ABOUT THRUSTMASTER OF TEXAS, INC.

Thrustmaster of Texas, Inc. is based in Houston, Texas USA with offices in Rotterdam, Dubai, Singapore, Brazil, and India. As the world's leading manufacturer of marine thrusters Thrustmaster has maintained its reputation over the years by strictly adhering to its mission statement of both quality and customer service.

Thrustmaster is ISO 9001 certified by the ABS. Thrustmaster field service engineers and technicians provide worldwide support 24 hours a day. Thrustmaster maintains a large inventory of all essential spare parts in Houston, Texas, backed up by a computer controlled inventory system, ensuring same-day shipping of breakdown spares to any destination in the world.

Agent Locations: Argentina - Australia - Brazil - Canada - Colombia – Egypt - England - Greece - India - Korea
Mexico - New Zealand - Pakistan - Peru - South Africa - Taiwan - Turkey - Venezuela

OTHER THRUSTMASTER PRODUCTS

Contact your Thrustmaster agent for help in choosing the correct thruster for you

Hydraulic Outboard Thrusters range from 26 to 1,500 kW and can be built in a variety of ways to suit your particular application. Sought after by construction and military managers needing a robust propulsion unit that is flexible and fast to install.

Standard Tunnel Thrusters range from 16in (406) to 84in (2134) diameter and 35hp (26kW) to 2000hp (1,500kW) and can be built for aluminum or steel hulls. Electric motors and complete VFD assemblies can be provided and classed accordingly.

Bottom Mount and Drop-In Azimuth Z-drive and L-drive configured thrusters range from 55 to 8 MW. Z and L drives use electric or diesel prime movers and are perfect for tractor tugs and work vessels needing maximum power in all directions.

Hydraulic Tunnel Thrusters up to 2000hp (1490kW) offer wider flexibility to the industry. Hydraulic thrusters as a whole allow the prime mover to be located anywhere on the vessel. The prime mover can be a diesel or electric motor driven.

The **Portable Dynamic Positioning System** is a Thrustmaster exclusive delivering dynamic positioning in a portable package to include 360° azimuth thrusters, HPU's and Control Van.

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Designers and Manufacturers of
Advanced Marine
Propulsion Systems

Thrustmaster

Z and L Drive Propulsion and Thrusters

Z and L Drive Propulsion and Trusters are for Dynamic Positioning and Main Propulsion of Offshore Semi-submersible Rigs, Tugs, OSV's, PSV's, and Drill Ships. Includes various mounting configurations and power options.

AZIMUTH THRUSTERS

This brochure is designed for **AZIMUTH THRUSTERS of the HYDRAULIC Z-DRIVE, MECHANICAL GEAR DRIVEN Z-DRIVE, and MECHANICAL GEAR DRIVEN L-DRIVE** styles. For applications requiring other types of thrusters and propulsion please see the appropriate brochure(s) or contact your regional sales representative.

Thrustmaster of Texas, Inc. designs and manufactures the most diverse variety of thrusters in the marine industry to also include;

- ✤ Hydraulic Outboard Propulsion
- ✤ Hydraulic and Mechanical Gear Driven Transverse Tunnel Thrusters
- ✤ Hydraulic and Mechanical Gear Driven Retractable Azimuth Thrusters
- ✤ Patented Portable Dynamic Positioning System

Hydraulic Z-Drive thrusters are available up to 2000hp (1500kW) for either steerable or non-steerable azimuth applications. Hydraulic Z-Drives are especially useful in applications where a shaft style propulsion cannot be aligned with the propeller. The hydraulic Z-Drive allows the HPU to be mounted any where on the vessel, even on deck.

Mechanical geared Z and L drives are available up to 10,750hp (8MW) for diesel engine or electric motor power input. These drives can be configured for bottom mount, underwater mount, or top mount installation and come with hydraulic steering HPU's with robust 3 r.p.m. azimuth steering as well as lube oil tanks.

Electric

Thrustmaster maintains a staff of highly qualified Design Engineers to assist you with your selection and answer any questions. Thrustmaster Service Engineers provide worldwide service and support for installation, start-up and sea trials.

Visit our web site, or consult with one of our many offices or agents around the world to determine the best solution for your application.

ICE CLASS OPERATIONS

One of the TH6000ML dynamic positioning thrusters for the Noble Bully 1 was ordered for ICE class service to insure that a ready to fit thruster was available for cold water contracts.

ICE CLASS HYDRAULIC THRUSTERS

Ice Class notations are available on Thrustmaster hydraulic thrusters providing more options for vessel operators.

Because of the mass inertia related to operations in ice conditions the size of components will increase dramatically with the same rated input power and speed all the while trying to keep the same propeller diameter as for a standard thruster.

Thrustmaster hydraulically powered thrusters uses podded drives, which eliminate the mass inertia factor while keeping the size of the thruster to the standard size (available up to 2000 HP). The hydraulic motor is monitored by a very accurate torque limitation system avoiding damage to the propeller due to ice impacts.

SPECIFICATIONS

Hydraulic Z-Drive Azimuth Thrusters

Model	Prop Data		Weight
	Dia. In.	RPM	Pounds
TH-100-N	24	937	2090
TH-150-N	28	820	4260
TH-200-N	32	600	4700
TH-250-N	35	600	5270
TH-300-N	39	540	5700
TH-400-N	43	540	10020
TH-500-N	49	495	11940
TH-600-N	51	416	12190
TH-750-N	55	416	16600
TH-850-N	59	370	17700
TH-1000-N	63	370	18600

Note: Hydraulic Z-Drive Azimuth Thrusters WITHOUT nozzles are also available in the similar power ratings as above. Simply remove the -N at the end of the model number. These Model TH-series azimuthing thruster units are equipped with a manganese-bronze, four-blade, high-thrust, monoblock propeller. The nominal diameter, blade pitch and disk area ratio of the propeller is selected to provide either maximum static bollard thrust or maximum thrust at design vessel speed

Note: Thrusters of the same model number can have different features, power ratings, and mounting configurations although the main unit is the same size and approximately the same weight. Please check with your sales contact or project manager to determine exactly what you need for your project.

MECHANICAL AZIMUTH Z DRIVE

Mechanical Z-Drive Azimuth Thrusters

Model	Prop Data		Rated HP at Input Shaft	Dry Weight
	Dia In.	RPM	HP	Pounds
TH-400-MZ	39.25	599	440	4450
TH-500-MZ	51	449	500	8600
TH-500-MZ	51	449	500	10200
TH-1000-MZ	57	404	1100	12100
TH-1250-MZ	69	360	1340	24300
TH-1500-MZ	78	279	1700	23000
TH-2000-MZ(1)	83	275	2250	35600
TH-2000-MZ(2)	83	275	2250	35600
TH-2000-MZ(3)	83	275	2250	28000
TH-2500-MZ(1)	94	247	2700	42500
TH-2500-MZ(2)	94	247	2750	42500
TH-2500-MZ(3)	125	153	2750	34300
TH-3000-MZ(1)	112	210	3000	69500
TH-3000-MZ(2)	121	210	3300	69500
TH-4000-MZ	118	195	4025	79500
TH-5000-MZ	132	177	4700	103620
TH-6000-MZ	154	146	5780	141095

Mechanical L-Drive Azimuth Thrusters

Model	Prop Data		Rated HP at Input Shaft	Dry Weight
	Dia In.	RPM	HP	Pounds
TH-300-ML	36	600	335	7500
TH-400-ML	42	545	400	7500
TH-500-ML	44	530	536	10500
TH-750-ML	55	420	800	14000
TH-1000-ML	57	385	1072	17300
TH-1250-ML	69	360	1340	24300
TH-1500-ML	78	290	1675	29760
TH-2000-ML	86	267	2010	32330
TH-2500-ML	93	235	2682	44000
TH-3000-ML	105	219	3350	59800
TH-4000-ML	118	194	4020	81570
TH-5000-ML	132	177	5100	103700
TH-6000-ML	154	146	5000	133000
TH-7000-ML	168	133	7375	183424
TH-8000-ML	168	142	9387	161378
TH-10000-ML	188	133	10057	187500

NOTES/DISCLAIMER:
1. VALUES SHOWN ARE FOR GENERAL ARRANGEMENTS ONLY. MANY CONDITIONS WILL AFFECT YOUR ENGINEERED THRUSTER(S). ONLY THE VALUES AND CONDITIONS UNDER WRITTEN CONTRACT WILL APPLY. ALL VALUES ARE SUBJECT TO CHANGE WITHOUT NOTICE OR CONSENT. CONTACT THRUSTMASTERS HIGHLY QUALIFIED ENGINEERS TO DETERMINE YOUR PROJECT PARAMETERS.
2. CONTACT YOUR REGIONAL AGENT OR INFO@THRUSTMASTERTEXAS.COM FOR MORE INFORMATION ON MODELS OR SIZES BETWEEN THOSE SHOWN.

HARBOR TUGS AND TOWBOATS

For centuries vessel designers have tried to make cargo ships slip through the water carrying the most cargo with the least resistance. That means optimizing the hull form and the shape of the propeller to require less power translating into lower cost per miles traveled. Maximum hydrodynamic efficiency is how ships make money. On the other hand harbor and river tugs would win no races as ***power and maneuverability*** are where they excel.

Tugboats and Towboats are entirely different.

Tugboats are blue-water workhorses of harbors designed to maneuver ships twenty and thirty times their size. Around the 1950's the increased capacity of dangerous cargo vessels coming into ports along with the demands for better harbor safety caused designers to start looking seriously at major changes and improvements in tug design.

Towboats, on the other hand, are brownwater masters of the rivers earning their keep by pushing strings of cargo laden barges reasonably long distances along trade routes of inland rivers and canals. Evolving from steam powered sternwheelers two centuries ago they needed only 18 inches of water. Skilled towboat captains often find themselves recruited to the position of pilots because of their exceptional ability to understand the simple nuances of currents and eddys and how they act against the vessel.

Both vessel types can find opportunities to need as much power throughout their 360 degree steering range as they do in the forward direction when pushing or taking up a tow.

Barges are about the least hydrodynamic objects on the water. The river tugs that push them are not typically considered strong candidates for twin Z-drives because they are assumed to travel long distances with little need for severe turning . However, maybe it is time for a paradigm shift.

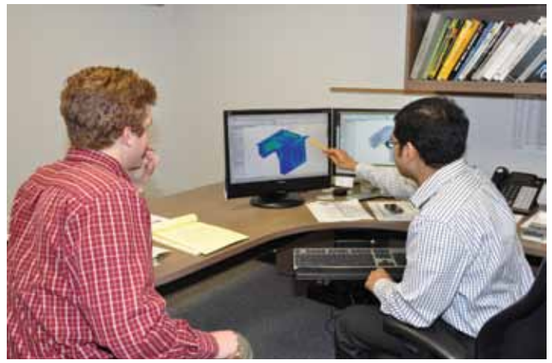
Rudders and struts are considered "wetted surfaces" which simply translates to resistance creating inefficiency. When not steering the vessel the rudder, rudder post, skeg and braces are nothing more than resistance creating appendages being dragged along until such time as they are needed for a course correction.

Everything with the Z drive in, on, and below the hull contributes to strength and thrust. Installing a pair of Z-Drives eliminates the unnecessary drag and turbulence of the large steering and flanking rudders, shafts, and struts. It might be argued that the nozzle simply replaces the rudders in terms of resistance, however, that is far from true because the nozzle is constantly increasing thrust whereas the rudder only contributes to changing course. The rest of the time it is dragging along consuming fuel and requiring more horsepower.

The Thrustmaster drop in style thruster and low profile allows a properly ballasted tug to swap or remove the thruster for a rare repair without drydocking in most cases.

Outflanking (pun intended) the rudders. If a 10 barge train shaves 10 hours off each transit cycle that means 10 hours for each barge load. If that river tug makes 20 transits per year that is 200 less hours of operational demand on the system and crew which either means reduced cost for the year, or substantially increased capacity for the single river tug…, take your pick.

THRUSTMASTER MEANS QUALITY



Dedicated Engineers and Production Staff

Thrustmaster is dedicated to the total engineering and manufacturing process of building thrusters and ***ONLY*** thrusters. The new 200,000 sq/ft factory and office was built to deliver thrusters to our customers. The first floor of the office supports operations and running the factory while the second floor houses the departments of training, finance, project managers, and top engineers, many with PhD's, who delve into the intricate and complicated sciences related to long term reliability and efficiency of your thruster design.

Thrustmaster engineers continue to invent new thruster concepts and improve existing designs using state-of-the-art design and analysis tools such as SolidWorks®, AutoCAD®, ANSYS®, STARCCM+ and Magma.

Fixed Pitch vs. Controllable Pitch Propellers

Controllable Pitch Propellers (CPP) were have their place but one tenant of Thrustmaster is that a fixed pitch propeller (FPP) is better than the CPP in terms of cost and service life. Long term use proves the fixed pitch propeller efficient and cost effective due to the absence of seals, push-rods, and bearings. The root of the blades on the FPP are much less susceptible to cracking and breakage, reducing the potential for downtime and drydocking fees.

The ability to quickly turn a thruster 180 degrees with an efficient robust four blade, high thrust Nickel-Aluminum-Bronze propeller and nozzle is nearly equal to or in some cases exceeds the CPP's ability to transfer from full forward to full reverse. Fixed pitch propellers used in Thrustmaster thrusters have been proven over and again in the harshest of environments.

ISO 9001:2001 Quality

Thrustmaster thrusters are built under strict quality standards and classed in accordance with the customers requirements. By the time it leaves our factory a thruster will have gone through numerous quality inspections.

Quality at Thrustmaster begins with selection and control of our suppliers and the basic elements from which our products are made. Materials are processed in strict accordance with our rigorous specifications.

Each step of our manufacturing process is controlled by our quality control procedures and requirements, all in line with our ISO 9001 Quality Management System. Part specifications are verified and monitored with the highest quality of instruments and latest technology, which provides us with exceptional control and confidence in the durability and performance of our products.

The Zeiss CMM (right) is of the newest addition to Thrustmasters many insurances of a quality product.

Z & L-DRIVE THRUSTER FEATURES

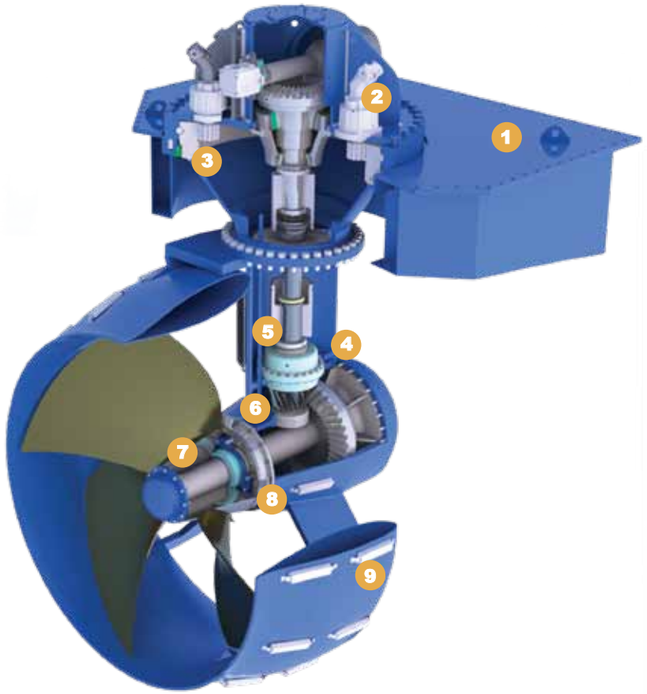
Much of Thrustmaster's Engineering and Fabrication facilities are devoted to the development of thrusters for the offshore oil and gas industries. Semi-submersibles, drillships, OSV's, PSV's, barges, and crew boats use Thrustmaster thrusters for dynamic positioning and slow speed maneuvering. By developing both Z and L drives Thrustmaster can handle just about any type of vessel needs you may encounter. Z and L Drives can be installed in a variety of ways such as through the deck for the Top Mount or from the bottom for a standard or underwater mounting.

Z-Drive - Thrustmasters Z-Drives have an optional clutch to disengage the diesel engine shaft for neutral. With several robust hydraulic steering motors the unit can be turned in seconds to provide optimum thrust in any direction. Eliminating the rudder reduces the amount of energy lost to deflection.

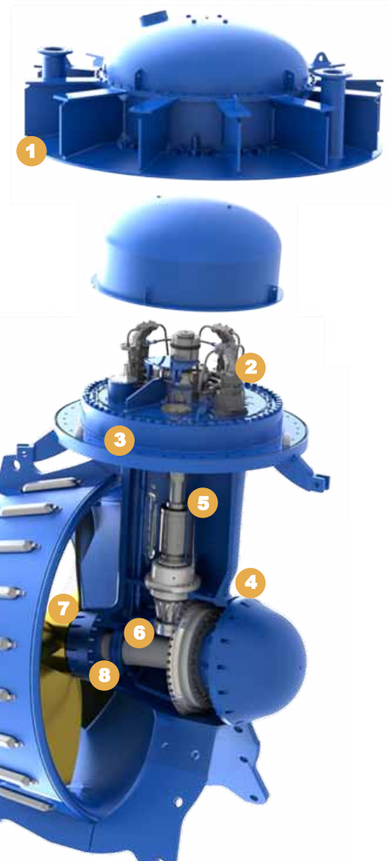
L-Drive - The Underwater Mounting style L drive thruster has lugs for lifting into position, caps for sealing out seawater, and spaced alignment pins to help insure that the truster is installed correctly every time. Seals and precision finishes insures water tight integrity once the thruster is installed.

FEATURES OF THRUSTMASTER Z & L DRIVES

1 Engineered heavy duty machined and fabricated mounting systems.
2 Multiple hydraulic steering drives are easy plug-in style.
3 Oversized slewing gear bearing to withstand intense dynamic loads.
4 All-welded steel construction provides a strong, ductile, tough and impact-resilient body with minimal deflection under load.
5 Floating intermediate shaft accommodates misalignment.
6 Between-bearing style pinions have less deflection than overhung style pinions maintaining accurate gear meshing at any operating load.
7 Keyless hydraulic fits on propeller and bull gear bore allow effortless assembly while ensuring maximum strength of shafts.
8 Mechanical face seal on propeller shaft for long maintenance-free life.
9 Ample anode protection to extend product life.



Thrustmaster Z-Drive (Drop-In Mount)



Thrustmaster L-Drive (Underwater Demountable)

DEMOUNTABLE THRUSTERS

UNDERWATER DEMOUNTABLE THRUSTERS ALLOW DRILLSHIPS TO REMAIN ON SITE LONGER BY ELIMINATING A RETURN TO PORT FOR DRY DOCKING TO CHANGE OR REPAIR THRUSTERS.

UNDERWATER DEMOUNTABLE

In the photo below one of seven TH3000ML Underwater Mount DP thrusters is being hoisted into it's receptacle under the Noble Leo Segarius.

Underwater Mounting and Demounting thrusters allow thrusters to be replaced without interrupting drilling operations.

A two cap system allows one cap to protect the steering motors and valves. The second cap is bolted over the opening to seal the hole. The thruster is then lowered for capture and hoisting aboard the replacement carrying vessel. (See graphic of Underwater Demountable L-Drive on other page.)

A new thruster can be installed in a short time on-site without going in to dry dock saving valuable time and money.

For Military and Government Services

Thrustmaster has over a quarter century of experience in supplying navies and government projects with a wide variety of thrusters. From active duty military ships such as the newest Littoral Combat Ship to inland dam and reservoir construction and maintenance, vessel operators find the exceptional maneuverability and functions of Thrustmaster thrusters.

For Dive Support, and Salvage Vessels

When anchors are forbidden because of water depth, active cable or pipes on the bottom, or sensitive ocean life, the ability to stay on track with working divers or chasing a ROV can be a daunting task. Thrustmaster's feed back systems when coupled to any reputable dynamic positioning system can provide maximum thrust any direction at up to three full revolutions per minute without having to return to a home position. This means they can track the diver or ROV safely and with the kind of precision found in the best equipment.

When the position of the diver or ROV changes from moving to stationary in order to perform work the Thrustmaster Z or L drive receives commands from the electronic DP system and precisely holds position within 1 meter or less.

Offshore Supply,

For over 50 years offshore supply vessels have needed absolute precision as they stand off from a platform or working rig. During a new drilling operation they may be part of the fleet bringing the first 10,000 feet of drill pipe to the rig so holding position alongside the rig without tying up to it to unload the pipe is crucial to the operation.