HAMMERODDE & DUEODDE

HANDY SIZE ROPAX FERRIES FOR BORNHOLMSTRAFIKKEN

Builders : Merwede Shipyard, Hardinxveld, The Netherlands
Owners : Bornholmstrafikken, Rønne, Denmark

Merwede Shipyard was BornholmsTrafikken's obvious choice for it was the sole shipyard boasting a ready-made and proven design for the type of Ro-Pax ferry which the Danish ferry operator had in mind and capable of delivering within the very constrained time frame of only 11 months from Bornholmstrafikken receiving the order for the concession and the date the vessels are required to enter service. The roll-on/roll-off passenger vessel 'Hammerodde' was delivered by Merwede Shipyard 20 April 2005 and sister vessel 'Dueodde' was delivered 27 April 2005. Both vessels were delivered according to schedule and in time to enter service on the first of May.

The ferries are being deployed on the route between the Island Bornholm, the Danish port Køge near Copenhagen and the Swedish port Ystad. Bornholms Trafikken also operates a high-speed catamaran ferry on this route. Bornholm is a fairly small island with some 44,000 inhabitants, the islanders representing thirty percent of BornholmsTrafikken's annual passenger volumes. Clearly, tourist traffic is very important, yet it only peaks during the holiday periods.

Successful Design

The 'Hammerodde' and 'Dueodde' are a further development of an extremely successful vessel design of which a number have already been built by Van der Giessen-de Noord for principals in Italy, England and PR China. This in-house design is perfectly suited for the transport of large numbers of trucks, cars, coaches and passengers between relatively small ports, subject to draught and length limitations.

The 13,400 gross tonne vessels will replace the two RoPax vessels currently operating the service. Following the introduction of the new RoPax ferries 'Hammerodde' and 'Dueodde', one of the existing vessels currently trading the route, the 'Jens Kofoed' was sold. The other vessel, the 'Povl Anker' remains in the BornholmsTrafikken fleet and will be painted in the company's new, distinctive livery, the

colours of which refer to the Bornholms Trafikken lettering as adopted on the ship's hulls before.
The 1978-built 'Povl Anker' will substitute for the other vessels during their annual refits and will also offer extra capacity during peak periods on the Rønne-Ystad and the Rønne-Saßnitz routes, the latter route being reopened by BornholmsTrafikken after Scandlines bowed out last year. The 'Povl Anker', together with the 'Hammerodde' and 'Dueodde', will also deputise for the fast ferry 'Villum Clausen' when fast crossings are cancelled due to poor sea conditions or technical problems.

General

The 'Hammerodde', built under yard number 702, is a very flexible vessel from the ship's operational point of view. The vessel can be operated either as a pure freight ferry or as a combined car/passenger ferry. The vessel features a total trailer lane capacity of approximately 1248 m. This total length is suitable for about 92 trucks or trailers and 280 cars. The ship can carry up to 400 passengers in reasonable comfort, which gives BornholmsTrafikken additional service, and provides all weather backup for its high speed service.
The maximum passenger capacity is 400 persons on short international voyages accommodated in twenty single cabins, thirty six double cabins and four 4-berth passenger cabins with private sanitary facilities. On deck 7 of the modern accommodation of the 'Hammerodde' includes a cafeteria area with 50 seats, a children's playground, the reception area, a shop and public sanitary spaces. Furthermore 256 reclining seats are provided in a Non-smokers School Lounge (57), a Non-smokers Viewing Lounge (91), an Allergy Lounge (48), a "Pet" Lounge (30) and Smokers Lounge (30). Additional Seating capacity (100) has been provided in cabins with convertible sofa-beds. The owner expects that the foreseeable future will demand for a larger passenger accommodation and for this purpose the accommodation has been prepared for future enlargement to 770 passengers.

The vessel features a comprehensive navcom package delivered and installed by Alphatron

Construction

Although the 'Hammerodde' is a conventional displacement ship, the design incorporates several technical innovations to ensure that she handles well and safely under all weather conditions. She has been equipped with state-of-the-art navigation aids, carries generous water ballast and active stabilizers, and has two powerful bow thrusters and in line high lift flap rudders to ensure a very high level of manoeuvrability.
The 'Hammerodde' is 129.14 metres long, 23.40 metres wide, and has a draught of 5.60 metres. The vessel is of all-welded steel construction featuring a bulbous bow and transom stern. Double bottom sections are arranged between fore and aftpeak bulkheads, outside the deep tanks.
Deck arrangement is as follows:
– Deck 1 (tanktop),
– Deck 3 (main vehicle deck),
– Deck 5 (upper vehicle deck),
– Deck 7-9 (accommodation decks).
Access from shore to Deck 3 is provided by a stern ramp/door. Access from Deck 3 to Deck 5 by means of a hoistable ramp.

View of the control panel in the wheelhouse from where all the Ro-Ro access equipment is controlled

Main Characteristics

The 'Hammerodde' features the following main dimensions:

Principal particulars

Length o.a.	124.90 m
Length b.p.	115.10 m
Breadth mld.	23.40 m
Depth to Deck 3	8.60 m
to Deck 5.	14.30/14.70 m
Design draught mld.	5.30 m
Scantling draught mld.	5.60 m

Tonnages

Deadweight at design draught	2,883 t
Deadweight at scantling draught	3,437 t
Gross tonnage	13,906 t

Performance

Propulsion power	8,640 kW
Speed	18.8 knots

Ro-Ro capacity

Trailer lane length on Deck 3.	645 m
Trailer lane length on Deck 5.	604 m
Total trailer lane length	1,248 m
Trailer lane width	3.10 m
Free height over lanes	4.90/5.20 m

Tank capacities

Fuel oil	346 cu.m
Marine diesel oil	95 cu.m
Lube oil	58 cu.m
Fresh water	200 cu.m
Ballast water	1,224 cu.m

Passenger capacity

Cabins.	20 x 1-berth
	36 x 2-berth
	4 x 4-berth
Reclining seats.	256

Class Notation

The 'Hammerodde' flies the Danish flag. The vessel has been designed and constructed to the rules and regulations of LR of Shipping ✠100A1 RoRo Passenger Ship, Ice Class 1C,LMC<UMS<NAV1.

The propulsion plant consists of two MaK 9M32 medium-speed non-reversible diesel engines

Navaids & Communications Equipment

In accordance to GMDSS requirements the 'Hammerodde' and 'Dueodde' have been fitted with a comprehensive range of communications systems and navigational aids. The equipment has been delivered and installed by Alphatron and features the following main components:

- radar system make Kelvin Hughes
- one complete 3 cm daylight colour viewing raster scan ARPA Nucleus 6000
- one complete 10 cm daylight colour viewing raster scan ARPA Nucleus 6000
- three handheld VHF Radio Mc Murdo RT2
- two EPIRBs Mc Murdo E3
- two Sart Mc Murdo RT9
- one UHF mobile radio base station ECR make Motorola
- one echosounder make JRC;
- one speedlog Yokogawa;
- two DGPS and GPS system make JVC;
- one VHF airband make Icom;
- one wind speed/direction indicator make Obsermet;
- one Auto pilot+ main steering;
- one gyro compass system make Yokogawa.
- one magnetic compass, make Obsermet
- one VDR, make Alphatron
  one ECDIS system, make Alphatron

Accommodation

Accommodation spaces are fully temperature and climate controlled by a Heinen & Hopman air conditioning and ventilating system. The air conditioning plant is of the single-pipe type with air handling units situated in the AC room. Public spaces on Deck 7 have their own reheaters with control device. The cabin units have a natural exhaust to the adjoining alleyways. Cabins and public spaces are ventilated at a minimum refreshing rate of 25 cu.m/h per person.

Hull Construction

Deck 3 and 5 are strengthened with longitudinal frames and transverse webs. Longitudinal frames are also fitted in the hull's bottom section and side shell from Deck 3 to Deck 7. Transverse frames are applied in the sides below Deck 3 and above Deck 7, and the fore and aft ship section. The flat bulkheads are strengthened with vertical stiffeners. The bottom sections in fore ship are reinforced with respect to heavy sea state conditions.

Cargo Concept

The 'Hammerodde' can carry private cars, possibly with caravans (passengers and trade cars), drop units, and road trailers. All cargo is accommodated on the two main vehicle decks, Deck 3 and 5. Both vehicle decks have seven 3.10 m wide lanes for trailers athwartships, with a total lane length of 1,248 m suitable for 92 articulated trailers with an average length of 13 m each. The free height over the lanes is 4.90 m. The aft part of deck 3 has a 5.20 m free height. The permissible axle load is 15 t at 1.36 m spacing or a single axle load of 26.3 t (solid rubber tyres). Reefer socket plugs have been fitted on Deck 3 and 5 (underneath the accommodation section), to allow carriage of reefer containers and/or reefer trailers.
Deck 3 offers 645 m lane length and Deck 5,620 m lane metres. The vehicle decks are equipped with lashing pots located on the trailer lane separations. The lashing pots are suitable for use with hooks and elephant foot fittings. These mild steel pots have a clear diameter of 250 mm, are welded into and on deck partly flush, and suitable for a maximum force of 25 t at 45 degrees heeling list.

RoRo Access Equipment

RoRo access equipment has been delivered by MacGregor. RoRo equipment includes one stern/ramp door, one internal hoistable ramp leading from Deck 3 to Deck 5, one pilot door, and one bunker door. The stern ramp door has a clear width of 11.5 m running the first 6.40 m part, and is then tapered to about 8.5 m at the end. The total length of the stern ramp, including 1.60 m flaps, is 12 m. The stern ramp/door has a free trailer height of 5.20 m. In stowed position the hydraulically operated ramp serves as a watertight door. The single-hinged internal hoistable ramp gives access from Deck 3 to Deck 5. The internal ramp has a clear width of 3.35 m and a total length (including flaps) of 45 m. The ramp opening in way of Deck 5 is closed by the internal hoistable ramp, thus acting as a watertight hatch. A single door for pilot entrance has been provided in the port side.

Steering Gear

Directional control of the twin-screw vessel is with two Tenfjord electro-hydraulic rotary vane steering gears, one for each rudder. The steering gears are electronically controlled to ensure synchronism of the spade rudders and independent operation of each rudder. The rudders have a maximum rudder angle of 45 degrees to both sides. The time of turning the rudders from 35 degrees at one side to 30 degrees at the other side at service speed is 28 seconds with one pump running and 14 seconds with two pumps running. Hydraulic power is provided by four constant delivery type pumps, which are directly driven by an electric motor through a

Starting air for the engines is generated by two Sperre air compressors, type HL2/120

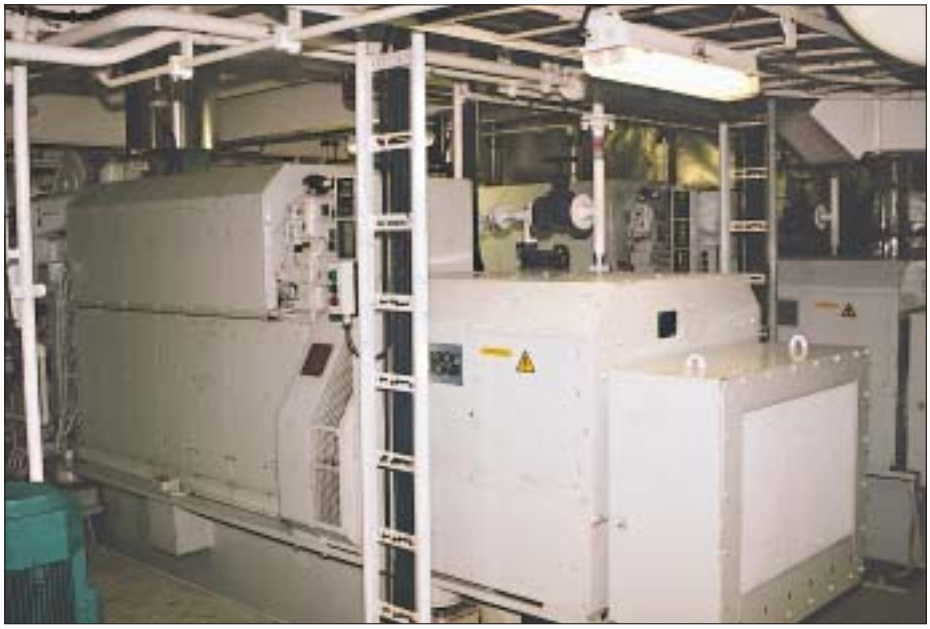
flexible coupling. To optimise passenger comfort during crossings the vessel is equipped with one set of folding-type fin stabilizers, make Fincantieri, mounted in fin boxes. The hydrofoil sections of the fins are of a rectangular shape and have a fin area of 4.2 m2 per side. The fin stabilizers reduce roll to 90% at a wave slope of 3.5 degree and a speed above 18 knots. The fin stabilizers are controlled from the bridge and are operating fully automatic. The stabilizer control equipment includes a bridge control panel, a control panel containing roll motion sensing and computer equipment located in the engine control room, and two local control panels.

Deck Equipment

Deck equipment on the fore ship includes two Bröhl windlasses/mooring winches, each with one steel cable lifter, one mooring drum and one warping head. Further, two roller type chain stoppers with turnbuckles, and two mooring winches, each with one mooring drum and warping head. The aft ship carries two mooring winches, each with two mooring drums and one warping head. The declutchable constant tensioning mooring drums feature a maximum pull of 15 tonnes at a hauling speed of 15 m/min. The slack rope speed is 30 m/min. Each mooring drum is fitted with 120 m mooring rope.
Anchors and chain cables, supplied by Schmitt, include two high holding power stockless bow anchors connected to 27.5 m stud link chain cable of U3 quality. Mooring fittings consist of fairleads with vertical and horizontal rollers, bulwark chocks for mooring wires, and an ample number of pedestal rollers and bollards.

Propulsion Plant

The heavy oil propulsion plant consists of two MaK 9M32 medium-speed, non-reversible, diesel engines, each having a maximum continuous rating of 4320 kW at 600 rpm. Each main engine drives a cp-propeller via a Jahnel reduction gearbox, Propeller speed is 161.30 rpm. The two propeller stern tubes are fitted with Supreme sealings complete with white metal bearing bushes, make IHC Lagersmit. The gearboxes are provided with a power-take-off for driving an alternator generating 1160 kW at 1500 rpm. Drive transmissions include Vulkan RATO super elastic couplings, type SG 341Q. The cooling systems of the main engines form part of a central cooling system.
The propulsion plant provides a service speed of 18.8 knots at 90% mcr with a 15% allowance to propulsion power for seaload and active fin stabilizers. A total propulsion power of 6670 kW was measured on the outgoing shafts under trial conditions with stabilizers active.



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Electric Power

Electric power is derived from three MAN Holeby 6L 16/24 gensets, each developing 515 kW. Emergency power is derived from a 260 kW MAN D2866 LXE201 emergency genset. Electric power at sea is supplied by one of the 1160 kW pto alternators. During manoeuvring electric power for the bowthruster unit is derived from the two auxiliary alternators. The complete electrical installation has been designed, delivered, installed, and commissioned by Croon TBI techniek. The electrotechnical company installed over 3,000 cables with a length of more than 100 kilometres and 60 different installations in both ferries. These are used, amongst other things, to check 1,600 alarm points. In order to integrate this complex infrastructure and its kilometres of cable ducts with other facilities on board (propulsion, air-conditioning, catering, water supply, fire alarm installations, closed circuit television, et cetera), prefab was used to a great extent. In the Croon workshops, the right cable ducts, switchboards, control panels and motor control centres were assembled per component in advance. The scope of supply included the switchboards, the motor control centres, the control desks in the engine room and on the bridge, and all main and emergency lighting panels. The shipboard electrical installation consists of the following mains:

- a 400 V/50 Hz, 3-phase circuit for power appliances, nautical equipment and catering;
- a 220 V/50 Hz, 2- and 3-phase circuit for lighting, small catering, small power appliances and nautical equipment;
- a 220 V/50 Hz, 2-phase circuit for control circuits;
- a 24 VDC circuit for safety and emergency appliances.

Alternator equipment consists of two 400 VAC pto alternators, three diesel driven 400 VAC main units and one 400 VAC diesel driven emergency unit. All alternators are of the synchronous, brushless type. A shore supply box (400 VAC/50 Hz) is fitted near the pilot door capable for 400 VAC. The emergency and safety systems are served by two 24 VDC maintenance free lead acid batteries. One battery for the bridge and accommodation area, and the other for the engine room area (engine control, automation and remaining services). Each battery is charged by means of a constant voltage, automatic floating, and charging system. A main switchboard has been installed in the engine control room for the control and protection of the alternators and 400 VAC distribution.

Climate control of accommodation spaces is with a Heinen & Hopman air conditioning system

Ancillaries

Starting air for the engines is supplied by two Sperre air compressors, type HL2/120, each with a delivery capacity of 50 cu.m/h. The com-

Fuel oil conditioning is carried out with a Mar-In ControIs fuel oil supply module

pressed air system comprises two starting air receivers with a volume of 1000 litres and 30 bars, and one emergency air compressor with a 125 litres air receiver.
Heat is generated by an oil-fired thermal oil boiler in port and at sea, and by two exhaust gas economizers, each suitable for and adapted to one main engine when at sea. When the capacity of the exhaust gas economizers is not sufficient, the thermal oil boiler supplies the additional amount of heat required automatically. The thermal oil system includes two thermal oil circulating pumps and one thermal oil transfer pump. Fuel oil and lube oil treatment is with Alfa Laval equipment and includes: Two self-cleaning separator systems for heavy fuel oil, one self-cleaning diesel oil separator, one lube oil separator, booster pumps, and fuel oil heaters. Treatment of engine room bilge water is with a bilge water separator fitted with automatic oil drain equipment. Fuel oil conditioning is carried out with a Mar-In ControIs fuel supply module which ensures a stable inlet pressure at the diesel engine by using a pneumatic control system with proportional and integral actions. The fuel supply module incorporates feeder pumps, pressure control system, auto-matic back flushing filter, fuel consumption metering system with automatic anti-blockage facility, degassing/mixing tank, circulating pumps, heaters and viscosity control system.
The system is provided with an alarm generating facility through a PLC in the control box. The viscosity measurement system features a patented Teflon coated capillary which prevents fuel Gil deposits formation on the inside of the capillary wall, which could cause erroneous readings. The precisely calculated degassing/mixing tank ensures enough stored heat capacity which means no offset of the to be controlled viscosity.
The central heating system consists of a closed type central heating system heated via a heat exchanger from the thermal oil system. Two circulation pumps, one running and one standby supply the following consumers: accommodation heaters, domestic hot water calorifier, preheater high temperature fresh cooling water system, and the bilge water separator.

Monitoring & Control System

Rotterdam-based SAM Electronics Nederland B.V. has been awarded a major contract for supply of integrated monitoring and control and automatic power management system aboard the new vessels. The system includes a proprietary type-approves Geamar 120 ISL monitoring and control assembly for centralised ship management and control using a series of operator workstations which collectively provide up to 1800 measuring points in addition to automated alarm functions. The assembly also incorporates a GEAPAS 10 automated power management system for control, display and monitoring of all the vessel's generators. The new Geamar 120 ISL combines more than 35 years experience in ship automation technology. It allows a one man monitoring and operating schedule. All control and monitoring functions are handled by independent outstations (PMCS) in the engine rooms. Standard hard- and software of the outstations handle all kind of shipboard signals (e.g. incl. tank measurement) as well as open and closed-loop control. The outstations are coupled to the Operator Workstations (OWS) via the redundant System Net. A total of 8 PMCS (Process Monitoring and Control Station) are installed through the vessel. The use of a fast System Net for data transmissions and the high performance at the outstation level ensures short reaction times and picture refresh rates. Geamar 120 ISL enables trouble-free connection with other shipboard computer systems (navigation system, PC based management system, etc.), loading computer, maintenance computer.
The PMCS is designed for direct use in the engine room. The configuration was designed during the engineering phase. The (PMCS) communicates via the redundant System Net with the hierarchically superior OWS. An Operator Workstation has direct access via the System Net to the process. The modular system structure and the use of high-performance coupling network permit flexible adaptation to a wide variety of different operations.

Bilging & Ballasting

Several pump systems have been fitted for bilging and ballasting purposes as well as for serving the vessel's deck wash/fire-fighting system: three 86 cu.m/h self-priming centrifugal general service (fire/deck wash) pumps, two 200 cu.m/h self-priming centrifugal bilge/ballast pumps, two 100 cu.m/h bilge pump, one 2.5 cu.m/h auxiliary bilge pump. Furthermore, one bilge water separator with automatic drain equipment and fitted with a 15 ppm oil alarm system. The bilge system is served by the bilge pumps located in the engine room and the pump room. The bilge system permits pumping from all compartments. A separate bilge system has been fitted for suction from the boatswain's store and chain lockers. The ballast system is served by the two ballast pumps. Each of the pumps is able to draw from the inlet chest in the engine room or from the ballast main and deliver to the ballast main respectively overboard via remote controlled valves. The deck wash/fire-fighting system is served by the fire-fighting pumps. All fire-fighting pumps are connected to the fire-fighting lines via non-return valves. The

Fuel oil and lube oil treatment is with Alfa Laval centrifugal separators

fire-fighting main on main deck has been fitted in longitudinal direction, with branches to the main deck and upper deck level.

Life-Saving Appliances

The 'Hammerodde' is fitted with life-saving appliances in compliance with the legal requirements for the maximum numbers of passengers and crew. Life-saving appliances include: two 150-person partially enclosed motor lifeboats, seven -35 person inflatable life rafts stored in GRP containers, one 6-person rescue boat and one 6-person fast rescue boat combined with the MOR. Life-saving appliances are complemented by life buoys and life jackets.

Fire-Fighting Equipment

Fire-fighting equipment includes a seawater fire-fighting system, a CO_2 fire-extinguishing system, a drencher system for the RoRo spaces, and a Sprinkler system for the accommodation. The CO_2 total flooding system protects the engine room, engine control room, workshop and bow thrusters room. The emergency alternator room and galley ventilation uptake are protected by separate CO_2 bottles. Local protection has been fitted for main and auxiliary engines, boiler front and separators. The Ro-Ro decks 3 and 5, including ramps and spaces under the ramps, are protected from fire hazards by a drencher system, Deck 5 only in way of Deck 7 area above. The accommodation section is protected by a Sprinkler plant consisting of a pressure tank and a Sprinkler pump. Miscellaneous fire-fighting equipment includes fire hoses, sand boxes, portable fire extinguishers (foam & powder), and firemen outfits.

Subcontractors and suppliers of equipment fitted on board the 'Hammerodde'
(partial list)

Alfa Laval, Maarssen . . . . . : fuel oil separator plant; heaters; plate coolers
Alphatron Marine,
Rotterdam . . . . . : communication & navigation equipment; nautical inventory
Beerens, Werkendam . . . . . : doors

Bouter delivered the comprehensive galley equipment

Bell Licht, Numansdorp . . . . : ship's illumination
Blomsma Signs & Safety,
Zoetermeer . . . . . : safety signalling marks IMO / SOLAS; pipemarking
Bouter, Zoetermeer . . . . . : galley equipment
Brabant Mobiel,
Oosterhout NB . . . . . : painting works
Castrol Marine, Rotterdam . : lube oils
Croon Elektrotechniek,
Spijkenisse . . . . . : electrical installation
Econosto, Rotterdam . . . . . : remote controlled valves
Endenburg, Gouda . . . . . : rigging
Fincantieri, Italy . . . . . : stabilizers
Hamworthy KSE, Rotterdam : pumps
Hatenboer-Water, Schiedam : freshwater treatment system
Heinen & Hopman,
Spakenburg . . . . . : AC & ventilating system
HMC, Almere . . . . . : CPC loading computer
Holland Marine Flooring,
Willemstad . . . . . : underfloors

The ferry can carry up to 400 passengers in all comfort

IHC Lagersmit, Kinderdijk . . : *Supreme* stern tube seals and white metal bearings
Inglasco Fire Systems,
Rotterdam . . . . . : fire-fighting equipment
Intec Office, Heerde . . . . . : thermal fluid installation
Intersona, Heerde . . . . . : noise and vibration consultancy
Kroon, Hoogezand . . . . . : *Inexa TNF* accommodation system; ship's hardware; manhole covers & rings
Leeuwen Jr's Buizenhandel,
P. van , Zwijndrecht . . . . . : steel pipes and components
Leroy-Somer, Soesterberg . : generators, bowthruster motor
MacGREGOR, Kaarine (FIN) : Ro-Ro equipment
Machine Support,
Ridderkerk . . . . . : pouring with *Epocast 36*® of main engines and gearbox
Maderas Jumilla, Spain . . . . : sanitary units
MaK, Kiel (G) . . . . . : main engines
MAN B&W Diesel,
Holeby, (Den) . . . . . : gensets
Mar-In Controls,
Krimpen a/d IJssel . . . . . : fuel oil flow meter; fuel supply module
Marktechnical, Dongen . . . . : *Trafag* pressure transmitters, pressostats, thermostats and accescoires
Merwede Meubel & Interieurbouw,
Hardinxveld-Giessendam . . . : carpentry
Newell Allard, Turnhout (B) . : castings
Nieuwburg,
Krimpen a/d IJssel . . . . . : insulation
N.R. Koeling,
Krimpen a/d IJssel . . . . . : provision refrigerating plant
Rolls-Royce Marine Benelux,
Pernis RT . . . . . : steering gear
Rometel Trade, Castricum . . : *Schulze* mechnical remote control for valves; *GK System* A60 multi cable transits

Ruyter Dieseltechniek, De,
Sliedrecht . . . . . : MAN / Leroy Somer generator sets
SAM Electronics Nederland,
Rotterdam . . . . . : integrated monitoring and control system; automatic power management system
Schmitt Anchors & Chaincables, Rotterdam . . . : anchors & anchor chains
Ship's Equipment Centre (SEC), Groningen . . . . . : lifeboats; rescue boats
Sperre, Ridderkerk . . . . . : starting- and working air compressors
SST Staalsnijtechniek,
Dordrecht . . . . . : steel cuttings
TBV Industry & Offshore,
Heerenveen . . . . . : passenger lifts, dumbwaiter
Theunissen, Malden . . . . . : *Semco* fire extinguishing systems
Trinoxx,
Hardinxveld-Giessendam . . . : WT steel pilot doors
Uittenbogaart, T.B.,
Rotterdam . . . . . : *Jahnel-Kestermann* gearboxes; *BioCompact* sewage treatment plant; *Bröhl* winches; *Jets* vacuum toilet system; WT doors; tank vent check valves; ventilation cowls; flame arrestors
VAF-CSI Control Systems,
Dordrecht . . . . . : alarm-, monitoring- & control system
Viking Life-Saving Equipment, Zwijndrecht . . . . : life rafts and live saving equipment
Wärtsilä Propulsion Netherlands, Drunen . . . . . : *Lips* propeller
Wingerden en Zonen, H.K. van, Vuren . . . . . : *Wigo*® windows
Witt, Jan de, Bussum . . . . . : *Dampa* ceilings; doors

GENERAL ARRANGEMENT