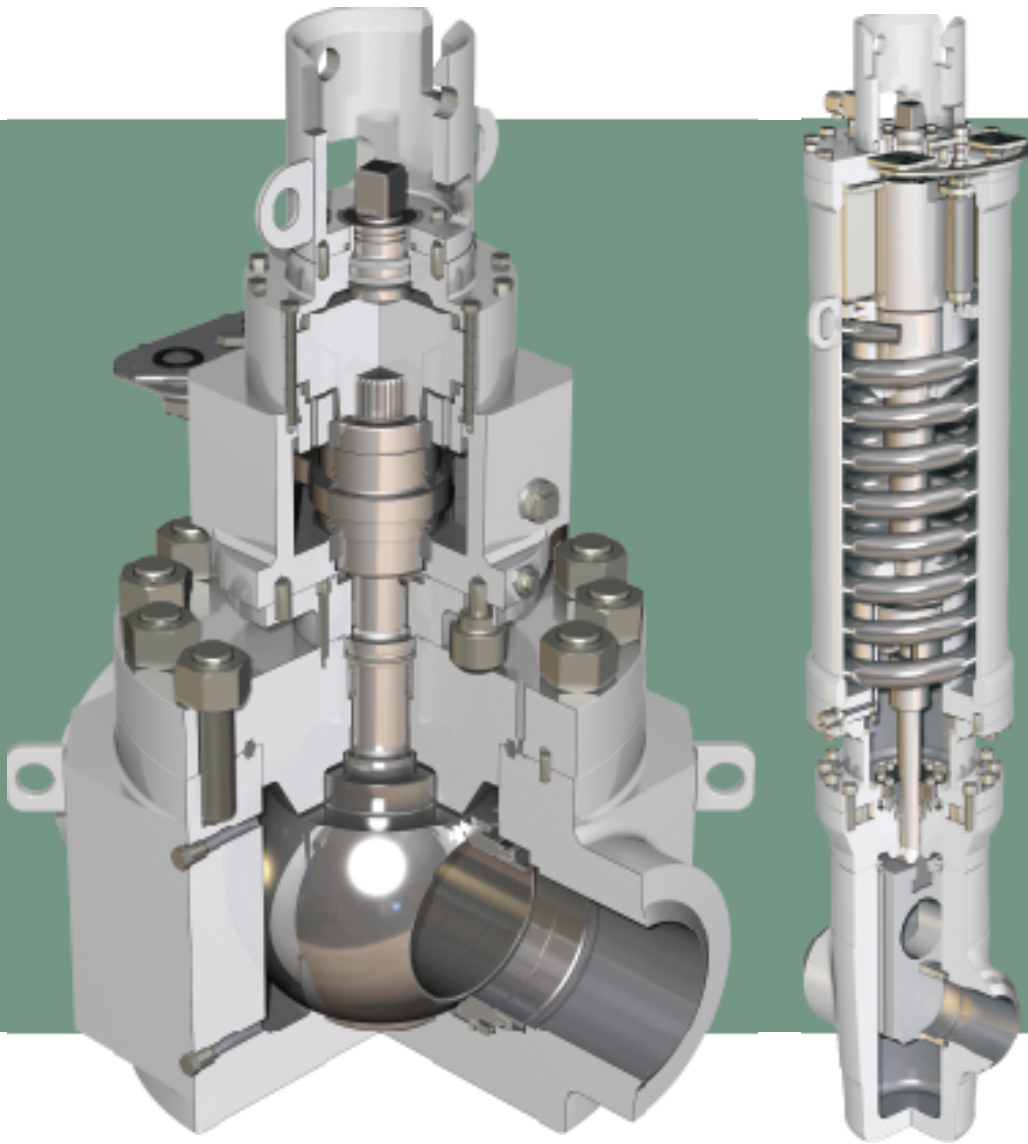
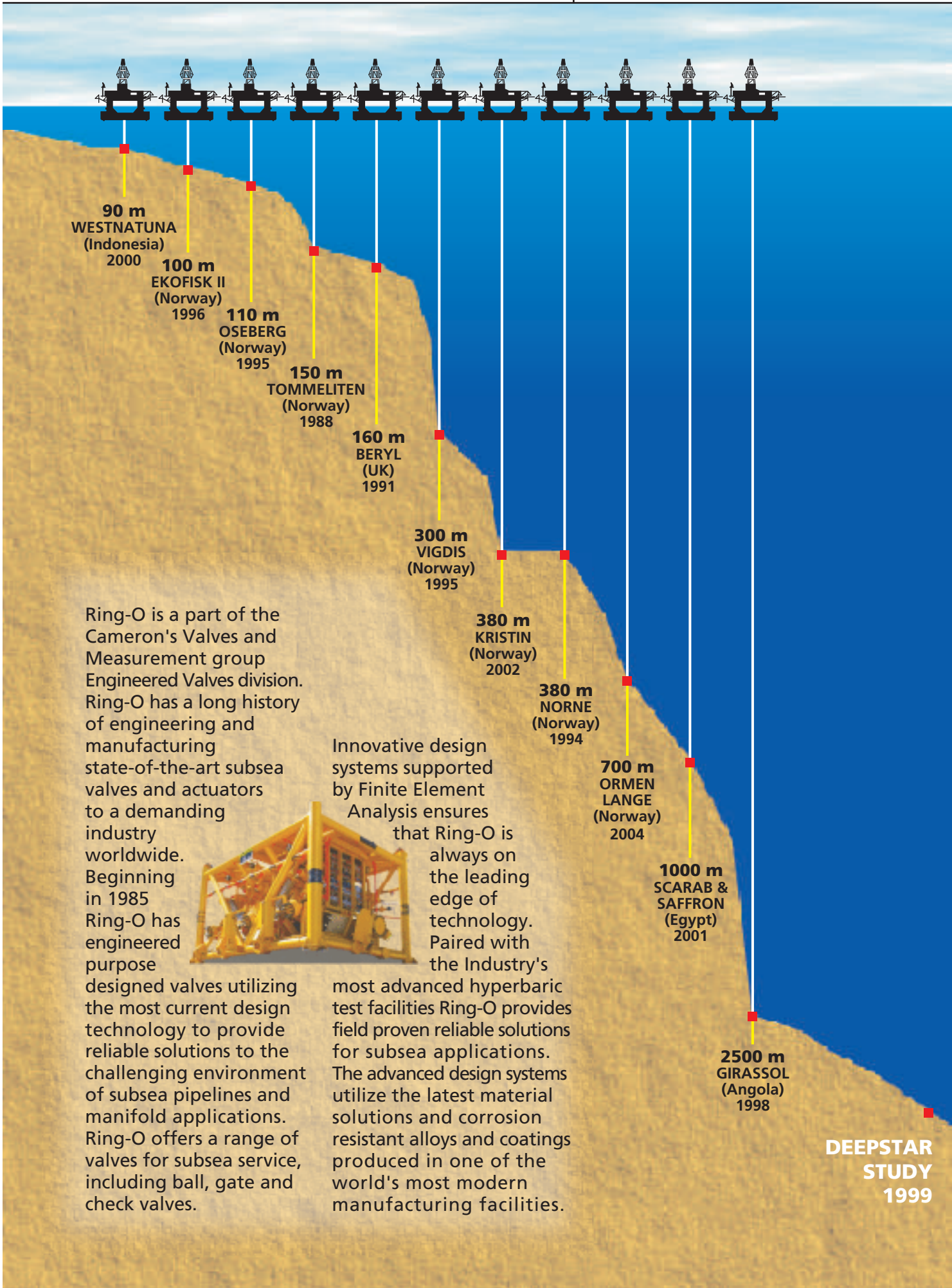


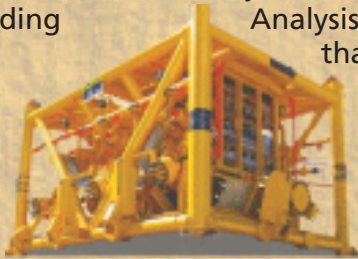
# RING-O<sup>®</sup> Valves and Actuators for Subsea Service



**RING-O<sup>®</sup>**



Ring-O is a part of the Cameron's Valves and Measurement group Engineered Valves division. Ring-O has a long history of engineering and manufacturing state-of-the-art subsea valves and actuators to a demanding industry worldwide. Beginning in 1985 Ring-O has engineered purpose designed valves utilizing the most current design technology to provide reliable solutions to the challenging environment of subsea pipelines and manifold applications. Ring-O offers a range of valves for subsea service, including ball, gate and check valves.



Innovative design systems supported by Finite Element Analysis ensures that Ring-O is always on the leading edge of technology. Paired with the Industry's most advanced hyperbaric test facilities Ring-O provides field proven reliable solutions for subsea applications. The advanced design systems utilize the latest material solutions and corrosion resistant alloys and coatings produced in one of the world's most modern manufacturing facilities.

**DEEPSTAR  
STUDY  
1999**

## SUBSEA SERVICE



In 1999 Ring-O installed one of the largest hyperbaric chambers in the industry, designed to simulate water depths of up to 3000 meters. The chamber dimensions are 2 meters in diameter and 6 meters high.

The maximum operating pressure is 300 BAR. Temperatures can be reduced to 2°C and maintained for the duration of testing.

The chamber has three external connections of 1 inch BSP and 29 connections of 1/2 inch BSP and adequate space for the standard equipment associated with hydraulic actuation and test monitoring equipment. This chamber enhances Ring-O's ability to meet the new API 6D SS Specification on Subsea Pipeline Valves which was adopted from ISO 14723. This standard requires new design features, such as hyperbaric testing and mandatory NDE.

The standard includes increased pressure testing durations and mandatory documentation requirements as well as a provision for supplemental

gas testing. Ring-O was issued and maintains the very first API 6D SS license in the industry and is uniquely qualified as Cameron's Valves & Measurement group Subsea Center for Excellence.

Ring-O has available all the hydraulic equipment, including a dedicated Hydraulic Power Unit, lab kit and personnel to keep the fluid clean to NAS 6 requirements.

Other test equipment is utilized as needed. Computers control sequential operations (cycling tests) and record data variables.

## SUBSEA DESIGN FEATURES

Subsea valve design is similar to equivalent topside valves, but has additional features to withstand the external pressure caused by the column of seawater at operating depths.

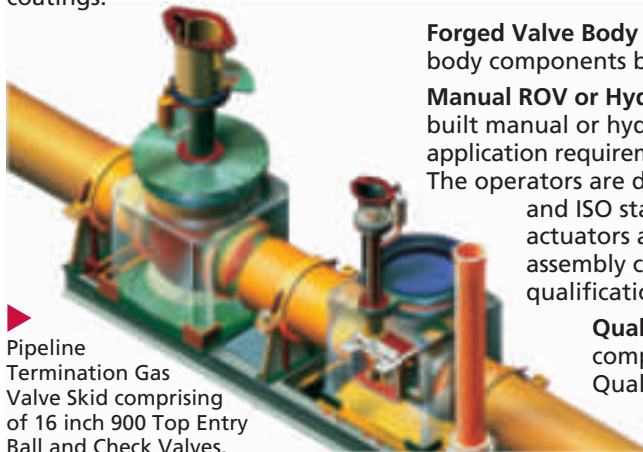
Subsea Valves typically have a design life equal to the design life of the pipeline. This can be up to 40 years, and valves placed in this type of service must be maintenance free for that lifetime. This is the most important design feature of Ring-O Subsea Valves. Ring-O designs and manufactures Subsea Ball Valves and Gate Valves for both pipeline and production applications.

### Recommendations for Subsea Valves include the following design features:

**Butt Weld Ends** - use of butt weld end connections eliminates leak paths that flange valves may have.

**Metal-to-Metal Sealing** The seat to body seal of both ball valves and gate valves can be either soft seated or Metal-to-Metal seated.

In critical subsea applications soft seated valves may become scratched by hard particles imbedded into the seat inserts by the flowing media. Metal-to-Metal seats are less likely to be affected by this and most of Ring-O's subsea valves feature Metal-to-Metal seats with sealing surfaces hardened by Tungsten Carbide or other hard faced coatings.



▶ Pipeline Termination Gas Valve Skid comprising of 16 inch 900 Top Entry Ball and Check Valves.

**Forged Valve Body and Bonnets** - Ring-O valves utilize forgings for critical body components because of the greater structural integrity over castings.

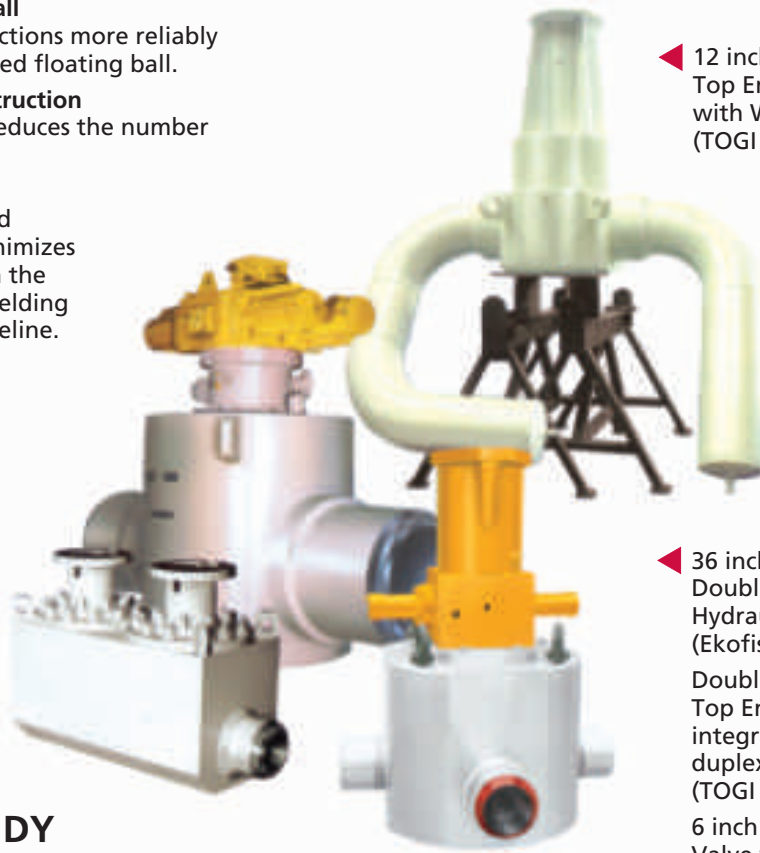
**Manual ROV or Hydraulic Operators** - Ring-O valves are fitted with purpose built manual or hydraulic operators made by Ring-O for the specific application requirements of the environment in which the valve will be used. The operators are designed and manufactured by Ring-O and meet all API and ISO standards required for ROV intervention. Because the actuators are designed by Ring-O the integrity of the valve design assembly can be tested and validated together through qualification testing.

**Qualification Testing** - Ring-O has completed the most comprehensive qualification testing in the industry. Qualification Testing is offered to prove designs prior to subsea deployment. The Ring-O facility is uniquely qualified to carry out these test requirements in-house.

## BALL VALVES

### Additional recommendations for the specific use of ball valves for subsea applications:

- **Trunnion Mounted Ball**  
The trunnion ball functions more reliably than the seat supported floating ball.
- **Top Entry Body Construction**  
The one-piece body reduces the number of leak paths.
- **Welded Pups**  
When factory installed prior to assembly, minimizes the impact of heat on the sealing areas when welding the valve into the pipeline.



◀ 12 inch 1500 Top Entry Ball Valve with Welded Pups (TOGI Project, Norway).

◀ 36 inch 900 Ball Valve with Double Acting Hydraulic Actuator (Ekofisk II Project, Norway).

Double-Block 6 inch 1500 Top Entry Ball Valve integrally made of forged duplex stainless steel (TOGI Project, Norway).

6 inch 1500 3-Way Ball Valve with Double Acting Hydraulic Actuator and ROV Interface (Troll Project, Norway).

## DEEP STAR STUDY

In 1999, as a voluntary contribution to the joint effort for the development of deep water technology. Ring-O Valve was part of the Deep Star Study project team set up to research and develop equipment for operation in over 10,000 feet of water in the Gulf of Mexico.

Deep Star brought together the industry's leading experts in a common multi-discipline forum to address technical issues confronting economically viable deepwater production.

The Deep Star Study focused on application of subsea and floating production systems for the Gulf of Mexico, however, much of the technology has equal usage on a worldwide basis.

### Ring-O Valve contributed two valves for examination and testing:

- 9 inch API 10,000 Through Conduit Gate Valve with a Hydraulic Linear Actuator.
- 9 inch API 10,000 Top Entry Ball Valve with a Hydraulic Rotary Actuator.



◀ 5-1/8 inch 740 BAR Gate Valve for the Norwegian Sector (Kristin/2002), featuring a manual ROV operated gear box with stem extension.

## GATE VALVES



◀ Ring-O Gate Valves are designed to meet API 6A or customer specifications.

Subsea Slab Gate Valves are used in subsea manifold applications and for isolation requirements.

They are available in soft seat or Metal-to-Metal seat configurations and can be manually, ROV or hydraulically actuated.

Fully or partially clad valves are available. This valve can be used in critical topside applications.

Double Expanding Gate Valves feature a "Bubble-Tight Double Expanding Gate" design with Double-Block capability.



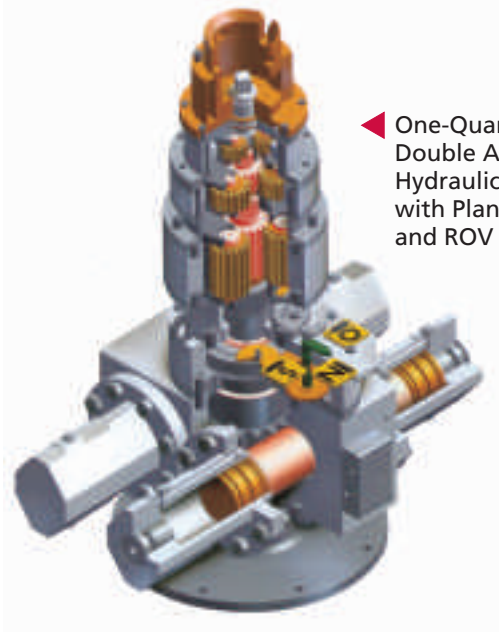
◀ 5 1/8 inch API 5,000 Gate Valve with ROV Interface (Girassol Project, West Africa).

9 inch API 10,000 Gate Valve with Mechanical Actuator for Manifold Isolation (Lillefrigg Project, Norway).

5 1/8 inch API 5,000 Gate Valve with Hydraulic Actuator and ROV Interface (Laminaria & Corallina, Australia).

## ACTUATORS

Ring-O provides a broad line of quarter-turn and linear actuators for subsea service to cover the complete range of ball and gate valves with a wide range of operating torques.



◀ One-Quarter Turn Double Acting Hydraulic Actuator with Planetary Gear and ROV Interface.



▲ One-Quarter Turn Single Acting Spring Return Hydraulic Actuator and ROV Interface.

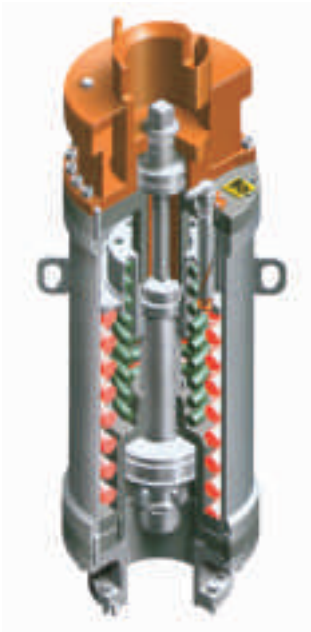
## ROV INTERFACE

When a valve is to be operated by a Remote Operated Vehicle, an interface receptacle is provided to meet the client's requirements. ▶

The interface may be required for direct drive of ROV actuated valves, as well as for valves with actuators.

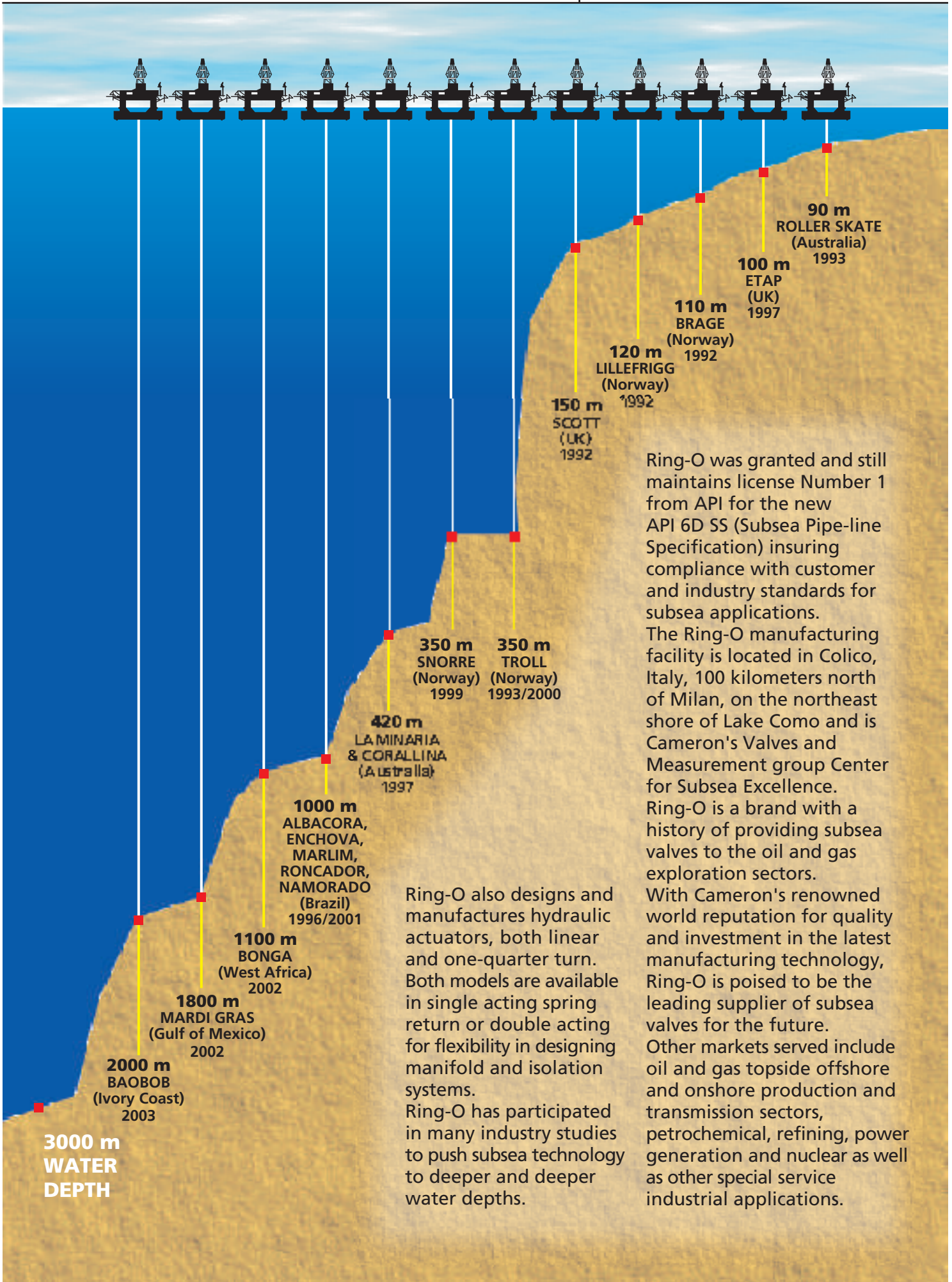
API 17D, which provides standards for various intervention fixtures, may be used as a reference.

The interface can be customized for special torques and design loads with extensions rods and vertical or horizontal operation.



▲ Single Acting Spring Return Hydraulic Linear Actuator and ROV Interface.





Ring-O was granted and still maintains license Number 1 from API for the new API 6D SS (Subsea Pipe-line Specification) insuring compliance with customer and industry standards for subsea applications.

The Ring-O manufacturing facility is located in Colico, Italy, 100 kilometers north of Milan, on the northeast shore of Lake Como and is Cameron's Valves and Measurement group Center for Subsea Excellence.

Ring-O is a brand with a history of providing subsea valves to the oil and gas exploration sectors.

With Cameron's renowned world reputation for quality and investment in the latest manufacturing technology, Ring-O is poised to be the leading supplier of subsea valves for the future.

Other markets served include oil and gas topside offshore and onshore production and transmission sectors, petrochemical, refining, power generation and nuclear as well as other special service industrial applications.

Ring-O also designs and manufactures hydraulic actuators, both linear and one-quarter turn. Both models are available in single acting spring return or double acting for flexibility in designing manifold and isolation systems. Ring-O has participated in many industry studies to push subsea technology to deeper and deeper water depths.

**3000 m  
WATER  
DEPTH**



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