

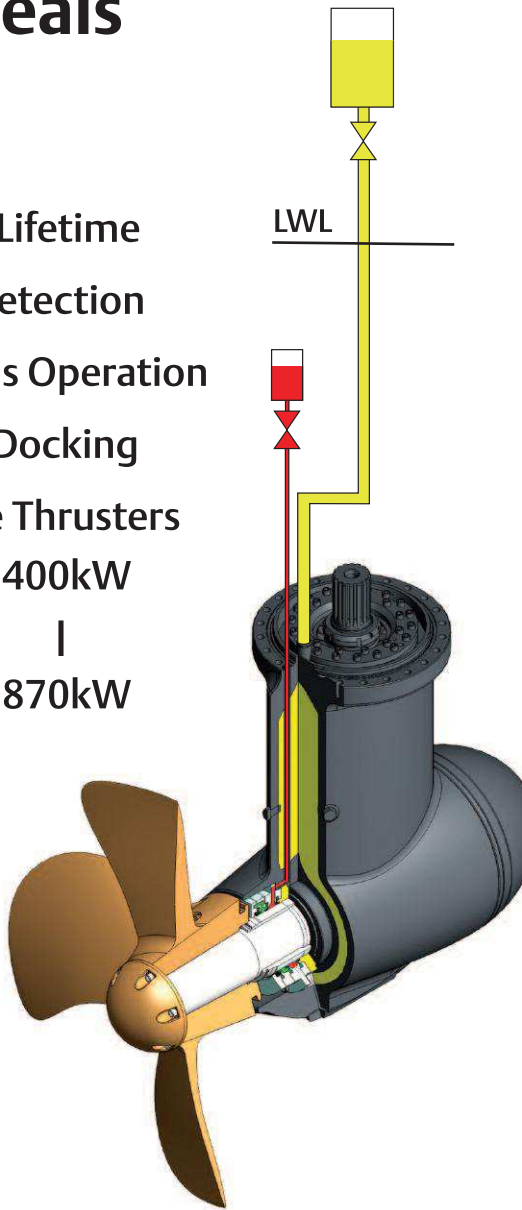


Condition Monitoring

High Performance Shaft Seals

- ▶ Enhanced Lifetime
- ▶ Leakage Detection
- ▶ Continuous Operation
- ▶ Extended Docking
- ▶ Transverse Thrusters

BU 90 400kW
 BU 100 |
 BU 120 870kW



The system detects the following leaks

- ▶ **Both water-side shaft seals are damaged:**
 The oil level in the locking oil gravity tank increases; the oil level in the gear oil gravity tank remains constant.
 If the alarm is triggered, the valve to the locking oil tank can be closed to prevent further ingress of water into the locking oil chamber.
- ▶ **The gear oil shaft seal is damaged:**
 The level in the gear oil gravity tank decreases, the level in the locking oil gravity tank increases, triggering an alarm. To reduce the loss of gear oil, the gear oil tank valve can be closed. Any temperature-related volume dilation of the gear oil is balanced by the locking oil tank.
- ▶ **All shaft seals are damaged:**
 The level in the gear oil tank decreases, the level in the locking oil tank increases, triggering an alarm; the locking oil level still increases rapidly even if the gear oil valve is closed. The valves to both tanks can be closed to reduce the loss of oil and the ingress of water to the vessel via the overflow of the locking oil tank. The valve to the locking oil tank can be opened for emergency thruster operation.

The vessel must be docked immediately and the seals repaired.

Condition Monitoring and High Performance Shaft Seals are available for the following transverse thruster types and power ranges. The technical specifications are based on continuous operation mode

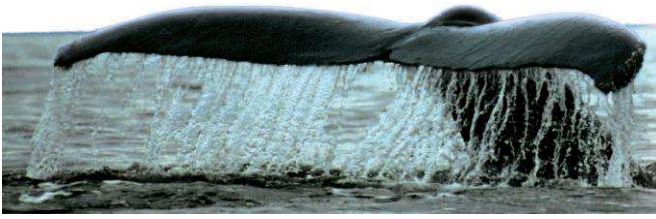
| Type | Prop Ø mm | Max Input RPM | Max kW continuous operation | Thrust approx. kN |
|--------|-----------|---------------|-----------------------------|-------------------|
| BU 90 | 1.600 | 1.800 | 600 | 73 - 86 |
| BU 100 | 1.970 | 1.200 | 825 | 103 - 121 |
| BU 120 | 2.270 | 1.200 | 870 | 118 - 139 |

Further Jastram products:



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Condition Monitoring and High Performance Shaft Seals

To meet the demanding requirements of the offshore industry for continuously operating transverse thrusters, high performance shaft seals combined with a pressure controlled leakage monitoring system are integrated.

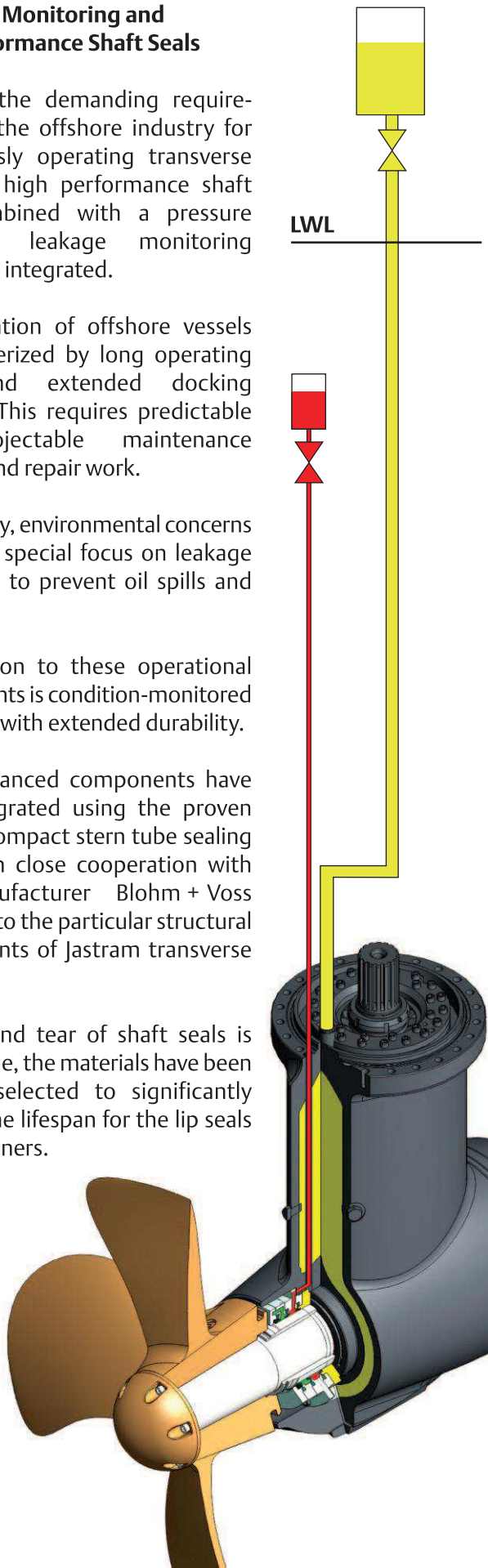
The operation of offshore vessels is characterized by long operating times and extended docking intervals. This requires predictable and projectable maintenance intervals and repair work.

Additionally, environmental concerns demand a special focus on leakage protection to prevent oil spills and pollution.

The solution to these operational requirements is condition-monitored shaft seals with extended durability.

These advanced components have been integrated using the proven Simplex-Compact stern tube sealing adapted in close cooperation with the manufacturer Blohm + Voss Industries to the particular structural requirements of Jastram transverse thrusters.

As wear and tear of shaft seals is unavoidable, the materials have been carefully selected to significantly increase the lifespan for the lip seals and shaft liners.



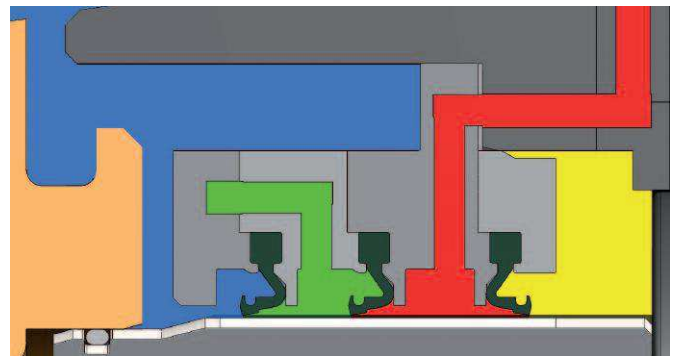
The condition monitoring unit detects even the smallest leakage at an early point and triggers an alarm, thus increasing protection against oil spills.

Hydrostatic pressure management allows the oil and water flow to be closely monitored until the seals can be renewed.

Mode of Operation

Three cascaded lip seals create two chambers which separate the gear oil (yellow) safely from the water (blue).

- ▶ The first water-side lip seal provides protection against abrasive materials and grit.
- ▶ The water-side chamber is filled with a lifetime lubrication (green) to ensure that the first and second lip seal run smoothly.
- ▶ The second water-side lip seal is pressure-resistant. It reduces the pressure to the second chamber.
- ▶ The second chamber is connected to a gravity tank situated below the waterline and is filled with locking oil (red).
- ▶ The third lip seal reduces the hydrostatic pressure from the gear oil (yellow) caused by the gravity tank above the waterline.



Both oil gravity tanks are equipped with level sensors and valves.

Any level changes caused by leakages will trigger a corresponding alarm.

The height positions of the gravity tanks, and thus the hydrostatic pressure of the locking oil and the gear oil, are adjusted to the installation position of the transverse thruster inside the vessel.

The lip seals and the shaft liner material can be adapted to comply with specific requirements. Biodegradable oil and grease can also be used.