Michigan Wheel Corporation

More from Michigan Wheel . . . . .

Demand the best for your vesseL —

FEDERAL CUSTOM PROPELLERS!

- Styles: Equi-Poise, Equi-Quad, EPX, EQX, and HX Series; high tolerance skewed constant pitch propellers. EPY, EQY CY5 and "CX" (CNC machine finished); high tolerance custom pleasure or commercial application specific with a variety of blade designs.
- Primary material - NiBrAl (Nickel, Bronze, Aluminum alloy - ABS 4)
- Alternative material - Manganese Bronze, Stainless Steel
- Compliance with certification agency classifications available.
- All Federal propellers are serialized and have full inspection report record.

FEDERAL PROPELLERS


HX-300


HX-400


HX-500


CX-400


CX-500


CX-600


CX-700


Equi-Poise


Equi-Quad


EPY


EQY


CY5

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Michigan Propeller Part #99022806

Michigan propellers

INBOARD PROPELLER CATALOG

QUALITY.

Michigan Wheel Corporation is committed to the pursuit of quality excellence. We have ongoing training for all of our personnel and suppliers. Engineering support is continually upgraded. Through this effort, we seek to continually reduce product and process variation. Michigan Wheel Corporation operates on the philosophy that quality is the cornerstone of economic growth and stability. Therefore, quality is the responsibility of every individual in our organization. With the cooperation and input from our suppliers and customers, we are committed to continuous improvement.

ENGINEERING.

With decades of experience as the Marine Propulsion Industry Leader, the Engineering Department at Michigan Wheel Corporation and select Michigan Distributors have the knowledge and experience to suggest the correct propellers for your boat. Propeller requirements often will change from factory original equipment, dependent on your operating condition. Our Naval Architects, Engineers, and many of our Distributors are available to review your vessel data and your performance expectations. Utilizing specialized proprietary software programs, our staff or our Distributors staff is proficient in determining the best propeller match, in size and style, for your boat's engine and gear ratio combination. See your Michigan Distributor, or contact us directly, to obtain a propeller analysis form.

MANUFACTURING.

Michigan Propellers has the capacity to CNC machine and hand-craft inboard mono-block, fixed pitch, and variable pitch propellers from 3" through 96" diameters. The primary certified materials used are Michalloy K (manganese bronze), Michalloy XX (nibral), and Michalloy S (CF3 stainless). Each of these alloys are strictly controlled in composition and purity. With our system of continuous improvement, manufacturing work cells are taking responsibility for propeller quality, from start to finish. Each work center is equipped with certified inspection gauging and balancing equipment, enabling quality to be built in through the process. Production flow is controlled with an ERP computerized program, which is enabling us to provide the levels of lead time flexibility needed to meet our customer's requirements. In addition to the inboard product line, we offer a range of replacement outboard and sterndrive aluminum and stainless propellers, and specialized industrial propellers, each of which has a separate catalog.

HISTORY.

Michigan Wheel was organized in 1903, as a machine shop for the production of a variety of items, including marine propellers. By 1934 the company's main activity was concentrated on the marine propeller field, concentrating on commercial vessel and industrial activity.

Real growth began with the war years, when military requirements demanded the "know-how" that Michigan Wheel had developed. After the war, recreational boating grew by leaps and bounds, and the Michigan Wheel Company was among the leaders in supplying propellers for a growth industry.

Propellers for outboard motors were established in the early 1940's, and a network of propeller distributors and authorized repair stations was established.

In 1949, the Michigan Wheel Company purchased Federal Propellers, uniting the primary suppliers of recreational propellers. With a combined volume of production, Michigan Wheel Company was able to incorporate efficient manufacturing process.

In the 1960's, the Michigan Wheel Company kept pace with the industry in offering propellers for the then new sterndrive propulsion packages.

In the 1970's, the Michigan Wheel Company became the Michigan Wheel Corporation, and entered a period of acquisition to enhance the range of propeller product offered.

In the 1980's, automated finishing equipment for stainless steel propellers, and computer controlled milling machines gained favor, and the Michigan Wheel Corporation was among the first to take advantage of such new technologies. Michigan's CAD-CAM abilities are unsurpassed in the ranks of propeller manufacturers.

With over 10 decades of history, despite several ownership and name changes, despite industry downturns and upturns, the Michigan Wheel Corporation has remained a reliable and dedicated supplier of marine propellers to the recreational and commercial marine industry. Today the Michigan Wheel Corporation offers tens of thousands of variations of propellers, and still retains its leadership position in original equipment and aftermarket propeller supply. The "Michigan" and "Federal" names are recognized and demanded world wide. Much credit goes to its loyal and supportive distributor and builder base, and its own dedicated employees. Our extensive history with marine propulsion has provided the Michigan Wheel Corporation with a solid foundation from which to continue meeting marine industry demands in the future.

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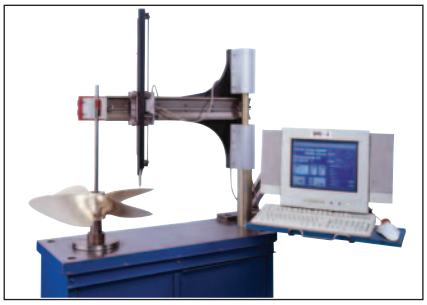
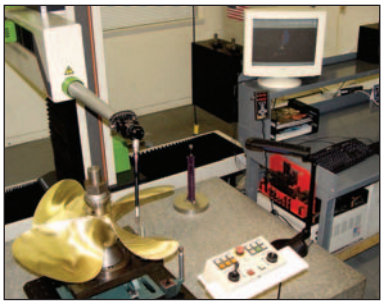



Pleasure Boat Propellers

Photo courtesy of Silverton Marine Corp.

Photo courtesy of Jefferson Yachts

Photo courtesy of Carver Boat Corp.

Photo courtesy of Cruisers Yachts

Photo courtesy of Albin Manufacturing, Inc.

Photo courtesy of Larson Boats

DJX

0.61 E.A.R.
Diameter range: 12" - 28"
21° of skew

DQX

0.81 E.A.R.
Diameter range: 23" - 32"
21° of skew

"X" Series

"**DJX**" and "**DQX**" are an evolution of the tried and true Dyna-Jet and Dyna-Quad series propellers. The designs have been modified to be better suited to highly loaded, limited tip clearance applications. All "X" series propellers are CNC machined to facilitate very accurate and repeatable product. The availability of this series will be progressive, with additional sizes being added regularly. Availability will be size specific, in a range of bores, and without or with all degrees of cup.

DQX

0.735 E.A.R.
Diameter range: 17" - 22"
21° of skew

Pleasure Boat Propellers

Dyna-Jet

0.56 E.A.R.
Diameter range: 19" - 46"
Pitch range: 0.7-1.1 dia/pitch ratio

The 3-blade **Dyna-Jet** is the most popular propeller in the world for moderate size boats, generally through 40', providing outstanding speed and performance. Designed for both the hard working fishing boats to get to their destination on time, to the pleasure craft owner who looks for the ultimate performance and speed. The **Dyna-Jet** pushes it to the limit.

Each **Dyna-Jet** propeller is carefully hand crafted and inspected to meet today's performance demands. When using NiBrAl material, a cupped trailing edge is available for maximizing thrust and minimizing vibration of a cavitating propeller where blade loading is at the upper end.

Photo courtesy of Silverton Marine Corp.

Photo courtesy of Cruisers Yachts

Dyna-Quad

0.69 E.A.R.
Diameter range: 19" - 46"
Pitch range: 0.7-1.1 dia/pitch ratio

The **Dyna-Quad** design is as popular as the three blade Dyna-Jet, but generally suggested for vessels larger than 40' requiring greater blade area due to the added weight and thrust requirements. The four blade design gives extreme smoothness, superb maneuverability, plus the speed and "dig" of a three blade.
In addition, if slight vibration is present with a 3 blade, the added blade in the **Dyna-Quad** may offer a more comfortable ride reducing that vibration. This is also an excellent choice for the performance minded commercial boat operators. Like the three blade Dyna-Jet, all **Dyna-Quads** in NiBrAl material are available with cupped trailing edges.

Photo courtesy of Gibson Fiberglass Products, Inc.

Photo courtesy of Island Packet Yachts

M-500

0.86 E.A.R.
Diameter range: 22" - 44"
Pitch range: 0.75-1.3 dia/pitch ratio

The **M-500** is selected by many operators for new boat construction, re-powers and upgrading of propellers. The excellent design and increased blade area provides superior and higher performance without increasing propeller diameter, which may be impossible due to clearance or tip speed consideration. The **M-500** is the top choice on installations where heavy vee-struts, dead wood or other hull appendages are agitating the water flow to the propeller. In addition, the **M-500** is the choice where vibration caused by resonance is a problem. The blade design reduces vibration caused by the propeller, achieving smoother and quiet cruising.

Available in NiBrAl (Nickel, Bronze, Aluminum) & Manganese Bronze. Also available cupped.

Photo courtesy of TPI Composites, Inc.

Photo courtesy of Carver Yachts

Pleasure Boat Propellers

Photo courtesy of Tiara Yachts

Photo courtesy of Larson Boats

Photo courtesy of Rampage Yachts

Photo courtesy of Pursuit Boats

Photo courtesy of Larson Boats

Photo courtesy of Cruisers Yachts

DJ355

0.56 E.A.R.
Diameter range: 9" - 18"
Pitch range: 0.7-1.1 dia/pitch ratio

DQ469

0.70 E.A.R.
Diameter range: 17" - 18"
Pitch range: 0.7-1.1 dia/pitch ratio

For smaller inboard craft, the 3 blade **DJ355** offers the best value for smooth, reliable, and quiet performance. This constant pitch, zero offset series is low maintenance, but meets the performance design criteria of a wide range of applications.

In the same design as the 3 blade, the 4 blade **DQ469** may be a more suitable choice for a particular application. Under certain loading conditions, or where full keels, tunnels, or pockets affect the water flow to the propeller, a 4 blade may be the better choice to maximize thrust and minimize noise and vibration.

Both **DJ355** and **DQ469** are available in certifiable manganese BRONZE or NiBrAl material. Standard SAE or metric bores are readily available. “Cupped” trailing edges are available in NiBrAl material.

The **DJ355** and **DQ469** are hand crafted, carefully inspected, and balanced to close tolerance. The designs offer exceptional service life, and contribute to trouble free enjoyment of boating.

Pleasure Boat Propellers

Sailer 2

0.36 E.A.R.
Diameter range: 10" - 24"

Sailer 3

0.44 E.A.R.
Diameter range: 10" - 24"

Photo courtesy of Island Packet Yachts

Photo courtesy of Island Packet Yachts

Sailboat Propellers

The **Sailer 2** fixed pitch propeller is the popular choice for sailboaters seeking to maximize sailing speed. It offers minimum drag while under sail and the power to get you where you're going when the wind stops blowing.

Our **Sailer 3** is the propeller of choice for the cruising sailboats. It offers superior dock handling maneuverability and the power to maintain speed in wind and waves when the weather gets nasty with a minimum increase in drag under sail.

For the cruiser over 30', the **MP 3** propeller has the blade area to get the job done. The thrust provided not only produces cruising performance when the sails are down, but also offers excellent maneuverability while docking.

Our 2 blade and 3 blade fixed pitch propeller series for sailboats are available in diameters of 10" through 24", in a wide range of pitch. Custom sizes are also possible. The typical material is Manganese Bronze Michalloy K, although Nibral Michalloy XX material is also available.

This series of propellers may be machined to fit a full range of metric standards as well as SAE standard Taper Shafts.

Photo courtesy of Catalina Yacht Corp.

MP 3

0.53 E.A.R.
Diameter range: 9" - 18"

Photo courtesy of Catalina Yacht Corp.

Pleasure Boat Propellers

Weedless A-C

Weedless W-C

Mud Boat Propellers

2 Blade Weedless A-C, W-C, H-D are designed for efficient, durable performance in weed-infested waters.

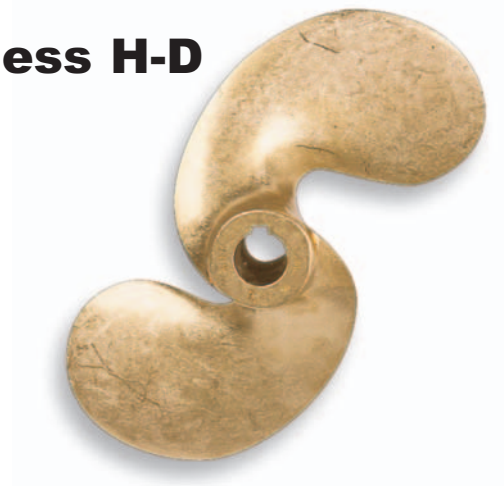
The **A-C series** is primarily for smaller air-cooled inboard engines. Diameters range from 6" to 10" with straight bores.

The **W-C series** offer heavier blades and a larger hub for water cooled engines. Diameters range from 6" to 10" with tapered bores.

The Weedless **H-D series** (heavy duty) is designed for maximum strength and durability in weed infested waters. It is designed to take on the heaviest of weeds. Diameters range from 10" to 16", with standard taper bores.

All 2 Blade Weedless propellers are Available in NiBrAl or Manganese Bronze.

Weedless H-D



For Stainless Steel 2 and 3-blade weedless propellers, contact Michigan Wheel Division, Quality Castings at 1-866-664-5443.

Pleasure/Commercial Boat Propellers

DQ Special

0.76 - 0.91 E.A.R.
Diameter range: 32" - 56"

More muscle than the traditional Dyna-Quad design through more blade area. The DQ Special is an authoritative extension of the tried and true Dyna-Quad design. This series is available in larger diameters, with area ratios suitable for today's high powered vessels. The DQ Special is an option for large superyachts as well as commercial boats operating at speed.

Available in NiBrAl or Manganese Bronze alloys.

Photo courtesy of Skipperliner

Commercial Boat Propellers

Dura-Quad

0.76 E.A.R.
Diameter range: 24" - 36"

The **Dura-Quad** is the choice for applications where more durability is desired and/or more blade area is required. The **Dura-Quad** series features the skewed and highly efficient blade design of the traditional Dyna-Quad series, with added blade thickness to optimize speed on high powered commercial applications, without sacrificing durability.

Available in NiBrAl or Manganese Bronze.

Photo courtesy of Marine Transportation Services

Photo courtesy of Marine Transportation Services

Pac-Master

0.69 E.A.R.
Even Diameters: 20" - 30"

Designed for maximum durability, the **Pac-Master** stainless steel series insures long-life running without giving up performance. Modeled from our popular Dyna-Quad pleasure series, this series provides smooth and efficient operation. The increased blade root thickness gives the **Pac-Master** series the extra durability for all commercial applications. Corrosion resistant CF3 Stainless Steel alloy is used to insure rugged, dependable operation. The **Pac-Master** keeps the work moving in the toughest conditions.

All **Pac-Masters** are available in select even diameters. Odd diameters and pitch combinations are also available upon request.

Available only in CF3 Stainless Steel alloy.

Photo courtesy of Gulf Craft, Inc.

Commercial Boat Propellers

Photo courtesy of Marine Inland Fabricators

Photo courtesy of Marine Inland Fabricators

Photo courtesy of Gulf Craft, Inc.

Machine Pitch

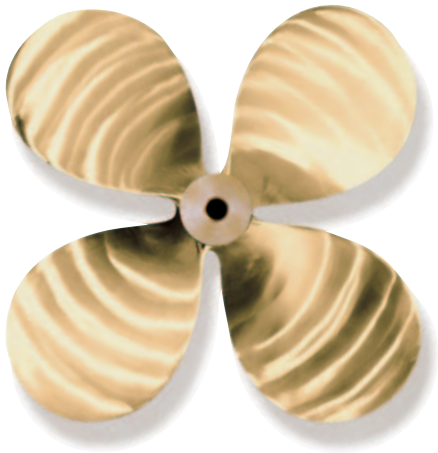
Machine Pitch (MP)/Heavy Duty (HD)

0.51 E.A.R. - Diameter range: 8" - 60"
0.47 E.A.R. - Diameter range: 62" - 96"

Machine Pitch™ (MP) is the finest and best known 3 blade for all-purpose use. The style and design is primarily used on vessels with speeds less than 15 knots. MP style propellers incorporate a semi-elliptical shape, constant pitch and ogival blade sections.

The **Heavy Duty (HD)** is identical in design to the MP, but includes thicker blade edges engineered specifically for severe conditions. Its heavy duty edges resist abrasion and blade fracture.

Available in NiBrAl, Manganese Bronze or Stainless Steel alloys.



Work Horse

0.71 E.A.R. - Diameter range: 24" - 60"
0.622 E.A.R. - Diameter range: 62" - 96"

The **Work Horse™** is the best known commercial four blade propeller in the world for its ability to push hard working boats. It is designed for tug boats, push boats, and applications requiring maximum thrust — where low speeds do not necessitate skewed blades. The semi-elliptical blade shape and constant pitch allows for excellent reverse thrust performance that is necessary in many work boat applications.

When it is time to work, the **Work Horse** delivers.

Available in NiBrAl, Manganese Bronze or Stainless steel alloys.

Trawler

0.44 E.A.R.
Diameter range: 40" - 72"

The **Trawler** series gives four blade performance without reduced diameter, and is primarily used on shrimp boats, trawlers and similar vessels that need thrust and smooth running performance.

Available in NiBrAl or Manganese Bronze alloys.

Commercial Boat Propellers

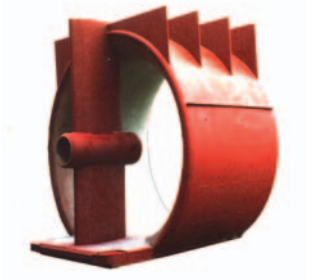
Kaplan

Standard 0.56 E.A.R., 0.71 E.A.R.
Diameter range: 35" - 95"
Custom & Skewed configurations available

The **Kaplan** propeller is designed for hard working Trawlers, Draggers and Tugs. Manufactured to operate in a nozzle, such as Michigan's ducted propeller system, the highly loaded applications can develop substantially greater thrust than open or free propellers at working speeds. The **Kaplan** system incorporates air foil sections at the inner radii and flat face ogival sections at the outer radii, for maximum thrust.

Kaplan is available in NiBrAl, Manganese Bronze or Stainless Steel alloys.

Photo courtesy of Marine Transportation Services



Nozzle Systems

With Nozzles, Trawlers and Draggers typically derive 25-30% greater thrust, while harbor tugs can easily deliver 30-40% more thrust versus open or free propellers.

Contact MWC Sales for Type 19b and Type 37 Kort Nozzles.

Maxima 3-Blade

0.63 E.A.R.
Diameter range: 26" - 50"

Maxima 4-Blade

0.836 E.A.R.
Diameter range: 26" - 50"

Photo courtesy of Breaux Brothers

Photo courtesy of Breaux Brothers

For high horsepower, moderate speed crew supply, and passenger boats that require maximum thrust, the **Maxima** series propeller delivers efficient and durable performance. The blade design is wider than the standard to provide maximum thrust for applications that require it.

Heavy-duty blade thickness distribution makes the **Maxima** the most durable of the commercial offering.

Available with 3 or 4 blade design, in NiBrAl or Manganese Bronze alloys.

Photo courtesy of Breaux Brothers

Propeller Series

The Standard series of propellers are designed to function in a non-cavitating to a partially cavitating environment. Cavitation is a water vapor cavity which forms on the surface of the hub or blade as a result of low pressure due to water flow over the blade surface. Stable cavitation is quite common on smaller performance propellers and often results in no adverse effects. Unstable cavitation can result in vibration and noise problems, or in extreme conditions, blade surface erosion. Cavitation is not necessarily bad, but needs to be controlled to avoid problems. A primary effort in sizing is to qualify an application as to the amount of blade loading (pressure in pounds per square inch), and what propeller area ratio is required.

STANDARDS

PROPELLER SERIES	EXPANDED AREA RATIO	BLADE NUMBER	SIZE RANGE, DIAMETER
DJ355	0.56	3	9" - 18"
DQ469	0.70	4	17" - 18"
DYNA-JET	0.56	3	19" - 46"
DYNA-QUAD	0.69	4	19" - 46"
DJX	0.61	3	See price list for available si
DQX	0.735	4	See price list for available si
DQX	0.81	4	See price list for available si
M-500	0.86	5	22" - 46"
MP 3	0.53	3	9" - 18"
MACHINE PITCH	0.51	3	19" - 60"
MACHINE PITCH	0.47	3	62" - 96"
WORK HORSE	0.71	4	24" - 60"
WORK HORSE	0.622	4	62" - 96"
DQ SPECIAL	0.76 to 0.91	4	32" - 56"
DURA-QUAD	0.76	4	24" - 36"
PAC-MASTER	0.69	4	20" - 30"
MAXIMA 3	0.63	3	26" - 50"
MAXIMA 4	0.836	4	26" - 50"
TRAWLER	0.44	4	40" - 72"
KAPLAN	0.56, 0.76, Custom	4	35” - 95”

Too much blade area can reduce the efficiency of a propulsion system because the more the area, the more drag. There are ranges of loading that will predicate which of the Michigan Propeller configurations could be used. Typically, this ranges from the 3 blade on moderately sized boats through 40'), 4 blade on mid-range to larger (40'-100'), with 5 blade coming into play where there is extreme blade loading and compromise of diameter. There may be over-riding considerations in selecting a 4 or 5 blade over a 3 blade, such as maximizing vibration reduction.

On moderately sized boats, generally speaking, if optimal diameter is possible with adequate tip clearance, a 3 blade will yield the best top end speed. However, the choice of a 4 blade may provide similar cruising speed, and may offer a more comfortable ride, with less vibration. With an increase in blade number, the "blade rate frequency" increases for a given shaft RPM. In general, the higher the blade rate frequency, the less problematic vibration is. On the larger, heavier applications, with higher gear ratios, the loading requires greater area ratios, and 4 or 5 bladed propellers have a better speed potential. Properly matching propeller area ratio to an application will optimize propulsion and reduce the possibility of destructive cavitation erosion.

	SPECIFICATIONS
	Skewed Blade Shape, Standard Thickness
	Skewed Blade Shape, Standard Thickness
	Skewed Blade Shape, Standard Thickness
	Skewed Blade Shape, Standard Thickness
izes.	High Skewed Blade Shape, Standard Thickness
izes.	High Skewed Blade Shape, Standard Thickness
izes.	High Skewed Blade Shape, Standard Thickness
	Skewed Blade Shape, Standard Thickness
	Symmetric Blade Shape, Standard Thickness
	Symmetric Blade Shape, Standard and Heavy Duty Thickness
	Symmetric Blade Shape, Standard and Heavy Duty Thickness
	Semi-Elliptical Blade Shape, Standard and Heavy Duty Thickness
	Semi-Elliptical Blade Shape, Standard and Heavy Duty Thickness
	Skewed Blade Shape, Standard Thickness
	Skewed Blade Shape, Heavy Duty Thickness
	Skewed Blade Shape, Stainless Steel, Heavy Duty Thickness
	Symmetric Blade Shape, Heavy Duty Thickness
	Symmetric Blade Shape, Heavy Duty Thickness
	Elliptical Blade Shape, Standard Thickness
	Kaplan Shape, Standard Thickness

Manufacturing Process

From design to final finish, Michigan Propellers has complete pattern making capacity, in wood, metal and plastic.

Whatever Your Particular Demands, Michigan Propellers Can Fit You With The Right Propeller.

Michigan Wheel Corporation has one goal — to produce the finest propellers possible, while maintaining the highest standards of quality.

Michigan Propeller standard series offerings are available, affordable, and readily repairable. Stocking distributors throughout North America and Europe carry a wide variety of diameter and pitch ranges. For immediate availability worldwide, Michigan Propellers provides a highly successful “field needs” service at no charge, which will locate a particular description of propeller in distributors’ stock to meet a customer’s needs. With lead time to manufacture, Michigan Wheel Corporation is experienced in handling custom orders and in export.

Michigan Propellers pattern vaults are unsurpassed in the variety of available propeller patterns.

Melt temperatures are critical, and tightly controlled on the special alloys used in Michigan Propellers foundry.

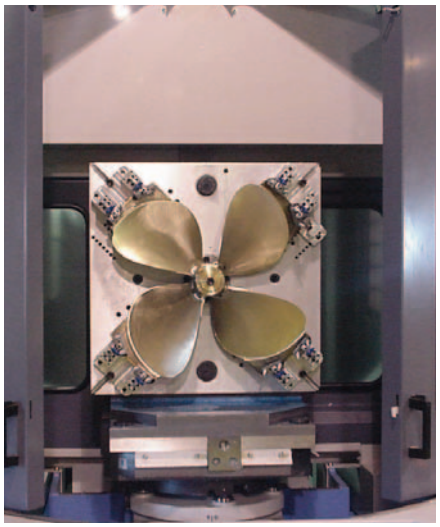
The use of “no bake” sand in molding larger Michigan Propeller patterns results in accurate castings.

Standard series propellers are manufactured on a volume production basis, through which are appreciated certain economies. With this volume, Michigan Propellers offers excellent value on a price/function ratio. Even with the volume, each propeller is CNC machined, or hand-crafted by the most experienced craftsmen in the world.

Authorized repair facilities throughout North America, Europe and other areas of the world have worked with Michigan Propeller product typically for decades. Such repair facilities are experienced and proficient in repair maintenance on our standard series propellers. In your maintenance or reconditioning requirements, be sure that the shop you use is Michigan certified; contact Michigan Wheel Corporation for the location closest to you.

A variety of machining equipment operated by skilled machinists assures accurate propeller bores, SAE and metric.

Each hand-crafted or machine finished propeller blade is templated, and each propeller is checked for pitch, spacing and track in process, to insure accuracy of the final product. Balancing equipment is located and used in each step of the finishing process.



High speed machining

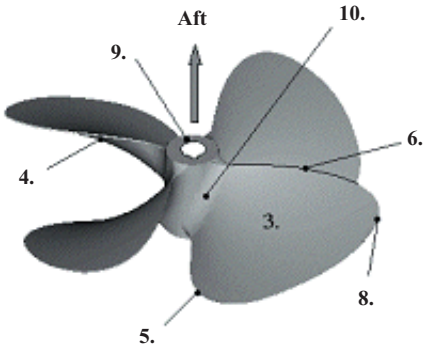
In process and final inspection with gauges, pitchometer, and computerized inspection (MRI), equipment insures production accuracy.

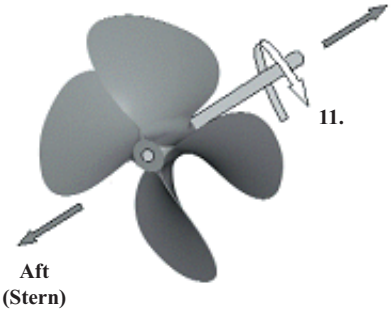
Computer generated carton labels, keyed off the part number, accurately identify critical information on each propeller that is packed.

Propeller Terms and Definitions

No.	TERM	DEFINITION
1.	Diameter	The diameter of the imaginary circle scribed by the blade tips as the propeller rotates.
2.	Radius	The distance from the axis of rotation to the blade tip. The radius multiplied by two is equal to the diameter.
3.	Blade Face	Pressure Side, Pitch Side. Aft side of the blade (surface facing the stern).
4.	Blade Back	Suction Side. Forward side of the blade (surface facing the bow).
5.	Leading Edge	The edge of the propeller blade adjacent to the forward end of the hub. When viewing the propeller from astern, this edge is furthest away. The leading edge leads into the flow when providing forward thrust.
6.	Trailing Edge	The edge of the propeller adjacent to the aft end of the hub. When viewing the propeller from astern, this edge is closest. The trailing edge retreats from the flow when providing forward thrust.
7.	Blade Number	Equal to the number of blades on the propeller.
8.	Blade Tip	Maximum reach of the blade from the center of the hub. Separates the leading and trailing edges.
9.	Hub	Solid cylinder located at the center of the propeller. Bored to accommodate the engine shaft. Hub shapes include cylindrical, conical, radius, & barreled.
10.	Blade Root	Fillet area. The region of transition from the blade surfaces and edges to the hub periphery. The area where the blade attaches to the hub.
11.	Rotation (Right hand shown here)	When viewed from the stern (facing forward):Right-hand propellers rotate clockwise to provide forward thrust.Left-hand propellers rotate counter-clockwise to provide forward thrust.
12.	Pitch	The linear distance that a propeller would move in one revolution with no slippage.
13.	Cylindrical Section	A cross section of a blade cut by a circular cylinder whose centerline is the propeller axis of rotation.
14.	Pitch Reference Line	Reference line used to establish the geometric pitch angle for the section. This line may pass through the leading and trailing edges of the section and may be equivalent to the chord line.
15.*	Geometric Pitch Angle, a	The angle between the pitch reference line and a line perpendicular to the propeller axis of rotation.
16.*	Controllable Pitch Propeller	The propeller blades mount separately on the hub, each on an axis of rotation, allowing a change of pitch in the blades and thus the propeller.
17.*	Fixed Pitch Propeller	The propeller blades are permanently mounted and do not allow a change in the propeller pitch.
18.*	Constant Pitch Propeller	The propeller blades have the same value of pitch from root to tip and from leading edge to trailing edge.
19.*	Variable Pitch Propeller	The propeller blades have sections designed with varying values of local face pitch on the pitch side or blade face.
20.*	Rake	The fore or aft slant of a blade with respect to a line perpendicular to the propeller axis of rotation.
20a.	Aft Rake	Positive Rake. Blade slant towards aft end of hub.
20b.	Forward Rake	Negative Rake. Blade slant towards forward end of hub.
21.	Track	The absolute difference of the actual individual blade rake distributions to the other blade rake distributions. Always a positive value and represents the spread between individual blade rake distributions.
22.*	Skew	The transverse sweeping of a blade such that viewing the blades from fore or aft shows an asymmetrical shape.
22a.	Aft Skew	Positive Skew. Blade sweep in direction opposite of rotation.
22b.	Forward Skew	Negative Skew. Blade sweep in same direction as rotation.
23.	Cup	Small radius of curvature located on the trailing edge of blade.

* denotes terms that do not have a graphic representation to aid in definition.





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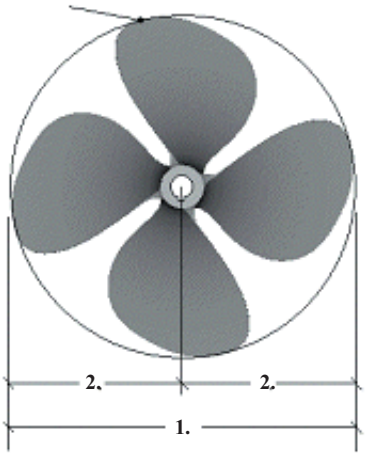
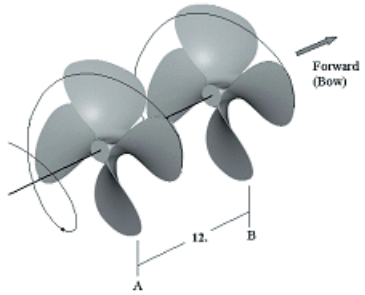
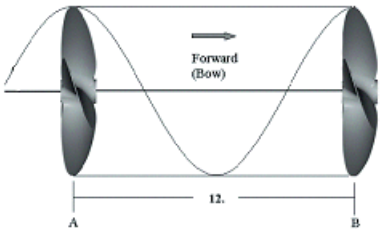
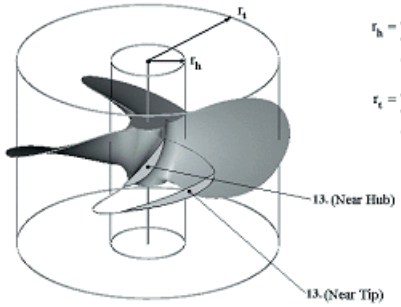


7. Blade Number = 4

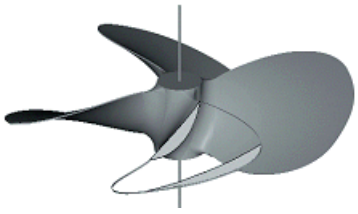


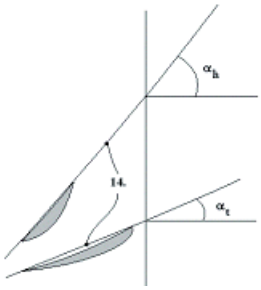


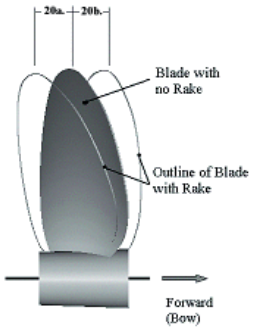


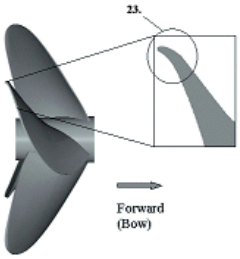
r_h = The radius of a cutting cylinder near the hub. The cylindrical section near the hub is located on the surface of this cylinder.

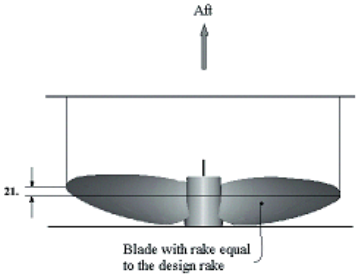
r_t = The radius of a cutting cylinder near the tip. The cylindrical section near the tip is located on the surface of this cylinder.

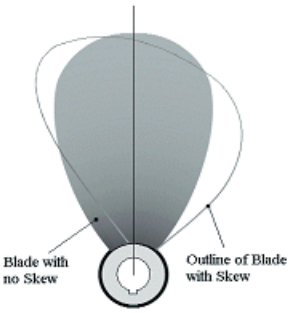


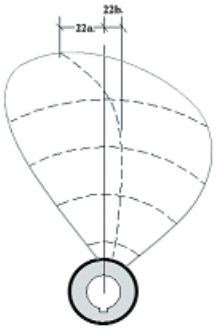












Michigan Wheel Corporation

Michigan propellers

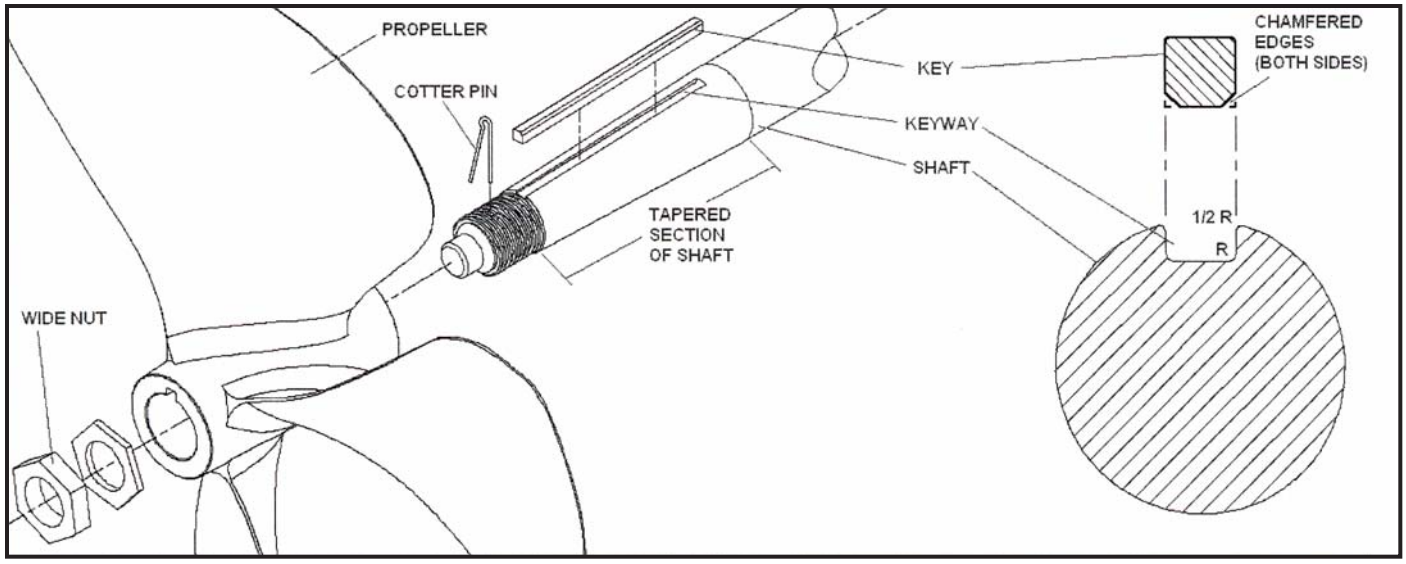
1501 Buchanan Avenue SW
Grand Rapids, MI 49507-1697

Phone # (616) 452-6941
Fax # (616) 247-0227

INBOARD PROPELLER INSTALLATION PROCEDURES

1. Push propeller snugly onto shaft taper WITHOUT key in either keyway (propeller or shaft).
2. Make sure the propeller is snug and there is no side to side movement by gently moving propeller back and forth.
3. Make a line on the shaft with a non-graphite marker at the forward end of the propeller where it stops up against the shaft taper.
4. Remove Propeller.
5. Put key into keyway on shaft taper with radiused or chamfered corners (down) in shaft keyway (if propeller shaft keyway has radiused corners).
6. Put propeller onto shaft taper.
7. Check to see that the propeller moves back to the forward line made in Step 3. If it does, skip down to Step 8. If not, perform the following:
   a. Remove propeller from shaft.
   b. Place a file on a flat surface area or work bench.
   c. Run opposite end of chamfered key back and forth over file (to remove any burrs) with a downward pressure on key until side being filed is clean.
   d. Install cleaned key in shaft keyway with chamfered corner side down in shaft (the cleaned, filed side up in keyway).
   e. Replace the propeller on the shaft and fit snugly on taper. Check to see if it reaches the line made as in Step 7. If it does not line up then repeat “Steps a. through e.”.

   NOTE: A vise can be used to hold key and then filed, but care must be taken not to tighten too much, causing burrs and irregularities on key.
8. When propeller hub moves to correct position, install propeller nut on shaft and torque to seat the propeller. Install the torque jam nut also, if your shaft is so equipped.
9. Install cotter pin at end of the shaft.



APPROVED S.A.E. STANDARD DIMENSIONS FOR SHAFTS ¾ TO 3 INCHES IN DIAMETER

Nom Shaft Dia.	Diameter Small End B		Taper Length	Keyway Width D			Keyway Side Depth [a] E			Keyway Fillet Radius [b] R	Thread [c] F		End of Taper to End of Thd	Ext. Beyond Taper	Undercut		Dia. of Pin end	Lgth. of Pin end	Cotter-Pin Hole		Cotter-Pin, Q		Nuts [d]			Keyway Length
A	Min.	Max	C	Nom	Min	Max	Nom	Min	Max		Dia.	Tpi	G	H	J	K	L	M	N	(drill) P	Nom dia.	Length	Size	Plain thick, T	Jamb thick, W	X
¾	0.624	0.626	2	3/16	0.1865	0.1875	3/32	0.095	0.097	1/32	½	13	1 1/16	1 5/16	25/64	⅛	⅜	¼	1 9/64	9/64	⅛	¾	½ -13	½	5/16	1½
⅞	0.726	0.728	2 3/8	¼	0.249	0.250	⅛	0.125	0.127	1/32	⅝	11	1¼	1½	31/64	⅛	7/16	¼	1 21/64	9/64	⅛	¾	⅝ -11	⅝	⅜	1 25/32
1	0.827	0.829	2¾	¼	0.249	0.250	⅛	0.125	0.127	1/32	¾	10	1 7/16	1¾	19/32	⅛	½	5/16	1 33/64	9/64	⅛	1	¾ -10	¾	7/16	2⅛
1⅛	0.929	0.931	3⅛	¼	0.249	0.250	⅛	0.125	0.127	1/32	¾	10	1 7/16	1¾	19/32	⅛	½	5/16	1 33/64	9/64	⅛	1	¾ -10	¾	7/16	2⅛
1¼	1.030	1.032	3½	5/16	0.3115	0.3125	5/32	0.157	0.160	1/16	⅞	9	1⅝	2	23/32	⅛	⅝	⅜	1 23/32	11/64	5/32	1¼	⅞ -9	⅞	½	2 13/16
1⅜	1.132	1.134	3⅞	5/16	0.3115	0.3125	5/32	0.157	0.160	1/16	1	8	1 13/16	2¼	13/16	⅛	¾	7/16	1 29/32	11/64	5/32	1½	1 - 8	1	9/16	3 3/16
1½	1.233	1.235	4¼	⅜	0.374	0.375	3/16	0.189	0.192	1/16	1⅛	7	2	2 7/16	29/32	3/16	⅞	7/18	2 3/32	11/64	5/32	1½	1⅛-7	1⅛	⅝	3½
1¾	1.437	1.439	5	7/16	0.4365	0.4375	7/32	0.219	0.222	1/16	1¼	7	2¼	2¾	1 1/32	3/16	1	½	2 23/64	13/64	3/16	1¾	1¼-7	1¼	¾	4 7/32
2	1.640	1.642	5¾	½	0.499	0.500	¼	0.251	0.254	1/16	1½	6	2⅝	3⅛	1¼	3/16	1¼	½	2 47/64	13/64	3/16	2	1½-6	1½	⅞	4 15/16
2¼	1.843	1.845	6½	9/16	0.5610	0.5625	9/32	0.281	0.284	3/32	1¾	5	3	3½	1⅜	3/16	1⅜	½	3 9/64	17/64	¼	2¼	1¾-5	1¾	1	5⅝
2½	2.046	2.048	7¼	⅝	0.6235	0.625	5/16	0.312	0.315	3/32	1¾	5	3	3½	1 7/16	3/16	1 7/16	½	3 9/64	17/64	¼	2¼	1¾-5	1¾	1	6 3/32
2¾	2.257	2.259	7⅞	⅝	0.6235	0.625	5/16	0.313	0.316	3/32	2	4½	3½	4	1 11/16	¼	1 11/16	½	3 41/64	17/64	¼	2½	2-4½	2	1⅛	6 21/32
3	2.460	2.462	8⅝	¾	0.7485	0.750	5/16	0.311	0.314	3/32	2¼	4½	3⅞	4⅜	1 15/16	¼	1 15/16	½	4 1/64	17/64	¼	3	2¼-4½	2¼	1¼	7 11/32

DIMENSIONS OF SHAFTS FROM 3¼ TO 8 INCHES IN DIAMETER

Nom Shaft Dia.	Diameter Small End B		Taper Length	Keyway Width D			Keyway Side Depth [a] E			Keyway Fillet Radius R	Thread [c] F		End of Taper to End of Thd	Ext. Beyond Taper	Undercut		Dia. of Pin end	Lgth. of Pin end	Cotter-Pin Hole		Cotter-Pin, Q		Nuts [d]			Sleeve Dia. [e] U		Clear-ance	Keyway Length
A	Min.	Max	C	Nom	Min	Max	Nom	Min	Max		Dia.	Tpi	G	H	J	K	L	M	N	(drill) P	Nom dia.	Length	Size	Plain thick, T	Jamb thick, W	Min	Max	Z	X
3¼	2.663	2.665	9⅜	¾	0.7485	0.750	5/16	0.311	0.314	⅛	2½	4	4⅜	5⅛	2⅛	⅜	2⅛	¾	4 37/64	⅜	⅜	3	2½-4	2½	1½	3.870	3.872	⅜	8½
3½	2.866	2.868	10⅛	⅞	0.8735	0.875	5/16	0.310	0.313	⅛	2½	4	4⅜	5⅛	2⅛	⅜	2⅛	¾	4 37/64	⅜	⅜	3	2½-4	2½	1½	4.120	4.122	⅜	9¼
3¾	3.069	3.071	10⅞	⅞	0.8735	0.875	5/16	0.310	0.313	⅛	2¾	4	4¾	5½	2⅜	⅜	2⅜	¾	4 61/64	⅜	⅜	3½	2¾-4	2¾	1⅝	4.369	4.371	⅜	10
4	3.272	3.274	11⅝	1	0.9985	1.000	5/16	0.309	0.312	⅛	3	4	5⅛	5⅞	2½	⅜	2½	¾	5 21/64	⅜	⅜	3½	3 - 4	3	1¾	4.619	4.621	⅜	10½
4½	3.827	3.829	10¾	1⅛	1.123	1.125	⅜	0.373	0.376	5/32	3¼	4	5⅝	6⅜	2¾	⅜	2¾	¾	—	—	—	—	3¼-4	3¼	1⅞	5.243	5.245	½	9⅝
5	4.249	4.251	12	1¼	1.248	1.250	7/16	0.434	0.437	3/16	3¾	4	6⅜	7⅛	3¼	⅜	3¼	¾	—	—	—	—	3¾-4	3¾	2⅛	5.993	5.995	½	10⅞
5½	4.671	4.673	13¼	1¼	1.248	1.250	7/16	0.435	0.438	3/16	4	4	6¾	7¾	3½	½	3½	1	—	—	—	—	4 - 4	4	2¼	6.492	6.494	½	12⅛
*6	4.791	4.793	14½	1⅜	1.373	1.375	½	0.493	0.496	7/32	4¼	4	7½	8½	3⅞	½	3⅞	1	—	—	—	—	4¼-4	4¼	2¼	6.992	6.994	½	13¼
*6½	5.187	5.189	15¾	1⅜	1.373	1.375	½	0.494	0.497	7/32	4½	4	8¼	9¼	4⅜	½	4⅜	1	—	—	—	—	4½-4	9½	2½	7.492	7.494	½	14⅜
*7	5.582	5.584	17	1½	1.498	1.500	9/16	0.555	0.558	¼	5	4	9	10	4⅞	½	4⅞	1	—	—	—	—	5 - 4	5	2¾	8.117	8.120	½	15⅝
*7½	5.978	5.980	18¼	1½	1.498	1.500	9/16	0.556	0.559	¼	5½	4	9⅜	10⅜	5⅛	½	5⅛	1	—	—	—	—	5½-4	5½	3	8.616	8.619	½	16⅞
*8	6.374	6.376	19½	1¾	1.748	1.750	9/16	0.553	0.556	¼	5¾	4	9¾	10¾	5⅜	½	5⅜	1	—	—	—	—	5¾-4	5¾	3⅛	9.240	9.243	½	18⅛

* 6" through 8" shaft has 1 inch per foot taper, 1/12" per inch taper. Angle with centerline is 2° 23' 9".

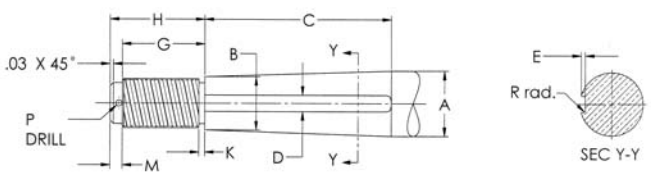
a Keyway shall be cut parallel to taper.

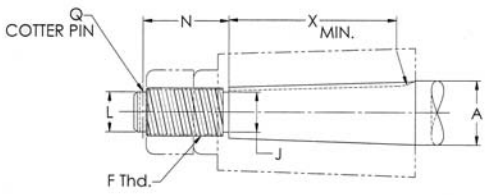
b Fillets are recommended for keyways in shafts through 2" in diameter. fillets are mandatory for shafts above 2" in diameter.

c Threads are Unified and American Standard, Class 3A..

d Nuts are to be semi-finished stock, American Standard B18.2.

e The shaft sleeve shown is recommended practice, but the use of a sleeve is optional.



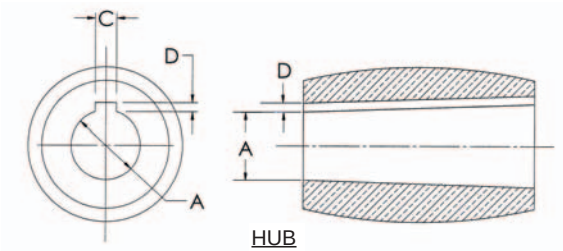


MARINE PROPELLERS HUB BORE DIMENSIONS

Taper: Per Foot = ¾"
Per Inch - 1/16" Angle with centerline = 1° 47' 24"

Std. Taper	Dia. Small End "A"		Keyway Width "C"			Keyway Side Depth "D"		
	Min.	Max.	Nom.	Min.	Max.	Nom.	Min.	Max.
¾	0.608	0.610	3/16	0.1865	0.1875	3/32	0.098	0.100
⅞	0.710	0.712	¼	0.249	0.250	⅛	0.129	0.131
1	0.812	0.814	¼	0.249	0.250	⅛	0.129	0.131
1⅛	0.913	0.915	¼	0.249	0.250	⅛	0.129	0.131
1¼	1.015	1.017	5/16	0.3115	0.3125	5/32	0.162	0.165
1⅜	1.116	1.118	5/16	0.3115	0.3125	5/32	0.161	0.164
1½	1.218	1.220	⅜	0.374	0.375	3/16	0.195	0.198
1¾	1.421	1.423	7/16	0.4365	0.4375	7/32	0.226	0.229
2	1.624	1.626	½	0.499	0.500	¼	0.259	0.262
2¼	1.827	1.829	9/16	0.561	0.5625	9/32	0.291	0.294
2½	2.030	2.032	⅝	0.6235	0.625	5/16	0.322	0.325
2¾	2.233	2.235	⅝	0.6235	0.625	5/16	0.322	0.325
3	2.437	2.439	¾	0.7485	0.750	5/16	0.323	0.326
3¼	2.640	2.642	¾	0.7485	0.750	5/16	0.323	0.326
3½	2.843	2.845	⅞	0.8735	0.875	5/16	0.324	0.327
3¾	3.046	3.048	⅞	0.8735	0.875	5/16	0.324	0.327
4	3.249	3.251	1	0.9985	1.000	5/16	0.326	0.329
4½	3.796	3.798	1⅛	1.123	1.125	⅜	0.388	0.391
5	4.218	4.220	1¼	1.248	1.250	7/16	0.450	0.453
5½	4.640	4.642	1¼	1.248	1.250	7/16	0.450	0.453
*6	4.749	4.751	1⅜	1.373	1.375	½	0.517	0.520
*6½	5.145	5.147	1⅜	1.373	1.375	½	0.516	0.519
*7	5.541	5.543	1½	1.498	1.500	9/16	0.579	0.582
*7½	5.937	5.939	1½	1.498	1.500	9/16	0.579	0.582
*8	6.332	6.334	1¾	1.748	1.750	9/16	0.582	0.585

Overseas specifications on request.



PROPELLER BORING

To insure retention of inherent factory accuracy, order your propeller factory-bored whenever possible. When bored in the field, propellers should be bored to the pilot hole, NOT to the hub or blade edges.

* 6" through 8" shaft has 1 inch per foot taper, 1/12" per inch taper. Angle with centerline is 2° 23' 9".

MARINE PROPELLER SHAFT END DIMENSIONS