



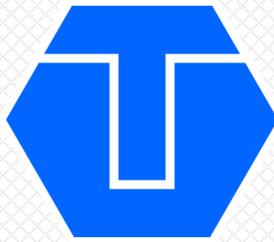
TENMAT

ADVANCED MATERIALS



FEROFORM F3637

HOT CARGO SUPPORT AND INSULATION PADS



TENMAT

ADVANCED MATERIALS

INNOVATION

SAFETY

SERVICE

QUALITY

TENMAT is a leading manufacturer of specialised, high performance engineering materials and components with over 100 years of experience.

TENMAT stands for innovation, safety products, commitment to our customers and the latest quality standards worldwide.

A World of Materials

The diversified product range includes composite wear parts and bearings, engineering ceramics, high temperature resistant materials, and passive fire protection solutions.

Commitment to Quality

TENMAT operates an ISO 9001:2008 Quality Management System for the design, development and manufacture of specialised high performance engineering materials and components.



Support System for Hot Independent Tanks



For over 25 years FEROFORM F3637, high load and bearing insulation pads, have been the industry standard for tankers carrying heated bulk liquids in independent tank constructions.

Approved by the main Marine Classification Societies and supplied to more than 70 tankers to date FEROFORM F3637 is designed to customer's requirements, easy and quick to install and is the ideal choice for new build and repairing or upgrading existing insulation systems.

TENMAT materials offers key advantages over competitor systems such as higher load and temperature capacity with fewer and smaller pads, and its easy and quick installation, both significantly resulting in a more economical solution.

FEROFORM insulation pads are maintenance free and will outlast the ship. No pad has ever required an in-service replacement. Leading ship owners continue to place their trust in **TENMAT** for tankers and barges ranging from 1,000—37,000dwt.

FEROFORM F3637 Benefits:

- Superior Load Bearing Capacity

Typically up to 3.5x higher load capacity than competitor systems. Resulting in fewer and smaller pads.

- Excellent Insulation Properties

Protecting the ship's hull from high cargo temperatures (up to 300°C).

- Controlled, Stable Friction

FEROFORM F3637 pads allow the tank to slide on the surface of the pads for controlled tank expansion and movement.

- Easy to Install

Easy adjustment ensuring simple and quick installation thus minimising installation and construction costs.

- Type Approved by All Major Classification Societies

FEROFORM F3637 is type approved by all leading Marine Classification Societies worldwide.

- Maintenance and Corrosion Free

FEROFORM pads do not seize (a metal to metal system may cause eventual seizure). Maintenance free, they are designed as a 'fit and forget' system. No pad has ever failed in over 25 years service (F3637 outlast ship's life).

- Bespoke Design and Machining

FEROFORM pads are designed and can be optimised to suit the actual load of the tank, particularly where peak loading occurs.

- Tank Supports for All Applications

FEROFORM F3637 is available for vertical support, anti-pitch and anti-roll applications.

FEROFORM F3637

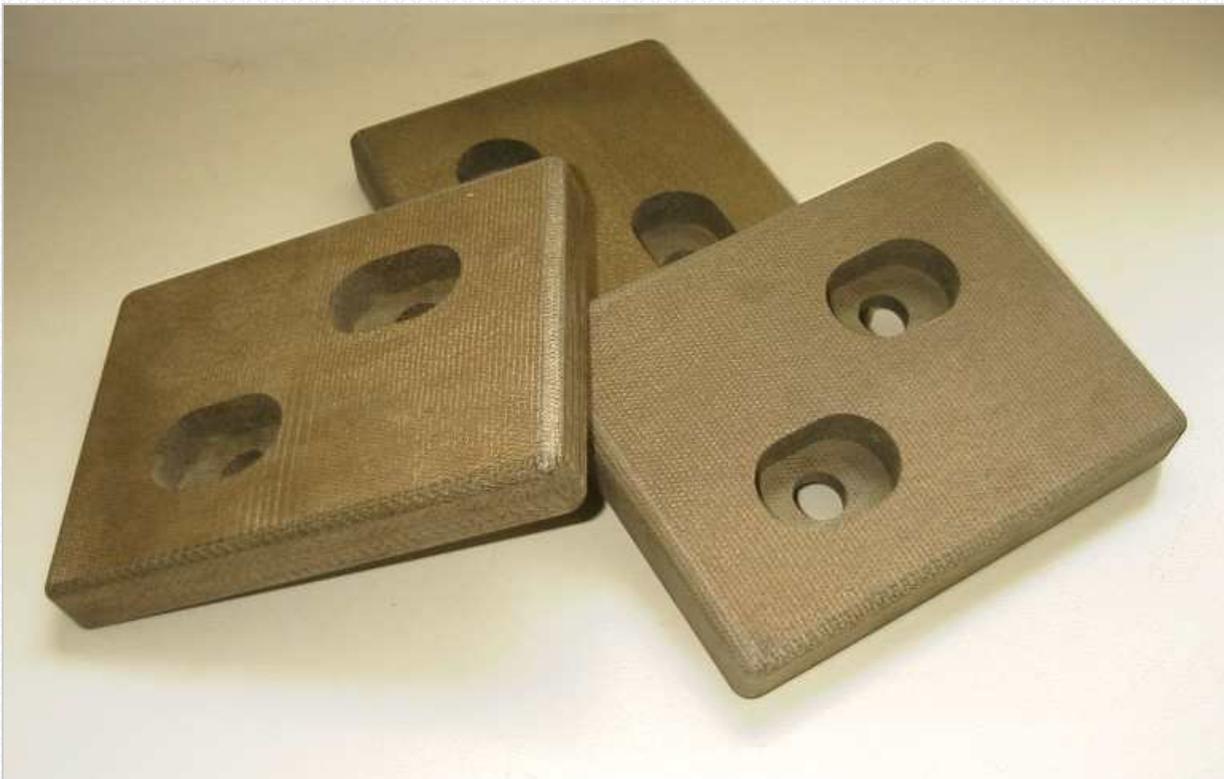
TENMAT FEROFORM 3637 is a high temperature insulation and bearing product, containing a variety of specialist fibres that have been impregnated with a phenolic resin. A range of specialist additives and friction modifiers make the product self-lubricating.

Material Properties:

PROPERTY	UNITS	FEROFORM F3637
Maximum Operating Temperature	°C	300
Coefficient of Thermal Expansion	$10^{-6} / ^\circ\text{C}$	29
Ultimate Compressive Strength	MPa	302
Normal Working Pressure	MPa	80
Compressive Yield @ 68.9 MPa	%	2.8
Coefficient of Friction (Dry)	-	0.28
Brinell Hardness	-	38
Impact Strength	kJ/m^2	90
Shear Strength	MPa	101
Density	g / cm^3	1.54

Hot Cargo Applications

- Bitumen / Asphalt (250°C)
- Sulphur (150°C)
- Coal Tar / Creosote (280°C)



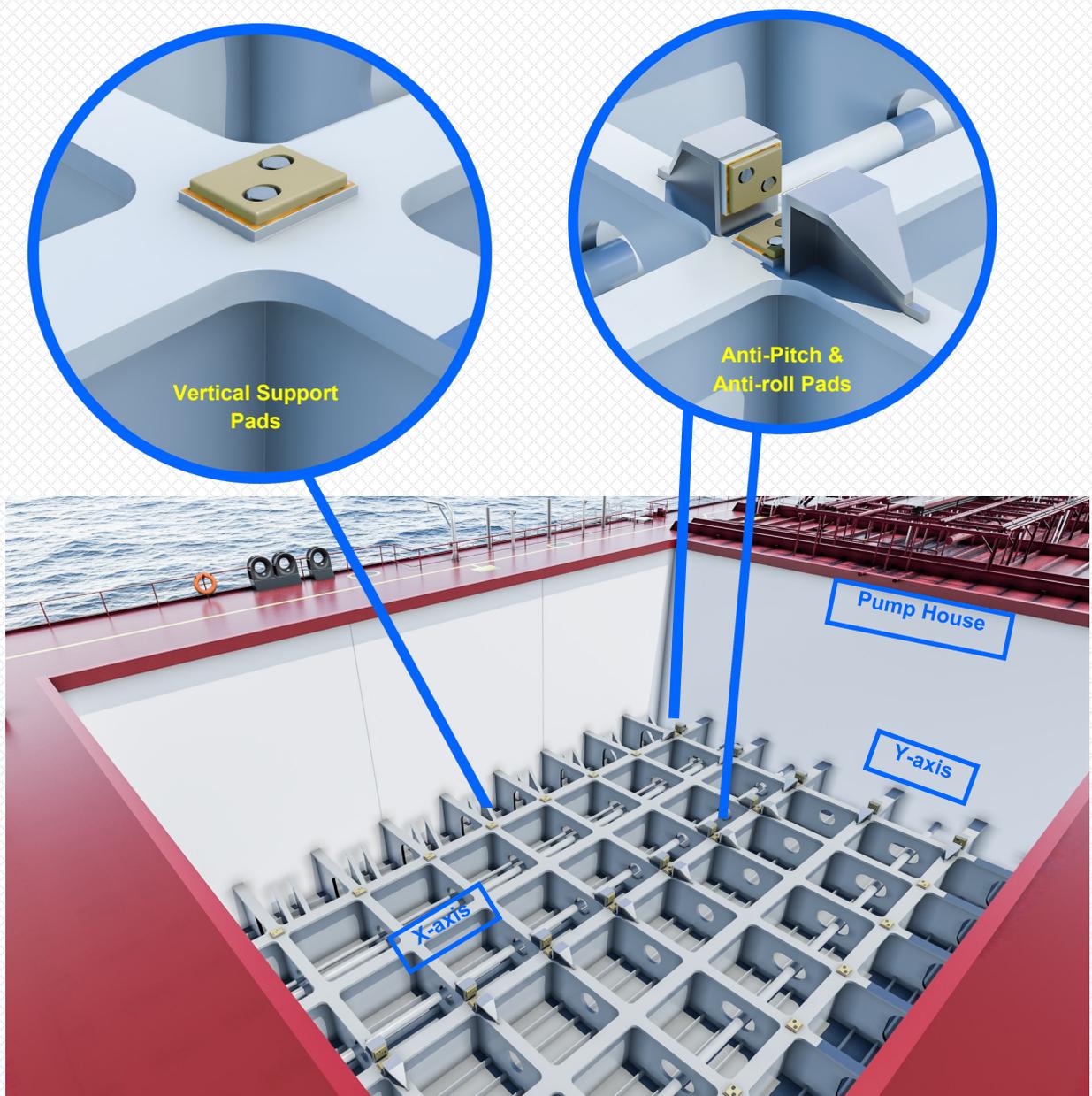
DESIGN

TENMAT tank support pad system is a simple, versatile and very efficient support system for hot cargo tanks. It's high load capacity means that fewer and smaller pads are required vs. competitor systems. F3637 versatility makes it easy to install and adjust, giving optimum support across the tank and is a very cost effective solution.

FEROFORM F3637 allows the tank to expand and contract by sliding over the surface of the F3637 pads, due to thermal expansion of the tank but also controlling the tank movement at sea using vertical, anti-pitch and anti-roll system keys.

Due to the flexibility of the **TENMAT** system, on occasions shipyards and designers prefer a slightly different design for their supports, and in these cases **TENMAT** can discuss and advise you with the best optimum design solution.

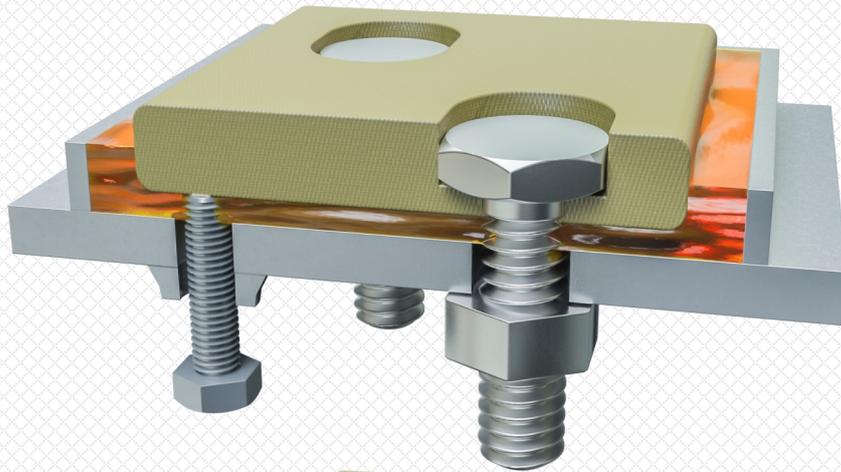
- Pads on X-axis are anti-roll pads/keys along the longitudinal girders
- Pads on Y-axis are anti-pitch pads/keys along the web frames
- Tank movement is controlled along the ship's major axes
- Tanks are allowed to expand away from pump room and either side of centreline
- Thermal expansion is minimised on the pipework at the pump room



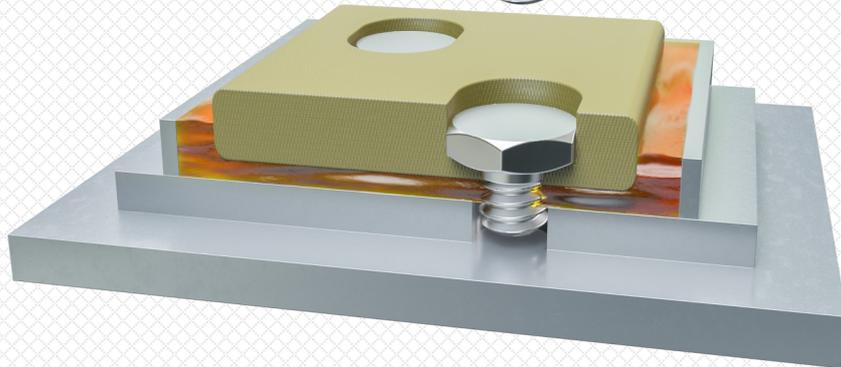
F3637 Typical Installations

Vertical Supports

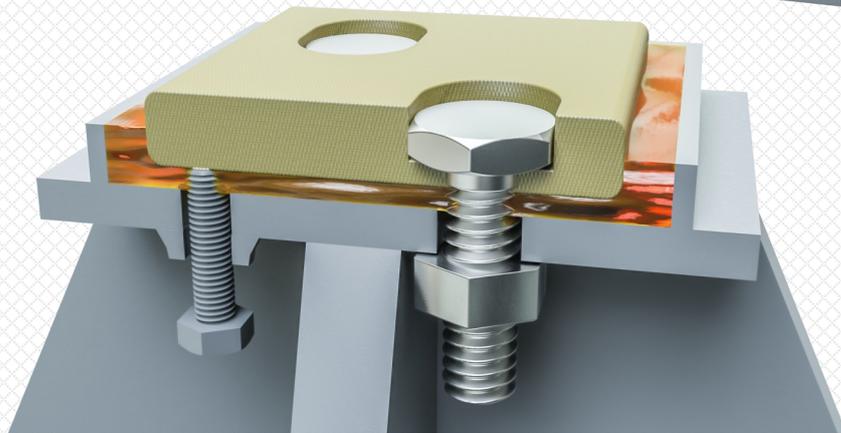
Typical Support Rib Arrangement



Typical No Penetration Arrangement



Typical Support Pillar Arrangement



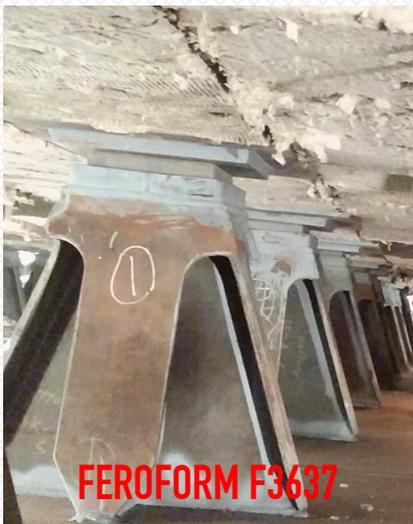
Side Load

Typical anti pitch / anti roll pad arrangement



FEROFORM vs. COMPETITION

FEATURE	FEROFORM F3637	MULTI-LAYER	CEMENT BOARDS
Design	<ul style="list-style-type: none"> • High load capacity 3.5x more than competitors • Fewer/smaller pads • Pad size to suit design • Sizes to suit specific load • Vertical, anti-pitch/roll • For small & large tankers • Can be in direct contact with tanks • Simple support structure • Typically 40mm thickness • Gaps are minimal (1-2mm). Minimum energy impact when tank moves 	<ul style="list-style-type: none"> • Low load capacity • Multiple pads required • Available presentations: <ul style="list-style-type: none"> - 200 x 200 (32 tonnes) - 350 x 350 (98 tonnes) • Vertical supports only • Not used on large tankers • Cannot be in direct contact with tank • Multi-layer structure: Rubber, Plastic & Steel • Requires special cast steel box • Typically 100mm thickness 	<ul style="list-style-type: none"> • Low load capacity • Multiple pads required • Standard sizes • Vertical, anti-pitch/roll • Limited to small tankers • Can be in direct contact with tanks • Thickness needs to be 75mm • Complex support structure • Traditional "cage design" needs large expansion gaps, resulting in high impact slamming
Health & Safety	<ul style="list-style-type: none"> • Not listed on Inventory of Hazardous Materials • Not considered hazardous 	<ul style="list-style-type: none"> • Not listed on Inventory of Hazardous Materials • Not considered hazardous 	<ul style="list-style-type: none"> • Needs listing in Inventory of Hazardous Materials • Contains crystalline quartz—World Health Organization known carcinogen • Sliding in use will cause respirable crystalline silica to be released
Durability	<ul style="list-style-type: none"> • LIFETIME GUARANTEE • Maintenance free • Will not corrode or seize • Minimal wear in service • Never replaced in service • Designed as a "fit & forget" system • Low friction, high load bearing material 	<ul style="list-style-type: none"> • Natural rubber degrades • Can suffer from creep • Can suffer from corrosion • Can suffer from pressure welding 	<ul style="list-style-type: none"> • Requires regular maintenance & repair • Absorbs moisture, rapid heating can cause cracks • Low impact strength = brittle = failure in use • Requires big clearances = high impact loads • High friction = high stress, thus failure in service
Installation	<ul style="list-style-type: none"> • Simple & quick process: <ul style="list-style-type: none"> Vertical Load Pitch & Roll Position tank Fit Pads Level pads Position tank Chock Fit shims 	<ul style="list-style-type: none"> • Complex procedure: <ul style="list-style-type: none"> Laser level base Weld cast steel box Machine steel pad per support 	<ul style="list-style-type: none"> • Complex <ul style="list-style-type: none"> Fit vertical load pads with wire Position tank Fit pitch & roll pads Remove vertical load pad wires (Cannot level pads to tank base)
Class Approval	<ul style="list-style-type: none"> • Type Approved by: ABS, NK, BV, KR, LR, CCS, DNV_GL 	<ul style="list-style-type: none"> • Type Approved by: BV, CCS 	<ul style="list-style-type: none"> • Type Approved by: None known
Overall System Cost	<ul style="list-style-type: none"> • Less supports = less work • Simple, quick installation • Maintenance free • Lifetime Guarantee 	<ul style="list-style-type: none"> • Special steel casing • Complex & slow installation • Labour intensive • Maintenance required 	<ul style="list-style-type: none"> • Traditional "cage design" gives high loads • Labour intensive • Maintenance required • Regular replacement



FEROFORM F3637



Multi Layer



Cement Boards

REFERENCES

Major Customers

- Wisby Tankers
- Sargent Marine
- Gearbulk
- Shell
- Tarbit Shipping
- Stolt Nielsen
- Vroon
- TIPCO
- Horizon Marine
- Kumiai Senpaku
- SDARI
- Delta Marine
- AVIC
- Hyundai Mipo
- CSSC
- Yangzijang
- Jiangsu Chengxi
- Nakatani
- RMK
- Sedef Shipyard



TENMAT has successfully supplied over 70 tankers (to date) with *FEROFORM* F3637 tanker pad system without a failure. In more than 25 years in service *FEROFORM* has always outlasted the ship's life, thus **TENMAT** has never supplied a spare part; *FEROFORM* F3637 pads are maintenance free.

TENMAT support pad system is considered the best option by both shipyards and ship owners:

"We have used *FEROFORM* F3637 pads as the load bearing high temperature insulation support in our bitumen tankers since 2003 and have found that this is the best material available exhibiting excellent performance. We tried competitors materials, but found the quality very poor. *FEROFORM* F3637 pads in service have proved to be excellent in service and we are fully satisfied with its performance"

Captain Hein, Fleet Superintendent, Sargent Marine

"We have used *FEROFORM* F3637 pads as the load bearing high temperature insulation support in bitumen tankers we have built since 2011 and have found that this is the best material available exhibiting excellent performance for this demanding application. *FEROFORM* F3637 is very easy to install, thus allowing us to provide excellent and rapid service to our customers.

Gencay Ok, Project Manager, Sedef Shipyard



REFERENCES

Owner	Vessel	Dwt	Product	Year	Class	Yard
Adnatco	Janna	9365	Sulphur	1993	Lloyds	Singmarine
Jebsens	Sharpness	28030	Bitumen	1995	Lloyds	HDW
Safmarine	Recife		Bitumen	1995	ABS	Hyundai Mipo
Polish Steamship	Penelope	15329	Sulphur	1995	DNV	Remontowa
PZ Shipping Pte	PM Alpha		Bitumen	1996	DNV	President Marine
Asphalt carriers Pte	Sotec Estel		Bitumen	1996	NKK	Southern Ocean
Polish Steamship	Kaliope	15329	Sulphur	1997	Lloyds	Remontowa
Gearbulk	Tern Arrow	42400	Coal Tar	1996	DNV	Hyundai Mipo
Mitrope Navigation	Mitrope	15500	Sulphur	1998	Lloyds	Szczszin
ShellINZ/Mobil	Kakarki	46700	Bitumen	1998	Lloyds	Szczszin
Shell SA	Hamrisa	45000	Bitumen	1998	Lloyds	Szczszin
Gearbulk	Hawk Arrow	42400	Bitumen	1999	DNV	Hyundai Mipo
Gearbulk	Osprey Arrow	42400	Bitumen	1996	DNV	Hyundai Mipo
PCS Phosphate	Aurora	21500	Sulphur	2000	ABS	ENVC
Sargent Marine	Hull 531	9240	Bitumen	2003	BV	Kraljevica
ENE Management	Horizon Lava	4999	Bitumen	2003	GL	Rousse
ENE Management	Etoile Lava	4999	Bitumen	2004	GL	Rousse
Sargent Marine	Hull 532	9240	Bitumen	2004	BV	Kraljevica
Sargent Marine	Hull 533	9240	Bitumen	2005	BV	Kraljevica
Sargent Marine	Hull 534	9240	Bitumen	2005	BV	Kraljevica
Sargent Marine	Asphalt Seminole	7500	Bitumen	2005	BV	Kraljevica
KGJS	Hull 398	15000	Bitumen	2005	BV	Kanrei
Sargent Marine	Hull 535	9240	Bitumen	2008	BV	Kraljevica
Nynas	Ardea	4700	Bitumen	2008	BV	Wuhan Nanhua
Nynas	Mergus	4700	Bitumen	2009	BV	Wuhan Nanhua
Sargent Marine	Hull 536	9240	Bitumen	2009	BV	Kraljevica
Sargent Marine	Hull 537	9240	Bitumen	2010	BV	Kraljevica
Horizon Marine	M/T Ain Zeft	5000	Bitumen	2008	GL	Rousse
Horizon Marine	M/T Ras Tomb	5000	Bitumen	2009	GL	Rousse
KGJS	Hawk Arrow	42400	Bitumen	2010	DNV	COSCO Nantong
Tarbit	Hull 538	9240	Bitumen	2010	BV	Kraljevica
VROON	Iver Balance	6180	Bitumen	2011	BV	Hyundai Mipo
VROON	Iver Beauty	6175	Bitumen	2011	BV	Hyundai Mipo
VROON	Iver Best	6187	Bitumen	2011	BV	Hyundai Mipo



REFERENCES

Owner	Vessel	Dwt	Product	Year	Class	Yard
VROON	Iver Blessing	6187	Bitumen	2011	BV	Hyundai Mipo
VROON	Iver Bright	6265	Bitumen	2012	BV	Hyundai Mipo
VROON	Iver Brilliant	6250	Bitumen	2012	BV	Hyundai Mipo
VP Petrochemical	VP Asphalt 1	2800	Bitumen	2011	DNV	Hong Ha
VP Petrochemical	VP Asphalt 2	2800	Bitumen	2011	DNV	Hong Ha
VROON	Iver Courage	3500	Bitumen	2012	Lloyds	Nanjing East Star
Stolt Neilsen	Stolt Kilauea	3500	Bitumen	2012	Lloyds	Nanjing East Star
Blue Sea	Asphalt Spirit	13000	Bitumen	2011	BV	Sedef
Wisby	Palanca Luanda	15000	Bitumen	2012	BV	Bi 3MAJ
Wisby	San Domingo Savio	15000	Bitumen	2012	BV	Bi 3MAJ
Wisby	Palanca Sydney	15000	Bitumen	2012	BV	Bi 3MAJ
Wisby	Palanca Singapore	15000	Bitumen	2012	BV	Bi 3MAJ
Elanco	Hull 176	6800	Bitumen	2012	BV	Sedef
Unknown	2356	3500	Sulphur	2012	?	Hyundai Mipo
Wisby	2324	19000	Bitumen	2012	BV	Hyundai Mipo
Wisby	2325	19000	Bitumen	2013	BV	Hyundai Mipo
Wisby	Palanca Montevideo	30000	Bitumen	2013	BV	Hyundai Mipo
Wisby	Palanca Muscat	30000	Bitumen	2013	BV	Hyundai Mipo
Ditas A.S.	Yard 92	18000	Bitumen	2013	DNV	RMK
Ditas A.S.	Yard 93	18000	Bitumen	2013	DNV	RMK
Sgt Marine	Asphalt Splendor	37000	Bitumen	2014	BV	AVIC
Wisby	Palanca Rio	16000	Bitumen	2015	BV	3MAJ
Wisby	Hull 731	16000	Bitumen	2015	BV	3MAJ
Wisby	2509	37000	Bitumen	2015	BV	Hyundai Mipo
Wisby	2510	37000	Bitumen	2015	BV	Hyundai Mipo
Sgt Marine	TBC	37000	Bitumen	2014	BV	AVIC
Hong Lam	Aspire	3500	Sulphur	2016	NKK	Nakatani
Tarbit Shipping	NB105	7760	Bitumen	2016	BV	RMK
Tarbit Shipping	NB106	7760	Bitumen	2016	BV	RMK
Kumiai Senpaku	CX5401	7800	Asphalt	2016	ABS	Jiangsu Chengxi
Kumiai Senpaku	CX5402	7800	Asphalt	2016	ABS	Jiangsu Chengxi
Kumiai Senpaku	CX5305A	37000	Asphalt	2016	BV	Jiangsu Chengxi
Mabong / Fussel	ISI 5001T	4990	Sulphur	2016	KR	Jiangsu Islands
TIPCO	2635	12000	Bitumen	2017	NKK	Hyundai Mipo
ASP	2561	50300	Bitumen	2017	BV	Hyundai Mipo
Reederai Jagers	Edgar Jagers	3340	Asphalt	2017	Lloyds	Teamco ShipYard



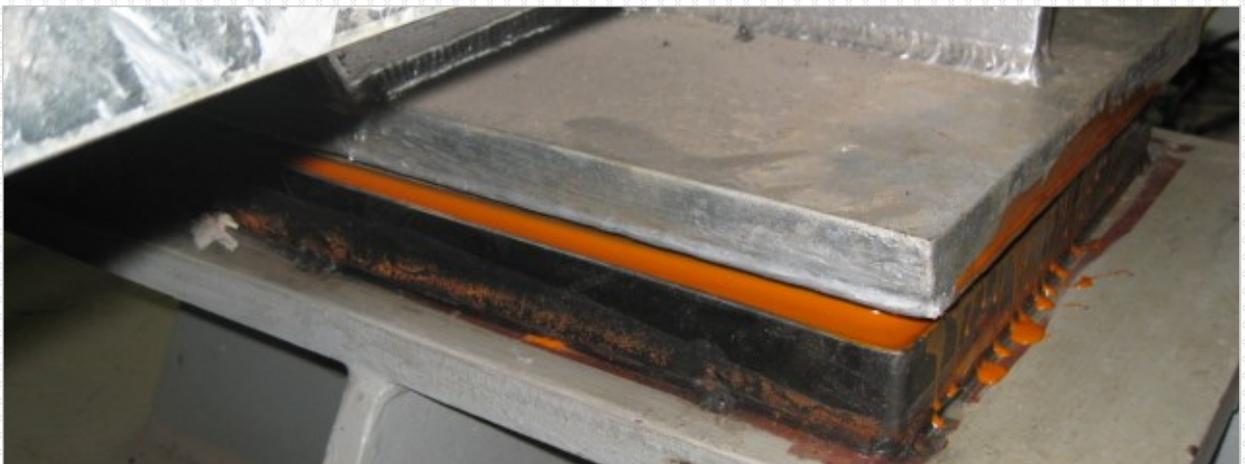
LIFE TIME WARRANTY

TENMAT marine solutions have been at the forefront of marine transportation for decades and continue to be trusted for safety-critical applications.

FEROFORM F3637 pads are not only approved by all Marine Classification Societies, but **TENMAT** also offers a life-time warranty on *FEROFORM* F3637.



TENMAT is an ISO 9001-2008 approved company





FEROFORM **RAILKO** *FEROGLIDE* *FEROBIDE*

REFRAVER **REFEL** **ARCLEX**

FIREFLY **NITRASIL** **SINDANYO**

TENMAT is committed to the highest standards in customer service and our international staff is looking forward to assist you.

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