



Modular installation buoyancy systems

MATRIX COMPOSITES AND ENGINEERING

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Modular installation buoyancy

Matrix's modular installation buoyancy system is used for mooring and installation purposes. The buoyancy is comprised of a closed cell syntactic foam system covered by tough integrated fibreglass and aramid skin. The robust subsea buoyancy system is configured with multiple intermediate modules to achieve the required uplift and depth rating.

The Matrix modular installation buoyancy system is available in a range of sizes, each with numerous configurations, depth ratings and uplifts. Uplifts range from 14kg to 150,000kg.

Further options are available on request, including ultralight syntactic foam densities where greater uplift per module and a lower dry weight (mass) are required. Matrix also manufactures and supplies customised buoyancy solutions designed to meet a client's specific set of requirements.

With warehouses in Australia and the US, Matrix can stock and supply modular installation buoyancy as and when required.



Buoyancy balls



Buoyancy cuboids



Buoyancy tablets



IsoBlox™ buoyancy building block system

Buoyancy balls

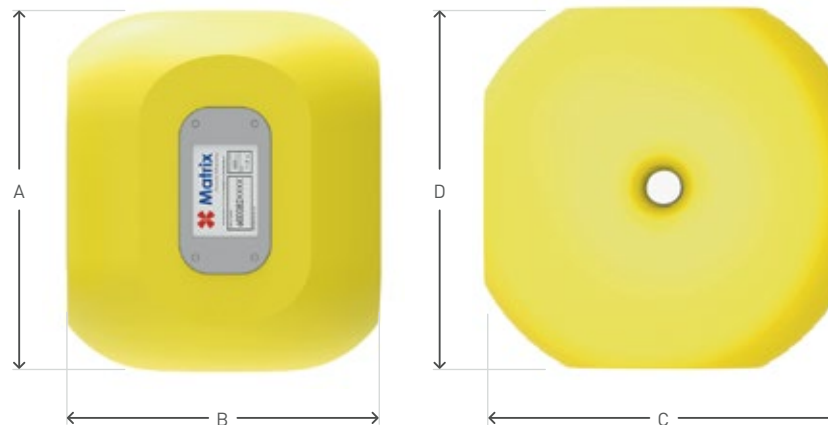
14kg TO 50kg UPLIFT

Buoyancy balls are a simple solution for small installation buoyancy needs. A 45mm through-hole allows the buoyancy balls to be threaded onto a large diameter rope or sling. Multiple balls can be strung together to allow greater uplift. The balls have a robust polymer shell which provides protection during transport, handling and operation.

Technical table

Size [mm]	Part number	Water depth* [msw]	Uplift [kg]	A [mm]	B [mm]	C [mm]	D [mm]
380	600088	1500	13.9	384	352	352	45
	600082	3000	11.3				
460	600085	1500	24.9	461	424	424	45
	600087	3000	20.2				
580	600090	1500	48.5	587	515	515	45
	600092	3000	39.3				

*Intermediate depth ratings can be supplied as a custom manufacture





Buoyancy cuboids

100kg TO 500kg UPLIFT

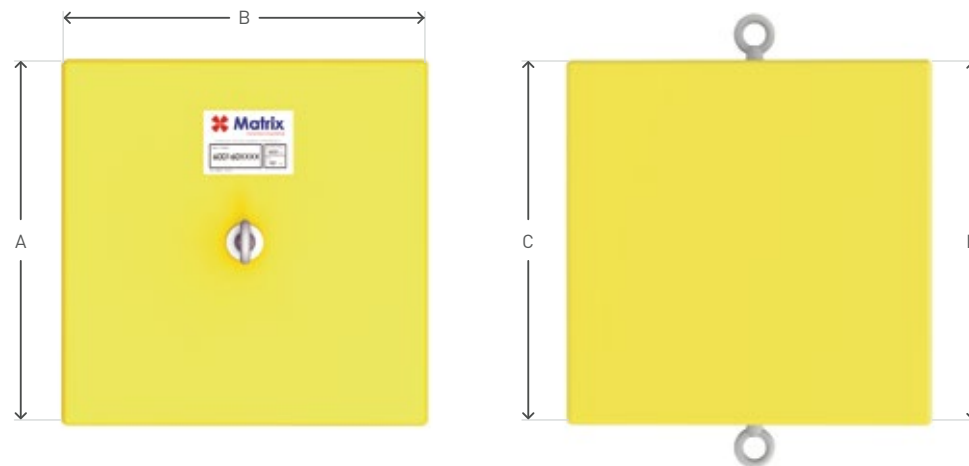
Buoyancy cuboids are a simple and economical structure that provides greater uplift than buoyancy balls.

- Range of uplifts between 100kg and 500kg
- Depth rated to 3,000msw
- Easy to handle and attach - upper and lower eye bolt
- Easy to stack and transport - flat sides
- Robust GRP skin which reduces buoyancy damage during transport, handling and operation

Dimensions

Config.*	Uplift for 1500msw [kg]	Uplift for 3000msw [kg]	A [mm]	B [mm]	C [mm]	D [mm]
A	110	84	600	600	600	720
B	190	143	600	600	1000	1120
C	230	171	600	600	1200	1320
D	324	242	600	1000	1000	1120
E	490	365	600	1000	1500	1620

*Other configurations and depth ratings are available upon request



Buoyancy tablets

500kg TO 2,500kg UPLIFT

Buoyancy tablets are used when uplift between 500kg and 2,500kg is required at depths of up to 3000msw. Buoyancy tablets are a simple way of providing mix and match solutions for a range of offshore installation and construction tasks.

- 5 different uplifts
- Range of depth ratings - 500msw to 3,000msw
- Easy to handle and attach - upper and lower load rated pad eye
- Through member/pad eye designed in accordance with DNV offshore standards and delivered with a NATA load test certificate if required
- Easy to stack and transport - flat sides



Individual block dimensions

Description	Dimension [m]
Block Height (x)	0.6m
Diagonal Length 1 (y)	1.5m
Diagonal Length 2 (z)	1.5m

Individual block uplifts

Water depth [msw]	Water depth [fsw]	Individual block dry mass [kg]	Individual block uplift [kg]
610	2,000	392	653
1,220	4,000	447	598
1,500	5,000	484	561
1,800	6,000	512	533
2,400	8,000	570	475
3,000	10,000	625	420

Assembly details

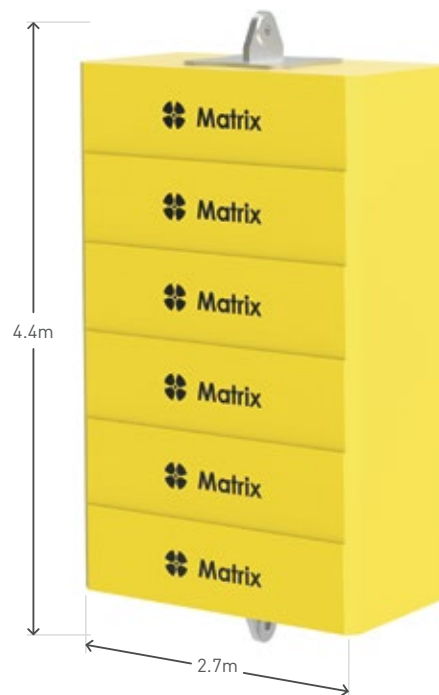
Number of blocks	Shaft length dimension [m]	Shaft weight in water [kg]	Nominal rating of shaft [tonnes]
1	0.846	74	1.5
2	1.446	87.5	3.0
3	2.054	101	4.5
4	2.658	114.5	6.0
5	3.262	128	7.5

IsoBlox™ buoyancy building block system

3,000kg TO 150,000kg UPLIFT

Matrix's IsoBlox™ buoyancy building block system is suitable for large offshore installation and construction tasks. The system is highly versatile as the blocks can be fastened together to produce any number of customised shapes, sizes and uplifts ranging from 3,000kg to 150,000kg or more.

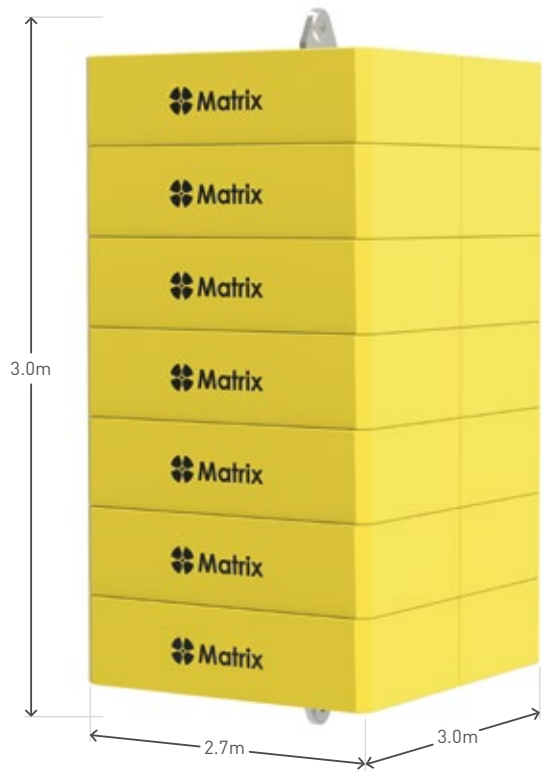
- Large number of standard arrangements
- Easily customised to most uplift requirements
- Range of depth ratings from 500msw to 3,000msw
- Easy to handle and attach - upper and lower load rated pad eyes
- Through member/pad eye designed in accordance with DNV offshore standards and delivered with a NATA load test certificate if required.



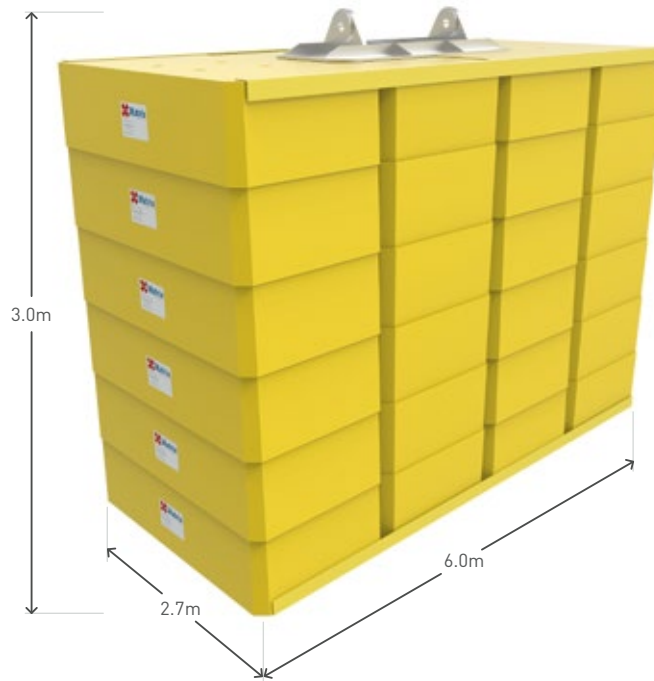
12 tonne



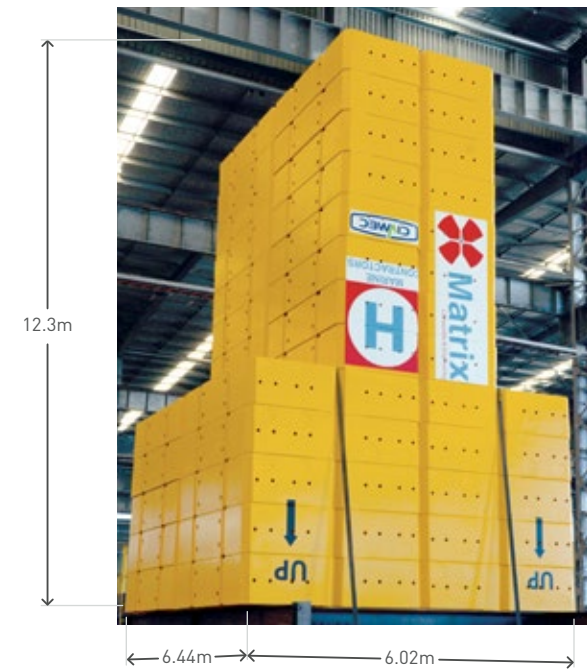
14 tonne



24 tonne



48 tonne



150 tonne

Other installation buoyancy

VERSASLAB – STANDARD SHEETS/FOAM BLOCKS

VersaSlab is a standard range of composite syntactic sheets and foam blocks used to produce buoyancy devices for subsea applications. VersaSlab is available in a variety of standard sizes and grades and is ideal for ROV applications including ROV tooling skids and buoyancy packs.

VersaSlab can be designed, manufactured and delivered in a significantly shorter time frame and for a lower cost than customised buoyancy products. Design costs are kept to a minimum as the product can adapt to a variety of configurations and applications. Labour costs are also significantly lower as the availability of large sizes eliminates the need to bond multiple small blocks together which in turn reduces assembly times. Stocked in Australia and the US, clients have access to buoyancy as and when required.

VersaSlab is available in a variety of depth ratings and grades including 1,200mm x 3,000mm slabs (thickness of up to 350mm).

VersaSlab is fully machineable and can be coated with a variety of surface treatments including fibreglass reinforced plastic (FRP), thermoplastic and polyurethane skin systems.

The approximate uplift in seawater for an engineered shape can be determined as follows:

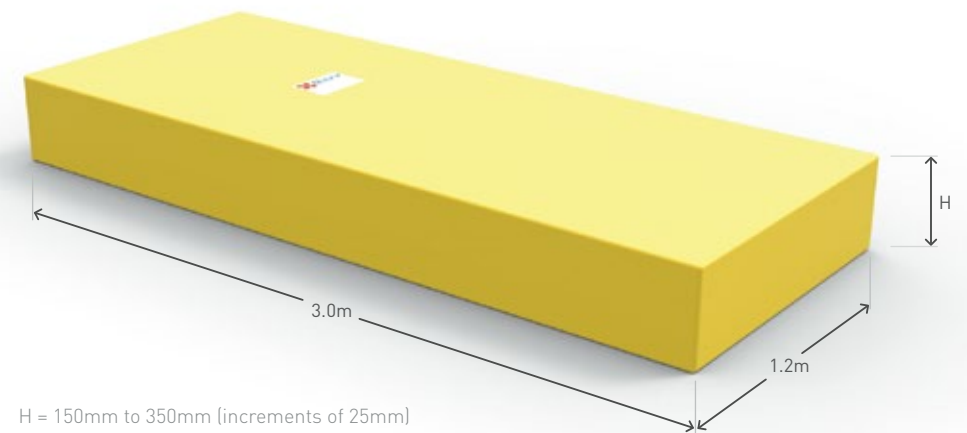
$$\text{Uplift [kg]} = (1025 \text{ [kg/m}^3\text{]} - \rho \text{ [kg/m}^3\text{]}) \times \text{Part Volume [m}^3\text{]}$$

Calculated uplift does not take into account the weight of the skin system.



Depth versus density

Depth rating [msw]	Buoyancy type	Density (ρ) [kg/m ³]
600	Standard	392
600	Ultralight	356
1000	Standard	408
1000	Ultralight	374
1500	Standard	472
1500	Ultralight	426
2250	Standard	542
2250	Ultralight	477
3000	Standard	614
3000	Ultralight	526



Other installation buoyancy

PIPELINE INSTALLATION BUOYANCY

Using the same materials technology and processes used in its market leading riser buoyancy systems, Matrix has developed buoyancy for use in rigid pipeline installation.

By reducing the in-water weight of the pipeline, deeper water pipe lay can take place using lay vessels built for shallower water. Matrix's buoyancy modules are contoured and strapped to the pipeline and can be linked together to allow for the controlled release of multiple modules by an ROV.

Utilising composite syntactic foam and advanced composite laminate technologies, Matrix's buoyancy is the lightest, most impact resistant available in the marketplace today.

Matrix's 4,000kg pipeline installation buoyancy modules can be purchased or rented.

Benefits

- Depth rating in excess of 3,000msw
- Easy to handle and install
- High impact resistance
- Extended lifecycle
- Fits a large range of pipeline diameters – single design
- Range of tailored uplifts - up to 4,000kg
- Range of depth ratings
- Upper and lower load rated pad eye linked removal and easy deck handling
- Versatile lower recess suitable for a range of pipe sizes
- Can be custom designed to meet client specific needs

Features

- Closed cell foam structure
- Through member/pad eye designed in accordance with DNV offshore standards and delivered with a NATA load test certificate if required
- Hydro-tested in accordance with API 16F



CUSTOM DESIGN

Matrix manufactures custom designed installation buoyancy with depth ratings greater than 3,000msw for general subsea applications.

RENTAL OPTIONS

Matrix provides installation buoyancy rental options from Perth and Singapore.

A range of adjustable installation buoys from 1,000kg to 3,000kg, 2,000kg to 5,000kg, 5,000kg to 7,000kg, and 7,000kg to 10,000kg are available.

These buoys allow for alterations to the buoyancy uplift during operations and reduce the amount of buoyancy required on-board where multiple lifts are required.

Materials development and qualification

To ensure the properties and performance of its subsea materials, Matrix undertakes vigorous testing and verification. This confirms that the proposed materials are fit for purpose and in line with the requirements of quality standards ISO-13628-16 and API 17L, and other specifications from clients and project developers.

Matrix has developed its own set of testing procedures to incorporate both industry and client driven standards. This allows for a consistent and comprehensive set of tests for its syntactic foams and thermoplastic material that will be used in a subsea environment for up to 40 years.

Material qualification tests

Throughout the manufacturing process, a regime of production verification tests can be applied including:

- Abrasion resistance
- Hardness
- Hydrostatic strength
- Entrapped air

- Bulk modulus and rate of buoyancy loss
- Shear strength, modulus, strain at break
- Tensile strength, modulus, strain at break
- Compressive strength, modulus, strain at break
- Density
- Water absorption
- Creep testing
- Ageing resistance testing (thermal degradation)
- Fatigue testing

The material qualification tests listed above are verified during the project and can be witnessed by clients and third party approval bodies if required.

Throughout the manufacturing process, a regime of verification tests and samples are collected to ensure the manufactured parts remain within agreed tolerances. Matrix has invested heavily in its testing capabilities to ensure the majority of tests can be performed on-site, thus eliminating potential bottlenecks in the process flow.

At the commencement of every SURF project, clients are invited to Matrix's production and quality meetings. During these meetings project specific measures and controls are agreed upon to ensure all concerns are dealt with in the process controls. A standard set of controls exists, although additional measures specific to a particular project can be incorporated.



Providing innovative solutions

Matrix is a leading developer of syntactic foam technology and has been providing the global oil and gas industry with innovative solutions for over 15 years. Its 20,000m² facility in Western Australia boasts some of the latest technologies producing durable products for use in subsea and other challenging environments.

Matrix has a global service and distribution network and can provide clients with local service and support.



ABOVE: Located in the Australian Marine Complex, the southern hemisphere's premier integrated marine industrial facility

RIGHT: One of Matrix's highly qualified material scientists



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