DENISON CALZONI
Radial Piston Motor
Type MRD, MRDE, MRV, MRVE
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## GENERAL CHARACTERISTICS

### CONSTRUCTION
Radial piston motor with dual displacement "MRD - MRDE" and variable displacement "MRV - MRVE"

### TYPE
MRD; MRDE; MRV; MRVE

### MOUNTING
Front flange mounting

### CONNECTION
Connection flange (See page 40)

### MOUNTING POSITION
Any (please note the installation notes on page 44)

### BEARING LIFE
See page 26

### DIRECTION OF ROTATION
Clockwise, anti-clockwise - reversible

### FLUID
HLP mineral oils to DIN 51 524 part 2; Fluid type HFB, HFC and Bio-fluids on enquiry. FPM seals are required with phosphorous acid-Ester (HFD)

### FLUID TEMPERATURE RANGE
From -22 °F to 176 °F (–30° to +80° °C)

### VISCOSITY RANGE 1)
From 85 to 4635 SUS (18 to 1000 mm²/s): Recommended operating range 141 to 230 SUS (30 to 50 mm²/s) (see fluid selection on page 8)

### FLUID CLEANLINESS
Maximum permissible degree of contamination of fluid NAS 1638 Class 9. We therefore recommend a filter with a minimum retention rate of $\beta_{90} \geq 75$. To ensure a long life we recommend class 8 to NAS 1638. This can be achieved with a filter, with a minimum retention rate of $\beta_5 \geq 100$.

---

1) For different valves of viscosity please contact DENISON Calzoni
FUNCTIONAL DESCRIPTION - MOTOR TYPE MRD - MRDE - MRV - MRVE

MRD-MRDE
FUNCTIONAL DESCRIPTION

The outstanding performance of the motor is the result of an original and patented design.
The principle is to transmit force to the driving shaft (2 and 6) by means of a pressurized column of oil (a) without any connecting rods, pistons, pads and pins.

This oil column is contained by a telescopic cylinder (1) with a mechanical connection at the lips at each end, which seal against the spherical surfaces (3) of the cylinder-head (4) and the spherical surface of the rotating shaft (2). These lips retain their circular cross section when stressed by the pressure so there is no alteration in the sealing geometry. The careful selection of materials and optimized design has minimized both friction and leakage.

Another advantage of this design stems from the elimination of any connecting rods, the cylinder can only expand and retract linearly so there are no transverse components of the thrust. This means no oval wear on the moving parts and no side forces on the cylinder joints.

Dual displacement is accomplished by having the eccentric shaft cam free to move radially changing its eccentricity. In this way the displacement can be chosen amongst many different values.

The radial motion is controlled by means of hydraulic cylinders (5) located in the drive shaft (6). The feeding of the displacement cylinders is accomplished by means of the rotating intake (7). The displacement can be changed even while rotating under full load.

TIMING SYSTEM

Timing is accomplished by means of a rotary valve (8) driven by the rotary valve driving shaft (9) that it is connected to the rotating eccentric shaft. The rotary valve rotates between the rotating intake (7) and the reaction ring (10) which are fixed to the rotary valve housing.

This timing system is also of a patented design being pressure balanced and self-compensating for thermal expansion.

EFFICIENCY

The advantages of this type of timing system, combined with a revolutionary propulsion system, produces a motor with extremely high values of mechanical and volumetric efficiency. The torque output is smooth even at very low speed under high pressure, and the motor offers high performance starting under load.
The outstanding performance of the motor is the result of an original and patented design. The principle is to transmit force to the driving shaft (2 and 6) by means of a pressurized column of oil (a) without any connecting rods, pistons, pads and pins. This oil column is contained by a telescopic cylinder (1) with a mechanical connection at the lips at each end, which seal against the spherical surfaces (3) of the cylinder-head (4) and the spherical surface of the rotating shaft (2). These lips retain their circular cross section when stressed by the pressure so there is no alteration in the sealing geometry. The careful selection of materials and optimized design has minimized both friction and leakage. Another advantage of this design stems from the elimination of any connecting rods, the cylinder can only expand and retract linearly so there are no transverse components of the thrust. This means no oval wear on the moving parts and no side forces on the cylinder joints.

Dual displacement is accomplished by having the eccentric shaft cam free to move radially changing its eccentricity. In this way the displacement can be chosen amongst many different values. The radial motion is controlled by means of hydraulic cylinders (5) and valve (11) located in the drive shaft (6), this valve allows the step by step movement of the cylinder inside the main shaft, so it is possible to change the displacement. The feeding of the displacement cylinders is accomplished by means of the rotating intake (7). The displacement can be changed even while rotating under full load.

Timing is accomplished by means of a rotary valve (8) driven by the rotary valve driving shaft (9) that it is connected to the rotating eccentric shaft. The rotary valve rotates between the rotating intake (7) and the reaction ring (10) which are fixed to the rotary valve housing. This timing system is also of a patented design being pressure balanced and self-compensating for thermal expansion.

The advantages of this type of timing system, combined with a revolutionary propulsion system, produces a motor with extremely high values of mechanical and volumetric efficiency. The torque output is smooth even at very low speed under high pressure, and the motor offers high performance starting under load.
MRV 450
FUNCTIONAL DESCRIPTION

The extreme versatility of this motor is because of two simple but ingenious designs combined in one machine. The rotation of the shaft is by the same original and patented mechanism as the MR motor but, in addition, the MRV has an arrangement of internal cylinders to actually change the motor displacement, even while turning under full load. The principle of the rotation mechanism is to transmit the effort from the stator to the eccentric part of the shaft by means of a pressurized column of oil. This oil column is contained by a telescopic cylinder with a mechanical connection only at the lips at each end which seal against the spherical surfaces of the stator and the rotor. These lips retain their circular cross section when stressed by the pressure so there is no alteration in the sealing geometry. The particular selection of materials and optimization of design has minimized both the friction and the leakage. Another advantage of this design stems from the elimination of any connecting rods, the cylinder can only expand and retract linearly so there are no transverse components of the thrust. This means no oval wear on the moving parts and no side forces on the cylinder joints.

In the MRV motor the eccentric part of the shaft is free to move radially. The radial motion is controlled by two lateral hydraulic cylinders which are an integral part of the shaft. As the eccentricity changes so does the stroke of the telescopic cylinders and hence the displacement. The variation is stepless between full eccentricity (maximum displacement) and full concentricity. It is possible to insert spacers in the lateral cylinders to limit the maximum and minimum displacements and so tailor the motor to the exact requirements of any application. The facility of variable displacement can be used with hydraulic regulation valves to create a variety of control systems ex. constant pressure operation, constant power operation, two speed operation. When used with electronic regulators even more control system are possible ex. high efficiency speed control, high efficiency ring main systems, high efficiency torque control etc.

In common with the MR range, this motor has a patented distributor valve being pressure balanced and self compensating for thermal expansion. The advantages of this type of valve coupled with a revolutionary cylinder arrangement produce a motor with extremely high values of mechanical and volumetric efficiency. The torque output is smooth even at very low speeds and the motor gives a high performance starting under load.
<table>
<thead>
<tr>
<th>Size Motor version</th>
<th>Displacement</th>
<th>Moment of inertia of rotating parts</th>
<th>Theoretical specific torque</th>
<th>Min. start. torque / Theoretical torque</th>
<th>Maximum Pressure</th>
<th>Speed range</th>
<th>Maximum output power</th>
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<td>psi psi psi psi psi rpm rpm HP HP lb</td>
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<td>0.5-160</td>
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</tbody>
</table>

(*) Please contact DENISON Calzoni
EXAMPLE: At a certain ambient temperature, the operating temperature in the circuit is 122° F (50°C). In the optimum operating viscosity range ($\nu_{\text{rec}}$; shaded section), this corresponds to viscosity grades VG46 or VG68; VG68 should be selected.

IMPORTANT: The drain oil temperature is influenced by pressure and speed and is usually higher than the circuit temperature or the tank temperature. At no point in the system, however, may the temperature be higher than 176° F (80°C).

If the optimum conditions cannot be met due to the extreme operating parameters or high ambient temperature, we always recommend flushing the motor case in order to operate within the viscosity limits. Should it be absolutely necessary to use a viscosity beyond the recommended range, you should first contact DENISON Calzoni for confirmation.

### GENERAL NOTES

More detailed information regarding the choice of the fluid can be requested to DENISON Calzoni. When operating with HF pressure fluids or bio-degradable pressure fluids possible limitations of the technical data must be taken into consideration, please see information sheet TCS 85, or consult DENISON Calzoni.

### OPERATING VISCOSITY RANGE

The viscosity, quality and cleanliness of operating fluids are decisive factors in determining the reliability, performance and life-time of an hydraulic component. The maximum life-time and performance are achievement within the recommended viscosity range. For applications that go beyond this range, we recommend to contact DENISON Calzoni.

$$n_{\text{rec.}} = \text{recommended operating viscosity} \quad 141...230 \text{ SUS (30...50 mm}^2/\text{s)}$$

This viscosity refers to the temperature of the fluid entering the motor, and at the same time to the temperature inside the motor housing (case temperature). We recommend to select the viscosity of the fluid based on the maximum operating temperature, to remain within the recommended viscosity range. To reach the value of maximum continuous power the operating viscosity should be within the recommended viscosity range of 30 - 50 cSt.

### LIMITS OF VISCOSITY RANGE

For limit conditions the following is valid:

$$n_{\text{min.abs.}} = 45 \text{ SUS (10 mm}^2/\text{s)} \text{ in emergency, short term}$$

$$n_{\text{min.}} = 85 \text{ SUS (18 mm}^2/\text{s)} \text{ for continuous operation at reduced performances}$$

$$n_{\text{max.}} = 4635 \text{ SUS (1000 mm}^2/\text{s)} \text{ short term upon cold start}$$

### CHOOSING THE TYPE OF FLUID ACCORDING TO THE OPERATING TEMPERATURE

The operating temperature of the motor is defined as the greater temperature between that of the incoming fluid and that of the fluid inside the motor housing (case temperature). We recommend that you choose the viscosity of the fluid based on the maximum operating temperature, to remain within the recommended viscosity range (see diagram). We recommend that the higher viscosity grade must be selected in each case.

### FILTRATION

The motor life also depends on the fluid filtration. At least it must correspond to one of the following cleanliness. class 9 according to NAS 1638

class 6 according to SAE, ASTM, AIA

class 18/15 according to ISO/DIS 4406

In order to assure a longer life a cleanliness class 8 to NAS 1638 is recommended, achieved with a filter of $b_1=100$. In case the above mentioned classes can not be achieved, please consult us.

### CASE DRAIN PRESSURE

The lower the speed and the case drain pressure, the longer the life of the shaft seal. The maximum permissible housing pressure is

$$p_{\text{max}} = 72.5 \text{ psi (5 bar)}$$

If the case drain pressure is higher than 5 bar it is possible to use a special 218 psi (15 bar) shaft seal (see page 45, Seals, Code “F1”).

### "FPM" SEALS

In case of operating conditions with high oil temperature or high ambient temperature, we recommend to use "FPM" seals (see page 45, Seals, Code "V1"). These "FPM" seals should be used with HFD fluids.
The motor case must be flushed when the continuous operating performances of the motor are inside the “Continuous operating area with flushing” (see Operating Diagram from page 11 to page 25), in order to assure the minimum oil viscosity inside the motor case of 141 SUS (30 mm²/s) (see page 8 - Fluid Selection). The flushing can be necessary also when the operating performances are outside the “Continuous operating area with flushing”, but the system is not able to assure the minimum viscosity conditions requested by the motor as specified at page 8.

NOTE1: The oil temperature inside the motor case is obtainable by adding 5°F (3°C) to the motor surface temperature ($t_A$, see figures).

NOTE2: With the standard shaft seal the maximum drain case pressure is 73.5 psi (5 bar). For the selection of the restrictor, please consult us.

FLOW

<table>
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<th>TYPE</th>
<th>MOTOR VERSION</th>
<th>FLUSHING FLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRD - MRDE</td>
<td>300, 330</td>
<td>Q = 1.6 gpm</td>
</tr>
<tr>
<td>MRD - MRDE</td>
<td>450, 500</td>
<td>Q = 2.0 gpm</td>
</tr>
<tr>
<td>MRD - MRDE</td>
<td>700, 800, 1100, 1400</td>
<td>Q = 3.0 gpm</td>
</tr>
<tr>
<td>MRD - MRDE</td>
<td>1800, 2100</td>
<td>Q = 4.0 gpm</td>
</tr>
<tr>
<td>MRD - MRDE</td>
<td>2800, 3100, 4500, 5400,</td>
<td>Q = 5.3 gpm</td>
</tr>
</tbody>
</table>
INTERNAL PILOTING

In order to change the motor displacement, see operating diagram for requested minimum pressure.

X = MIN. DISPLACEMENT
Y = MAX DISPLACEMENT

INTERNAL PILOTING

Two displacement valve fed by motor pressure

EXTERNAL PILOTING

External piloting pressure requested is 160 bars.

X = MIN. DISPLACEMENT
Y = MAX DISPLACEMENT

EXTERNAL PILOTING

Two displacement valve fed by motor pressure

Internal piloting

Solenoid operated displacement control valve fed by motor pressure

External piloting

Solenoid operated displacement control valve fed by motor pressure
OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

OPERATING DIAGRAM

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

Min. pilot pressure for displacement changing in autopiloting (pilot pressure derived from pressure line)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni.

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OPERATING DIAGRAM

(average values) measured at \( n = 167 \) SUS (36 mm²/s); \( t = 113^\circ F (45^\circ C) \); \( \rho_{\text{outlet}} = 0 \text{ psi (0 bar)} \)

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

MRDE 330

set to 20.26 in³

Min. pilot pressure for displacement changing in autopiloting (pilot pressure derived from pressure line)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni

Min. required boost Pressure with pump operation

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OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

MRD 450
set to
27.58 in³

MRD 450
set to
13.79 in³

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni.
OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

(average values) measured at \( n = 167 \) SUS (36 mm²/s); \( t = 113^\circ \) F (45° C); \( p_{\text{outlet}} = 0 \) psi (0 bar)

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

**MRV 450**
- set to 27.58 in³

**MRV 450**
- set to 8.18 in³

Min. pilot pressure for displacement changing in autopiloting (pilot pressure derived from pressure line)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni
OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

h \text{T} \text{Total efficiency} \quad \text{h} \text{v} \text{Volumeter efficiency}

(average values) measured at \( \kappa = 167 \text{ SUS (36 mm}^2/\text{s}) \); \( t = 113^\circ \text{ F (45}^\circ \text{ C}) \); \( p_{\text{outlet}} = 0 \text{ psi (0 bar)} \)

MRDE 500
set to
30.39 in\(^3\)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni

Min. required boost Pressure with pump operation

For back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni

Min. required pressure difference \( \Delta p \) with idling speed (shaft unloaded)

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OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

(average values) measured at $\eta = 167$ SUS (36 mm²/s); $\nu = 113^\circ$ F (45° C); $p_{\text{outlet}} = 0$ psi (0 bar)

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

**MRD 700**
**MRV 700**

set to
43.14 in³

**MRD 700**
**MRV 700**

set to
20.69 in³

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni.

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The specified data are for product description purposes only and must not be interpreted as warranted characteristic in a legal sense. All rights reserved. Subject to revision.
OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

(average values) measured at \( \eta = 167 \) SUS (36 mm²/s); \( t = 113^\circ F \) (45° C); \( \rho_{\text{outlet}} = 0 \) psi (0 bar)

1. Output power  
2. Intermittent operating area  
3. Continuous operating area with flushing  
4. Continuous operating area  
5. Inlet pressure

**MRD 1100**

MRV 1100

set to

68.71 in³

**MRD 1100**

MRV 1100

set to

31.00 in³

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni.
OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

(average values) measured at \( n = 167 \text{ SUS (36 mm}^2/\text{s)}; \ t = 113^\circ \text{ F (45}^\circ \text{ C); } p_{\text{outlet}} = 0 \text{ psi (0 bar)} \)

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni

Min. pilot pressure for displacement changing in autopiloting (pilot pressure derived from pressure line)

Min. required pressure difference \( \Delta p \) with idling speed (shaft unloaded)

Min. required boost pressure with pump operation

The specified data are for product description purposes only and must not be interpreted as warranted characteristic in a legal sense. All rights reserved. Subject to revision.
OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

Min. pilot pressure for displacement changing in autopiloting (pilot pressure derived from pressure line)

Min. required pressure difference \( \Delta p \) with idling speed (shaft unloaded)

Min. required boost Pressure with pump operation

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni

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OPERATING DIAGRAM (average values) measured at \( n = 167 \text{ SUS (36 mm}^2/\text{s)}; \) \( t = 113^\circ \text{ F (45}^\circ \text{ C)}; \) \( p_{\text{outlet}} = 0 \text{ psi (0 bar)} \)

1. Output power  
2. Intermittent operating area  
3. Continuous operating area with flushing  
4. Continuous operating area  
5. Inlet pressure  

\( h_t \) Total efficiency  
\( h_v \) Volumeter efficiency

**MRDE 2100**  
**MRVE 2100**  
set to  
127.60 in\(^3\)

**Torque [lbf ft]**

<table>
<thead>
<tr>
<th>Speed [rpm]</th>
<th>25</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
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</thead>
<tbody>
<tr>
<td>6.38 gpm</td>
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<td>9.59 gpm</td>
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<td>13.17 gpm</td>
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<td>17.75 gpm</td>
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<td>24.50 gpm</td>
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</table>

**Speed [rpm]**

<table>
<thead>
<tr>
<th>1100</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
<th>3500</th>
<th>4000</th>
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<tbody>
<tr>
<td>73</td>
<td>1475</td>
<td>2213</td>
<td>2950</td>
<td>3688</td>
<td>4425</td>
<td>5163</td>
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</table>

**Idling pressure [psi]**

<table>
<thead>
<tr>
<th>Speed [rpm]</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
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</thead>
<tbody>
<tr>
<td>13.21 gpm</td>
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<tr>
<td>26.42 gpm</td>
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<td>39.63 gpm</td>
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<tr>
<td>52.83 gpm</td>
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<tr>
<td>66.04 gpm</td>
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<tr>
<td>79.25 gpm</td>
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</table>

**Min. required boost Pressure with pump operation**

<table>
<thead>
<tr>
<th>Idling pressure [psi]</th>
<th>73</th>
<th>147</th>
<th>221</th>
<th>295</th>
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</thead>
<tbody>
<tr>
<td>508</td>
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</tr>
<tr>
<td>508</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Min. required pressure difference \( \Delta p \) with idling speed (shaft unloaded)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 bar.  
For other working conditions please consult DENISON Calzoni

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The specified data are for product description purposes only and must not be interpreted as warranted characteristic in a legal sense. All rights reserved. Subject to revision.

OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

(average values) measured at \( \mathcal{N} = 167 \text{ SUS (36 mm}^2/\text{s)}; \ t = 113^\circ \text{ F (45}^\circ \text{ C)}; \ p_{\text{outlet}} = 0 \text{ psi (0 bar)}

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

**MRD 2800**
MRV 2800
set to
170.38 in\(^3\)

**MRD 2800**
MRV 2800
set to
85.19 in\(^3\)

Min. pilot pressure for displacement changing in autopiloting (pilot pressure derived from pressure line)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni.

Min. required pressure difference \( \Delta p \) with idling speed (shaft unloaded)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
OPERATING DIAGRAM

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

MRDE 3100
MRVE 3100

set to
189.42 in³

set to
94.71 in³

Min. pilot pressure for displacement changing in autopiloting (inlet pressure derived from pressure line)

Min. required pressure difference \( \Delta p \) with idling speed (shaft unloaded)

Min. required boost Pressure with pump operation

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni.
OPERATING DIAGRAM

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

MRD 4500
MRV 4500

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni
OPERATING DIAGRAM - MOTOR TYPE MRD - MRDE - MRV - MRVE

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(average values) measured at \( n = 167 \text{ SUS (36 mm}^2/\text{s)} \); \( t = 113^\circ \text{ F (45}^\circ \text{ C)} \); \( p_{\text{outlet}} = 0 \text{ psi (0 bar)} \)

1. Output power
2. Intermittent operating area
3. Continuous operating area with flushing
4. Continuous operating area
5. Inlet pressure

\( \eta_t \) Total efficiency
\( \eta_v \) Volumeter efficiency

**OPERATING DIAGRAM**

- **MRDE 5400**
  - Set to 329.59 in\(^3\)
  - Graph showing output power, speed, and torque relationships.

- **MRVE 5400**
  - Set to 164.83 in\(^3\)
  - Graph showing additional output power, speed, and torque relationships.

Min. pilot pressure for displacement changing in autopiloting (pilot pressure derived from pressure line)

Min. required pressure difference \( \Delta p \) with idling speed (shaft unloaded)

Valid for back pressure up to 725 psi, drain pressure up to 72.5 psi.
For other working conditions please consult DENISON Calzoni
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BEARING LIFE

$L_{10h}$ is the theoretically service life value normally reached or exceeded by the 90% of the bearings. 50% of the bearings reach the value $L_{50h} = 5$ times $L_{10h}$.

<table>
<thead>
<tr>
<th>MOTOR TYPE</th>
<th>K</th>
<th>MOTOR TYPE</th>
<th>K</th>
<th>MOTOR TYPE</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRD 300</td>
<td>950</td>
<td>MRDE 1400</td>
<td>693</td>
<td>MRV 4500</td>
<td>709</td>
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<tr>
<td>MRDE 330</td>
<td>850</td>
<td>MRVE 1400</td>
<td>693</td>
<td>MRDE 5400</td>
<td>591</td>
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<tr>
<td>MRD 450</td>
<td>1126</td>
<td>MRD 1800</td>
<td>835</td>
<td>MRVE 5400</td>
<td>591</td>
</tr>
<tr>
<td>MRV 450</td>
<td>1126</td>
<td>MRV 1800</td>
<td>835</td>
<td>MRDE 5400</td>
<td>591</td>
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<tr>
<td>MRDE 500</td>
<td>1021</td>
<td>MRDE 2100</td>
<td>722</td>
<td>MRVE 2100</td>
<td>722</td>
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<tr>
<td>MRD 700</td>
<td>920</td>
<td>MRVE 2100</td>
<td>722</td>
<td>MRD 2800</td>
<td>924</td>
</tr>
<tr>
<td>MRV 700</td>
<td>920</td>
<td>MRD 2800</td>
<td>924</td>
<td>MRV 2800</td>
<td>924</td>
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<tr>
<td>MRDE 800</td>
<td>808</td>
<td>MRV 2800</td>
<td>924</td>
<td>MRDE 3100</td>
<td>828</td>
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<td>MRVE 800</td>
<td>808</td>
<td>MRD 3100</td>
<td>828</td>
<td>MRVE 3100</td>
<td>828</td>
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<tr>
<td>MRD 1100</td>
<td>844</td>
<td>MRVE 3100</td>
<td>828</td>
<td>MRD 4500</td>
<td>709</td>
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<tr>
<td>MRV 1100</td>
<td>844</td>
<td>MRD 4500</td>
<td>709</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Splined shaft with flank contact (for dimension see page 30)
   Ordering code "N1"
   (for further shaft ends see page 30 - 31)

2. Case drain port
   BSP threads to ISO 228/1

3. On request the port flange can be rotated by 36°

4. Port 1/4" BSP threads to ISO 228/1
   for pressure reading.

<table>
<thead>
<tr>
<th>MOTOR TYPE</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>L9</th>
<th>L10</th>
<th>L11</th>
<th>L12</th>
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<th>L14</th>
<th>L15</th>
<th>L16</th>
<th>L17</th>
<th>L18</th>
<th>L19</th>
<th>L20</th>
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<tbody>
<tr>
<td>MRV 450</td>
<td>16.06</td>
<td>10.04</td>
<td>4.29</td>
<td>7.36</td>
<td>4.33</td>
<td>0.57</td>
<td>0.65</td>
<td>2.77</td>
<td>1.58</td>
<td>6.87</td>
<td>5.12</td>
<td>3.31</td>
<td>0.43</td>
<td>5.98</td>
<td>0.55</td>
<td>1.56</td>
<td>1.44</td>
<td>2.99</td>
<td>1.69</td>
<td>4.61</td>
</tr>
</tbody>
</table>

| MOTOR TYPE | B1  | B2  | B3  | B4  | D1  | D2  | D3  | D4  | D5  | D6  | D7  | T1  | D8  | D9  | D10 | D11 | D12 | α   | β   | γ   |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| MRV 480    | 5.59 | 2.36 | 4.72 | 4.69 | 14.49 | 7.48 | 8.47 | 5.9055 | 5.9031 | 150 mm | - | 6.14 | M10 | 0.71 | G 3/8 | 0.53 | 7.64 | 0.98 | G 1/4 | 90° | 36° | 18° |
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MOTOR DIMENSIONS - MOTOR TYPE MRD - MRDE - MRV - MRVE

1. Splined shaft with flank contact
   (for dimension see page 30)
   Ordering code "N1"
   (for further shaft ends see page 30 - 31)

2. Case drain port
   BSP threads to ISO 228/1

3. On request the port flange can be rotated by 72°
   (For MRD 300, MRDE 330, MRD 450, MRDE 500, MRD 700, MRDE 800 can be rotated by 36°)
   For standard position see angle a.

4. Port 1/4" BSP threads to ISO 228/1
   for pressure reading.

<table>
<thead>
<tr>
<th>Dir. of Rotation (Viewed on shaft end)</th>
<th>Port inlet</th>
<th>ordering code (see page 35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>clockwise</td>
<td>A</td>
<td>&quot;N&quot;</td>
</tr>
<tr>
<td>anti-clockwise</td>
<td>B</td>
<td>&quot;S&quot;</td>
</tr>
<tr>
<td>clockwise</td>
<td>B</td>
<td>&quot;S&quot;</td>
</tr>
<tr>
<td>anti-clockwise</td>
<td>A</td>
<td>&quot;S&quot;</td>
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<td>MOTOR TYPE</td>
<td>L1</td>
<td>L2</td>
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</tbody>
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### SHAFT END DIMENSIONS - MOTOR TYPE MRD - MRDE - MRV - MRVE

**Code N 1 (Standard)**

![Diagram of Code N 1]

**Code B 1 - BS 3550 - 1)**

![Diagram of Code B 1]

**Code D 1 - DIN 5480**

![Diagram of Code D 1]

<table>
<thead>
<tr>
<th>Version</th>
<th>N1</th>
<th>B1</th>
<th>D1</th>
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<tbody>
<tr>
<td><strong>Type</strong></td>
<td><strong>L5 (in)</strong></td>
<td><strong>L21 (in)</strong></td>
<td><strong>L22 (in)</strong></td>
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<td>MRVE 800</td>
<td>6.02</td>
<td>4.72</td>
<td>3.90</td>
</tr>
<tr>
<td>MRV 1100</td>
<td>8.27</td>
<td>6.81</td>
<td>5.67</td>
</tr>
</tbody>
</table>

**NOTE:** The threaded holes (D12/T10) for the shaft versions "N1", "B1" and "D1" must be considered as service holes. In case the holes dimensions required by the application are different from the ones listed here above, please contact DENISON Calzoni.

1) on enquiry
### SHAFT END DIMENSIONS - MOTOR TYPE MRD - MRDE - MRV - MRVE

<table>
<thead>
<tr>
<th>Version</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td><strong>L5</strong> (in)</td>
<td><strong>L21</strong> (in)</td>
</tr>
<tr>
<td>MRD 300</td>
<td>1.06</td>
<td>0.20</td>
</tr>
<tr>
<td>MRD 450</td>
<td>1.10</td>
<td>0.20</td>
</tr>
<tr>
<td>MRV 450</td>
<td>1.30</td>
<td>0.20</td>
</tr>
<tr>
<td>MRD 700</td>
<td>1.10</td>
<td>0.20</td>
</tr>
<tr>
<td>MRD 1100</td>
<td>1.50</td>
<td>0.31</td>
</tr>
<tr>
<td>MRD 1800</td>
<td>1.85</td>
<td>0.31</td>
</tr>
<tr>
<td>MRD 2800</td>
<td>1.89</td>
<td>0.31</td>
</tr>
<tr>
<td>MRD 4500</td>
<td>1.97</td>
<td>0.55</td>
</tr>
</tbody>
</table>

**NOTE**<br>For higher values of the torque to be transmitted, please consult DENISON Calzoni.

----

**NOTE**<br>The threaded holes (D12/T10) for the shaft versions "P1" must be considered as service holes. In case the holes dimensions required by the application are different from the ones listed here above, please contact DENISON Calzoni.
COMPONENTS FOR SPEED CONTROL - MOTOR TYPE MRD - MRDE - MRV - MRVE

MECHANICAL
TACHOMETER DRIVE

TACHOGENERATOR
DRIVE

ENCODER
DRIVE

Dimensions in inch (threaded holes in mm)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;C1&quot;</td>
<td>2x M8x1.77 (2x M8x1.97)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>&quot;T1&quot;</td>
<td>2x M8x1.77 (2x M8x1.97)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>&quot;Q1&quot;</td>
<td>2x M8x1.77 (2x M8x1.97)&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>*</sup> Motor MRD 300, MRDE 330

INCREMENTAL ENCODER
DIMENSIONS

Dimensions in inch (in)

<table>
<thead>
<tr>
<th>Protection</th>
<th>Encoder Drive Flange</th>
<th>Encoder</th>
</tr>
</thead>
</table>

Female connector included in the supply

a = 54° for the motor types MRD 300, MRDE 330
a = 45° for the other types

The specified data are for product description purposes only and must not be interpreted as warranted characteristic in a legal sense. All rights reserved. Subject to revision.
INCREMENTAL ENCODER

CONNECTION DIAGRAMS

Monodirectional

Bidirectional

Color wires and function

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>Power Supply (8 to 24 Vdc)</td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td>Output B phase (MAX 10 mA - 24 Vcc)</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>Power Supply (0 Vdc)</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>Output A phase (MAX 10 mA - 24 Vcc)</td>
</tr>
</tbody>
</table>

INCREMENTAL ENCODER

TECHNICAL DATA

Encoder type: ELCIS mod. 478
Supply voltage: 8 to 24 Vcc
Current consumption: 120 mA max
Current output: 10 mA max
Output signal: A phase- MONODIRECTIONAL, A and B phase BIDIRECTIONAL
Response frequency: 100 KHz max
Number of pulses: 500 (others on request - max 2540)
Slew speed: Always compatible with maximum motor speed
Operating temperature range: from 32° to 158°F
Storage temperature range: from -22° to +185°F
Ball bearing life: 1.5x10^9 rpm
Weight: 0.220 lb
Protection degree: IP 67 (with protection and connector assembled)

Connectors:

MONODIRECTIONAL
RSF3/0.5 M (Lumberg) male
RKT3-06/5m (Lumberg) female

BIDIRECTIONAL
RSF4/0.5 M (Lumberg) male
RKT4-07/5m (Lumberg) female

Note: Female connectors cable length equal to 5 m.
RCE

USING GENERALITIES
The electronic regulator type RCE is designed to be mounted on board of the motors type “MRV/MRVE”, to control their displacement in relation to a reference value of:
- displacement
- pressure
- speed

The RCE regulator is of the bi-directional ON-OFF type, with successive integratory pulses. It is mounted directly on a 4 way, 3 position solenoid valve (CETOP size 6) which pilots the displacement variation of the motor. The power supply is 24 V DC or 24 V AC rectified.

TECHNICAL DATA

Supply Voltage: 24 Vcc ± 10% rectified (Vmax. peak 35 V)
Max power needed: 35 W (60 W if you use the solenoid output: SOLENOID C)
Referenced voltage: 0 - 10 Vcc (range 2 - 10 Vcc)
Displacement output signal: 2 - 10 Vcc
Pressure - speed output signal: 0 - 10 Vcc
Regulation and speed aptitude pulse command: 12 - 24 Vcc (opto-insulated input)
Galvanic insulation between power and control circuits
Reversal of input polarity protection
Output power with self proofed MOSFET
IP 64 protection
Complying with standard CEE

DIMENSION AND DATA

1 Electronic unit RCE/I-20
2 Middle plate
3 DENISON valve
4 Double metering valve VDD
5 House case fixing screw
The circuits of the regulator are powered through a DC/DC converter having 15 V DC output, so to obtain a total galvanic separation from the 24 V DC power lines. The input reference signal to the regulator has been set in the range 2¸10 V DC, as for the output of the regulated values (displacement, pressure, speed). Three internal led show the command condition (+ or -). The pilot oil is dosed at each pulse by a specific dual metering valve type “VDD”, fitted beneath the solenoid valve. In relation to the parameter that it is wished to keep under control by acting on the motor displacement, the RCE/I regulator can allow 3 different regulation modes.

**CONSTANT DISPLACEMENT MODE**

The hydraulic motor is equipped with an inductive (TEC) displacement transducer powered by the regulator, which statically reads and saves the current displacement position at each motor revolution.

Through special built-in valves, the motor keeps the set displacement position constant. Due to an intrinsic feature of radial-piston motors, the tendency under load is to move toward maximum displacement.

Thus the function of the regulator is to restore the original setting with an external voltage reference (range 2¸10 V DC from min. displ. to max displacement).

The precision of the actual displacement value is approximately + 2¸3% over the rated value set.

For remote reading of the displacement a 2¸10 V DC output signal is provided, almost linear in the range of the motor displacement variation.

To quickly change from one value to another of the set displacement, a special opto-insulated input circuit may be activated in transitory mode with a 24 V DC signal.

To enable the regulator only when the motor is running, it is necessary to activate a special opto-insulated input circuit with a 24 V DC signal simultaneously with the start command; an internal trimmer allows a short enabling delay to be inserted if desired.

The regulator is normally set to perform stable adjustments up to a minimum speed of 60 r.p.m.

For lower speeds, to approximately 6 r.p.m., it is necessary to use an internal multiple-turn trimmer to modify the pause length between the control pulses.

The pause length must be greater than the time required by the motor to complete one turn, this is to permit the displacement position read by the transducer at each shaft revolution to be updated in the memory.
CONSTANT WORKING PRESSURE MODE

When the motor is used in systems equipped with hydraulic accumulators and the torque required by the motor may vary in relation to the process characteristics, the displacement is controlled in relation to the working pressure set for the motor, so that the working pressure remains constant as the required torque varies.

The constant pressure regulation can be achieved for torque variations within the displacement variation ratio allowed by the motor.

The hydraulic circuit that feeds the motor must include a pressure transducer that may be powered by the regulator itself with a voltage of 15 V DC and a signal output of 0.10 V DC or 4.20 mA. The hydraulic motor is equipped with built-in valves, to maintain the displacement, as well as with the displacement transducer if it is wished to read the actual displacement during torque changes (by processing the displacement signal together with the pressure and speed signals, it is possible to determine the torque and absorbed power). The pressure setting is achieved by means of an external signal in the range 0.10 V DC (2–10 V DC); the 10 V value must correspond to the full scale value (10 V or 20 mA) of the pressure transducer. The minimum acceptable reference value is 2 V DC. During the startup transitory, the regulator remains disabled for an adjustable period of time (internal trimmer).

Also in this case the regulator is enabled with a 24 V DC input signal.

Even with frequent start-stop cycles, the regulator can change the motor displacement to adapt it to the average pressure value saved during the running cycle.

The saved pressure signal can be read remotely, again in the range 0–10 V DC. A third 24 V DC power output is available on the regulator to simultaneously energize a 2-way solenoid valve of the type with a conical diaphragm, which intercepts the pilot oil upstream the 4-way solenoid valve.

CONSTANT SPEED MODE

If multi-stage fixed displacement pumps are used to drive the motor, in certain conditions it is necessary to drain off the excess delivery in relation to the set motor speed.

In order to avoid this dissipation, it is possible to use a variable-displacement motor which would absorb the excess delivery by adjusting its displacement. The regulator in this case accents the speed signal and compares it to the reference value; when the motor speed exceeds the set value, the regulator increases the displacement until the excess delivery provided by the pump is absorbed; at the same time, the working pressure is proportionally reduced, to the advantage of the life of the components of the system (pump, motor, etc.).

This provides a simple speed regulating system without energy dissipation, since the circuit includes neither flow regulator valves nor drainage valves. The speed signal saved is also available as output signal for remote reading, again in the field of 0–10 V DC; this signal may be useful for detecting the maximum speed reached when the motor running cycle is very short (< 2 sec). Here again, the regulation is enabled by activating the special 24 V DC input circuit; the command may be delayed by the time the motor needs to accelerate in order to reach the rated speed. If it is wished to switch quickly the speed from one value to another, a special input may be activated with a 24 V DC signal in transitory mode. The precision attainable through this system varies: it is approximately ± 2% on the full scale value with the motor at maximum displacement; at minimum displacement the precision is slightly lower.
### ELECTRONIC DISPLACEMENT TRANSDUCER

**DIMENSIONS**

<table>
<thead>
<tr>
<th>MOTOR TYPE</th>
<th>A</th>
<th>B</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRV 450</td>
<td>4.25</td>
<td>5.34</td>
<td>12° 30'</td>
</tr>
<tr>
<td>MRV 700</td>
<td>4.54</td>
<td>5.82</td>
<td>12°</td>
</tr>
<tr>
<td>MRV 800</td>
<td>5.21</td>
<td>8.27</td>
<td>5°</td>
</tr>
<tr>
<td>MRV 1100</td>
<td>4.91</td>
<td>7.05</td>
<td>5°</td>
</tr>
<tr>
<td>MRV 1400</td>
<td>5.56</td>
<td>9.35</td>
<td>5°</td>
</tr>
<tr>
<td>MRV 1800</td>
<td>5.56</td>
<td>9.35</td>
<td>5°</td>
</tr>
<tr>
<td>MRV 2800</td>
<td>5.56</td>
<td>9.35</td>
<td>5°</td>
</tr>
<tr>
<td>MRV 4500</td>
<td>6.13</td>
<td>10.47</td>
<td>7°</td>
</tr>
</tbody>
</table>

**ELECTRONIC DISPLACEMENT TRANSDUCER TECHNICAL DATA**

- **Max cont. pressure:** 36 psi (2.5 bar)
- **Supply voltage:** 18 - 24 Vdc - stab. ± 0.5%
- **Current consumption:** 10 mA
- **Output current:** 1 - 6 mA
- **Working temperature range:** da 0 a 60°C
- **Load impedance:** 1 kΩ
- **Reading displacement range:** 1:3
- **Protection degree:** IP 68
- **Precision F.S.** ± 1%

Female connector included in the supply 3x0.34 - length 2 m
RPC
FUNCTIONAL DESCRIPTION

The RPC hydraulic regulator keeps the motor working at a constant pressure while supplying a variable torque. The pressure value can be set in the range from 50 to 250 bar.

BASIC CIRCUITS

RPCSD - 1 code 229776
with pressure ≤2321 psi (160 bar) internal piloting

RPCSD - 1/X code 229777
with pressure >2321 psi (160 bar) external piloting

RPC5DT - 1 code 231217
with pressure ≤2321 psi (160 bar) internal piloting
max displacement remote control

RPC5DT - 1 code 231218
with pressure >2321 psi (160 bar) external piloting
max displacement remote control
RPC

USING GENERALITIES
A variable torque and speed, constant power system can be obtained by using the MRV - MRVE motor provided with the RPC constant pressure regulator along with a fixed displacement pump.

REGULATION SCHEME

HYDRAULIC CIRCUIT
RPC = motor constant pressure regulator
\[ P = Q \times p_{\text{max}} = \text{constant} \]
\[ M_1 \times n_1 = M_2 \times n_2 = \text{constant} \]

RPC

USING GENERALITIES
By replacing the fixed displacement pump with a variable one provided with a constant regulator, it is possible to obtain an enlargement of the torque and speed regulation range to constant power.

REGULATION SCHEME

HYDRAULIC CIRCUIT
RPCp = pump constant power regulator
RPCm = motor constant pressure regulator
\[ P = M_1 \times n_1 = M_2 \times n_2 = \text{constant} \]
STANDARD CONNECTION FLANGE
Code "C1"
Flange is supplied complete with screws and seals.

<table>
<thead>
<tr>
<th>MRD - MRDE</th>
<th>D (BSP)</th>
<th>H (inch)</th>
<th>CODE</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRV - MRVE</td>
<td></td>
<td></td>
<td>NBR</td>
<td>FPM</td>
</tr>
<tr>
<td>300 - 330</td>
<td>3/4&quot;</td>
<td>1.42</td>
<td>262 098</td>
<td>229 394</td>
</tr>
<tr>
<td>450 - 500</td>
<td>1 1/4&quot;</td>
<td>1.57</td>
<td>262 089</td>
<td>229 395</td>
</tr>
<tr>
<td>700 - 800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1100 - 1400</td>
<td>1 1/2&quot;</td>
<td>1.77</td>
<td>262 093</td>
<td>229 396</td>
</tr>
<tr>
<td>1800 - 2100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2800 - 3100</td>
<td>1 1/2&quot;</td>
<td>2.36</td>
<td>264 572</td>
<td>229 397</td>
</tr>
<tr>
<td>4500 - 5400</td>
<td>2&quot;</td>
<td>2.36</td>
<td>272 724</td>
<td>229 398</td>
</tr>
</tbody>
</table>

Permitted up to 6000 PSI

SAE CONNECTION FLANGE
Code "S1"
Code "T1"
Code "G1"
Code "L1"

Flange is supplied complete with screws and seals. FPM seals enquiry.

<table>
<thead>
<tr>
<th>MRD - MRDE</th>
<th>D (SAE)</th>
<th>H (inch)</th>
<th>CODE</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRV - MRVE</td>
<td></td>
<td></td>
<td>NBR</td>
<td>FPM</td>
</tr>
<tr>
<td>500 - 530</td>
<td>3/4&quot;</td>
<td>0.748</td>
<td>19 mm</td>
<td>1.42</td>
</tr>
<tr>
<td>450 - 500</td>
<td>1&quot;</td>
<td>0.984</td>
<td>25 mm</td>
<td>1.57</td>
</tr>
<tr>
<td>700 - 800</td>
<td></td>
<td></td>
<td></td>
<td>1.77</td>
</tr>
<tr>
<td>1100 - 1400</td>
<td>1 1/4&quot;</td>
<td>1.220</td>
<td>31 mm</td>
<td>1.77</td>
</tr>
<tr>
<td>1800 - 2100</td>
<td></td>
<td></td>
<td></td>
<td>1.92</td>
</tr>
<tr>
<td>2800 - 3100</td>
<td>1 1/2&quot;</td>
<td>1.457</td>
<td>37 mm</td>
<td>2.36</td>
</tr>
<tr>
<td>3600 - 3900</td>
<td></td>
<td></td>
<td></td>
<td>2.84</td>
</tr>
<tr>
<td>4800 - 5400</td>
<td>2&quot;</td>
<td>1.969</td>
<td>50 mm</td>
<td>2.36</td>
</tr>
</tbody>
</table>

BSP threads to ISO 228/1
COUPLINGS

For standard male splined shaft version "N1" (see page 26).

ADAPTERS WITH KEY

For standard male splined shaft version "N1" (see page 26).

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The specified data are for product description purposes only and must not be interpreted as warranted characteristic in a legal sense. All rights reserved. Subject to revision.

### HOLDING BRAKE UNIT DIMENSIONS - MOTOR TYPE MRD - MRDE - MRV - MRVE

<table>
<thead>
<tr>
<th>BRAKE TYPE</th>
<th>B 300</th>
<th>B 450</th>
<th>B 700</th>
<th>B 1100</th>
<th>B 1800</th>
<th>B 2800</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR TYPE</td>
<td>MRD - MRDE</td>
<td>300 - 330</td>
<td>450 - 500</td>
<td>700 - 800</td>
<td>1100 - 1400</td>
<td>1800 - 2100</td>
</tr>
</tbody>
</table>

| L1 | L2 | L3 | L4 | L5 | L6 | L7 | L10 | L11 | L21 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D12 | D13 | T10 | α1 | α2 |
|----|----|----|----|----|----|----|-----|-----|-----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| B 300 | 5.35 | - | 0.98 | 0.59 | 3.19 | 1.65 | 1.56 | 0.63 | 3.39 | 2.36 | 1.81 | 10.06 | 9.13 | 6.89 | - | G1/4” | G3/8” | 0.41 | M12 | B 8x42x45 | ex DIN 5463 | 1.10 | 22°30’ | 22°30’ |
| B 450 | 5.79 | - | 1.06 | 0.59 | 3.82 | 1.95 | 1.42 | 0.94 | 3.94 | 2.91 | 2.22 | 11.66 | 10.47 | 7.48 | - | G1/4” | G3/8” | 0.53 | M12 | B 8x46x54 | ex DIN 5463 | 1.10 | 22°30’ | 22°30’ |
| B 700 | 6.77 | - | 1.10 | 0.59 | 3.98 | 2.17 | 1.81 | 0.98 | 4.13 | 3.07 | 2.44 | 12.60 | 11.42 | 8.66 | - | G1/4” | G3/8” | 0.53 | M12 | B 8x52x60 | ex DIN 5463 | 1.10 | 22°30’ | 22°30’ |
| B 1100 | 7.40 | 0.79 | 1.02 | 0.94 | 4.60 | 2.80 | 53.5 | 1.88 | 4.72 | 3.46 | 2.83 | 14.17 | 12.99 | 9.84 | 4.72 | G1/4” | M16 x1.5 | 0.59 | M12 | B 8x62x72 | ex DIN 5463 | 1.10 | 0° | 0° |
| B 1800 | 8.50 | - | 1.10 | 0.83 | 5.20 | 63.5 | 58.5 | 1.34 | 5.31 | 3.94 | 3.11 | 16.85 | 14.96 | 11.42 | - | G1/4” | G1/2” | 0.69 | M12 | B 10x72x72 | ex DIN 5463 | 1.10 | 22°30’ | 22°30’ |
| B 2800 | 10.35 | - | 1.18 | 0.94 | 153 | 87 | 67 | 42.5 | 165 | 120 | 99 | 19.45 | 17.32 | 13.19 | - | G1/4” | G1/2” | 0.75 | M12 | B 10x82x82 | ex DIN 5463 | 1.10 | 22°30’ | 22°30’ |

α1, α2 Corresponding angles to the release ports 1 and 2, to case the drain ports 1 and 2

Same dimensions standard male splined shaft version "N1" (see page 30)

- **D1**: Reference diameter
- **D2**: Diameter of the blind hole
- **D3**: Diameter of the tapped hole
- **D4**: Diameter of the screw
- **D5**: Diameter of the thread
- **D6**: Diameter of the boss
- **D7**: Diameter of the bolt
- **D8**: Diameter of the screw
- **D9**: Diameter of the screw
- **D12**: Diameter of the screw
- **D13**: Diameter of the screw
- **T10**: Taper length

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**TECHNICAL DATA**

(For operation outside these parameters, please consult **DENISON Calzoni**)

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>B 300</th>
<th>B 450</th>
<th>B 700</th>
<th>B 1100</th>
<th>B 1800</th>
<th>B 2800</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATIC BRAKING TORQUE lbf.ft</td>
<td>1328</td>
<td>1955</td>
<td>2950</td>
<td>4573</td>
<td>8408</td>
<td>12612</td>
</tr>
<tr>
<td>DYNAMIC BRAKING TORQUE lbf.ft</td>
<td>885</td>
<td>1069</td>
<td>1623</td>
<td>3098</td>
<td>4610</td>
<td>8851</td>
</tr>
<tr>
<td>RELEASE PRESSURE psi</td>
<td>406</td>
<td>392</td>
<td>392</td>
<td>392</td>
<td>435</td>
<td>435</td>
</tr>
<tr>
<td>MAX. OPERATING PRESSURE psi</td>
<td>6092</td>
<td>6092</td>
<td>6092</td>
<td>6092</td>
<td>6092</td>
<td>6092</td>
</tr>
<tr>
<td>MOMENT OF INERTIA OF ROTATING PARTS lbf.ft²</td>
<td>0.147</td>
<td>0.688</td>
<td>1.020</td>
<td>1.448</td>
<td>4.746</td>
<td>6.407</td>
</tr>
<tr>
<td>WEIGHT lb</td>
<td>86</td>
<td>119</td>
<td>163</td>
<td>220.5</td>
<td>348.5</td>
<td>577.5</td>
</tr>
</tbody>
</table>

**MOTOR TYPE** MRD - MRDE - MRV - MRVE

<table>
<thead>
<tr>
<th>MOTOR TYPE</th>
<th>MRD</th>
<th>MRDE</th>
<th>MRV</th>
<th>MRVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example: **BRAKE - B 450 - N1 V1**

**CODE**

1. **BRAKE - B 450 N1 V1**

BRAKE TYPE

- B 180 Brake for motor size "C"
- B 300 Brake for motor size "D"
- B 450 Brake for motor size "E"
- B 700 Brake for motor size "F"
- B 1100 Brake for motor size "G"
- B 1800 Brake for motor size "H"
- B 2800 Brake for motor size "I"

2. **BRAKE - B 450 - N1 V1**

SHAFT

- N1 Spline ex DIN 5463 (see page 30)
- D1 * Spline DIN 5480 (see page 30)
- F1 * Female spline DIN 5480 (see page 31)

* please contact **DENISON Calzoni**

3. **BRAKE - B 450 - N1 V1**

SEALS

- N1 NBR: mineral oil
- V1 * FPM seals
- U1 No shaft seal (for brake)

* please contact **DENISON Calzoni**

4. **BRAKE - B 450 - N1 V1**

SPECIAL

- ** Space reserved to Denison Calzoni
**Mounting**

Any mounting position
- Note the position of the case drain port (see below)

Install the motor properly
- Mounting surface must be flat and resistant to bending

Min. tensile strength of mounting screws to DIN 267 Part 3 class 10.9
- Note the prescribed fastening torque

**Pipes, pipe connections**

Use suitable screws!
- Depending on type of motor use either threaded or flange connection

Choose pipes and hoses suitable for the installation
- Please note manufacturing data!

Before operation fill with hydraulic fluid
- Use the prescribed filter!

**NOTE:** Two of the mounting screws must be precisely located/fitted if operation is started and stopped frequently or if high reversible frequencies exist.

---

**DRAIN AND FLUSHING LINK INSTALLATION EXAMPLES**

**Note:** Position the case drain pipe, so that the motor cannot run empty.

**Installation instructions for motors of the series "MRD - MRDE - MRV - MRVE"**

Low pressure case drain returns to tank. (release to bleed)

- Bleed point
- Tank located in higher position
- N° 2 locking screw for bleed point (on enquiry)
- Cooling circuit for high power continuous operation
- **Flushing** $p_{\text{max}} = 5$ bar

*) Special designs for applications, where the equipment needs to be filled with oil (e.g. in a salty atmosphere)

**Installation instructions for motors of the series "MRD - MRDE - MRV - MRVE with brakes"**

Low pressure case drain returns to tank.

- Tank located in higher position
- N° 2 locking screw for bleed point (on enquiry)
- Cooling circuit for high power continuous operation
- **Flushing** $p_{\text{max}} = 5$ bar

Motors without shaft seal used with brake

**T** = Seal
**Y** = Motor housing feeding line
$\rightarrow$ = Bleed
### ORDERING CODE - MOTOR TYPE MRD - MRDE - MRV - MRVE

#### CODE

1. **MRD 700 F 340 N1 M1 F1 N1 N**

   **SERIES**

2. **MRD 700 F 340 N1 M1 F1 N1 N**

   **SIZE & DISPLACEMENT**

<table>
<thead>
<tr>
<th>D</th>
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<th>MRDE 800 F 390</th>
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<th>MRDE 1400 G 620</th>
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3. **MRD 700 F 340 N1 M1 F1 N1 N**

   **SHAFT**

   - N1: spline ex DIN 5463 (see page 30)
   - D1: spline DIN 5480 (see page 30)
   - F1: female spline DIN 5480 (see page 31)
   - P1: shaft with key (see page 31)
   - B1: spline B.S. 3550 (see page 30)

4. **MRD 700 F 340 N1 M1 F1 N1 N**

   **SPEED SENSOR OPT ION**

   - N1: none
   - Q1: encoder drive (see page 32)
   - C1: mechanical tachometer drive (see page 32)
   - T1: tachogenerator drive (see page 32)
   - M1: incremental Elcis encoder (500 pulse/rev) (see page 32)
   - B1: Uni-directional
   - Bi-directional

5. **MRD 700 F 340 N1 M1 F1 N1 N**

   **SEALS**

   - N1: NBR mineral oil
   - F1: NBR, 218 psi shaft seal
   - V1: FPM seals
   - U1: no shaft seal (for brake)

6. **MRD 700 F 340 N1 M1 F1 N1 N**

   **CONNECTION FLANGE**

   - N1: none
   - C1: standard DENISON Calzoni (see page 40)
   - S1: standard SAE metric (see page 40)
   - T1: standard SAE UNC (see page 40)
   - G1: SAE 6000 psi metric (see page 40)
   - L1: SAE 6000 psi UNC (see page 40)

7. **MRD 700 F 340 N1 M1 F1 N1 N**

   **ROTATION**

   - N: standard rotation (CW: inlet in A, CCW: inlet in B)
   - S: reversed rotation (CW: inlet in B, CCW: inlet in A)

8. **MRD 700 F 340 N1 M1 F1 N1 N**

   **SPECIAL**

   **** space reserved to Denison Calzoni
NOTES - MOTOR TYPE MRD - MRDE - MRV - MRVE
International Distributors

### Asia-Pacific

<table>
<thead>
<tr>
<th>Country</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Denison Hydraulics PTY 41-43 St Hilliers Road P.O.Box 192 Auburn N.S.W. 2144, Australia Tel: +61 (2) 9646 5200 Fax: +61 (2) 9643 1305</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Denison Hydraulics Ltd. Unit 6A, 33/F Cable TV Tower 9 Ho Shing Road, Tsuen Wan NT, Hong Kong Tel: +852 2498 8381 Fax: +852 2499 1522</td>
</tr>
<tr>
<td>Japan</td>
<td>Denison Japan Inc. 4-2-1 Tsujido-Shinmachi Fujisawa 251, Japan Tel: +(81) (466) 35-3050 Fax: +(81) (466) 35-2019</td>
</tr>
<tr>
<td>China</td>
<td>Denison Hydraulics Engineering Ltd. Room 8018, No. 601, Zhang Yang Road Pudong New Area Shanghai 200120, China Tel: +86 (21) 58205042 / 58205034 Fax: +86 (21) 58205014</td>
</tr>
<tr>
<td>Singapore</td>
<td>Denison Hydraulics Sea Pte LTD Blk 59/06-12 Ang Mo Kio Industrial Park 2A Singapore 567760 Tel: +65 6268 7840 Fax: +65 6268 7847</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Denison Hydraulics LTD 6F-10, No. 79,Sec. 2 Roosevelt Road, Taipei Tel: +65 268 7840 Fax: +65 268 7847</td>
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### Europe

<table>
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<tr>
<th>Country</th>
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<tbody>
<tr>
<td>Austria</td>
<td>Denison Hydraulics GmbH Zweigniederlassung Linz Halbarchstraße 69 4061 Pasching, Austria Tel: +43 (72 29) 48 87 Fax: +43 (72 29) 6 30 92</td>
</tr>
<tr>
<td>Benelux</td>
<td>Denison Hydraulics Benelux B.V. Pascalstraat 100 3316 GR Dordrecht, Holland Tel: +31 (78) 6179 900 Fax: +31 (78) 6175 765</td>
</tr>
<tr>
<td>Denmark</td>
<td>Denison Hydraulics Denmark A/S Industrikrogen 2 2635 Ishøj, Denmark Tel: +45 (4371) 15 00 Fax: +45 (4371) 15 16</td>
</tr>
<tr>
<td>Finland</td>
<td>Denison Lokomec Oy Pulumäenkatu 22 P.O.Box 116 33721 Tampere, Finland Tel: +358 (3) 3575 100 Fax: +358 (3) 3575 111</td>
</tr>
<tr>
<td>France</td>
<td>Denison Hydraulics France S.A. 14 route du bois blanc BP 539 18105 Vierzon, Cedex, France Tel: +33 (2) 48 53 01 20 Fax: +33 (2) 48 75 02 91</td>
</tr>
<tr>
<td>Great Britain</td>
<td>Denison Hydraulics UK LTD Kenmore road Wakefield 41, Industrial Park Wakefield, WF2 OXE West Yorkshire, England Tel: +44 (1924) 826 021 Fax: +44 (1924) 826 146</td>
</tr>
<tr>
<td>Germany</td>
<td>Denison Hydraulik GmbH. Auf dem Sand 14 D-40721 Hilden, Germany Tel: +49 (2103) 940 300 Fax: +49 (2103) 940 558</td>
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### North America

<table>
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<tr>
<th>Country</th>
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<tbody>
<tr>
<td>Canada</td>
<td>Denison Hydraulics Canada Inc. 2880 Brighton Road, Unit 1 Oakville, ON L6H 5S3, Canada Tel: +1 (905) 829 5800 Fax: +1 (905) 829 5805</td>
</tr>
<tr>
<td>Mexico, Central America, South America, Caribbean countries</td>
<td>Denison Hydraulics Corp. 6167 NW 181 Terrace Circle North Miami, FL 33015, USA Tel: +1 (305) 362 2246 Fax: +1 (305) 362 2246</td>
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### Others

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<td>Other European, Middle East, African countries</td>
<td>Denison Hydraulics France S.A. 14 route du bois blanc BP 539 18105 Vierzon, France Tel: +33 (2) 48 53 01 20 Fax: +33 (2) 48 53 01 46</td>
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**Your local Denison Hydraulics representative**

![Denison Calzoni S.p.a.](image-url)

Denison Calzoni S.p.a. Via Caduti di Sabbiuno 15/17 40011 Anzola dell’Emilia Bologna Italy Tel: +39 (051) 6501611 Fax: +39 (051) 736221 e-mail: rco@rco.it