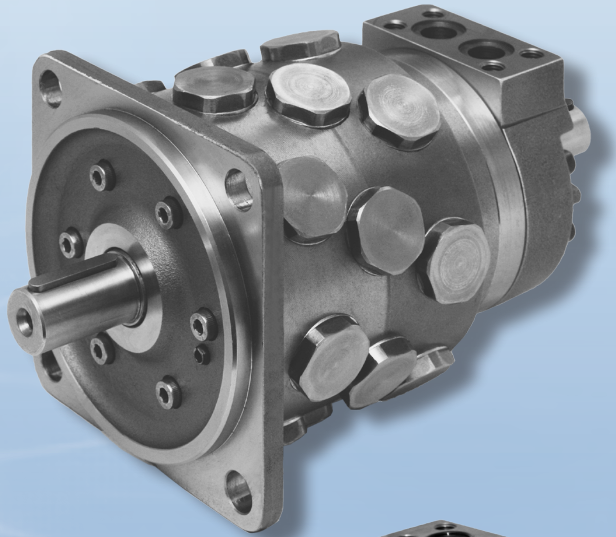
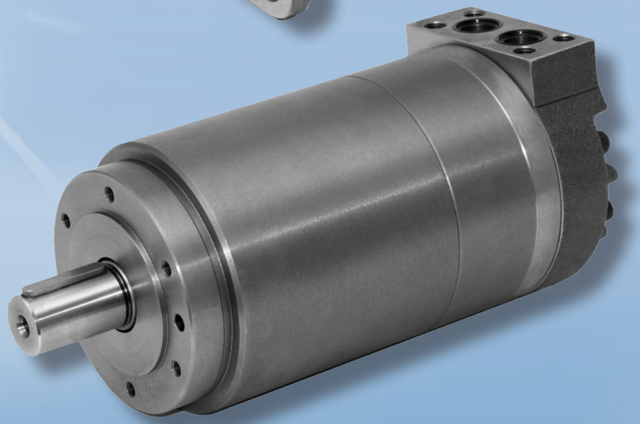
DÜSTERLOH Fluidtechnik

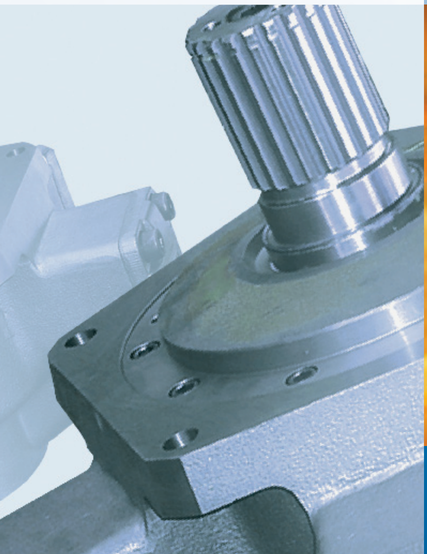
High-Precision Hydraulic Motors



Radial Piston Motors
with fixed displacement
RMHP 90 - RMHP 110
V_g = 88,4 ccm/rev - 109,5 ccm/rev



Axial Piston Motor
with fixed displacement
AEHP 40
V_g = 43,7 ccm/rev



Doc.-No. HM1-018 UK

Special characteristics of the high precision hydraulic motors

Duesterloh high precision hydraulic motors generate an extreme low cyclic irregularity. The RMHP-motors have a cyclic irregularity of just 0,28 % and the AEHP of 0,73 %. In combination with a highly precise control of the oil flow to the pistons, the motors generate a high speed constancy, specially by driving low numbers of rotations.

Characteristics of the high precision Duesterloh hydaulic motors

- long service due to mature design
- shaft end able to support large radial and axial forces
- small number of components in drive
- extreme low moment of inertia
- by default with measuring shaft
- translationally operating control unit with play adjustment control
- suitable for use with liquids with low combustion properties
- maintenance free
- quiet running
- wide speed range
- 100 % torque throughout the entire speed range
- immediately reversible
- high starting torque
- no counterpressure required for motor operation
- can be used as pump if feed is available
- suitable for several applications as a control unit
- feed and discharge control possible
- total efficiency of up to 93 %
- direct valve mounting available as a standard option

Characteristic:

Motor	Displace-ment	Torque		Speed		Cont. pressure	Maximum pressure	Peak pressure	Output	
	V_g [ccm/rev]	T_{spec} [Nm/bar]	T_{max} [Nm]	n_{min*} [rpm]	n_{max} [rpm]	$p_{cont.}$ [bar]	p_{max} [bar]	p_{peak} [bar]	$P_{cont.}$ [kW]	$P_{intermit.}$ [kW]
RMHP 90	88,4	1,24	252	1	900	140	210	250	8,5	10
RMHP 110	109,5	1,55	310	1	750	140	210	250	8,5	10
AEHP 40	43,7	0,63	155	1	2000	210	250	315	18,0	21

Calculation - Performance limits:

With known pressure difference Δp:

RMHP 90: $$n \leq \frac{8{,}5kW \times 9549{,}3}{\Delta p \times 1{,}24Nm/bar} = \frac{65459}{\Delta p} \text{ [rpm]}$$

RMHP 110: $$n \leq \frac{8{,}5kW \times 9549{,}3}{\Delta p \times 1{,}55Nm/bar} = \frac{52367}{\Delta p} \text{ [rpm]}$$

AEHP 40: $$n \leq \frac{18kW \times 9549{,}3}{\Delta p \times 0{,}63Nm/bar} = \frac{272837}{\Delta p} \text{ [rpm]}$$

With known number of rotations n:

RMHP 90: $$\Delta p \leq \frac{8{,}5kW \times 9549{,}3}{n \times 1{,}24Nm/bar} = \frac{65459}{n} \text{ [bar]}$$

RMHP 110: $$\Delta p \leq \frac{8{,}5kW \times 9549{,}3}{n \times 1{,}55Nm/bar} = \frac{52367}{n} \text{ [bar]}$$

AEHP 40: $$\Delta p \leq \frac{18kW \times 9549{,}3}{n \times 0{,}63Nm/bar} = \frac{272837}{n} \text{ [bar]}$$

Δp	inlet pressure p_1 minus outlet pressure p_2
$p_{cont.}$	if limited to $P_{cont.}$
p_{max}	if limited to $P_{intermit.}$ operating for a maximum duration of 10 % in every hour
p_{peak}	highest pressure at which the components will remain functional
$P_{cont.}$	continuous output (at a return pressure of 10 bar); if this output is constantly exceeded, the drive mus be flushed
$P_{intermit}$	output with which the motor can be run intermittently (for an operating time of 10 % in every hour).

High-precision hydro motor

Motortyp
with play self-adjustment

Motortyp/Displacement	Denotation
Radial-piston motor 88 cm³/U	= **RMHP 90**
Radial-piston motor 109 cm³/U	= **RMHP 110**
Axial-piston motor 44 cm³/U	= **AEHP 40**

Drive shaft	Denotation
Cylindrical Keyway DIN 6885 T1	= **Z**

Connections	Denotation
Flange connection, radial Duesterloh standard (for mounting the valve)	= **A1**
Threaded connection, radial G 1/2 DIN ISO 228-1	= **A**
Threaded connection, axial G 3/4 DIN ISO 228-1	= **B5**

Sealing material	Denotation
NBR seals, suitable for HLP mineral oils according to DIN 51524 part 2	= *
FPM seals, suitable for ester of phosphoric acid (HFD).	= **V**

Additional information	Denotation
Flush connection	= **S99 (AEHP standard)**

Flange dimensions

Attachment	Denotation
S = ø80; K = ø100	= *
S = ø120; K = ø140	= **F3 (only RMHP)**

Flange connection

S = ø160; K = ø200 ISO 3019/2	= **F**

(S = diameter of the centring ring)
(K = circle diameter for screw holes)

Second shaft end	Denotation
cylindrical measuring shaft $ø10_{h6}$ for sensor (incremental speed sensor etc.)	= **M (Not available for B5 connections)**
without second shaft end	= *

* No information given in the type key number.

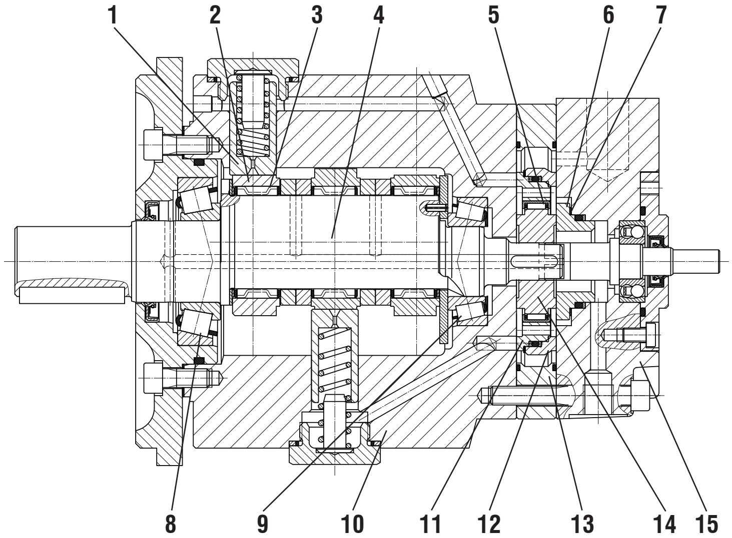
1. General properties and features

Hydrostatic radial piston motor

Purpose:
Transformation of hydraulic power to drive power.
High efficiency, also suitable for very low speeds, low moment of inertia, rapidly reversible, four-quadrant operation possible, very suitable for applications as a control, quiet operation.

2. Structure and function

2.1 Drive unit



Design:
Internal piston support
Method of functioning:
Twenty-one radial pistons **(1)** load the crankshaft **(4)** via a heptagon ring **(2)** with a needle bearing cage **(3)**.

Drive details
Crankshaft bearing: Prestressed, amply dimensioned taper roller bearing **(8/9)** in X-arrangement.
High guiding accuracy, therefore smooth running, high axial and radial load capacity (e.g. a flying arrangement of a pinion on the drive shaft). Load transmission piston **(1)** - crank shaft **(4)**:
Through heptagon ring **(2)** with needle bearing **(3)**.
Advantage: Low frictional losses, very long service life, relatively insensitive to dirt, high starting torque, high continuous torque, no stick-slip effect at low speeds, only minor leakage (necessary for the lubrication and cooling of the drive), high efficiency.

2.2 Control

Design:
Planar translational distribution valve with play adjustment.

Purpose:
Distribution of the volume feed to the twenty-one cylinders, collection of the return volume flow.

Methode of functioning:
Control rings **(11/12)** with the external ring **(13)** and with the eccentric **(14)** form an external and an internal ring space.
By moving the control rings **(11/12)** between the motor housing **(10)** and the end cover **(15)** by means of the eccentric **(4)** which is fixed to the crankshaft **(14)**, the internal and the external ring spaces are connected to the cylinders in turn. The ring spaces themselves are connected to the outside through pressure connections to the motor.

Control details
Roller bearing **(5)** between the control rings **(11/12)** and the eccentric **(14)**. The control rings **(11/12)** mainly move translationally, nevertheless rotationally movement is possible (two-degree-of-freedom-system) - this means small frictional losses at the control rings **(11/12)** and a cleaning effect in the sealing gap, approximately equal relative speeds of the sealing faces. Sinusoidal opening function for the control openings - this means smooth running even at low speeds and quiet running at high speeds, large volume flow in the control ring **(11)**.
Adjustment of the play on the control rings **(11/12)** and the flats on the eccentric **(14)**:
Through hydrostatic pressure, the control rings **(11/12)** are forced against the flats. In case of zero and low pressure situations, the contect between rings and flats is guranteed throughout a spring washer, hydrostatic re-adjustment of the eccentric flats to each other, supported by a pressure thrust piece **(6)** and by a helical spring **(7)**.
Very low leakage and small frictional losses, automatic compensation of pressure and temperature influences (temperature shocks among others), relatively insensitive to dirt.

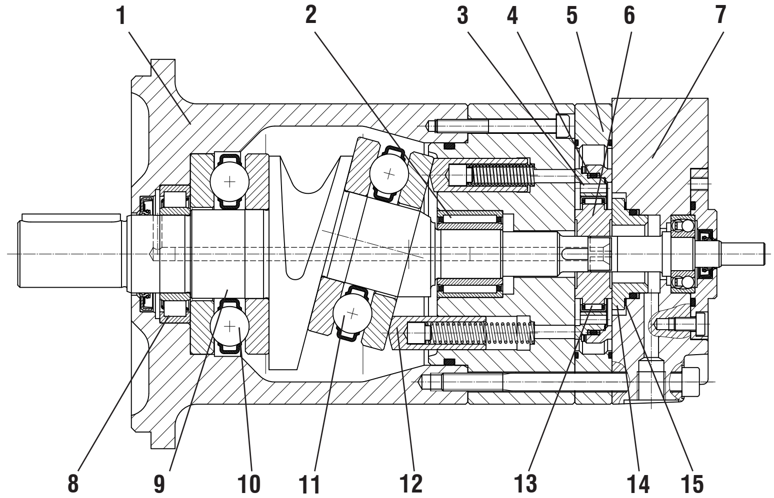
1. General properties and features

Hydrostatic axial piston motor

Purpose:
Transformation of hydraulic power to drive power. High efficiency, also suitable for very low speeds, low moment of inertia, rapidly reversible, high totals printout load capacity, four-quadrant operation possible, very suitable for applications as a control, quiet operation.

2. Structure and function

2.1 Drive unit



Design:
Wobble plate
Method of functioning:
Thirteen axial pistons **(12)** load the wobble spindle **(9)** via deep groove ball thrust bearing **(11)**.

Drive details
Balanced wobble spindle **(9)**, bedded in a deep groove ball thrust bearing **(10)** and a cylinder roller bearing **(8)** facing drive side. The wobble spindle **(9)** facing the control unit is bedded in a needle bearing **(2)**. High radial load capacity (e.g. a flying arrangement of a pinion on the drive shaft).The generation of the torque results from the power transmission through the operating medium to the pistons **(12)**. By means of deep groove ball thrust bearings **(10/11)** in combination with the wobble plate the pistons affect the wobble spindle **(9)**.
Advantage: Low frictional losses, very long service life, relatively insensitive to dirt, high starting torque, high continuous torque, no stick-slip effect at low speeds, only minor leakage (necessary for the lubrication and cooling of the drive), high efficiency.

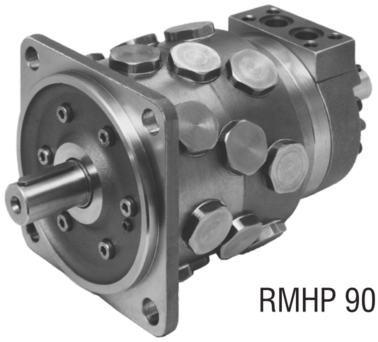
2.2 Control

Design:
Planar translational distribution valve with play adjustment.

Purpose:
Distribution of the volume flow to the thirteen cylinders, collection of the return volume flow.

Methode of functioning:
Control rings **(3/4)** with the external ring **(5)** and with the eccentric **(6)** form an external and an internal ring space.
By moving the control rings **(3/4)** between the motor housing **(1)** and the end cover **(7)** by means of the eccentric **(6)** which is fixed to the wobble spindle **(9)**, the internal and the external ring spaces are connected to the cylinders in turn. The ring spaces themselves are connected to the outside through pressure connections to the motor.

Control details
Roller bearing **(13)** between the control rings **(3/4)** and the eccentric **(6)**. The control rings **(3/4)** mainly move translationally, nevertheless rotational movement is possible (two-degree-of-freedom-system) - this means small frictional losses at the control rings **(3/4)** and a cleaning effect in the sealing gap, approximately identical relative speeds of the sealing faces. Sinusoidal opening function for the control openings - this means smooth running even at low speeds and quiet running at high speeds, large volume flow in the control ring **(13)**.
Adjustment of the play on the control rings **(3/4)** and the flats on the eccentric **(6)**:
Through hydrostatic pressure, the control rings **(3/4)** are forced against the flats. In case of zero and low pressure situations, the contact between rings and flats is guaranteed throughout a spring washer, hydrostatic re-adjustment of the eccentric flats to each other, supported by a pressure thrust piece **(14)** and by a helical spring **(15)**.
Very low leakage and small frictional losses, automatic compensation of pressure and temperature influences (temperature shocks among others), relatively insensitive to dirt.



RMHP 90 ZA1MF

Hydraulic characteristic values RMHP 90

Geometr. displacement	[ccm/rev]	88,4
Theor.spec. torque	[Nm/bar]	1,4
Average spec. torque	[Nm/bar]	1,24
Peak pressure*	[bar]	250,0
Max. operationg pressure**	[bar]	210,0
Continuous pressure	[bar]	140,0
Max. operationg torque	[Nm]	252,0
Continuous torque	[Nm]	173,0
Drain line pressure:	[bar]	
Hydraulic fluid temperature range:	[K]	243- 363
	[°C]	-30-+90
Viscosity range	[mm²/s]	20- 150
	(max. 1000 mm²/s at start)	

Pressure fluids:
HM and HV, definition to CETOP RP 75 H (mineral oil based fluids).
Mineral oil H-LP in conformity with DIN 51424 part 2.
Bio-degradable fluids available on request.

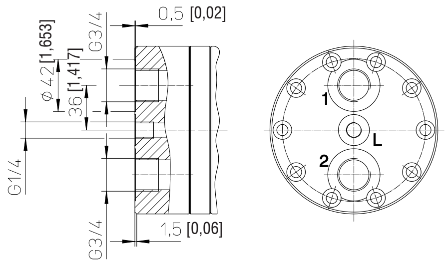
* Definition according to DIN 24 312. Peak pressure = exceeding the maximum operating pressure for a short time at which the motor remains able to function.

** If the sum of inlet pressure and outlet pressure is higher than the peak pressure, please consult the manufacturer.

HFC	Reduce HFC pressure to 70 % Check the bearing service life	Definition to CETOP RP 77 H ISO/DIS 6071
HFD	FPM-/FKM seals are required	

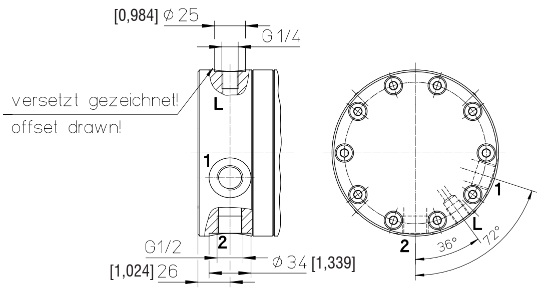
Filtering

Max. permissible degree of contamination of the pressure fluid according to NAS 1638 class 9.
We recommend filters with a minimum retention rate of $\beta_{10} \geq 100$
For a long service life we recommend filtering acc. to NAS 1638 class 8 and filters with a minimum retention rate of $\beta_5 \geq 100$.



Alternative End Cover B5

Inch measurements in brackets

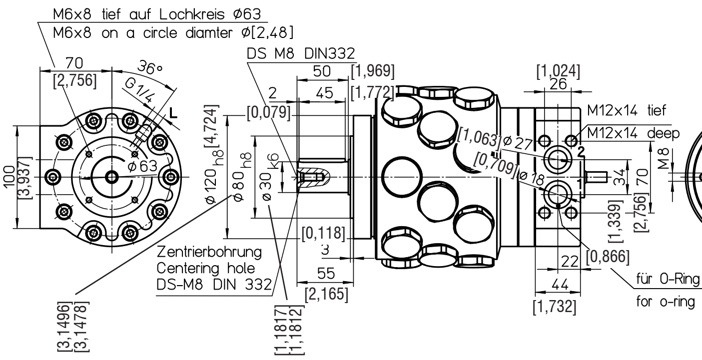


Alternative End Cover A

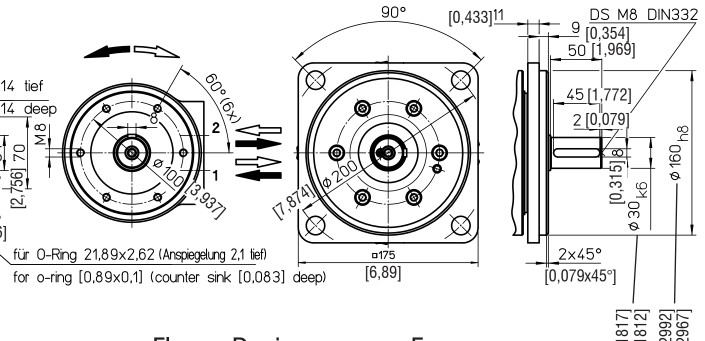
Inch measurements in brackets

Characteristic values according to VDI 3278

Weight:	[kg]	25,2
Mounting position: as required		
Direction of rotation, if viewed at the shaft end		
clockwise: flow from connection 2 to connection 1		
anti-clockwise: flow from connection 1 to connection 2		
Operating speed range:	[rpm]	1÷900
Moment of inertia:	[kgm²]	0,00032
Continuous power:	[kW]	8,5
Intermittent power:	[kW]	10,0



Standard Design RMHP 90 ZA1M



Flange Design F

Inch measurements in brackets

Type number key for radial piston motor RMHP 90

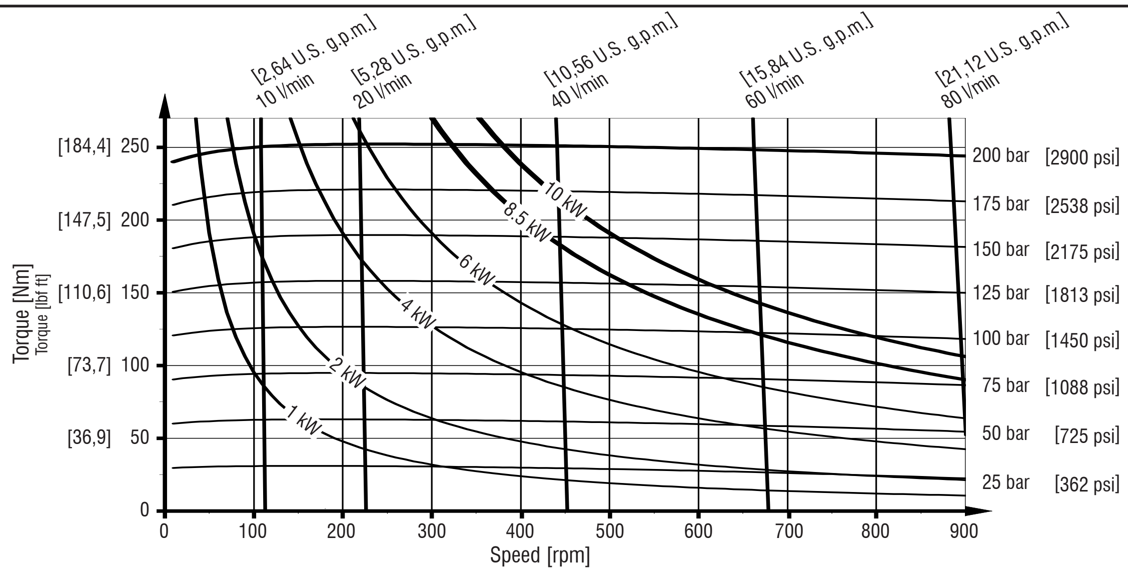
	Size	Shaft end	End cover	Seal	Instrument shaft [1])	Flange	additional speces.
RMHP	90						
Radial Piston Motor		Keyway Z	Valve face A1	NBR	with M	S=Ø 80;K=Ø100	with out
			Radial ports A	FPM V	without	S=Ø160;K=Ø200 F	flush connection S99
			Axial ports B5			S=Ø120;K=Ø140 F3	

[1]) In Case of B5 flange, instrument shaft is not possible

Pressure medium: HLP 46 — operating temperature: T = 50°C — pressure difference: Δp = p_1-p_2; p_2 = 0 bar

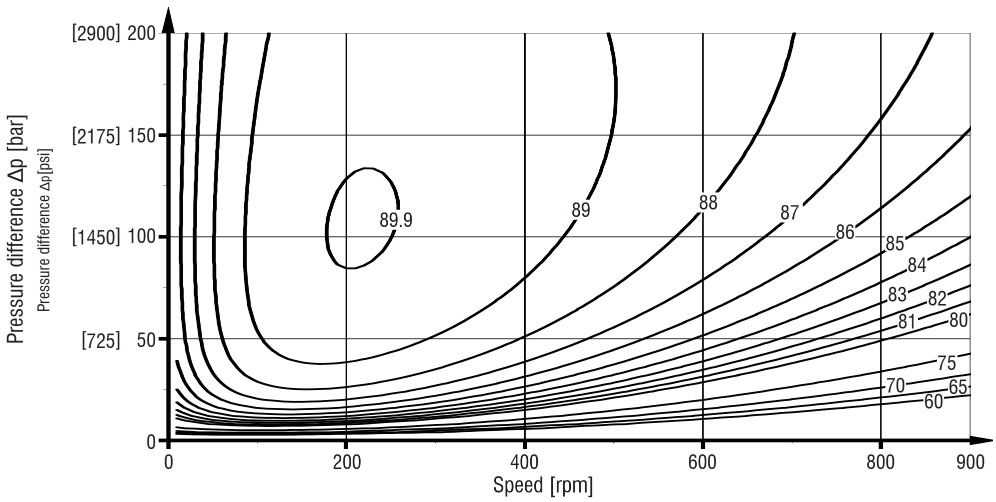
Torque characteristic

Diagram A:



Hydraulic-mechanical efficiency in percentage

Diagram B:



Strength of the shaft

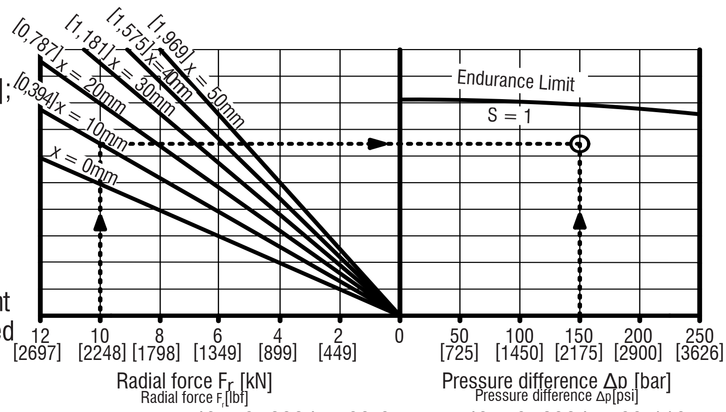
Diagram C:

Example:

Given: Fr = 10 kN [2248 lbf]; x = 10 mm [0,394 in]; Δp = 150 bar [2175,5 psi]

Required: Shaft strength

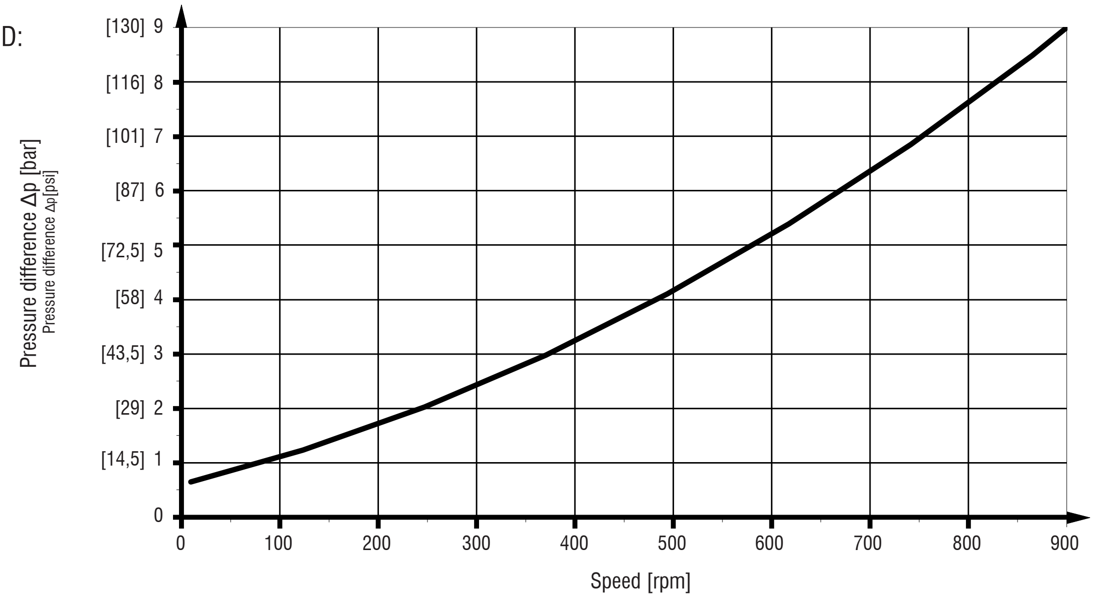
Draw a vertical line from Fr = 10 kN [2248 lbf] to distance x = 10 mm [0,394 in] and a straight horizontal line to the right. If the intersection of the horizontal with the vertical line of Δp = 150 bar [2175,5 psi] is below the curve, the shaft has sufficient fatigue strength. Allowable axial forces will be provided on request.



Pressure medium: HLP 46 operating temperature: T = 50°C pressure difference: $\Delta p = p_1 - p_2$; p_2 = 0 bar

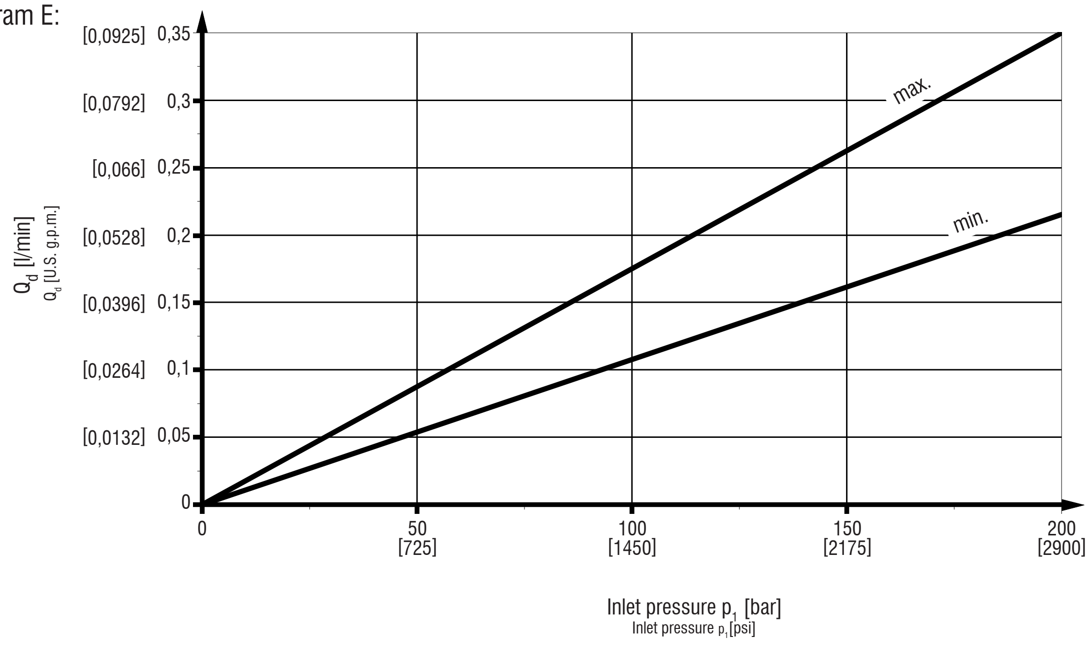
Idle speed

Diagram D:



External leakage through flow

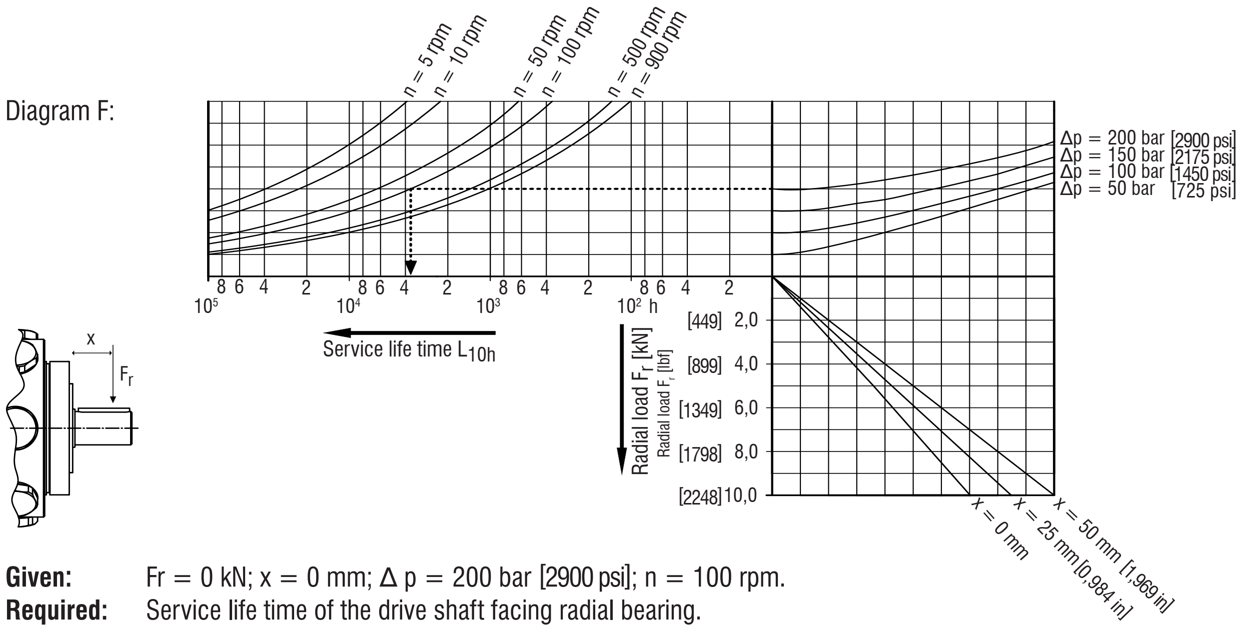
Diagram E:



DUESTERLOH Fluidtechnik GmbH · Im Vogelsang 105 · D-45527 Hattingen · Phone +49 / (0) 2324 / 709-0 · Fax +49 / (0) 2324 / 709-110

Service life of the radial bearing loaded with a radial force facing the drive shaft.

Diagram F:



Given: Fr = 0 kN; x = 0 mm; Δ p = 200 bar [2900 psi]; n = 100 rpm.

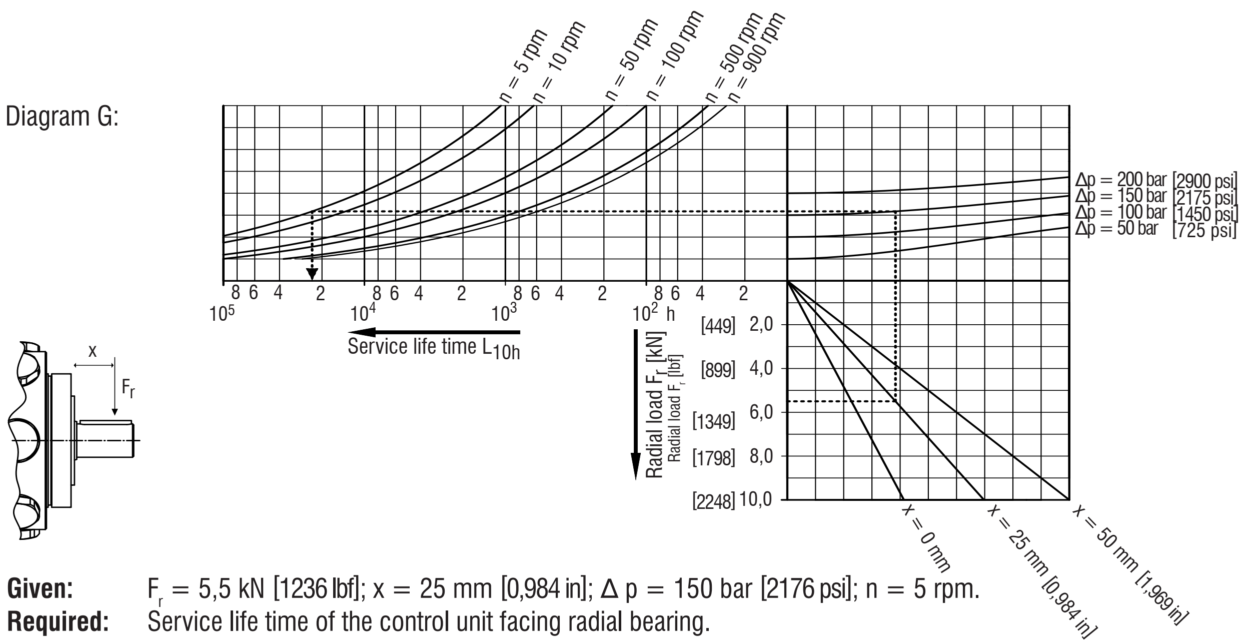
Required: Service life time of the drive shaft facing radial bearing.

Diagram F:

Form a horizontal line from the Δp = 200 bar [2900 psi] curve to the n = 100 rpm curve. From this follows a service life time value of L_{10h} = 3665,5 h.

Service life of the radial bearing loaded with a radial force facing the control unit.

Diagram G:



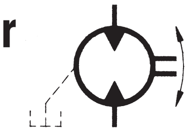
Given: F_r = 5,5 kN [1236 lbf]; x = 25 mm [0,984 in]; Δ p = 150 bar [2176 psi]; n = 5 rpm.

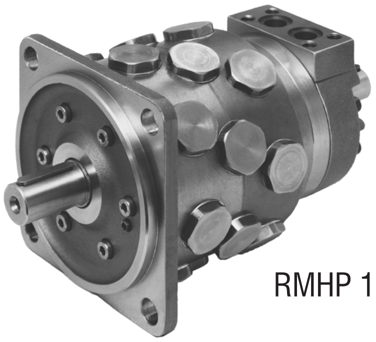
Required: Service life time of the control unit facing radial bearing.

Diagram G:

Form a horizontal line from F_r = 5,5 kN [1236 lbf] to x = 25 mm [0,984 in]. From the intersection form a vertical line to the pressure curve Δp = 150 bar [2176 psi]. Afterwards, draw a line from the pressure curve to the speed curve n = 5 rpm. The intersection shows the service life time L_{10h} = 23351 h.

DÜSTERLOH Fluidtechnik	**Radial Piston Motor** RMHP 110 Technical data	Catalogue **HM1 - 018 UK** Page 12 Edition 2012.04 / 02





RMHP 110 ZA1MF

Hydraulic characteristic values RMHP 110

Geometr. displacement	[ccm/rev]	109,5
Theor.spec. torque	[Nm/bar]	1,74
Average spec. torque	[Nm/bar]	1,55
Peak pressure*	[bar]	250,0
Max. operationg pressure**	[bar]	210,0
Continuous pressure	[bar]	140,0
Max. operationg torque	[Nm]	310,0
Continuous torque	[Nm]	217,0
Drain line pressure:	[bar]	
Hydraulic fluid temperature range:	[K]	243- 363
	[°C]	-30-+90
Viscosity range	[mm²/s]	20- 150
	(max. 1000 mm²/s at start)	

Pressure fluids:
HM and HV, definition to CETOP RP 75 H (mineral oil based fluids).
Mineral oil H-LP in conformity with DIN 51424 part 2.
Bio-degradable fluids available on request.

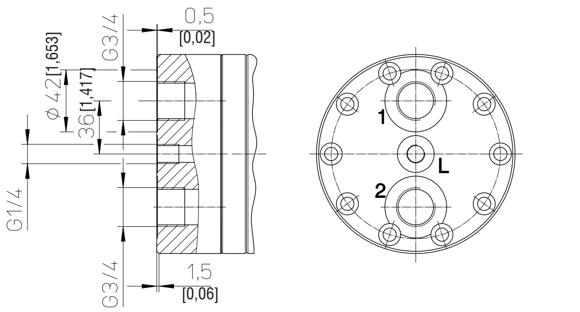
* Definition according to DIN 24 312. Peak pressure = exceeding the maximum operating pressure for a short time at which the motor remains able to function.

** If the sum of inlet pressure and outlet pressure is higher than the peak pressure, please consult the manufacturer.

HFC	Reduce HFC pressure to 70 % Check the bearing service life	Definition to CETOP RP 77 H ISO/DIS 6071
HFD	FPM-/FKM seals are required	

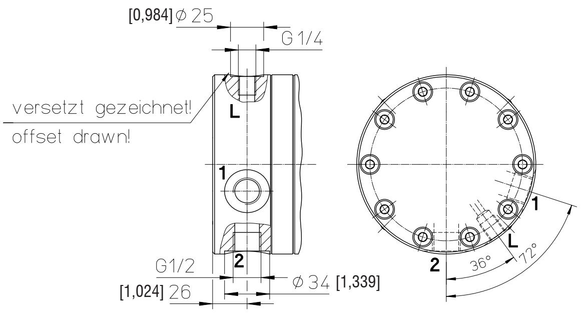
Filtering

Max. permissible degree of contamination of the pressure fluid according to NAS 1638 class 9.
We recommend filters with a minimum retention rate of $\beta_{10} \geq 100$
For a long service life we recommend filtering acc. to NAS 1638 class 8 and filters with a minimum retention rate of $\beta_5 \geq 100$.



Alternative End Cover B5

Inch measurements in brackets

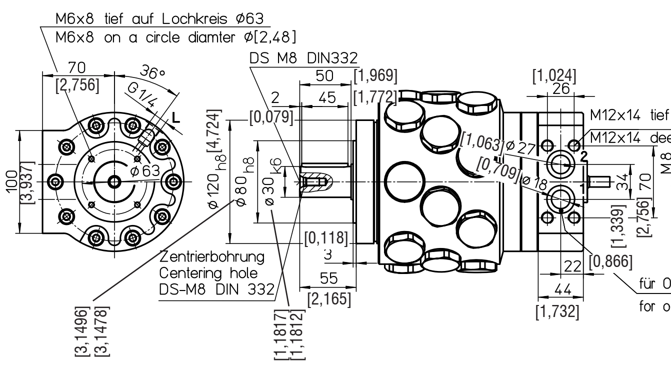


Alternative End Cover A

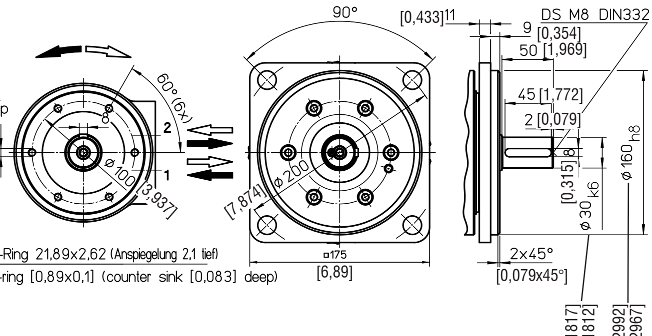
Inch measurements in brackets

Characteristic values according to VDI 3278

Weight:	[kg]	25,2
Mounting position: as required		
Direction of rotation, if viewed at the shaft end		
clockwise: flow from connection 2 to connection 1		
anti-clockwise: flow from connection 1 to connection 2		
Operating speed range:	[rpm]	1÷750
Moment of inertia:	[kgm²]	0,00034
Continuous power:	[kW]	8,5
Intermittent power:	[kW]	10,0



Standard Design RMHP 90 ZA1M



Flange Design F

Inch measurements in brackets

Type number key for radial piston motor RMHP 110

	Size	Shaft end	End cover	Seal	Instrument shaft ¹)	Flange	additional speces.
RMHP	110						
Radial Piston Motor		Keyway Z	Valve face A1	NBR	with M	S=Ø 80;K=Ø100	with out
			Radial ports A	FPM V	without	S=Ø160;K=Ø200 F	flush connection S99
			Axial ports B5			S=Ø120;K=Ø140 F3	

¹) In Case of B5 flange, instrument shaft is not possible

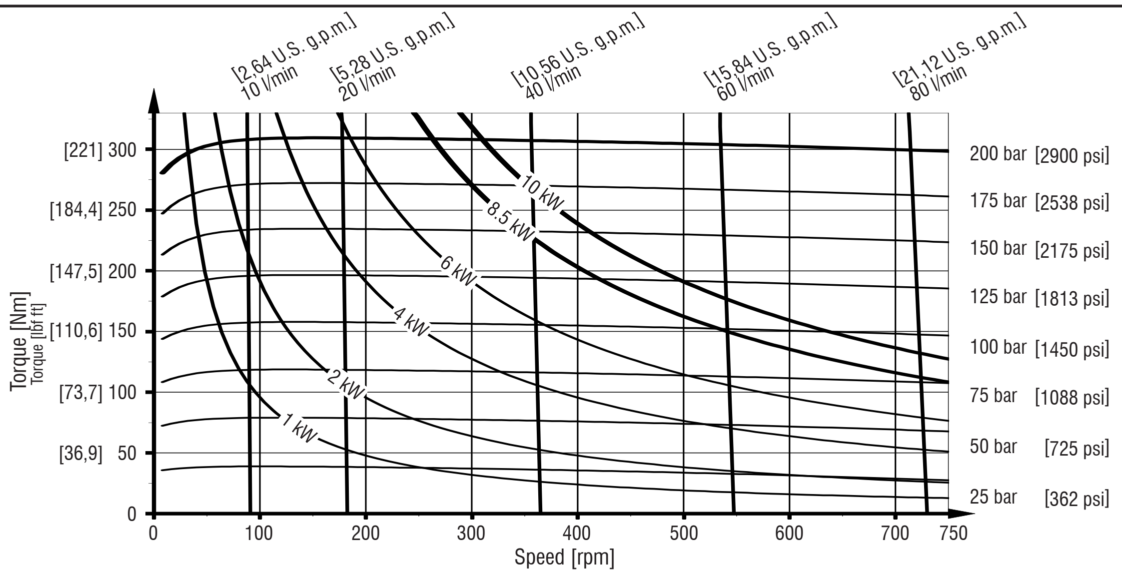
Changes reserved!

DUESTERLOH Fluidtechnik GmbH · Im Vogelsang 105 · D-45527 Hattingen · Phone +49 / (0) 2324 / 709-0 · Fax +49 / (0) 2324 / 709-110

Pressure medium: HLP 46 operating temperature: T = 50°C pressure difference: $\Delta p = p_1 - p_2$; p_2 = 0 bar

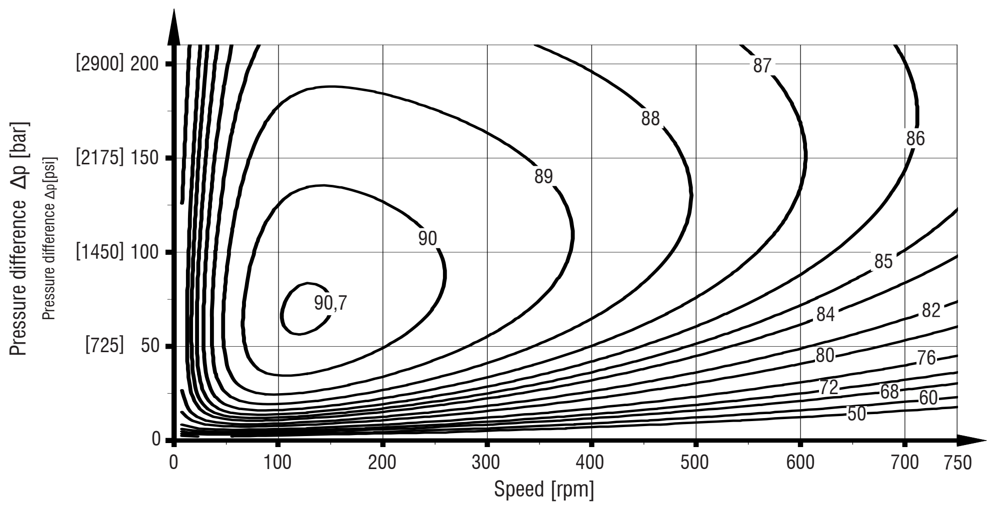
Torque characteristic

Diagram A:



Hydraulic-mechanical efficiency in percentage

Diagram B:



Strength of the shaft

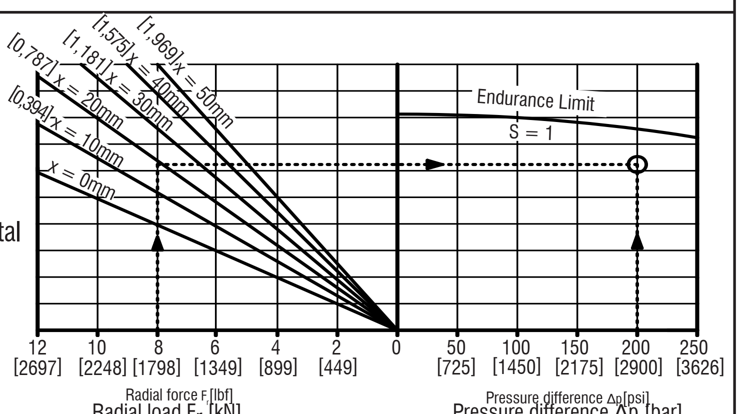
Diagram C:

Example

Given: Fr = 8 kN [1798 lbf]; x = 20 mm [0.787 in]; Δp = 200 bar [2900 psi]

Required: shaft strength

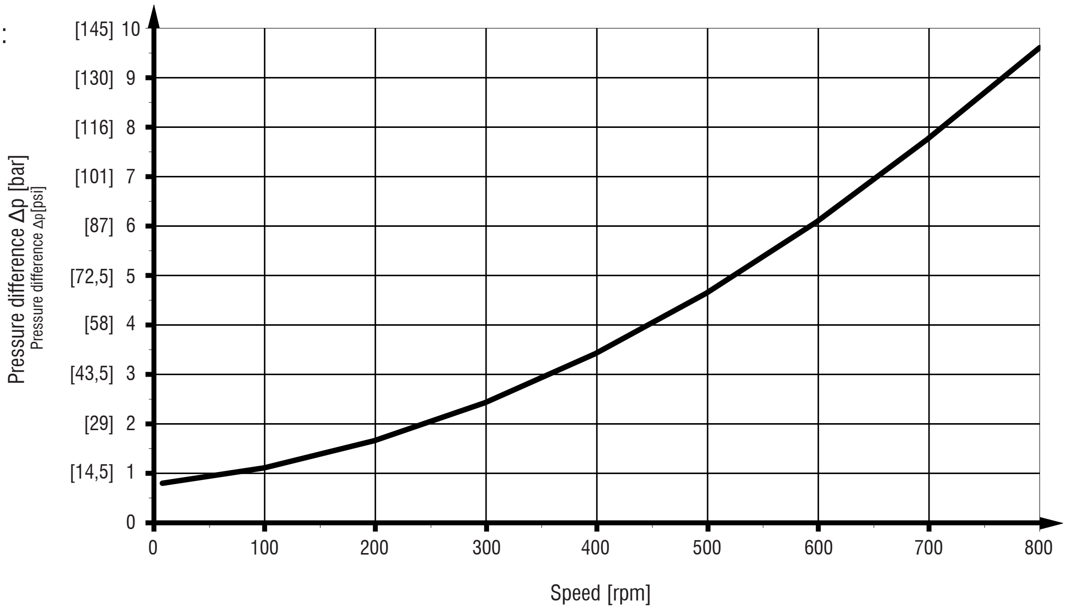
Draw a vertical line from F_r = 8 kN [1798 lbf] to distance x = 20 mm [0,787 in] and a straight horizontal line from there. If the intersection of the horizontal with the vertical line of Δp = 200 bar [2900 psi] is below curve the shaft has sufficient fatigue strength.



Pressure medium: HLP 46 operating temperature: T = 50°C pressure difference: Δp = p_1-p_2; p_2 = 0 bar

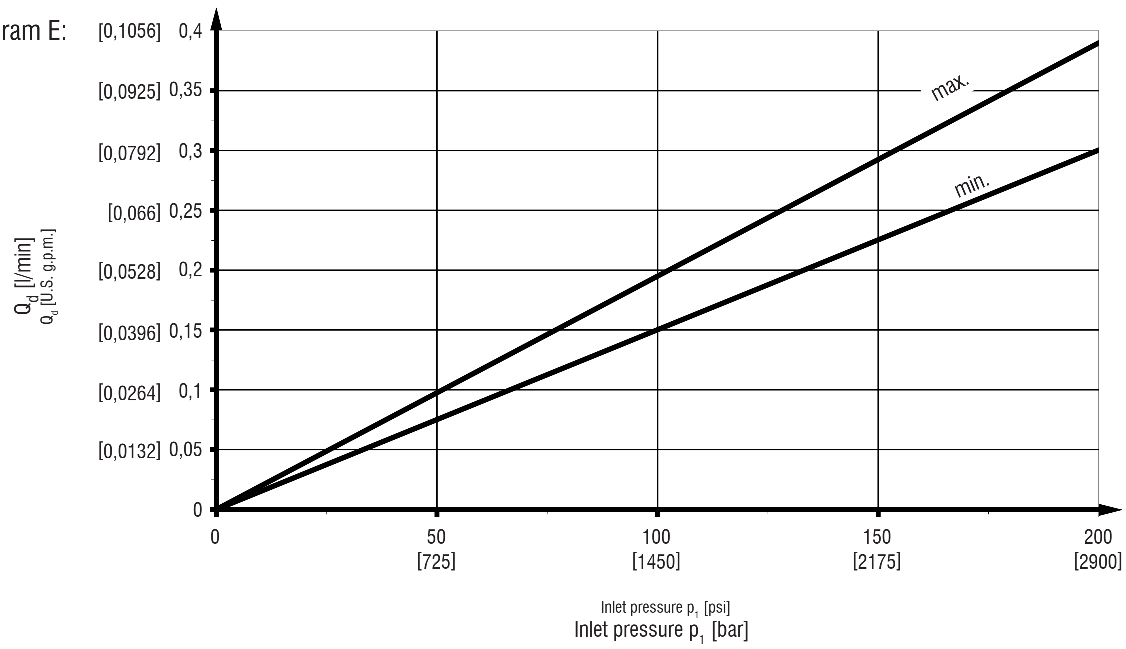
Idle speed

Diagram D:



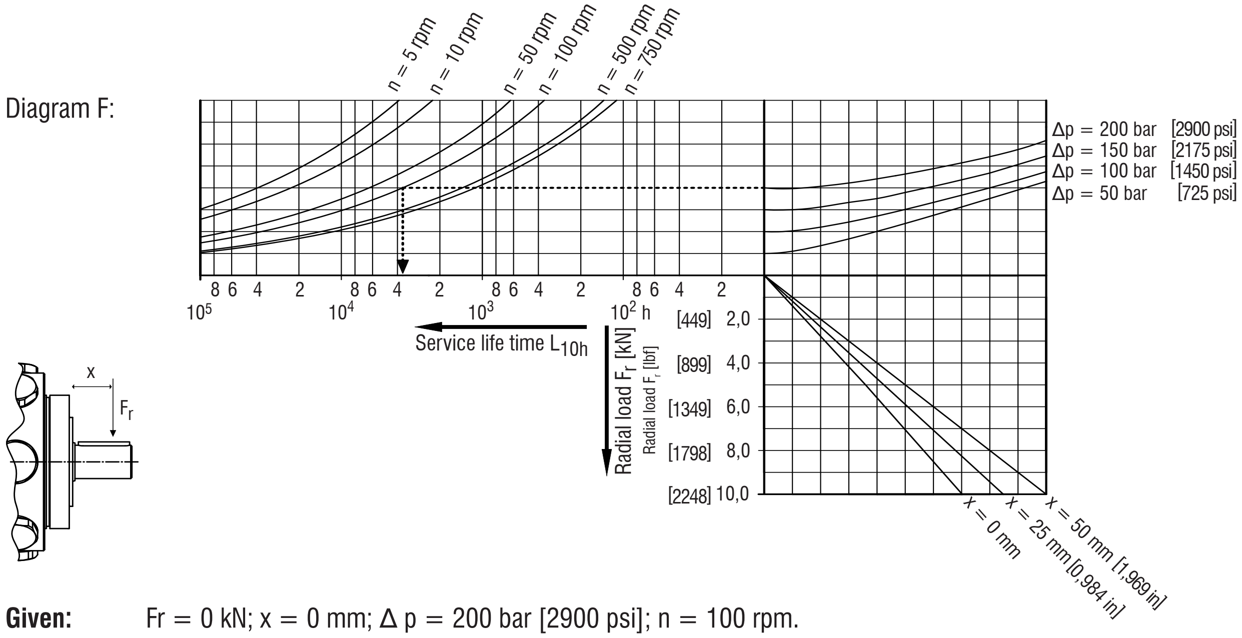
External leakage through flow

Diagram E:



Service life of the radial bearing loaded with a radial force facing the drive shaft.

Diagram F:

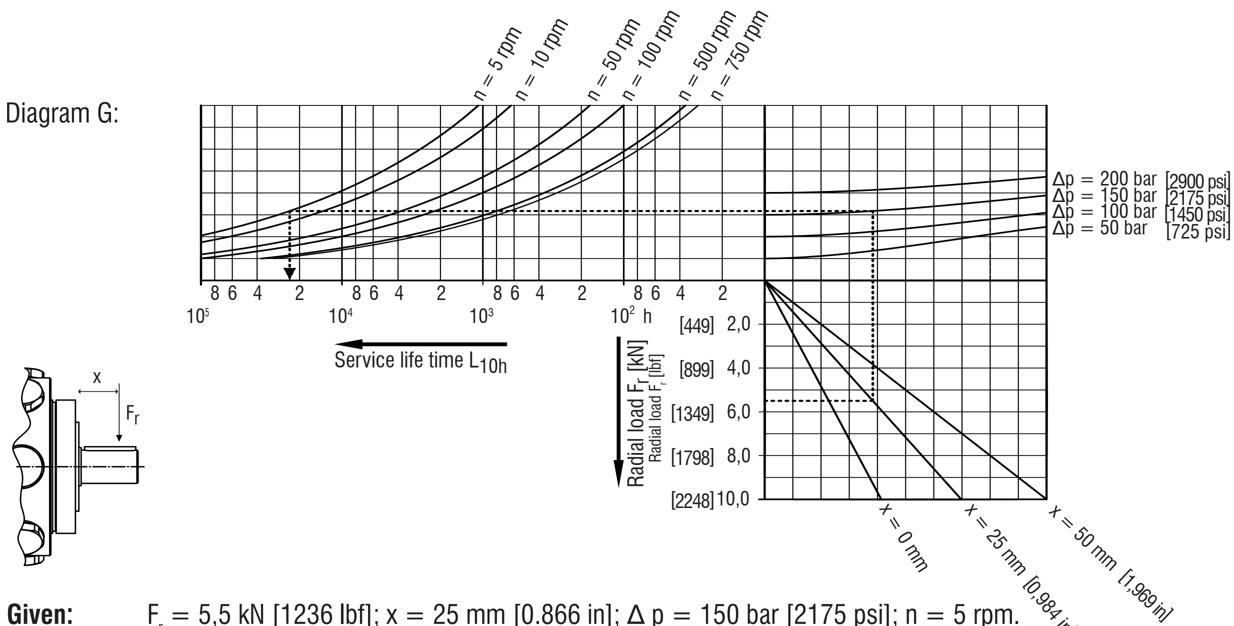


Given: F_r = 0 kN; x = 0 mm; Δ p = 200 bar [2900 psi]; n = 100 rpm.
Required: Service life time of the drive shaft facing radial bearing.

Diagram F:
Form a horizontal line from the Δp = 200 bar [2900 psi] curve to the n = 100 rpm curve. A vertical line down form the intersection shows a service life time value of L_{10h} = 3665,5 h.

Service life of the radial bearing loaded with a radial force facing the control unit.

Diagram G:

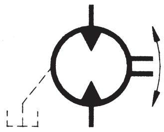


Given: F_r = 5,5 kN [1236 lbf]; x = 25 mm [0.866 in]; Δ p = 150 bar [2175 psi]; n = 5 rpm.
Required: Service life time of the control unit facing radial bearing.

Diagram G:
Form a horizontal line from F_r = 5,5 kN [1236 lbf] to x = 25 mm [0.866 in]. From the intersection form a vertical line to the pressure curve Δp = 150 bar [2175 psi]. Afterwards, draw a line from the pressure curve to the speed curve n = 5 rpm. The intersection dedicats the service life time L_{10h} = 23351 h.

Axial Piston Motor

AEHP 40
Technical data



AEHP 40 ZA1

Hydraulic characteristic values AEHP 40

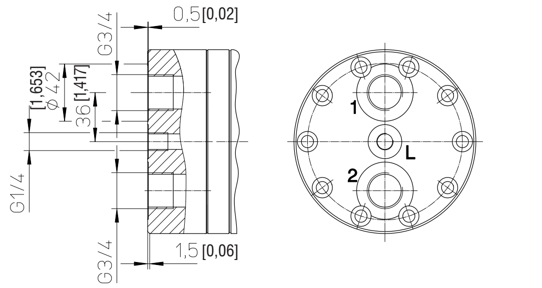
Geometr. displacement:	[ccm/rev]	43,7
Theor.spec. torque:	[Nm/bar]	0,7
Average spec. torque:	[Nm/bar]	0,63
Peak pressure:*	[bar]	315,0
Max. operating pressure:**	[bar]	250,0
Continuous pressure:	[bar]	210,0
Max. operating torque:	[Nm]	159,0
Continuous torque:	[Nm]	131,5
Drain line pressure:	[bar]	
Hydraulic fluid temperature range:	[K]	243- 363
	[°C]	-30-+90
Viscosity range:	[mm²/s]	20- 150
	(max. 1000 mm²/s at start)	

Pressure fluids:
HM and HV, definition to CETOP RP 75 H (mineral oil based fluids).
Mineral oil H-LP in conformity with DIN 51424 part 2.
Bio-degradable fluids available on request.

* Definition according to DIN 24 312. Peak pressure = exceeding the maximum operating pressure for a short time at which the motor remains able to function.

** If the sum of inlet pressure and outlet pressure is higher than the peak pressure, please consult the manufacturer.

HFC	Reduce HFC pressure to 70 % Check the bearing service life	Definition to CETOP RP 77 H ISO/DIS 6071
HFD	FPM-/FKM seals are required	

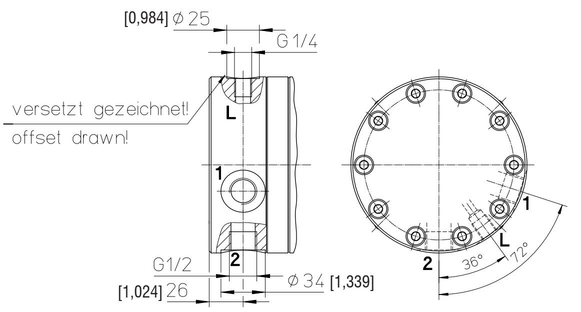


Alternative End Cover B5

Inch measurements in brackets

Filtering

Max. permissible degree of contamination of the pressure fluid according to NAS 1638 class 9.
We recommend filters with a minimum retention rate of $\beta_{10} \geq 100$
For a long service life we recommend filtering acc. to NAS 1638 class 8 and filters with a minimum retention rate of $\beta_5 \geq 100$.

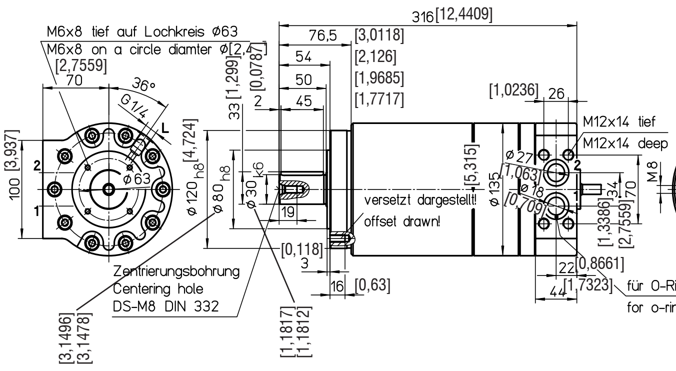


Alternative End Cover A

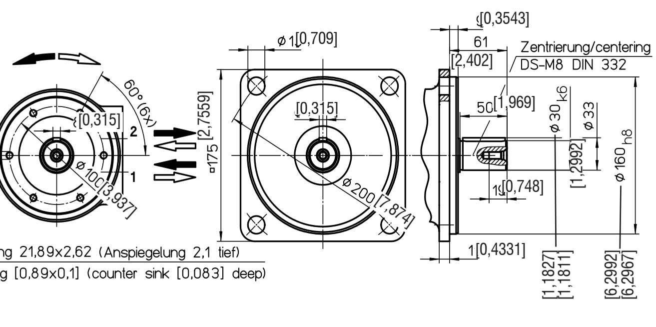
Inch measurements in brackets

Characteristic values according to VDI 3278

Weight:	[kg]	25,0
Mounting position: as required		
Direction of rotation, if viewed at the shaft end		
clockwise: flow from connection 2 to connection 1		
anti-clockwise: flow from connection 1 to connection 2		
Operating speed range:	[rpm]	1÷2000
Moment of inertia:	[kgm²]	0,0011
Continuous power:	[kW]	18,0
Intermittent power:	[kW]	21,0



Standard Design AEHP 40 ZA1M



Flange Design F

Type number key for axial piston motor AEHP 40

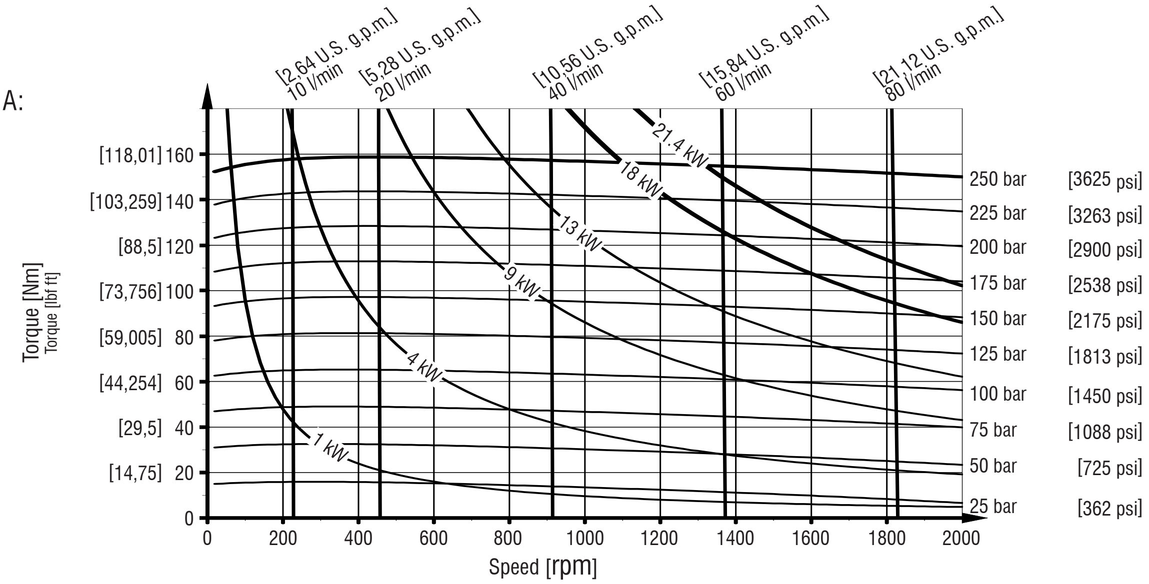
	Size	Shaft end	End cover	Seal	Instrument shaft ¹)	Flange	additional speces.
AEHP	40						
Axial Piston Motor		Keyway Z	Valve face A1	NBR	with M	S=Ø 80;K=Ø100	The AEHP is standardized equipped with a flush conection S99
			Radial ports A	FPM V	without	S=Ø160;K=Ø200 F	
			Axial ports B5				

¹) In Case of B5 flange, instrument shaft is not possible

Pressure medium: HLP 46 operating temperature: T = 50°C pressure difference: $\Delta p = p_1 - p_2$; p_2 = 0 bar

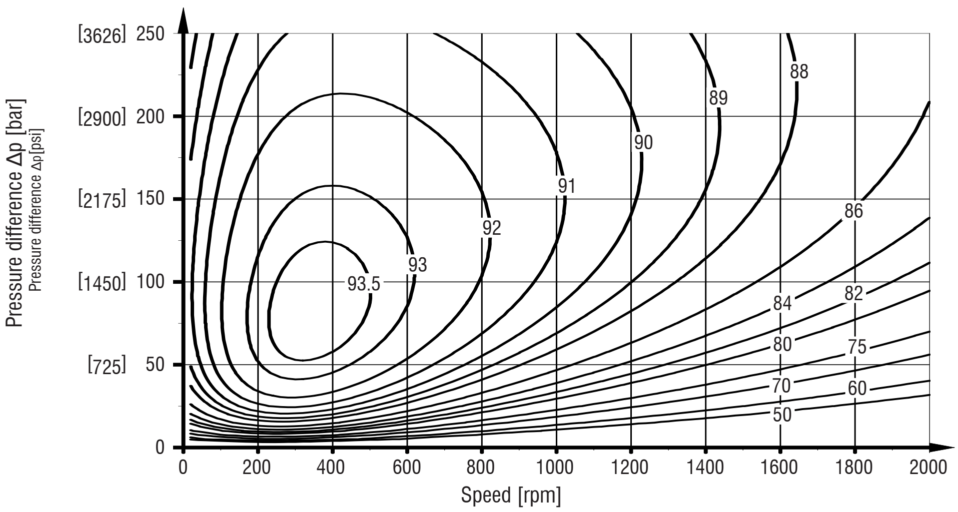
Torque characteristic

Diagram A:



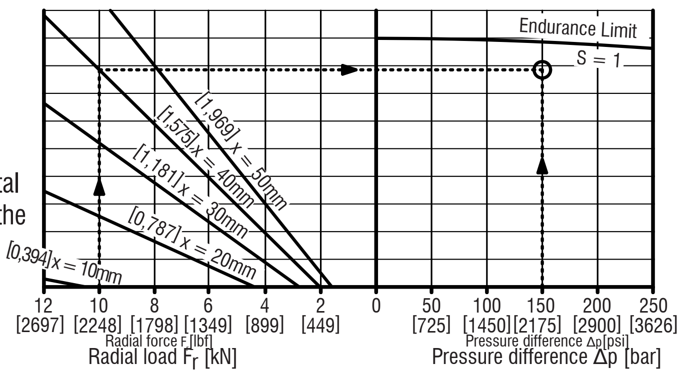
Hydraulic-mechanical efficiency in percentage

Diagram B:



Strength of the shaft

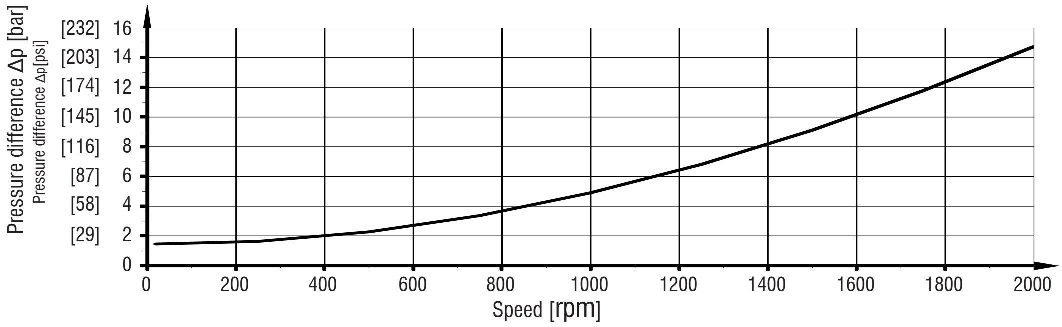
Diagram C:
Example
Given: Fr = 10 kN [2248 lbf]; x = 40 mm;
Δp = 150 bar [2175 psi]
Required: Strength
Draw a vertical line from F_r = 10 kN [2248 lbf] to distance x = 40 mm [1,5748 in] and a straight horizontal line from there. If the intersection ot the horizontal with the vertical line of Δp = 150 bar [2175 psi] is below curve the shaft has sufficient fatigue strength.



Pressure medium: HLP 46 operating temperature: T = 50°C pressure difference: $\Delta p = p_1 - p_2$; $p_2 = 0$ bar

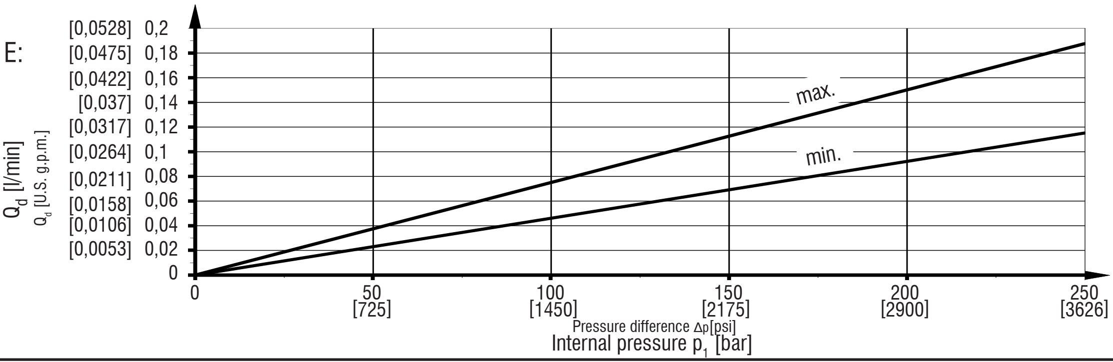
Idle speed

Diagram D:



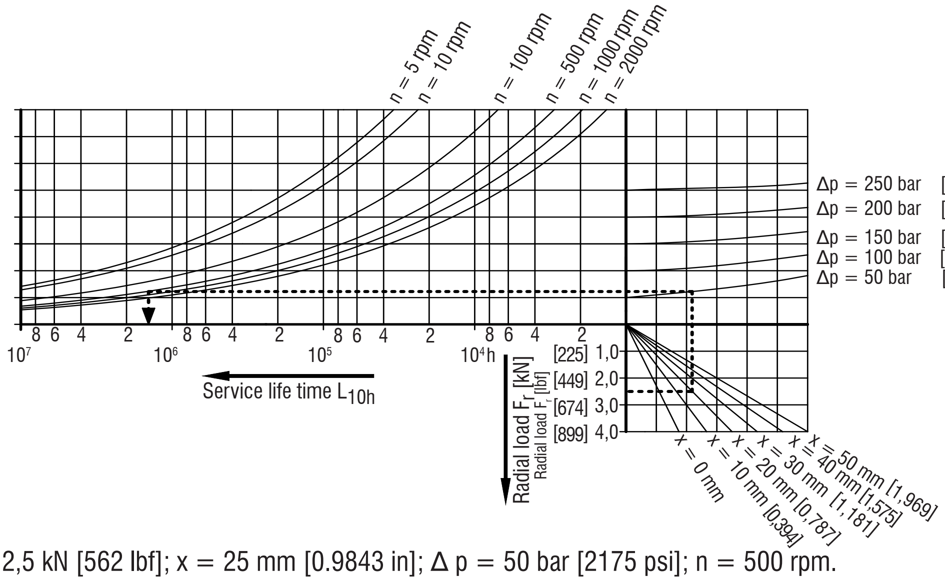
External leakage through flow

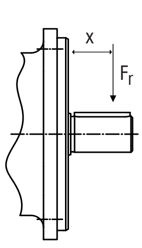
Diagram E:



Service life of the radial bearing loaded with a radial force facing the control unit.

Diagram F:





Given: F_r = 2,5 kN [562 lbf]; x = 25 mm [0.9843 in]; Δ p = 50 bar [2175 psi]; n = 500 rpm.

Required: Service life time of the control unit facing radial bearing.

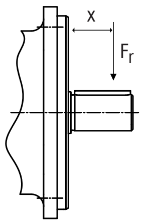
Diagram F:

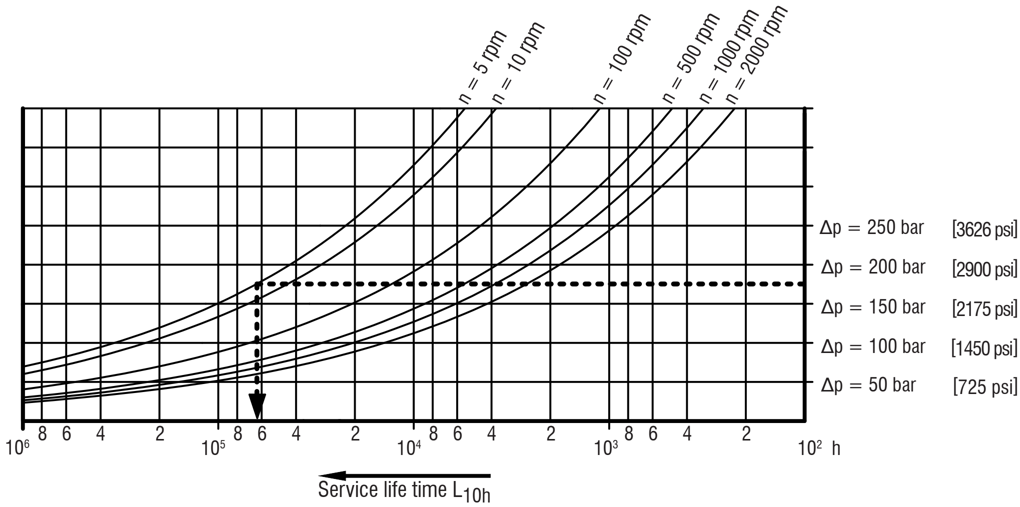
Form a horizontal line from F_r = 2,5 kN [562 lbf] to x = 20 mm [0.7874 in]. From the intersection form a vertical line to the pressure curve Δp = 50 bar [2175 psi]. Afterwards, draw a line from the pressure curve to the speed curve n = 500 rpm. The intersection shows the service life time L_{10h} = 1.686.674 h.

DUESTERLOH Fluidtechnik GmbH · Im Vogelsang 105 · D-45527 Hattingen · Phone +49 / (0) 2324 / 709-0 · Fax +49 / (0) 2324 / 709-110

Service life of the axial bearing facing the output shaft.

Diagram G:



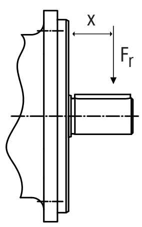


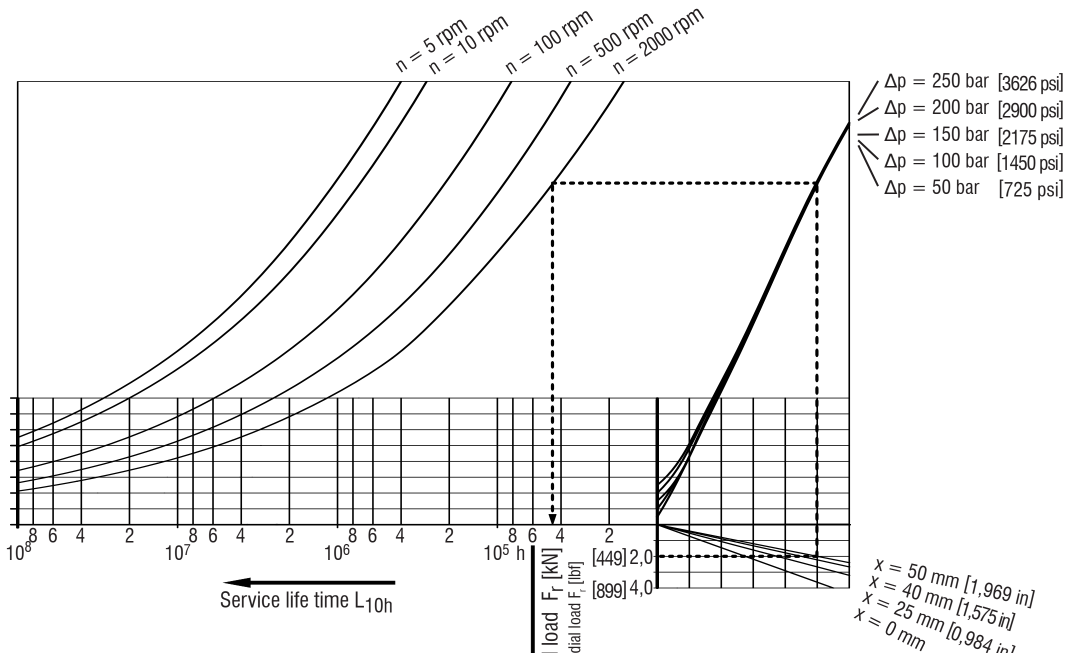
Given: F_r = 0 kN; x = 0 mm; Δ p = 175 bar [2538 psi]; n = 5 rpm.
Required: Service life time of the axial bearing facing the control unit.

Diagram G:
Form a horizontal line from the pressure curve Δp = 175 bar [2175 psi]. Afterwards, draw a vertical from n = 5 rpm. The intersection shows the service life time L_{10h} = 71.068 h.

Service life of the radial bearing loaded with a radial force facing the output shaft.

Diagram H:





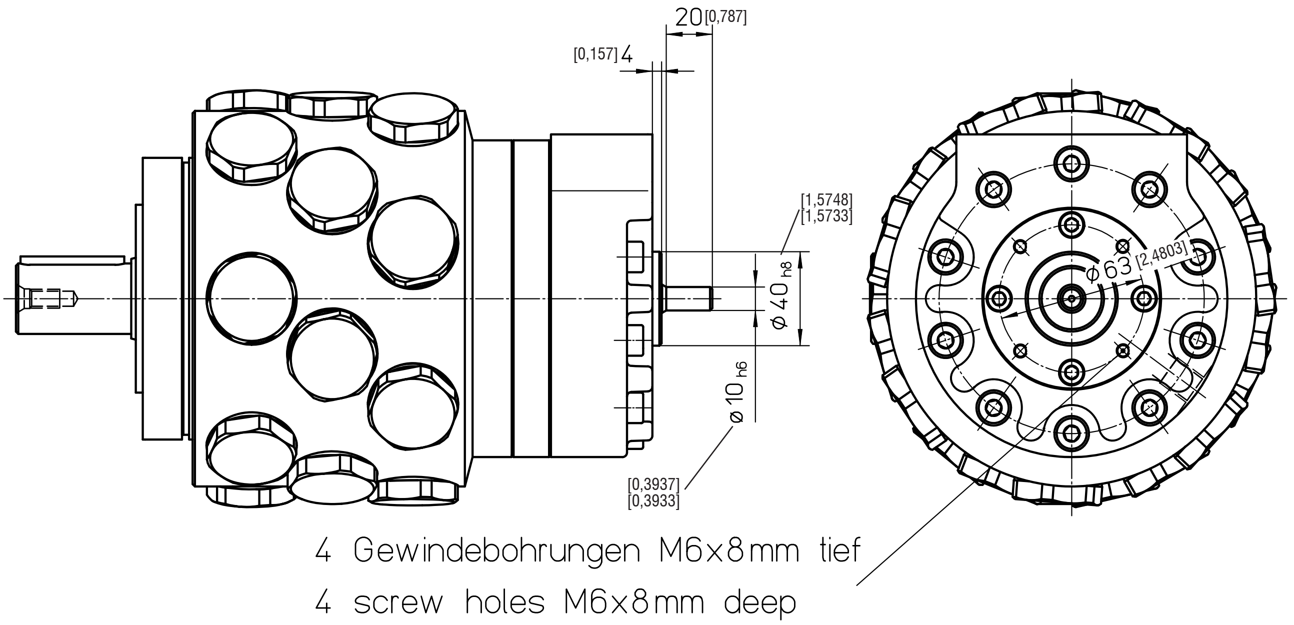
Given: F_r = 2 kN [449 lfb]; x = 50 mm [1.9685 in] ;
Δ p = 100 bar [1450 psi] bar; n = 2000 rpm.
Required: Service life time of the control unit facing radial bearing.

Diagram H:
Form a horizontal line from F_r = 2 kN [449 lbf] to x = 50 mm [1.9685 in]. From the intersection form a vertical line to the pressure curve Δp = 100 bar. Afterwards, draw a line from the pressure curve to the speed curve n = 2000 rpm. The intersection shows the service life time L_{10h} = 45.477 h.

Cylindrical measuring shaft: M

Radial- and axial piston motors of the series RMHP 90, RMHP 110 and AEHP 40 with the addititonal denotation "M" are coupled to a cylindrical measuring shaft to determine the speed of the engine. The cylindrical measuring shaft is fixed to the crankshaft and is able to assign a torque of about 5 Nm [3,688 lbf ft]. If a higher torque is required, please request separately. Informations about accessories like speed indicators, dynamos, impuls generators and power frequency generators please request also separately.

RMHP 90 ZA1M:

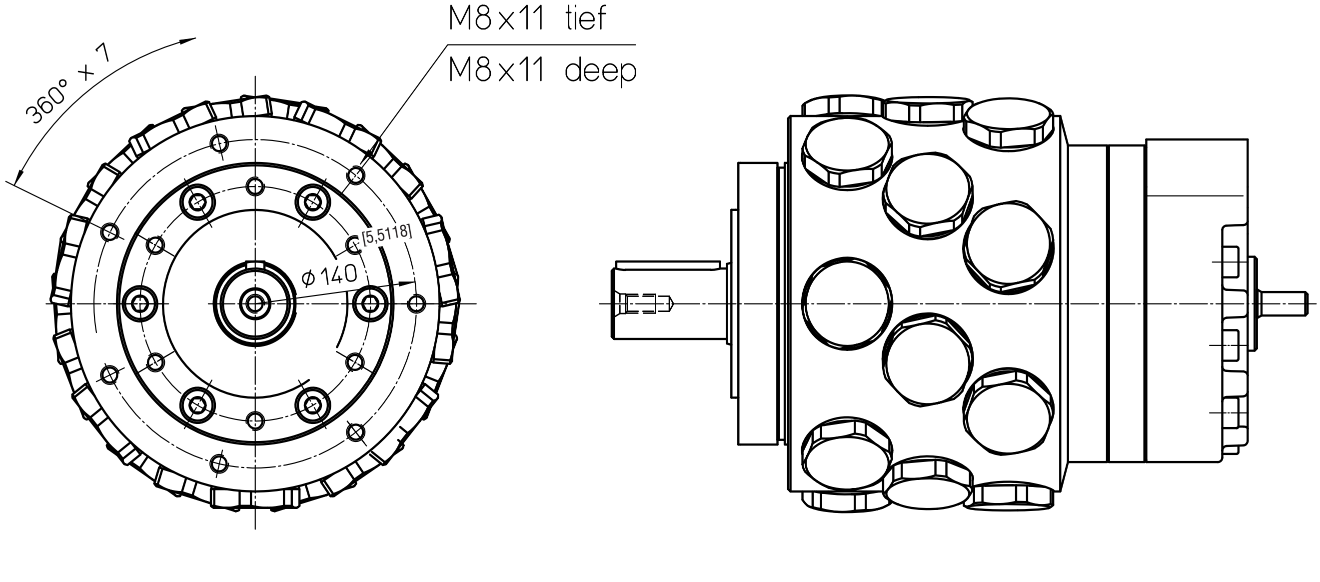


Inch measurements in brackets

Flange connection: F3 (just RMHP)

Seven additional mounting boreholes M8 x 11 deep on a pitch circle Ø 140 [5,5118].

RMHP 90 ZA1MF3:



Inch measurements in brackets

You know your product, we know our high-precision motors! Give us your conditions, we will calculate all important data for a suitable drive.

1. **Company***____________ **For attention of***____________
Street / P.O.Box ____________ Department ____________
Postal code / City____________ **Phone No***____________
Country____________ **E-Mail*** ____________

2. **Operating data:** secondary drive
2.1 Machine type: ____________ project:____________
2.2 Machine operating factor / gearboxes k = ________
2.3 Installation position: ☐ horizontal ☐ vertical
☐ drive shaft upwards ☐ drive shaft downwards
2.4 Forces on drive shaft: ☐ pressure ☐ tension
radial: ________ N axial: ________ N
2.5 Nominal torque T_N = ______Nm speed n = ______ min^{-1} time = ______min
2.6 **Continuous torque*** T_{cont}* = ______**Nm** **speed** **n*** = ______ **min^{-1}** time = ______min
2.7 Maximum torque T_{max} = ______Nm speed n = ______ min^{-1} time = ______min
2.8 Minimum torque T_{min} = ______Nm speed n = ______ min^{-1} time = ______min
2.9 Maximum speed n_{max} = ______ min^{-1} time t = ______ min
2.10 Minimum speed n_{min} = ______ min^{-1} time t = ______ min
2.11 Information about working cycle: ____________
____
2.12 ☐ Secondary drive with valve assembly on the motor
2.13 ☐ Control drive with proportinal- / servo valve
2.14 Maximum power: P_{max} = ______kW **continuous power*: P_{dauer}* = ______ kW**
2.15 ☐ one-shift-operation ☐ two-shift-operation ☐ three-shift-operation
2.16 Desired bearing life: L_{h10} = ______ hours
2.17 Remarks:____________
____
____

3. **Operating data:** primary drive
Hydraulic fluid: ____________
operating temperature: Θ = ______°C
Delivery volume of pump Q_P = ______l/min
☐ opened circuit ☐ closed circuit
Feeding pressure p_F = ______bar
System pressure p_{Sys} = ______bar
Desired operating pressure at T_N p_N ~ ______bar

*** Requested fields, which are necessary for the first design.**
(The more informations we get about the technical conditions and the applicationarea, the more specific will be our consulting and design for you.)

Notes

DÜSTERLOH has been developing fluid technology products for more than 100 years.
The drives, controls and hydraulic power units from Hattingen are appreciated throughout the world for their complete reliability; including under extreme conditions. The owner-managed company´s own development and construction department and the wide range of products cater for distinctive flexibility and customer-orientation.

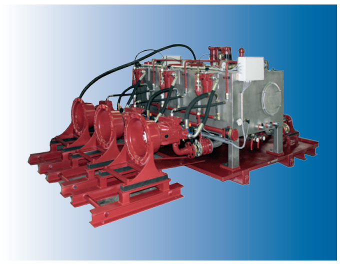
Products

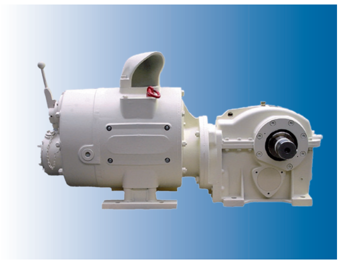
- Hydraulic radial piston motors
- Hydraulic axial piston motors
- Pneumatic motors
- Pneumatic starters
- Hydraulic and pneumatic controls
- Hydraulic power units

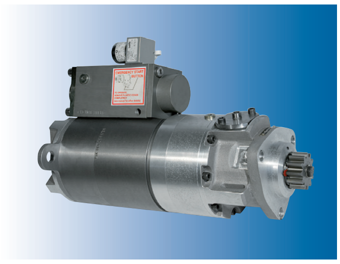
Designing controls and hydraulic power units specific to the customer is our company´s major strength. Vast product diversity is also available for standardized products.

Industrial areas of application

- Machine tools
- Smelting and rolling mill equipment
- Foundry machines
- Testing machines
- Shipbuilding (diesel engines)
- Offshore technology
- Printing and paper technology
- Vehicle construction
- Manipulators
- Environmental technology
- Mining equipment
- Materials handling equipment







Düsterloh Fluidtechnik GmbH
Im Vogelsang 105
D-45527 Hattingen

Tel.: +49 2324 709-0
Fax: +49 2324 709-110

DÜSTERLOH Fluidtechnik

e-mail: info@duesterloh.de
Internet: www.duesterloh.de

Certified acc. to ISO 9001