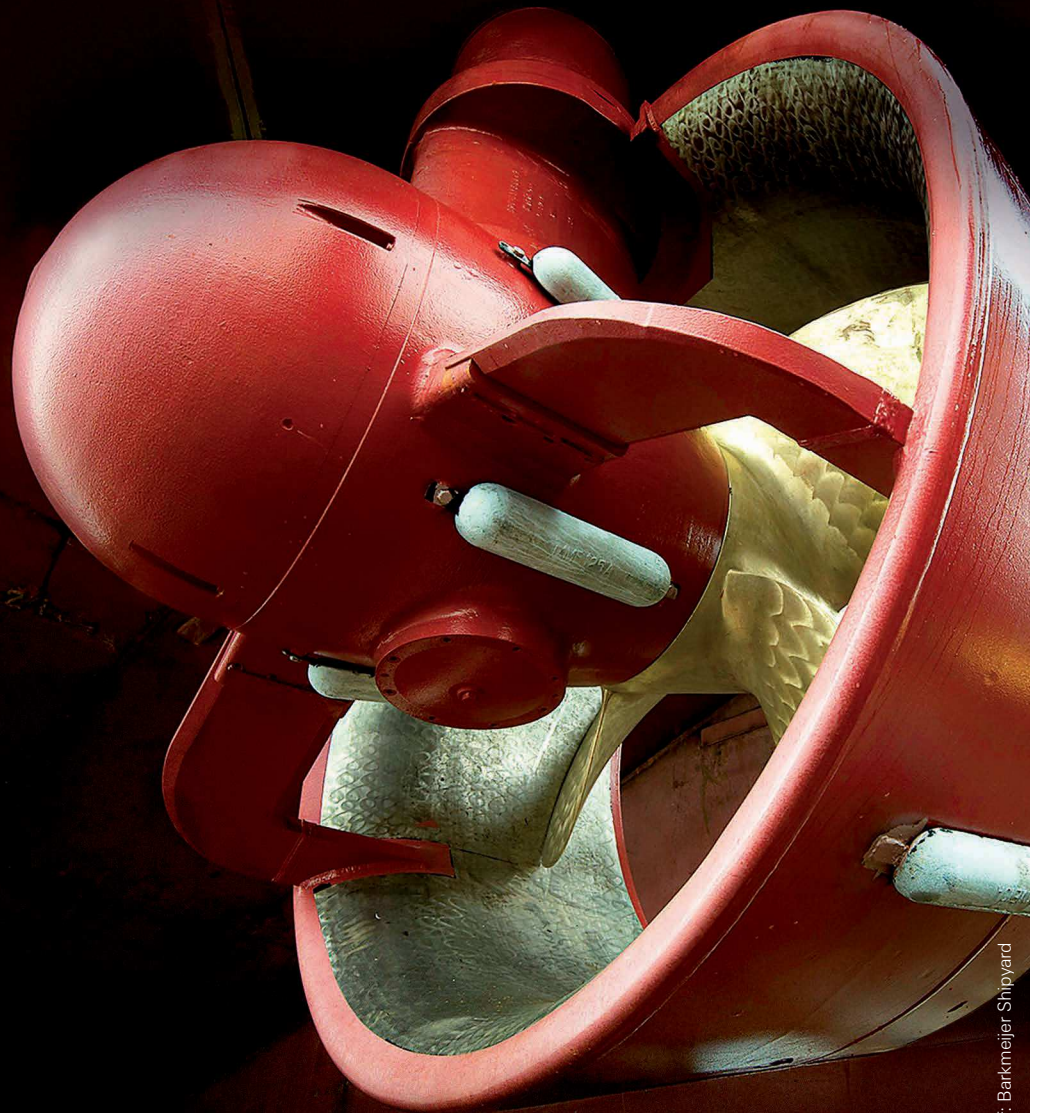


COMMERCIAL CRAFT THRUSTER SYSTEMS



MARINE PROPULSION SYSTEMS
AUGUST 2014

Courtesy of: Barkmeijer Shipyard



ZF MARINE KRIMPEN is a company with more than 35 years experience in building azimuth propulsion units. Over the years, the company has designed, produced and commissioned various models of thrusters, for a multitude of applications around the world. This brought ZF Marine Krimpen the reputation of a reliable and renowned thruster supplier. All ZF marine thruster systems are developed, designed, and produced in-house, built under the umbrella of constant quality control which guarantees the reliability of the product.

THRUSTER PRODUCTS

The current range of thruster products up to a power of 2150 kW comprises:



Well Mounted Azimuth Thrusters



Contra Rotation Azimuth Thrusters



Deck Mounted Azimuth Thrusters



Retractable Azimuth Thrusters



Tunnel Thrusters



Shallow Draught Thrusters

WELL MOUNTED AZIMUTH THRUSTERS

Z-DRIVE Horizontal inputshaft



MODEL	Max. power*		Typical prop. dia. open		Typical prop. dia. nozzle	
	kW	hp	mm	inch	mm	inch
ZF AT 2000 WM-FP	180	241	750	30	700	28
ZF AT 3000 WM-FP	300	402	1050	41	1000	39
ZF AT 400 WM-FP	440	590	1150	45	1100	43
ZF AT 4000 WM-FP	525	704	1350	53	1300	51
ZF AT 5000 WM-FP	825	1105	1700	67	1650	65
ZF AT 6000 WM-FP	1200	1608	1950	77	1900	75
ZF AT 7000 WM-FP	1650	2211	2300	91	2200	87
ZF AT 8000 WM-FP	2000	2680	2500	98	2400	94

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

WELL MOUNTED AZIMUTH THRUSTERS

L-DRIVE Vertical inputshaft



MODEL	Max. power*		Typical prop. dia. open		Typical prop. dia. nozzle	
	kW	hp	mm	inch	mm	inch
ZF AT 2000 WM-FP	200	268	750	30	700	28
ZF AT 3000 WM-FP	300	402	1050	41	1000	39
ZF AT 400 WM-FP	440	590	1200	47	1150	45
ZF AT 4000 WM-FP	525	703	1350	53	1300	51
ZF AT 5000 WM-FP	825	1105	1700	67	1650	65
ZF AT 6000 WM-FP	1200	1608	1950	77	1900	75
ZF AT 7000 WM-FP	1650	2211	2300	91	2200	87
ZF AT 8000 WM-FP	2000	2680	2500	98	2400	94

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

CONTRA ROTATION AZIMUTH THRUSTERS

Z-DRIVE & L-DRIVE



MODEL	Max. power*		Propeller dia. pulling prop.		Propeller dia. pushing prop.	
	kW	hp	mm	inch	mm	inch
ZF AT 2000 WM-CR	150	201	700	28	670	26
ZF AT 3000 WM-CR	300	402	1125	44	1000	39
ZF AT 400 WM-CR	385	516	1000	39	960	38
ZF AT 4000 WM-CR	435	583	1250	49	1150	45
ZF AT 5000 WM-CR	770	1032	1400	55	1250	49

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

Advantages compared to thruster with single propeller:

- Higher efficiency with same propeller diameter.
- Same efficiency with reduced propeller diameter beneficial for shallow-draught applications.
- Reduced noise due to lower blade load.

Typical applications are river going passenger vessels where noise is a critical issue, guaranteeing the comfort on board.

DECK MOUNTED AZIMUTH THRUSTERS

Z-DRIVE Horizontal inputshaft



MODEL	Max. power*		Typical prop. dia. open		Typical prop. dia. nozzle	
	kW	hp	mm	inch	mm	inch
ZF AT 2000 DM-FP	180	241	750	30	700	28
ZF AT 3000 DM-FP	300	402	1050	41	1000	39
ZF AT 400 DM-FP	440	590	1150	45	1100	43
ZF AT 4000 DM-FP	525	703	1350	53	1300	51
ZF AT 5000 DM-FP	825	1105	1700	67	1650	65
ZF AT 6000 DM-FP	1200	1608	2100	83	2050	81

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

RETRACTABLE AZIMUTH THRUSTERS

Z-DRIVE Horizontal inputshaft



MODEL	Max. power*		Typical prop. dia. nozzle	
	kW	hp	mm	inch
ZF AT 2000 RT-FP	180	241	700	28
ZF AT 3000 RT-FP	300	402	1000	39
ZF AT 400 RT-FP	440	590	1100	43
ZF AT 4000 RT-FP	525	703	1300	51
ZF AT 5000 RT-FP	825	1105	1650	65
ZF AT 6000 RT-FP	1200	1608	1900	75
ZF AT 7000 RT-FP	1650	2211	2200	87
ZF AT 8000 RT-FP	2000	2680	2400	94

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

RETRACTABLE AZIMUTH THRUSTERS

L-DRIVE Vertical inputshaft



MODEL	Max. power*		Typical prop. dia. nozzle	
	kW	hp	mm	inch
ZF AT 2000 RT-FP	200	268	700	28
ZF AT 3000 RT-FP	300	402	1000	39
ZF AT 400 RT-FP	440	590	1150	45
ZF AT 4000 RT-FP	525	703	1300	51
ZF AT 5000 RT-FP	825	1105	1650	65
ZF AT 6000 RT-FP	1200	1608	1900	75
ZF AT 7000 RT-FP	1650	2211	2200	87
ZF AT 8000 RT-FP	2000	2680	2400	94

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

FIXED PITCH TUNNEL THRUSTERS

Z-DRIVE Horizontal inputshaft



MODEL	Max. power*		Typical prop. dia.		Tunnel outer dia.		Tunnel wall thickness stand.		Tunnel length stand.	
	kW	hp	mm	inch	mm	inch	mm	inch	mm	inch
ZF TT 1000 FP	100	134	600	24	660	26	15	0,6	1000	39
ZF TT 2000 FP	180	241	700	28	760	30	15	0,6	1000	39
ZF TT 3000 FP	300	402	1050	41	1110	44	15	0,6	1000	39
ZF TT 400 FP	440	590	1150	45	1220	48	15	0,6	1000	39
ZF TT 4000 FP	525	703	1350	53	1420	60	16	0,6	1500	59
ZF TT 5000 FP	825	1105	1650	65	1730	70	18	0,7	2000	79
ZF TT 6000 FP	1200	1608	1900	75	1990	80	20	0,8	2000	79
ZF TT 7000 FP	1650	2211	2300	91	2400	90	22	0,9	2200	80
ZF TT 8000 FP	2000	2680	2450	97	2550	100	22	0,9	2550	100

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

FIXED PITCH TUNNEL THRUSTERS & CONTROLLABLE PITCH TUNNEL THRUSTERS

L-DRIVE Vertical inputshaft



Fixed Pitch Tunnel Thrusters

MODEL	Max. power*		Typical prop. dia.		Tunnel outer dia.		Tunnel wall thickness stand.		Tunnel length stand.	
	kW	hp	mm	inch	mm	inch	mm	inch	mm	inch
ZF TT 1000 FP	100	134	600	24	660	26	15	0,6	1000	39
ZF TT 2000 FP	200	268	700	28	760	30	15	0,6	1000	39
ZF TT 3000 FP	300	402	1050	41	1110	44	15	0,6	1000	39
ZF TT 400 FP	440	590	1150	45	1220	48	15	0,6	1000	39
ZF TT 4000 FP	525	703	1350	53	1420	60	16	0,6	1500	59
ZF TT 5000 FP	825	1105	1650	65	1730	70	18	0,7	2000	79
ZF TT 6000 FP	1200	1608	1900	75	1990	80	20	0,8	2000	79
ZF TT 7000 FP	1650	2211	2300	91	2400	90	22	0,9	2200	80
ZF TT 8000 FP	2000	2680	2450	97	2550	100	22	0,9	2550	100

Controllable Pitch Tunnel Thrusters

MODEL	Max. power*		Typical prop. dia.		Tunnel outer dia.		Tunnel wall thickness stand.		Tunnel length stand.	
	kW	hp	mm	inch	mm	inch	mm	inch	mm	inch
ZF TT 4000 CP	500	670	1350	53	1425	56	16	0,6	1500	59
ZF TT 5000 CP	850	1139	1650	65	1730	68	18	0,7	2000	79

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

SHALLOW DRAUGHT THRUSTERS

Z-DRIVE & L-DRIVE



MODEL	Max. power*		Diameter outer well appr.		Height of outer well appr.	
	kW	hp	mm	inch	mm	inch
ZF SDT 2000 FP	100	134	1030	41	615	24
ZF SDT 3000 FP	195	261	1460	57	867	34
ZF SDT 4000 FP	350	469	1960	77	1158	46
ZF SDT 5000 FP	575	770	2520	99	1493	59
ZF SDT 6000 FP	825	1105	3060	120	1805	71

* Rating subject to classification and application.
Mentioned data for indication purposes only.
Consult ZF Marine Krimpen's technical staff to determine applicable power for each specific use.

ZF Shallow Draught Thruster

- 360° steering, no thrust deduction in any angle.
- Compact design, water intake and nozzle within one circle.
- Thanks to the unique design a relatively low intake speed of water, reducing the chances of sucking-in foreign objects or debris. Also very safe for divers.

This thruster can be used as:

1. Main Propulsion

on ships required to be able to navigate in shallow waters e.g. ferries, pontoons, landing craft.

2. Auxiliary Propulsion

as steerable thruster for auxiliary or back-up type propulsion e.g. research vessels, offshore-platforms, coasters (as 'get-you-home' unit), inland cargo ships.

3. Bow Thruster

as better alternative and also to replace (especially long) tunnel thrusters e.g. work pontoons, freighters (inland and ocean going), sheerlegs, dredgers.

ZF Thruster Systems offers you this thruster in combination with the other range of steerable thrusters (retractable, well mounted and deck mounted propulsion units) and tunnel thrusters.

THRUSTER MOUNTING CONFIGURATIONS



There are three different mounting configurations within the range of the ZF thrusters used for main propulsion.

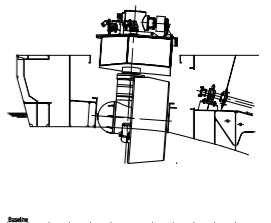
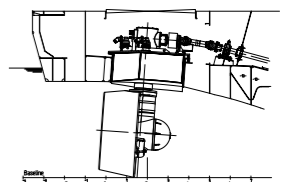
WELL MOUNTED FROM TOP

Well mounted top removal

Recommended for ships operating in areas with limited dry-docking facilities. This mounting configuration makes it possible to either install or remove the thruster from the ship while the vessel is still afloat.

Advantages of this configuration are:

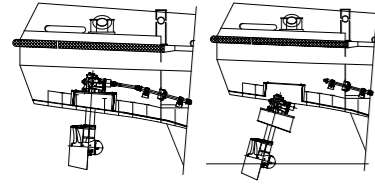
- Easy maintenance or repair is possible since the thruster can be removed from the vessel without the need for dry-docking. This requires a permanent deck hatch or soft patch above the thruster.
- Downtime is limited since repair or replacement of a damaged thruster is easily accomplished in hours.



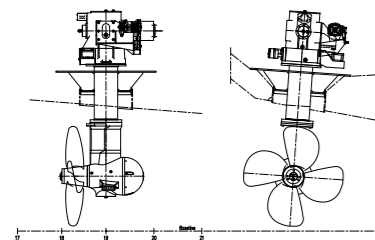
THRUSTER MOUNTING CONFIGURATIONS

WELL MOUNTED FROM BOTTOM

Well mounted bottom removal

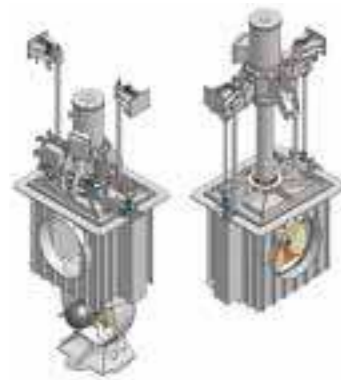


When top mounting isn't possible due to design restrictions in the vessel's construction that make access via a deck hatch above the thruster impossible, the thruster can be installed from below with a bottom mounting flange arrangement. The main advantage of this design is that the thruster can still be withdrawn from the ship if required. Dry-docking of the vessel is usually required, unless its possible to trim the vessel sufficiently forward to allow the thruster to be removed from below while keeping the outer well flange and thruster upper gearbox above the waterline.



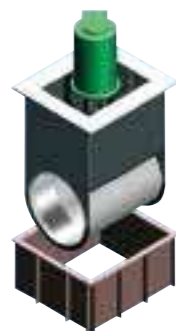
WELD IN

When neither a top mounting nor bottom mounting arrangement is possible or desired, the thruster can be delivered with a suitable welding structure around the vertical stem section, which will be incorporated into the vessel's hull construction and welded into place.



RETRACTABLE AZIMUTH THRUSTERS

A retractable thruster is used for auxiliary propulsion system or to increase the vessel's "station keeping" capabilities. Once deployed below the hull, the thruster operates in full azimuth mode and when retracted, the thruster is completely "parked" inside the hull. A retractable thrusters is most commonly installed in the bow of a vessel where a tunnel can be incorporated into the design of the outer well to allow the thruster to be used as a conventional side thruster when fully retracted in shallow water.



REMOVABLE TUNNEL THRUSTERS

In addition to the conventional tunnel thruster arrangement where the tunnel is welded integral to the vessel's structure with the gearbox bolted directly onto the mounting flange, it is also possible to suspend the thruster in rubber. In this manner the thruster is isolated from the hull and direct contact between tunnel and hull construction is avoided. This reduces "structure borne noise" significantly. The flange arrangement also makes it possible to remove the thruster from the vessel without drydocking, provided that the vessel can be trimmed so the outerwell flange is above the waterline for removal.

REMOTE CONTROL SYSTEM



REMOTE CONTROL SYSTEM

A complete remote control system is a standard item in the ZF scope of supply. It is designed to control a single azimuth thruster and provides follow-up steering- and propulsion control, as well as independent backup- and emergency stop functionality.

The system is capable of interfacing with diesel engines and electric or hydraulic motors as power source for propulsion. For steering the system interfaces with a hydraulic or electric steering system.



REMOTE CONTROL SYSTEM

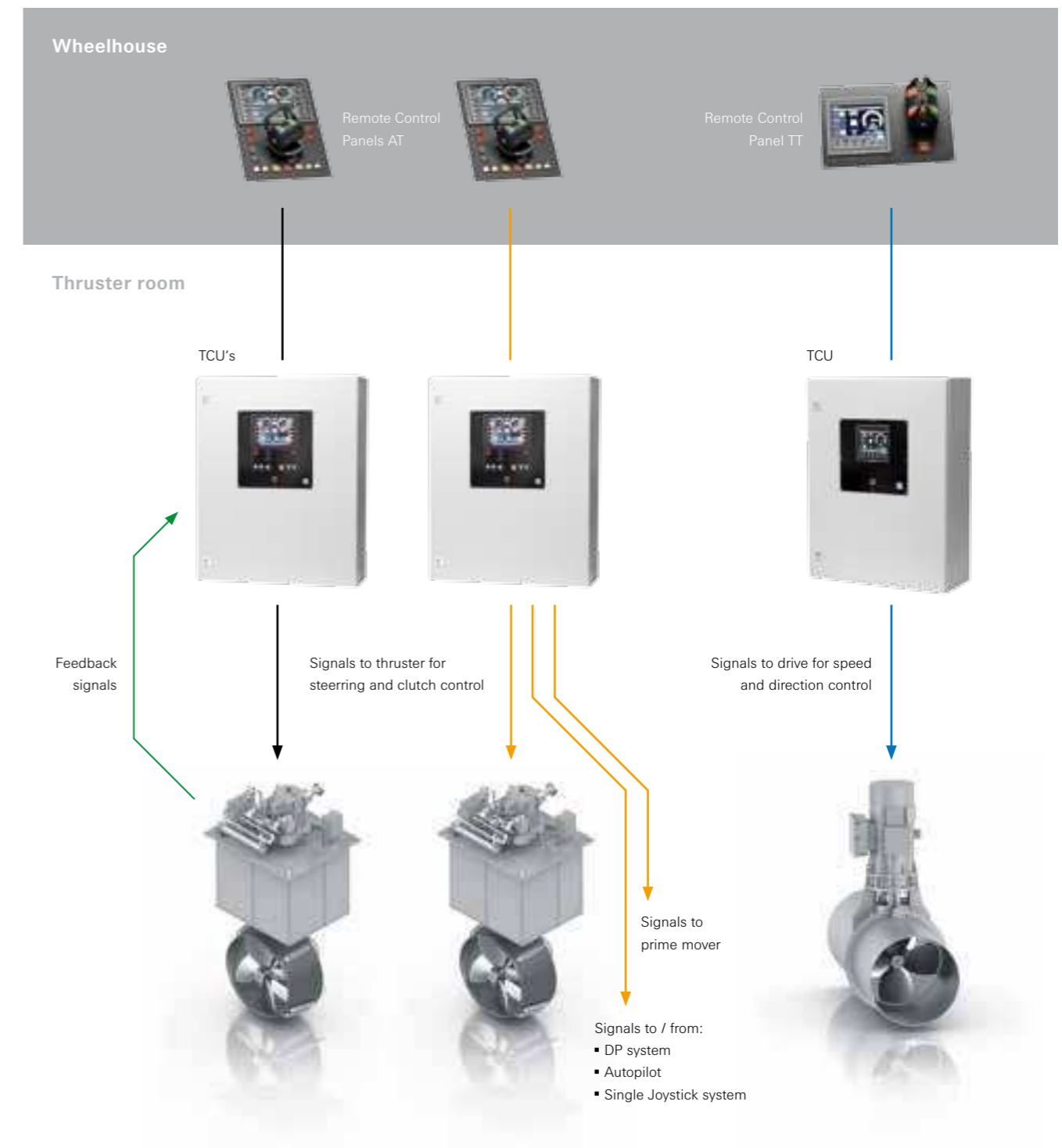


Standard control system consists of a Thruster Control Unit (TCU), which is to be placed in the immediate vicinity of the thruster, and one remote control panel on the bridge. Optionally a number of additional remote control panels can be connected.

The local control facility is mounted on the door of the TCU. The TCU houses the electronics for interfacing with the thruster and power sources for steering and propulsion, as well as vertical positioning.

INTERFACING

Interfacing to several other systems such as Dynamic Positioning, joystick system, auto pilot, Voyage Data Recorder (VDR), alarm- and monitoring etc. can be supplied as an option.

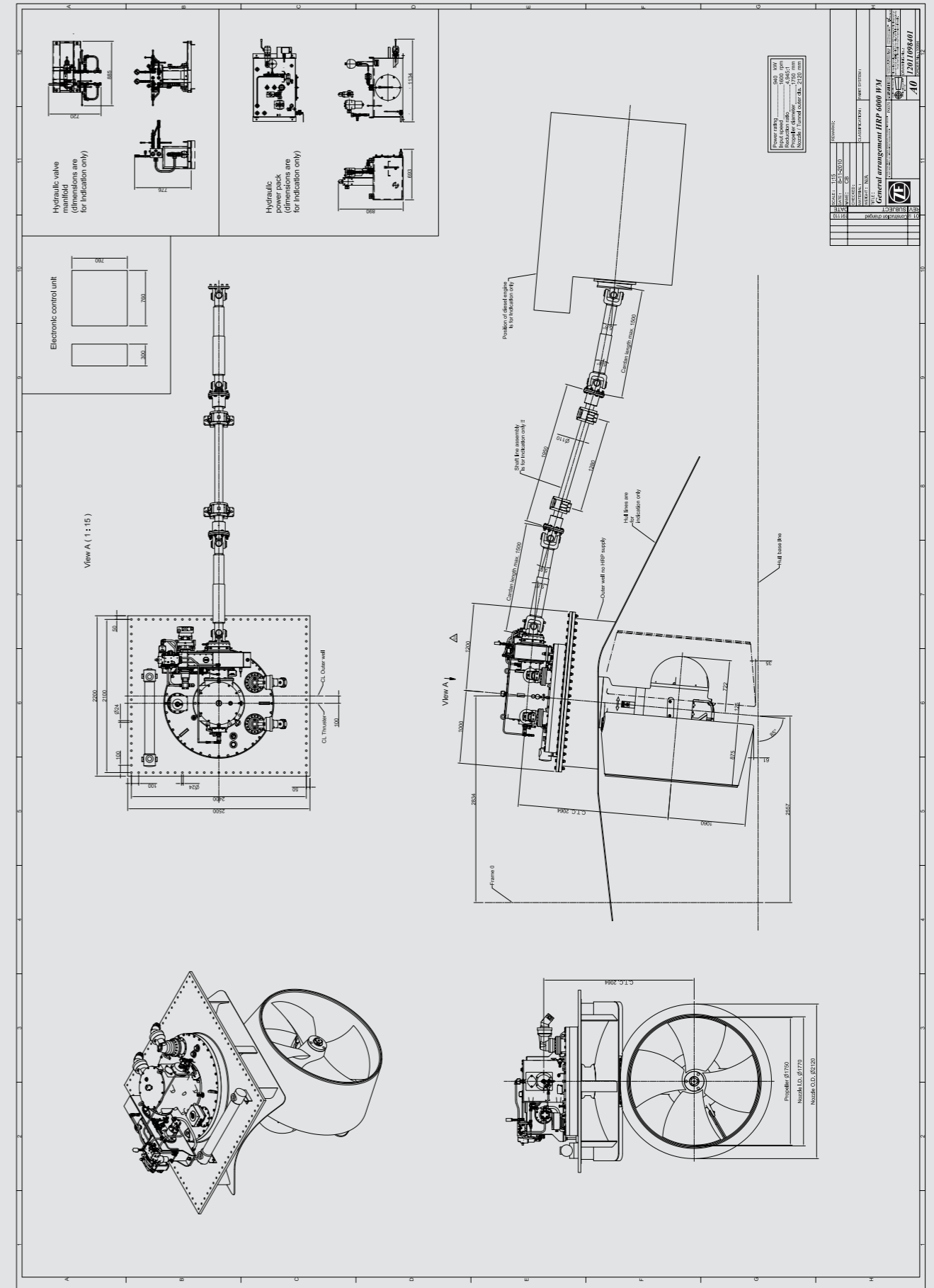


MULTI-PURPOSE SUPPORT VESSEL "ZWERVER III" – NETHERLANDS



Length o.a. : 35.10 m
Breadth : 15.00 m
Draught : 2.60 m
ZF-Reference : 10983 / 10984
Model : ZF AT 6000 WM-FP / ZF TT 3000 FP
Rated power : 940 kW at 1600 rpm / 220 kW at 1500 rpm
Supplied to : Shipyard Kooiman – Netherlands
Owner : HvS Dredging Support – Netherlands

Equipped with one (1) ZF AT 6311 well mounted azimuth thruster and two (2) ZF TT 3001 hydraulic driven tunnel thrusters.

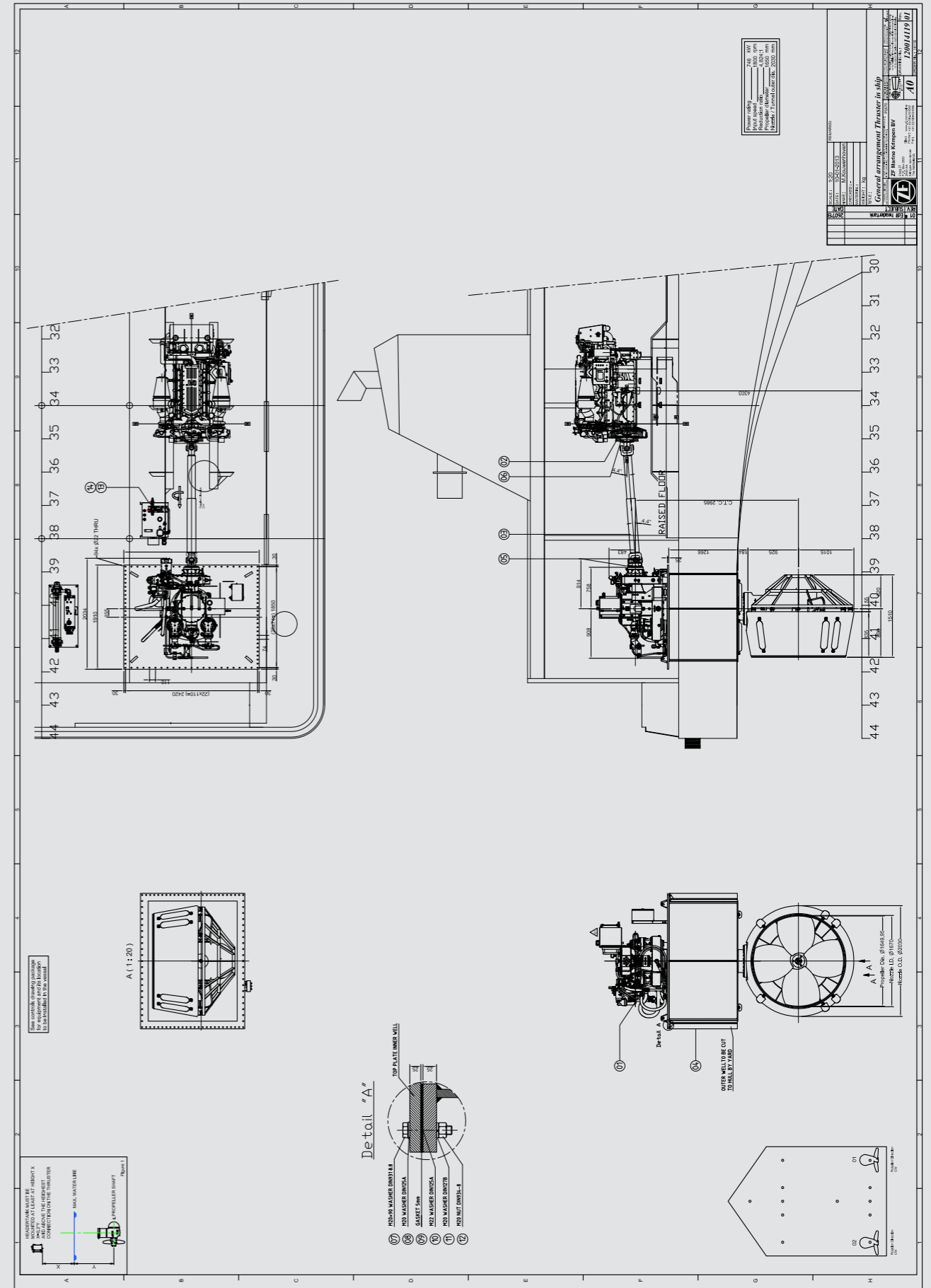


PUSHER TUG "MV FREEDOM" – USA



Length o.a. : 25.00 m
Breadth : 10.00 m
Draught : 3.30 m
ZF-Reference : 14119
Model : ZF AT 5000 WM-FP
Rated power : 746 kW at 1800 rpm
Shipyard : John Bludworth Ship Yard, LLC – USA
Owner : Enterprise Marine Services – USA

Equipped with two (2) ZF AT 5111 well mounted azimuth thrusters.

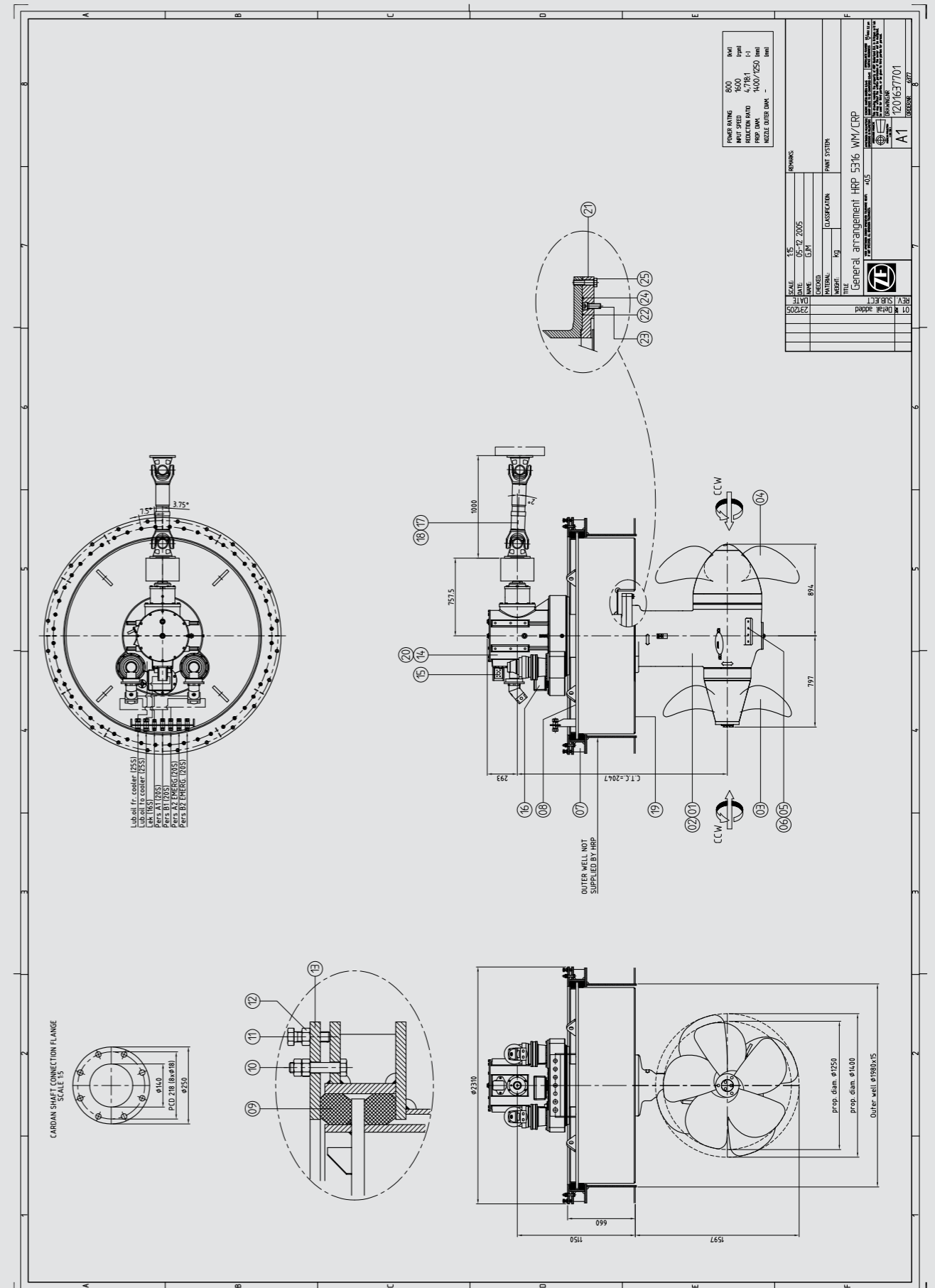


RIVER CRUISE PASSENGERS VESSEL "SERENADE 1" – NETHERLANDS



Length o.a. : 110.00 m
Breadth : 11.45 m
Draught : 1.55 m
ZF-Reference : 6377
Model : ZF AT 5000 WM-CR
Rated power : 783 kW at 1600 rpm
Supplied to : De Gerlien van Tiem B.V. – Netherlands
Owner : Select Cruise Voyages B.V. – Netherlands

Equipped with two (2) ZF AT 5116 well mounted azimuth thrusters with contra-rotating propellers.

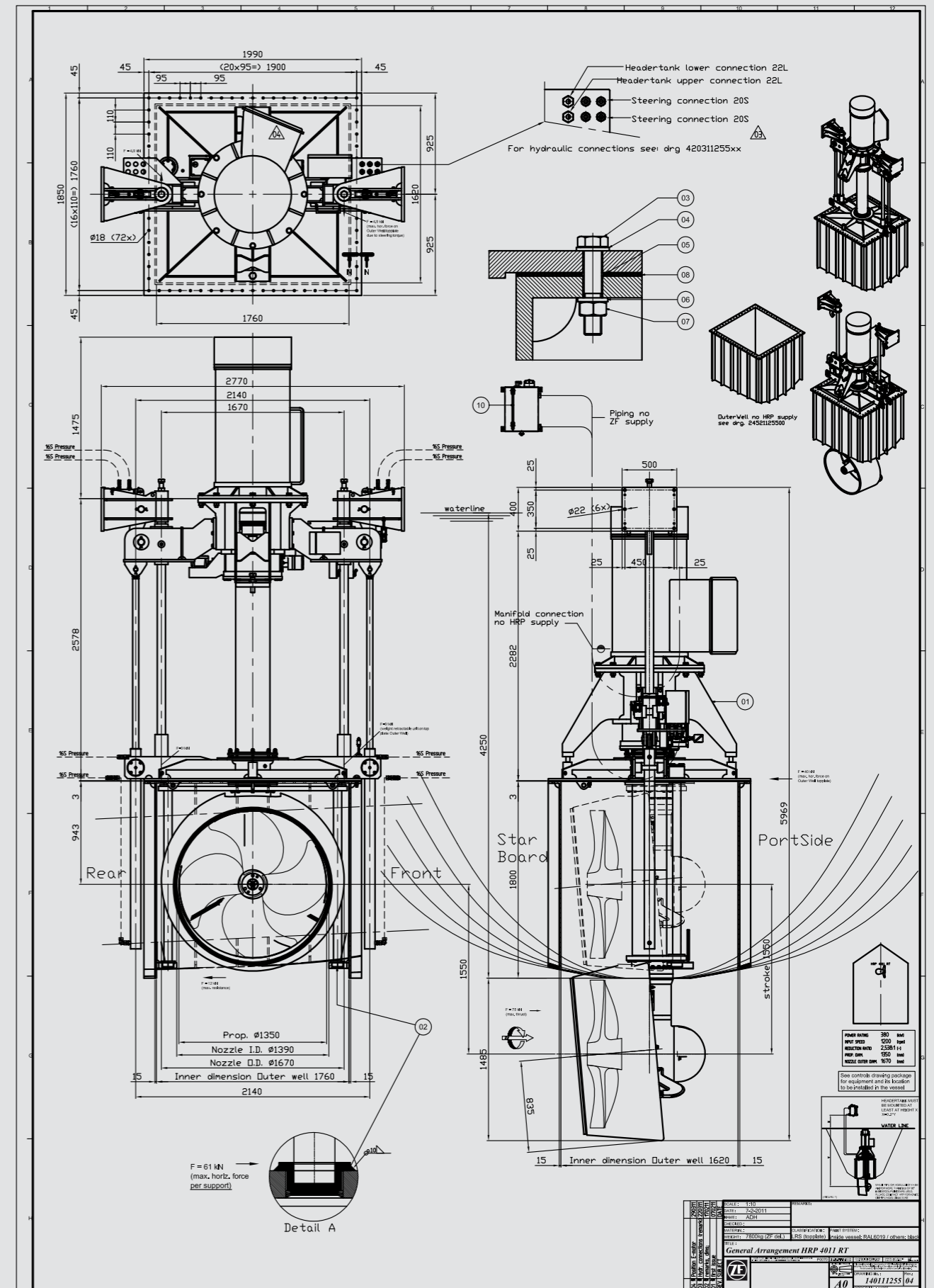


STANDBY VESSEL "GRAMPIAN DON" – SPAIN



Length o.a. : 50.70 m
 Breadth : 13.00 m
 Draught : 4.30 m
 ZF-Reference : 11255
 Model : ZF AT 4000 RT-FP
 Rated power : 380 kW at 1200 rpm
 Supplied to : Astilleros Balenciaga – Spain
 Owner : North Star Shipping – Spain

Equipped with one (1) ZF AT 4011 retractable azimuth thruster.

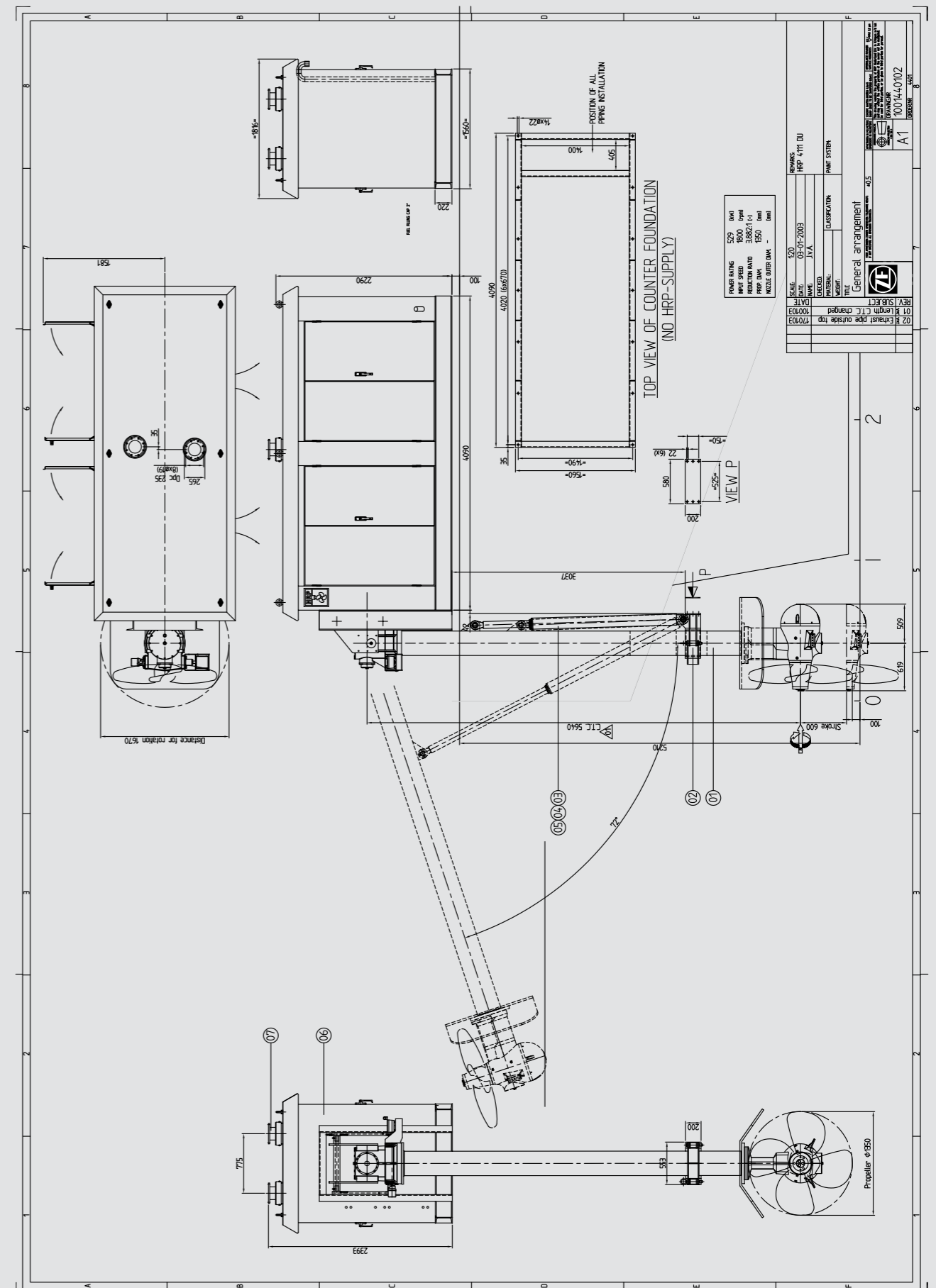


4700 DWT COAL BARGES "SINAR BARITO/ BORNEO/BANJAR" – INDONESIA



Length o.a. : 82.30 m
Breadth : 21.40 m
Draught : 3.71 m
ZF-Reference : 4401
Model : ZF AT 4000 DM-FP
Rated power : 529 kW at 1800 rpm
Supplied to : ASL Shipyard Batam – Indonesia
Owner : PT Cumawis – Indonesia

Equipped with two (2) ZF AT 4111 deck mounted azimuth thrusters.

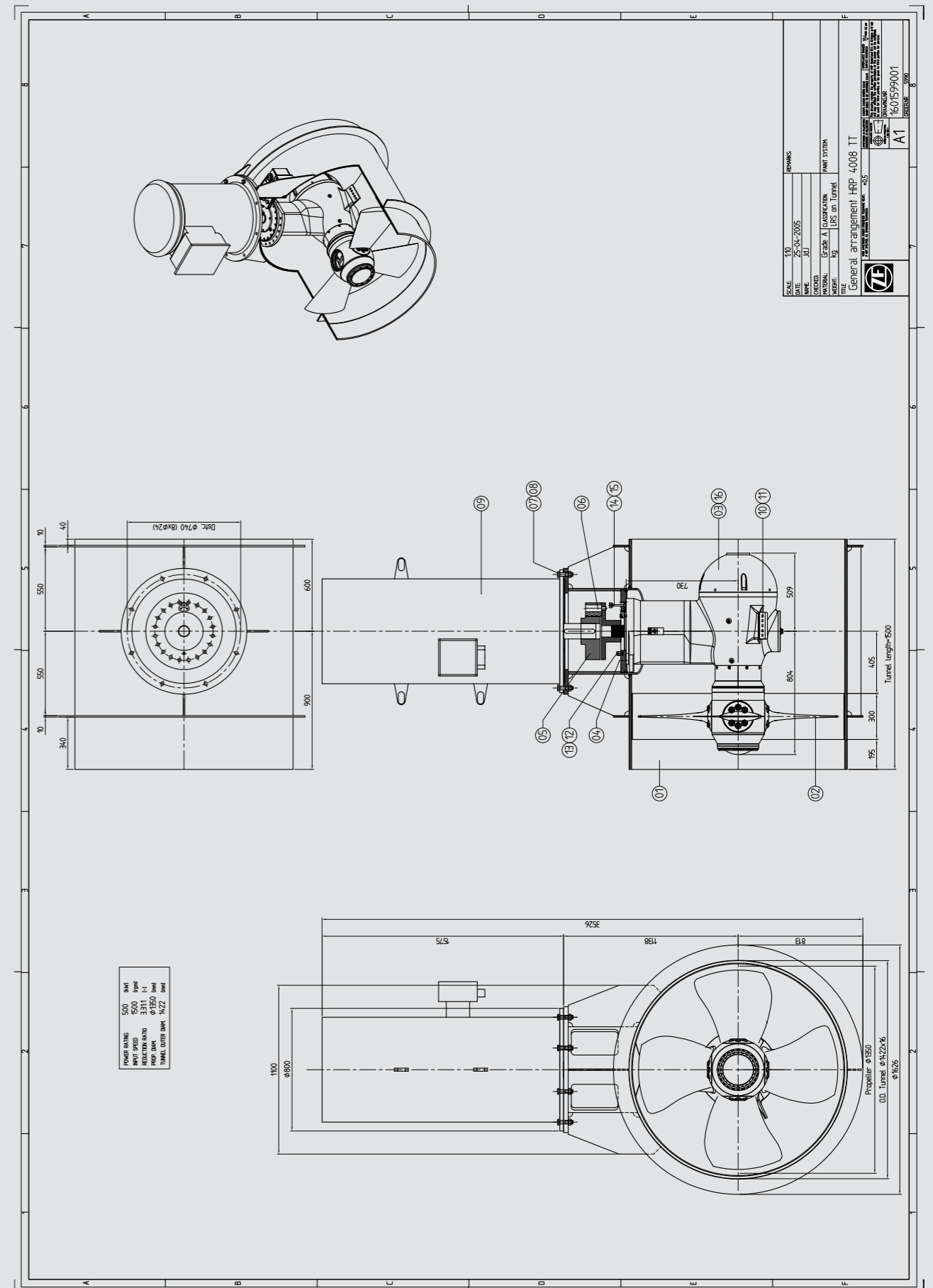


5400 HP AHSV "MORRISON TIDE" – USA



Length o.a. : 64.00 m
 Breadth : 14.00 m
 Draught : 4.00 m
 ZF-Reference : 5266
 Model : ZF TT 4000 CP
 Rated power : 400 kW at 1800 rpm
 Supplied to : P.T. Batamec Shipyard – Indonesia
 Owner : Tidewater – USA

Equipped with two (2) electric driven ZF TT 4008
 controllable pitch tunnel thrusters (bow and stern).



THE ZF GROUP

Shaping the future responsibly

Our enthusiasm for innovative products and processes and our uncompromising pursuit of quality have made us a global leader in driveline and chassis technology. We are contributing towards a sustainable future by producing advanced technology solutions with the goal of improving mobility, increasing the efficiency of our products and systems, and conserving resources.

Our customers in the automotive and industrial sectors welcome our determined focus on products and services, which provide great customer value. Improvements in energy efficiency, cost-effectiveness, dynamics, safety, and comfort are key to our work. Simultaneously, we are aiming for continuous improvement in our business processes and the services we provide. As a globally active company, we react quickly and flexibly to changing regional market demands with the goal of always providing a competitive price/performance ratio.

Our independence and financial security form the basis of our long-term business success. Our profitability allows us to make the necessary investments in new products, technologies, and markets, thus securing the future of our company on behalf of our customers, market affiliates, employees, and the owners of ZF.

Our tradition and values strengthen our managerial decisions. Together, they are both an obligation and an incentive to maintain a reliable and respectful relationship with customers, market affiliates, and employees. Our world-wide compliance organization ensures that locally applicable laws and regulations are adhered to. We accept our responsibility towards society and will protect the environment at all of our locations.

Our employees worldwide recognize us as a fair employer, focusing on the future and offering attractive career prospects. We value the varied cultural backgrounds of our employees, their competencies, and their diligence and motivation. Their goal-oriented dedication to ZF, beyond the borders of their own field of work and location, shapes our company culture and is the key to our success.



MOTION AND MOBILITY

Pkw-Antriebstechnik
Car Powertrain
Technology

Pkw-Fahrwerktechnik
Car Chassis
Technology

Nutzfahrzeugtechnik
Commercial Vehicle
Technology

Industrietechnik
Industrial
Technology

Lenksysteme
Steering Systems

ZF Lenksysteme GmbH ist ein Gemeinschaftsunternehmen der ZF Friedrichshafen AG und der Robert Bosch GmbH. ZF Lenksysteme GmbH is a joint venture of ZF Friedrichshafen AG and Robert Bosch GmbH.



ZF Services



Learn more
about ZF

ZF Marine Krimpen B.V.

Zaag 27, P.O. Box 2020
2930 AA Krimpen aan de Lek
The Netherlands
Phone +31 180 331000
Fax +31 180 331099
E-mail info.zfmarine@zf.com
www.zf.com/marine



MOTION AND MOBILITY