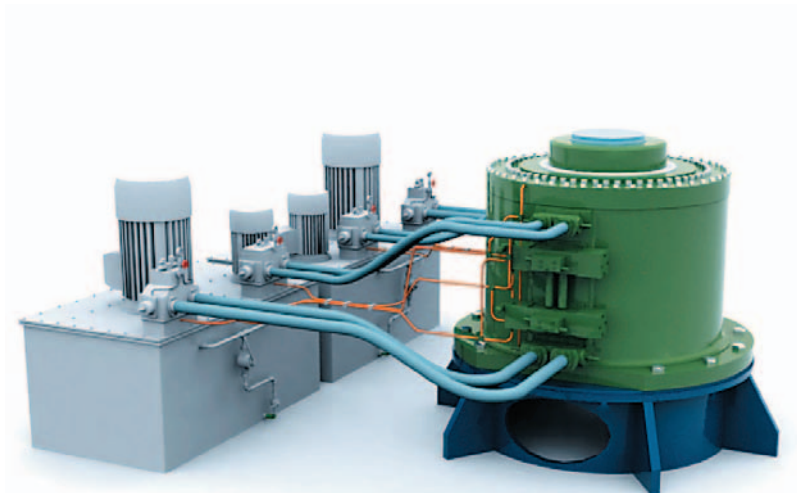


Frydenbö™ steering gear

4-vane steering gear - the compact solution for large vessels

As a response to market demands Rolls-Royce has developed a range of compact rotary vane steering gear suitable for large vessels, including tankers above 100 000 dwt, large bulk carriers and post-panamax container vessels. The 4-vane steering gear are delivered both in standard execution and as 'IMO-type', fulfilling all statutory requirements.



The illustration is showing an IMO-type IRV 6000-4 steering gear in a configuration with 4 pumps and integrated storage tank. In this set-up a smaller pump is used for emergency steering, something which reduces the emergency power need and thus also yard installation costs.

Key features

Easy Installation

- Low weight, typically 50% less than RAM-type
- Compact size due to 4-vane design
- Few components due to integrated storage tank and rudder carrier, no expansion tank

Safety

- No external moving parts
- Automatic lock valve
- No external oil leakages
- Double hydraulic sealing system on IMO-type

Easy Maintenance

- No lubrication required, internal bearings are lubricated by the hydraulic oil

Reliability

- Polymer sealings ensure superior tightness of < 1°/min.
- Robust, submerged fixed displacement spindle screw pumps
- Medium pressure, reducing noise, tear & wear

Modulated flow control valve

- Maintains the simplicity of a standard on-off valve
- Smooth rudder movements as with variable displacement pumps
- Rudder positioning in line with or better than proportional valves

Fact Sheet

Proven technology

The 4-vane steering gear are a further development of Rolls-Royce's well proven Frydenbö range of steering gear with 2 and 3 vanes ranging from 625 to 4200 kNm working torque. Industrial standard screw spindle pumps and electric motors are combined with carefully selected polymer seals and Frydenbö's proven and unique modulated flow control valve.

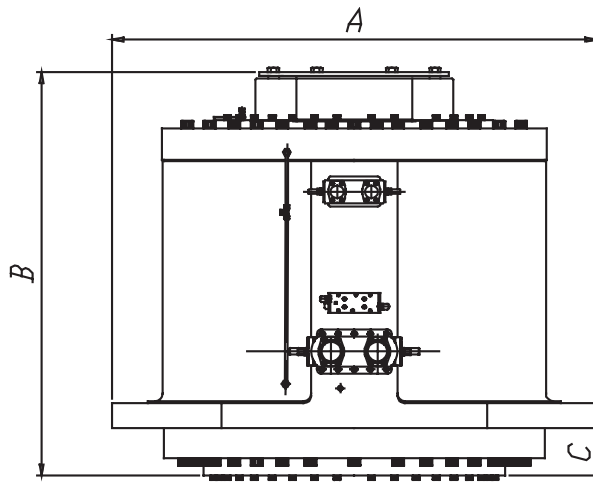
Double sealing system

The IRV series actuator is equipped with a double sealing system, completely separating the actuator in two individual pressure chambers. A specially designed sensor system maintains constant control of the integrity of the seals.

When one pressure chamber is operated alone, the steering gear torque is reduced to 50 % of the normal working torque, but steering time is maintained.

Modulated flow control

The control system modulates the oil flow to the actuator in order to give a soft start and low rudder speed for small rudder movements. The oil flow gradually increases up to full flow, allowing full turning speed on the rudder. The system ensures a very precise rudder positioning for small rudder angles, with close course keeping, while the full flow provides for full manoeuvring requirements when needed. In this way the simple and reliable fixed displacement screw pump is efficiently controlled to provide smooth and accurate steering in line with a variable displacement pump, however without introducing the complexity of such a pump. Frydenbö Modulated Flow Control is also ideal in combination with the most advanced steering controls including Adaptive Autopilot.



| Type | Max. rudder stock dia (mm) | Max. working pressure (bar) | Max working torque (kNm) | Max. mech. rudder angle | Weight approx (kg) | Max. radial load (kN) | Max. axial load (kN) | Width A (mm) | Height B (mm) | Height C (mm) |
|----------|----------------------------|-----------------------------|--------------------------|-------------------------|--------------------|-----------------------|----------------------|--------------|---------------|---------------|
| RV 4500 | 850 | 160 | 4500 | 2 x 36,5 | 18000 | 3000 | 4500 | 2250 | 1560 | 220 |
| RV 6000 | 850 | 160 | 6000 | 2 x 36,5 | 22000 | 3000 | 4500 | 2250 | 1870 | 220 |
| IRV 4500 | 850 | 160 | 4500 | 2 x 36,5 | 18500 | 3000 | 4500 | 2250 | 1560 | 220 |
| IRV 6000 | 850 | 160 | 6000 | 2 x 36,5 | 22500 | 3000 | 4500 | 2250 | 1870 | 220 |



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