

Balmoral Subsea Test Centre

Hydrostatic, mechanical and laboratory testing



The industry's most comprehensive, accessible and commercially available hyperbaric facility opened its doors in 2018 when the new Balmoral Subsea Test Centre was launched. With more than £20m being spent on the centre a wide range of test facilities is available to third parties spanning the subsea, renewables, defence and oceanographic sectors.



Hydrostatic testing

Substantial investment has been made in improving and expanding the Balmoral Subsea Test Centre which is now the most comprehensive commercially available hydrostatic test facility in Europe.

Upgraded vessels, 5, 20 and 40 tonne lifting cranes, remote monitoring software and procedures are in place offering independent testing for all types of subsea equipment to 7000msw (700bar) equivalent.

Standard tests include:

- Uplift determination
- Water ingress
- Instrumented buoyancy loss
- Hydrostatic compression and creep
- Hydrostatic collapse
- Bulk modulus
- Buckle arrestment performance
- Subsea controls testing
- Valve testing

The hydrostatic vessels use air driven liquid pumps and can accommodate electric, hydraulic and instrumentation connections. Each vessel can be fitted with chart recorders, pressure and temperature data loggers that provide highly detailed results for analysis, while a computer controlled hydrostatic test system that automatically performs customisable tests using high capacity intensifier pumps via touch screen is available on vessels TC1, 2 and 3. This allows pressure and temperature data to be fed back to a networked server providing remote real-time test monitoring.

A pan and tilt subsea camera can be placed in the vessels to visually monitor tests when required.

Mechanical testing

Balmoral's multi-purpose load rig performs the following test-types and is available for third party use:

- Axial and lateral slip loads to 60t
- Static loading and 3-point bend to 100t
- Bend restrictor/stiffener load to 10t
- Bend restrictor locking radius measurement under load
- Compression and shear testing on companion cylinders to 200t and tensile testing to 150t
- Dropped weight and swing arm impact testing
- Lifting point/insert load testing





Development and test laboratories

Due to the complexities of bespoke project testing, stringent customer specifications and compliance to standards such as API 17L1, Balmoral continually invests in state-of-the-art laboratory test equipment to ensure these requirements are satisfied. This programme of investment ensures the company retains total control over time schedules, test conditions and methodologies used to fulfil customer requirements.

Balmoral's technical team works from the company's new custom designed and purpose built laboratories at company HQ in Aberdeen – a state-of-the-art temperature and humidity controlled environment that is fully furnished with a wealth of chemical, thermal, hydrostatic and mechanical test equipment.

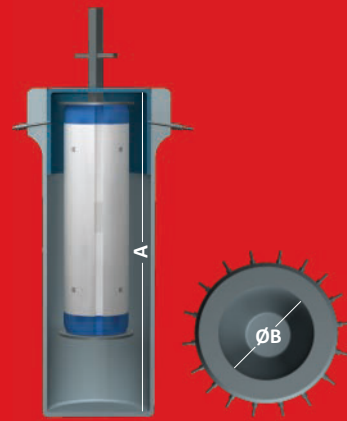
- A range of universal testing machines (10 tonnes maximum load) capable of performing fatigue, tensile, compression, flexure and hydrostatic pressure testing using a complementary pressure vessel at temperatures of -70°C to $+350^{\circ}\text{C}$
- Dynamic fatigue test equipment for testing polyurethane materials fully submerged at elevated temperature
- Differential scanning calorimeters for determining specific heat capacity, glass transition temperatures and oxidation induction time of polymer products
- Lasercomp Fox 50 thermal analyser for the determination of thermal conductivity
- Gas pycnometers for determining the true density of materials such as powders and gels
- Temperature controlled water ageing baths
- Hydrothermal ageing cells for long term analysis of materials up to 260°C
- Laboratory scale pressure vessels capable of operating at sub-ambient temperature to 200°C and up to 10,150psi, 700bar
- Temperature and humidity environmental cabinets
- UV weathering cabinet
- Karl Fischer titrator for determination of water content
- Automated titrators for quantitative analysis
- Lab scale CNC machine for test piece preparation

As well as providing professional in-house services, the development laboratory is available for third party development and testing programmes.

Hydrostatic test vessels

The Balmoral Subsea Test Centre offers 23 test vessels, each with its own characteristics. Most vessels can be fitted with electronic equipment allowing tests to be monitored remotely.

Ranging from 1010mm (3'3") to 10,400mm (35'6") in length, with internal diameters of 360mm (14") to 2500mm (98") and testing to pressure equivalents of 700bar (10,150psi), most products and components are readily accommodated.



Vessel specifications

Vessel	Orientation	Internal length - A		Internal dia - B		Safe working pressure		Fresh water temp °C	Penetrator quantity	Penetrator ID mm	Crane capability Tonnes
		mm	ft/in	mm	ft/in	psi	bar				
TC 1	Vertical	8,970	29' 5"	2,500	8' 2"	6,880	475	Ambient	8	100	40
TC 2	Vertical	7,010	23'	1,800	5' 10"	6,880	475	Ambient to 50	2	100	40
TC 3	Vertical	7,200	23' 7"	1,830	6'	5,940	410	Ambient	2	80	40
TC 4	Vertical	2,500	8' 2"	500	1' 7"	7,680	530	Ambient	2	60	40
TC 5	Vertical	2,500	8' 2"	500	1' 7"	7,680	530	Ambient	2	60	40
TC 6	Vertical	2,500	8' 2"	500	1' 7"	7,680	530	Ambient	2	60	40
TC 7	Vertical	2,500	8' 2"	500	1' 7"	7,680	530	Ambient	2	60	40
TC 8	Vertical	2,500	8' 2"	500	1' 7"	7,680	530	Ambient	2	60	40
TC 9	Vertical	2,500	8' 2"	500	1' 7"	7,680	530	Ambient	2	60	40
TC 10	Vertical	2,500	8' 2"	500	1' 7"	10,150	700	Ambient	2	60	40
TC 11	Vertical	2,500	8' 2"	500	1' 7"	10,150	700	Ambient	2	60	40
TC 12	Vertical	2,500	8' 2"	500	1' 7"	10,150	700	Ambient	2	60	40
TC 13	Vertical	2,500	8' 2"	500	1' 7"	10,150	700	Ambient	2	60	40
TC 14	Vertical	2,500	8' 2"	500	1' 7"	10,150	700	Ambient to 50	2	60	40
TC 15	Vertical	2,500	8' 2"	500	1' 7"	10,150	700	Ambient to 50	2	60	40
TC 16	Horizontal	10,400	34' 1"	1,320	4' 3"	5,190	358	Ambient	2	70	12
TC 17	Vertical	5,000	16' 5"	1,520	4' 11"	1,390	96	Ambient	2	60	12
TC 18	Vertical	6,000	19' 8"	1,570	5' 1"	2,240	155	Ambient	2	60	12
TC 19	Vertical	7,000	22' 11"	1,570	5' 1"	6,380	440	Ambient	2	60	12
TC 20	Vertical	2,380	7' 9"	482	1' 7"	10,150	700	Ambient	3	25	12
TC 21	Vertical	2,380	7' 9"	482	1' 7"	10,150	700	Ambient	3	25	12
TC 22	Vertical	2,380	7' 9"	482	1' 7"	10,150	700	Ambient to 50	3	25	12
TC 23	Vertical	1,010	3' 3"	360	1' 2"	5,940	410	Ambient	1	50	12

Submersion test tanks

Test tanks are available for the following procedures:

- Product weight in water and air
- ROV submersion and functionality
- Submersion and gas leakage
- Underwater NDT inspection
- Flotation
- Riser testing
- Abandonment and cutting tool trials
- Stack up trials

Submersion test tank specifications

Tank	Length		Width		Depth		Fresh water temp °C	Crane capability Tonnes
	mm	ft/in	mm	ft/in	mm	ft/in		
Test tank 1	6,500	21' 3"	3,500	11' 5"	4,000	13'	Ambient	40
Test tank 2	6,600	21' 6"	2,300	7' 5"	2,200	7' 2"	Ambient	12
Test tank 3	Ø9,000	29' 6"	Ø9,000	29' 6"	4,500	14' 9"	Ambient	-



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