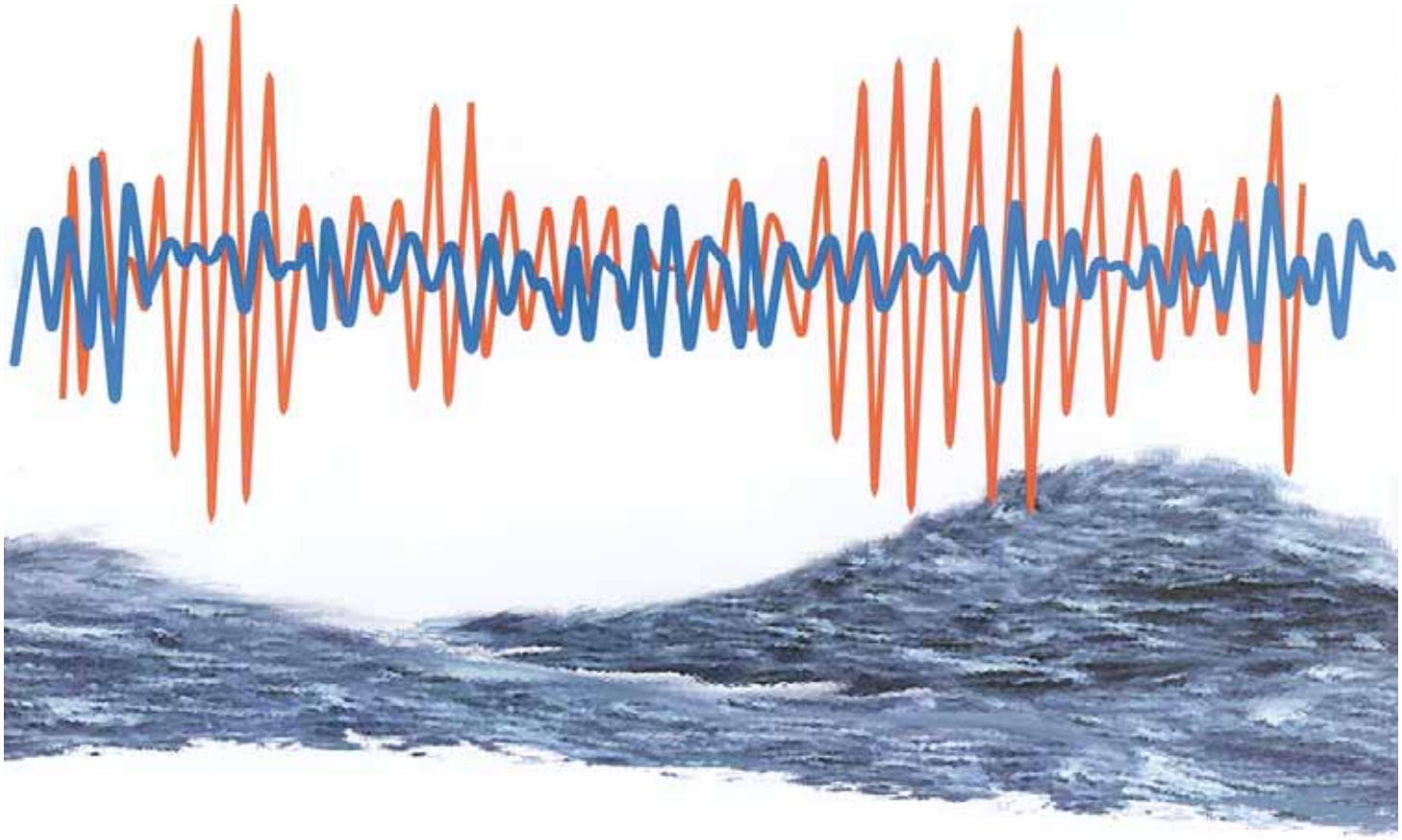
Rolls-Royce

Intering Products

Intering Tank Stabilizers

Proven since 1970



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Improve Comfort & Operating Performance

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Geschäftsführer: Derek Birkenfield
Steuer Nr. 11 290 17582

INTERING Stabilizers

on Offshore, Research and Service Vessels and on Navy and Government Ships

CONTENT

Intering Products: Ship Tank Stabilizers /; Anti-Heeling Systems / Stability Test Systems --- Homepage: http://www.intering.com
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1. Brief System and Feature Description

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Brief System and Feature Description

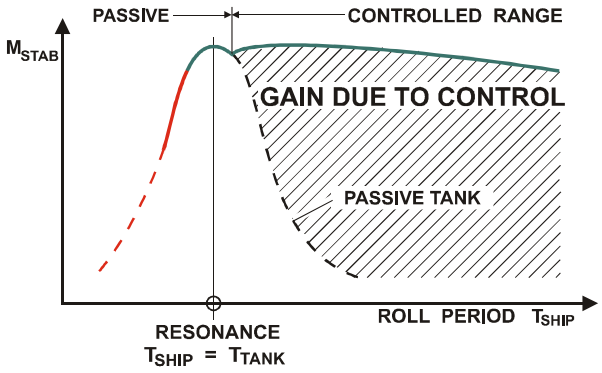
The passive controlled INTERING Stabiliser is based on a U-shaped tank system half filled with water. Side tanks are connected by a water cross duct and air cross duct(s) are installed for air exchange between side tanks. Stabiliser valves are integrated into the air cross duct.

The system is called passive since the attacking sea, which caused the roll of the vessel, supplied the necessary energy for roll reduction. The roll of the vessel is used to cause an oscillatory athwartships movement of the tank water.

The controlled part of the system is the 'active' influence of system control together with the stabiliser valves by cyclic blocking of tank water on the upwards moving ship side to adapt the tank period to the actual ship's roll period.

The dimensions of the tank are so defined that the resulting natural tank period corresponds about the expected shortest ships roll period. Vessel's roll period is changing dependent on loading and sea condition.

Due to the 'active' tank period tuning the system is able to ensure the right phase lag between tank water oscillation and ship's roll motion to maintain the stabilising effect over a wide range of ship's roll periods. The effect is shown in following diagram.

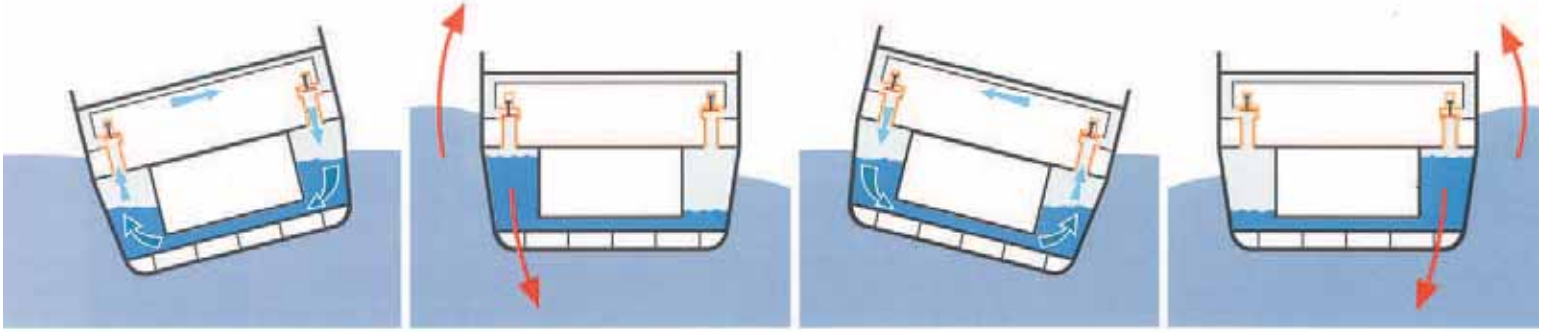


System Features:

- space between u-shape tank system can be used for other purposes
- system works fully automatic
- system efficiency is independent from ship speed even at zero speed
- tank water filling is constant for all loading conditions
- Security Principle: closing of stabiliser valves to prevent uncontrolled water flow in case of black out or loss of electric power or control air
- system maintenance is reduced to a minimum
- system works reliable and is proven since more than 30 years
- 3 years guarantee is standard

Fore more detailed function description and references pls. see following pages.

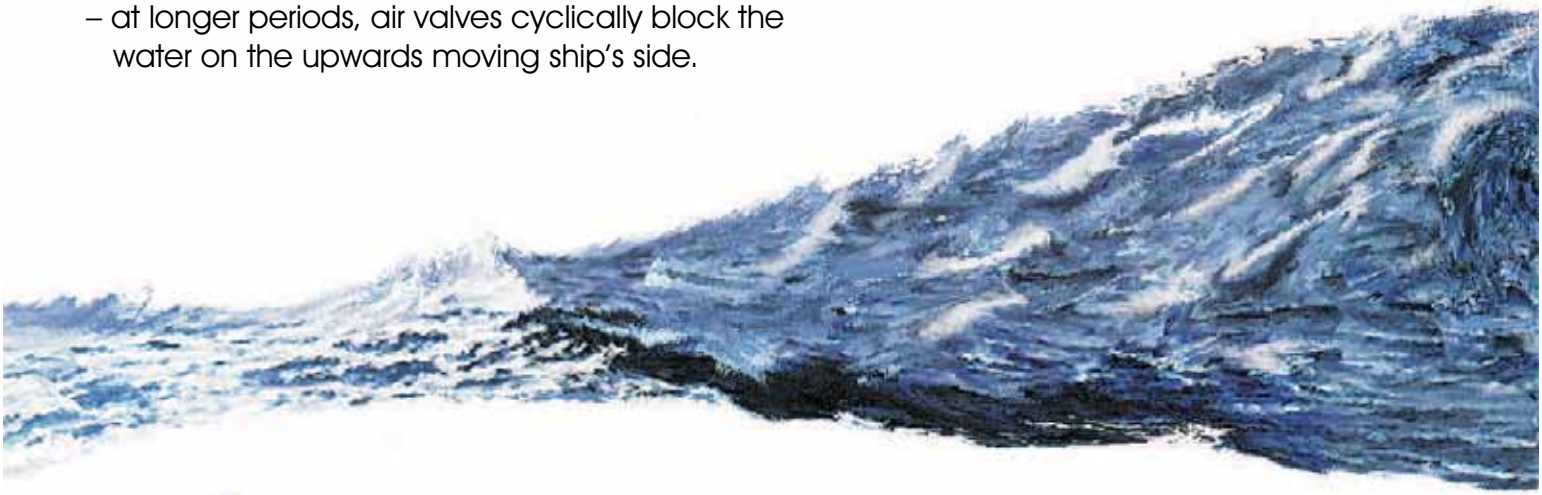
Roll reduction with Energy supplied by the sea

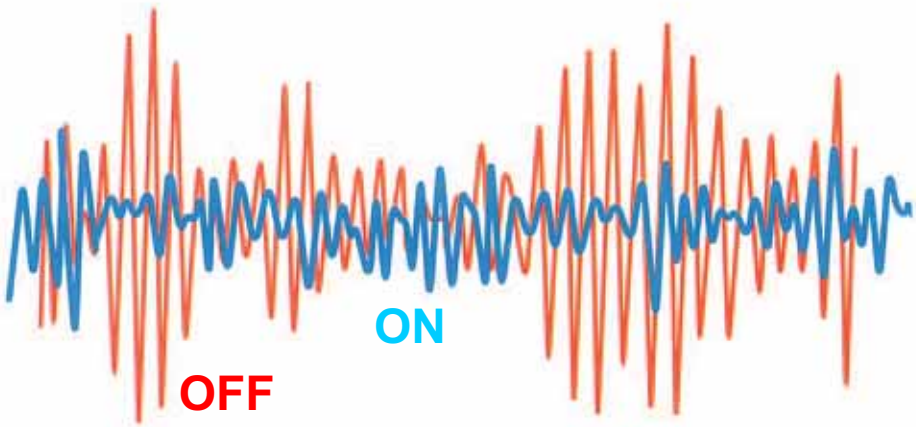


Caused by the ship's roll, the tank water oscillates athwartship to counteract the roll:

– at short periods by natural oscillation,

– at longer periods, air valves cyclically block the water on the upwards moving ship's side.





Automatic control reacts within 1/4 roll period

Roll reduction in normal irregular seas approximately 40 - 60 %

No moving parts in water

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2. General Information and Phase Cycle Diagrams

General Information and Phase Cycle Diagrams

1 TANK ARRANGEMENT

U-shaped tank system, athwartships arranged, half-filled with water, designed to reduce the vessel's roll motion at sea, independently from the ship's speed.

2 MAIN COMPONENTS:

- Control Unit
- Stabilizer Valves
- Pneumatic Control Devices
- Remote Control Panel

3 STABILIZER OPERATION AT SEA

The effect of the INTERING Stabilizer is based on an advantageous physical principle:

The roll of the vessel is used to cause an oscillatory athwartships movement of water in an U-shaped tank system. Due to the design of the tanks and by the automatic control blocking the water cyclically on the upwards moving ship's side, the movement of the tank water is permanently tuned to counteract and reduce the roll.

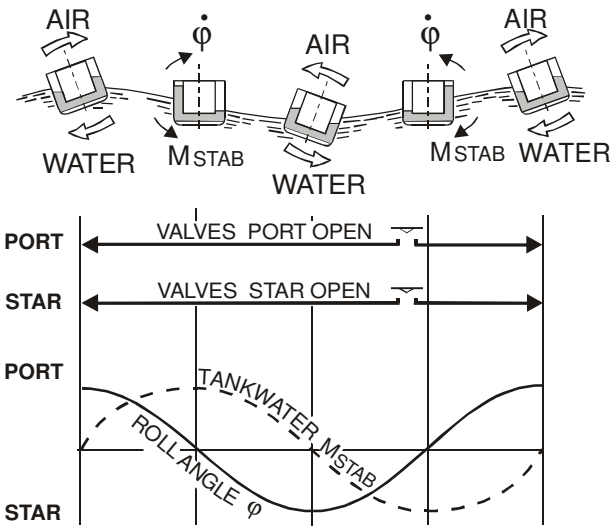
Thus the sea, in causing the vessel's roll, delivers the necessary energy to reduce the roll.

Two main operational ranges are to be distinguished: a purely passive operation at short periods and the passive controlled range at periods longer than the natural period of the tank system.

4 THE PASSIVE OPERATIONAL RANGE

The dimensions of the INTERING Stabilizer are so defined that the natural period of the tank (time for a full oscillation of the tank fluid) has about the same value as the shortest roll period to be expected in the service of the vessel. When the ship rolls with this period the stabilizer valves (see Fig. A) are kept continuously open and the tank fluid oscillates athwarthships within the U-shaped tank system in such a way that it always obtains its maximum level in the side tank which is moving upwards.
This state is called resonance and is demonstrated as a phase cycle in Fig. A at the next page.

4.1 Fig. A: Phase Cycle - Ship and Tank in Resonance

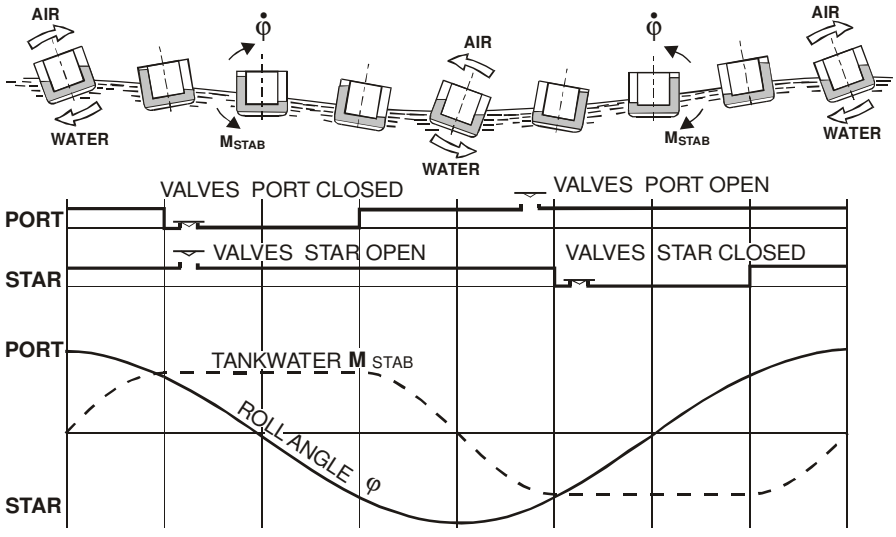


ROLL PERIOD = NATURAL PERIOD OF TANK

5 THE EFFECT OF THE INTERING CONTROL

As soon as the ship rolls with periods slightly longer than the natural period of the tank system due to reduced GM values or the effect of the waves, the tank fluid is immediately adapted to the changed roll motion by the automatic control. This is shown schematically in Fig. B.

5.1 Fig. B: Phase Cycle for Roll Periods longer than natural Period of Tank



ROLL PERIOD > NATURAL PERIOD OF TANK

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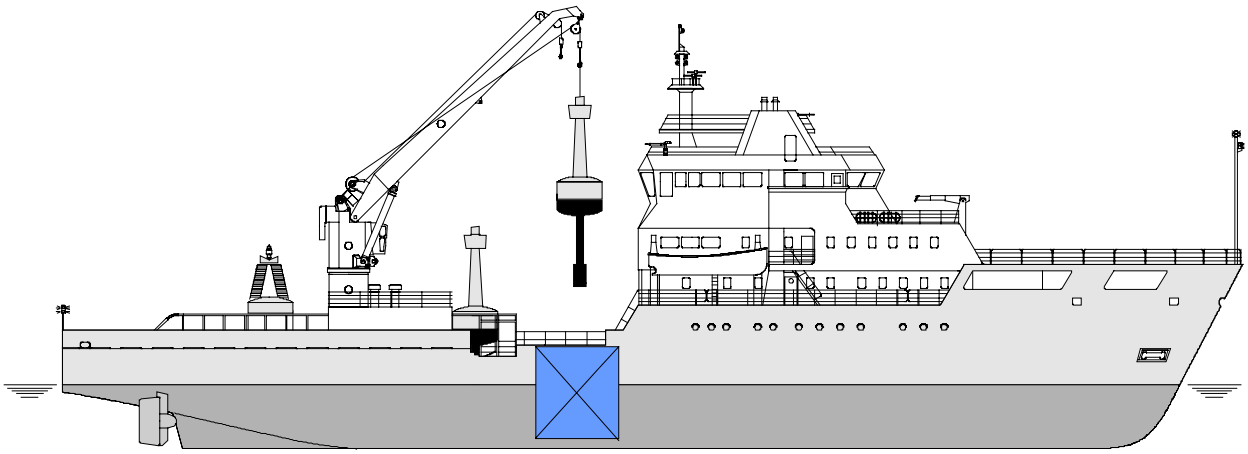
3. Stabilizer Function Schemes

- Buoy Tender / DAMEN SY NB. 6912
- Aids to Navigation Vessel / Ferguson SB NB. 706

INTERING SYSTEM on Buoy Tender for Northern Lighthouse and Commissioners of Irish Lights



Buoy Tender Damen SY Nb. 6912

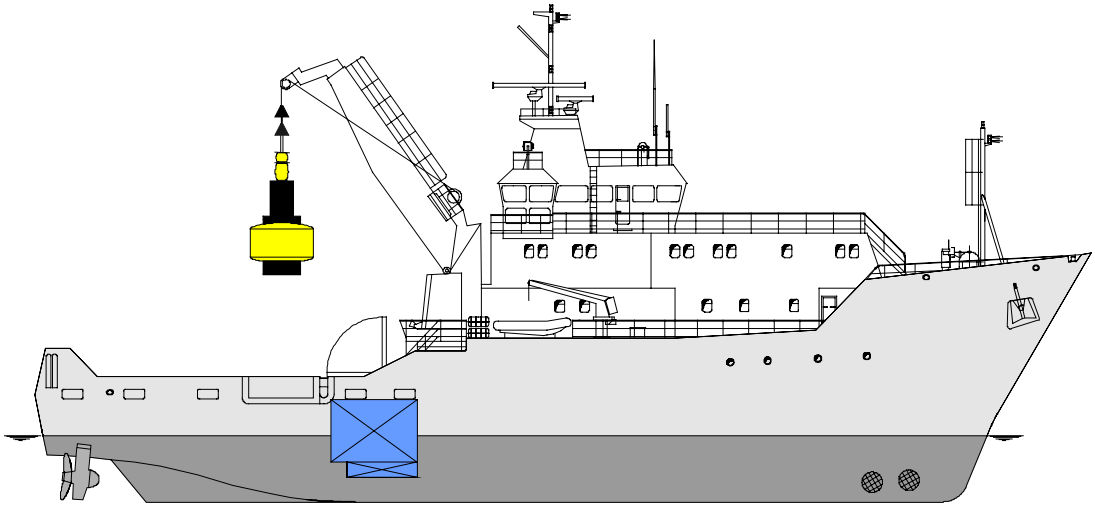
INTERING Stabilizer

- U-shaped stabilizer tank installed in the side tanks.
- 50% roll reduction in average:
  - Extends operation performance
  - Increases crews comfort
  - Reduces ship's resistance

INTERING Heavy Fluid

OPERATING LIQUID FOR STABILIZER TANK

- Increases volume efficiency by 48%
- No tank heating required
- No special tank coating since it inhibits corrosion of steel



Aids to Navigation Tender Ferguson Shipbuilders Nb. No. 709

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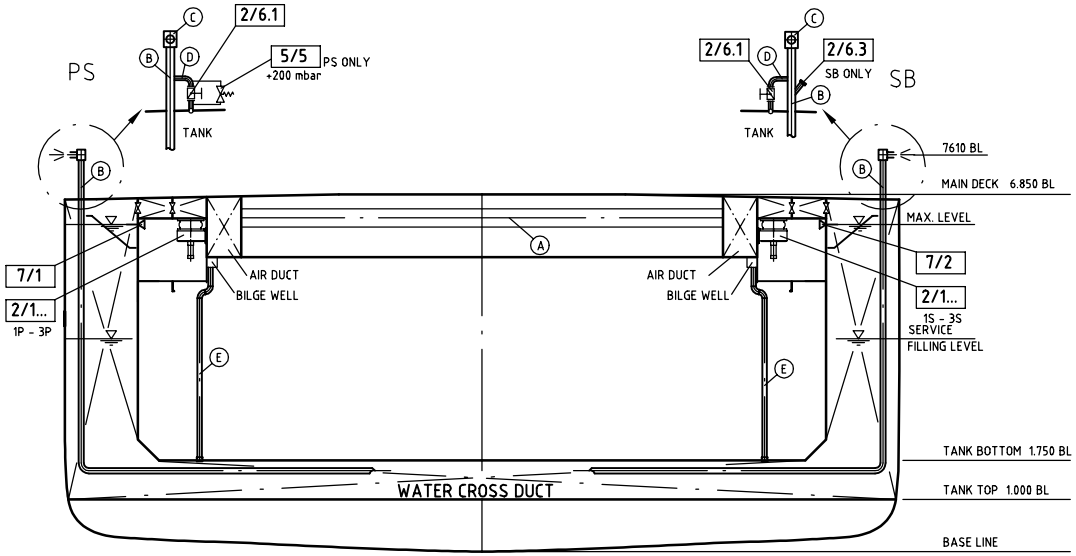
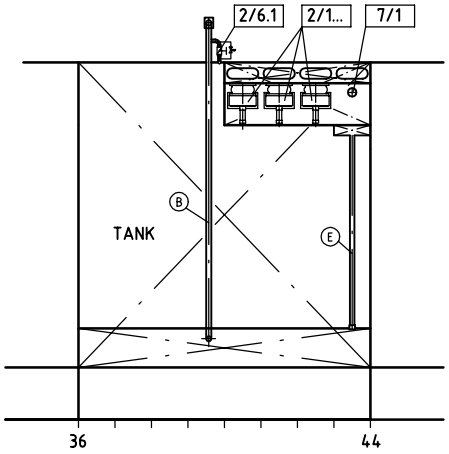
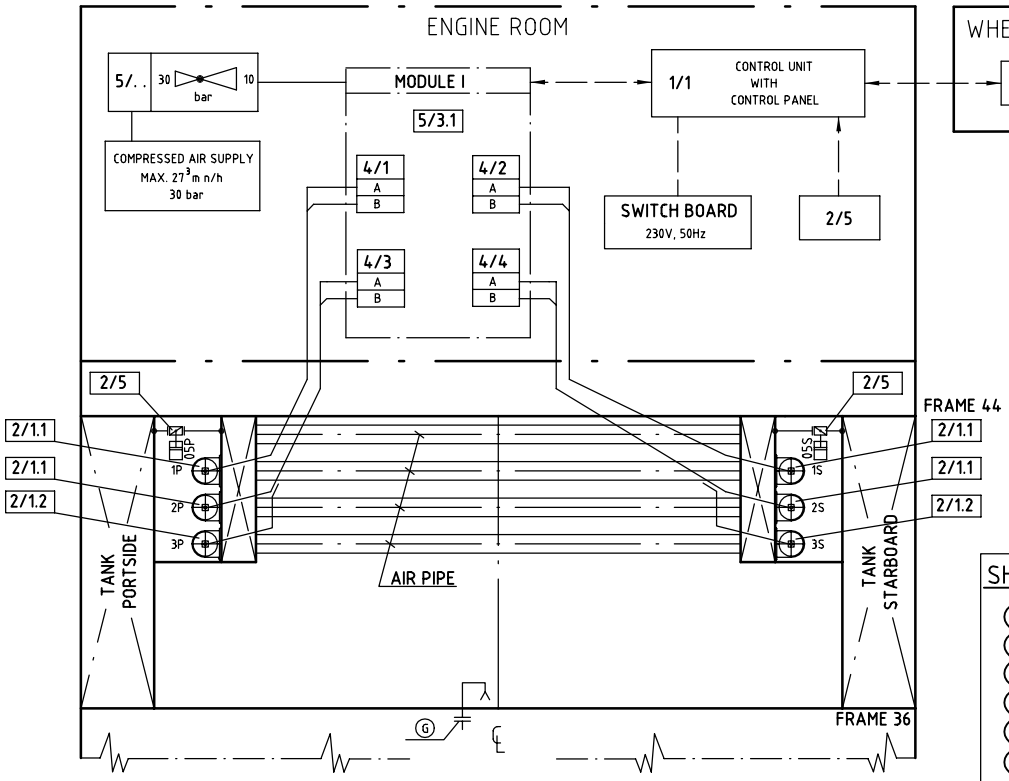


LONGITUDINAL SECTION PS





SHIPYARDS SUPPLY

- (A) AIR PIPE,DN 350
- (B) OVERFLOW PIPE, DN 80
- (C) AIR PIPE VENT HEAD, DN 80
- (D) VENTILATION PIPE
- (E) DRAIN PIPE, DN 80
- (G) CONNECTION FOR PORTABLE PUMP

CAUTION !

ALKALINE FLUID IN STABILIZER TANK!
ALL MATERIAL OF EQUIPMENT IN CONNECTION WITH STABILIZER TANK (PIPES, VALVES ETC.) WHICH CAN COME IN CONTACT WITH **INTERING** HEAVY FLUID HAVE TO BE FROM STAINLESS STEEL AS FAR AS PRACTICABLE.
NON-FERROUS METALS NOT TO BE USED!

FIG. 0-2

PART NO.	DESIGNATION	SUPPLIER
7/1 + 7/2	SENSOR "MAX. WATER LEVEL"	INTERING
5/5	LEAKAGE AIR RELIEF VALVE	INTERING
5/...	PNEUMATIC COMPONENTS	INTERING
MODULE I	PNEUMATIC CONTROL MODULE	INTERING
4/1 - 4/4	PNEUMATIC VALVE BLOCKS	INTERING
3/1	REMOTE CONTROL PANEL -WHEELHOUSE-	INTERING
2/6.3	FILLING SOCKET - SB ONLY	INTERING
2/6.1	AUX. VENTILATION VALVE, DN 50	INTERING
2/5	BY-PASS VALVE WITH SOLENOID VALVE, DN 80	INTERING
2/1...	STABILIZER VALVES	INTERING
1/1	CONTROL UNIT WITH CONTROL PANEL	INTERING

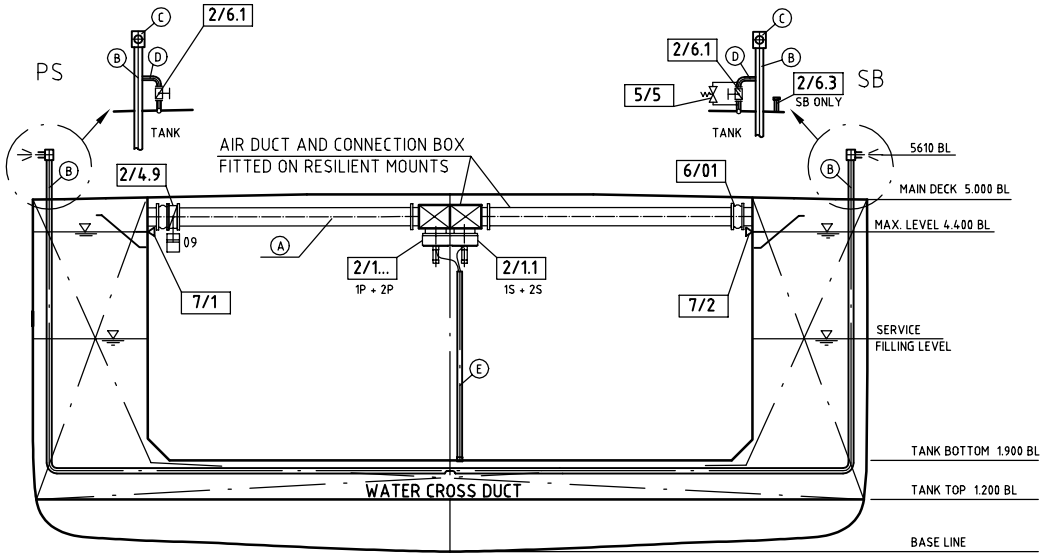
MODIFICATION D C B A | NAME | DAT.

DRAWN BY Ba-Ho DATUM 8/98
CHECKED DATUM
REF. DAMEN SHIPYARD NB. 6912

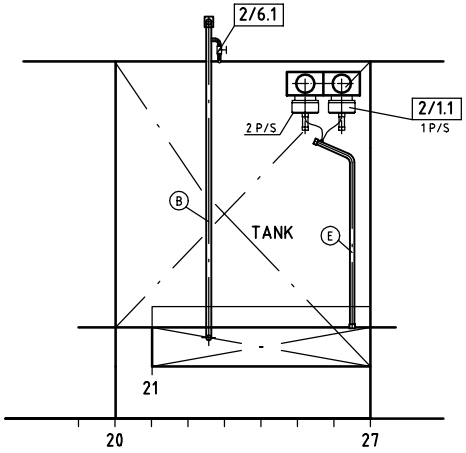
FUNCTION SCHEME

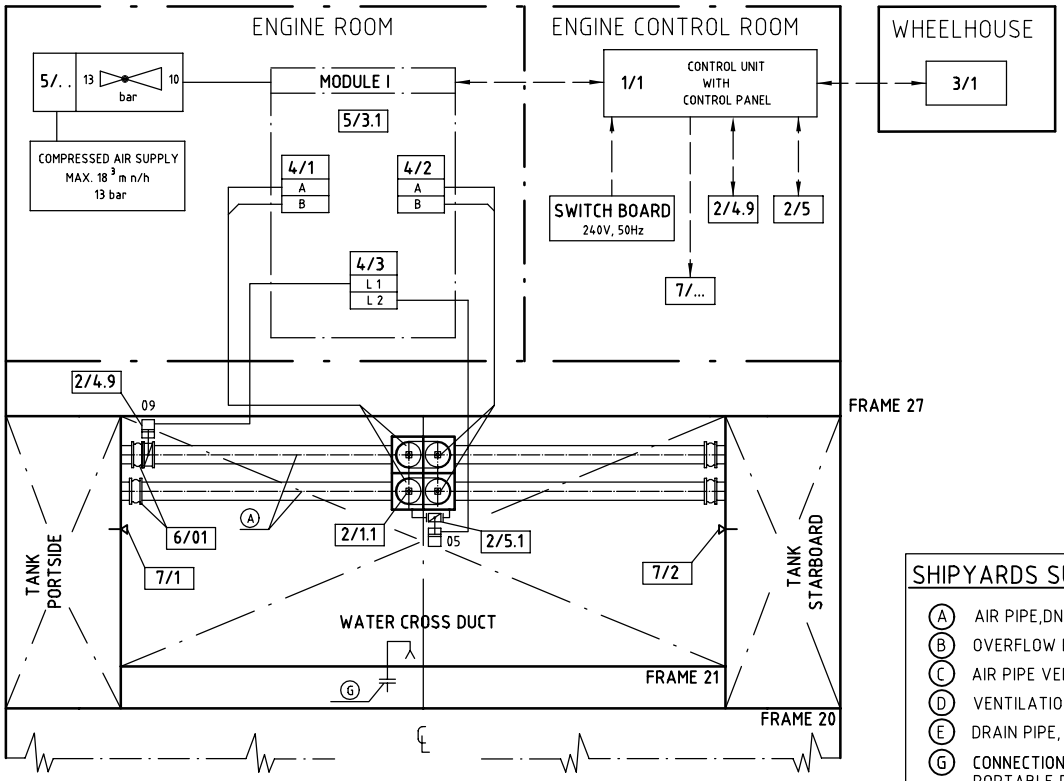
SCALE SCALED
MODIFICATION
STOCK NO. A B C D E F G H I K
NUMBER **2831-12**
INTERING REF. 2831
BLATT / SHEET 1 v 1

INTERING



LONGITUDINAL SECTION





SHIPYARDS SUPPLY

- (A) AIR PIPE,DN 350
- (B) OVERFLOW PIPE, DN 80
- (C) AIR PIPE VENT HEAD, DN 80
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- (G) CONNECTION FOR PORTABLE PUMP

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WHICH CAN COME IN CONTACT WITH
INTERING HEAVY FLUID HAVE TO
BE FROM STAINLESS STEEL AS FAR AS
PRACTICABLE.
NON-FERROUS METALS NOT TO BE USED!

FIG. 0-2

PART NO.	DESIGNATION	SUPPLIER
7/1 + 7/2	SENSOR "MAX. WATER LEVEL"	INTERING
5/5	LEAKAGE AIR RELIEF VALVE, SET POINT:200 mbar	INTERING
5/...	PNEUMATIC COMPONENTS	INTERING
MODULE I	PNEUMATIC CONTROL MODULE	INTERING
4/3	PNEUMATIC VALVE BLOCK, TYPE 2	INTERING
4/1 + 4/2	PNEUMATIC VALVE BLOCKS, TYPE "S"	INTERING
3/1	REMOTE CONTROL PANEL -WHEELHOUSE-	INTERING
2/6.3	FILLING SOCKET - SB ONLY	INTERING
2/6.1	AUX. VENTILATION VALVE, DN 50	INTERING
2/5.1	BY-PASS VALVE, DN 80	INTERING
2/4.9	THROTTLE VALVE , DN 350	INTERING
2/1.1	STABILIZER VALVES	INTERING
1/1	CONTROL UNIT WITH CONTROL PANEL	INTERING

MODIFICATION			
D			
C			
B	2/4.9 POSITION MODIFIED	Sch 06/00	
A	2/6.3 POSITION MODIFIED	BaHo 12/99	
		NAME	DAT.

DRAWN BY	DATUM	REF.
Sch	6/99	FERGUSON SHIPBUILDERS NB. 709
CHECKED	DATUM	

FUNCTION SCHEME

SCALE	STOCK NO.	NUMBER	INTERING REF.	BLATT / SHEET
SCALED		3243-12	3243	1 v 1
MODIFICATION	A B C D E F G H I K			

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4. INTERING Stabilizer in Practical Operation

Extracts of Sea Trial Report MV “Melville”

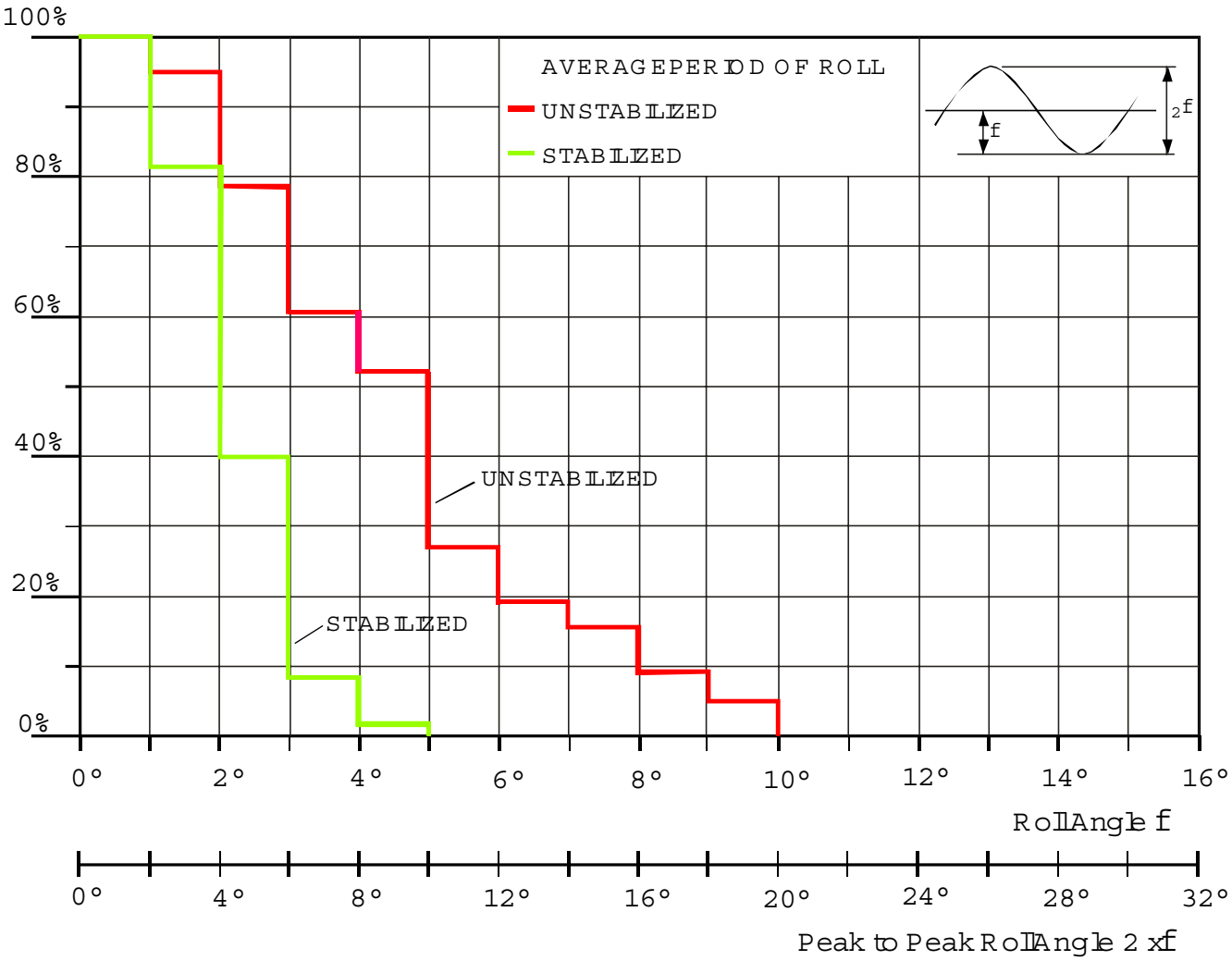
- Presentation of roll recorder strips (Stabilizer: On/Off)
- Overall Reduction of the System

Sea Trial Report

Ship : MV "MELVILLE"
Newbuilding /No.: NQEA /200
INTERING Ref. No.: 2109.2

INTERING
14.04.2000

Fig. 1 : Relative Frequency Distribution - Trial 1 + Trial 2



Definition of overall reduction:
Area between stabilized and unstabilized curves divided by area below unstabilized curve.

Overall reduction for tests No. 1 and No. 2 :

$$\frac{(SR)_U - (SR)_S}{(SR)_U} \cdot 100\,\% = \frac{459 - 232}{459} \cdot 100\,\% = 49.5\,\%$$

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INTERING Stabilizers

on Offshore, Research and Service Vessels and on Navy and Government Ships

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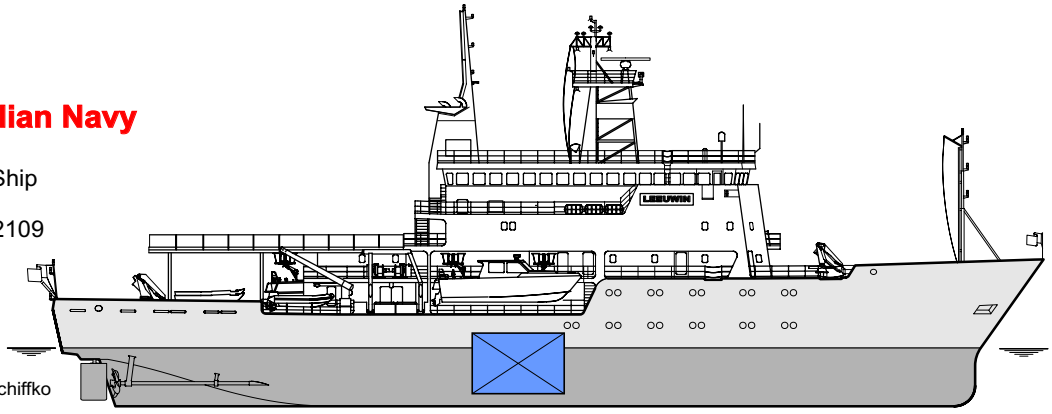
5. INTERING Stabilizer References for Offshore, Research and Service Vessels and Navy and Government Ships

INTERING Stabilizer System on Research Vessels

Rolls-Royce

Royal Australian Navy

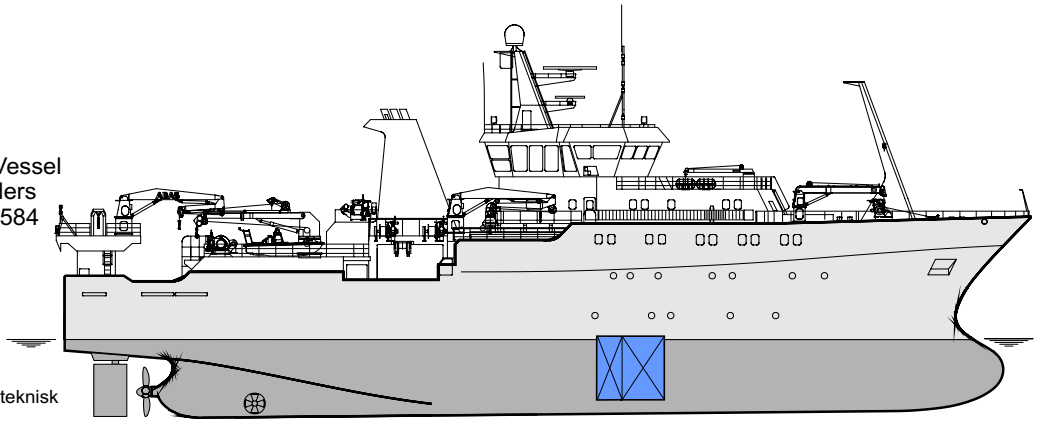
2 x Hydrographic Ship
NQEA Australia
INTERING Order 2109



Design Schiffko

SOAFD

Fishery Research Vessel
Ferguson Shipbuilders
INTERING Order 2584

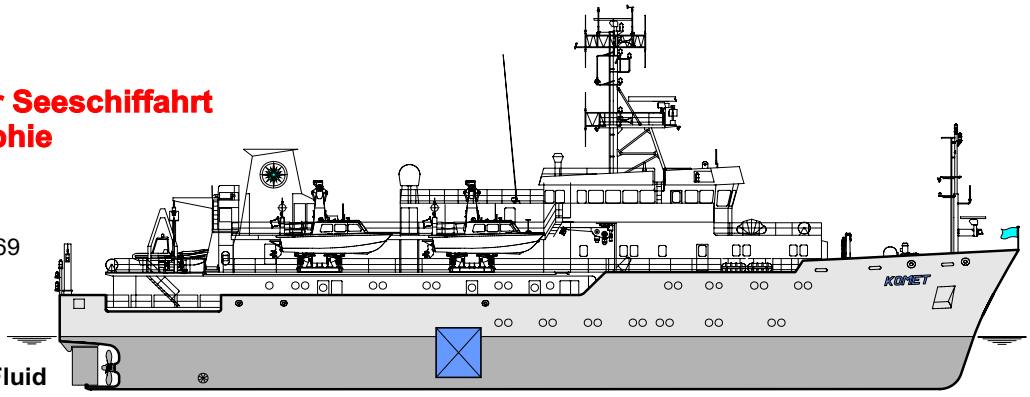


Design Skipsteknisk

Bundesamt für Seeschiffahrt und Hydrographie

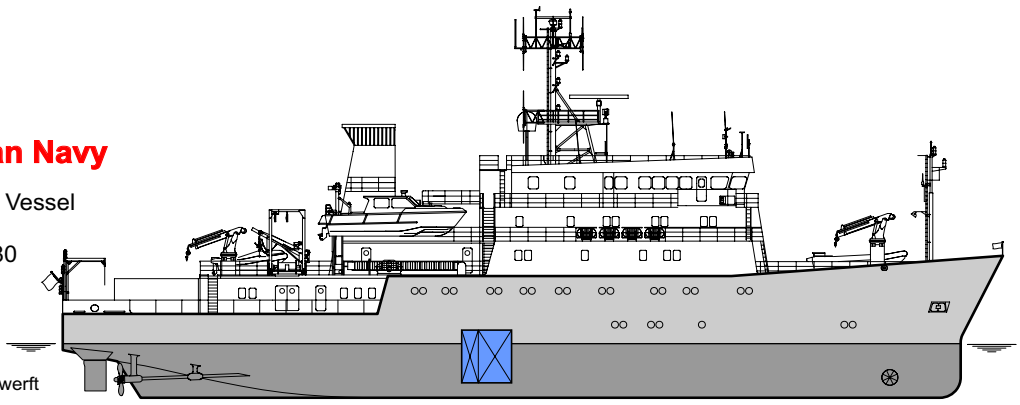
Survey Vessel
Krögerwerft
INTERING Order 2269

INTERING Heavy Fluid



Royal Malaysian Navy

Hydrographic Survey Vessel
Hong Leong Lürssen
INTERING Order 2680



Design Krögerwerft

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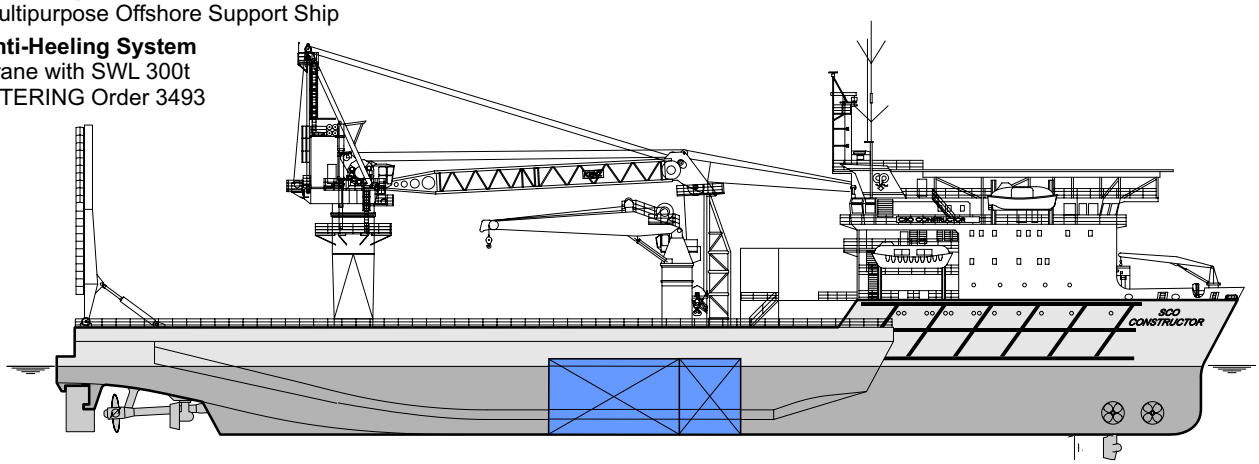
INTERING System on Offshore Vessels

Rolls-Royce

Coflexip Stena Offshore

Multipurpose Offshore Support Ship

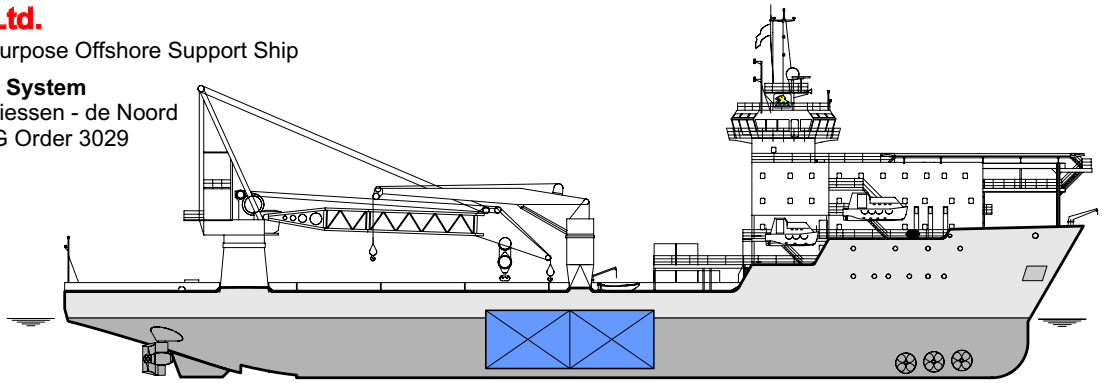
Anti-Heeling System
Crane with SWL 300t
INTERING Order 3493



Toisa Ltd.

2 x Multipurpose Offshore Support Ship

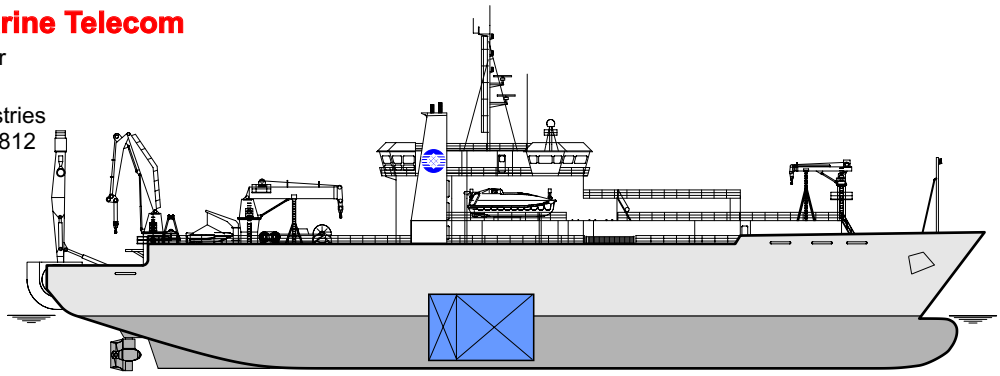
Stabilizer System
van der Giessen - de Noord
INTERING Order 3029



Korea Submarine Telecom

95,6 m Cable Layer

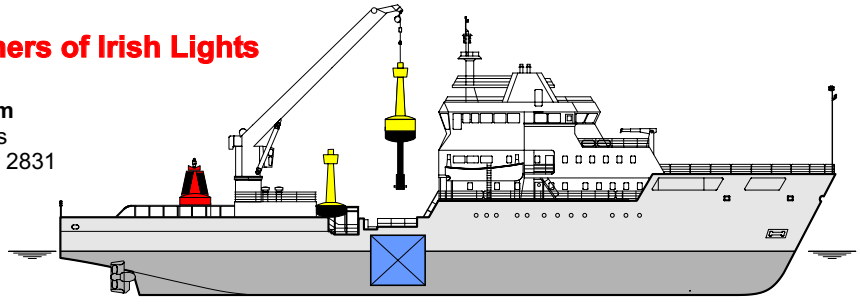
Stabilizer System
Hanjin Heavy Industries
INTERING Order 2812



Commissioners of Irish Lights

Buoy Tender

Stabilizer System
Damen Shipyards
INTERING Order 2831



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INTERING Stabilizer System on Navy and Government Ships

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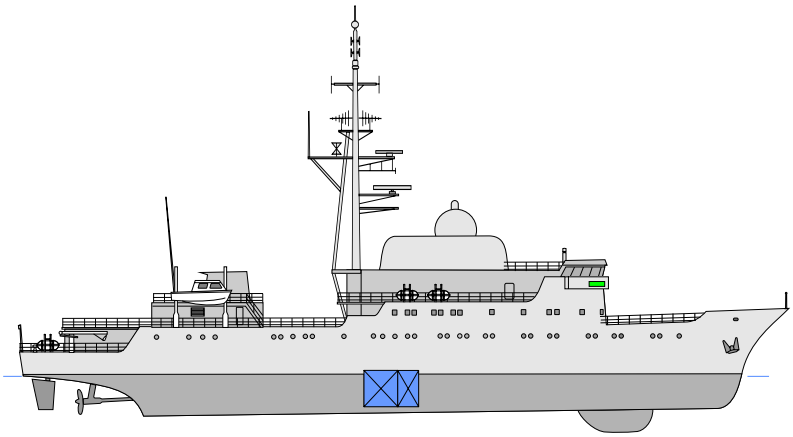
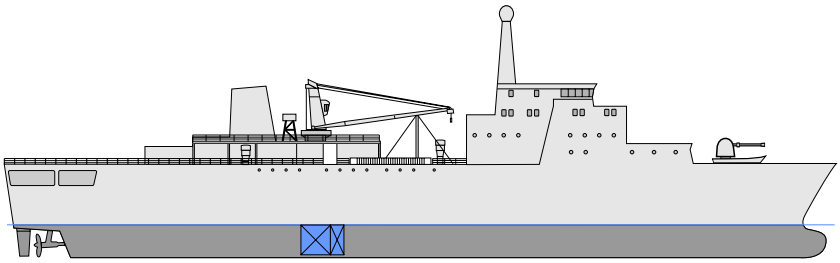


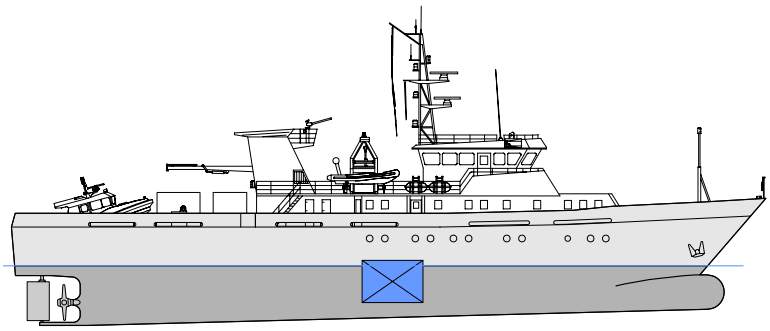
German Navy

Reconnaissance / Command Ship
LBP: 75,7m; B: 14,6m, Displ: 3300t
260tm Stabilizer Moment
130t Weight Tankfilling
Flensburger Schiffbau
INTERING Order 864



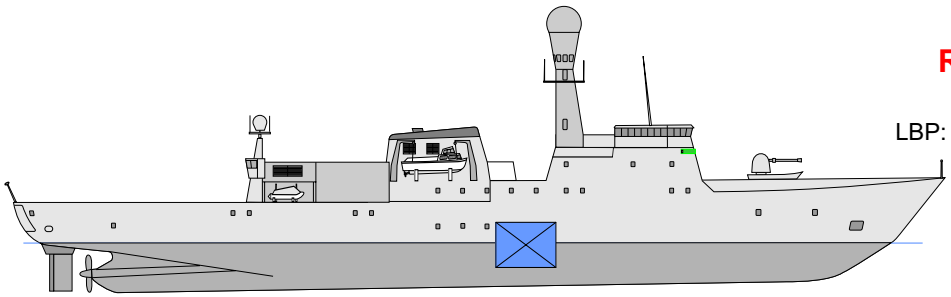
Malaysian Navy

MP Training / Support Ship
LBP: 90m; B: 15m; Displ: 4500t
420tm Stabilizer Moment
150t Weight Tankfilling
Korea Tacoma Marine
INTERING Order 853



Mauretanian State

Fishery Survey Ship
LBP: 54m; B: 10.6; Displ: 970t
60tm Stabilizer Moment
44t Weight Tankfilling
Fassmer Werft
INTERING Order 2990



Royal Danish Navy

Patrol Frigate
LBP: 99.75m; B: 14.4m; Displ: 5300t
INTERING STABILIZER
+ ICE- HEELING
330tm Stabilizer Moment
143t Weight Tankfilling
Svendborg Vaerft
INTERING Order 1317

INTERING Stabilizer on “POLE STAR”
Northern Lighthouse Aids to Navigation Tender

Aids to Navigation Tender --- S1 Ferguson Shipbuilders Nb. No. 709

INTERING Stabilizer on ”Merikarhu”
Finnish Board of Navigation --- Patrol Vessel

Patrol Vessel --- S1 Finnyards Nb. No. 406

INTERING Stabilizer on “JAMES CLARK ROSS”
British Antarctic Survey --- Polar Research Vessel

Research Vessel --- S2 EB3 Swan Hunter Shipbuilders Ltd. Nb. No. 132

INTERING Stabilizer on “POLARSTERN”
German Government --- Polar Research Vessel

Polar Research Vessel --- S2 EB3 HDW-Nobiskrug. Nb. No. 787

INTERING Stabilizer on “Seaway Condor”

Stolt – Nielsen Rederi AB --- Diving Support Vessel

Diving Support --- S1 K1 HDW – Nobiskrug Nb. No.: 710

INTERING Stabilizer on “TOISA PERSEUS”

Toisa --- Offshore Support Vessel

MP Offshore Support --- S2 van der Giessen – de Noord Nb. No.: 972

INTERING Stabilizer on ”SVALBARD”
Norwegian Coast Guard Vessel

Coast Guard Vessel --- S1 Langsten AS Nb. No. 108

INTERING Stabilizer on ”ARGUIN”
State of Mauretania

Fishery Surveillance Vessel --- S1 Fr. Fassmer SY – Nb. No.: 98/1/5300

INTERING Stabilizers

on Offshore, Research and Service Vessels and on Navy and Government Ships

Rolls-Royce

6. Dimensioning Questionnaire

Rolls-Royce

Intering Products

Dimensioning Questionnaire

☐ **Stabilizer** ☐ **Anti-Heeling System** ☐ **Stability Test System ISTS**

☐ **Parametric Roll Preventer IPRP** Project No.

Yard / Owner: _____ Project-/N.B.-No.: _____

Type of Vessel: _____ TEU / tdw: _____

Class: _____ Delivery: _____ Mains Supply: _____ V, _____ Hz

Lbp: _____ m B: _____ m BWL: _____ m Draught: _____ m

Double bottom: _____ m (BL)
Tween deck: _____ m (BL)
Tween deck: _____ m (BL)
Freeboard deck: _____ m (BL)

Side tank-beam: _____ m
Side tank-length: _____ m
Frame spacing: _____ m
Web frame spacing: _____ m

GA-sketch ☐
Midship section ☐
Hull form ☐
Drawing of possible heel/ stab tanks ☐

☐ Data for Stabilizer / IPRP Layout: ☐ Data for Stability Test System Layout:

1. Loading conditions for ship in service:

No.	Load condition	Displacement (t)	GMsolid (m)1)	GMfluid min. (m)2)	Remarks

1) GM_{solid} values without correction for any free surfaces.

Permissible minimum GM_{fluid} value after correction for all free surfaces incl. stabilizer tank acc. to applicable stability criteria.

☐ **Data for Anti-Heeling System Layout:**

2. Cranes Shore ☐ Deck ☐
   Number : _ _ _ _ _ _
   Safe working load : _ _ _ _ _ _ t SWL
   Outreach beyond ship's side : _ _ _ _ _ _ m
   Slewing speed with full load : _ _ _ _ _ _ rpm
3. Cell Guides ☐ yes ☐ no
4. Ramps ☐ yes ☐ no
   Stern ramp dimensions(LxB) : _ _ _ x _ _ _ m
   Max. load : _ _ _ _ _ _ t
   Side ramp length : _ _ _ _ _ _ m
   Max. load : _ _ _ _ _ _ t
5. Cargo Units
   ☐ Trailer ☐ Cassette+Truck ☐ .....
   ☐ Container ☐ Waggon
   Unit weight : _ _ _ _ _ _ t
   Speed : _ _ _ _ _ _ km/h
6. Simultaneous operation ☐ yes ☐ no
7. Max. asymmetric load distribution to be compensated : _ _ _ _ _ _ tm
8. Max. permissible heeling angle: _ _ _ _ _ °
9. Required rate of anti-heeling moment : _ _ _ _ _ _ tm/min
10. Ice heeling required: ☐ yes ☐ no
11. Further data & requirements (levers, distances, speeds etc.):

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INTERING Interferenztechnik Ingenieurwesen GmbH
Stettiner Strasse 3
D 22850 Norderstedt

Telefon +49 (0) 40 - 528 73 6-0
Telefax +49 (0) 40 - 523 15 80
www.intering.com
ID No. DE 134845836

Commerzbank AG, Hamburg
BLZ 200 400 00
Konto 4018032
S.W.I.F.T. COBADE FF 200

Handelsregister HRB 1099
Amtsgericht Norderstedt
Geschäftsführer: Derek Birkenfield
Steuer Nr. 11 290 17582