Selecting the correct Subsea Choke Valve technology for Subsea Well & field Applications:
AGENDA:

- Company Overview
- Where are Subsea Choke valves Used?
- Why is a Subsea choke valve important?
- Subsea Choke Technology overview
  - Types
  - Trim Technology
- Selection considerations

AOB
About KOSO:

KOSO M Mac International. Inc. (Pacific Seismic Products, Inc)

KOSO America Inc.

KOSO Kent Introl Ltd

KOSO America Inc. Houston Office

KOSO Kent Introl – Singapore Office

KOSO India Private (Nashik) Ltd

KOSO Controls Asia Pte. Ltd

KOSO Control Engineering (Wuxi) Co., Ltd

Wuxi KOSO Valve Casting Co., Ltd

Hangzhou Hangyang KOSO Pump & Valve Co, Ltd

Nihon KOSO Co., Ltd Beijing Representative Office

Nihon KOSO Co., Ltd.

Ar-KOSO Automatic Control Instrument Co., Ltd

Korea KOSO Co., Ltd

Korea KOSO Engineering Co., Ltd

Nihon KOSO Co., Ltd.

Herutu Electronics Co., Ltd

Anshan Automation Control Instrument Co., Ltd.
About KOSO:

KOSO Valve Group

- $500 million annual sales
- 1500 employees
- More than 50 years of experience
- Installed base +700,000 valves worldwide
- Installed base +50,000 severe service valves worldwide
- Installed base +25,000 high-tech self-contained E-H actuator systems
- Factories in China, UK, USA, Korea, India, Japan
- Own foundries in China & India
KKI are specialists in:

- Process Control Valves for Onshore / Offshore
- Severe Service Control Valves
- Surface Choke Valves
- Subsea Choke Valves
- Actuators & Associated Instrumentation
- Valves & Desuperheaters for Power Generation
Where are Subsea Chokes Used?
Subsea Choke Valve Criticality:

- Traditionally the only piece of equipment in the subsea system controlling the well.
- Because of this critical duty most operators require the choke to be retrieved for maintenance.
- Normal maintenance consists of removal and replacement with new. Removed choke returned to beach, refurbished and carried as spare.
- One example for maintenance can be unexpected high sand production or debris.
- Many other valves exist in the system but are only isolation duty – gate or ball valve.
NON RETRIEVEABLE CHOKE VALVES:

Non-retrievable chokes often mounted in a retrievable module.
DIVER RETRIEVABLE CHOKE VALVES:

- Modern specs often allow diver install with ROV maintenance for field life – diving is a dangerous activity and is reduced where possible

Diver can retrieve choke insert from body, typical max water depth 200m
DEEPWATER RETRIEVABLE CHOKES:

Water depth > 200m requires tool retrievable chokes. Clamps or collets used for bonnet.
SUBSEA CHOKE SECTIONAL:

STEM SEALS
Body / Bonnet Seal (Primary)
Lower Guide ‘Brick Stopper’
Carbide Guide

STEM
Stem Seal

BONNET
Bonnet
Remote Clamp
Guide Posts
Body
Carbide Plug Head
Bean Seal

RESTRICION

VALVE TRIM
COMMON PROBLEMS:

- Forecast Sheet / Outlook / Bookings
- Wins / losses this month
- Movements this month
- Territory News
- AOB

Pipe vibration
Noise
Poor control
System shutdown

Trim & body wear
Lost production
High maintenance
Downstream pipe erosion
High Pressure Drops

High Pressure Drop

High Fluid Velocity / Energy

Enemy
Information to Size & Select a Choke:

<table>
<thead>
<tr>
<th>Application:</th>
<th>Production Choke Valves</th>
<th>Process Fluid Contaminates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>Flow rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td>Oil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gas / Vapour</td>
<td></td>
</tr>
<tr>
<td>Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outlet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>Specific Gravity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vapour Pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Critical Pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viscosity</td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td>Specific Gravity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vapour Pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Critical Pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viscosity</td>
<td></td>
</tr>
<tr>
<td>Gas / Vapour</td>
<td>Molecular Weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compressibility (Z)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specific Heat Ratio (γ)</td>
<td></td>
</tr>
</tbody>
</table>
Choke Valve Selection:

- Pressure Rating, temperature rating, Material Class Rating -
  - Pressure temperature Min / Max (Design)
  - Corrosive / erosive properties of fluid
- Valve size
  - Flow Coefficient (Design CV)
  - Fluid Velocity
- Trim Design
  - single or multi-stage
  - material
  - solid or balanced

Factors affecting Trim design
Noise level - cavitation / aerodynamic noise.
Vibration
Erosion considerations
Choke Valve Selection Cont....

- Bonnet style
- Packing type
- Plug seal material
- Flow characteristic
- Seat leakage
- Actuation and instrumentation

Temperature
External leakage
Seat Leakage
Customer specification
Valve design and process requirements
Variation in Pressure & Velocity:

- Pressure Variation
- Velocity Variation
- ΔP

Diagram showing pressure variations at different points:
- Valve Inlet
- Trim Inlet
- Trim Exit
- Vena Contracta
- Valve Outlet
Cavitation / Flashing:

Micro jets are formed as the pressure recovers and cause the bubble to implode creating pressure waves with forces up to 100,000 psi.
Eliminating Cavitation:
Protecting Tungsten Carbide:

• Protection of Tungsten Carbide is essential
• Metallic “brickstopper” Does this
• Field Proven
TRIM TECHNOLOGY:

- **Design CV’s:**
  - 0.0013 to 785
- **Pressure Drop Capability:**
  - <1 Bar to 800 Bar DP
- HF (High Friction) Single Stage & Multi-Stage For Production Applications.
- Micro spline & Multi-spline For MEG and Methanol Injection.
- LCV (Level Control Valve) For Sandy Applications.
- Vari-Stage Trims.
- Torturous Path Trims.
WE WELCOME YOUR QUESTIONS

T:  +44 (0)1484 710311
E:  info@kentintrol.com
W:  www.kentintrol.com

A:  Koso Kent Introl Limited
    Armytage Road
    Brighouse
    West Yorkshire
    HD6 1QF

Local Contact:

Francis Yap - Business Manager Asia Pacific
Email: francis.yap@kentintrol.com
Phone:  +65 6248 4670 | +65 9155 2177

ULTRA DELTA MAJU, PT

Lim Agus Santosa (Managing Director)
Email: agussantosa@udm.co.id
Phone: (021) 5830 0678