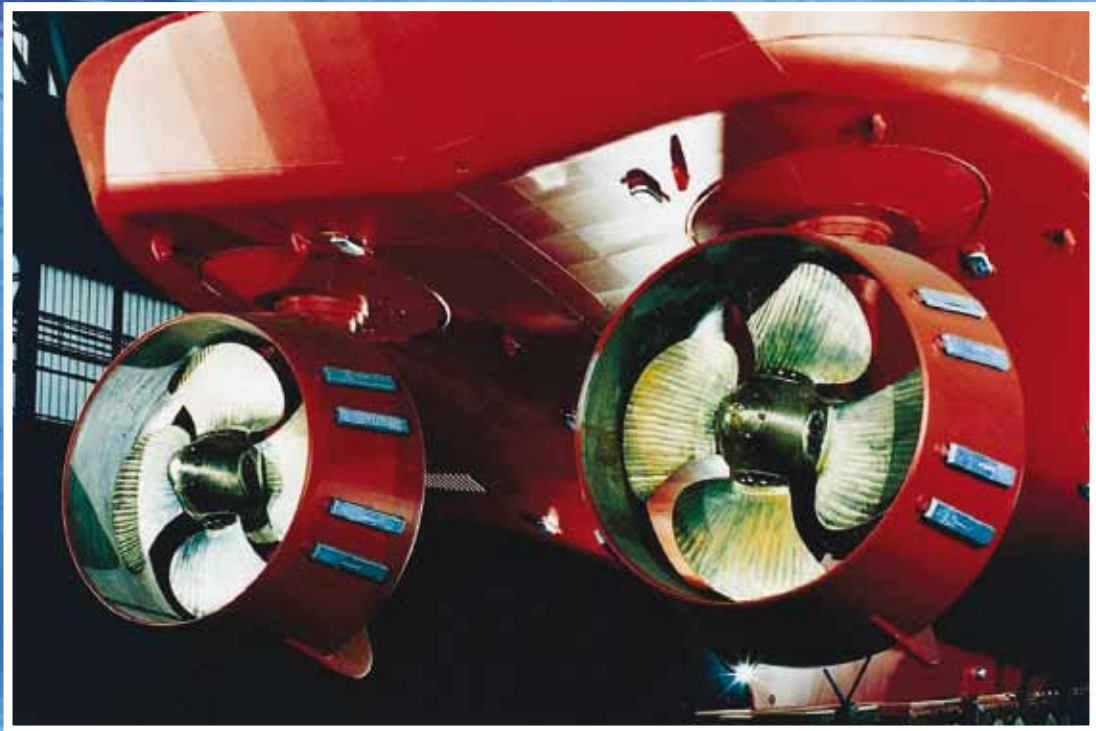




STONE MARINE SEALS

## ECOSEAL ORIGINS & DEVELOPMENT





STONE MARINE SEALS

Stone Marine Seals is a member of the Stone Marine Group of companies, which is itself part of Langham Industries.

The Stone Marine Group is among the world's leading companies in ship propeller and stern gear design, manufacture, service and repair. The Group is a truly worldwide operation with bases in the UK, Singapore, Namibia and South Africa. Propeller design and manufacture is undertaken for vessels of all sizes and types. The Groups maintenance and service companies have highly trained and experienced engineers on standby, 24 hours a day, 365 days a year, to attend any vessel in need of assistance wherever it might be located.



STONE MARINE  
GROUP



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SERVICES



STONE MARINE  
SHIPCARE



STONE MARINE  
SINGAPORE



STONE MARINE  
PROPULSION



BRUNTONS  
PROPELLERS

More details of the Stone Marine Group companies and their activities can be found on the Group website at [www.stonemarine.co.uk](http://www.stonemarine.co.uk)

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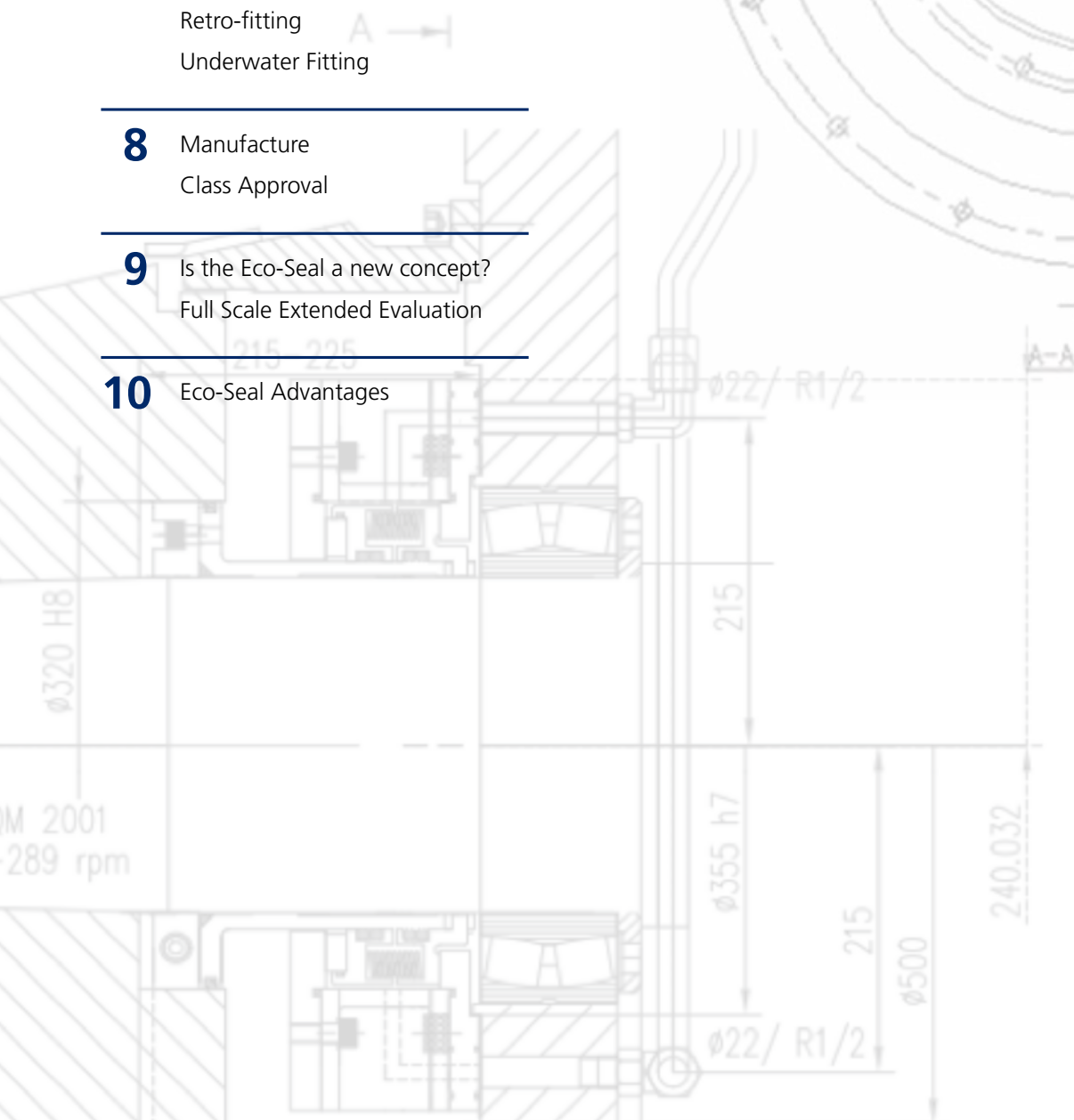
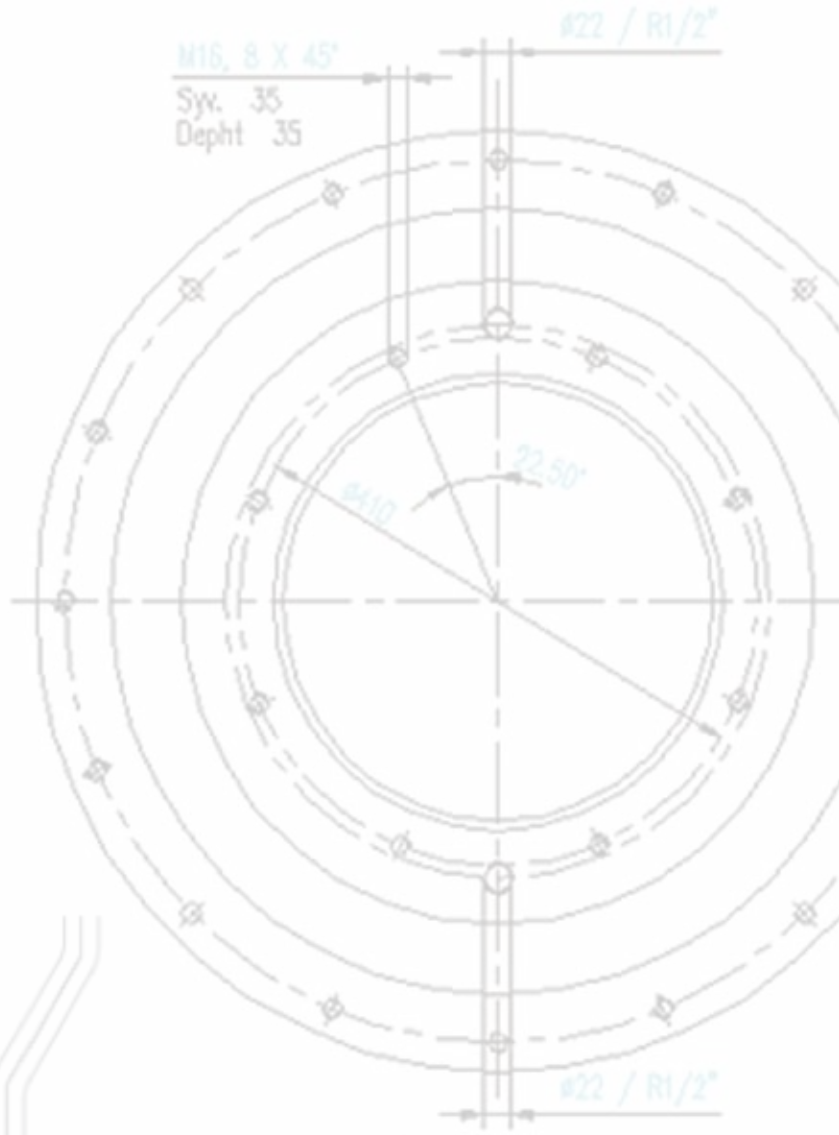
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# EcoSeal, a seal for the future – its origins and development

## History

The family run Ocean Venture Seals (OVS), is now a Stone Marine Group Company and has been renamed Stone Marine Seals Ltd.

Many years previously, OVS had acquired the USMP and Newark seal brands and patented the waterjet "Softork" sealing system.

From the 1960s, the Newark Seal was the preferred seal for British Shipbuilders Ltd and was fitted to every ship they built.



Worldwide, more than 40,000 units have been supplied for main shaftlines, bow thrust units and azimuthing thrusters.

Around 2004, to satisfy the growing need for an environmentally friendly seal, the best well-proven design features of the USMP and Newark seals were incorporated into a new double-barrier seal called the ECOSEAL.

The design was specifically chosen to overcome the known problems with radial lip seals and also mechanical face seals.

## What is the EcoSeal?

The EcoSeal is a double-barrier rotating mechanical seal which can be supplied in cartridge form, either in solid or fully split format.

Mechanical seals are well known for their leak-free ability and long service life.

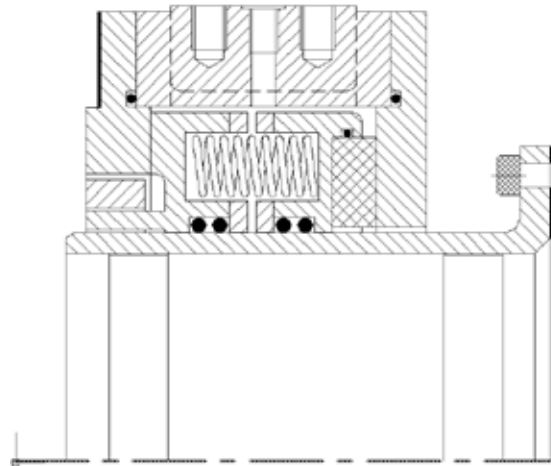
The rule for operating them successfully always remains the same; "keep the flat faces together and the seal will not leak".

## How does it work?

Two inner rings, driven through an arrangement connected to the shaft liner, are connected together and rotate inside a built-up housing.

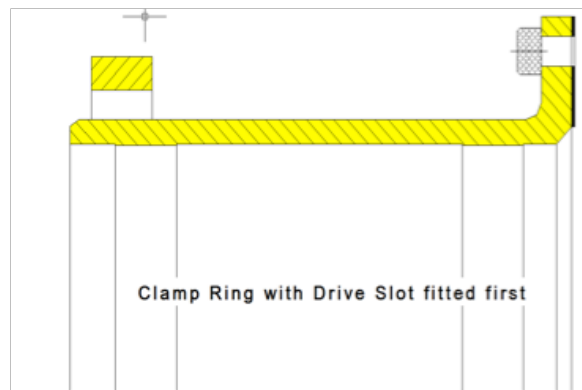
The rings are forced apart by specially designed springs which are tailored to the individual vessel's operating draft.

The Fwd ring has a metal-to-metal face contact (the USMP concept) and the Aft ring carries a PTFE encapsulated insert.



In retrofit situations, if replacing a Deep Sea Seal or Simplex / Kobelco Seal, the existing liner can be left in place and re-used, no matter how badly damaged it may be.

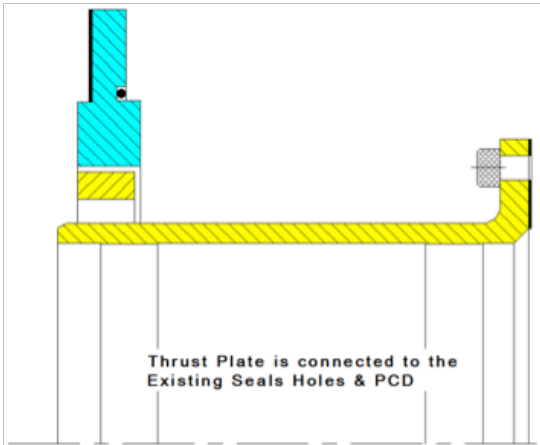
A drive clamp is attached to the Fwd end of the liner



Next, the Thrust plate is fitted which carries the rest of the seal housing.

This is tabulated to fit the standard drillings and recess diameters of popular radial seals such that it can be directly retrofitted without any additional work.



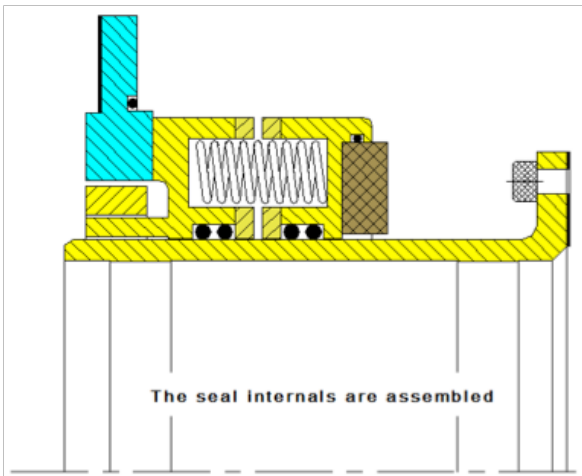


The rest of the seal internals are carefully assembled.

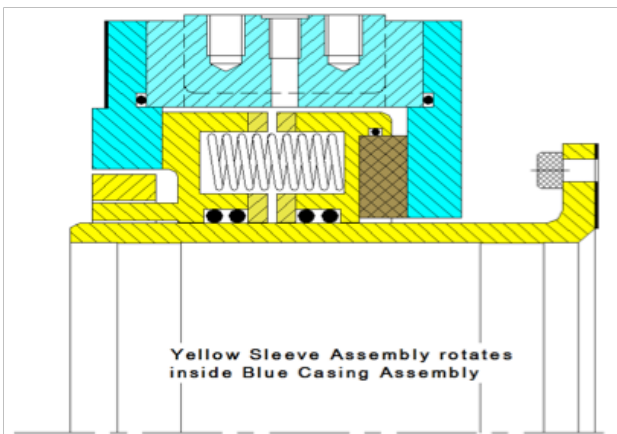
They sit on 4No. static sealing rings which are positioned to land between the wear grooves of a standard radial seal which allows a badly worn liner to be left in place and re-used.

**The flexibility of the design allows for any axial and radial movement of the propeller shaft without compromising the seal's performance.**

**This unique design eliminates any pumping action to which other types of seal are prone.**



And the outer housing fitted.



### What is the EcoSeal made of?

The component materials have been carefully chosen for their resistance to corrosion and wear.

The inner rings are a self-lubricated Leaded Bronze which contain the Stainless Steel springs and the PTFE Phenolic Resin insert.

In the case of a new-build, the liner can be either Stainless Steel or Bronze.

For a retrofit, the existing liner is left in place and re-used.

### How was the EcoSeal tested?

A full scale test rig was manufactured which could reproduce all the external and internal fluid pressures whilst simultaneously monitoring the temperatures and RPM etc.



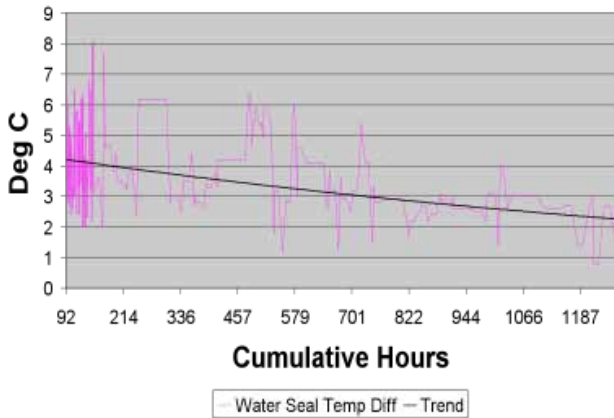
The rig was driven by a large hydraulic pump and fitted with an alarm / shut-down system to allow 24 hour unattended running.



For this particular trial the shaft diameter was 330mm running at 240RPM with seawater pressure of 0.6Bar (6M draft) and a sterntube oil pressure of 0.2Bar giving a differential of 0.4Bar.

Temperatures of the seal faces were carefully monitored and never reached more than 20°C above the surrounding water temperature at any time.

**ECO SEAL RESULTS**



In fact, the above graph shows a downward trend in seal face temperature difference as the faces further bedded in over time.



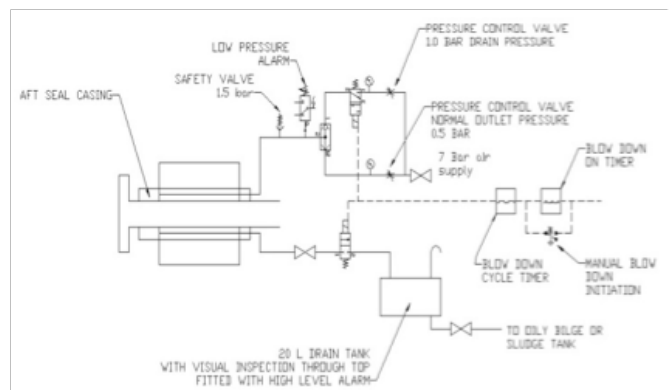
After 18 months of trials, the first seal was fitted to a 6000 dwt dredger in 2006. After 8,000 hours of running in the harshest of environments, the seal was examined for wear.

This fully operational test proved to be a 100% success with no measurable wear and zero pollution to either the surrounding seawater or to the sterntube oil.

The same seal is still running on this vessel today (2013).

**Vent & Drain System**

Should it be required by the owner as an additional assurance, an optional Vent & Drain system can be fitted.



This pressurises the interspace between the inner rings with compressed air and can flush out any fluid that may find its way in.

The outlet feeds into a drain tank which can be analysed for oil / water content.

The system can be fully automatic (blowing for 5 minutes every hour) or manually operated.



### Deep Drafts

The interspace between the inner rings can also be filled with oil and pressurised from within the ship.

This increases the interface pressure between the sealing faces and can be used to maintain the optimum interface pressure as the draft increases.

Heavy lift ships and semi-submersibles can have drafts approaching 40M.



Consequently, whilst carrying out tests for one of the world’s largest manufacturers of azimuthing thrust units, we were asked to test the seal for these depths.

We actually tested it to 50M by pressurising the interspace with oil to 5.5Bar and increasing the external seawater pressure to 6.0Bar with perfect results.

### Sizing Philosophy

Hole sizes and PCDs have been deliberately tabulated and chosen to mirror the standard sizes of most modern radial lip seals and other well-known face seals.

ITEM NO.	DESCRIPTION	QTY	UNIT	REMARKS
1	SEAL ASSEMBLY	1	UNIT	
2	...	...	...	...
3	...	...	...	...
4	...	...	...	...
5	...	...	...	...
6	...	...	...	...
7	...	...	...	...
8	...	...	...	...
9	...	...	...	...
10	...	...	...	...
11	...	...	...	...
12	...	...	...	...
13	...	...	...	...
14	...	...	...	...
15	...	...	...	...
16	...	...	...	...
17	...	...	...	...
18	...	...	...	...
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21	...	...	...	...
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25	...	...	...	...
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27	...	...	...	...
28	...	...	...	...
29	...	...	...	...
30	...	...	...	...
31	...	...	...	...
32	...	...	...	...
33	...	...	...	...
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42	...	...	...	...
43	...	...	...	...
44	...	...	...	...
45	...	...	...	...
46	...	...	...	...
47	...	...	...	...
48	...	...	...	...
49	...	...	...	...
50	...	...	...	...

In this way, it can be directly retrofitted without any modifications.

Sizes can range from 100mm Diameter liners to 700mm plus.

With the standard materials used (see above), the seal has been tested for a mean interface speed of 6 metres/second.

This equates to a 750mm diameter liner at 145RPM.

Larger diameters and higher speeds can be accommodated with Silicon Carbide inserts.

### Retro-fitting

As mentioned above, in retrofit situations (e.g. replacing a Deep Sea Seal or Simplex / Kobelco Seal) the existing liner can be left in place and re-used, no matter how badly damaged it may be.

For other makes of seal that do not have a liner (Cedervall for example), a fully split liner can be provided.

Most retro-fits can be completed within a 24 hour period.

### Underwater Fitting

A partnership has been formed with one of the leading underwater maintenance companies in the world (UMC International).





Their divers have been specially trained to install the EcoSeal under the supervision of a top-side Service Engineer through a hat-mounted video link.

As the seal can be fully split, there is no bonding required and, consequently, no time consuming curing needed.

Everything can be flown to the location of choice anywhere in the world and fitted with the vessel fully laden.

All personnel fly on maritime tickets (same as crew) with minimal cost.

**Manufacture**

All casting and machining is carried out in the UK to ISO9001:2008 Standards.

CNC machining is performed within the Group's state-of-the-art facility at Tridan Engineering Ltd.

Tridan's main business involves producing complicated components for the Aerospace Industry, so their Quality Assurance system is well suited for seal manufacture and assembly.



Upon completion, seal cartridges are assembled and stored, ready for despatch.



Also, quantity is not a problem as CNC machining is purpose made for batch production.

**Class Approval**

Initial type approval was obtained from DNV in 2004 (their Cert No. M-9987).

DNV called their tailshaft condition monitoring survey arrangement TMON, whilst ABS call it TCM and BV call it MON-SHAFT.

However, in order to obtain the extended survey period, they all have the same requirement.

Namely, that the sealing rings in the stern tube sealing box must be replaceable without having to withdraw the shaft or remove the propeller.





As a matter of interest, type approval is required for main-line tailshaft / sterntube sealing but there is no requirement for the sealing of tunnel or azimuthing thrust units.



The vessel racked up 22,000 running hours by the time the prototype thruster was taken out for detailed examination by Rolls Royce.

(22,000 hours divided by 24 and then 365 is 2.51 years!!!!).

The reference statement they provided (see below) states that **“the seal performed extremely well and after dismantling showed perfect condition”**.

**Is the EcoSeal a new concept?**

The EcoSeal is not a “new” seal but has evolved from the necessity to produce a non-polluting eco-friendly seal for today’s demanding requirements.

The materials are well proven, the concept is well proven and extensive test-rig and full scale tests have shown this seal to be superior in every respect to sealing options currently offered.

**Full Scale Extended Evaluation**

In 2006, Rolls Royce Marine Ulstein of Finland asked us to produce a sealing solution for a prototype azimuthing thrust unit they intended to fit to a ferry.

This road ferry (“Sterna”) would need to run 7 days a week throughout the year in all weather conditions including heavy ice (well known as a problem for most seals).





**Reference Statement**

Date of issue: 24<sup>th</sup> January 2011  
 Subject: Propeller shaft seal  
 Ref: Azimuth thruster type US 2001

Ocean Venture ECO seal has been used for more than 20000 hours in the road ferry “Sterna” that operates in Turku archipelago in Finland. During that time the seal has performed extremely well. After dismantling the seal showed perfect condition.

The ferry in question has ice class 1A Super and operates throughout the year in all weather conditions including heavy ice.



Road ferry “Sterna”

Best regards,  
 Rolls-Royce Oy Ab  
  
 Juha Pekka Vesa  
 Technical Manager, Product Management  
 Azimuth Thrusters

Handled by: Juha Pekka Vesa  
 01/24/11 4:37 PM

Rolls-Royce Oy Ab, P.O. Box 225, FIN-28101 Rauma, Finland  
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## EcoSeal Advantages

- **No oil leakage to the surrounding environment**

Because of the double barrier design of the EcoSeal, any fluid transfer must pass between two sealing faces before any pollution can take place.

Using the option to drain the seal casing inboard the vessel using our "Vent and Drain" system, the Eco seal virtually eliminates the possibility of sea water contamination into the stern tube or oil pollution into the surrounding sea water.

- **No Parts rotate against the sleeve liner**

Unlike a conventional lip seal, all wearing parts rotate with the sleeve liner which eliminates the need to remove the tail shaft or for expensive bonding.

Seal maintenance can be carried out insitu with the split or semi-split seal option.

The sleeve liner should last the life of the vessel.

- **Option to retrofit using an existing seal liner**

The EcoSeal can be supplied fully split and can be retrofitted to an existing Lip seal liner.

This option gives the owner the advantages of using the EcoSeal without the expense of removing the propeller, rudder or the tailshaft or the Output shaft of a Thrust Unit.

- **Option to adjust the seal interface pressure from inboard the vessel**

The EcoSeal casing can be pressurised using either oil or air in order to adjust the sealing face pressures.

Regular samples can be taken from the seal casing to ensure that the seal is performing at its optimum and can be adjusted to compensate for any change in draft or running conditions.

This option is particularly useful on vessels such as semi-submersible drilling vessels or where the draft would change dramatically when loaded and unloaded (as with Heavy Lift vessels, for instance).

- **Design compensates for any thermal expansion, hydraulic pumping or axial movement of the propeller shaft**

Unlike other mechanical seals on the market, the EcoSeal does not rely on the space between the sterntube end and the propeller hub to give the seal its working compression.

The unique design mean that the distance between the static wearing faces always remains constant.

Any axial movement in the shaft will not result in a pumping effect either drawing sea water into the seal or expelling oil into the surrounding environment.

- **Tested to 50M depth**

Unlike our competitors, the EcoSeal is designed for the vessel.

The seal is produced for the draft with which the vessel is running, so the customer can be reassured that the seal is perfectly suited for the application.

Tested to 50M, the EcoSeal can suit all applications from shallow coastal vessels to deep water drill ships.

- **Environmental Acceptable Lubricants (EALs)**

US Environmental Protection Agency (EPA) has issued a new Vessel General Permit (VGP) which requires ships sailing in US waters to use EALs in all oil-to-sea interfaces "unless technically infeasible".

The EcoSeal is fully compatible with biodegradable oils and aluminium anodes, complying with the EPA regulations without any modification needed.



TO IDENTIFY IF THE ENVIRONMENTALLY ACCEPTABLE LUBRICANT (EAL) USED OR PLANNED FOR USE IS SUITABLE FOR YOUR INSTALLED WÄRTSILÄ SEAL, PLEASE USE THE TABLE BELOW. THE SPECIFIC EAL IS LISTED IN THE FIRST COLUMN; THE SUBSEQUENT COLUMNS HIGHLIGHT WHETHER IT IS APPROVED FOR USE WITH A PARTICULAR SEAL TYPE OR WHETHER IT IS TECHNICALLY INFEASIBLE.

Oil Name	Generic Grade	Kinematic Viscosity [cSt] at 40 [°C]	Emulsifying	Leak Reduction / Emergency Oils Only **	A-58 (OFS OFF)	STERNGUARD **				HUBGUARD **
						MANEBAR	MANEBAR S & EN	WORKSAFE (OFS1R)	MN & ML (OFS1H)	T SERIES (OFS1H)
Castrol										
Biotat	150	150	Yes	Yes						
Biotat	68	68	Yes							
Castrol										
Clarity Hydraulic	100	100	No							
Cognis										
Pro Eco	100 EP	100	No							
Fragol										
Hydraulic	TR 46	46	No							
Kleber										
Kleber Bio	EG 150	150	No	Yes						
Kleber Bio	RM 2 - 100	100	No							
Mobil										
SHC Aware	ST 220	220	Yes	Yes						
SHC Aware	ST 100	100	Yes							
Parolin										
HLP Synth	100	100	No							
HLP Synth	46	46	No							
Shell										
Naturelle	HF-E15	15	No							
Naturelle	HF-E32	32	No							
Naturelle	HF-E46	46	No							
Naturelle	HF-E68	68	No							
Tarvosolve										
Envirologic	200	68								
Envirologic	211									



## BIODEGRADABLE OIL LIST FOR STERN TUBE SEALS

The following list serves as recommendation to apply to gears, clutches, etc.

The technical data sheet for each oil is available on the website.

It solely applies to stern tube seals and other components of the propulsion system from the oil companies.

Environmental friendly and or EALs as per VGS for approval before use on your individual stern tube seals with sealing rings of VitonPod material.

Other oils / lubricants which are not listed below are not approved.

# product data

## BIOGEAR XP68 / BIOGEAR XP100 / BIOGEAR XP150

**Description:**

Biodegradable, low-toxicity high performance EP gear oils based on saturated synthetic ester. BIOGEAR XP oil has a high degree of renewability and is designed for use in sensitive environments, especially marine, where there is potential for fluid loss to occur. Designed for an exceptionally wide operating temperature range, protecting equipment from -25°C to over 100°C (-13°F to +212°F). A highly thermally stable top-tier fluid that provides superior oxidation protection under severe conditions, excellent water separation extended fluid lifetime, high EP protection and low wear.

**Compatibilities:**

Good compatibility with common sealing materials including Nitrile and Viton®. Miscible with common mineral based gear oils, but, in common with good practice, old oils should be drained completely to avoid any risk of additive incompatibility and ensure that the full benefits and performance are achieved. Water content must not exceed 1000ppm (0.1%). This must be strictly adhered to. Any free water must be separated off on a regular basis. Unlike the Vickers HYDROX range, these oils do NOT emulsify.

**Characteristics:**

- Appearance:
- Viscosity:
- Viscosity Index:
- Density @ 15°C (kg / ltr):
- Flashpoint SETA (°C):
- Pour point (°C):
- Shelf life:

	BIOGEAR XP68	BIOGEAR XP100	BIOGEAR XP150
Appearance:	Clear / bright yellow	Clear / bright yellow	Clear / bright yellow
Viscosity:	ISO vg 68	ISO vg 100	ISO vg 150
Viscosity Index:	145	140	137
Density @ 15°C (kg / ltr):	0.91	0.92	0.92
Flashpoint SETA (°C):	>180	>180	>180
Pour point (°C):	<-28	<-28	<-28
Shelf life:	Expected indefinite in original sealed containers.		

**Performance Data:**

- Biodegradability:** Biodegradable according to OECD 301B, with a biodegradability of >60% in the 28 day test.
- Toxicity:** Practically non toxic to Fish, Daphnia and Algae, representing the Marine food chain.
- Viscosity Index:** Does not use Viscosity Improvers, therefore should not shear down in service.
- Foaming:** Passes maximum foam test according to ISO 6247 / ASTM D892 and shows minimal foaming tendency in Flender foam test.
- Demulse / Water Separation:** Very good demulsification properties, ensuring easy water separation, if contaminated.

Hydraulic oil	Other	Stern tube oil	VG com
	X		X
		X	X
	X		X
		X	X
		X	
	X		X
		X	
	X	X	
		X	

continued ...

the quality touch

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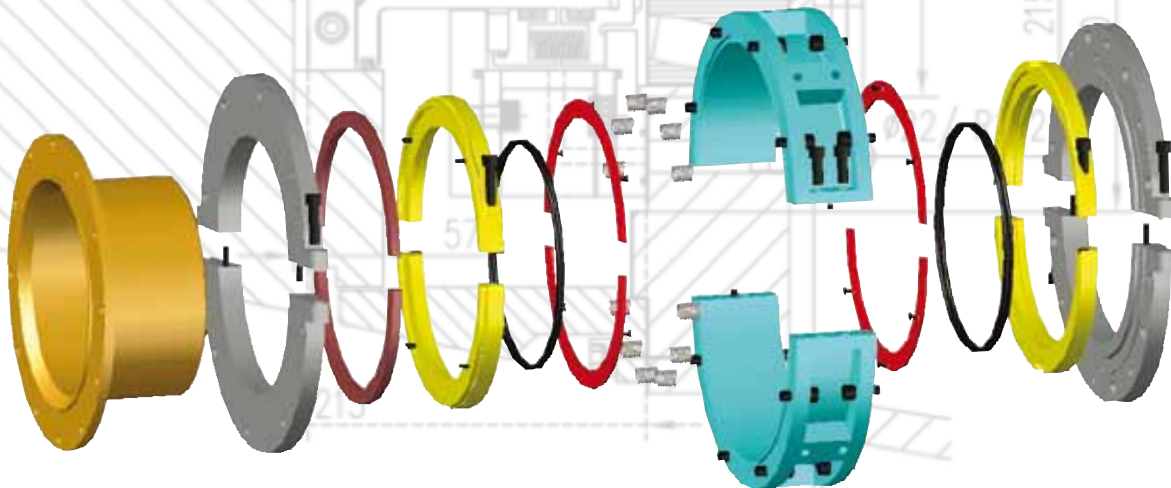
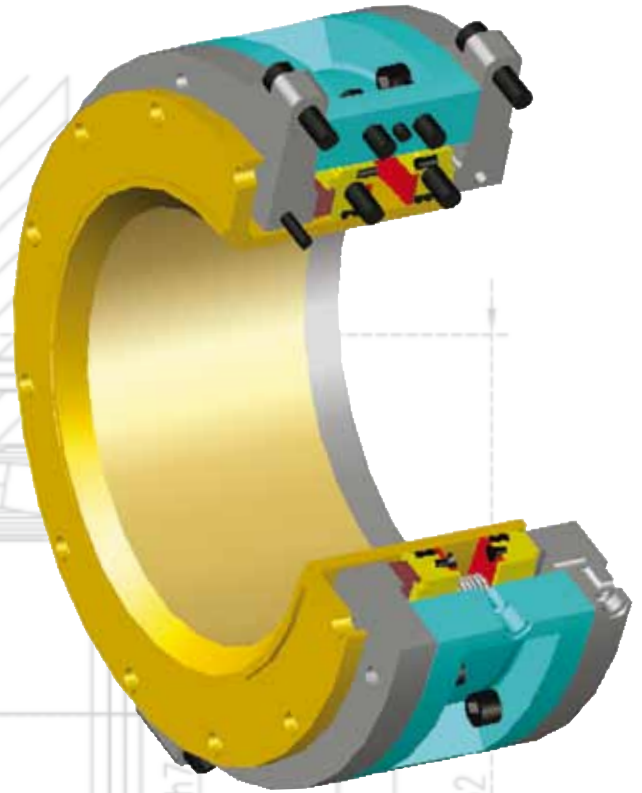
This data sheet is given for guidance only and does not constitute a specification. It is given in good faith but without warranty.



# ECO-SEAL

## Protecting the environment

- No oil leakage to the surrounding environment
- No water ingress into the stern tube oil system
- No parts rotate against the shaft liner
- Option to retrofit using existing shaft liner
- Option to adjust seal interface pressure from inboard
- Any fluid transfer into the seal casing can be drained inboard
- Can be fully split for ease of maintenance
- Design compensates for any thermal expansion or hydraulic pumping of the shaft line
- Tested to 50M depth
- Fully compatible with all EALs and Bio-Oils



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