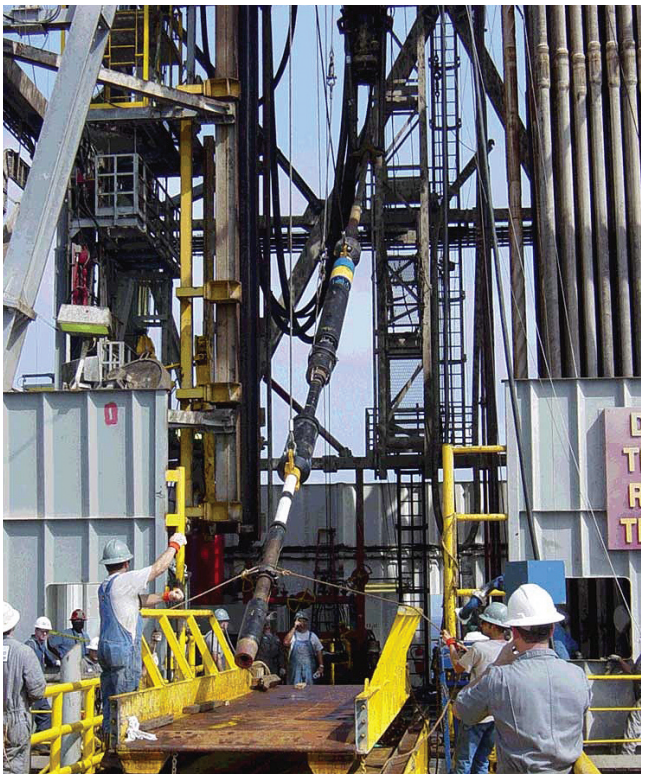
ELSA®-EA (Exploration and Appraisal)

The ELSA®-EA has been developed to service the exploration and appraisal market. Originally introduced nearly thirty years ago, systems have evolved to meet operational demands and client's requirements. The landing string systems are designed and qualified up to 15,000 psi, 300 degF and 10,000ft water depth.



These landing string systems provide our clients with the safety and reliability required to conduct well testing operations in fields with these challenging conditions. The landing string systems are designed to operate with direct hydraulic (DH) and electro hydraulic (EH) control systems.

In addition Expro has developed tools for specific applications such as high rate testing as well as well testing operations requiring an Electric Submersible Pump (ESP).

All systems include a subsea test tree, which provides a dual barrier to isolate the well and a disconnect facility from the well in case of emergency. A retainer valve is added to the system just above the BOP shear rams ensuring the landing string contents is isolated upon disconnect. Single or dual lubricator valves can be provided to allow safe deployment of intervention tool strings.

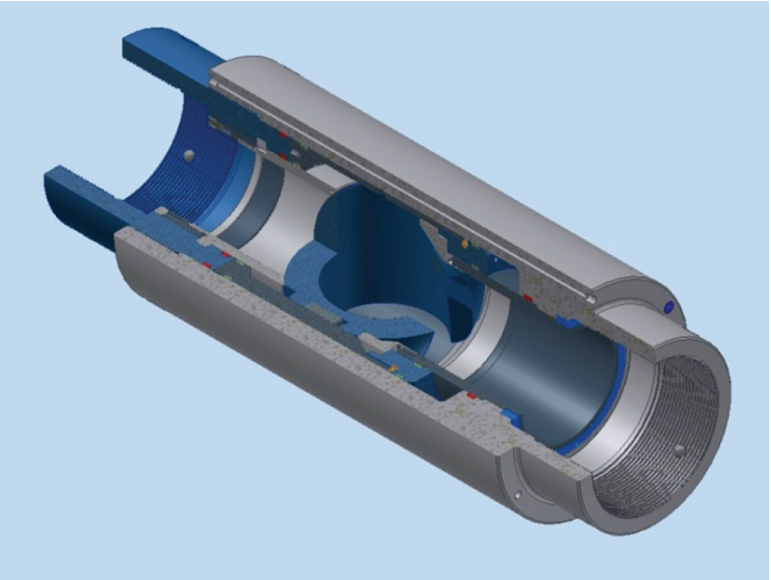
Features:	Benefits:
Cutting Capability	Guarantees well isolation
Pump through Capability	Ability to kill well
Independent Ball Closure	Allowing one ball to cut coiled tubing or wire and other ball to seal
Small Operating Volumes	Rapid response well isolation and unlatch
Redundancy	Secondary unlatching system
Downhole Functionality	optional to allow permanent monitoring cable, SSSV control line or chemical injection line to pass across disconnect point of subsea test tree

ELSA®-EA (Exploration and Appraisal)

The Lubricator Valve

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

ELSA®-EA (Exploration and Appraisal)

The Lubricator Valve

Technical Specifications:	
Standards	API 6A - specification for wellhead and christmas tree equipment API 14A - specification for subsurface safety valve equipment
Service	NACE MR0175 / ISO 15156 - materials for use in H_2S - containing environments in oil and gas production
Maximum working pressure	10,000 psig (690 bar)
Design temperature	0°F to 250°F (-18°C to 121°C)
Maximum tensile load @ W.P	400,000 lbs (1,779 kN)
Maximum tensile load @ 0psi	560,000 lbs (2,491 kN)
Max torque	up to 8,000ft lbs
Minimum internal diameter	3" (7.62cm)
Maximum external diameter	12.5" (31.75cm)
Pump through capability	Yes
Differential pressure support from below	10,000 psig (690 bar)
Cutting capability	Optional
HPHT	
Standards	API 6A - specification for wellhead and christmas tree equipment API 14A - specification for subsurface safety valve equipment
Service	NACE MR0175 / ISO 15156 - materials for use in H_2S - containing environments in oil and gas production
Maximum working pressure	15,000 psig (1035 bar)
Maximum tensile load @ WP	up to 350,000 lbs (1,556 kN)
Maximum tensile load @ 0psi	up to 600,000lbs (2,668 kN)
Design temperature 0°F	up to 350°F (-18°C to 177°C)
Max torque	up to 12,000ft lbs
Internal diameter	2.75" (6.99cm) up to 3" (7.62cm)
Maximum external diameter	Up to 15,755" (40.02cm)
Pump through capability	Yes
Differential pressure support from below	15,000 psig (1035 bar)
Cutting capability	Optional
High Rate	
Standards	API 6A - specification for wellhead and christmas tree equipment API 14A - specification for subsurface safety valve equipment
Service	NACE MR0175 / ISO 15156 - materials for use in H_2S - containing environments in oil and gas production
Maximum working pressure	10,000 psig (690 bar)
Maximum tensile load @ WP	400,000 lbs (1,779 kN)
Maximum tensile load @ 0 psi	828,000lbs (3,683 kN)
Design temperature	0°F to 250°F (-18°C to 121°C)
Max torque	up to 8,000ft lbs
Minimum internal diameter	5" (12.7cm)
Maximum external diameter	13" (33.02cm)
Pump through capability	Yes
Differential pressure support from below	10,000 psig (690 bar)
Cutting capability	Optional

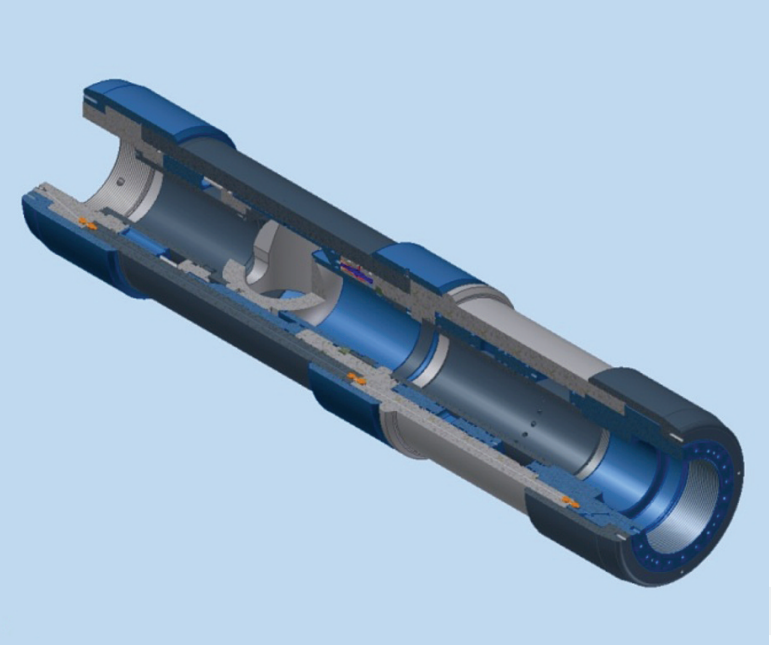
ELSA®-EA (Exploration and Appraisal)

The Retainer Valve

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

The RV is configurable to be 'fail-safe 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, this allows 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 space out 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
- Integral part of the production string enabling hydrocarbons to flow to surface
- To provide a bore large enough to accommodate plugs or tool strings specified by the customer
- Coil tubing cutting – (optional)

ELSA®-EA (Exploration and Appraisal)

The Retainer Valve

Technical Specifications:	
Standards	API 6A - specification for wellhead and christmas tree equipment API 14A - specification for subsurface safety valve equipment
Service	NACE MR0175 / ISO 15156 - materials for use in H_2S - containing environments in oil and gas production
Maximum working pressure	10, 000 psig (690 bar)
Design temperature	0°F to 250°F (-18°C to 121°C)
Maximum tensile load @ WP	400,000 lbs (1,779 kN)
Maximum tensile load @ 0 psi	560,000 lbs (2,491 kN)
Max torque	up to 8,000ft lbs
Minimum internal diameter	3" (7.62cm)
Maximum external diameter	10.75" (27.31cm)
Differential pressure support from above	10,000 psig (690 bar)
Cutting capability	No
HPHT	
Standards	API 6A - specification for wellhead and christmas tree equipment API 14A - specification for subsurface safety valve equipment
Service	NACE MR0175 / ISO 15156 - materials for use in H_2S - containing environments in oil and gas production
Maximum working pressure	15,000 psig (1035 bar)
Maximum tensile load @ WP	up to 350,000 lbs (1,556 kN)
Maximum tensile load @ 0 psi	up to 600,000 lbs (2,668 kN)
Design temperature	0°F up to 350°F (-18°C to 177°C)
Max torque	up to 15,000ft lbs
Internal diameter	2.75" (6.99cm) up to 3" (7.62cm)
Maximum external diameter	up to 12.89" (32.74cm)
Differential pressure support from above	15,000 psig (1035 bar)
Cutting capability	No
High Rate	
Standards	API 6A - specification for wellhead and christmas tree equipment API 14A - specification for subsurface safety valve equipment
Service	NACE MR0175 / ISO 15156 - materials for use in H_2S - containing environments in oil and gas production
Maximum working pressure	10,000 psig (690 bar)
Maximum tensile load @ WP	400,000 lbs (1,779 kN)
Maximum tensile load @ 0 psi	828,000lbs (3,683 kN)
Design temperature	0°F to 250°F (-18°C to 121°C)
Max torque	up to 8,000ft lbs
Minimum internal diameter	5" (12.7cm)
Maximum external diameter	13.5" (34.29cm)
Differential pressure support from above	10,000 psig (690 bar)
Cutting capability	No

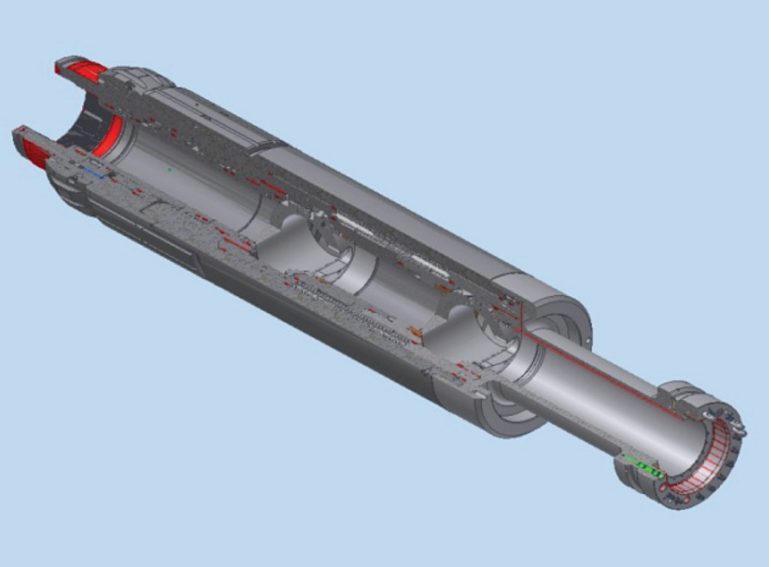
ELSA®-EA (Exploration and Appraisal)

The Subsea Test Tree

The subsea test tree (SSTT) forms an integral part of the subsea landing string for well test operations. The SSTT 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 SSTT is configured with one ball valve capable of cutting wireline and/or coil tubing, while the second valve (ball or flapper) guarantees well isolation. The SSTT has a latch arrangement which is capable of multiple unlatch/latch operations without the requirement of retrieval to surface. Should all hydraulic pressure be lost downhole, a secondary disconnect can be performed with the application of pressure below the closed annular ram or mechanically.

Inherent to the valve is an interlock with the retainer valve that ensures the well is isolated prior to disconnection.



Features:

- To provide a means to isolate the well
- To provide a means to disconnect safely from the well
- Compact in size, thus facilitating the closure of the BOP pipe rams below and shear rams above the SSTT.
- To provide secondary methods for disconnection, closure.
- To allow chemicals to be injected directly into the well stream through a dual sealing/backflow valve arrangement, with injection point above or between the balls
- To provide a bore large enough to accommodate plugs or tool strings specified by the customer
- Downhole (below mudline) chemical injection - optional
- Latch retrieval tool profile (LRT) – optional

ELSA®-EA (Exploration and Appraisal)

The Subsea Test Tree

Technical Specifications:	
Standards	API 6A - specification for wellhead and christmas tree equipment API 14A - specification for subsurface safety valve equipment
Service	NACE MR0175 / ISO 15156 - materials for use in H_2S - containing environments in oil and gas production
Maximum working pressure	10, 000 psig (690 bar)
Design temperature	0°F to 250°F (-18°C to 121°C)
Maximum tensile load @ WP	400,000 lbs (1,779 kN)
Maximum Tensile load @ 0psi	560,000 lbs (2,491 kN)
Max torque	up to 8,000ft lbs
Minimum internal diameter	3" (7.62cm)
Maximum external diameter	12.5" (31.75cm)
Pump through capability	Yes
Differential pressure support from below	10,000 psig (690 bar)
Cutting capability	1.75", 0.134wt 80ksi c/w $^{7}/_{32}$" braided cable
HPHT	
Service	H_2S NACE MR 0175 CO_2
Standards	
Maximum working pressure	15,000 psig (1035 bar)
Maximum tensile load @ WP	up to 350,000 lbs (1,556 kN)
Maximum tensile load @ 0psi	up to 600,000lbs (2,668 kN)
Design temperature 0°F	up to 350°F (-18°C to 177°C)
Max torque	up to 12,000ft lbs
Internal diameter 2.75" (6.99cm)	up to 3" (7.62cm)
Maximum external diameter	up to 15,755" (40.02cm)
Pump through capability	Yes
Differential pressure support from below	15,000 psig (1035 bar)
Cutting capability	1.75", 0.134wt 80ksi c/w $^{7}/_{32}$" braided cable
High Rate	
Service	H_2S NACE MR 0175 + CO_2
Standards	
Maximum working pressure	10,000 psig (690 bar)
Maximum tensile load @ WP	400,000 lbs (1,779 kN)
Maximum tensile load @ 0psi	828,000lbs (3,683 kN)
Design temperature	0°F to 250°F (-18°C to 121°C)
Max torque	up to 8,000ft lbs
Minimum internal diameter	5" (12.7cm)
Maximum external diameter (SSTT)	18" (45.72cm)
Pump through capability	Yes
Differential pressure support from below	10,000 psig (690 bar)
Cutting capability	1.75", 0.134wt 80ksi c/w $^{7}/_{32}$" braided cable

ELSA®-EA (Exploration and Appraisal)
181218_v3