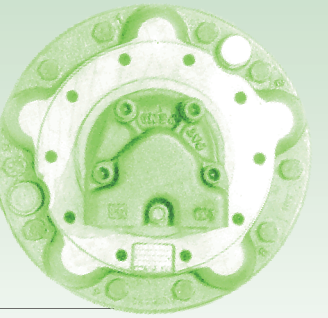
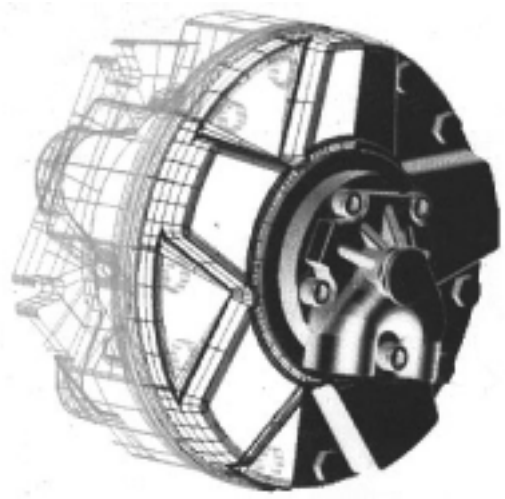
GS Series Motors



Crankshaft Design
Radial Piston Hydraulic Motors



GS SERIES

TECHNICAL CATALOG

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100103ED1

TABLE OF DISPLACEMENTS

GS1/D47		100	150	175	200	250
Displacement	in^3/rev	6.04	9.40	10.50	12.27	14.83
Specific torque	lb.ft/100 psi	7.83	12.20	13.60	16.00	19.30
Cont. pressure	psi	3600	3600	3600	3600	3600
Peak pressure	psi	6100	5800	5400	5000	5000
Max. Speed	rpm	2750	2200	1800	1500	1250
Peak power	hp	95	95	95	95	95

GS2/D47		200	250	300	350	420	500
Displacement	in^3/rev	11.72	15.32	18.55	21.18	25.94	30.08
Specific torque	lb.ft/100 psi	15.30	19.90	24.20	27.60	33.70	39.10
Cont. pressure	psi	3600	3600	3600	3600	3600	3600
Peak pressure	psi	6100	6100	5800	5400	5000	5000
Max. Speed	rpm	1350	1250	1150	1100	900	850
Peak power	hp	110	110	110	110	110	110

GS3/D47		350	425	500	600	700	800
Displacement	in^3/rev	21.48	26.00	29.65	36.31	42.11	48.33
Specific torque	lb.ft/100 psi	27.90	33.80	38.60	47.20	54.90	63.10
Cont. pressure	psi	3600	3600	3600	3600	3600	3600
Peak pressure	psi	6500	6100	6100	5800	5000	5000
Max. Speed	rpm	1000	850	800	800	750	750
Peak power	hp	135	135	135	135	135	135

GS4/D47		400	500	600	800	900	1000	1100
Displacement	in^3/rev	24.53	30.69	37.59	48.39	55.17	62.37	68.10
Specific torque	lb.ft/100 psi	31.90	39.90	48.90	63.10	71.70	81.40	88.50
Cont. pressure	psi	3600	3600	3600	3600	3600	3600	3600
Peak pressure	psi	6500	6500	5800	5800	5400	5000	5000
Max. Speed	rpm	830	780	750	730	700	700	650
Peak power	hp	200	200	200	200	200	200	200

GS5/D47		525	650	800	1000	1200	1300	1450	1600	1800
Displacement	in^3/rev	32.10	40.82	49.25	63.40	72.31	81.77	89.22	99.70	110.82
Specific torque	lb.ft/100 psi	41.80	52.40	64.10	82.40	94.10	106.30	116.00	128.90	144.00
Cont. pressure	psi	3600	3600	3600	3600	3600	3600	3600	3600	3600
Peak pressure	psi	6500	6500	6100	6100	5800	5800	5400	5400	5000
Max. Speed	rpm	750	730	700	680	630	600	600	600	550
Peak power	hp	270	270	270	270	270	270	270	270	270

GS6/D47		1700	2100	2500
Displacement	in^3/rev	103.13	129.80	153.35
Specific torque	lb.ft/100 psi	134.30	168.90	199.40
Cont. pressure	psi	3600	3600	3600
Peak pressure	psi	6500	5800	5000
Max. Speed	rpm	600	575	500
Peak power	hp	400	400	400

HIGH SPEED HIGH PRESSURE HIGH POWER

RADIAL INJECTION CYLINDER FEED

PIVOT CYLINDER
No side load between piston and cylinder

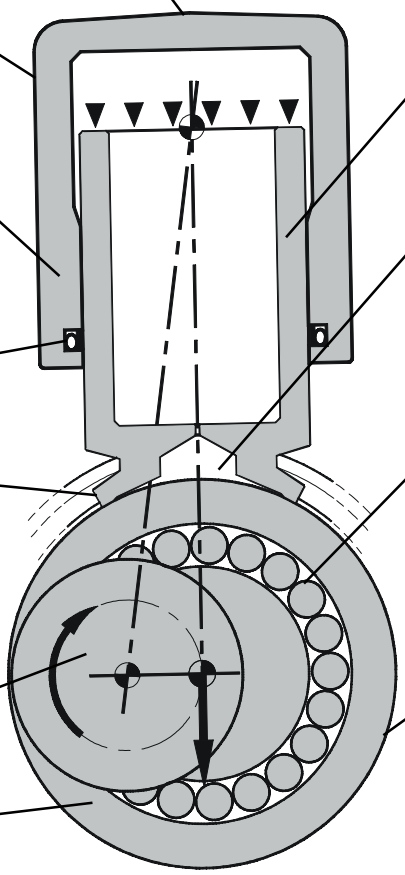
SURFACE HARDNESS 60 HRC
Wear and contamination resistant

HIGH EFFICIENCY SEALS
No leakage

PISTON RETAINING RINGS
Piston remain in full contact with shaft even with sustained cavitation or vacuum pressure in cylinder

CRANKSHAFT DESIGN
High starting torque

SPHERICAL PISTON SUPPORT RING
High dynamic stability of piston



WIDE CLEARANCE
Resistance to thermal shock and contamination

HYDROSTATIC BALANCING
Very low friction and heat generation allows high power operation

PISTON SUPPORT BEARING
Minimal sliding speed between piston foot and piston support ring allows high speed operation

DISC CAGE
The use of bearing disc cage allows extremely better performance in order to reach higher speeds, or alternatively to extend component lifetime

HIGH SPEED

Self-aligning piston

Piston support bearing

Piston retaining rings

HIGH STARTING TORQUE

Crankshaft design

Pivot cylinder

Hydrostatic balancing

High volumetric efficiency

VACUUM FREEWHEELING

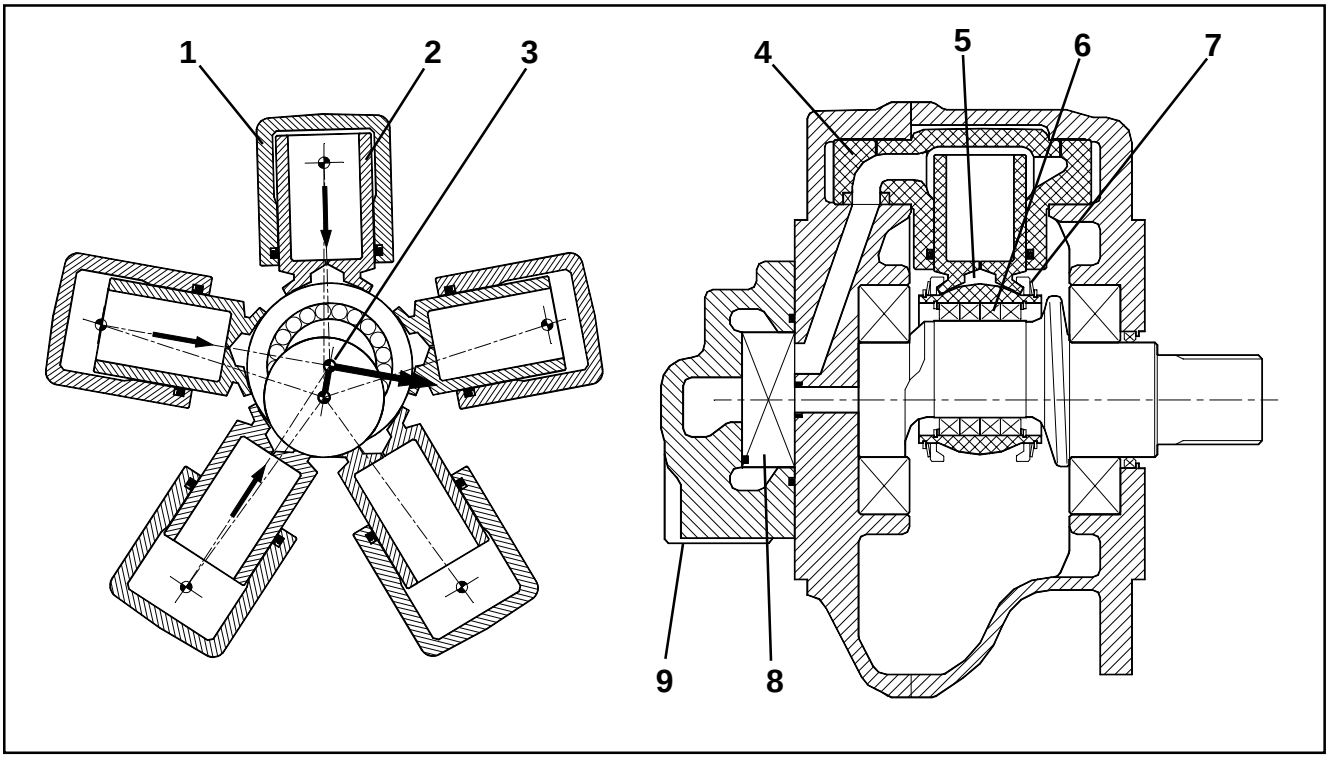
Piston retaining rings

Rotating mechanism independent of pressure conditions

High speed capability

Crankshaft Design Radial Piston Motors

The main characteristics of this type of design are high mechanical efficiency, especially at start up, and high volumetric efficiency.
A number of features distinguish SAI Motors from other radial piston designs:



Pivoting cylinder: the cylinder **(1)** remaining aligned with the eccentric of the crank **(3)**, eliminates side loading between the cylinder and piston **(2)**. The articulation of the cylinder-piston assembly is achieved with large diameter trunnions **(4)** ensuring low specific loads.

Double piston support bearing: the pistons transmit their load to the shaft via a hydrostatic bearing **(5)** and a central roller bearing **(6)**. The roller bearing eliminates the sliding velocity between the piston foot and the spherical piston support ring, reducing heat, friction, wearing and improving starting torque, low speed operation (reduced stick slip) and high speed operation. The hydrostatic bearing reduces metal-metal contact ensuring optimal lubrication and low friction.

Piston retaining rings (7) ensure the piston remains in contact with the shaft in all operating conditions, even during cavitation.

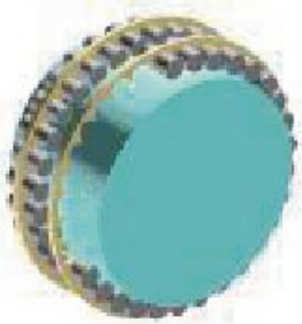
Rotary axial distributor (8) ensures optimal distribution with short, large section ducts for reduced power-loss with high flows, and very high volumetric efficiency; extensive clearance recovery capability of the seals ensures optimal functionality throughout the motor lifetime and in conditions of thermal shock.

Interchangeable motor (9): a wide range of distributors are available with various pressure and flow control valves.

GS SERIES FEATURES

High Speed
The GS Series high speed motors have maximum speeds which are two to three times higher than those normally expected in LSHT motors.

Low Speed
The radial piston design ensures excellent low speed characteristics.



Disc bearing cage

High specific speed range
The ratio (max speed); (min speed) is higher than any other type of equivalent hydraulic motor, giving greater flexibility of application.

High power ratings
The motors rugged design and high operating efficiency enable high continuous powers to be transmitted.

Disc Cage
Hydraulic motor makes the most of speed with disc cage on crankshaft central roller bearing. This particular kind of cage offers two remarkable advantages, compared to most of the cages available on the market:

- minimize heat generation, due to the reduced friction area;

- maximize heat dissipation, as surfaces of the rolling parts are easier to flush.

The high speed capability, with equivalent high power ratings, is possible due to the following factors;

Forced lubrication of all load-bearing surfaces - hydraulic balancing of piston foot, cylinder trunnion and distributor rotor;

Low sliding speeds of load bearing surfaces - compact distributor rotor, central piston support bearing, cylinder trunnions.

High dynamic stability of the pistons - the sleeves of the oscillating cylinder have been extended in order to give the piston added directional guidance. Also, the lightweight, single-component design of the piston minimizes the effects of inertial forces at high speeds. The stability of the piston is further helped by the spherical surface of the piston-support ring which favors self-centering of the piston at high speed and eliminates stick-slip phenomena at low speeds.

Mechanical, non-elastic piston guidance design - the pistons follow the shaft eccentric without separation and hammering under all normal and anomalous hydraulic or mechanical operating conditions (cavitation, high case pressure, vibration, centrifugal forces, etc.)

Surface finishing of the pistons and cylinders to prevent seizure.

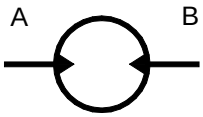
Increased cylinder-wall thickness and stronger cylinder trunnions for stiffer, higher strength cylinders.

PRESSURE RATINGS

GS Series motors are rated at a nominal continuous pressure rating of 3,600 psi and up to 6,500 psi peak pressure. The continuous and average operating pressure, however, should be chosen in function of the required bearing lifetime (see bearing lifetime graphs). The motors may work at peak pressures for periods not exceeding 1% per minute, no more than 10 times per hour.
Higher continuous and peak pressure ratings can be performed. For details contact SAI technical department.

BACK-PRESSURE

The motors are capable of operating with high back-pressures with high efficiency, e.g. for series circuit applications.
The allowable pressures vary in function piston diameter and other factors. If the motors are required for an application with high back pressure contact the technical department for further details.



Typical allowable back-pressure

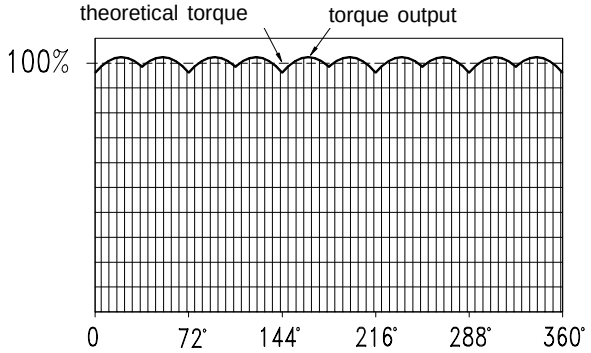
	Port A	Port B
Cont.	3,000 psi	2,200 psi
Peak	5,200 psi	5,200 psi

CASE PRESSURE

Continuous case pressure: 15 psi
Peak case pressure: 75 psi
The case pressure is independent of the return line pressure. For higher pressures (up to 200 psi) contact the technical department.

TORQUE

To obtain the theoretical output torque of a motor, multiply the specific torque (lb.ft/psi) given in the displacement tables by the pressure (psi).
The graph below shows the output torque variation as the shaft rotates through 360°.

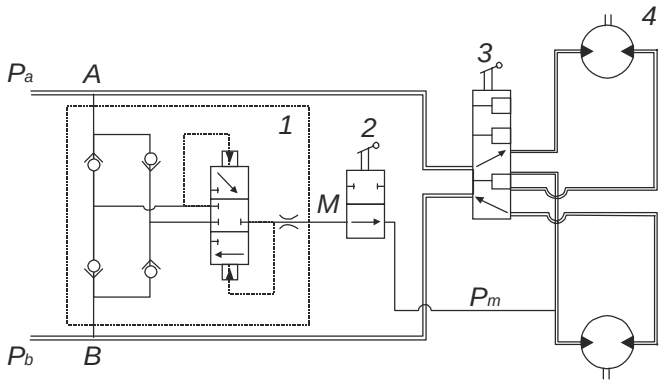


STARTING TORQUE

Typical starting torque efficiencies are given in the performance graphs of the motors. The starting torque, however, also depends on the starting position of the shaft (see graph above).

2-SPEED OPERATION

For applications containing at least two drive units that require 2-speed operation, SAI can supply the flow control valves for a series-parallel circuit with speed differential also in series mode.
The series-parallel directional valve DV5 enables dynamic switching from parallel circuit configuration (high torque, low speed) to series configuration (high speed, low torque).
The B5 proportional pressure reducing valve (1) simulates the differential effect of the parallel circuit enabling vehicles to be steered also when operating in series mode.
Directional valve (3) can be used as differential lock in conditions of poor traction. This valve must be in the closed position when the motors are connected in parallel.



NOISE LEVELS

The motors operate at lowest noise levels with a back-pressure of 75-150 psi, such as in closed circuits. Pressure lines and motor support structures can be efficient noise propagators or amplifiers. Pressure lines should preferably be made up of straight rigid lengths, flexible corners, firmly fixed to rigid supports at irregular intervals away from sheet panelling. Motors must be rigidly fixed to solid supports.

SILENT MOTORS

Motors can be supplied with special distributor that run nearly silently in a wide operating range.
Please contact technical department for further details.

VIBRATION

The motors can be supplied with a counterbalanced shaft to reduce vibrations at high speeds.
Please contact technical department for further details.

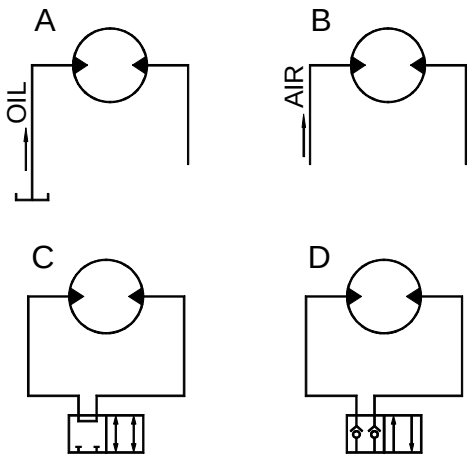
SPEED STABILITY

The motors are capable of operating at low speeds with a high degree of speed stability. The minimum stable speed depends on the displacement of the motor. In general the motors remain sensitive to flows of 0.1 qt/min + motor leakage rate. Best results are obtained with 75 - 150 psi back-pressure and after the circuit has been completely purged of air by running it at 2/3 max speed for 5 - 10 minutes.

CAVITATION
The design of the motors ensures they are not damaged if subjected to cavitation. The motors will rotate normally even with empty cylinders (i.e. no oil - just air, or vacuum), which is useful for disconnecting the motor from the hydraulic circuit (see below).

DISCONNECTION FROM HYDRAULIC CIRCUIT
The motors can be disconnected from the hydraulic, circuit and driven externally (freewheeling, free fall, in case of breakdown, etc.) at speeds of up to the maximum.

The diagram below show four possible circuit configurations for motor disconnection and/or for operation in freewheeling:



A: Freewheeling with oil circulation: this condition is acceptable for low speeds only. At high speeds the motor inlet must be pressurized to prevent noise due to cavitation.
B: Freewheeling with air circulation: this condition is ideal for high speed freewheeling applications; transition from or to normal operation must be effected at low speed and pressure while the pistons are emptied or filled with oil.
C: "Short circuit" freewheeling: the motor runs with inlet and outlet ports connected. This circuit does not cause cavitation and is suitable for applications where speed control is required (e.g., with throttle); beware of heat build up in unfavorable conditions, especially with throttle.
D: "Vacuum" freewheeling: this is the most suitable freewheeling condition, especially for very high speeds; the check valves allow oil to be expelled from the pistons which subsequently operate in these conditions for several hours without being damaged or overheating; torque absorption is constant with speed and equivalent to 30 - 45 psi pressure. Transition from or to normal operation must be effected at low speed and pressure while the pistons are emptied or filled with oil. For further information please contact SAI. Check the flow such that maximum speed should not overcome peak speed.

HYDRAULIC FLUIDS

MINERAL OILS
SAI recommends the use of high quality mineral-based hydraulic oil, containing anti-wear, anti-foaming, anti-oxidation and extreme pressure additives.

Oil temperature:	ideal	+86°F to +122°F
	allowable	-68°F to +176°F

On request, motors can be supplied to operate with lower (to -104°F) or higher (to +248°F) temperatures.

Oil viscosity:	ideal	40 to 60 cSt
	allowable	5 to 3000 cSt

The choice of oil should be made so that the viscosity of the oil lies within the given range at its normal operating temperature.

ALTERNATIVE FLUIDS

- Synthetic fluids:
(Phosphate esters, polyesters, ...)
These fluids have similar properties to mineral oils and the same pressure, speed, temperature and viscosity ratings apply.
These fluids may require seals made of a different material (e.g. Viton), which are available on request.

- Water-based fluids:
(Water-oil emulsions, water-glycol solutions, ...) with these fluids the following limits apply:

max. continuous pressure	1,450 psi
max. speed reduction	50%
allowable temperature	+50 to +140°F

- Vegetable oils
The characteristics of these oils vary widely and manufacturers' recommendations should be followed. In general, while lubricating qualities are similar to those of mineral oils, temperature limits may apply and the oil may need to be changed frequently.

The warranty on motors operating with fluids other than mineral oils for high pressure hydraulic applications is only valid if the application is first approved by SAI.

FILTRATION
SAI recommend filters of 25 um or better.
Recommended oil contamination class:

ISO/DIS 5540/4	- class 18/12
SAE 749	- class 5
NAS 1638	- class 8

BRONZE COMPONENTS
Standard SAI distributors contain bronze components. No other part contains bronze components

DIRECTION OF SHAFT ROTATION (Fig. 1)
All motors are bi-directional. The direction of shaft rotation is determined by the direction of oil flow. Standard motors are supplied so that flow entering in Port A causes the shaft to rotate clockwise (as seen from the shaft side of the motor). Flow entering Port B causes anticlockwise rotation. Motors can be supplied with the reverse configuration: see motor order codes.

DRAIN-LINE POSITIONING (Fig. 2)
The drain-line must be positioned in such a way that there is always sufficient oil in the casing for the lubrication of the dynamic components in the motor.
If the motor is installed with the shaft in a horizontal position, the drain-line should be connected to the uppermost drain-line port.
The drain-line should be of a diameter corresponding to the size of the drain line port and flow must not be obstructed by sharp corners, restrictions, etc.
Standard motors are supplied with drain port Y (Fig. 3) closed (zinc plated HH plug) and drain port X open (with plastic plug). Motors can be supplied with Y-open, X-closed.

DISTRIBUTOR COVER ORIENTATION (Fig. 3)
Motors may be supplied with the distributor assembled with the arrow pointing towards any one of the five pistons. To order, use assembly code DM1, DM2, DM3, etc.
(DM1 = standard)

START-UP
Before connecting any tubes ensure that they are thoroughly cleaned, any excess material that could work loose should be removed and there should not be any oxidation of surfaces that come into contact with the oil.
Before starting work the motor casing must be filled with oil.
Before starting work the hydraulic circuit should be purged of air. This can be achieved by running the motor without load for 10-20 minutes, during which time checks should be made for leakages from connections.
During the first few hours of working under load checks should be made for leakages from connections and to ensure that all components remain firmly fixed to their supports.
All motors are factory tested and do not require to be run in.

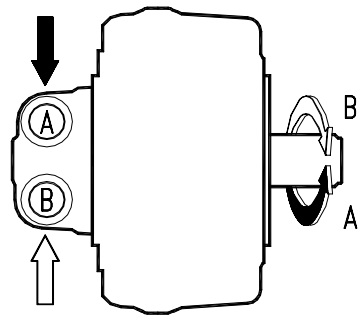


Fig.1 Direction of shaft rotation

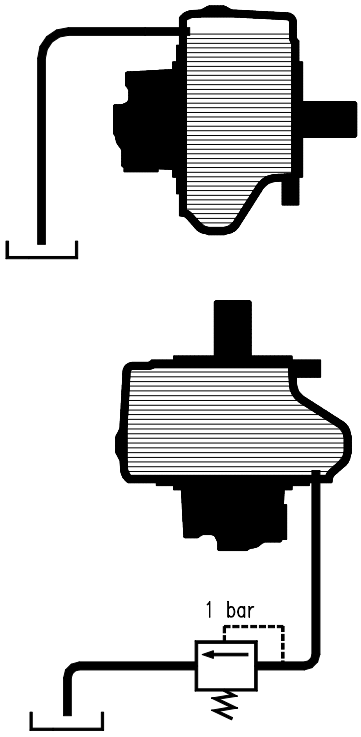


Fig.2 Drain line positioning

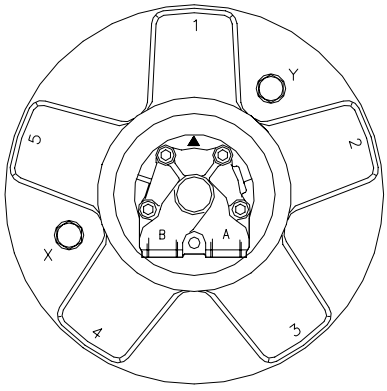


Fig.3 Distributor cover orientation

BEARING LIFETIME (As per ISO 287:1990)
The bearing lifetimes given in this catalogue are L10 lifetimes. The L10 lifetime is the period of work after which 10% of the bearings can be expected to show signs of wearing. The average lifetime of the bearing, the L50 lifetime (where 50% of the bearings show signs of wearing), is approximately 5 times the L10 value.

To determine the lifetime of the bearings in an application, constant or average pressures and speeds should be used, not peak or max values. The continuous operating pressures of any motor should be chosen in function of the required motor lifetime.

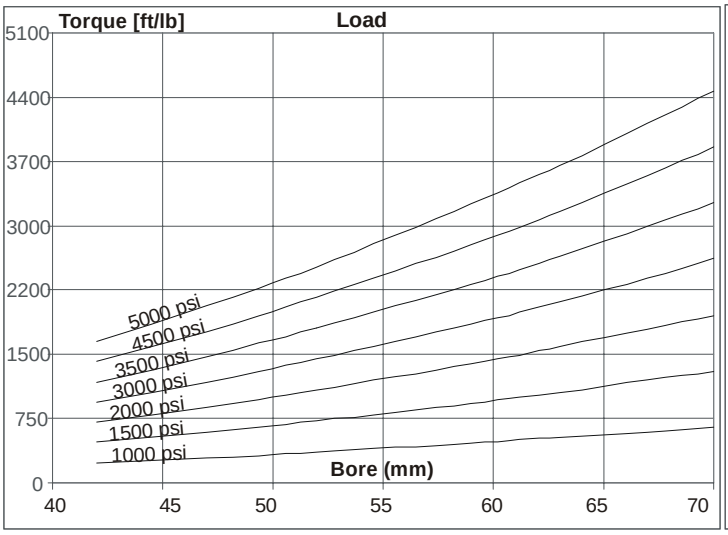
Bearing Lifetime Graphs
The bearing lifetime graphs enable the bearing lifetime to be calculated for a given power input and speed output. If necessary use the power charts to determine the power input for a given pressure.

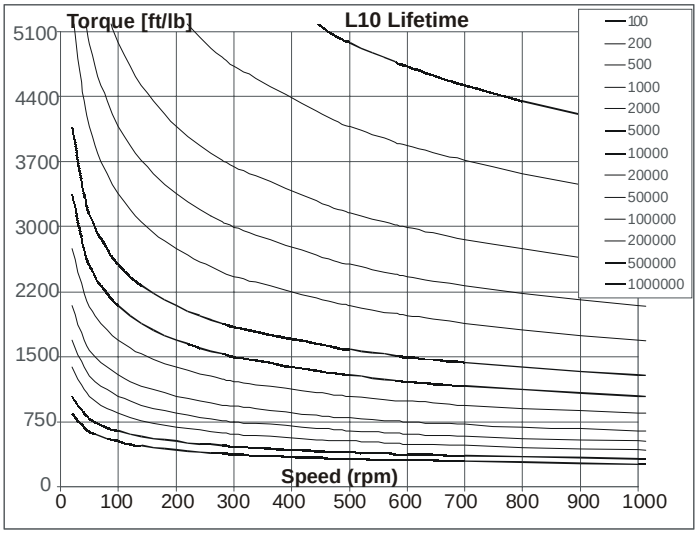
If the calculated lifetime is insufficient, please contact SAI technical department.

MOTOR LIFETIME REQUIREMENT
The required bearing lifetime may be calculated using the following formula:
Life (hours) = Hours of work per day x Days work per year x No. of years x Correction factor

Correction factor: The calculated lifetime of the bearings presumes favorable lubrication conditions with oil having values of temperature, viscosity and oil cleanliness that lie within the given ranges.
A correction factor should be applied for applications, for example including continuous duty over several hours, where high oil temperatures or other anomalous working conditions can occur.
The table below indicates the correction factor to be applied in function of the duration of the cycle of continuous work, for applications in which the working conditions of the oil are not regularly checked.

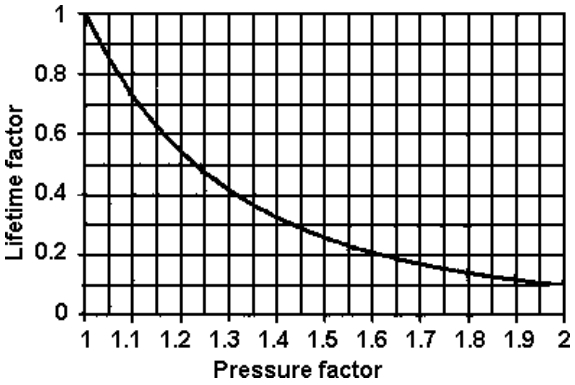
Non-Stop Work Cycle (hrs)	<3	6	12	18	24
Correction Factor	1	1.25	1.5	2	3





PRESSURE-LIFETIME RELATIONSHIP

Please note that a small variation in the pressure used to calculate the lifetime can produce a large difference in the calculated lifetime.
The relationship between the working pressure and the lifetime is not linear, but as shown in the graph.



Example:
If, with 1000 psi (load factor = 1), the lifetime is 10,000 hours (lifetime factor = 1), then with 1200 psi (load factor = 1.2) the lifetime becomes 5500 hours (lifetime factor 0.55)

GS1

GS1		100	150	175	200	250
Displacement	*in³/rev*	6.04	9.40	10.50	12.27	14.83
Bore Diameter	*mm*	28	35	37	40	44
Stroke	*mm*	32	32	32	32	32
Specific torque	*lb.ft/100psi*	7.83	12.20	13.60	16.00	19.30
Cont. pressure	*psi*	3600	3600	3600	3600	3600
Peak pressure	*psi*	6100	5800	5400	5000	5000
Cont. speed	*rpm*	1000	1000	900	800	700
Max. speed	*rpm*	2750	2200	1800	1500	1250
Peak power	*HP*	95	95	95	95	95

Max. freewheeling speed: 2800 rpm

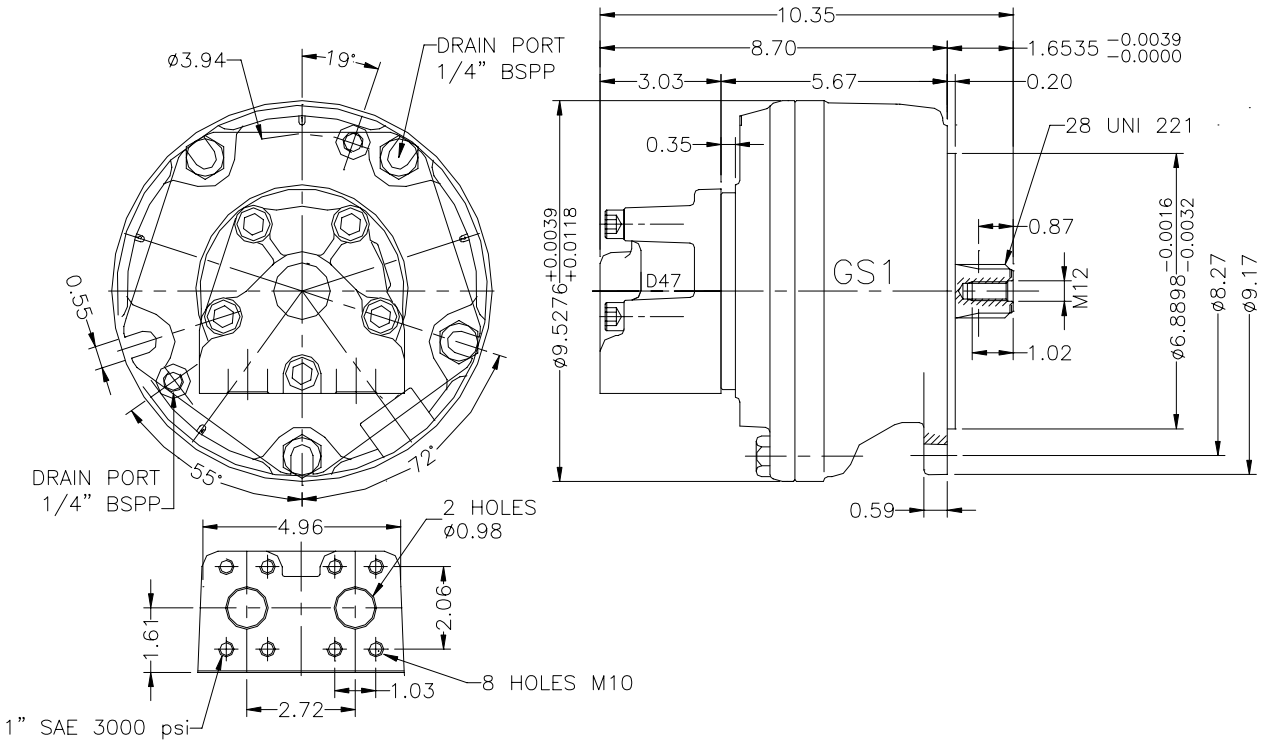
Approximate weight: 66 lbs

Motor casing oil capacity: 1 qt / 61 in^3

Max. casing pressure: 42 psi continuous
85 psi peak

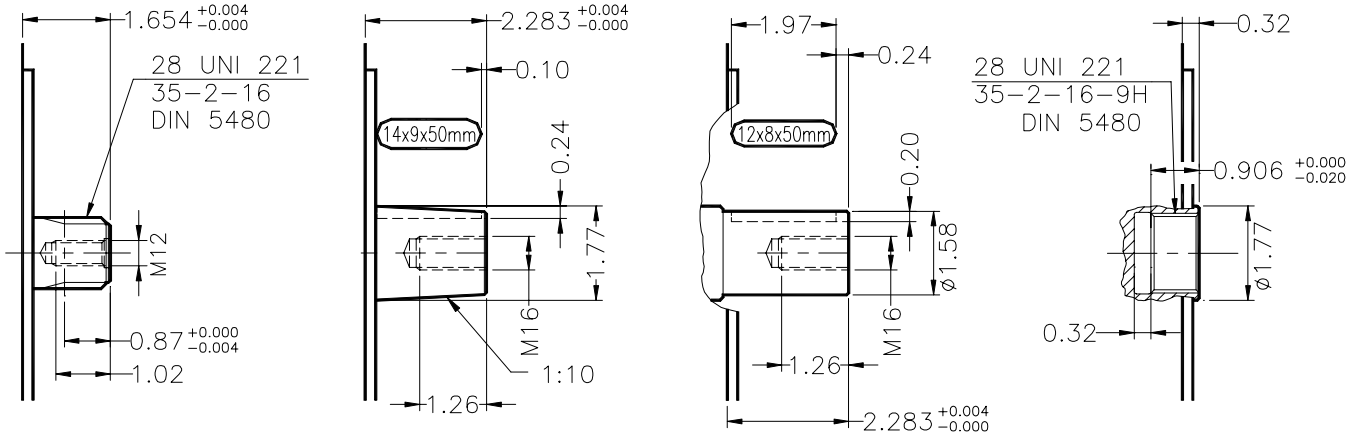
NB: Continuous or average working pressure should be chosen in function of the required service lifetime (see bearing lifetime).

DIMENSIONS



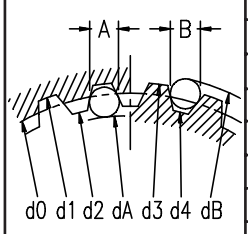
SHAFT OPTIONS

Splined	UNI 221 **1**	Tapered **2**	Parallel Keyed **8**	Internal spline	DIN 5480 **9**
	DIN 5480 **7**				UNI 221 **3**



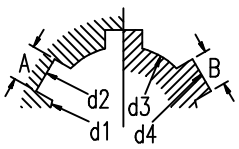
SPLINE DATA *(dimensions in metric [1 in = 25.4 mm])*

35-2-16 DIN 5480



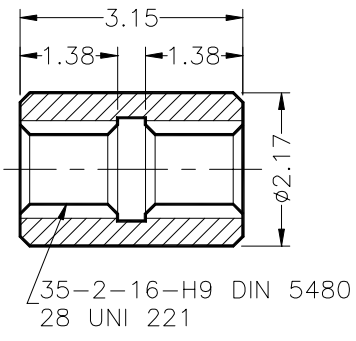
d0	Ø32.0	
d1	Ø35.0 +0.520 +0	H14
d2	Ø31.0 +0.160 +0	H11
A	Ø3.5	
da	Ø27.711	H11
d3	Ø34.6 -0 -0.160	h11
d4	Ø30.6 -0 -0.520	h14
B	Ø4.0	
db	Ø39.000	f 8

28 UNI 221 (6-28-34 DIN 5463)



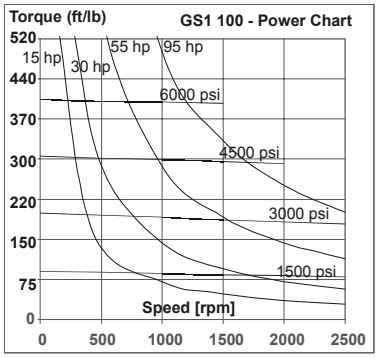
d1	Ø28.0 +0.021 +0	H7
d2	Ø34.0 +0.160 +0	H11
A	7.0 +0.028 +0.013	F7
d3	Ø28.0 -0.007 -0.020	g6
d4	Ø34.0 -0.065 -0.160	d11
B	7.0 -0.013 -0.028	f7

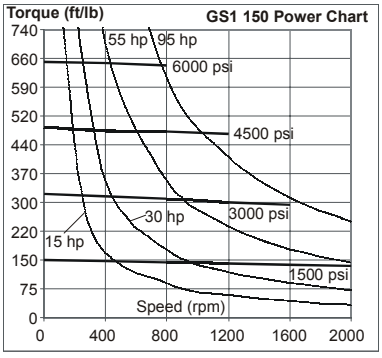
ADAPTOR

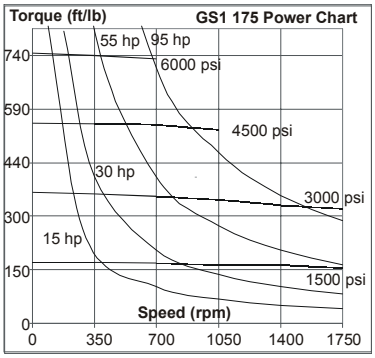


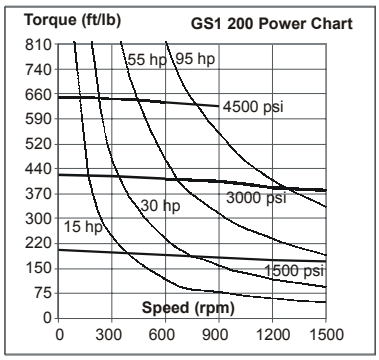
PERFORMANCE

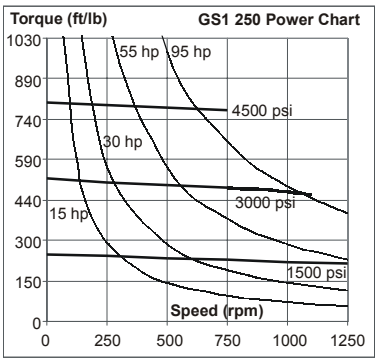
The graphs indicate the typical performance characteristics of the motors operating with mineral oil (standard ISO 68).









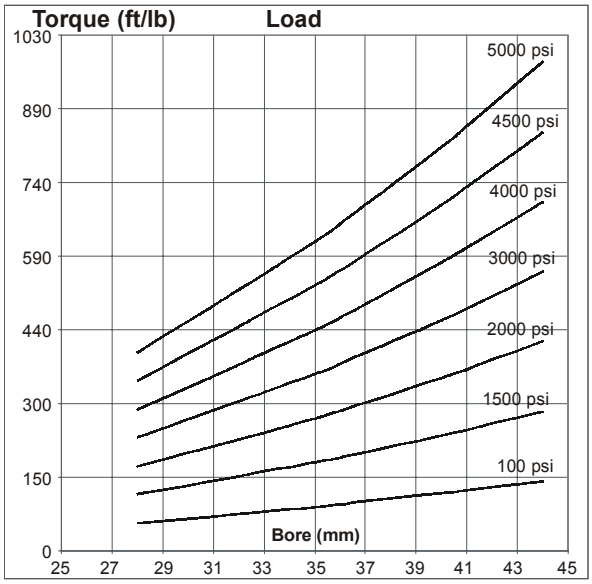


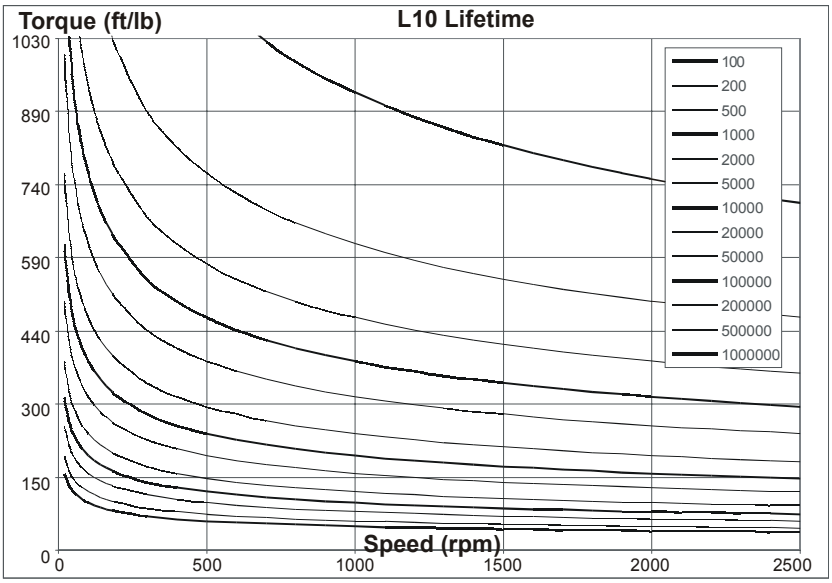
STARTING/STALLING TORQUE

The output torque of the motors does not fall off at stalling speed.
The graphs above indicate the starting torque of the motors (torque at 0 rpm).

BEARING LIFETIME

The graph refers to the motor with GP option bearings.
Note that the average lifetime of a bearing (B_{50} lifetime) is approximately 5 times the B_{10} lifetime.





BEARING OPTIONS

Special **higher capacity** spherical roller bearing (option GPX) - the lifetime is approximately equivalent to the bearing lifetime given in the graph.

ORDER CODES

GS1	-	1	H	-	D47	-	-	-

MOTOR CODE

1. Nominal displacement - See motor spec. table

2. Shaft options: 1 = Ext. 28 UNI 221 (std)
7 = Ext. 35-2-16 DIN 5480
9 = Int. 35-2-16 DIN 5480
3 = Int. 28 UNI 221
2 = Tapered Keyed Ø45x58
8 = Parallel Keyed Ø40x58

3. Bearings: H = Roller Bearings (std)
GPX = Spherical Roller Bearings on motor cover and roller bearing on shaft output side

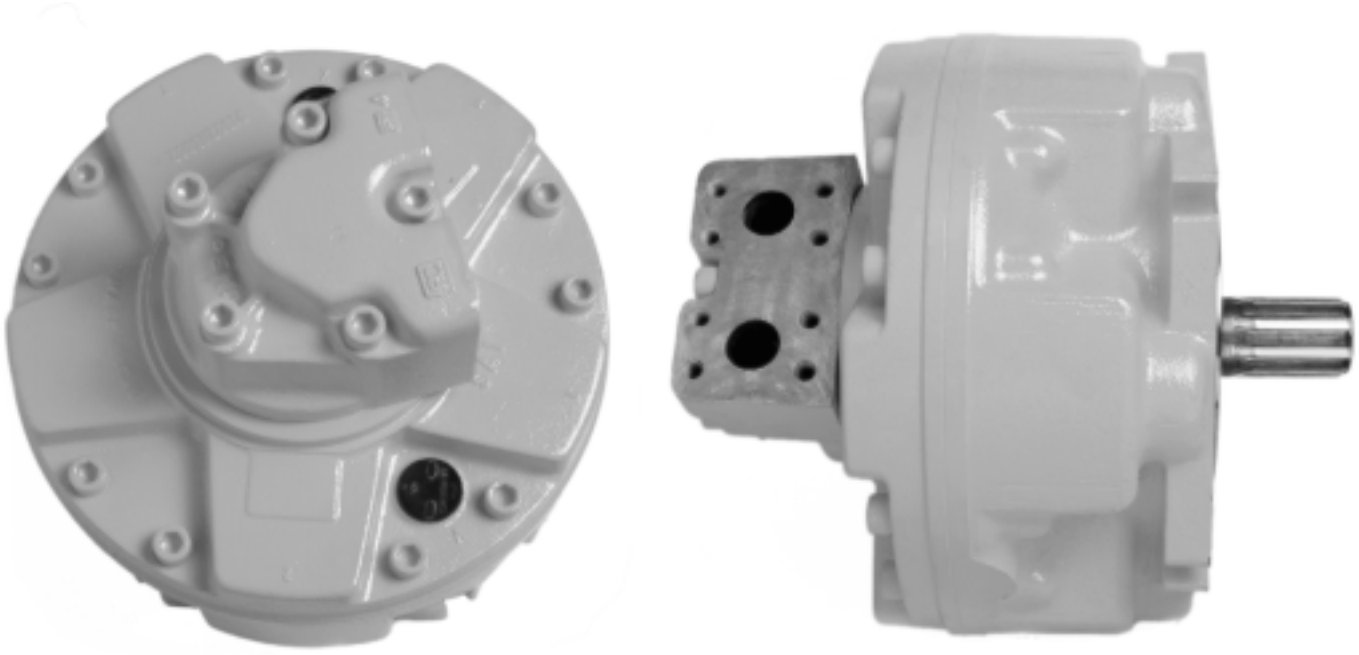
4. Other options:
U = Without shaft seal
SV = Shaft seal protection
VI = Viton seals
I = Case press. relief valve 43psi
A = High pressure shaft seal in motor (218 psi max)
SB = Disc cage in spherical supporter body to always match opt. X

5. Distributor: D47 standard

6. Tachometer: K = Prepared for tachometer
J = with tachometer coupling

7. Direction of shaft rotation: standard motors are supplied with clockwise rotation (viewed from shaft end) with flow in port A, out port B.
No code = Clockwise rotation
L = Counter-Clockwise rotation

8. Distributor cover position: See Page 7
No code = Position DM1
DM ~ = Other position

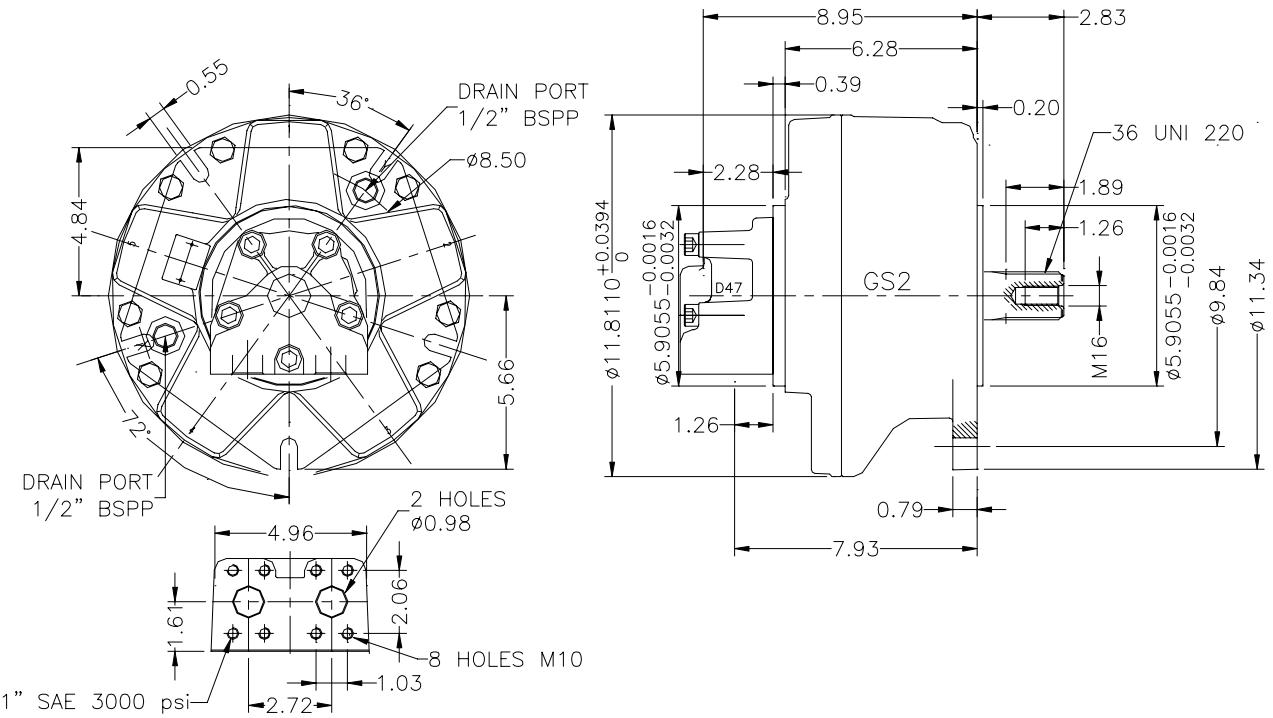


GS2		200	250	300	350	420	500
Displacement	*in³/rev*	11.72	15.32	18.55	21.18	25.94	30.08
Bore diameter	*mm*	35	40	44	47	52	56
Stroke	*mm*	40	40	40	40	40	40
Specific torque	*lb.ft/100psi*	15.30	19.90	24.20	27.60	33.70	39.10
Cont. pressure [1)]	*psi*	3600	3600	3600	3600	3600	3600
Peak pressure	*psi*	6100	6100	5800	5400	5000	5000
Cont. speed	*rpm*	900	700	650	600	525	525
Max. speed [3)]	*rpm*	1350	1250	1150	1100	900	850
Peak power	*HP*	110	110	110	110	110	110

Max. freewheeling speed:	2000 rpm
Approximate weight:	114 lbs
Motor casing oil capacity:	2 qt / 122 in³
Max. casing pressure:	42 psi continuous 85 psi peak

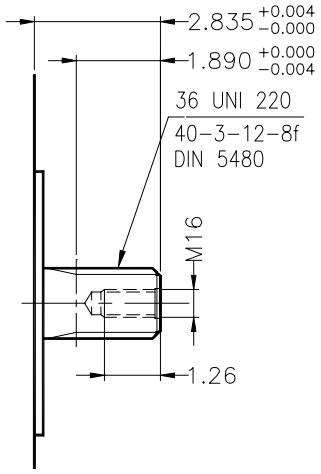
NB: Continuous or average working pressure should be chosen in function of the required service lifetime (see bearing lifetime).

DIMENSIONS

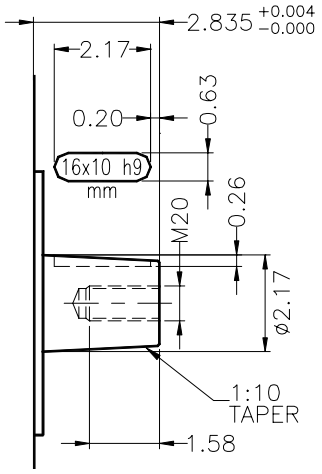


SHAFT OPTIONS

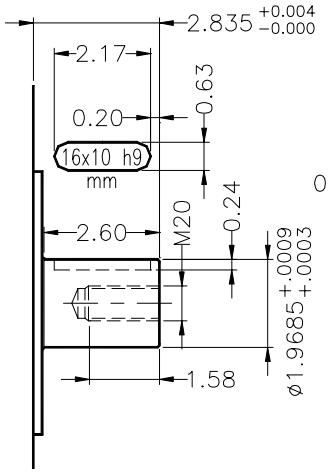
Splined DIN 5480 **7**
UNI 220 **1**



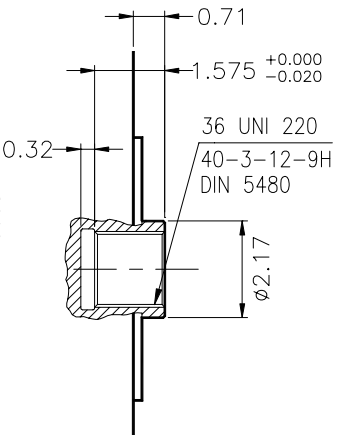
Tapered **2**



Parallel Keyed **8**

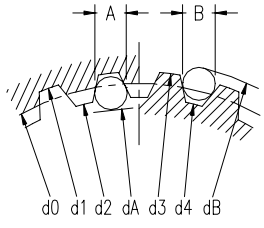


Internal Spline DIN 5480 **9**
UNI 220 **3**



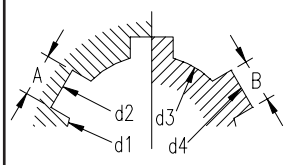
SPLINE DATA *(dimensions in mm [1 in = 25.4 mm])*

40-3-12 DIN 5480



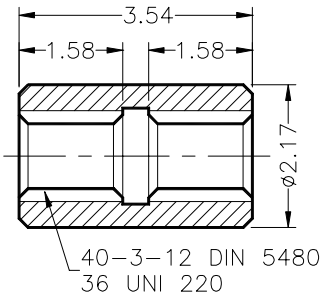
d0	Ø36.0		
d1	Ø40.0	$^{+0.620}_{+0}$	H14
d2	Ø34.0	$^{+0.160}_{+0}$	H11
A	Ø5.25		
da	Ø28.96	$^{+0.130}_{+0}$	H11
d3	Ø39.4	$^{-0}_{-0.160}$	h11
d4	Ø33.4	$^{-0}_{-0.620}$	h14
B	Ø6.0		
db	Ø45.989	$^{-0.025}_{-0.064}$	f 8

36 UNI 220 (DIN 5462)



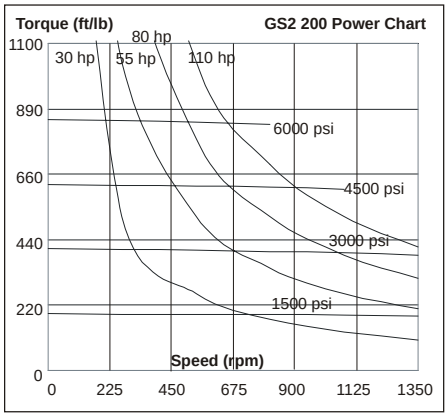
d1	Ø36.0	$^{+0.025}_{+0}$	H7
d2	Ø40.0	$^{+0.160}_{+0}$	H11
A	7.0	$^{+0.028}_{+0.013}$	F7
d3	Ø36.0	$^{-0.009}_{-0.025}$	g6
d4	Ø40.0	$^{-0.080}_{-0.240}$	d11
B	7.0	$^{-0.013}_{-0.028}$	f 7

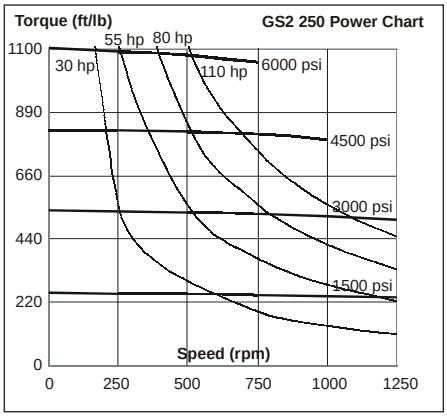
ADAPTOR

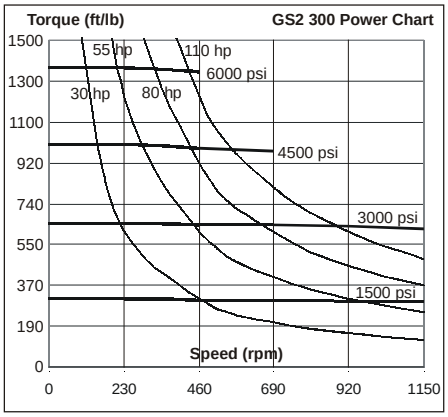


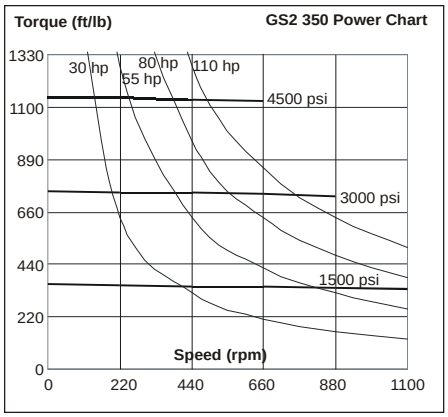
PERFORMANCE

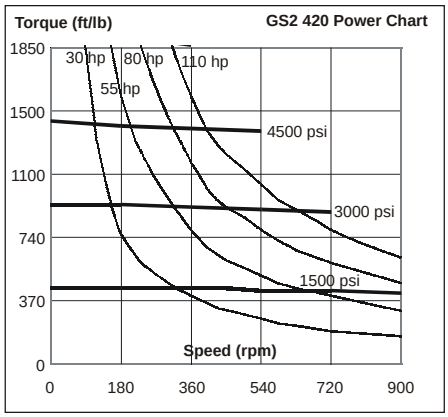
The graphs indicate the typical performance characteristics of the motors operating with mineral oil (standard ISO 68).

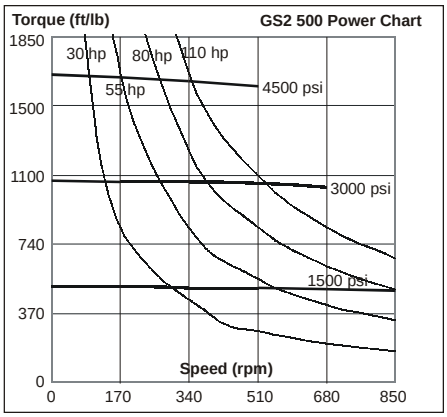










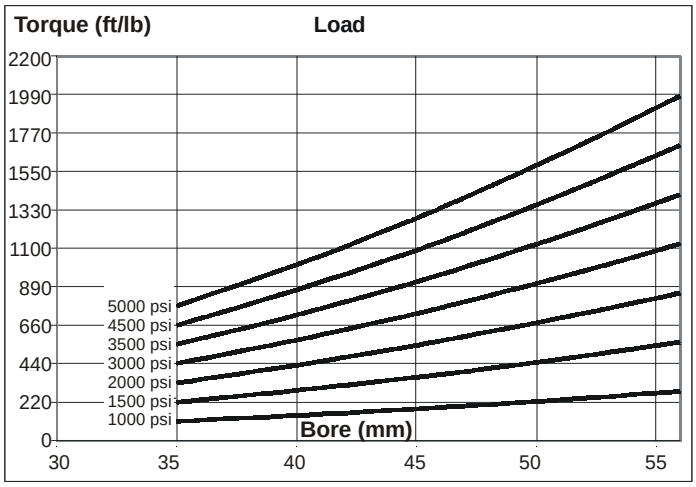


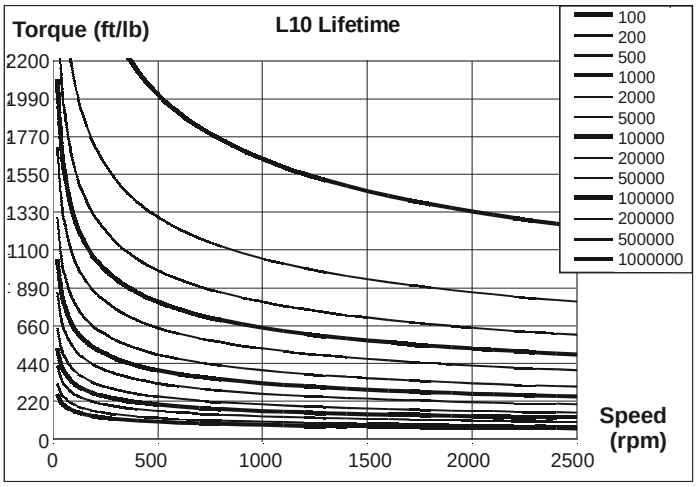
STARTING/STALLING TORQUE

The output torque of the motors does not fall off at stalling speed.
The graphs above indicate the starting torque of the motors (torque at 0 rpm).

BEARING LIFETIME

The graphs refer to the motors with spherical roller bearings (option GP).
Note that the average lifetime of a bearing (B_{50} lifetime) is approximately 5 times the B_{10} lifetime.





BEARING OPTIONS

Special **higher capacity** spherical roller bearing (option GPX) - the lifetime is approximately 1.66 times the equivalent lifetime given in the graph.

ORDER CODES

GS2	-	1	-	-	D47	-	-	-

MOTOR CODE

1. Nominal displacement - See motor spec. table

2. Shaft options: 1 = Ext. 36 UNI 220 (std)
7 = Ext. 40-3-12 DIN 5480
9 = Int. 40-3-12 DIN 5480
3 = Int. 36 UNI 220
2 = Tapered Keyed
8 = Parallel Keyed

3. Bearings: H = Roller Bearings
GPX = Spherical Roller Bearings higher capacity on motor cover and roller bearing on shaft output side

4. Other options:
U = Without shaft seal
SV = Shaft seal protection
VY = Viton seals
I = Case press. relief valve 43psi max
A = High pressure shaft seal in motor body (217 psi max)

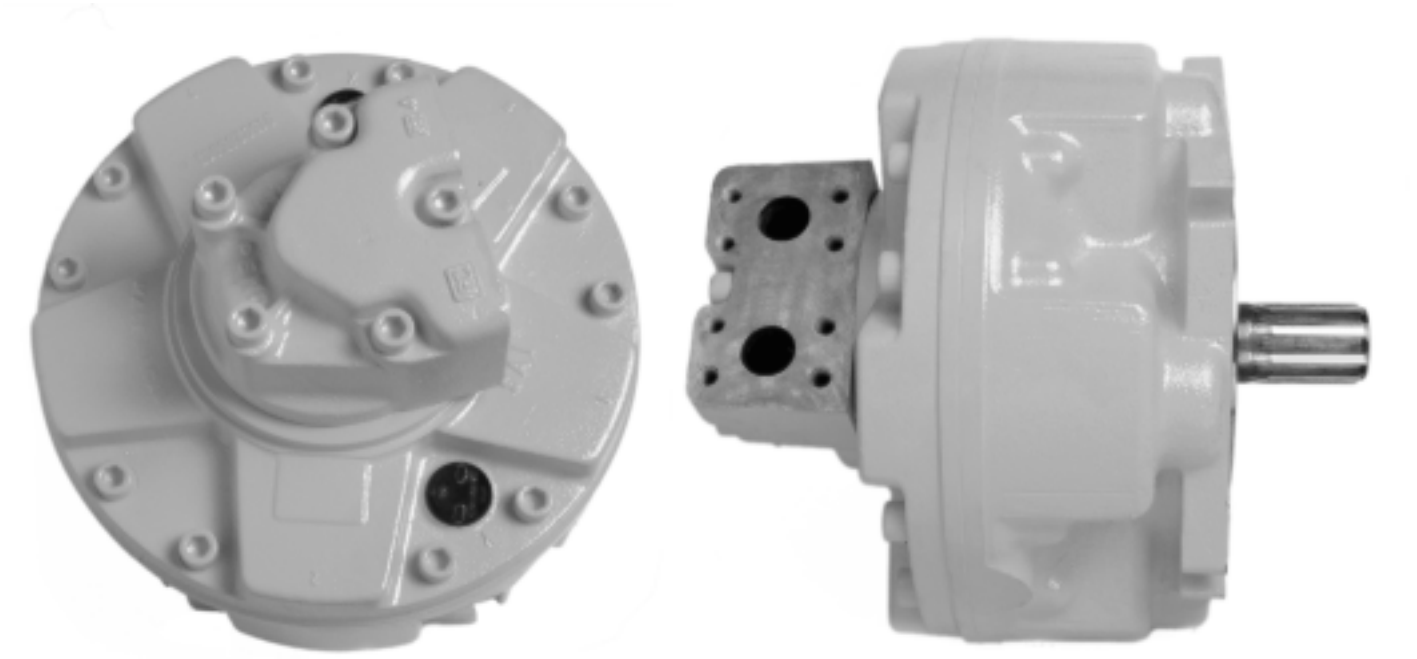
5. Distributor: D47 standard

6. Tachometer: K = Prepared for tachometer
J = With tachometer coupling

7. Direction of shaft rotation: standard motors are supplied with clockwise rotation (viewed from shaft end) with flow in port A, out port B.
No Code = Clockwise rotation
L = Counter-Clockwise rotation

8. Distributor cover position: See Page 7
No code = Position DM1
DM~ = Other position

GS3



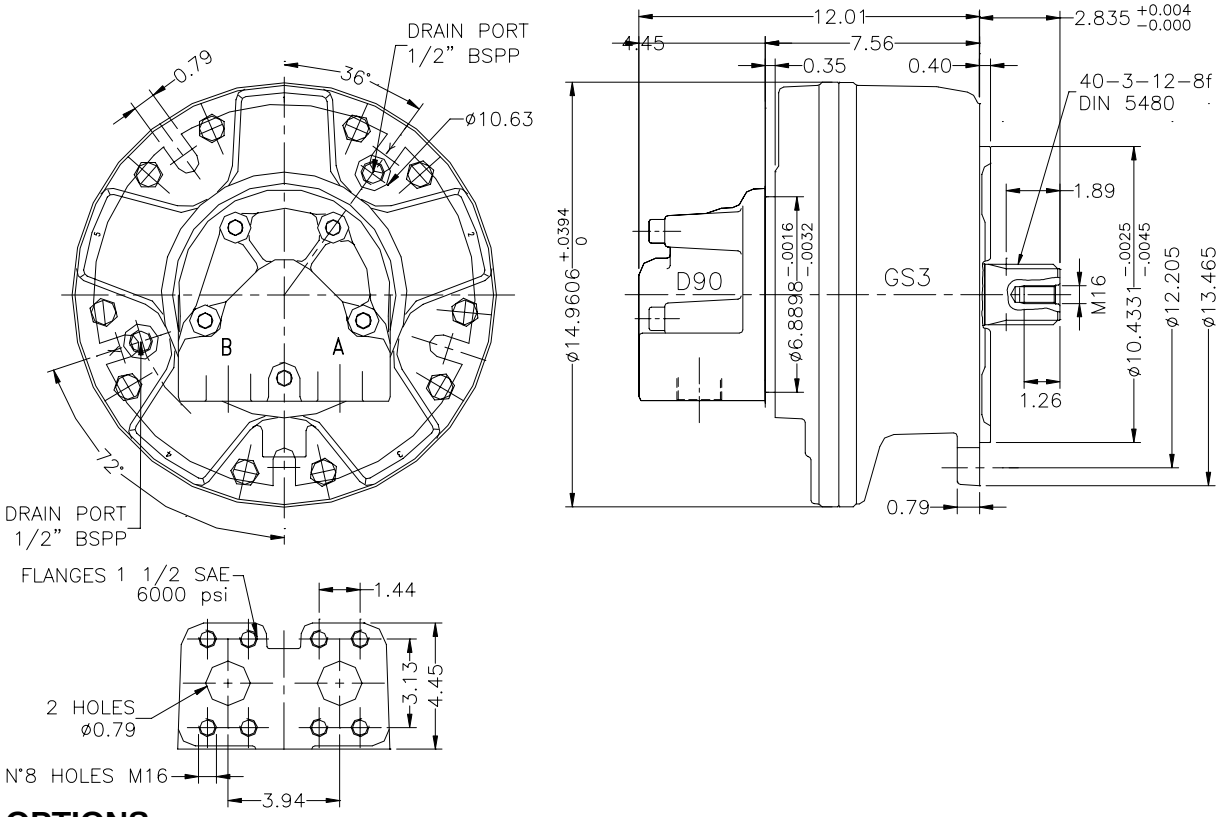
GS3		350	425	500	600	700	800*
Displacement	*in³/rev*	21.48	26.00	29.65	36.31	42.11	48.33
Bore diameter	*mm*	40	44	47	52	56	60
Shaft	*mm*	*56*	*56*	*56*	*56*	*56*	*56*
Specific torque	*lb.ft/100psi*	27.90	33.80	38.60	47.20	54.90	63.10
Cont. pressure	*psi*	3600	3600	3600	3600	3600	3600
Peak pressure	*psi*	6500	6100	6100	5800	5000	5000
Cont. speed	*rpm*	575	550	500	400	375	375
Max. speed	*rpm*	1000	850	800	800	750	750
Peak power	*HP*	135	135	135	135	135	135

* available under SAI approval of the application

Max. freewheeling speed	1600 rpm
Approximate weight:	191 lbs
Motor casing oil capacity:	1.3 gal / 305 in^3
Max. casing pressure:	42 psi continuous 85 psi peak

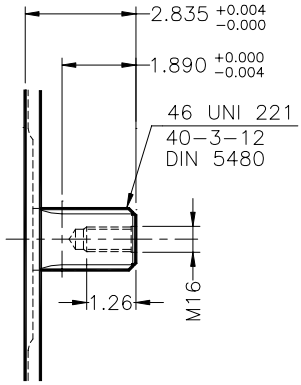
NB: Continuous or average working pressure should be chosen in function of the required service lifetime (see bearing lifetime).

DIMENSIONS

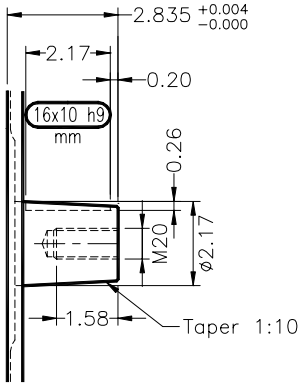


SHAFT OPTIONS

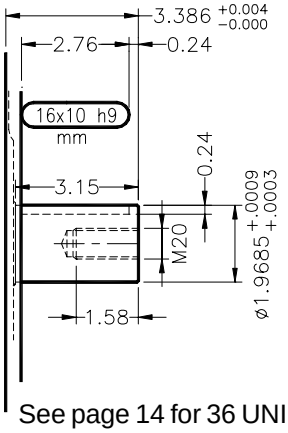
Splined DIN 5480 **7**
UNI 221 **1**



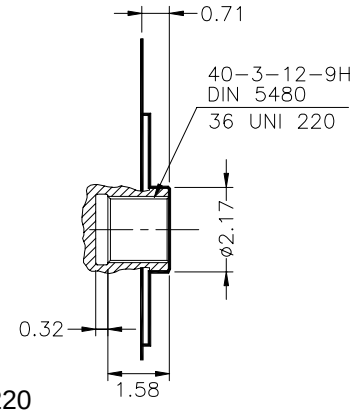
Tapered **2**



Parallel Keyed **8**



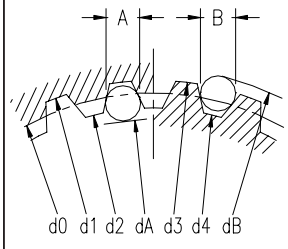
Internal Spline DIN 5480 **9**
UNI 220 **3**



See page 14 for 36 UNI 220 spline data.

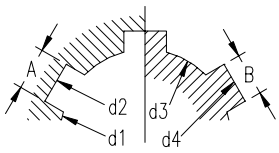
SPLINE DATA *(dimensions in mm [1 in = 25.4 mm])*

40-3-12 DIN 5480



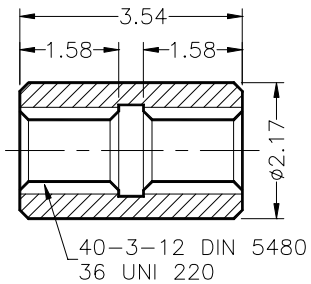
d0	Ø36.0		
d1	Ø40.0	+0.620 +0	H14
d2	Ø34.0	+0.160 +0	H11
A	Ø5.25		
da	Ø28.96	+0.130 +0	H11
d3	Ø39.4	-0 -0.160	h11
d4	Ø33.4	-0 -0.620	h14
B	Ø6.0		
db	Ø45.989	-0.025 -0.064	f 8

46 UNI 221 (8-46-54 DIN 5463)



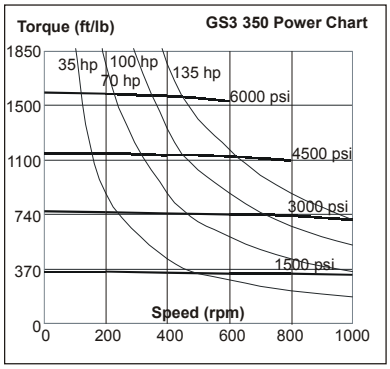
d1	Ø46.0	+0.025 +0	H7
d2	Ø54.0	+0.190 +0	H11
A	9.0	+0.028 +0.013	F7
d3	Ø46.0	-0.009 -0.025	g6
d4	Ø54.0	-0.100 -0.290	d11
B	9.0	-0.013 -0.028	f 7

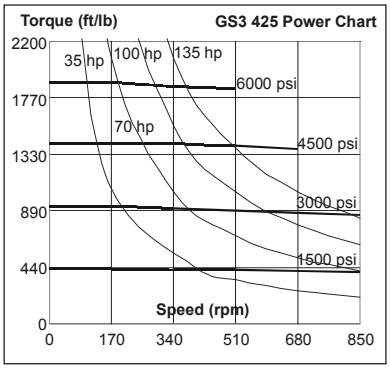
ADAPTOR

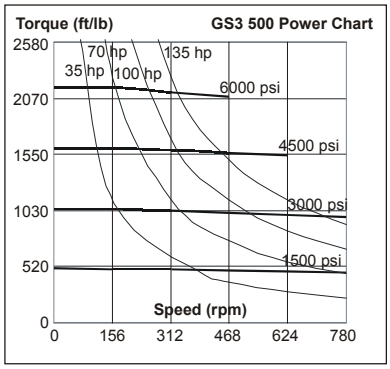


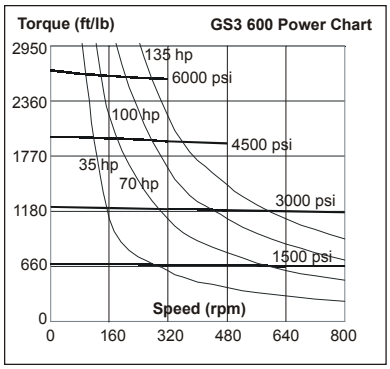
PERFORMANCE

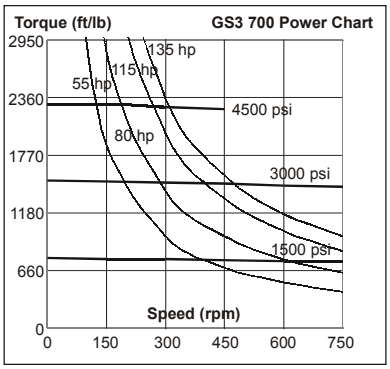
The graphs indicate the typical performance characteristics of the motors operating with mineral oil (standard ISO 68).

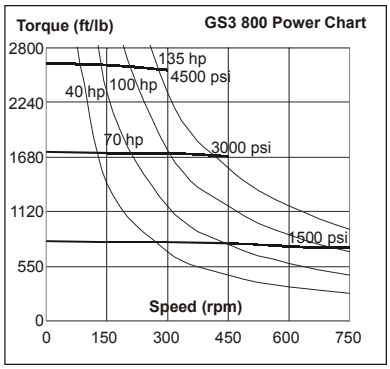










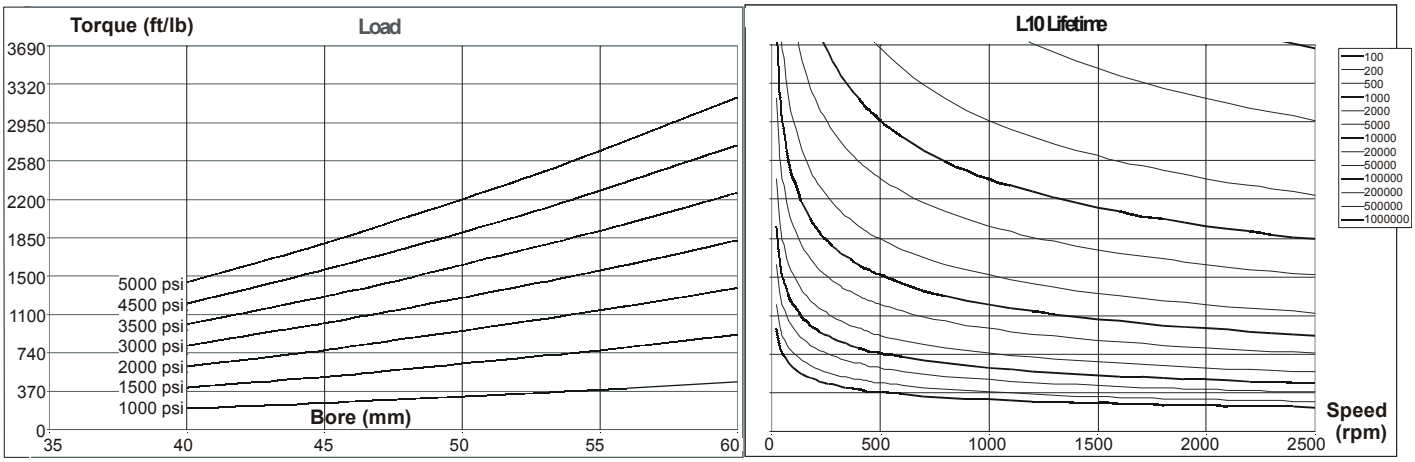


STARTING/STALLING TORQUE

The output torque of the motors does not fall off at stalling speed.
The graphs above indicate the starting torque of the motors (torque at 0 rpm).

BEARING LIFETIME

The graphs refer to the motors with spherical roller bearings (option GP).
Note that the average lifetime of a bearing (B_{50} lifetime) is approximately 5 times the B_{10} lifetime.



BEARING OPTIONS

Special **higher capacity** spherical roller bearing (option GPX) - the lifetime is approximately 1.36 times the equivalent lifetime given in the graph.

ORDER CODES

MOTOR CODE

1. Nominal displacement - See motor spec. table

2. Shaft options:

1 = Ext. 46 UNI 221 (std)
7 = Ext. 40-3-12 DIN 5480
9 = Int. 40-3-12 DIN 5480
3 = Int. 36 UNI 220
2 = Tapered Keyed
8 = Parallel Keyed

3. Bearings:

No code = Roller bearings (std)
GPX = Higher capacity spherical roller bearing in motor cover and in motor body

4. Other options:

U = Without shaft seal
SV = Shaft seal protection
VY = Viton seals
I = Case press. relief valve 43psi
SB = Disc cage in spherical support to always matchopt. X
A = High pressure shaft seal in motor body

5. Distributor: D90 standard

6. Tachometer:

K = Prepared for tachometer
J = With tachometer coupling

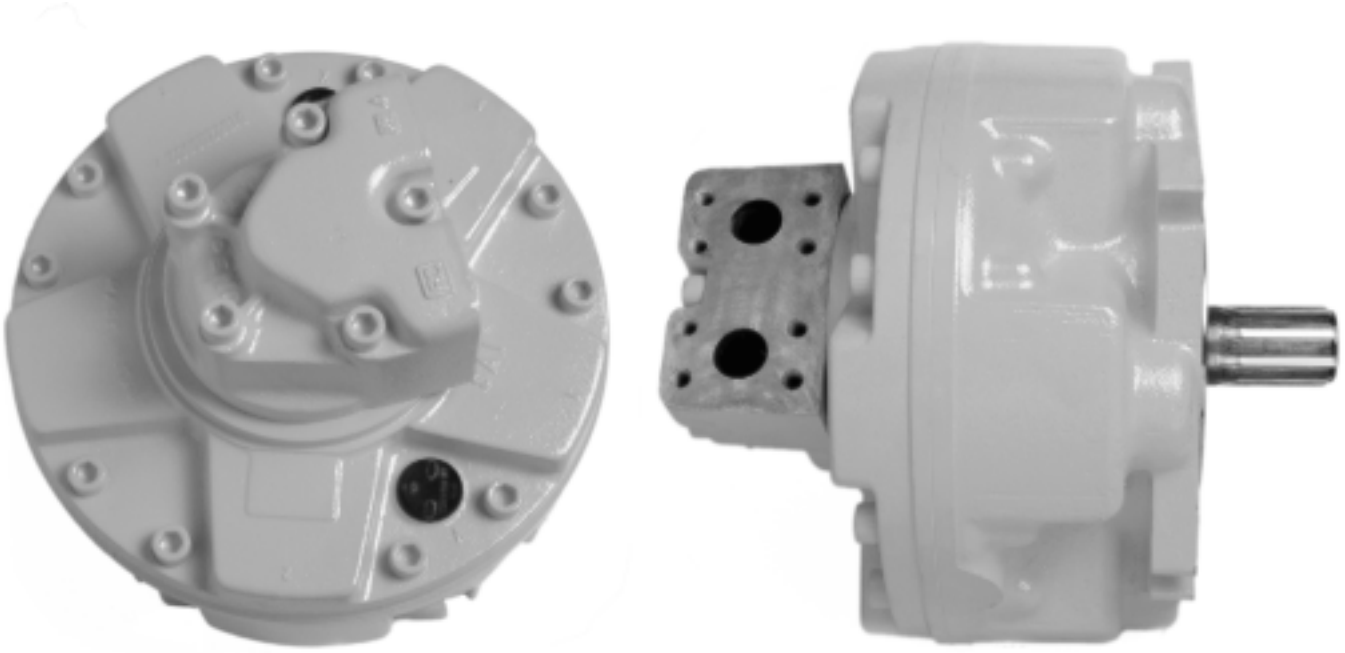
7. Direction of shaft rotation: standard motors are supplied with clockwise rotation (viewed from shaft end) with flow in port A, out port B.

No code = Clockwise rotation
L = Counter-Clockwise rotation

8. Distributor cover position: See Page 7

No code = Position DM1
DM~ = Other position

GS4

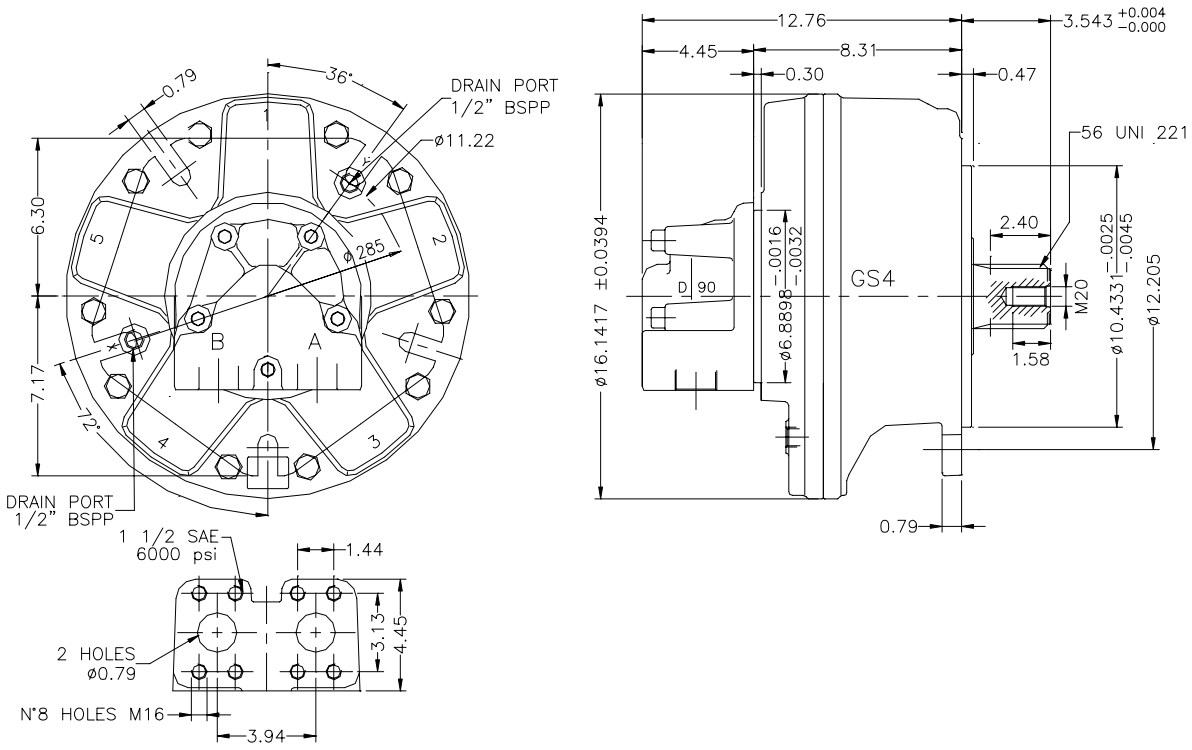


GS4		400	500	600	800	900	1000	1100
Displacement	*in³/rev*	24.53	30.69	37.59	48.39	55.17	62.37	68.10
Bore diameter	*mm*	42	47	52	59	63	67	70
Stroke	*mm*	58	58	58	58	58	58	58
Specific torque	*lb.ft/100psi*	31.90	39.90	48.90	63.10	71.70	81.40	88.50
Cont. pressure	*psi*	3600	3600	3600	3600	3600	3600	3600
Peak pressure	*psi*	6500	6500	5800	5800	5400	5000	5000
Cont. speed	*rpm*	600	600	575	550	500	450	400
Max. speed	*rpm*	830	780	750	730	700	700	650
Peak power	*HP*	200	200	200	200	200	200	200

Max. freewheeling speed	1400 rpm
Approximate weight:	255 lbs
Motor casing oil capacity:	2 gal / 427 in^3
Max. casing pressure:	42 psi continuous 85 psi peak

NB: Continuous or average working pressure should be chosen in function of the required service lifetime (see bearing lifetime).

DIMENSIONS



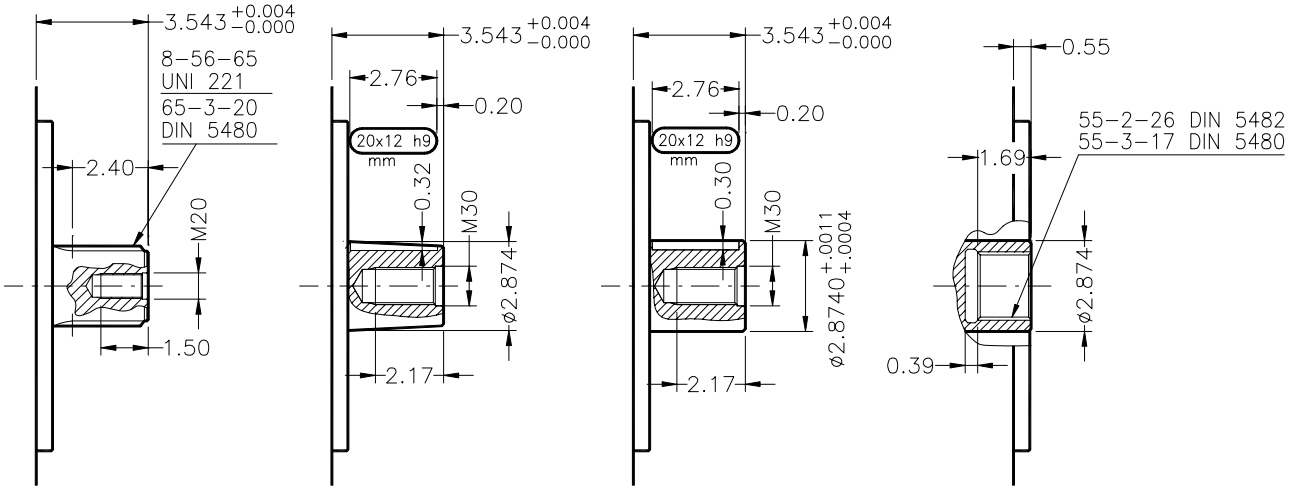
SHAFT OPTIONS

Splined DIN 5480 **7**
UNI 221 **1**

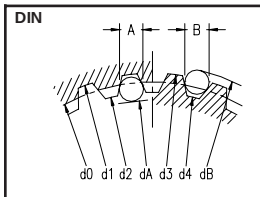
Tapered **2**

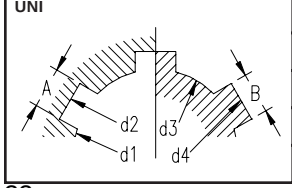
Parallel Keyed **8**

Internal DIN 5480 **9**
Spline DIN 5482 **3**



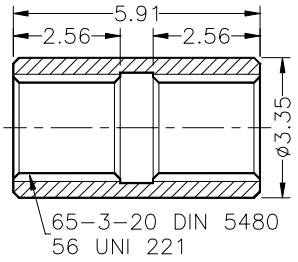
SPLINE DATA *(dimensions in mm [1 in = 25.4 mm])*





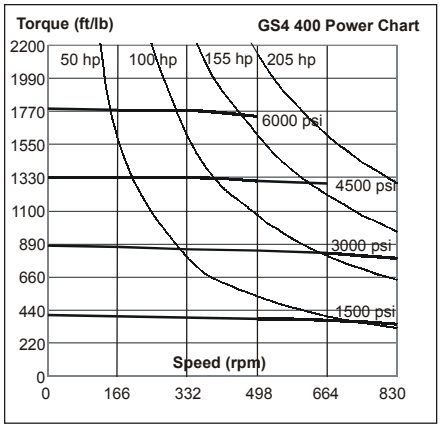
	65-3-20 DIN 5480	55-2-26 DIN 5482	55-3-17 DIN 5480	56 UNI 221
d0	Ø60.0	Ø52.0	Ø51.0	
d1	Ø65.0 +0.740 +0 H14	Ø55.0 +0300 +0 H12	Ø55.0 +0.740 +0 H14	Ø56.0 +0.030 +0 H7
d2	Ø59.0 +0.190 +0 H11	Ø50.0 +0.160 +0 H11	Ø49.0 +0.160 +0 H11	Ø65.0 +0.190 +0 H11
A	Ø5.25	Ø3.5	Ø5.25	10.0 +0.028 +0.013 F7
da	Ø54.101 +0.190 +0 H11	Ø46.902 +0.100 +0 H10	Ø43.807 +0.160 +0 H11	**d3** Ø56.0 -0.010 -0.029 g6
d3	Ø64.4 -0 -0.190 h11	Ø54.5 -0 -0.190 h11	Ø54.4 -0 -0.190 h11	**d4** Ø65.0 -0.100 -0.290 d11
d4	Ø58.4 -0 -0.740 h14	Ø49.0 -0 -0.300 h12	Ø48.4 -0 -0.620 h14	**B** 10.0 -0.013 -0.028 f7
B	Ø6.0	Ø3.5	Ø6.0	
db	Ø70.999 -0.030 -0.076 f8	Ø56.953 -0.060 -0.134 e9	Ø60.873 -0.030 -0.076 f8	

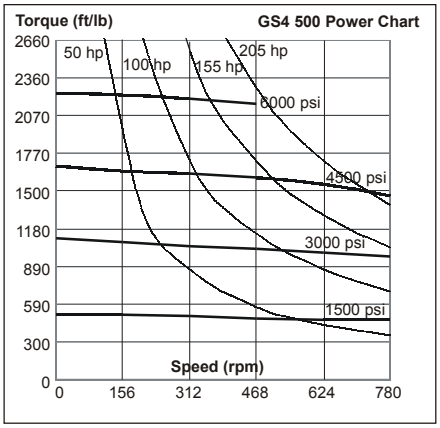
ADAPTOR

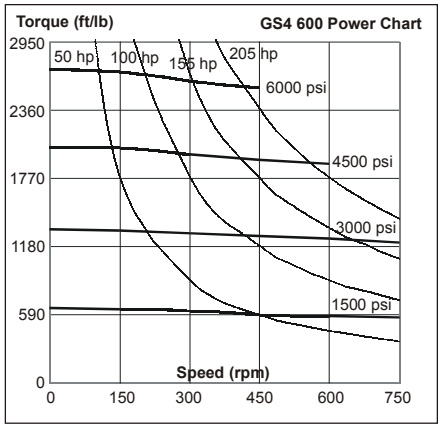


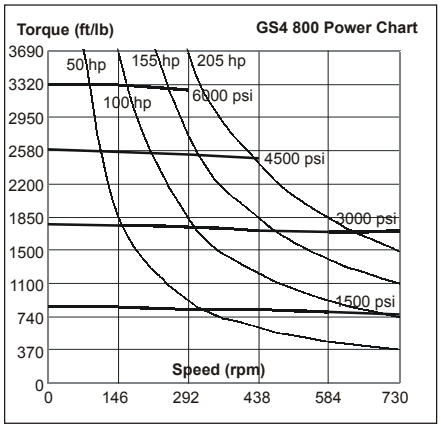
PERFORMANCE

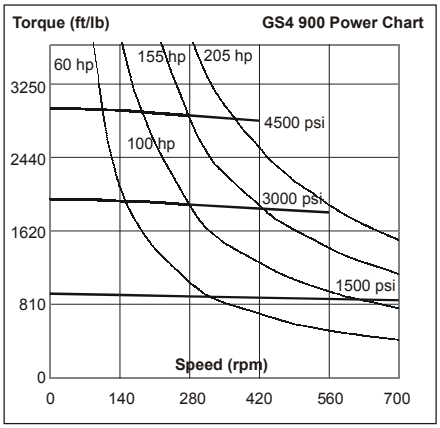
The graphs indicate the typical performance characteristics of the motors operating with mineral oil (standard ISO 68).

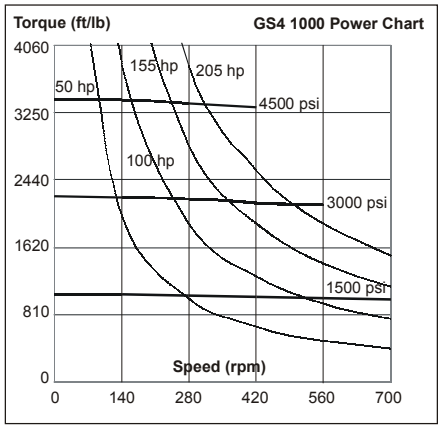


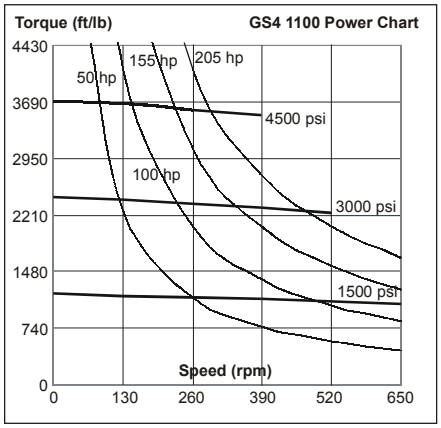










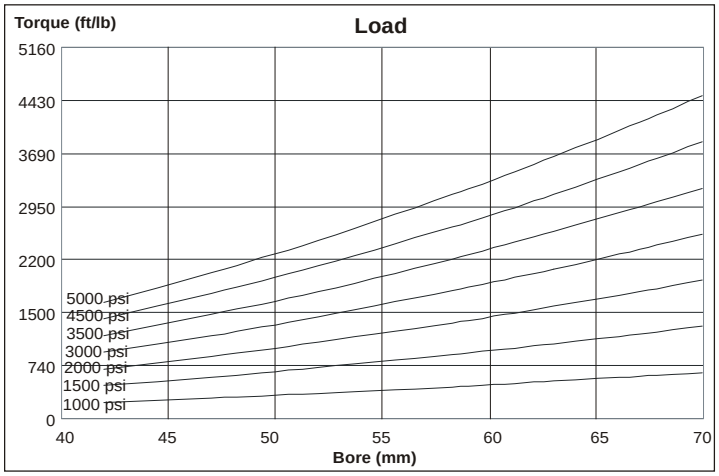


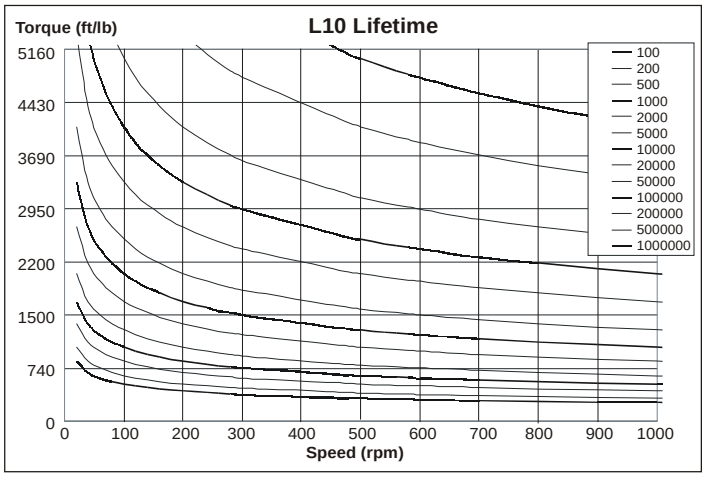
STARTING/STALLING TORQUE

The output torque of the motors does not fall off at stalling speed.
The graphs above indicate the starting torque of the motors (torque at 0 rpm).

BEARING LIFETIME

The graphs refer to the motors with spherical roller bearings (option GP).
Note that the average lifetime of a bearing (B_{50} lifetime) is approximately 5 times the B_{10} lifetime.





BEARING OPTIONS

Special **higher capacity** spherical roller bearing (option GX) - the lifetime is approximately 2.29 times the equivalent lifetime given in the graph.

ORDER CODES

GS4	-	-	-	-	D90	-	-	-

MOTOR CODE

1. **Nominal displacement** - See motor spec. table
2. **Shaft opt:**
   1 = Ext. 56 UNI 220
   7 = Ext. 65-3-20 DIN 5480
   9 = Int. 55-3-17 DIN 5480
   3 = Int. A 55-50 DIN 5482
   2 = Tapered Keyed
   8 = Parallel Keyed
3. **Bearings:**
   H = Roller bearings
   GX = Spherical roller bearings
4. **Other opt:**
   U = Without shaft seal
   SV = Shaft seal protection
   V = Viton seals
   I = Case press. relief valve 43psi
   SB = Disc cage in spherical support to always match opt. X
   A = High pressure shaft seal in motor body (max 217 psi)
5. **Distributor**: D90 standard
6. **Tachometer:**
   K = Predisposed for tachometer
   J = Mechanical Tach. mount
7. **Direction of shaft rotation:** standard motors are supplied with clockwise rotation (viewed from shaft end) with flow in port A, out port B.
   No code = Clockwise rotation
   L = Counter-Clockwise rotation
8. **Distributor cover position:** See Page 7
   No code = Position DM1
   DM~ = Other position

GS5A

GS5A		525	650	800	1000	1200	1300	1450	1600	1800
Displacement	*in³/rev*	32.10	40.82	49.25	63.40	72.31	81.77	89.22	98.70	110.82
Bore diameter	*mm*	42	47	52	59	63	67	70	74	78
Shaft	*mm*	76	76	76	76	76	76	76	76	76
Specific torque	*lb.ft/100psi*	41.80	52.40	64.10	82.40	94.10	106.30	116.00	128.90	144.00
Cont. pressure	*psi*	3600	3600	3600	3600	3600	3600	3600	3600	3600
Peak pressure	*psi*	6500	6500	6100	6100	5800	5800	5400	5400	5000
Cont. speed	*rpm*	500	500	500	475	475	450	450	400	375
Max. speed	*rpm*	750	730	700	680	630	600	600	600	550
Peak power	*HP*	270	270	270	270	270	270	270	270	270

Max. freewheeling speed: 1200 rpm

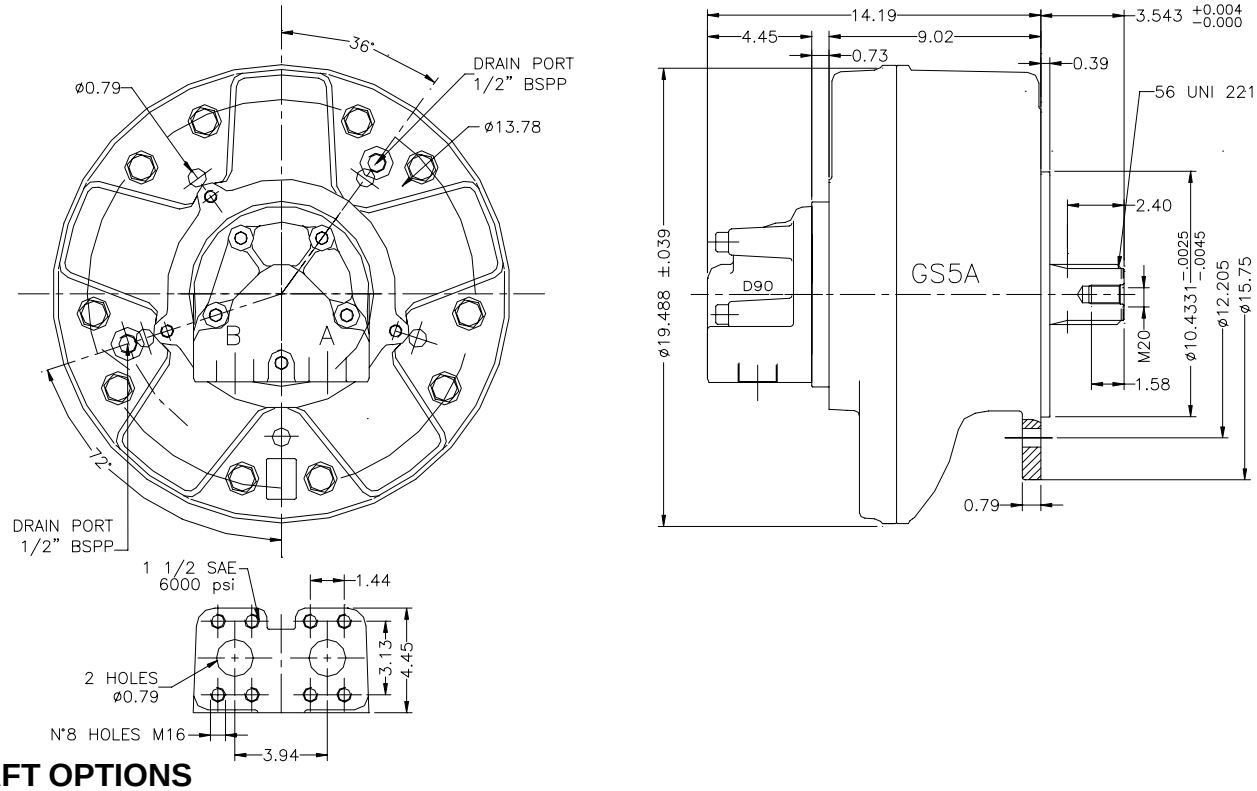
Approximate weight: 400 lbs

Motor casing oil capacity: 2.6 gal / 610 in^3

Max. casing pressure: 42 psi continuous
85 psi peak

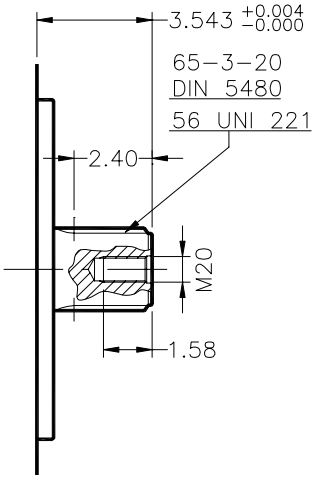
NB: Continuous or average working pressure should be chosen in function of the required service lifetime (see bearing lifetime).

DIMENSIONS

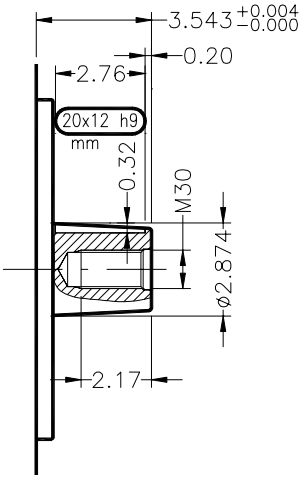


SHAFT OPTIONS

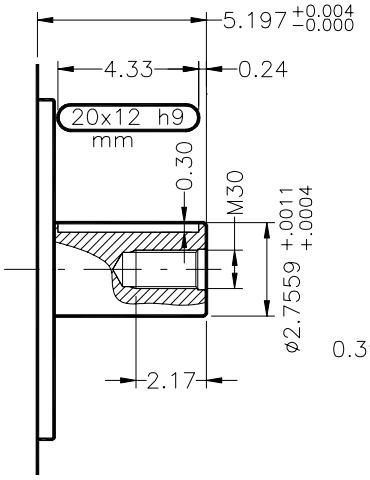
Splined DIN 5480 **7**
UNI 221 **1**



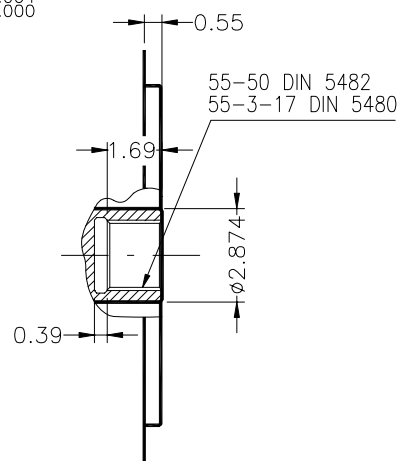
Tapered **2**



Parallel Keyed **8**

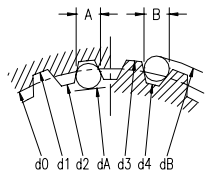


Internal Spline DIN 5480 **9**
DIN 5482 **3**

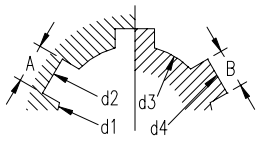


SPLINE DATA *(dimensions in mm [1 in = 25.4 mm])*

DIN

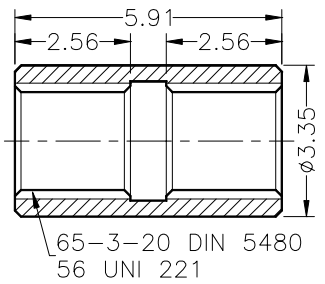


UNI



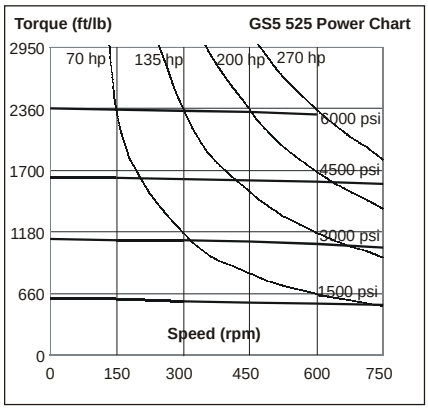
	65-3-20 DIN 5480	55-2-26 DIN 5482	55-3-17 DIN 5480	56 UNI 221
d0	Ø60.0	Ø52.0	Ø51.0	**d1** Ø56.0 +0.030 +0 H7
d1	Ø65.0 +0.740 +0 H14	Ø55.0 +0300 +0 H12	Ø55.0 +0.740 +0 H14	**d2** Ø65.0 +0.190 +0 H11
d2	Ø59.0 +0.190 +0 H11	Ø50.0 +0.160 +0 H11	Ø49.0 +0.160 +0 H11	**A** 10.0 +0.028 +0.013 F7
A	Ø5.25	Ø3.5	Ø5.25	**d3** Ø56.0 -0.010 -0.029 g6
da	Ø54.101 +0.190 +0 H11	Ø46.902 +0.100 +0 H10	Ø43.807 +0.160 +0 H11	**d4** Ø65.0 -0.100 -0.290 d11
d3	Ø64.4 -0 -0.190 h11	Ø54.5 -0 -0.190 h11	Ø54.4 -0 -0.190 h11	**B** 10.0 -0.013 -0.028 f7
d4	Ø58.4 -0 -0.740 h14	Ø49.0 -0 -0.300 h12	Ø48.4 -0 -0.620 h14	
B	Ø6.0	Ø3.5	Ø6.0	
db	Ø70.999 -0.030 -0.076 f8	Ø56.953 -0.060 -0.134 e9	Ø60.873 -0.030 -0.076 f8	

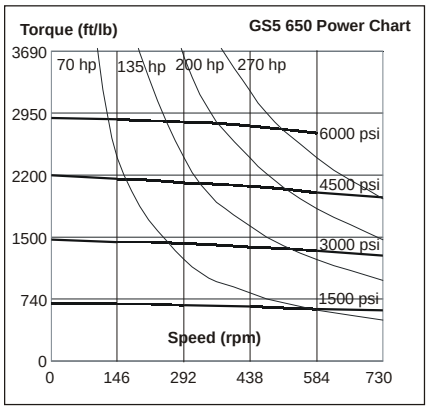
ADAPTOR

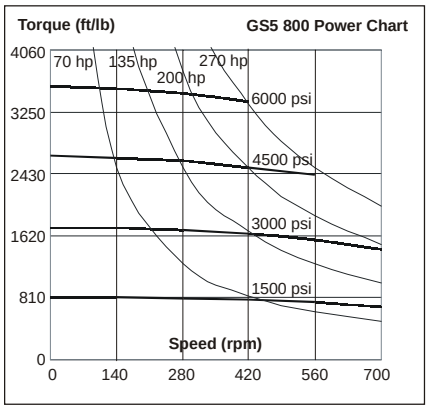


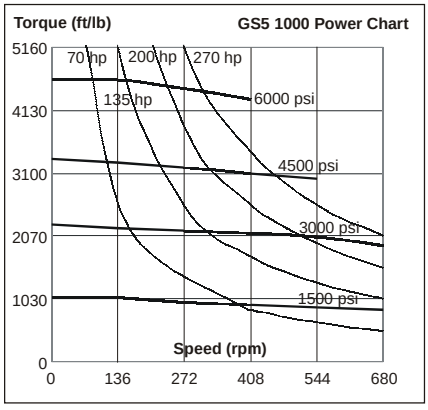
PERFORMANCE

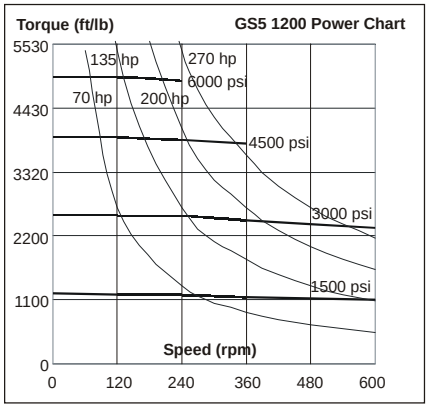
The graphs indicate the typical performance characteristics of the motors operating with mineral oil (standard ISO 68).

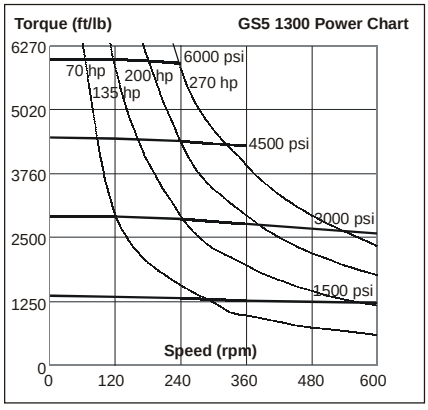


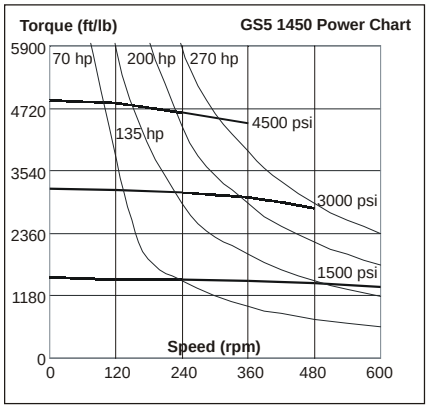


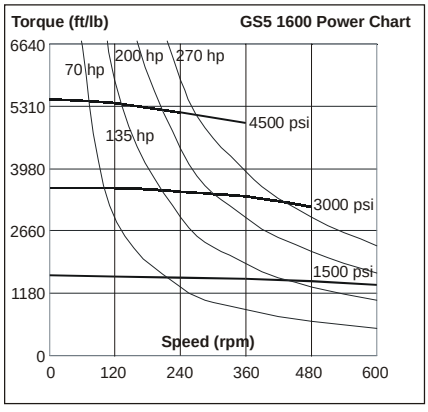


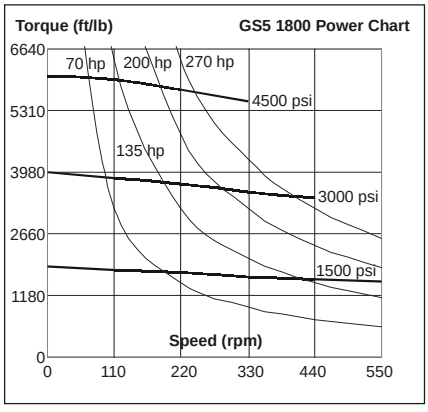










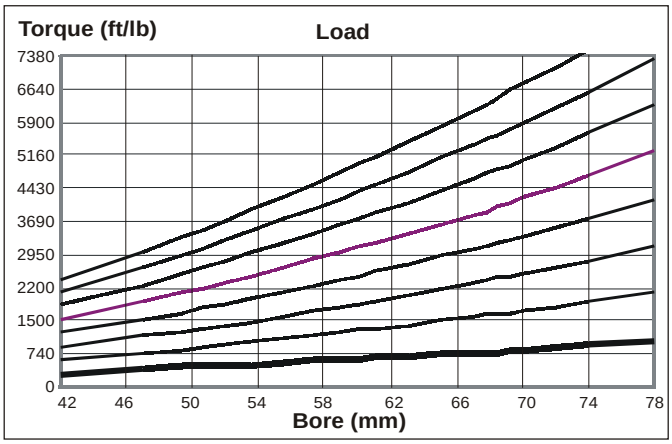


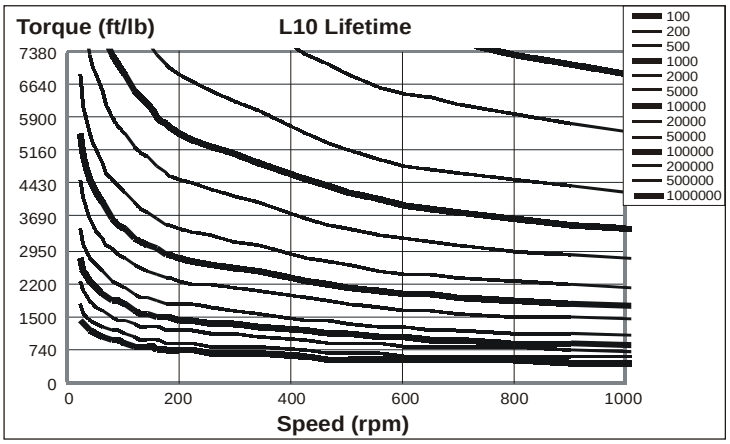
STARTING/STALLING TORQUE

The output torque of the motors does not fall off at stalling speed.
The graphs above indicate the starting torque of the motors (torque at 0 rpm).

BEARING LIFETIME

The graphs refer to the motors with spherical roller bearings (option G).
Note that the average lifetime of a bearing (B_{50} lifetime) is approximately 5 times the B_{10} lifetime.





BEARING OPTIONS

Special **higher capacity** spherical roller bearing (option GX) - the lifetime is approximately 2.29 times the equivalent lifetime given in the graph.

ORDER CODES

GM5A	-	-	-	-	D90	-	-	-

MOTOR CODE

1. Nominal displacement - See motor spec. table

2. Shaft opt:
- 1 = Ext. 56 UNI 221
- 7 = Ext. 65-3-20 DIN 5480
- 9 = Int. 55-3-17 DIN 5480
- 3 = Int. 55-50 DIN 5482
- 2 = Tapered Keyed
- 8 = Parallel Keyed

3. Bearings:
- No code = Roller bearings
- GX = Spher. roller bearings high cap.

4. Other opt:
- U = Without shaft seal
- SV = Shaft seal protection
- VY = Viton seals
- I = Case press. relief valve 43psi
- SB = Disc cage in spher support to always match opt. X

5. Distributor: D90 standard

6. Tachometer:
- K = Predisposed for tachometer
- J = with tach. coupling

7. Direction of shaft rotation: standard motors are supplied with clockwise rotation (viewed from shaft end) with flow in port A, out port B.
- No code = Clockwise rotation
- L = Counter-Clockwise rotation

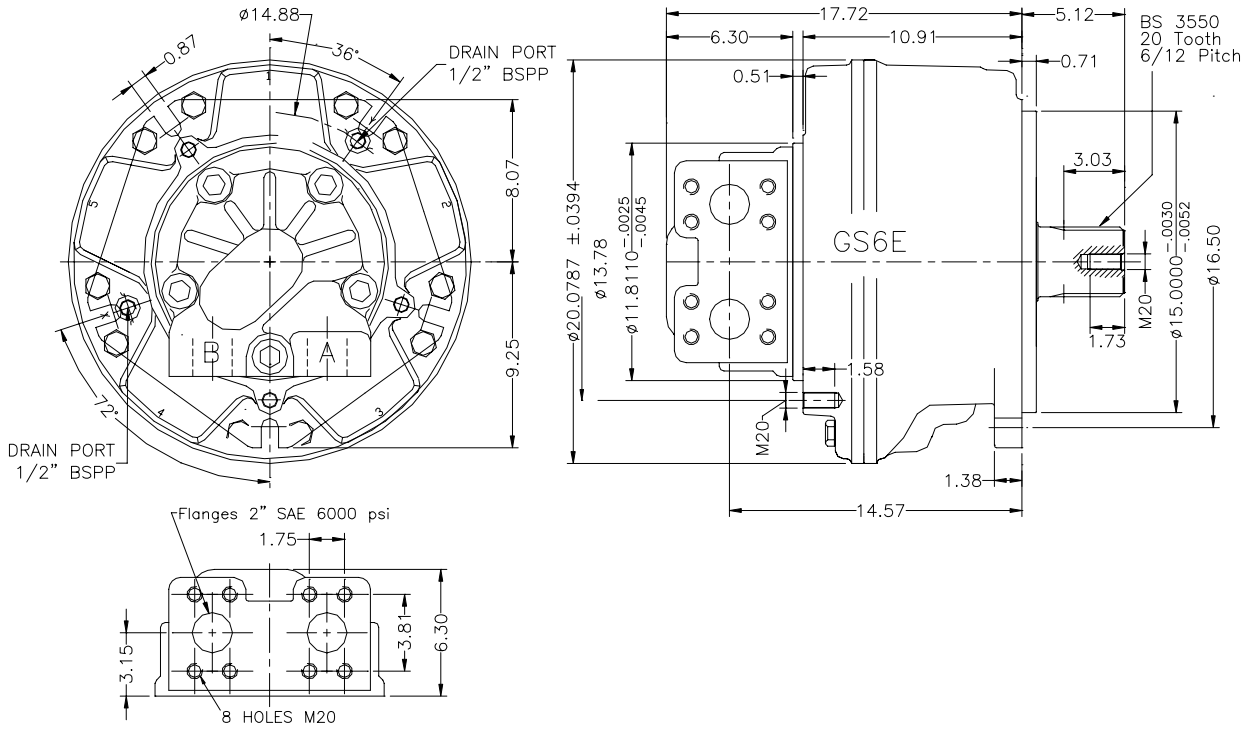
8. Distributor cover position: See Page 7
- No code = Position DM1
- DM~ = Other position

GS6		1700	2100	2500
Displacement	*in³/rev*	103.13	129.80	153.35
Bore diameter	*mm*	82	92	100
Shaft	*mm*	64	64	64
Specific torque	*lb.ft/100psi*	134.30	168.90	199.40
Cont. pressure	*psi*	3600	3600	3600
Peak pressure	*psi*	6500	5800	5000
Cont. speed	*rpm*	400	400	300
Max. speed	*rpm*	600	575	500
Peak power	*HP*	400	400	400

Max. freewheeling speed:	800 rpm
Approximate weight:	640 lbs
Motor casing oil capacity:	6.6 gal / 1527 in^3
Max. casing pressure:	42 psi continuous 85 psi peak

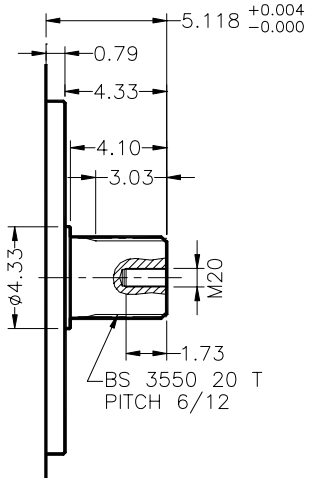
NB: Continuous or average working pressure should be chosen in function of the required service lifetime (see bearing lifetime).

DIMENSIONS



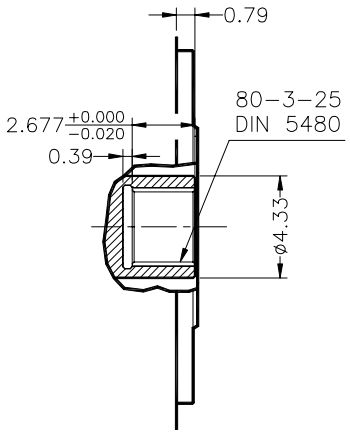
SHAFT OPTIONS

Splined BS 3550 **1**



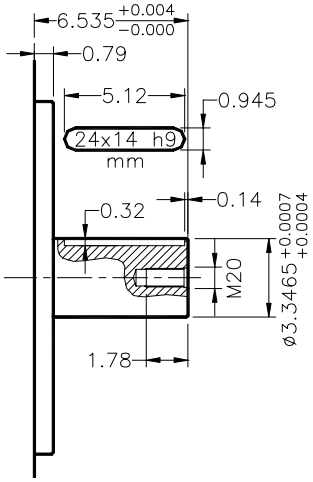
Internal Spline **9**

BEARING OPTION E ONLY

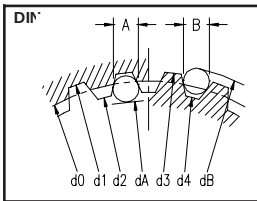


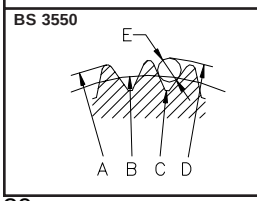
Parallel Keyed **8**

BEARING OPTION E ONLY



SPLINE DATA *(dimensions in mm [1 in = 25.4 mm])*

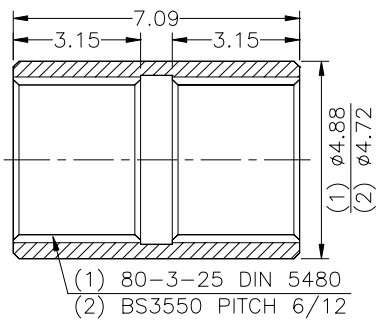




	80-3-25 DIN 5480
d0	Ø75.0
d1	Ø80.0 +0.740 +0 H14
d2	Ø74.0 +0.190 +0 H11
A	Ø5.25
da	Ø68.9 +0.740 +0 H9
d3	Ø79.4 -0 -0.190 h11
d4	Ø73.4 -0 -0.740 h14
B	Ø6.0
db	Ø85.9 -0.036 -0.090 f 8

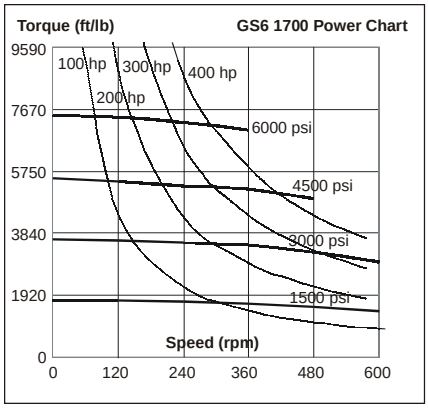
	BS3550 6/12 Pitch
A	Ø88.0 -0.047 -0.17
B	Ø84.6
C	Ø80.0 -0.480 -0.070
D	Ø97.0 -0.082 -0.030
E	Ø8.12

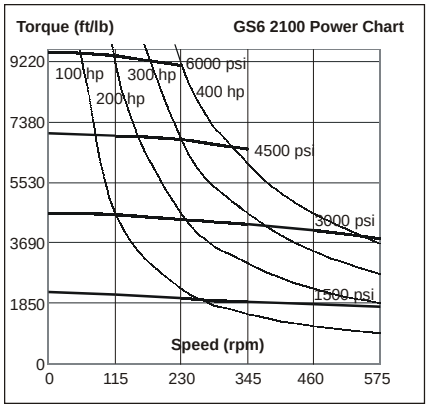
ADAPTOR

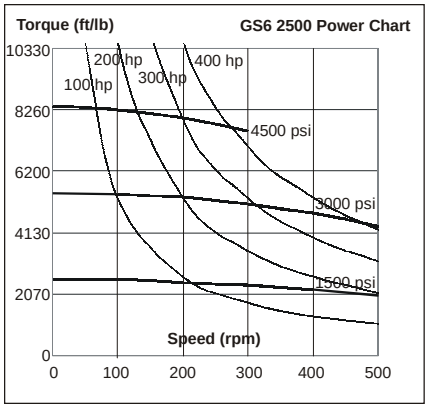


PERFORMANCE

The graphs indicate the typical performance characteristics of the motors operating with mineral oil (standard ISO 68).





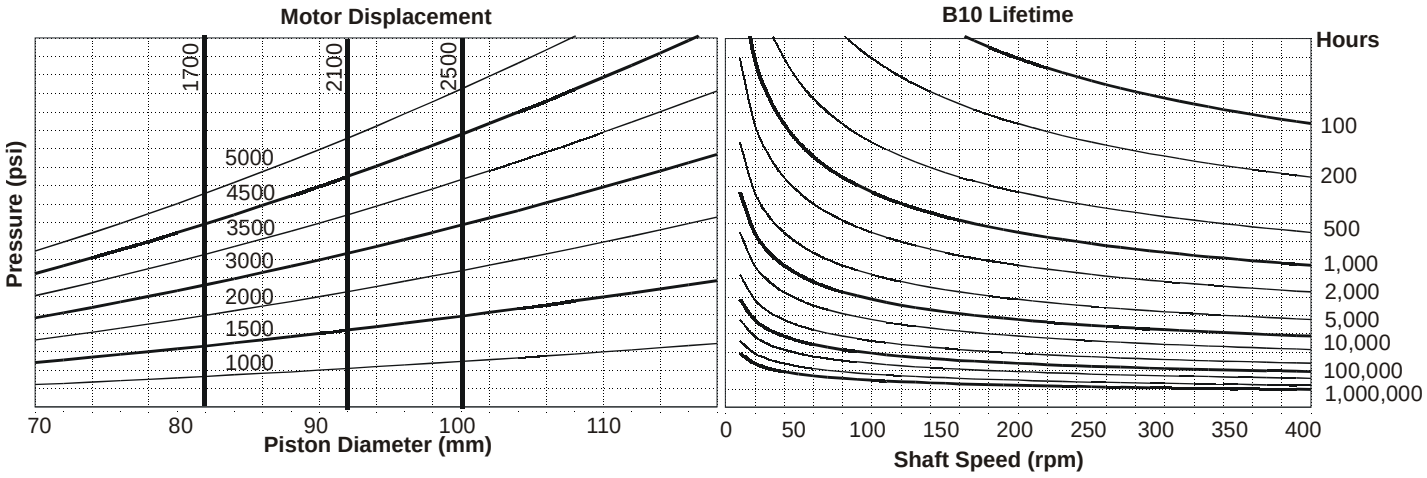


STARTING/STALLING TORQUE

The output torque of the motors does not fall off at stalling speed.
The graphs above indicate the starting torque of the motors (torque at 0 rpm).

BEARING LIFETIME

The graphs refer to the motors with spherical roller bearings (option G).
Note that the average lifetime of a bearing (B_{50} lifetime) is approximately 5 times the B_{10} lifetime.



BEARING OPTIONS

Special **higher capacity** spherical roller bearing (on request) - the lifetime is approximately 1.6 times the equivalent lifetime given in the graph.

ORDER CODES

MOTOR CODE

1. Nominal displacement - See motor spec. table

2. Shaft options: 1 = Ext. BS 3550 (std)
8 = Parallel Keyed
(only with "E" bearings)
9 = Int. 80-3-25 DIN 5480
(only with "E" bearings)

3. Bearings: GX = Higher capacity
spherical roller bearings

4. Other options:
U = Without shaft seal
SV = Shaft seal protection
VY = Viton seals
I = Case press. relief valve 43psi
SB = Disc cage in spherical
support to always match
opt. X

5. Distributor: D250 standard

6. Tachometer: K = Prepared for tachometer
J = With tachometer coupling

7. Direction of shaft rotation: standard motors are supplied with clockwise rotation (viewed from shaft end) with flow in port A, out port B.
No code = Clockwise rotation
L = Counter-Clockwise rotation

8. Distributor cover position: See Page 7
No code = Position DM1
DM~ = Other position

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