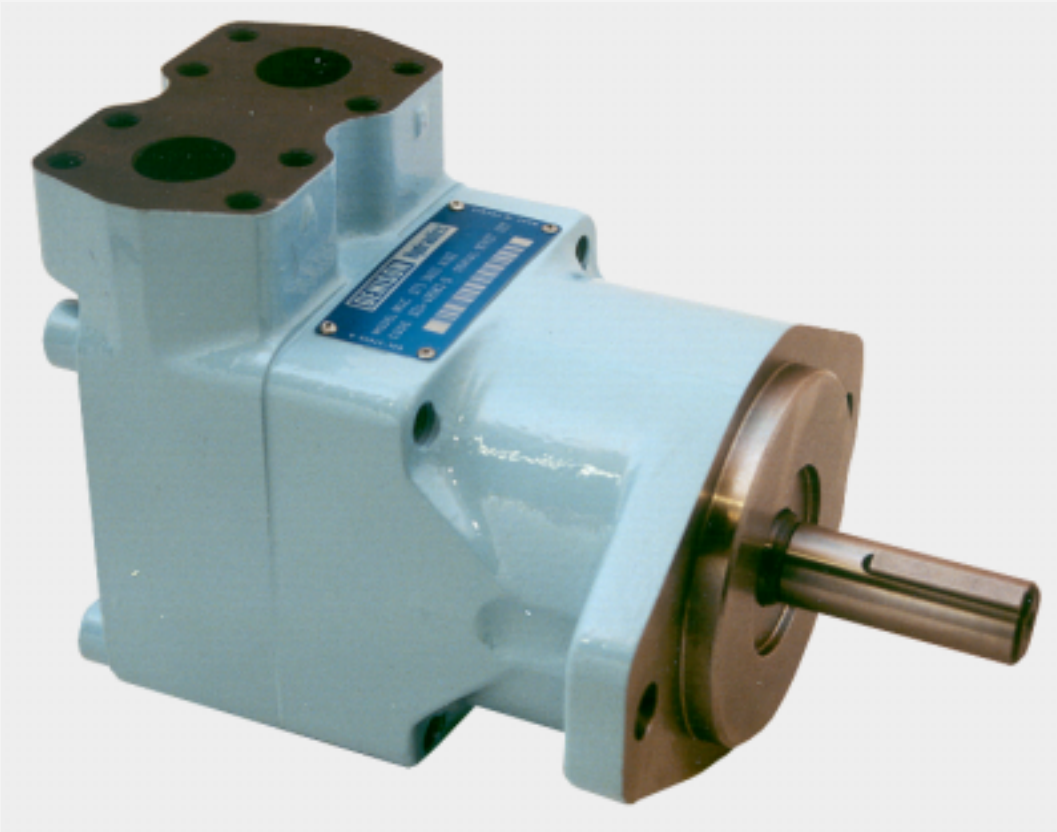
# Vane motors
# Single & double
# M3B - M4 / M4S series



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DENISON Hydraulics

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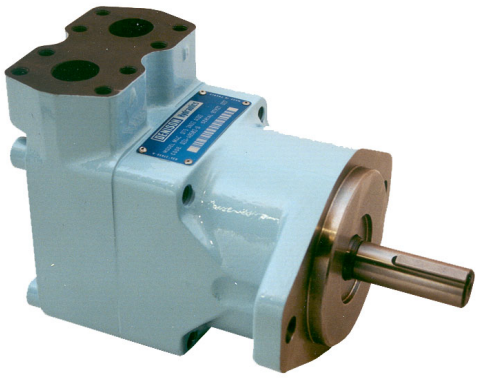

**HIGH STARTING TORQUE EFFICIENCY**

The high starting torque efficiency of vane type motors makes them especially applicable in load hoist winch drives, swing drives and propulsion drives. This high starting torque efficiency allows the motor to start under high load without pressure overshoots, jerks and high instantaneous horsepower loads.

**HIGH VOLUMETRIC EFFICIENCY**

Vane motors begin life with high volumetric efficiency and maintain that efficiency throughout their operating life.

**LOW TORQUE RIPPLE AT LOW SPEED**

When operating at very low speeds on applications such as swing and load hoist drives, the vane motor exhibits very low torque ripple.

**2 AND 3-SPEED VERSIONS AVAILABLE**

The M4DC, because of its unequal size cartridges, allows the use of-3 speed operation. This makes them more applicable in traction drive circuits to replace manually shifted gear-boxes. 2-speed motors are available in a wider range of ratios than standard gear motors.

**BALANCED DESIGN**

Vane, rotor and cam ring are pressure balanced to increase life and efficiency over full speed range.

**INTERCHANGEABLE ROTATING GROUPS**

Rotating groups may be easily replaced to renew the motor or change displacement to suit altered requirements for speed or torque.

**REVERSIBLE ROTATION**

The motors may be stopped or reversed repeatedly and rapidly driving or braking the connected shaft load at controlled torque levels.

**WIDE SPEED RANGE**

Starting to maximum RPM, with full torque capability during acceleration.

**PORTS AND MOUNTING**

Conform fully to SAE J744c (ISO-3019-1) standards to simplify refitting and installation.

**FIRE RESISTANT FLUIDS**

Are easily used in the standard M3B and M4* versions of these motors. These include phosphate or organic ester fluids and blends, water-glycol solutions and water-oil invert emulsions.

**M3B AND M4* SERIES MOTORS**

The M3B and M4* have been designed especially for severe duty applications which require high pressure up to 3400 PSI, high speed up to 4000 RPM and low fluid lubricity (HF-1, HF-2A, HF-3, HF-4, HF-5).

| Series | Size | Displ. | Theor. Displ. $V_i$ | Torque T | Power at 100 Rev/min | Torque T | Power P |
|---|---|---|---|---|---|---|---|
| | | | | | | n = 2000 RPM at Δ p 2500 PSI | |
| | | | $in^3/rev.$ | in.lbf/PSI | HP/100 PSI | in.lbf | HP |
| M3 | B<br>B1 | 009 | .56 | 0.08 | 0.014 | 174.3 | 5.8 |
| | | 012 | .75 | 0.11 | 0.018 | 236.3 | 7.8 |
| | | 018 | 1.13 | 0.19 | 0.030 | 412.4 | 13.4 |
| | | 027 | 1.70 | 0.30 | 0.046 | 680.5 | 21.8 |
| | | 036 | 2.26 | 0.38 | 0.060 | 902.6 | 28.3 |
| M4 | C<br>C1<br>SC<br>SC1 | 024 | 1.49 | 0.24 | 0.037 | 535.4 | 17.0 |
| | | 027 | 1.72 | 0.28 | 0.043 | 619.5 | 19.7 |
| | | 031 | 2.11 | 0.33 | 0.054 | 768.0 | 24.1 |
| | | 043 | 2.84 | 0.45 | 0.072 | 1062.0 | 33.6 |
| | | 055 | 3.59 | 0.57 | 0.091 | 1318.6 | 41.8 |
| | | 067 | 4.34 | 0.69 | 0.111 | 1504.5 | 47.7 |
| | | 075 | 4.89 | 0.78 | 0.120 | 1752.2 | 55.6 |
| | D<br>D1<br>SD<br>SD1 | 062 | 3.97 | 0.63 | 0.102 | 1460.0 | 46.4 |
| | | 074 | 4.69 | 0.75 | 0.120 | 1770.0 | 56.2 |
| | | 088 | 5.56 | 0.88 | 0.139 | 2088.5 | 66.2 |
| | | 102 | 6.44 | 0.96 | 0.166 | 2336.3 | 74.1 |
| | | 113 | 7.12 | 1.13 | 0.185 | 2655.0 | 84.2 |
| | | 128 | 8.08 | 1.28 | 0.203 | 3009.0 | 95.5 |
| | | 138 | 8.81 | 1.40 | 0.222 | 3292.0 | 104.5 |
| | E<br>E1<br>SE/SE1 | 153 | 9.67 | 1.54 | 0.240 | 3522.0 | 111.8 |
| | | 185 | 11.69 | 1.86 | 0.296 | 4283.2 | 136.0 |
| | | 214 | 13.55 | 2.16 | 0.342 | 5017.7 | 159.3 |
| | DC<br>DC1<br>SDC<br>SDC1 | See M4C/C1/SC/SC1 and M4D/D1/SD/SD1 | | | | | |

Internal drain : All these motors may be equiped with internal drain. Then the model numbers will be M3B1, M4C1, M4SC1, M4D1, M4SD1, M4E1, M4SE1, M4DC1, M4SDC1.

For further information or if the performance characteristics outlined above do not meet your own particular requirements, please consult your local DENISON Hydraulics office.

## GENERAL CHARACTERISTICS

| | Mounting standard | Weight without connector and bracket - lbs | Moment of inertia $lb.in^2$ | Option for inlet and outlet port | |
|---|---|---|---|---|---|
| M3B | SAE J744c<br>ISO/3019-1 SAE A | 17.6 | 1.03 | SAE threaded<br>SAE 4 bolt J718c ISO/DIS 6162-1 - 3/4"<br>BSPP threaded | |
| M4C/SC | SAE J744c<br>ISO/3019-1 SAE B | 34.0 | 2.7 | SAE threaded<br>SAE 4 bolt J718c ISO/DIS 6162-1 - 1" | |
| M4D/SD | SAE J744c<br>ISO/3019-1 SAE C | 59.5 | 1.4 | SAE threaded<br>SAE 4 bolt J718c ISO/DIS 6162-1 - 1"1/4 | |
| M4E/SE | SAE J744c<br>ISO/3019-1 SAE C | 99.0 | 20.0 | SAE threaded<br>SAE 4 bolt J718c ISO/DIS 6162-1 - 2" | |
| M4DC/SDC | SAE J744c<br>ISO/3019-1 SAE C | 88.0 | 10.0 | SAE 4 bolt J718c<br>ISO/DIS 6162-1 - 1"1/4 | **P2 = See M4C/M4SC** |



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## MAXIMUM SPEED, PRESSURE RATINGS - M3B AND M4* SERIES

| Series | Size | Displ. | Max. pressure | | | | | Operating pressure range drain | Max. speed for low loaded condition [1] | Max. speed for max. pressure ratings | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HF-0 HF-2 | HF-2A | HF-1 | HF-3 HF-5 | HF-4 | | | HF-0, HF-2 | | HF-2A | | HF-1 | |
| | | | | | | | | | | Cont. | Int.[2] | Cont. | Int.[2] | Cont. | Int.[2] |
| | | | PSI | PSI | PSI | PSI | PSI | PSI | RPM | RPM | RPM | RPM | RPM | RPM | RPM |
| M3 | B B1 | 009 | 2500 | | | | | 22 | 4000 | 3000 | 3600 | | | | |
| | | 012 | 3000 | | | | | | | | | | | | |
| | | 018 | | | | | | | | | | | | | |
| | | 027 | | | | | | | | | | | | | |
| | | 036 | | | | | | | | | | | | | |
| M4 | C C1 | 024 | 2500 | 2500 | 2500 | | | 50 | 4000 | 2500 | 3600 | 2500 | 3000 | 2000 | 2500 |
| | | 027 | | | | | | | | | | | | | |
| | | 031 | | | | | | | | | | | | | |
| | | 043 | | | | | | | | | | | | | |
| | | 055 | | | | | | | | | | | | | |
| | | 067 | | | | | | | | | | | | | |
| | | 075 | | | | | | | | | | | | | |
| | SC SC1 | 024 | 3400 | 3000 | 2500 | 2500 | 2000 | | | | | | | | |
| | | 027 | | | | | | | | | | | | | |
| | | 031 | | | | | | | | | | | | | |
| | | 043 | | | | | | | | | | | | | |
| | | 055 | 3000 | 3000 | | | | | | | | | | | |
| | | 067 | | | | | | | | | | | | | |
| | | 075 | 2500 | 2500 | | | | | | | | | | | |
| | D D1 | 062 | 2500 | 2500 | 2000 | | | | 4000 | 2500 | 3000 | 2500 | 2800 | 2000 | 2500 |
| | | 074 | | | | | | | | | | | | | |
| | | 088 | | | | | | | | | | | | | |
| | | 102 | | | | | | | | | | | | | |
| | | 113 | | | | | | | | | | | | | |
| | | 128 | | | | | | | | | | | | | |
| | | 138 | | | | | | | | | | | | | |
| | SD SD1 | 062 | 3400 | 2700 | 2000 | 2000 | 2000 | | | | | | | | |
| | | 074 | | | | | | | | | | | | | |
| | | 088 | | | | | | | | | | | | | |
| | | 102 | 3000 | 2700 | | | | | | | | | | | |
| | | 113 | | | | | | | | | | | | | |
| | | 128 | 2700 | 2700 | | | | | | | | | | | |
| | | 138 | 2500 | 2500 | | | | | | | | | | | |
| | E E1 | 153 | 2500 | 2500 | 2000 | | | | 3600 | 2500 | 3000 | 2500 | 2800 | 1800 | 2200 |
| | | 185 | | | | | | | | | | | | | |
| | | 214 | | | | | | | | | | | | | |
| | SE SE1 | 153 | 2700 | 2500 | 2000 | 2000 | 2000 | | | | | | | | |
| | | 185 | 2600 | | | | | | | | | | | | |
| | | 214 | 2500 | | | | | | | | | | | | |
| | DC DC1 | All models | 2500 | 2500 | 2000 | | | | 4000 | 2500 | 3000 | 2500 | 2800 | 2000 | 2500 |
| | SDC SDC1 | D-062 at 088 | 3400 | 2700 | 2000 | 2000 | 2000 | | | | | | | | |
| | | C-024 at 043 | | | | | | | | | | | | | |
| | | D-102 | 3000 | 2700 | | | | | | | | | | | |
| | | D-113 | | | | | | | | | | | | | |
| | | C-055 | | | | | | | | | | | | | |
| | | C-067 | | | | | | | | | | | | | |
| | | D-128 | 2500 | 2500 | | | | | | | | | | | |
| | | D-138 | | | | | | | | | | | | | |
| | | C-075 | | | | | | | | | | | | | |

1) Low loaded condition 500 PSI for M3 and M4, 1160 PSI max. for M4S (see page 6).
2) Intermittent speed - Do not exceed 6 seconds per minute of operation.
HF-0, HF-2 = Antiwear petroleum base. HF-2A = Crankcase. HF-1 = Non antiwear petroleum base. HF-5 = Synthetic fluids.
HF-3 = Water in oil emulsions. HF-4 = Water glycols.
Internal drain : All these motors may be equiped with internal drain. Then the model numbers will be M3B1, M4C1, M4SC1, M4D1, M4SD1, M4E1, M4SE1, M4DC1, M4SDC1.



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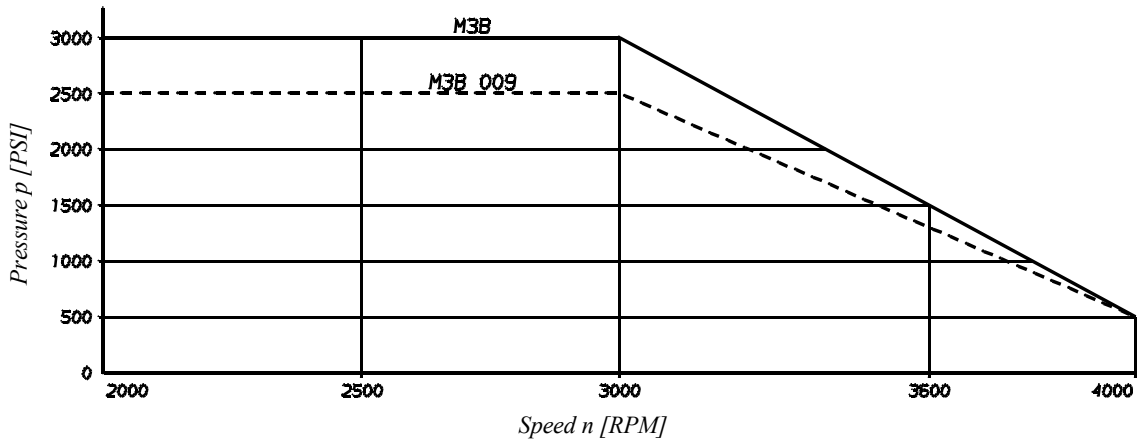
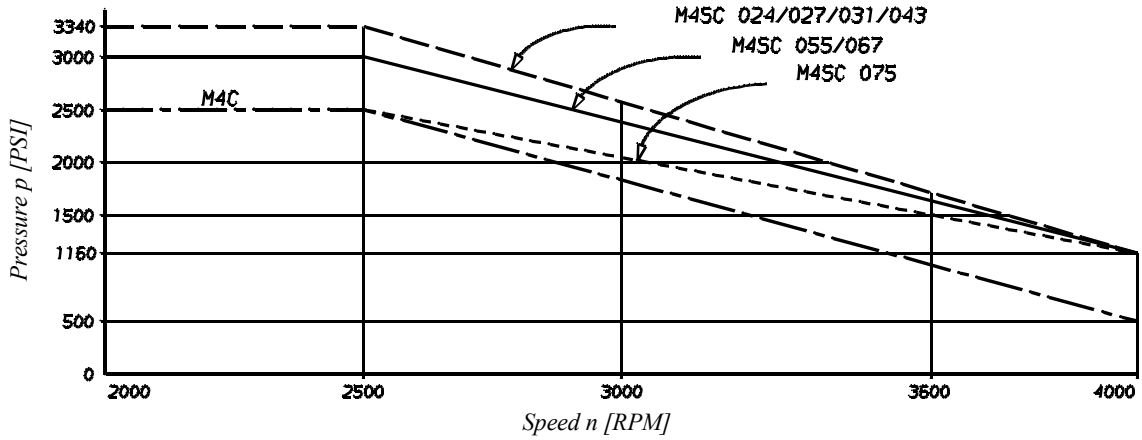
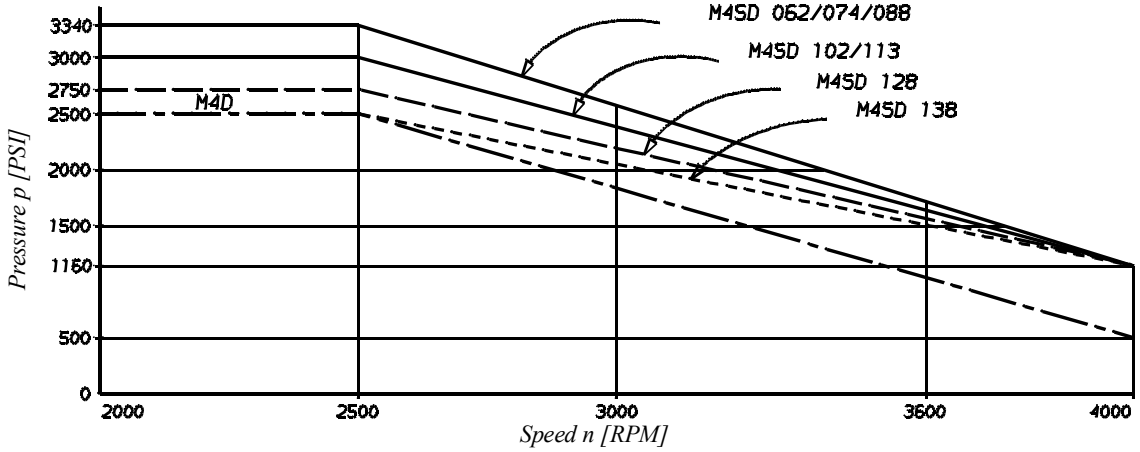
**M3B**



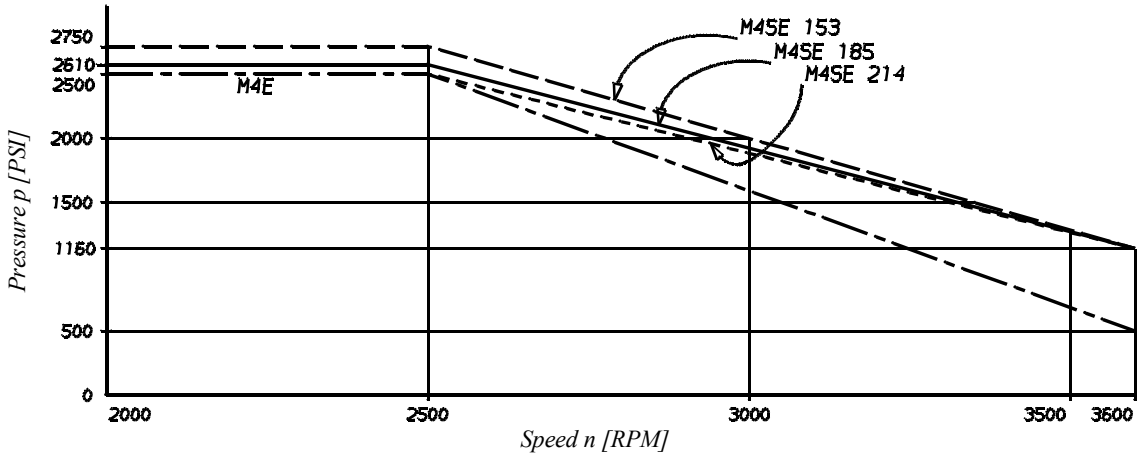

**M4C/M4SC**




**M4D/M4SD**




**M4E/M4SE**



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*Performances required*

| | | | |
|---|---|---|---|
| *Torque* | *T* | *[in.lbf]* | *1240* |
| *Pump flow (available) at 115 SUS* | $q_{Ve}$ | *[GPM]* | *30.4* |
| *Speed* | *n* | *[RPM]* | *1500* |
| *Pressure* | *p* | *[PSI]* | *2500* |

1. Check if available power is compatible with required power (0.85 estimated overall efficiency).

$$0.85 \ x \ \frac{Q_{Ve} x\, p}{1714} \geq \frac{T x\, RPM}{63025}$$

$$0.85 \ x \ \frac{30.4 \ x \ 2500}{1714} \geq \frac{1240 \ x \ 1500}{63025}$$

$37.7 > 29.5$

*Two ways of calculation :*

*2a. Calculate $V_i$ from T required torque*

$$V_i = \frac{2 \pi x\, T}{p} = \frac{2 \pi \ x \ 1240}{2500} = 3.12 \ in^3/_{rev.}$$

*3a. Motor choose from $V_i$ immediately greater*
*M4C 055 $V_i$ = 3.59 $in^3$/rev.*

*4a. Check real motor pressure for T = 1240 in.lbf around 1500 RPM*
*M4C 055 T = 1240 in.lbf n = 1500 RPM*
*p = 2370 PSI (see page 15)*

*5a. Flow loss M4C 055 at 2370 PSI at 115 SUS*
$q_{Vs}$ *= 4.2 GPM (see page 22)*
*Real flow used by the motor :*
$q_V = q_{Ve} - q_{Vs}$ *= 30.4 - 4.2 = 26.2 GPM*

*6a. Real speed of the motor :*

$$n = \frac{q_V \ x \ 231}{V_i} = \frac{26.2 \ x \ 231}{3.59} = 1686 \ RPM$$

Real performances

| | | | |
|---|---|---|---|
| $V_i$ | = | 3.59 $in^3$/rev. | } *M4C 055* |
| n | = | 1680 RPM | |
| T | = | 1240 in.lbf | |
| p | = | 2370 PSI | |

*2b. Calculate $V_i$ from $q_{Ve}$ available flow*

$$V_i = \frac{30.4 \ x \ 231}{1500} = 4.68 \ in^3/_{rev.}$$

*3b. Motor choose from $V_i$ immediately smaller*
*M4C 067 $V_i$ = 4.34 $in^3$/rev. (see page 22)*

*4b. Check motor press. with T = 1240 in.lbf at 1500 RPM*
*M4C 067 T = 1240 in.lbf n = 1500 RPM*
*p = 2030 PSI (see page 15)*

*5b. Flow loss of M4C 067 at 2030 PSI at 115 SUS*
$q_{Vs}$ *= 3.7 GPM (see page 22)*
*Real flow used by the motor :*
$q_V = q_{Ve} - q_{Vs}$ *= 30.4 - 3.7 = 26.7 GPM*

*6b. Real speed of the motor :*

$$n = \frac{q_V \ x \ 231}{V_i} = \frac{26.7 \ x \ 231}{4.34} = 1420 \ RPM$$

Real performances

| | | | |
|---|---|---|---|
| $V_i$ | = | 4.34 $in^3$/rev. | } *M4C 067* |
| n | = | 1420 RPM | |
| T | = | 1240 in.lbf | |
| p | = | 2030 PSI | |

In each case always choose the smallest motor which will operate at the highest speed and pressure, and offers the most efficient solution.



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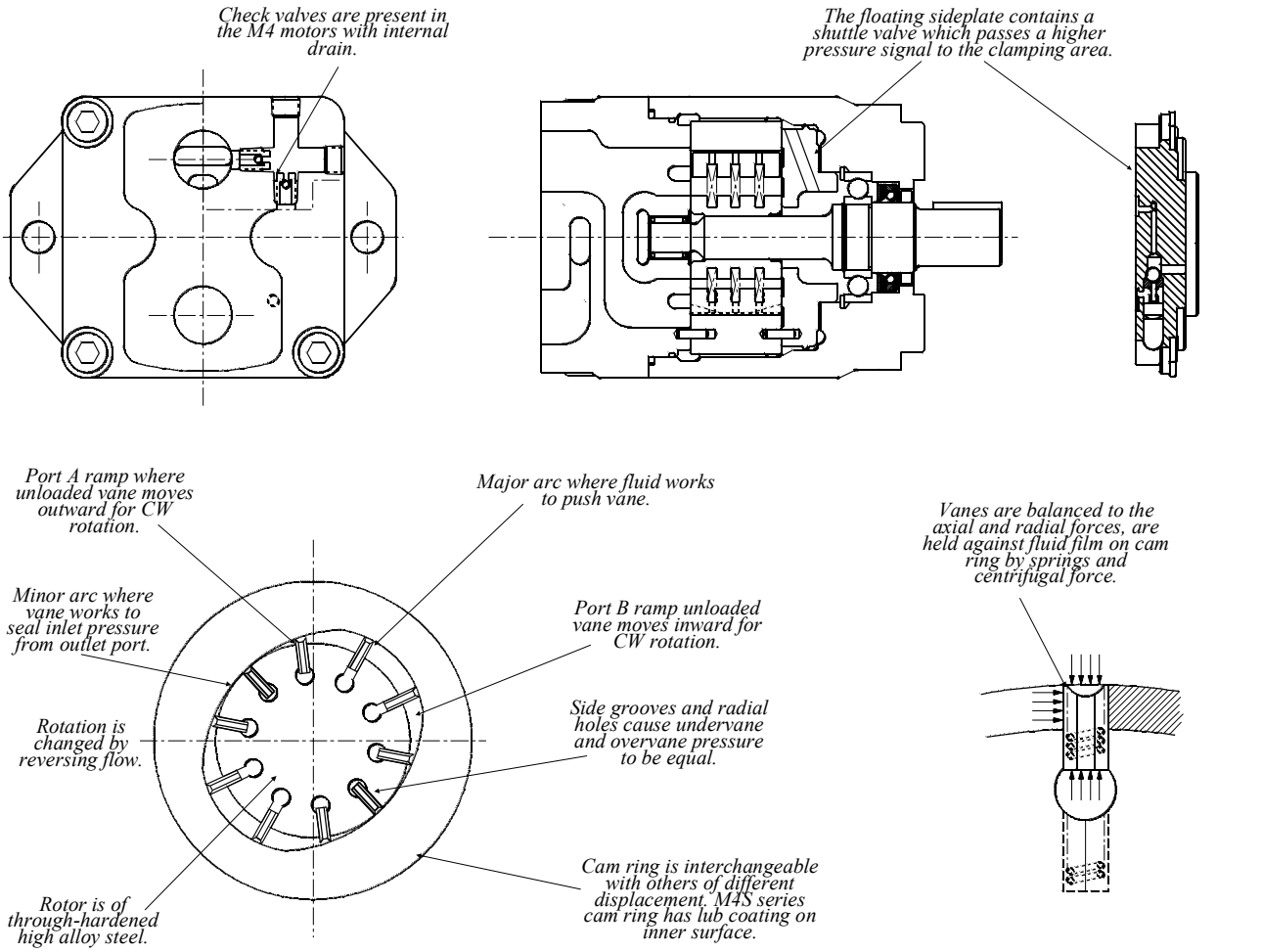


## OPERATION - SINGLE CARTRIDGE

- The motor shaft is driven by the rotor. Vanes, closely fitted into the rotor slots move radially to seal against the cam ring. The ring has two major and two minor radial sections joined by transitional sections called ramps. These contours and the pressures exposed to them are balanced diametrically.
- Light springs urge the vanes radially against the cam contour assuring a seal at zero speed so the motor can develop starting torque. The springs are assisted by centrifugal force at higher speeds. Radial grooves and holes through the vanes equalize radial hydraulic forces on the vanes at all times. Fluid enters and leaves the motor cartridge through opening in the side plates at the ramps. Each motor port connects to two diametrically opposed ramps. Pressurized fluid entering at Port A torques the rotor clockwise. The rotor transports it to the ramp openings which connect to Port B from which it returns to the low pressure side of the system. Pressure at Port B torques the rotor counter-clockwise.
- The rotor is separated axially from the sideplate surfaces by the fluid film. The front sideplate is clamped against the cam ring by the pressure, maintains optimum clearance as dimensions change with temperature and pressure. A 3-way shuttle valve in the sideplate causes clamping pressure in Port A or B, whichever is the highest.
- Materials are chosen for long life efficiency. Vanes, rotor and cam ring are made out of hardened high alloy steels. Cast semi-steel sideplates are chemically etched to have a fine crystalline surface for good lubrication at start-up.

**PORTS**
**EXTERNALLY DRAINED**
**SINGLE CARTRIDGE MOTORS**

These motors may be alternately pressurized at Ports A & B to 3400 PSI max. Whichever port is at low pressure should not be subjected to more than 500 PSI. If it is necessary to exceed these limitations, please contact DENISON Hydraulics for application assistance.

**INTERNALLY DRAINED**
**TANDEM CARTRIDGE MOTORS**

These motors must have a drain line connected to the center housing drain connection of sufficient size to prevent back pressure in excess of 50 PSI, and returned to the reservoir below the surface of the oil as far away from the supply pump suction as possible. Model M4DC1 does not require an external drain line, howewer the outlet pressure must not exceed 50 PSI.

**INTERNALLY DRAINED MOTORS**
**(M4C1, M4D1, M4E1, M4DC1)**

May be alternately pressurized at Ports A & B to 3400 PSI max. Whichever port is at low pressure must not be subjected to more than 22 PSI for M3B, 50 PSI for M4* (pressure peak 100 PSI).
To insure maximum motor performance in conjunction with your specific application, consult your DENISON Hydraulics Representative if your application requires :

- minimum speed of less than 100 RPM,
- indirect drive,
- overrunning loads,
- braking or retarding.

**M4S SEVERE DUTY MOTORS**

M4S motors are recommended to be used when back pressure is over 2000 PSI and speed is over 2000 RPM. They are also recommended when fluid viscosity can be under 115 SUS and speed over 2000 RPM. For such severe duty applications M4S motors will exhibity longer life time at high efficiency.

**RECOMMENDED FLUIDS**

Petroleum based antiwear R & O fluids.
These fluids are the recommended fluids for M3B and M4* series motors. Maximum catalog ratings and performance data are based on operation with these fluids. These fluids are covered by DENISON Hydraulics HF-0 and HF-2 specifications.

**ACCEPTABLE ALTERNATE FLUIDS**

Acceptable alternate fluids :
The use of fluids other than petroleum based antiwear R & O fluids requires that the maximum ratings of the motors will be reduced. In some cases, the minimum replenishment pressures must be increased. Refer to the following chart and the operating characteristics chart for each M3B and M4* motor model for specific details of the reduced ratings.

**VISCOSITY**

| | |
|---|---|
| Max. (cold start, low speed & pressure) | 3900 SUS |
| Max. (full speed & pressure) | 500 SUS |
| Optimum (max. life) | 140 SUS |
| Min. (full speed & pressure for HF-1 fluid) | 89 SUS |
| Min. (full speed & pressure for HF-0 & HF-2 fluids) | 59 SUS |

**VISCOSITY INDEX**

90° min. Higher values extend range of operating temperatures and life time.

| | |
|---|---|
| Maximum fluid temperature (θ) °F | |
| HF-0, HF-1, HF-2 | + 176° |
| Minimum fluid temperature (θ) °F | |
| HF-0, HF-1, HF-2 | - 0.4° |

**FLUID CLEANLINESS**

The fluid must be cleaned before and during operation to maintain contamination level of NAS 1638 class 8 (or ISO 18/14) or better. Filters with 25 micron (or better, ß10 ≥ 100) nominal ratings may be adequate but do not guarantee the required cleanliness levels.

**OPERATING TEMPERATURES AND VISCOSITIES**

Operating temperatures are a function of fluid viscosities, fluid type, and the pump. Fluid viscosity should be selected to provide optimum viscosity at normal operating temperatures. For cold starts the pumps should be operated at low speed and pressure until fluid warms up to an acceptable viscosity for full power operation.

**WATER CONTAMINATION IN THE FLUID**

Maximum acceptable content of water.

- 0,10 % for mineral base fluids.
- 0,05 % for synthetic fluids, crankcase oils, biodegradable fluids.

If amount of water is higher then it should be drained off the circuit.

**SPLINED SHAFTS**
**COUPLINGS SPLINES**

- The mating female spline should be free to float and find its own center. If both members are rigidly supported, they must be aligned within .006 TIR or less to reduce fretting. The angular alignment of two spline axes must be less than ± .002 per 1".
- The coupling spline must be lubricated with a lithium molydisulfide grease or a similar lubricant.
- The coupling must be hardened to a hardness between 27 and 45 HRc.
- The female spline must be made to confom to the Class 1 fit as described in SAE-J498b (1971). This is described as a Flat Root Side Fit.

**KEYED SHAFT**

DENISON Hydraulics supplies the M3B and M4* series keyed shaft motors with high strength heat-treated keys. Therefore, when installing or replacing these motors, the heat-treated keys must be used in order to ensure maximum life in the application. If the key is replaced, it must be a heat-treated key between 27 and 34 R.C. hardness. The corners of the keys must be chamfered .03 to .04 at 45° to clear radii in the key way.

**NOTE**

Alignment of keyed shafts must be within tolerances given for splined shafts.

**SHAFT LOADS**

Axial or radial load are permissible. Consult specific sections for more details.

**MINIMUM REPLENISHMENT PRESSURE (PSI)**

| Series | Speed [RPM] - Oil viscosity = 150 SUS | | | | |
|---|---|---|---|---|---|
| | **500** | **1000** | **2000** | **3000** | **3600** |
| **M3B** | 8.7 | 14.5 | 27.6 | 50.8 | 84.2 |
| **M4C/SC** | 10.2 | 20.3 | 45.0 | 79.8 | 135.0 |
| **M4D/SD** | 10.2 | 20.3 | 45.0 | 79.8 | 135.0 |
| **M4E/SE** | 20.3 | 40.6 | 75.5 | 159.6 | |
| **M4DC/SDC** | | | | | |
| **2-C-DC** | 24.7 | 55.1 | 145.1 | 325.1 | 410.7 |
| **2-D-DC** | 16.0 | 24.7 | 79.8 | 155.3 | 219.2 |
| **3-D-C-DC** | 24.7 | 55.1 | 145.1 | 325.1 | 410.7 |

The inlet port of the fluid motor must be supplied with replenishment pressure as listed above to prevent cavitation during dynamic braking. These pressures should be multiplied by a coefficient of 1,5 for M4S motors used with fire resistant fluids (HF-3, HF-4, HF-5).
Replenishment pressure for tandem 2 & 3-speed motors must be provided during periods when the motor is dynamic braking, shutting down or coasting. When the motor is operating in the high speed mode and the nonworking cartridge is at low pressure, it is necessary to create a back pressure, as listed above, at the motor discharge port. The above mentioned minimum replenishment pressure chart is for maximum displacement cartridges. Smaller cartridges require lower minimum pressures.
Contact DENISON Hydraulics for further information.

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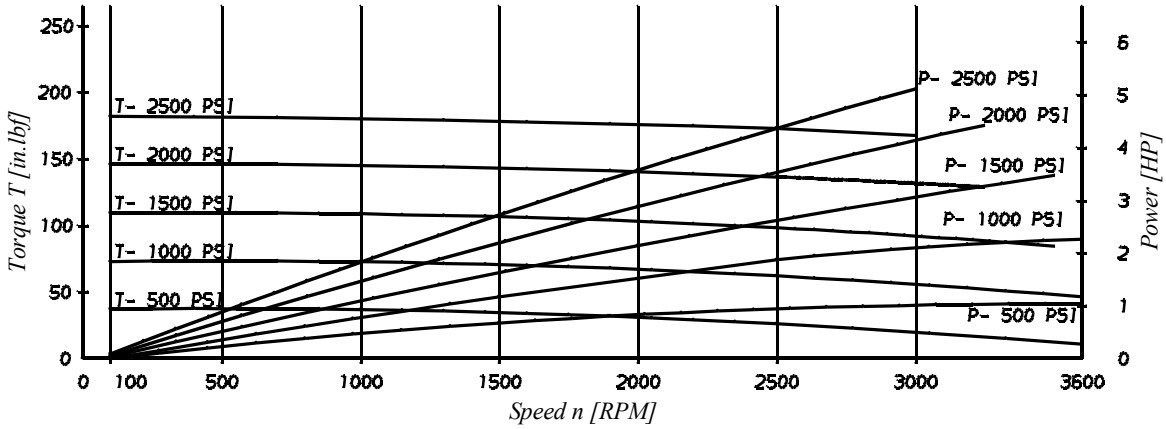
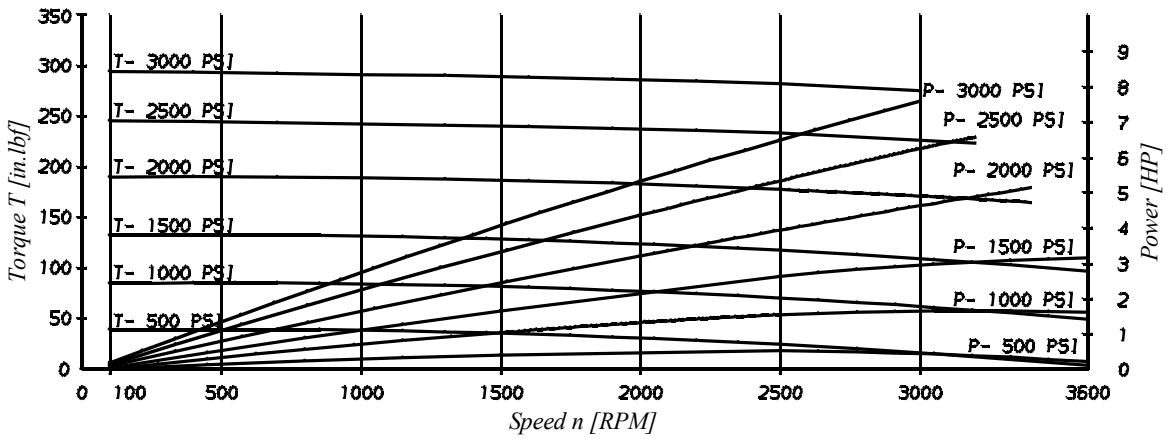
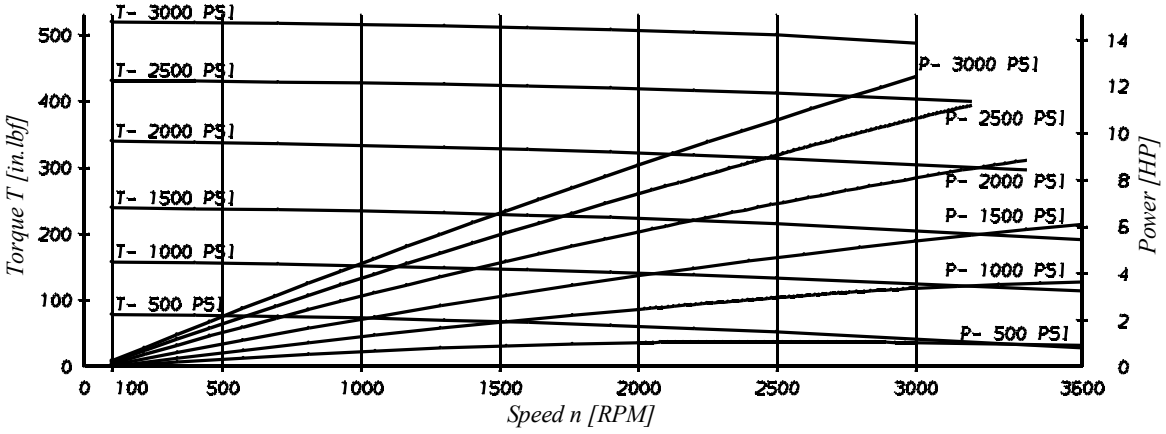
**M3B 009**



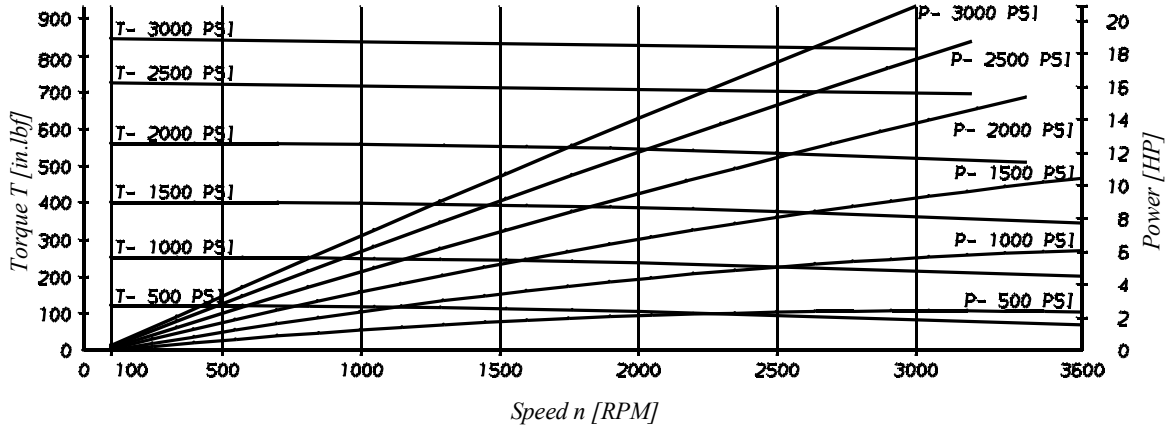

**M3B 012**




**M3B 018**




**M3B 027**



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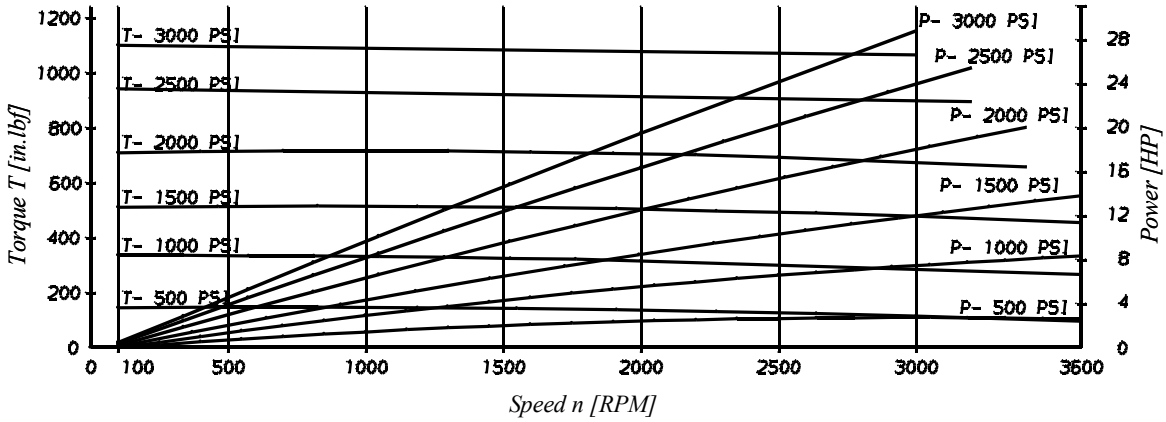
**M3B 036**



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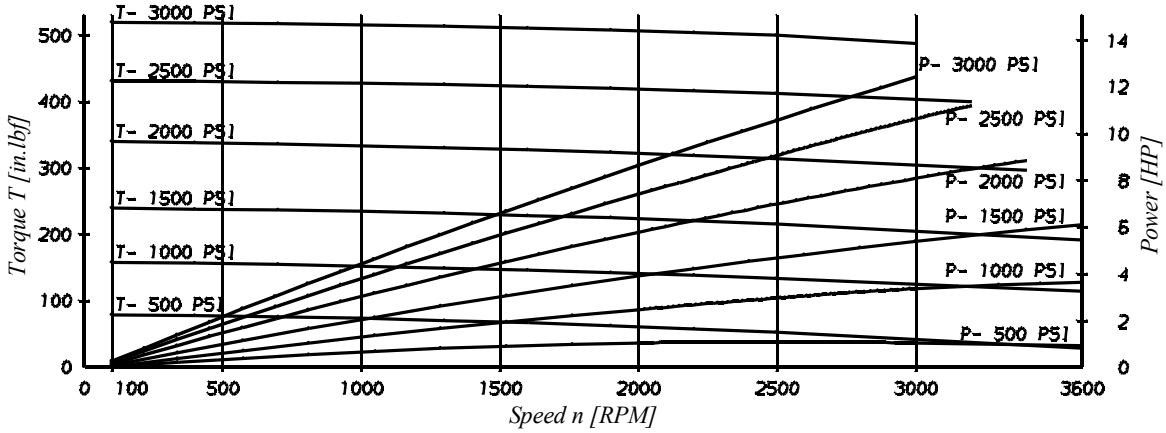
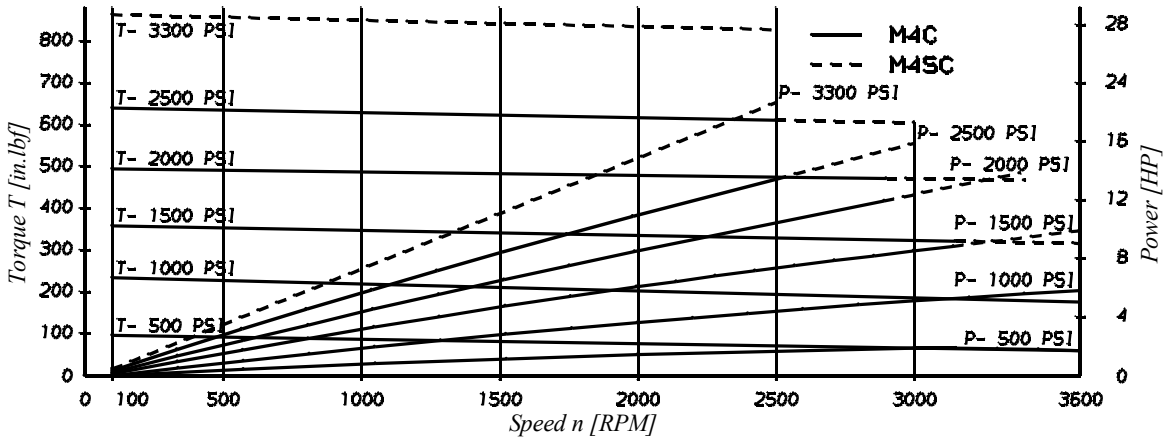
Vierzon - France

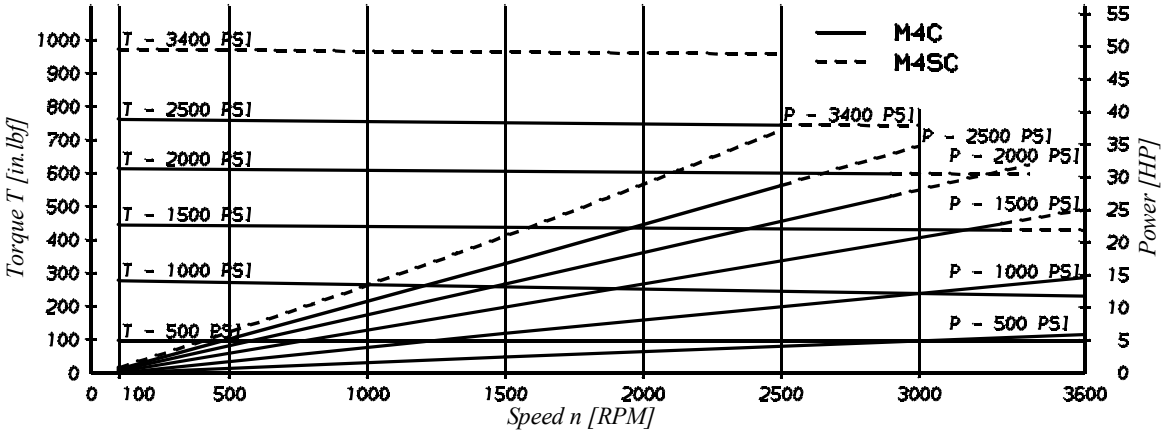
**M4C 024**



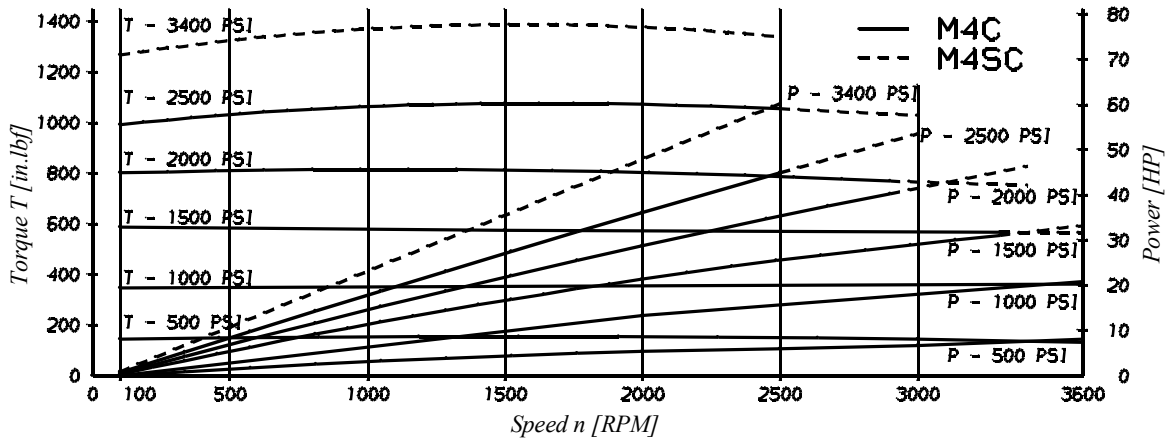

**M4C 027**




**M4C 031**




**M4C 043**



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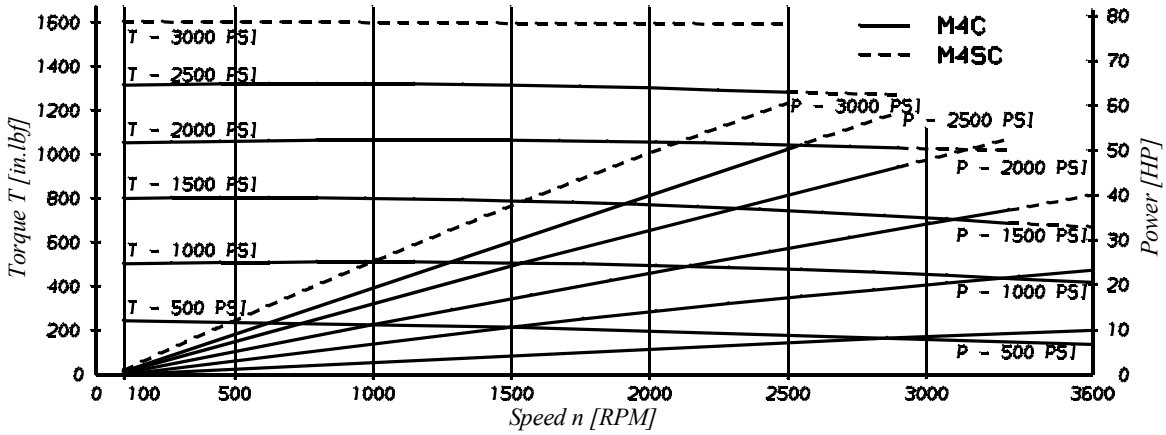
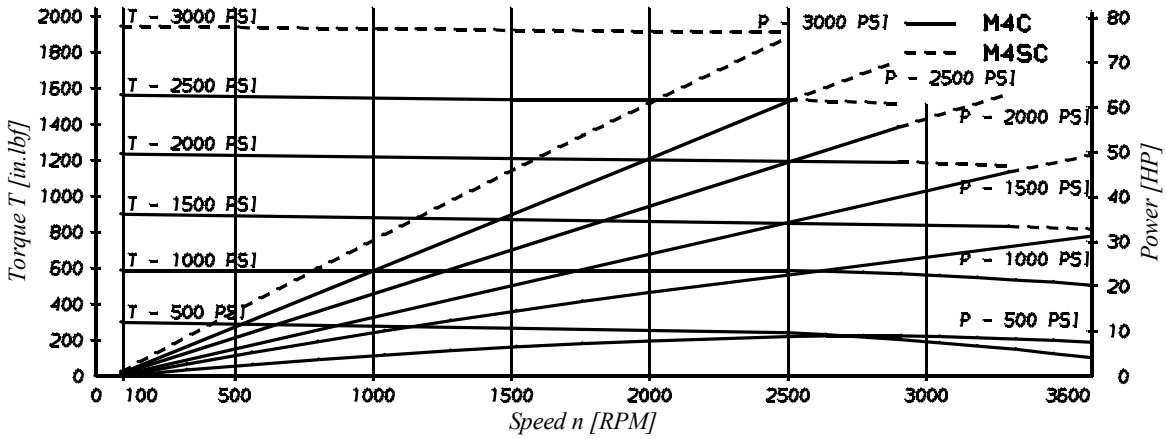
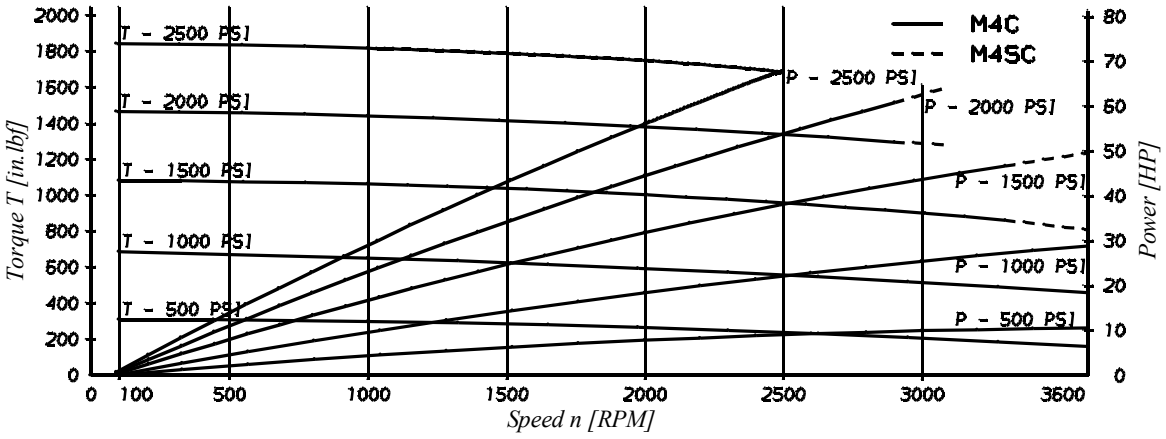
**M4C 055**




**M4C 067**




**M4C 075**



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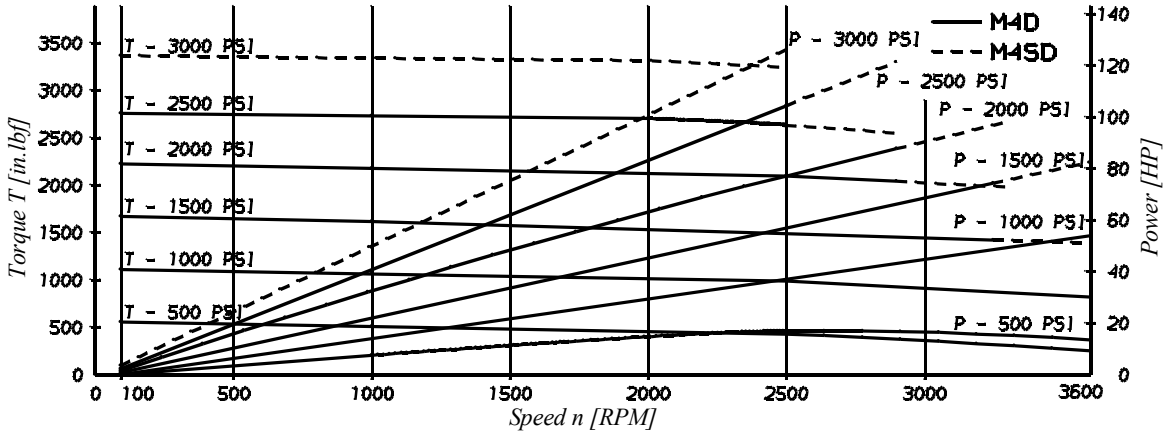
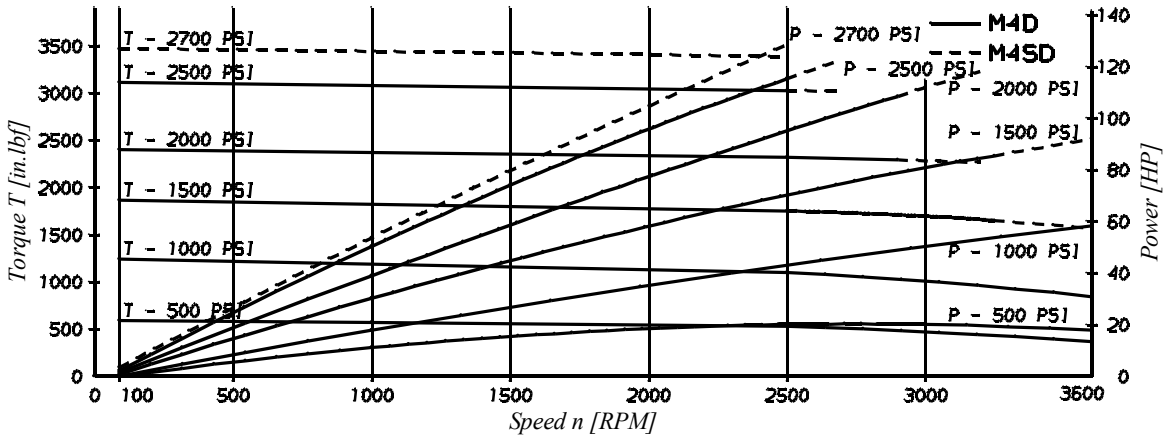
Vierzon - France

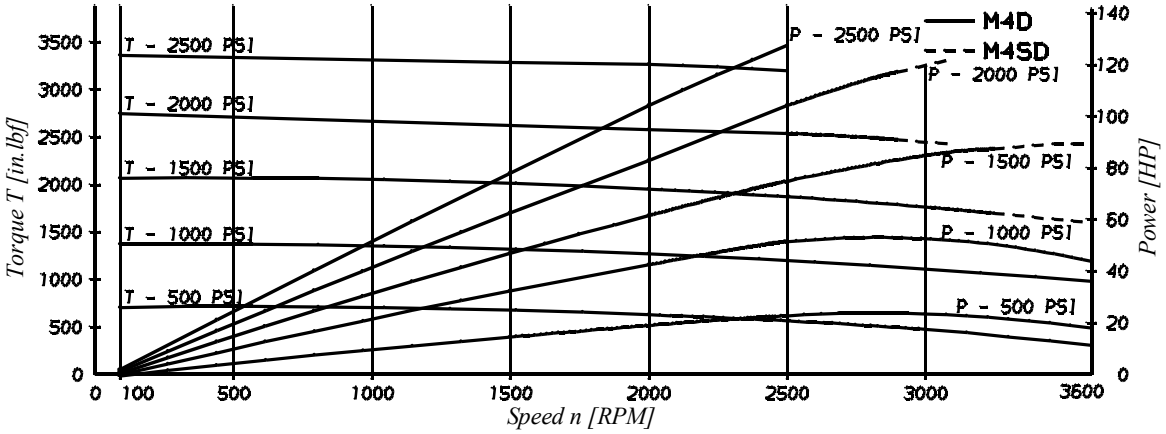
**M4D 113**




**M4D 128**




**M4D 138**



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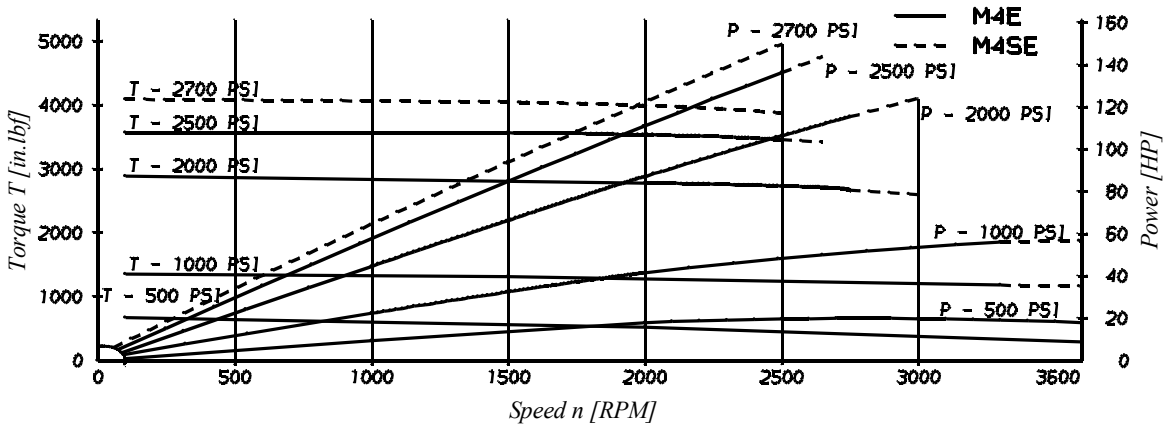
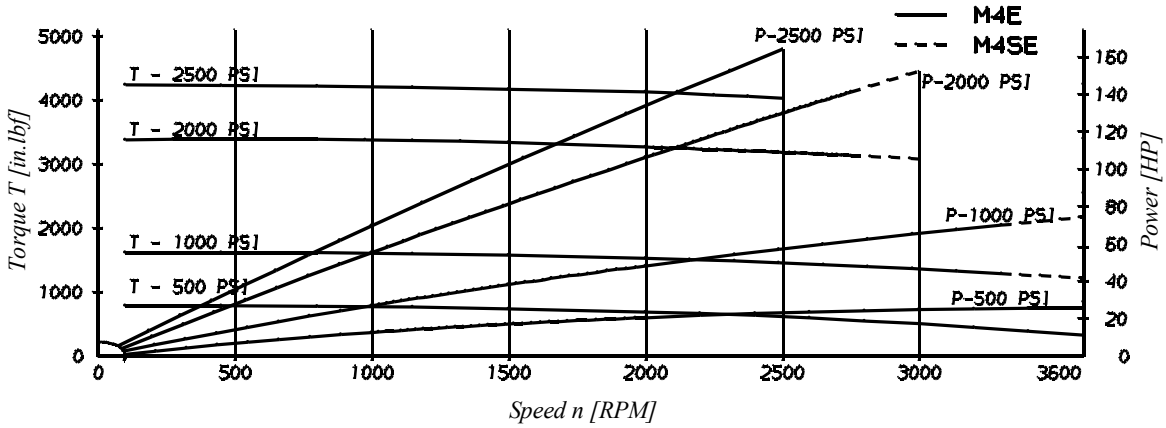
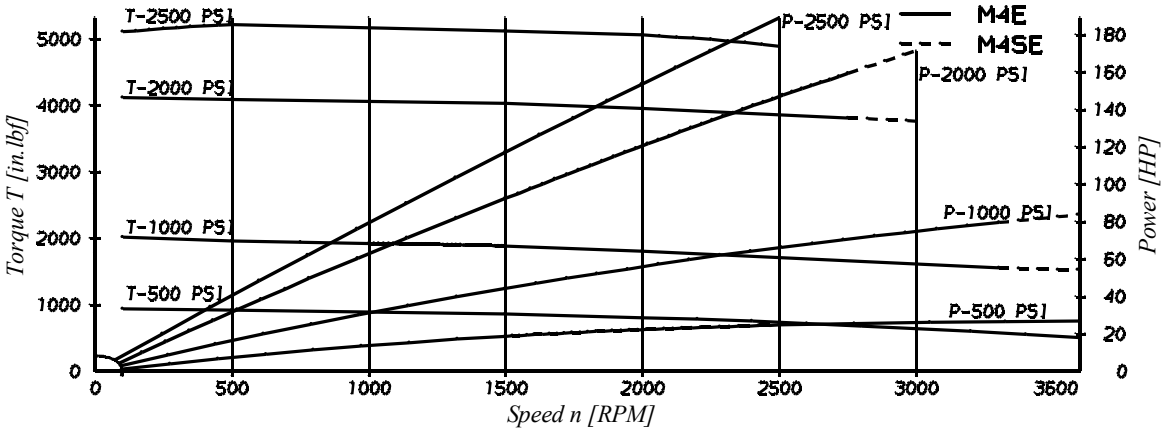
**M4E 153**




**M4E 185**




**M4E 214**



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## ORDERING CODE - M3B SERIES

**Model No.** M3B1 / M3B - 036 - 1 N 00 - B 1 01 ..

**Series external drain**

**Series internal drain**

**Torque**
009 = .08 in.lb/PSI
012 = .11 in.lb/PSI
018 = .19 in.lb/PSI
027 = .30 in.lb/PSI
036 = .38 in.lb/PSI

**Type of shaft**
1 = keyed (non SAE)
3 = splined (SAE A)
4 = splined (SAE B)

**Rotation**
N = bi-directional

**Modification**

**Port connections**
00 = SAE threaded port
SAE drain
01 = SAE 4 bolt flange
BSPP drain
02 = BSPP threaded port
BSPP drain

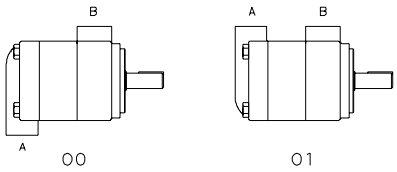
**Seal class**
1 = S1 - BUNA N
4 = S4 - EPDM
5 = S5 - VITON

**Design letter**

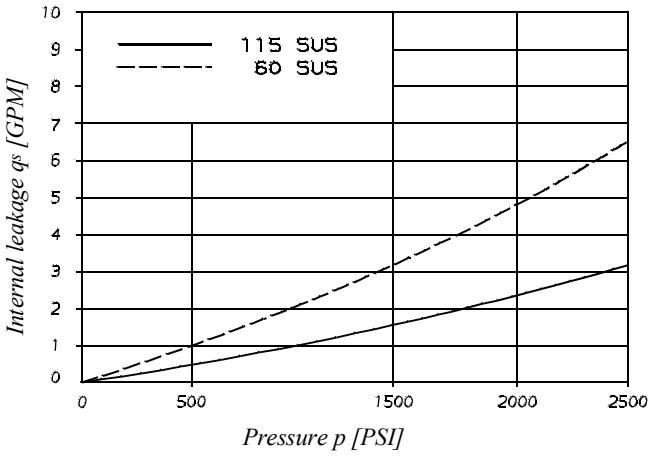
**Porting combination**
00 = standard

**View from shaft end :**

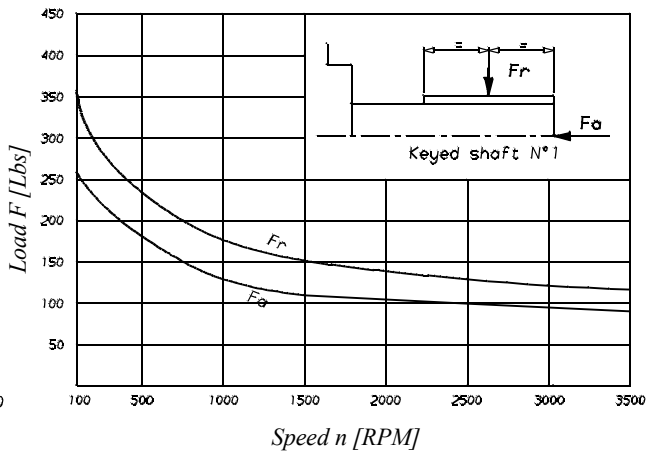
| CW rotation | A = inlet<br>B = outlet | CCW rotation | A = outlet<br>B = inlet |
|---|---|---|---|




### INTERNAL LEAKAGE



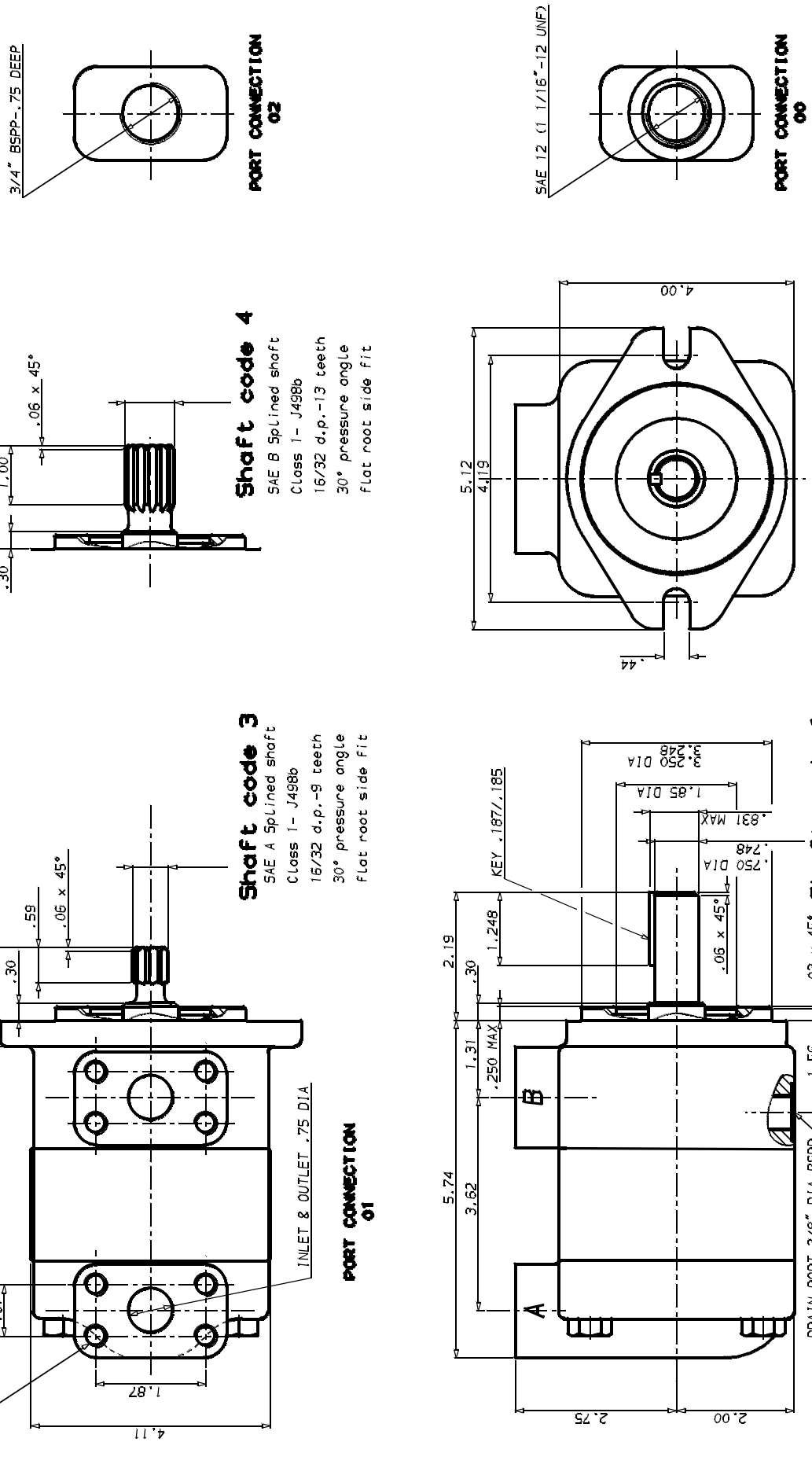

### PERMISSIBLE RADIAL AND AXIAL LOADS




*Do not apply Fr and Fa loads simultaneously*

### OPERATING CHARACTERISTICS - TYPICAL [115 SUS]

| Model | Volumetric displacement $V_i$ | Input flow at n = 2000 RPM | | Torque T at n = 2000 RPM | Power output at n = 2000 RPM |
|---|---|---|---|---|---|
| | | Theorical | at 2500 PSI Δ p | at 2500 PSI Δ p | at 2500 PSI Δ p |
| | $in^3$/rev. | GPM | GPM | in.lbf | HP |
| M3B 009 | .56 | 4.9 | 8.0 | 174.3 | 5.8 |
| M3B 012 | .75 | 6.5 | 9.7 | 236.3 | 7.8 |
| M3B 018 | 1.13 | 9.8 | 12.9 | 412.4 | 13.4 |
| M3B 027 | 1.70 | 14.7 | 17.8 | 680.5 | 21.8 |
| M3B 036 | 2.26 | 19.6 | 22.8 | 902.6 | 28.3 |



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Denison Vane Pump Division
Vierzon - France

**Model No.** M4*C1 / M4*C - 067 - 1 - N - 00 - A - 1 - 02 - ..

**Series external drain**

**Series internal drain**

**Torque**
024 = .24 in.lb/PSI
027 = .28 in.lb/PSI
031 = .33 in.lb/PSI
043 = .45 in.lb/PSI
055 = .57 in.lb/PSI
067 = .69 in.lb/PSI
075 = .78 in.lb/PSI

**Type of shaft**
1 = keyed (SAE B)
2 = keyed (non SAE)
3 = splined (SAE B)

**Rotation**
N = bi-directional

**Modification**

**Port connections**
01 = SAE threaded port
SAE drain
02 = SAE 4 bolt flange
UNC threaded - SAE drain
04 = SAE 4 bolt flange
UNC threaded - BSPP drain
M4 = SAE 4 bolt flange
metric threaded - BSPP drain

**Seal class**
1 = S1 (M4C)
5 = S5 (M4SC)

**Design letter**

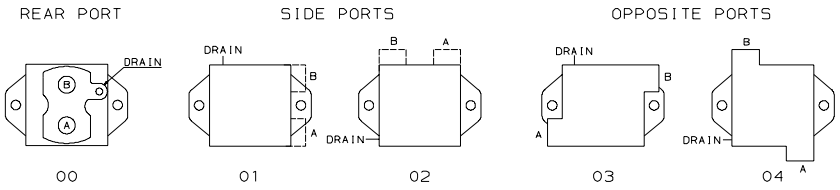
**Porting combination**
00 = standard

* = S = *Severe duty motor.*

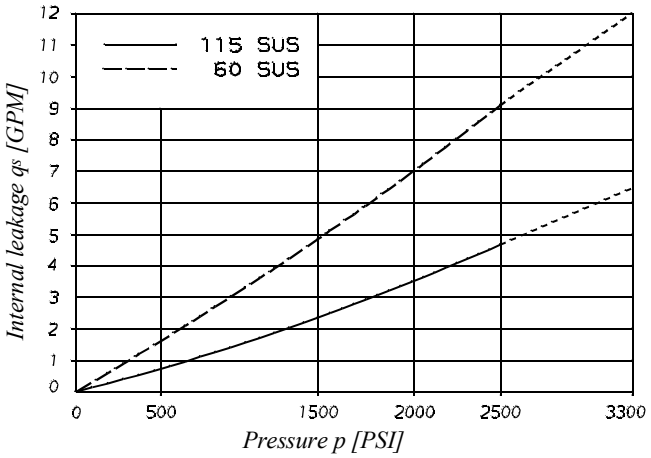
*M4C1 - M4SC1 : Drain port is plugged.*

**View from shaft end :**
CW rotation A = inlet
B = outlet
CCW rotation A = outlet
B = inlet

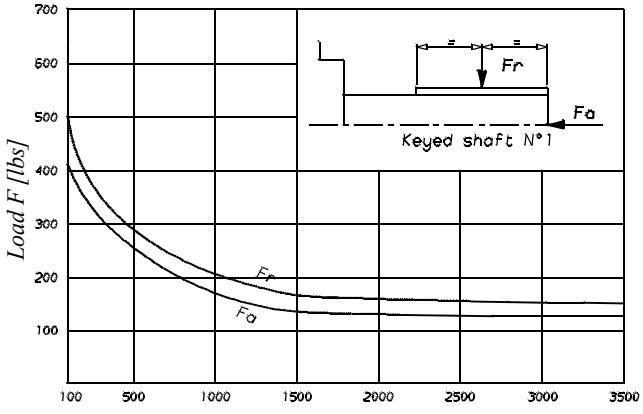
**Porting combination**




## INTERNAL LEAKAGE




## PERMISSIBLE RADIAL AND AXIAL LOADS




*Do not apply Fr and Fa loads simultaneously*

## OPERATING CHARACTERISTICS - TYPICAL [115 SUS]

| Model | Volumetric displacement $V_i$ | Input flow at n = 2000 RPM | | Torque T at n = 2000 RPM | Power output at n = 2000 RPM |
|---|---|---|---|---|---|
| | | Theorical | at 2500 PSI Δ p | at 2500 PSI Δ p | at 2500 PSI Δ p |
| | $in^3$/rev. | GPM | GPM | in.lbf | HP |
| M4C - M4SC 024 | 1.49 | 13.0 | 17.7 | 535.4 | 17.0 |
| M4C - M4SC 027 | 1.72 | 14.8 | 19.5 | 619.5 | 19.7 |
| M4C - M4SC 031 | 2.11 | 18.5 | 23.2 | 768.0 | 24.0 |
| M4C - M4SC 043 | 2.84 | 24.6 | 29.3 | 1062.0 | 33.6 |
| M4C - M4SC 055 | 3.59 | 31.2 | 36.0 | 1318.6 | 41.8 |
| M4C - M4SC 067 | 4.34 | 37.5 | 42.3 | 1504.5 | 47.7 |
| M4C - M4SC 075 | 4.89 | 42.3 | 47.0 | 1752.2 | 55.6 |



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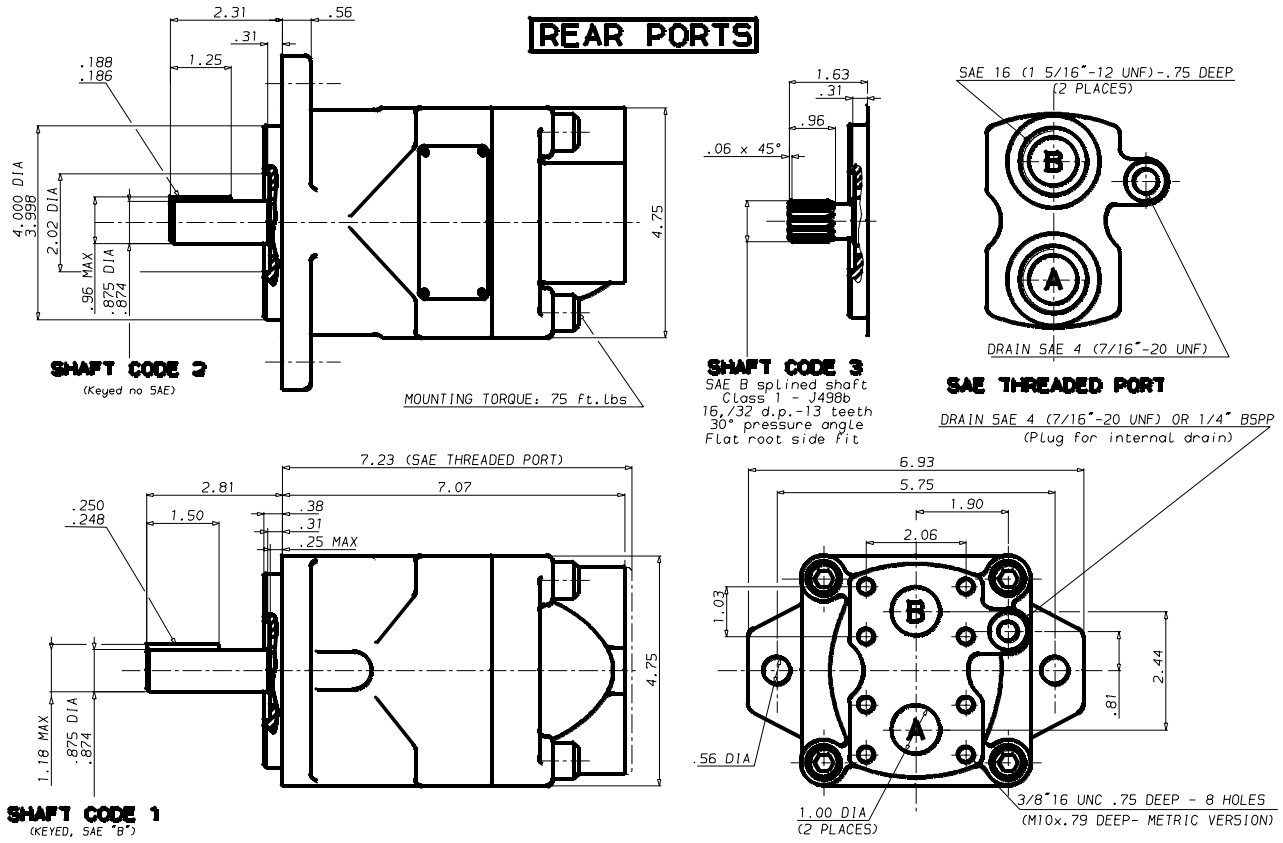


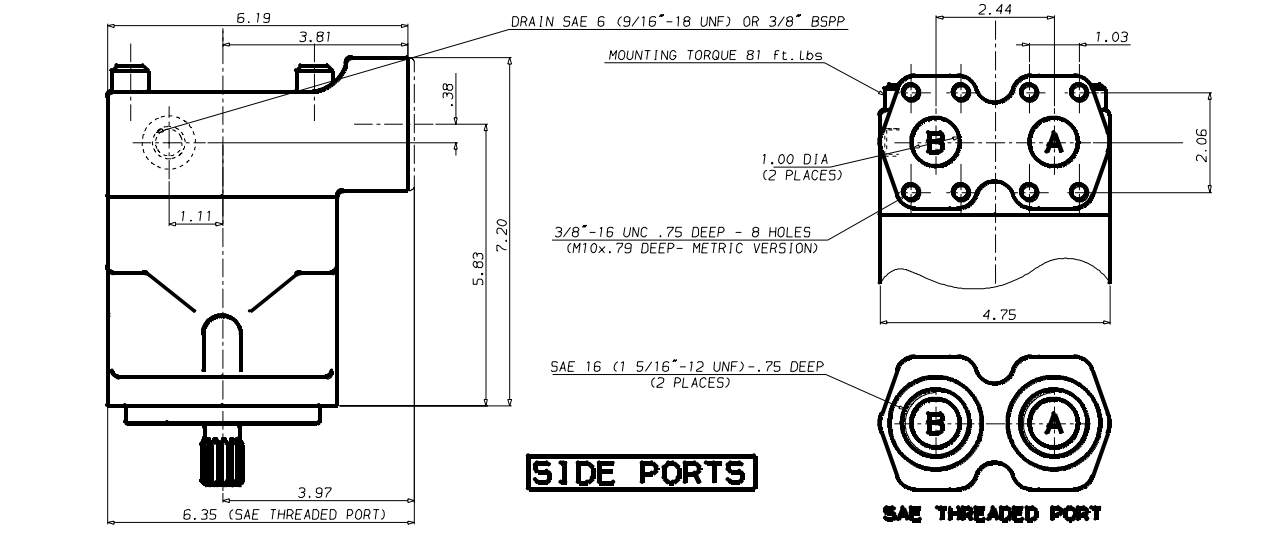


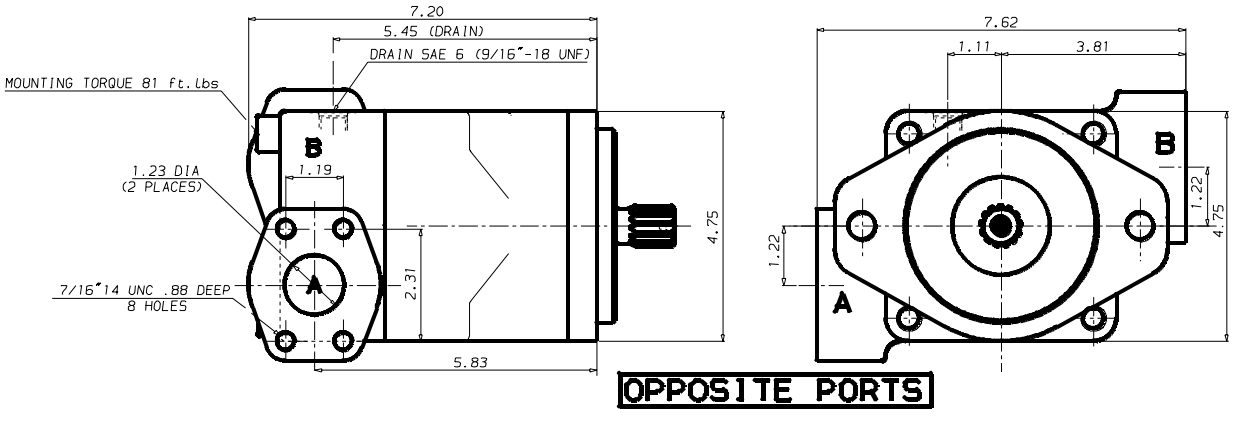




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Vierzon - France

**Model No.** M4*D1
**M4*D - 138 - 1 N 00 - B 1 02 ..**

**Series external drain**

**Series internal drain**

**Torque**
062 = .63 in.lb/PSI
074 = .75 in.lb/PSI
088 = .88 in.lb/PSI
102 = .96 in.lb/PSI
113 = 1.13 in.lb/PSI
128 = 1.28 in.lb/PSI
138 = 1.40 in.lb/PSI

**Type of shaft**
1 = keyed (SAE C)
3 = splined (SAE C)

**Rotation**
N = bi-directional

**Modification**

**Port connections**
01 = SAE threaded port
SAE drain
02 = SAE 4 bolt flange
UNC threaded - SAE drain
04 = SAE 4 bolt flange
UNC threaded - BSPP drain
M4 = SAE 4 bolt flange
metric threaded - BSPP drain

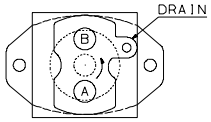
**Seal class**
1 = S1 (M4D)
5 = S5 (M4SD)

**Design letter**

**Porting combination**
00 = standard

* = S = *Severe duty motor.*

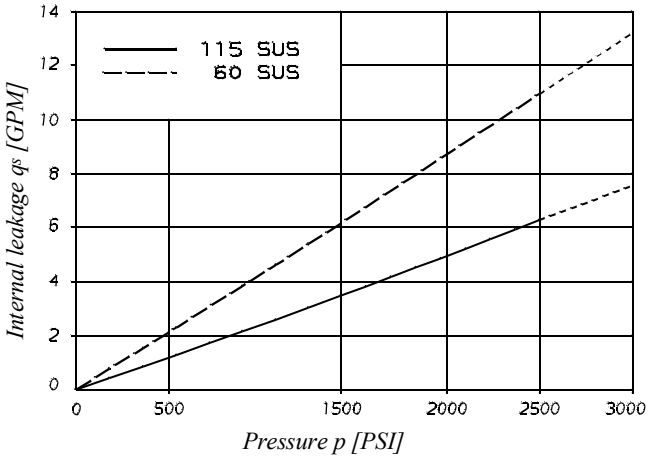
*M4D1 - M4SD1 : Drain port is plugged.*



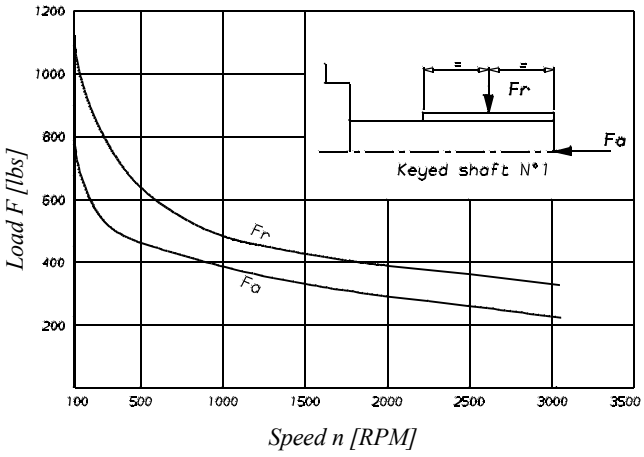

00

**View from shaft end :**
CW rotation A = inlet B = outlet
CCW rotation A = outlet B = inlet

**INTERNAL LEAKAGE**




**PERMISSIBLE RADIAL AND AXIAL LOADS**




*Do not apply Fr and Fa loads simultaneously*

**OPERATING CHARACTERISTICS - TYPICAL [115 SUS]**

| Model | Volumetric displacement $V_i$ | Input flow at n = 2000 RPM | | Torque T at n = 2000 RPM | Power output at n = 2000 RPM |
|---|---|---|---|---|---|
| | | Theorical | at 2500 PSI Δ p | at 2500 PSI Δ p | at 2500 PSI Δ p |
| | $in^3/rev.$ | GPM | GPM | in.lbf | HP |
| M4D - M4SD 062 | 3.97 | 33.8 | 40.0 | 1460.0 | 46.4 |
| M4D - M4SD 074 | 4.69 | 41.5 | 47.8 | 1770.0 | 56.2 |
| M4D - M4SD 088 | 5.56 | 48.0 | 54.4 | 2088.5 | 66.2 |
| M4D - M4SD 102 | 6.44 | 55.5 | 61.8 | 2336.3 | 74.1 |
| M4D - M4SD 113 | 7.12 | 61.5 | 67.9 | 2655.0 | 84.2 |
| M4D - M4SD 128 | 8.08 | 70.0 | 76.3 | 3009.0 | 95.5 |
| M4D - M4SD 138 | 8.81 | 76.3 | 82.7 | 3292.0 | 104.5 |



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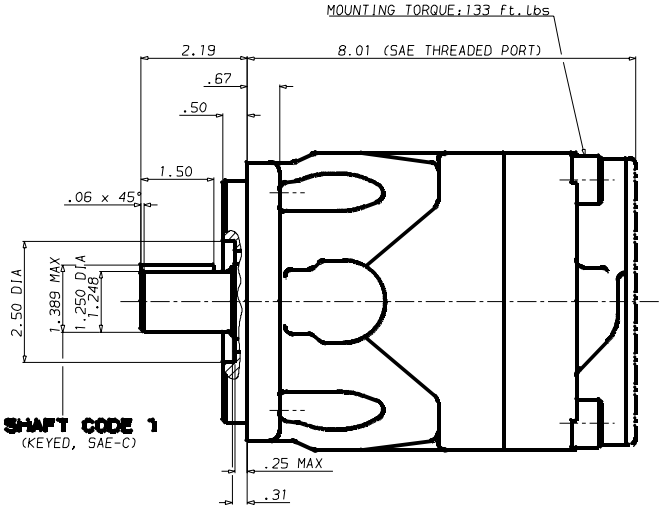


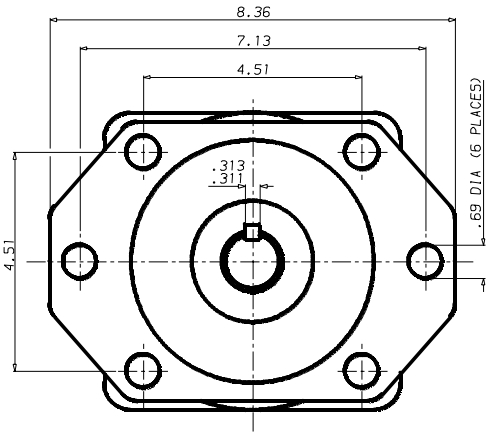


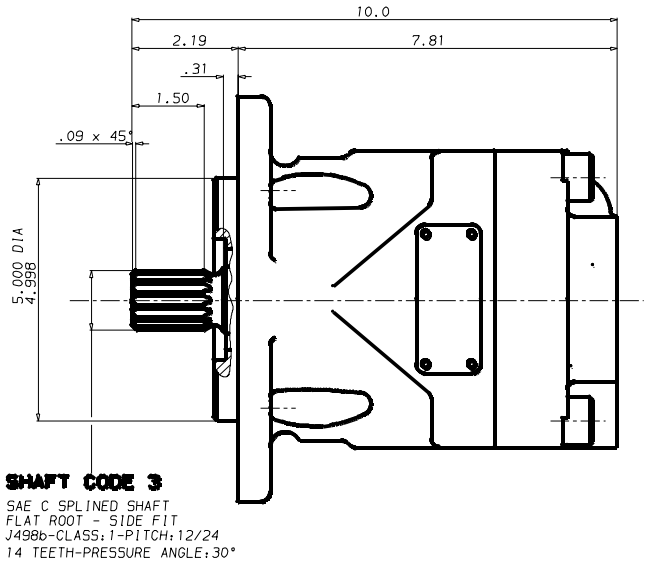


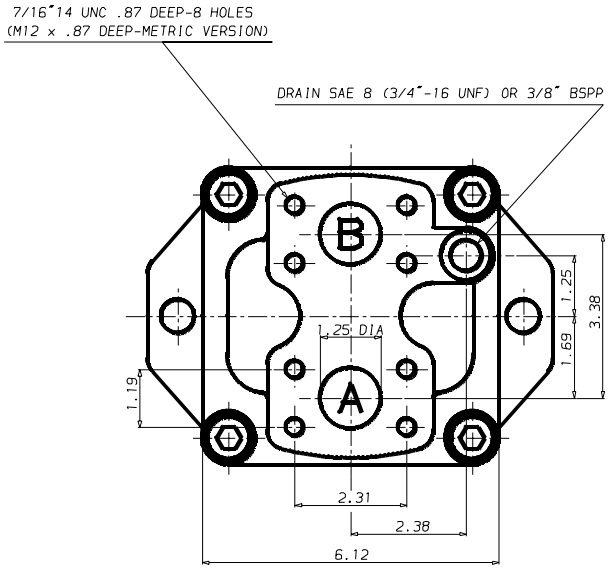


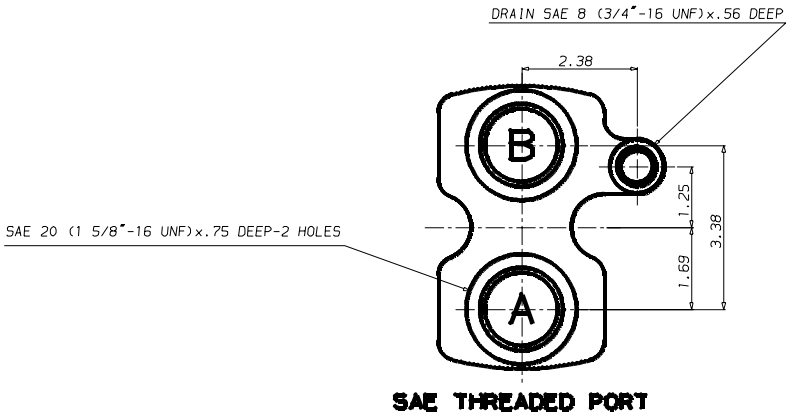




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## ORDERING CODE - M4E - M4SE SERIES

**Model No.** **M4*E1**
**M4*E - 214 - 1 N 00 - B 5 02 ..**

**Series external drain**

**Series internal drain**

**Torque**
153 = 1.54 in.lb/PSI
185 = 1.86 in.lb/PSI
214 = 2.16 in.lb/PSI

**Type of shaft**
1 = keyed (SAE C)
3 = splined (SAE C)

**Rotation**
N = bi-directional

* = S = *Severe duty motor.*

*M4E1 - M4SE1 : Drain port is plugged.*

**View from shaft end :**

| CW rotation | | CCW rotation | |
|---|---|---|---|
| | A = inlet | | A = outlet |
| | B = outlet | | B = inlet |

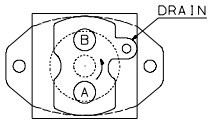
**Modification**

**Port connections**
01 = SAE threaded port
SAE drain
02 = SAE 4 bolt flange
UNC threaded - SAE drain
04 = SAE 4 bolt flange
UNC threaded - BSPP drain

**Seal class**
5 = S5

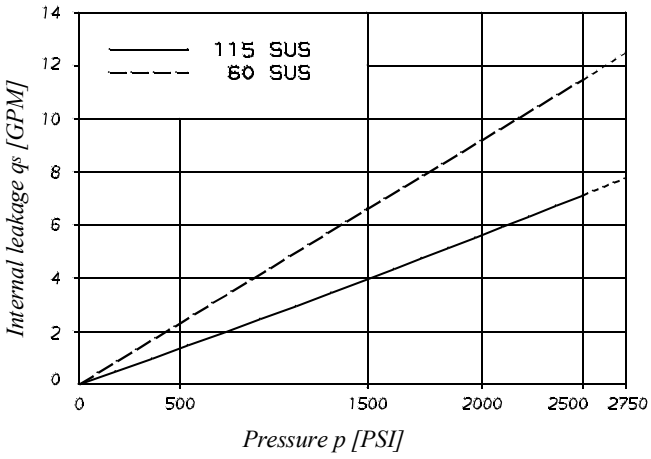
**Design letter**

**Porting combination**
00 = standard



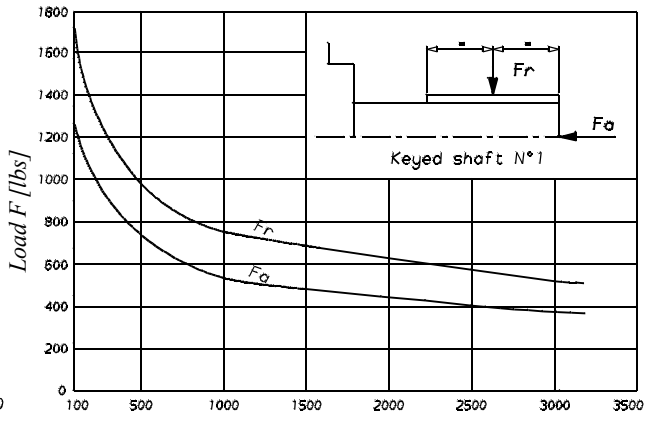

00

### INTERNAL LEAKAGE




*Pressure p [PSI]*

### PERMISSIBLE RADIAL AND AXIAL LOADS




*Speed n [RPM]*

*Do not apply Fr and Fa loads simultaneously*

### OPERATING CHARACTERISTICS - TYPICAL [115 SUS]

| Model | Volumetric displacement $V_i$ | Input flow at n = 2000 RPM | | Torque T at n = 2000 RPM | Power output at n = 2000 RPM |
|---|---|---|---|---|---|
| | | Theorical | at 2500 PSI Δ p | at 2500 PSI Δ p | at 2500 PSI Δ p |
| | $in^3$/rev. | GPM | GPM | in.lbf | HP |
| M4E - M4SE 062 | 9.67 | 83.7 | 90.6 | 3522.0 | 111.8 |
| M4E - M4SE 074 | 11.69 | 101.2 | 108.0 | 4283.2 | 136.0 |
| M4E - M4SE 088 | 13.55 | 117.3 | 124.2 | 5017.7 | 159.3 |



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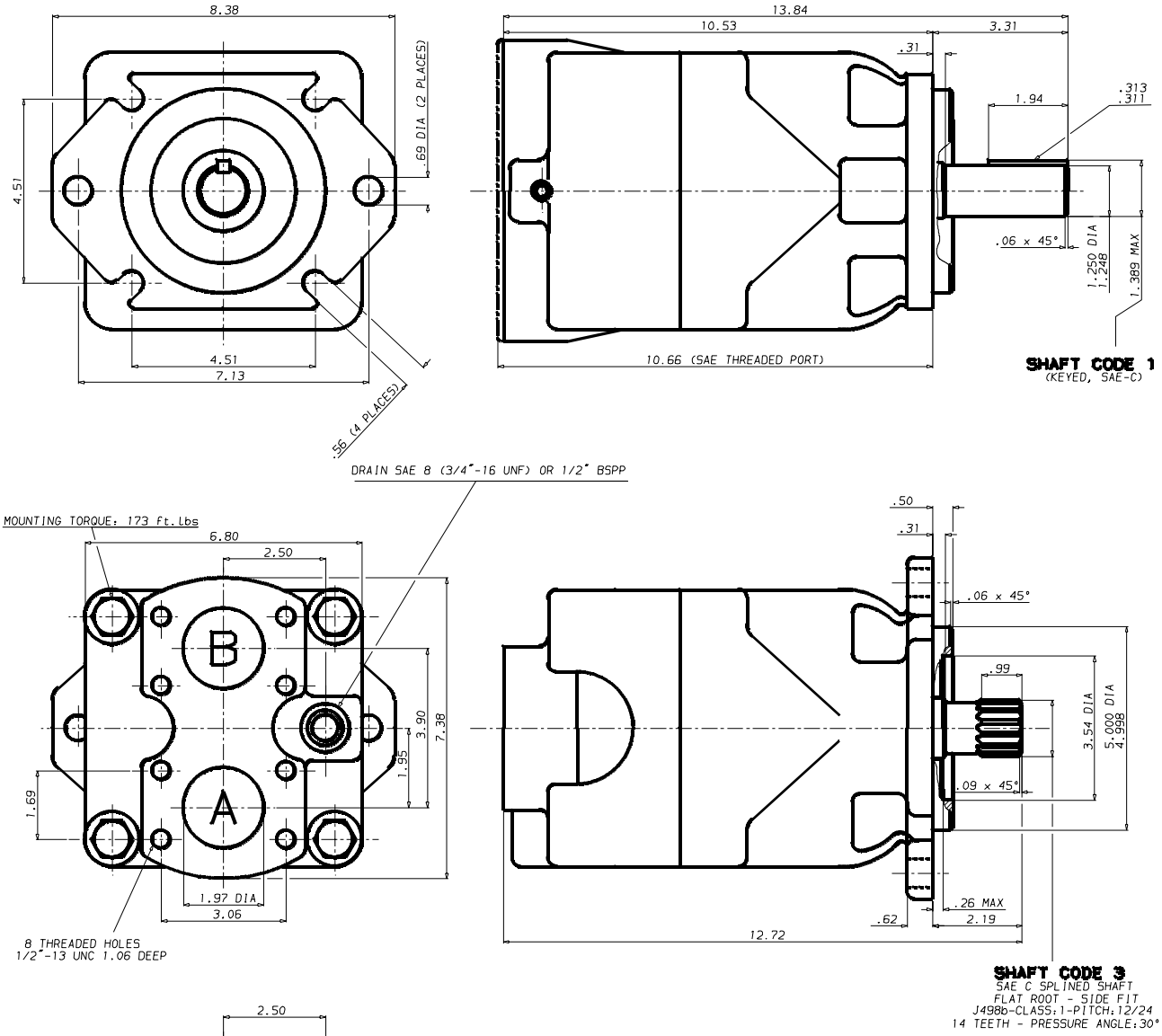
Denison Vane Pump Division
Vierzon - France


8.38
.69 DIA (2 PLACES)
4.51
4.51
7.13
.56 (4 PLACES)
13.84
10.53
3.31
.31
1.94
.313
.311
.06 x 45°
1.250 DIA
1.248
1.389 MAX
10.66 (SAE THREADED PORT)
SHAFT CODE 1
(KEYED, SAE-C)
DRAIN SAE 8 (3/4"-16 UNF) OR 1/2" BSPP
MOUNTING TORQUE: 173 ft.lbs
6.80
2.50
B
A
1.69
1.95
3.90
7.38
1.97 DIA
3.06
8 THREADED HOLES
1/2"-13 UNC 1.06 DEEP
.50
.31
.06 x 45°
.99
3.54 DIA
5.000 DIA
4.998
.09 x 45°
.26 MAX
2.19
.62
12.72
SHAFT CODE 3
SAE C SPLINED SHAFT
FLAT ROOT - SIDE FIT
J498b-CLASS:1-PITCH:12/24
14 TEETH - PRESSURE ANGLE:30°
2.50
DRAIN SAE 8 (3/4"-16 UNF)x.56 DEEP
B
A
3.90
1.95
SAE 32 (2 1/2"-12 UNF)x.75 DEEP-2 HOLES
SAE THREADED PORT

**Model No.** M4*DC1
M4*DC - 138 - 031 - 1 N 00 - B 1 02 00 ..

**Series external drain**

**Series internal drain**

**Torque for A1 - B1**
062 = .63 in.lb/PSI
074 = .75 in.lb/PSI
088 = .88 in.lb/PSI
102 = .96 in.lb/PSI
113 = 1.13 in.lb/PSI
128 = 1.28 in.lb/PSI
138 = 1.40 in.lb/PSI

**Torque for A2 - B2**
024 = .24 in.lb/PSI
027 = .28 in.lb/PSI
031 = .33 in.lb/PSI
043 = .45 in.lb/PSI
055 = .57 in.lb/PSI
067 = .69 in.lb/PSI
075 = .78 in.lb/PSI

**Type of shaft**
1 = keyed (SAE C)
3 = splined (SAE C)

**Modification**

**No control**

**Port connections (P2)**
01 = SAE threaded SAE drain
02 = SAE 4 bolt flange SAE drain
04 = SAE 4 bolt flange BSPP drain

**Seal class**
1 = S1 (M4DC)
5 = S5 (M4SDC)

**Design letter**

**Porting combination**
See below

**Rotation**
N = bi-directional

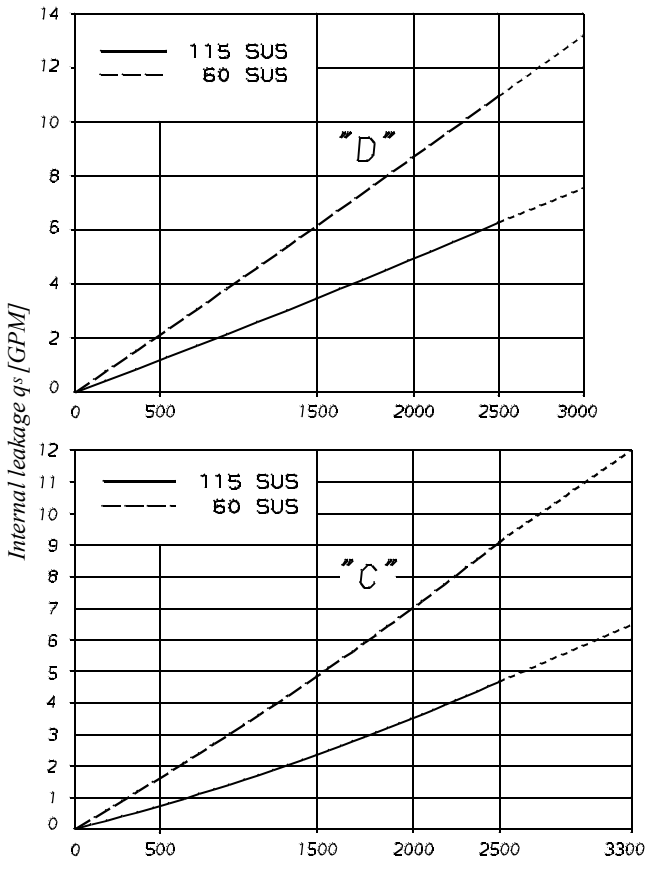
* = S = *Severe duty motor.*

*M4DC1 - M4SDC1 : Drain port is plugged.*

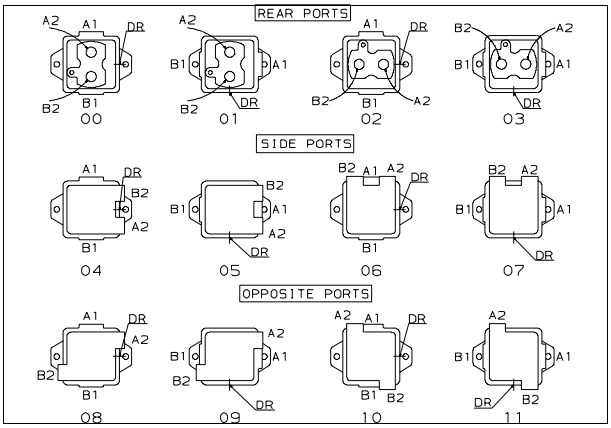
**View from shaft end :**

| CW rotation | | CCW rotation | |
|---|---|---|---|
| | A = inlet<br>B = outlet | | A = outlet<br>B = inlet |

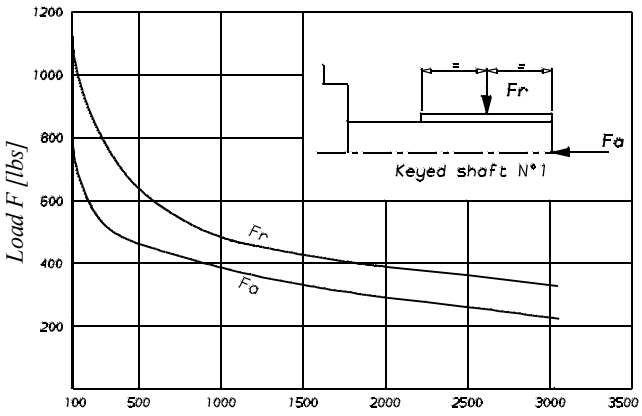
## INTERNAL LEAKAGE




## PORTING COMBINATION




## PERMISSIBLE RADIAL AND AXIAL LOADS




*Do not apply Fr and Fa loads simultaneously*



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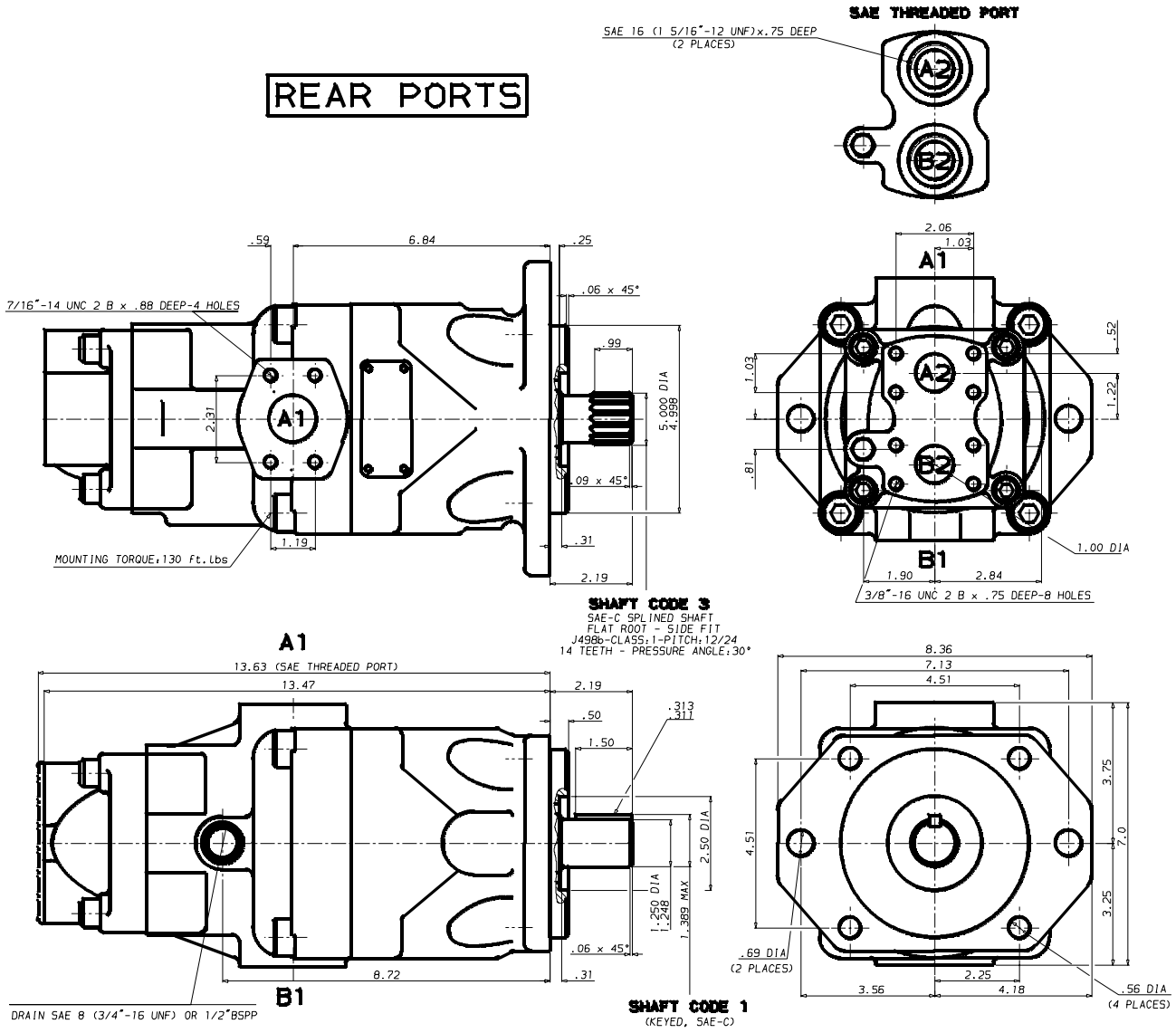


## OPERATING CHARACTERISTICS - TYPICAL [115 SUS]

| Model | Volumetric displacement $V_i$ | Input flow at n = 2000 RPM | | Torque T at n = 2000 RPM | Power output at n = 2000 RPM |
|---|---|---|---|---|---|
| | | Theorical | at 2500 PSI Δ p | at 2500 PSI Δ p | at 2500 PSI Δ p |
| | $in^3$/rev. | GPM | GPM | in.lbf | HP |
| M4D - M4SD 062 | 3.97 | 33.8 | 40.0 | 1460.0 | 46.4 |
| M4D - M4SD 074 | 4.69 | 41.5 | 47.8 | 1770.0 | 56.2 |
| M4D - M4SD 088 | 5.56 | 48.0 | 54.4 | 2088.5 | 66.2 |
| M4D - M4SD 102 | 6.44 | 55.5 | 61.8 | 2336.3 | 74.1 |
| M4D - M4SD 113 | 7.12 | 61.5 | 67.9 | 2655.0 | 84.2 |
| M4D - M4SD 128 | 8.08 | 70.0 | 76.3 | 3009.0 | 95.5 |
| M4D - M4SD 138 | 8.81 | 76.3 | 82.7 | 3292.0 | 104.5 |
| M4C - M4SC 024 | 1.49 | 13.0 | 17.7 | 535.4 | 17.0 |
| M4C - M4SC 027 | 1.72 | 14.8 | 19.5 | 619.5 | 19.7 |
| M4C - M4SC 031 | 2.11 | 18.5 | 23.2 | 768.0 | 24.0 |
| M4C - M4SC 043 | 2.84 | 24.6 | 29.3 | 1062.0 | 33.6 |
| M4C - M4SC 055 | 3.59 | 31.2 | 36.0 | 1318.6 | 41.8 |
| M4C - M4SC 067 | 4.34 | 37.5 | 42.3 | 1504.5 | 47.7 |
| M4C - M4SC 075 | 4.89 | 42.3 | 47.0 | 1752.2 | 55.6 |



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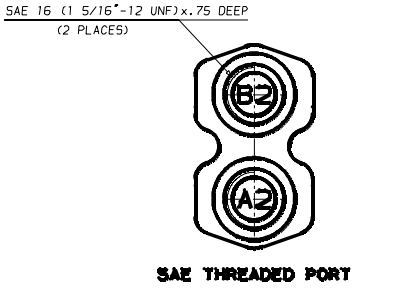
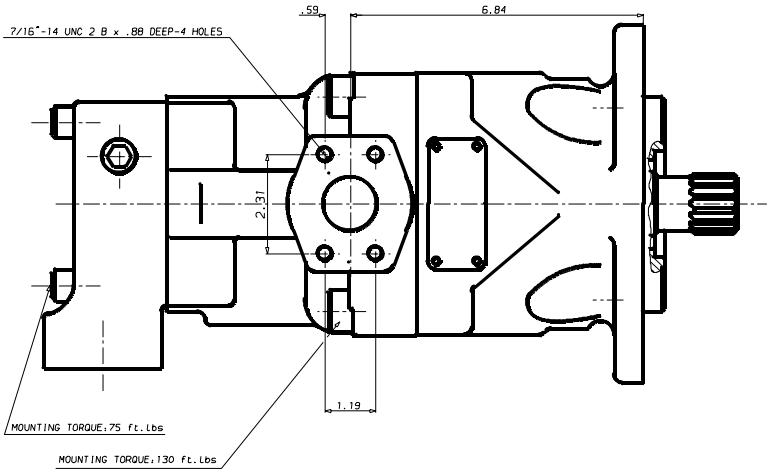
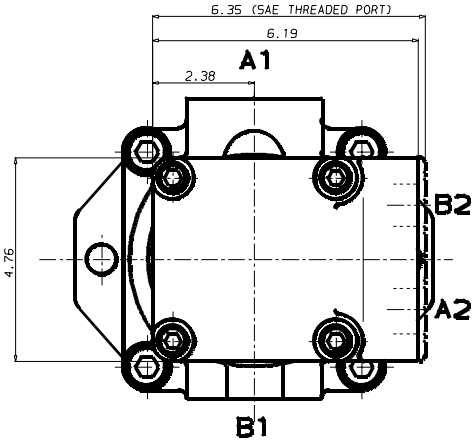
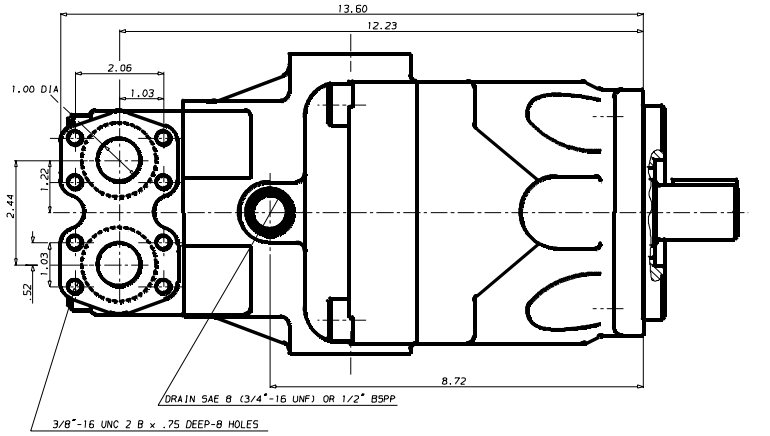
## SIDE PORTS



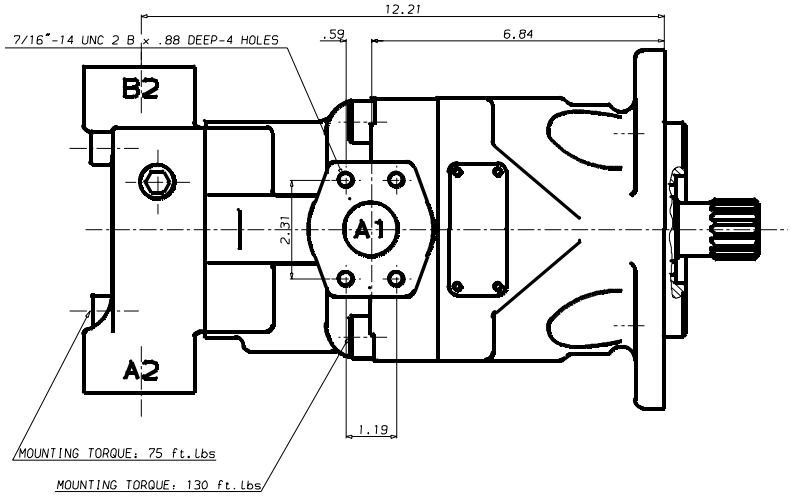

SAE THREADED PORT

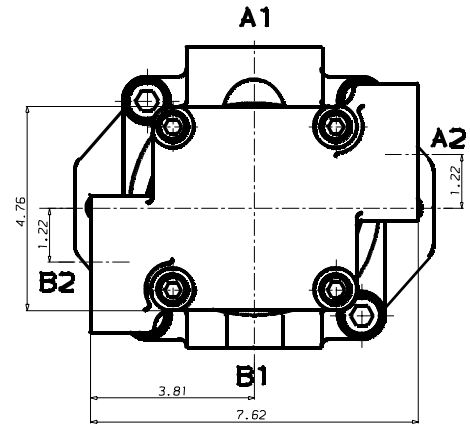


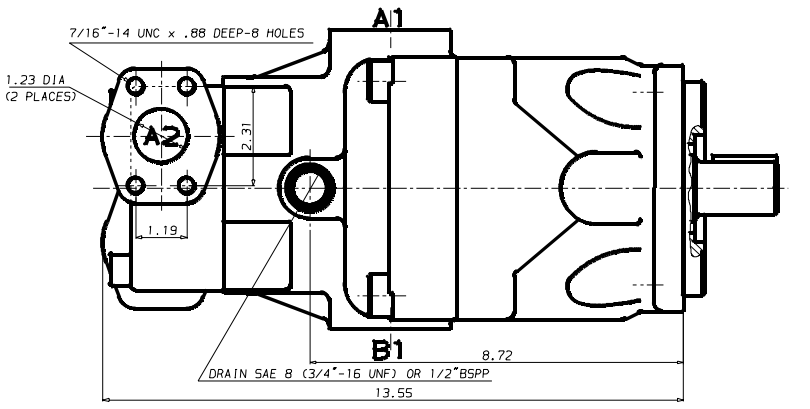




## OPPOSITE PORTS



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