Dutch Hydraulic Consultants

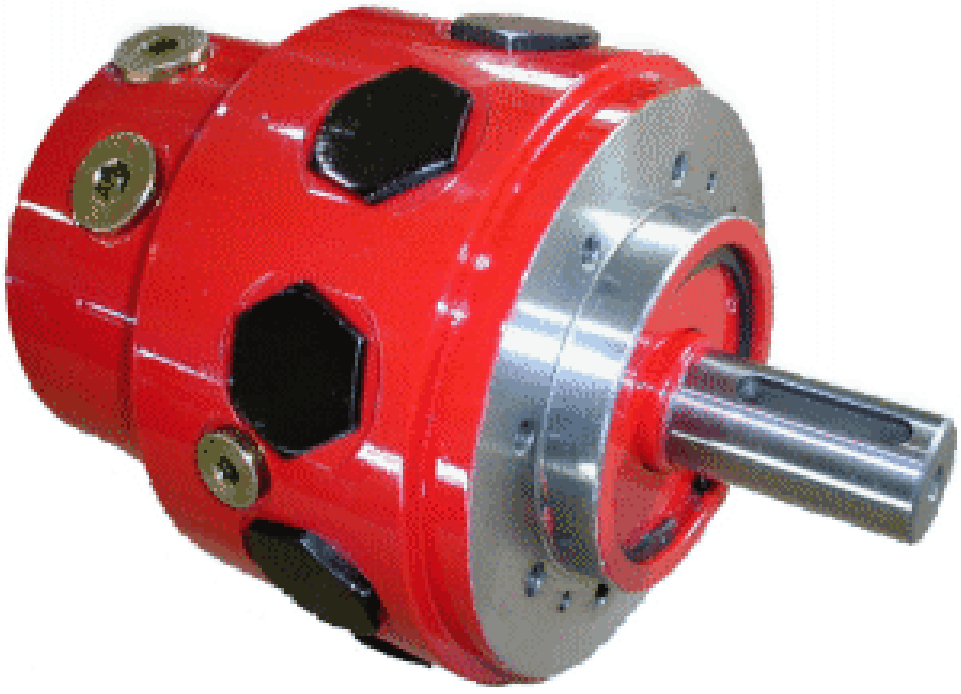
HANSA · TMP srl

HYDRAULIC COMPONENTS
HYDROSTATIC TRANSMISSIONS
GEARBOXES - ACCESSORIES

HT 18 / A / 305 / 0308 / E

High Speed Radial Pistons Hydraulic Motors

Single Displacement G Series
Dual Displacement GD Series



CONTENT

General Informations

The G motor range varies from 20 cm3 to 100 cm3 displacement and it is completed by GD series Dual displacement motors and special motors created in cooperation with our clients for different applications such as : underwater, high & low speed and wheel motors and with the possibility to assemble valves, brakes or gear reductions.
You can directly contact our Technical Department which will give you all the necessary support to find the right solutions to your problems.
Our Company is a flexible work reality and manages deliveries also within the same day of order; we produce motors exactly interchangeable with our competitors, always ready on stock which our clients particularly appreciate.

Description
As these are a radial piston motors, they keep their operating features: a high starting torque along with a high stability during the torque transmission.
It is worth bearing in mind that,as compared to the other motors, the "G" motors,thank to the great number of pistons,has very high overall performance, even at low speed.
The "G" motors can operate in free-wheeling.

Features
- High efficiency
- High running speed
- Low running speed
- Reversible
- Nine pistons
- Oil Temperature Range -30 + 70 °C

Output Shaft
- Spline male
- Keyed parallel
- Special on request

Optionals
- Electronic Speed Transducer EST 30

Single Displacement G Series - Technical Data

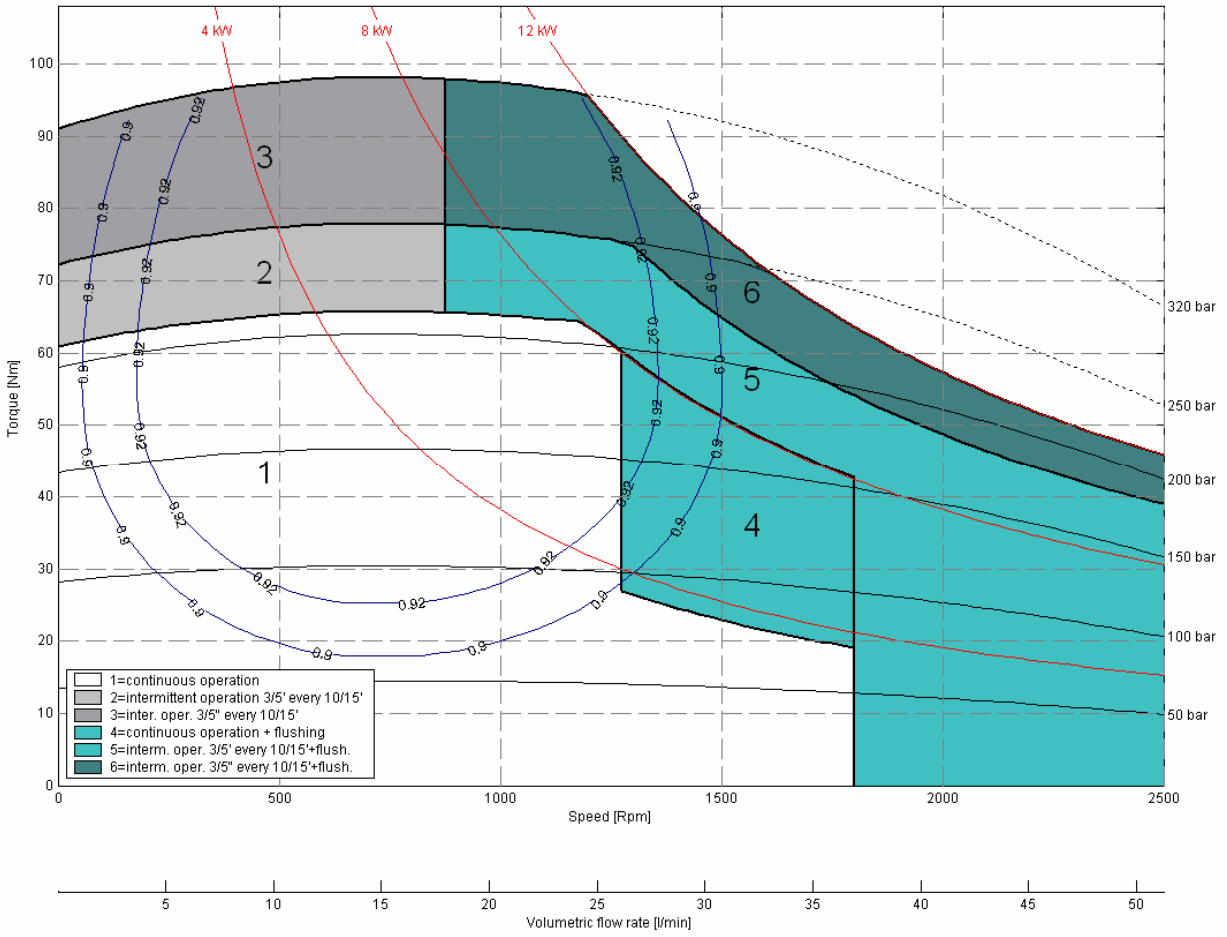
MODEL		G 20	G 27	G 34	G 50	G 75	G 90	G 100
Displacement	cm^3 / n	20,5	27,3	34,2	50,9	76,3	89	102
Specific Torque	Nm/bar	0,32	0,43	0,54	0,81	1,21	1,41	1,61
Continuous Speed	n/min.	1800	1800	1800	1700	1700	1700	1700
Max. Intermitt. Speed	n/min.	2200	2200	2200	2000	2000	2000	2000
Max. Peak Speed	n/min.	2500	2500	2500	2200	2200	2200	2200
Minimum Speed	n/min.	40	35	30	25	20	15	10
Continuous Pressure	bar	210	210	210	210	210	210	210
Intermittent Pressure	bar	250	250	250	250	250	250	250
Max.Pressure	bar	320	320	320	320	320	320	320
Max.Output cont.Power	kW	12	17	21	31	44	52	60
Weight	kg	19	19	19	25	25	25	25

- N° of pistons: 9
- Max. case pressure: 6 bar
- Max. back pressure: 70 bar
- Temperature range: -30°C + 70°C

G 20 TECHNICAL SPECIFICATIONS

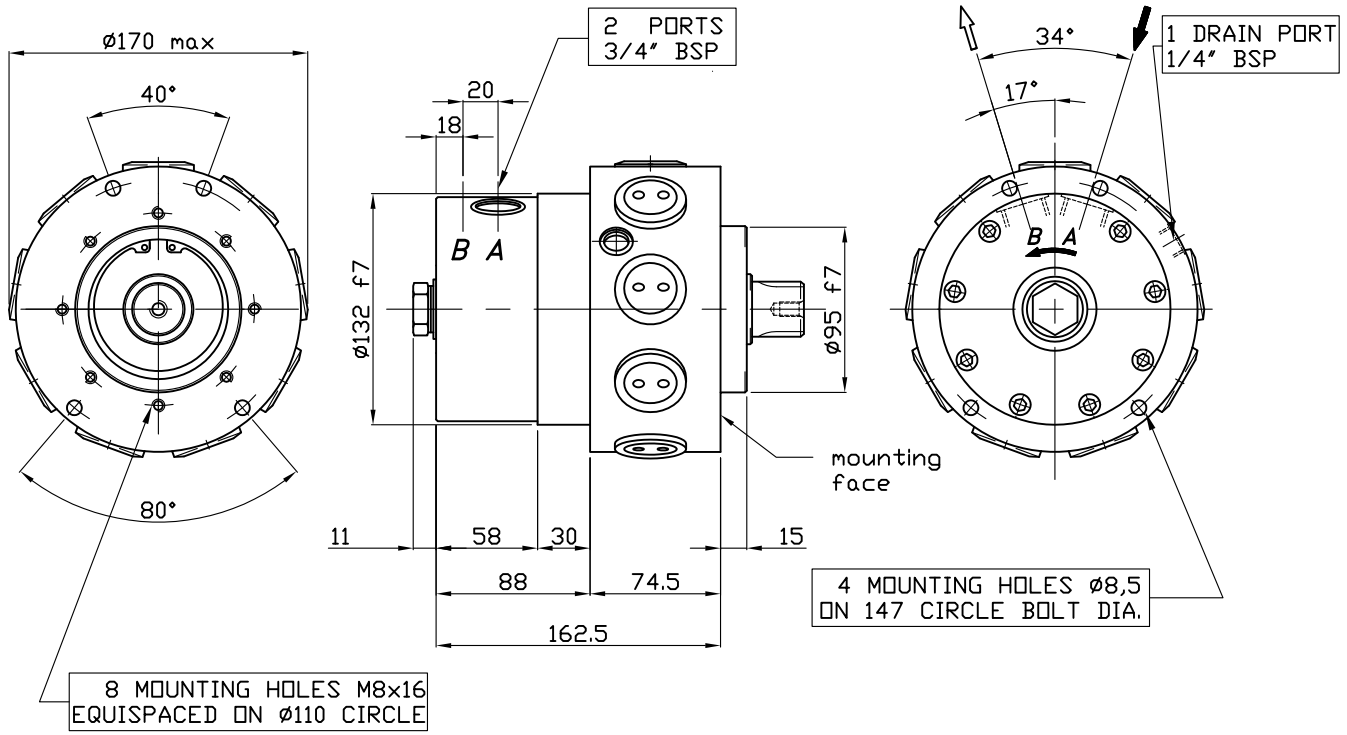
Displacement	cm^3/n	20,5
Theoretical specific torque	Nm/bar	0,32
Continuous pressure	bar	210
Intermittent pressure	bar	250
Peak Pressure	bar	320
Max. Continuous Speed	n/min	1800
Intermittent Speed	n/min.	2200
Peak Speed	n/min.	2500
Minimum Speed	n/min.	40
Max. Output Power	kW	12
Weight	kg	19

G 20 EFFICIENCY DIAGRAM

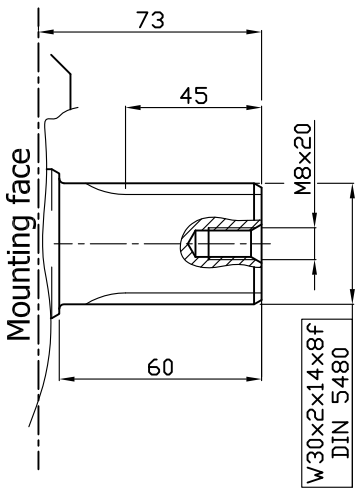
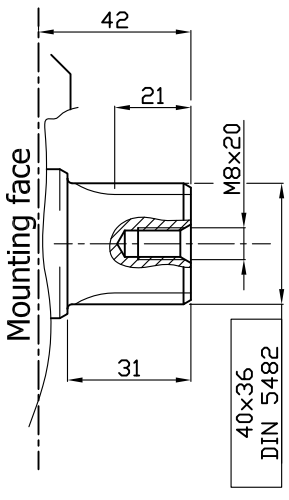
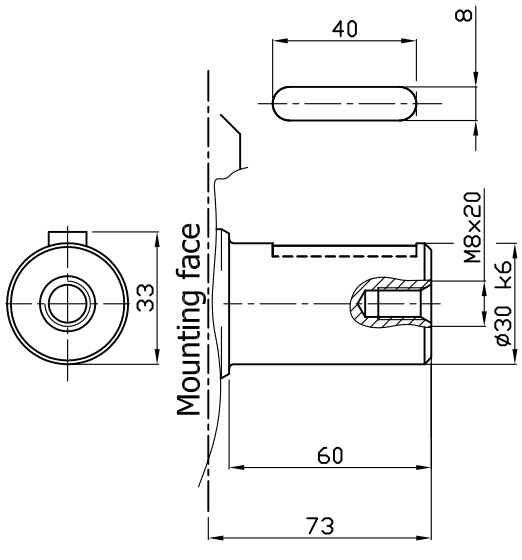


G 20 INSTALLATION DRAWING

STANDARD SERIES



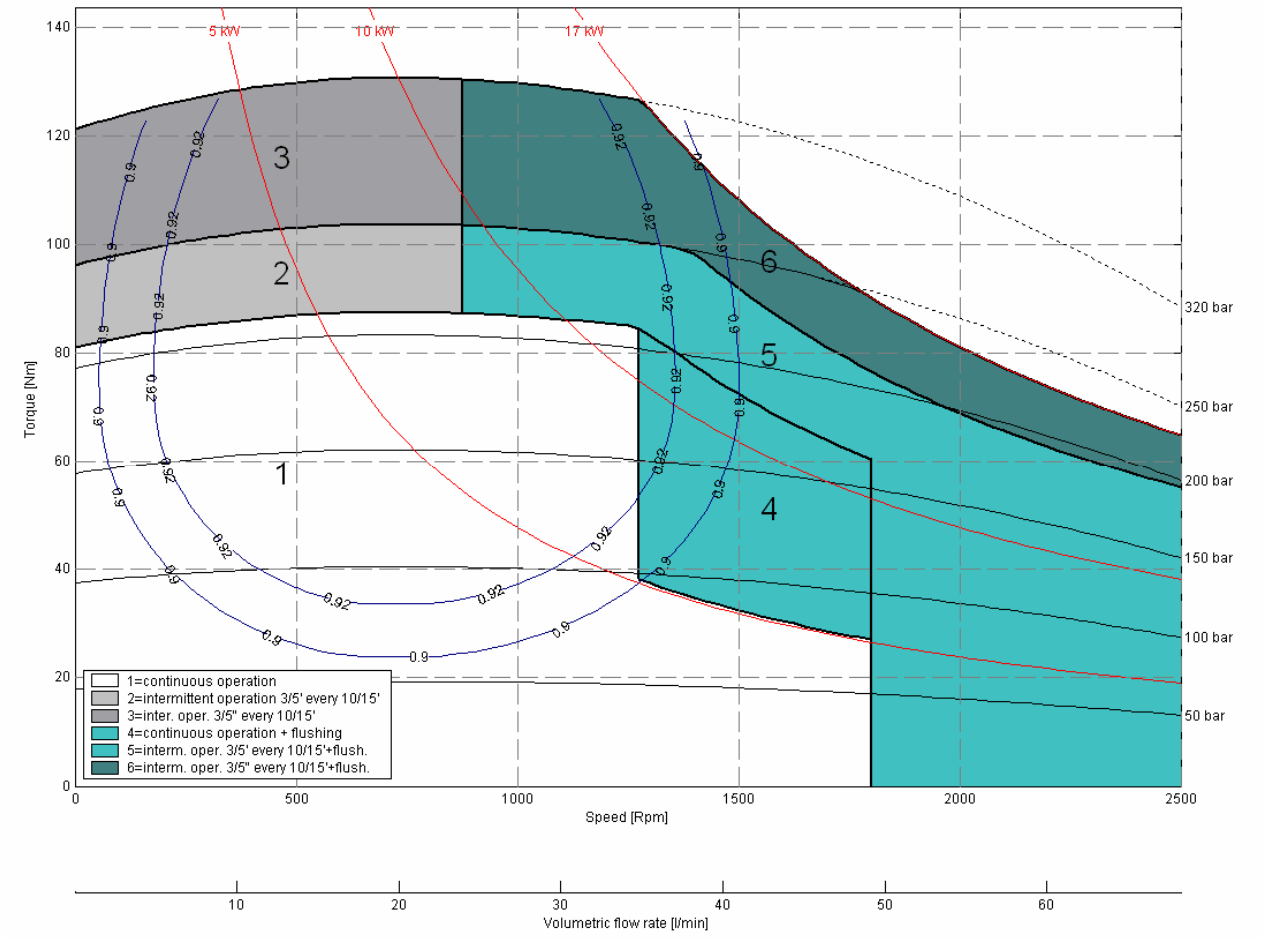
G 20 SHAFT OPTION

A0: Standard Splined Shaft	A1: Splined Shaft on request	A2: Parallel shaft on request
		

G 27 TECHNICAL SPECIFICATIONS

Displacement	cm^3/n	27,3
Theoretical specific torque	Nm/bar	0,43
Continuous pressure	bar	210
Intermittent pressure	bar	250
Peak Pressure	bar	320
Max. Continuous Speed	n/min	1800
Intermittent Speed	n/min.	2200
Peak Speed	n/min.	2500
Minimum Speed	n/min.	35
Max. Output Power	kW	17
Weight	kg	19

G 27 EFFICIENCY DIAGRAM



G 27 INSTALLATION DRAWING

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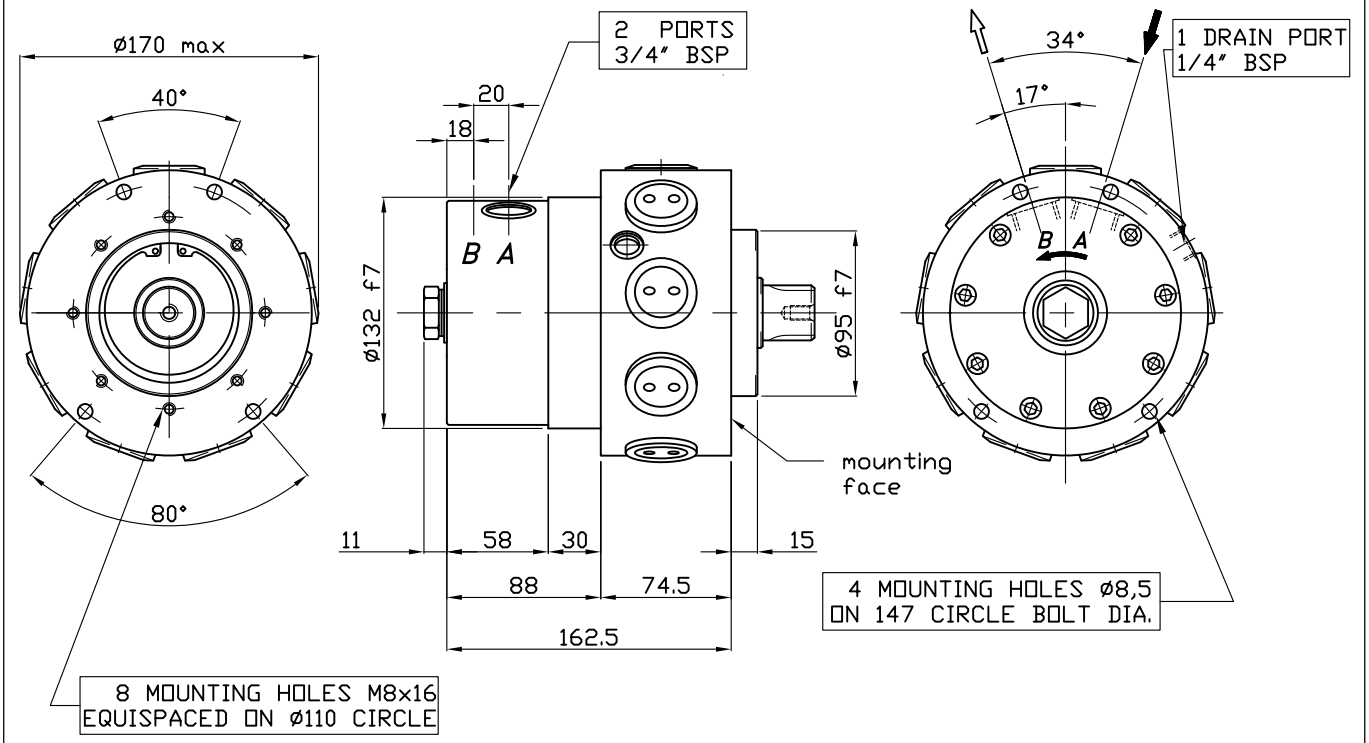
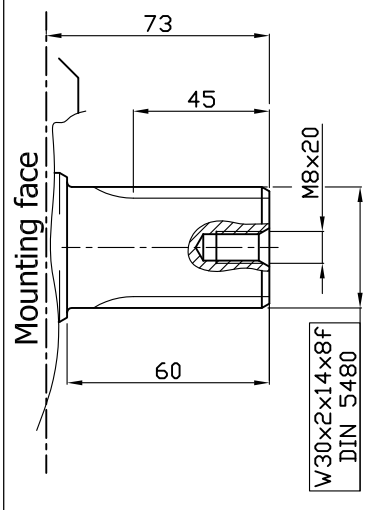
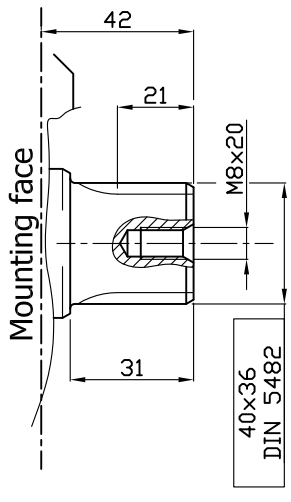
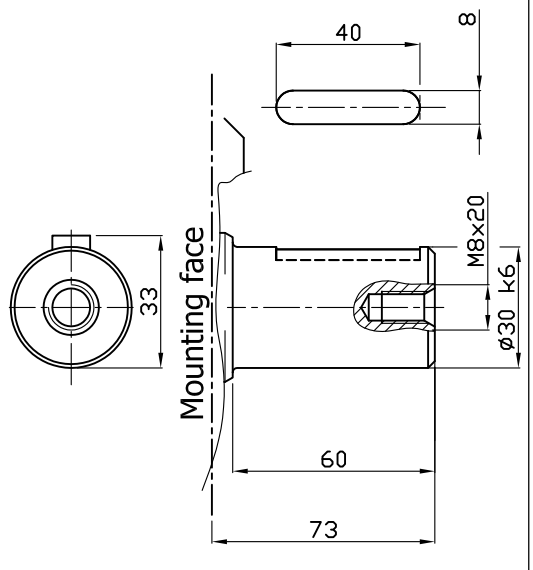


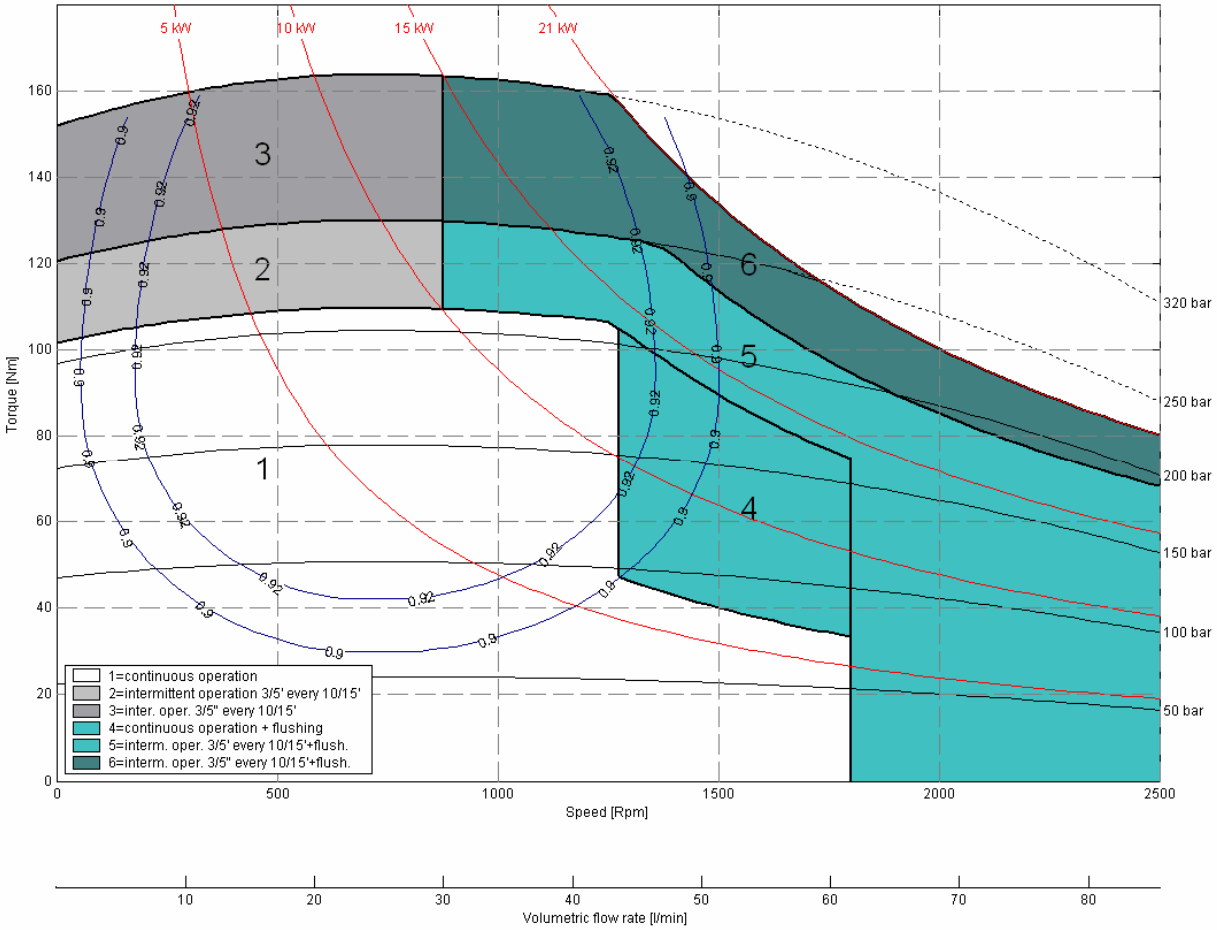
G 27 SHAFT OPTION

A0: Standard Splined Shaft	A1: Splined Shaft on request	A2: Parallel shaft on request
		

G 34 TECHNICAL SPECIFICATIONS

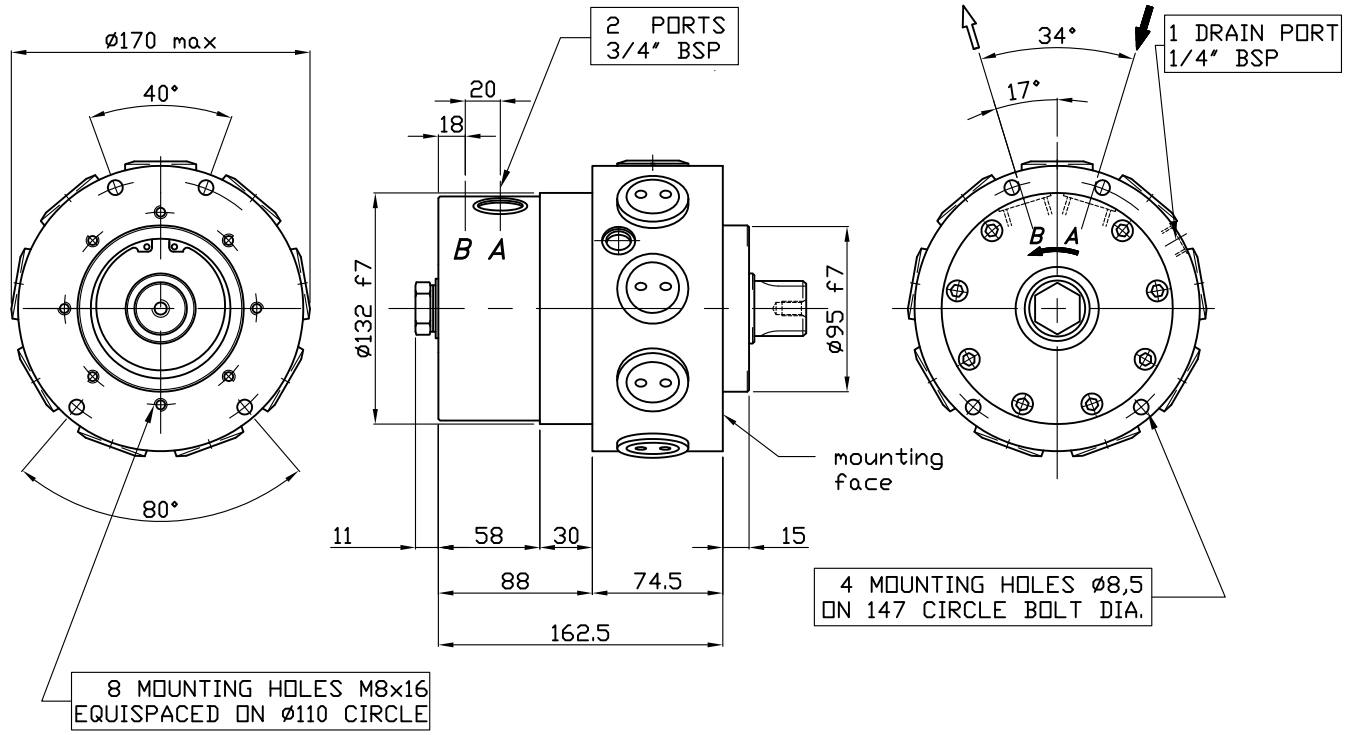
Displacement	cm^3/n	34,2
Theoretical specific torque	Nm/bar	0,54
Continuous pressure	bar	210
Intermittent pressure	bar	250
Peak Pressure	bar	320
Max. Continuous Speed	n/min	1800
Intermittent Speed	n/min.	2200
Peak Speed	n/min.	2500
Minimum Speed	n/min.	30
Max. Output Power	kW	21
Weight	kg	19

G 34 EFFICIENCY DIAGRAM

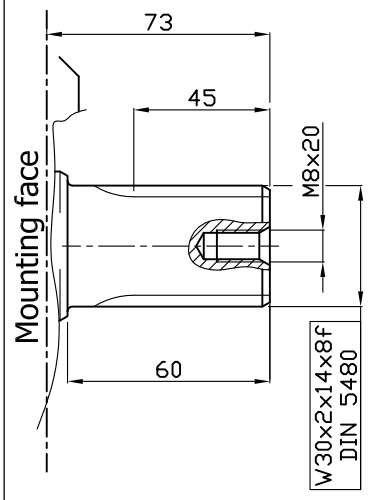
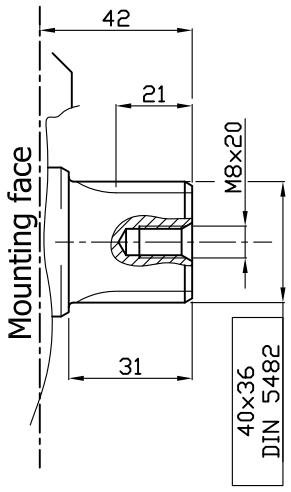
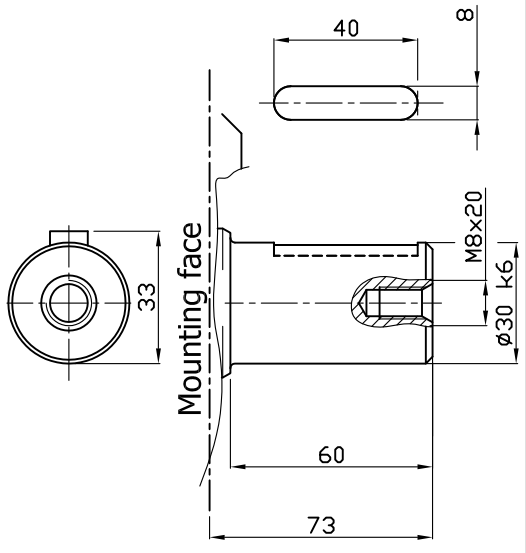


G 34 NSTALLATION DRAWING

STANDARD SERIES



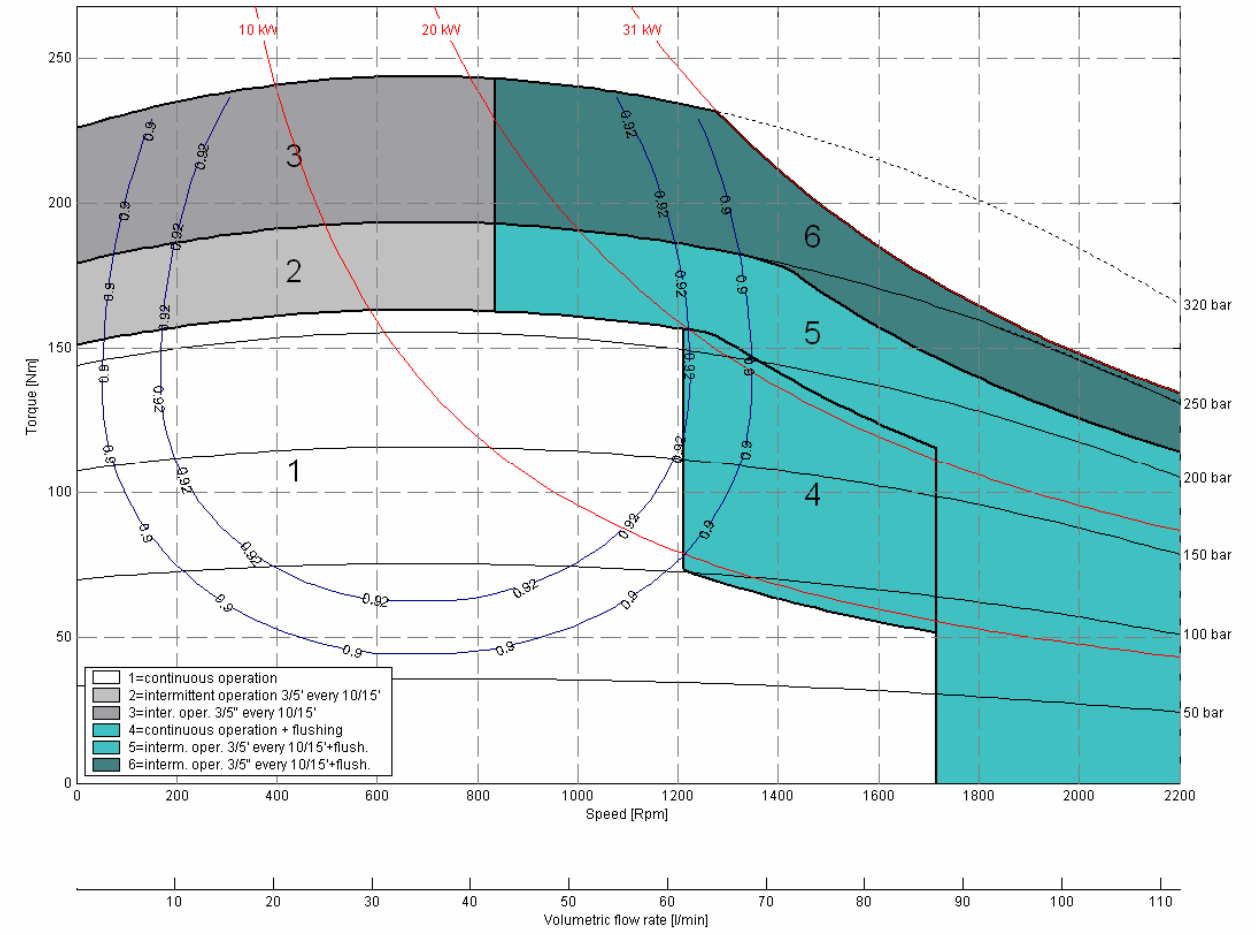
G 34 SHAFT OPTION

A0: Standard Splined Shaft	A1: Splined Shaft on request	A2: Parallel shaft on request
		

G 50 TECHNICAL SPECIFICATIONS

Displacement	cm^3/n	50,9
Theoretical specific torque	Nm/bar	0,81
Continuous pressure	bar	210
Intermittent pressure	bar	250
Peak Pressure	bar	320
Max. Continuous Speed	n/min	1700
Intermittent Speed	n/min.	2000
Peak Speed	n/min.	2200
Minimum Speed	n/min.	25
Max. Output Power	kW	31
Weight	kg	25

G 50 EFFICIENCY DIAGRAM



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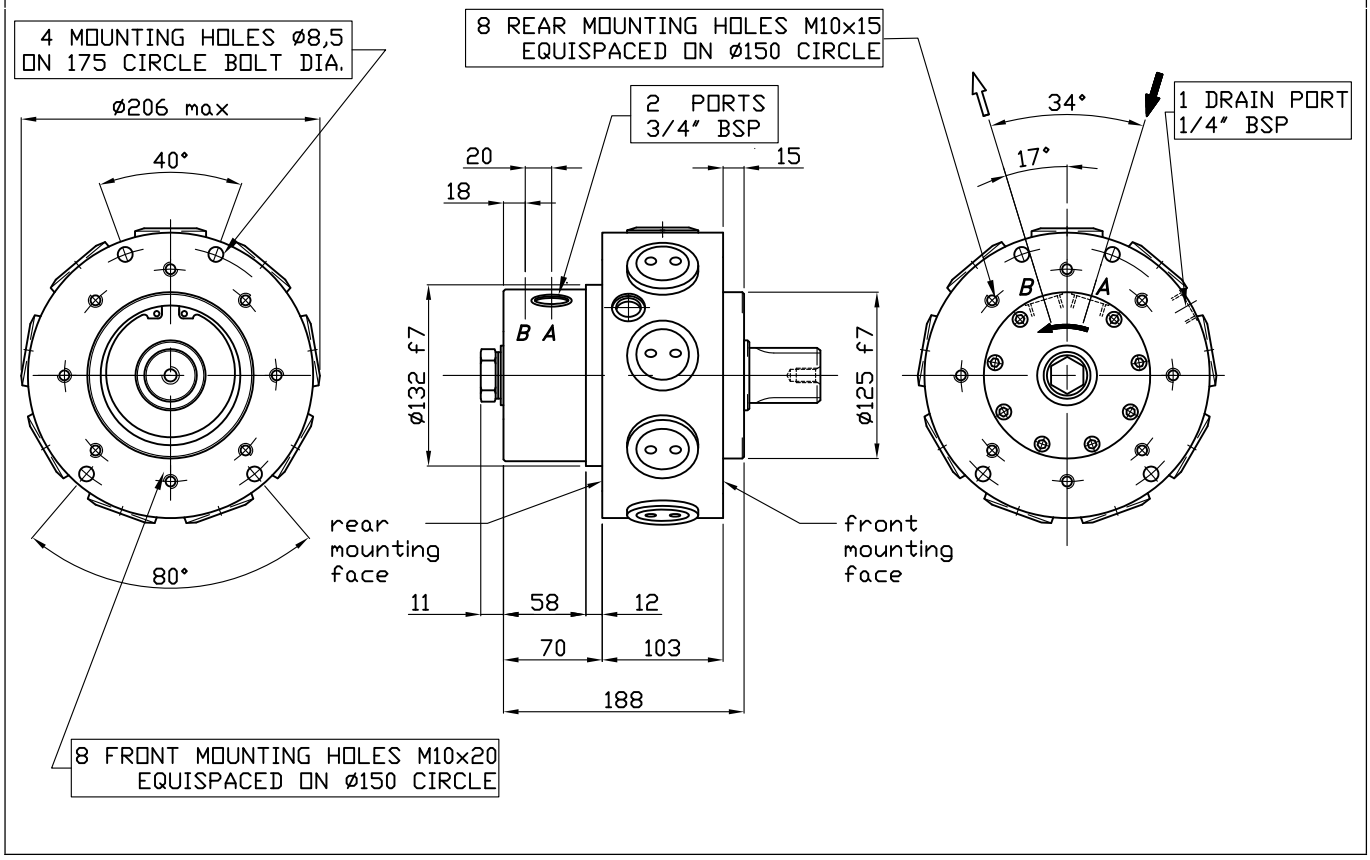

G 50 SHAFT OPTION

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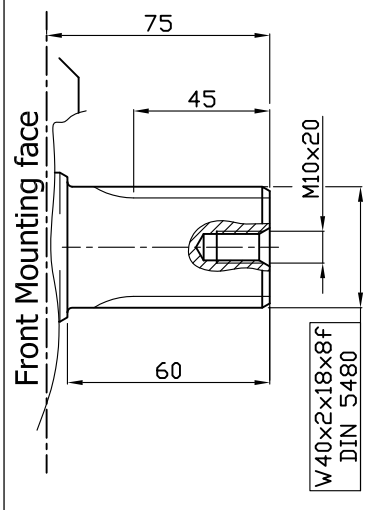
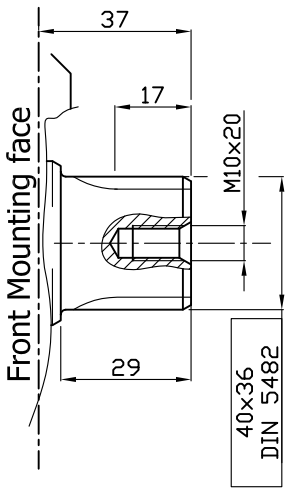
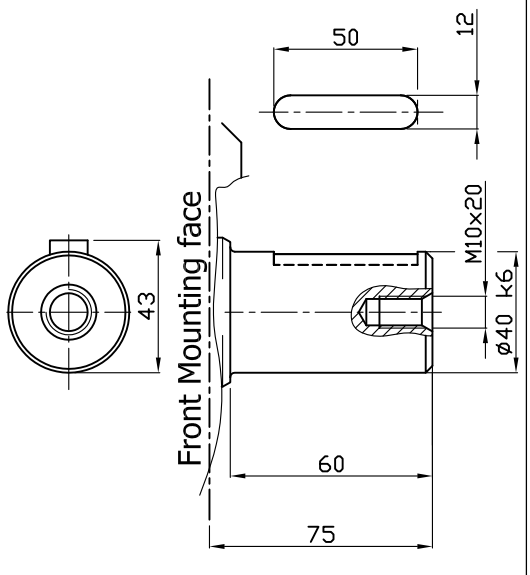
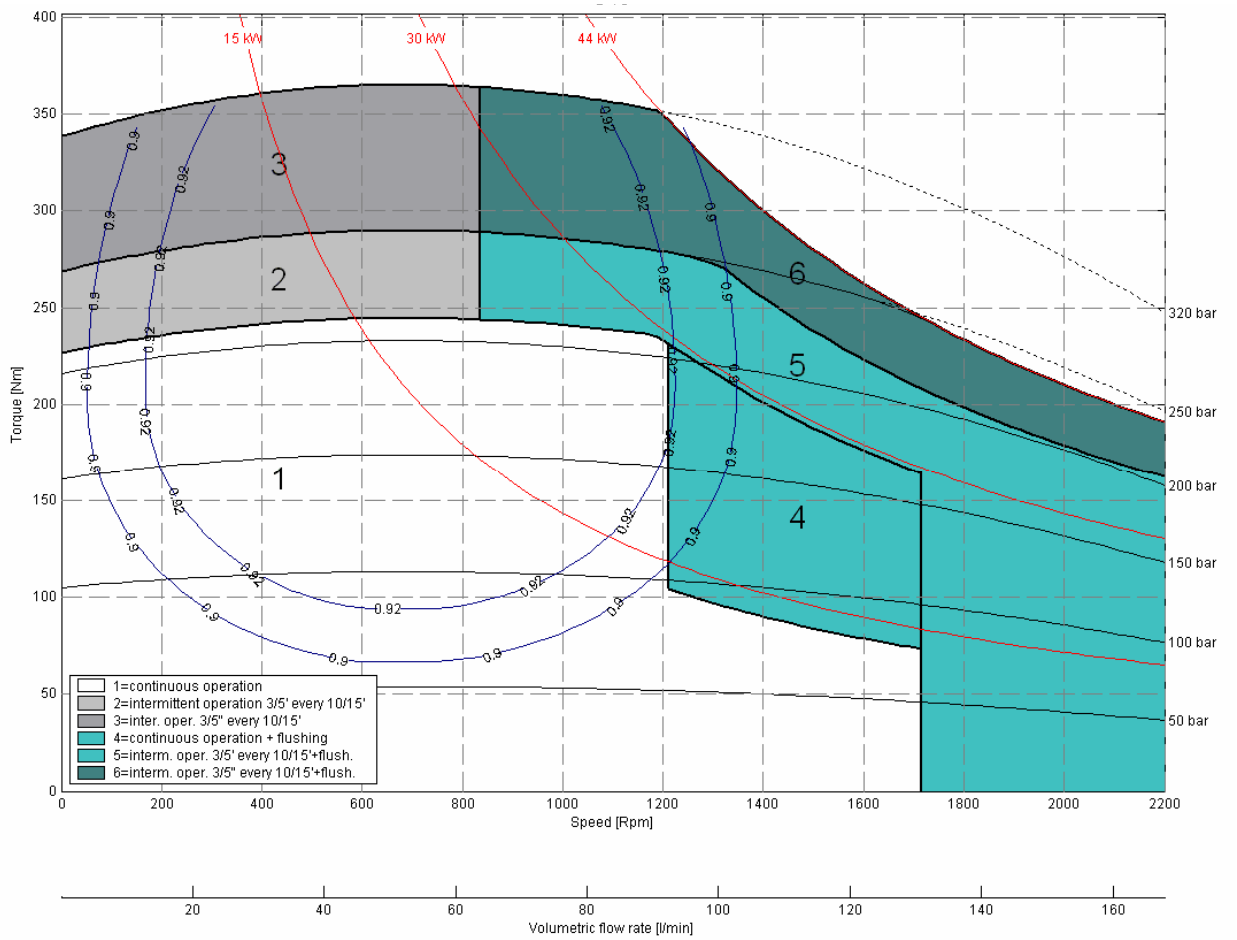
		

G 75 TECHNICAL SPECIFICATIONS

Displacement	cm^3/n	76,3
Theoretical specific torque	Nm/bar	1,21
Continuous pressure	bar	210
Intermittent pressure	bar	250
Peak Pressure	bar	320
Max. Continuous Speed	n/min	1700
Intermittent Speed	n/min.	2000
Peak Speed	n/min.	2200
Minimum Speed	n/min.	20
Max. Output Power	kW	44
Weight	kg	25

G 75 EFFICIENCY DIAGRAM



G 75 INSTALLATION DRAWING

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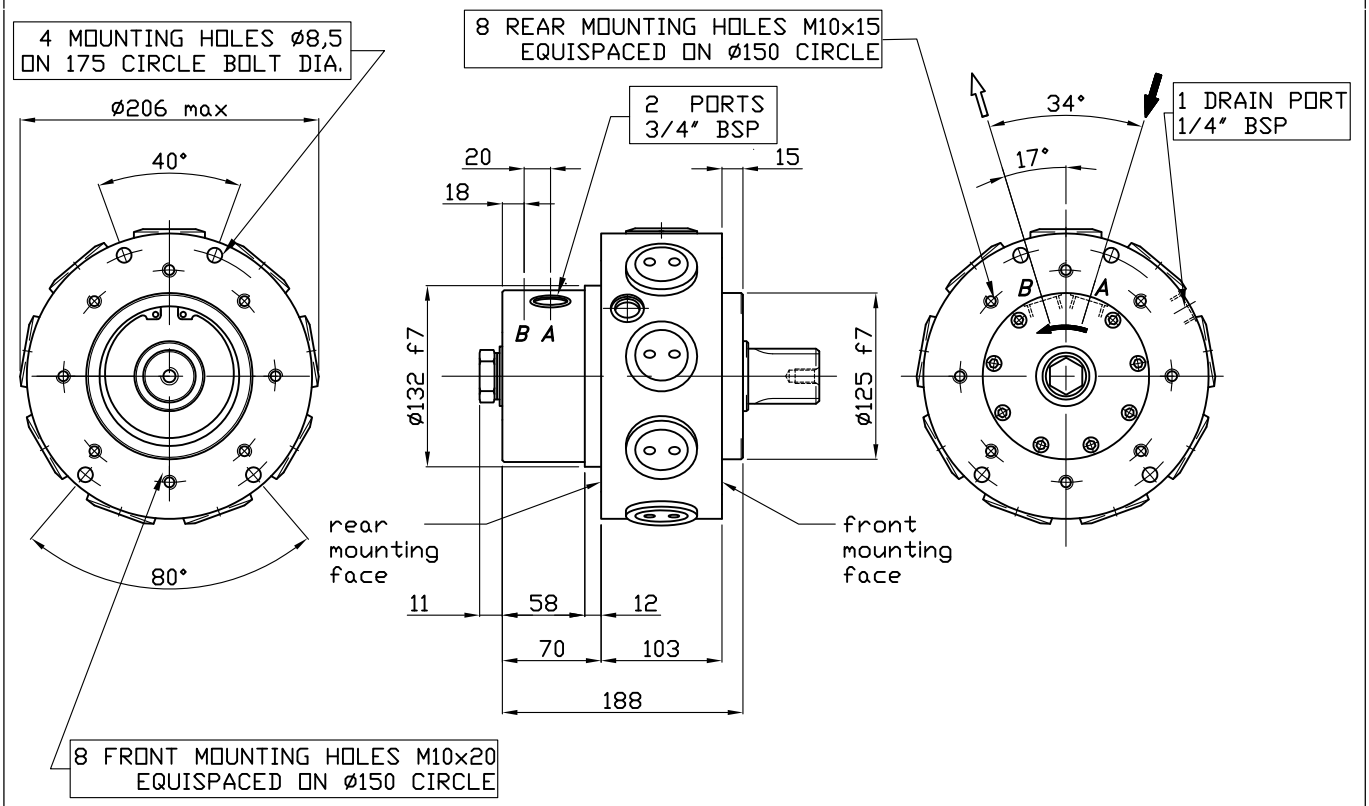
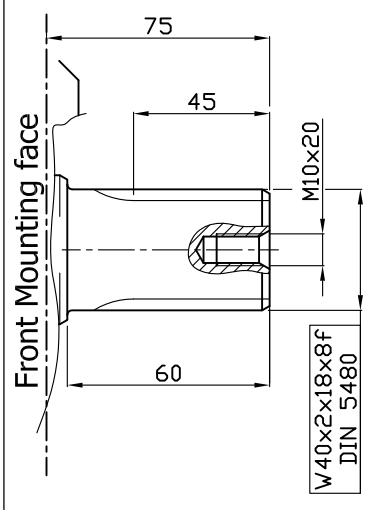
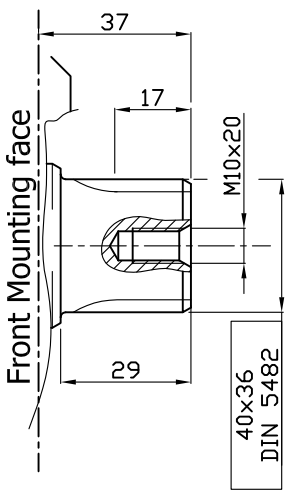
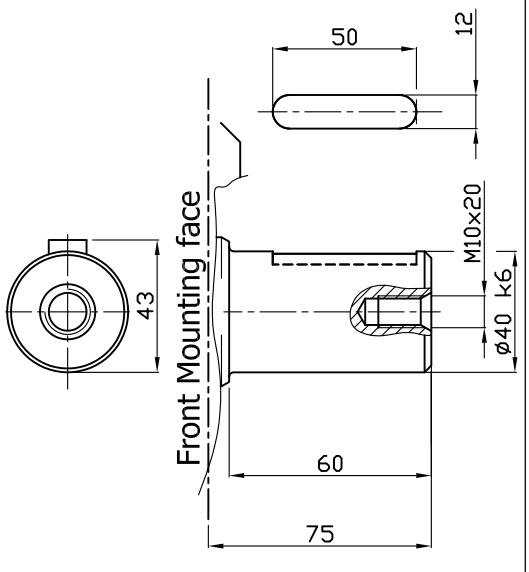


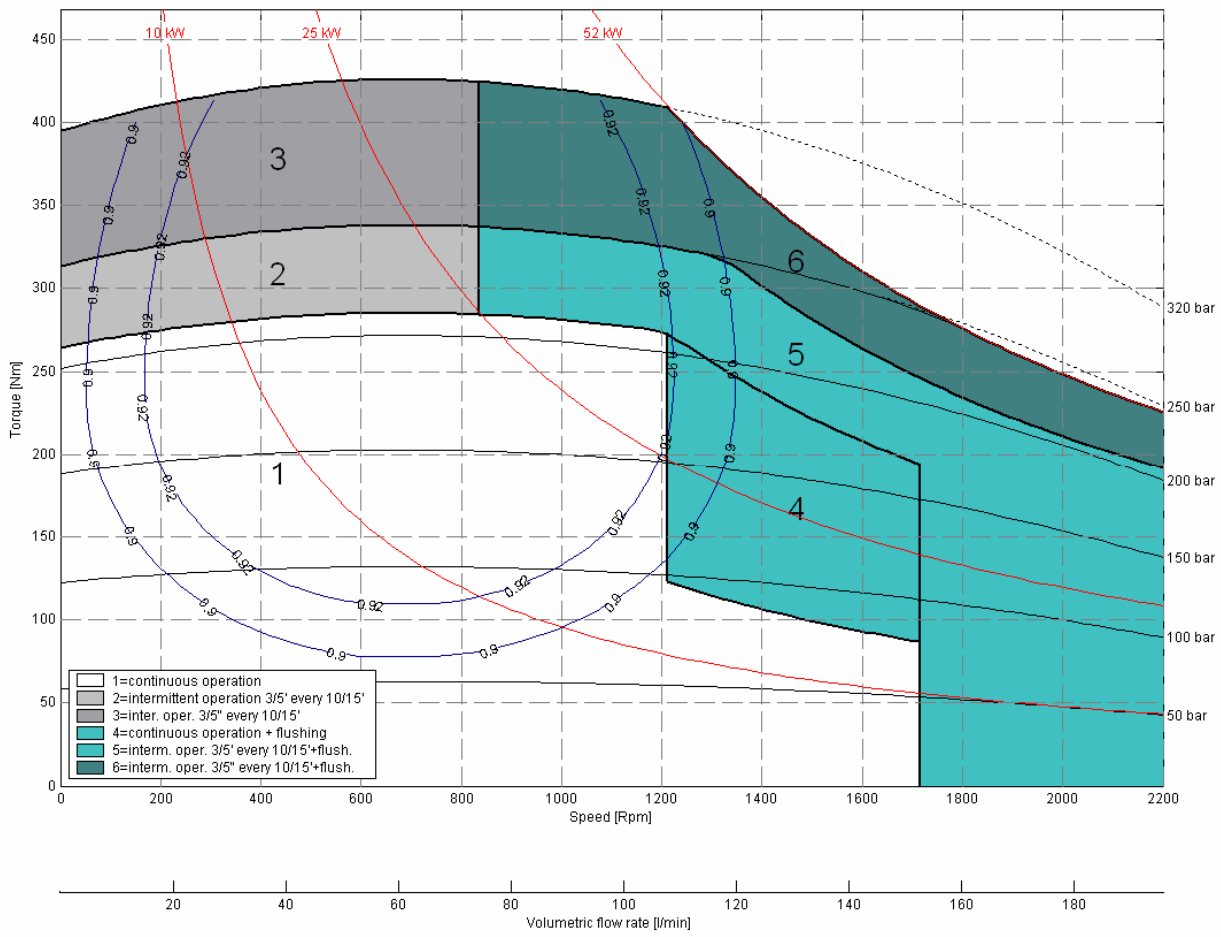
G 75 SHAFT OPTION

A0: Standard Splined Shaft	A1: Splined Shaft on request	A2: Parallel shaft on request
		

G 90 TECHNICAL SPECIFICATIONS

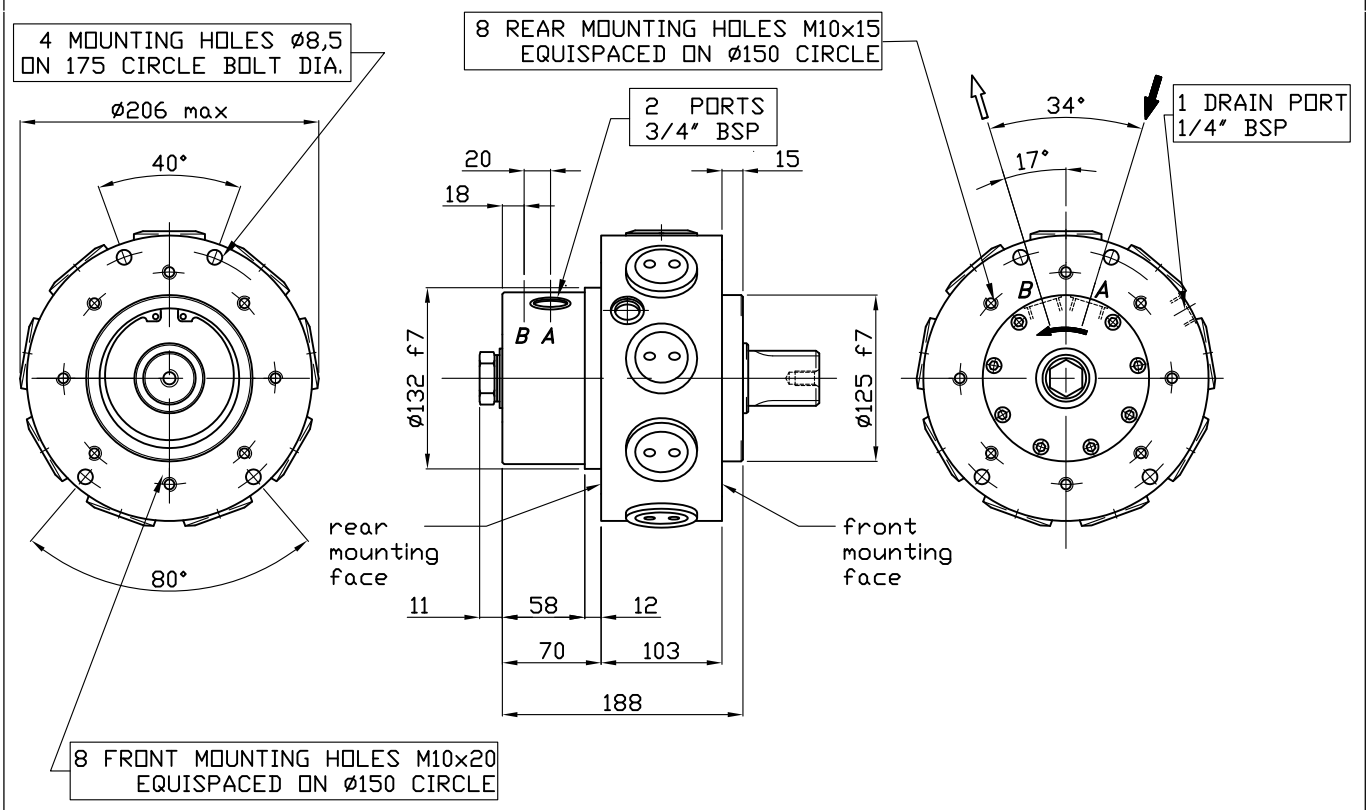
Displacement	cm^3/n	89
Theoretical specific torque	Nm/bar	1,41
Continuous pressure	bar	210
Intermittent pressure	bar	250
Peak Pressure	bar	320
Max. Continuous Speed	n/min	1700
Intermittent Speed	n/min.	2000
Peak Speed	n/min.	2200
Minimum Speed	n/min.	15
Max. Output Power	kW	52
Weight	kg	25

G 90 EFFICIENCY DIAGRAM

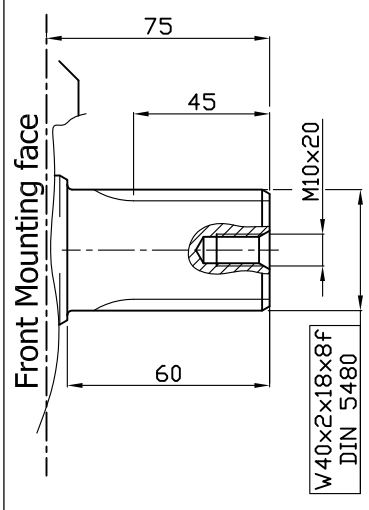
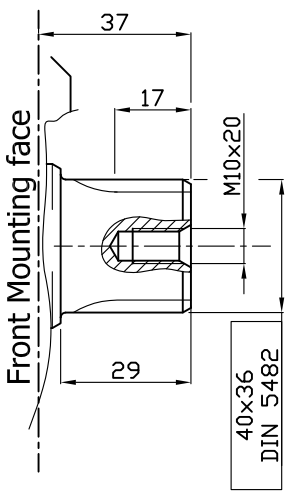
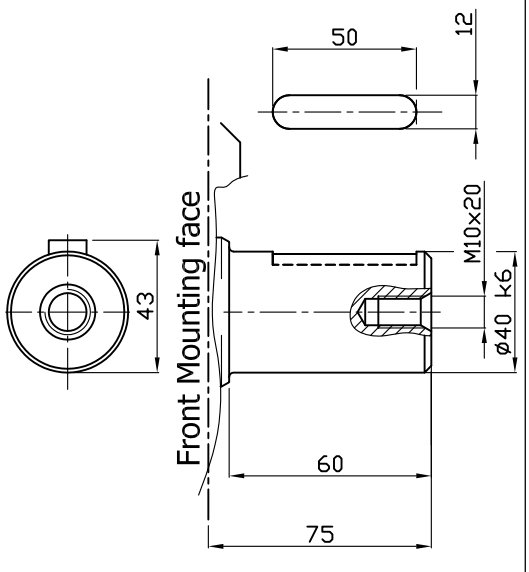


G 90 INSTALLATION DRAWING

STANDARD SERIES



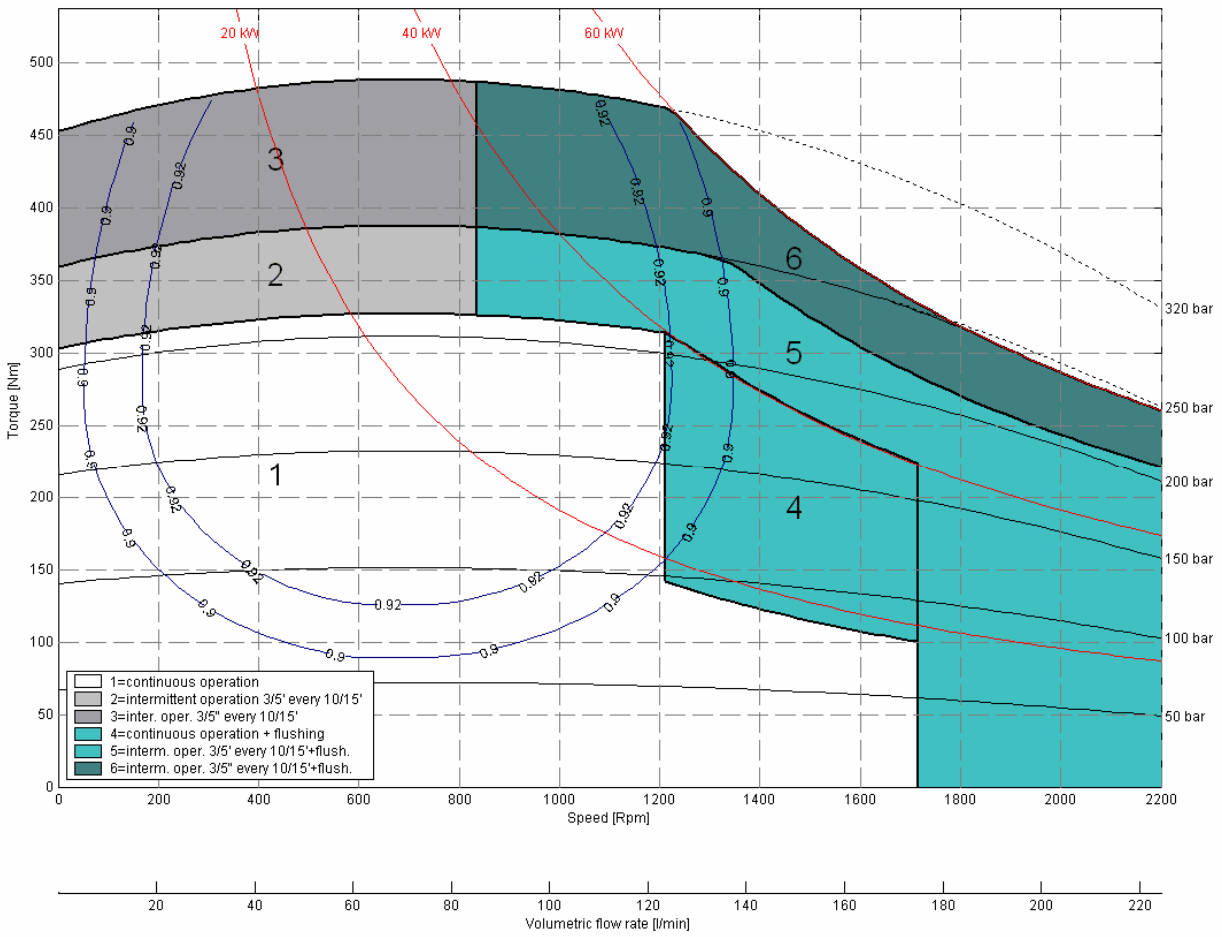
G 90 SHAFT OPTION

A0: Standard Splined Shaft	A1: Splined Shaft on request	A2: Parallel shaft on request
		

G 100 TECHNICAL SPECIFICATIONS

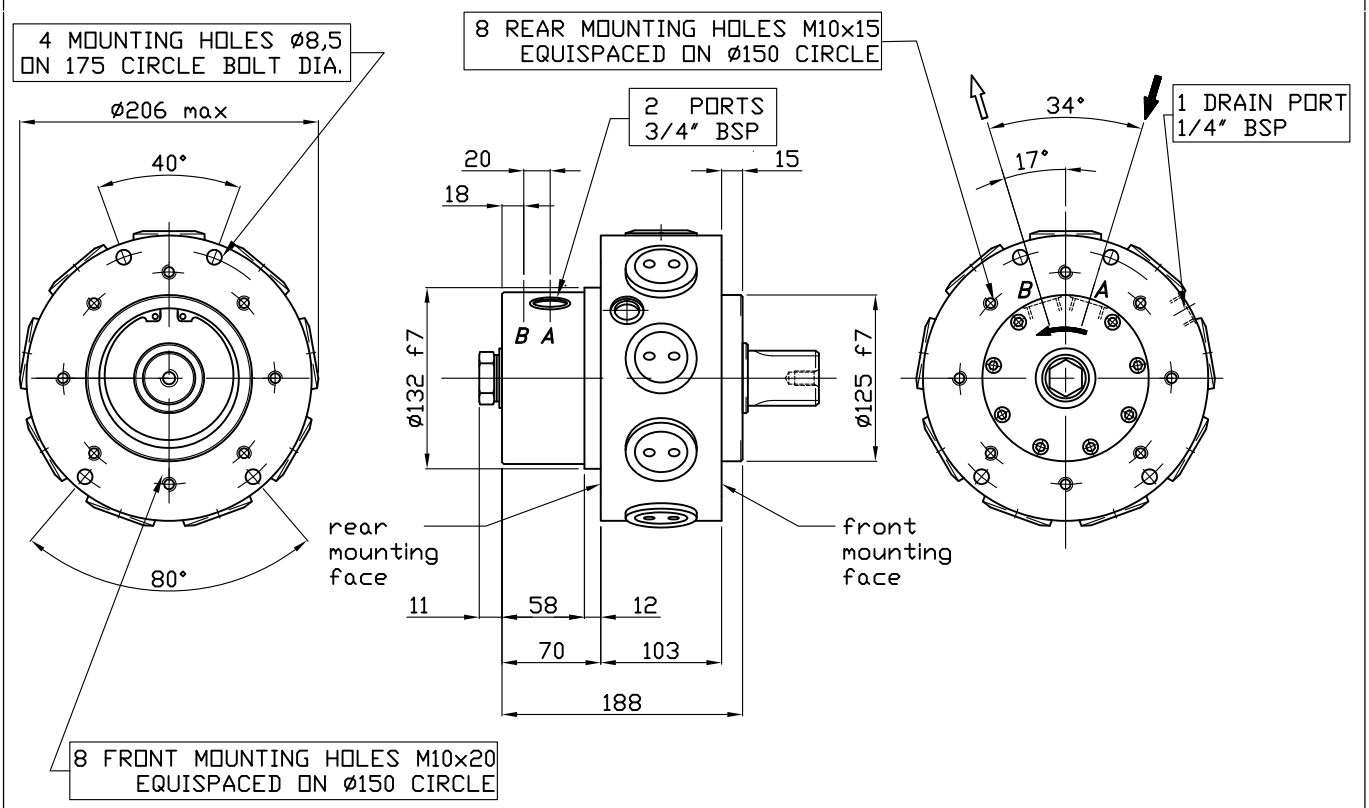
Displacement	cm^3/n	102
Theoretical specific torque	Nm/bar	1,61
Continuous pressure	bar	210
Intermittent pressure	bar	250
Peak Pressure	bar	320
Max. Continuous Speed	n/min	1700
Intermittent Speed	n/min.	2000
Peak Speed	n/min.	2200
Minimum Speed	n/min.	10
Max. Output Power	kW	60
Weight	kg	25

G 100 EFFICIENCY DIAGRAM



G 100 INSTALLATION DRAWING

STANDARD SERIES



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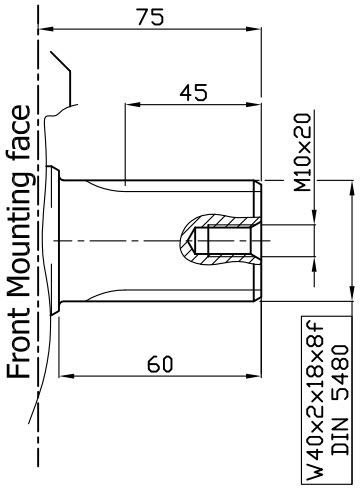
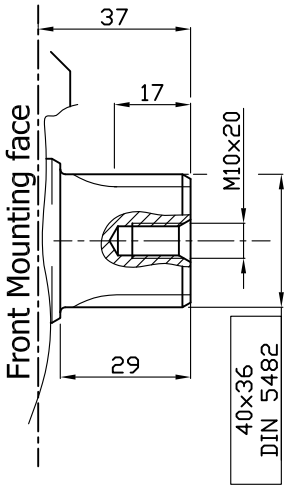
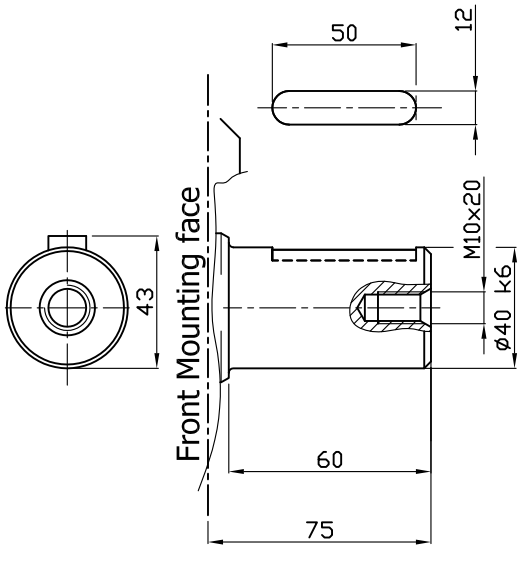
		

Dual Displacement GD Series - Technical Data

DISPLACEMENT CHANGE DURING THE MOTOR FUNCTIONING

The user can choose beetween two displacements, acting on the hydraulic circuit. When the X port is at high pressure (system pressure) and the Y port is at low pressure (drain pressure), the motor functions at the maximum displacement, otherwise, when the Y port is at high pressure (system pressure) and the X port is at low pressure (drain pressure), the motor functions at the minimum displacement. When the X and Y ports are at low pressure the motor automatically switch in the maximum displacement.

DISPLACEMENTS SELECTION

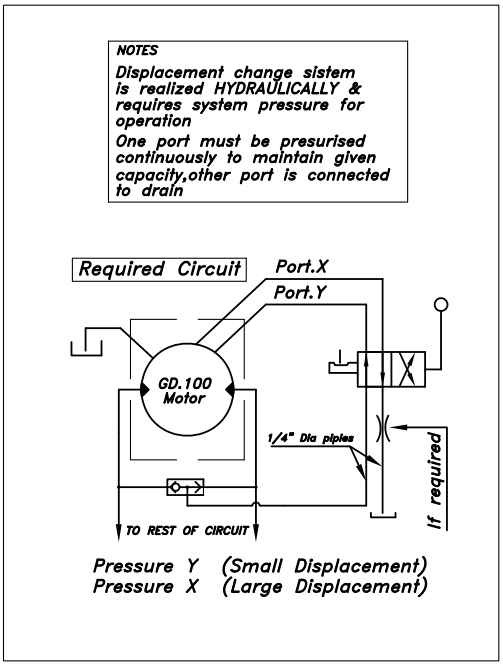
Not all max and minimum displacements are possible, the displacements have a range, for the maximum displacement the customer can choose beetween 100 and 38 cc/Rev; for the minimum displacement the user can choose beetween 89 and 31 cc/Rev. In the following table are showed the technical data for some of the possible displacements.

		MAX DISPLACEMENT					
Max Displacement	cc/Rev	100	89	76.3	63.6	50.3	38
Specific torque	Nm/bar	1.61	1.41	1.21	1.01	0.81	0.60
MAX.SPEED	Rpm	1700					1800
CONT.PRESSURE	Bar	210					
MAX. POWER	Kw	60	52	44	39	31	23
	HP	82	71	59	53	42	32

		MIN DISPLACEMENT					
Min Displacement	cc/Rev	89	76,3	63.6	50.3	38	31
Specific torque	Nm/bar	1.41	1.21	1.01	0.81	0.60	0.49
MAX.SPEED	Rpm	1700				1800	
CONT.PRESSURE	Bar	210					
MAX. POWER	Kw	52	44	39	31	23	19
	HP	71	59	53	42	32	25

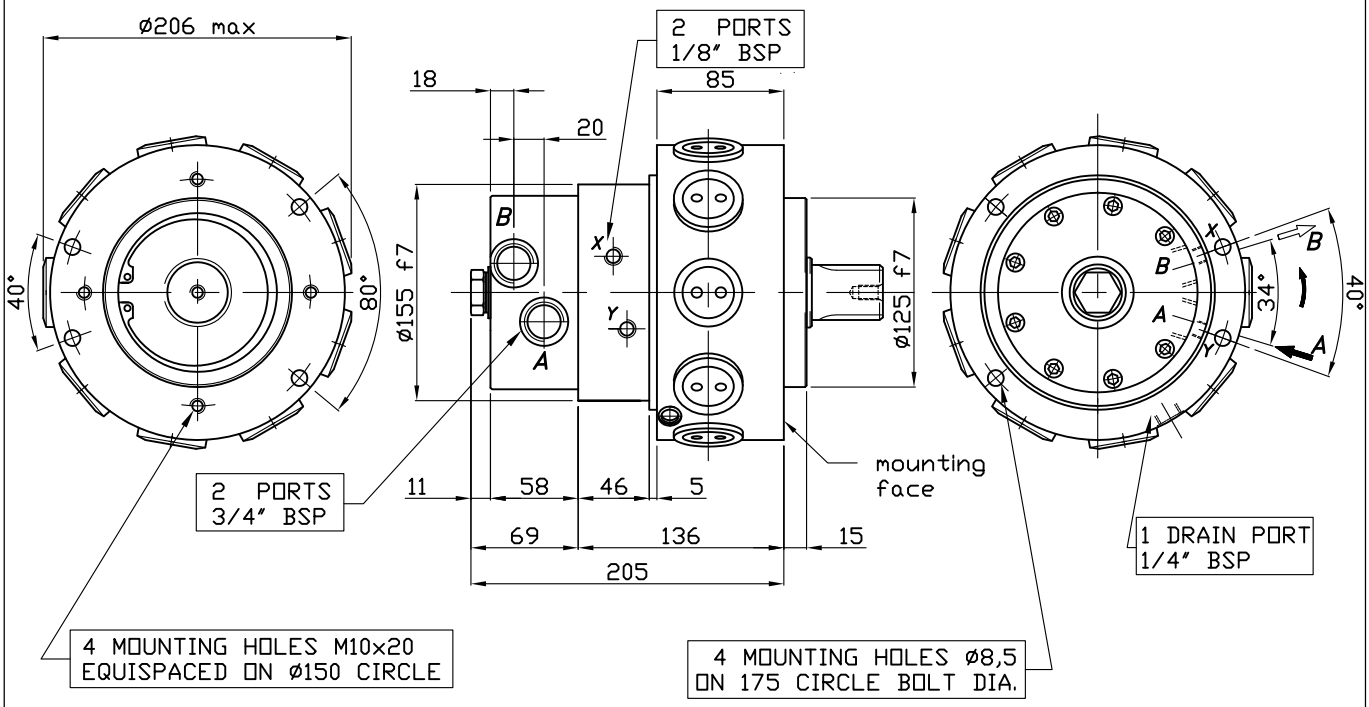
CONT.PRESSURE	210 Bar
INT.PRESSURE	250 Bar
PEAK.PRESSURE	320 Bar
MAX.DRAIN.PRESSURE	6.0 Bar
DRY WEIGHT	30 Kg
TEMP.INTERVAL	−30 +70°C

- N° of pistons: 9
- Max case pressure: 6 bar
- Max back pressure: 70 bar
- Temperature range: -30°C ÷ +70°C



GD 100 INSTALLATION DRAWING

STANDARD SERIES



GD 100 SHAFT OPTION

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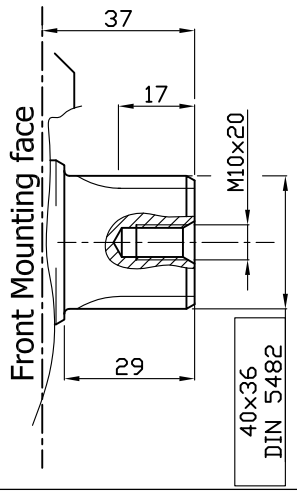
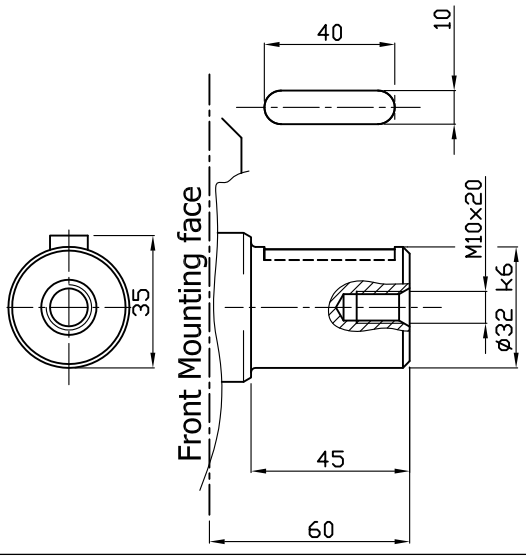
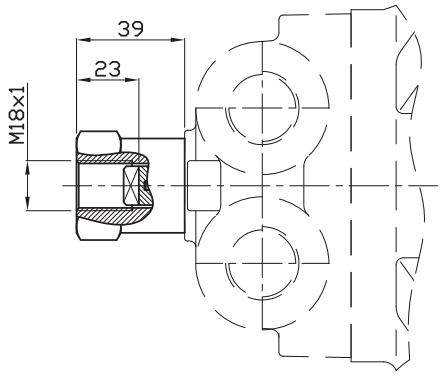
	

Optionals

Tachometer

TA



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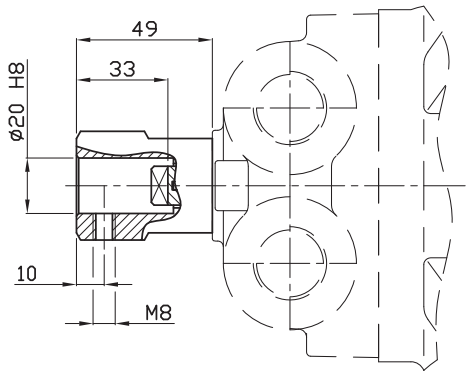

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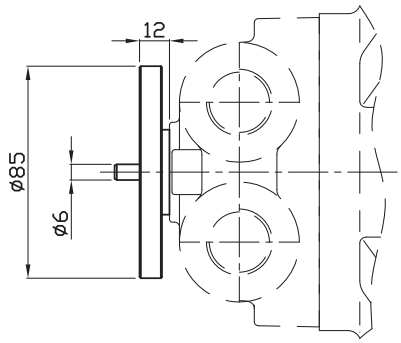
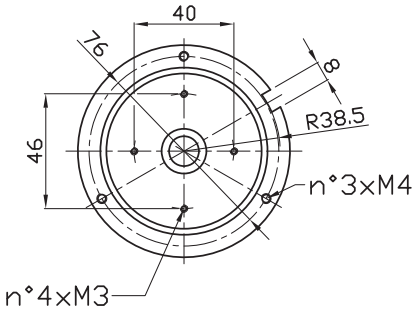
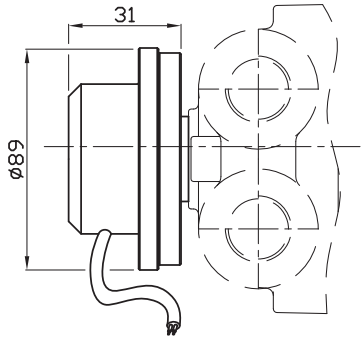




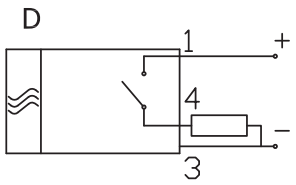
EST.30



Operating parameters	E-...../3
Power supply (VDC)	10-30
Switching current (mA)	150
Frequency (Hz) 100rpm	50
Impulse/rpm	30
Operating temp. (°C)	-24/+70
Protection degree	IP67
Output	NPN
Motor type	All types

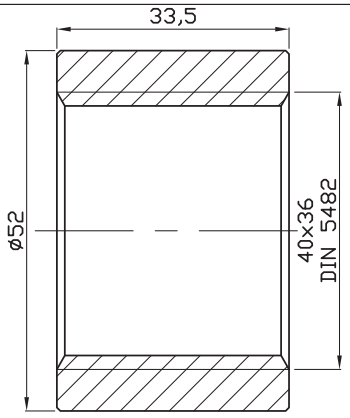
MODEL	Ø5
Torque	1 Nm

Model	Output	Fig.
E-..../.AP/....	PNP	D



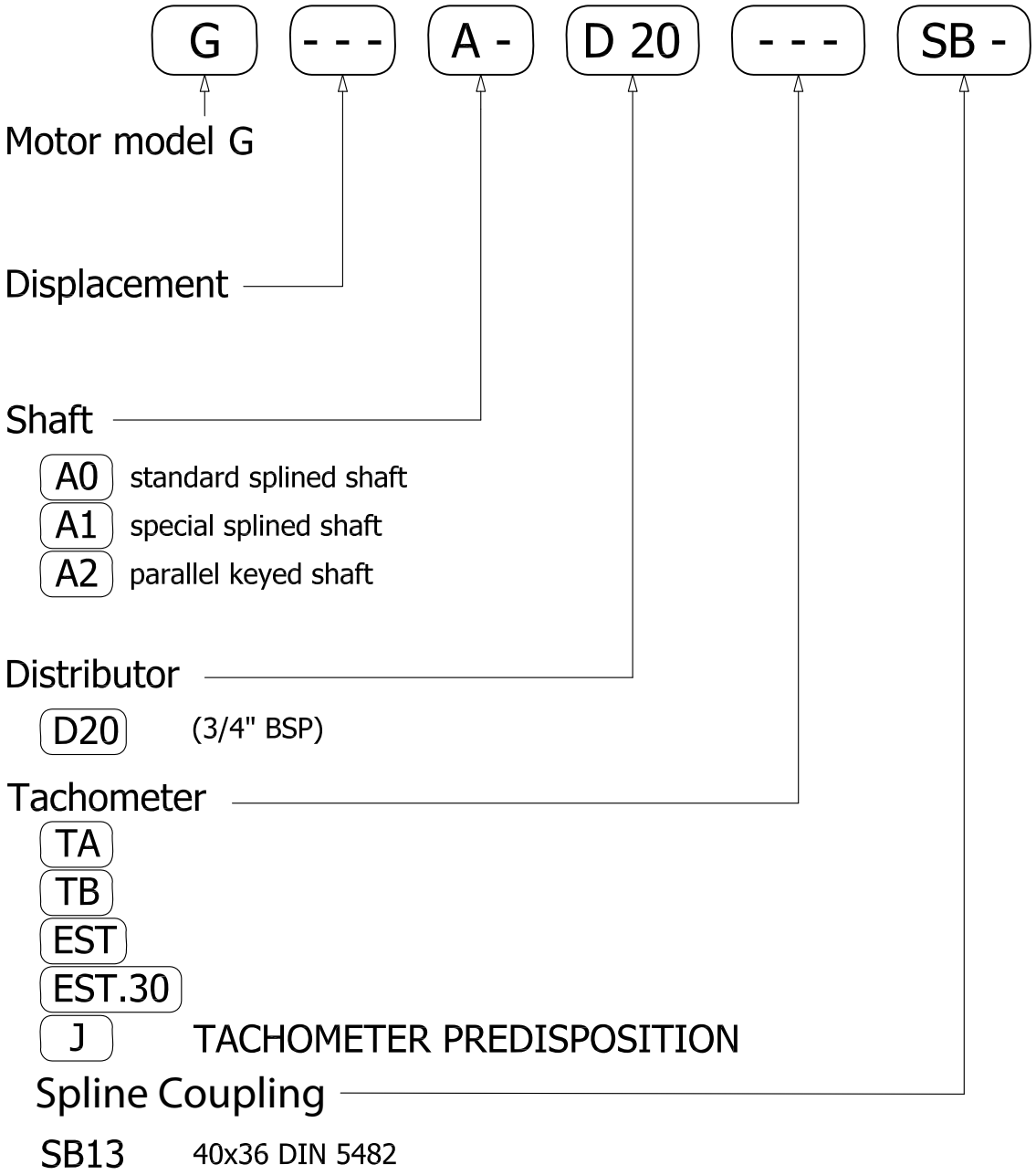
Shaft Coupling

SB13



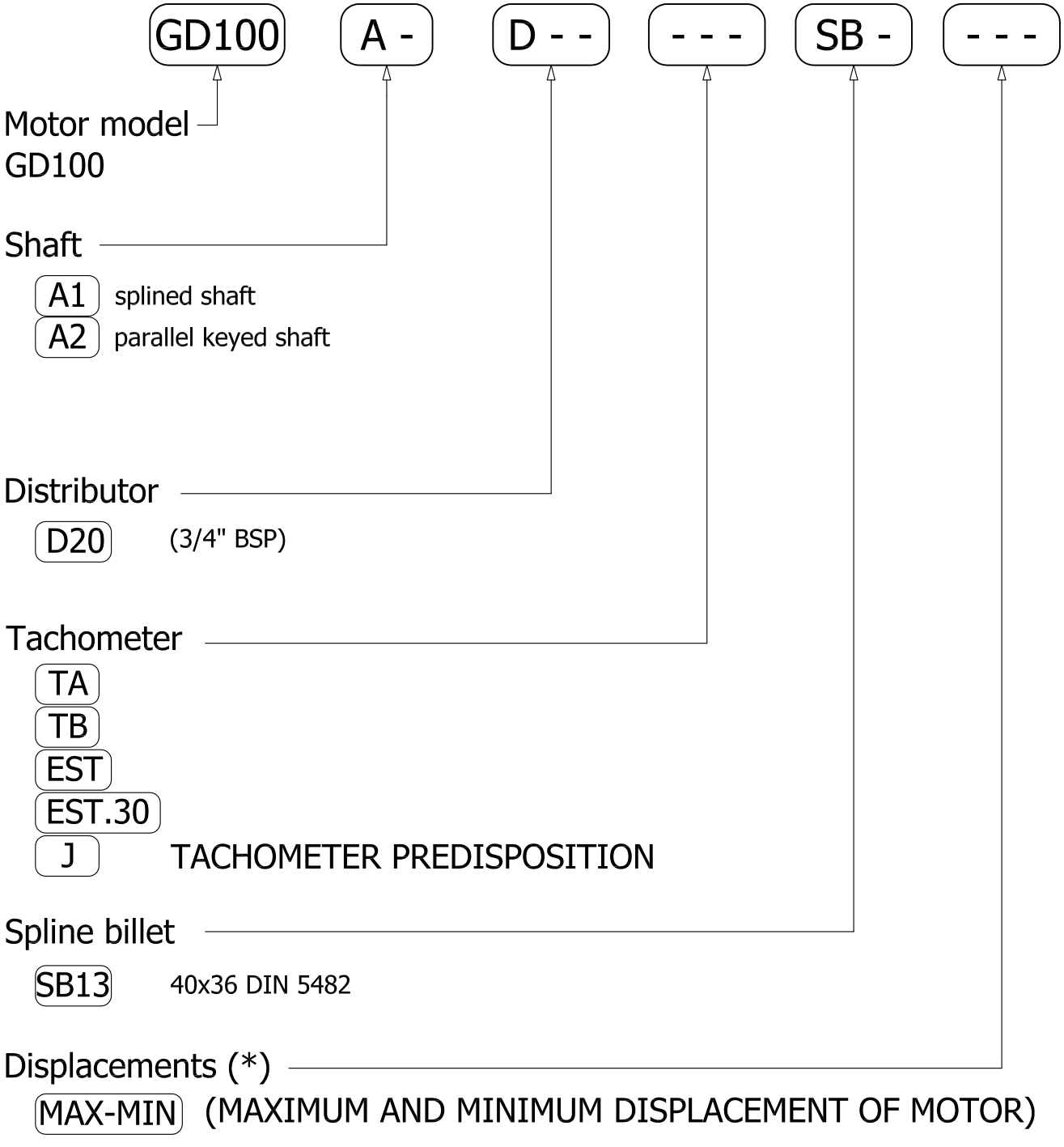
only for:
G20-27-34-50-75-90-100 A1

Single Displacement G Series - Order Code



EXAMPLE: G.34.A1.D20.SB13
G.100.A0.D20.TA

Dual Displacement GD Series - Order Code



(*) see page 3 for available maximum and minimum displacements

EXAMPLE:
GD100.A1.D20.100-38
GD100.A2.D20.TA.75-31
GD100.A1.D20.J.60-38

Hydraulic Fluids Recommendations

HYDRAULIC FLUIDS

We recommend the use of hydraulic oils with anti-wear additives (ISO HM or HV) and minimum viscosity index of 95.
Once normal working temperature is reached, oil viscosity must be at least 12 cSt, preferably in the range from 20 to 60 cSt.
Hydraulic oils meeting Denison MF-O, Vickers M-2952-S I - 286-S performance requirements and DIN 51524 specifications, are preferred.

Mineral hydraulic oils are divided into four main types, designated by the International Standards Organisation (ISO) as HH, HL, HM and HV. We advise to use only products with HM or HV specifications.

HM type

These are the most widely employed hydraulic oils. They include small quantities of anti-wear additives to provide significant improvement in wear reduction. "Superior" quality HM type oils can be used for all equipment, with the added assurance that they will be suitable for the highest temperature.

HV type

HV hydraulic oils show minimal change in viscosity with temperature variations.

OIL VISCOSITY RECOMMENDATION

Room temperature HM type ISO-VG

- -20°C / 0°C BP ENERGOL HLP - HM 22
- -15°C /+5°C BP ENERGOL HLP - HM 32
- -8°C /+15°C BP BNERGOL HLP - HM 46
- 0°C /+22°C BP ENERGOL HLP - HM 68
- +8°C /+30°C BP ENERGOL HLP - HM100
- -20°C /+5°C BP BARTRAN HV 32
- -15°C /+22°C BP BARTRAN HV 46
- 0°C /+30°C BP BARTRAN HV 68

Our motors have been designed to work also with:

- oils type ATF (Automatic Transmission Fluid)
- oils with viscosity SAE 10W - 20 -30
- multigrade motor oils SAE 10 W/40 or 15 W/40
- universal oils

During cold start-up, avoid high-speed operation until the system is warmed up to provide adequate lubrication.
Continuous working temperature must not exceed 70°C.

FIRE RESISTANT OIL LIMITATIONS

	Max cont. pressure	Max int. pressure	Max speed
HFA, 5-95% oil-water	103	138	50%
HFB, 60-40% oil-water	138	172	100%
HFC, water-glycol	103	138	50%
HFD, ester phosphate	250	293	100%

FILTRATION

Hydraulic systems oil must always be filtered.
The choice of filtration grade derives from needs of service life and money spent. In order to obtain stated service life it is important to follow our recommendations concerning filtration grade.
When choosing the filter it is important to consider the amount of dirt particles that filter can absorb and still operate satisfactorily. For that reason we recommend filters showing when you need to substitute filtering cartridge.

- 25 µm filtration required in most applications
- 10 µm filtration in closed circuit applications

OXIDATION

Hydraulic oil oxidizes with time of use and temperature. Oxidation causes changes in colour and smell, acidity increase or sludge formation in the tank. Oxidation rate increases rapidly at surface temperatures above 60°C, in these situations oil should be checked more often.
The oxidation process increases the acidity of the fluid; the acidity is stated in terms of the "neutralization number". Oxidation is usually slow at the beginning and then it increases rapidly.
A sharp increase (by a factor of 2 to 3) in neutralization number between inspections shows that oil has oxidized too much and should be replaced immediately.

WATER CONTENT

Oil contamination by water can be detected by sampling from the bottom of the tank. Most hydraulic oils repel the water, which then collects at the bottom of the tank. This water must be drained off at regular intervals. Certain types of transmission oils and engine oils emulsify the water; this can be detected by coatings on filter cartridges or a change in the colour of the oil. In such cases, obtain your oil supplier advice.

DEGREE OF CONTAMINATION

Heavy contamination of the oil causes wear rising in hydraulic system components. Contamination causes must be immediately investigated and remedied.

ANALYSIS

It is recommended oil being analyzed every 6 months. The analysis should cover viscosity, oxidation, water content, additives and contamination. Most oil suppliers are equipped to analyze oil state and to recommend appropriate action. Oil must be immediately replaced if the analysis shows that it is exhausted.

Instriction and Advices

INSTALLATION
Hoses and piping must be clean and free from contamination. No other special requirements are necessary.
- Motor can be mounted in any position
- In run-away conditions you must use counterbalance valves
- Consult factory for intermittent applications

Splined adaptors (sleeves) are available upon request.

INSTALLATION CIRCUIT
The choice of open or closed loop circuit will be determined by the application.
Open loop circuits are cheaper and simpler to install.
Closed loop circuit is a superior circuit and usually takes up less space. It also offers better control features.

START UP
Motor case and pistons must be completely filled with oil before starting.
Do not load motor to maximum working pressure. Increase load gradually at start-up.

CASE DRAIN – CASE PRESSURE
Connect the case drain directly to tank.
The case drain port on the motor must be located on the highest point of the installation to ensure that the motor will always be full of oil. The case drain pressure must not exceed 6 bar continuous pressure.

IMPORTANT
When the motor is installed vertically with shaft pointing upwards, consult our Technical Department. If the motor is connected to high inertial loads, the hydraulic system must be designed to prevent peaks of pressure and cavitation.

TEMPERATURE
Maximum oil temperature must not exceed 70°C. Heath exchangers must be used with higher temperatures.

VISCOSITY
The motor works satisfactory in a range of 3°E to 10°E oil viscosity. Best performance is obtained at the highest viscosity.

BACK PRESSURE
Don't exceed 70 bar back pressure.

HIGH PEAKS APPLICATIONS
In case of high pressure peaks applications, a Nitemper treatment on motor body is suggested to increase wear and tear resistance.

CONTINUOUS HIGH SPEED DUTY
In case of continuous high speed duty, it is suggested to mount a central reinforced bearing on motor shaft, please contact our Technical Department.

MINIMUM SPEED
Standard minimum speed is about 5 to 40 rpm (depending on motor displacement). If you need less speed, it is possible to modify some parts of the distributor.

FOR MORE DETAILS ON THE ABOVE MENTIONED ARGUMENTS AND FOR ANY FURTHER INFORMATION PLEASE CONTACT OUR TECHNICAL DEPARTMENT.

Bearings

Bearings lifetime depends on the type of bearing, on motor speed and on working loads.
Lifetime is measured by L_{10} which is called "theoretic lifetime". It represents the number of cycles that 90% of identical bearings can effort at the same load without showing wear and tear. It is calculated by the following equation:

$$L_{10} = \left(\frac{C}{P}\right)^{p}$$

where: C = theoretical dynamic coefficient (depending on the bearing size)
P = radial load
p = exponent (p=3 for ball bearings, p=10/3 for roller bearings)

When you work at constant speed, you can calculate the lifetime in hours with the following equation:

$$L_{10h} = \frac{10^6 \cdot L_{10}}{60 \cdot rpm} = \frac{10^6}{60 \cdot rpm}\left(\frac{C}{P}\right)^{p} [h]$$

When you don't have only radial or axial loads, you have to calculate an equivalent load:

$$P = X \cdot F_R + Y \cdot F_A$$

Where F_R = radial load,
X = radial coefficient,
F_A = axial load,
Y = axial coefficient

While F_R and F_A come from working conditions (i.e. torque), X and Y depend on the type of bearing and on the ratio $\frac{F_A}{F_R}$.

To help you in the expected lifetime calculation, Intermot provides you with an EXCEL calculation sheet. With this instrument you can easily calculate lifetime: you only need to choose the motor model, put speed, pressure and loads.

For further information or to have the calculation sheet, please contact our Technical Department.

Flushing

FLUSHING FLOW

Cooling flow is necessary to assure the minimum oil viscosity and depends on motor displacement.

Motor	Flushing flow [l/min]
G 20-27-34	3
G 50-75-90-100	5
GD 100	3-5

FLUSHING IN PERFORMANCE DIAGRAMS

Each performance diagram shows working conditions where flushing is suggested (areas numbered form 4 to 6 in each performance diagram).

Area 1: Continuous operation
Area 2: Intermittent operation for period 3-5 minute every 10-15 10-15 minute
Area 3: Intermittent operation for very short period (3-5 seconds every 10-15 minutes)
Area 4: **Continuous operation with flushing**
Area 5: **Intermittent operation for period 3-5 minute every10-15 minute with flushing**
Area 6: **Intermittent operation for very short period (3-5 seconds every 10-15 minutes) with flushing**

HIGH VOLUMETRIC EFFICIENCY MOTORS

On radial piston hydraulic motors with high volumetric efficiency, and therefore G and GD motors series, there can be a phenomenon of oil-overheating in the body motor.
Oil drawing from the piston and from the distributor goes into body motor. When this oil quantity is very scanty, it means there's a good volumetric efficiency.
In some cases this is positive, like for winch on crane truck or trawl winch, because high volumetric efficiency avoids motor rotation even under external stress.
This scanty quantity of oil is not a problem because the motor works at high pressure only for a short period of time.
In other cases, this high efficiency can cause problems on the motor because oil exchange is missing.
In fixed applications, for example, where the motor is running constantly for 8 or more hours a day (like injection machines for plastic materials, press, bending machines, etc.) high volumetric efficiency can create temperature increasing in motor body.
In this case temperature increasing is to be avoided with the use of flushing.
Flushing consists in carrying fresh oil (taken from hydraulic circuit) in the body motor.
Oil is usually taken from return line to avoid any loss of efficiency.
In this way, all internal parts of the motor are protected with this lubrication and cooled with fresh oil, so that total efficiency is optimised.

DRAIN RECOMMENDATIONS

IMPORTANT: For all motors G and GD Series, it is necessary to fill the motor case with hydraulic fluid,through the drain pipe, before the first start-up.

Shaft Seals Features

Type: BABSL
Form: AS DIN 3760
Material: SIMRIT® 72 NBR 902
SIMRIT® 75 FKM 595

1. Features

SIMMERRING® radial shaft seal with rubber covered O.D., short, flexibility suspensed, spring loaded sealing lip and additional dust lip: see Part B/ SIMMERRING®, sections 1.1 and 2.

2. Material

Sealing lip and O.D.:

- Acrylonitrile-butadiene rubber with 72 Shore A hardness (designation: SIMRIT® 72 NBR 902)
- Fluoro rubber with 75 Shore A hardness (designation: SIMRIT®75 FKM 595)

Metal insert:

- Plain steel DIN 1624

Spring:

- Spring steel DIN 17223

3. Application

For sealing pressurised media without additional backup ring, e. g. for rotational pressure sealing in hydraulic pumps, hydraulic motors, hydrodynamic clutches. Rubber covered O.D. assures sealing in the housing bore even in case of considerable surface roughness, thermal expansion or split housing.

Particularly suitable for sealing low viscosity and gaseous media.

Where high thermal stability and chemical resistance are required, SIMRIT® 75 FKM 595 material should be used.

Additional dust lip to avoid the entry of light and medium dust and dirt.

4. Operating conditions

See Part B/ SIMMERRING®, sections 2. 4.

Media:	mineral oils, synthetic oils	
Temperature:	-40°C to +100°C	(SIMRIT® 72 NBR 902)
	-40°C to +160°C	(SIMRIT® 75 FKM 595)
Surface speed:	up to 5 m/s	
Working pressure:	see diagram 1	

Maximum permitted values, depending on other operating conditions.

5. Housing and Machining Criteria

See Part B/ SIMMERRING®, sections 2.

Shaft:	Tolerance:	ISO h11
	Concentricity:	IT 8
	Roughness:	Ra=0.2-0.8 µm
		Rz=1-4 µm
		Rmax=6 µm
	Hardness:	45-60 HRc
	Roughness: preferably by	non oriented; plunge grinding
Housing:	Tolerance:	ISO H8
	Roughness:	Rmax<25 µm

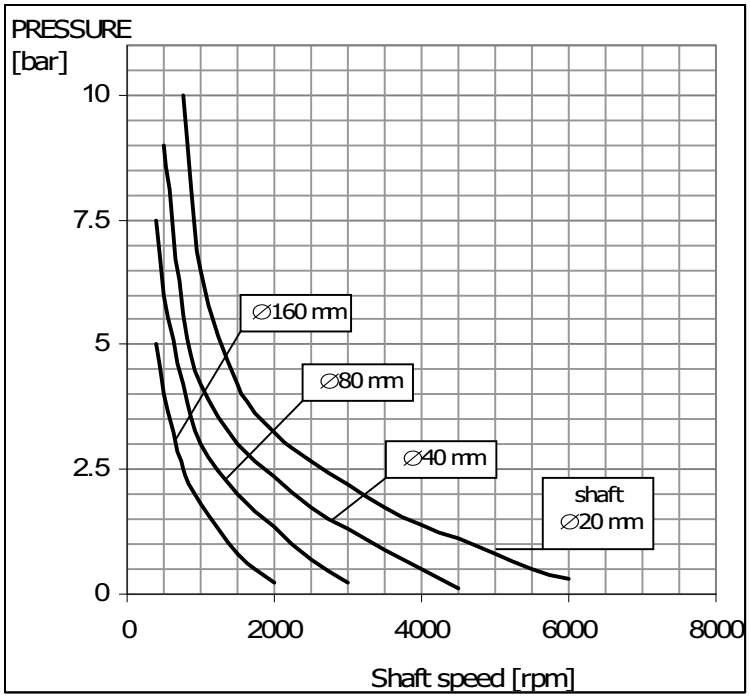


Diagram 1: Pressure Loading Limits

For more details please contact our Technical Department.

Formulas

- TORQUE (1) $\text{Torque} = (\text{specific torque}) \cdot (\text{pressure})$
- TORQUE (2) $\text{Torque [Nm]} = \frac{\text{displacement [cc/rev]} \cdot \text{pressure [bar]}}{62.8}$
- POWER (1) $\text{Power [kW]} = \frac{\text{Torque [Nm]} \cdot \text{speed [rpm]}}{9549}$
- POWER (2) $\text{Power [CV]} = \frac{\text{Torque [Nm]} \cdot \text{speed [rpm]}}{7023}$
- SPEED $\text{speed [rpm]} = \frac{\text{flow rate [l/min]} \cdot 1000}{\text{displacement [cc/rev]}}$
- REQUIRED MOTOR DISPLACEMENT $\text{displacement [cc/rev]} = \frac{\text{max required torque [Nm]} \cdot 62.8}{\text{max pressure [bar]}}$
- REQUIRED PUMP FLOW RATE $\text{flow [l/min]} = \frac{\text{displacement [cc/rev]} \cdot \text{max speed [rpm]}}{1000}$

Conversions

LENGTH	1 m	=	39.3701	in
		=	3.2808	ft
		=	1.0936	yd
		=	1000	mm
	1 in	=	0.0833	ft
		=	25.4	mm
	1 ft	=	0.3048	m
		=	0.3333	yd
		=	12	in
	1 yd	=	0.9144	m
		=	3	ft
		=	36	in
	1 km	=	1000	m
		=	1093.6	yd
		=	0.6214	mile
	1 mile	=	1.609	km
		=	1760	yd
MASS	1 kg	=	2.2046	lb
	1 lb	=	0.4536	kg
SPEED	1 m/s	=	3.6	km/h
		=	2.237	mph
		=	3.2808	ft/s
	1 km/h	=	0.2778	m/s
		=	0.6214	mph
		=	0.9113	ft/s
	1 mph	=	1.609	km/h
		=	0.447	m/s
		=	1.467	ft/s
	1 ft/s	=	0.3048	m/s
		=	1.0973	km/h
		=	0.6818	mph

FORCE	1 N	=	0.102	kgf
		=	0.2248	lbf
	1 kgf	=	2.205	lbf
		=	9.806	N
	1 lbf	=	0.4536	kgf
		=	4.448	N
PRESSURE	1 bar	=	14.223	psi
		=	0.99	atm
		=	1.02	ata
		=	100000	Pa
		=	100	kPa
		=	0.1	MPa
	1 psi	=	0.0703	bar
FLOW	1 l/min	=	0.264	gpm
		=	1000	cc/min
	1 gpm	=	3.785	l/min
		=	3785	cc/min
	1 m3/s	=	60000	l/min
		=	15852	gpm
POWER	1 kW	=	1.341	HP
		=	1.3596	CV
	1 HP	=	0.7457	Kw
		=	1.0139	CV
TORQUE	1 Nm	=	0.102	kgm
		=	0.7376	lbf ft
	1 kgm	=	9.806	Nm
		=	7.2325	lbf ft
	1 lbf ft	=	0.1383	kgm
		=	1.3558	Nm

As HANSA-TMP has a very extensive range of products and some products have a variety of applications, the information supplied may often only apply to specific situations.
If the catalogue does not supply all the information required, please contact HANSA-TMP.

In order to provide a comprehensive reply to queries we may require specific data regarding the proposed application.

Whilst every reasonable endeavour has been made to ensure accuracy, this publication cannot be considered to represent part of any contract, whether expressed or implied.

HANSA-TMP reserves the right to amend specifications at their discretion.

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