

HydroActive™ Bulkhead Seals



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Technology & operational need

PRODUCT OPTIONS

Midé Marine sells three types of bulkhead seals. All of our seals have been rigorously tested following US Naval and Class Certification guidelines.

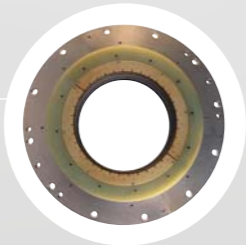
Reliant RM

The Reliant RM range of bulkhead seals are cartridge or diaphragm replacements for ships that already have bulkhead seal housings. For these ships, Reliant RM seals offer a cost effective solution, along with all of the advantages and benefits of Midé Marine HydroActive™ technology. Measurements on Reliant RM seals, installed on US Navy ships, concluded that the non-rotating seals offer superior wear performance over existing diaphragms that rotate with the shaft.



Reliant YM

Reliant YM is Midé Marine's next evolution seal design in which total system weight is reduced and maintenance is simplified. Instead of a housing, the Reliant YM series uses flat interface plates bolted to the bulkhead, on which the seal floats, to allow for large radial motions of the shaft. Reliant YM seals are installed and operating on many vessels.



Omni

Omni seals are designed for vessels that don't have the large shaft radial deflections typically required for naval ships. With fewer components, the non-floating Omni seals are significantly less expensive, and easier to install and maintain.



HYDROACTIVE™ TECHNOLOGY

Foam with embedded hydrogel particles is the key technology that enables our HydroActive™ seals. The foam is placed inside a lip seal that is not normally in contact with the shaft. The hydrogel particles absorb water during a flooding event, and, as the particles swell, the foam pushes the lip seal into contact with the shaft - creating a water tight seal.

In summary, under normal operating conditions, no part of the seal is in contact with the shaft - allowing for unlimited shaft rotation speed without any seal wear. During a flooding event, the engaged lip seal still allows the shaft to rotate, allowing the stricken ship to reach a safe haven.

OPERATIONAL NEED

Bulkhead seals are safety components on ships. Their purpose is to stop compartment-to-compartment flooding through the shaft opening in the bulkhead. Currently most bulkhead seals on the market are based on designs that are constantly contacting or have the seal spinning with the shaft. Due to radial and axial shaft motions, shaft run out, vibrations, poor shaft/bulkhead alignment, and air differential pressures these types of seals are unreliable and expensive to maintain. High installation and maintenance costs result in unacceptable seal life-cycle costs. Midé Marine's patented non-contacting HydroActive™ bulkhead seals are not in contact with the shaft until a flooding event occurs - essentially eliminating wear.

Key HydroActive™ Features

Features & benefits

HYDROACTIVE™ BENEFITS

All of Midé Marine's bulkhead seals use HydroActive™ foam, which offers the following benefits:

Reduced installation & maintenance costs

Reduced operating costs

Ability to operate in a wide range of applications and environments

Improved safety

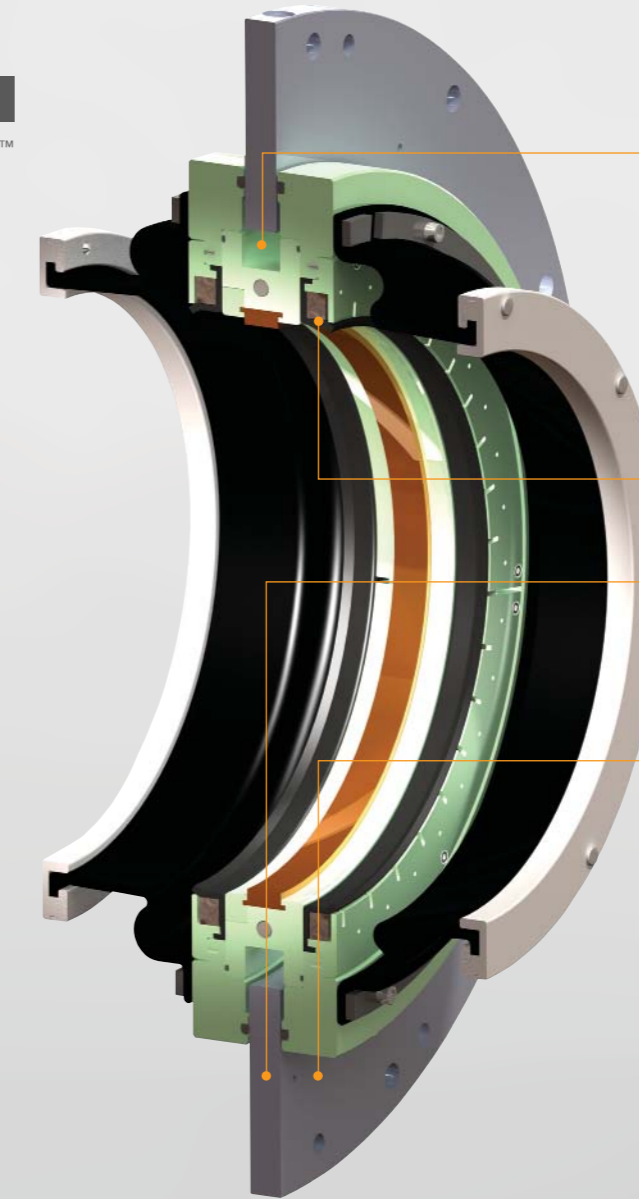
Unique ability to operate in multiple orientations - including vertical

Vertical orientation may cause premature activation in conventional contacting seals

Resettable and re-usable

Smart HydroActive™ foam requires no shipboard system integrations

Including oil, air, water, etc.



HYDROACTIVE™ KEY FEATURES

Non-contacting & non-rotating

- No pre-mature wear – only works when needed
- Reduced installation & alignment requirements
- Allows for high radial & axial motion
- Can accommodate unlimited shaft speed when not engaged
- Can operate in vertical & high angle shaft applications
- Zero acoustic noise

Water activated

- Does not prematurely activate due to air pressure

Split design

- Can be installed around existing shafts
- Easy to maintain
- Reduces installation costs

Light weight

- Rigging not required
- Lower freight & transportation costs
- Easy to install

ABS, DNV, BV and LR Type Approved

Reliant YM & RM Series

Complete assembly & retrofit models

RELIANT KEY FEATURES & BENEFITS

Non-contacting, non-rotating floating design

Can withstand large axial and radial shaft movements
Up to 50mm of radial shaft deflection and unlimited axial deflection allowed
Self-centering seal

Utilizes HydroActive™ technology to engage seal

Shock & vibration qualified to military standards

Dirt excluder & emergency clamp ring

Provides backup seal

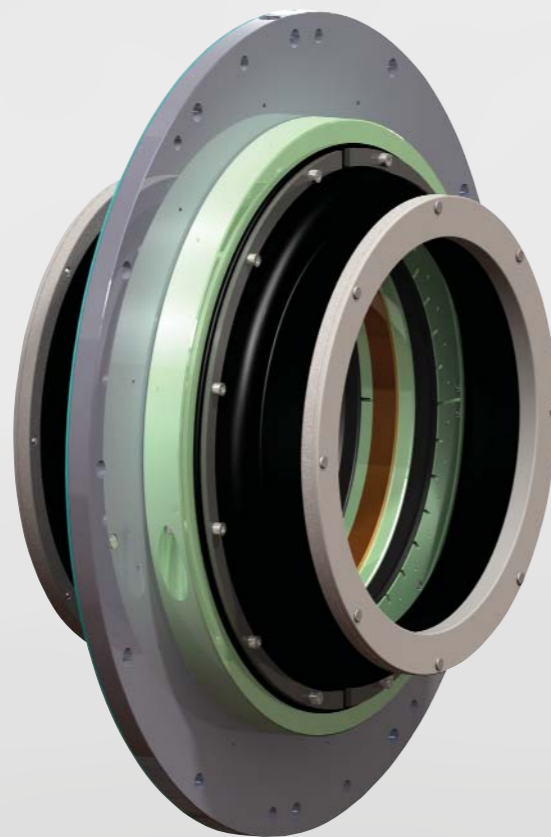
Components are lightweight & non corroding

Superior performance

Ready to integrate into military ships & boats

Retrofit solution

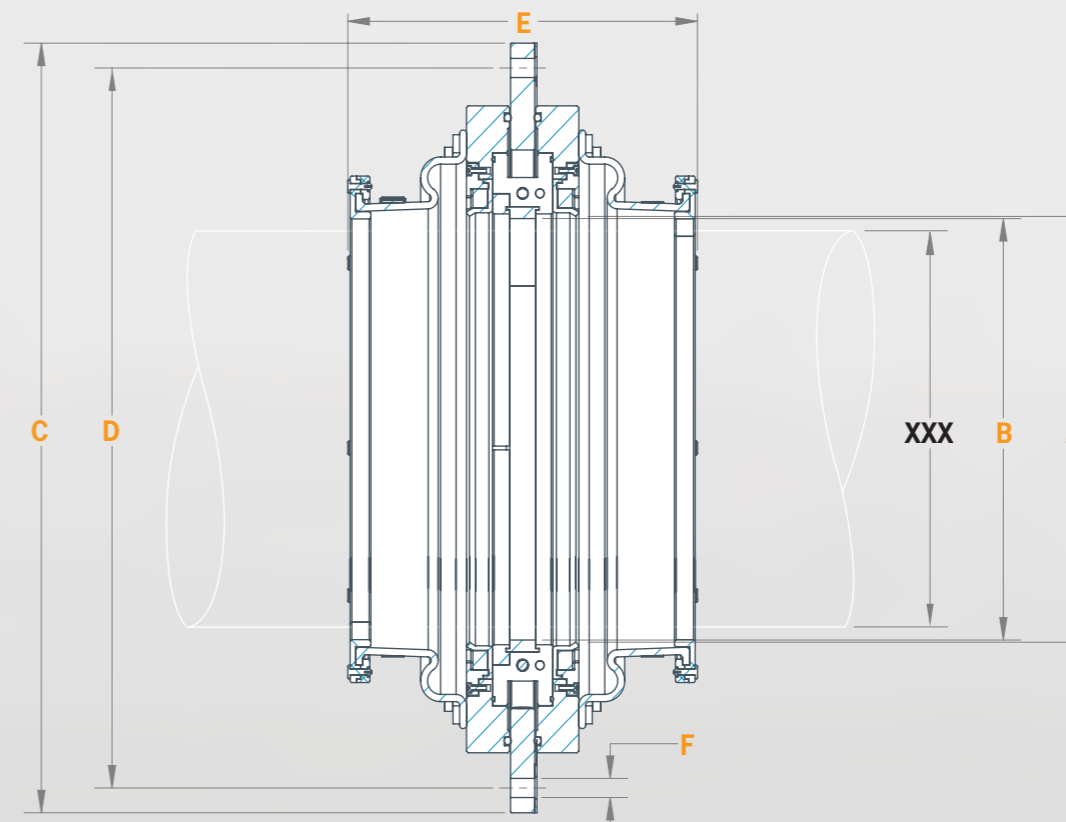
For Reliant RM models only



Operating Pressures	up to 30 psi (2 bar)
Shaft Surface Speed	Dry = Unlimited. Flooded = up to 82 ft/s (25 m/s)
Surface Finish Required	63 μ-inch or better (1.6 μ-meter)
Allowable Angular Misalignment	0.5 degrees
Leak Rate	Less than 1 US Pint per minute (473 mL/min)
Shaft Deflections	Up to 50mm, 1.97" (zero to peak)
Key Features	Non-Contacting, Non-Rotating, Reusable
Approvals	NAVSEA, MIL-S-901D, MIL-STD-167-1A, ABS, DNV, BV and LR Type Approved

Standard Reliant Dimensions

Shaft diameters from 100mm – 1000mm



Dimensions - all dimensions are in mm

Shaft Size Range (mm)	PN (Part Number)	A Lip Seal ID	B PTFE ID	C Outer Diameter	D Bolt Circle	E Overall Width	F Bolt Thru Hole Diameter	Allowable Travel	# Holes
100-350	110-XXX-20	XXX+6	XXX+3	XXX+310	XXX+275	254.0	13.5	20.0	12
351-750	110-XXX-38	XXX+6	XXX+3	XXX+550	XXX+500	279.4	20.5	38.0	18
751-1000	110-XXX-42	XXX+6	XXX+3	XXX+500	XXX+465	304.8	23.0	42.0	20

ORDERING INFORMATION

Part Number Scheme

PN: 110 - XXX - 20

Reliant YM Shaft Diameter Allowable Travel

RELIANT YM

> All seals can be custom engineered.

RELIANT RM - RETROFIT

The dimensions for the Reliant RM seal will be based on the customer's existing housing.

Omni Series

Cost effective HydroActive™ solutions

OMNI KEY FEATURES & BENEFITS

Utilizes HydroActive™ technology to engage seal

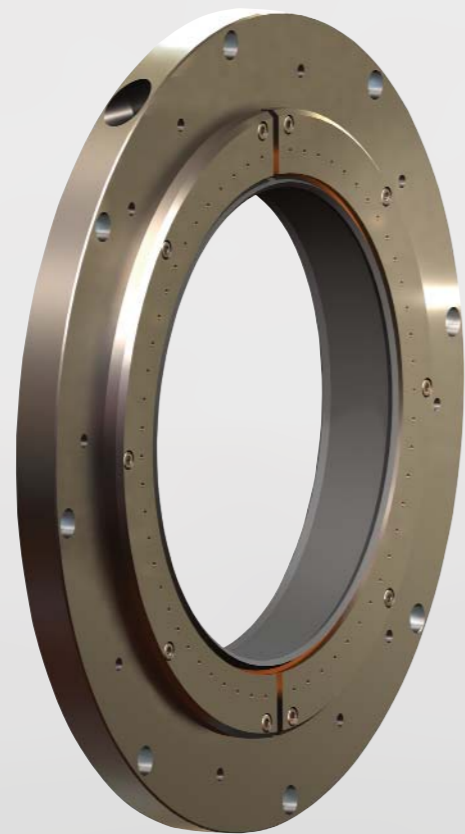
Simple non-floating static design

Can be used in applications where radial motion is less than 10mm.

Simplified shipboard installation

Lower part count

Lower procurement cost



Operating Pressures	up to 30 psi (2 bar)
Shaft Surface Speed	Dry = Unlimited. Flooded = up to 82 ft/s (25 m/s)
Surface Finish Required	63 μ-inch or better (1.6 μ-meter)
Allowable Angular Misalignment	0.5 degrees
Leak Rate	Less than 1 US Pint per minute (473 mL/min)
Shaft Deflections	Up to 10mm, 0.4" (zero to peak)
Key Features	Non-Contacting, Non-Rotating, Reusable, Cost Effective
Approvals	ABS, DNV, BV and LR Type Approved

OMNI APPLICATIONS

Military and Commercial Vessels: Omni seals have designs and sizes that meet the requirements of a wide range of military and commercial vessels.

Composite Shaft Systems: Omni seals reduce the potential for shaft damage or grooving to composite shafts, which may result from a constantly contacting seal. Midé Marine's seals are an optimal solution for use with lightweight composite shafts.

Cardan Shafts: Omni seals allow for the typical radial run out of the intermediate shaft between the universal joints of the cardan shaft - the only technically sound solution for a reliable bulkhead seal for cardan shafts.

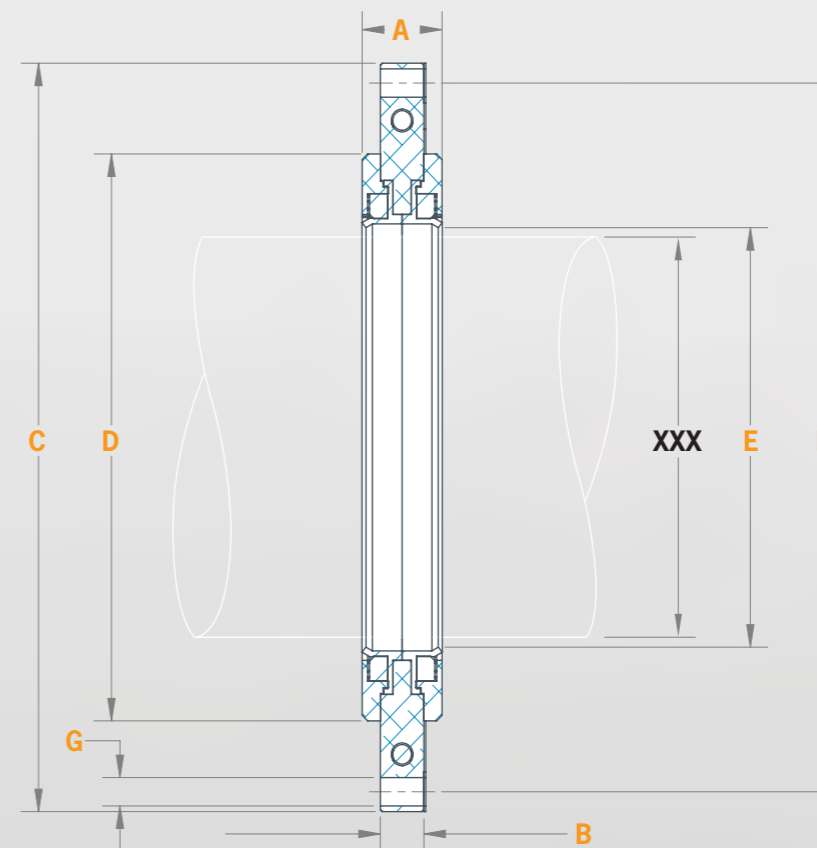
Hollow Steel Shafts: Omni seals' non-contacting design is an enabling feature where there is no need to machine a shaft to a strict roundness, as required by contacting seals. Midé Marine's seals have been tested to seal successfully on shafts with high out of round values.

Waterjets and Higher RPM Shafts: Due to their non-contacting design, Omni seals are well suited to applications with high shaft speed, and subsequent high frequency shaft motions. When not engaged, Midé Marine's HydroActive™ seals can withstand large radial and axial shaft motions, and shaft speed is unlimited due to the non-contacting nature of the design.

Vertical Shaft Applications: Omni seals are ideally suited to vertical shaft applications due to their non-contacting HydroActive™ technology. Unlike contacting seals, Omni seals will not prematurely engage due to gravitational forces acting on the seal in vertical or high angle applications.

Standard Omni Dimensions

Shaft diameters from 50mm – 1000mm



Dimensions - all dimensions are in mm

Shaft Size (mm)	A Overall Width	B Flange Width	C Outer Diameter	D Minimum Bore Internal Diameter	E Internal Diameter	F B. C. Diameter
XXX	44	24	XXX+180	XXX+138	XXX+6	XXX+159

ORDERING INFORMATION

Part Number Scheme

PN: 900 - XXX

Omni Shaft Diameter

> All seals can be custom engineered.

Shaft Size (mm)	G Thru Hole Bore	# of Holes
XXX	15	6
50-99	15	6
100-199	15	8
200-299	15	12
300-399	15	12
400-499	17	16
500-599	19	16
600-699	21	18
700-799	21	18
800-899	25	20
900-1000	25	20

Origins

Midé Marine's HydroActive™ Seal

Midé Marine is an engineering company that excels in the development of advanced engineering components and systems. After the United States Navy Destroyer USS Cole (DDG 67), was attacked in Yemen in 2000, and a compartment was flooded when a bulkhead seal failed, the United States Navy sought a better bulkhead seal design to protect its fleet and sailors.

Through a Navy small business innovative research (SBIR) award, the Navy funded Midé Marine to develop a novel approach to solving the bulkhead seal problem. The

HydroActive™ bulkhead seal was the outcome of this multi-year development program.

Today Midé Marine offers a turn-key solution to bulkhead seal systems, with the analytical and experimental facilities to develop new designs for unique marine applications and to analyze, test and validate that the design will perform according to customer requirements. Midé Marine's quality assurance standards and procedures have been reviewed and approved by large OEM customers and Midé Marine anticipates ISO 9001 certification early in 2013.



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