HYDROSTAR®

MRH-190
SINGLE SPEED

MRH 2-190
TWO SPEED

LOW SPEED • HIGH TORQUE
HYDRAULIC MOTORS

KYB®
MRH - 190 SINGLE SPEED HYDRAULIC MOTOR

MRH-190 Performance Curve

Graph 1
Static Leakage

Graph 2
Idling Pressure Requirement

Total static leakage is: internal leakage & external leakage.
Total static leakage is used when the outlet port is blocked and the
torque load attempts to rotate the shaft as in winch applications.
Values given will be considerably greater unless sufficient inlet
pressure is maintained. The creep speed can be calculated
from the following formula:

\[
\text{Creep Speed} = \frac{\text{Total Static Leakage (IN.}^3/\text{MIN.)}}{191.6 (\text{IN.}^3/\text{REV.})}
\]

Graph 2 indicates pressure difference required to idle the motor at
various speeds and no output torque. Values will be slightly
greater at higher viscosities. Caution should be taken to assure
sufficient inlet pressure is maintained to prevent cavitation when
the motor operates as a pump or when the load overruns the motor.
Sufficient back pressure should be maintained to counteract centrifugal
forces in the motor. Back or boost pressure is the pressure present
at the low pressure port of the motor. These minimum pressures
can be calculated as follows:

\[
\text{Boost or Back Pressure (PSI)} = \frac{1}{2} \text{ Idling Pressure (PSI)} + \text{Crankcase Pressure (PSI)}
\]

Graph 3
Volumetric Efficiency

Graph 4
Starting Torque Characteristic

Input flow required to attain any
given speed and pressure can be
computed from the graph using the nominal motor displacement of
191.6 IN.\(^3\)/REV.

\[
\text{Input Flow (IN.}^3/\text{MIN.}) = \frac{191.6 (\text{IN.}^3/\text{REV.}) \times \text{Motor Speed (RPM)} \times 100}{\text{Motor Volumetric Efficiency (\%)}}
\]

Starting torque varies with the
 crankshaft angle and maximum
 and minimum values are shown by
the graph. A reduction in torque
occurs if back pressure is excessive
but viscosity effects are negligible.

Above curves are results obtained
on mineral oil of 160-200 SUS
viscosity.

SPECIFICATIONS

Displacement volume 191.6 IN.\(^3\)/REV.
Maximum continuous pressure 3570 PSI
Intermittent peak pressure 4000 PSI
Maximum continuous back pressure 350 PSI
Maximum intermittent back pressure 1000 PSI
Maximum continuous output torque 8575 FT.-LBS.
Starting torque at 3570 PSI 7250 FT.-LBS.
Maximum continuous speed 175 RPM
Maximum continuous power 230 HP
Moment of inertia (GD\(^2\)) 2655 LB.-IN.\(^2\)
Maximum fluid temperature 175°F
Dry weight 617 LBS.

HOW TO ORDER

Model Displacement Shaft Type Ports
MRH 190 S—— Spline (23T) SAE W
T—— Taper 4-Bolt Flange
E—— Spline (20T)
Oil and Filtration

Because the oil not only transfers the force but also lubricates mating parts of the motor, care must be taken to assure minimum fluid viscosity is 120 SUS. However, it is recommended for continuous operation to maintain the viscosity between 165 and 345. Maximum operating temperature should be less than 175°F.

However, even when the proper oil is used, wear will accelerate as oil becomes contaminated. Hydraulic fluid life depends on conditions under which it is used and only experience can determine precise intervals at which fluids should be changed. With mineral oils it is recommended that samples be taken at about 1000 hour intervals and sent to the manufacturer for analysis. This will help determine the best timing for fluid changes.

Filtration recommendation is 25 micron. Since pumps are more critical to contamination, it is advisable to investigate what filtration will be required to sustain the life of the pump.

Minimum Operating Speed

Minimum operating speed of 1 rpm is possible depending on load characteristics, but smooth performance of 3 rpm is normal. Starting torque varies with crankshaft angle. A reduction in torque occurs if the back pressure is excessive, but viscosity effects are negligible.

Bearing B10-LIFE

Bearing B10-LIFE of taper roller bearings used in HYDROSTAR® motors is explained in Graph 5 below. Bearing B10-LIFE is the number of hours at which 10% of the bearings may be expected to show some evidence of wear. The other 90% will be satisfactory. In fact, the average life of the bearings is 4 times the B10-LIFE.

Graph 5

Example of use (See chain dotted line)

**GIVEN**
- Side load: \( W = 9,000 \text{ LBS.} \)
- Distance from mounting face: \( A = 3 \text{ IN.} \)
- Pressure: \( P = 2000 \text{ PSI} \)
- Speed: \( N = 25 \text{ RPM} \)

**ANSWER**
- Estimated Bearing B10-LIFE: \( 30,000 \text{ HOURS} \)
# MRH 2-190 Two Speed Hydraulic Motor

## MRH 2/3-190 Performance Curve

Graph 6

### Static Leakage

Total static leakage is the combination of internal leakage and external leakage. Total static leakage is used when the outlet port is blocked and the torque load attempts to rotate the shaft, such as a winch application. Unless significant back pressure is maintained, the creep speed will increase drastically and the motor may rotate out of control. The creep speed can be calculated from the following formula:

\[
\text{Creep Speed (RPM)} = \frac{\text{Total Static Leakage (IN./MIN.)}}{191.6 \text{ or } 95.8 \text{ (IN./REV.)}}
\]

Graph 7

### Idling Pressure and Boost Pressure Requirement

Boost or Back Pressure (PSI) = \frac{1}{2} \text{ Idling Pressure (PSI)} + \text{Crankcase Pressure (PSI)}

Graph 8

### Torque Requirement When Free Wheeling

Input torque to motor when free wheeling.

## Specifications

### Model

<table>
<thead>
<tr>
<th>Model</th>
<th>MRH 2-190-1</th>
<th>MRH 2-190-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement (IN./REV.)</td>
<td>191.6/95.8</td>
<td>191.6/0</td>
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<tr>
<td>Max. Continuous Pressure (PSI)</td>
<td>3570</td>
<td>3570/150</td>
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<td>Intermittent Peak Pressure (PSI)</td>
<td>4000</td>
<td>4000/250</td>
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<tr>
<td>Max. Continuous Back Pressure (PSI)</td>
<td>350</td>
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<tr>
<td>Max. Intermittent Back Pressure (PSI)</td>
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<tr>
<td>Max. Continuous Output Torque (FT.-LBS.)</td>
<td>8460/4050</td>
<td>8460/0</td>
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<tr>
<td>Maximum Speed (RPM) @3570 PSI</td>
<td>100/130</td>
<td>100/—</td>
</tr>
<tr>
<td>Speed (RPM) @3000 PSI</td>
<td>175/260</td>
<td>175/—</td>
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<tr>
<td>Free Wheeling</td>
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<td>2000</td>
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<tr>
<td>Max. Continuous Power (HP)</td>
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<tr>
<td>Max. Fluid Temperature (°F)</td>
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<tr>
<td>Dry Weight (LBS.)</td>
<td>695</td>
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</tbody>
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### How To Order

Model: MRH

- No. of Speeds: 2
- Displacement: See specification (Standard) chart for displacement designation
- Shaft Type: E
- Ports: W

SAE 4-Bolt Flange
TYPICAL CIRCUIT

NOTE:
1. Pilot pressure should be equal to or greater than system pressure and at least 150 psi.
2. When freewheeling the pressure above the pistons should be less than 200 psi.
3. Cooling may be required if motor is freewheeled for long periods. Consult KYB America LLC.

Graph 9

Volumetric Efficiency (Full Displacement)

Graph 10

Volumetric Efficiency (Half Displacement)

Input flow required to attain any given speed and pressure can be calculated from the graph using the nominal motor displacement of 191.6 IN. ³/REV. (Graph 9) or 95.8 IN. ³/REV. (Graph 10).

\[
\text{Inut Flow (IN. ³/MIN.)} = \frac{191.6 \text{ (IN. ³/REV.) x Motor Speed (RPM)} \times 100}{\text{Motor Volumetric Efficiency ()})} \quad \text{OR} \quad \frac{95.8 \text{ (IN. ³/REV.) x Motor Speed (RPM)} \times 100}{\text{Motor Volumetric Efficiency ()})}
\]

1 GALL./MIN. = 231 IN. ³ / MIN.
Above curves are results obtained on mineral oil of 160-200 SUS viscosity.
DIMENSIONS (IN INCHES)

SINGLE SPEED

Drain port on body housing (3 locations) MAXIMUM CRANKCASE PRESSURE 15 PSI
5 holes .78 DIA equally spaced on 18.5 PCD POSN. TOL. .012 DIA.

TWO SPEED

Drain port on body housing (3 locations) MAXIMUM CRANKCASE PRESSURE 15 PSI
5 holes .78 DIA equally spaced on 18.5 PCD POSN. TOL. .012 DIA.

Z PORT FOR 3 SPEED ONLY

S-type shaft
2 holes 1/2-20 UNF-2B deep .54
Mounting face 4.05 DIA
SAE Involute spline (J486b) Flat root side ft (class 1 fit) 6/12 pitch 23T. 30°PA
3.90373, 3.9077 D.D.
3.8283 RITCH DIA

E-type shaft
1 hole 3/4-16 UNF-2B deep 1.18
Mounting face 5.48 DIA
SAE Involute spline (J486b) Flat root side ft (class 1 fit) 6/12 pitch 20T. 30°PA
3.44070, 3.4077 D.D.
3.3233 Pitch Dia.

T-type shaft
1-3/4-6 UNC
Taper 1/10
Basic taper .0099 Per inch on diameter

Key:
1.0239/1.011 WIDE
0.087/0.089 THICK

Spline adapter billets
A steel billet having internal splines to match the motor spline shaft is available. The shaft fits into the billet, which is intended for welding onto drive gears, sprockets, etc.