

In order to ensure the correct application control performance and satisfactory valve, field life engineers must ensure the correct Control valve technology is used. Typical application valve selection considerations being:

SEPARATION (SEPARATOR LEVEL/PRESSURE CONTROL)

- Fast modulating control action compared with traditional stepping hydraulic choke
- Accurate fine resolution control
- Effective long-term shut-off
- Control valve trim technology to prevent premature valve failure due to vibration, cavitation or flow-induced erosion.

LIQUID/TWO-PHASE BOOSTING (PUMP RECYCLE/ FLOW CONTROL)

- Fail open pump recycle, fail closed flow control
- Modulating control action compared with traditional stepping hydraulic choke
- Accurate fine resolution control
- Effective long-term shut-off
- Control valve trim technology to prevent premature valve failure due to vibration, cavitation, or flow-induced erosion.

GAS BOOSTING, COMPRESSION (ANTI-SURGE, RECYCLE/ FLOW CONTROL)

- Fast fail open compressor ASV/recycle, fail closed flow control
- Modulating control action compared with traditional stepping hydraulic choke
- Accurate fine resolution control
- Effective long-term shut-off
- Control Valve trim technology to prevent premature valve failure from vibration or control of hydrates formation (JT – Joules Thompson effect)
- Correct capacity sizing for ASV to prevent compressor damage.

WATER INJECTION (IF MANIFOLD CONTROL VALVE IS USED INSTEAD OF TREE INJECTION CHOKE)

Trim/actuation selection can be based on a traditional christmas tree water injection choke selection, however for high pressure-drop applications, multi-stage/anti-cavitation trim technology may be required to prevent premature valve failure from vibration, cavitation and flow-induced erosion.

CONTROL VALVE ACTUATION

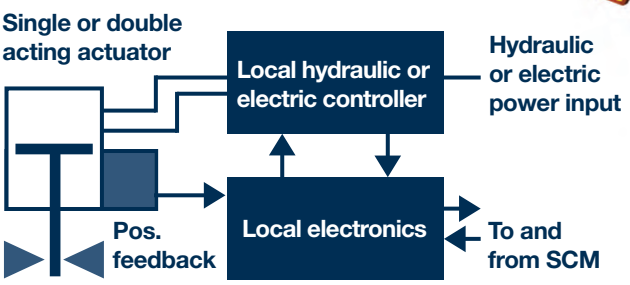
FOR DEEP WATER SUBSEA PROCESS SYSTEMS THE BENEFIT OF COMPACT SEPARATOR SYSTEMS BECOMES SIGNIFICANT. AS A RESULT, PROCESS CONTROL VALVES (PCVS) ARE REQUIRED.

ACTUATOR SUMMARY

Traditional subsea fields are normally optimised to operate one single valve at a time in order to maintain minimum system hydraulic pressure. The substantially higher flow requirements of PCVs would inevitably cause pressure drop. In the event that time between consecutive operations can be relaxed and reasonable subsea accumulation can be provided, problems maybe overcome for shorter step-outs.

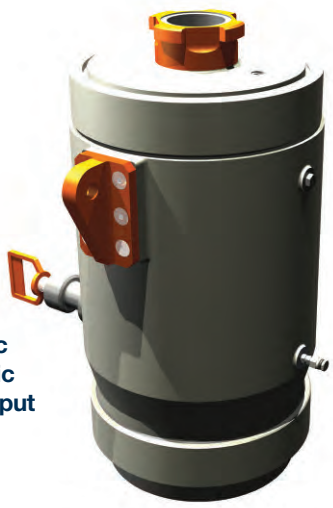
For longer offsets, a subsea hydraulic power unit (HPU) is required to operate fast-acting PCVs. Subsea HPUs are a viable option but, as they require more frequent servicing, this architecture is deemed to be less desirable. Ultimately, an all-electric solution can provide the operator with a fast-acting PCV on any step-out, within reason.

TYPICAL PCV SCHEMATIC



Control system architecture dictates the subsea utilities, which in turn determine actuator functionality. Subsea actuation and control options typically consist of:

- Single or double acting hydraulic
- Fast or medium speed of operation
- Hydraulic only (all controls within the subsea control module (SCM))
- Electro/hydraulic (controls within PCV and SCM)
- All-electric actuation
- ROV operation only via mechanical gearbox.



HYDRAULIC ONLY

Hydraulic only installed with 4-20mA feedback provides the operator with a cost effective actuator when moderate speeds are required.

This design may be utilised with a surface-located, supply-supported subsea accumulation.

ELECTRO/HYDRAULIC

Electro/hydraulic actuators add local electronics and hydraulic controls allowing for faster operating speeds and increased accuracy.

ALL ELECTRIC

All electric actuators provide significant benefits for operators with long step out distances and are able to provide fast acting and accurate control. Features for operator consideration consist of:

- Power packs with a wide range that can accept AC or DC inputs
- Maximum torque produced 2700 Nm at 1500 watt power rating
- MODbus or CANbus control signal protocols
- Two approaches – brown field vs green field
- Typical green field input 3-phase 415VAC connected to a dedicated ASCM controlling all actuators in system
- Typical brown field input 24V and 200W from existing controls SCM Capacitors or batteries within actuator trickle charged from SCM
- Brown field design is subject to demand, High = batteries, Low = capacitors, acceptable charge times, acceptable speeds, etc
- Single or double acting or fail stay put options.

NEW ACTUATOR TEST FACILITY

KKI has invested in a new test hydraulic power unit (THPU) with automated programmable logic control (PLC) for the qualification and factory testing of subsea hydraulic actuators. The unit was installed and commissioned in May 2010 and in the first instance has been used for the performance and million-step testing of the subsea actuator range.

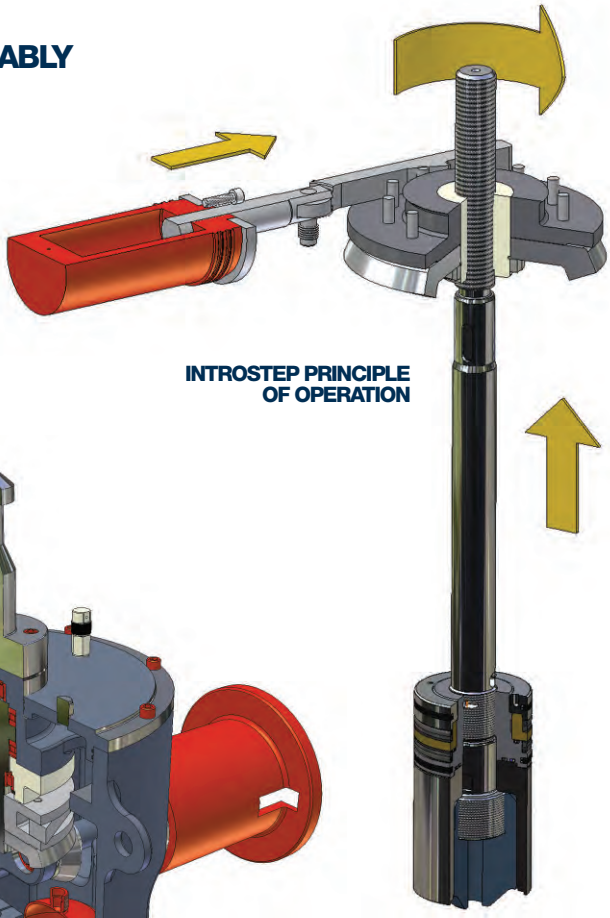
The unit is capable of testing up to 5,000 psi working pressure systems and either stepping or modulating functionality. Its PLC is fully programmable with data logging and download capability.

CHOKE ACTUATION

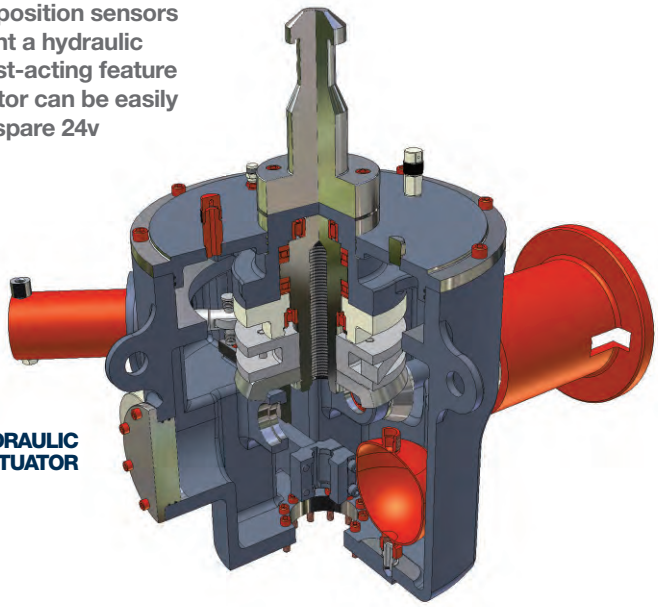
THE KKI SUBSEA STEPPING ACTUATORS ARE PROBABLY THE MOST ROBUST UNIT IN THE MARKET PLACE.

Most hydraulic stepping actuator designs use piston-pawl methods and pinion wheels to transmit the rotation to the choke stem. To ensure high reliability KKI has elected to use highly reliable industrial bevel gears with large indexing wheels and hydraulic cylinders. All actuators are million-step endurance tested under full and partial load conditions.

The units have an oil-filled, compensated housing with remote 4-20mA feedback via either a linear variable displacement transducer (LVDT) or rotary variable displacement transducer (RVDT). Both units are non-contacting position sensors and are separately qualified. In the event a hydraulic stepping actuator with an additional fast-acting feature is required, a proprietary electric actuator can be easily installed and connected to a standard spare 24v output of the SCM.



INTROSTEP PRINCIPLE OF OPERATION



INTROSTEP HYDRAULIC STEPPING ACTUATOR

STEPTROL AND INTROSTEP FEATURES

LINEAR THRUST
30,000 lbf

CHOKE TRAVEL AND STEP SUMMARY
1 1⁄2” choke travel and 67 steps
2 1⁄4” choke travel and 100 steps
3 1⁄2” choke travel and 156 steps

HYDRAULIC PRESSURE OPERATING RANGE
Designed for 3,000 & 5,000 psi LP control systems.

HYDRAULIC FLUID COMPATIBILITY
Water-based or mineral oil control fluid.

HYDRAULIC CLEANLINESS
Typically SAE AS4059 class 6 B-F or better.

MECHANICAL OVERRIDE – SIDE-MOUNTED
1 1⁄2” choke travel and 13 turns
2 1⁄4” choke travel and 20 turns
3 1⁄2” choke travel and 31 turns
390 lbf/ft maximum operating torque
500 lbf/ft damage torque.

MECHANICAL OVERRIDE – TOP-MOUNTED
1 1⁄2” choke travel and 6 turns
2 1⁄4” choke travel and 9 turns
3 1⁄2” choke travel and 14 turns
510 lbf/ft maximum operating torque
600 lbf/ft damage torque.

LOCAL POSITION INDICATOR
Graduated percentage scale as standard. Bio-fouling resistant material.

REMOTE POSITION INDICATOR
Resolution typically better than 0.5% of actuator travel. Dual redundancy options available.

POSITION ACCURACY
Better than 2% of actuator travel

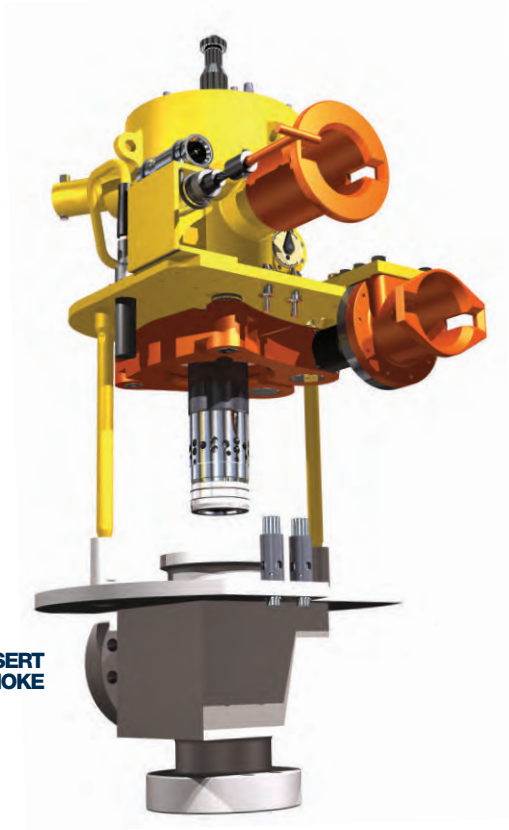
REPEATABILITY
Better than 1% of actuator travel

QUALIFICATION SUMMARY
- Million-step test at 3,000 and 5,000 psi LP system pressures with variable choke load conditions
- Hyperbaric testing to 240 bar equalling typical depth of 2,300 metres (designed for 3,000 metres).

REMOTE TOOL RETRIEVABLE CHOKES

THE FIRST DEEP WATER RETRIEVABLE CHOKE WAS SUPPLIED BY KKI IN 1991.

KOSO KENT INTROL CHOKE AND CONTROL VALVES OFFER A HIGH RELIABILITY SOLUTION AND PROVEN DESIGN TO THE SUBSEA MARKET. THE FLEXIBILITY OF THIS DESIGN FACILITATES MANY DIFFERENT TRIM AND BODY MATERIAL OPTIONS.



TYPICAL INSERT RETRIEVABLE CHOKE

The choke is often considered a critical component in the system and in today's subsea architecture it is common-place for a separately retrievable choke insert to be specified.

The Koso Kent Introl design uses a single bolt connector for ease of insert installation and removal and is modular in design for either diver or ROV maintenance.

Koso Kent Introl and Subsea 7 engineered work over systems interface with the insert. Alternatively standard ISO-13628-8 interfaces are provided for use with third-party tooling packages.

RETRIEVABLE CHOKE FEATURES

- 2" to 8" size range
- Up to 15,000 psi rated designs
- -60°C to +121°C (classification K-V) as standard
- Up to material class HH
- Up to 750 design CVs with linear or equal percent characteristic
- Choke production, injection or artificial lift applications
- Stepping type and modulating hydraulic actuators
- Side- or top-mounted receptacles and visual indicators
- Linear or rotary variable displacement transducers for remote position indication
- Optional body/bonnet primary seal test via hotstab feature
- Optional integral funnel guidance and landout structure for use with KKI running tool.

QUALIFICATION TESTING

Recent qualification programmes have been executed to ensure the KKI subsea product range is in accordance with current international standards, specifications and legislation:

Choke PR2 test in accordance with API 6A/ISO 10423 section F



CHOKE IN ENVIRONMENTAL CHAMBER DURING PR2 QUALIFICATION

Hyperbaric test of choke in accordance with ISO-13628-4 (API17D)



SUBSEA CHOKES ON HYPERBARIC CHAMBER LOADING BED

Million-step endurance test at 3,000 and 5,000 psi LP system pressures with variable choke load conditions



INTROSTEP SUBSEA ACTUATOR ON DOUBLE ACTING PISTON LOAD RIG

subsea 7

IWOS - INTERVENTION WORK OVER SYSTEM

KKI HAS ENTERED INTO A JOINT VENTURE WITH SUBSEA 7 FOR THE ENGINEERING, RUNNING TOOL (RT) MANUFACTURE, HANDLING AND TEST SYSTEMS FOR USE DURING INTEGRATION TESTING AND OFFSHORE INTERVENTIONS.

RUNNING TOOL DESIGN

KKI market research has indicated that traditional ISO compliant tooling interfaces were causing envelope size problems for system integrators. Additionally, it was found that the running tools traditionally specified by control system engineers were over-complicated for choke retrievals. KKI and Subsea 7 took this onboard and designed a simple, fit-for-purpose, cost effective running tool.

The choke insert running tool is designed to provide protection to the insert during deployment, and guidance into the choke body during installation.

The running tool consists of the following key components:

- Guide chute
- Jacking mechanism
- Soft landing device
- Tool lockdown/load reaction mechanism
- Failsafe insert lifting and securing interface.

HANDLING AND TEST SYSTEMS

Different installation contractors dictate different requirements and therefore our handling and test system design is completely modular. KKI/Subsea 7 standard options consist of:

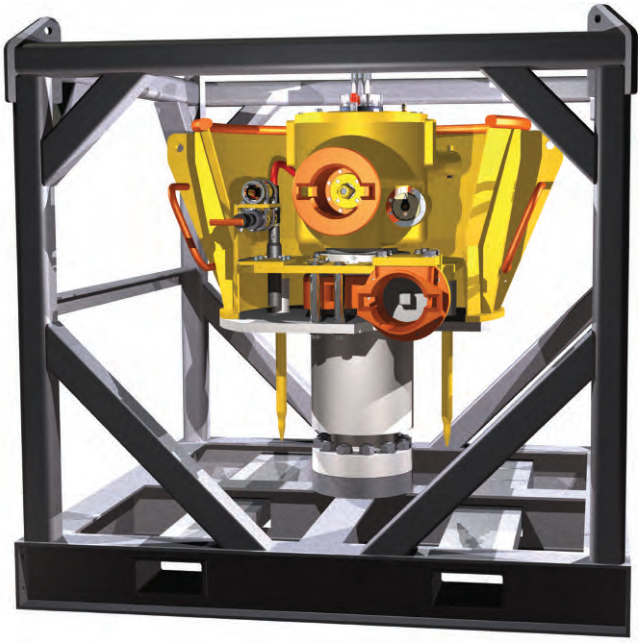
- Mono or dual porch handling /test frames
- Separate or integral offshore test module
- Onshore handling frames
- Offshore handling frames.

OPTIONAL EQUIPMENT

- Debris or protection covers
- Dropped object protection covers
- Over-trawl protection covers
- Guideline interfaces



CHOKE INSERT RUNNING TOOL (CIRT)



CHOKE INSERT TRANSPORTATION FRAME OPTIONAL TEST EQUIPMENT MODULE AVAILABLE

NON-RETRIEVABLE CHOKES

THE FIRST SUBSEA NON-RETRIEVE CHOKE WAS SUPPLIED BY KKI IN 1985. SINCE THEN AROUND 300 HAVE BEEN SUPPLIED BY OUR BRIGHOUSE FACILITY.

Subsea non-retrievable chokes are a popular choice when the system design dictates the mounting of a choke in a separately retrievable module or the operator specifies a non-retrieve design.

Common non-retrievable host structures consist of choke/flow modules or choke bridges.

NON-RETRIEVABLE DESIGN FEATURES

- 2” to 8” size range
- Up to 15,000 psi rated designs
- - 46°C to +121°C (classification L-V) as standard
- Up to material class HH
- Up to 750 design CVs with linear or equal percent characteristic
- Single or multi-phase production, water or chemical injection and artificial gas lift applications
- Stepping type and modulating hydraulic actuators
- Side- or top-mounted receptacles and visual indicators
- Linear or rotary variable displacement transducers for remote position indication, non-redundant, redundant electronics or full redundancy options.



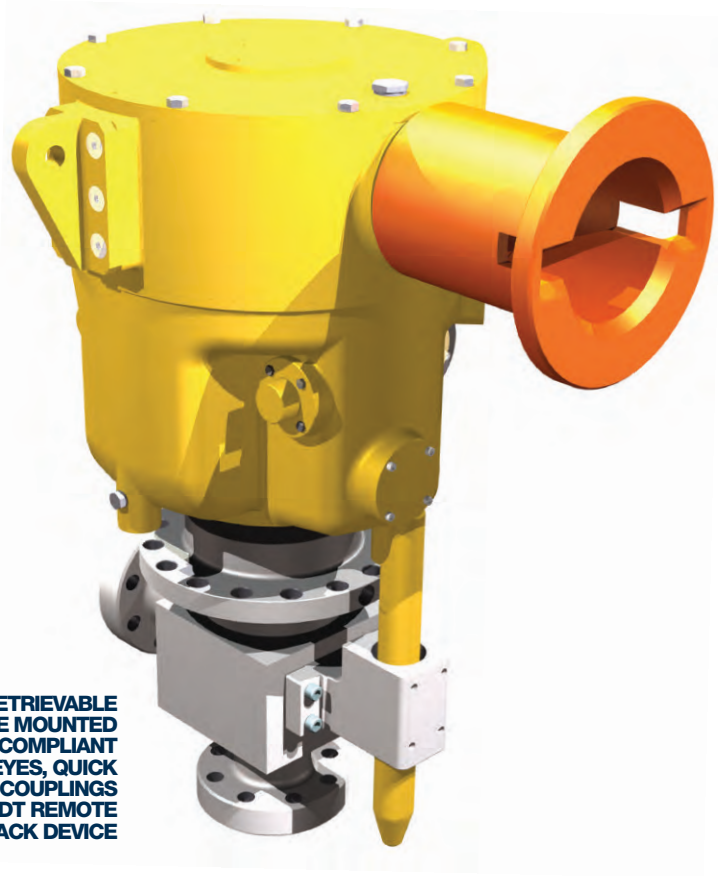
TYPICAL BI-DIRECTIONAL PRODUCTION 10KSI RATED CHOKE FOR FLOW MODULES

DIVER-RETRIEVABLE CHOKES

THE DIVER RETRIEVABLE CHOKE DESIGN IS USED WHEN A COMPACT DESIGN IS REQUIRED FOR SHALLOW WATER APPLICATIONS UP TO 200 METRES WATER DEPTH, TYPICALLY ON MARGINAL FIELD DEVELOPMENTS.



DIVER RETRIEVABLE CHOKE WITH TOP OVERRIDE AND VISUAL INDICATOR



2" DIVER RETRIEVABLE CHOKE WITH SIDE MOUNTED OVERRIDE, DNV COMPLIANT PAD EYES, QUICK DISCONNECT COUPLINGS AND RVDT REMOTE FEEDBACK DEVICE

A locking ring is used to retain the choke insert to the body and can be removed using diver operable hydraulic tooling and a removable reaction adaptor. A maximum of two turns is required to release the insert from the choke body. The choke insert is provided with certified lifting points and with a single guide post to assist insert-to-body alignment.

Interfaces are designed on a project basis and consist of a diver wet mate electrical interface for the remote position indicator, and two diver hydraulic couplings for the open and closed function lines. Visual indication and overrides are positioned to suit diver or ROV access to the host structure.



DIVER AND ROV ACTUATORS

Infrequent operation or as an interface for third party actuation can mean a diver or ROV actuator is selected. A typical application would be for flow or pressure control in a none critical application or maybe when control is required only as a one off life of field event. These actuators are available with either side or top access interfaces and can be operated by Diver or ROV and are suitable for the KKI product range.

LIFE OF FIELD SERVICES

KKI PROVIDES THE OPERATOR WITH A COMPLETE LIFE OF FIELD SERVICE FOR SUPPORT OF INSTALLED EQUIPMENT.







THE MANAGEMENT OF SUBSEA EQUIPMENT IS COMPLEX, BOTH TECHNICALLY AND LOGISTICALLY. BY USING THE KKI FIELD LIFE MANAGEMENT PROGRAMME, THE CUSTOMER CAN SELECT ANY COMBINATION OF THE AFTERMARKET SUBSEA SERVICES WE HAVE TO OFFER.

These include:
- Refurbishment to ISO 10423 (API 6A) Annex J
- Applications engineering
- Critical spares storage and maintenance
- Site Integration Testing (SIT)
- Offshore interventions
- Purchase or rental of intervention equipment.

REFURBISHMENT
Care and attention is taken over the refurbishment of subsea chokes and often product enhancements are included within the scope of work. Prior to and during disassembly onerous procedures are executed to verify the condition of the choke and provide detailed feedback to the client.

The choke is then completely stripped, cleaned and inspected in accordance with ISO 10423 (API 6A) appendix J and re-usable components parts are identified, replacement parts are manufactured and OEM proprietary assemblies are returned to the manufacturer for refurbishment. At this stage a full technical report is generated by the responsible project engineer and issued to the client for consideration.

Following client approval for the proposed refurbishment, the new choke and refurbished parts are staged ready for assembly and factory acceptance test to approved procedures. The choke is then re-assembled, tested and third party or client witnessed as required ready for dispatch.

PEOPLE
The success of our service works relies on the quality of our people and our service facilities. KKI uses only fully trained choke service personnel, working to recognised procedures. Within our service facility, safety is of the utmost importance.

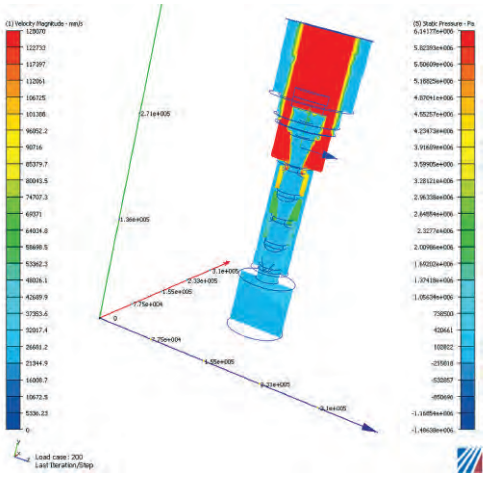
TRAINING
We offer a range of KKI courses that can be performed at customer facilities or in house. We also provide bespoke training courses to meet the specific requirements of the customer.

APPLICATIONS ENGINEERING
We offer technical support for all projects from the date of despatch. It is recognised that more frequent servicing is required for severe service applications, and therefore inspection and design reviews can be executed to ensure the correct technology is selected.

PRODUCT ENHANCEMENTS

KOSO KENT INTROL IS COMMITTED TO PROVIDING FULLY ANALYSED AND TESTED SUBSEA PRODUCTS. OUR SPECIALIST ENGINEERING STAFF DESIGNS, DEVELOPS, ENHANCES AND TESTS PRODUCTS TO MEET THE EVER-CHANGING NEEDS OF THE INDUSTRY WHILE SUPPORTING PRODUCTS THAT ARE ALREADY INSTALLED AND OPERATING THROUGHOUT THE WORLD.

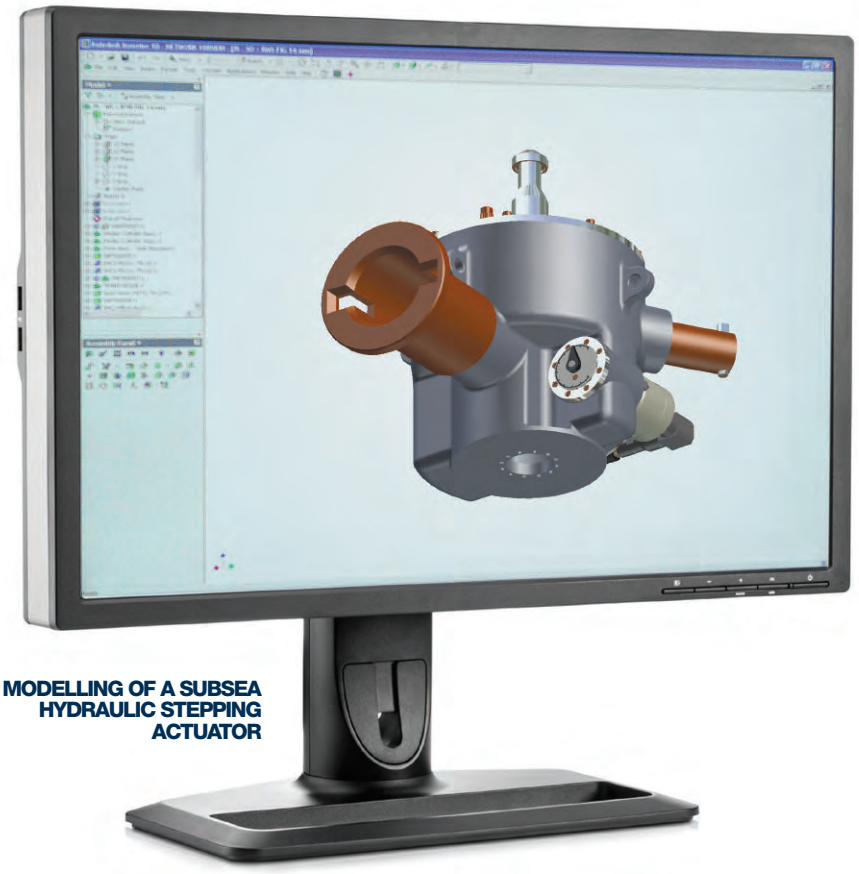
WE USE LEADING ENGINEERING TOOLS AND TECHNIQUES SUCH AS CAD, FINITE ELEMENT ANALYSIS, 3D MODELLING AND CFD ANALYSIS TO ENSURE THAT OUR PRODUCTS ARE DESIGNED TO THE HIGHEST LEVEL OF INTEGRITY AND RELIABILITY.



CFD ANALYSIS OF A 5 STAGE MULTI-SPLINE TRIM

PERFORMANCE TESTING OF SUBSEA ASSEMBLIES

- API 6A PR2 testing – of various sizes and ratings
- API 17D testing – of various sizes and ratings
- Flow testing – verification of flow capacity and trim characteristic
- Bend testing – to validate design integrity of pressure envelope
- Low temperature testing – to verify suitability of the subsea product at sub-zero temperatures
- Erosion qualification and CFD reports – to verify the expected life of the choke under sandy service conditions
- Trim impact testing – to verify that the trim does not collapse when hit by solid components at high velocity
- Endurance cycle testing – to verify the operational design life of the subsea product.



3D MODELLING OF A SUBSEA HYDRAULIC STEPPING ACTUATOR

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KOSO

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