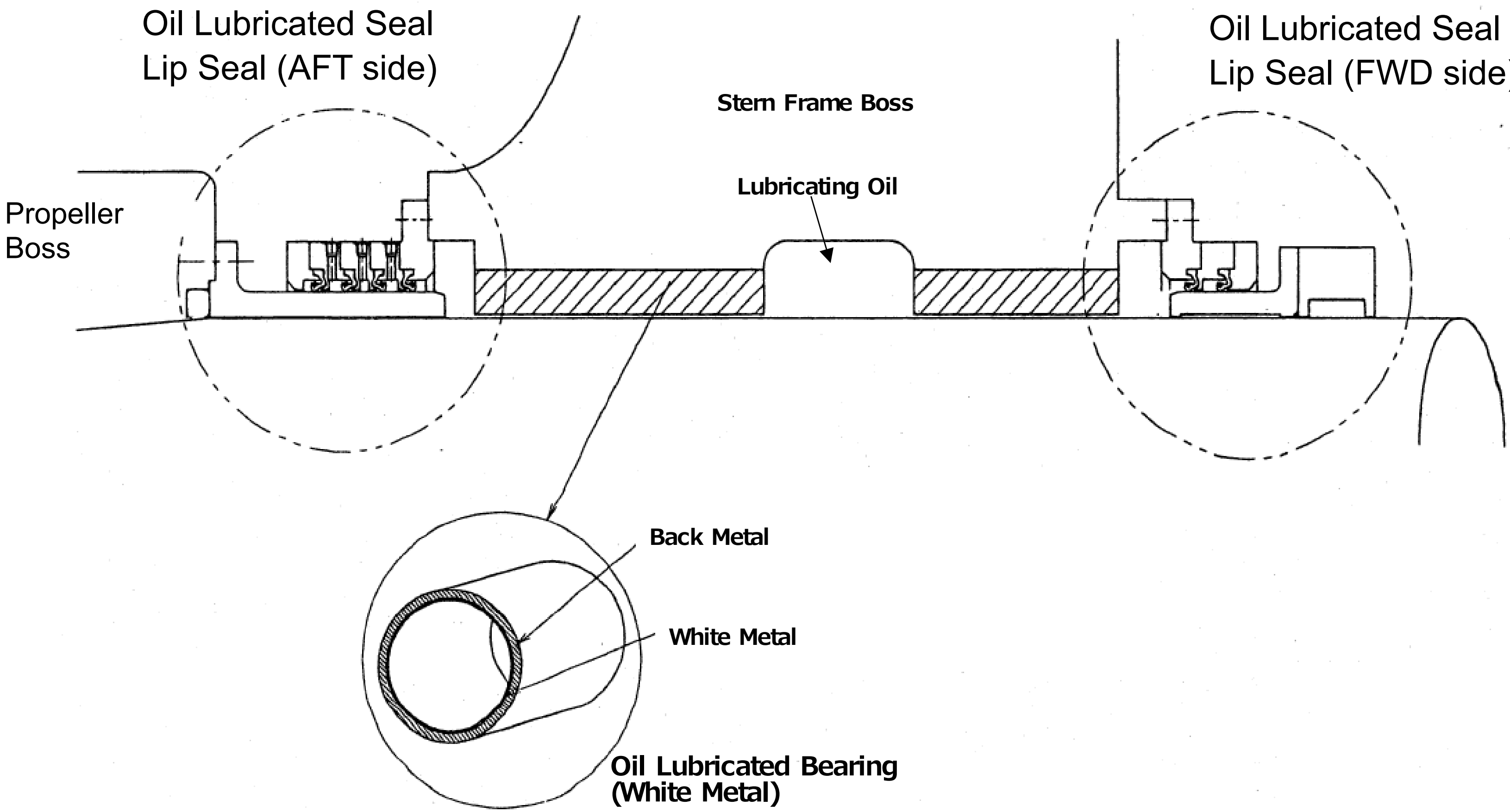
KOBELCO Air Seal

Structure of Oil Lubricated Stern Tube System

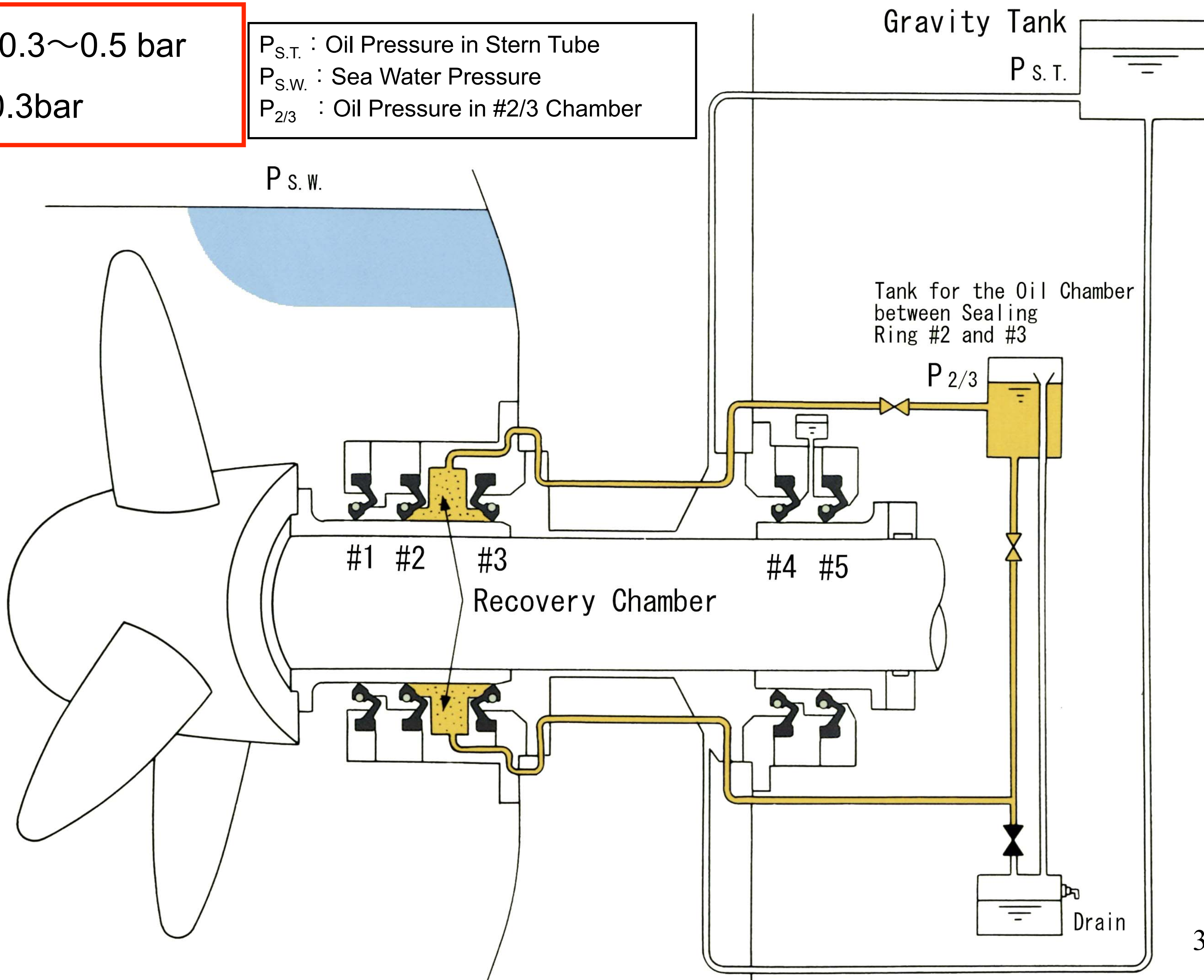


Pressure Balance of Stern Tube Seal

$P_{S.T.} = P_{S.W.} + 0.3 \sim 0.5$ bar

$P_{2/3} \leqq P_{S.W.} - 0.3$bar

$P_{S.T.}$: Oil Pressure in Stern Tube
$P_{S.W.}$: Sea Water Pressure
$P_{2/3}$: Oil Pressure in #2/3 Chamber



Double Security Seal (DX-type)

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Fig.A : Normal condition

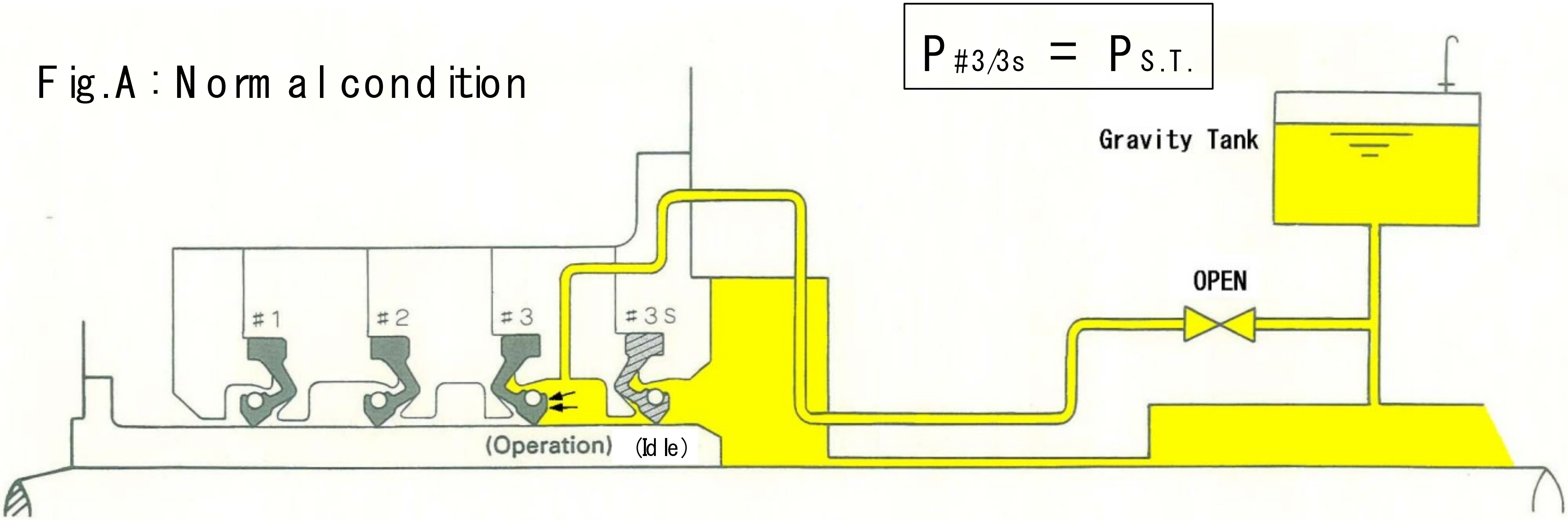
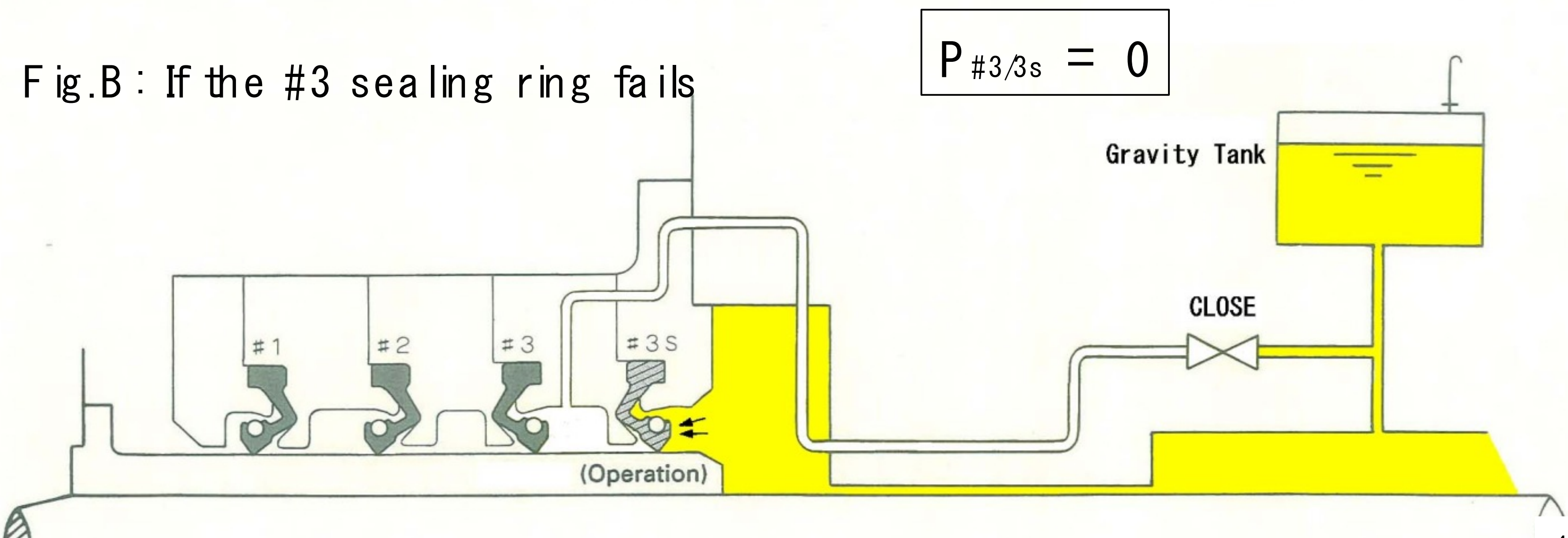


Fig.B : If the #3 sealing ring fails



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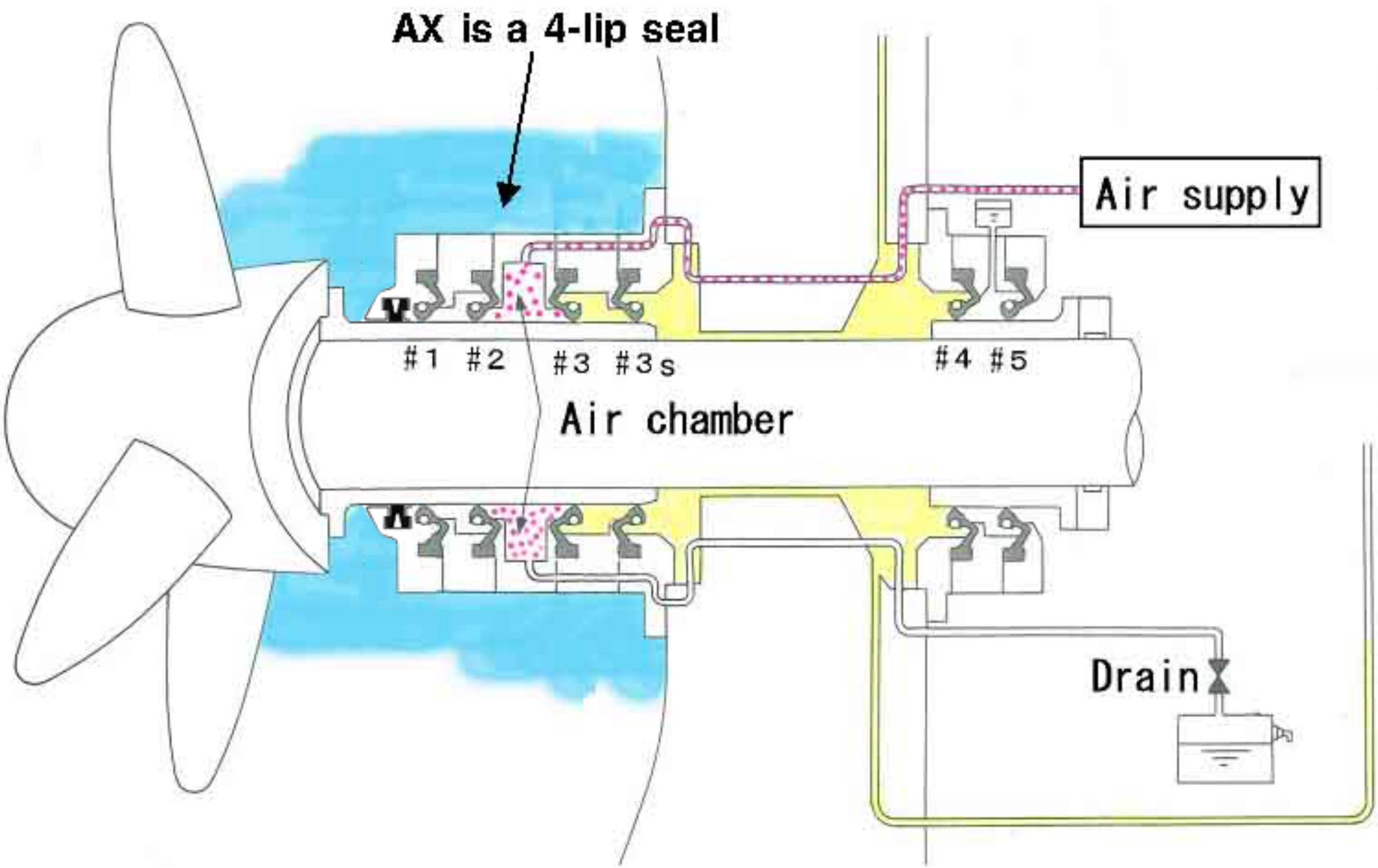
Definition of Air Seal

There is an air chamber in the aft stern tube seal, which separates stern tube oil from sea water.



Oil Lubricated System

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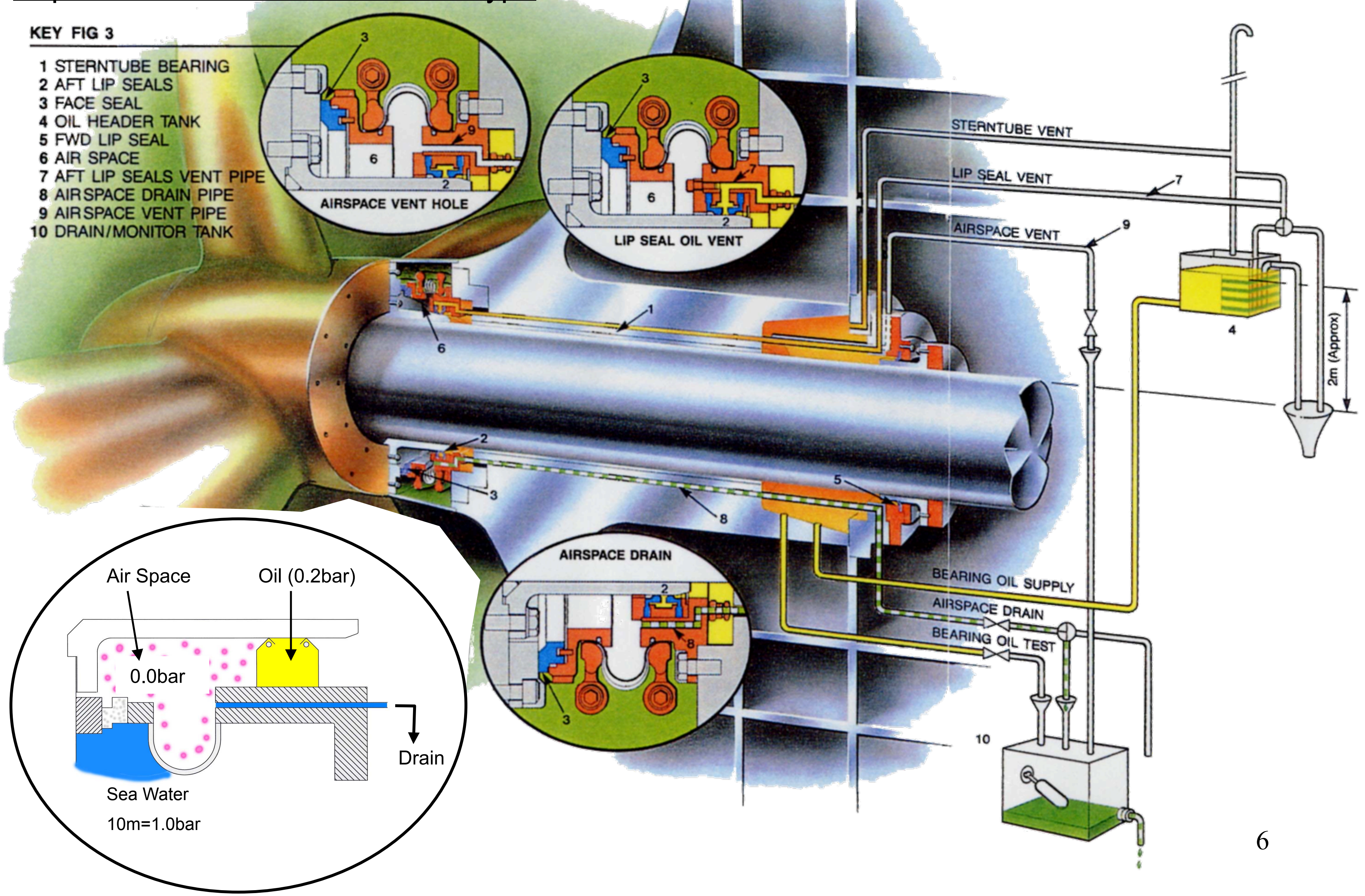
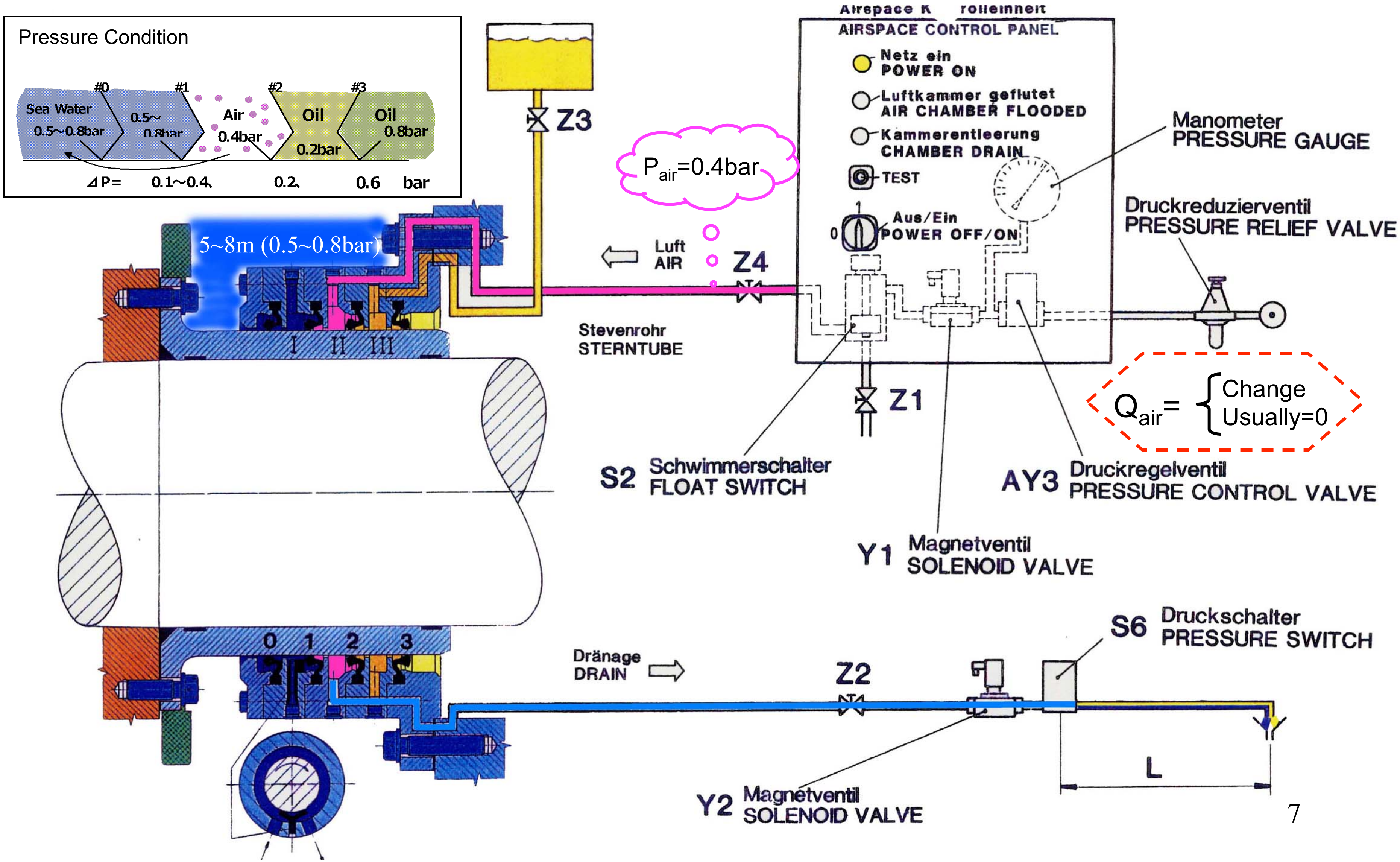
Separation of Oil and Sea Water Type



Constant Air Pressure Type

Constant Air Pressure Type



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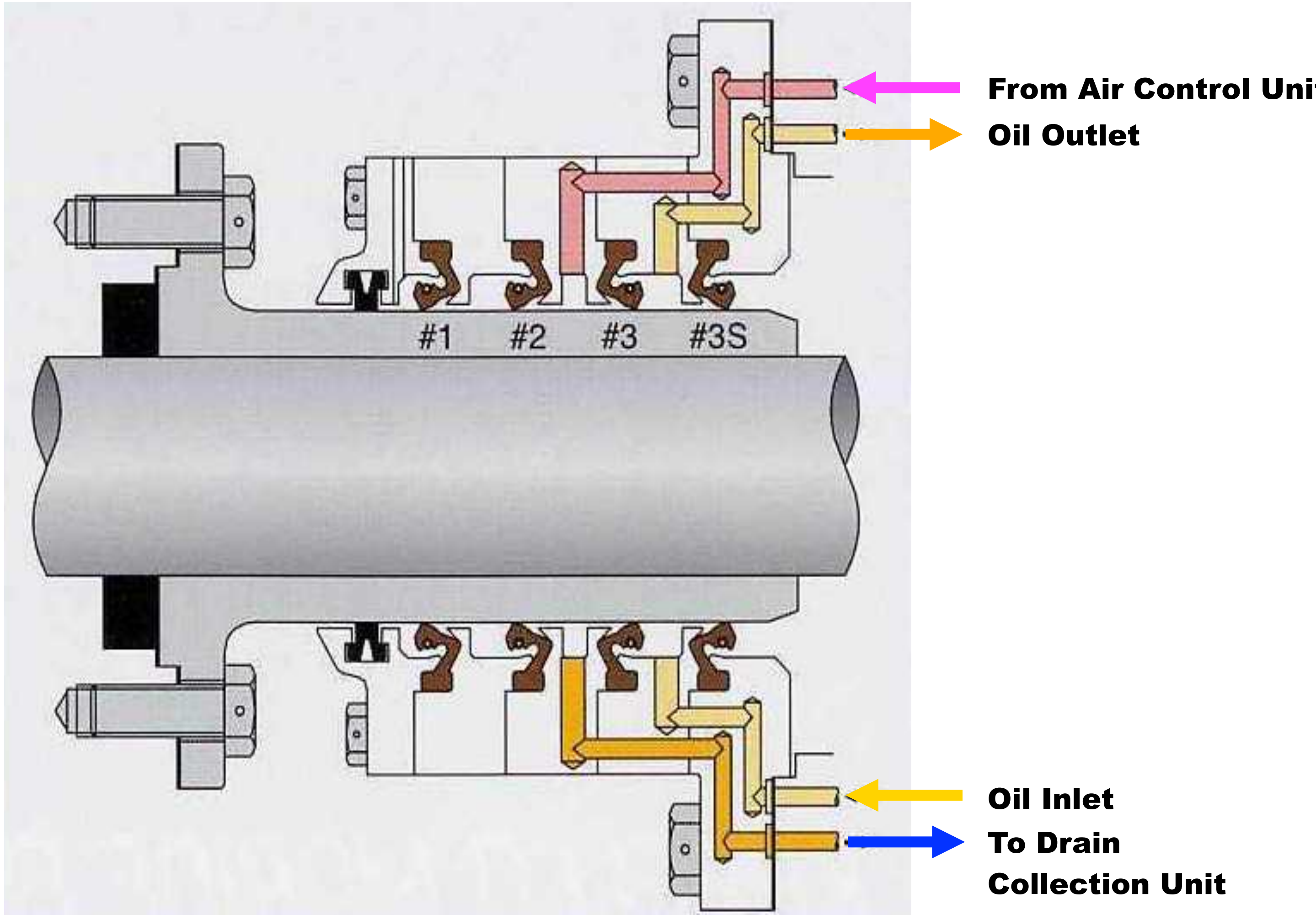
The Structure of AFT Seal



- **Same structure as conventional DX-type**
- **Standard equipment of Net Stopper**

Air Seal (AX-type)

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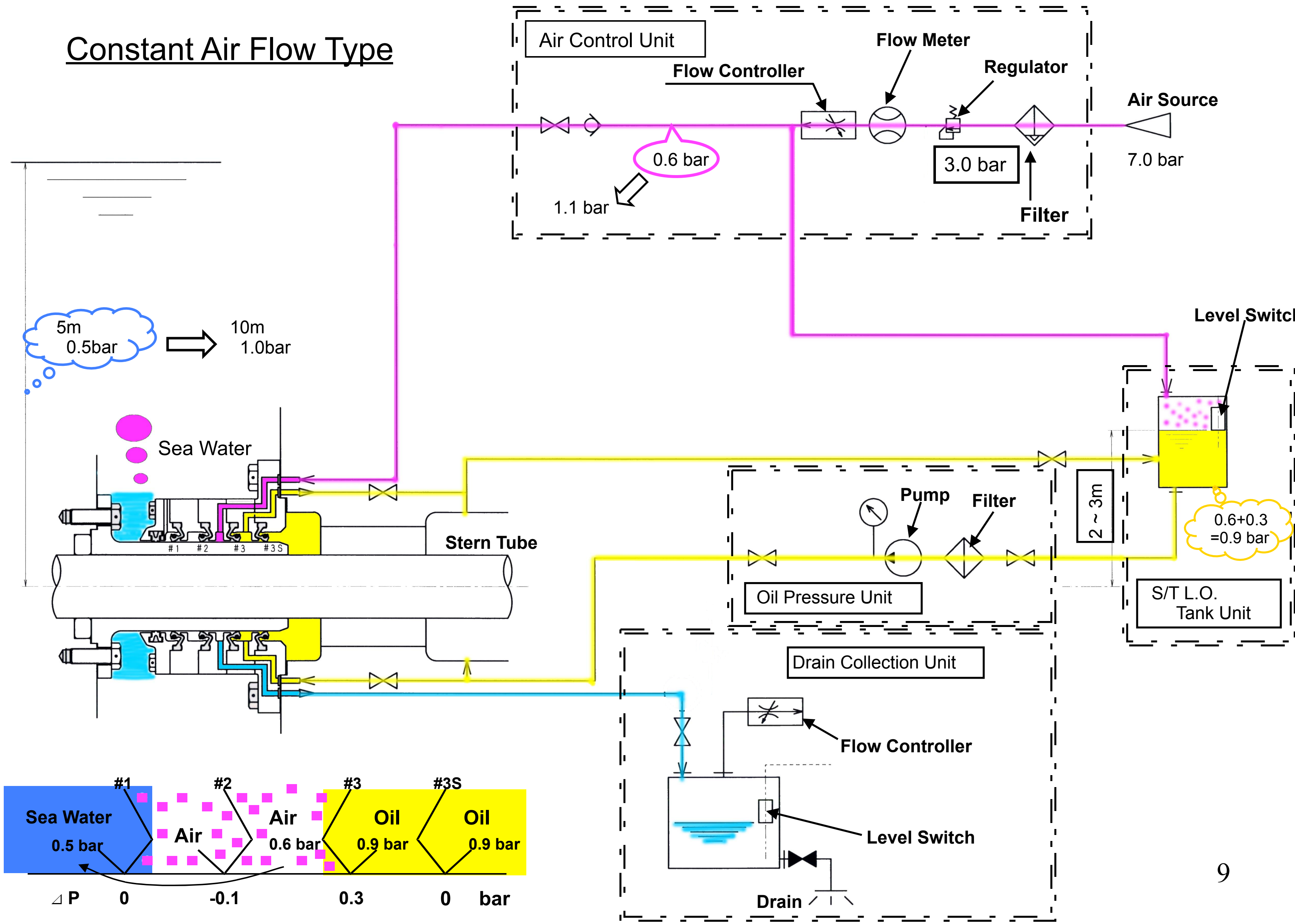
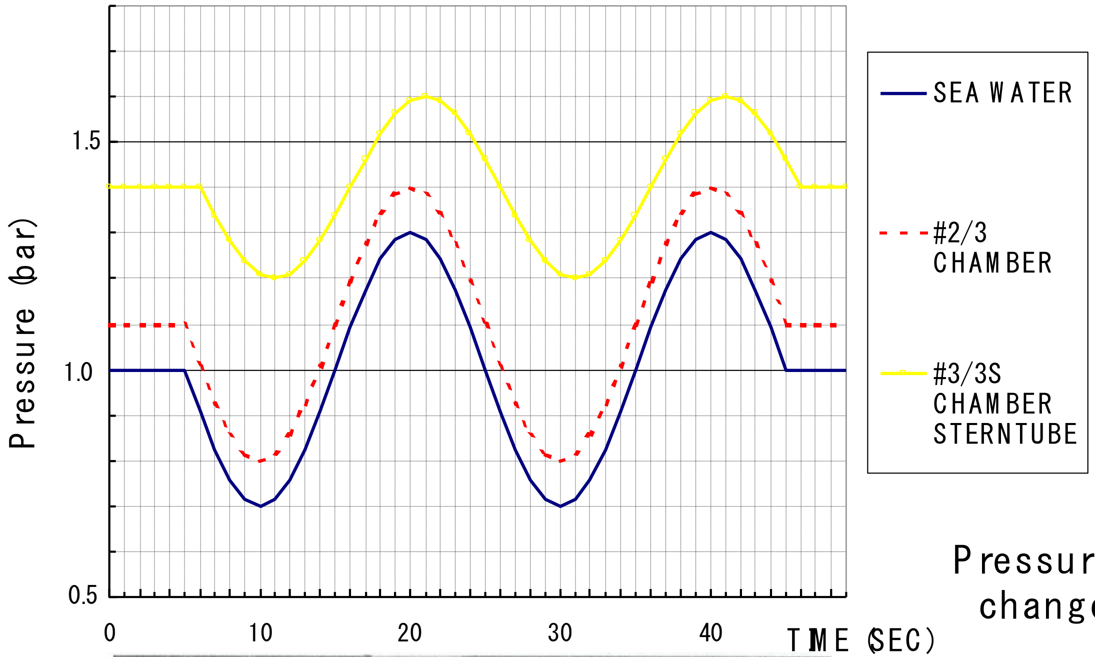
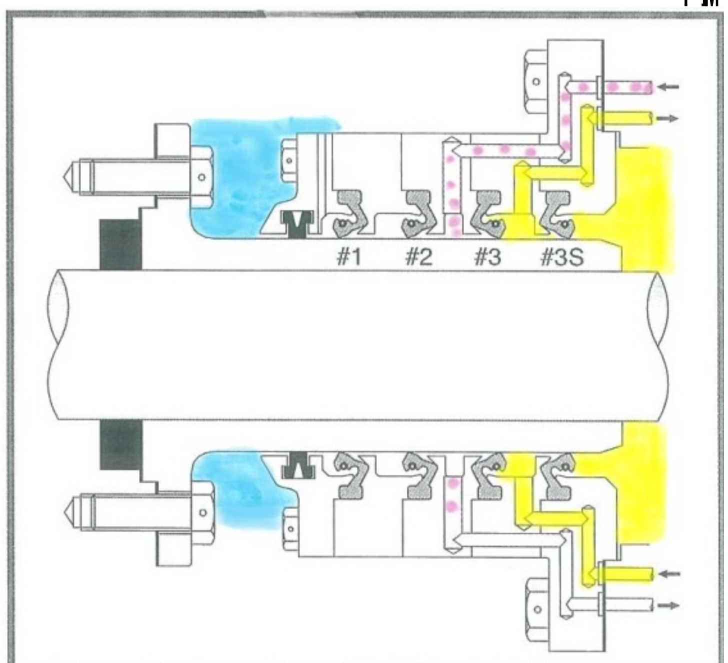
Constant Air Flow Type



Pressure curve



Pressure curve due to wave change in ideal condition



Key Technology of Air Seal

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Key Technology of Constant Flow Type Air Seal

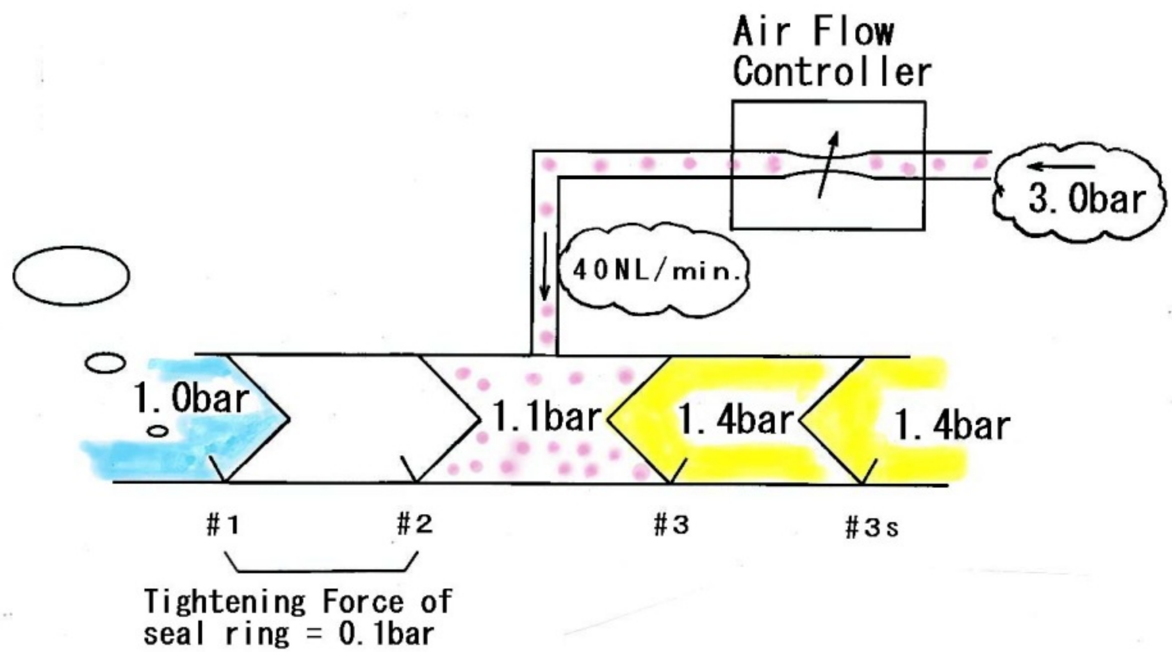
・Supplied air pressure must be higher than sea water pressure

・Air flow (Air consumption) must be 20～60nl/min in for detecting sea water pressure correctly.

Advantage of KOBELCO Air seal

・Sea water can not come in.

・Longer life of sealing rings due to small pressure differential.



Double Acting Tanker

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Fortum takes delivery of first revolutionary design vessel that cuts both ways


The ship is designed to travel stern first in heavy ice

Tanker double act

SIMON JONES DEPUTY EDITOR

The Yokosuka shipyard of Sumitomo Heavy Industries in Japan has handed over the first of two double acting tankers to Finland's Fortum Oil and Gas. The 106,200 dwt Aframax tanker, delivered at the end of August and called *Tempera*, features a stern form designed to break ice, an extended double hull, twin wheelhouses and diesel-electric pod propulsion.

The Double Acting Tanker (DAT) design is a product of Kvaerner Masa-Yards, the Finnish shipbuilding group, which has a patent on it. This is the first time it has been used on new tankers. A second ship, to be called *Mastera*, is scheduled for delivery in a few months.

The DAT principle essentially involves the ship travelling ahead in open water and astern in heavy ice. In this latter operating profile, the stern form breaks the ice while a pod propulsion unit creates a lubricating water stream between the ice and the hull. It is claimed the tanker will do three knots travelling astern in one metre thick ice. Fortum says ice this thick was broken in laboratory tests.

Year round supply

Fortum owns two oil refineries in Finland – one in Porvoo (near Helsinki) and one in Naantali (near Turku). It imports crude oil from places such as the Primorsk oil harbour in Russia. All are above the 60°N parallel meaning its ships are highly likely to encounter heavy ice conditions in the northern hemisphere winter.

Ice and ships are a dangerous mix at the best of times. Throw in some oil and the dangers – through the potential environmental consequences of a ship colliding with ice – are heightened still further. Yet Finland needs its oil in winter more than at any other time – to generate energy for heating and lighting. So Fortum (formerly Neste) tankers have to traverse through icy waters.

Ice strengthened

The DAT crude oil carriers are 1 A super ice strengthened. They have a specially reinforced double hull – with a fatigue life of 40 years – protecting the cargo tanks, double skin cofferdams protecting the bunker tanks and a double bottom protecting the pump room. Fortum specified an extension of the ice strengthening in some areas of the bow and stern based on its experience and recommendations from Kvaerner Masa-Yards.

The hydrodynamic form of the hull is intended to combine maximum efficiency in open sea (travelling forward) with the ability to maintain a supply line when harbours are ice bound (travelling astern).

Electric propulsion

Propulsion drive is supplied by a single 360 deg.-rotating ABB Azipod unit with a maximum continuous output of 16MW (nominal rating 15MW). The pod is located outside the hull and contains the electric motor and a fp propeller.

Five Wärtsilä diesel generators, comprising two 6MW 9L38B diesel engines, two 4MW 6L38B diesel engines and one 1.7MW 6L26A diesel engine, each produce a 6.6kV AC current at 60Hz. The current is fed into a switchboard and on to a cycloconverter propulsion system, which ultimately contains the pod motor. Transformers and frequency converters direct power, as required, to the bow thruster motors and the pump motors. ABB supplied the ships' complete electric propulsion system.

System redundancy

Fortum recognises that in the event of total pod failure the ships

Stern view showing the ice cutting stern and the podded drive

Double Acting Tanker (TEMPERA)

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Schematic piping of seal for Azipod

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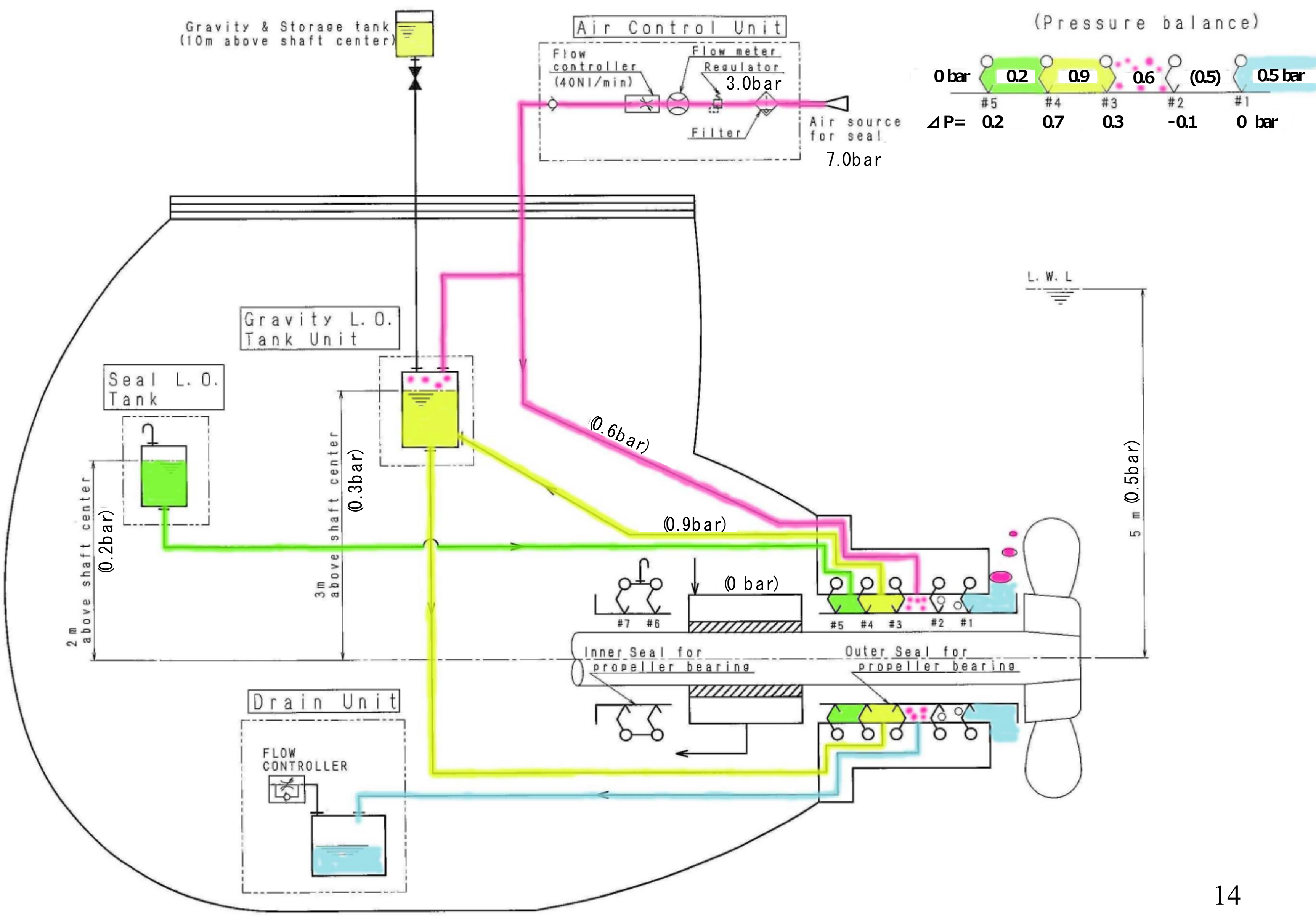

CRP Pod Ferry

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www.motorship.com

MHI to build ropax ferries with innovative contra-rotating azimuthing pod behind a mechanically-driven propeller

Japanese CRP pod ferry order

Artist impression of the new Shin-Nihonkai Ferry ropax ferry

PAUL VAN DYCK TECHNICAL EDITOR

Mitsubishi Heavy Industries (MHI) is to build two high-speed ropax ferries, featuring CRP Azipod propulsion, for Osaka-based Shin-Nihonkai Ferries. It is the first application of the innovative contra-rotating pod propulsion solution devised by ABB.

Both ships will be built at MHI's Nagasaki yard and are slated for delivery in June 2004.

At around 17,000g, the ferries will be the largest ropax ferries in Japan. They will also be the fastest with a maximum design speed of 31.5 knots. The ferry operator plans to run both vessels on the Maizuru (north of Kyoto and Osaka) to Otaru (on Hokkaido, near Sapporo) route, in place of existing 21.5 knot ships. The new 224.5m long by 26m wide ferries will be able to carry 158 trailers, 66 passenger cars and 820 passengers.

Propulsion system

The single-skeg ferries will be equipped with an azimuthing pod unit, supplied by Finland's ABB, installed in a contra-rotating mode immediately behind a standard mechanically driven main propeller. The concept was first revealed in *The Motor Ship* in May 2001 and was developed by ABB as a solution to powering ultra-large post-Panamax boxships and fast monohull ropax vessels without resorting to using larger and more powerful diesel engines. Located on the same axis, but without any physical connection, the pulling propeller of the pod will contra-rotate in relation to the shaft driven main propeller.

The theoretical efficiency gain of the contra-rotating propeller principle has been touted for many years, but it has rarely been used in commercial vessels. In high-power applications with co-axial shafts rotating in opposite direction, the complexity of gears and bearings has been an obstacle to further commercial success. Azimuthing propulsors, with their shaftless electric drive, offer a solution to this.

Compared with a conventional twin-shaft configuration, ABB reckons total installed power can be significantly reduced with the CRP Azipod solution. It says the concept gives an improvement of some 10-15 per cent in propulsion efficiency, mainly because the absence of shaft-brackets reduces hull resistance and improves propeller efficiency with the gain of the contra-rotating principle.

The aft propeller uses the rotative energy left in the slipstream of the forward propeller when it turns in the opposite direction. The single-skeg hull also leads to a favourable wake field for the propellers. In addition to the fuel savings and reduced emissions, ABB says the steerable Azipods will provide a strong thrust in all directions allowing the vessels to achieve increased manoeuvrability when berthing.

The power plant will be of the combined diesel-electric and diesel-mechanical (CODED) system. This consists of two Wärtsilä 12V46C medium speed diesel engines with a combined output of 25.2MW used for mechanical drive, through a reduction gear, of the main controllable pitch propeller. The electrical power for the 17.6MW azimuthing pod drive and the hotel load is supplied in each ferry by two similar Wärtsilä 12V46C engines as main generating sets and one smaller harbour generating set. The 27MW main electrical power plant will be linked to three main alternators and a 6.6 kV main switchboard.

Tests and fine tuning

Talking to The Motor Ship, a spokesman for ABB reveals that most of the tests on the CRP pod have been successfully completed although the system still has to be fine-tuned. In particular, there is the perceived problem of some cavitation with the CRP pod during high-speed manoeuvres. A solution to this may be to install a small rudder. ABB is also investigating covering the exposed parts of the pod strut, at the height where the propeller vortex hits it, with stainless steel. The company is confident any unresolved design issues will be resolved soon and should not have any adverse impact on the completion dates of the two Japanese ferries. □

CRP arrangement for a fast ropax vessel

Photo of Cruising Ferry

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Photo of CRP Azipod

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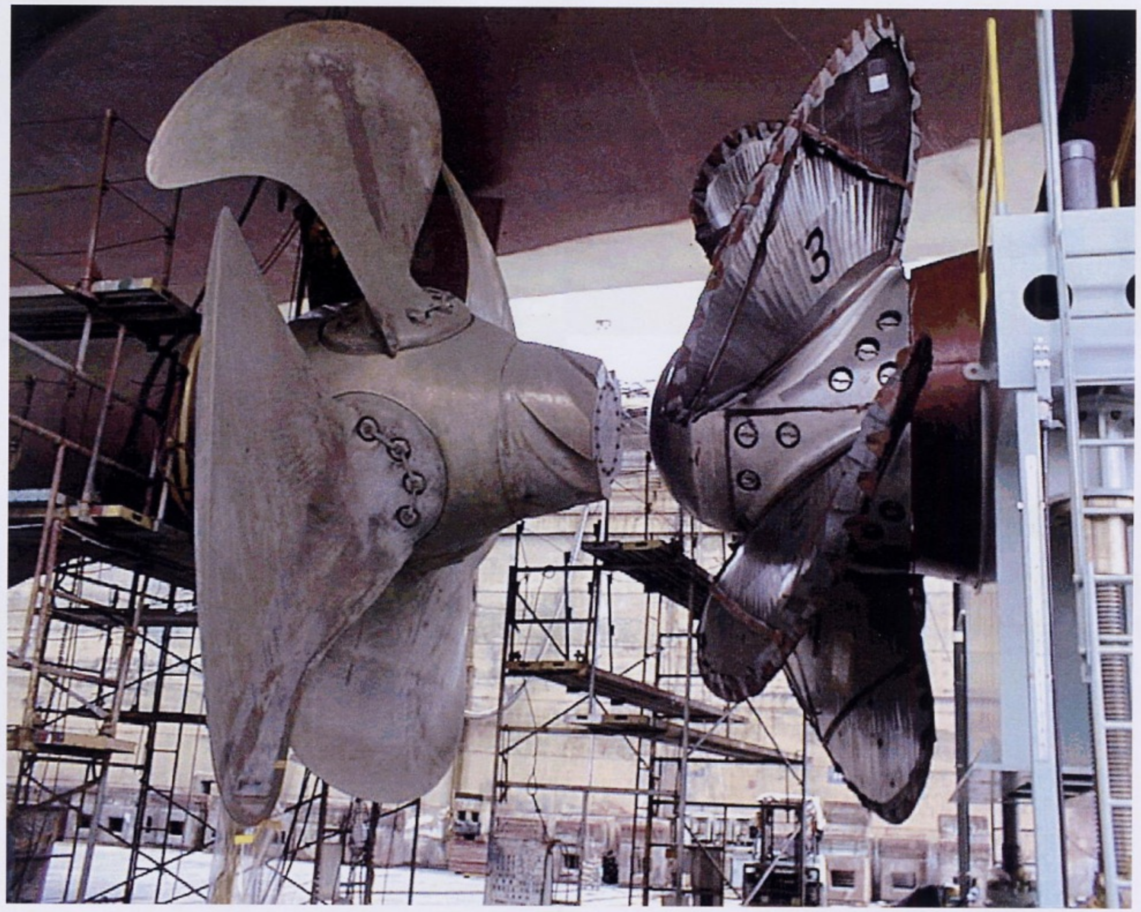
First CRP Azipod Installation

- The first propeller set at MHI yard in Nagasaki



ABB

Cruising Ship “Inspiration”

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Conversion from conventional Oil Seal to Air Seal

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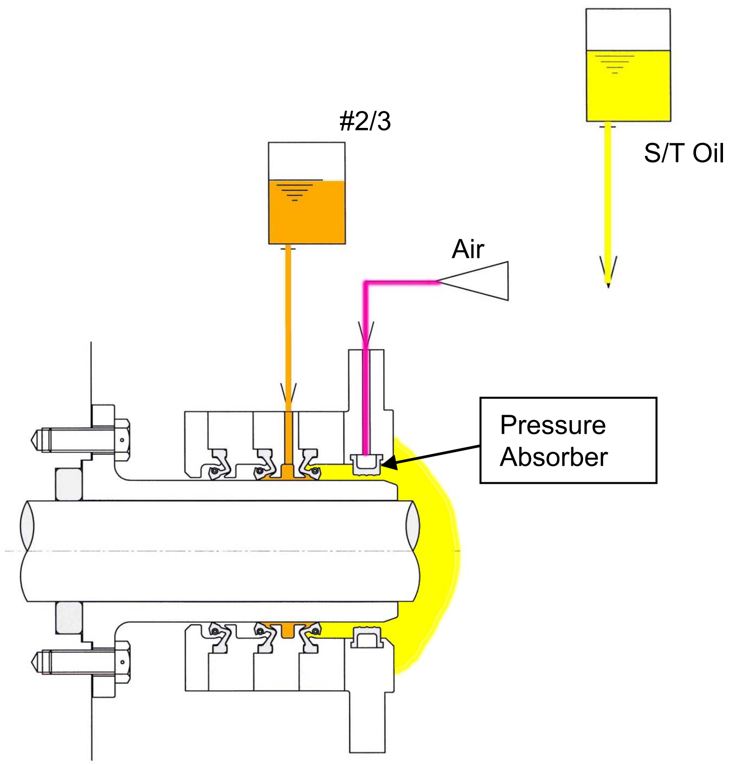
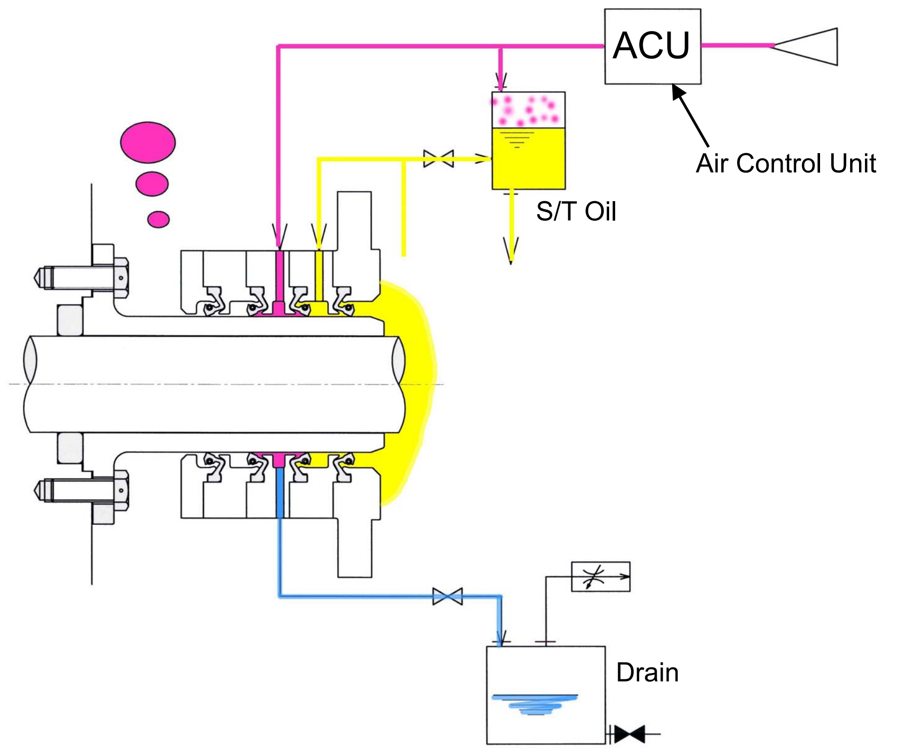
Conventional Oil Seal	Air Seal
	
• **There are two pipes in the top side.**	• **An additional pipe was installed for a drain tank** • **"Air Control Unit", "S/T L.O. Tank Unit" and "Drain Tank" were provided.**

Supply List of KOBELCO Air Seal

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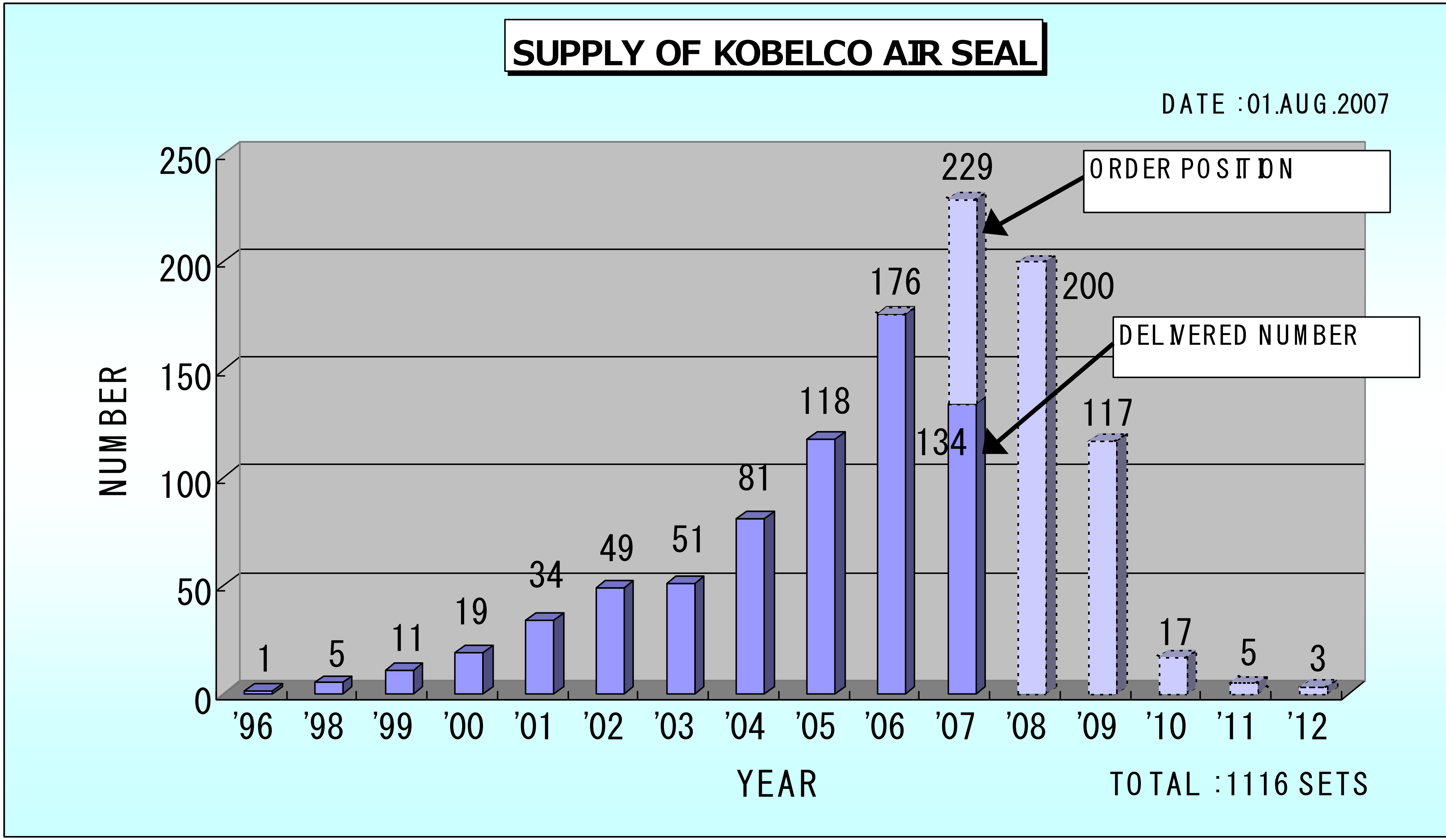

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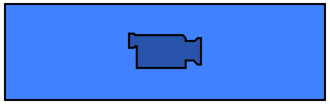
Moving Picture of Air Seal



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