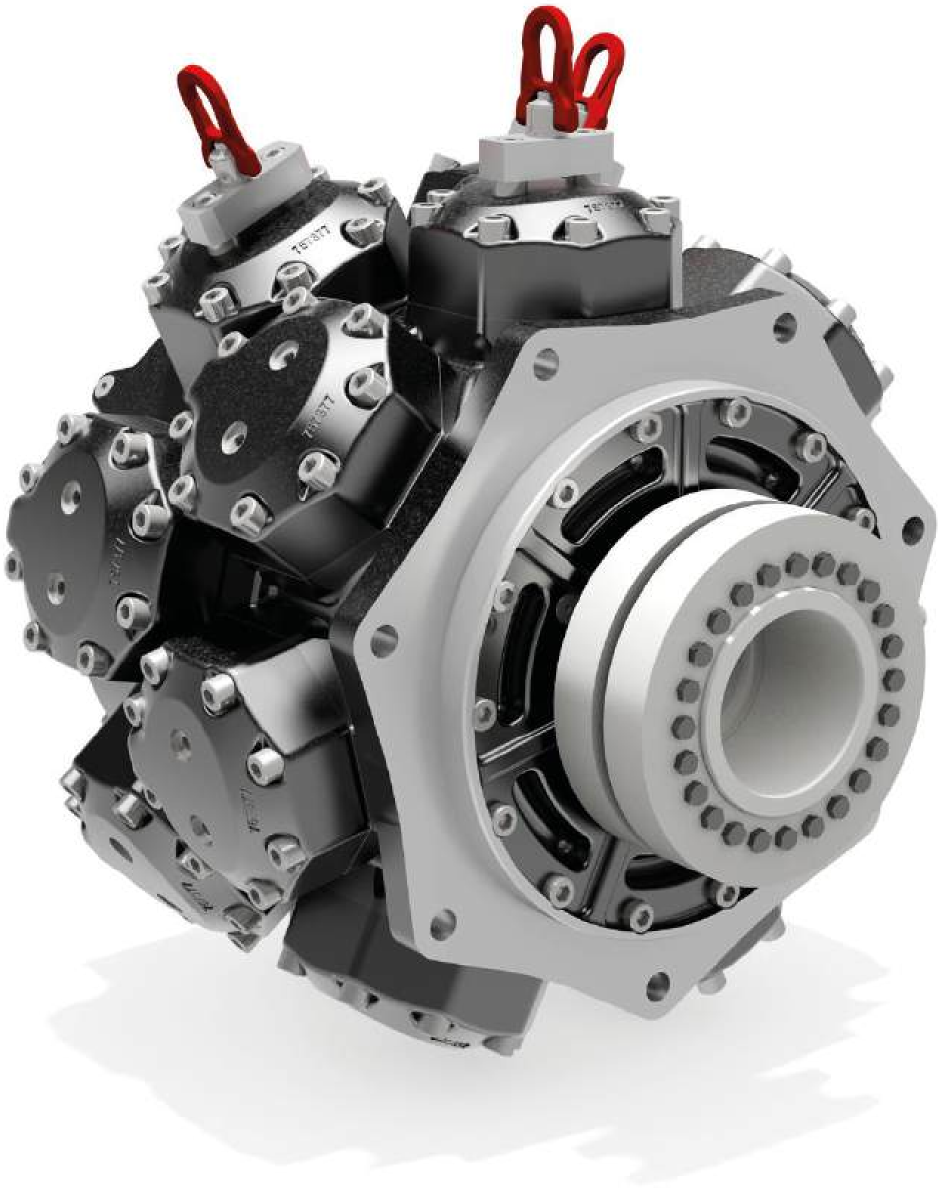


High Torque Radial Piston Motors MRT Type

Fixed displacement (up to 53250 cm^3/rev)

CALZONI HYDRAULICS

Conversion factors

1 kg .... 2.20 lb
1 N .... 0.225 lbf
1 Nm .... 0.738 lbf ft
1 bar ....14.5 psi
1 l ....0.264 US gallon
1 cm3 ....0.061 cu in
1 mm .... 0.039 in
1 °C .... (5/9)(°F-32)
1 kW .... 1.34 hp

Conversion factors

1 lb .... 0.454 kg
1 lbf ....4.448 N
1 lbf ft ....1.356 Nm
1 psi .... 0.068948 bar
1 US gallon .... 3.785 l
1 cu in 16.387 cm3
1 in .... 25.4 mm
1 °F .... (9/5)(°C) + 32
1 hp .... 0.7457 kW

WARNING – USER RESPONSIBILITY

This document and other information from Calzoni Hydraulics provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Calzoni Hydraulics.

To the extent that Calzoni Hydraulics provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

Content

Page

General Information

Calzoni MRT hydraulic motors are of the radial piston type. Unique Fluid Column Technology is utilized to achieve superior performances compared to competitive designs. The motors are engineered for high mechanical and volumetric efficiency over a wide range of speed and torque

Due to their special design, the MRT motors deliver their maximum performance when the application requires high torque values. The MRT motors combine precise and smooth movements, both at low speed and during acceleration and deceleration transitions.
In addition, the high starting torque (up to 96 %) allows the user to select a smaller displacement of the motor, optimizing the size of all the other system's components

Other typical characteristics of MRT motors are:
- high volumetric and mechanical efficiency
- high starting torque
- high resistance to thermal shock
- very low operating noise levels
- suitable for fire-resistant and biologically degradable fluids
- extremely well suited for control engineering applications
- reversible operation (motor and pump)

MRT motors are grouped into 5 different frame sizes, corresponding to 24 standard displacements available.

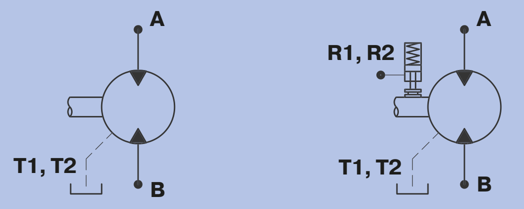
Motors can be customized by selecting different types of shafts, speed sensors, seals, and connection flanges.
Optional accessories include parking brakes (available for frame size P and R).
Furthermore, MRT motors can be equipped with optional built-on manifold blocks (cross relief, anti-cavitation, flushing and drain valves) to suit the customer needs.

To ensure high quality production standards, we maintain a Quality Assurance System, certified to standard EN ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2015.

The product has been approved by ABS for use on ABS classed vessels.

ATEX version is available for use in potentially explosive atmospheres (Directive 2014/34/EU).

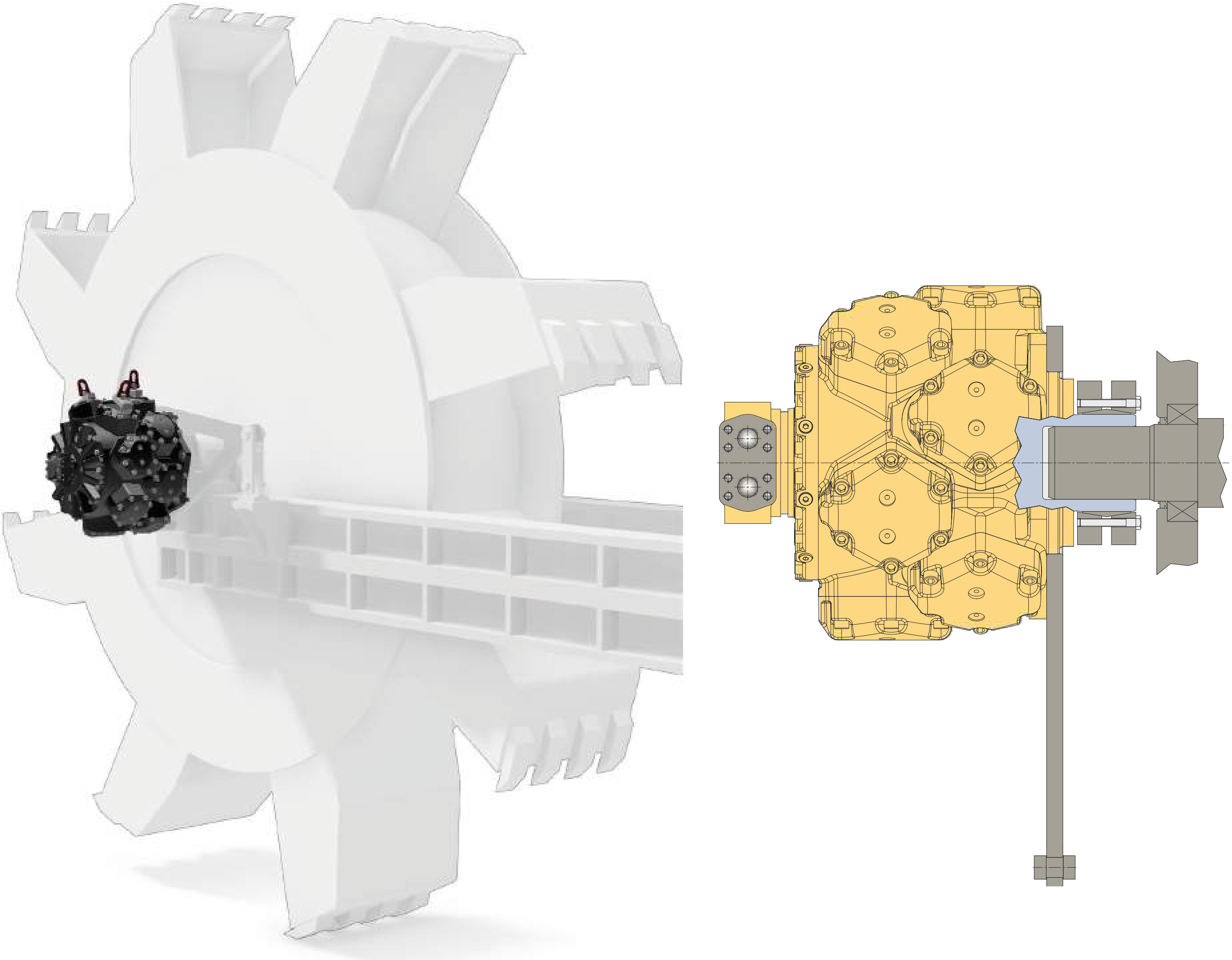
Hydraulic symbols



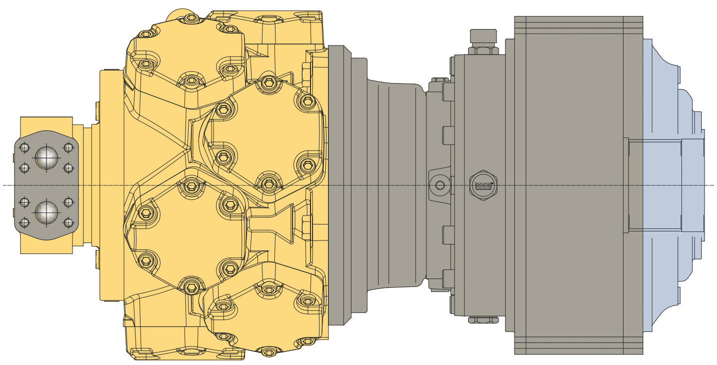
Motor without brake *Motor with brake*

Hydraulic motor	
Construction	Fixed displacement radial piston motors, fluid column type
Mounting type	Flange, shrink disk
Maximum pressure	Up to 420 bar (6000 psi) (¹)
Displacement	Up to 53250 cm³/rev (3250 in³/rev)
Torque	Up to 210000 Nm (154900 lbf.ft)
Temperature range	-30 to +80 °C (-22° to +176°F)
Direction of rotation	Reversible (clockwise / counterclockwise)
Operation type	Reversible (motor and pump) (²)
(¹) = Peak value, see operating diagrams for complete motor parameters; (²) = Charge pressure is required during pumping operation.	

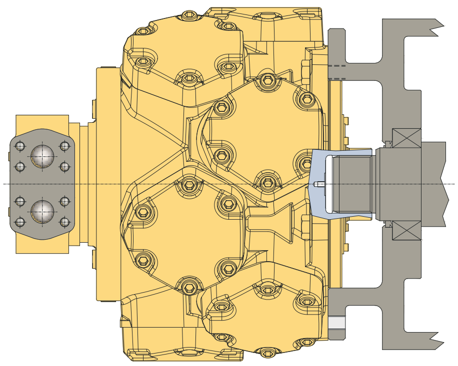
Examples of installations



Torque arm mounted motor with shrink disk (bucket wheel)



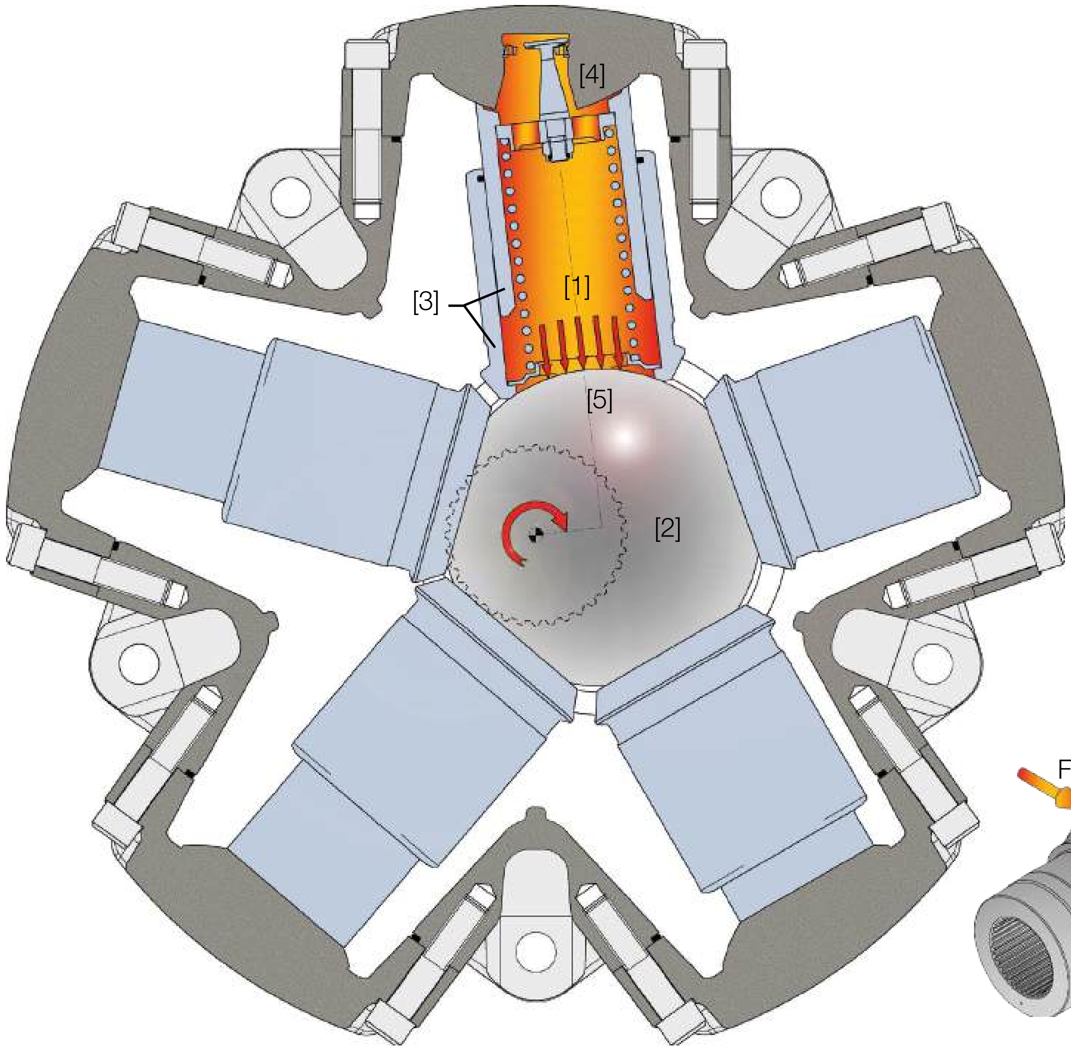
Flange mounted motor with gearbox and parking brake

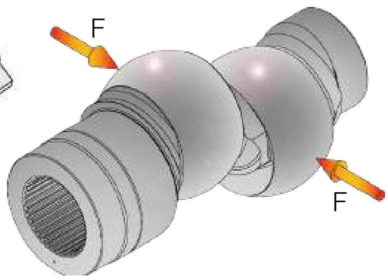


Flange mounted motor

Propulsion: "The fluid column technology" and "The double eccentric cam design"

The main concept of this unique and outstanding technology is to convert fluid power (pressure and flow) into mechanical power (torque and speed) by means of pressurized columns of fluid [1] which act directly on a spherical eccentric shaft [2], thereby avoiding the use of conventional connecting rods, pistons, and pins.





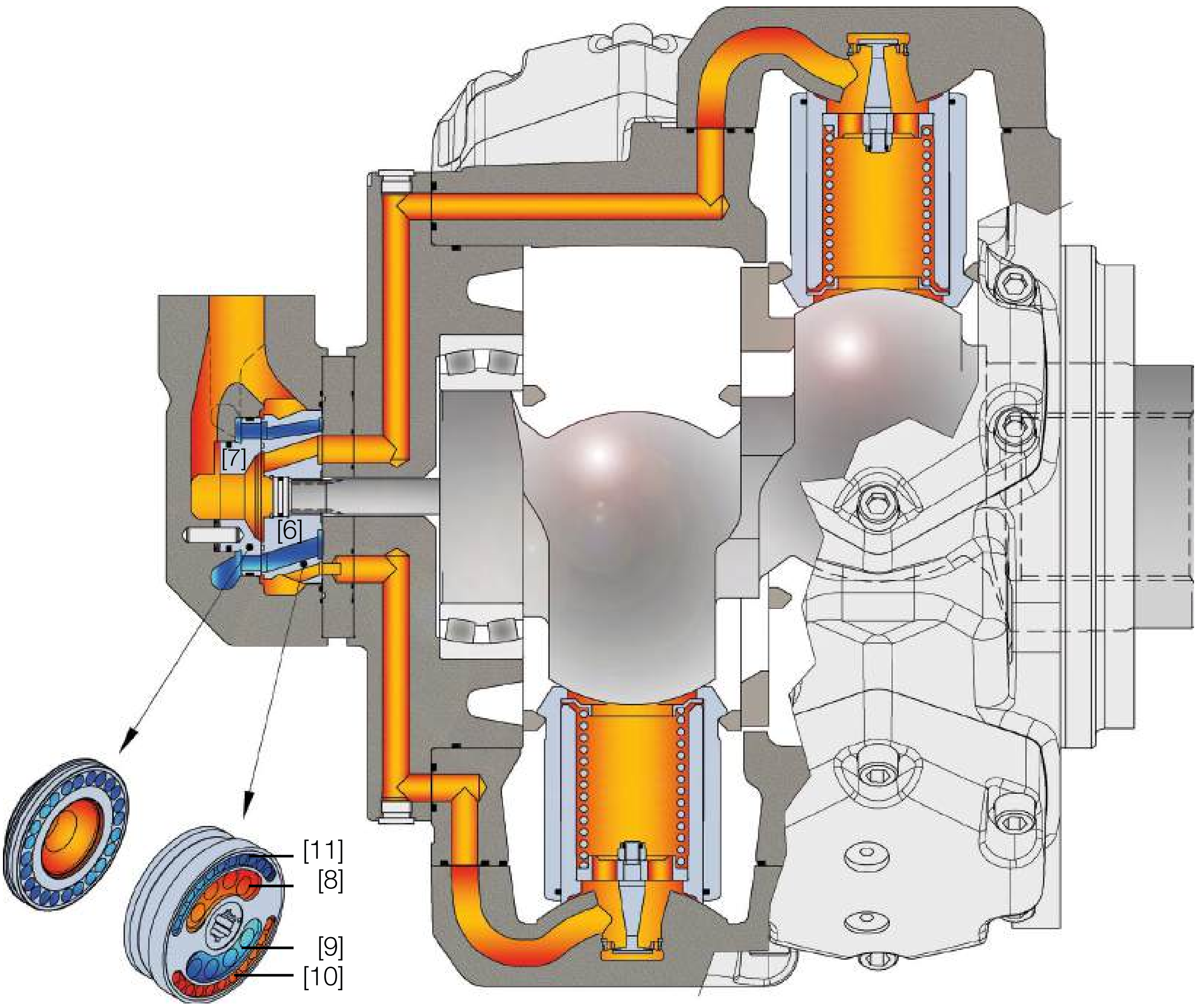
Torque is generated by the columns of pressurized fluid [1] that directly push the eccentric cam [2] producing the shaft rotation.

In each propulsion unit, the pressurized fluid is contained within a telescopic cylinder [3] that is sealed by two spherical surfaces, one on the propulsion cover [4] and one on the eccentric shaft [5]. The two spherical surfaces guide the telescopic cylinder so that no side forces are generated during the shaft rotation. Thanks to the limited friction and wear caused by the "metal to metal" contact, the fluid column propulsion system guarantees high values of volumetric and mechanical efficiency, combined with smooth and precise movements of the motor shaft, even at the lowest speeds.

The double eccentric design is such to have two opposed and self balancing radial forces (F) acting on the cams, resulting in a close to zero reaction on bearings. This unique design guarantees extremely long bearings lifetime and high reliability in demanding applications (up to 3 time drive lifetime versus competitors).

Timing system: “The balanced forces concept”

The timing system - consisting of the rotary valve [6] and the reaction ring [7] - supplies the columns of fluid precisely in the correct sequence to generate a smooth motor output torque. While the reaction ring is used to adjust the clearance and to compensate for thermal shocks, the rotary valve rotates at the same speed as the eccentric shaft and connects the reaction ring to the piston chambers by means of two slots [8] and [9]. Two additional balancing slots [10] and [11] cancel the tilting moments (patented), feeding at the same time fluids to the second row of pistons.



Product philosophy: “Design for performance and durability”

The human intelligence has always been applied to design mechanisms in which the movements and forces are the result of different components working together providing stresses and strains against each other.
Our product philosophy has allowed us to achieve the balancing of each of these movements, making our motors more efficient and resistant to wear and tear over time.

Newton’s Third Law
“For every action, there is an equal and opposite reaction”: inside our motors, we hydraulically transmit and balance forces to generate high torque values combined with low friction and high efficiency.

Calculation fundamentals

Required flow: $Q = \dfrac{V \times n}{1000 \times \eta_v}$ (l/min)

Output torque: $M = \dfrac{V \times \Delta p \times \eta_m}{62.8} = T_S \times \Delta p$ (N.m)

Output power: $P = \dfrac{Q \times \Delta p \times \eta_t}{600} = \dfrac{M \times n}{9549}$ (kW)

V = displacement (cm³/rev)
n = speed (rpm)
T_S = specific torque (Nm/bar)
Δp = differential pressure (bar)
η_v = volumetric efficiency
η_m = mechanical efficiency
η_t = overall efficiency

Technical data

MOTOR TYPE	DISPLA-CEMENT	SPECIFIC TORQUE	MAXIMUM PRESSURE				MAXIMUM SPEED		MAXIMUM OUTPUT POWER		WEIGHT
							flushing		flushing		
			CONT.	IN-TER.	PEAK	A+B	without*	with	without*	with	
	cc/rev	Nm/bar	bar	bar	bar	bar	rpm	rpm	kW	kW	kg**
MRT 7100 P	7100	113	250	300	420		75	150	200	330	
MRTF 7800 P	7809	124	210	250	350		70	130	174	280	
MRTE 8500 P	8517	136					60	120	164	290	
MRT 9000 P	9005	143	250	300	420	400	70	130	235	370	920
MRTF 9900 P	9904	158	210	250	350		60	120	185	300	
MRTE 10800 P	10802	172					65	110	216	310	
MRTA 12000 P	12012	191	190	230	330		60	105	203	290	
MRT 13000 R	12921	206					65	110	220	355	
MRT 14000 R	13935	222	250	300	420		60	105	220	365	
MRTF 15200 R	15194	242				400	55	95	220	365	1490
MRTE 16400 R	16453	262					50	85	220	365	
MRTA 17500 R	17488	278	230	280	400		40	70	220	345	
MRT 17000 Q	16759	267	250	300	420		40	70	260	371	
MRTF 18000 Q	18025	287	210	250	350		35	65	208	316	
MRT 19500 Q	19508	310	250	300	420		35	60	269	371	
MRTE 20000 Q	19788	315				400	35	60	228	316	3100
MRTF 21500 Q	21271	339	210	250	350		30	55	211	311	
MRTE 23000 Q	23034	367					30	50	225	306	
MRTA 26000 Q	26029	414	190	230	330		25	40	150	258	

MOTOR TYPE	DISPLA-CEMENT	SPECIFIC TORQUE	MAXIMUM PRESSURE				MAXIMUM SPEED		MAXIMUM OUTPUT POWER		WEIGHT
							flushing		flushing		
			CONT.	IN-TER.	PEAK	A+B	without*	with	without*	with	
	cc/rev	Nm/bar	bar	bar	bar	bar	rpm	rpm	kW	kW	kg**
MRTA 30000 T	30030	478	190	230	330	400	25	35	155	262	3300
MRTA 35000 T	35025	557					20	30	155	270	
MRT 40000 U	40400	643	250	300	420	400	18	30	220	340	5000
MRT 50000 U	49876	794	250	300	420		15	25	260	375	
MRTE 53000 U	53256	848	210	250	350		15	20	165	280	

** Motors with female output shaft option are considered for weight calculation.

Definitions

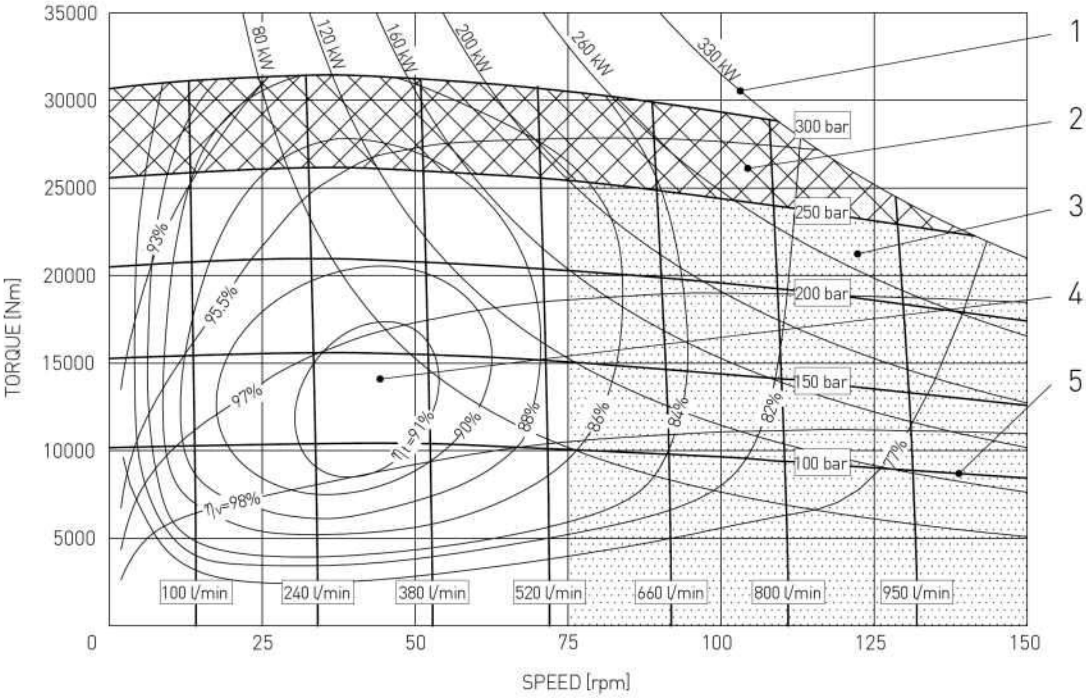
- Continuous pressure ($p_{cont.}$): Maximum pressure during continuous working operations.
- Intermittent pressure ($p_{int.}$): Maximum pressure during non-continuous operations (intermittent pressure may occurr max 10 % of duty cycle and not more then 20 consecutive seconds inside each cycle).
- Peak pressure (p_{peak}): Pressure exceeding the maximum operating pressure for a short time at which the motor remains able to function (milliseconds corresponding to the reaction time of the system relief valve).
- Additional pressure (p_{A+B}): Maximum sum of inlet pressure and outlet pressure.

Operating Diagram

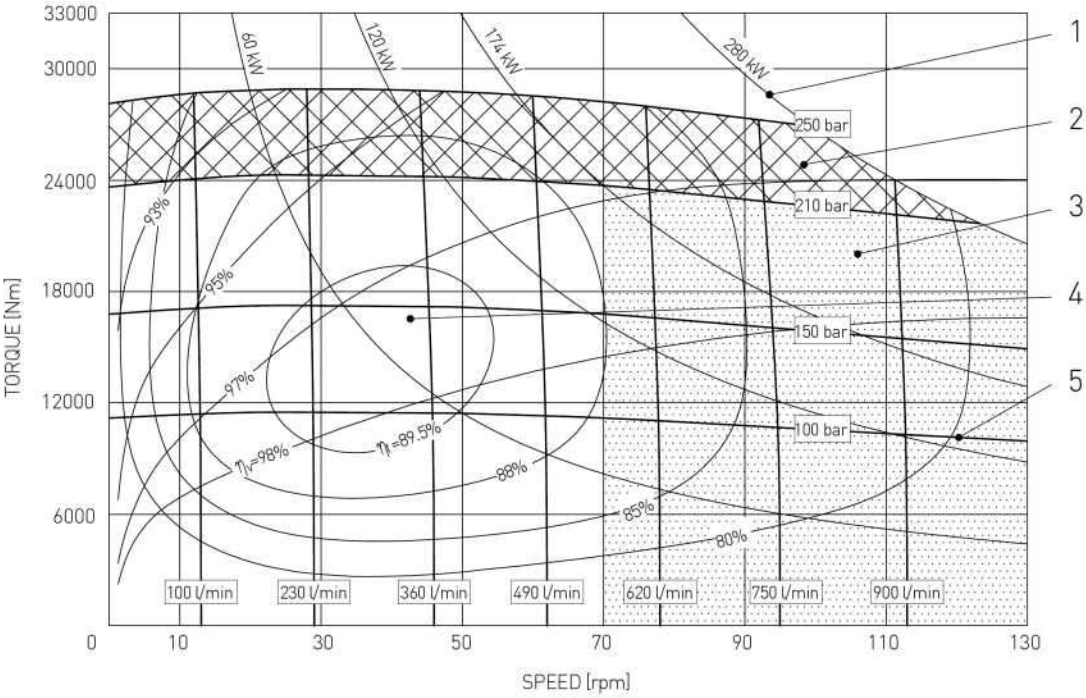
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRT 7100 P



MRTF 7800 P

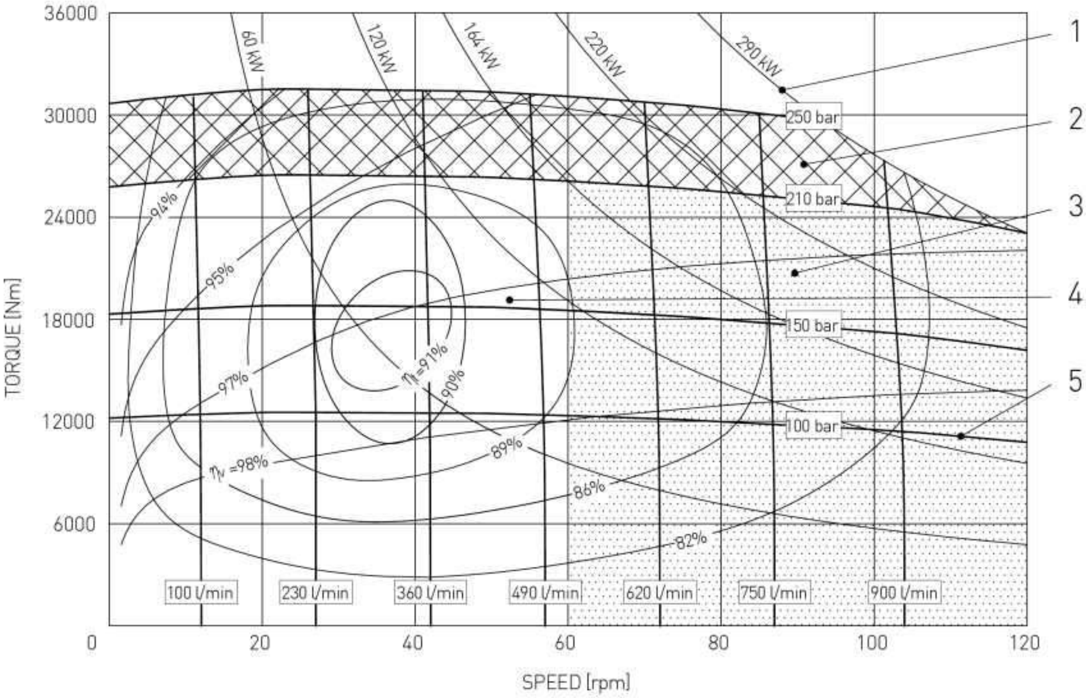


Operating Diagram

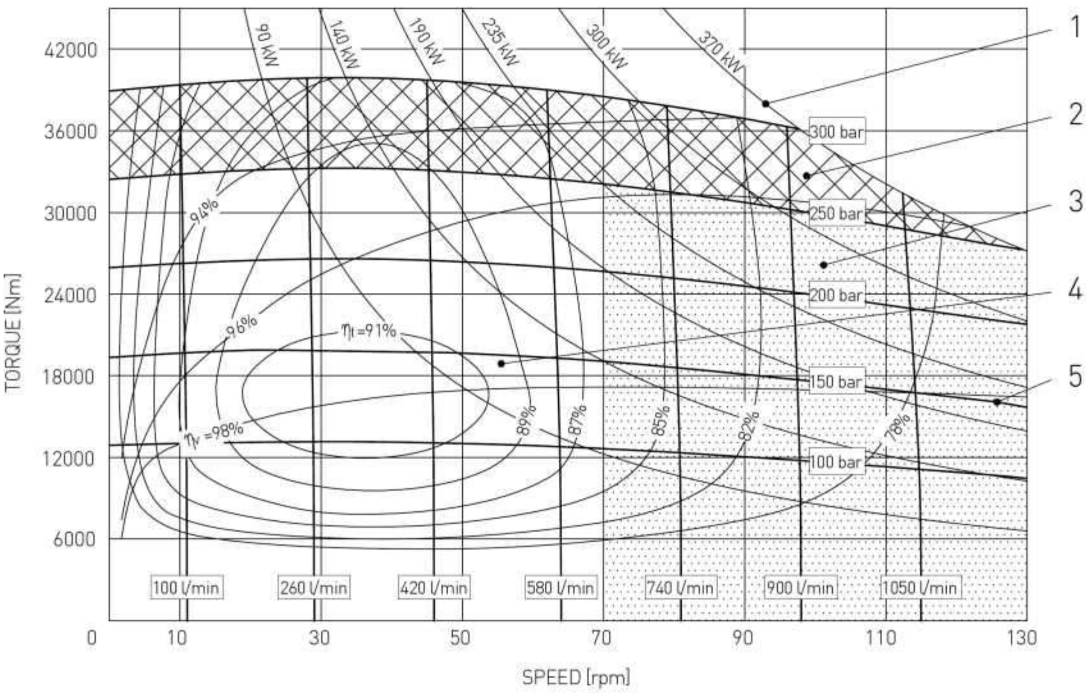
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRTE 8500 P



MRT 9000 P

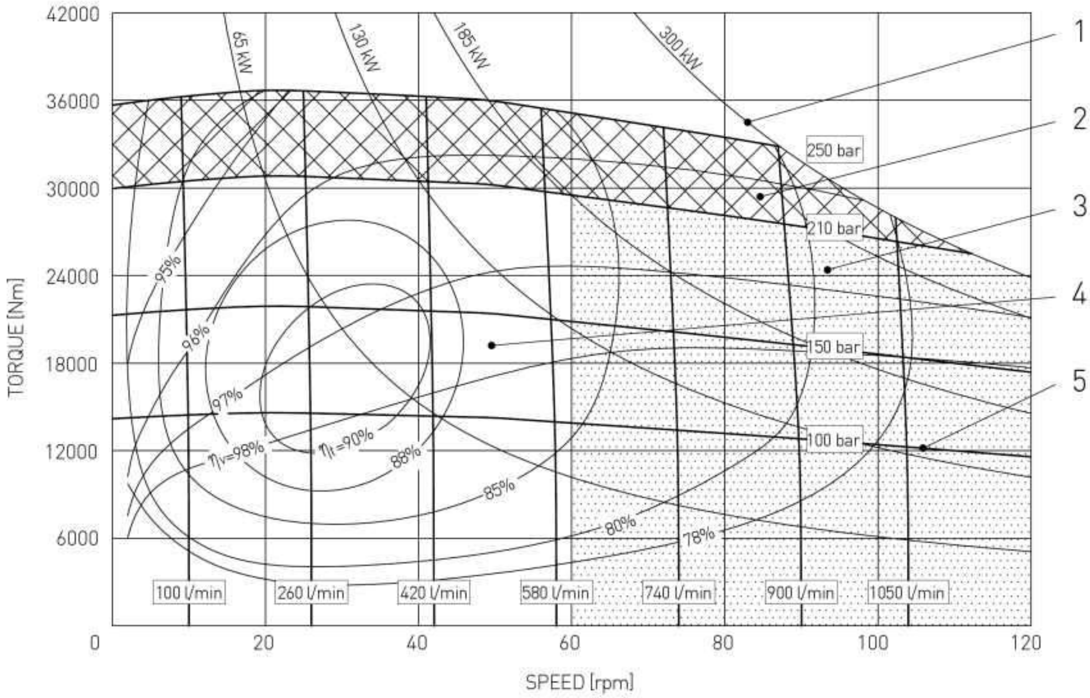


Operating Diagram

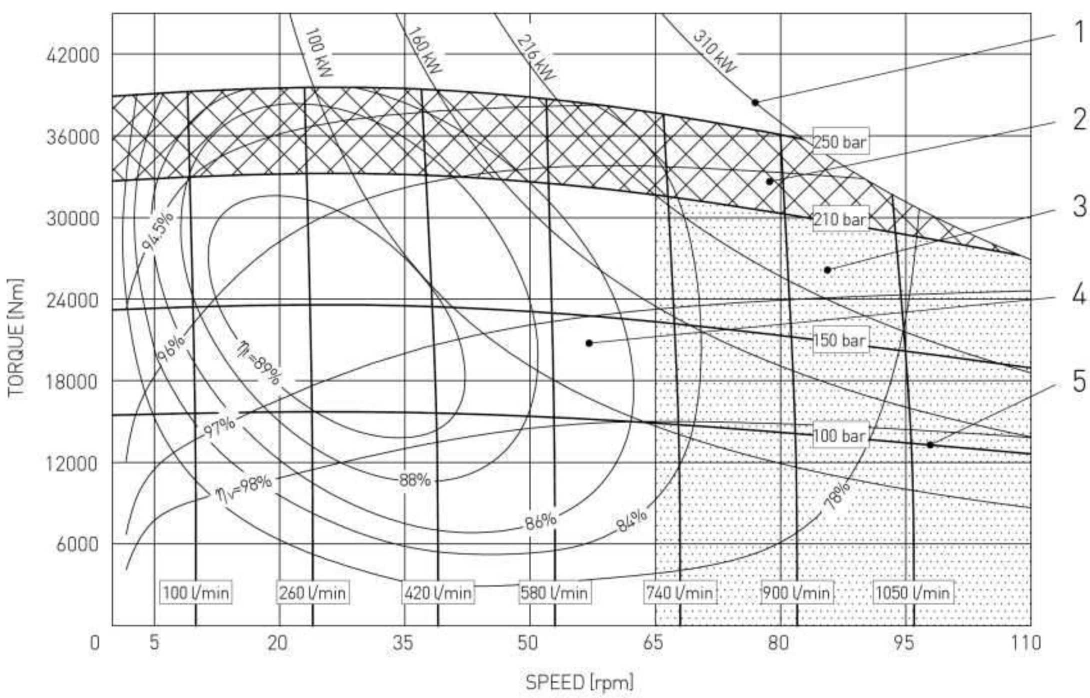
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRTF 9900 P



MRTE 10800 P

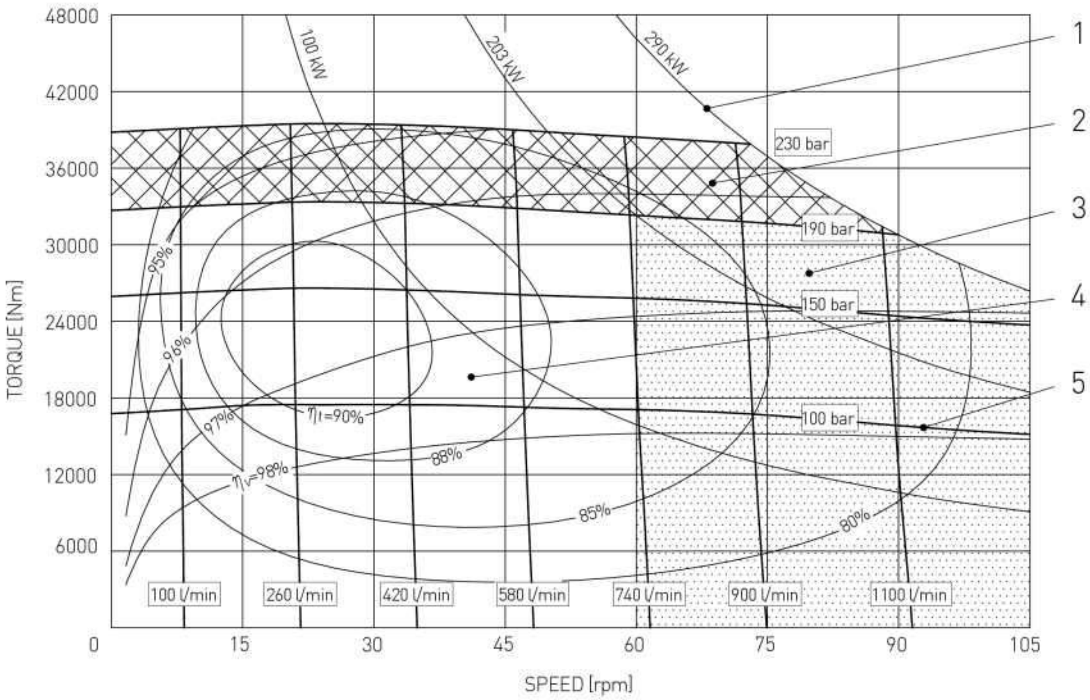


Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

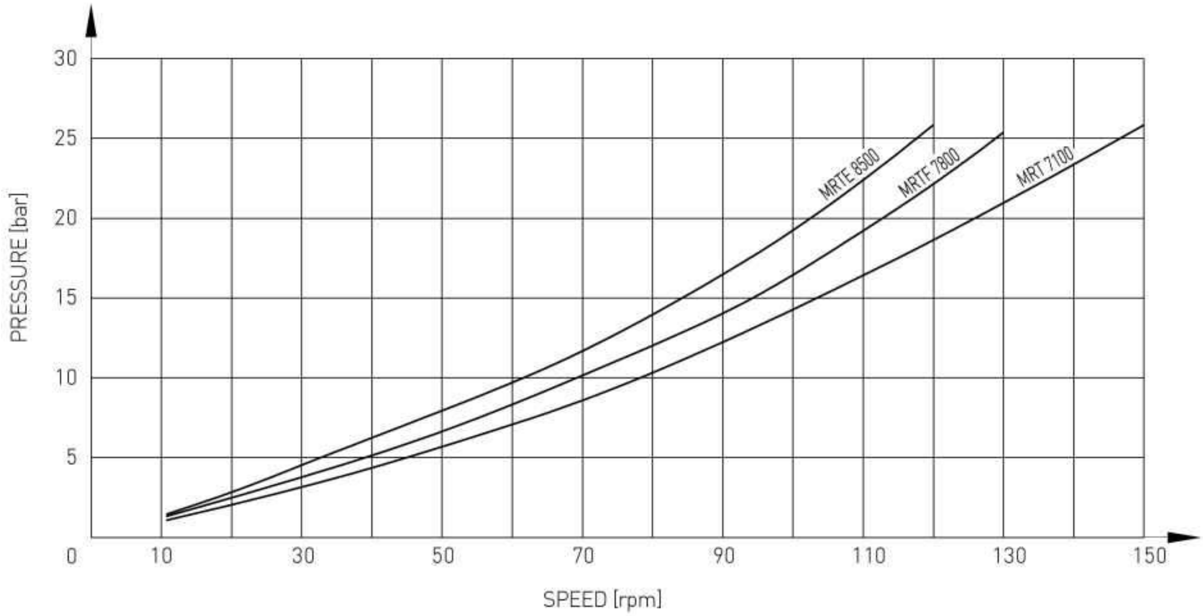
MRTA 12000 P

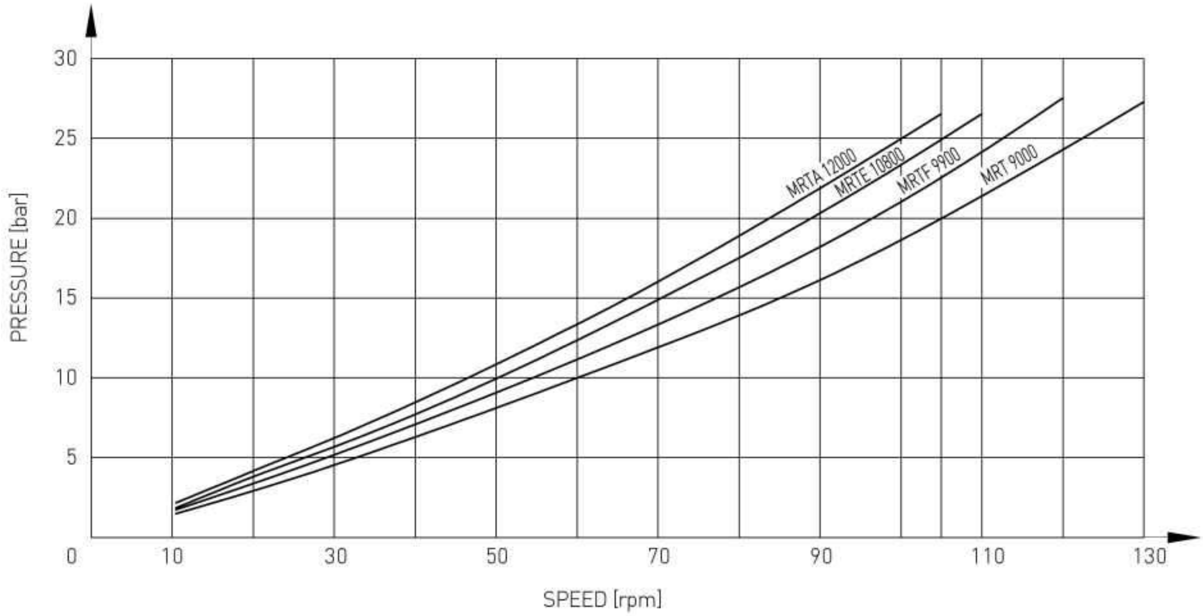


Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

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

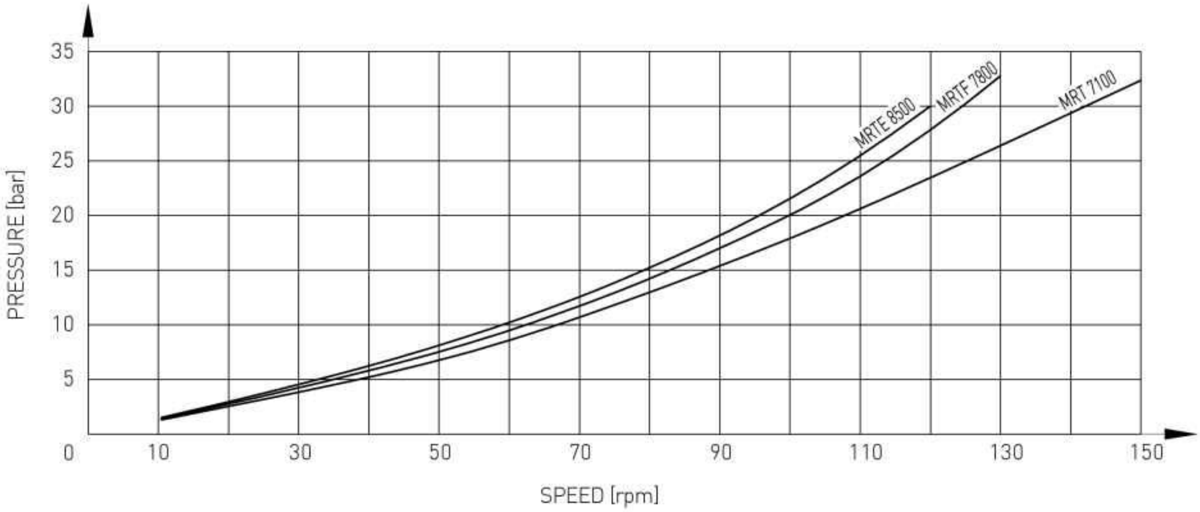


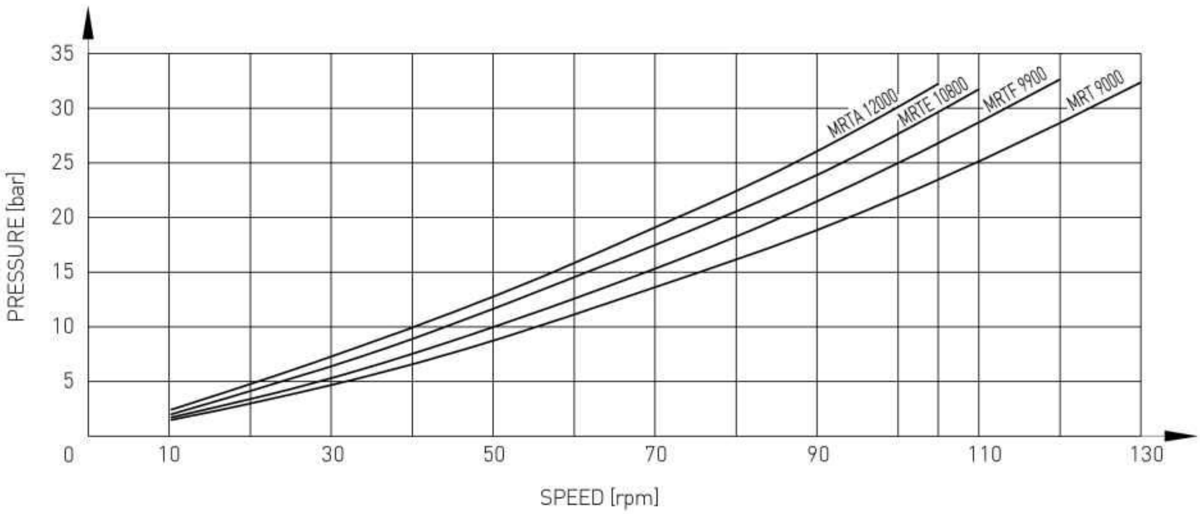


Operating Diagram

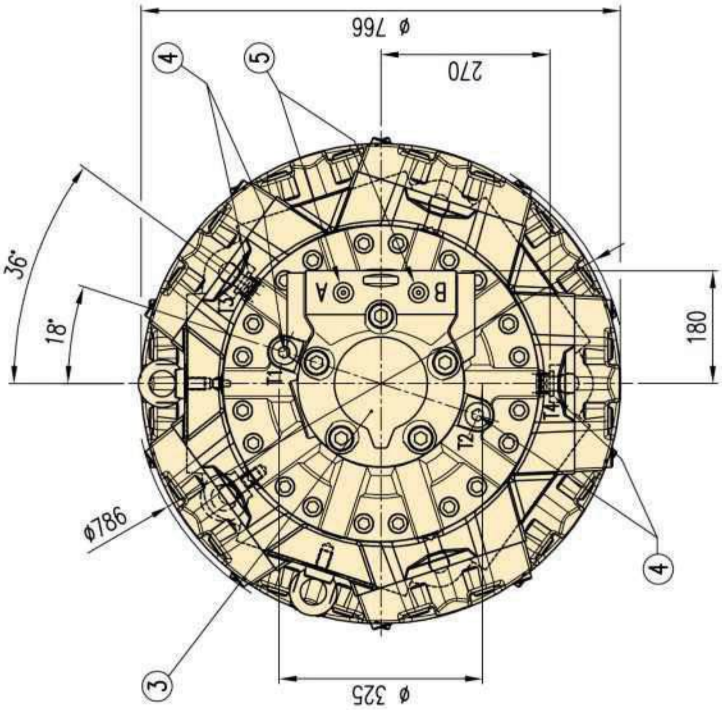
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

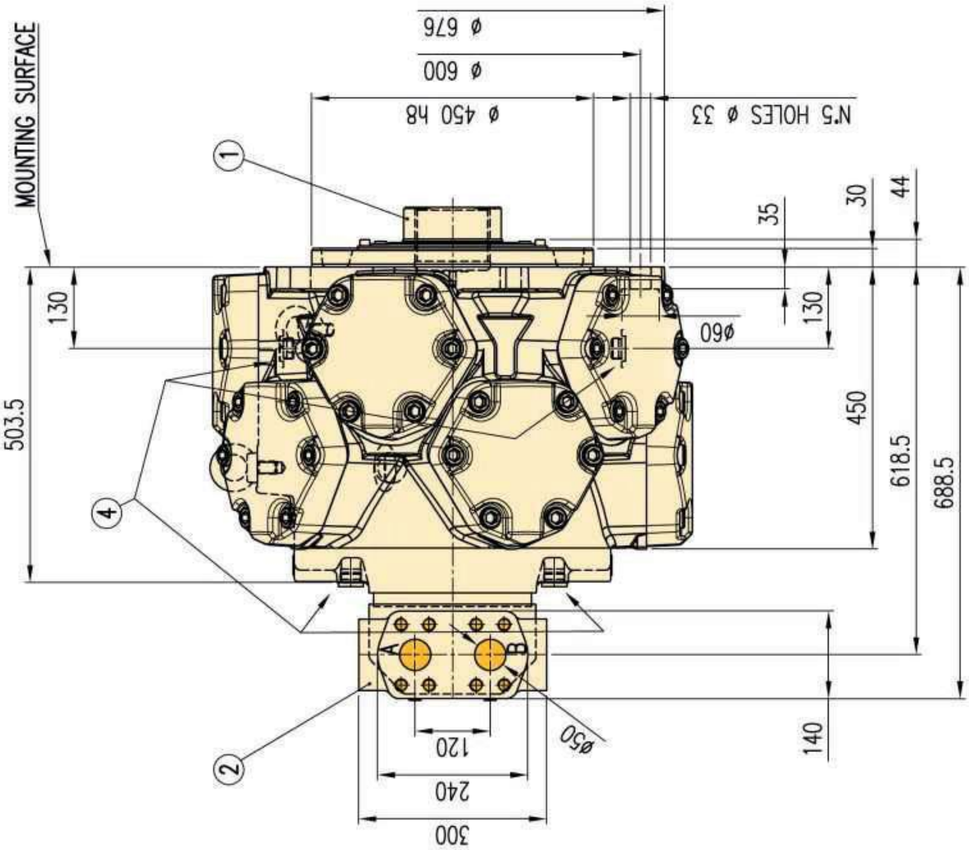
Min. required pressure difference ∆p with idling speed (shaft unloaded)





Overall Dimensions





1 **See output shaft options at page 17**

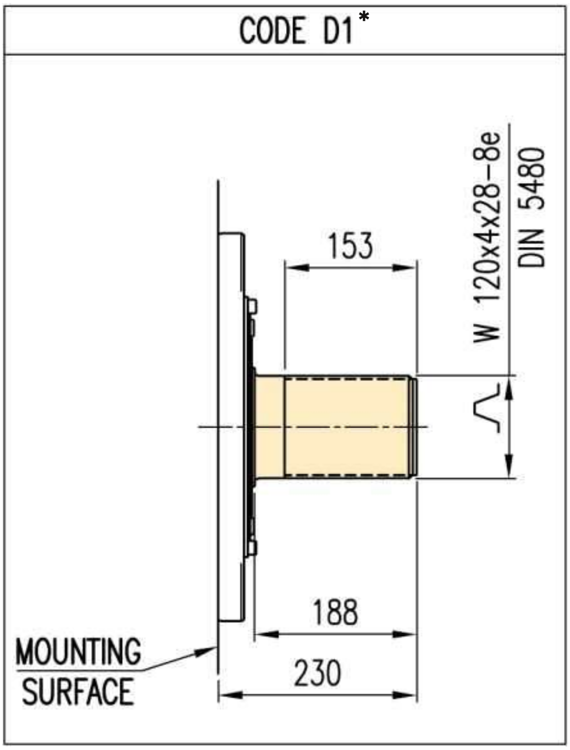
2 **See connection ports options at page 49**

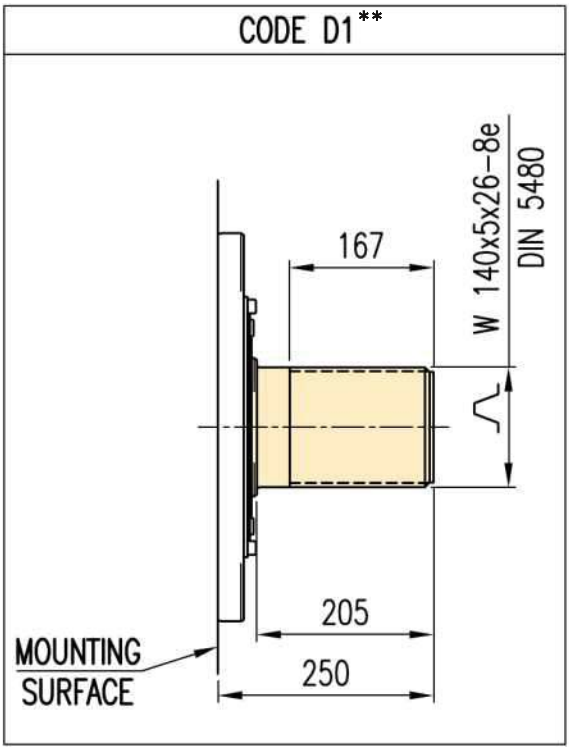
3 **On request the port flange can be rotated by 72°**

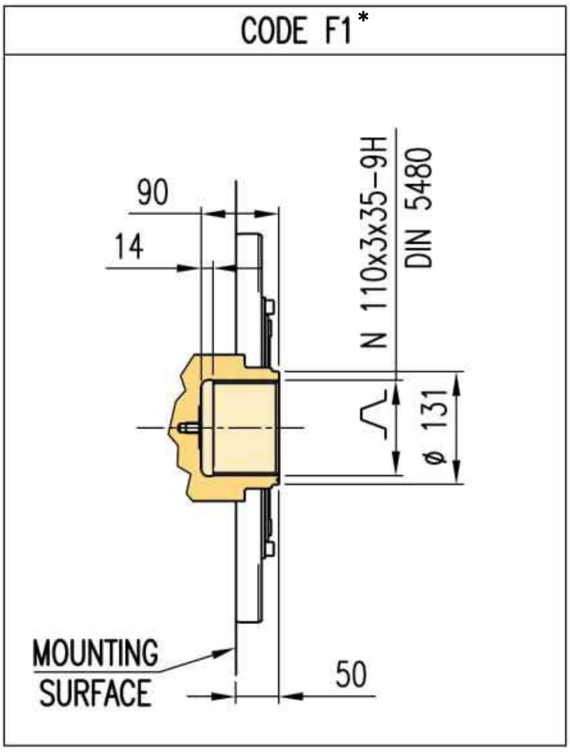
4 **Case drain ports: G 1"**

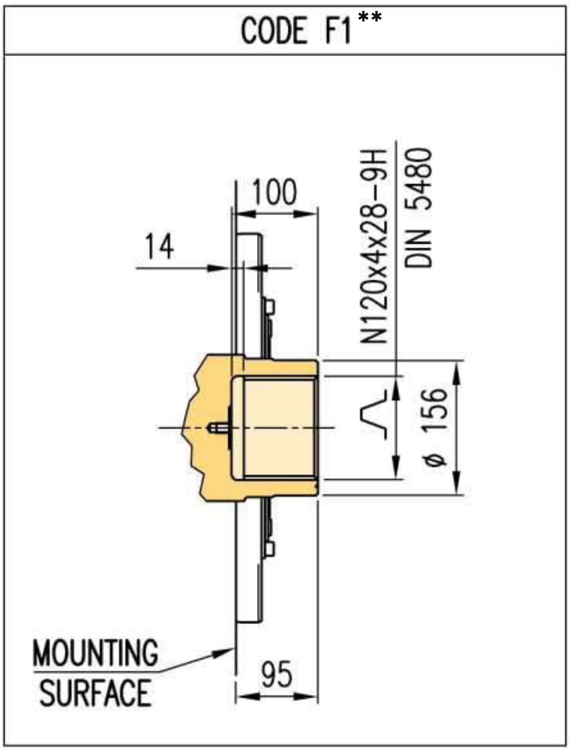
5 **Port 1/4" BSP threads to ISO 228/1 for pressure reading**

Output Shaft Options and Dimensions





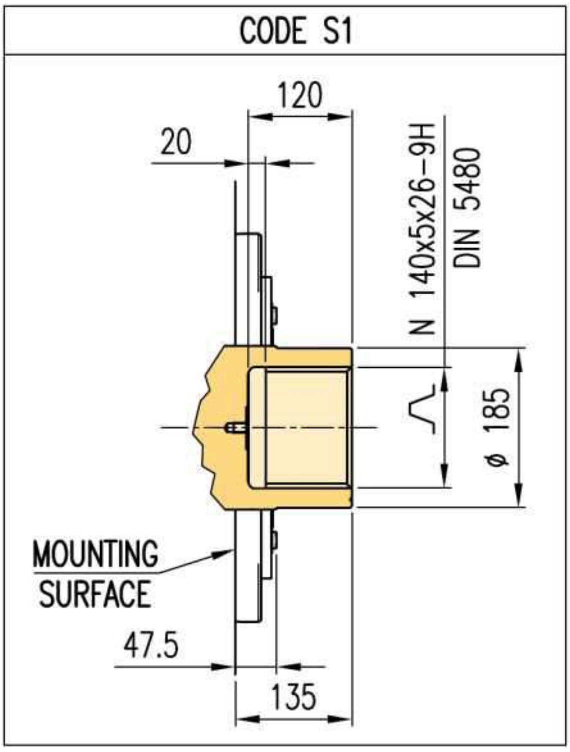


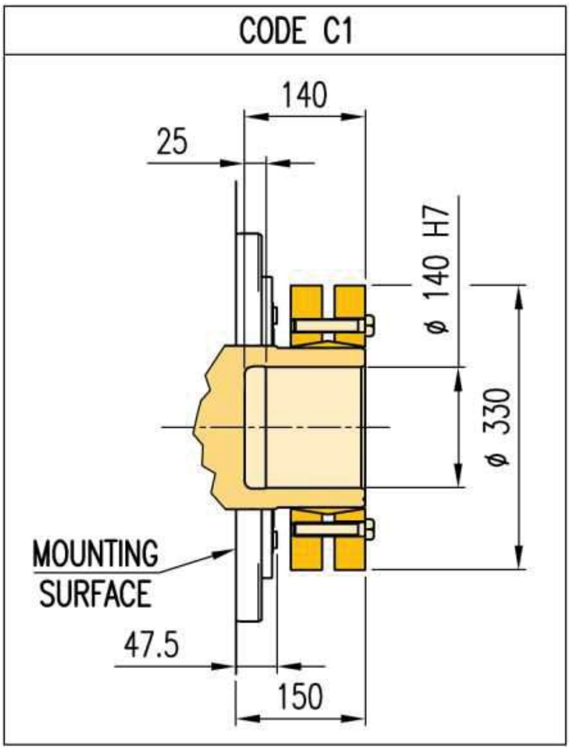


* Dimensions valid for motors:
MRT 7100, MRTF 7800, MRTE 8500

* Dimensions valid for motors:
MRT 9000, MRTF 9900, MRTE 10800, MRTA 12000

Output Shaft Options and Dimensions





Ordering Information

MRT ...	P						**

Motor type & displacement

MRT 7100
MRTF 7800
MRTE 8500
MRT 9000
MRTF 9900
MRTE 10800
MRTA 12000

Shaft type (see pages 17-18)

D1	Spline DIN 5480
F1	Female spline DIN 5480
S1	Female spline DIN 5480
C1	Shrink disk coupling

Speed sensor option (see pages 47-48)

N1	None
Q1	Encoder drive
C1	Mechanical tachometer drive
T1	Tachogenerator drive
M1	Monodirectional incremental encoder
B1	Bidirectional incremental encoder

Seals

NBR mineral oil	**N1**
NBR, 15 bar shaft seal	**F1**
FPM seals	**V1**
No shaft seal (for brake coupling)	**U1**

Connection flange (see page 49)

Standard pressure SAE metric (3000 psi)	**S1**
High pressure SAE metric (6000 psi)	**G1**

Rotation (see page 49)

Standard rotation	**N**
Reversed rotation	**S**

**: reserved (leave blank): customization on customer request (contact Calzoni)

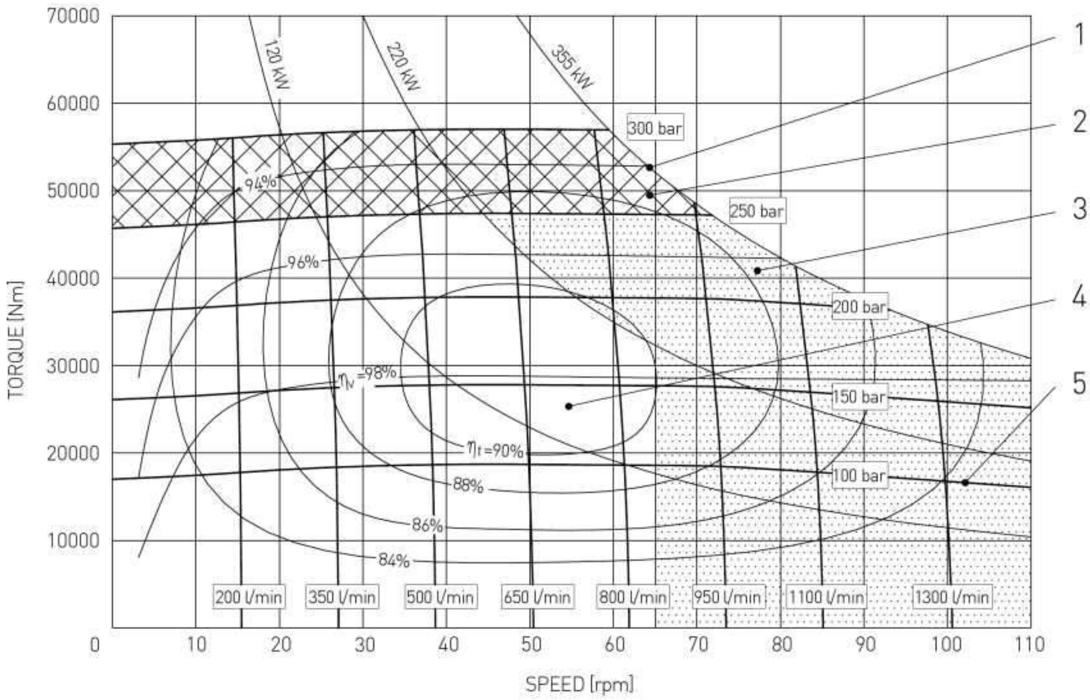
Ordering code example: **MRT 7100 P - D1 M1 N1 S1 N**

Operating Diagram

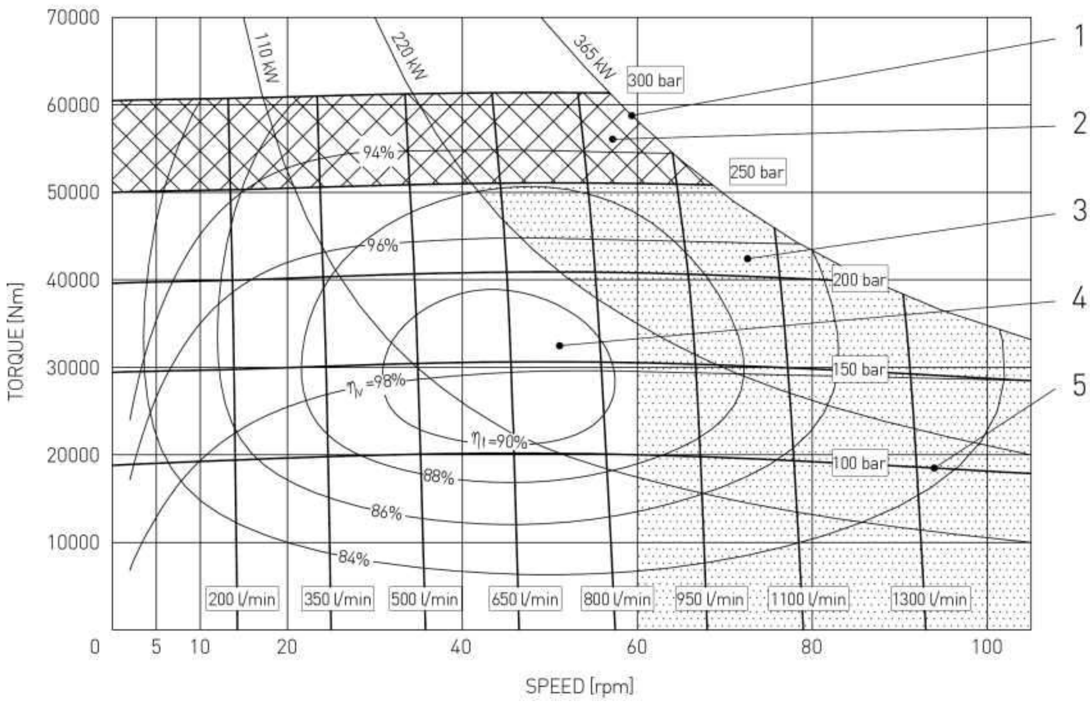
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRT 13000 R



MRT 14000 R

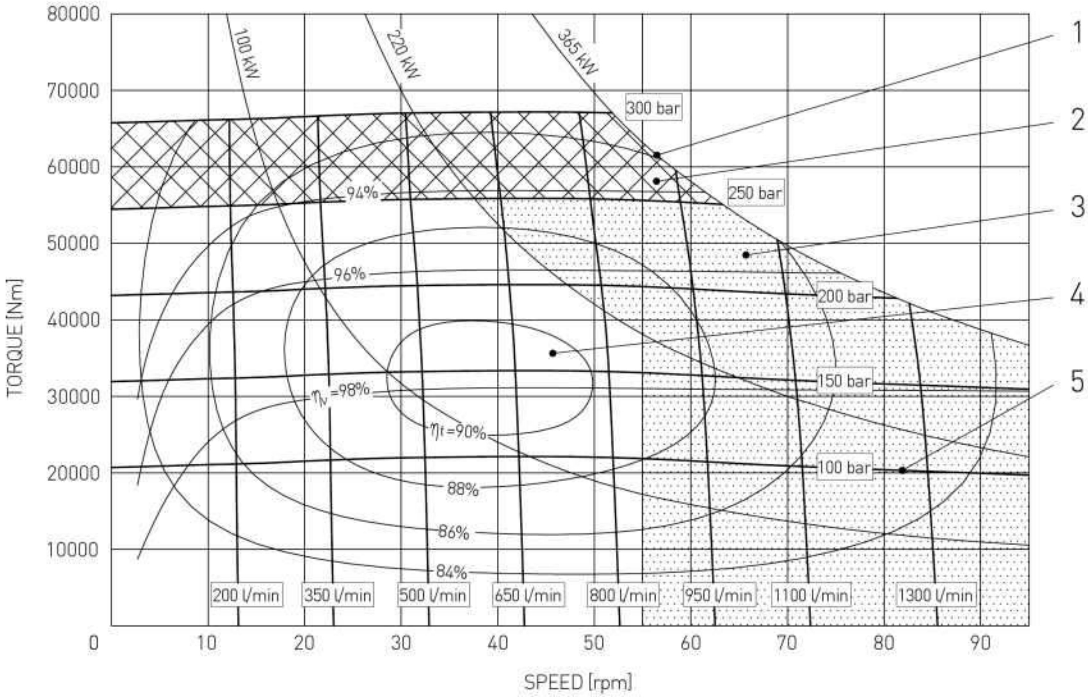


Operating Diagram

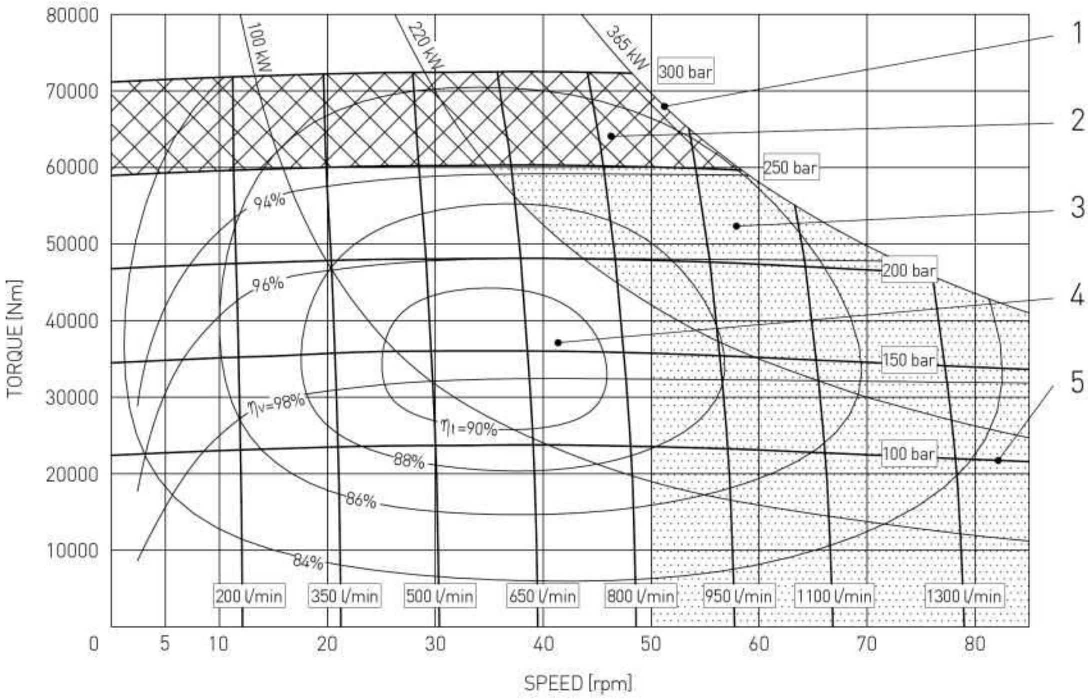
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRTF 15200 R



MRTE 16400 R

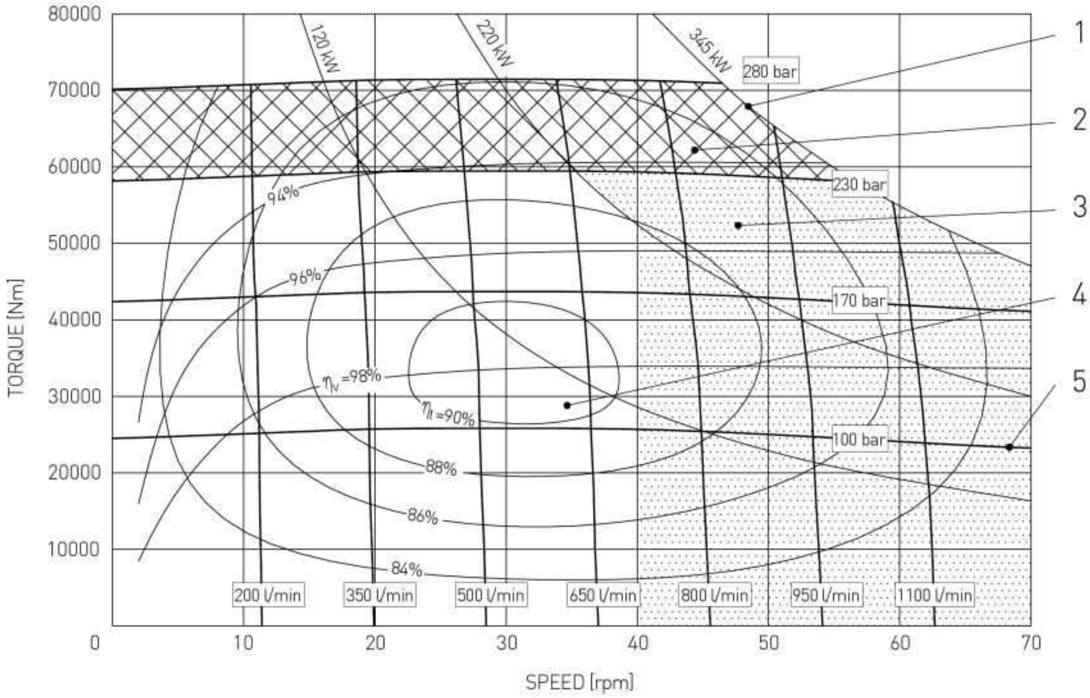


Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

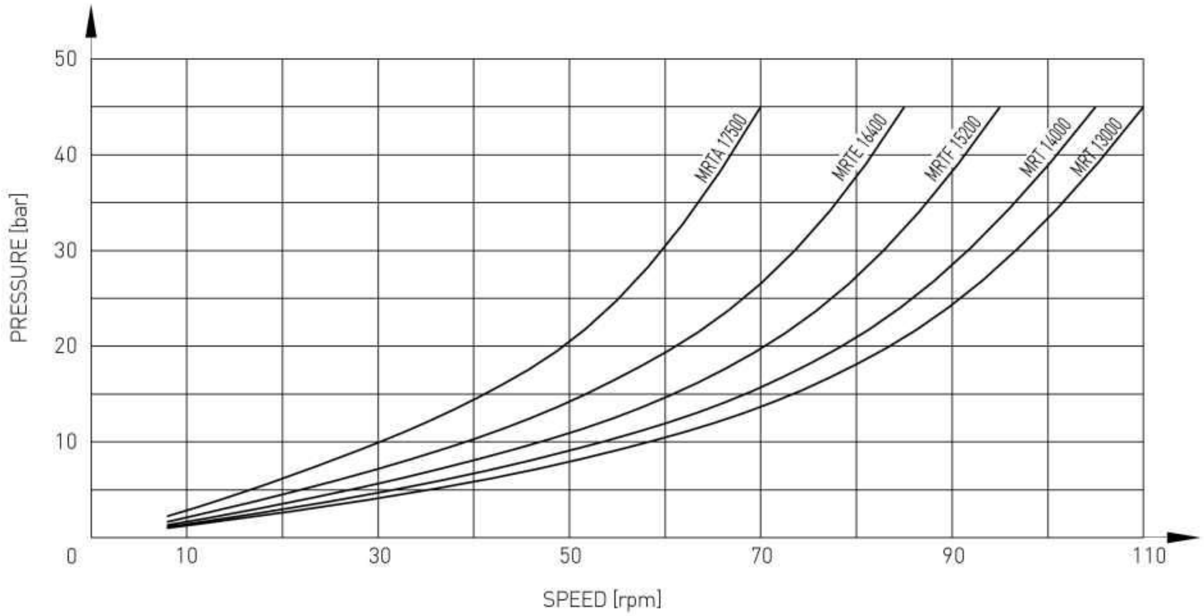
MRTA 17500 R



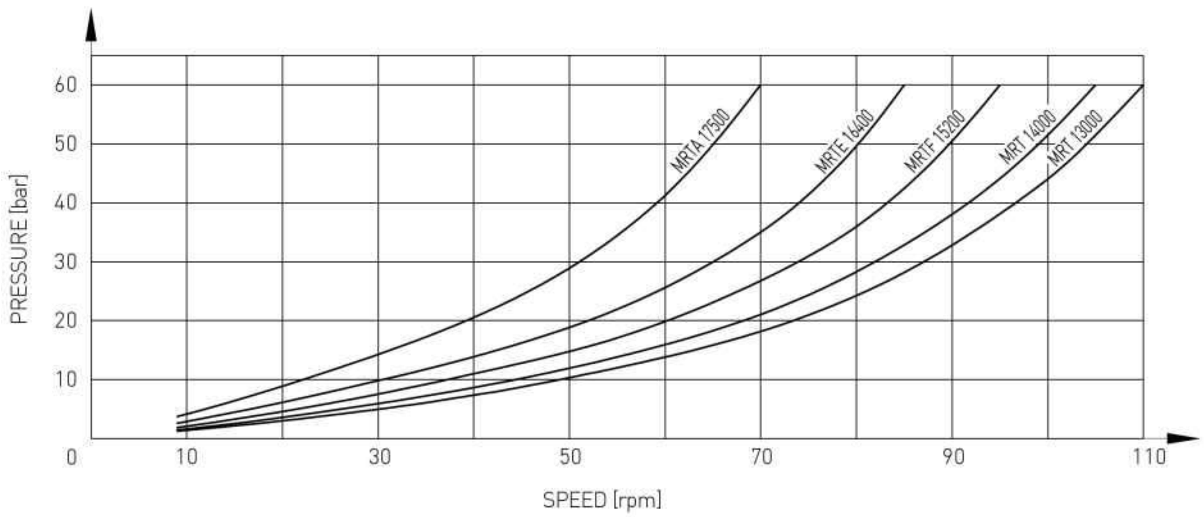
Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

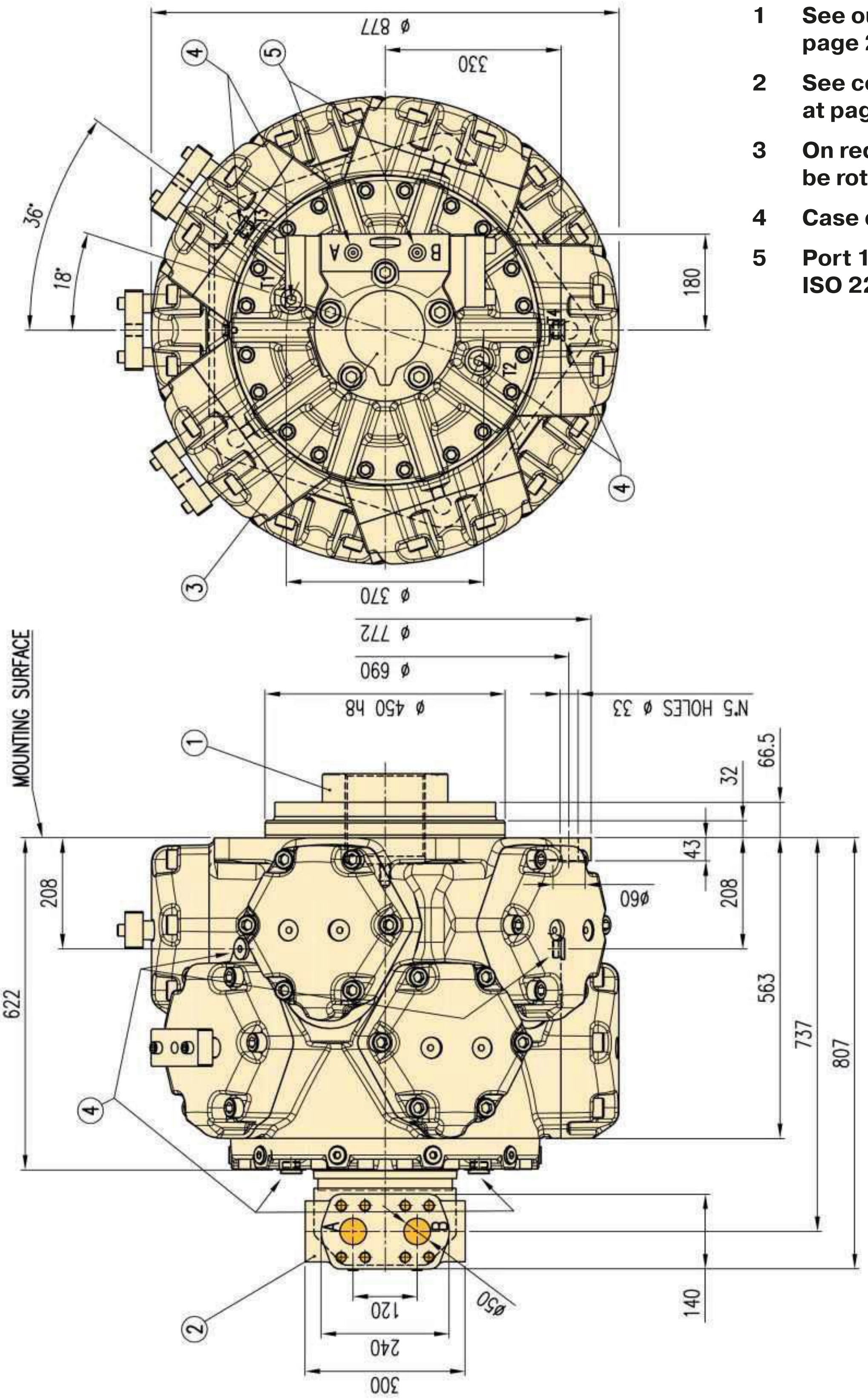
Min. required pressure difference Δp with idling speed (shaft unloaded)



Minimum boost pressure during pump operation



Overall Dimensions



1 **See output shaft options at page 25**

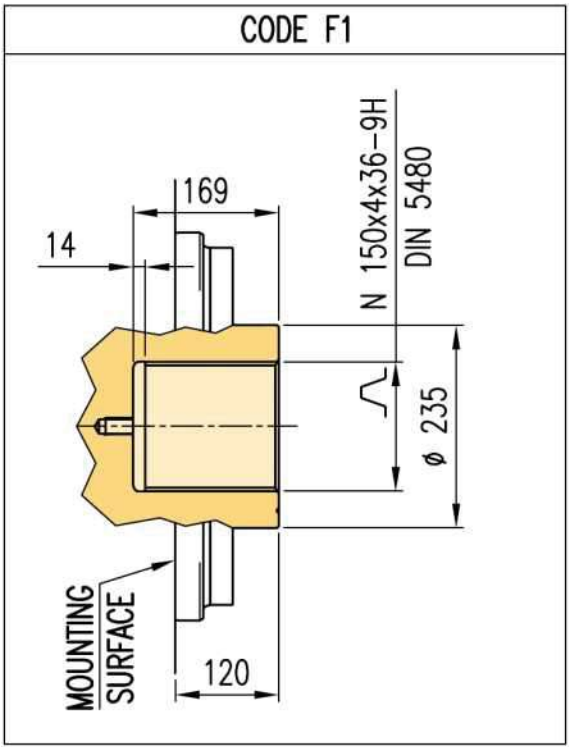
2 **See connection ports options at page 49**

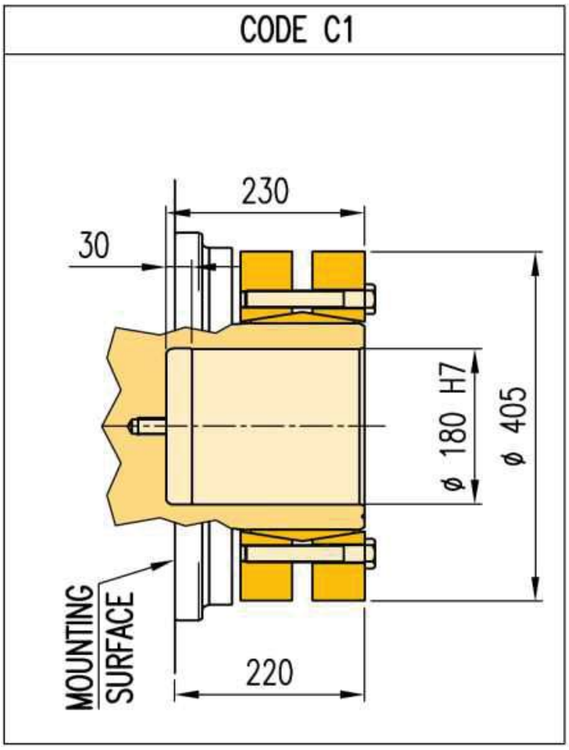
3 **On request the port flange can be rotated by 72°**

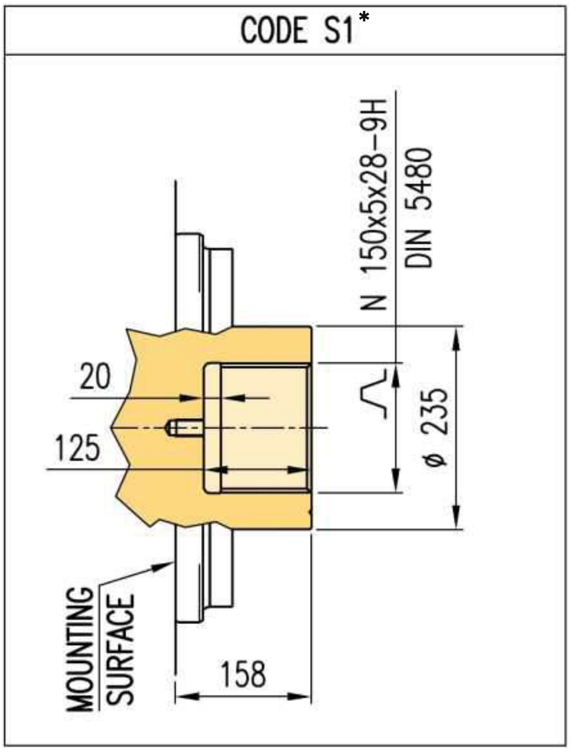
4 **Case drain ports: G 1"**

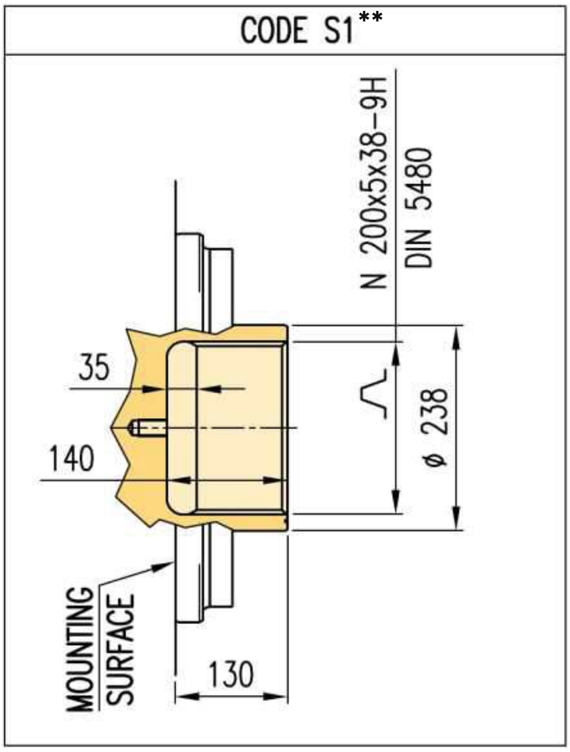
5 **Port 1/4" BSP threads to ISO 228/1 for pressure reading**

Output Shaft Options and Dimensions









* Dimensions valid for motor MRT 13000

* Dimensions valid for motors:
MRT 14000, MRTF 15200, MRTE 16400, MRTA 17500

Ordering Information

MRT ...	R							**

Motor type & displacement

MRT 13000
MRT 14000
MRTF 15200
MRTE 16400
MRTA 17500

Shaft type (see page 25)

F1	Spline N 150x4x36 - DIN 5480
S1	Spline N 200x5x38 - DIN 5480
C1	Shrink disk coupling

Speed sensor option (see pages 47-48)

N1	None
Q1	Encoder drive
C1	Mechanical tachometer drive
T1	Tachogenerator drive
M1	Monodirectional incremental encoder
B1	Bidirectional incremental encoder

Seals

NBR mineral oil	N1
NBR, 15 bar shaft seal	F1
FPM seals	V1
No shaft seal (for brake coupling)	U1

Connection flange (see page 49)

Standard pressure SAE metric (3000 psi)	S1
High pressure SAE metric (6000 psi)	G1

Rotation (see page 49)

Standard rotation	N
Reversed rotation	S

** reserved (leave blank): customization on customer request (contact Calzoni)

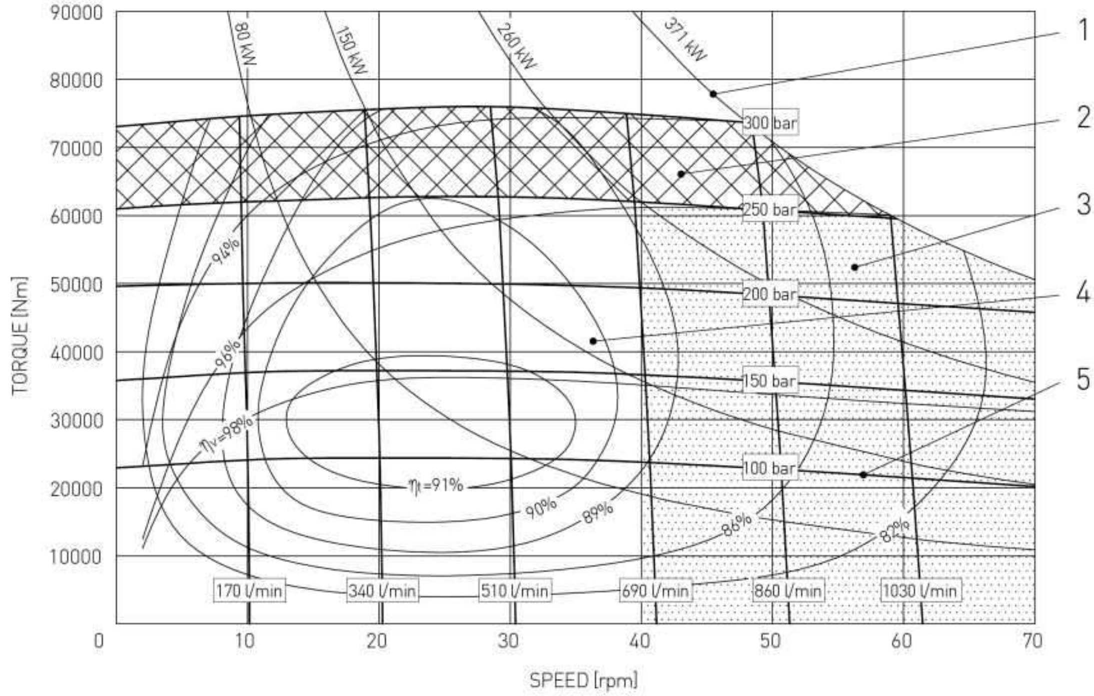
Ordering code example: **MRTE 16400 R - F1 N1 V1 S1 N**

Operating Diagram

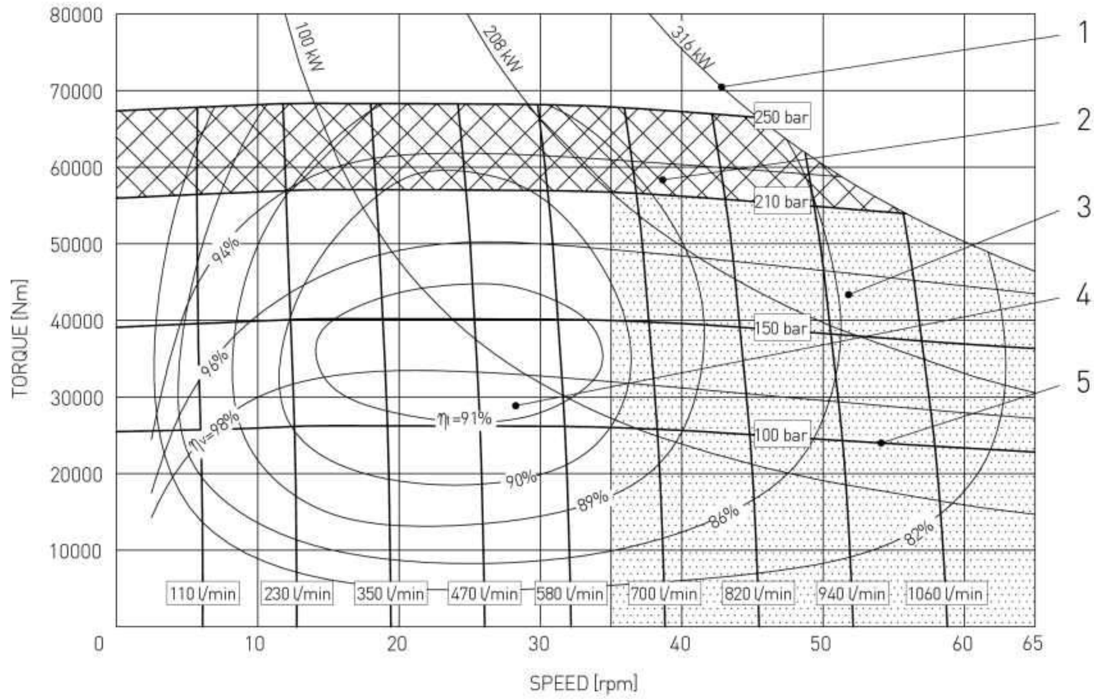
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRT 17000 Q



MRTF 18000 Q



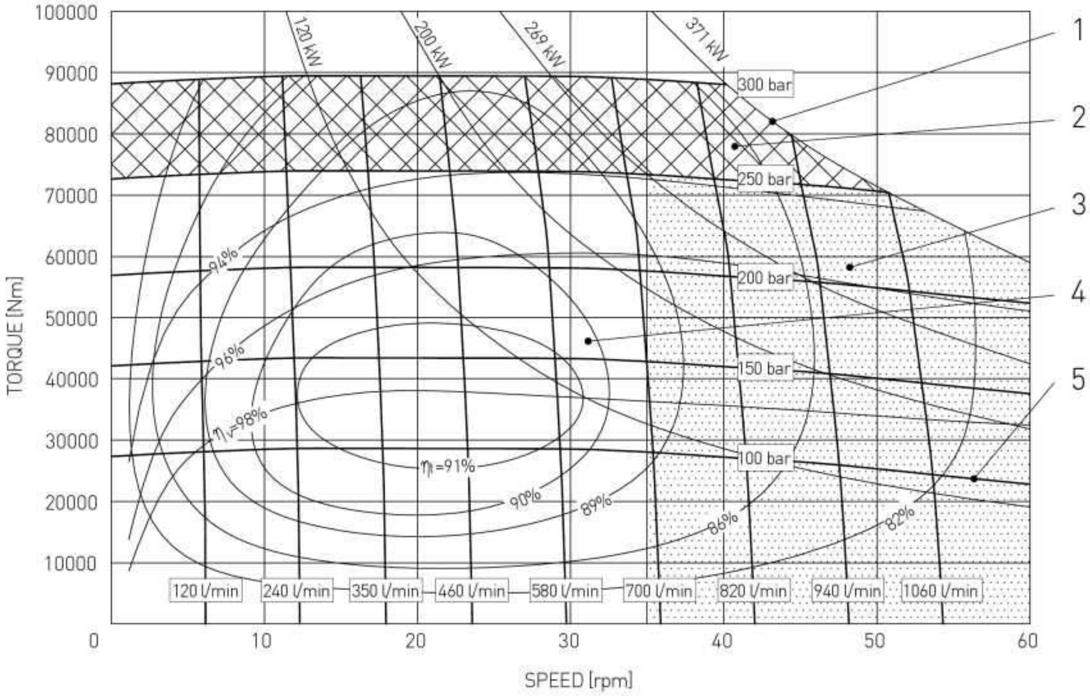
Calzoni Hydraulics Germany Gmbh
Calzoni Hydraulics Italy Srl

Operating Diagram

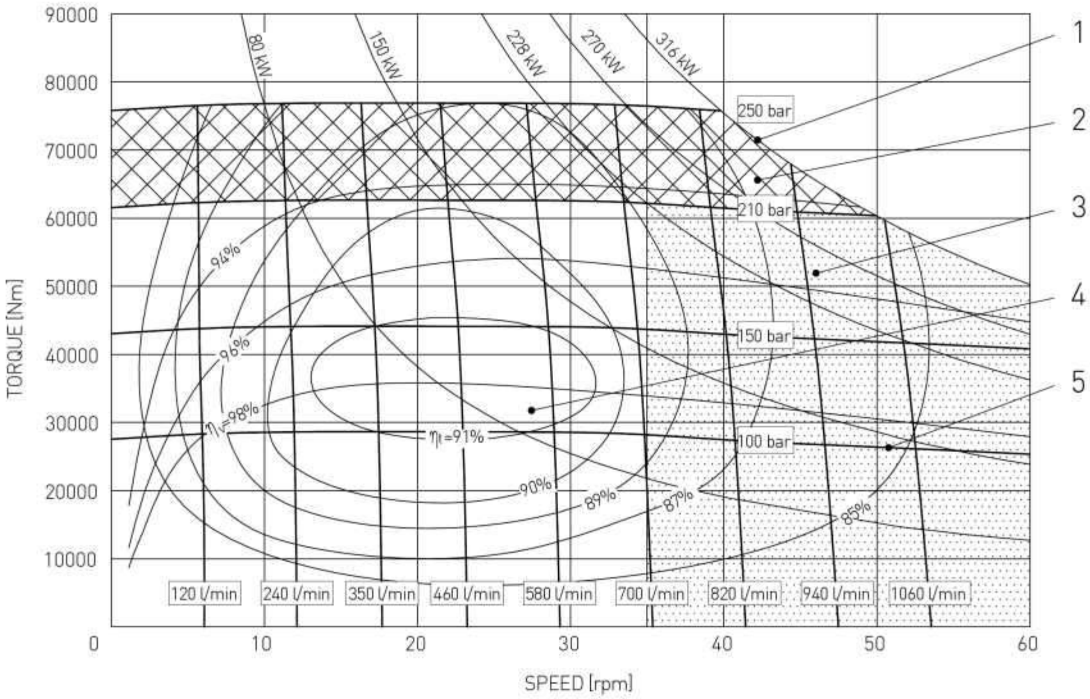
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRT 19500 Q



MRTE 20000 Q

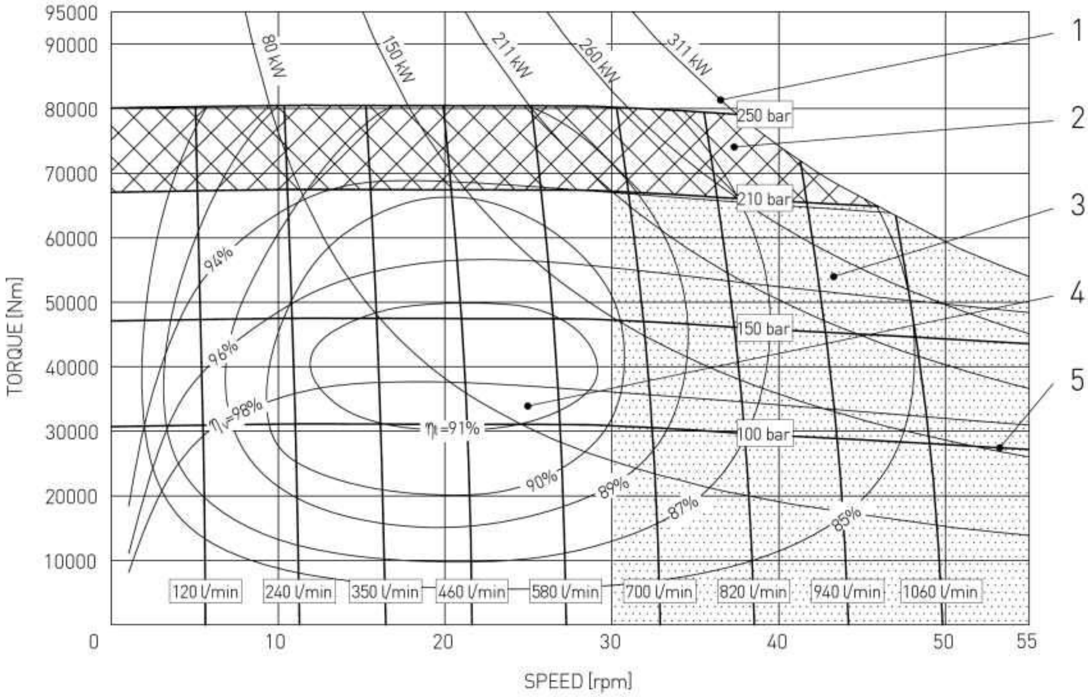


Operating Diagram

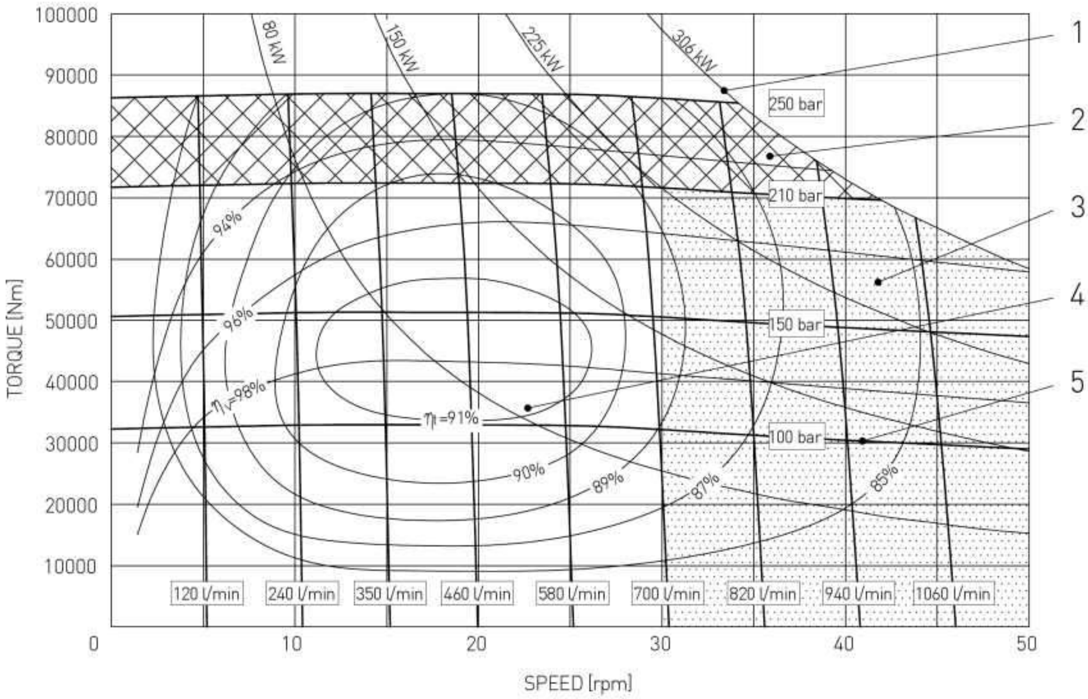
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRTF 21500 Q



MRTE 23000 Q

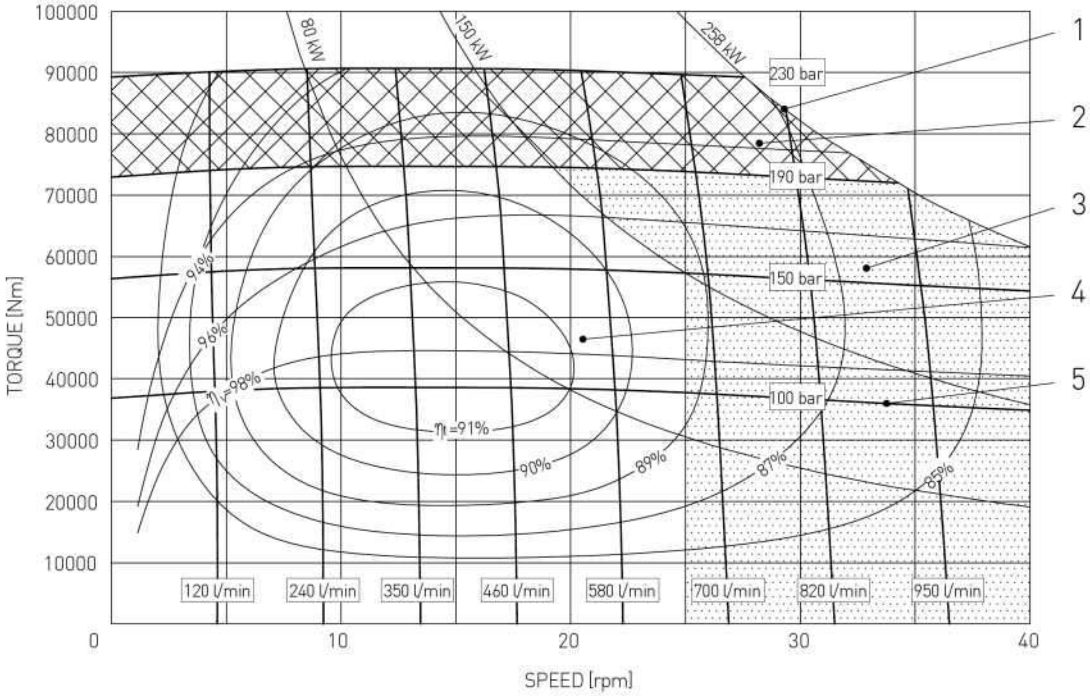


Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

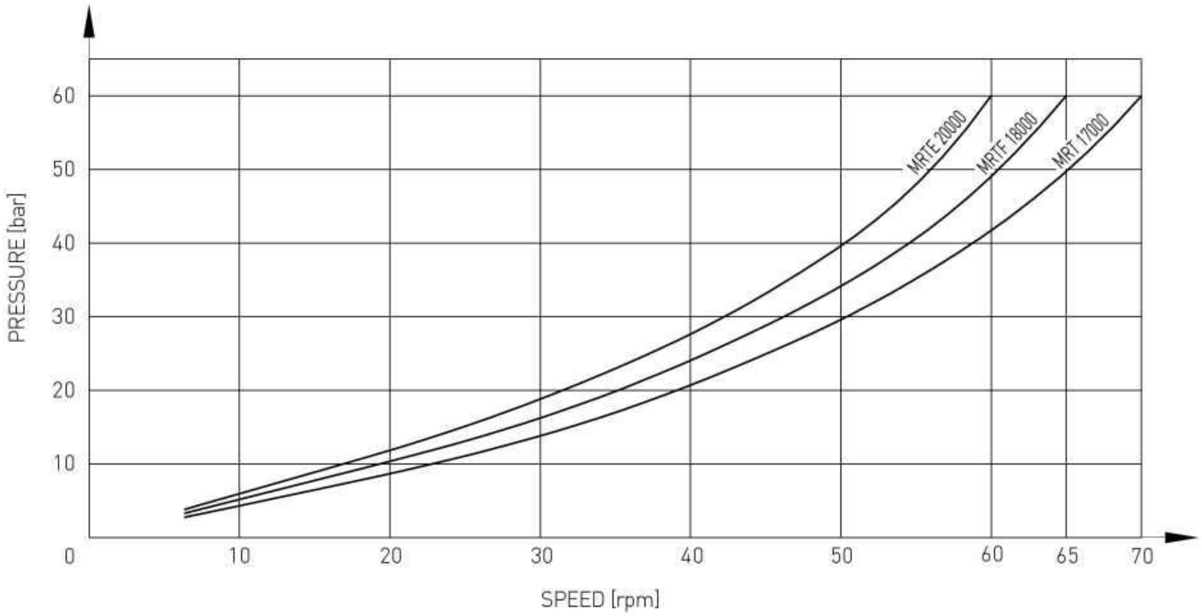
MRTA 26000 Q

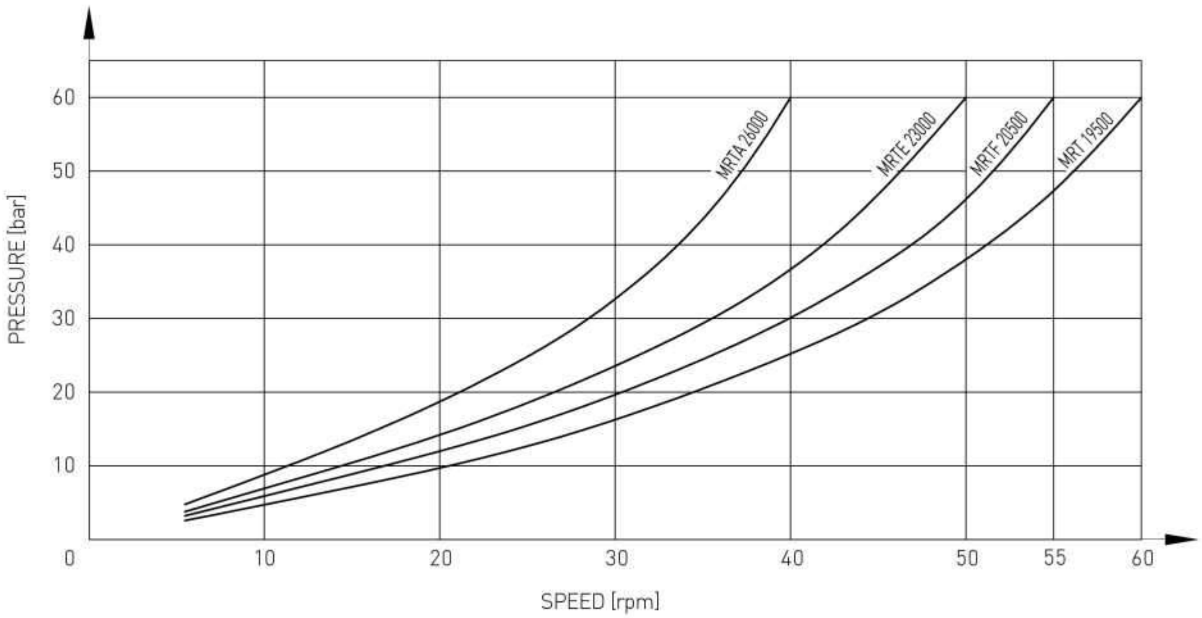


Operating Diagram

(average values) measured at ν = 36 mm^2/s; t = 45°C; $_{Poutlet}$ = 0 bar

Min. required pressure difference Δp with idling speed (shaft unloaded)

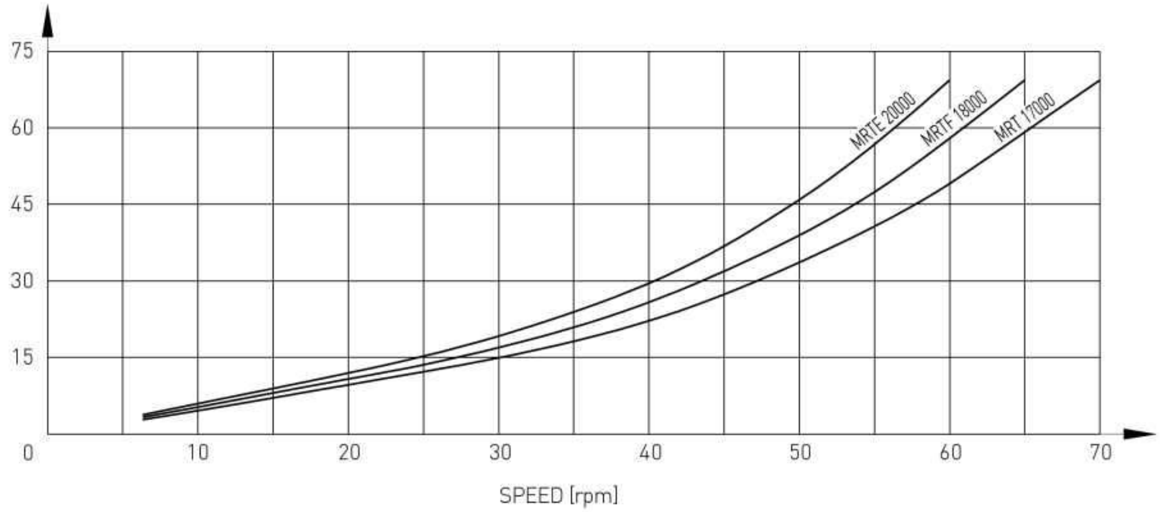


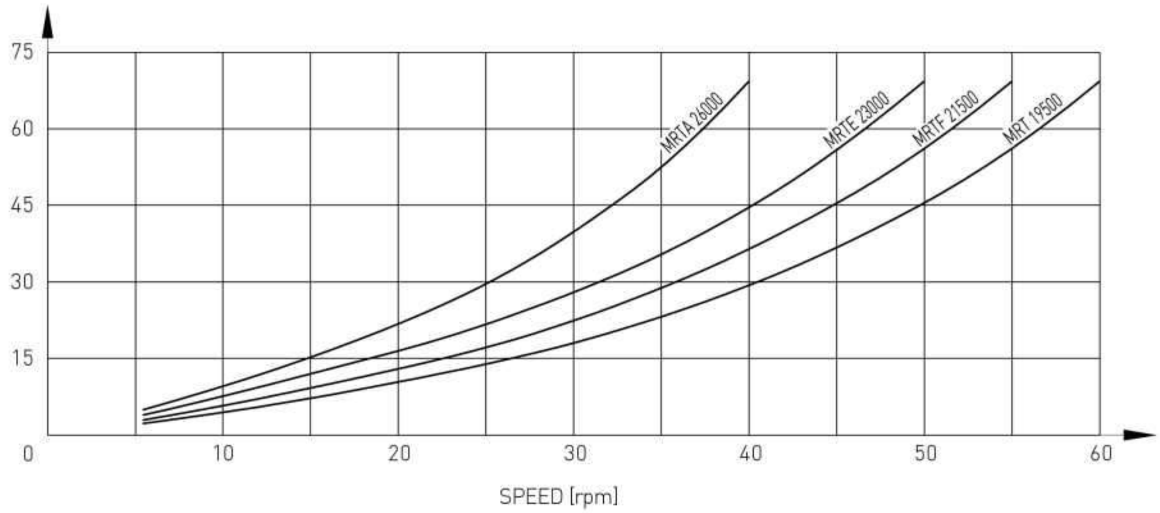


Operating Diagram

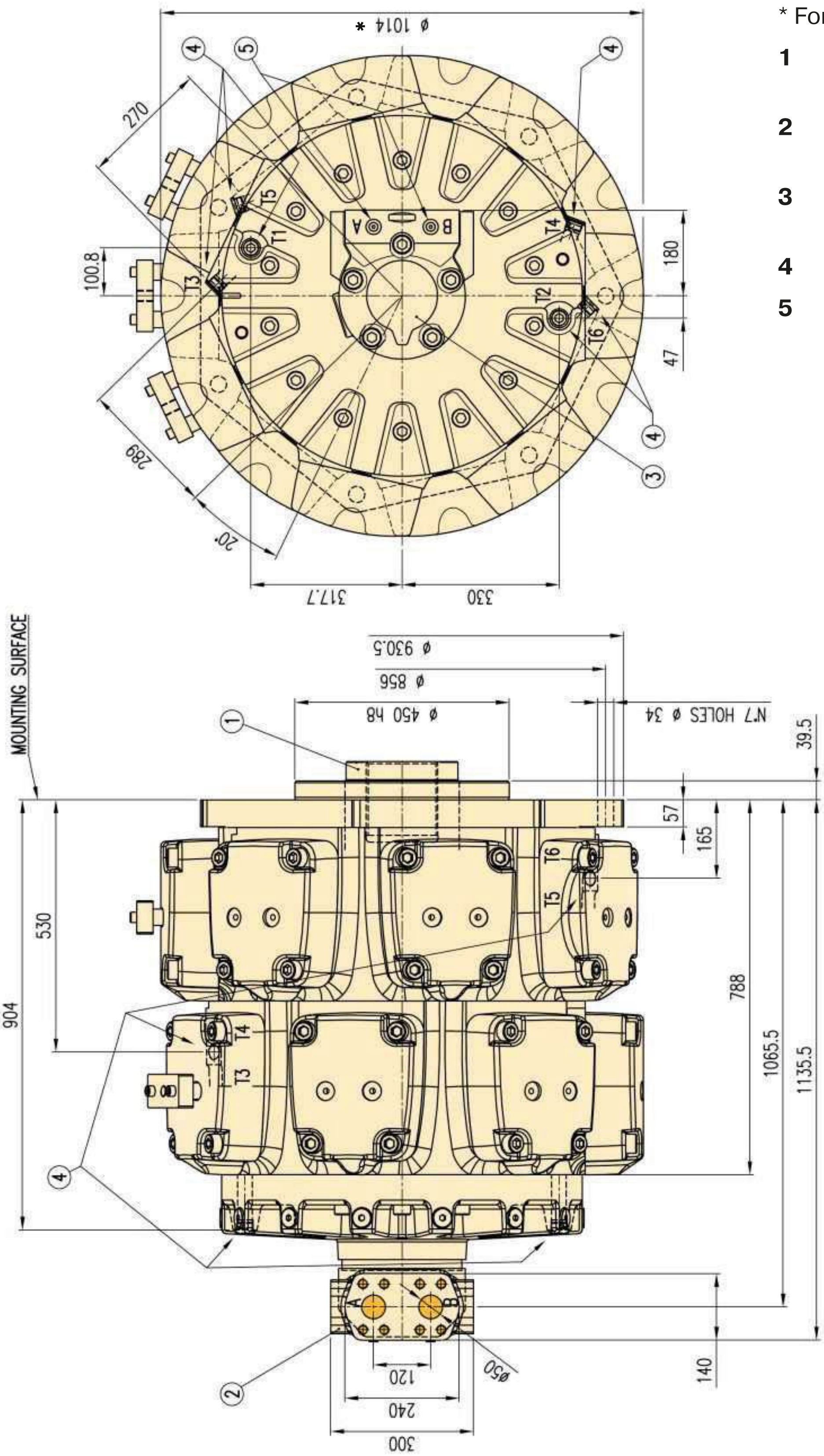
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

Minimum boost pressure during pump operation





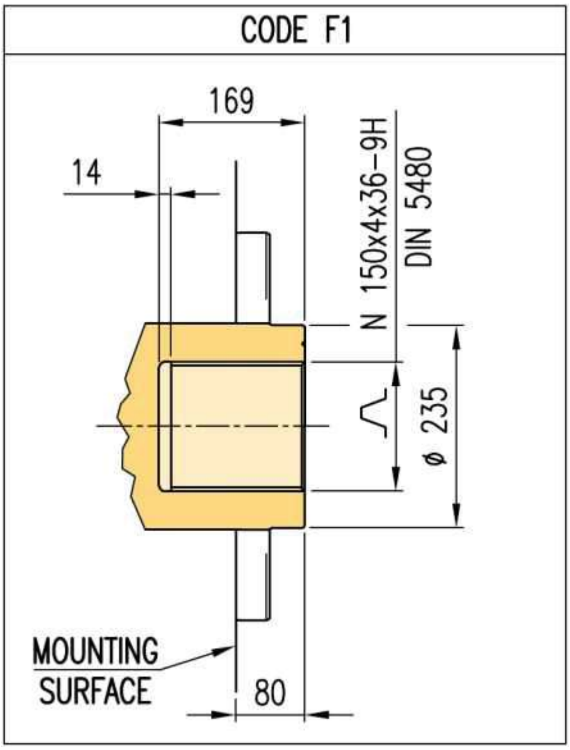
Overall Dimensions

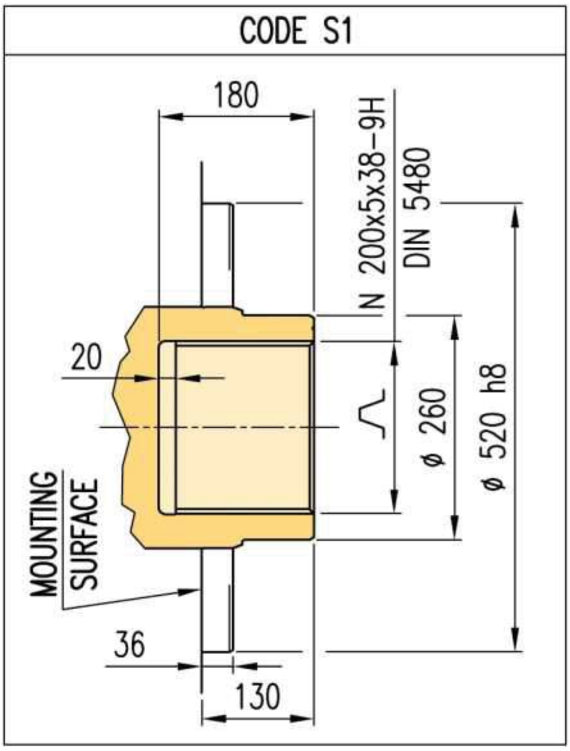


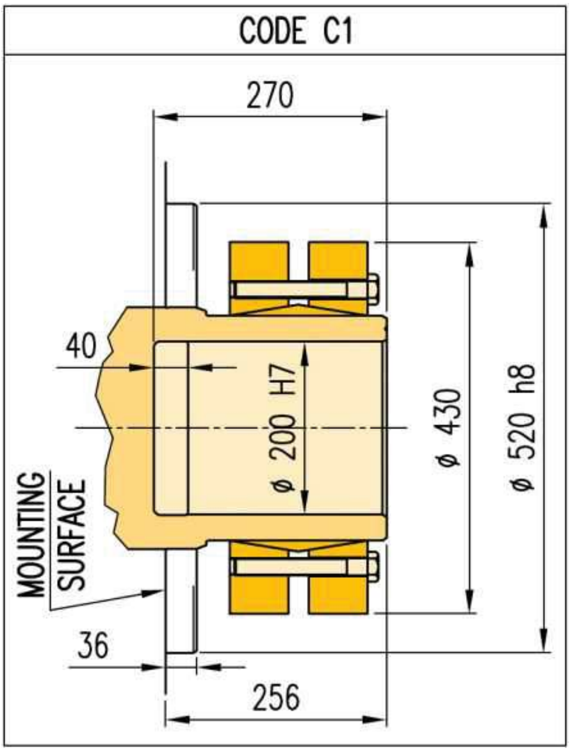
* For MRTA26000: Φ 1052

1. **See output shaft options at page 34**
2. **See connection ports options at page 49**
3. **On request the port flange can be rotated by 72°**
4. **Case drain ports: G 1"**
5. **Port 1/4" BSP threads to ISO 228/1 for pressure reading**

Output Shaft Options and Dimensions







Ordering Information

MRT ...	Q						**

Motor type & displacement

MRT 17000
MRTF 18000
MRT 19500
MRTE 20000
MRTF 21500
MRTE 23000
MRTA 26000

Shaft type (see page 34)

F1	Female spline DIN 5480
S1	Spline DIN 5480
C1	Shrink disk coupling

Speed sensor option (see pages 47-48)

N1	None
Q1	Encoder drive
C1	Mechanical tachometer drive
T1	Tachogenerator drive
M1	Monodirectional incremental encoder
B1	Bidirectional incremental encoder

Seals

NBR mineral oil	N1
NBR, 15 bar shaft seal	F1
FPM seals	V1
No shaft seal (for brake coupling)	U1

Connection flange (see page 49)

Standard pressure SAE metric (3000 psi)	S1
High pressure SAE metric (6000 psi)	G1

Rotation (see page 49)

Standard rotation	N
Reversed rotation	S

** reserved (leave blank): customization on customer request (contact Calzoni)

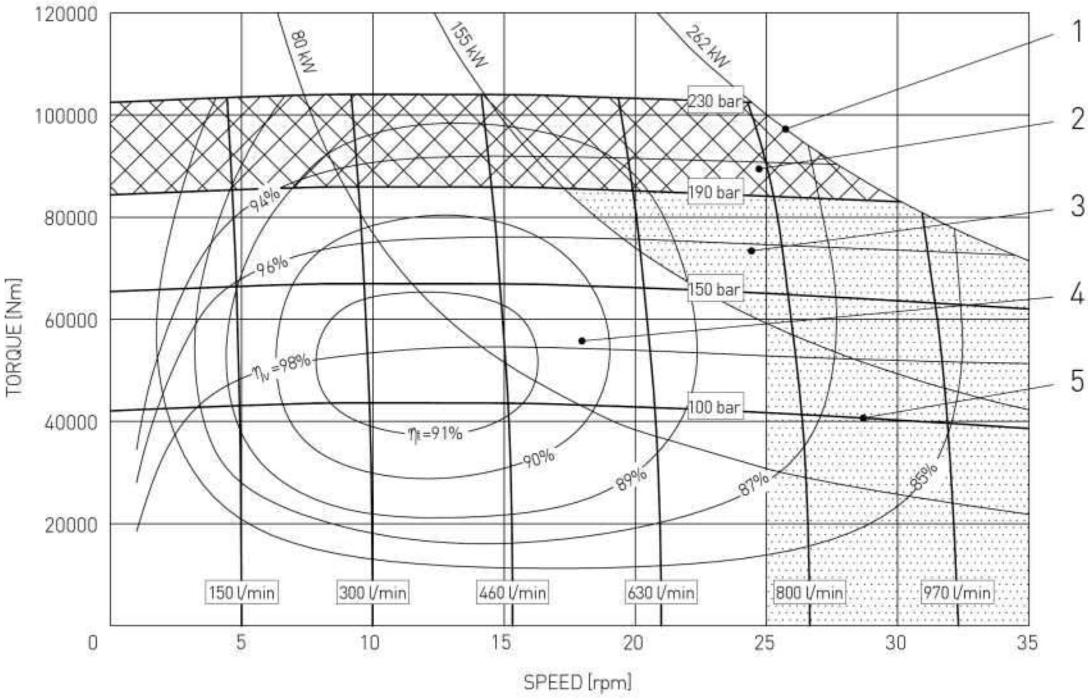
Ordering code example: **MRT 19500 Q - F1 M1 N1 S1 N**

Operating Diagram

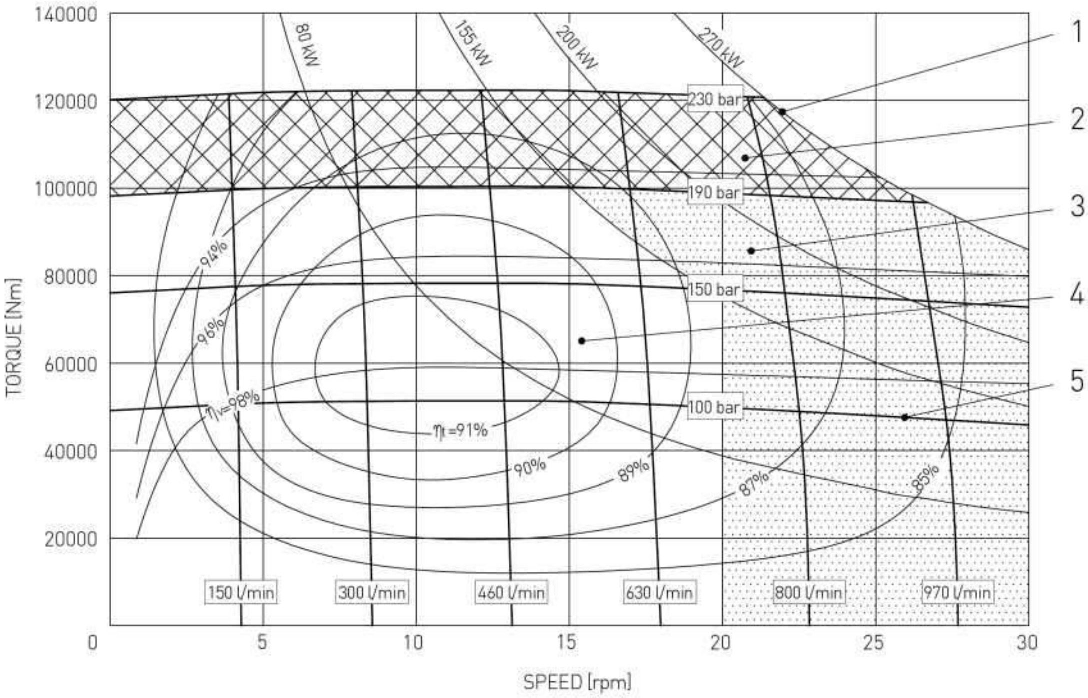
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRTA 30000 T



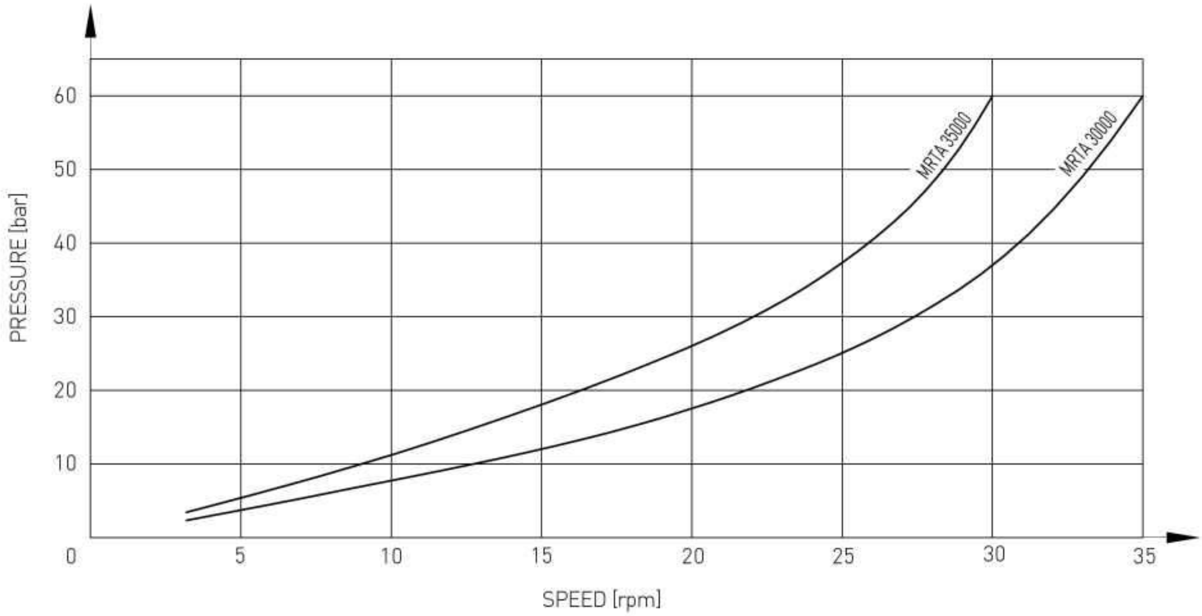
MRTA 35000 T



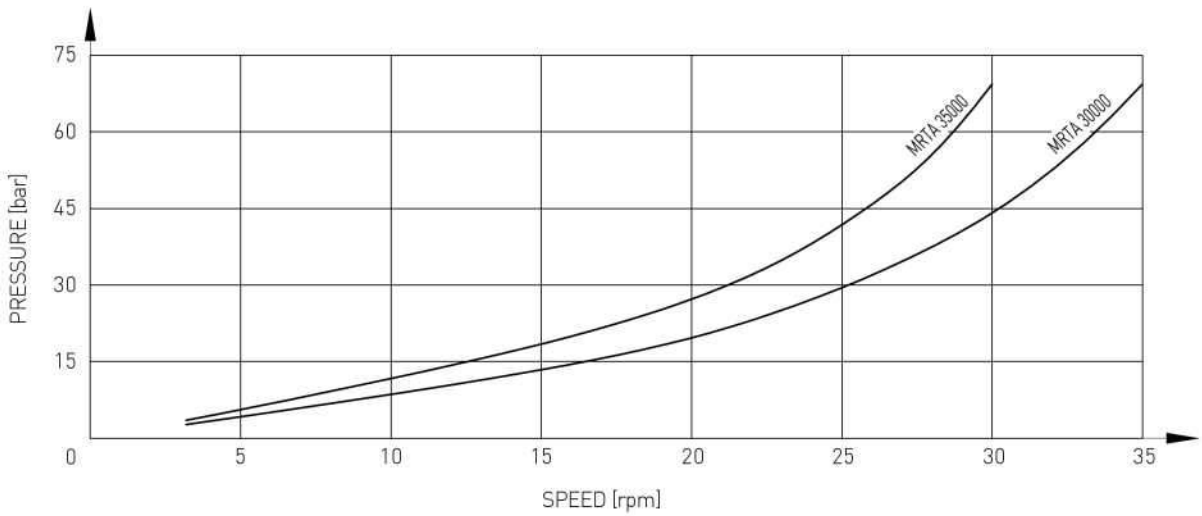
Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; P_{outlet} = 0 bar

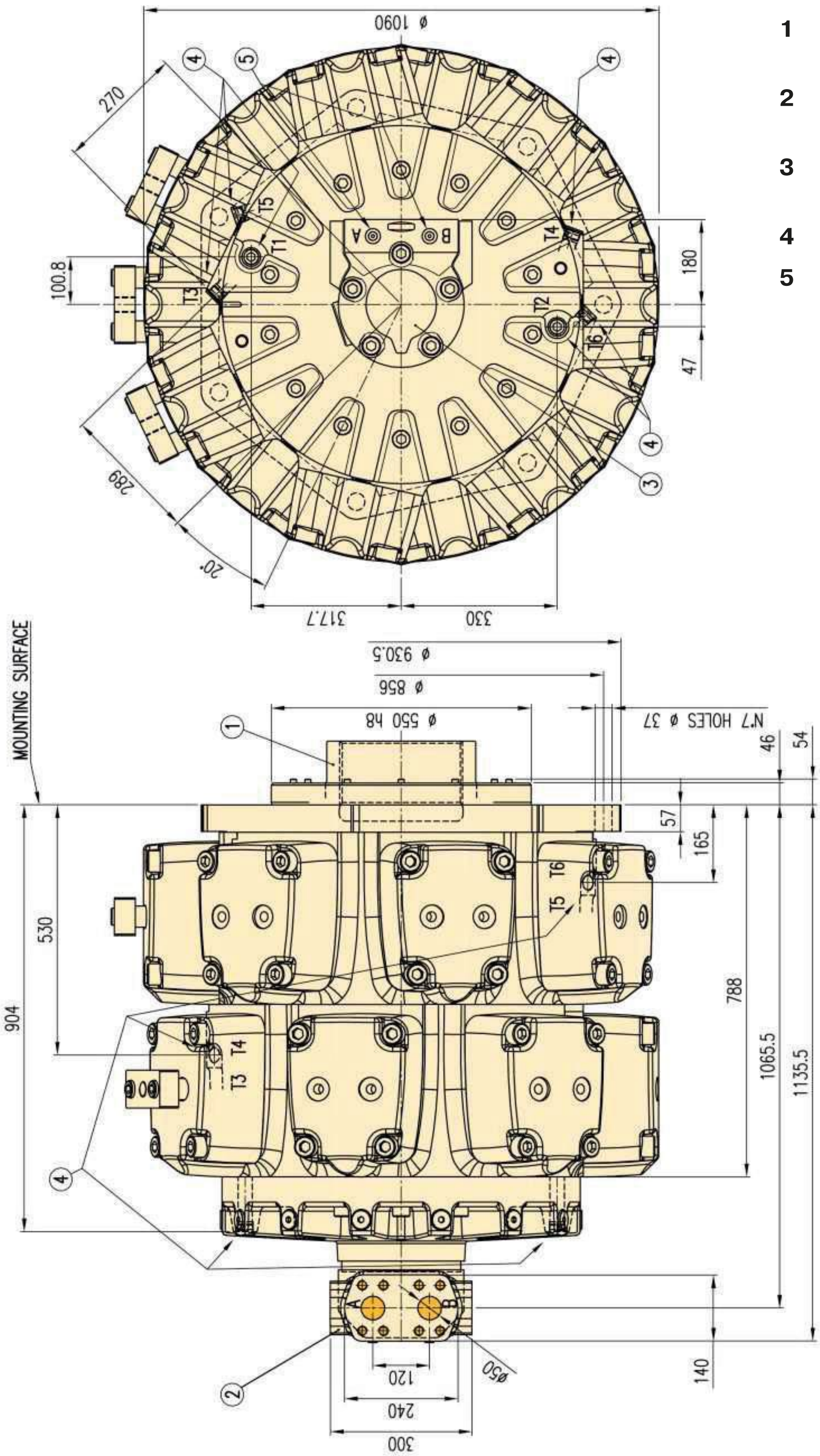
Min. required pressure difference Δp with idling speed (shaft unloaded)



Minimum boost pressure during pump operation

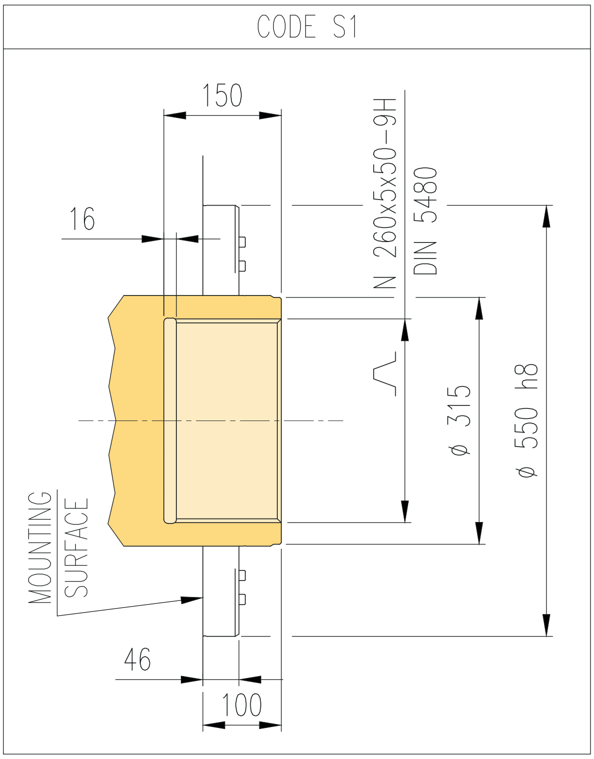


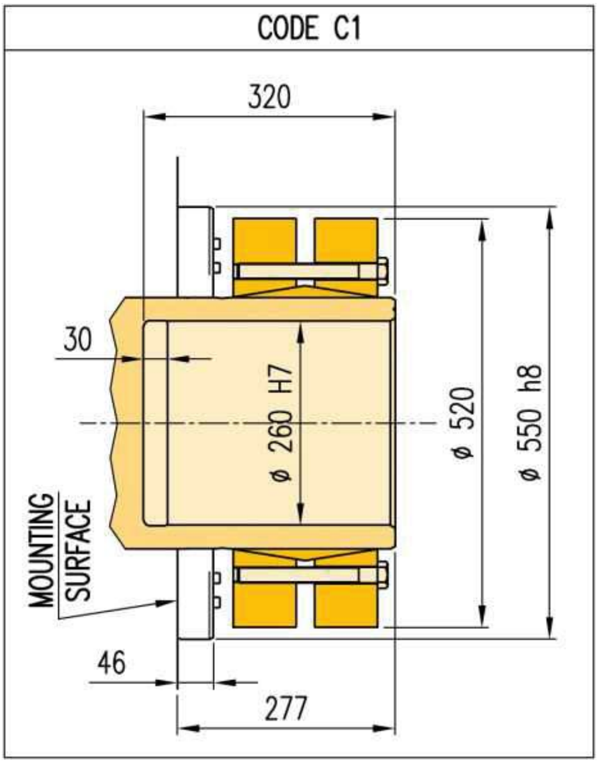
Overall Dimensions



1 See output shaft options at page 39
2 See connection ports options at page 49
3 On request the port flange can be rotated by 72°
4 Case drain ports: G 1"
5 Port 1/4" BSP threads to ISO 228/1 for pressure reading

Output Shaft Options and Dimensions





Ordering Information

MRT ...	T							**

reserved (leave blank): customization on customer request (contact Calzoni)

Motor type & displacement

MRTA 30000
MRTA 35000

Rotation (see page 49)

Standard rotation	**N**
Reversed rotation	**S**

Shaft type (see page 39)

S1	Female spline DIN 5480
C1	Shrink disk coupling

Connection flange (see page 49)

Standard pressure SAE metric (3000 psi)	**S1**
High pressure SAE metric (6000 psi)	**G1**

Speed sensor option (see pages 47-48)

N1	None
Q1	Encoder drive
C1	Mechanical tachometer drive
T1	Tachogenerator drive
M1	Monodirectional incremental encoder
B1	Bidirectional incremental encoder

Seals

NBR mineral oil	**N1**
NBR, 15 bar shaft seal	**F1**
FPM seals	**V1**
No shaft seal (for brake coupling)	**U1**

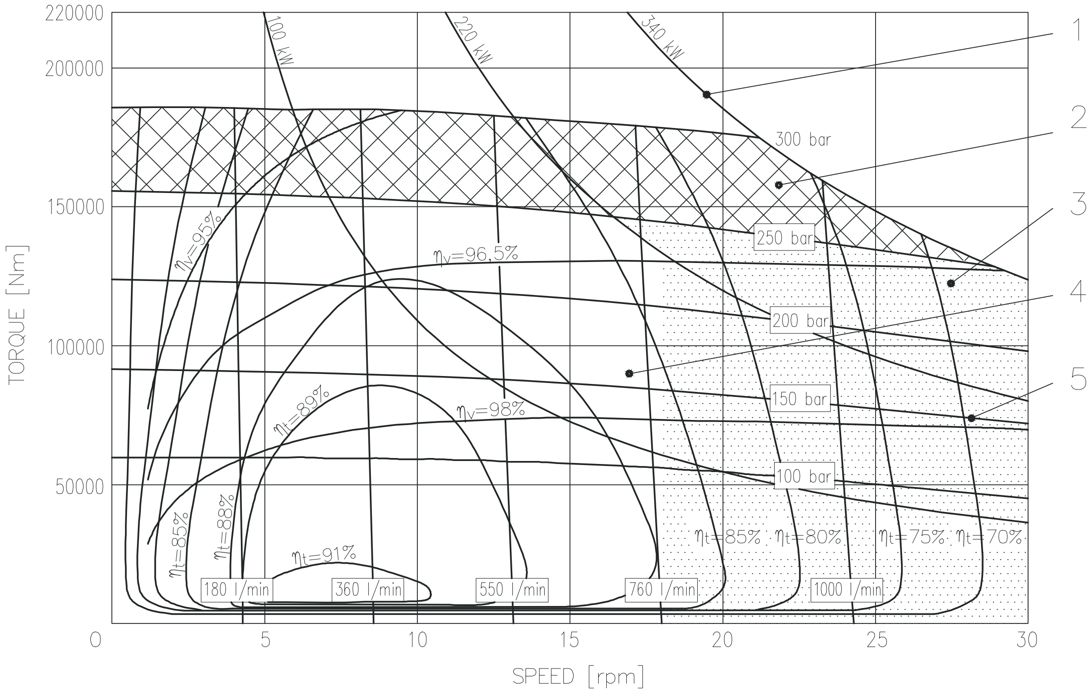
Ordering code example: **MRTA 35000 T - F1 N1 N1 S1 N**

Operating Diagram

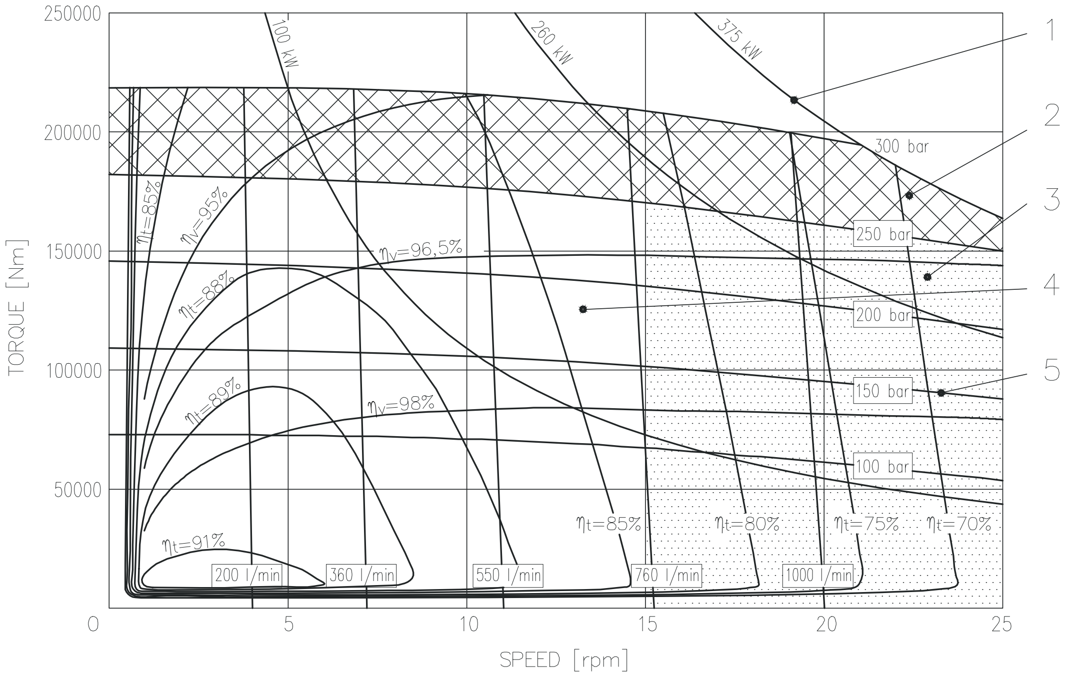
(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

MRT 40000 U



MRT 50000 U

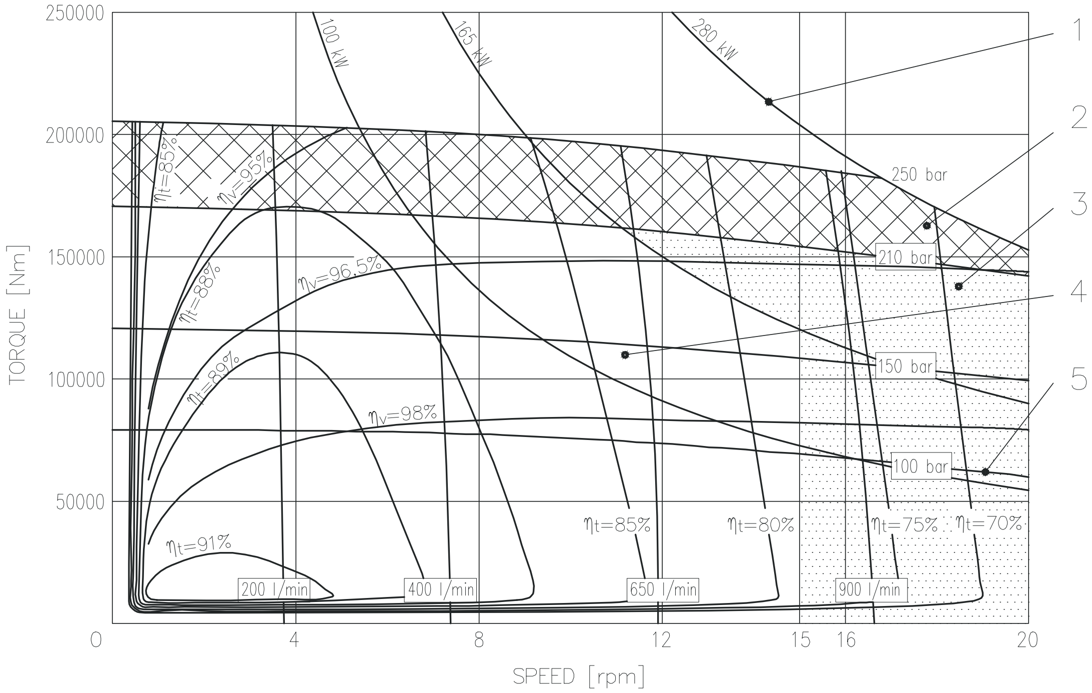


Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

1 Output power **2** Intermittent operating area **3** Continuous operating area with flushing
4 Continuous operating area **5** Inlet pressure η_t Total efficiency η_v Volumetric efficiency

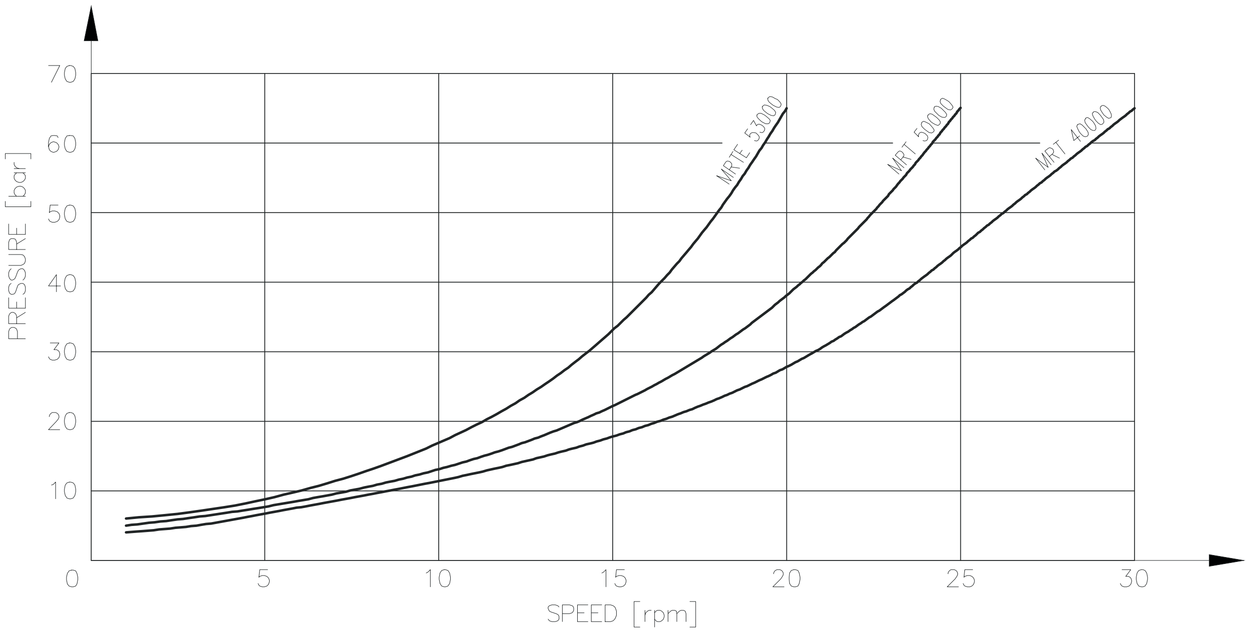
MRTE 53000 U



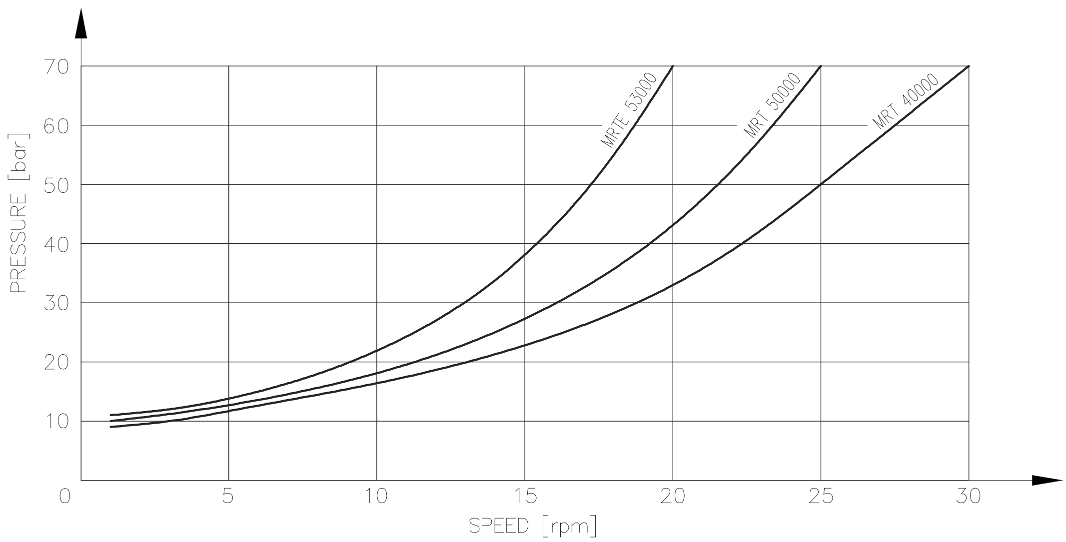
Operating Diagram

(average values) measured at ν = 36 mm²/s; t = 45°C; $_{Poutlet}$ = 0 bar

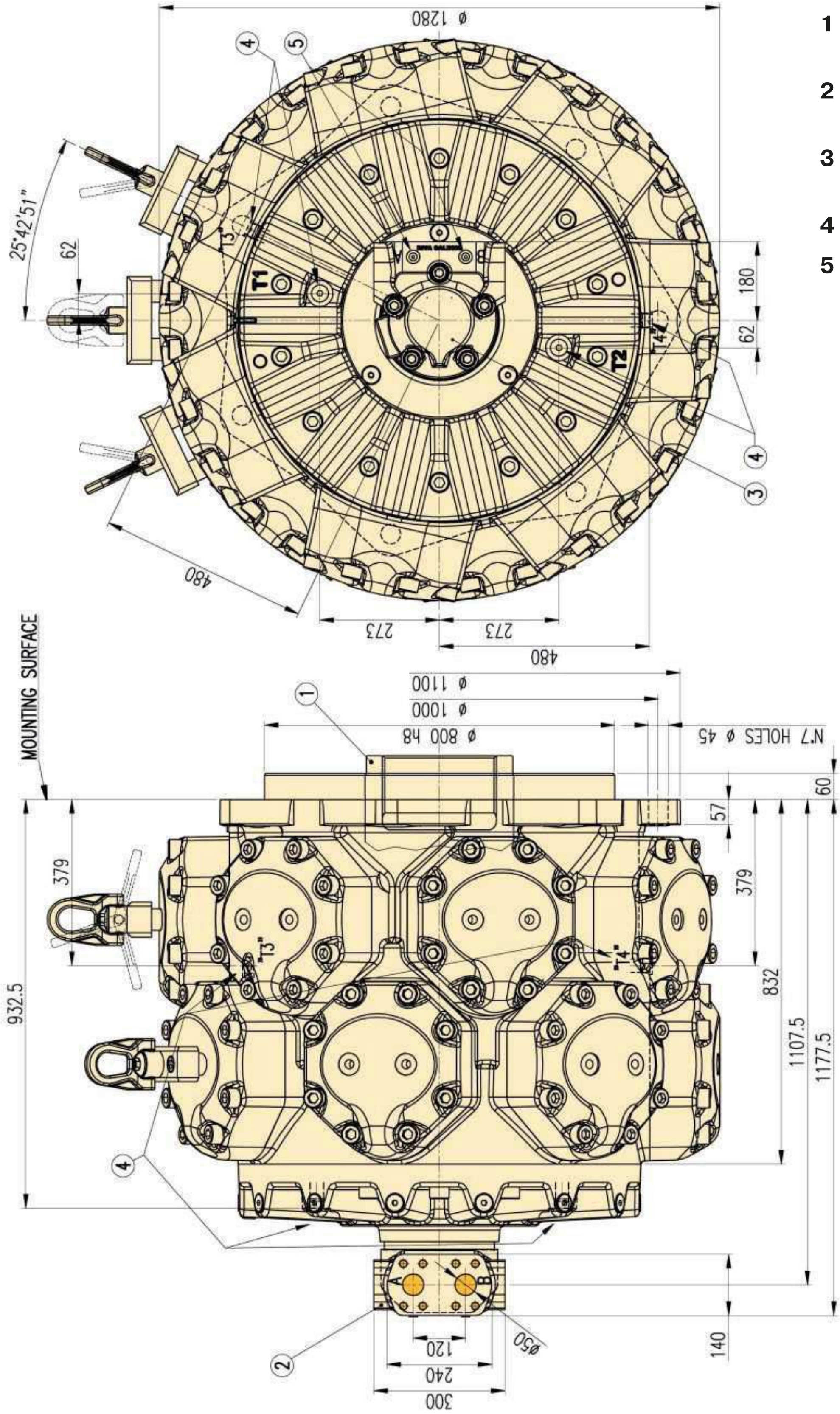
Min. required pressure difference Δp with idling speed (shaft unloaded)



Minimum boost pressure during pump operation



Overall Dimensions



1 **See output shaft options at page 45**

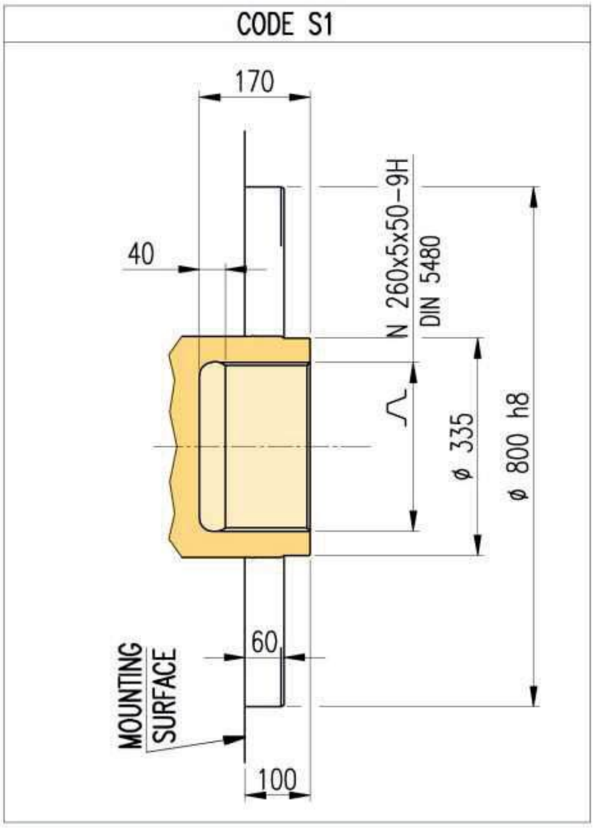
2 **See connection ports options at page 49**

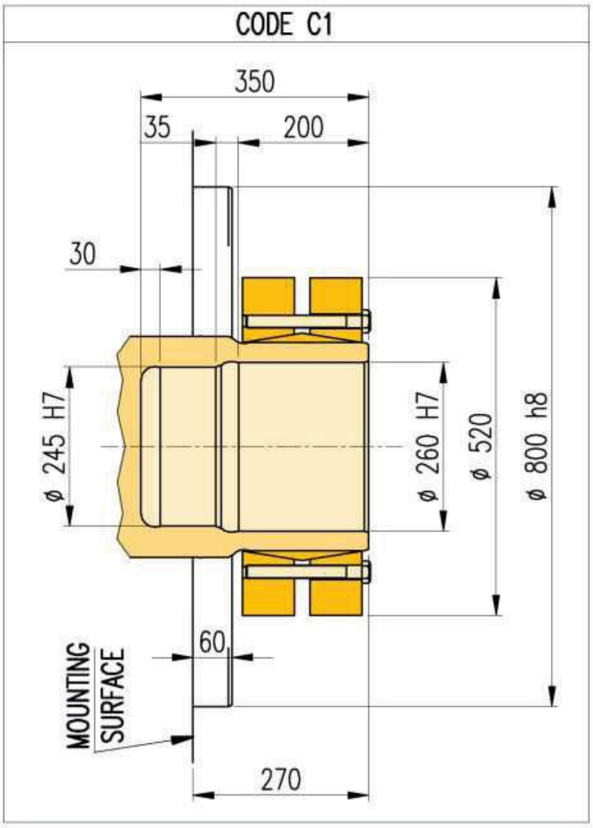
3 **On request the port flange can be rotated by 72°**

4 **Case drain ports: G 1"**

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

Output Shaft Options and Dimensions





Ordering Information

MRT ...	U						**

reserved (leave blank): customization on customer request (contact Calzoni)

Motor type & displacement

MRT40000
MRT 50000
MRTE 53000

Rotation (see page 49)

Standard rotation	N
Reversed rotation	S

Shaft type (see page 46)

F1	Female spline DIN 5480
C1	Shrink disk coupling

Connection flange (see page 49)

Standard pressure SAE metric (3000 psi)	S1
High pressure SAE metric (6000 psi)	G1

Speed sensor option (see pages 47-48)

N1	None
Q1	Encoder drive
C1	Mechanical tachometer drive
T1	Tachogenerator drive
M1	Monodirectional incremental encoder
B1	Bidirectional incremental encoder

Seals

NBR mineral oil	N1
NBR, 15 bar shaft seal	F1
FPM seals	V1
No shaft seal (for brake coupling)	U1

Ordering code example: **MRT 50000 U - C1 N1 N1 S1 N**

Speed Sensor Options

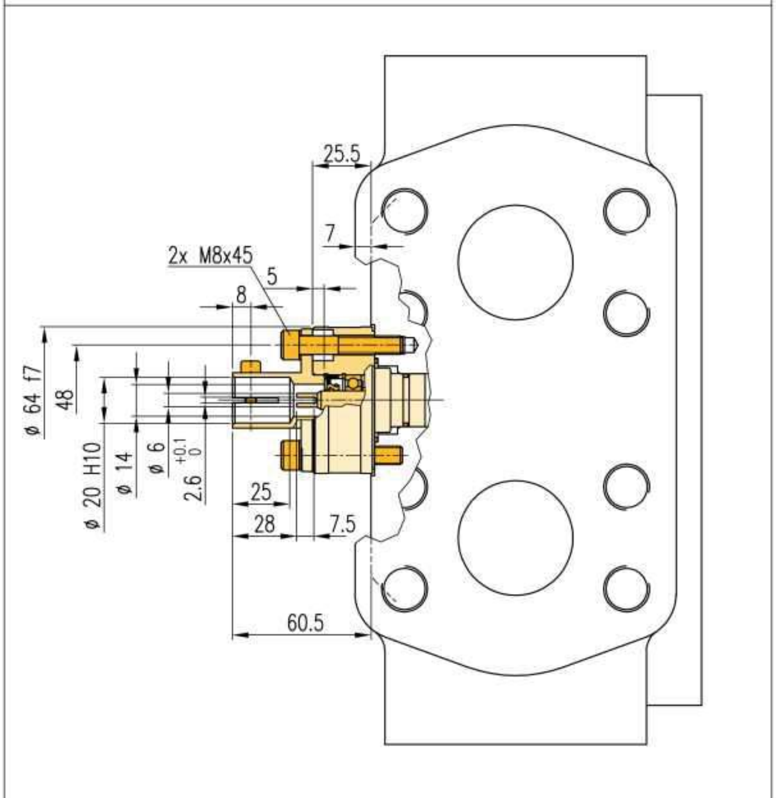
- **Standard:**

N1	**None**

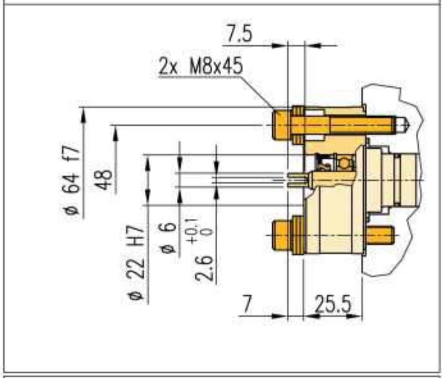
- **Speed sensor drives:**

C1	**Mechanical tachometer drive**
T1	**Tachogenerator drive**
Q1	**Encoder drive**

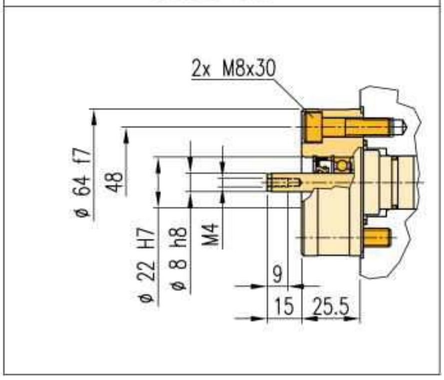
CODE C1



CODE T1



CODE Q1

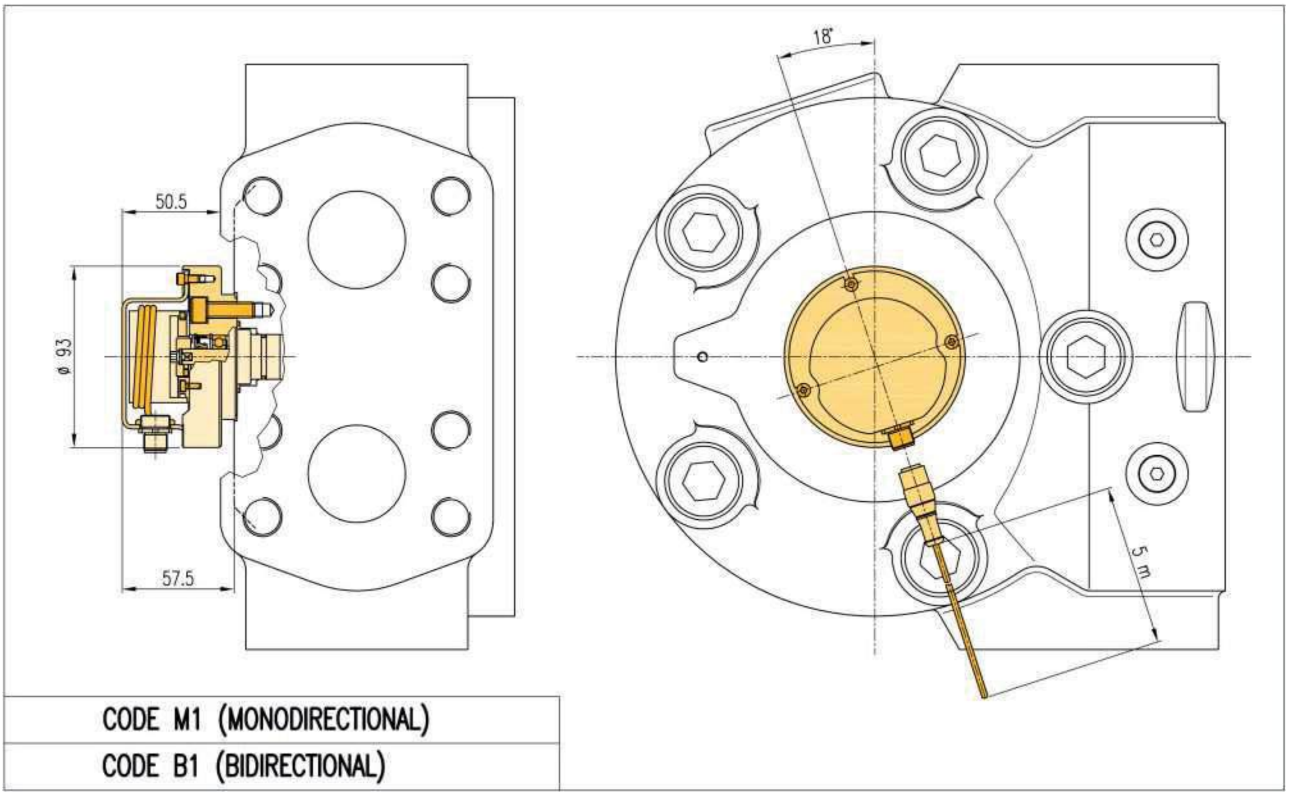


These codes consist on the predisposition for the desired speed sensors. For sensor specifications and connection look at the technical catalogue of the sensor manufacturer.

- **Incremental encoder:**

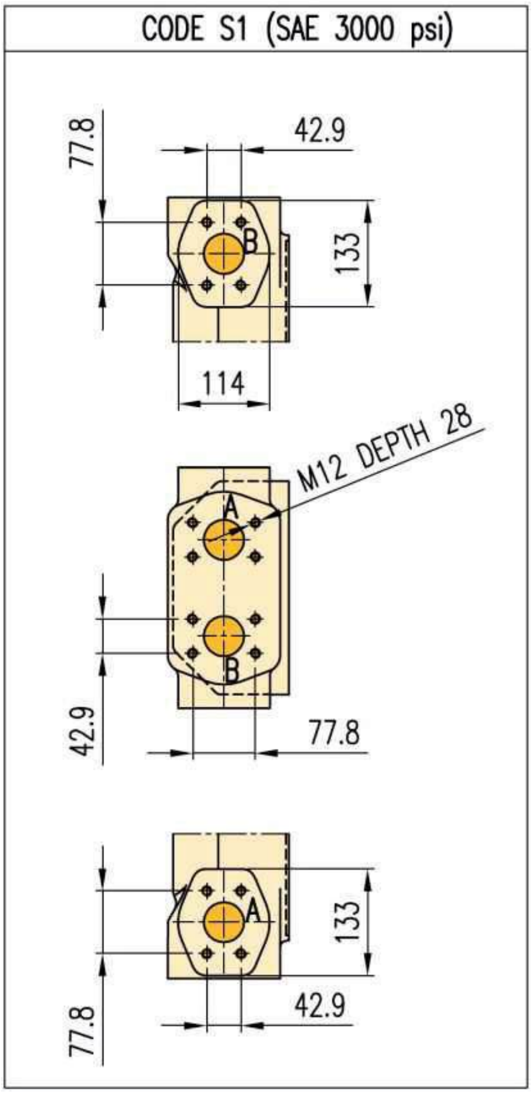
M1	**Monodirectional incremental encoder**
B1	**Bidirectional incremental encoder**

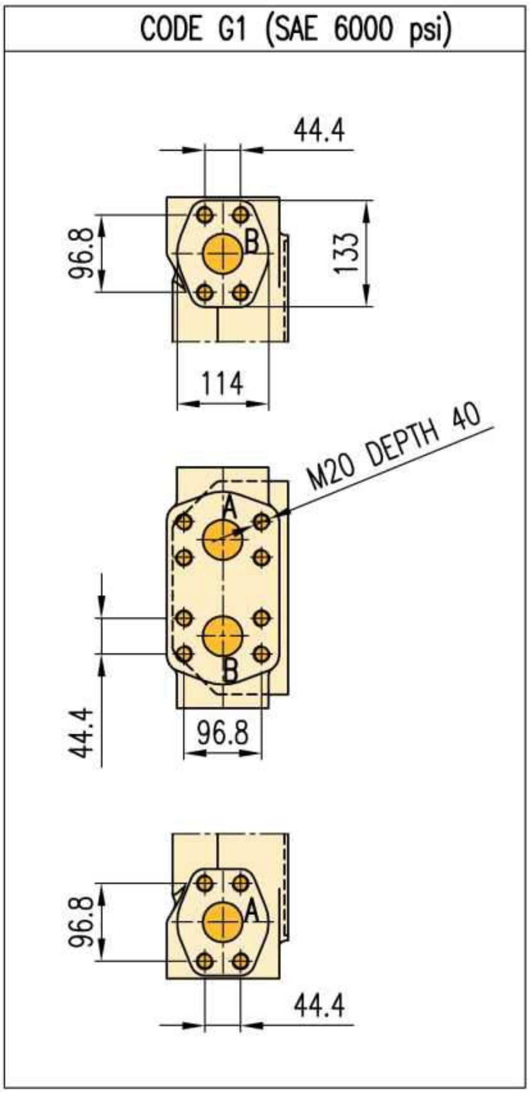
The 2 codes above consist on the whole incremental encoder kit, already installed on the rotary valve housing. For technical data see the table in the following page



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	**CODE M1**
	A and B phase - BIDIRECTIONAL	**CODE B1**
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 0 to 70°C	
STORAGE TEMPERATURE RANGE	from -30 to +85°C	
BALL BEARING LIFE	1.5x109 rpm	
WEIGHT	100 g	
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.		

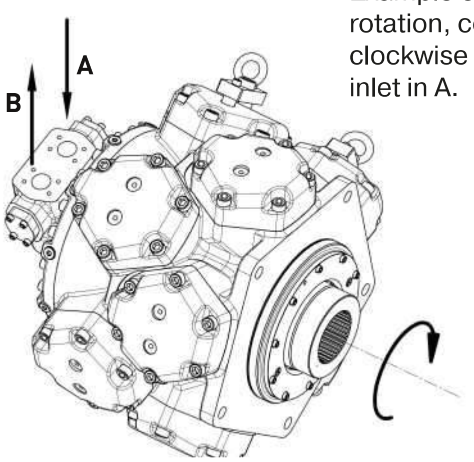
Connection Flanges





Direction of Rotation

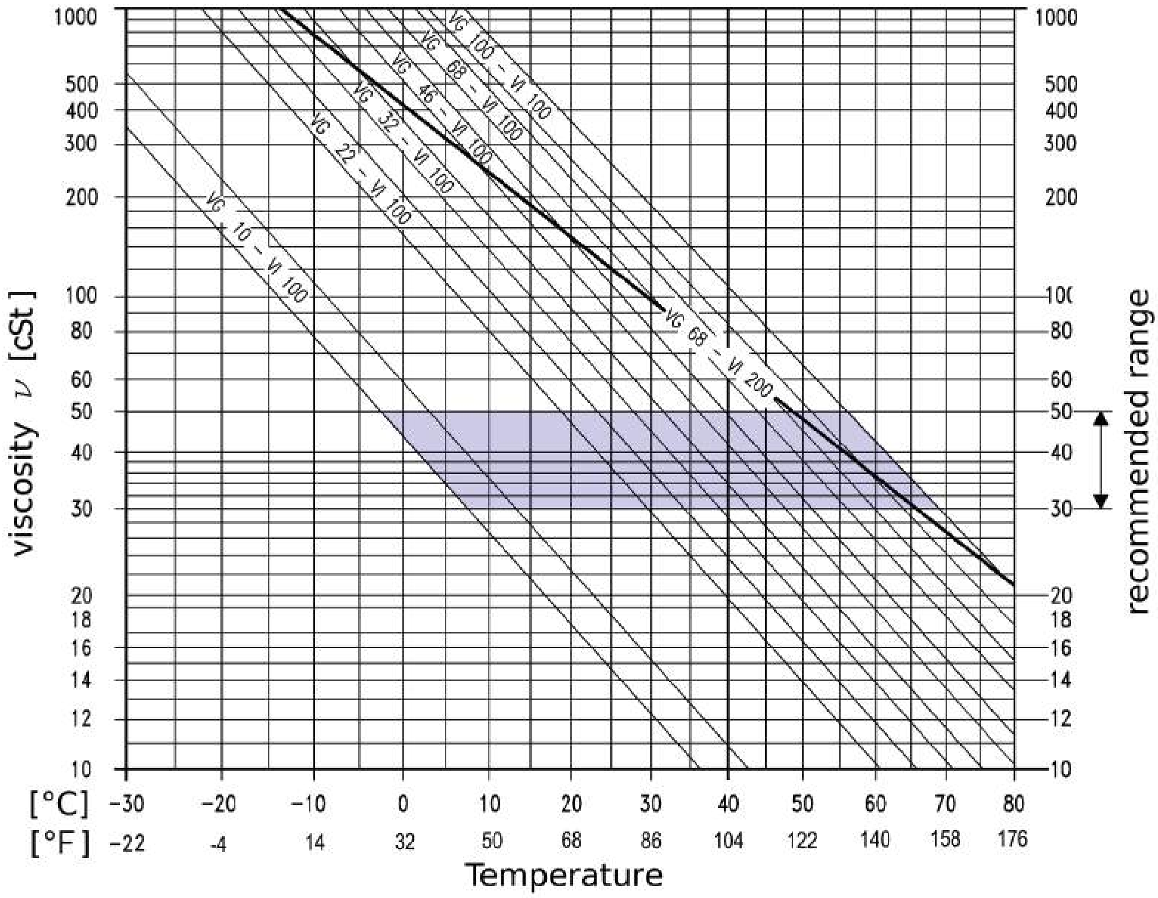
Direction of rotation (viewed from shaft end)	Inlet port	Ordering code
clockwise **counter-**	**A** **B**	**N**
clockwise	**B** **A**	**S**



Example of standard rotation, code **N:** clockwise rotation, inlet in A.

Mineral-oil based fluids

Performance data of this catalogue is valid when motors are operating with mineral oil based fluids, according to DIN 51525. The fluid should contain anti-oxidant, antifoam, demulsifying and antiwear or EP additives.
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 achieved within the recommended viscosity range of 30 - 50 cSt.
For applications that go beyond this range, we recommend to contact the manufacturer of the motor.



The viscosity refers both to the temperature of the fluid entering the motor and to the temperature inside the motor housing (case temperature). Based on the maximum operating temperature, we recommend to select the fluid so that its viscosity remains within the recommended viscosity range.

For critical operation conditions the following values apply:

$\nu_{min.peak}$ = 10 cSt in emergency, short term;
$\nu_{min.cont.}$ = 18 cSt for continuous operation at reduced performances;
$\nu_{max.}$ = 1000 cSt short term upon cold start.

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 motor, however, may the temperature be higher than 80°C (max admitted temperature).

In case of operating conditions with high oil temperature or high ambient temperature, we recommend to use “FPM” seals (option code “V1”). These “FPM” seals should be also used with HFD fluids.

If these viscosity requirements cannot be met, due to extreme operating parameters or high environment temperature, motor case flushing is strictly recommended in order to operate within the viscosity limits.
Should it be absolutely necessary to use a viscosity exceeding the recommended range, please contact Calzoni.
Filtration improves the cleanliness level of the hydraulic fluid and increases the service life of the motor. To ensure the functional reliability of the motor, a cleanliness level of at least 20/18/15 to ISO 4406 (equivalent to level 9 according to NAS 1638 or 6 to SAE 749) is to be maintained in the circuit.

Other fluids

Calzoni radial piston motors can operate successfully on a wide variety of fluids. As a general guide de-rating factors are set out below:

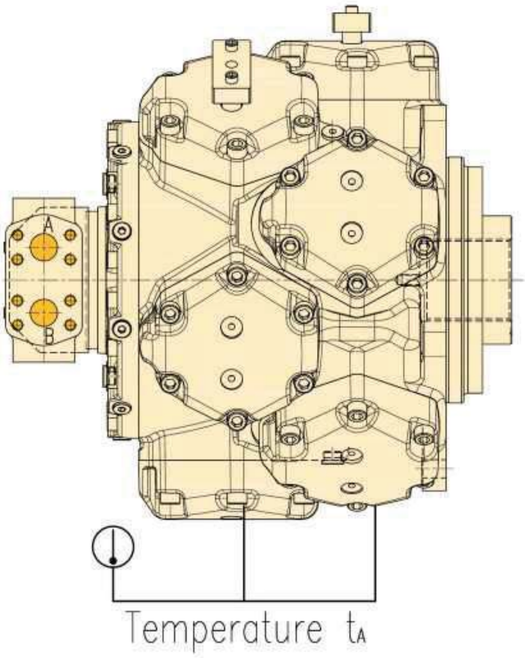
Class	Description	Pressure	Speed	Power	Temperature	
-	-	(% of nominal pressure)	(% of max speed)	(% of max power)	Max	Ideal
HFA	Oil-water emulsion	50	50	25	50 °C 122 °F	40 °C 104 °F
HFB	Water-oil emulsion	80	80	60	60 °C 140 °F	45 °C 113 °F
HFC	Water-based solution (mostly with glycol)	60	60	30	60 °C 140 °F	45 °C 113 °F
HFD	Synthetic fluids (water free)	100	100	100	80 °C 176 °F	50 °C 122 °F

The use of synthetic fluids (type HFD) is allowed with motors supplied with seals in “FPM” material (pls. contact Calzoni about the use of motors with synthetic fluids). The use of synthetic fluids (type HFD) does not imply any motor performances reduction.
Please specify make and type of fluid on your order if other than petroleum oil.

Flushing of motor case

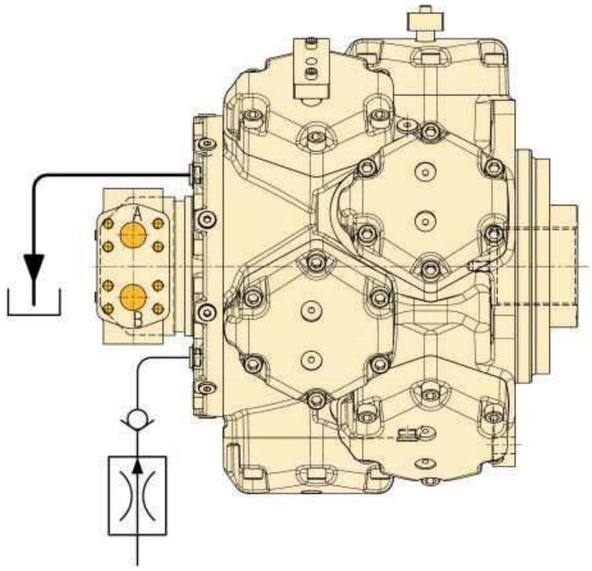
Motor case flushing is compulsory when the motor has to operate in the "Continuous operating area with flushing" (pls. refer to the Operating Diagrams), in order to ensure a minimum fluid viscosity inside the motor case of 30 mm²/s.
Flushing may also be necessary out of the "Continuous operating area with flushing" when high temperature is reached in the motor case and the system is unable to ensure the minimum recommended degree of viscosity.

The fluid temperature inside the motor case can be obtained by adding 3°C to the motor case surface temperature t_A ,measered between two cylinders.

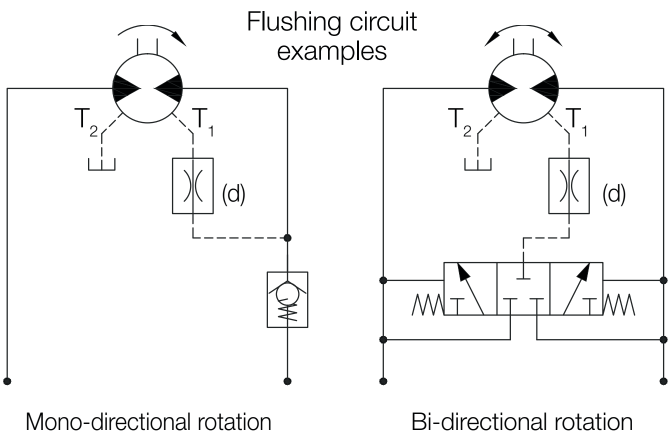


For MRT motors, the required flushing flow rate is **23 l/min**; the flushing line can be realized in two different ways:

- **External flushing:**
flushing flow rate is obtained by means of an external source.



- **Internal flushing:**
The motor return line can be used as source flow to flush the motor case (see “Flushing circuit examples”). The requested flow rate can be obtained selecting the correct restrictor diameter (d) according to the differential pressure between the motor case and the return line. Please contact Calzoni Hydraulics for internal flushing option.



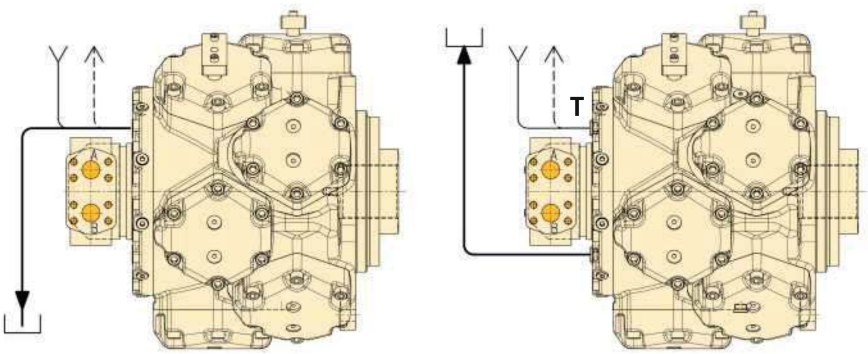
Drain and Feeding Connection

Before installation, fill the motor with hydraulic fluid.

Note:
Install leakage line in such a way that motor **cannot** run empty.

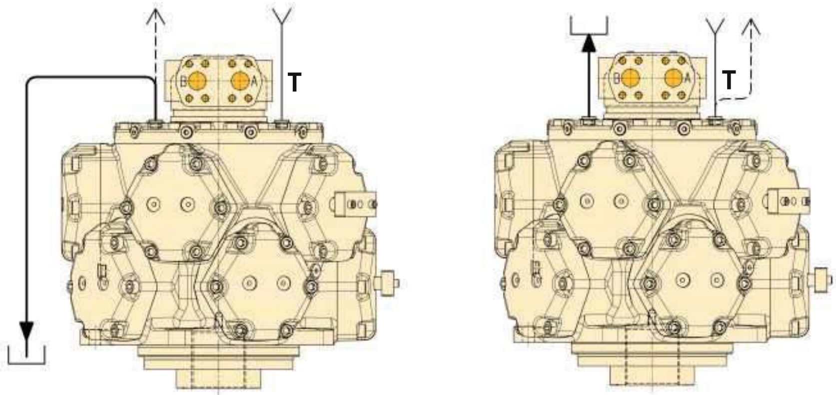
T = To be plugged after motor case feeding
Y = Motor case feeding point
↑ = Air bleeding
▲ = Drain line

Horizontal installation

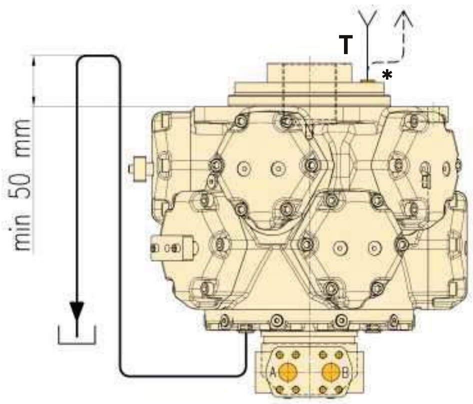


Choose the drain port in order to allow the complete filling of the motor case with hydraulic fluid.

Vertical installation - output shaft downward



Vertical installation - output shaft upward



* Optional plug for feeding and air bleeding (pls contact the manufacturer).

Notes

Notes

Calzoni Hydraulics Germany GmbH
Max-Eyth-Straße 65
72622 Nürtingen, Germany
Phone: +49 7022 405990

Calzoni Hydraulics Italy Srl
Via Casteldebole 10
40069 Zola Predosa (BO) Italy
Phone: +39 051 6501611

Email: info@calzoni-hydraulics.com

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