Engtek Manoeuvra Systems Pte Ltd

Rotatable Rudder Propeller SYSTEMS

A full Series of Azimuthing Propeller Drives ranging from 200 to 6000 Hp providing full 360 degree Capabilities.

Engtek Manoeuvra Systems Pte Ltd manufactures and Markets a unique “Series” of deck and through hull mounted 360 degree Rotatable Propeller Drives in the standard “Z” and “L” configurations.

The Rotatable Propeller Drives are normally deck mounted or through hull units mounted in a well, with the engine inside an enclosure or the hull and are usually installed in barges, ships, tugs, deck cranes, supply vessels and platforms for special work, diving, pipe laying, cable laying/repair, where maneuverability is a must and sometimes are used with dynamic positioning systems.

Tugs are fitted with Rotatable Propeller Drives either as conventional, or as tractor tugs with the propulsion units at the first third from fore.

More and more vessels will be fitted out with Engtek Manoeuvra Drives for an easy design for compact power with prime mover and propeller assembly, canceling the conventional rudder, and sometimes transverse thruster requirements.

The reliability of EMS – Marine Thruster Rotatable Drives is complete coping with all navigation areas, open sea, harbors and in all weather conditions.

A lot of innovation and safety devices, with agreement of Classification Boards and MARPOL regulations give EMS – Marine Thruster Systems Rotatable Thruster Drives a Leading Position in the Marine Propulsion Markets.
In general, EMS – Marine Thruster Systems, Rudder Propeller Propulsion Drives have been designed around the latest demands and technical standards, to meet today’s high demands for reliability, sturdiness and quality. A long record of building thrusters and a related level of know-how has brought the Aqua Manoeuvra products to this high quality level.

**Model Selection**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unit</th>
<th>ZM200</th>
<th>ZM300</th>
<th>ZM400</th>
<th>ZM700</th>
<th>ZM1200</th>
<th>ZM1700</th>
<th>ZM2000</th>
<th>ZM3000</th>
<th>ZM3500</th>
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<td>597</td>
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<td></td>
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...Optional...

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<tr>
<th>Model</th>
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<th>ZM3000</th>
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<td>1500</td>
<td>2000</td>
<td>2000</td>
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</table>
The full range of Rotatable Propulsion Drives available meet the design requirements of the major classification societies, including Lloyd’s (and Indian) Register of Shipping, Bureau Veritas, G.L., American Bureau of Shipping and Det Norske Veritas.

Well Mounted Through Hull Rudder Propeller System

**The EMS Rudder Propeller Drives consist of the following**

A. Rudder Propeller (Z-drive) section, comprising upper and lower gear box, intermediate stem section, steering gear and propeller with nozzle optional.

B. Hydraulic control/operation system.

C. Remote control system.
Rudder Propeller (Z-drive) section, comprising of upper and lower gear box, intermediate stem section, steering gear, propeller and nozzle.

The lay-out of the Rudder Propeller Drive is as follows (Typical – various for different Power ranges.

**Upper gear box**

A gearbox made out of marine grade cast iron, offering sufficient strength and provides for noise damping. The gearwheels are of high tensile steel, carbonized and case hardened spiral bevel gear designs, which are lapped in pairs for silent-mesh operation.
Steering Gear

EMS – Marine Thruster Systems uses a worm/worm wheel steering gear, comprising a bronze gearwheel and carbonized and hardened steel worm, with a reduction ratio ranging from 40:1 to 70:1.

The steering mechanism is of the self-locking type and offers smooth and precise thrust angle accuracy. For larger units, the steering system operates with a large diameter gear with internal teeth and one hydraulic motor up to 1000 mdaN at the propeller shaft and two motors beyond these figures and gear for steering. Furthermore, automatic brakes keep stability of the drive when the hydraulic motor(s) are not activated.

Hydraulic motors drive the steering device capable to operate 180 degree steering angle in 6-7 seconds at constant speed. However, the speed is controllable from the bridge console.

Steering Gear Assembly

The steering system is also provided with a mechanical pointer, driven directly off the worm shaft, for local thrust angle indication and independent from the electrical power supply.

The local pointer is indicating the thrust angle with 1:1 ration to the actual angle.
**Vertical Stem**

The vertical stem has ample sized pipe and vertical drive shaft. Outside diameter of the support tube is chromium plated for corrosion protection.

The diameter of the tubes is of sufficient size to create a high safety factor against bending forces, as well as to create a stable operation.

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**Underwater Gear Box**

The gearbox is made out of high tensile nodular cast iron ASTM395 series (60,000 tensile, 40,000 yield and 18% elongation), offering adequate strength.

The underwater gear box is of a “Torpedo” shape, designed to keep the hydrodynamic resistance to a minimum level and to make sure the optimum hydrodynamics aspects are met.

The gearwheels are of the high tensile strength, carbonized and case hardened spiral bevel gear designs, which are lapped in pairs for silent mesh and operation.

The propeller mounts to a 1:10 taper on an ample sized propeller shaft and is pushed in position by an end-plate, fitted with axial bolts in the propeller shaft. For larger units, the propeller is mounted without key according to SKF assembling on a conical shaft (hydraulically mounted).
The end-plate protects vulnerable threads and provides also for the possibility to pull the propeller off the shaft by flipping it over.

All underwater used bolts are of the stainless steel type.

**Thruster “Pod” Assembly**

**Bearings:**

All bearings used in EMS - Marine Rotatable Propeller Drives are roller bearings, sized for a long life time.

Mechanical losses are kept to a minimum.

The design life time of the bearings is over 20,000 hours, under full continuous load. The bearings lay-out is such that in case of an overhaul, the gear-mesh set-up is uncomplicated.

**Sealing Systems:**

High quality nitrate rubber O-rings are applied between all static surfaces. Oil sealing opposing air is by means of lip seals.

The steering tube Quad-rings at the seawater sealing, which are running on a stainless surface on the steering tube.
Special attention has been given to the most important seal in the Z-drive: The propeller shaft sealing system.

**EMS – Marine Thruster Systems**

Uses an axial “Deep-Sea Seal” pressed by the propeller hub to a ni-resist seat. This sealing system is very reliable and resistant against penetration of dirt/debris (such as sand, mud, plastics, fishing lines etc.) The application of this seal offers supreme protection against oil leakage, giving the best environmental protection as well as a safeguard for the valuable internal power transmission parts inside the thruster drive.

**Lubrication:**

The lubrication of EMS Rotatable Propeller Drives is of the oil bath type, the optimum solution to provide supreme lubrication of all rotating parts such as gearwheels and bearings, as well as the seals.

In order to achieve a positive pressure inside the rudder propeller drive, the lubricant is pressurized by a header tank.

The header tank is complete with a self closing type oil level sight glass and a filler/breather cap offering a single oil-filling point for the complete system.

To safeguard the mechanism against damage from a possible loss of oil due to a broken seal, a low level alarm switch is installed, to deploy the thruster.

**Propeller and Nozzle:**

The EMS Rotatable Propeller Drives are fitted with high performance propellers, or the customer’s selection, using the latest design standards to get the best performance possible.

The propeller can run in a nozzle (optional), which is bolted to the underwater gearbox.

Removal of the nozzle for maintenance during dry-dock is easily achieved. The inner lining of the nozzle is made out of stainless steel AISI 316, over the full nozzle length. The stainless steel lining gives the highest degree of protection of the inner side of the nozzle against corrosion.
Hydraulic Steering System

The EMS – Marine Thruster Systems Rotatable Propeller Drive is provided with a Hydraulic System, for…

- Steering
- Retraction and lock-hook control (retractable units)

Hydraulic Power Pack:

A tank unit is mounted on the thruster, on which all components such as valves, pressure gauges, filters, filling cap, etc., are located. Maintenance and monitoring is therefore possible from one center location.

The standard with AMS is the use of well proven and reliable hydraulics, of which components are readily available in many local markets.

Hydraulic Pump:

The system incorporates a hydraulic axial-piston type pump(s), with a load-sensing control. The pressure of the pump is automatically adjusted to a pressure level demanded by any of the power consumers in the hydraulic load system. In case no power is required, the pressure drops to approx. 20 bar.

The pump is driven by a direct coupled electric motor, fitted on the thruster or driven off the front of the diesel engine drive.

Steering:

Rotation of the rudder propeller over 360 degrees is done by means of either a single or dual steering motor on the worm/worm wheel steering gear (internal gear drive for larger units). The steering speed is proportional to the command given by the control system. In a range of 20 degrees the steering speed accelerates from zero to maximum and comes to a stop over the same degree of steering rotation.

A 24 volt (dc) proportional controlled hydraulic directional valve is mounted on the thruster unit. Steering characteristics are therefore shockless and precise.

Emergency Operation:

The system is provided with a back-up steering system, provided through a separate 24 volt (dc) valve, using emergency power supply for operation in combination with the non-follow-up control system.
Pipes and Hoses:

All hoses are delivered with the system, are suitable to withstand a pressure of four times the normal operating pressure. Pipes are of the high tensile steel precision type, adequately supported in plastic clamps.

Remote Control Systems.

Electrical Remote Control Steering Systems

360 degree Rotatable Propeller units...

MKI-Series
(Standard Master Control System)

Master Control MKI Series is a reliable all weather control system designed to operate remote steering control of EMS Rotatable Propeller Drives, in all circumstances and environments (Seaworthy-cold and tropical temperatures).

The control is carried out by 24 volt dc electro valves fed with available current on board, with weal sensitiveness to wetness and actual voltage current (the electro valves are activated with more or less 15% voltage).

The Master Control System comprises of the following:

- The **HYDRAULIC MOTOR** operating the steering device of the Rotatable part of the stem. Two (2) hydraulic motors are used beyond 1000 mdaN shaft torque of the propeller.
- A **HYDRAULIC POWER PACK** with one hydraulic pump driven either by the diesel engine or an electric motor. The hydraulic pump is fitted with a capacity regulation system providing a constant quick speed of steering (180 degree angle in 7/8 seconds).

- A **CONTROL PANEL** with controls is either located close to the power pack, or installed in the wheelhouse console.

One or several panels with selector switches can be located at various control stations to operate the ship.

The panels and the electric cabinet in the power pack are linked by electrical cables, without any other mechanical devices.

The Standard Main Control Console is fitted with the following:

A Steering hand lever for combined controls
- 360 degree steering control and throttle control of the e-motor controller.
- E-motor control and alarms

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*Ship Shape*

“Stay on course with EMS-Thrusters Marine Systems”
Control System, Pilothouse

Pilot house controls consist of joysticks, steering angle indicators, switches and indicator lights mounted in a panel for customer installation. A dimmer is provided for illumination level control.

Primary Control (Full Follow-up)

The illuminated primary control head controls propeller speed, clutch and direction of thrust in one joystick. The propeller speed is controlled by advancing the bail handle, first engaging the clutch, then increasing the engine speed. Thrust direction is selected by rotating the control head to the desired angle. The thruster will steer to the selected position and maintain that position. This control head has detents at 0° (directly ahead) and at engine idle (clutch engaged). Illumination level is controlled by the panel dimmer.

Secondary Control (Non Follow-up)

In the non follow-up mode, the spring-centered steering joystick commands the direction of rotation, and the thruster rotates as long as the command is given. Clutch engagement and engine speed are controlled by a turning knob. Rotating clockwise engages the clutch, and then increases engine speed.

Steering Angle Indicator

The Steering Angle Indicator displays the thrust direction of the unit. The propeller insignia on the gauge indicates the direction of the propeller wash. The indicator operates independently of the controls, and is active in full follow-up and in non follow-up modes.

Clutch Engaged Indicator

A green light indicates clutch engagement. Illumination level is controlled by the panel dimmer.

Engine Room Controls

Prime mover speed control is available in the machinery space by selecting “Local” control. The clutch actuation and the prime mover speed are then locally controlled by a rotary knob. A clutch engaged light is also provided in this panel.

Local Thruster Controls

Clutch control valves can be manually actuated at the thruster for maintenance and troubleshooting and in the event of an emergency.
Introducing Deck Mounted Hydraulically Driven Rotatable Propeller Drives with Height Adjustment and 90 degree tilt capability and ranging from 200kw up to 1200Kw complete with Diesel Drive, accessories and full enclosure ..... A Complete Drive Package

The EMS-Marine Thruster Systems Deck Mounted, Rotatable Propeller Drives units and available from 200Kw up to 1200Kw are of a very heavy duty construction, offering 360 degree continuous steering in either rotation, right angle lower gear drive with hydrostatic hydraulic drive system offers high thrust performance in a very compact drive package. The hydraulic transmission is diesel engine driven through a combined marine clutch and PTO driving the hydraulic variable displacement pump.

The diesel engine operates at a constant speed with full rpm control through the hydrostatic drive with high quality cardan drive shaft in the stem into the heavy duty transmission and fitted with a high thrust propeller.

The unit incorporates our unique transmission kick-up device which is specifically designed for shallow water or beaching applications and protects the transmission from unknown underwater hazards.

The Rotatable Propeller Drive has full height adjustment to allow operation in shallow draft application.

Designed for on-deck mounting, all assemblies are incorporated on a substantial fabricated steel chassis to provide a completely self contained marine propulsion system ready for immediate installation. Both local and remote control options are available as standard.
All EMS Units are contract specific, dependant on vessel design, operating environment and application, and our customer’s requirements as to choice of engine and controls. We will then suggest the most economical drive solution. To assist ease of installation the drive systems are offered in two (2) basic drive configurations:

- Inline Mount
- Side Mount

MKII – Series (Mastronic Control System)

The **Mastronic Control System Model MKII** is designed for the steering control of vessels fitted out with two or more Engtek Manoeuvra Rotatable Propeller Drives, Azimuthing and transverse thrusters.

It is implemented with NAVIS JP3000 Joystick engineering and instrumentation for **AUTOPILOT** and **JOYSTICK CONTROL**; and because of its modular concept, it can be upgraded to incorporate full Dynamic Positioning Systems.

The EMS – Marine Thruster Systems MASTRONIC CONTROL SYSTEM includes the following:

- Sensors and controls of the Thrusters, engines and auxiliary equipment.
- The MASTRONIC programmable AUTOMAT.
- The emergency hand operated control for each thruster:
  - MASTER CONTROL TYPE.
- The MASTRONIC NAVIS3000 JOYSTICK control
- The interface to GYROCOMPASS and NAVIGATION RECEIVER.
- Option: Interface to a Dynamic Positioning System.
1. Steering Motors
2. Position sensor
3. Automat
4. Display of stated direction
5. Steering indicator
6. Sensor of the direction
7. Control Panel
8. Proportional control
9. Low speed steering control
10. Quick speed steering control
11. Steering brake control
   A. Revolution direction of propeller (in case of reverse)
   B. Selector switch: Automatic operation / Hand operated – Emergency

Propulsion Units under Control:

The MASTRONIC CONTROL is designed to interface to the following propulsion equipment:
- Two (2) or more Thrusters

Mastronic AutoMat;

The MASTRONIC CONTROL AUTOMAT assumes following controls...
- Input revolution speed – diesel engine or electric motor
- Output revolution speed of propellers (steerable or transverse thrusters).
- Thrust combination of propulsion units, and transverse, for steering.
- Management of outside parameters with input interfaces to Gyro Compass and D.P. (optional).

MASTRONIC CONTROL operates the steering from an angular direction stated by the operator.

The order is converted in numeric data, compared to the actual position of the propulsion units and the thrust is steered in suitable position, kept by an automatic brake.

Acceleration or throttle controls are managed by the MASTRONIC CONTROL SYSTEM.

Adjustments of parameters are operated through the AUTOMAT...
- Time of acceleration.
- Accuracy of steering.
- Temporization.

The Joystick Control System has three (3) operational modes:
- AUTOPilot
- MANUAL JOYSTICK
**Control Model:**

MANUAL JOYSTICK with AUTOMATIC HEADING CONTROL

**Joystick:**

The MASTRONIC EMS Joystick Control System integrates manual control of two azimuthal thrusters in a single Joystick controller.

The Joystick system interfaces to and controls the azimuthal thrusters and engine installation, based on information from the vessel’s gyrocompass and navigation receiver.

The MASTRONIC CONTROL is capable of automatically controlling vessel heading while vessel position is controlled manually.

The system also has the ability to rotate the vessel about three pre-determined points (i.e., mid-ship, bow or stern).

This interface is designed to accept information from a navigation receiver with a standard NEMA 0183 output having a resolution of +/- 18 meters.

Should better accuracy be required, a more accurate positioning reference system should be installed on the vessel and accurate AUTOMATIC TRACK STEERING software installed.

**Equipment Installed on the Main Control Console:**

One (1) JP3000 Joystick with AUTOPILOT CONTROL UNIT with the following features:
- Digital display of set course and analogue display of deviation from set course.
- Rotary set course heading selector.
- Off course alarm.
- Watch alarm.
- Common gyrocompass interface unit.
- Gyrocompass input as main heading reference and second input from backup compass, which is selectable.
- Rate of turn control.
- Mode selector.
- Station selector.

One (1) NAVIS JP3000 CONTROL MODULE with the following features:
- Joystick maneuvering mode.
- Auto Heading control mode.
- Vessel Rotation Point selection.
- Heading Change control.

One (1) THRUSTER DISPLAY MODULE with the following features:
- Vessel mimic display for positive orientation.
- Thruster and propulsion display.
- Thrust magnitude and direction indicators.
- Thruster and main propulsion on/off selection.
The MASTRONIC SYSTEM and AUTOPILOT are fed with 24vdc.

Optional:
- Interface to Gyrocompass.
- Interface to Dynamic Positioning Systems.

About the Company

Engtek Manoeuvra Systems Pte Ltd offers Engineered Propulsion for vessels of all types.

We design, manufacture and support marine equipment which has a worldwide reputation as the standard of excellence in the industry.

The Company has an experienced staff of technical personnel who are familiar with the demanding requirements of the ocean environment. We are small enough to give you personal attention, yet big enough to give you excellent service. We maintain an extensive inventory of spare parts ready for rapid air shipment to your location.

We have sales and service representatives in many key locations around the world. Several of these representatives have systems and spare parts in stock for immediate delivery.

We have a complete manufacturing facility which includes a full CNC Machining Center for prototype development, manufacturing and assembly plus our test tank.

Our in-house engineering department utilizes SolidWorks, TekSoft CAMWorks 2D/3D Mill, BobCAD/CAM and AutoCad, with... ProCad (Propeller Design and Drafting Software); PropExpert (Propeller Selection and Analysis Software; and MAKASS (Program for Ka-series / Propeller and Nozzle Selection). In addition to our line of standard products, we invite customer inquiries for special systems or service. Please feel free to call on us for assistance in your application.

Stay ON COURSE with EMS - Marine Thruster Systems ...

We offer tailored designed systems to suit any application. This, in combination with evolutionary designs, will fulfill your every need for propulsion and effective side-power. We have over 30 years experience in the maritime propulsion world.

Engtek Manoeuvra Systems Pte Ltd

Engtek Manoeuvra Systems Pte Ltd
Main Offices – Sales and Marketing
50 Kian Teck Road – Singapore 628788
Tel: + 65 6265 6288
Fax: +65 6264 0254
www.ams-thrusters.com