

REPORT

Roxtec pipe seals
onboard cruiseliner



Cruise liner 'Freedom of the Seas' is the first ship in a series of three of its type ordered by the Royal Caribbean International and built by Aker Finnyards in

Turku, Finland. Among the new solutions chosen for the ship is the frequent use of plastic pipes and the change from welded method of sealing metal pipes to

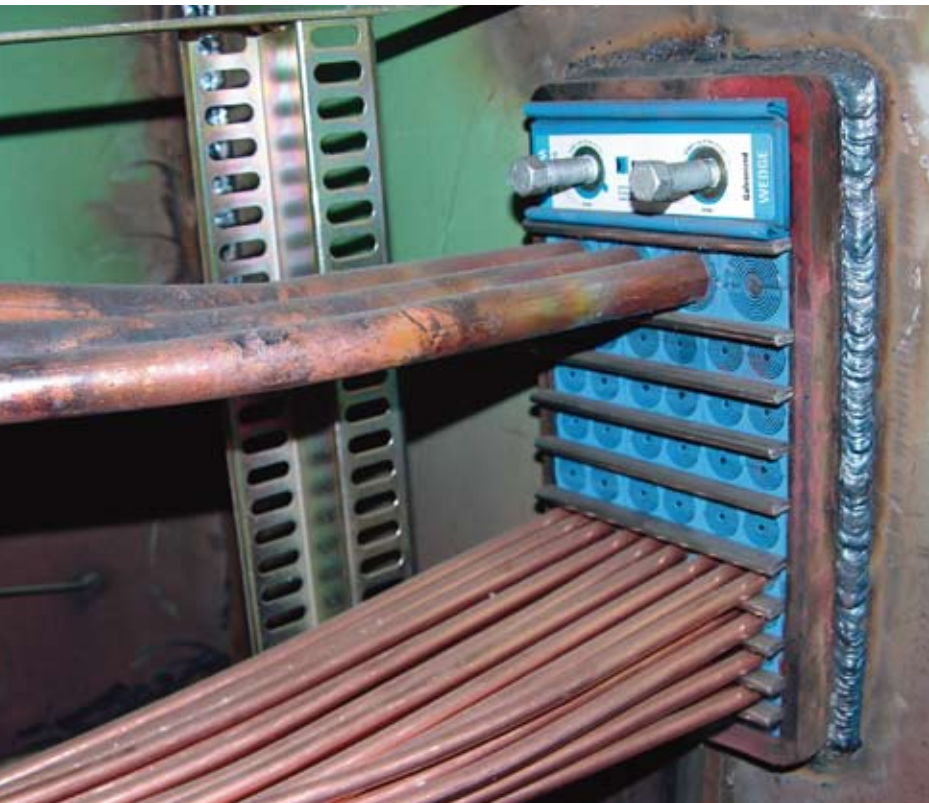
the use of modular seals. In both cases the flexible technology Multidiameter™ from Roxtec is the chosen solution.

Roxtec team reports on site

From the build of the cruiseliner "Freedom of the Seas", in Finland

We Seal Your World

Innovation in pipe technology supported by Roxtec



As Aker Finnyards were preparing their new series of luxury cruise liners to replace the existing Voyager series, their attention was among other things focused on creating longlasting and cost-effective pipe solutions onboard the ships. A common known issue on larger cruise ships is the wear down of metal pipes over time and eventually the inconvenience of replacing old ones and installing new. To address this problem and try finding



better solutions Aker Finnyards made test installations in 2002 onboard their Voyager series. Roxtec multidiameter seals came out a winner.

Flexibility and simplicity with Roxtec

Petri Kulmala, responsible for pipe installations at the Outfitting department of Aker Finnyards, explains that the owner's specification for the Freedom of the Seas requires metal pipes to be used in the lower decks on the ship - in particular the machine room and utility areas. Now, instead of using the old welding method to attach and seal off pipes that pass through bulkheads and decks, or by use of rubber ring plugs, the yard is able to use adaptable multidiameter seals from Roxtec. The pipes are simply routed through the Roxtec unit which can be closed and opened all according to the need during the routing and installation. As a result the Roxtec seals facilitate much more flexibility and simplicity during every installation.

Where single pipes pass through the deck or bulkhead, most often the Roxtec RS seal is used. If a bundle of pipes, such as pneumatic copper pipes for valve control pass through, they are more often sealed with a Roxtec S frame transit, either

(Top left): Copper pipes sealed by Roxtec S 6x1. (Left): Roxtec PPS protects both PVC and PB plastic pipes onboard the Freedom of the Seas.

Roxtec PPS plastic pipe seal consists of two RS seals inserted at both ends of a metal sleeve. In the middle of the sleeve is an intumescent material that will expand if fire tries to pass through the sleeve. This design allows a plastic pipe to be routed through the RS seals. Should the plastic pipe catch fire, the PPS will effectively stop fire from passing through the sleeve. Picture shows opened up Roxtec PPS.

Roxtec R frames are also used for pipes. Here Roxtec R 100.

(Below): Roxtec PPS for PB plastic pipes.

Joining technology attachment to plastic pipes coming out from Roxtec RS and PPS seals is easy.



as a single frame opening or in width or height combinations.

Plastic pipes also sealed and firestopped with Roxtec

The use of plastic pipes is increasing in shipbuilding. The advantages are obvious compared to metal pipes: better resistance against corrosion and less weight, just to mention a few. Subsequently plastic pipes are common onboard the

Freedom of the Seas. In particular they are used for fresh water and waste water systems onboard, as well as for cooling in the HVAC. Roxtec is following suit with the development of the new Roxtec PPS plastic pipe seal. This product enables customers to use plastic pipes in fire rated decks and bulkheads. It also allows installations to be made in a way very similar to metal pipes.

Roxtec benefits

- Less welding of pipes to decks and bulkheads during installation.
- Allows flexible timing during pipe and cable routing.
- Unique sealing and fire-stopper for plastic pipes.
- Vibration dampening.

Steel pipes sealed with Roxtec RS 125.



Petri Kulmala (right) of the Piping department at Aker Finnyards in Turku and Jouko Karilahti from Roxtec Finland.



Facts

Project type: Passenger Luxury Cruise Ship, NB-1352
339 m long, 39 m wide, 18 decks, Gross tonnage 158 000.

Rated by the builder as the most innovative and revolutionising ship in the cruise industry.

Ship's name: Freedom of the Seas

Client/Owner: Royal Caribbean International (RCI).

Engineering & Main contractor: Former Kvaerner Masa-Yards, now Aker Finnyards in Åbo/Turku, Finland

Construction: Aker Finnyards in Åbo/Turku,

Time: Keel laid November 08, 2004.
Delivery estimated week 17, 2006

Sealing requirements: Fireprotection A0-A60,
Water pressure
Gas tight

Roxtec solutions: Roxtec S frame transits, Roxtec R frame transits, Roxtec RS seals and Roxtec PPS plastic pipe seals welded in decks, bulkheads, cabinets and in additional applications such as security doors and gully traps.

Transits were used also for cables.

Roxtec transits: Pipe sealing:
2500 pcs PPS seals for plastic pipes.
2000 pcs RS seals for steel pipes.
200 pcs S frames and R frames for Copper pipes.

Cable sealing:
1800 Roxtec S frame openings in total.
200 pcs R frames.
350 pcs RS seals for Tebul watertight doors.
300 pcs RS seals for outside area cables.

Roxtec benefits: High flexibility during installation and maintenance of pipes, and for cables. Easy to adjust, route and reroute pipes and cables during the build of the ship. Less welding of pipes to decks and bulk heads. Unique plastic pipe seal with the same flexible Roxtec benefits. Vibration dampening.



Roxtec General Shipbuilding References (extract)

Aker Yards
AP Möller
Avondale Industries
Bergesen DY ASA
Brostrom AB
Carnival Corporation
Chantiers de l'Atlantique
China Shipping Company
Color Line
Dalian Shipyard
Disney Cruise Lines
Fincantieri
Holland America Line
Jiangnan Shipyard
Kvaerner Fjellstrand
Meyer Werft
Mitsubishi Heavy Industries
P&O European Ferries
Princess Cruises
Royal Caribbean Cruise Line
Spanish Navy
US Navy



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