

User's Perspective

East West Pipeline Experience

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Requirements of Valves

Like Process Industry, Valves are an essential components of any pipeline system for:

◆ Stopping/Allowing Flow

- ▶ Requires On/Off type valve like Gate Valves and Ball Valves (for bidirectional flow), Check Valves (for unidirectional flow)

◆ Controlling Pressure/Flow

- ▶ Requires valves which can be used with variable opening like Globe Valves, Butterfly Valves, Axial Flow Valves, Plug Valves

◆ Pressure Protection

- ▶ Requires valves which can either open or close on sensing high pressure to prevent over pressurization like Safety Valves, Slam Shut Valves

Pipelines valves need to be:

◆ Highly Reliable

- ▶ Once installed in pipeline, especially mainline block valves, almost impossible to repair without major shutdown and economic loss

◆ Minimum Fugitive Emissions

- ▶ Pipeline carry large volumes thus even small percentage of leakage of carried fluid (liquid/gas) can cause heavy environmental damage

▶ Design with extra features to prevent, check and stop passing

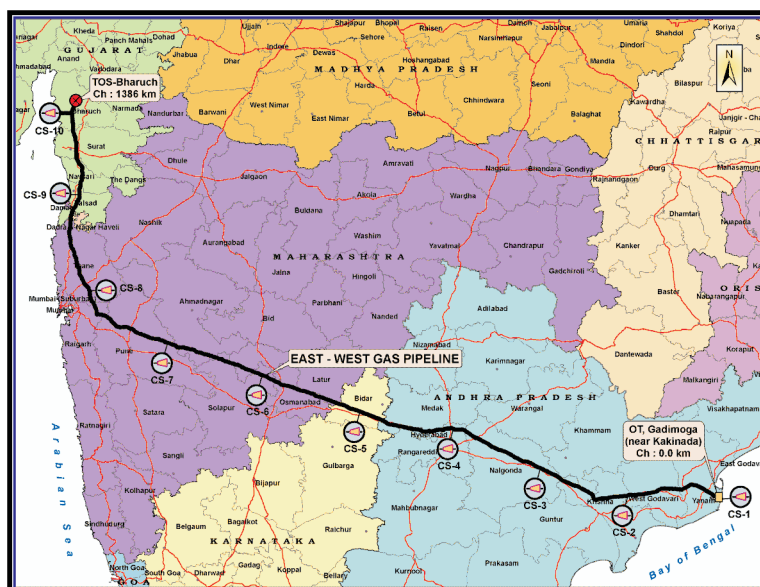
- ▶ Subjected to high forces, mechanical design needs to be robust there

minimize if detected

East West Pipe Line (EWPL)

To transport 80 MMSCMD Gas from KGD6 Field to West Coast of India - Commissioned in April 2009.

48" OD, 1375 km long pipeline, 37 mainline valves and approx. 100 km of spur lines



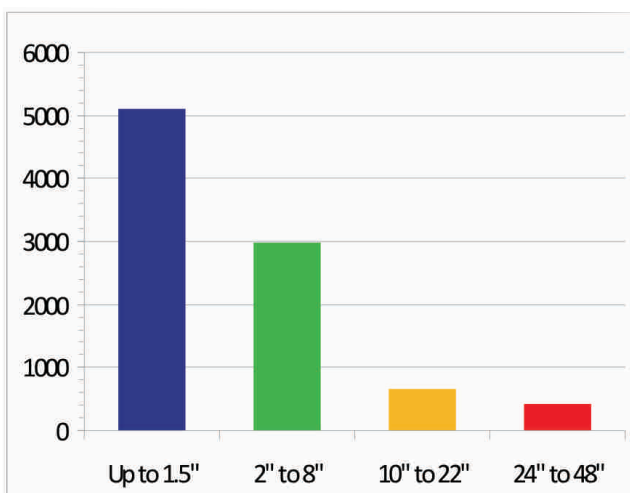
should be provisions for periodic checking of passing and stop /

pipe, World record river crossings by HDD and Micro-tunneling

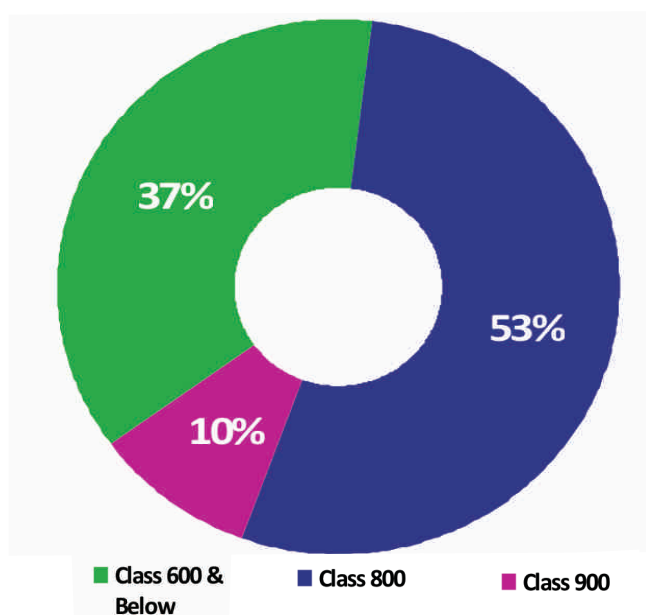
11 Compressor Stations with 32 GTCs (total installed power of about 950 MW) and 6 M&R Stations

750000 Tons of carbon steel line

EWPL Valves – Size Distribution



EWPL Valves – Rating Distribution



EWPL Valves – Procurement

◆ Ball Valves

- ▶ Schuck, Germany; Tyco (Raimondi), Italy; Valbart (Velan), Italy; MSA, Czech Republic; Valvitalia, Italy; Virgo Engineers, India; Audco India Ltd., India

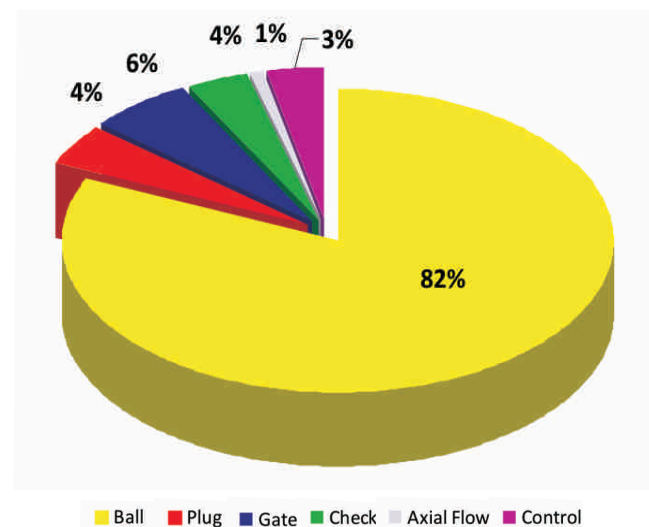
◆ Plug and Gate Valves

- ▶ Audco India Ltd., India

◆ Check Valves

- ▶ Dual Plate – Advance Valves, India, Goodwin, UK; Niton Valves, India

EWPL Valves – Type Distribution



EWPL Valves – Operating Devices

Manual (Gear /Hand wheel / Lever)

- Supplied by Valve Vendor/ Rotork/ Azzaline

Electrical Motor Operated

- M/s Rotork

Gas Over Oil

- Schuck, Valvitalia, Biffi and Ledeen

Pneumatic

- Rotork Fluid Systems and Ledeen

- ▶ Swing Check – Audco India Ltd, India;
- ▶ Nozzle Check – Mokveld, The Netherlands; Crane, UK

◆ Gate Valves

- ▶ Audco India Ltd., India

◆ Other Valves

- ▶ Anti-Surge Valves – GE Oil and Gas
- ▶ Station Recycle Valves – Mokveld
- ▶ Slam Shut Valves – Tartarini, Gortar
- ▶ Pressure Regulators – Tartarini, Valvitalia
- ▶ Control Valves – Fisher
- ▶ Safety Valves - Tyco

EWPL Valves – Specifications

◆ Ball Valves (2" and Above), API 6D

- ▶ Trunnion Mounted solid ball
- ▶ Double Block and Bleed
- ▶ Self Relieving Seats (a few valves with double piston effect seats)
- ▶ Primary Metal Seats with Soft seals for bubble tight shutoff at low pressures
- ▶ Anti-blowout stem with stem seals replaceable under pressure
- ▶ Vent and drain connections
- ▶ Sealant Injection for stem and seat areas (8" and above)
- ▶ CS/LTCS /Alloy Steel Ball, stem, trunnion and Seats ENP coated
- ▶ SS overlay in seat pocket area for CS /LTCS body valves
- ▶ Welded or Bolted body design (cylindrical or spherical)
- ▶ Materials – Mostly Impact Tested CS and LTCS a few valves of SS

◆ PlugValves, API 6D

- ▶ Lubricated Pressure Balanced (inverted) plug
- ▶ Metal Seated
- ▶ Anti-blowout stem
- ▶ ENP coated CS /LTCS Plug
- ▶ Body and cover – Mostly Impact Tested CS and LTCS
- ▶ Cast bolted body and cover
- ▶ Bubble tight shut-off
- ▶ Sealant injection for seat and stem

◆ Ball Valves (Below 2"), BS 5351

- ▶ Floating Ball
- ▶ Soft seated
- ▶ SW ends (few with pups)
- ▶ Anti-blowout stem
- ▶ Ball and stem SS or 13% Cr. Steel
- ▶ Body – Mostly CS and LTCS a few valves of SS
- ▶ Bolted body (2 or 3 piece design)

◆ Actuators

- ▶ Mainline valves all double acting Gas Over Oil
- ▶ Station valves Mostly double acting Gas Over Oil(few Pneumatic with spring return)
- ▶ Scotch Yoke Mechanism
- ▶ Hydraulic pump for hand operation for Gas Over Oil actuators
- ▶ Solenoid valves for remote operation (independent solenoid for ESD operations with manual reset facility)
- ▶ Metering stream change over valves and few other valves have Electrical Motor Actuators suitable for remote operation/ESD
- ▶ Design Torque for actuator is 150% of maximum break to Open torque but less than MAST.

EWPL Valves – Final product



EWPL Valves – Installed Valves



EWPL Valves – Problems Faced

◆ Damages during Transportation and/or Installation

- ▶ Mostly Limited to large diameter valves and valves on large skid mounted equipment
- ▶ Mostly due to deficient packing and / or improper handling / transportation

- ▶ Result 2 valves complete replacement
- ▶ Other damages include broken actuators mountings, broken/bent vent drain piping, actuator hydraulic tubing etc. resulting in repair and /or replacement of components
- ◆ **Action Taken**
 - ▶ Improved Packaging to suit Indian road conditions
 - ▶ Care during handling

EWPL Valves – Handling Damages



EWPL Valves – Problems Faced

◆ Design / Manufacturing Related

- ▶ Hydraulic oil of Gas over oil actuators
- ▶ Vent and drain piping leaked due to weld joint deficiencies
- ▶ Bolted body Joint leakage
- ▶ Failure of bolted body drain valve located underground
- ▶ Improper adjustment of stops
- ▶ Valve support foot
- ▶ Improper soft seat material of valves below 2" size
- ▶ Faulty gear box design

EWPL Valves – Manufacturing Faults



EWPL Valves – Design Faults

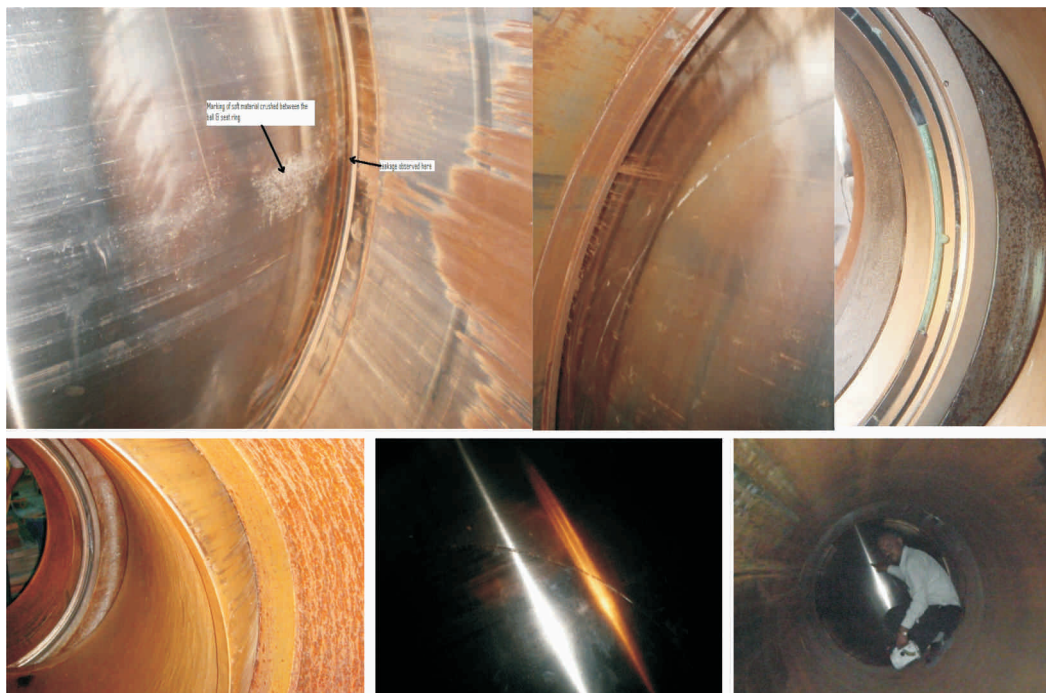


EWPL Valves – Problems faced

◆ Valve Passing

- ▶ Significant number of valves found to be passing after gas in / commissioning
- ▶ Varied degree of seat damages noticed
- ▶ Soft seals of primary metal seated valves found damaged.
- ▶ Soft seats of SW end valves of size less than 2" damaged during field welding
- ▶ Few large diameter primary metal seated valves found to have partially damaged metallic seats rings.
- ▶ Drying of sealant used in plug valves
- ▶ Improper adjustment of valve stops

EWPL Valves – Seat Damages



EWPL Valves – Arresting valve Passing

◆ Seat Replacement

- ▶ All soft seats of improper material or that got damaged during welding were replaced with new seats and body seals

◆ Adjustment of stops

- ▶ First step taken to ensure ball/plug position was correct for proper open/close position. Trials were made with over and under travel.

◆ Flushing of Valve Seats

- ▶ Online flushing of valve seat areas with high pressure diesel / solvent (e.g. glycol) carried out to soak and is lodge dirt and debris from the seat areas thus improving sealing with over 90% success in completely stopping the passing or reducing to an acceptable level.

◆ Reversal of valve

- ▶ Where even after readjustment of stops and flushing failed to arrest leakage, reversal of valve was tried just in case downstream seat was undamaged and holding just to buy enough time before the valve can be taken out for repairs/ replacement. Success in two out of three cases.

◆ Replacement /refurbishment of complete Valve

- ▶ Finally when nothing succeeded in stopping leakage (i.e

where both upstream and downstream seats were damaged), the valves were replaced and / or refurbished at vendors works.

Recommendations

- ▶ Double piston effect Seats should be used with or without pressure body cavity pressure relief .
- ▶ Utmost care should be taken in cleaning the pipeline/piping before installation of valves.
- ▶ Valves requiring 100% leak tightness in closed condition (e.g. compressor inlet/outlet piping, equipment isolation, blowdown lines etc.) should be of bolted body design (preferably top entry) for onsite repairs.
- ▶ All buried valves including those in valve body vent and drain should be of fully welded construction.
- ▶ Must include all pressure containing components in valve body hydro testing prior to shipment.
- ▶ Select appropriate materials suitable for pressure rating and service.
- ▶ Special care should be taken during packaging to prevent damage during transportation and handling.

(This paper was presented at CII's Valves Conference on 6th December 2010 in Mumbai).