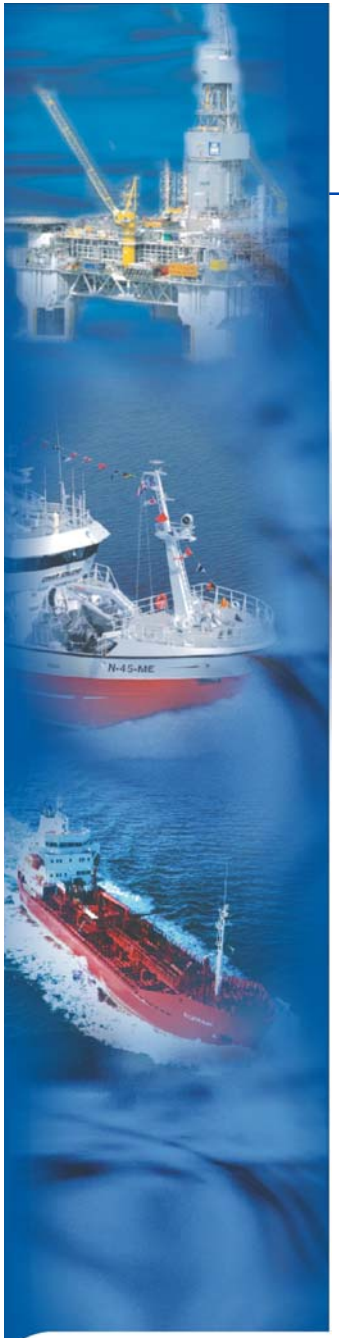
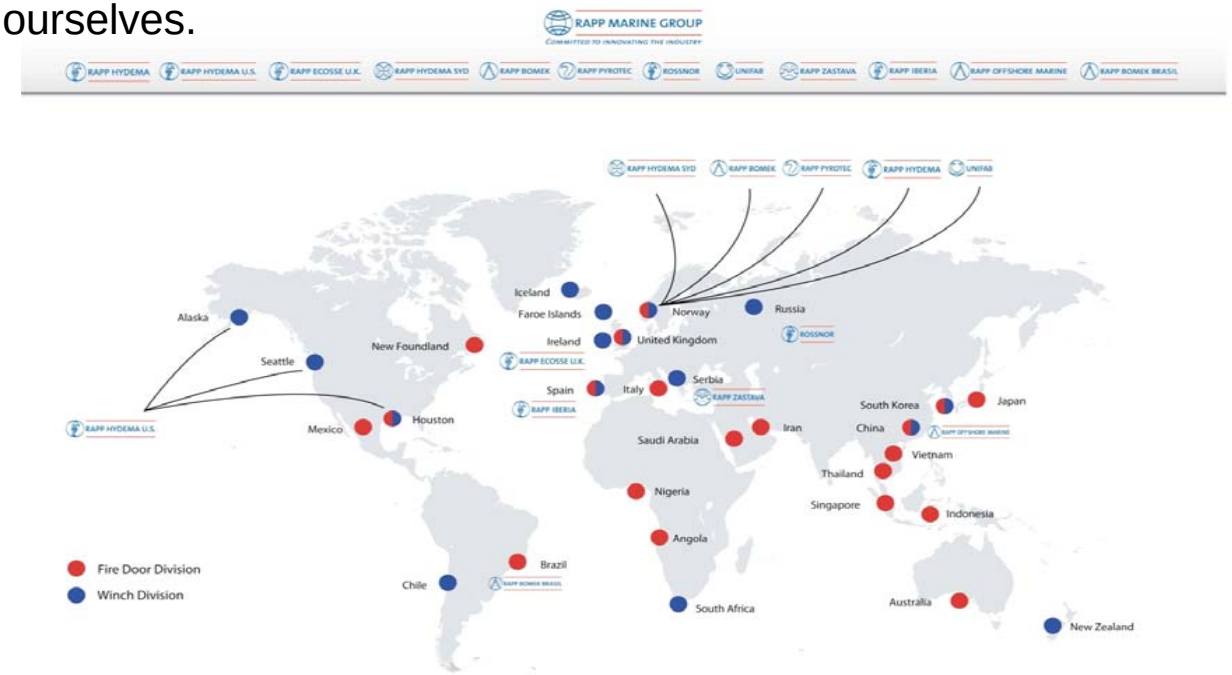


Rapp Marine Group

For 100 years the Rapp Marine Group successively developed new generations of advanced machinery and equipment for the marine and offshore oil industries world wide.

Our high priority of R&D activities create products and solutions at the technological forefront.

We emphasize optimal performance and rational operations for customers and ourselves.



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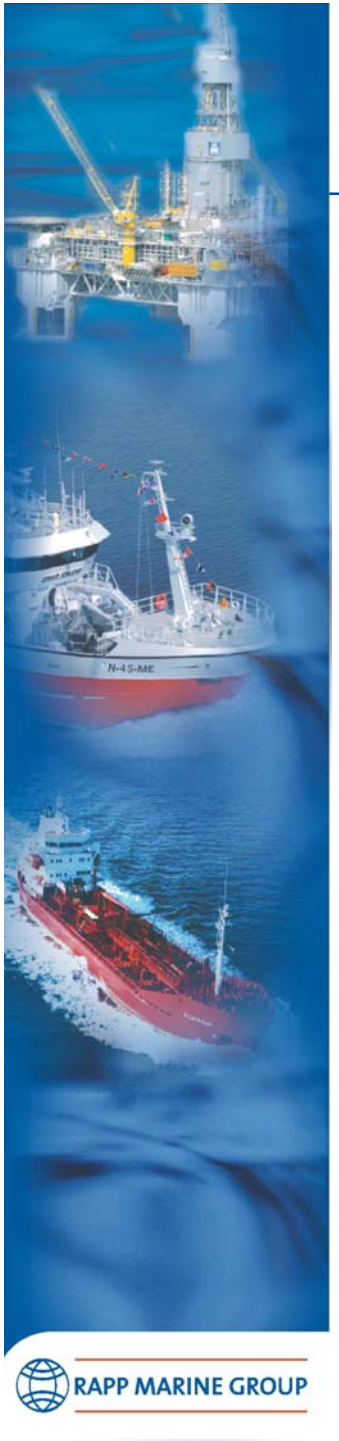


Rapp Hydema AS

RAPP HYDEMA
COMMITTED TO INNOVATING THE INDUSTRY

Founded 1907 in Norway and served the Marine Industry in more than a century.

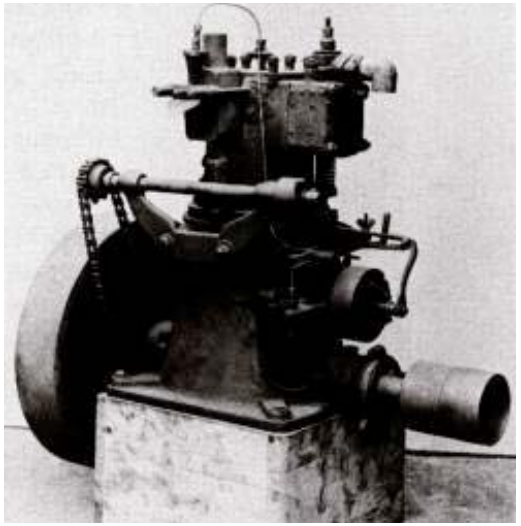
Our arctic location has provided a unique opportunity to develop and manufacture equipment for the most demanding marine sector.

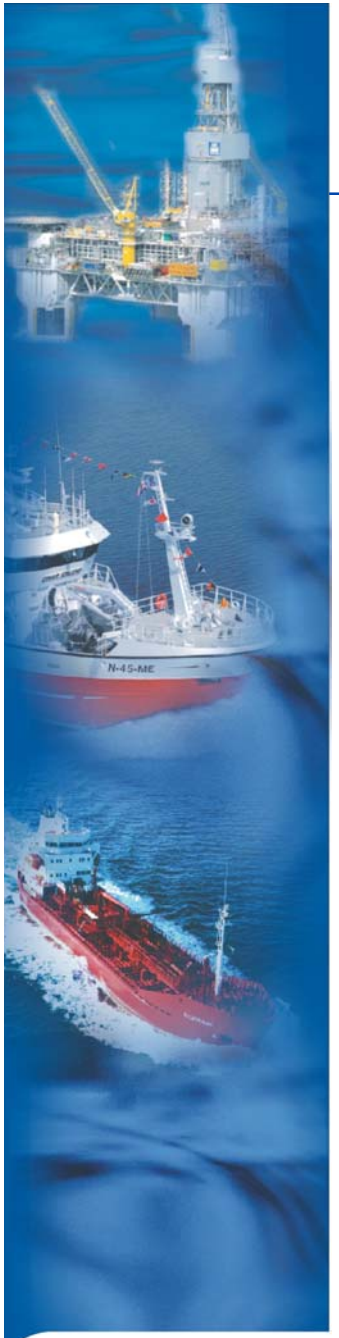
Main products are towing, research, trawl winches and more recently winches for special applications on offshore vessels.

HPUs, Controls and Monitoring systems provide winches with optimal functionality of delivered turn key systems.

Total engineering and supervision secure overall system reliability.

Maintenance and service provided worldwide.





Review of Topics

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- ✓ With Focus on NOAA research vessels - The FRV- 40 class.
- ✓ Practical Focus Areas Dealing With Winches Specifically Designed For Handling Submersible Scientific Equipment.
  - ➢ Technical Clarifications with Focus on Operational Criteria
  - ➢ Documentation Requirements, Support during installation, Crew Training, etc.
  - ➢ After Sales Service
- ✓ Presentation of Technical News as to Fishery Research Winches - Trawling
- ✓ Self Contained Hydrographic - and Oceanographic Winches with Automatic Heave Compensation.
- ✓ Rapp Hydema's views on Electric Winch Drives for Multiple Applications.

NOAA Research Vessels FRV40 - Class

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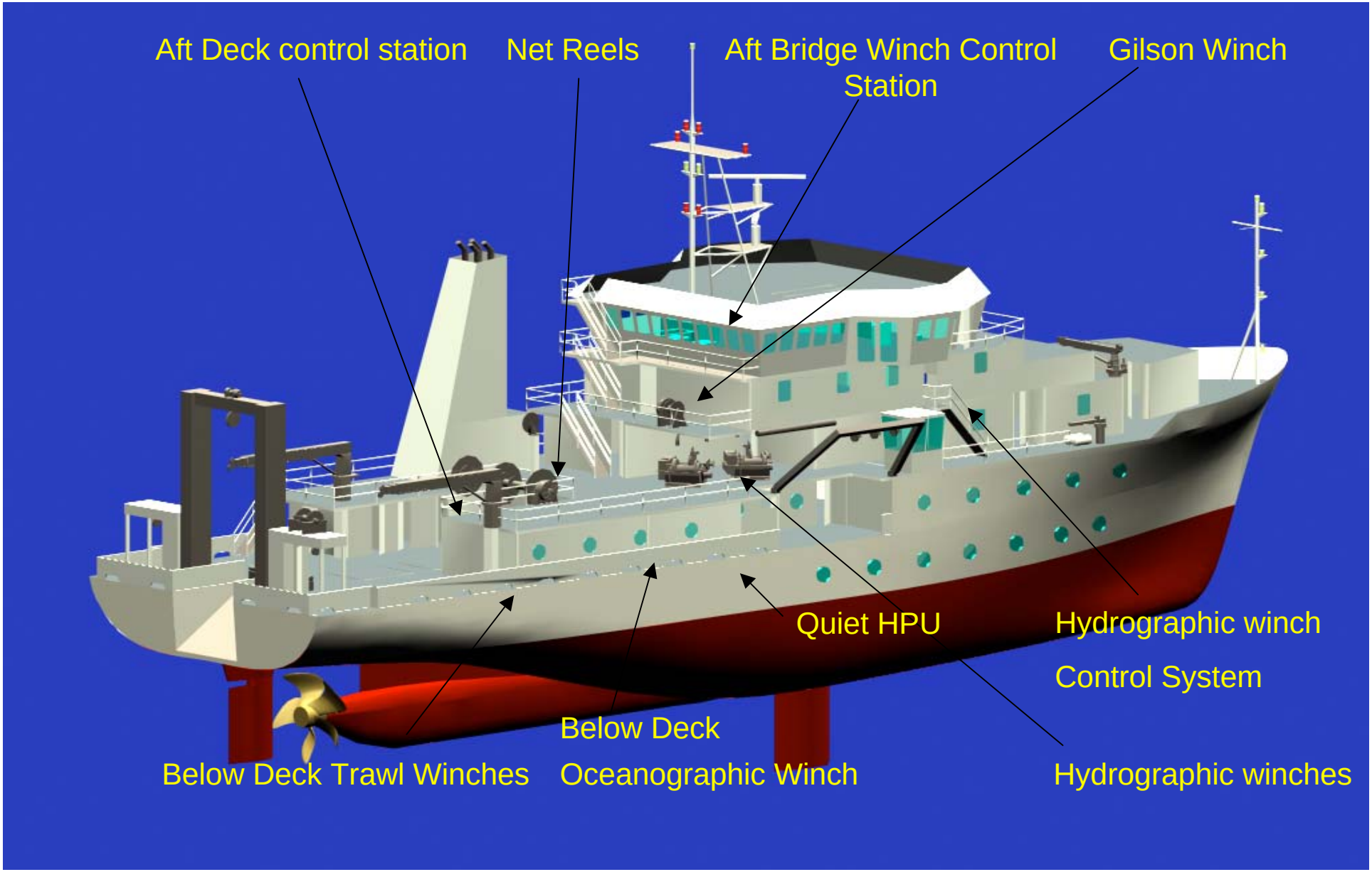

Winches for Handling Scientific Equipment

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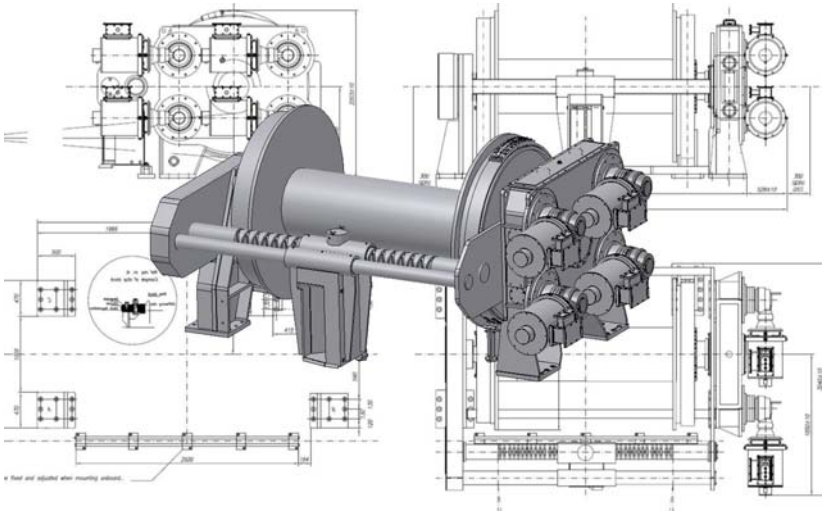
Functional matters:

- Operational functions and control sensitivity
- Redundancy level.
- HMI, human to machine interface, with focus on intuitive and logic operation.
- AHC, Active heave compensation.

Calculation based on:

- Cable size (SWL), length and weight
- Pull and variable speed
- Safety factors
- Brake dimension and fail safe.
- Design temperature
- Life time calculation



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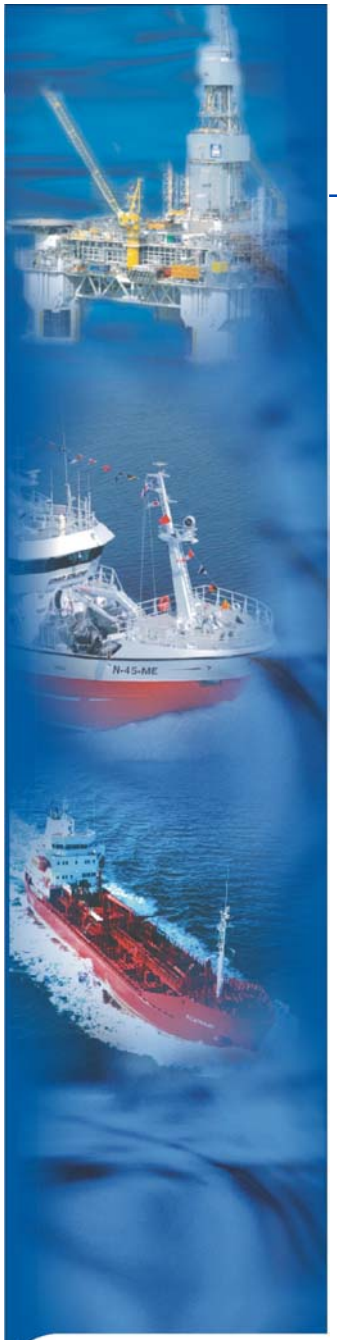

Winches for Handling Scientific Equipment

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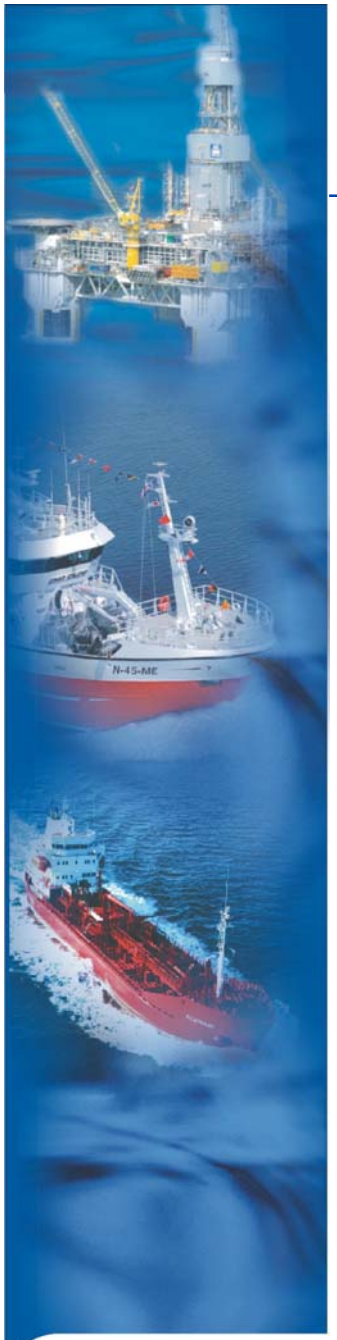
The Importance of accurate and detailed communication:

- Design meetings with operators to emphasize the needs of control and operational issues.
- Understanding the user technology and operation needed in the field to secure the desired functions.
- Identify multiple applications for same winch and limitations of such.
- Exemplifications needed by referring to previously delivered systems with information of advantages and disadvantages.
- Bring discussions out to where the action is – excursion trips to other vessels in operation with participation on exploration voyages.
- Do not underestimate the importance of thoroughness by exchanging minutes from design meetings and technical review discussions.
- Confirm in writing all agreed operational functions, specialties around controls an locations of these and communicated limitations of the winch system.



Winches for Handling Scientific Equipment

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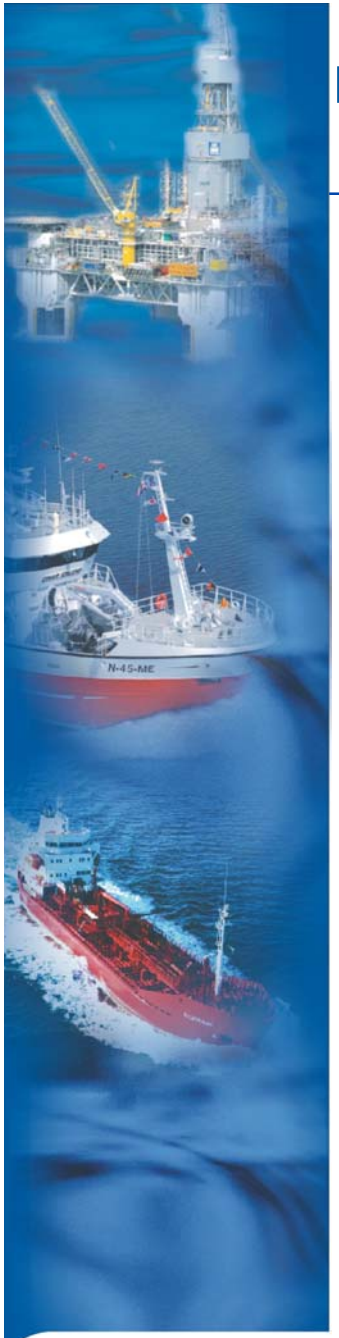
- Pre-engineering with the operators to secure the user technology, understanding and knowledge being built into the final product.

- Rapp's objective # 1 is to deliver turn key systems that ensures functional requirements are met.

"Yes! We Got All Functions And Capacities of The Original System Descriptions And Technical Specifications!"



Documentation, Installation, Crew Training

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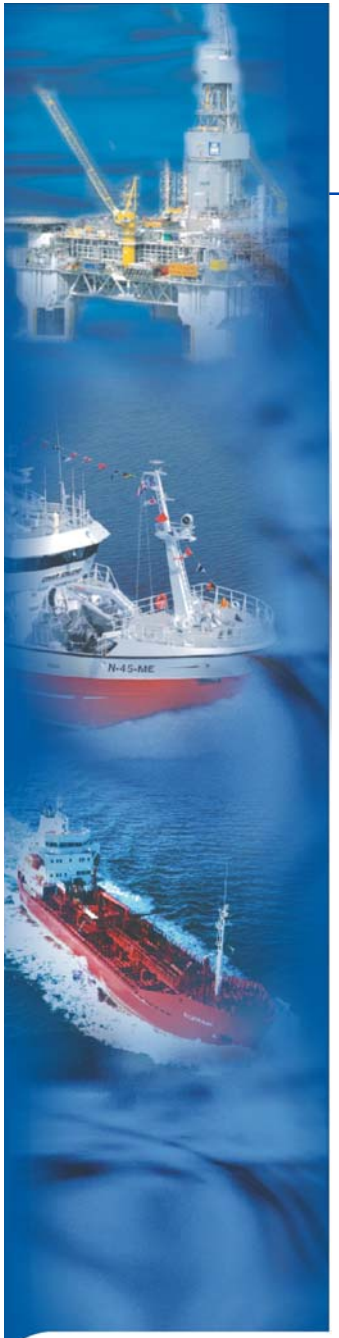
Rapp Process to Ensure Optimal Winch Performance:

- Detailed and illustrated installation documentation submitted and explained across the table with installer.
  - Alignment procedures
  - Secure sufficient deck and foundation stiffness
  - Pipe dimensions, fittings, wiring, etc.
- Supervision of installation by Rapp's technician included in contract.
- Dock side trials
- Sea trials and Sea Acceptance Tests
- Training of **Crew** based on Instructional manuals tailored for the individual winch system.
- Manuals with maintenance and service procedures to be communicated to operating crew on the vessel.
- Limited amount of Spare Parts on the vessel, but consumables such as oil filters, etc. are a must.



After Sales Service

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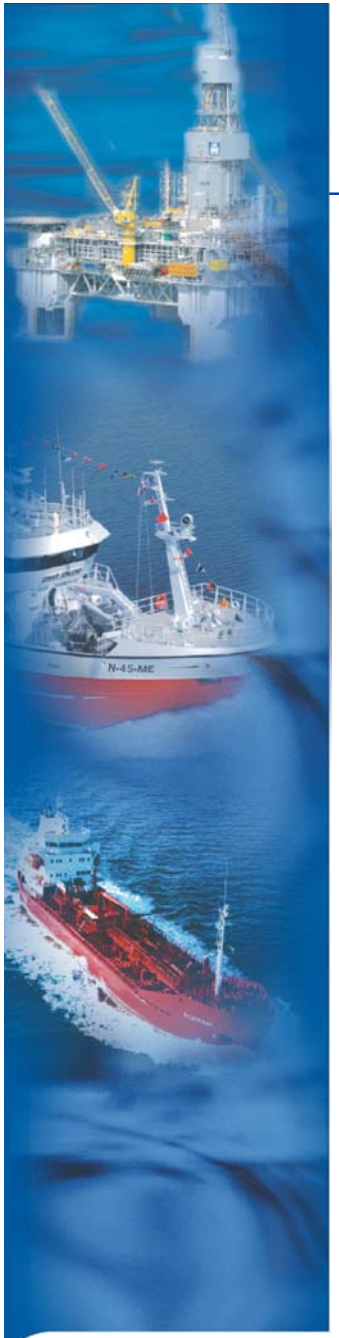
What we offer:

- Routine inspections twice a year
- Keeping an overview of the state of the entire system
- Provide written reports to ship-owner, which in return provide options for planned maintenance
- Prioritized assistance when in need of immediate support.
- Two year service contract with fixed rates
- Discounts on Spare Part deliveries and hourly service rates

”We provide service contracts that suit your needs and ultimately safeguard the maintenance of winches and systems throughout years of operation”

Arne Martin Myre, Service Manager



Technical News as to Fishery Research Winches - Trawling

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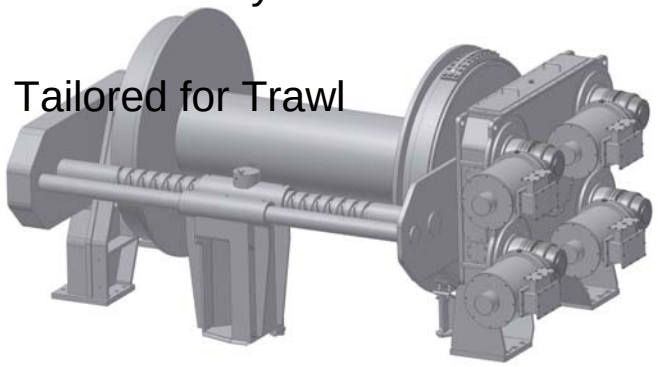
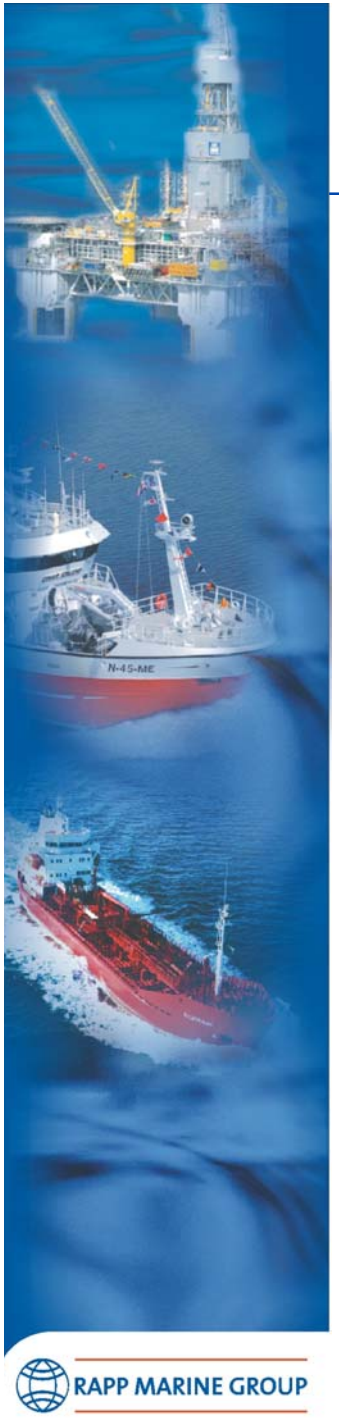
Design Criteria:

- Must handle multiple trawl nets to target research on a verity of fish species.
- Different wire sizes/lengths
- Balance winch torque to size of net and length/wire dia.
- Flexibility through Multi Motor Drive Units. Fine tuned ratio between Torque/pull/speed/Power input.
- Service life of
- Space saving design. Length and size of wire determining factors for the overall size of winch
- A vast variety of control functions
- Computerized Level Wind System with electric or Hydraulic Drive.
- Pentagon C-bus.(New PTS Pentagon Tailored for Trawl Winches with electric drives).





Technical News as to Fishery Research Winches - Trawling

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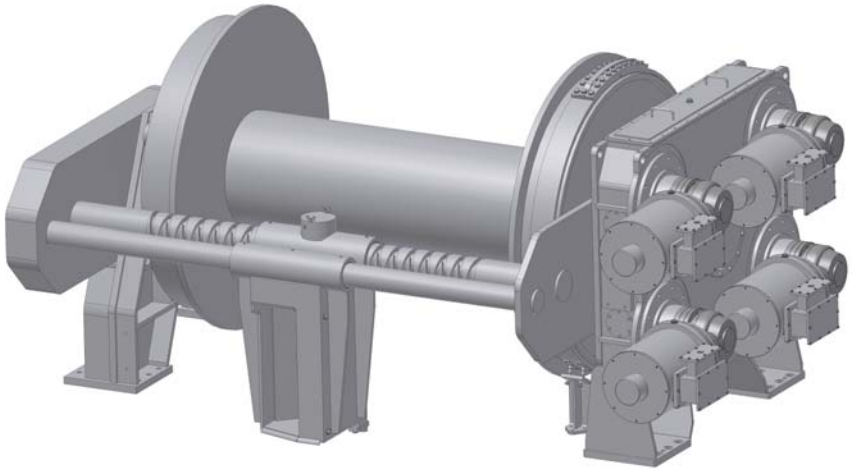
Robust Winch Drives with Multiple Torque and Speed



Optimized Ratio Between Wire Capacity/Torque/Weight/Overall Dimensions

Hydraulic and electric systems

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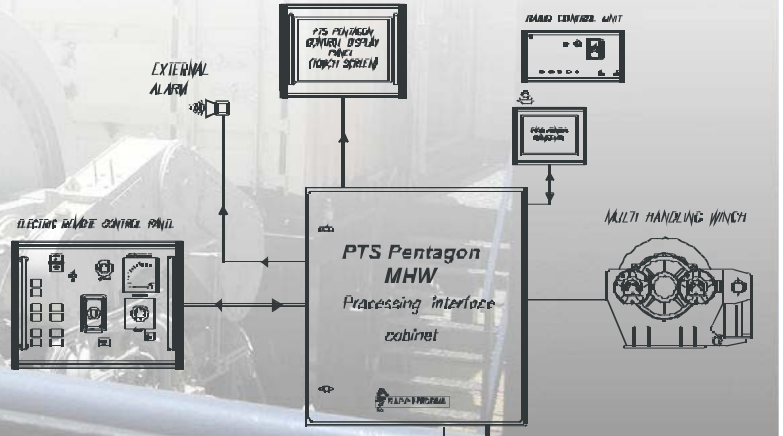
PTS Pentagon® MHW

Hydraulic power pack designed with optimal performances and low noise



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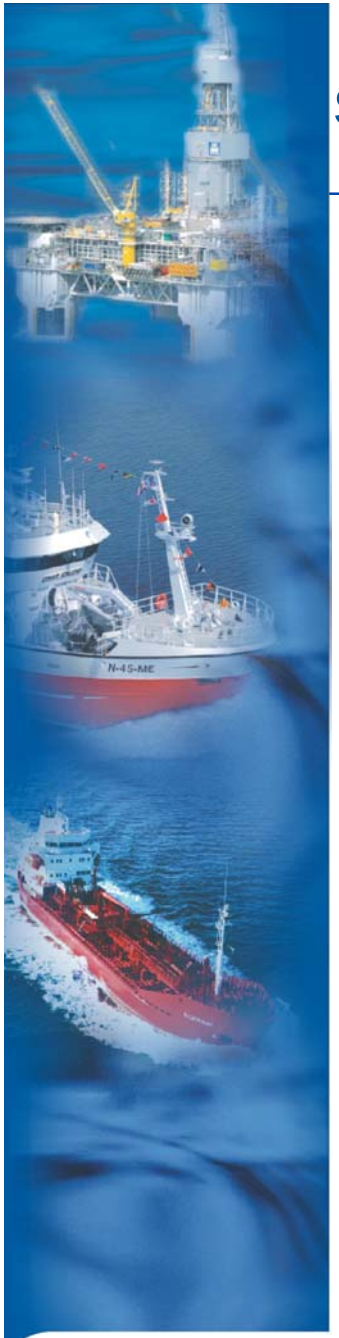

Self Contained Hydrographic Winches

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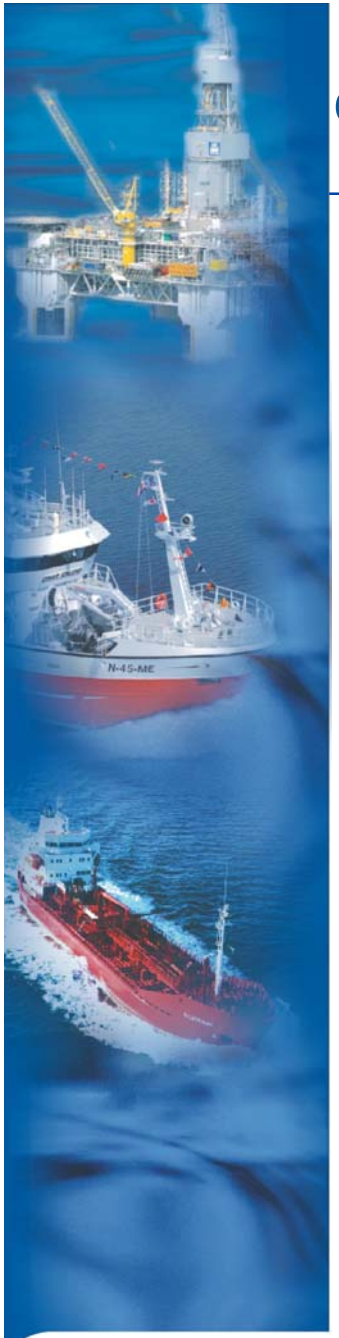
Hydrographic Winch on NOAA's FRV 40

- Hydrographic Winches, model HW-500, storage capacity 3600 m of dia. 9,5 mm, max pull 5,0 t

- Winch Control of haul in/pay out is electric on bridge, deck and local.
- Automatic control from PTS Pentagon R.



Oceanographic Traction Winches

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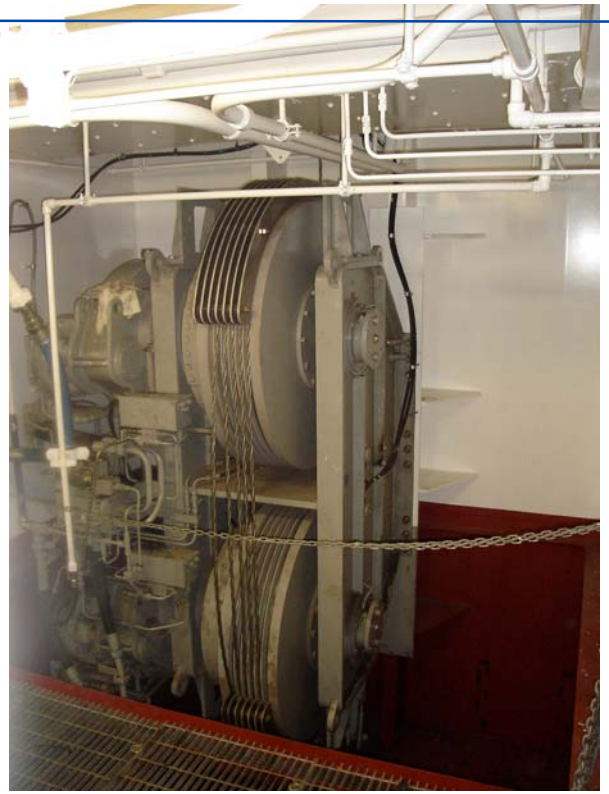
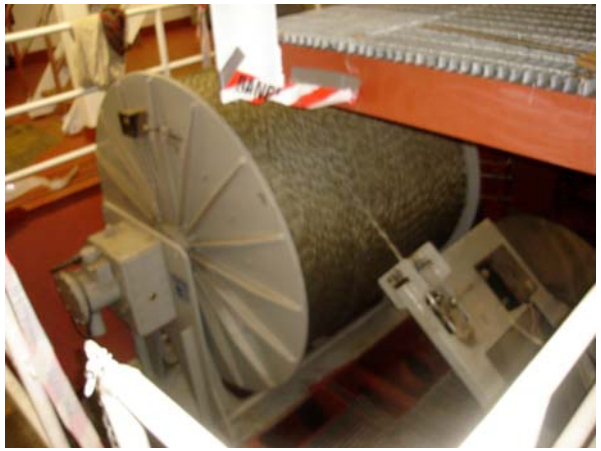
Oceanographic Winch on NOAA's FRV 40

- Oceanographic Traction max. pull 13,6 MTe
- Slack Wire Compensator
- Oceanographic Storage reel wire capacity 5100 m. 16 mm dia. wire, max. pull 3,4 MTe
- Hydraulic Level Wind

- Combined and synchronized controls of Oceanographic Traction Winch, Storage Reel for haul in/pay out all electric from ACS on bridge and from winch.
- Automatic control from PTS Pentagon R.





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Automatic Heave Compensation

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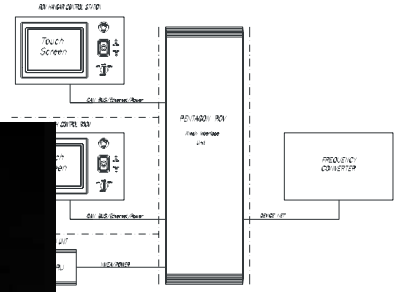
- Works and compensate directly on Winch
- Feedback with different curves for the accuracy of Compensation
- [illegible] system which gi[illegible]
  [illegible]ms in clear text



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Control systems

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Control system with AHC

HMI by :

- Joystick for manual winch control
- Touch screen for:
  - parameters read out
  - winch control
  - Alarms and system mapping
  - Historical operation data

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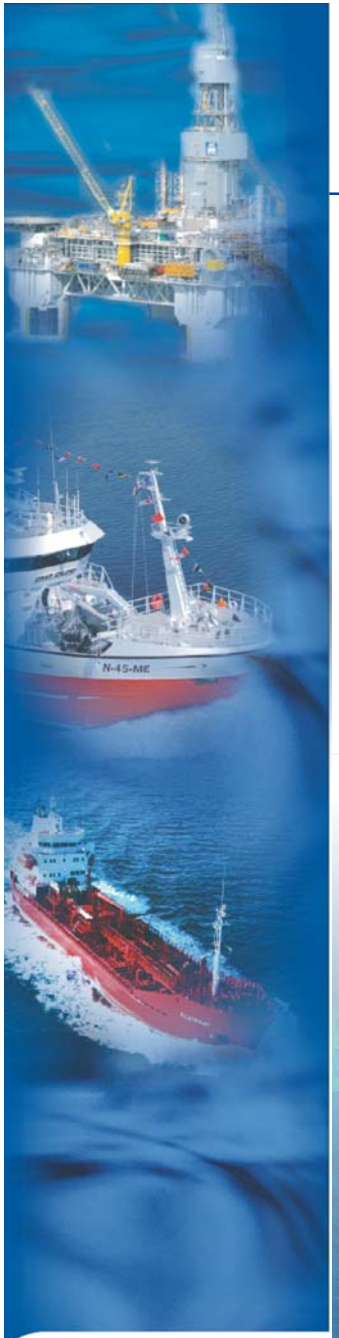

Control Systems for ATC

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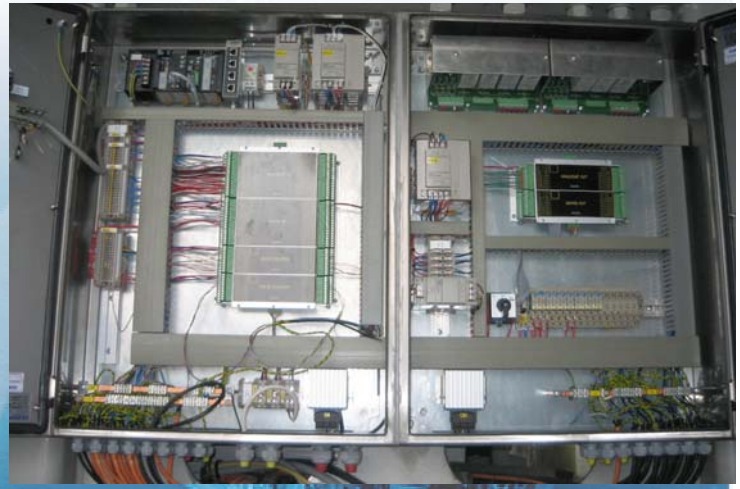
Electro hydraulic control system
HMI by touch screen

- AHC (active heave compensation)
- Intelligent alarm system, to avoid unexpected operations
- Historical data logging



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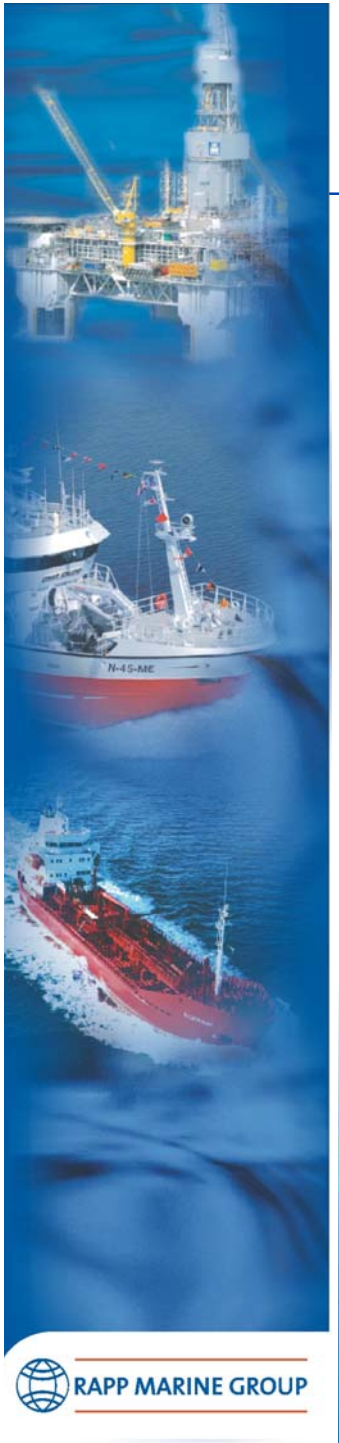

Fluid cooled electric motor

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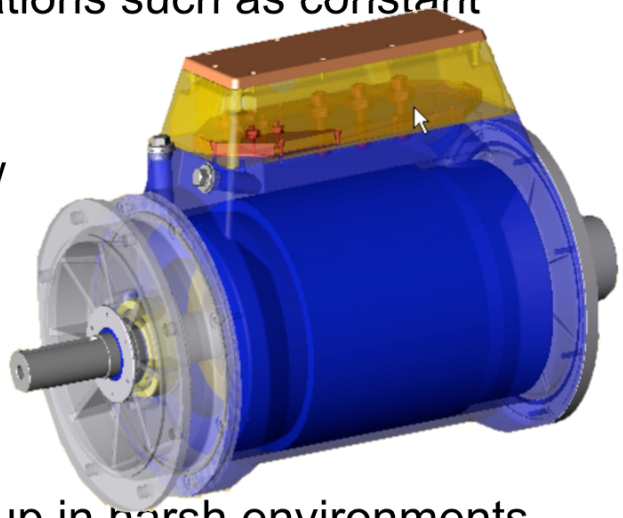
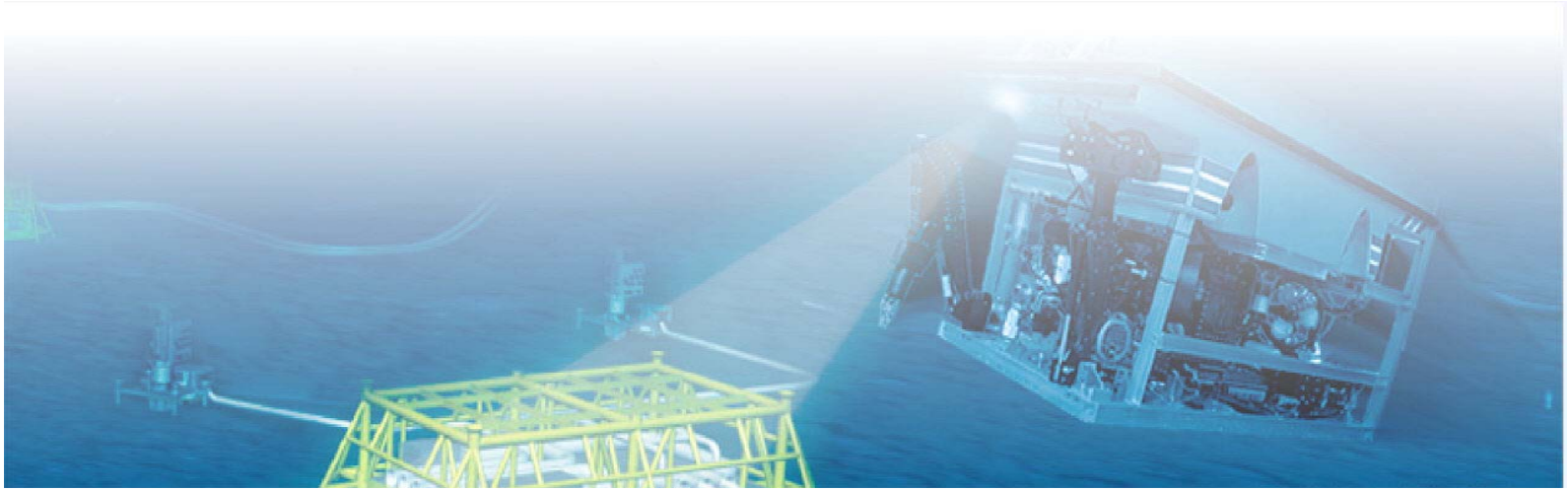
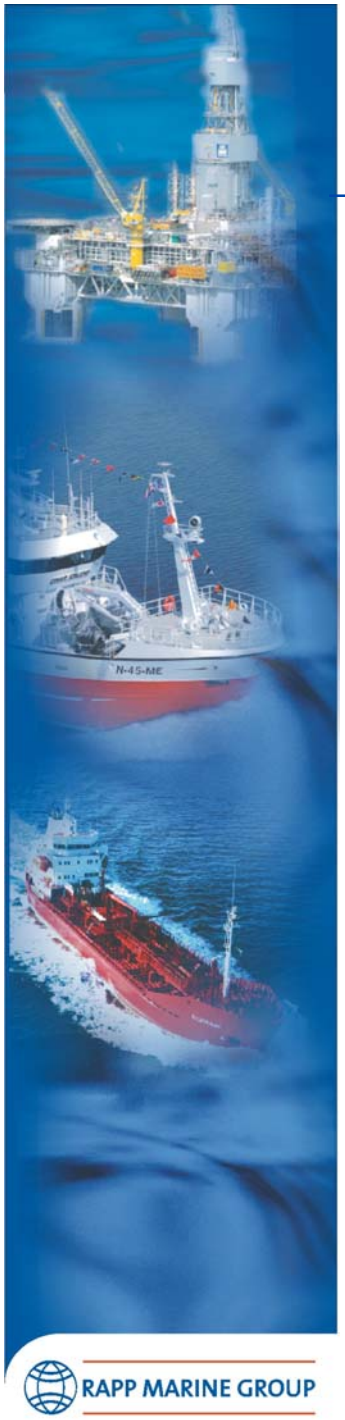
An electric motor for special winch applications such as constant tension winches.



- The motor is able to run at power 180Kw
- Maximum torque at 0 RPM
- Small overall size.
- Totally enclosed and designed to stand-up in harsh environments.





Fluid cooled electric motor

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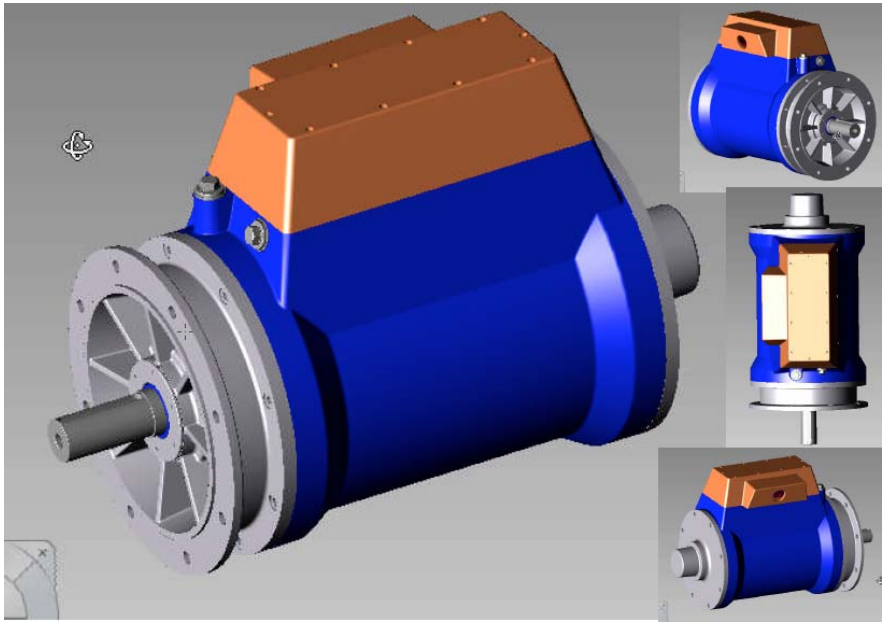
Fluid cooled electric motor

- Power up to 180KW
- Weight 350 kg.
- Size L=772mm, W=438mm
- Norm size 225
- 0-3000 RPM
- Cooling flow approx 50 l/min.
- Cooling fluid, environmental safe oil.



Patent pending