

ELECTRO-HYDRAULIC
FAN DRIVE SYSTEM

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Replaces: 03/11.2004

○ 04/02.2014

○ **Modification from former edition.**

INTRODUCTION

HYDRAULIC GEAR MOTORS FOR DRIVING COOLING FANS

One of Casappa's aims is to produce targeted engineering solutions to improve machine performance. Designers of vehicle cooling systems require complete and flexible control systems.

A cooling fan featuring a hydraulic drive offers significant advantages over traditional solutions with electric or belt drives.

Replaces: 03/03.2004

THE ADVANTAGES OF A HYDRAULIC SYSTEM

- Fan speed control
- Changing fan direction of rotation
- Energy savings - Low noise level
- Long working life expectancy and flexibility
- Integrated controls - reduced overall dimensions

AVAILABLE SYSTEMS

➤ FIXED RATIO

Fan speed proportional to the engine speed



➤ TWO SPEED



➤ VARIABLE SPEED

Variable speed and changing the direction of rotation.
Fan speed independent of engine speed.



ELECTRONIC CONTROL UNIT CED200X

04/02.2014

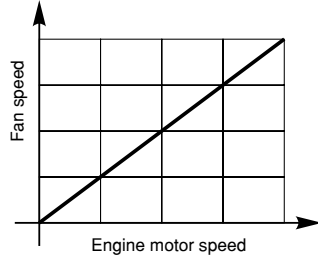
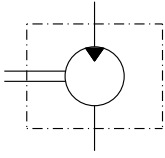
Electronic control unit CED200X with Casappa service tool software controls the hydraulic motor speed and change the direction of rotation.



FIXED RATIO SYSTEM

Fan speed proportional to the engine speed.

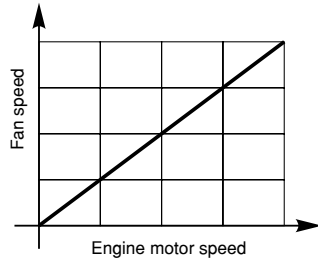
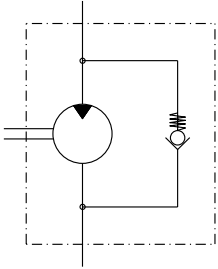
WITHOUT VALVE



- Cost reduction
- Straightforward system

ANTI-CAVITATION VALVE

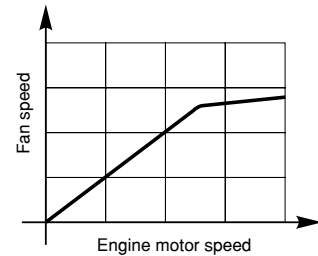
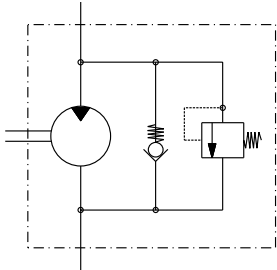
V8



- High speeds
- Motor protected against any system stops

MAX. PRESSURE RELIEF VALVE FIXED SETTING AND ANTI-CAVITATION

VPIF (...)



- High speeds
- Long life is expected
- Motor protected against any pressure peaks or accidental stops

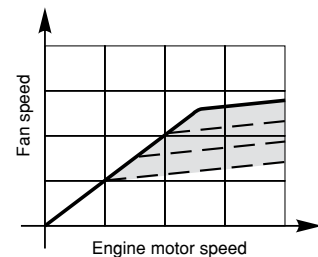
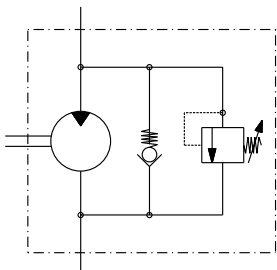
Max. pressure relief valve [setting values in bar (psi)]

VPIF (...)	50	70	80	100	120	125	140	150	160	175	180	190	200	210	230	250
	(725)	(1015)	(1160)	(1450)	(1740)	(1813)	(2030)	(2175)	(2320)	(2538)	(2610)	(2755)	(2900)	(3045)	(3335)	(3625)

The valve is sized to control a Q=40 l/min (10.57 US gpm) maximum flow rate. For different values, please consult our technical sales department.

MAX. PRESSURE RELIEF VALVE ADJUSTABLE SETTING AND ANTI-CAVITATION

VMP5/TS/V9



- High speeds
- Large size fans
- Motor protected against any pressure peaks or accidental stops
- System optimisation thanks to adjustability

Max. pressure relief valve [setting values in bar (psi)]

VMP5/TS/V9	50 ÷ 220 (725 ÷ 3190)
-------------------	-----------------------

The valve is sized to control a Q=40 l/min (10.57 US gpm) maximum flow rate. For different values, please consult our technical sales department.

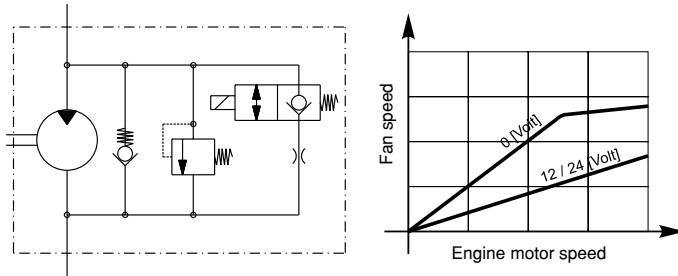
01/05.2003

TWO SPEED SYSTEM

**BY-PASS ELECTRIC VALVE, PILOT OPERATED (NORMALLY CLOSED)
MAX. PRESSURE RELIEF VALVE FIXED SETTING AND ANTI-CAVITATION**

**EC08 ...
VPIF (...)**

Replaces: 01/05.2003



- High speeds
- Large size fans
- Motor protected against any pressure peaks or accidental stops
- ON/OFF solenoid operated two speed (12 and 24 VDC)
Intermediate speed adjustments are not possible.

By-pass valve	Max. flow	Max. pressure	Seals	Voltage
	l/min (US gpm)	bar (psi)		VDC
EC08-A/2-0-N	20 (5.28)	210 (3045)	B (buna) - V (viton)	12 - 24
EC08-M/2-0-N	40 (10.57)	350 (5075)		



Max. pressure relief valve [setting values in bar (psi)]

VPIF (...)	50	70	80	100	120	125	140	150	160	175	180	190	200	210	230	250
	(725)	(1015)	(1160)	(1450)	(1740)	(1813)	(2030)	(2175)	(2320)	(2538)	(2610)	(2755)	(2900)	(3045)	(3335)	(3625)

The valve is sized to control a Q=40 l/min (10.57 US gpm) maximum flow rate. For different values, please consult our technical sales department.

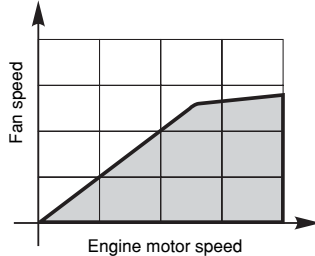
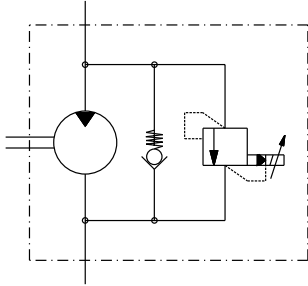
● 04/02.2014

VARIABLE SPEED SYSTEM

Fan speed independent of engine speed.

PROPORTIONAL RELIEF VALVE ANTI-CAVITATION VALVE

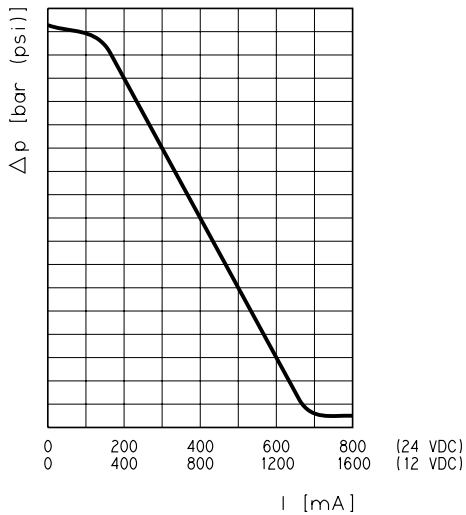
**DBVSA ...
V8**



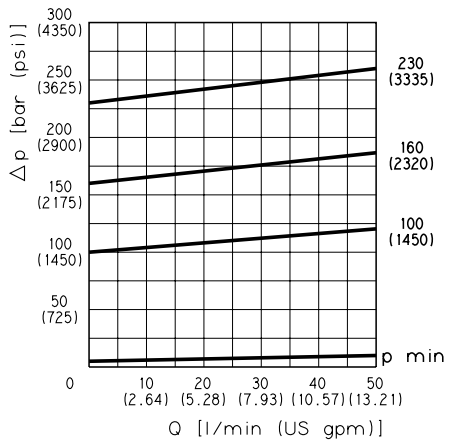
- High speeds
- Long life is expected
- Motor protected against any system stops
- Precise control of coolant temperature
- Maximum fan speed in case of control current failure

Replaces: 03/03.2004

Pressure/current curve

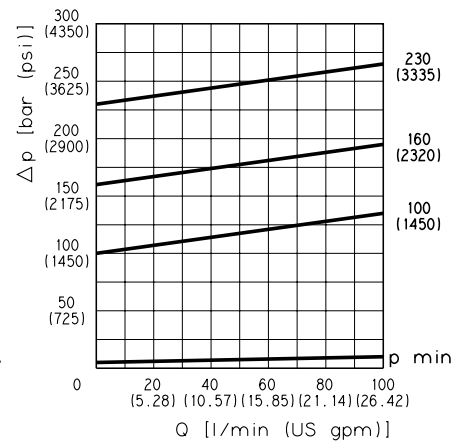


DBVSA-1LG..



Pressure/flow curves

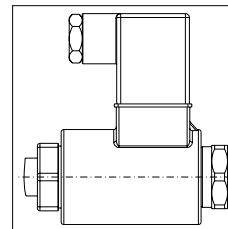
DBVSA-1CG..



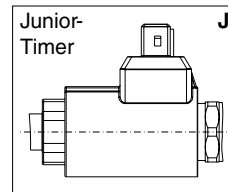
Technical data valve DBVSA

Ambient temperature	-25°C ÷ +80°C (-13°F ÷ +176°F)
Fluid temperature	-25°C ÷ +80°C (-13°F ÷ +176°F)
Fluid viscosity	12 ÷ 380 mm ² /s (cSt) (60 ÷ 1727 SSU)
Rated power supply voltage	12 VDC - 24 VDC
Power supply current	750 mA (at 24 VDC) 1400 mA (at 12 VDC)
Current adjustment	PWM ≥ 180 Hz
Standard connectors	DIN 43 650 / ISO 4400
Connectors on request	Junior-Timer and Deutsch
Protection IP 65 (DIN 40050)	Connectors standard and Junior-Timer
Protection IP 67	Connectors Deutsch

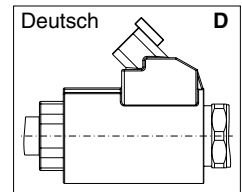
Connectors



DIN 43 650/ ISO 4400
Standard (no code)



Junior-Timer **J**



Deutsch **D**

04/02.2014

○	Proportional relief valve	Max. flow l/min (US gpm)	● Pressure setting values bar (psi)	◆ Power supply voltage VDC	■ Connectors on request
○	DBVSA-1LG-(●)-5-3-(◆) VDC-(■)/...	50 (13.21)	100 (1450) 160 (2320)	12 VDC - 24 VDC	J - D
○	DBVSA-1CG-(●)-10-3-(◆) VDC-(■)/...	100 (26.42)	230 (3335)		

Note: Standard valves are supplied complete with DIN 43 650 / ISO 4400 connectors.
For values outside of the listed range, please consult our technical sales department.

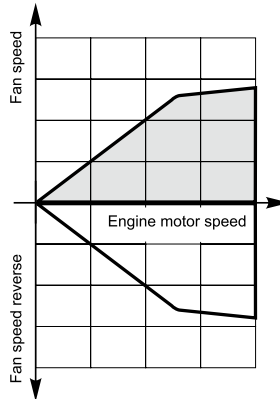
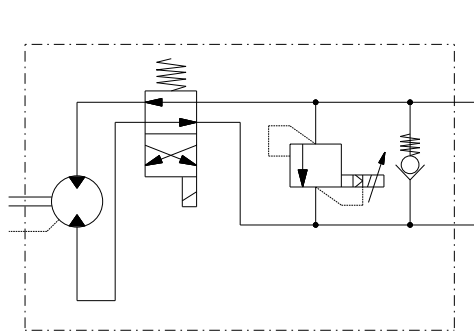
VARIABLE SPEED AND CHANGING THE DIRECTION OF ROTATION

Fan speed independent of engine speed.

REVERSE VALVE (4 way, 2 positions electric valve to change the direction of rotation)
PROPORTIONAL RELIEF VALVE
ANTI-CAVITATION VALVE

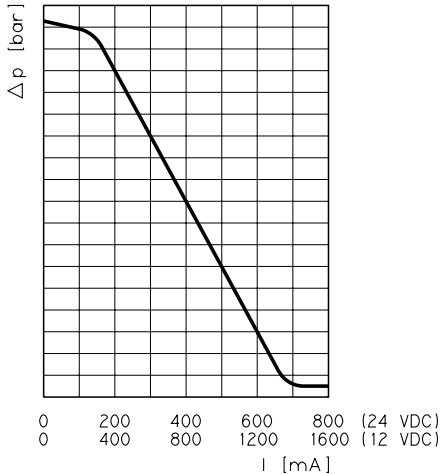
ER12-M ...
DBVSA ...
V8

Replaces: 03/03.2004

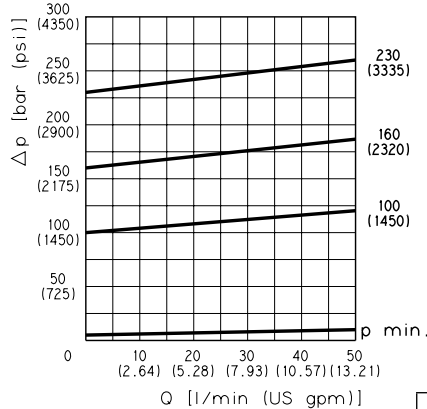


- High speeds
- Long life is expected
- Motor protected against any system stops
- Precise control of coolant temperature
- Reversible fan drive feature allows fan to clean radiator
- Maximum fan speed in case of control current failure

Pressure/current curve



Pressure/flow curves

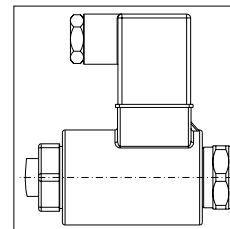


DBVSA-1LG..

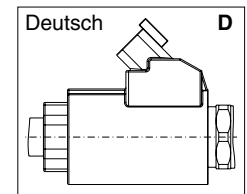
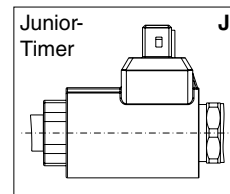
Technical data valve DBVSA

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Current adjustment	PWM ≥ 180 Hz
Standard connectors	DIN 43 650 / ISO 4400
Connectors on request	Junior-Timer and Deutsch
Protection IP 65 (DIN 40050)	Connectors standard and Junior-Timer
Protection IP 67	Connectors Deutsch

Connectors



DIN 43 650/ ISO 4400
Standard (no code)



04/02.2014

●	Reverse valve	Max. flow l/min (US gpm)	Max. pressure bar (psi)	Seals	Voltage VDC	■ Connectors on request
●	ER12-M/1-0-N-B-■	60 (15.85)	250 (3625)	B (buna)	12 VDC - 24 VDC	J - D
●	Proportional relief valve	Max. flow l/min (US gpm)	Max. pressure bar (psi)	● Pressure setting values bar (psi)	◆ Power supply voltage VDC	■ Connectors on request
●	DBVSA-1LG-●-5-3-◆ VDC-■/...	50 (13.21)	50 (725)	100 ÷ 160 ÷ 230 (1450) ÷ (2320) ÷ (3335)	12 VDC - 24 VDC	J - D

Note: Standard valves are supplied complete with DIN 43 650 / ISO 4400 connectors.
 For values outside of the listed range, please consult our technical sales department.

ELECTRONIC CONTROL UNIT CED200X - GENERAL INFORMATION



The CED200X electronic control unit can control the current of two proportional solenoid valves at the same time, according to the analog and digital input signals, based on a programmable logic.

The power supply current is controlled by modulation in PWM frequency with an adjustable dither frequency.

The electronic control unit is protected against incorrect connections and over-currents, against short-circuits and solenoid over-currents.

Replaces: 03/11.2004

Features:

24 pins: 2 x 12 poles Deutsch DTM

16 bit fixed point DSP running at 32 Mhz

12 bit A/D Converter

3 ways watch-dog to cut off power outputs:
 - External pin
 - Main microprocessor watchdog
 - Independent watchdog

1 CAN 2.0B port

1 RS-232 serial port

5 VDC Power Supply for external sensors:
 - Internally monitored and regulated
 - Max current 200 mA

Input (n.10)

4 Temperature Sensors

6 Digital / Frequency inputs
 - Digital: pull up, pull down or pull to center.
 - Frequency: up to 10 KHz npn/pnp

Output (n.6)

4 High Side drive 2A bidirectional pairs

2 Low Side drive 2A with current feedback

Working Conditions

Supply Voltage: 8-32V

Current Consumption: 50 mA

Max Load: 2A

EMC Compatibility 100 V/m - ISO 13877/ISO 14982

ESD 25 kV - ISO 7637-2

Load Dump 130 V - EN61000-4-2

Working Temperature: from -40 °C to 85 °C
 (-40°F ÷ +185°F)

Protection Degree: IP67 with mating connector attached

Weight: 0,3 Kg (0.66 lbs)

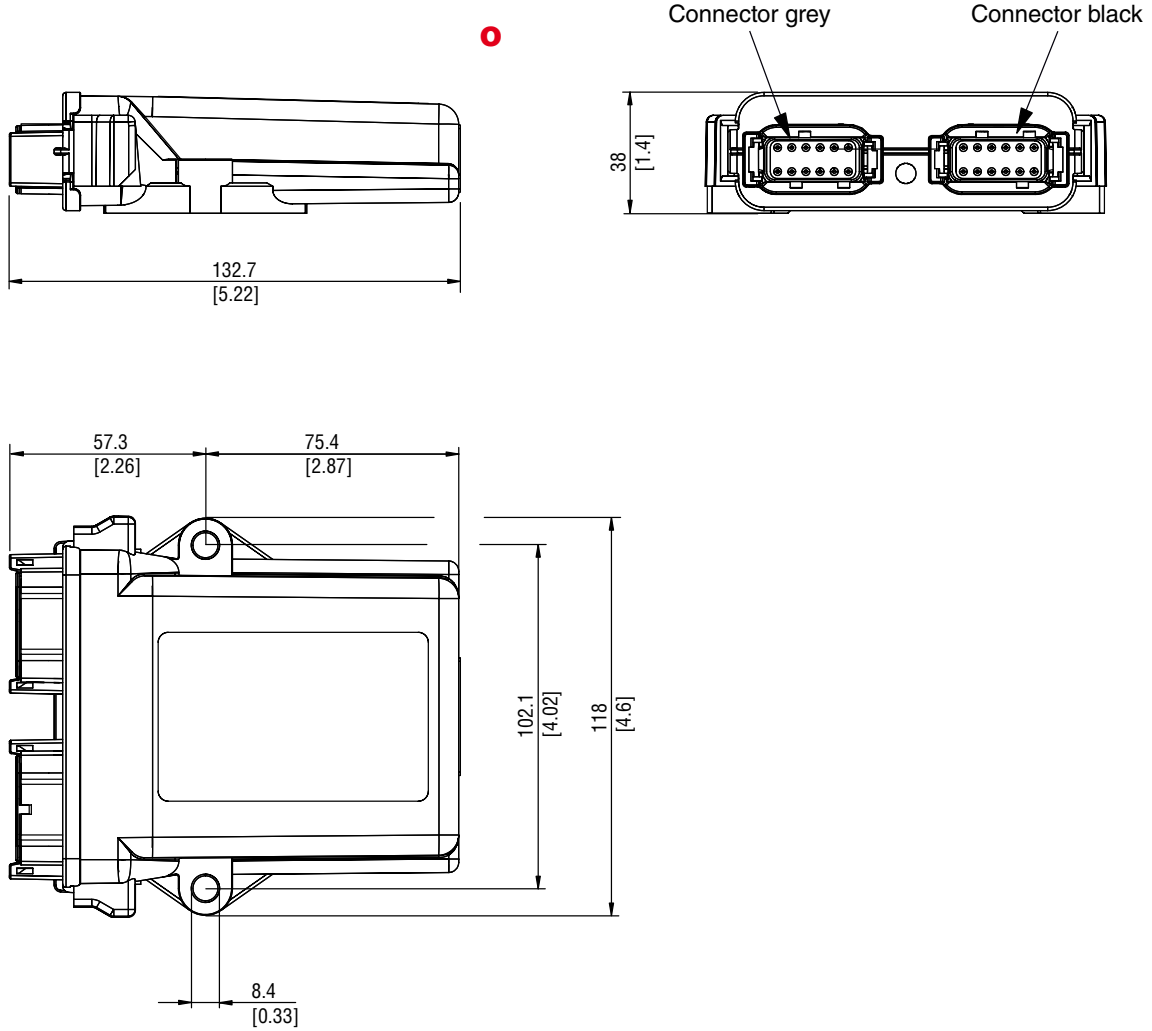
Environmental compatibility: IEC 60068-2-64/27

Connector: 2 x DEUTSCH DTM

 04/02.2014

ELECTRONIC CONTROL UNIT CED200X - DIMENSIONS

Replaces: 01/05.2003



Connector grey					
7	8	9	10	11	12
6	5	4	3	2	1

Connector black					
1	2	3	4	5	6
12	11	10	9	8	7

04/02.2014

1	Power VBB
2	Temperature sensor T4
3	Temperature sensor T3
4	Speed sensor input
5	RS232 Rx
6	CAN Low
7	CAN High
8	RS232 Tx
9	Retarder command (+12 V)
10	Temperature sensor T1
11	Temperature sensor T2
12	Power GND RS232 GND, CAN GND, Temperature sensor GND

1	GND
2	E1 - Emergency output
3	N.C.
4	Reverse valve +
5	Reverse command (+12 V)
6	Digital input 3
7	Digital input 5
8	Reverse valve -
9	Proportional valve -
10	Digital input 4
11	Proportional valve +
12	5V

ELECTRONIC CONTROL UNIT FOR FAN DRIVE SYSTEM

Variable speed and changing the direction of rotation.

The electronic control unit controls the hydraulic motor speed of the fan drive system by controlling the proportional relief valve and allows to change the direction of rotation by controlling the reverse valve.
Fan drive system provides for a maximum of ten input signals.

- 4 analog signals for controlling the water, air and oil temperatures in the system
- 1 digital signal for the “Retarder” function
- 1 digital signal for the “Reverse” function
- 1 frequency signal for speed sensor
- 3 digital signals for other functions

Electronic control unit can also receive CAN SAEJ 1939 standard messages. The temperature signals available on CAN bus (Engine Coolant Temperature, Engine Intercooler Temperature, Ambient Air Temperature, Intake Manifold Temperature) can be used to control the fan drive system. Retarder and Reverse command can also be provided from the CAN.

CONTROL MODES OF THE PROPORTIONAL VALVE

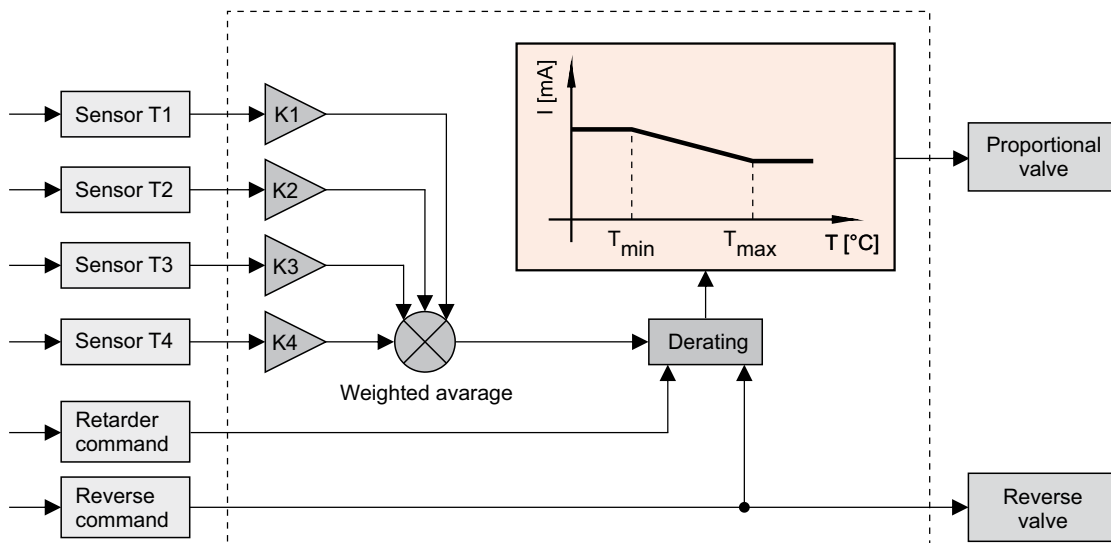
HIGHER MODE:

Current to proportional valve = $\text{Max} (K1 \cdot I(T1), K2 \cdot I(T2), K3 \cdot I(T3), K4 \cdot I(T4))$

MEAN MODE:

Current to proportional valve = $\frac{K1 \cdot I(T1) + K2 \cdot I(T2) + K3 \cdot I(T3) + K4 \cdot I(T4)}{K1 + K2 + K3 + K4}$

SINGLE FAN DRIVE SYSTEM - CED200X



Replaces: 03/03.2004

04/02.2014

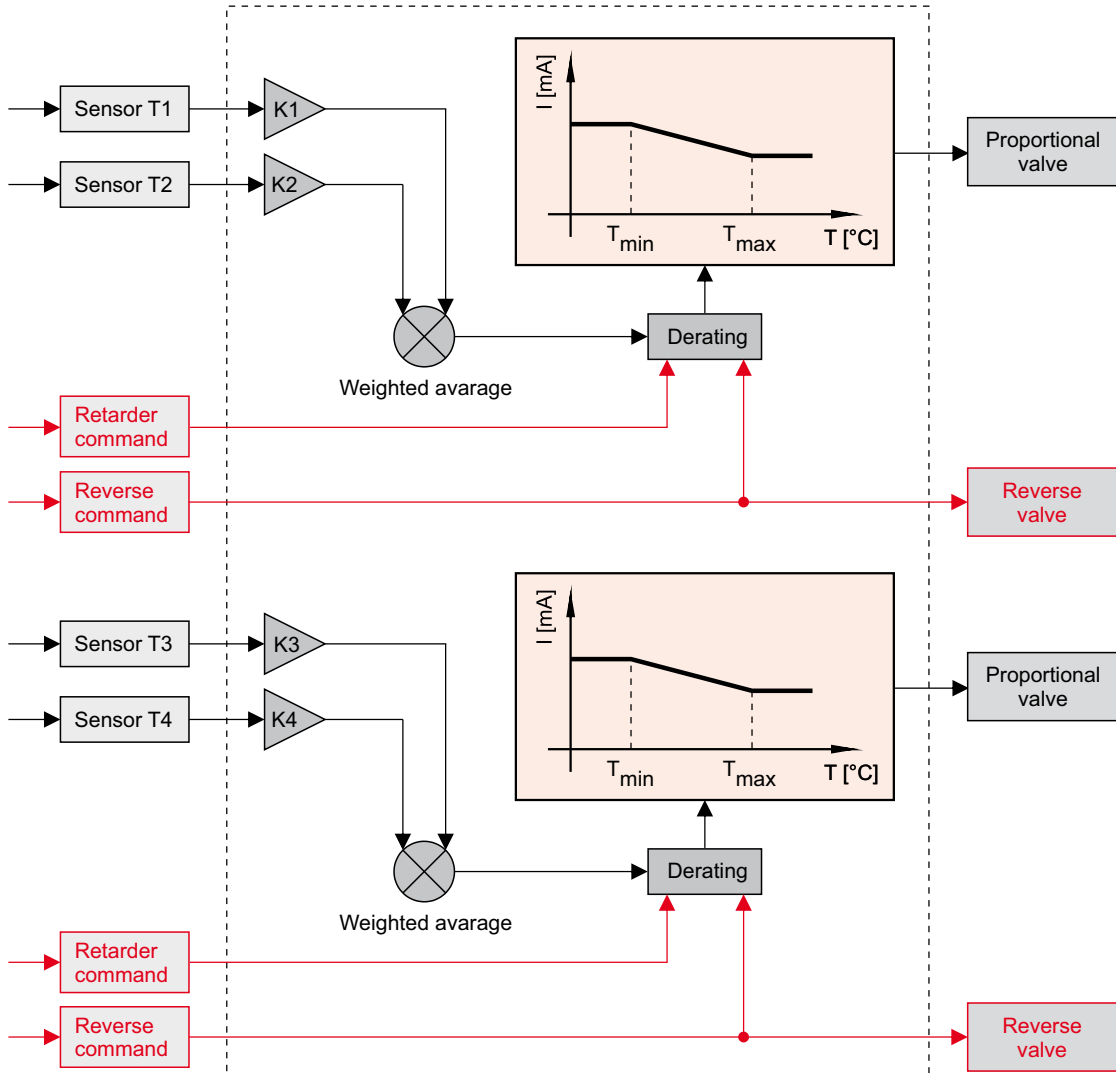
ELECTRONIC CONTROL UNIT FOR FAN DRIVE SYSTEM

Variable speed and changing the direction of rotation.

DOUBLE FAN DRIVE SYSTEM - CED200X

Double fan drive system with reverse valve require electronic control unit CED400X.

For more information please consult our sales department.



04/02.2014

ELECTRONIC CONTROL UNIT CED200X FOR FAN DRIVE SYSTEM

Variable speed and changing the direction of rotation.

CASAPPA SERVICE TOOL SOFTWARE

Ordering code

44090200



The software for managing the configuration of the electronic control unit CED200X.

Replaces: 03/03.2004



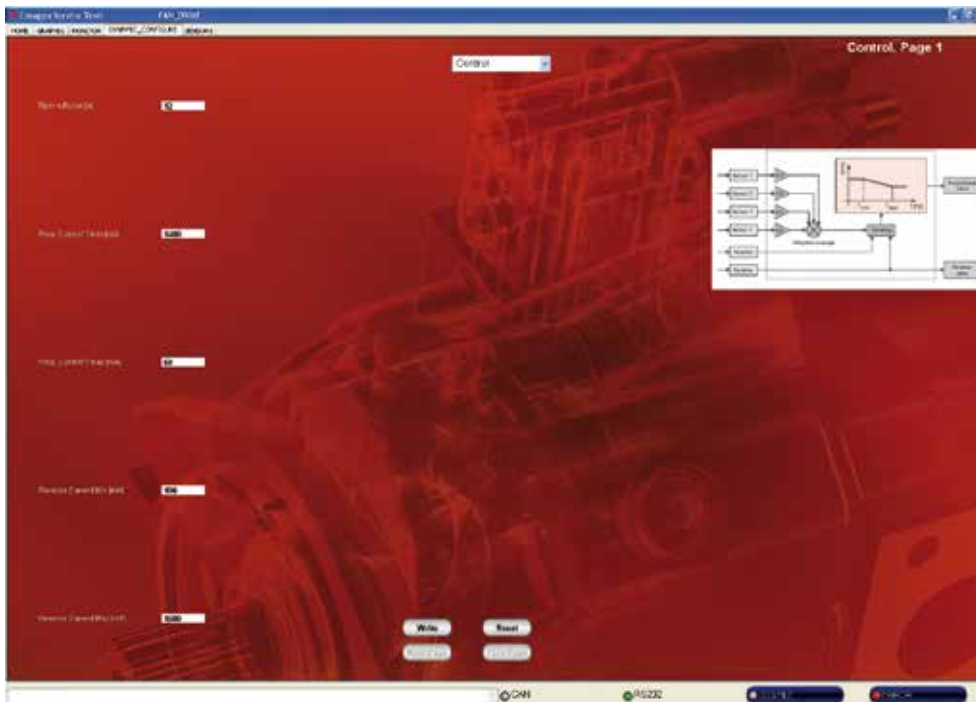
04/02.2014

ELECTRONIC CONTROL UNIT CED200X FOR FAN DRIVE SYSTEM

Variable speed and changing the direction of rotation.

CASAPPA SERVICE TOOL - CONTROLS

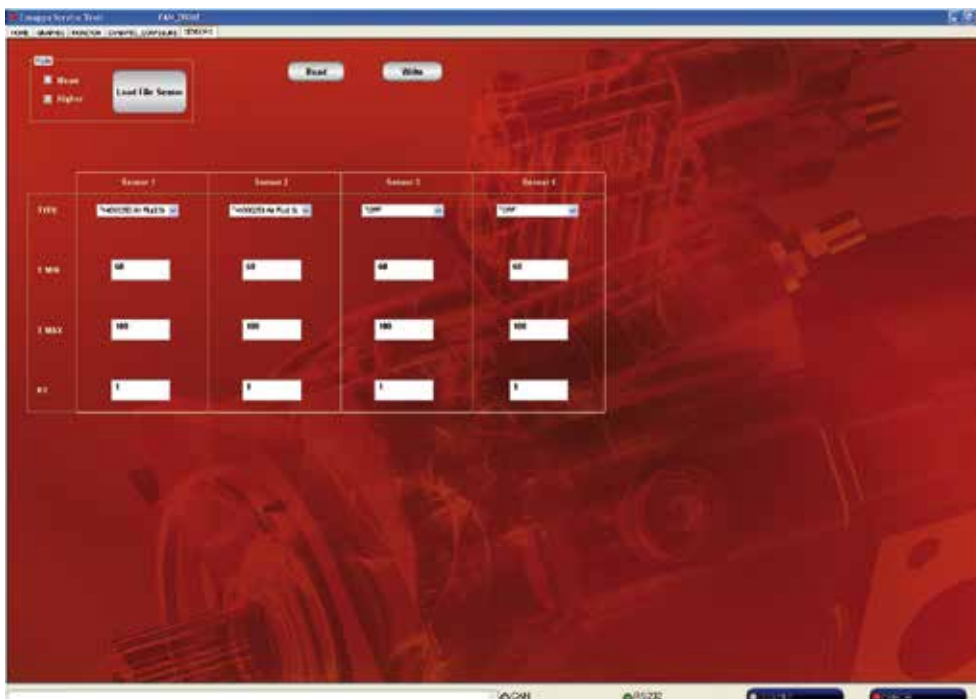
Replaces: 03/03.2004



TEMPERATURES

Fan motor speed is controlled by electro-proportional valve. The valve is supplied by a current calculated according a weighted average, which take into account of machine fluids temperature.

04/02.2014



The electronic control unit provides from a minimum of 1 to a maximum of 4 temperature sensors. For each channel can be settled the type of sensor fitted in the system "Type" for air or liquid, "Tmin and Tmax" control temperature and mathematical weight coefficient "Kt" according to a thermal importance of fluid of the system. In case of supply current failure the fan runs to maximum speed. Minimum and maximum limit of control current can be customized according to the technical data of proportional valve.

ELECTRONIC CONTROL UNIT CED200X FOR FAN DRIVE SYSTEM

Variable speed and changing the direction of rotation.

CASAPPA SERVICE TOOL – CONTROLS



RETARDER

Retarder function allows to increase or decrease the hydraulic motor speed changing the control current of proportional valve according configurable logics.

Replaces: 03/03.2004



REVERSE

Reverse function is available only for reversible motor with reverse valve and allows to change the direction of rotation for cleaning cycles of radiators. The engaging modality can be done in various way: manually from the operator "On Command", on system start-up "At Reset" or at programmed interval times "On Timeout". During the cleaning cycles, fan speed can be controlled setting the limit of proportional valve control current "Currents – Proportional min/max". Phase time of cleaning cycles can be adjusted to the system requirements "Cycle Control – Phase Time."

04/02.2014

ELECTRONIC CONTROL UNIT CED200X FOR FAN DRIVE SYSTEM

Variable speed and changing the direction of rotation.

CASAPPA SERVICE TOOL - CONTROLS

Replaces: 03/03.2004



N#	NAME	VALUE	UNIT
	Proportional Measure	0	mA
	Sensor T1	23	C
	Sensor T2	-40	C
	Sensor T3	-40	C
	Sensor T4	-40	C
	Actual Retarder Value	85	%
	Vbb mV	11909	mV
	Retarder Command	0	mV

MONITOR

Real time monitoring of the system temperature, coils supply currents, battery supply voltage and running state of "Retarder" and "Reverse" controls.

- Sensor 1 cc to Gnd
- Sensor 2 Discon.
- Sensor 3 Discon.
- Sensor Error Connection
- Sensor Error CAN

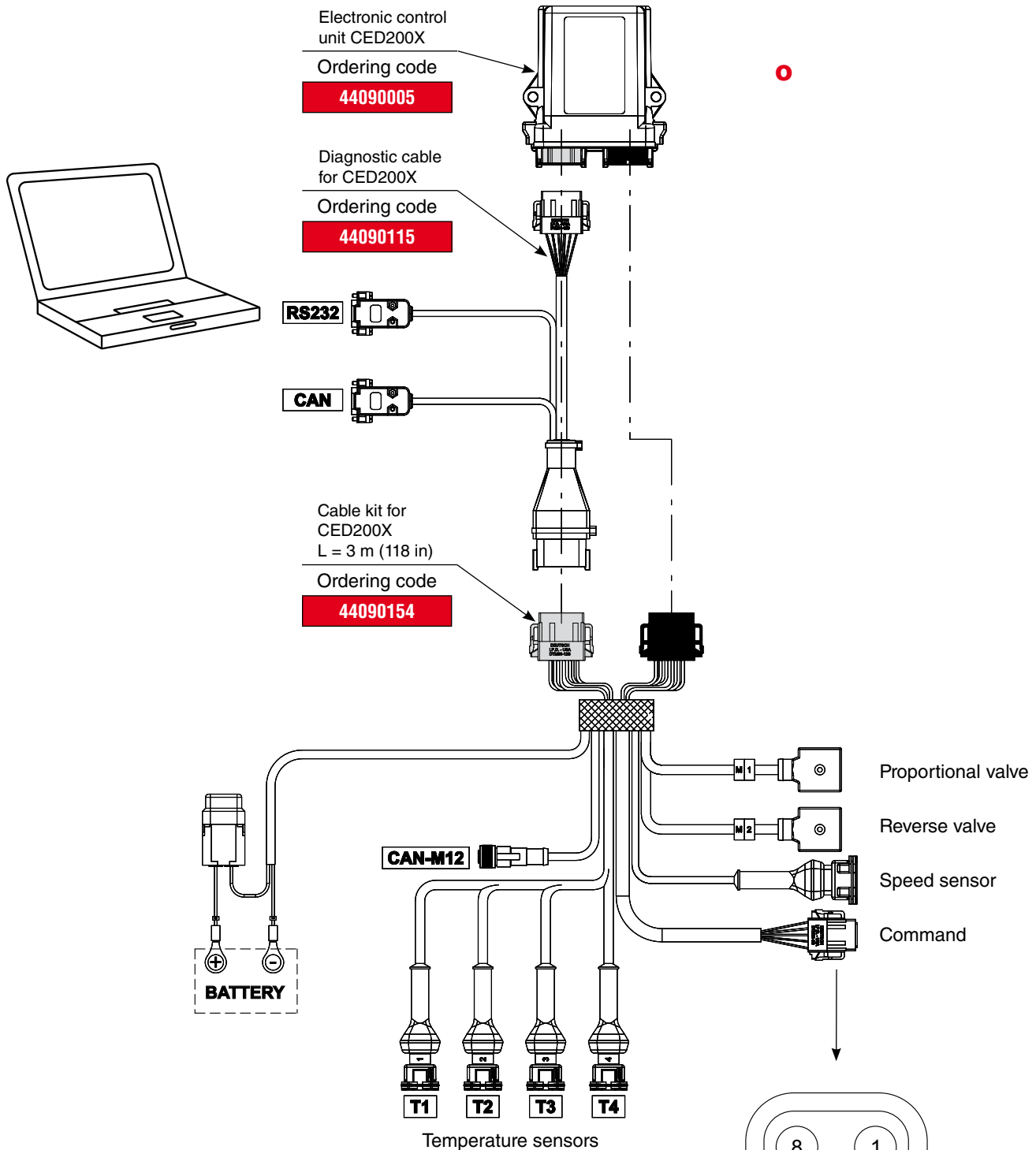
DIAGNOSTIC

Debug/diagnostic function indicating signal display of possible failures system.

● 04/02.2014

ELECTRONIC CONTROL UNIT CED200X FOR FAN DRIVE SYSTEM

Variable speed and changing the direction of rotation.

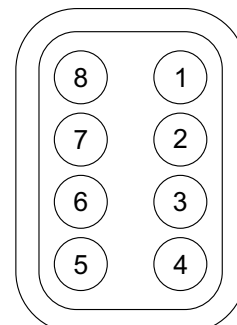


Replaces: 03/03.2004

04/02.2014

Command connector pinout

1	Retarder command (+12 V)	5	GND
2	Digital input 3	6	Emergency output
3	Digital input 4	7	Digital input 5
4	5 V	8	Reverse command (+12 V)



TEMPERATURE SENSOR AND KIT CONNECTORS

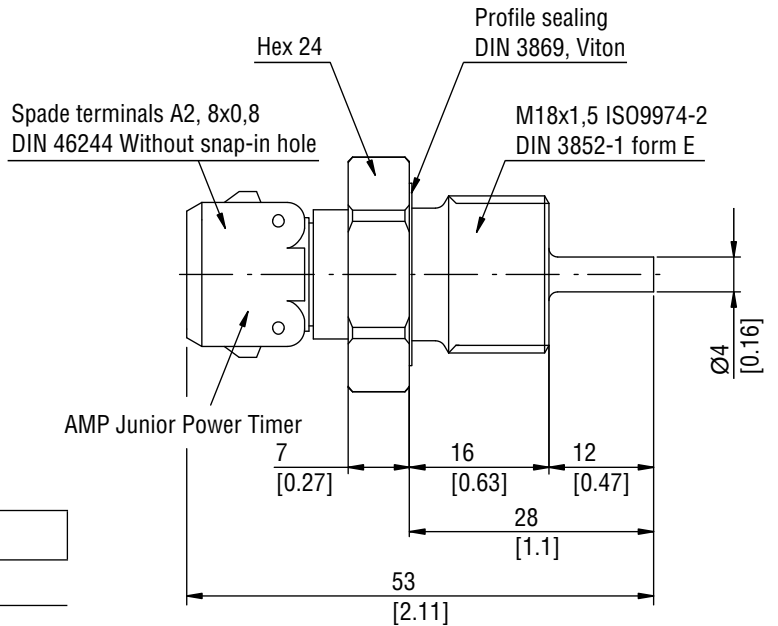
FLUID TEMPERATURE SENSOR

Replaces: 03/03.2004



Ordering code

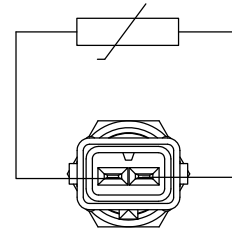
44090250



Technical Data

Version	Thermistor
Resistive Element	NTC
Operating Temperature	-40 °C ÷ +150 °C (-40°F ÷ +302°F)
Resistance	5000 Ohm (a 25°C) 16325 Ohm (a 0°C)
Plug Connection	AMP Junior Power Timer (2 pin 2,8x0,8 mm)
Protection	IP67

Electrical Diagram



KIT CONNECTORS

Ordering code

44090140



Ordering code

44090145



04/02.2014

Technical Data

Female Connector	DTM06-12SA
Number of ways	12
Operating Temperature	-40 °C ÷ +125 °C (-40°F ÷ +257°F)
Protection	IP68

Technical Data

Female Connector	DTM06-12SB
Number of ways	12
Operating Temperature	-40 °C ÷ +125 °C (-40°F ÷ +257°F)
Protection	IP68

FEATURES OF THE POLARIS 20 HYDRAULIC GEAR MOTORS

PLM 20

Construction	External gear type motors
Mounting	EUROPEAN -SAE -GERMAN -standard flanges
Line connections	Threaded and flange
Direction of rotation (looking on drive shaft)	Anti-clock (S) -clockwise (D) -reversible external drain (R)
Max back pressure for single rotation motors (◆) ○	5 bar (73 psi)
Max drain line pressure on the reversible rotation motors	5 bar (73 psi)
Max back pressure on the series motors	150 bar (2175 psi)
Fluid temperature range	See table (1)
Fluid	Mineral oil based hydraulic fluids to ISO/DIN and fire resistant fluids [see table (1)]. For other fluids please consult our technical sales department.
Viscosity range	From 12 to 100 mm ² /s (cSt) recommended [60 to 456 SSU] Up to 750 mm ² /s (cSt) permitted [3410 SSU]
Filtering requirement	See table (2)

(◆) For max back pressure value outside the recommended limits it is necessary to use reversible motors with external drain R.

Replaces: 03/03.2004

Tab. 1

Type	Fluid composition	Max pressure bar (psi)	Max speed min ⁻¹	Temperature °C (°F)	Seals (●)	Special shaft seal (◆)
ISO/DIN	Mineral oil based hydraulic fluid to ISO/DIN	See page 19	See page 19	-25 ÷ +80 (-13 ÷ +176)	N	C - D - H - R
				-25 ÷ +110 (-13 ÷ +230)	V	--

- (●) **N**= Buna N (standard) - **V**= Viton
- (◆) **C**= High back pressure seal with wiper seal
D= Standard seal with wiper seal
H= High back pressure seal
R= Special seal with high resistance to external contaminants (only for clockwise rotation motor with shaft 82, 31 and 54)

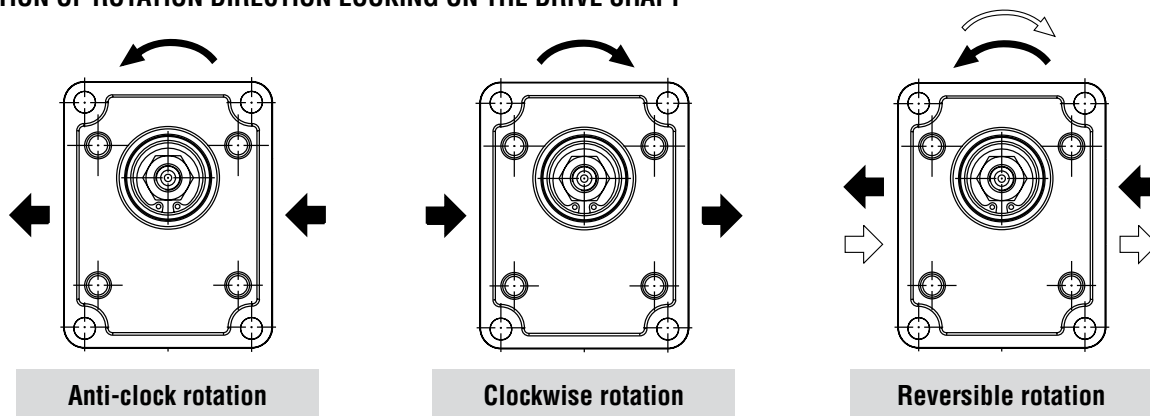
Tab. 2 ○

Working pressure bar (psi)	$\Delta p < 140$	$140 < \Delta p < 210$	$\Delta p > 210$
	(2030)	(2030)	(3045)
Contamination class NAS 1638	10	9	8
Contamination class ISO 4406:1999	21/19/16	20/18/15	19/17/14
Achieved with filter $\beta_{10}(c) \geq 75$ according to ISO 16889	-	10 μ m	10 μ m
Achieved with filter $\beta_{25}(c) \geq 200$ according to ISO 16889	25 μ m	-	-

Casappa recommends to use its own production filters:



DEFINITION OF ROTATION DIRECTION LOOKING ON THE DRIVE SHAFT

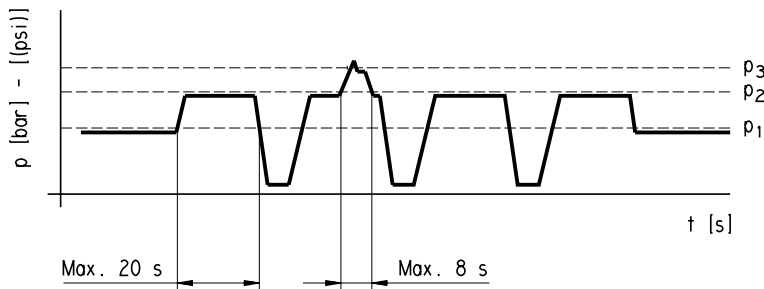


○ 04/02.2014

POLARIS 20 MOTOR GENERAL DATA

PLM 20

PRESSURE DEFINITION



p_1 Max. continuous pressure
 p_2 Max. intermittent pressure
 p_3 Mac. peak pressure

Motor type	Displacement cm ³ /rev (in ³ /rev)	Max. pressure			Max. speed min ⁻¹	Min. speed min ⁻¹
		p_1 bar (psi)	p_2 bar (psi)	p_3 bar (psi)		
PLM 20•4	4,95 (0.30)	250 (3625)	280 (4060)	300 (4350)	4000	600
PLM 20•6,3	6,61 (0.40)	250 (3625)	280 (4060)	300 (4350)	4000	600
PLM 20•7,2	7,29 (0.44)	250 (3625)	280 (4060)	300 (4350)	4000	600
PLM 20•8	8,26 (0.50)	250 (3625)	280 (4060)	300 (4350)	3500	600
PLM 20•9	9,17 (0.56)	250 (3625)	280 (4060)	300 (4350)	3500	600
PLM 20•10,5	10,9 (0.66)	250 (3625)	280 (4060)	300 (4350)	3500	600
PLM 20•11,2	11,23 (0.69)	250 (3625)	280 (4060)	300 (4350)	3500	600
PLM 20•14	14,53 (0.89)	250 (3625)	280 (4060)	300 (4350)	3500	500
PLM 20•16	16,85 (1.03)	250 (3625)	280 (4060)	300 (4350)	3000	500
PLM 20•19	19,09 (1.16)	200 (2900)	200 (2900)	240 (3480)	3000	500
PLM 20•20	21,14 (1.29)	200 (2900)	200 (2900)	240 (3480)	3000	500
PLM 20•24,5	24,84 (1.52)	170 (2465)	190 (2755)	210 (3045)	2500	500
PLM 20•25	26,42 (1.61)	170 (2465)	190 (2755)	210 (3045)	2500	500
PLM 20•27,8	28,21 (1.72)	130 (1885)	150 (2175)	170 (2465)	2000	500
PLM 20•31,5	33,03 (2.01)	130 (1885)	150 (2175)	170 (2465)	2000	500

The values in the table refer to unidirectional motors.
 Reversible motors max pressures are 15% lower than those shown in table.
 For different working conditions please consult our sales department.

DESIGN CALCULATIONS FOR MOTORS

03/03.2004

P	kW (HP)	Power
Δp	bar (psi)	Pressure
Q	l/min (US gpm)	Delivery
M	Nm (lbf in)	Torque
V	cm ³ /rev (in ³ /rev)	Displacement
n	min ⁻¹	Speed
$\eta_v = \eta_v(V, \Delta p, n)$	Volumetric efficiency	(≈ 0,96)
$\eta_m = \eta_m(V, \Delta p, n)$	Mechanical efficiency	(≈ 0,85)
$\eta_t = \eta_v \cdot \eta_{hm}$	Overall efficiency	(≈ 0,82)

$$Q = \frac{Q_{theor.}}{\eta_v} \quad [l/min]$$

$$Q_{theor.} = \frac{V \cdot n}{1000}$$

$$M = M_{theor.} \cdot \eta_{hm} \quad [Nm]$$

$$M_{theor.} = \frac{\Delta p \cdot V}{62,83}$$

$$P_{IN} = \frac{\Delta p \cdot Q}{600} \quad [kW]$$

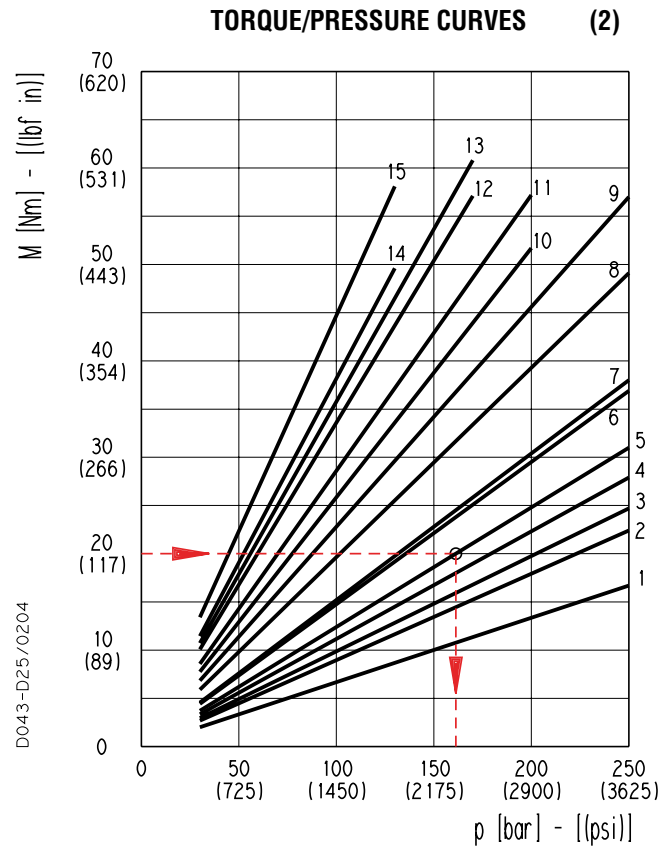
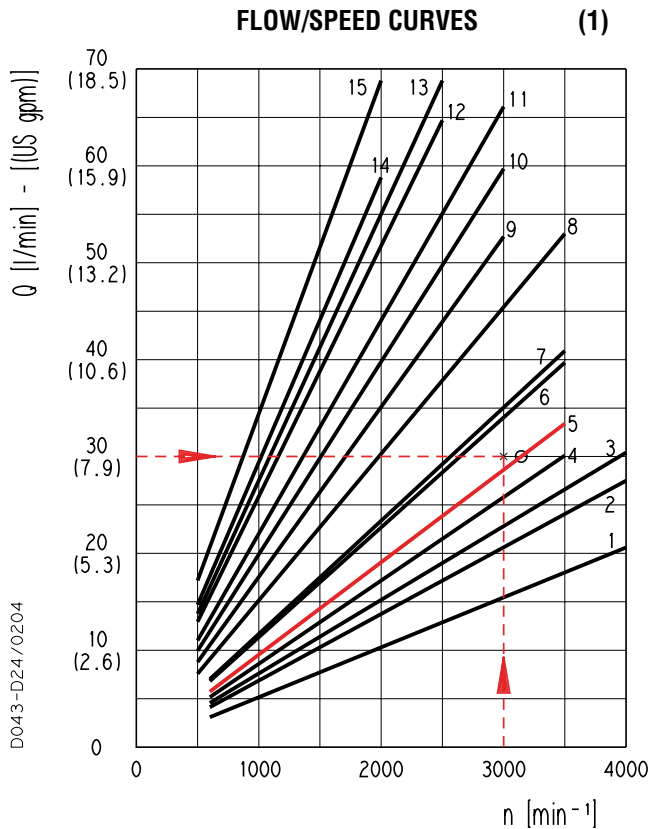
$$P_{OUT} = P_{IN} \cdot \eta_t$$

HYDRAULIC GEAR MOTOR SIZING

In the cooling system, the airflow of the fan needed to dissipate the heat produced by the system is proportional to speed rotation. The fan absorbed torque is proportional to speed², to fan dimensions and to the loss of power that the air encounters while flowing through the radiator.

To make sure that the cooling system is correctly sized is necessary to know the following input parameters:

- Maximum fan speed
- Maximum fan absorbed torque
- Hydraulic system oil flow rate
- Maximum system pressure



Each curve has been obtained at 50 °C (122 °F), using oil with viscosity 168 SSU (36 cSt) at 40 °C (104 °F) and at these pressures.

Example	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hydraulic system oil flow	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)	30 l/min (7.9 US gpm)
Maximum system pressure	200 bar (2900 psi)	250 bar (3265 psi)	250 bar (3265 psi)	250 bar (3265 psi)	250 bar (3265 psi)	250 bar (3265 psi)	250 bar (3265 psi)	250 bar (3265 psi)	250 bar (3265 psi)	200 bar (2900 psi)	200 bar (2900 psi)	170 bar (2465 psi)	170 bar (2465 psi)	130 bar (1885 psi)	130 bar (1885 psi)	250 bar (3265 psi)
Maximum fan speed	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹	3000 min ⁻¹
Maximum fan absorbed torque	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)	20 Nm (117 lbf in)
		PLM 20•4	PLM 20•6,3	PLM 20•7,2	PLM 20•8	PLM 20•9	PLM 20•10,5	PLM 20•11,2	PLM 20•14	PLM 20•16	PLM 20•19	PLM 20•20	PLM 20•24,5	PLM 20•25	PLM 20•27,8	PLM 20•31,5

In using graph (1), simply locate the system flowrate 30 l/min (7.9 US gpm) on the Y axis and the speed rate 3000 min⁻¹ on the X axis to find the hydraulic motor displacement. Select the line referring to displacement that is nearest to the point of meeting intersection of the X and Y axis previously traced out. In this example the best selection is PLM 20•9 (line 5).

In graph (2) simply locate the fan absorbed torque rate 20 Nm (177 lbf in) on the Y axis and trace a horizontal line to the right

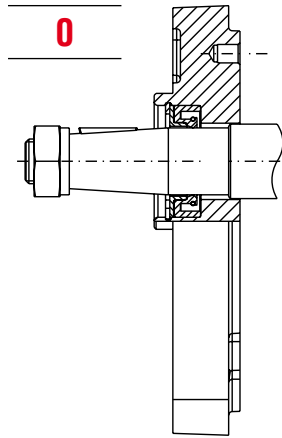
until encountering the line 5 previously selected from graph 1 and descend vertically to find the working pressure of the motor. In this case the pressure of 160 bar (2320 psi) is an acceptable value because the maximum allowable pressure of 200 bar (2900 psi) was not exceeded.

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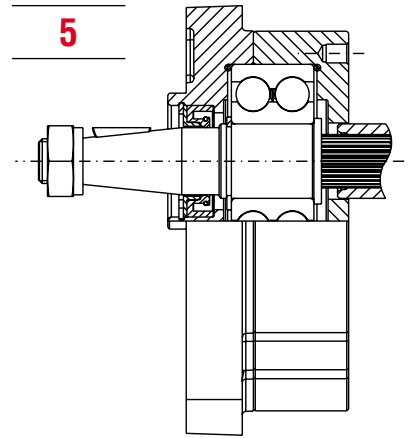
VERSIONS

The fan stresses the hydraulic motor shaft with a combination of loads.

- Constant radial load due to the fan mass
- Variable axial load according to fan speed



Version for applications without radial and axial load on the drive shaft.



Version with outboard bearing for applications with radial and axial load on the drive shaft.

For the outboard bearing life expectancy, diagrams providing approximate selection data will be found on subsequent pages.

Customized evaluations for applications with supports are available.

When you contact our customer technical service, please provide the information required in the following table.

Fan information

Number of blades	n_p	—
External diameter	d_e	mm (inch)
Internal diameter	d_i	mm (inch)
Average blade width	b_m	mm (inch)
Blade pitch	α	degrees
Fan mass	m	kg (lbs)
Fan speed	n	min^{-1}

01/05.2003

Hydraulic gear motors information

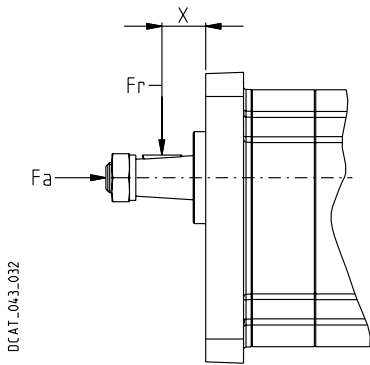
Lubricant temperature	t	$^{\circ}\text{C}$ ($^{\circ}\text{F}$)
-----------------------	-----	-------------------------------------------

Note: If available, please provide the performance curves of the fan.

POLARIS 20

VERSION WITH OUTBOARD BEARING

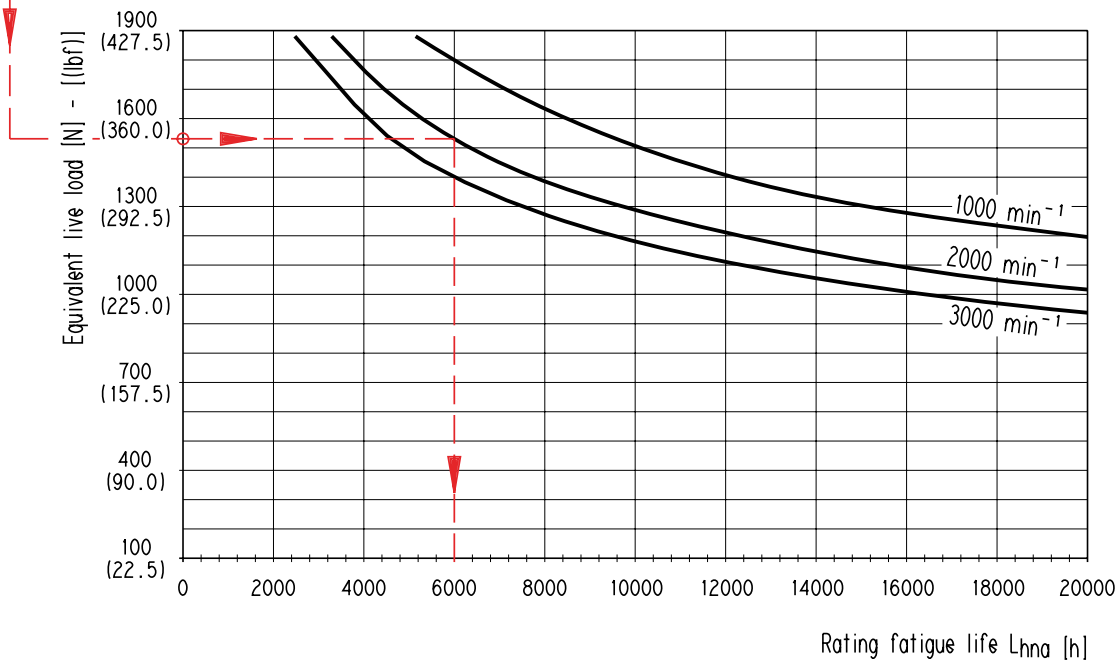
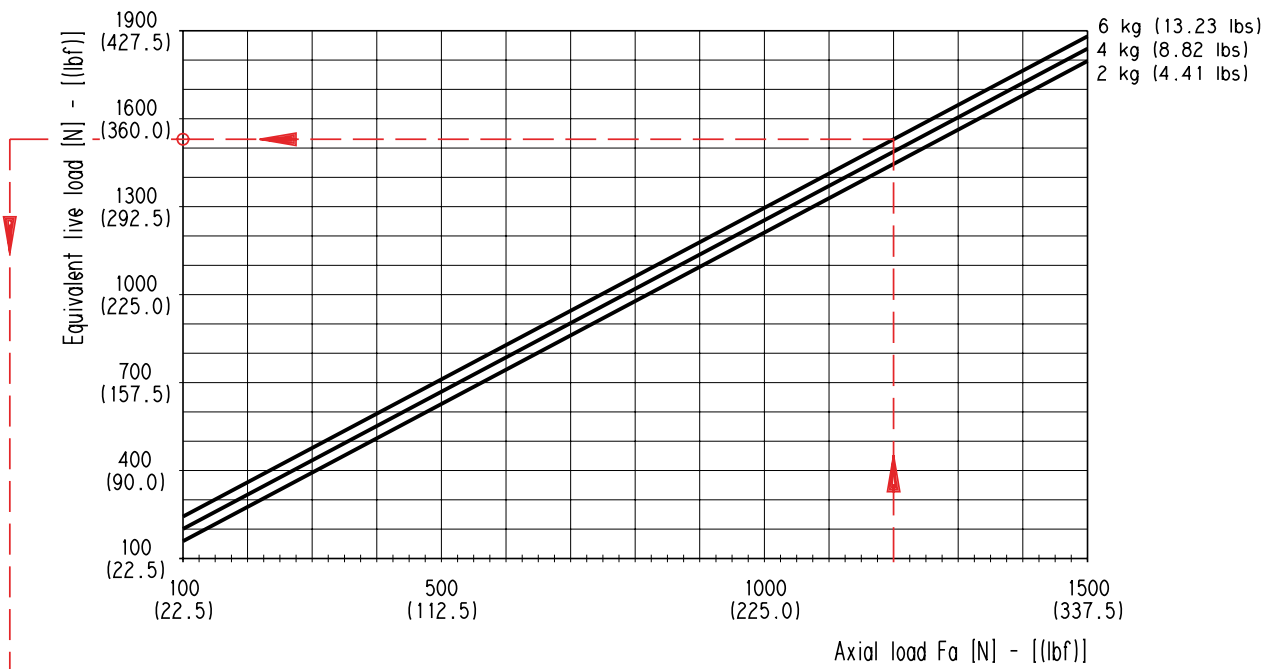
5



Each curve has been obtained at:
 Lubricant oil ISO VG 46
 Temperature 60 °C (140 °F)
 Distance of the radial load from the mounting flange **X** = 20 mm (0.787 inch)

Example

Axial load generate from the fan	1208 N (272 lbf)
Fan mass	6 kg (13,23 lbs)
Fan speed	2000 min ⁻¹
Rating fatigue life (hours)	≈ 6000 h



D043-D21/0503

01/05.2003

POLARIS 20

DRIVE SHAFTS

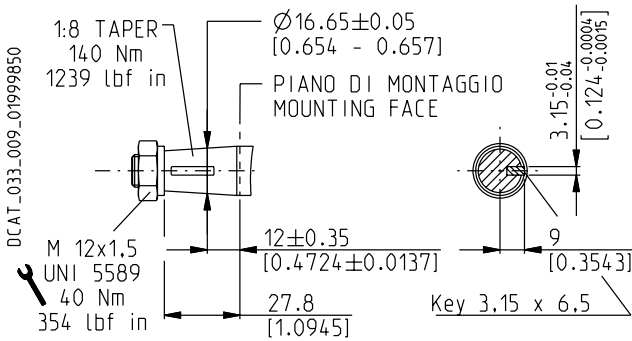
EUROPEAN TAPERED 1:8

82

Not available with size:

20•10,5 20•24,5 20•27,8

Mounting face refer to flange code **E2**



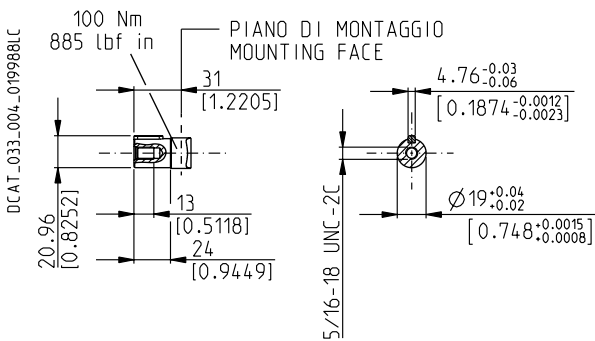
STRAIGHT

50

Not available with size:

20•7,2 20•10,5 20•19 20•24,5 20•27,8

Mounting face refer to flange code **S1**

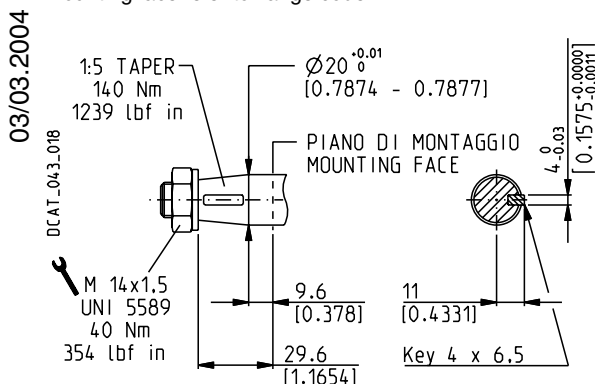


GERMAN TAPERED 1:5

55

Only for version 5 with outboard bearing

Mounting face refer to flange code **B2**



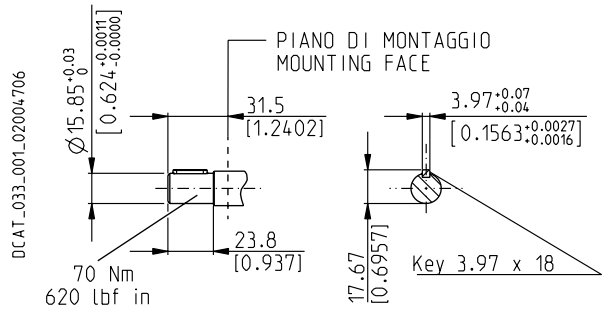
SAE "A" STRAIGHT

31

Not available with size:

20•10,5 20•19 20•24,5 20•27,8

Mounting face refer to flange code **S1**



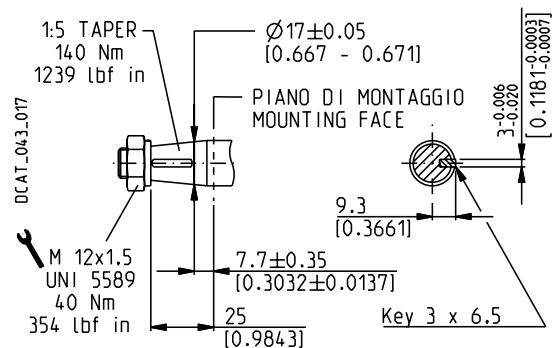
GERMAN TAPERED 1:5

54

Not available with size:

20•7,2 20•10,5 20•19 20•24,5 20•27,8 20•31,5

Mounting face refer to flange code **B2**

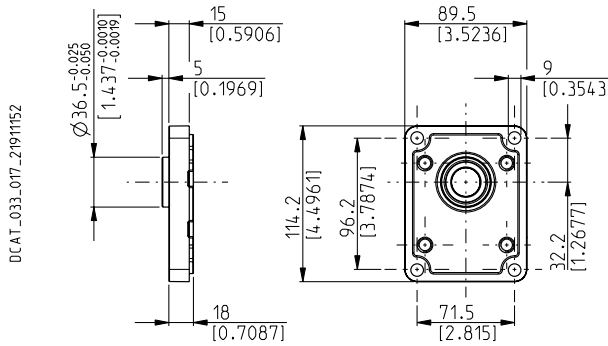


03/03.2004

POLARIS 20 MOUNTING FLANGES AND TABLE OF COMPATIBILITY

EUROPEAN

E2



DRIVE SHAFTS

See page 23

VERSIONS

See page 21 and 22

82

0



5

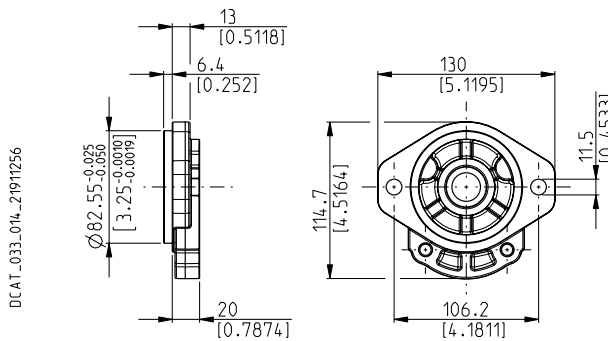


- Standard combination
- Available combination

SAE "A" 2 BOLTS

S1

Conforms to SAE J744



DRIVE SHAFTS

See page 23

VERSIONS

See page 21 and 22

31

50

82

0



5



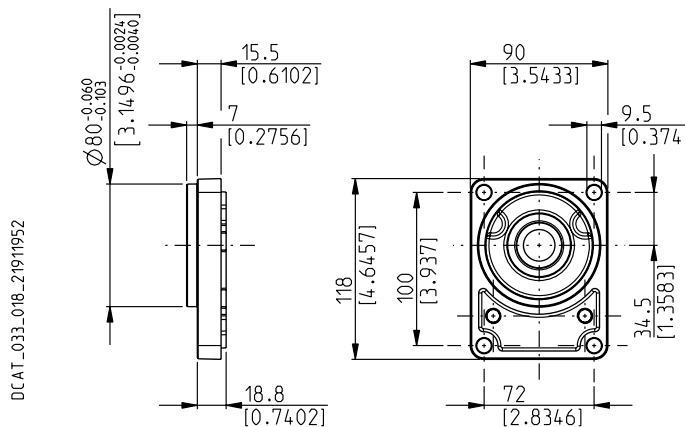
- Standard combination
- Available combination

01/05.2003

POLARIS 20 MOUNTING FLANGES AND TABLE OF COMPATIBILITY

GERMAN

B2



DRIVE SHAFTS

See page 23

VERSIONS

See page 21 and 22

54

55

0

■

Not available

5

■

●

- Standard combination
- Available combination

01/05.2003

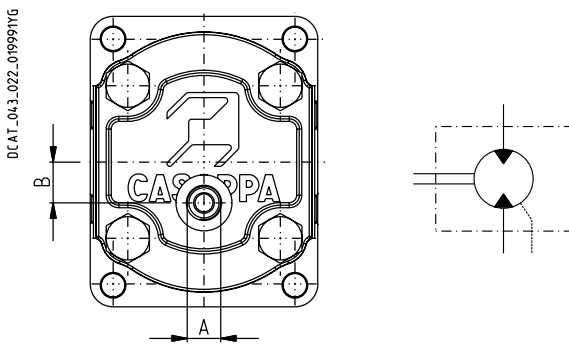
PORT OPTION

SIDE PORTS

PORTS TYPE Motor type	European		German		Gas BSPP		SAE ODT	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT
PLM 20•4	EA	EA	BC	BE	GD	GD	OC	OC
PLM 20•6,3	EA	EA	BC	BE	GD	GD	OC	OC
PLM 20•7,2	EA	EA	BC	BE	GD	GD	OC	OC
PLM 20•8	EA	EA	BC	BE	GD	GD	OC	OC
PLM 20•9	EA	EA	BC	BE	GD	GD	OC	OC
PLM 20•10,5	EA	EA	BC	BE	GD	GD	OC	OC
PLM 20•11,2	EA	EA	BC	BE	GD	GD	OC	OC
PLM 20•14	EA	EB	BC	BE	GD	GE	OC	OD
PLM 20•16	EA	EB	BC	BE	GD	GE	OC	OD
PLM 20•19	EA	EB	BC	BE	GD	GE	OC	OD
PLM 20•20	EA	EB	BC	BE	GD	GE	OC	OD
PLM 20•24,5	EA	EB	BC	BE	GD	GE	OC	OD
PLM 20•25	EA	EB	BC	BE	GD	GE	OC	OD
PLM 20•27,8	EA	EB	BC	BE	GD	GE	OC	OD
PLM 20•31,5	EA	EB	BC	BE	GD	GE	OC	OD

Replaces: 03/03.2004

DRAIN PORT FOR REVERSIBLE MOTORS (R)



PORTS IN/OUT

Drain port	European		German		Gas BSPP		SAE ODT		A	B
	A	B (◆)	A	B (◆)	A	B (◆)	A	B (◆)		
	GAS (BSPP)	mm (inch)	Metric	mm (inch)	GAS (BSPP)	mm (inch)	SAE (ODT)	mm (inch)	SAE (ODT)	mm (inch)
	GB	16,075 (0.6329)	TA	16,075 (0.6329)	GB	16,075 (0.6329)	03	16,075 (0.6329)	OA	○ ----

(◆): For motors with proportional valve (DBVSA..) please consult our sales department.

04/02.2014

PORT DIMENSIONS



Tightening torque for high pressure side port (values obtained at 350 bar [5075 psi]).



Tightening torque for low pressure side port.

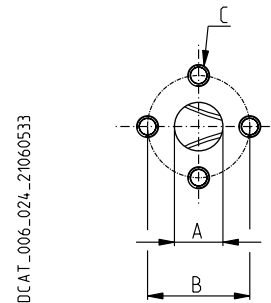
For reversible rotation, please consult only the tightening torque for high pressure side port.

EUROPEAN FLANGED PORTS - 4 bolts

EUROPEAN

Metric thread ISO 60° conforms to ISO/R 262

CODE	A	B	C		
	mm (in)	mm (in)	Thread Depth mm (in)	Nm (lbf in)	Nm (lbf in)
EA	13 (0.5118)	30 (1.1811)	M 6 13 (0.5118)	8 ^{+0.5} (71 ÷ 75)	8 ^{+0.5} (71 ÷ 75)
EB	19 (0.7480)	40 (1.5748)	M 8 14 (0.5512)	15 ⁺¹ (133 ÷ 142)	15 ⁺¹ (133 ÷ 142)



DCAT_006_024_21060533

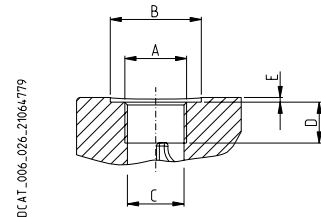
METRIC STRAIGHT THREAD PORTS ISO 6149

METRIC

Metric thread ISO 60° conforms to ISO/R 262

CODE	A	Ø B	Ø C	D	E		
		mm (in)	mm (in)	mm (in)	mm (in)	Nm (lbf in)	Nm (lbf in)
TA (◆)	M 10x1	22 (0.8661)	9 (0.3543)	13 (0.5118)	0,5 (0.0197)	----	10 ^{+0.5} (89 ÷ 93)

(◆) = Drain port



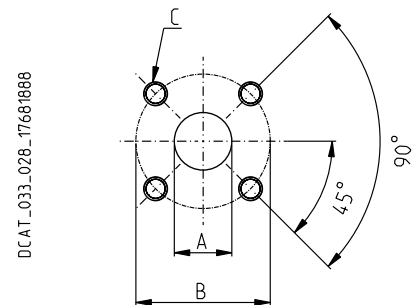
DCAT_006_026_21064779

GERMAN FLANGED PORTS - 4 bolts

GERMAN

Metric thread ISO 60° conforms to ISO/R 262

CODE	A	B	C		
	mm (in)	mm (in)	Thread Depth mm (in)	Nm (lbf in)	Nm (lbf in)
BC	15 (0.5906)	35 (1.3780)	M 6 12 (0.4724)	8 ^{+0.5} (71 ÷ 75)	8 ^{+0.5} (71 ÷ 75)
BE	20 (0.7874)	40 (1.5748)	M6 12 (0.4724)	15 ⁺¹ (133 ÷ 142)	15 ⁺¹ (133 ÷ 142)



DCAT_033_028_176681888

01/05.2003

PORT DIMENSIONS

Tightening torque for high pressure side port (values obtained at 350 bar [5075 psi]).

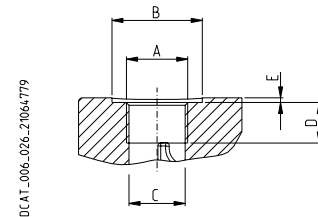
Tightening torque for low pressure side port.

For reversible rotation, please consult only the tightening torque for high pressure side port.

GAS STRAIGHT THREAD PORTS

BSPB

British standard pipe parallel (55°) conforms to UNI - ISO 228



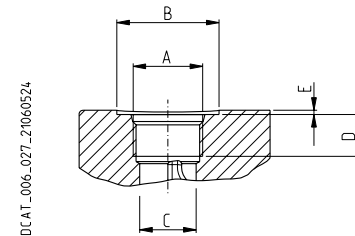
CODE	Nominal size	A	Ø B	Ø C	D	E		
			mm (in)	mm (in)	mm (in)	mm (in)	Nm (lbf in)	Nm (lbf in)
GB (◆)	1/4"	G 1/4	21,5 (0.8465)	12 (0.4724)	15 (0.5906)	1,5 (0.0591)	----	15 ⁺¹ (133 ÷ 142)
GD	1/2"	G 1/2	----	19 (0.7480)	17 (0.6693)	----	50 ^{+2,5} (443 ÷ 465)	20 ⁺¹ (177 ÷ 186)
			30 (●) (1.1811)	11 (●) (0.4331)	20 (●) (0.7874)	2 (●) (0.0787)	50 ^{+2,5} (●) (443 ÷ 465)	
GE	3/4"	G 3/4	----	24,5 (0.9646)	18 (0.7087)	----	90 ⁺⁵ (797 ÷ 841)	30 ^{+2,5} (266 ÷ 288)

(◆) = Drain port
(●) = Reverse valve

SAE STRAIGHT THREAD PORTS J514

ODT

American straight thread UNC-UNF 60° conforms to ANSI B 1.1



CODE	Nominal size	A	Ø B	Ø C	D	E		
			mm (in)	mm (in)	mm (in)	mm (in)	Nm (lbf in)	Nm (lbf in)
03 (◆)	1/4"	7/16" - 12 UNF - 2B	21 (0.8268)	9,5 (0.3740)	14 (0.5512)	1 (0.0394)	----	12 ⁺¹ (106 ÷ 115)
0A (◆) ○	3/8"	9/16" - 18 UNF - 2B	26 (1.0236)	----	13 (0.5118)	2,5 (0.0984)	----	15 ⁺¹ (133 ÷ 142)
0B (●) ○	1/2"	3/4" - 16 UNF - 2B	32 (1.2598)	11 (0.4331)	15 (0.5906)	2 (0.0787)	45 ^{+2,5} (398 ÷ 420)	45 ^{+2,5} (398 ÷ 420)
			20,5 (0.8071)	17 (0.6693)	0,5 (0.0197)	70 ⁺⁵ (620 ÷ 664)	30 ^{+2,5} (266 ÷ 288)	
0C	5/8"	7/8" - 14 UNF - 2B	35 (1.3780)	11 (●) (0.4331)	20 (●) (0.7874)	2 (●) (0.0787)	70 ⁺⁵ (●) (620 ÷ 664)	70 ⁺⁵ (●) (620 ÷ 664)
			42 (1.6535)	24,8 (0.9764)	20 (0.7874)	0,5 (0.0197)	120 ⁺¹⁰ (1062 ÷ 1151)	40 ^{+2,5} (354 ÷ 376)

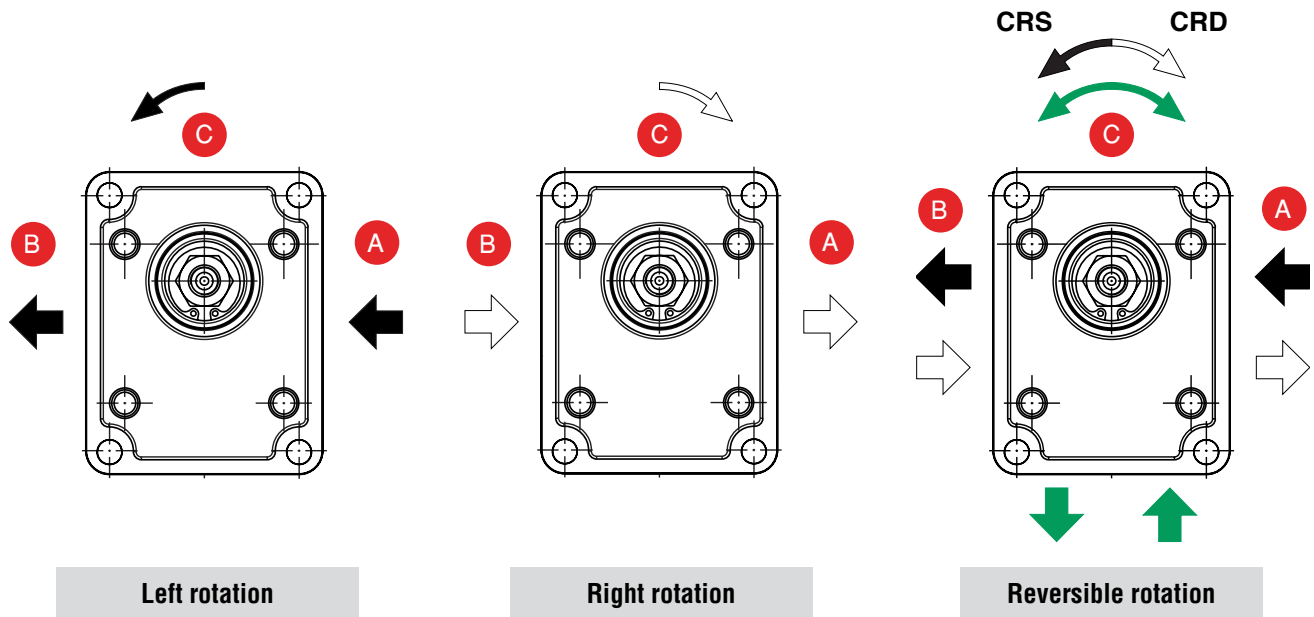
(◆) = Drain port
(●) = Reverse valve

Replaces: 03/03.2004

○ 04/02.2014

VALVE MOUNTING POSITIONS

Replaces: 03/03.2004



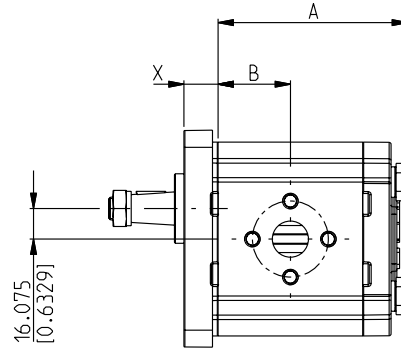
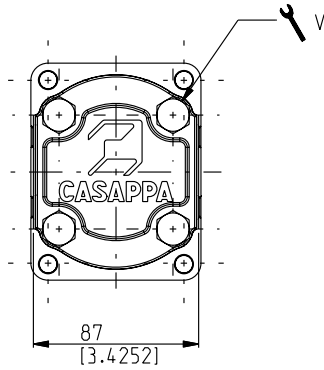
Rotation	Valve type	Mounting position
Left 	V8 - VPIF (...)	A
	VMP5/TS/V9 - DBVSA ..	B
	EC08...	C
Right 	V8 - VPIF (...)	B
	VMP5/TS/V9 - DBVSA ..	A
	EC08...	C
Reversible (ER12-M) 	ER12-M ...	A
	DBVSA ..	B
	V8	A
Reversible (CRS) 	V8 - VPIF (...)	A
	VMP5/TS/V9 - DBVSA ...	B
	EC08...	C
Reversible (CRD) 	V8 - VPIF (...)	B
	VMP5/TS/V9 - DBVSA ...	A
	EC08...	C

(CRS) = Left rotation control
(CRD) = Right rotation control

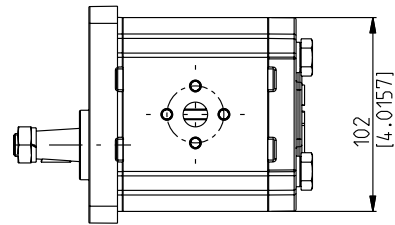
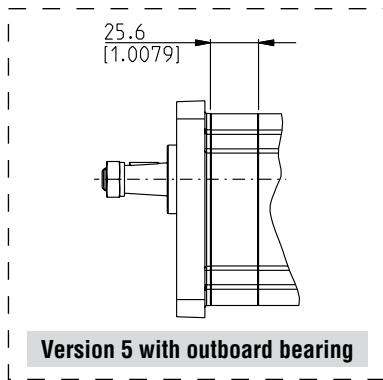
04/02.2014

DIMENSIONS - FIXED RATIO SYSTEM

Without valve



DCAT_043_026



Mounting flange material	Tightening torque
	Nm (lbf in)
	V
Aluminium	45 \pm 4.5 (358 \div 438)
Cast iron	70 \pm 7 (558 \div 682)

DRIVE SHAFTS: see page 23

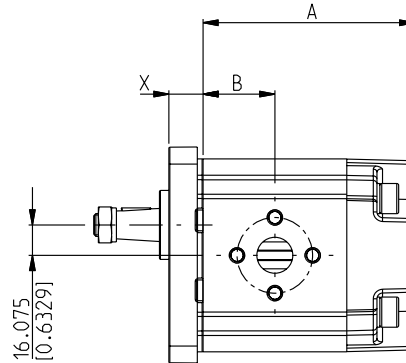
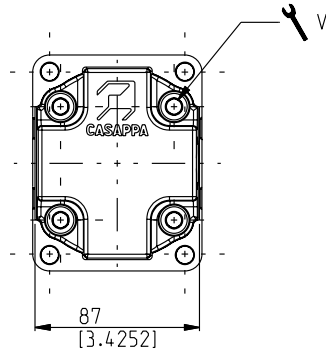
MOUNTING FLANGE: see page 24 and page 25

Motor type	A	B
	mm (in)	mm (in)
PLM 20•4	75,1 (2.9567)	25,8 (1.0157)
PLM 20•6,3	77,5 (3.0512)	27 (1.0630)
PLM 20•7,2	78,5 (3.0906)	27,5 (1.0827)
PLM 20•8	80,1 (3.1535)	28,3 (1.1142)
PLM 20•9	81,3 (3.2008)	28,9 (1.1378)
PLM 20•10,5	84,1 (3.3110)	30,3 (1.1929)
PLM 20•11,2	84,5 (3.3268)	30,5 (1.2008)
PLM 20•14	89,5 (3.5236)	33 (1.2992)
PLM 20•16	93,1 (3.6654)	34,8 (1.3701)
PLM 20•19	96,5 (3.7992)	36,5 (1.4370)
PLM 20•20	99,5 (3.9173)	38 (1.4961)
PLM 20•24,5	105,1 (4.1378)	40,8 (1.6063)
PLM 20•25	107,5 (4.2323)	42 (1.6535)
PLM 20•27,8	110,3 (4.3425)	43,4 (1.7087)
PLM 20•31,5	117,5 (4.6260)	47 (1.8504)

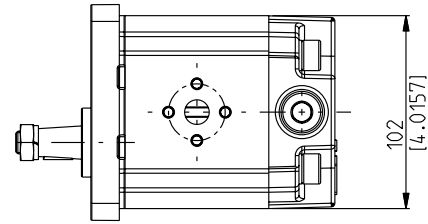
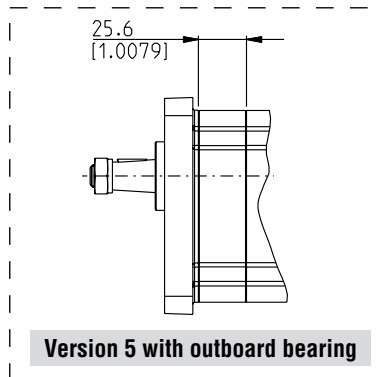
03/03.2004

DIMENSIONS - FIXED RATIO SYSTEM

Anti-cavitation valve: **V8**



DCAT_043_027



DRIVE SHAFTS: see page 23

MOUNTING FLANGE: see page 24 and page 25

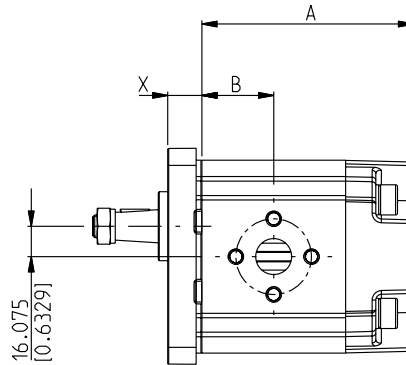
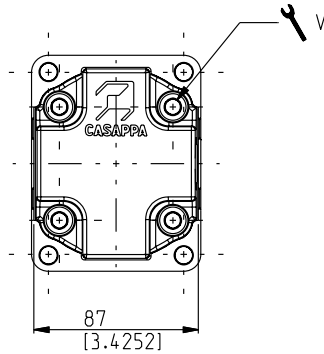
Mounting flange material	Tightening torque
	Nm (lbf in)
Aluminium	V 45 ^{±4.5} (358 ÷ 438)

03/03.2004

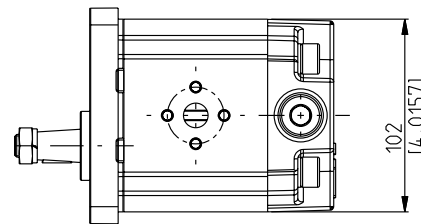
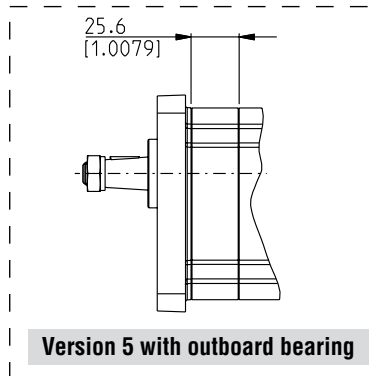
Motor type	A	B
	mm (in)	mm (in)
PLM 20•4	86,6 (3.4094)	25,8 (1.0157)
PLM 20•6,3	89 (3.5039)	27 (1.0630)
PLM 20•7,2	90 (3.5433)	27,5 (1.0827)
PLM 20•8	91,6 (3.6063)	28,3 (1.1142)
PLM 20•9	92,8 (3.6535)	28,9 (1.1378)
PLM 20•10,5	95,6 (3.7638)	30,3 (1.1929)
PLM 20•11,2	96 (3.7795)	30,5 (1.2008)
PLM 20•14	101 (3.9764)	33 (1.2992)
PLM 20•16	104,6 (4.1181)	34,8 (1.3701)
PLM 20•19	108 (4.2520)	36,5 (1.4370)
PLM 20•20	111 (4.3701)	38 (1.4961)
PLM 20•24,5	116,6 (4.5906)	40,8 (1.6063)
PLM 20•25	119 (4.6850)	42 (1.6535)
PLM 20•27,8	121,8 (4.7953)	43,8 (1.7087)
PLM 20•31,5	129 (5.0787)	47 (1.8504)

DIMENSIONS - FIXED RATIO SYSTEM

Max. pressure relief valve fixed setting and anti-cavitation: **VPIF (...)**



DCAT_043_028



DRIVE SHAFTS: see page 23

MOUNTING FLANGE: see page 24 and page 25

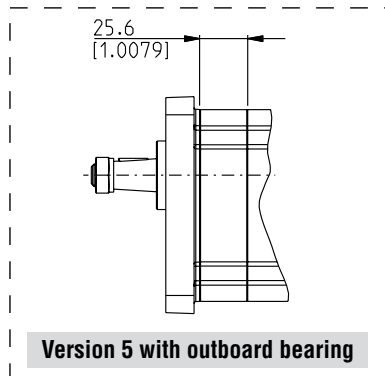
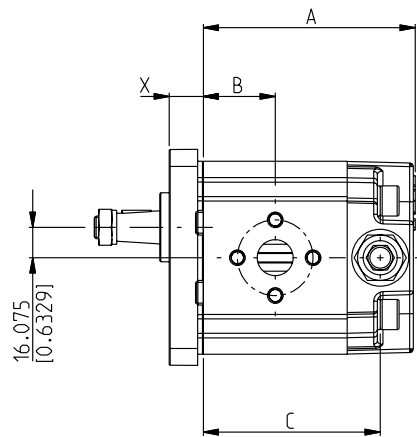
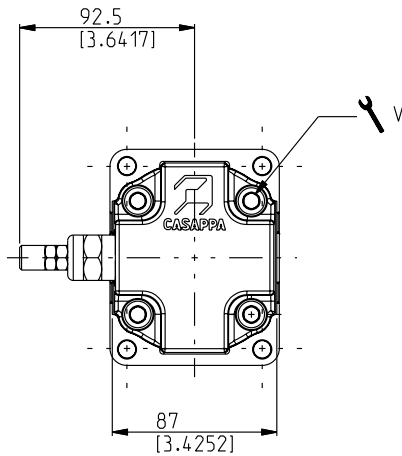
Mounting flange material	Tightening torque
	Nm (lbf in)
Aluminium	V 45 ^{±4.5} (358 ÷ 438)

Motor type	A	B
	mm (in)	mm (in)
PLM 20•4	86,6 (3.4094)	25,8 (1.0157)
PLM 20•6,3	89 (3.5039)	27 (1.0630)
PLM 20•7,2	90 (3.5433)	27,5 (1.0827)
PLM 20•8	91,6 (3.6063)	28,3 (1.1142)
PLM 20•9	92,8 (3.6535)	28,9 (1.1378)
PLM 20•10,5	95,6 (3.7638)	30,3 (1.1929)
PLM 20•11,2	96 (3.7795)	30,5 (1.2008)
PLM 20•14	101 (3.9764)	33 (1.2992)
PLM 20•16	104,6 (4.1181)	34,8 (1.3701)
PLM 20•19	108 (4.2520)	36,5 (1.4370)
PLM 20•20	111 (4.3701)	38 (1.4961)
PLM 20•24,5	116,6 (4.5906)	40,8 (1.6063)
PLM 20•25	119 (4.6850)	42 (1.6535)
PLM 20•27,8	121,8 (4.7953)	43,8 (1.7087)
PLM 20•31,5	129 (5.0787)	47 (1.8504)

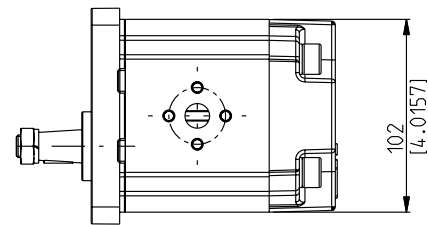
03/03.2004

DIMENSIONS - FIXED RATIO SYSTEM

Max. pressure relief valve adjustable setting and anti-cavitation: **VMP5/TS/V9**



DCAT_043_029



DRIVE SHAFTS: see page 23

MOUNTING FLANGE: see page 24 and page 25

Mounting flange material	Tightening torque
	Nm (lbf in)
Aluminium	V 45 ^{±4.5} (358 ÷ 438)

Motor type	A	B	C
	mm (in)	mm (in)	mm (in)
PLM 20•4	86,6 (3.4094)	25,8 (1.0157)	69,1 (2.7205)
PLM 20•6,3	89 (3.5039)	27 (1.0630)	71,5 (2.8150)
PLM 20•7,2	90 (3.5433)	27,5 (1.0827)	72,5 (2.8543)
PLM 20•8	91,6 (3.6063)	28,3 (1.1142)	74,1 (2.9173)
PLM 20•9	92,8 (3.6535)	28,9 (1.1378)	75,3 (2.9646)
PLM 20•10,5	95,6 (3.7638)	30,3 (1.1929)	78,1 (3.0748)
PLM 20•11,2	96 (3.7795)	30,5 (1.2008)	78,5 (3.0906)
PLM 20•14	101 (3.9764)	33 (1.2992)	83,5 (3.2874)
PLM 20•16	104,6 (4.1181)	34,8 (1.3701)	87,1 (3.4291)
PLM 20•19	108 (4.2520)	36,5 (1.4370)	90,5 (3.5630)
PLM 20•20	111 (4.3701)	38 (1.4961)	93,5 (3.6811)
PLM 20•24,5	116,6 (4.5906)	40,8 (1.6063)	99,1 (3.9016)
PLM 20•25	119 (4.6850)	42 (1.6535)	101,5 (3.9961)
PLM 20•27,8	121,8 (4.7953)	43,8 (1.7087)	104,3 (4.1063)
PLM 20•31,5	129 (5.0787)	47 (1.8504)	111,5 (4.3898)

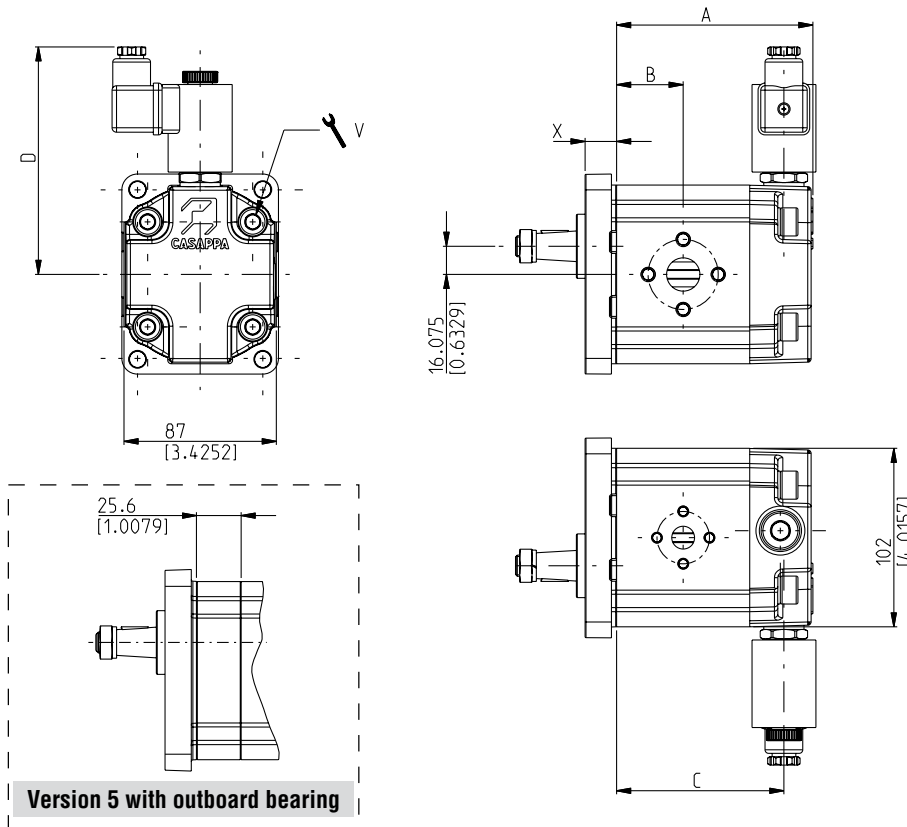
03/03.2004

DIMENSIONS - TWO SPEED SYSTEM

By-pass electric valve, pilot operated (normally closed): **EC08...**
Max. pressure relief valve fixed setting and anti-cavitation: **VPIF (...)**



Replaces: 03/03.2004



DCAT_043_031

DRIVE SHAFTS: see page 23 - MOUNTING FLANGE: see page 24 and page 25

Valve type	Max. flow l/min (US gpm)	Max. pressure. bar (psi)	D mm (in)
EC08-A/2-0-N	20 (5.28)	210 (3045)	130 (5.1181)
EC08-M/2-0-N	40 (10.57)	350 (5075)	134 (5.2756)

Mounting flange material	Tightening torque Nm (lbf in)
	V
Aluminium	45 ^{±4.5} (358 ÷ 438)

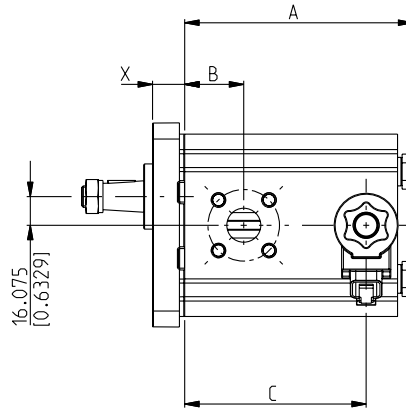
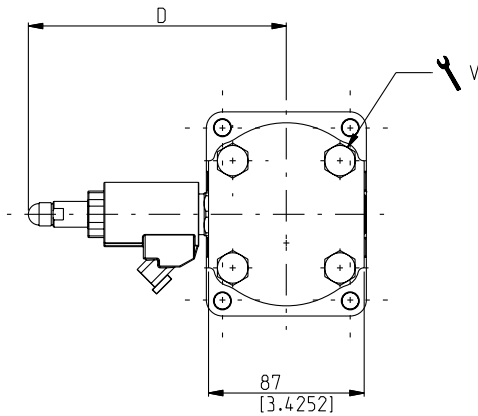
Motor type	A mm (in)	B mm (in)	C mm (in)
	PLM 20•4	86,6 (3.4094)	25,8 (1.0157)
PLM 20•6,3	89 (3.5039)	27 (1.0630)	73,5 (2.8937)
PLM 20•7,2	90 (3.5433)	27,5 (1.0827)	74,5 (2.9331)
PLM 20•8	91,6 (3.6063)	28,3 (1.1142)	76,1 (2.9961)
PLM 20•9	92,8 (3.6535)	28,9 (1.1378)	77,3 (3.0433)
PLM 20•10,5	95,6 (3.7638)	30,3 (1.1929)	80,1 (3.1535)
PLM 20•11,2	96 (3.7795)	30,5 (1.2008)	80,5 (3.1693)
PLM 20•14	101 (3.9764)	33 (1.2992)	85,5 (3.3661)
PLM 20•16	104,6 (4.1181)	34,8 (1.3701)	89,1 (3.5079)
PLM 20•19	108 (4.2520)	36,5 (1.4370)	92,5 (3.6417)
PLM 20•20	111 (4.3701)	38 (1.4961)	95,5 (3.7598)
PLM 20•24,5	116 (4.5906)	40,8 (1.6063)	101,1 (3.9803)
PLM 20•25	119 (4.6850)	42 (1.6535)	103,5 (4.0748)
PLM 20•27,8	121,8 (4.7953)	43,8 (1.7087)	106,3 (4.1850)
PLM 20•31,5	129 (5.0787)	47 (1.8504)	113,5 (4.4685)

04/02.2014

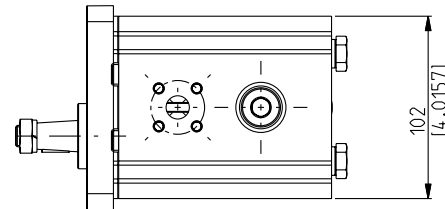
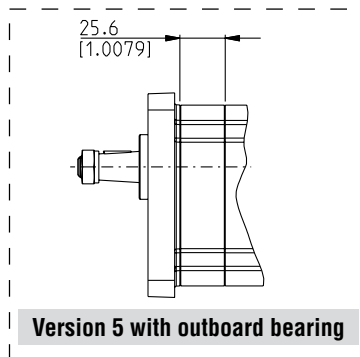
DIMENSIONS - VARIABLE SPEED SYSTEM

Proportional relief valve: **DBVSA ...**

Anti-cavitation valve: **V8**



DCAT_043_030



DRIVE SHAFTS: see page 23

MOUNTING FLANGE: see page 24 and page 25

Valve type	Max. flow l/min (US gpm)	C mm (in)	D mm (in)
DBVSA-1LG..	50 (13.21)	101,5 (3.9961)	143,3 (5.6417)
DBVSA-1CG..	100 (26.42)	106,5 (4.1929)	168,3 (6.6260)

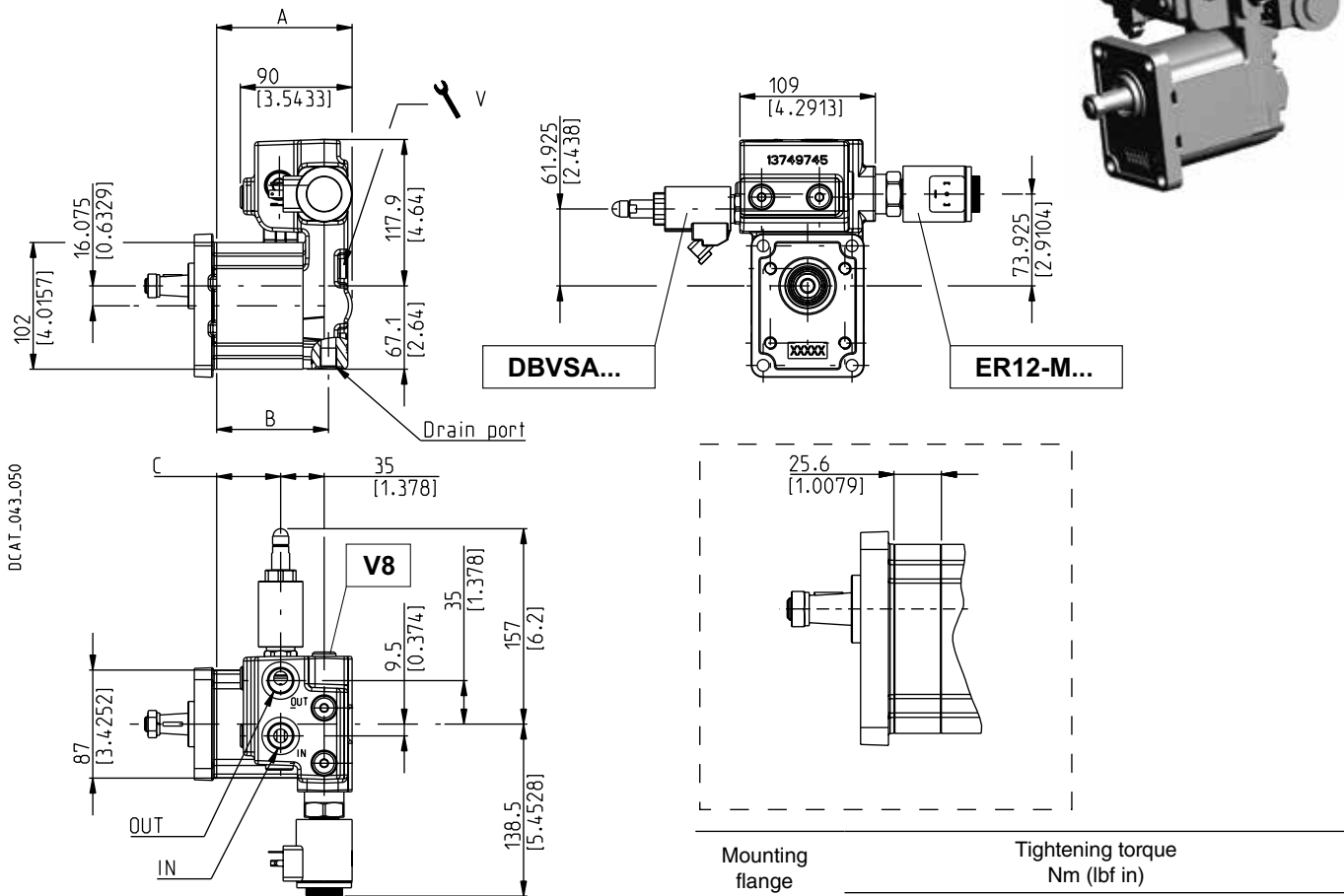
Mounting flange material	Tightening torque Nm (lbf in)
	V
Aluminium	45 ^{±4,5} (358 ÷ 438)
Cast iron	70 ^{±7} (558 ÷ 682)

Motor type	A mm (in)	B mm (in)
	PLM 20•4	113,1 (4.4525)
PLM 20•6,3	115,5 (4.5472)	27 (1.0630)
PLM 20•7,2	116,5 (4.5866)	27,5 (1.0827)
PLM 20•8	118,1 (4.6496)	28,3 (1.1142)
PLM 20•9	119,3 (4.6969)	28,9 (1.1378)
PLM 20•10,5	122,1 (4.8071)	30,3 (1.1929)
PLM 20•11,2	122,5 (4.8228)	30,5 (1.2008)
PLM 20•14	127,5 (5.0197)	33 (1.2992)
PLM 20•16	131,1 (5.1614)	34,8 (1.3701)
PLM 20•19	134,5 (5.2953)	36,5 (1.4370)
PLM 20•20	137,5 (5.4134)	38 (1.4961)
PLM 20•24,5	143,1 (5.6339)	40,8 (1.6063)
PLM 20•25	145,5 (5.7283)	42 (1.6535)
PLM 20•27,8	148,3 (5.8386)	43,4 (1.7087)
PLM 20•31,5	155,5 (6.1220)	47 (1.8504)

03/03.2004

DIMENSIONS - SYSTEM WITH VARIABLE SPEED AND CHANGING THE DIRECTION OF ROT.

Reverse valve: **ER12-M**
Proportional relief valve: **DBVSA ...**
Anti-cavitation valve: **V8**



DRIVE SHAFTS: see page 23
MOUNTING FLANGE: see page 24 and page 25
IN/OUT PORTS DIMENSIONS: see page 28
DRAIN PORTS: see page 26 and 28

Mounting flange material	Tightening torque Nm (lbf in)
Aluminium	45 ± 4.5 (358 ÷ 438)
Cast iron	70 ± 7 (558 ÷ 682)

Motor type	A mm (in)	B mm (in)	C mm (in)	IN/OUT	
				Gas BSPP	SAE ODT
PLM 20•4	91 (3.5827)	72 (2.8346)	33,5 (1.3189)		
PLM 20•6,3	93,5 (3.6811)	74,5 (2.9331)	36 (1.4173)		
PLM 20•7,2	94,5 (3.7205)	75,5 (2.9724)	37 (1.4567)		
PLM 20•8	96 (3.7795)	77 (3.0315)	38,5 (1.5157)		
PLM 20•9	97,3 (3.8307)	78,3 (3.0827)	39,8 (1.5669)		
PLM 20•10,5	100 (3.9370)	81 (3.1890)	42,5 (1.6732)		
PLM 20•11,2	100,5 (3.9567)	81,5 (3.2087)	43 (1.6929)		OB/OB
PLM 20•14	105,5 (4.1535)	86,5 (3.4055)	48 (1.8898)	GD/GD	
PLM 20•16	109 (4.2913)	90 (3.5433)	51,5 (2.0276)		OC/OC
PLM 20•19	112,4 (4.4252)	93,4 (3.6772)	54,9 (2.1614)		
PLM 20•20	115,5 (4.5472)	96,5 (3.7992)	58 (2.2835)		
PLM 20•24,5	121,1 (4.7677)	102,1 (4.0197)	63,6 (2.5039)		
PLM 20•25	123,5 (4.8622)	104,5 (4.1142)	66 (2.5984)		
PLM 20•27,8	126,2 (4.9685)	107,2 (4.2205)	68,7 (2.7047)		
PLM 20•31,5	133,5 (5.2559)	114,5 (4.5079)	76 (2.9921)		

Replaces: 03/03.2004

04/02.2014

HOW TO ORDER

1	2	3	4	5	6	7	8	9	10	11	12	13
PLM 20•4	R	0	- 82	E2	- L	EA/EA	- N	- EL	- C	V8	-	(CRS)

Replaces: 03/03.2004

1	Type	Motor type
4,95 cm ³ /rev (0.30 in ³ /rev)		PLM 20-4
66,61 cm ³ /rev (0.40 in ³ /rev)		PLM 20-6,3
7,29 cm ³ /rev (0.44 in ³ /rev)		PLM 20-7,2
8,26 cm ³ /rev (0.50 in ³ /rev)		PLM 20-8
9,17 cm ³ /rev (0.56 in ³ /rev)		PLM 20-9
10,9 cm ³ /rev (0.66 in ³ /rev)		PLM 20-10,5
11,23 cm ³ /rev (0.69 in ³ /rev)		PLM 20-11,2
14,53 cm ³ /rev (0.89 in ³ /rev)		PLM 20-14
16,85 cm ³ /rev (1.03 in ³ /rev)		PLM 20-16
19,09 cm ³ /rev (1.16 in ³ /rev)		PLM 20-19
21,14 cm ³ /rev (1.29 in ³ /rev)		PLM 20-20
24,84 cm ³ /rev (1.52 in ³ /rev)		PLM 20-24,5
26,42 cm ³ /rev (1.61 in ³ /rev)		PLM 20-25
28,21 cm ³ /rev (1.72 in ³ /rev)		PLM 20-27,8
33,03 cm ³ /rev (2.01 in ³ /rev)		PLM 20-31,5

2	Rotation	CODE
Left		S
Right		D
Reversible external drain		R

3	Version	CODE
Without outboard bearing		0
With outboard bearing		5

4	Drive shaft	CODE
European tapered 1:8		82
SAE "A" spline		31
Straight		50
German tapered 1:5		54
German tapered 1:5 (only for version 5)		55

5	Mounting flange	CODE
European		E2
SAE "A" 2 bolts		S1
German		B2

6	Ports position	CODE
Side		L

CODE	Ports IN/OUT (a)	7
EUROPEAN FLANGED PORTS		
Side	Type	
EA/EA	PLM20	4-6,3-7,2-8-9-10,5-11,2
EA/EB		14-16-19-20-24,5-25-27,8-31,5
GERMAN FLANGED PORTS		
Side	Type	
BC/BE	PLM20	4-6,3-7,2-8-9-10,5-11,2
		14-16-19-20-24,5-25-27,8-31,5
GAS STRAIGHT THREAD PORTS (BSPP)		
Side	Type	
GD/GD	PLM20	4-6,3-7,2-8-9-10,5-11,2
GD/GE		14-16-19-20-24,5-25-27,8-31,5
SAE STRAIGHT THREAD PORTS (ODT)		
Side	Type	
OC/OC	PLM20	4-6,3-7,2-8-9-10,5-11,2
OC/OD		14-16-19-20-24,5-25-27,8-31,5

CODE	Seals	8
N	Buna (standard)	
V	Viton	

CODE	Cover options	9
	Cast iron mounting flange and rear cover (standard - no code)	
E	Aluminium mounting flange and cast iron rear cover	
L	Cast iron mounting flange and aluminium rear cover	
EL	Aluminium mounting flange and rear cover	

CODE	Shaft seal options	10
C	High back pressure seal with wiper seal	
D	Standard seal with wiper seal	
H	High back pressure seal	
R	High resistance to contamination seal (b)	

CODE	Valves	11
V8	Anti-cavitation (c)	
VPIF (...)	Max. pressure relief valve fixed setting (b)	
VMP5/TS/V9	Max. pressure relief valve adjst. setting (b)	
EC08 ...	Two way electric valve (see example) (b)	
DBVSA ...	Proportional relief valve (see example)	
ER12-M	Reverse valve	

04/02.2014

HOW TO ORDER

12	Options	CODE
	Without rear cover (d)	2P
	Reverse valve (e)	SK



13	Valve position (f)	CODE
	Left rotation control	(CRS)
	Right rotation control	(CRD)

- (a) With reverse valve see page 36
- (b) Only for clockwise rotation motor with shaft 82, 31 and 54
- (c) Only with L and EL cover
- (d) Only with proportional relief valve DBVSA...
- (e) Only with reverse valve
- (f) Only for reversible rotation R

Replaces: 03/03.2004

Order example with by-pass valve	-	By-pass valve	/	max. pressure valve		Position valve	
		PLM 20•4 R0-82 E2-L EA/EA-N-EL-H	-	EC08-A/2-0-N-B (24 VDC)	/	VPIF (160)	(CRS)
Order example proportional valve	-	Proportional valve	/	Anti-cavitation valve		Type body	Position valve
		PLM 20•4 R0-82 E2-L EA/EA-N-EL-H	-	DBVSA-1LG 160-5-3-24 VDC-J	/	V8	2P

04/02.2014

Our policy is one of continuous improvement in product. Specification of items may, therefore, be changed without notice.

FD 04 T A

Edition: 04/02.2014

Replaces: FD 03 T A



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