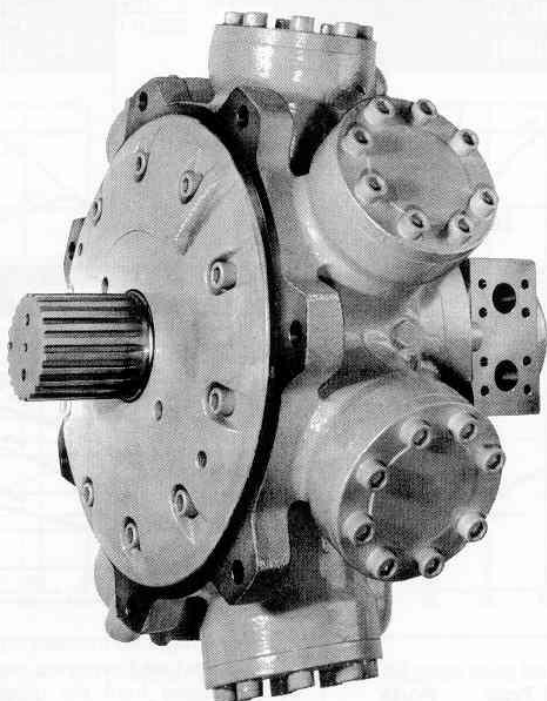# HYDROSTAR®

SAMT
HYDRAULICS

MRH-270
MRH2-270

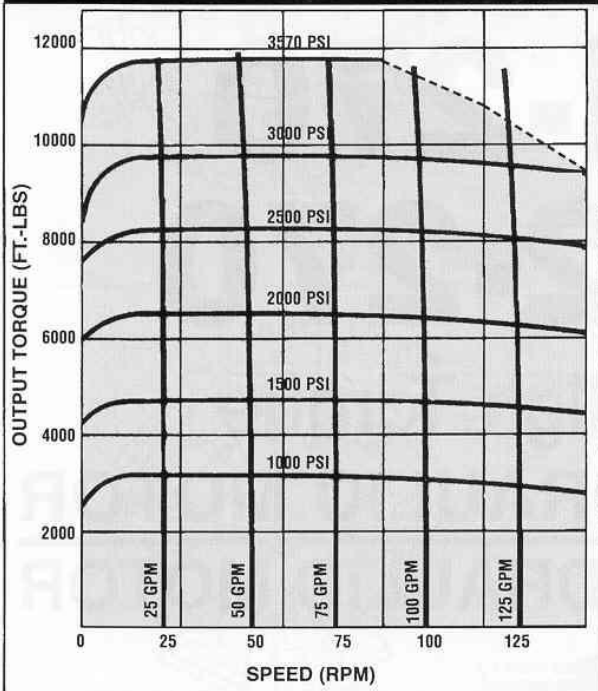## Low Speed—High Torque
SINGLE SPEED HYDRAULIC MOTOR
MULTIPLE SPEED HYDRAULIC MOTOR

KYB®

MRH-270 Single Speed Hydraulic Motor
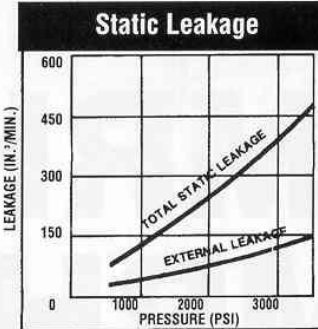
MRH-270 Performance Curve

Output torque (FT.-LBS.) vs Speed (RPM), with pressure curves 3570 PSI, 3000 PSI, 2500 PSI, 2000 PSI, 1500 PSI, 1000 PSI and flow lines 25 GPM, 50 GPM, 75 GPM, 100 GPM, 125 GPM.

Specifications

Displacement	268.4 IN³/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	11648 FT.-LBS.
Starting torque at 3570 PSI	9550 FT.-LBS.
Maximum continuous speed	125 RPM
Maximum continuous power	225 HP
Moment of inertia (GD²)	4354 LB.-IN²
Maximum fluid temperature	175°F
Dry weight	820 LBS.

How To Order

Model	Displacement	Shaft Type	Ports
MRH	270	☐	W

S—Spline (23T)   SAE 4-Bolt Flange
T—Taper
E—Spline (20T) (Interchangeable)

Graph 1

Static Leakage

Leakage (IN.³/MIN.) vs Pressure (PSI), showing Total Static Leakage and External Leakage.

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:

$$\text{Creep Speed (RPM)} = \frac{\text{Total Static Leakage (IN.}^3\text{/MIN.)}}{268.4 \ (\text{IN.}^3\text{/REV.})}$$

Graph 2

Idling Pressure Requirement


Pressure (PSI) vs Speed (RPM).
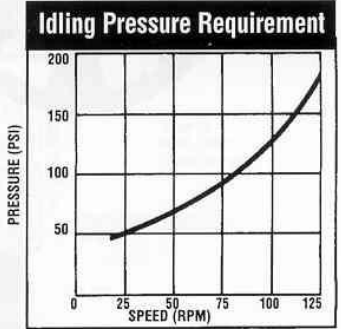
Graph 2 indicates pressure difference required to idle the motor at various speeds and no output torque. Values will be slightly greater at higher viscosities.

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:

Boost or Back Pressure (PSI) = 1/2 Idling Pressure (PSI) + Crankcase Pressure (PSI)

Graph 3
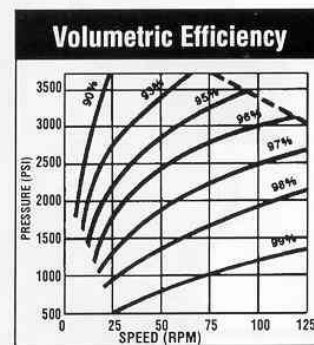
Volumetric Efficiency

Pressure (PSI) vs Speed (RPM), with efficiency curves 90%, 93%, 95%, 96%, 97%, 98%, 99%.
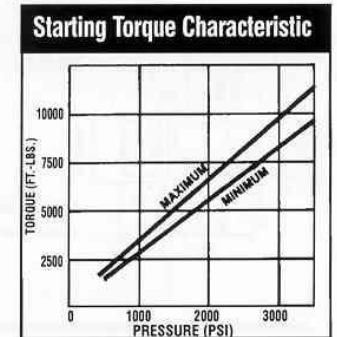
Input flow required to attain any given speed and pressure can be calculated from the graph using the nominal motor displacement of 268.4 cu. in./rev.

$$\text{Input Flow (IN.}^3\text{/MIN.)} = \frac{268.4 \ (\text{IN.}^3\text{/REV.}) \times \text{Motor Speed (RPM)} \times 100}{\text{Motor Volumetric Efficiency (\%)}}$$

1 GAL./MIN. = 231 IN.³/MIN.

Graph 4

Starting Torque Characteristic

Torque (FT.-LBS.) vs Pressure (PSI), showing MAXIMUM and MINIMUM curves.

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.

by Hydrostar

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 recommendable 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. The hydraulic fluid's life depends on conditions under which it is used and only experience can determine precise intervals at which fluid 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. Generally the pumps are more critical to contamination, therefore, it is advisable to investigate what filtration will be required to sustain the life of the pump.
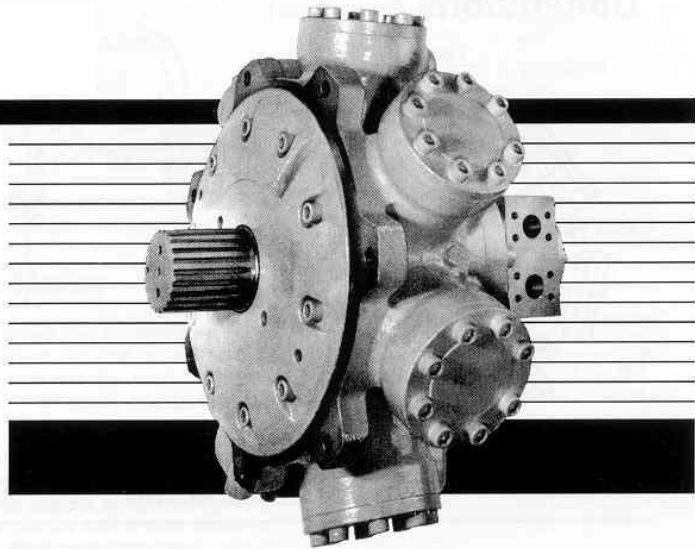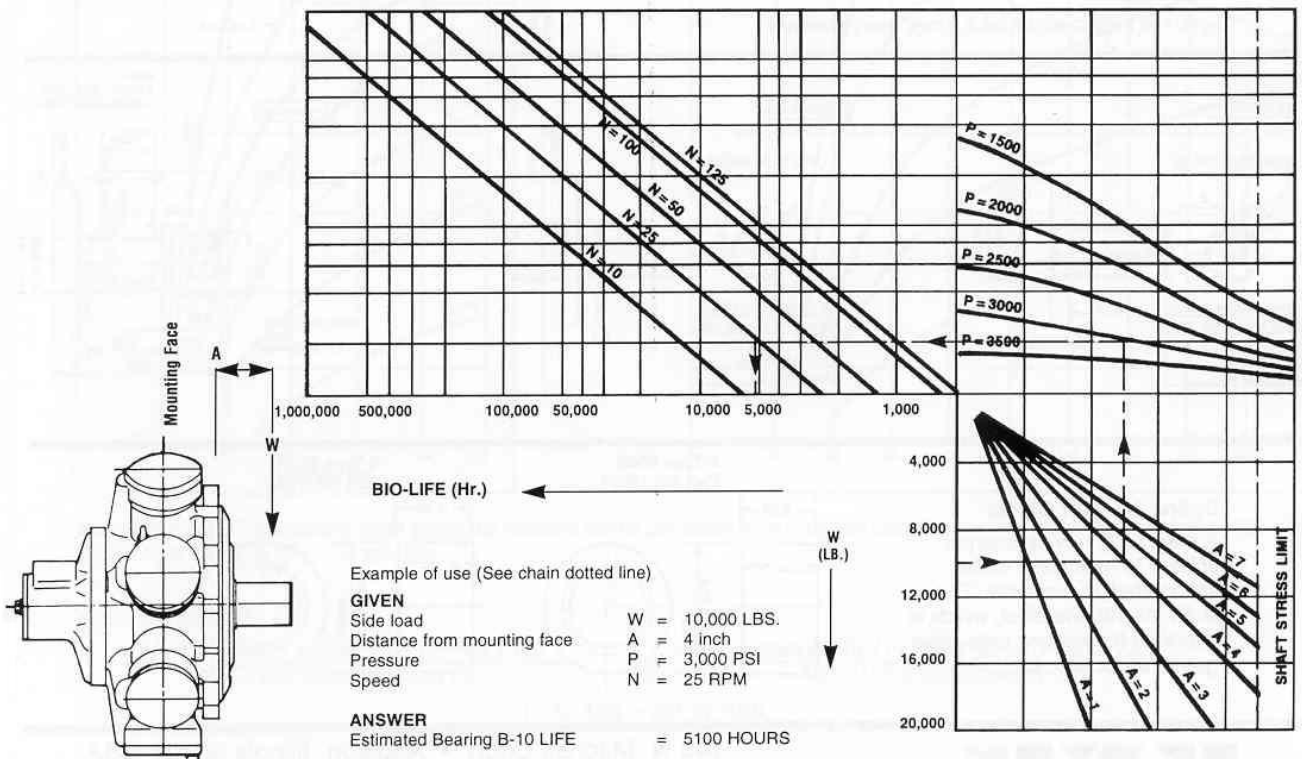
Minimum operating speed

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.
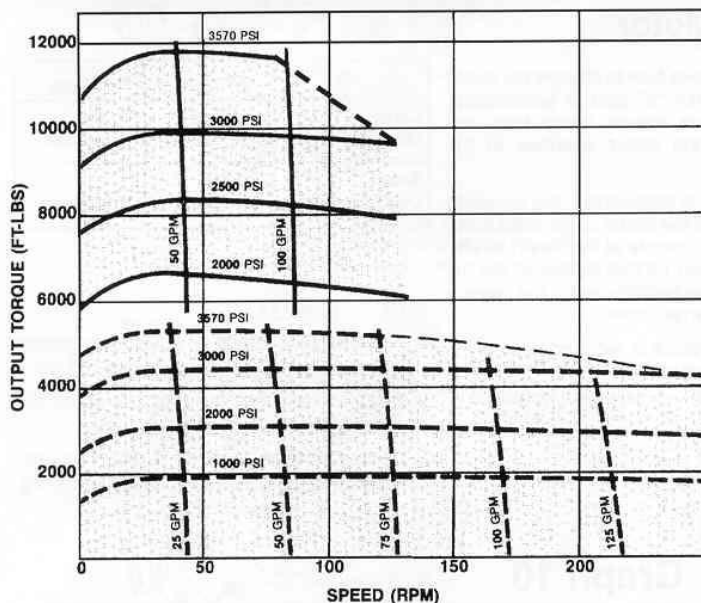
Bearing B10-LIFE

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

Mounting Face

N = 100
N = 125
N = 50
N = 25
N = 10

P = 1500
P = 2000
P = 2500
P = 3000
P = 3500

1,000,000 500,000   100,000 50,000   10,000 5,000   1,000

BIO-LIFE (Hr.)

W (LB.)

4,000
8,000
12,000
16,000
20,000

SHAFT STRESS LIMIT

A = 7
A = 6
A = 5
A = 4
A = 3
A = 2
A = 1

Example of use (See chain dotted line)

GIVEN
Side load	W	= 10,000 LBS.
Distance from mounting face	A	= 4 inch
Pressure	P	= 3,000 PSI
Speed	N	= 25 RPM

ANSWER
Estimated Bearing B-10 LIFE = 5100 HOURS

3

MRH2-270 Performance Curve

Legend:
- —— 100% Displacement
- ----- 50% Displacement

Specifications

|	MRH2-270	
	MRH2-270-1	MRH2-270-2
Displacement (IN³/REV.)	**268.4/134.2**	**268.4/0**
Max. Continuous Pressure (PSI)	3570	3570/150
Intermittent Peak Pressure (PSI)	4000	4000/250
Max. Continuous Back Pressure (PSI)	350	350/–
Max. Intermittent Back Pressure (PSI)	1000	1000/–
Max. Continuous Output Torque (FT.-LBS.)	11640/5540	11640/0
Maximum Speed (RPM) @3570 PSI	75/120	75/–
Maximum Speed (RPM) @3000 PSI	125/240	125/–
Maximum Speed (RPM) Free Wheeling	–	2000
Max. Continuous Power (HP)	225	
Max. Fluid Temperature °F	175	
Dry Weight (LBS.)	899	

For other displacement combinations consult KYB Corporation.

How To Order

| Model	No. of Speeds	Displacement	Shaft Type	Ports
MRH	2 — 270 —	☐	E	W
		See specification chart for displacement designation	(Standard)	SAE 4-bolt Flange

Graph 6

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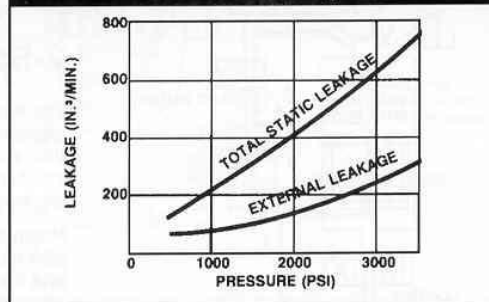
Total static leakage is the combination of internal leakage and external leakage. Total static leakage is used when the outlet port is blocked and the torque load attempts to rotate the shaft, such as a winch application. Unless significant back pressure is maintained, the creep speed will increase drastically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

$$\text{Creep Speed (RPM)} = \frac{\text{Total Static Leakage (IN.}^3\text{/MIN.)}}{268.4 \text{ or } 134.2 \text{ (IN.}^3\text{/REV.)}}$$
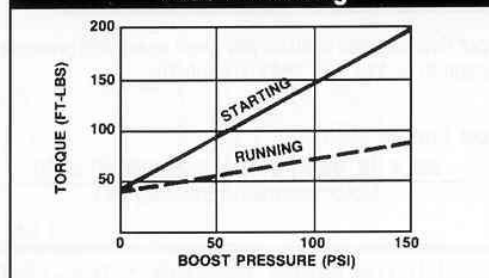
Graph 7

Idling Pressure and Boost Pressure Requirement
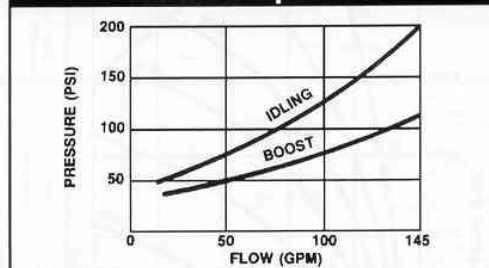
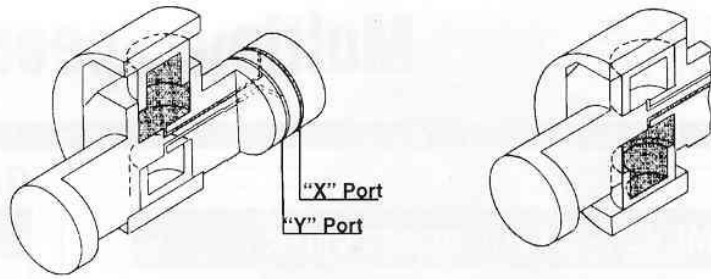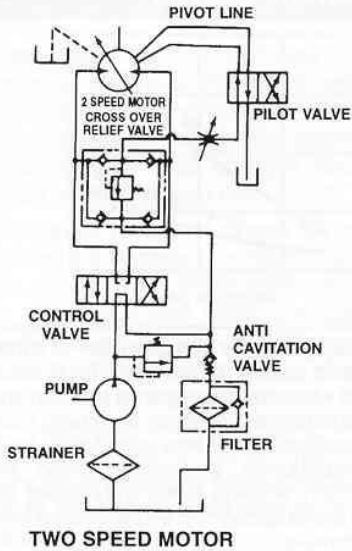Boost or Back Pressure (PSI) = 1/2 Idling Pressure (PSI) + Crankcase Pressure (PSI)

Graph 8

Torque Requirement When Free Wheeling

Input torque to motor when free wheeling.

4

Typical Circuit

"X" Port
"Y" Port

TWO SPEED MOTOR

Labels in circuit diagram:
PIVOT LINE, PILOT VALVE, 2 SPEED MOTOR CROSS OVER RELIEF VALVE, CONTROL VALVE, ANTI CAVITATION VALVE, PUMP, STRAINER, FILTER

2-Speed Motor

The illustration shows how to change the motor displacement. When "X" port is pressurized, the eccentric cam moves away from the crankshaft, and the motor operates at full displacement.

When the "Y" port is pressurized, the eccentric cam moves toward the center of the crankshaft, and the motor will operate at the minimum displacement. This can be half or less of the full displacement, dependent upon the piston length used to change stroke.

**Note:** System pressure is required to actuate the change.

	"X" Port	"Y" Port
Large Displacement	Pressurize	To the Reservoir
Small Displacement	To the Reservoir	Pressurize

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 free-wheeled for long periods. Consult KYB Corp.

Graph 9

Volumetric Efficiency (Full Displacement)
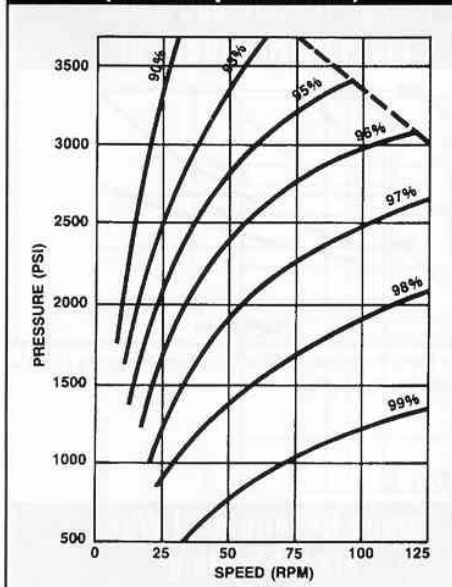
Graph 10

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 268.4 IN.³/REV. (Graph 9) or 134.2 IN.³/REV. (Graph 10).

Input Flow (IN.³/MIN) =

$$\frac{268.4 \ (IN.^3/REV.) \times Motor \ Speed \ (RPM) \times 100}{Motor \ Volumetric \ Efficiency \ (\%)}$$

OR

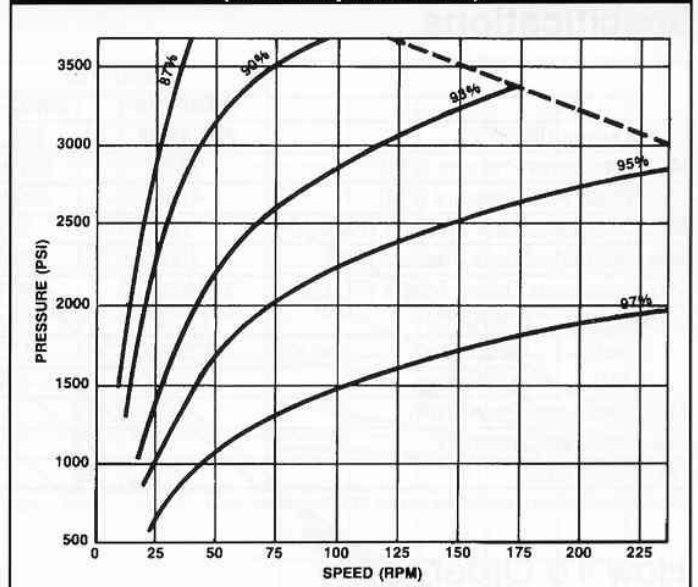$$\frac{134.2 \ (IN.^3/REV.) \times Motor \ Speed \ (RPM) \times 100}{Motor \ Volumetric \ Efficiency \ (\%)}$$
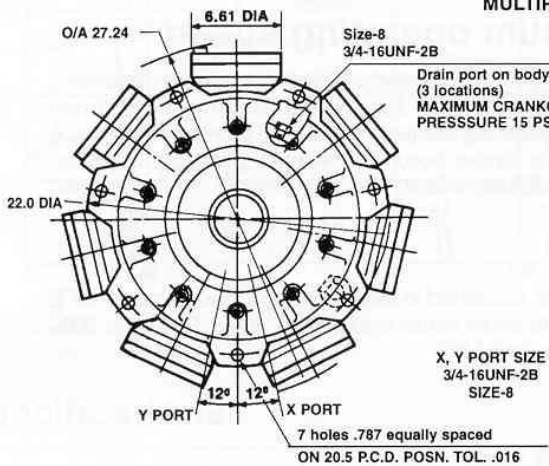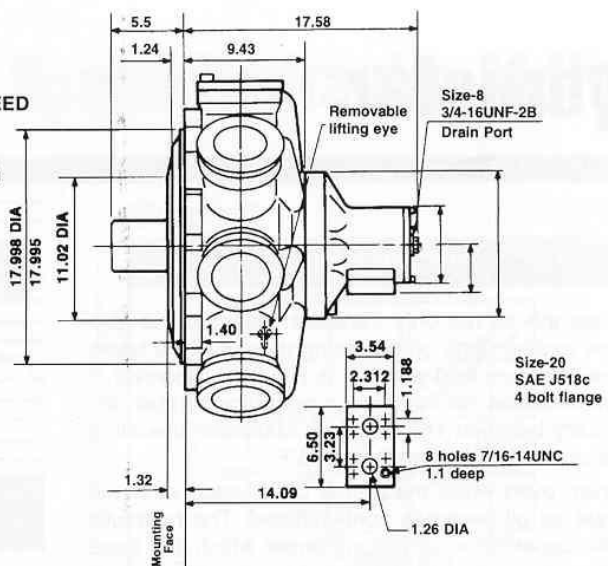
1 GAL./MIN. = 231 IN.³/MIN.

Above curves are results obtained on mineral oil of 160-200 SUS viscosity.
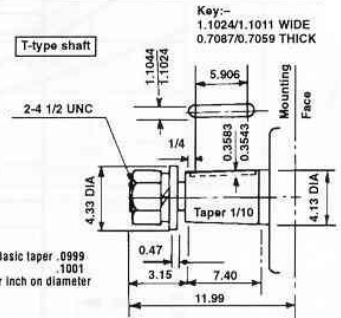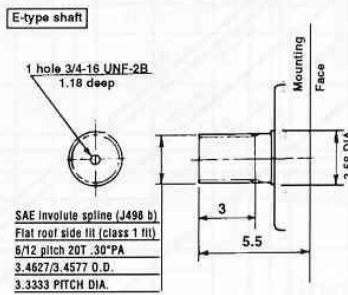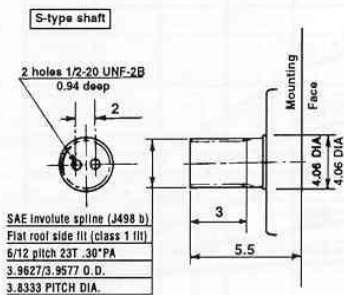
Dimensions (in inches)

SINGLE SPEED

O/A 27.24
6.61 DIA
Size-8 3/4-16UNF-2B
Drain port on body housing (3 locations)
MAXIMUM CRANKCASE PRESSSURE 15 PSI
22.0 DIA
7 holes .787 equally spaced ON 20.5 P.C.D. POSN. TOL. .016

5.5
1.24
17.58
9.43
Removable lifting eye
Size-8 3/4-16UNF-2B Drain Port
17.998 DIA
17.995
11.02 DIA
1.40
1.32
14.09
Mounting Face

3.54
2.312
1.188
6.50
3.23
Size-20 SAE J518c 4 bolt flange
8 holes 7/16-14UNC 1.1 deep
1.26 DIA

MULTIPLE SPEED

O/A 27.24
6.61 DIA
Size-8 3/4-16UNF-2B
Drain port on body housing (3 locations)
MAXIMUM CRANKCASE PRESSSURE 15 PSI
22.0 DIA
X, Y PORT SIZE 3/4-16UNF-2B SIZE-8
12° 12°
Y PORT
X PORT
7 holes .787 equally spaced ON 20.5 P.C.D. POSN. TOL. .016

NOTE: FOR 2 SPEED MOTOR ONLY. E-TYPE SHAFT STANDARD

5.5
1.24
20.26
9.43
Size-8 3/4-16UNF-2B Drain Port
Removable lifting eye
17.998 DIA
17.995
11.02 DIA
5.91 DIA
3.74
11.42 DIA
1.40
10.00
10.39
1.32
16.77
Mounting Face

3.54
2.312
1.188
6.50
3.23
Size-20 SAE J518c 4 bolt flange
8 holes 7/16-14UNC 1.1 deep
1.26 DIA

S-type shaft
2 holes 1/2-20 UNF-2B 0.94 deep
2
Mounting Face
4.06 DIA
4.06 DIA
3
5.5
SAE involute spline (J498 b)
Flat root side fit (class 1 fit)
6/12 pitch 23T .30°PA
3.9627/3.9577 O.D.
3.8333 PITCH DIA.

E-type shaft
1 hole 3/4-16 UNF-2B 1.18 deep
Mounting Face
3.58 DIA
3
5.5
SAE involute spline (J498 b)
Flat root side fit (class 1 fit)
6/12 pitch 20T .30°PA
3.4627/3.4577 O.D.
3.3333 PITCH DIA.

T-type shaft
Key:- 1.1024/1.1011 WIDE 0.7087/0.7059 THICK
1.1044
1.1024
5.906
2-4 1/2 UNC
1/4
0.3583
0.3543
4.33 DIA
Mounting Face
4.13 DIA
Taper 1/10
Basic taper .0999 .1001 Per inch on diameter
0.47
3.15
7.40
11.99

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.

S-Type Shaft Part No. 19020
3.25
6.0016 DIA
6.000

E-Type Shaft Part No. 19021
3.25
5.0016 DIA
5.0000