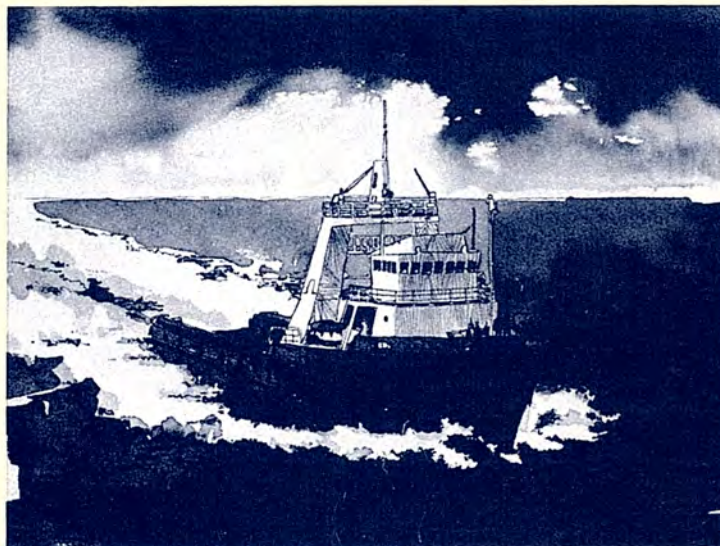
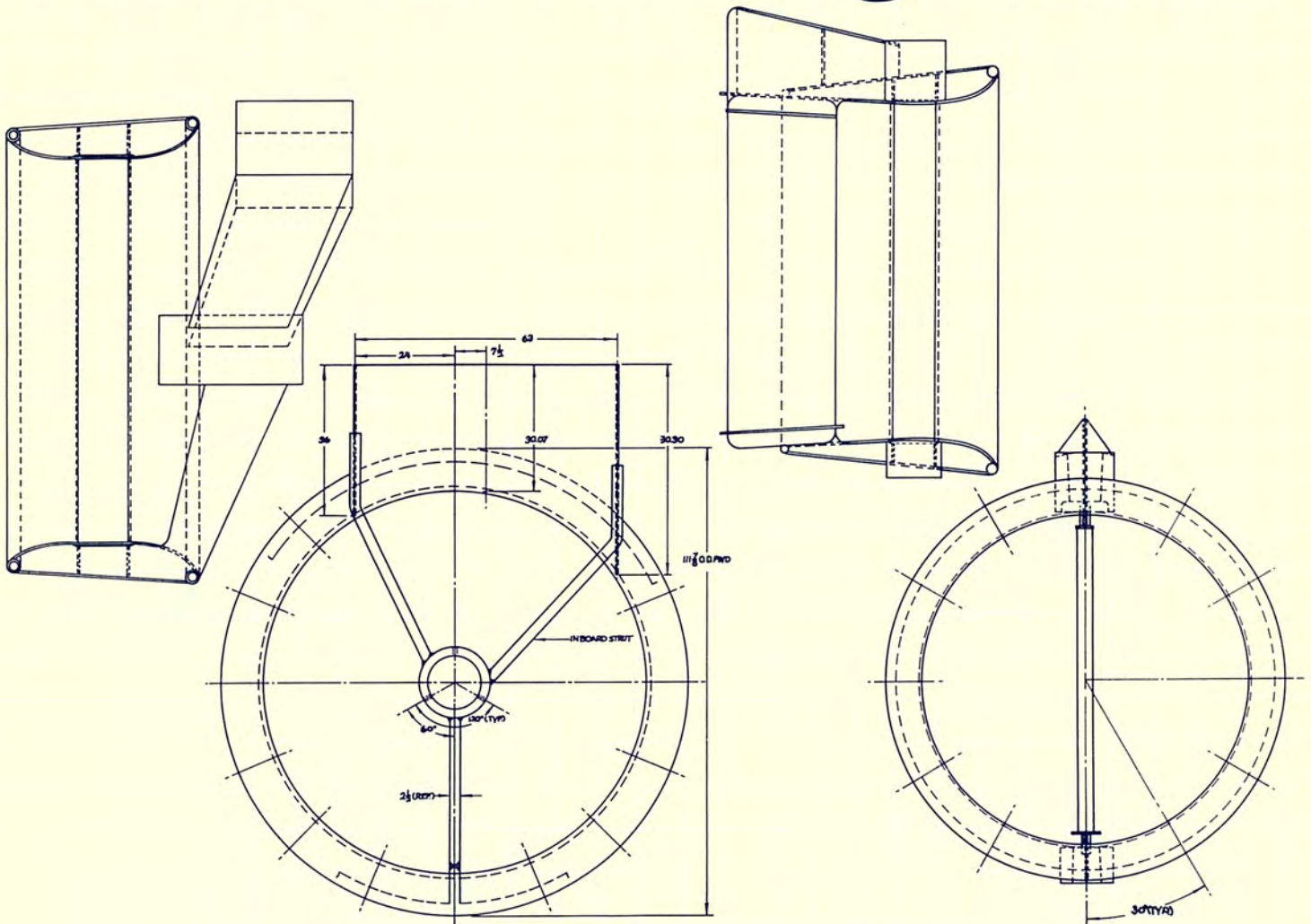


# Michigan Wheel Fixed and Steering Nozzles



**Michigan Wheel Corporation**  
WORLD LEADERS IN PROPULSION AND MARINE MANEUVERABILITY SYSTEMS

# Michigan Wheel Fixed and Steering Nozzles

The economical way to increase thrust efficiency.  
With less power.

As you face increasing pressures to operate your vessels more efficiently and profitably, you also face a critical decision on the method of propulsion you will depend on for the future.

Open propellers. Or ducted propulsion.

The traditional open propeller method is a proven way to operate efficiently. If speed is your primary concern.

However, if you face a need to improve thrust, stopping ability, and reduce vibration levels, it makes better sense to consider installing a Michigan Wheel fixed or steering nozzle system.

The economics of a ducted propeller system are significant. The performance, exceptional.

instances, you can achieve the performance and thrust you desire with a smaller engine. Which means you save money on the initial cost of the engine, plus the cost of fuel in service. Because smaller engines use less fuel than would be required with a standard open propeller.

If you're considering retrofitting an older vessel, you can de-rate the engine and still maintain the thrust and maneuverability you need. Which lowers operating costs because less fuel is consumed.

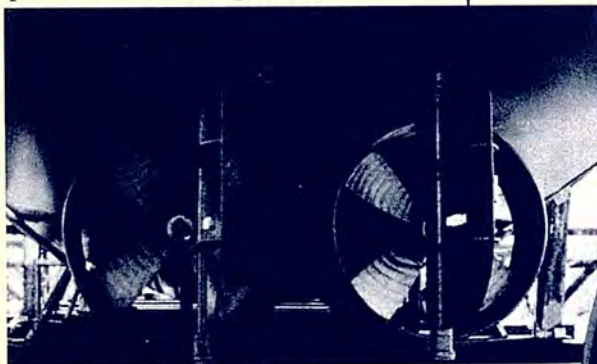
One trawler owner found, for example, that with a Michigan

Wheel ducted propulsion system, he achieved the same trawling thrust while using less power, thereby reducing fuel consumption by 20%!

**2. A ducted propulsion system provides improved thrust with the same power plant.**

A study of the history of nozzle application and replacement of open propulsion indicates that you can significantly improve thrust at low operating speeds if you retain the same power plant you're now using. You also improve operating efficiency and lower costs in the process.

Trawlers with nozzles typically derive 25-35% greater thrust, so



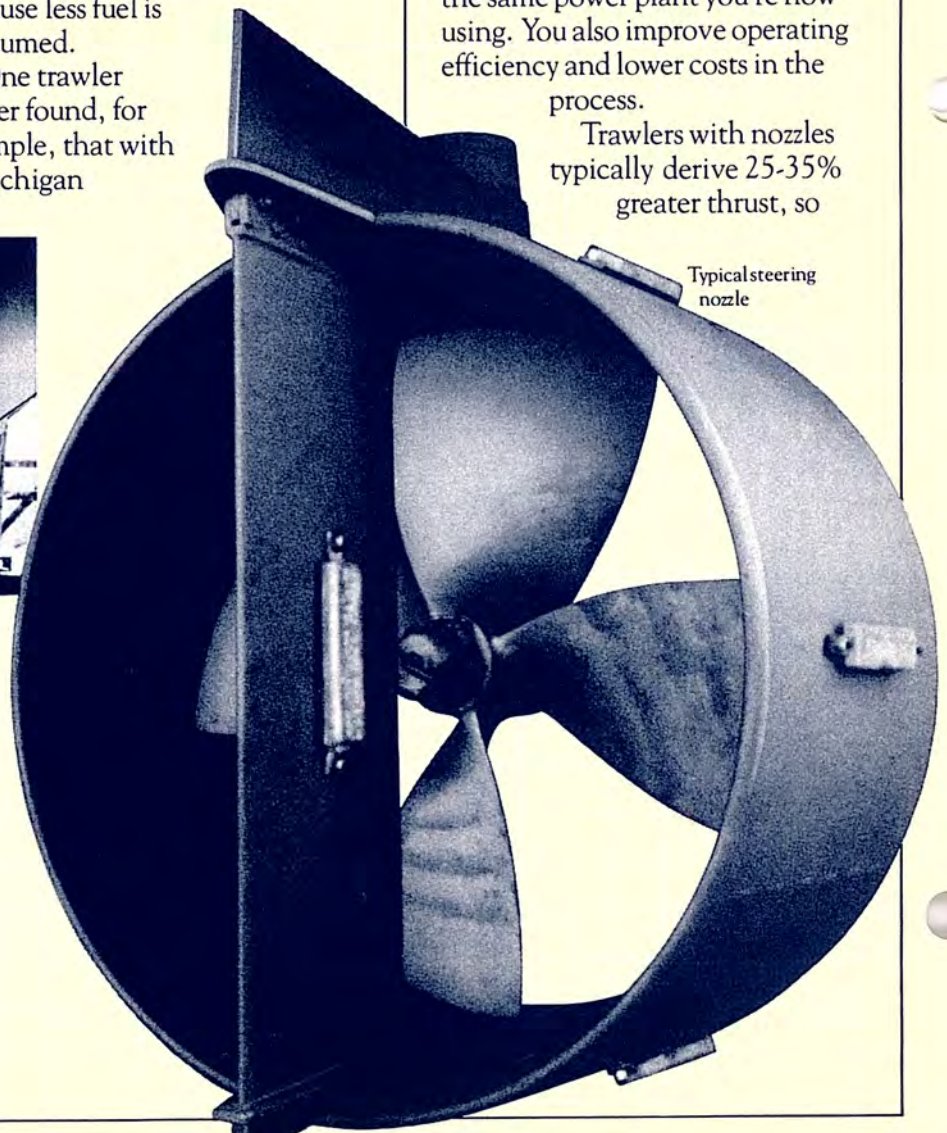
Typical fixed nozzle system

## The Advantages of a Michigan Wheel Ducted Propulsion System

As fuel consumption and operating costs escalate, the addition of a ducted propulsion system can offer significant economic and performance benefits:

**1. A ducted propulsion system requires less power to achieve the thrust you desire.**

If you're considering the construction of new vessels, in many



Typical steering nozzle

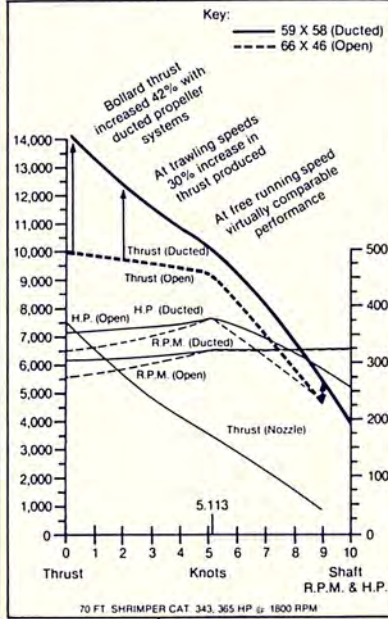
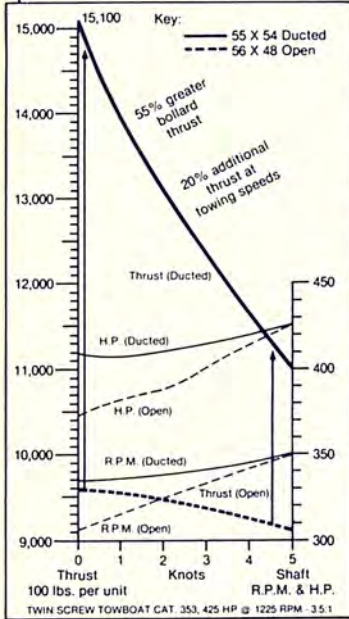
they can work with larger nets. Towboats can push or pull more barges. Harbor tugs can achieve up

**4. Many ducted propulsion systems reduce vibration and noise, and improve stopping ability.**

solutions to significantly improved maneuverability.

**6. Michigan Wheel's exceptional engineering and design resources assure you that you get the most efficient propulsion system available.**

Before we recommend the specific ducted system for your application, we carefully evaluate the propulsion requirements, the conditions, the demands, and the costs—using modern nozzle technologies and model test research. The results are programmed on high-speed computers so our recommendations can be completed quickly and accurately.



Because water is accelerated more uniformly through the nozzle, you reduce the vibration that normally can be encountered with open propulsion. Noise levels and wake vibrations are also reduced.

Stopping ability is improved, as well, because the nozzle of the ducted system acts as a sea anchor.

to 50% more bollard thrust, relative to open propellers, when moving ships.

The improved thrust you achieve with a ducted propeller system can quickly make a difference in your overall profit picture. Now, and in the future.

**3. A ducted propulsion system reduces operating costs significantly.**

In addition to reduced fuel consumption, a Michigan Wheel ducted propeller system offers benefits that will contribute to decreased operating costs.

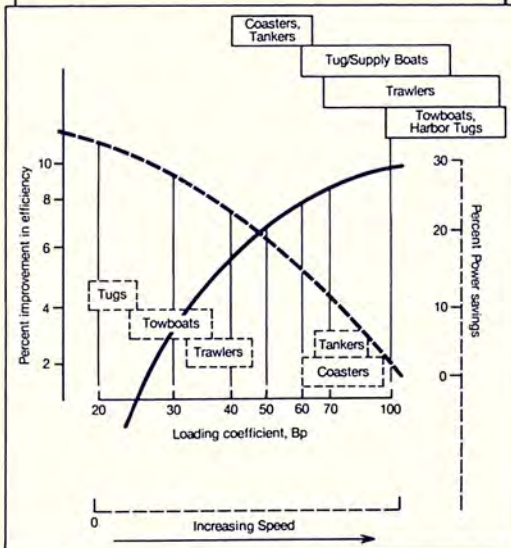
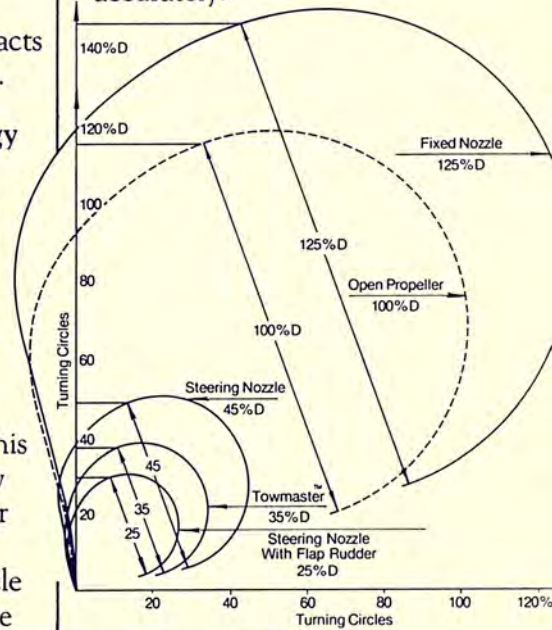
Because the propeller is ducted and protected, you reduce, or even eliminate, net damage. Also, you reduce the costs of repair to damaged propellers.

Because of the efficiency of Michigan Wheel engineering and production (our nozzles are fabricated from fewer individual parts, which saves time and money), Michigan Wheel nozzles require less initial cost than competitive nozzle systems.

**5. With recent rudder technology innovations, Michigan Wheel fixed and steering nozzles offer significantly improved turning ability.**

Particularly at low speeds, fixed nozzles with Towmaster™ rudder systems or steering nozzles with slave flap rudders result in significantly reduced turning circles. This improved maneuverability is only exceeded by azimuthing (360°) or rotatable propulsive systems.

Towmaster™ and steering nozzle systems are the most cost-effective

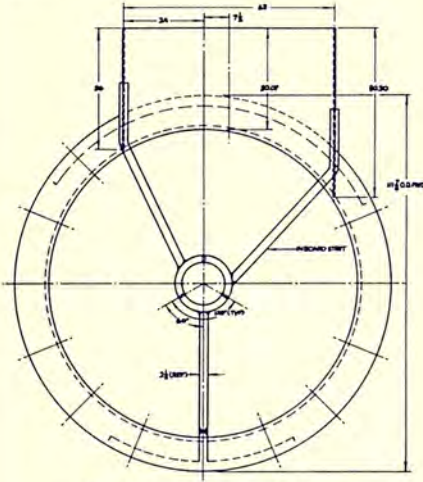


**The Fixed Nozzle System**

As we've indicated earlier, the advantages of the fixed nozzle system clearly outweigh the advantages of the open propulsion system in applications where thrust and fuel efficiency are primary concerns.

It is a system that works efficiently for trawlers, towboats, shrimpers, druggers, and harbor tugs, to name but a few.

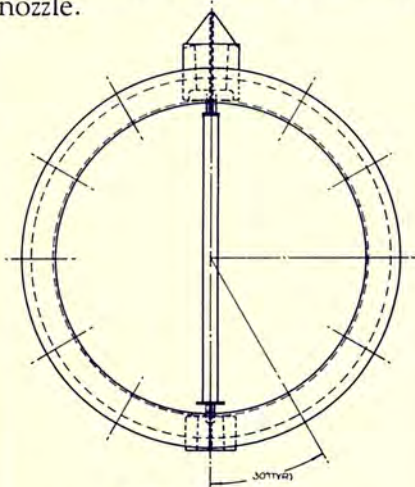
Fixed nozzles in conjunction with Towmaster™ rudder systems will yield significantly improved maneuverability. For a more complete description of the Michigan Wheel Towmaster™ rudder system, refer to the brochure on that subject.



Fixed nozzle with attached struts

## The Steering Nozzle System

Vessel owners and designers, who require the increased thrust and operating efficiencies the fixed nozzle system offers, plus a high degree of maneuverability, should take a careful look at the steering nozzle.



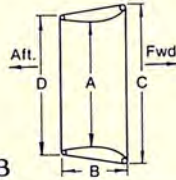
Typical steering nozzles

Michigan Wheel steering nozzles offer increased maneuverability for applications that require close turning in tight circumstances. And you accomplish these maneuvers with minimum loss of thrust during turning.

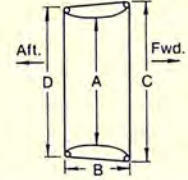
The nozzle is mounted on a shaft and turned hydraulically. Each system is custom-engineered by Michigan Wheel's staff.

## The Kaplan Type Propeller

Nozzle Dimensions.



NSMB Type 19-B



NSMB Type 37

Principal Dimensions				Approx. Net Wgt. (lbs.)
A	B	C	D	
36"	18"	43.60"	38.16"	300
40"	20"	48.45"	42.40"	585
44"	22"	53.30"	46.64"	870
46"	23"	55.72"	48.75"	1000
48"	24"	58.14"	50.88"	1150
52"	26"	62.98"	55.12"	1425
54"	27"	65.41"	57.24"	1600
56"	28"	67.83"	59.36"	1725
60"	30"	72.68"	63.60"	2000
64"	32"	77.52"	67.84"	2450
68"	34"	82.36"	72.08"	2850
72"	36"	87.21"	76.32"	3150
76"	38"	92.06"	80.56"	3650
80"	40"	96.90"	84.80"	4150
84"	42"	101.74"	89.04"	5050
88"	44"	106.59"	93.28"	5800
92"	46"	111.44"	97.52"	6500
96"	48"	116.28"	101.76"	7500
100"	50"	121.12"	106.00"	8500
104"	52"	125.97"	110.24"	9600
108"	54"	130.82"	114.48"	11000
112"	56"	135.66"	118.72"	12250
116"	58"	140.50"	122.96"	13750
120"	60"	145.35"	127.20"	16000
124"	62"	150.20"	131.44"	18000
128"	64"	155.04"	135.68"	20000
132"	66"	159.88"	139.92"	23000

Principal Dimensions				Approx. Net Wgt. (lbs.)
A	B	C	D	
36"	18"	43.80"	41.67"	300
40"	20"	48.67"	46.30"	585
44"	22"	53.53"	50.93"	870
46"	23"	55.97"	53.24"	1000
48"	24"	58.40"	55.56"	1150
52"	26"	63.27"	60.19"	1425
54"	27"	65.70"	62.51"	1600
56"	28"	68.14"	64.82"	1725
60"	30"	73.00"	69.45"	2000
64"	32"	77.87"	74.08"	2450
68"	34"	82.74"	78.71"	2850
72"	36"	87.60"	83.34"	3150
76"	38"	92.47"	87.97"	3650
80"	40"	97.34"	92.60"	4150
84"	42"	102.20"	97.23"	5050
88"	44"	107.07"	101.86"	5800
92"	46"	111.94"	106.49"	6500
96"	48"	116.80"	111.12"	7500
100"	50"	121.67"	115.75"	8500
104"	52"	126.54"	120.38"	9600
108"	54"	131.40"	125.01"	11000
112"	56"	136.27"	129.64"	12250
116"	58"	141.14"	134.27"	13750
120"	60"	146.00"	138.90"	16000
124"	62"	150.87"	143.53"	18000
128"	64"	155.74"	148.16"	20000
132"	66"	160.60"	152.79"	23000

Whether it be a fixed or steering nozzle, one of the most important components of the Michigan Wheel ducted propulsion system is the Kaplan-type propeller. Primarily designed for highly loaded applications in a ducted configuration, the Kaplan-type propeller offers significantly greater thrust than conventional propeller designs.

either Michalloy K, Ni-Bral, or stainless steel. Michalloy K provides high tensile and yield strength, plus good elongation. Ni-Bral provides greater strength with somewhat less elongation, relative to manganese bronze, and is excellent in applications involving high horsepower and loading. Stainless steel construction offers high corrosion resistance and impact strength, especially suited for vessels that work in rivers or shallow areas.

## Suggested Tolerances and Dimensional Data

- Tolerance on Nozzle ID: +.7% Radius (or+.35% Diameter)\*  
— .000"
- Suggested design tip clearance: 1% Radius (or.5% Diameter)\*
- Tolerance on diameter: — .3% Radius (or.15% Diameter)\*  
+ .000"

\*All values rounded off to 1/64" increments.

# Michigan Wheel Nozzle Construction:

Because no two vessels have identical hull lines or interior framing, Michigan Wheel can custom design and supply a suitable head-box or attaching structure.

Michigan Wheel has developed specialized fabrication equipment which makes it possible to construct sophisticated double curvature at competitive and attractive pricing—often involving short-term payoff in two years.

All nozzles are engineered to close tolerances, resulting from a unique roll-forming or spinning process utilizing a complete sheet of steel. Quality is assured with this method. A nozzle with a high degree of dimensional accuracy and fewer weld beads than other methods is the result.

## Materials

### 1. Stainless steel interior.

Normally used on highly loaded applications that require special propellers with relatively high blade area ratios. The corrosion protection characteristics of stainless steel make it particularly suited for inland riverboat and other shallow water applications.

### 2. Fabricated steel, with stainless steel wear rings.

When normal blade area ratios are used and the bulk of operations are in deep water, fabricated steel nozzles with stainless steel wear rings are more cost-effective than a complete interior of stainless steel.



Completed nozzles  
ready for installation

# Most Vessels Can Benefit From A Michigan Wheel Nozzle

Michigan Wheel ducted systems offer many exceptional benefits for a wide variety of commercial applications. Particularly where you need the advantages of increased thrust or fuel economy.

For your quick reference, we've listed inside those specific applications and vessels where either a fixed or steering nozzle system can offer performance and cost advantages over other methods of propulsion.



Typical steering nozzle

# The Dimensions Of Michigan Wheel Quality

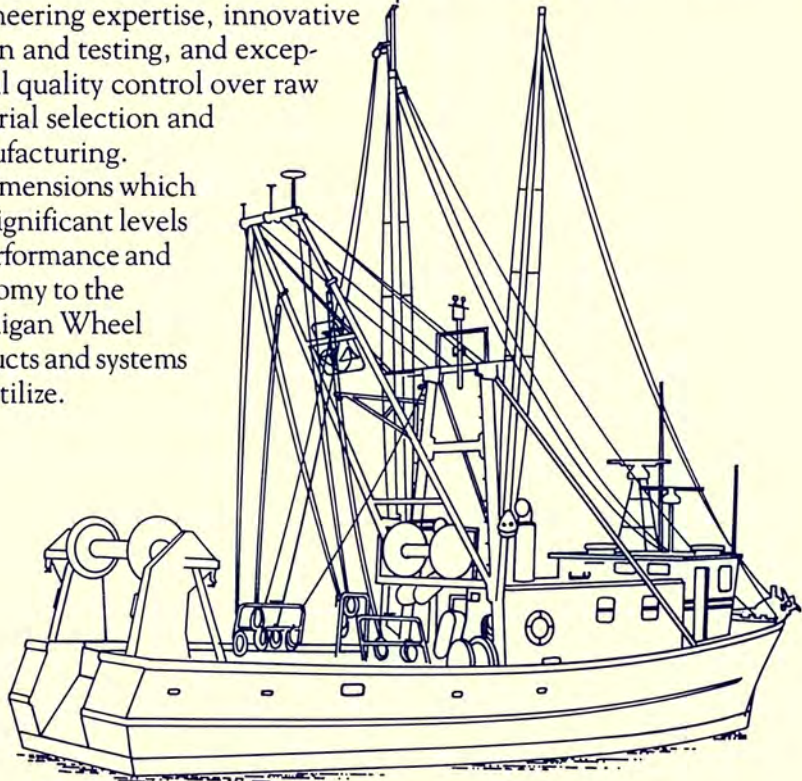
For more than 75 years, Michigan Wheel Corporation has been a leading force in the development and production of marine propulsion and maneuverability systems.

This experience allows us to provide valuable dimensions of engineering expertise, innovative design and testing, and exceptional quality control over raw material selection and manufacturing.

Dimensions which add significant levels of performance and economy to the Michigan Wheel products and systems you utilize.

Dimensions designed to help your operation improve productivity and profits in the future.

Call Michigan Wheel. Let us show you how the engineering expertise and wide-ranging technology we've acquired over the past 75 years can be put to work for you in forging a new dimension of efficiency and profitability in your operations.



## Michigan Wheel Corporation

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1501 Buchanan, S.W.  
Grand Rapids, Michigan 49507  
Phone: 616/452-6941  
FAX: 616/247-0227