

Port security barriers



Creating complete flexible containment solutions

Trelleborg Flexible Containment Solutions (formerly Dunlop GRG), design, develop and manufacture polymer fabrications for many industries. For over 40 years we have been producing an extensive range of products, particularly in the field of heavy duty, rubber-coated textile, PU, TPU and PVC fabrications. Our experience in many challenging settings, industries and applications, has allowed us to continuously improve and develop our products for demanding commercial operations around the world.

Being part of the **Trelleborg Engineered Fabrics** division of the **Trelleborg Group**, one of the largest polymer processors in the world, puts us in a unique position. While working closely with you developing your project, we are supported by a large group of companies with a broad scope of technical expertise resulting in single ownership from raw material to finished product.

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PRODUCT OVERVIEW

Providing effective seaborne defence systems presents many unique challenges. Trelleborg Flexible Containment Solutions inflatable boat and port barriers provide a cost-effective, highly flexible and adaptable port security solutions to protect sensitive assets from seaborne attack. Manufactured in the UK, Trelleborg inflatable barriers are a widely used sea and port defence system.

Often installed to safeguard some of the largest sea vessels worldwide and protect valuable shipping ports and defence assets.

Trelleborg has been manufacturing boat barriers for in excess of 25 years using composite technologies originally conceived at Cambridge University. An incident in 2000 led to a global review of port security. Following successful testing as an anti-terrorist device by the US Navy in San Diego Harbour in 2001, the units were enhanced further, making them larger and more robust to combat a broader range of threats.

Trelleborg port security boat barrier systems are currently installed around the world. Their design is such that they can be adapted to any port situation, naval or commercial, and also for the protection of vulnerable coastal land-based assets.



FEATURES & BENEFITS

- Extremely durable, manufactured to resist harsh conditions
- Require little maintenance with a life expectancy in excess of 20 years
- Imposing and highly visual deterrent
- Effectively resists sea borne attack

Designed for high impact - the primary function is to prevent or delay an attacking vessel entering restricted area's, allowing time for secondary security measures to be activated.

Inherently flexible, the portable units are lightweight and easy to inflate or deflate and transport. This design makes them highly versatile with set lengths easily coupled together to configure to many different port layouts, providing a distinct advantage over heavier fixed or fencing based barrier systems which require more complex and costly operations to transport and install.

Easily manoeuvred in water, they are shackled together using standard buoys and anchor systems at predetermined intervals and can be linked in any configuration in lengths of many kilometres. A series of units operates as a simple gate system where access is required. The space between connecting buoys is dependent on geography, climate and tides, and is adaptable to any naval or commercial sea-based or port situation.

Key safety features

- Operates at low pressure.
- No danger of 'bursting' if accidentally punctured.
- If punctured, they will not sink and can still function as an effective barrier. The barrier will slowly deflate (only to 50% of diameter due to a central cable) to enable backup systems to come into play.
- Multiple punctures will not cause catastrophic failure.
- The rubber body of the barrier will not damage passing ships' paint or surfaces which accidentally scrape across the barrier.
- The barrier 'softness' will cause no harm to public or their craft hitting the barrier by accident.



APPLICATIONS

Trelleborg port security barriers are in operation in many settings **worldwide** for the protection of vulnerable assets from seaborne attack. Some of these include the UK submarine service at HM Naval Base in Clyde, home of Britain's Trident nuclear facility, NATO's European naval maintenance shipyard in Croatia, US Navy Mediterranean bases in Italy and Spain, an LNG port in the Middle East and a shipyard in Singapore.

With a versatile design, the units can easily be adapted to any port situation, **naval** or **commercial**, as well as the protection of sensitive land-based assets that may be vulnerable to sea attack, such as **coastal power plants**.

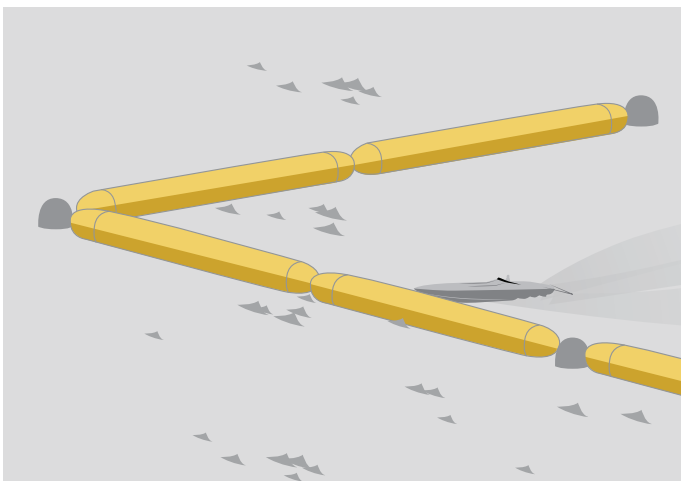
In addition to their extensive use at military sites, they have many other applications including **commercial shipyards**, coastal oil and **gas ports**, **nuclear power plants** and security forces protecting **private residences** on the coast.



Norfolk, USA



Croatia



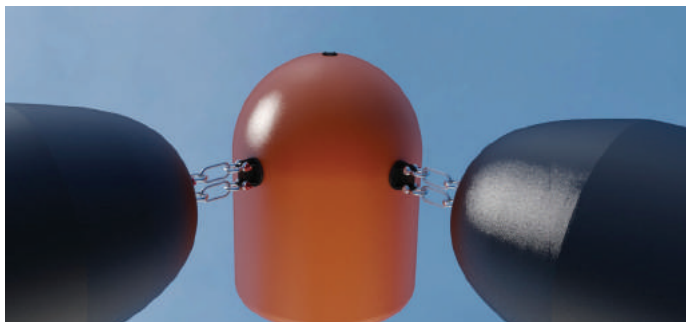
Faslane, Scotland

GENERAL DESCRIPTION

UNIT SPECIFICATION	Manufactured in various sizes typically in 25m lengths and 2.3m diameter. Operating with an initial internal pressure of 1Psi.
INSTALLATION	Trelleborg Flexible Containment Solutions have a partner company which specialise in the installation and continual maintenance of our barrier systems.
INFLATION & DEFLATION	Each end of the barrier is inflated and deflated through a corrosion resistant valve located in one of the end closure plates, which also houses a separate pressure monitoring valve. The two closure plates are linked internally by a high strength sheathed wire cable running the length of the barrier, externally they are both fitted with an integral mooring fitting.
CONNECTION & MOORING	Shackled together with buoys and anchor systems, design dependent on environmental conditions and threat levels.
TESTING	Barriers have been tested against multiple shots from small hand guns 50 calibre, 7.63 and 5.56 NATO. The worst penetration was a 4mm hole left by 0.375 magnum, other rounds just separated the fabric and closed back over.

Accessories

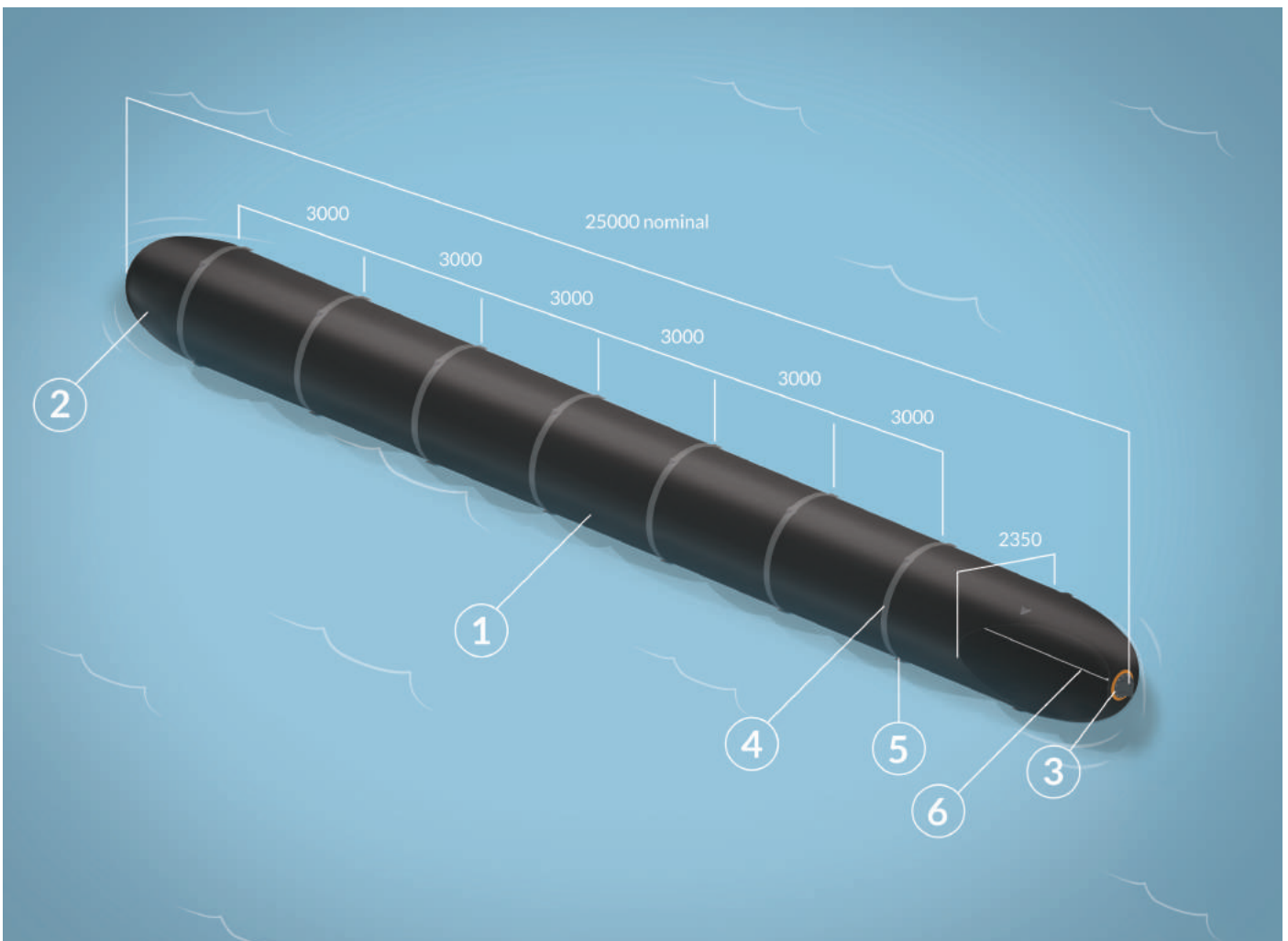
- A range of sonar, radar and camera equipment can be installed to provide a more comprehensive protection package
- Duck Dive Net for further protection from Jet Ski craft
- Navigational lighting
- Barrier covers printed with warning signs
- Tamper alarms at connectors



Buoys manufactured to order from our sister company Trelleborg Offshore



Item	Description
1	Barrier Body
2	Hemispherical End Moulding
3	End Assembly
4	Suspension Band
5	Suspension Band Connection Point
6	Tension Cable



*In accordance with our established policy of constant improvement, we reserve the right to amend these specifications at any time without notice. Photographs shown may feature non-standard equipment.



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Ship To Ship Operations



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PRODUCT OVERVIEW

Trelleborg low-pressure (LP) floating pneumatic fenders play an essential role in the safe berthing of ships at sea in an emergency or other operations such as refuelling. Unlike other fenders, Trelleborg LP fenders are designed to spread berthing forces over a large area, achieving a far lower load reaction than any other fender system. This makes them ideal for use when berthing naval vessels with thin or weakened hulls.

While durable enough to stand up to the most hostile environments at sea, the LP fenders are considerably lighter than a high-pressure fender of equivalent performance, and can easily be carried, inflated and deployed in a range of emergency applications.

They are also easy to deflate and store for later use. Available in a range of standard sizes, they can also be custom made to a specific requirements. Trelleborg have been supplying LP pneumatic fenders to the maritime industry for over 30 years.



FEATURES & BENEFITS

- Avoid high developed pressure upon the hull structure of vessels during berthing
- Effectively absorbs the kinetic energy of the moving vessel during the berthing operation
- Spreads berthing forces over a large area
- A far lower load reaction is achieved than any other fender system, including solid rubber, foam filled and high-pressure pneumatic fenders
- Ideal for use with thin-hulled or weakened vessels or those sensitive electronic systems requiring protection when berthing

LP Fender units can easily be carried, inflated and deployed in a range of emergency applications via air, sea or land. This flexibility makes them particularly suited to ship to ship operations and has a significant impact on time and costs of transport. As they can be transported and deployed quickly, the fenders are key to preventing oil spill from damaged vessels, thereby minimising damage to people and the environment.

Easy to deflate and store for later use. When deflated they can be rolled into small, lightweight packages and are therefore increasingly becoming a permanent Health and Safety requirement onboard ships. This can in turn reduce the insurance costs for vessel operation. As they operate at a nominal pressure of 70mbar (1Psi), any convenient air supply, compressor or blower, can be used for inflation. The low pressure also makes repairs and maintenance easier to carry out.

Durable and unencumbered by external fittings, the units can be towed while inflated and attachments suitable for towing and mooring can be provided at each end of the fender. In addition girthing ropes are fitted for ease of handling, and are easily maneuvered with ordinary ships' mechanical handling gear.

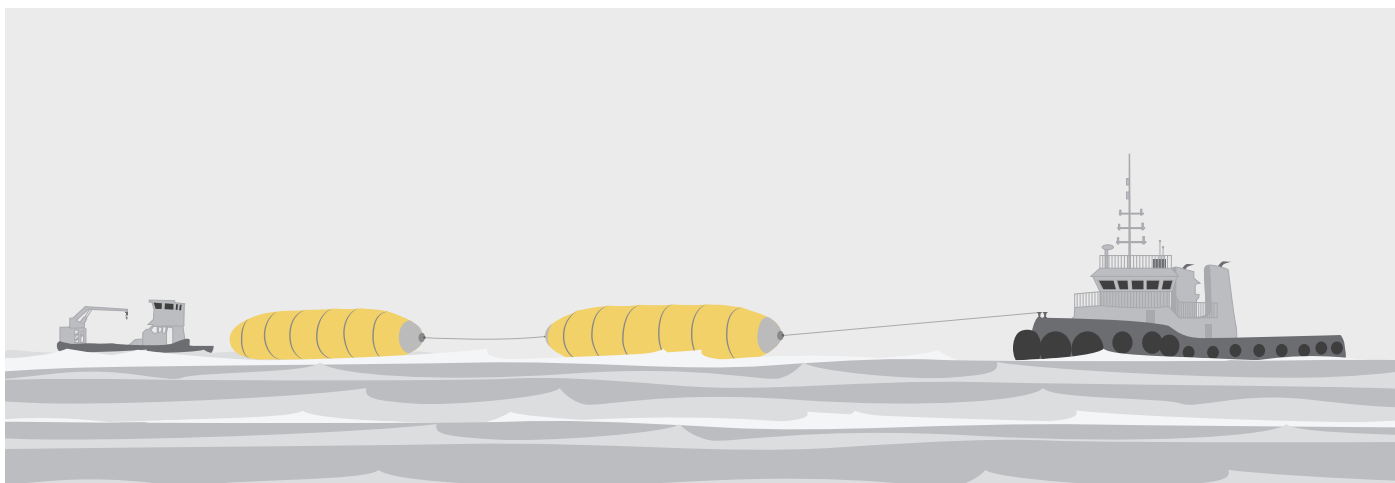
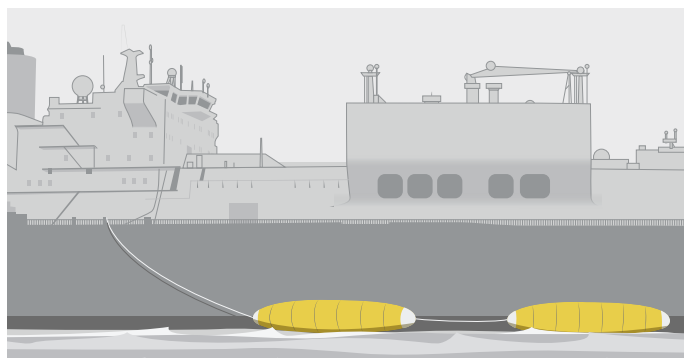


APPLICATIONS

A high-energy absorbing capacity coupled with ease of handling enables ships of even the largest tonnage to be safely fendered in various conditions and berthing operations. Trelleborg LP pneumatic fenders are in operation worldwide in many applications both military and commercial.

These include ship to ship transfer and refuelling, offshore mooring, naval applications, salvage and cargo recovery and emergency floatation. They are in use for military operations at sea by both the UK and US Navy. Many commercial companies specialising in salvage and emergency response also use Trelleborg fenders.

They feature in the operations of the International Salvage Companies who specialise in providing a quick response to marine emergencies around the globe and by specialist shipbuilders.



GENERAL DESCRIPTION

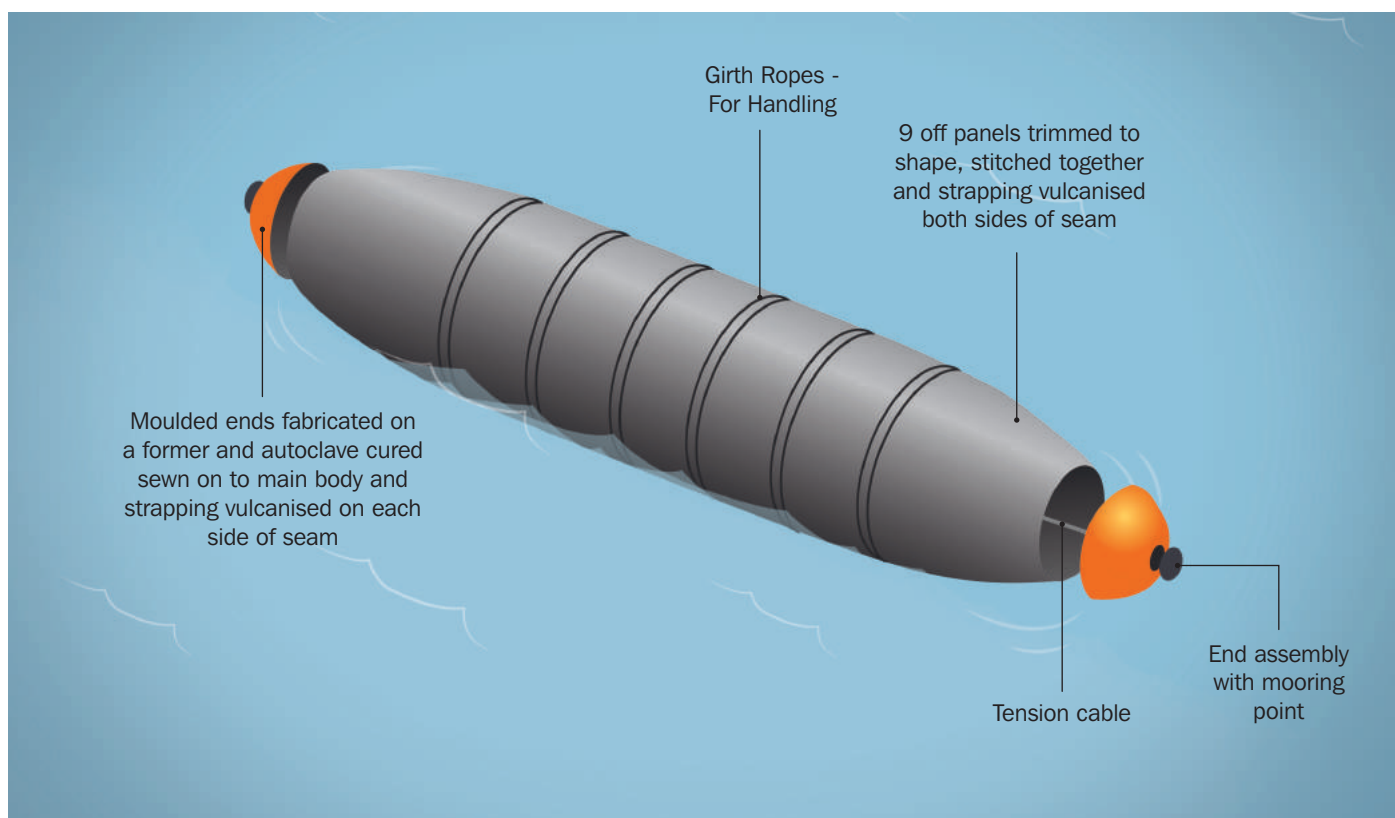
UNIT SPECIFICATION	Manufactured in diameters from 1.0m to 4.5m; lengths of fenders can be made to customer requirements.
MATERIALS AND CONSTRUCTION	Constructed from a woven high tenacity, continuous filament nylon-based fabric, coated on both sides with an abrasion resistant synthetic rubber compound. Individual sections are constructed such that they are of strength equivalent to the base material or fabric.
LOAD REACTION	The maximum specific load reaction pressure that can be developed from a LP fender occurs at at 60% compression and is 11 tonnes per m ²
ENERGY ABSORPTION	Dependent on the size of the fender
INFLATION AND DEFLATION	Units operate at a nominal pressure of 70mbar (1Psi). Any convenient air supply, compressor or blower can be used for inflation.

Trelleborg LP pneumatic fenders are made to the ISO 17357-2:2014 specification

Accessories

- Blower unit
- Inflation adaptor
- Repair kits
- Lifting slings
- Medium duty delivery and suction hose
- Transportation/storage case
- Pressure gauge assembly
- Cargo nets

NOMINAL SIZE (M)		NOMINAL WEIGHT (KG)	APPROX. FOLDED SIZE (M) LENGTH X WIDTH X HEIGHT	(TYPICAL) FENDER END CONSTRUCTION
DIAMETER	LENGTH			
1.0	5.0	90	1.5 x 0.8 x 0.7	}Parcel End
1.0	6.0	110	1.5 x 0.9 x 0.7	
1.0	8.0	140	1.5 x 0.9 x 0.8	
1.5	4.0	110	1.6 x 0.8 x 0.7	
1.5	5.0	135	1.6 x 0.9 x 0.8	
1.5	6.0	160	1.6 x 1.0 x 0.9	
1.5	8.0	210	1.6 x 1.0 x 1.0	
1.8	6.0	210	1.8 x 1.0 x 0.9	
1.8	8.0	270	1.8 x 1.0 x 1.0	}Clamped End
1.8	10.0	330	1.8 x 1.2 x 1.1	
1.8	12.0	390	1.8 x 1.2 x 1.2	
2.3	8.0	360	2.0 x 1.0 x 1.0	
2.3	10.0	440	2.0 x 1.2 x 1.0	
2.3	12.0	520	2.0 x 1.2 x 1.2	
2.3	16.0	680	2.0 x 1.4 x 1.3	
2.75	10.0	600	3.8 x 1.3 x 1.25	
2.75	14.0	800	3.8 x 1.45 x 1.35	}Moulded End
2.75	18.0	1200	3.8 x 1.6 x 1.4	
2.75	22.0	1600	3.8 x 1.7 x 1.55	
3.2	12.0	800	3.8 x 1.4 x 1.3	
3.2	16.0	1040	3.8 x 1.5 x 1.4	
3.2	20.0	1280	3.8 x 1.65 x 1.5	
3.2	24.0	1520	3.8 x 1.75 x 1.6	
4.5	18.0	1600	3.8 x 1.6 x 1.45	
4.5	22.0	2000	3.8 x 1.7 x 1.6	
4.5	26.0	2400	3.8 x 1.8 x 1.75	
4.5	30.0	2800	3.8 x 1.9 x 1.9	



	STANDARD	DESCRIPTION	REMARKS
Material Testing	Various international standards.	Properties of the rubber coating compound	Hardness/tensile/elongation before ageing to be tested on every batch. Static Ozone Ageing, type approval for any new formulations
Dimensional Inspection	ISO 17357-2	Properties of the coated textile	Abrasion resistance/breaking and tear strength/Surface coat adhesion to be tested on every production lot.
		Length +10%, -5% Diameter +15%, -5%	Dimensional inspection to be carried out at the working pressure
Air Leakage		Pressure drop and soapy water test carried out at the working pressure	All fenders to be tested for each and every order
Hydrostatic Test			The frequency of the test shall be one in 20 fenders for each size.

Dunlop low pressure fenders have also undergone third party type approval testing based on the requirements of ISO 17357:2002. These tests included parallel plate compression, compression recovery, angular compression and durability testing. The results of these tests confirmed previous test data and theoretical performance ratings and were witnessed, reviewed and endorsed by the American Bureau of Shipping. Further details of the testing procedures and the results can be provided on request.





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PRODUCT OVERVIEW

The Trelleborg Dracone barge is an essential component in the ship to shore transfer of bulk liquids. In sea-based situations where a ship is too large to dock or the conditions are unsuitable, these units provide a unique, easily accessible system of liquid storage and transfer. Available in a range of sizes, the Dracone barge is a flexible, towable bladder constructed from high-performance materials enabling it to withstand hostile ocean conditions. Manufactured in the UK, the flexible Dracone design can be adapted to fit many different ship to shore applications including, military and commercial fuel movement, water transport and remote liquid storage.

The Dracone barge, whose name derives from the Latin and Greek words for 'serpent', was originally developed at Cambridge University in the 1950's during the Suez oil crisis in order to transport fuel from the Persian Gulf. Since that time, this unique and highly reliable product has had an unrivalled record of operational performance worldwide for nearly 40 years.

Applications - Dracone barges continue to operate extensively worldwide, providing a unique system of bulk liquid transport for a range of applications and industries.

Originally used for military purposes for the bulk transportation of refined fuels, they have many commercial and military applications and one of the key functions of the Dracone barge today is in the ship to shore transfer of bulk liquids.

Over 500 units have been produced and some key customers that have used Dracone barges are the **UK Ministry of Defence, the United States and Indian Coast Guards, the US Navy** and the **Marine Spill Response Corporation**. In UK military operations, they are used to quickly transfer fuel from a ship to the shore. Commercial uses include offloading waste water from ships that are unable to dock because the conditions are unsuitable.



FEATURES & BENEFITS

Dracone barges

- Large capacity floating liquid storage
- Durable and able to withstand harsh conditions
- Specially designed to store fuels
- Easily towed in open water
- Flexible and easily deployed

Strong and reliable under harsh conditions - the Dracone barge is constructed from synthetic rubber-coated nylon fabric, making it highly resistant to all weather conditions, abrasion, sunlight, oil and sea water. The construction of the nose and tail mouldings, based on modern composite technology and extensively tested under stress analysis, is essential to the overall strength of the unit. For use in pollution control, the inside has a nitrile coating that is specially designed to store distillate fuel oils of up to 30% aromatic content.

Easily towed in open water - with non-inflatable buoyancy panels, the Dracone barge will float whether empty or full and will follow the exact course of the towing vessel, allowing tight manoeuvres to be executed. Designed for towing in open seas, the unit has undergone intensive stress analysis to determine the optimal design for maximum stability in water.

Rapidly deployable and adaptable - with a large capacity and 'fold away' flexibility the Dracone barge is an essential part of the oil spill first response kit. Easy to set up and quick to launch from a quayside, the deck of an offshore vessel, or drop launched by crane or helicopter with minimal lifting equipment, it can be quickly transported to critical areas, filled to an enormous capacity to limit oil spill movements, and then easily towed for safe disposal.

Other products - alongside the Dracone barge, Trelleborg also provide other essential products for pollution control:

- Flexible pillow tanks - primarily for use on land for the temporary storage of large quantities of liquid fuels, flexible tanks can be manufactured to specified sizes to fit available space on oil spill collection ships. The tanks are easily filled and once emptied can be folded or stored away.
- Bund liners - used in conjunction with flexible tanks they provide a reliable containment around the tanks to prevent fuel spillage.



GENERAL DESCRIPTION

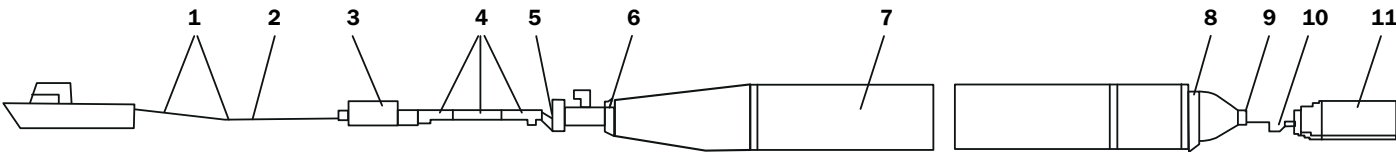
UNIT SPECIFICATION	Available in a range of sizes and capacities, but can also be custom made to fulfil a specific client need. Table below.
MATERIALS AND CONSTRUCTION	Constructed from high-tenacity woven nylon fabric coated with polychloroprene. Interior coated with nitrile rubber for transporting distillate fuel oils of up to 30% aromatic content. Nose and tail mouldings constructed based on modern composite technology using rubber encapsulated nylon cord.
CONNECTIONS	Fill/discharge hoses can be offered to suit customer requirements. Standard connections include 4" or 6" (100m or 150mm) but it is possible to modify hardware to suit.
TOWING	Depending on size can be safely towed at 6-10 knots in moderate seas.

		DRACONE TYPE								
		A1	A2	D5	D10	E	F	J	L	O
100% CAPACITY	m³	4.55	9.1	22.75	45.50	100.00	191.00	385.00	519.00	1100.00
85% CAPACITY	m³	3,90	7.80	45.50	38.60	85.00	162.00	327.25	441.00	935.00
LENGTH	m	8.58	14.17	15.95	31.45	38.45	50.45	66.00	66.00	91.45
DIAMETER	m	0.94	0.94	1.42	1.42	1.87	2.35	2.82	3.28	4.23
EMPTY WEIGHT	kg	270	310	430	780	1000	2275	3540	4060	6500

Accessories

- Towing hose
 - Recovery bend
 - Cargo net
 - Navigation marker
- Quick release hook
 - Towing rope

LAYOUT OF A DRACONE



Accessories

- 1 Main towing ropes

2 Towing pendant

3 Recovery bend

4 Towing hose
- 5 Nose cone

6 Mooring ring

7 Dracone barge

8 Stabiliser
- 9 Mooring ring

10 Tow line

11 Light float with navigation light



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