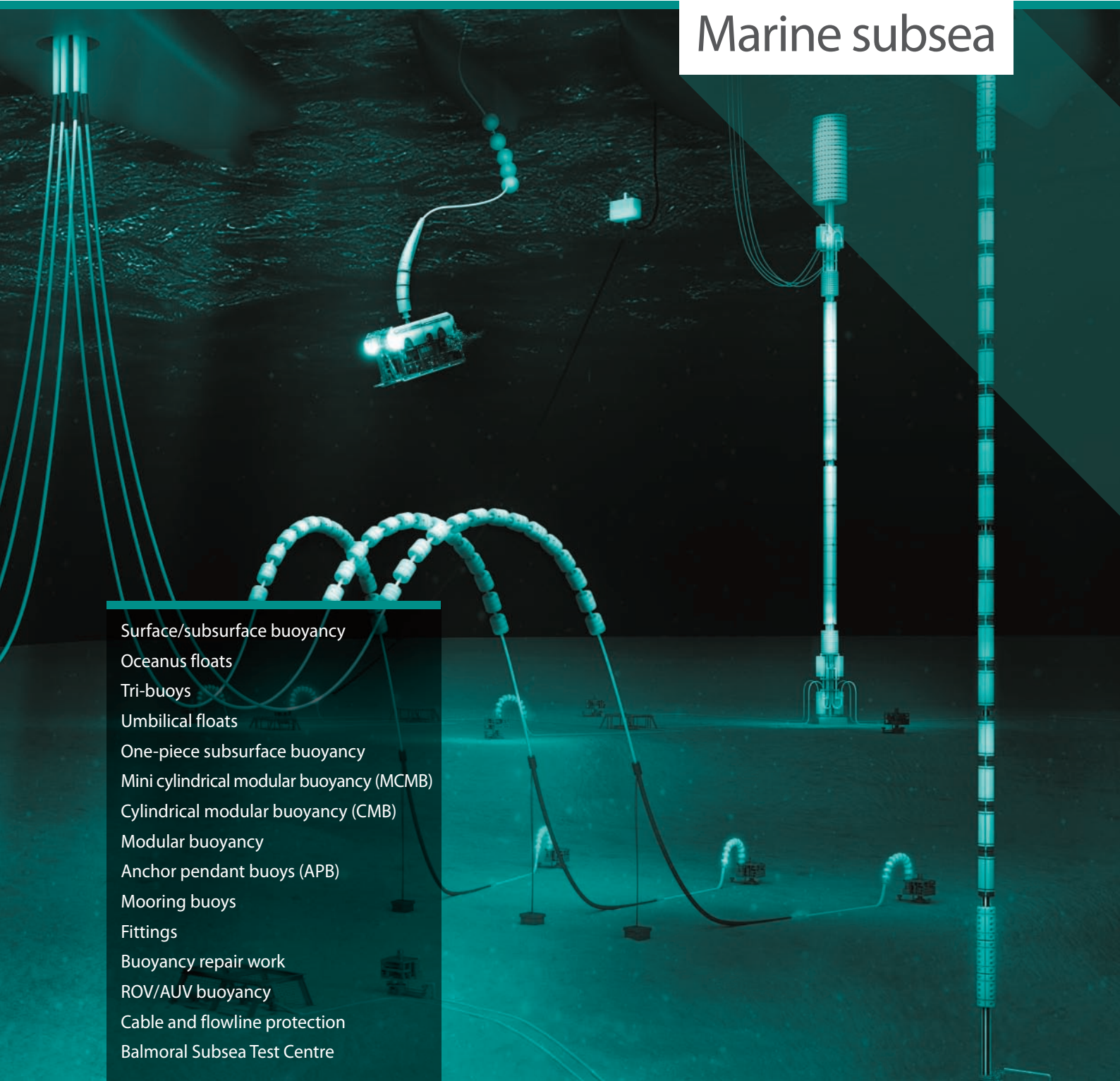




Balmoral Offshore Engineering

Buoyancy, insulation and elastomer products

Marine subsea



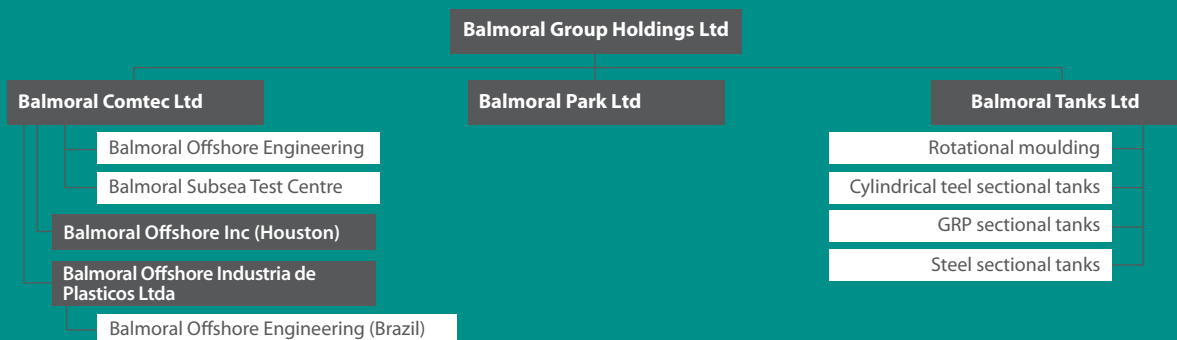
Surface/subsurface buoyancy
Oceanus floats
Tri-buoys
Umbilical floats
One-piece subsurface buoyancy
Mini cylindrical modular buoyancy (MCMB)
Cylindrical modular buoyancy (CMB)
Modular buoyancy
Anchor pendant buoys (APB)
Mooring buoys
Fittings
Buoyancy repair work
ROV/AUV buoyancy
Cable and flowline protection
Balmoral Subsea Test Centre

Connect with us:



Balmoral Group

Balmoral Offshore Engineering is a division of Balmoral Comtec Ltd which is wholly owned by Balmoral Group Holdings Ltd, a privately owned company headquartered in Aberdeen, UK.



The company has been providing solutions to the offshore oil and gas, seismic, renewable energy, marine and construction industries since 1980.

Since 'Day 1' Balmoral's reputation has been built on innovation and development. Across the Group attention to detail, health and safety, customer communication, supply chain control and on-time delivery of the highest quality products at the best possible price is paramount. Market differentiation drives the company alongside a zero defect tolerance policy.

By virtue of this philosophy, Balmoral has become a strategic partner, rather than a supplier, to its broad customer base. The Balmoral brand is recognised worldwide and is aligned with innovation, technical excellence and exceptional customer service.

Balmoral Group Core Values

The values described below apply to employee relationships with all customers – whether that is within Balmoral Group or with the company's highly valued client base.

Customer focus	Leading and working together as a team to deliver high quality products on time at the best possible price with no surprises
Respect	Treating clients and colleagues as we wish to be treated ourselves, with respect and decency
Integrity	Reliability, flexibility, honesty, openness and fairness. Supporting clients and colleagues at all times with a focus on the common end goal
Accountability	Being proactive in setting and achieving objectives. Taking responsibility in one's role and enhancing the company reputation at all times
Change management	A commitment to the company's philosophy of innovation, continuous improvement and clear communication, internally and externally
Motivation	Maintaining a focus on aligning efforts and energy to achieve common goals, ie, successful projects. Constantly seeking to add value

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Surface/subsurface buoyancy



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ROV/AUV buoyancy



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Cable and flowline protection



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Balmoral Subsea Test Centre

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www.balmoraloffshore.com

Balmoral Offshore Engineering

A client focused company, Balmoral Offshore Engineering is dedicated to technologically-driven composite and polymer solutions for today's demanding global subsea and deepwater oil and gas industry

Proprietary training, laboratory, hyperbaric and mechanical testing facilities enable Balmoral to research, identify and develop cost effective materials across a spectrum of applications.

The company has invested heavily in the most comprehensive suite of syntactic, composite and polymer processing facilities the sector has ever seen.

From 0-35,000ft, Balmoral products including rigid and distributed riser buoyancy, thermal insulation, ROV/AUV and subsurface buoyancy through to elastomer cable protection, bend restrictors, stiffeners, clamps and riser protection guards are used in the deepest and most hostile waters of the world.

Providing services from concept development through detailed design, manufacturing and testing, the team at Balmoral Offshore Engineering will help your project achieve its full potential.

Engineering design, research and development

A significant differentiator at Balmoral, as a privately owned company, is the ability to invest in continuous research and development programmes.

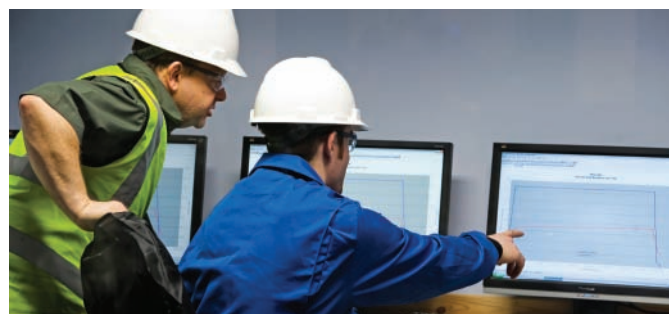
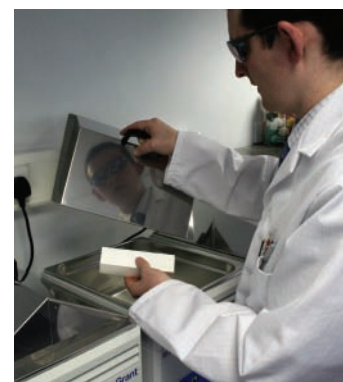
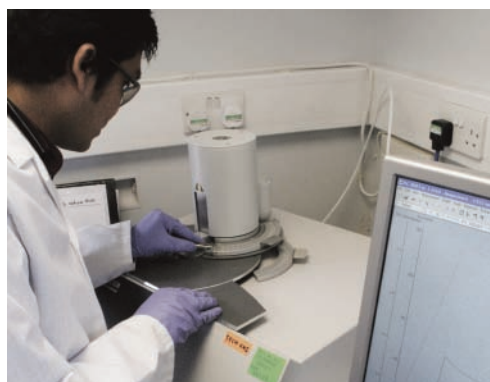
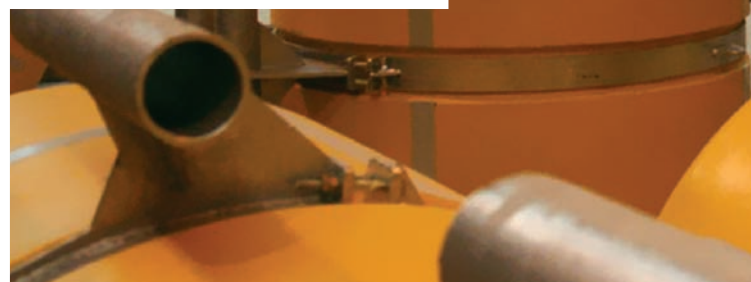
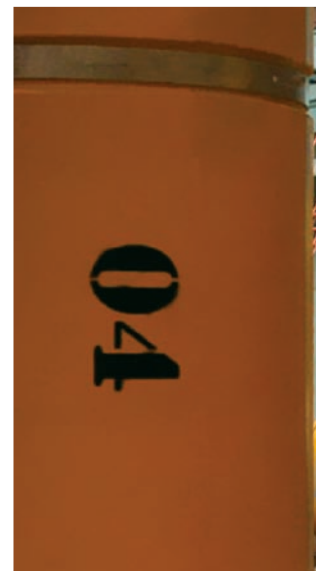
This not only translates into an unrivalled range of innovative materials but also the depth of experience available from the company's design engineering team.

For more than three decades the company's experienced scientists and technologists have provided combinations of buoyancy, insulation and polyurethane products to assist in the exploration and exploitation of ever deeper waters and ever harsher environments.

The company's R&D programme has evolved to include material innovation and, in conjunction with process engineers and technicians, the optimisation of production processes and control techniques designed to improve safety, quality and productivity.

Augmented by contemporary 3D modelling, finite element analysis, CFD, lab and testing facilities, the engineering design department is wholly committed to a policy of continuous innovation and improvement.

The team is encouraged to develop professional relationships with customers to help it deliver a personalised service at all levels and at all times.



**Manufacturing**

Balmoral's policy of continuous improvement means that the company is constantly developing its manufacturing operations to retain its place at the forefront of buoyancy, insulation and elastomer production technology.

Now offering even more efficiency and automation the facility has been re-designed and laid out to provide consistently high quality fit-for-purpose products on a continuous basis.

Comprising thermoset syntactic, aliphatic amine cold cure, anhydride hot cure capabilities and an advanced polyurethane elastomer processing facility - supported by macrosphere tumblers, shakers, vacuum chambers and curing ovens – the advanced facility represents a huge step forward in the way buoyancy and elastomer products are manufactured.

**Rotational moulding**

Balmoral operates a highly developed in-house rotational moulding facility at Group HQ in Aberdeen.

This facility produces the shells for many of Balmoral Offshore Engineering's products including distributed buoyancy modules and modular buoyancy elements.

These shells are roto-moulded in medium density polyethylene providing a one piece, seamless product with no structural welds or inherent stresses. The manufacturing process is automated providing a high quality and consistent product.

This in-house capability affords the company total control over material selection, dimensional tolerances and, ultimately, project scheduling.

Syntactic production and curing

The combination of hollow glass microspheres and a resin matrix, known as syntactic foam, is central to any buoyancy manufacturing operation. Balmoral operates a fully automated system that provides syntactic material of a consistent quality which is critical to the manufacture of high performance buoyancy and insulation products.

By implementing hot and cold cure processing, supported by refined hardware to provide control over temperature, duration and cool-down times, Balmoral Offshore Engineering has overcome product failure issues such as stress, material instability and brittleness that are experienced by traditional manufacturing operations.

This investment in production technology ensures best in class products that are exceptionally suited to the hostile deepwater environments commonly experienced by the industry today.

Project management

With extensive experience of managing the design, manufacture and despatch of subsea buoyancy and elastomer products, Balmoral Offshore Engineering's project management team works closely with clients to ensure projects are delivered on time and on budget.

As members of the Association of Project Management, Balmoral Offshore Engineering's PM team operates to recognised global competency standards from order placement through to delivery and installation where contracted.

Personnel development:**Balmoral Skills Academy**

Balmoral has developed an in-house training facility offering structured programmess in multi-discipline core competencies.

The Balmoral Skills Academy is a company-wide resource dedicated to supporting the training and development requirements across all areas of the business.

This is an exciting development which further demonstrates the company's commitment to invest and develop its employees and to assist them in performing to the highest standards demanded by industry.

The target is for the Balmoral Skills Academy to be qualified by the Scottish Qualifications Authority (SQA) for provision of Scottish Vocational Qualifications (SVQs) by the end of 2013.

Operational Excellence Group (OEG)

The Operational Excellence Group implements lean manufacturing methodologies and continuous improvement practices to drive operational excellence; to understand value streams and how, by improving these, it can improve the company's service to the customer.

THE OEG takes a systematic approach to all processes in achieving world class performance by efficiently using tools and equipment, optimising resources and the elimination of process waste and inefficiencies.



HSEQ

Balmoral acknowledges the importance of health and safety and is committed to providing a safe and healthy working environment for its employees, subcontractors and visitors, on- or off-site.



The company is a member of the British Safety Council, holding 4-star certification, and operates a management system that is certified to BS OHSAS 18001:2007.

Environmental impact

Protecting the environment from the impact of its activities is central to all Balmoral operations. This includes a commitment to continual improvement in operational performance ensuring minimal environmental impact. The company operates a management system to the requirements of EN ISO 14001:2004.

Quality assurance

Balmoral's stated aim is to become the first choice, best in class supplier in its sector and the company is committed to providing products and services that exceed customer expectations.

A key objective is the implementation and continuous improvement of a Quality Management System that is certified to BS EN ISO 9001:2008 and in adherence to the American Petroleum Institute's specification for marine drilling riser equipment: API 16F:2004.

Surface/subsurface buoyancy

Providing a range of surface/subsurface products including one-piece, modular, 'off-the-shelf' and ROV/AUV buoyancy, with a wide variety of fittings and accessories, Balmoral Offshore Engineering offers a comprehensive range of solutions for your installation project.

- Oceanus floats
- Tri-buoys
- Umbilical floats
- One-piece subsurface buoyancy
- Mini cylindrical modular buoyancy (MCMB)
- Cylindrical modular buoyancy (CMB)
- Modular buoyancy
- Anchor pendant buoys (APB)
- Navigation aids
- Fenders
- Mooring buoys
- Fittings
- Buoyancy repairs



Oceanus floats



Balmoral Offshore Engineering's design team created the Oceanus float to provide a range of standard, readily available, buoyancy units suitable for all ocean depths.

Oceanus floats comprise a high performance low density composite foam buoyancy core, encapsulated within a tough impact and abrasion resistant polyethylene shell and are supplied in a variety of colours with moulded-in client graphics where required.

To simplify the handling of Oceanus floats during deployment and recovery, each Oceanus features a pair of recessed lifting holes sized to accommodate 'gloved hands'. The floats also incorporate a series of flat surfaces to assist on-board stability and facilitate close grouping as part of operation or storage.

The standard range of Oceanus floats covers four uplift capacities and six standard operating depths.

Oceanus float values

Operating depth msw	Weight in air kg / Nominal buoyancy kg			
	OF1	OF2	OF3	OF4
1000	7.5 / 8.1	11.3 / 12.8	20.1 / 24.3	41.4 / 52.8
1500	8.1 / 7.5	12.3 / 11.8	22 / 22.4	45.6 / 48.6
2000	8.9 / 6.7	13.4 / 10.6	24.2 / 20.2	50.4 / 43.8
2500	9.2 / 6.4	14 / 10	25.4 / 19	53.1 / 41.1
3000	9.8 / 5.8	14.9 / 9.2	27 / 17.4	56.6 / 37.6
6000	10.6 / 5	16.2 / 7.9	29.6 / 14.8	62.3 / 31.9
Bore ØID mm	19.05	38.1	38.1	38.1

Tri-buoys

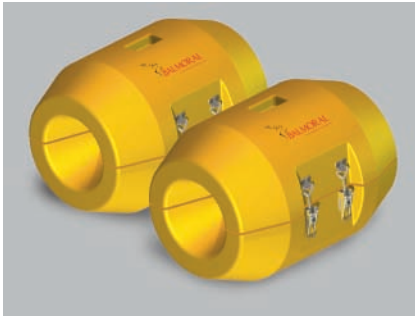


Tri-buoys offer a simple cost effective solution where additional buoyancy may be required as part of an installation operation or small permanent mooring.

The tri-buoys are finished either in GRP or elastomer and are supplied with central steelwork bearing a pad eye and swivel at either end. If required a smooth central bore can be created to enable the use of a mooring rope.

Balmoral tri-buoys provide a buoyancy uplift of between 125-175kg with depth rating capabilities of 610-3050msw.

Umbilical floats



BOE provides a range of floats to suit most control umbilicals. These floats comprise a pair of symmetrical half shells which are profiled to permit the line to flex within its specified bend radius. Each float is manufactured using a low density composite foam core covered in a high performance impact and abrasion resistant polyethylene shell.

BOE's umbilical floats are hinged using two stainless steel latches. The floats are designed to grip the umbilical by means of a natural rubber internal grommet.

Balmoral umbilical floats are designed to suit umbilical diameters ranging from 25mm-50mm OD. Umbilical floats can be supplied to suit larger diameter umbilicals if required.

Umbilical float values

Operating depth msw	Weight in air kg	Nominal buoyancy kg
1000	14.7	15.2
1500	15.9	14.0
2000	17.3	12.6
2500	18.1	11.8
3000	19.1	10.8

One-piece subsurface buoyancy



Balmoral provides a range of one-piece subsurface buoys, suitable for service to 3000msw, which have a proven track record on subsea projects undertaken by marine installation contractors.

These products are manufactured using a central tension member encapsulated within a syntactic foam core of varying densities to suit the required depth rating.

External finishes include rotationally moulded polyethylene, polyurethane elastomer and glass reinforced vinyl-ester, giving a durable, abrasion resistant surface finish. The external surface is pigmented with a high visibility colour – typically yellow, white or orange – to assist with deployment and retrieval although other colours are available on request.

Modular buoyancy

Balmoral has developed its range of modular subsurface buoyancy products to include standardised “off-the-shelf” solutions.

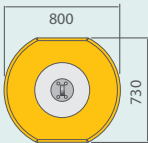

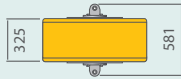
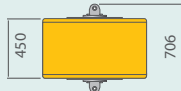
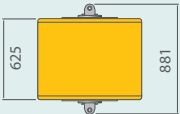
Designed to offer a cost effective and rapid response to immediate buoyancy requirements, the new buoys complement the company’s existing range of products suitable for use from 0-3000msw.

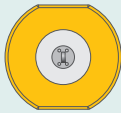
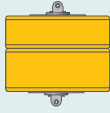



These modules incorporate ‘flats’ which provide easier handling and deck storage whilst simultaneously improving robustness.

We believe these are the most user-friendly subsurface buoys on the market.



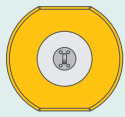
Mini cylindrical modular buoys (MCMB)

MCMB Buoyancy modules									
	MCMB1		MCMB2		MCMB3		MCMB4		
									
Weight in air (kg) Nominal buoyancy (kg)									
Surface	99	77	103	108	109	158	118	229	
300msw	130	46	144	67	167	101	199	149	
500msw	133	43	148	62	173	95	208	140	
1000msw	135	38	150	56	175	87	322	129	
1500msw	139	34	156	50	184	78	224	116	
2000msw	145	28	164	43	195	67	238	102	

MCMB Typical configurations									
	MCMB 5 MCMB 1 + MCMB 2		MCMB 6 MCMB 2 + MCMB 3		MCMB 7 MCMB 1 + MCMB 4		MCMB 8 MCMB 2 + MCMB 4		
									
Weight in air (kg) Nominal buoyancy (kg)									
Surface	115	202	126	283	131	324	135	354	
300msw	187	130	224	185	242	212	256	233	
500msw	195	122	235	174	255	200	270	219	
1000msw	198	112	239	160	259	184	274	202	
1500msw	208	101	254	145	276	167	293	184	
2000msw	222	88	272	127	297	147	315	161	

Note: All buoyancy and weight in air values are nominal and subject to specific configuration.

MCMB Typical configurations continued



MCMB 9
MCMB 3 + MCMB 4



MCMB 10
MCMB 4 + MCMB 4



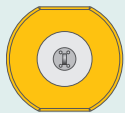
MCMB 11
MCMB 2 + MCMB 3 + MCMB 4



Weight in air (kg)
Nominal buoyancy (kg)

Surface	141	405	150	476	157	530
300msw	279	267	311	315	336	351
500msw	294	252	329	297	356	331
1000msw	300	233	336	275	363	306
1500msw	321	211	361	250	391	278
2000msw	347	186	390	220	424	246

MCMB 12
MCMB 2 + MCMB 4 + MCMB 4



MCMB 13
MCMB 4 + MCMB 4 + MCMB 4

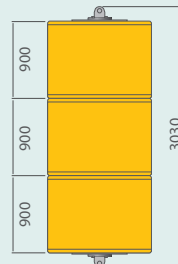
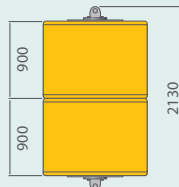
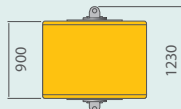
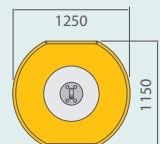


Weight in air (kg)
Nominal buoyancy (kg)

Surface	166	601	182	723
300msw	368	399	423	481
500msw	391	376	451	454
1000msw	399	348	460	421
1500msw	430	317	498	383
2000msw	467	280	542	339

Cylindrical modular buoys (CMB)

CMB1 general arrangements



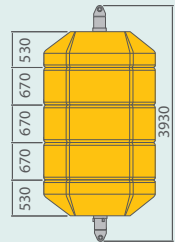
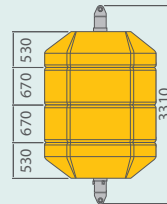
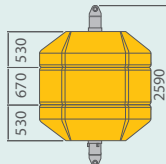
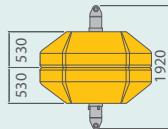
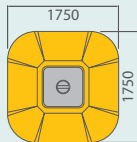
Weight in air (kg)
Nominal buoyancy (kg)

Surface	289	890	376	1819	463	2749
300msw	587	592	972	1223	1357	1855
500msw	621	558	1040	1156	1458	1753
1000msw	632	527	1063	1094	1493	1660
1500msw	679	480	1156	1000	1633	1521
2000msw	733	426	1265	896	1796	1358

Designed for use from 0-3000msw these buoys are used predominantly as suspended moorings or subsea markers. Balmoral modular buoyancy is highly adaptable and can be fitted with a comprehensive range of end fittings.

BOE's modular buoyancy utilises a range of tough, abrasion resistant core materials contained within a rotational moulded polyethylene shell. Other external finishes are available on request.

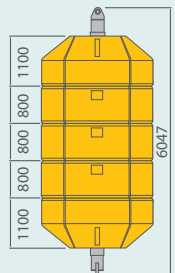
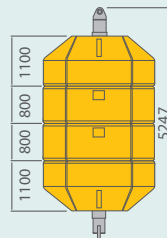
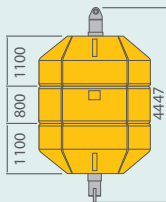
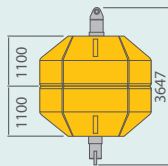
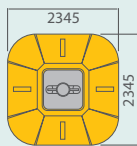
MB17 General arrangements



Weight in air (kg)
Nominal buoyancy (kg)

Surface	708	1695	975	3279	1241	4863	1507	6447
300msw	1333	1070	2104	2149	2875	3229	3646	4308
500msw	1405	999	2233	2021	3061	3042	3890	4064
1000msw	1422	912	2270	1880	3118	2848	3966	3815
1500msw	1520	815	2447	1703	3374	2592	4301	3481
2000msw	1634	701	2653	1497	3672	2294	4691	3091

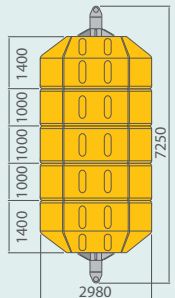
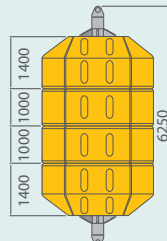
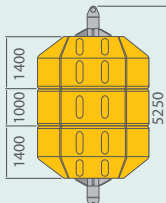
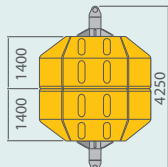
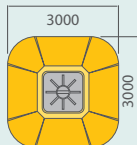
MB23 General arrangements



Weight in air (kg)
Nominal buoyancy (kg)

Surface	1645	7061	2179	10597	2714	14134	3249	17670
300msw	4033	4673	5693	7083	7354	9494	9014	11905
500msw	4305	4401	6094	6683	7883	8965	9672	11247
1000msw	4394	4165	6227	6392	8060	8559	9893	10756
1500msw	4767	3792	6776	5813	8785	7834	10794	9855
2000msw	5203	3356	7417	5172	9632	6987	11846	8803

MB30 General arrangements



Weight in air (kg)
Nominal buoyancy (kg)

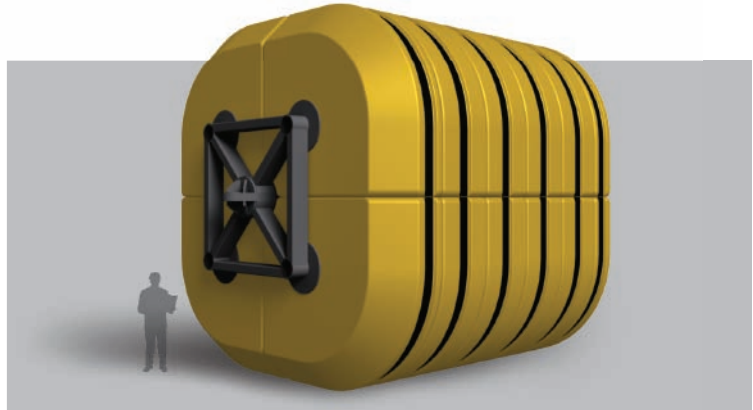
Surface	3516	17097	4593	24841	5671	32586	6748	40331
300msw	9244	11369	12769	16639	16348	21909	19900	27179
500msw	9897	10716	13731	15704	17565	20691	21400	25679
1000msw	10099	10061	14031	14839	17962	19618	21893	24396
1500msw	10995	9165	15313	13557	19631	17948	23949	22340
2000msw	12040	8120	16809	12061	21579	16001	26348	19941

Note: Thin-mid modules are available for these ranges to provide a broad range of configuration and operating parameters. Please contact BOE for further details.
All buoyancy and weight in air values are nominal and subject to specific configuration.

MB60 modular buoys

Used predominantly as support buoys and in suspended mooring systems BOE MB60 modular buoys are available in sizes ranging from 100-300 tonnes.

The rotationally moulded shells are filled with a resilient core material to provide long lasting practically maintenance free performance.



Anchor pendant buoys (APB)

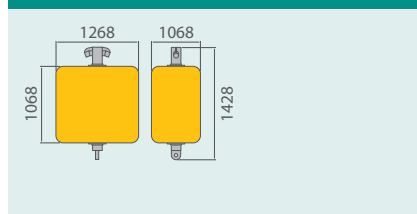
Balmoral Offshore Engineering offers a range of surface buoyancy which includes mooring buoys, anchor pendant buoys, support buoys, chain-through buoys and pick-up buoys which are extremely robust and suitable for the most severe environments.

These buoys are typically constructed from a rigid polyurethane foam core, cast around a central steel tension member that is reinforced with a glass reinforced polyester skin. The buoys are clad in a resilient polyethylene layer which is externally coated with a tough abrasion resistant polyurethane elastomer skin.

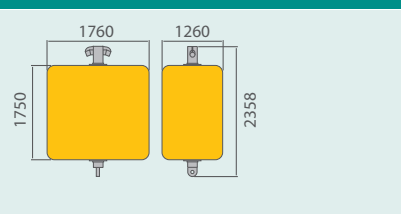
These units are suitable for deployment over the stern roller of anchor handling vessels.



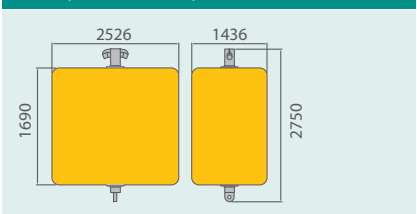
APB1 | Weight 310kg | Nom buoyancy 1000kg



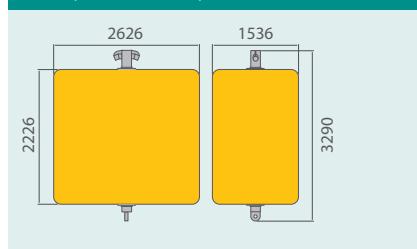
APB2 | Weight 560kg | Nom buoyancy 2000kg



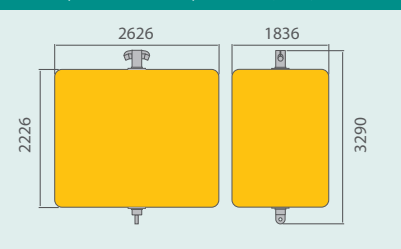
APB4 | Weight 1160kg | Nom buoyancy 4000kg



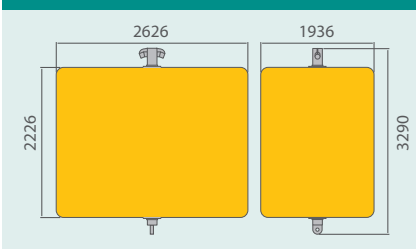
APB6 | Weight 1330kg | Nom buoyancy 6000kg



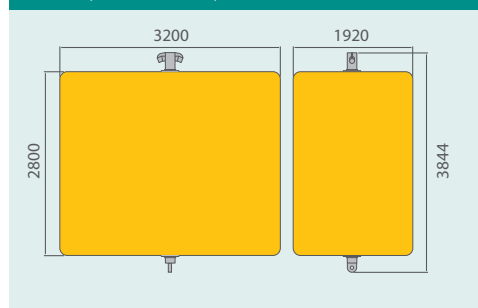
APB8 | Weight 1580kg | Nom buoyancy 8000kg



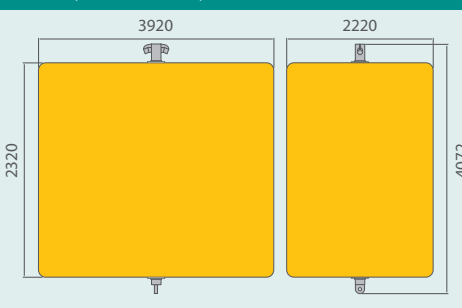
APB10 | Weight 1770kg | Nom buoyancy 10000kg



APB15 | Weight 2360kg | Nom buoyancy 15000kg



APB20 | Weight 2860kg | Nom buoyancy 20000kg



Note: All buoyancy and weight in air values are nominal and subject to specific configuration.

Mooring buoys

The BOE range is unique and was developed and designed in house.

Two forms of standard mooring buoys are available, ie, cylindrical and rectangular in section.

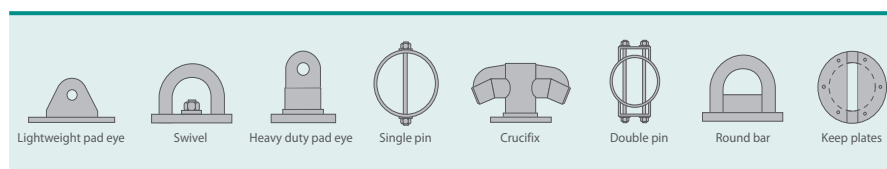
Specials are available and are usually based on a standard modular construction incorporating platforms, ladders, solar panels, electronic monitoring and lighting equipment.



Fittings

A wide range of steelwork is available to complement Balmoral Offshore Engineering's surface and subsurface products.

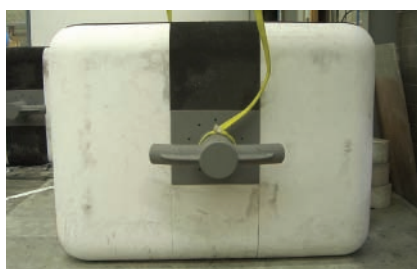
This includes crucifix, pad eye, round bar, swivel, double and single pin, keep plates and through-hawse end fittings.



Buoyancy repair work

It is vital that repair and refurbishment is carried out by fully qualified teams that understand the materials, procedures and environments to which marine buoyancy is exposed.

Balmoral benefits from many years' design, manufacture and materials experience and has dedicated teams of experienced repair personnel travelling the world on a regular basis.



ROV/AUV buoyancy

With advances in deepwater technology the need for remote intervention as part of field installation has seen major increases in the number of deepwater remotely operated and autonomous underwater vehicles



As the complexity of these vehicles evolves the demand for lower density, high performance composites buoyancy systems has increased. This is an area where Balmoral has made significant technological advances.

The use of conventional cast composite buoyancy packs still has many commercial benefits for large vehicles used for trenching of pipelines or submarine cables. However, for deep dive work class ROVs, operating beyond 2000msw, the performance benefits of Balmoral's LDF series becomes significant.

This low density, pure foam composite provides the operator an opportunity to increase the uplift (buoyancy) of the vehicle thereby resulting in increased payload capacity. It also provides an opportunity to reduce the size of the buoyancy modules thereby reducing the overall weight and dimensions of the vehicle.

Balmoral LDF buoyancy is available from stock for operating at depths to 7000msw.

Balmoral also supplies ROV support equipment for use on the umbilical systems including floats and FlexLink™, a buoyant umbilical bend control system.



Composite foam systems

A “composite” buoyancy system refers to a syntactic foam comprising glass microspheres and macrospheres held together within an epoxy resin system to create a homogenous matrix.

Composite buoyancy systems are cast using dedicated mould tooling providing repeatable consistent production and are therefore ideally suited in applications such as work class ROV's - particularly on a multi-build requirement.

Each component within any given Balmoral syntactic foam is individually rated for specific operating depths resulting in a strong, lightweight composite formulation.

There is an overlap in the operating depth ranges which is caused by macro efficiency changes in design operating depths. This means that more efficient, lower density composites may generate improved uplift for a given volume as the operating depth increases.

Composite buoyancy systems comprise an integrated shell to ensure maximum protection of the core material in the event of accidental impact.



Pure foam systems

Pure foams offer many advantages over macrosphere composite foam systems including robustness, ease of repair and modification in the event of damage or design changes, and extremely low water ingress rates.

It should be noted, however, that this is a premium product and is therefore typically selected for more demanding service conditions such as extreme operating depths and/or service criticality such as manned service.

The “ultra-low density range” of pure syntactic foam is normally produced in pre-cast blocks. These blocks may be supplied for client assembly or can be factory assembled into finished buoyancy modules.

The buoyancy performance of Balmoral's ultra-low density material is understood to be unique amongst ROV buoyancy foams in that the buoyancy does not progressively reduce due to hydrostatic compression as the ROV moves into deeper water. This is because the bulk modulus - ie, the compressibility under hydrostatic pressure - of the foams is marginally less than sea water.

Pure foam ultra-low density range (LDF)

Typical operating depth ft/msw	Typical core density kg/m ³
3250/1000	395
6500/2000	435
9850/3000	450
13100/4000	470
16500/5000	490
23000/7000	565
32800/10000	640

ROV buoyancy machining and milling

During 2013 Balmoral Offshore Engineering introduced an in-house ROV buoyancy block milling capability.

Taking internal control of this process allows Balmoral to create intricate ROV PFS and LDF buoyancy profiles with virtually no size limitations using its 5-axis CAD/CAM-controlled milling machine.

ROV/AUV external finishing

Selecting a coating for buoyancy modules of any type is a critical issue. These coatings provide impact and abrasion resistance while offering a high visibility smooth gloss finish.

The most frequently supplied ROV/AUV coating is a 3-5mm spray-applied elastomer which is applied to all upper and external surfaces to give a very effective finish, particularly for work class vehicles.

Standard finishes are provided in high gloss yellow, orange, red or white. Other colours are available to suit project parameters. An extremely high quality smooth finish is available for specialised applications.

Where a quantity of modules of the same generic shape is required, in applications such as skid module blocks or trim modules for example, Balmoral provides an alternative to PU or GRP skins by utilising rotationally moulded polyethylene shells.

Polyethylene is a material used extensively in the offshore industry and these shells can be manufactured for heavy duty applications with thicknesses ranging from 6-14mm.

Provision should be made within the design to accommodate the tolerances applicable to rotationally moulded products.



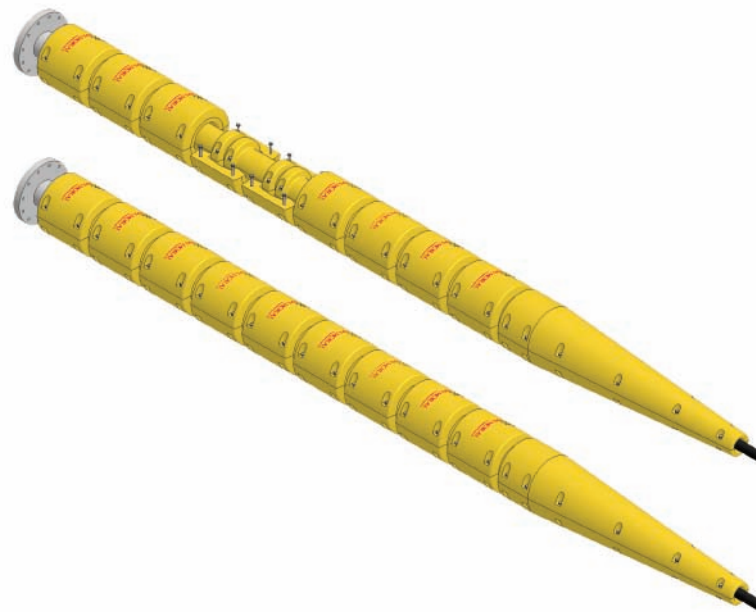
FlexLink™ umbilical buoyancy

Flexlink was developed to meet the needs of large, tracked, trenching vehicles that operate on the sea bed.

To prevent such vehicles damaging their control lines, FlexLink is installed at the tether point to provide a continuous, articulate buoyant section above the vehicle, thereby ensuring the umbilical remains out of the vehicle work zone at all times.

FlexLink is used as a permanent installation which is designed to pass through the sheave wheels of launch and recovery systems (LARS). It is supplied for installation onto umbilicals ranging in size 25-75mm OD while the buoyancy can be specified to suit project requirements.

Typical uplift ranges from 6-12kg/m in design operating depths of 0-6000msw.



Umbilical floats



BOE provides a range of floats to suit most control umbilicals. These floats comprise a pair of symmetrical half shells which are profiled to permit the line to flex within its specified bend radius.

Each float is manufactured using a low density composite foam core covered in a high performance impact and abrasion resistant polyethylene shell.

BOE's umbilical floats are hinged using two stainless steel latches. The floats are designed to grip the umbilical by means of a natural rubber internal grommet.

Balmoral umbilical floats are designed to suit umbilical diameters ranging from 25-50mm OD. Umbilical floats can be supplied to suit larger diameter umbilicals where required.

Cable and flowline protection

Duraguard was developed for the protection of subsea cables, flexible jumpers, flexible flowlines and riser touchdown zones although many other applications have been identified

Balmoral Duraguard provides a cost effective localised impact and abrasion protection system and is supplied as pairs of interlocking half shells secured around the core product using circumferential straps.

It is manufactured in a range of polyurethane elastomer grades, depending on the specific operational conditions, and can be supplied in a wide range of diameters, thicknesses and lengths. Typical lengths are determined by the individual half shell weight and can vary from 500-2000mm.

Balmoral provides four differing systems:

- Duraguard™ Standard
- DuraguardPlus™
As Duraguard standard but supplied as one-piece hinged modules with integrated banding system
- Duraguard HD™ ballast system
- Duramat™



Duraguard HD ballast system

For projects which demand cable protection with added ballast, Duraguard HD (High Density) ballast system provides much more than straightforward abrasion and impact resistance.

Heavy filler materials are added to the Duraguard mix to increase density and overall weight. The ballast provided gives extra on-bottom stability while the added mass improves dynamic response thus reducing the risk of clashing.

Densities ranging from 2300-8000kg/m³ can be achieved with the Duraguard HD ballast system.

Duraguard applications

Ballast

Filler materials can be added to increase density and provide extra stability.

Buoyancy

Standard PU is practically neutrally buoyant in seawater. However, hollow microspheres can be added to reduce density and provide uplift ranging typically from 650-800kg/m³.

Impact absorption

PU is a relatively resilient material which can absorb moderately heavy impact. Reinforced options are available for extreme environments.

Protection

Protects risers from abrasion/gouging at touchdown points, over rough seabeds, coral or rock.

Stiffening

Duraguard provides added stiffness to support cable over the seabed and/or assist in laying operations.

Thermal insulation

Lab tests have shown a significant increase in thermal insulation performance when Duraguard is fitted.



Duraguard installation

Duraguard can be fitted during unreeling/laying or prior to reeling and is installed by placing the two modules around the flowline and banding them into place.

Incanell or titanium bands are normally set 300mm apart. Adjacent segments with overlapping ends are added to provide a continuous protected length.

Duramat

Moulded in marine grade polyurethane elastomer, Duramat provides dropped object impact and abrasion protection to seabed umbilicals, flowlines and pipelines.

During manufacture, the PU is filled with barites that provide ballast and prevent tidal movement while the grooved element design allows flexing and separation of the protected lines.

Duramat is ROV and diver installable and is generally supplied with through holes for rope handling. Typically provided in 3000x3000x40mm sections, the mats can be custom sized to meet project specifications.

Balmoral Subsea Test Centre

Balmoral's test house facility offers a comprehensive range of procedures including hyperbaric, mechanical and laboratory trials

Predominantly used for in-house testing and development work these facilities and services are also available to external customers.

The facility provides the industry with a fully comprehensive resource for buoyancy and PU materials and product testing - from concept through development and deployment.

Hyperbaric testing

Substantial investment has been made in improving and expanding the Balmoral Subsea Test Centre which now offers the largest commercially available hyperbaric vessel in Europe.

Upgraded vessels, software and procedures are in place offering independent testing for all types of subsea equipment to 7000msw equivalent.

Standard tests include:

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

The hyperbaric 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.

Balmoral hydrostatic testing facilities

Vessel	Safe working pressure		Internal length		Internal dia		Orientation
	psi	bar	ft/in	mm	in	mm	
PV1	5200	358	35' 6"	10825	52"	1320	Hor
PV2	10000	700	7' 9"	2380	19"	485	Vert
PV3	10000	700	7' 9"	2380	19"	485	Vert
PV4	10000	700	7' 9"	2380	19"	485	Vert
PV5	10000	700	1' —	300	5.5"	140	Vert
PV6	6000	410	29' 6"	9000	72"	1830	Vert

Displacement tanks are available for large scale uplift testing. Internal dimensions of the two tanks are:

- 6250x2250x1300mm deep
- 9800x2500x2750mm deep (unfilled weight 16 tonne)





Mechanical testing

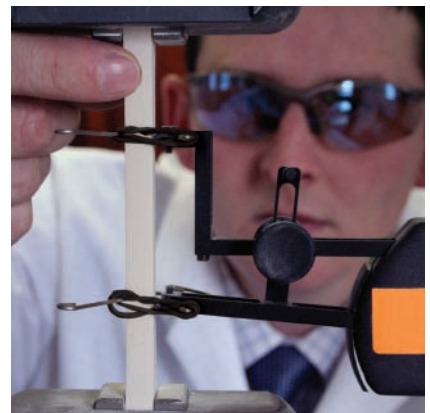
A multi-purpose load rig, capable of performing axial slip loads, lateral and static loading, three-point bending and clamp overload tests is also available.

Development laboratory

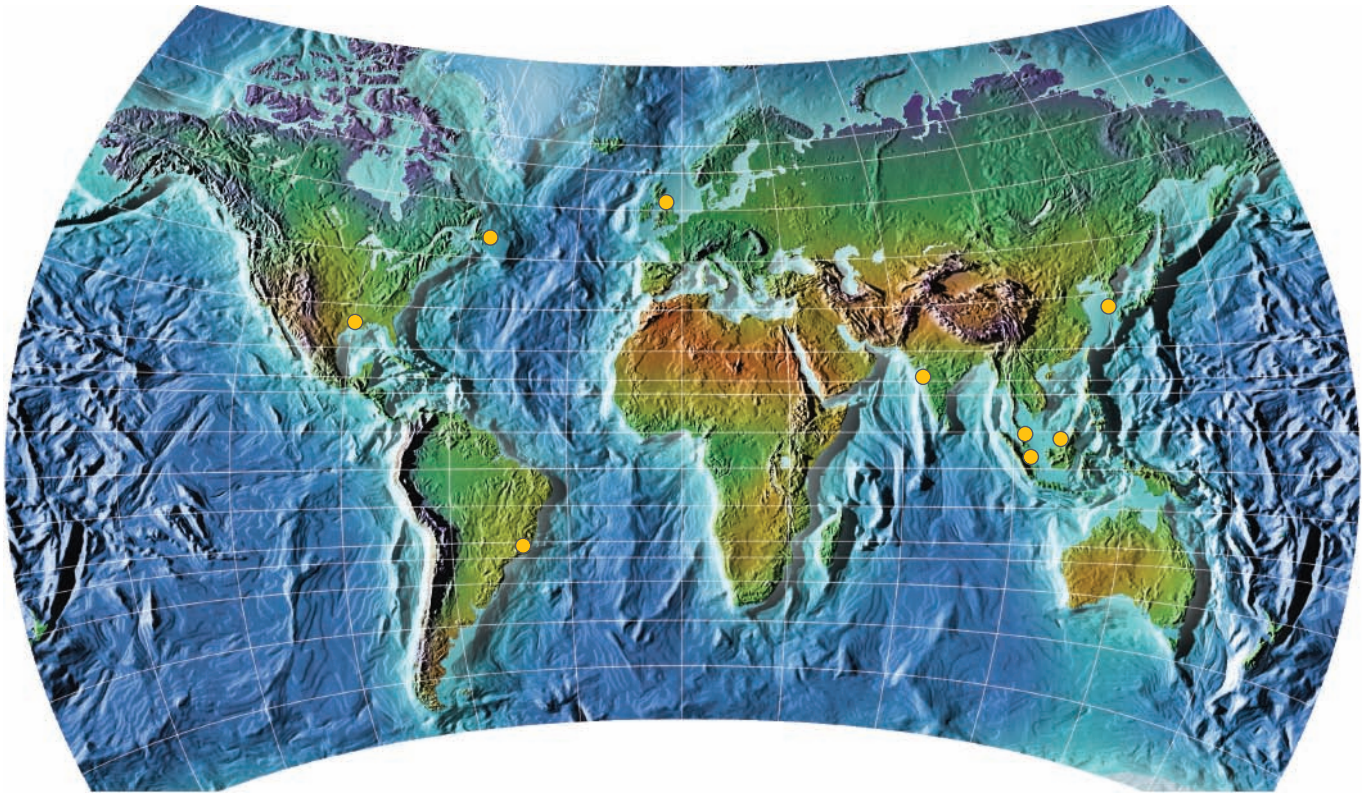
The laboratory at Balmoral Offshore Engineering is equipped with state-of-the-art development, testing analysis and inspection apparatus.

Managed by a highly experienced and dedicated technical team the lab plays a central role in the company's R&D programme.

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



Balmoral Offshore Engineering: Developing global relationships



Project portfolio

Alba	Dunbar	Kizomba	Ruby
Agbami	Ekofisk	Kristin	Scarv
AKPO	Elgin/Franklin	Liuhua	Schiehallion
ASAP	Foinaven	Livorno	Snorre
Åsgard	Galapagos	MA:D6	Thunder horse
Azurite	Gimboa	Miller	Troll
BC10	Galahad	Olowi	Typhoon
Block 31	Girassol	OYO	Tyrihans
Brent	Green Canyon	Pazflor	Visund
Britannia	Heidrun	Pluto	Wandoo
Canapu	Ivanhoe/Rob Roy	Poinsettia	Xijiang/Wenchang
Dalia	Janice	Pompano	
Djambala	Jubilee	Pyrenees	

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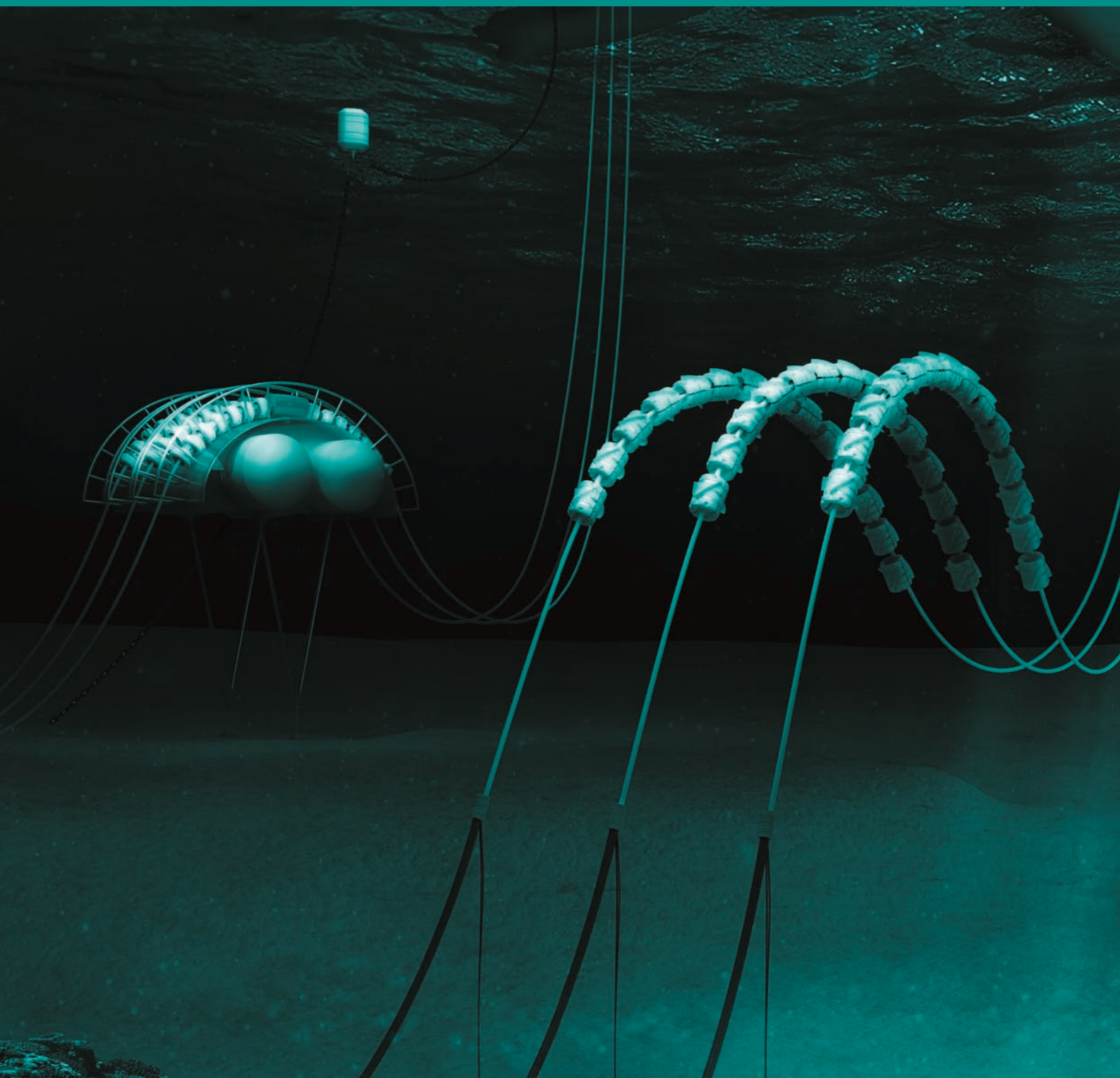
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