

## ELSA-LB (Large Bore)

Our landing string assemblies are designed for direct hydraulic (DH) and electro hydraulic (EH) completion and intervention applications and interface with all mono-bore completions when used in conjunction with horizontal and conventional subsea production trees.

The ELSA – LB comprises of a full suite of valve assemblies. The lubricator valve, retainer valve and subsea test tree provide a full range of well intervention, pressure control functions and disconnection capabilities for harsh completion installation, workover or intervention operations.

### Applications:

Completion installation, workover and intervention operations on horizontal subsea xmas trees from mobile offshore drilling units in water depths up to 10,000 ft (3048m)

Drill stem testing, well clean up and extended appraisal operations requiring a large flow bore

Specifically designed to operate in batch completion campaigns where minimal redress operations between runs are critical

### Benefits:

Provides a dual primary subsea barrier between the well and surface during subsea operations

Allows subsea well operations to be conducted under controlled conditions without having to function the BOP

Disconnect function allows mobile offshore drilling unit (MODU) to unlatch and re-latch safely should environmental conditions dictate

Independent ball closure allows a single cutting device to be selected

System reliability and maintenance requirements virtually eliminating rig down time

Electrical feed through to facilitate surface readout

Can be run with either EXPRESS subsea control systems or direct hydraulic (DH)

Facilitate injection of chemicals to production bore

Pump through capability for well equalisation or bull heading

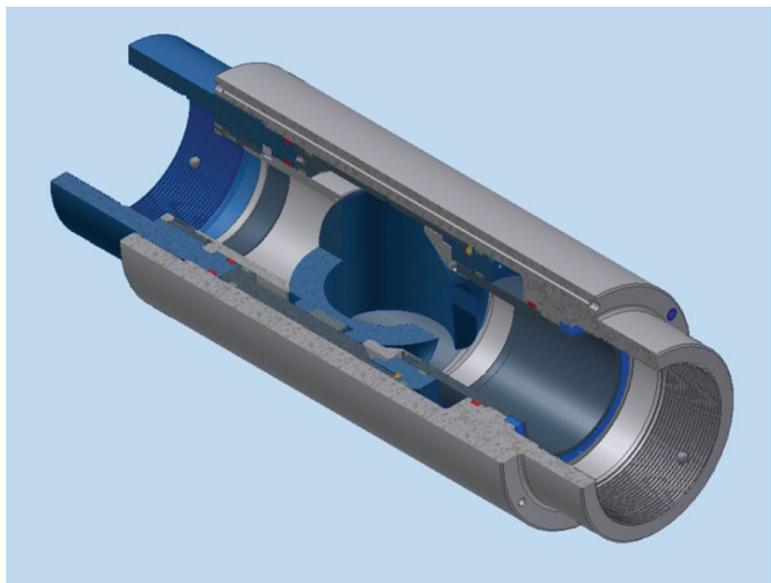


## ELSA-LB (Large Bore)

### The Lubricator Valve

The lubricator valve (LV) forms an integral part of the subsea landing string for well test or intervention operations and can be set at a pre-determined point below the rotary table or deepset in shallow wells. It is the “work horse” within the production string isolating the well facilitating the introduction of any through tubing tools.

The valve is of a ‘fail-as-is’ design. To cycle the ball to the open position, control fluid is pumped into the ball open line, displacing the piston/mandrel assembly; the displaced fluid will vent up the ball close line. The valve is closed by pumping fluid into the ball close line and allowing it to vent into the ball open line. For well isolation purposes the LV is designed to hold a pressure differential from below without further application of control pressure. To hold pressure from above, close control line pressure is applied to override the pump through feature. It is possible to equalise pressure across the valve by pumping through before opening the ball or bull heading the well whilst in the closed position. The pump through pressure should not exceed the maximum working pressure.



#### Features:

- To facilitate the introduction of through tubing tools (i.e. coiled tubing and wireline) into the production string longer than those acceptable in a customary derrick installed lubricator assembly
- To provide a method of isolating surface equipment from the production flow
- To provide a means of pressure testing the surface equipment and lubricator sections once the wireline tool string has been installed
- Provides through port capability for either dual high set LV's or downhole functionality when run deep set
- To allow the safe passage of an umbilical/s along its length (high-set option)
- To allow chemicals to be injected directly into the well stream through a dual sealing/backflow valve arrangement, with injection point below the ball
- To provide a pressure tight barrier between the well bore and BOP stack and/or marine riser
- Slickline cutting - optional

## ELSA-LB (Large Bore)

### The Lubricator Valve

#### Technical Specifications:

Service		H <sub>2</sub> S NACE MR 0175 + CO <sub>2</sub>
Maximum Working Pressure		10,000 psi (690 bar)
Test Pressure		15,000 psi (1,034 bar)
Design Temperature		-18°C to 121°C (0°F to +250°F)
Maximum Tensile Loading @ MWP		Up to 400,000 lbs (1,779,288 N)
Maximum Tensile Loading @ 0 psi / Bar		1,000,000 lbs (4,448,220 N)
Torsion Capacity		30,000 ft lbs (40,675 Nm)
Pump Through Capability		Yes
Pressure Differential Support Facility	Above Ball	10,000 psi (690 bar)
	Below Ball	10,000 psi (690 bar)
Overall Length		42.435 in (1078 mm)
Outside Diameter (Max)		15.260 in (4388 mm)
Internal Diameter (Min)		7.365 in (187 mm)
Valve Failure mode		Fail-As-Is
Hydraulic Control Working Pressure		10,000 psi (690 Bar)
Hydraulic Control Fluid Cleanliness		Up to AS 4059 Class 6B through to F
Chemical Injection Facility		Injection below Ball
Chemical Injection Working Pressure		10,000 psi (690 bar)
Weight Approximately		1235 lbs (560 kgs)

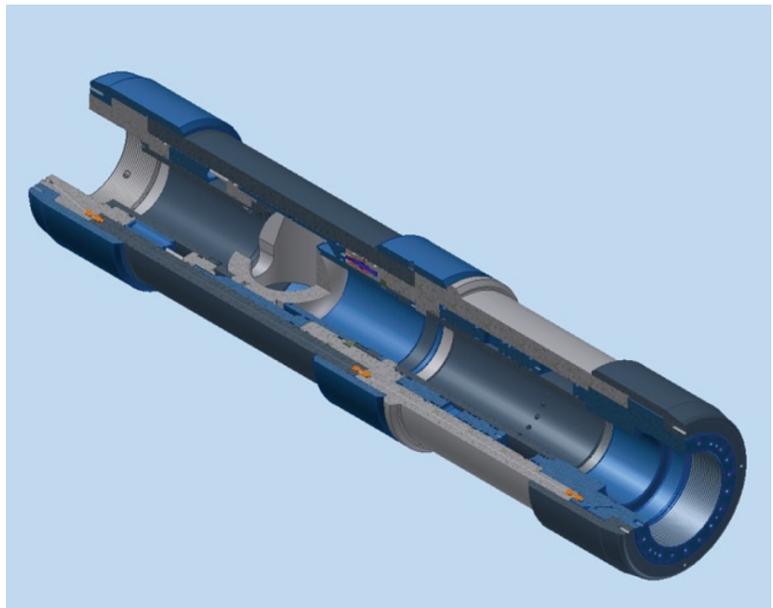
## ELSA-LB (Large Bore)

### The Retainer Valve

The retainer valve (RV) forms an integral part of the subsea landing string for well test or intervention operations. It is situated above the shear sub within the BOP stack. In the event of an emergency the RV acts as an environmental valve reducing the spill of hydrocarbons into the environment.

The RV is configurable to be 'failsafe close' or 'fail as is' and would be set up as per hazard and operability study (HAZOP) requirements prior to deployment. To cycle the ball to the open position, control fluid is pumped into the ball open line, displacing the piston/mandrel assembly; the displaced fluid will vent up the ball close line. The valve is either closed by pumping fluid into the ball close line and allowing it to vent into the ball open line or allowing the spring pack to close the mechanism. Once the ball is in the fully closed position an interlock (which can be disabled, depending on the selected failure mode) is opened allowing control fluid to move the vent sleeve into the open position and equalise pressure between production bore and marine riser. The vent sleeve is cycled into the closed position before the ball valve is opened again.

For well isolation purposes the valve is designed to hold pressure differential from above only.



#### Features:

- To retain the contents of the landing string above the ball after disconnection
- To vent the production bore pressure between the RV and the subsea test tree (SSTT) to the marine riser prior to disconnection of the SSTT
- To provide a slick diameter for the annular preventer to seal around (BOP spaceout dependant)
- To provide hydraulic interlock feature between the RV and SSTT latch assembly to ensure the RV has fully sequenced prior to disconnection (optional)
- To provide through porting capability for hydraulic control lines
- To provide a pressure tight barrier between the well bore and BOP stack
- To provide a bore large enough to accommodate plugs or tool strings specified by the customer
- Coil tubing cutting – (optional)

## ELSA-LB (Large Bore)

### The Retainer Valve

#### Technical Specifications:

Service	H <sub>2</sub> S NACE MR 0175 + CO <sub>2</sub>
Maximum Working Pressure	10,000 psi (690 bar)
Test Pressure	15,000 psi (1,034 bar)
Design Temperature	-18°C to 121°C (0°F to +250°F)
Maximum Tensile Loading @ MWP	Up to 400,000 lbs (1,779,288 N)
Maximum Tensile Loading @ 0 psi / Bar	1,000,000 lbs (4,448,220 N)
Torsion Capacity	30,000 ft lbs (40,675 Nm)
Pump Through Capability	No Facility
Pressure Differential Support Facility From Above Only	10,000 psi (690 bar)
Overall Length (Shoulder to Shoulder)	79.05 in (2008 mm)
Outside Diameter (Max)	17.625 in (448 mm)
Production Bore Internal Diameter (Min)	7.365 in (187 mm)
Valve Failure mode	Fail-Safe-Close or Fail as Is
Hydraulic Control Working Pressure	10,000 psi (690 bar)
Hydraulic Control Fluid Cleanliness	Up to AS 4059 Class 6B through to F
Through Bore Hydraulic Lines	Up to 18
Weight Approximately	3649 lbs (1655 kgs)

## ELSA-LB (Large Bore) – DH Mode Only

### The Subsea Test Tree

The subsea test tree (SSTT) forms an integral part of the subsea landing string for well test or intervention operations, and mimics the functionality of the blowout preventer (BOP) stack. It provides an operable primary safety system to control tubing pressure with dual barrier isolation in the event of an undesired situation or emergency.

The upper ball within the SSTT is capable of cutting wireline and/or coil tubing. The SSTT has a latch arrangement which is capable of multiple unlatch/latch operations. The latch assembly also isolates the hydraulics after disconnection and facilitates communication upon reconnection. Should all hydraulic pressure be lost downhole then a secondary disconnect can be performed with the application of pressure below the closed annular element. To open either valve, hydraulic pressure is applied to the open side of the actuation piston which compresses the spring pack, and an offset camming pin arrangement rotates the ball to the open position. To close either valve the open hydraulic pressure is vented to allow the spring pack to push the piston, which in turn closes the ball. Inherent to the valve is an interlock with the retainer valve that ensures the well is isolated prior to disconnection.

Functional redundancy can be provided via a secondary system that is activated independently from the primary hydraulic circuit; pressure manipulation from surface through the choke / kill lines below the BOP pipe rams will access a pre-arranged sequential set of shuttles that direct the pressure to the desired function.

#### Features:

- To provide a means to isolate the well
- To provide a means to disconnect safely from the well
- By being compact in size, thus facilitating the closure of the BOP pipe/shear rams
- To provide a connectable conduit for hydraulic control functions for the tree vendor and down hole functions
- To provide secondary methods for disconnection, closure and THRT disconnection
- To allow chemicals to be injected directly into the well stream through a dual sealing/backflow valve arrangement, with injection point between the balls
- To provide a pressure tight barrier between the well bore and BOP stack
- To provide a bore large enough to accommodate plugs or tool strings specified by the customer
- To facilitate the pressure testing of the landing string above the upper ball
- Latch retrieval tool profile (LRT) – optional



## ELSA-LB (Large Bore) – DH Mode

### The Subsea Test Tree

#### Technical Specifications:

Service		H <sub>2</sub> S NACE MR 0175 + CO <sub>2</sub>
Maximum Working Pressure		10,000 psi (690 bar)
Test Pressure		15,000 psi (1,034 bar)
Design Temperature		-18°C to 121°C (0°F to +250°F)
Maximum Tensile Loading @ MWP		Up to 400,000 lbs (1,779,288 N)
Maximum Tensile Loading @ 0 psi / Bar		1,000,000 lbs (4,448,220 N)
Torsion Capacity		30,000 ft lbs (40,675 Nm)
Pump Through Capability		Yes
Pressure Differential Support Facility	Above Upper Ball Only	4,000 psi (276 bar)
	Below Ball Valves	10,000 psi (690 bar)
Overall Length (Shoulder to Shoulder)		Up to 101.95 in (2590 mm) *Slick Joint Dependent
Slick Joint Diameter (project dependant)		9.625 in (245 mm)
Outside Diameter (Maximum)		18.550 in (471 mm)
Production Bore Internal Diameter (Minimum)		7.365 in (187 mm) * Slick Joint Dependent
Valve Failure mode		Fail-Safe-Close
Hydraulic Control Working Pressure	Open and Close	6,000 psi (414 bar)
Hydraulic Control Fluid Cleanliness		Up to AS 4059 Class 6B through to F
Through Bore Hydraulic Lines		10
Through Bore Hydraulic Control Working Pressure		10,000 psi (690 bar)
Chemical Injection Facility		Injection Between Balls
Chemical Injection Facility Working Pressure		10,000 psi (690 bar)
Coil Tubing Cutting Capability		Ø 2.375 in x 0.203 in WT(80Kpsi yield) c/w 0.438" Mono-conductor
Weight Approximately		3565 lbs (1629 kgs)

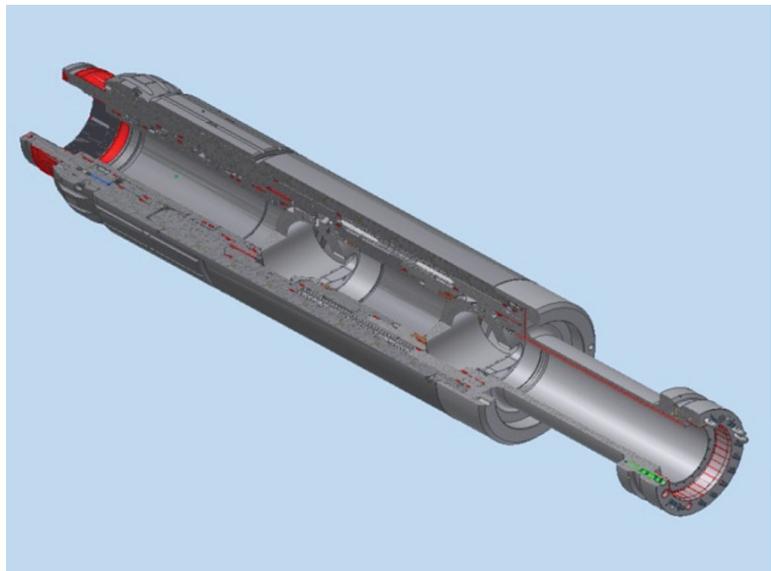
## ELSA-LB (Large Bore) – EH Mode

### The Subsea Test Tree

The subsea test tree (SSTT) forms an integral part of the subsea landing string for well test or intervention operations, and mimics the functionality of the BOP stack. It provides an operable primary safety system to control tubing pressure with dual barrier isolation in the event of an undesired situation or emergency. The SSTT can be deployed direct or electro hydraulically.

The upper ball within the SSTT is capable of cutting wireline and/or coil tubing. The SSTT incorporates a disconnect / reconnect feature, which in conjunction with the Electro-Hydraulic controls will give the required disconnect criteria required whilst operating from a DP vessel. The SSTT has a high debris tolerant, high tensile latch arrangement, which is capable of multiple unlatch/latch operations. The latch assembly also isolates the hydraulics after disconnection and facilitates communication upon reconnection. Should all hydraulic pressure be lost downhole then a secondary disconnect can be performed with the application of pressure below the closed annular element. To open either valve, hydraulic pressure is applied to the open side of the actuation piston which compresses the spring pack, and an offset camming pin arrangement rotates the ball to the open position. To close either valve the open hydraulic pressure is vented to allow the spring pack to push the piston, which in turn closes the ball. Inherent to the valve is an interlock that ensures the well is isolated prior to disconnection.

Functional redundancy can be provided via a secondary system that is activated independently from the primary hydraulic circuit; pressure manipulation from surface through the choke / kill lines below the BOP pipe rams will access a pre-arranged sequential set of shuttles that direct the pressure to the desired function.



#### Features:

- To provide a means to isolate the well
- To provide a means to disconnect safely from the well
- By being compact in size, thus facilitating the closure of the BOP pipe/shear rams
- To provide a connectable conduit for hydraulic control functions for the tree vendor and down hole functions
- To provide secondary methods for disconnection, closure and THRT disconnection
- To allow chemicals to be injected directly into the well stream through a dual sealing/backflow valve arrangement, with injection points between the balls
- To provide a pressure tight barrier between the well bore and BOP stack
- To provide a bore large enough to accommodate plugs or tool strings specified by the customer
- To facilitate the pressure testing of the landing string above the upper ball
- Latch retrieval tool profile (LRT)

## ELSA-LB (Large Bore) – EH Mode

### The Subsea Test Tree

#### Technical Specifications:

Service		H <sub>2</sub> S NACE MR 0175 + CO <sub>2</sub>
Maximum Working Pressure		10,000 psi (690 bar)
Test Pressure		15,000 psi (1,034 bar)
Design Temperature		-18 °C to 121 °C (0°F to +250°F)
Maximum Tensile Loading @ MWP		Up to 400,000 lbs (1,779,288 N)
Maximum Tensile Loading @ 0 psi / Bar		1,000,000 lbs (4,448,220 N)
Torsion Capacity		30,000 ft lbs (40,675 Nm)
Pump Through Capability		Yes
Pressure Differential Support Facility	Above Upper Ball Only	4,000 psi (276 bar)
	Below Ball Valves	10,000 psi (690 bar)
Overall Length (Shoulder to Shoulder)		105 in (2667 mm) *Slick Joint Dependent
Slick Joint Diameter(project dependant)		9.625 in (245 mm)
Outside Diameter (Maximum)		18.550 in (471 mm)
Production Bore Internal Diameter (Minimum)		7.365 in (187 mm) *Slick Joint Dependent
Valve Failure mode		Fail-Safe-Close
Hydraulic Control Working Pressure	Open and Close	6,000 psi (414 bar)
Minimum Hydraulic Control Fluid Cleanliness		Up to AS 4059 Class 6B through to F
Through Bore Hydraulic Lines		10
Through Bore Hydraulic Control Working Pressure		10,000 psi (690 bar)
Chemical Injection Facility		Injection Between Balls
Chemical Injection Working Pressure		10,000 psi (690 bar)
Coil Tubing Cutting Capability		Ø 2.375 in x 0.203 in WT(80Kpsi yield) c/w 0.438" Mono-conductor
Weight Approximately		4599 lbs (2086 kgs) inc. slickjoint