# HIGH AND LOW SPEED DUAL DISPLACEMENT RADIAL PISTON MOTORS

## GD SERIES

### GD 100

## INDEX

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL INFORMATION</td>
<td>14</td>
</tr>
<tr>
<td>MOTOR TECHNICAL DATA</td>
<td>15</td>
</tr>
<tr>
<td>FREEWHEELING</td>
<td>16</td>
</tr>
<tr>
<td>- STANDARD SERIES - SIZE &amp; SHAFT -</td>
<td></td>
</tr>
<tr>
<td>GD 100</td>
<td>17</td>
</tr>
<tr>
<td>TACHOMETER</td>
<td>18</td>
</tr>
<tr>
<td>SPLINED BILLET</td>
<td>18</td>
</tr>
<tr>
<td>ORDERING INSTRUCTIONS</td>
<td>19</td>
</tr>
<tr>
<td>HYDRAULIC FLUIDS RECOMMENDATIONS</td>
<td>20</td>
</tr>
<tr>
<td>INSTRUCTIONS AND ADVICES</td>
<td>21</td>
</tr>
<tr>
<td>BEARINGS</td>
<td>21</td>
</tr>
<tr>
<td>FLUSHING</td>
<td>22</td>
</tr>
<tr>
<td>DRAIN RECOMMENDATIONS</td>
<td>23</td>
</tr>
<tr>
<td>PERFORMANCES</td>
<td>23</td>
</tr>
<tr>
<td>SHAFT SEAL FEATURES</td>
<td>24</td>
</tr>
<tr>
<td>FORMULA CONVERSIONS</td>
<td>25</td>
</tr>
<tr>
<td>CONTACT US</td>
<td>26</td>
</tr>
</tbody>
</table>
INTERMOT produces RADIAL PISTON HYDRAULIC MOTORS since 1985: our yearly production is more than 13,000 units which we sell all over the world through our agents and authorized sellers. Our motor range varies from 20cc to 8500cc displacement and it is completed by two-speed 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.

INTERMOT 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.
The user can choose between 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 between 100 and 38 cc/Rev; for the minimum displacement the user can choose between 89 and 31 cc/Rev. In the following table are showed the technical data for some of the possible displacements.

<table>
<thead>
<tr>
<th>MAX DISPLACEMENT</th>
<th>cc/Rev</th>
<th>102</th>
<th>89</th>
<th>76.3</th>
<th>63.6</th>
<th>50.9</th>
<th>38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific torque</td>
<td>Nm/bar</td>
<td>1.61</td>
<td>1.41</td>
<td>1.21</td>
<td>1.01</td>
<td>0.81</td>
<td>0.60</td>
</tr>
<tr>
<td>Max continuous speed</td>
<td>Rpm</td>
<td>1850</td>
<td>1900</td>
<td>2100</td>
<td>2300</td>
<td>2350</td>
<td>2400</td>
</tr>
<tr>
<td>Peak speed</td>
<td>Rpm</td>
<td>2200</td>
<td>2200</td>
<td>2300</td>
<td>2400</td>
<td>2400</td>
<td>2400</td>
</tr>
<tr>
<td>Max freewheeling speed (*)</td>
<td>Rpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Max power</td>
<td>Kw</td>
<td>60</td>
<td>52</td>
<td>44</td>
<td>37</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>HP</td>
<td>82</td>
<td>71</td>
<td>59</td>
<td>49</td>
<td>42</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MIN DISPLACEMENT</th>
<th>cc/Rev</th>
<th>89</th>
<th>76.3</th>
<th>63.6</th>
<th>50.9</th>
<th>38</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific torque</td>
<td>Nm/bar</td>
<td>1.41</td>
<td>1.21</td>
<td>1.01</td>
<td>0.81</td>
<td>0.60</td>
<td>0.49</td>
</tr>
<tr>
<td>Max continuous speed</td>
<td>Rpm</td>
<td>1900</td>
<td>2100</td>
<td>2300</td>
<td>2350</td>
<td>2400</td>
<td>2500</td>
</tr>
<tr>
<td>Peak speed</td>
<td>Rpm</td>
<td>2200</td>
<td>2300</td>
<td>2400</td>
<td>2400</td>
<td>2400</td>
<td>2500</td>
</tr>
<tr>
<td>Max freewheeling speed (*)</td>
<td>Rpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Max power</td>
<td>Kw</td>
<td>52</td>
<td>44</td>
<td>37</td>
<td>31</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>HP</td>
<td>71</td>
<td>59</td>
<td>49</td>
<td>42</td>
<td>32</td>
<td>25</td>
</tr>
</tbody>
</table>

(*) For the hydraulic circuit, please refer to page 16 (freewheeling operation).

### TECHNICAL DATA

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

This is the most suitable circuit for high speed freewheeling. The motor operates under vacuum conditions, therefore it can work several hours without causing any damage and overheating. The switch from normal to freewheeling operation (and vice versa) must be done at low speed and pressure. For further informations please contact Intermot technical department.

For further information contact Intermot technical department.
**SIZE**

**GD 100**

STANDARD SERIES

- Ø206 max
- 2 PORTS 3/4" BSP
- 4 MOUNTING HOLES M10x20 EQUISPACED ON Ø150 CIRCLE

**SHAFT**

**GD 100**

<table>
<thead>
<tr>
<th>A1: Splined Shaft</th>
<th>A2: Parallel shaft on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Mounting face</td>
<td>M10x20</td>
</tr>
<tr>
<td>17</td>
<td>Front Mounting face</td>
</tr>
<tr>
<td>37</td>
<td>M10x20</td>
</tr>
</tbody>
</table>

03/2008 Pag. 17
**TACHOMETER**

**TA**

**TB**

**EST**

**EST.30**

**SPLINE BILLET**

**SB13**

---

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

---

**MODEL**: Ø5
**Torque**: 1 Nm

---

only for: GD100 A0

---

Pag. 18  03/2008
ORDERING INSTRUCTIONS

GD100

Motor model
GD100

Shaft
A1 splined shaft
A2 parallel keyed shaft

Distributor
D20 (3/4" BSP)

Tachometer
TA
TB
EST
EST.30
J TACHOMETER PREDISPOSITION

Spline billet
SB13 40x36 DIN 5482

Displacements (*)
MAX-MIN (MAXIMUM AND MINIMUM DISPLACEMENT OF MOTOR)

(*) see page 15 for available maximum and minimum displacements

GD100.A2.D20.TA.75-31
**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**

<table>
<thead>
<tr>
<th></th>
<th>Max cont. pressure</th>
<th>Max int. pressure</th>
<th>Max speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFA, 5-95% oil-water</td>
<td>103</td>
<td>138</td>
<td>50%</td>
</tr>
<tr>
<td>HFB, 60-40% oil-water</td>
<td>138</td>
<td>172</td>
<td>100%</td>
</tr>
<tr>
<td>HFC, water-glycol</td>
<td>103</td>
<td>138</td>
<td>50%</td>
</tr>
<tr>
<td>HFD, ester phosphate</td>
<td>250</td>
<td>293</td>
<td>100%</td>
</tr>
</tbody>
</table>

**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.
INSTRUCTIONS 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. Heat exchangers must be used with higher temperatures.

VISCOITY
The motor works satisfactorily 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 Nittemper 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.

COOLING FLOW
If the motor operates in the Intermittent Power zone, it may require a cooling flow of 20 l/min (5 gpm) to keep a drain flow viscosity of 40 cSt minimum.

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

BEARINGS
Bearing lifetime depends on the type of bearing, on motor speed and on working loads.
Liftime is measured by L₁₀ 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:
\[ L₁₀ = \left( \frac{C}{P} \right)^{p} \]
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:
\[ L₁₀h = \frac{10^6 \cdot L₁₀}{60 \cdot rpm} = \frac{10^6 \left( \frac{C}{P} \right)^{p}}{60 \cdot rpm} \] [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
\[ F_R = \text{radial load}, \]
\[ X = \text{radial coefficient}, \]
\[ F_A = \text{axial load}, \]
\[ Y = \text{axial coefficient} \]

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 \( \frac{F_R}{F_A} \).

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

<table>
<thead>
<tr>
<th>Motor</th>
<th>Flushing flow [l/min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>GD 100</td>
<td>3÷5</td>
</tr>
</tbody>
</table>

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 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 every 10-15 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 Intermot G 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.
IMPORTANT
For all motors GD series, it is necessary TO FILL the motor case with hydraulic fluid, through the drain pipe, before start-up.

PERFORMANCES
For obtain the diagrams in wich are showed the motor characteristics contact Intermot technical departement.
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 suspended, 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.

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

<table>
<thead>
<tr>
<th>LENGTH</th>
<th>1 m = 39.3701 in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.2808 ft</td>
</tr>
<tr>
<td></td>
<td>1.0936 yd</td>
</tr>
<tr>
<td></td>
<td>1000 mm</td>
</tr>
<tr>
<td>1 in</td>
<td>0.0833 ft</td>
</tr>
<tr>
<td></td>
<td>25.4 mm</td>
</tr>
<tr>
<td>1 ft</td>
<td>0.3048 m</td>
</tr>
<tr>
<td></td>
<td>0.3333 yd</td>
</tr>
<tr>
<td>1 yd</td>
<td>0.9144 m</td>
</tr>
<tr>
<td></td>
<td>3 ft</td>
</tr>
<tr>
<td>1 km</td>
<td>1000 m</td>
</tr>
<tr>
<td></td>
<td>1093.6 yd</td>
</tr>
<tr>
<td>1 mile</td>
<td>1.609 km</td>
</tr>
<tr>
<td></td>
<td>1760 yd</td>
</tr>
</tbody>
</table>

| FORCE | 1 N = 0.102 kgf |
|       | 0.2248 lbf |
|       | 9.866 N |
|       | 4.448 N |
| 1 kgf | = 2.205 lbf |
|       | 9.806 N |
| 1 lbf | = 0.4536 kgf |

| 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 |
|      | 3.785 l/min |
| 1 gpm | = 100 cc/min |
|      | 6000 l/min |
| 1 m3/s | = 15852 gpm |
|      | 1.3596 CV |

| 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 |
|        | 9.806 Nm |
| 1 kgm  | = 7.2325 lbf ft |
| 1 lbf ft | = 0.1383 kgm |
|        | 1.3558 Nm |