HYDROSTER Ltd.
Na Ostrowiu Str. 1
80-958 Gdańsk
Phone: (48 58) 307 12 90, fax (48 58) 307 12 92, e-mail: market@hydroster.com.pl

CATALOGUE CARD
HYDRAULIC MOTOR
SOK1
KKA – 16713/12.99

1. DESIGN

Hydraulic motors SOK1 due to their energetic-motive properties and easiness of building- up can be applied in different drives of rotation motions for units and machines: winches, mining machines, wheels of vehicles, boring jigs, mixers, transporters.

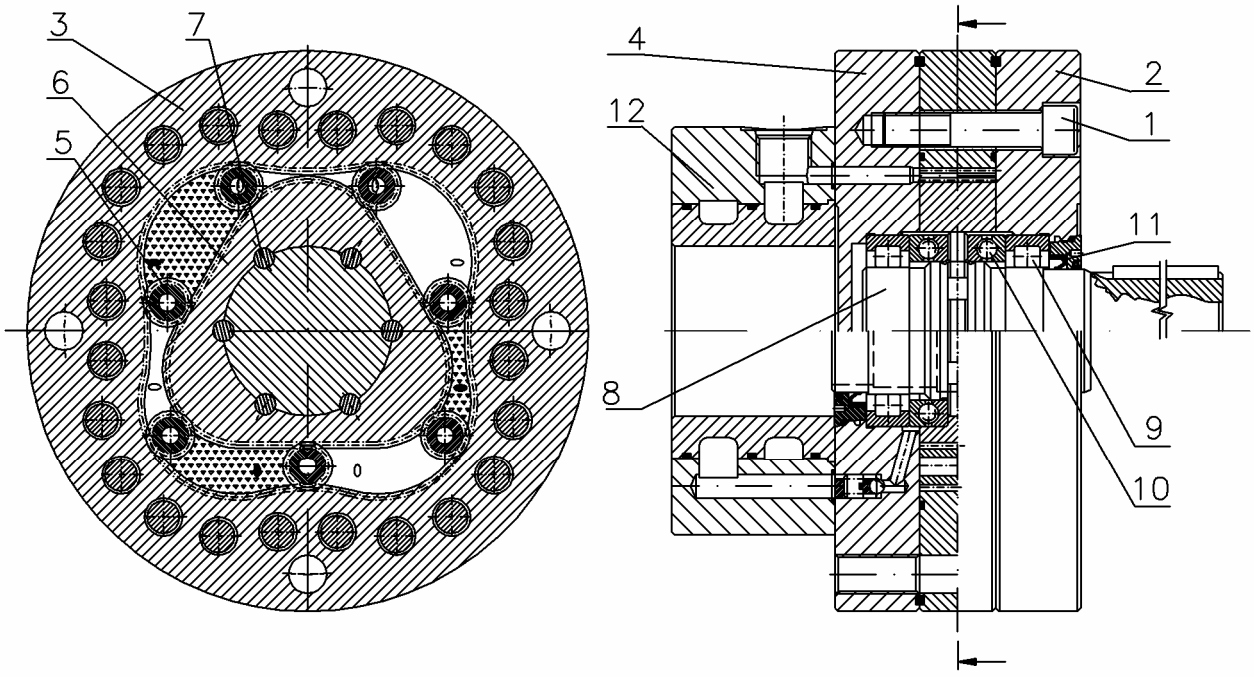
2. TECHNICAL DESCRIPTIONS OF MOTOR SOK1

2.1. Motor structure

The motor consists of: frontal cover "2", square "3" of internally toothed and rear cover "4", turned with screws "1".Between frontal and rear covers there are satellites "5" and triangle "6" which are externally toothed. The triangle, through barrels "7" is coupled with shaft "8". Shaft is supported by rolled bearings "9" mounted in covers, and by longitudinal ball bearings "10". The shaft outlet from cover is sealed by sealing rings, which are sealing rotational shafts "11". Collector "12" is the integral part of motor.

2.2. Principle of motor operation

The circulating-cam motor SOK1 acts under pressure of working fluid delivered to working chambers through passages in the rear cover. Working fluid causes the rotation of triangle in relation to square, forcing the circulation of satellites between them. Special shaping of the triangle and square during the triangle rotation causes forming of working chambers of variable capacity. Supplied chambers, making the working cycle, increase their capacity, and chambers, which are decreasing their capacity, press out working fluid. Satellites are used as sealing between working chambers and at the same time they control inlet and outlet of fluid.



3. TECHNICAL CHARACTERISTICS

Motor work position - optional.
Rotations - reversible, left and right rotations.
Motor mass - see Chapter 6.

3.1. Fixed displacement motor - operation parameters.

Size			63	100	160	250	400	630	1000	1600
Geometric displacement		cm^3	250	400	630	1000	1600	2500	4000	6300
Pressure	nominal	MPa	16							
	maximal[1/]		25							
Torque	nominal	daNm	63	100	160	250	400	630	1000	1600
	maximal[1/]		100	160	250	400	630	1000	1600	2500
Speed	nominal	rpm	160					100		80
	maximal[1/]		250					160		125
	minimal[2/]		3	2	3	2	3	2	3	2
Nominal power		kW	10,4	17	26,4	42,4	68	68	106	134

[1/] It is permissible the work on higher parameters than nominal and not exceeding maximal in time not longer than 60 seconds, while that work can occur not frequently than every 60 minutes.
[2/] Motor work with speeds lower than minimal speed, can have character of insignificant pulsation of rotary speed.
The real torque of motor, working fluid demand of motor and real motor power should be determined using efficiently diagrams shown in Chapter 3.7.
Hydraulic diagrams supply fixed displacement motors and installation dimensions are shown in Chapters 7.1 ÷ 7.4.

3.2. Dual displacement motor - operation parameters.

Size			63		100		160		250	
Geometric displacement (V_g/0,5V_g)		cm^3	250	125	400	200	630	315	1000	500
Pressure	nominal	MPa	16							
	maximal[1/]		25							
Torque	nominal	daNm	63	32,5	100	50	160	80	250	125
	maximal[1/]		100	50	160	80	250	125	400	200
Speed	nominal	rpm	160							
	maximal[1/]		250							
	minimal[2/]		3	10	2	10	3	10	2	10
Nominal power		kW	10,4	5,2	17	8,5	26,4	13,2	42,4	21,2

Size			400		630		1000		1600	
Geometric displacement (V_g/0,5V_g)		cm^3	1600	800	2500	1250	4000	2000	6300	3150
Pressure	nominal	MPa	16							
	maximal[1/]		25							
Torque	nominal	daNm	400	200	630	315	1000	500	1600	800
	maximal[1/]		630	315	1000	500	1600	800	2500	1250
Speed	nominal	rpm	160		100				80	
	maximal[1/]		250		160				125	
	minimal[2/]		3	10	2	10	3	10	2	10
Nominal power		kW	68	34	68	34	106	53	134	67

[1/, 2/] - notes acc. to Chapter 3.1.

The real torque of motor, used working fluid by motor and real power of motor should be determined by using of efficiency diagrams, shown in chapter 3.7, for motor operation on the second speed (the half of geometric displacement), mechanical - hydraulic efficiencies should be lowered of ab. 10% for rotation speeds lower than 100 rpm and ab. 15% for rotation speeds higher than 100 rpm. In those motors it is recommended to increase the pressure of rotation speeds on the outlet up to ab. 0,3 MPa.
Hydraulic diagrams and installation dimensions of supply of dual displacement motors are shown in Chapters 7.5 and 7.6

3.3. Motor for work in the synchronic system

Motors designed for work in the synchronic systems enable the realisation of drive with synchronisation of rotation movement for two or more motors. Motor work parameters for work in the synchronic system are the same as for dual displacement motor working on the second speed (the half of geometric displacement) - see Chapter 3.2.
The hydraulic diagram and installation dimensions of motor supply for work in the synchronic system are shown in Chapter 7.7.

3.4. Motor with collector - "free wheel"

The motor with free-wheel collector enables the realisation of two motor working conditions:
- work of motor on full geometric displacement, working parameters - see Chapter 3.1 (motor connected to hydraulic drive systems),
- motor driven from outside, by shaft (motor disconnected from hydraulic drive system).
The maximal speed for motor driven from outside:

Size		**63**	**100**	**160**	**250**	**400**	**630**	**1000**	**1600**
Max. speed	min^{-1}	400	400	400	400	400	315	315	250

The hydraulic diagram and installation dimensions of motors supply with free-wheel collector is shown in Chapter 7.8.

3.5. Working fluid

Type	hydraulic oil L-HL acc. to PN-91/ C-96057/04 and HL acc. to DIN 51524:1
Viscosity range	20 ÷ 600 mm^2/s
Fluid temperature range	-20º ÷ +80º C
Fluid cleanliness	≤ 100 µm

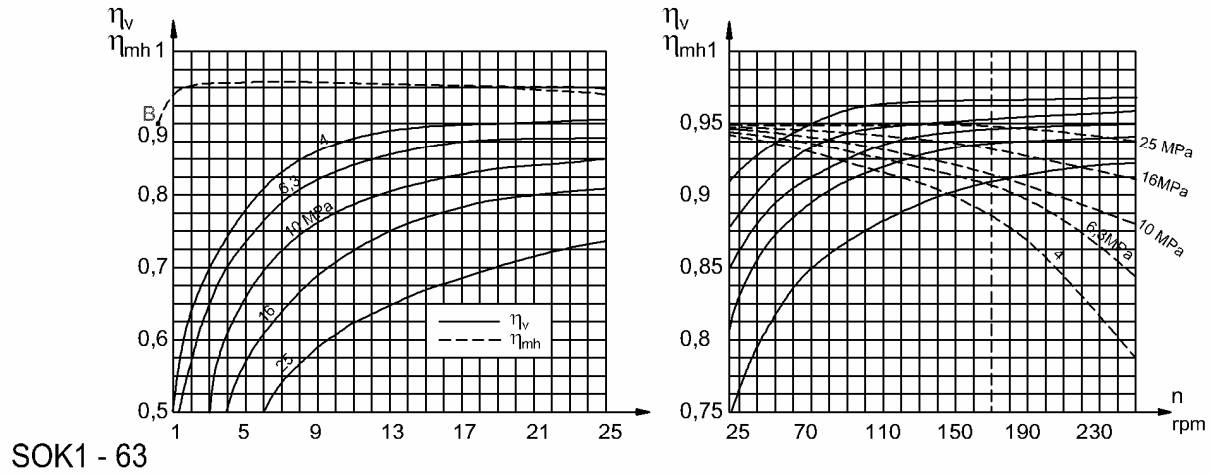
3.6. Leakage draining

In motors it is required leakage draining from inner space of body outside the motor.
Admissible flow resistance of working fluid in installation of draining leakage, amounts to:
- 0,25 MPa for motors marked by letter **K**,
- 0,6 MPa for motors marked by letter **F** .

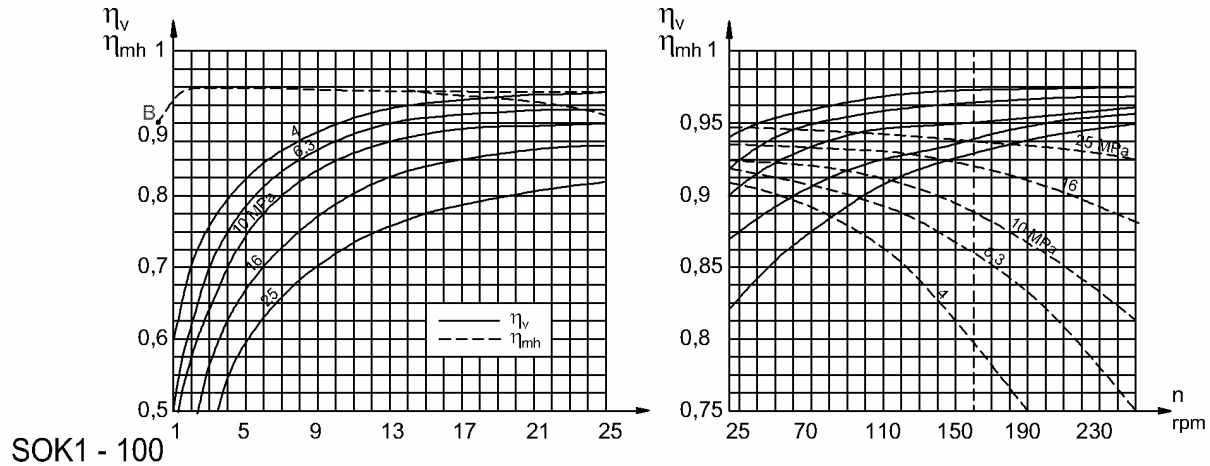
For motors working in open systems, where pressure of fluid in outlet branch of motor drives does not exceed the value:
- 0,1 MPa for motors marked by letter **K**,
- 0,4 MPa for motors marked by letter **F** it is admissible not to drain leakage from inner space of body. It does not concern motors with mono-block collectors version "7A" and "8A".

3.7 Efficiency of motors - for fluid viscosity $\nu = 40\ mm^2/s$, $B = \eta_m$ for n = 0

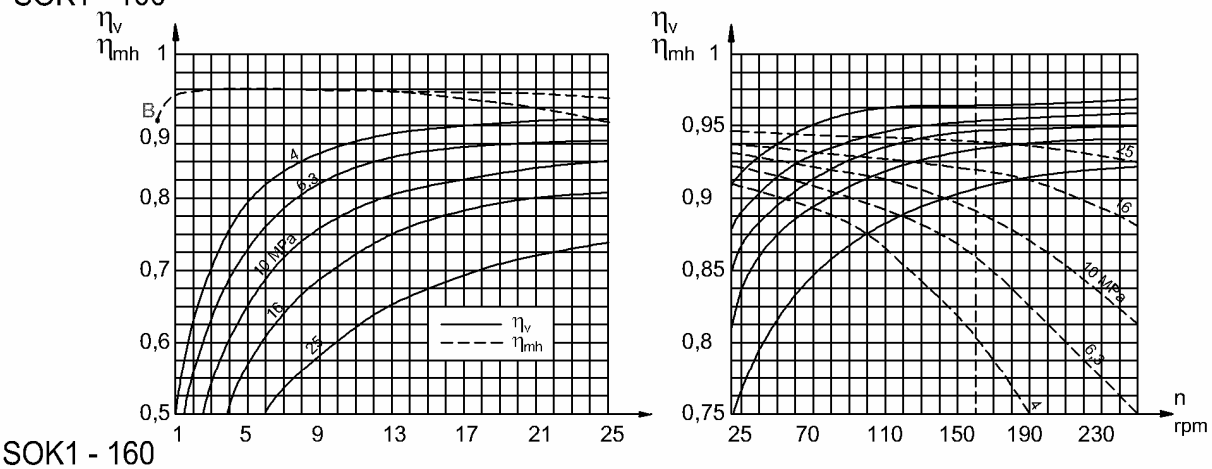
η_v - volumetric efficiency
η_{mh} - mechanical - hydraulic efficiency
n - speed



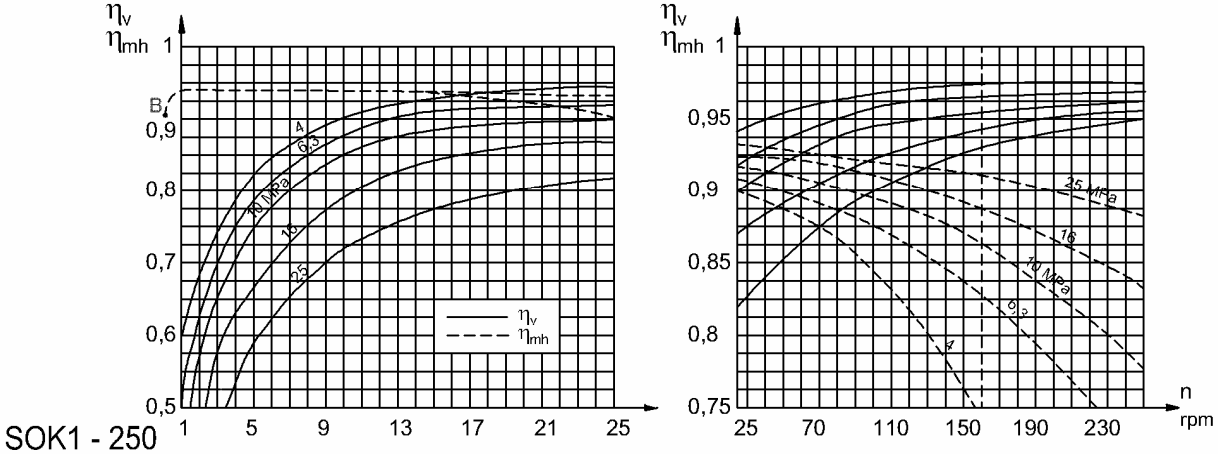
SOK1 - 63



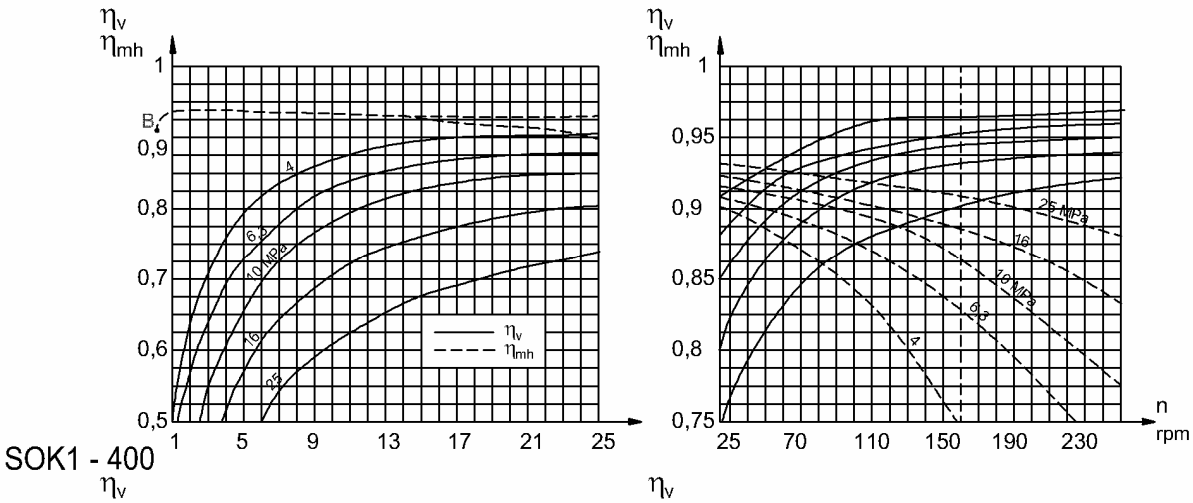
SOK1 - 100



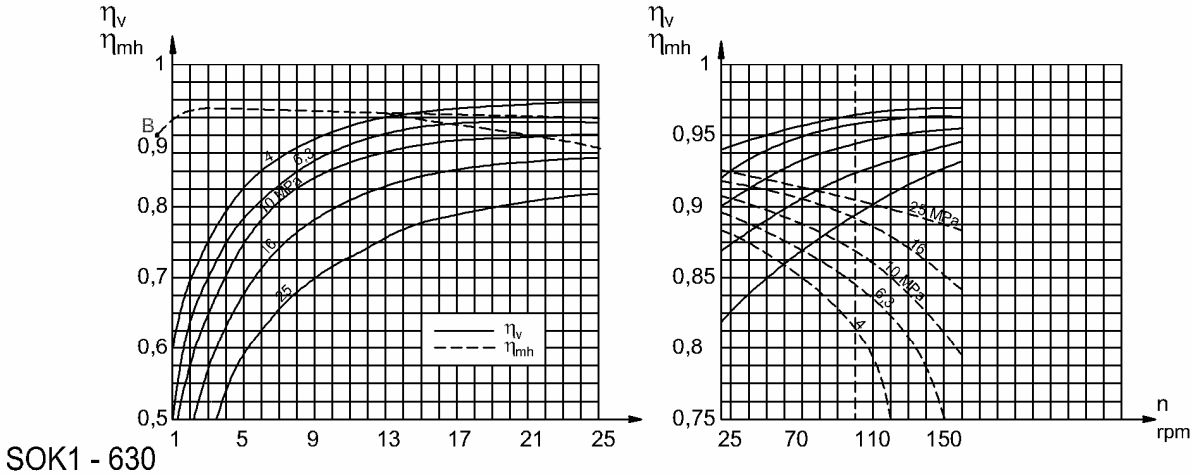
SOK1 - 160



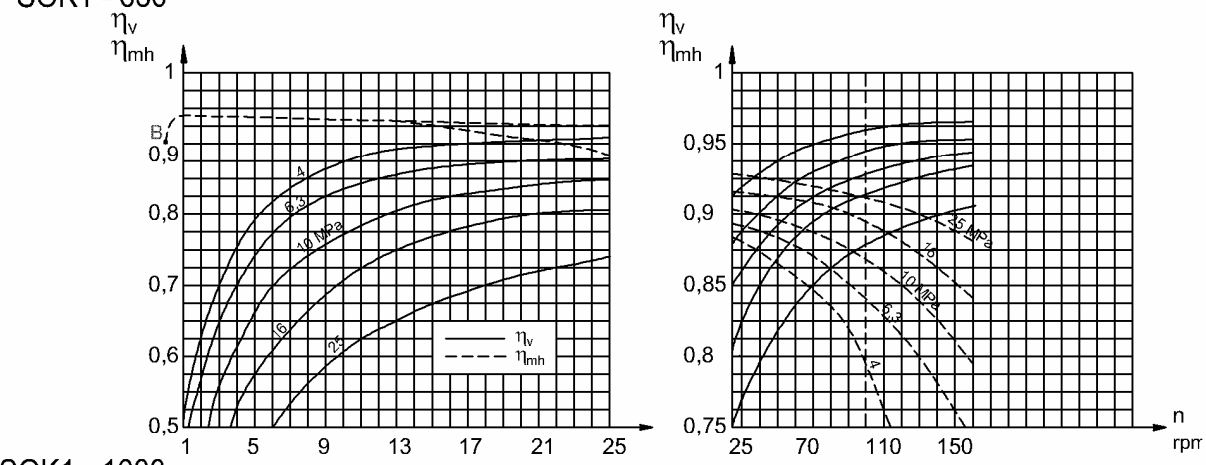
SOK1 - 250



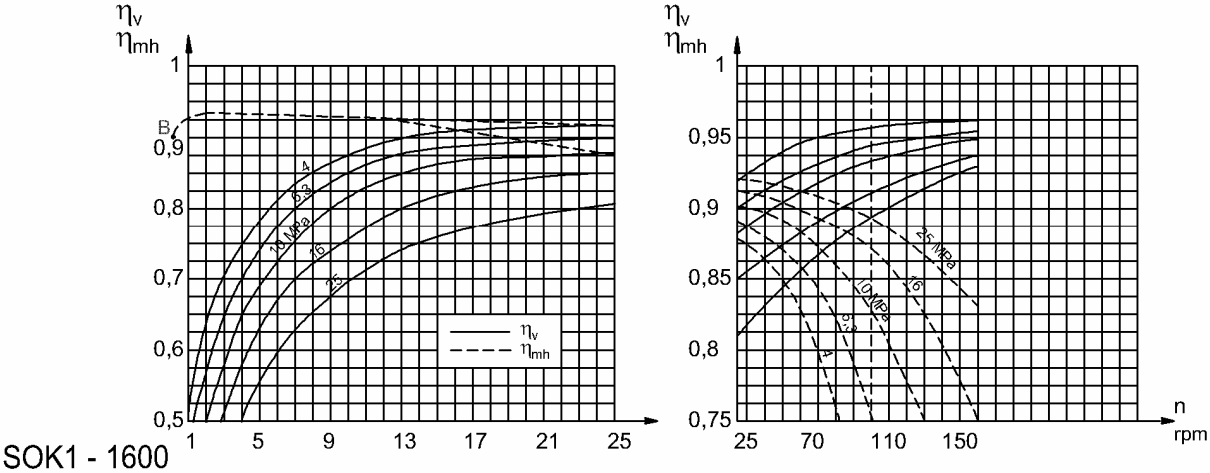
SOK1 - 400



SOK1 - 630



SOK1 - 1000



SOK1 - 1600

4. DESIGNATION STRUCTURE OF HYDRAULIC MOTOR SOK1

SOK1 | | | | | |

Type of hydraulic motor

Size

63	100	160	250	400	630	1000	1600

Design version: (as in it. 3.6 page 3)

- **K**
- **F** 1/
- **H** 2/

Collector version:

- without collector	**- 0**
- fixed displacement built - up radial	**- 7**
- fixed displacement mono - block radial	**- 7A**
- fixed displacement built - up axial	**- 8**
- fixed displacement mono - block axial	**- 8A**
- dual displacement controlled hydraulically	**- 2**
- dual displacement controlled manually	**- 6**
- synchronous	**- 5**
- free wheel	**- 9**

Shaft version:

- parallel with 2 keys	**- 1**
- splined of involute teeth α=20°	**- 2**
- splined of involute teeth α=30°	**- 3**
- tapered	**- 4** 3/
- two - sided for special application	**- 6** 3/
- hollow	**- 7**

Additional requirements are determined in the clear text (to be agreed with the manufacturer):

- chromium surface of shaft for sealing the shaft . **- 2**

1/ it occurs in motor sizes 400 and 630 only with shaft end in version "1" and in motor sizes 1000 and 1600 with all shaft ends,
2/ it occurs only with free wheel collector,
3/ as specially agreed - upon.

5. WAY OF ORDERING

The order of hydraulic motor SOK1 should include:
- name: Hydraulic motor SOK1
- designation acc. to it. 4
- no. of catalogue card KKA-16713/12.99

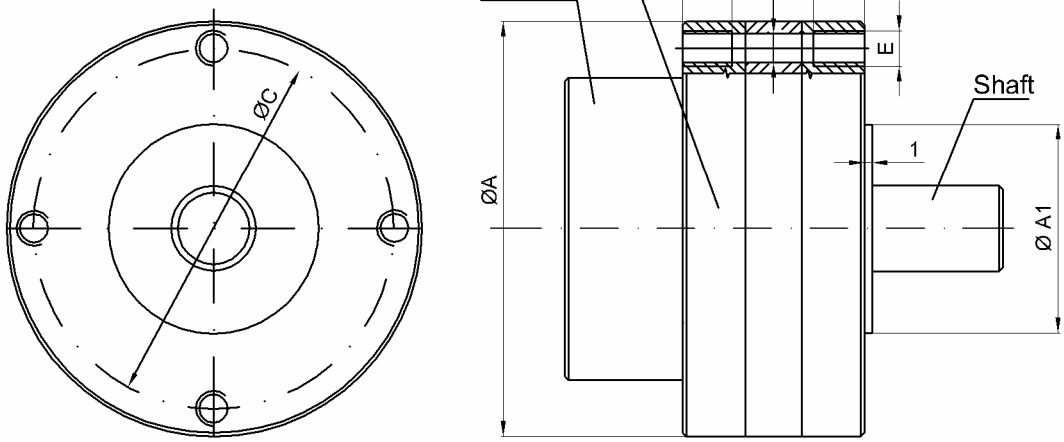
the example: Hydraulic motor SOK1- 630 F 61 acc. to KKA-16713/12.99

The hydraulic motor SOK1 of nominal torque 630 daNm, design version - F, with dual displacement collector controlled manually - 6, with parallel shaft with 2 keys - 1.

After agreement with the producer it is possible to make hydraulic motors with Classification Societies' receipt.

6. INSTALLATION OF MOTOR - dimensions

Motors are installed to the base using four passage holes or four threaded holes in the frontal or rear cover. External diameters of covers are tolerated what enables to use them to the fit connections.



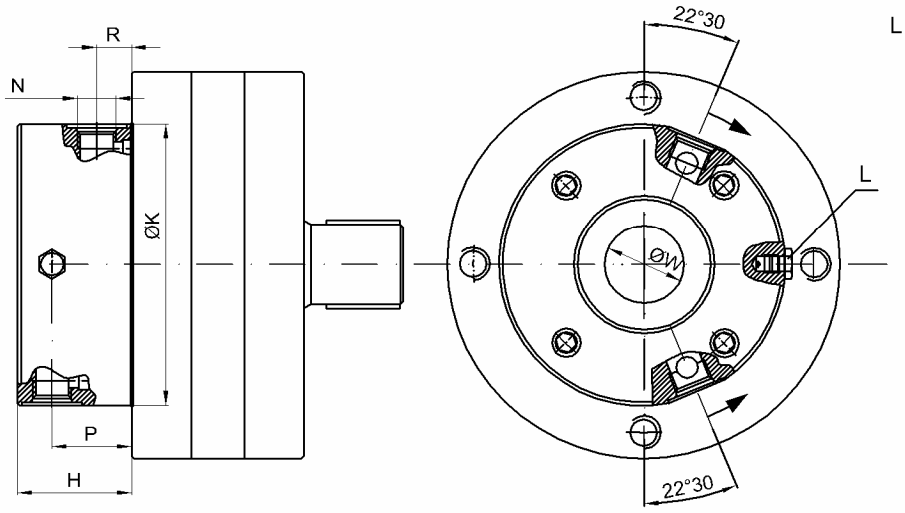
Size	A(h7)	A1	B	C	$D_{-0,5}$	E	G	Oil guantity for filling – up body and collector	Mass of body
	mm							dm^3	kg
63	210	74	96	180	14	M16	25	0,5	21
100			110					0,6	24
160	265	93	116	230	18	M20	30	0,8	41
250			136					1,0	48
400	320	112	158	280	22	M24	40	1,25	78
630			192					1,7	94
1000	420	147	216	370	30	M33x2	50	2,5	179
1600			266					3,5	217

The total mass of motor is the sum of: mass of body, mass of collector and mass of shaft.

7. COLLECTORS - dimensions

The installation, which is draining leakage from the inner space of body outside the motor, should be connected with the port "L" acc. to the mark ocurring in chapters about collectors.
All supplying and leakage draining ports, shown in chapters about collectors are made acc. to the standard PN/M-73101.
After agreement with the producer it is possible to make supplying ports acc. to other requirement.

7.1 Fixed - displacement built - up radial collector - version "7"



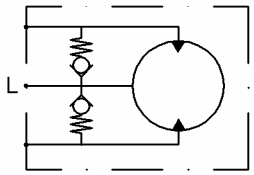
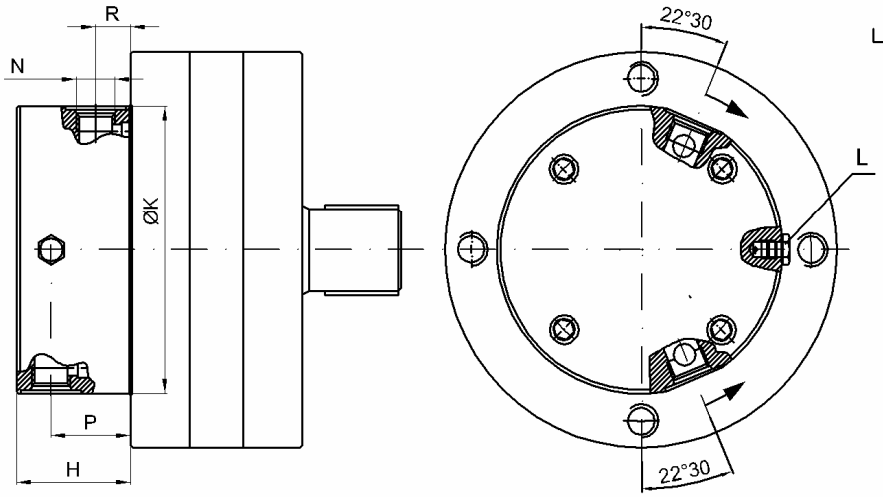


Diagram of fixed - displacement motor

Size	H	K	L[1/]	N[2/]	P	R	W	Mass
	mm							kg
63 100	63	150	M12x1,5	M22x1,5	45	20	60	6,2
160 250	77	192	M14x1,5	M27x2	55	24	80	11,2
400 630	81	240	M16x1,5	M33x2	56	25	100	18,1
1000 1600	101	302	M20x1,5	M42x2	71	30	110	39,0

[1/]- 1 threaded port [2/] - 2 threaded ports

7.2 Fixed - displacement built - up mono-block radial collector - version "7A"



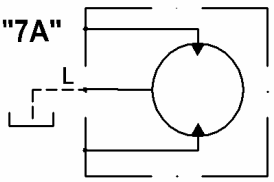
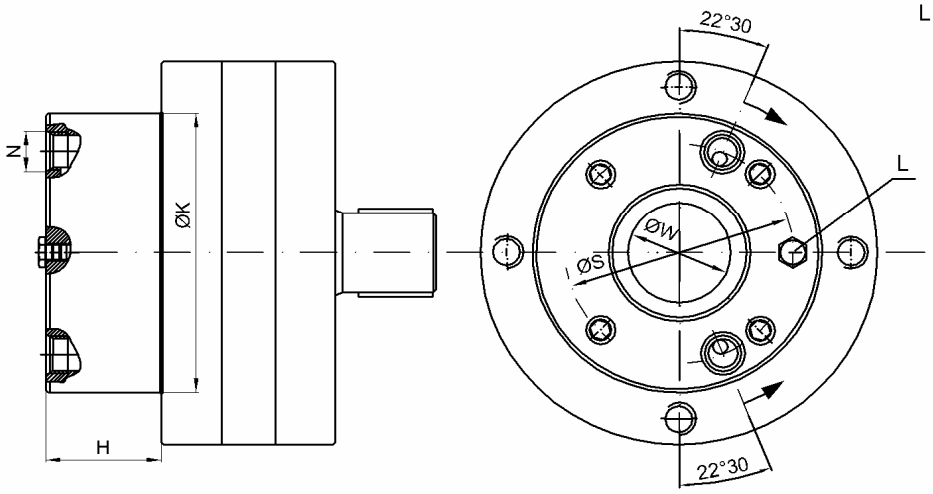


Diagram of fixed - displacement motor

Size	H	K	L[1/]	N[2/]	P	R	Mass
	mm						kg
63 100	63	150	M12x1,5	M22x1,5	45	20	7,7
160 250	77	192	M14x1,5	M27x2	55	24	15,7
400 630	81	240	M16x1,5	M33x2	56	25	25,1
1000 1600	101	302	M20x1,5	M42x2	71	30	43,0

[1/]- 1 threaded port [2/] - 2 threaded ports

7.3 Fixed - displacement, built - up axial collector - version "8"



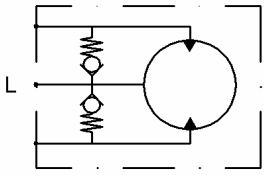
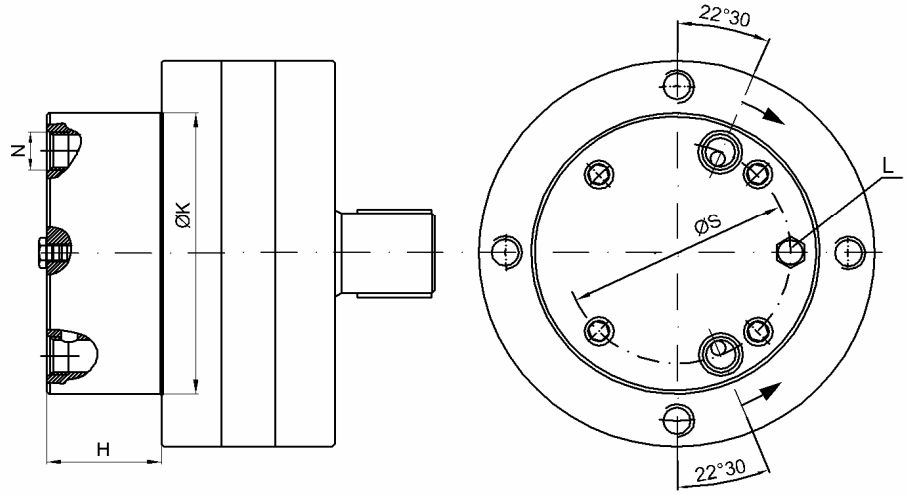


Diagram of fixed - displacement motor

Size	H	K	L[1/]	N[2/]	S	W	Mass
	mm						kg
63 100	63	150	M12x1,5	M22x1,5	118	60	6,2
160 250	77	192	M14x1,5	M27x2	156	80	11,2
400 630	81	240	M16x1,5	M33x2	195	100	18,3
1000 1600	101	302	M20x1,5	M42x2	246	110	39,0

[1/]- 1 threaded port [2/] - 2 threaded ports

7.4 Fixed - displacement, mono - block axial collector - version "8A"



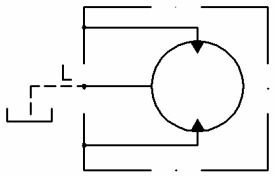
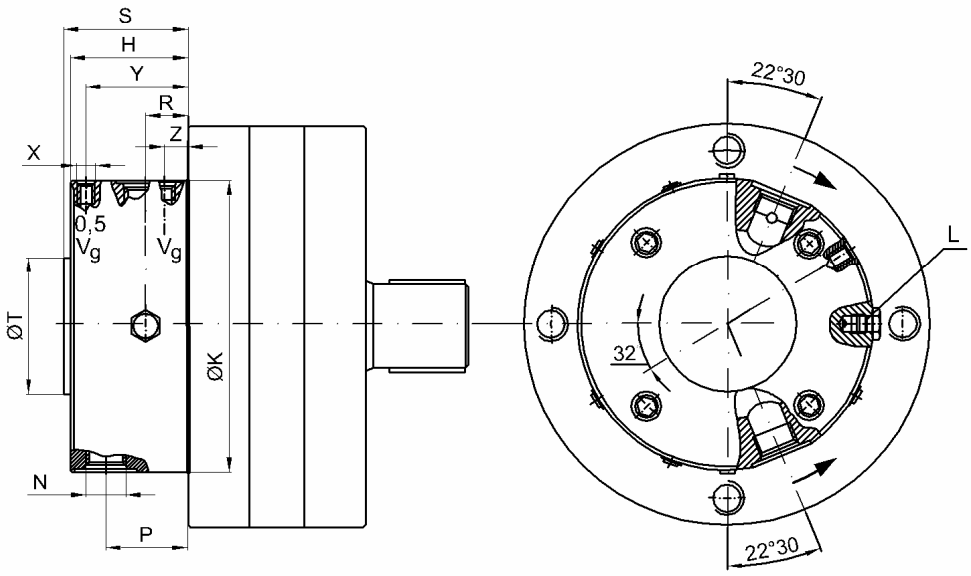


Diagram of fixed -displacement motor

Size	H	K	L[1/]	N[2/]	S	Mass
	mm					kg
63 100	63	150	M12x1,5	M22x1,5	118	7,8
160 250	77	192	M14x1,5	M27x2	156	15,6
400 630	81	240	M16x1,5	M33x2	195	26,3
1000 1600	101	302	M20x1,5	M42x2	246	43,7

[1/]- 1 threaded port [2/] - 2 threaded ports

7.5. Dual - displacement collector controlled hydraulically version"2"



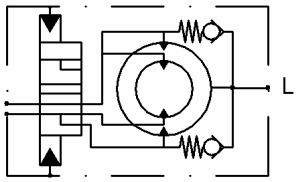
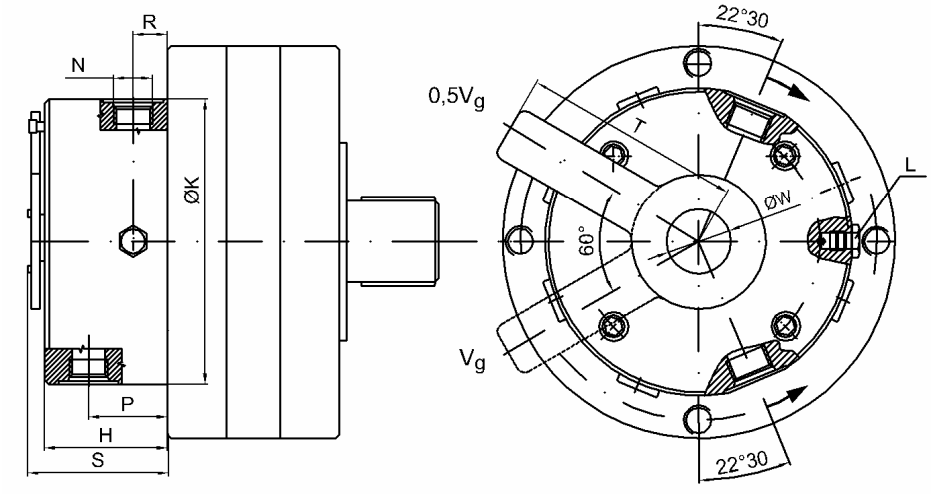


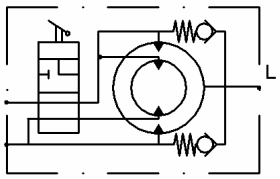
Diagram of
dual - displacement
controlled hydraulically
Control pressure
of motor running
$p_{str.}$=1 ÷ 16MPa

Size	H	K	L[1/]	N[2/]	P	R	S	T	X[2/]	Y	Z	Mass
	mm											kg
63	75	150	M12x1,5	M22x1,5	52	30	80	60	M10x1,0	64	18	10,3
100												
160	85	196	M14x1,5	M27x2	62	37	90	70	M12x1,5	78	22	17,6
250												
400	104	240	M16x1,5	M33x2	70	44	109	90	M12x1,5	88	27	30,0
630												
1000	110	303	M20x1,5	M42x2	77	44	117	90	M12x1,5	93	29	50,5
1600												

[1/]- 1 threaded port [2/] - 2 threaded ports

7.6. Dual – displacement collector controlled manually - version "6"



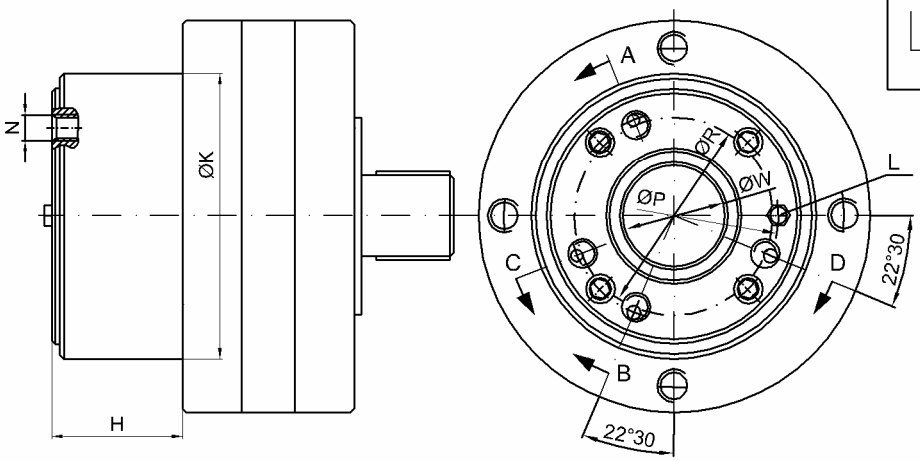


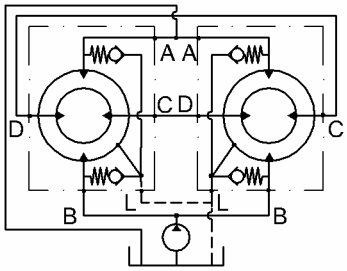
Schemat silnika
dwubiegowego
sterowanego ręcznie.

Size	H	K	L[1/]	N[2/]	P	R	S	T	W	Mass
	mm									kg
63	65	152	M12x1,5	M22x1,5	50	25	75	180	30	7,3
100										
160	75	196	M14x1,5	M27x2	55	30	85	200	41	13,6
250										
400	-	-	-	-	-	-	-	-	-	-
630										
1000	-	-	-	-	-	-	-	-	-	-
1600										

[1/]- 1 threaded port [2/] - 2 threaded ports

7.7 Collector for synchronic work - version "5"



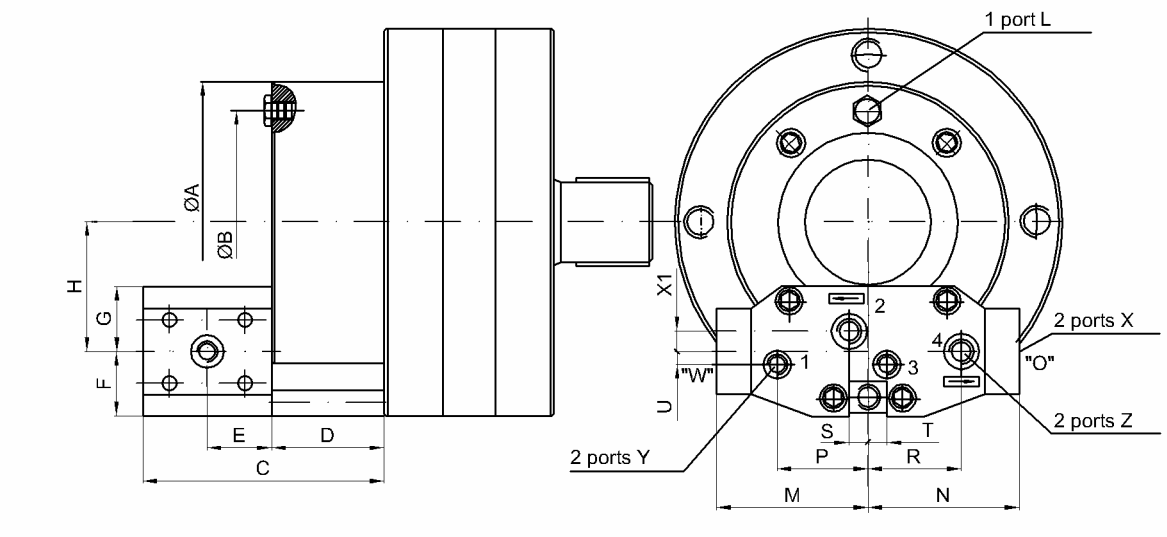


Work diagram of two motors in the synchronic system

Size	H	K	L[1/]	N[2/]	P	R	W	Mass
	mm							kg
63	-	-	-	-	-	-	-	-
100								
160	72	200	M14x1,5	M22x1,5	147	140	80	9,3
250								
400	85	242	M16x1,5	M27x2	184	175	115	18,0
630								
1000	-	-	-	-	-	-	-	-
1600								

[1/]- 1 threaded port [2/] - 2 threaded ports

7.8 Free wheel collector - version "9"



Size	A	B	C	D	E	F	G	H	L	M	N	P	R	S	T
	mm														
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100															
160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
250															
400	240	184	166	81	40	58	48	98	M16x1,6	120,5	125,5	72,5	75	13	15,5
630															
1000	302	238	200	101	47	77	61	126	M22x1,5	150	158	92	98	16,5	20
1600															

Size	U	X	X1	Y	Z	Mass
	mm					kg
63	-	-	-	-	-	-
100						
160	-	-	-	-	-	-
250						
400	10	M14x1,5	24,5	M27x2	M33x2	-
630						
1000	15	M14x1,5	30	M33x2	M42x2	-
1600						

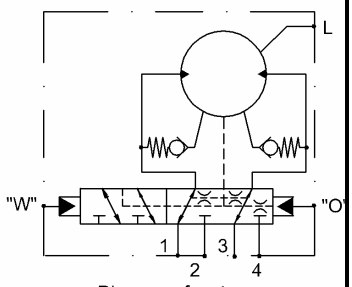


Diagram of motor with free wheel collector.

1. Working position as on the drawing.
2. Rate of lubricating fluid flow Q_{lubr} = 0,5 ÷ 0,75 dm^3/min.
3. Control pressure p_{contr} = 2 ÷ 5 MPa.
4. Fluid,supplied through port "O", disconnects motor from hydraulic system and when it is supplied through port "W" it connects the motor to the system (marks "O" and "W" - on plates of collector).
5. It is recommended to guide lines from ports "1" and "3" in the way enabling gravitational blowing of air - oil mixture whereas their ends in the tank must be above the working fluid surface and should not be facing that surface.

8. SHAFTS - installation dimensions

8.1 Admissible load of shaft end

a) Admissible load of shaft end by radial force - "Y" (marks and measurement units as in tables on pages showing shafts).

$$Y = \frac{C_1 \times M \times \frac{0,9}{f_1} - F \times \Delta p \times \frac{M}{2}}{M + N} \quad [N], \qquad \text{where:}$$

M - spacing of rolled bearings,
N - distance from the frontal rolled bearings to the point of acting force "Y" (on drawings of shaft, the force "Y" acts on the half of length L)
C_1 - dynamic load capacity of rolled barings,
f_1 - coefficient considering number of rolled baring cycles, where:

$f_1 = 1$ for 10^6 cycles,
$f_1 = 2$ for 10^7 cycles,
$f_1 = 3,98$ for 10^8 cycles,

F - unbalanced acting field of fluid pressure on triangle
Δp - difference of fluid pressures on the motor's discharge and suction side [MPa].

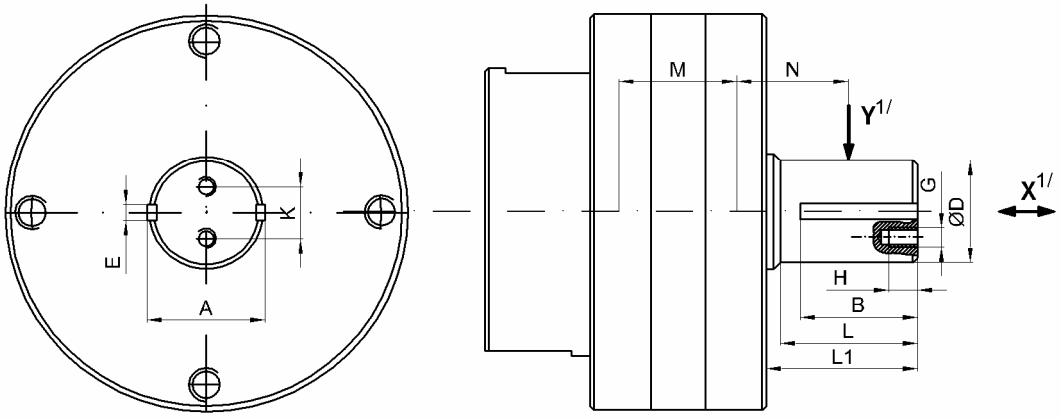
b) Admissible load of shaft end by axial force - "X" (marks as in table on pages showing shafts)

$$X = 0,8 \times C_2 \times f_2 \quad [N], \qquad \text{where:}$$

C_2 - dynamic load capacity of longitudinal ball bearings,
f_2 - coefficient considering number of longitudinal ball bearings' cycles, where:

$f_2 = 1$ for 10^6 cycles,
$f_2 = 2,15$ for 10^7 cycles,
$f_2 = 4,64$ for 10^8 cycles,

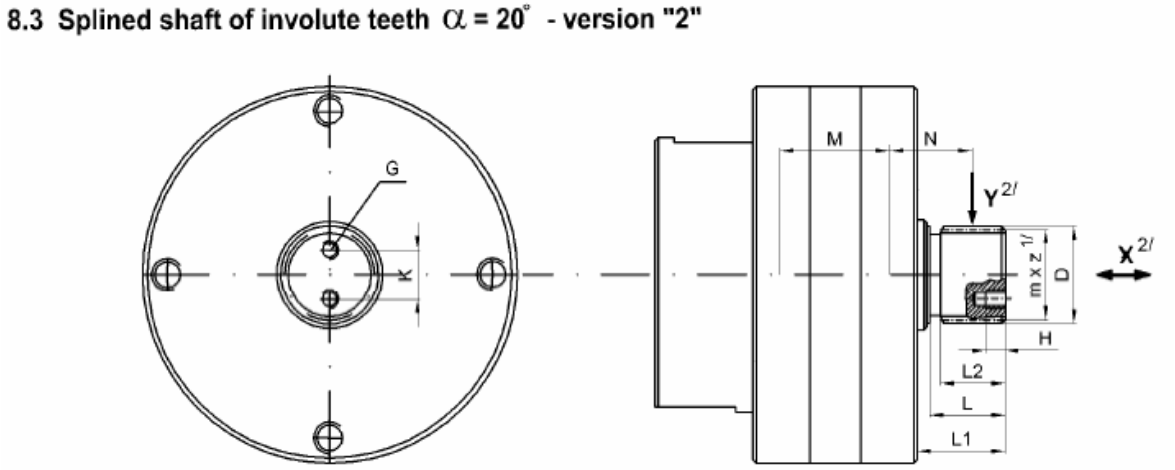
8.2. Parallel shaft with 2 - keys - version "1"



1/ Calculation forces "X" and "Y" shown in Chapter 8.1

Size	L	L1	D (m6)	A	B	E	G	H	K	M	N	No. of rolled bearing	Dynamic load capacity C_1	No. of longitudinal ball bearing	Dynamic load capacity C_2	F	Mass
													N		N	mm^2	kg
63	82	85	40	46	60	12	M8	10	20	54	62	RNU207E	48400	51109	28000	600	2
100										68						900	2,3
160	82	86	55	64	60	16	M12	16	30	68	70	RNU210E	64000	51113	43500	1080	4
250										85		RNU2210E	78000			1680	4,6
400	105	109	70	79	80	20	M12	16	36	92	92	RNU2213E	150000	51117	46000	2200	9
630										135				51216	83000	3460	10,7
1000	130	135	90	100	100	25	M16	20	60	150	100	RNU2217E	216000	51122	87000	4100	20
1600										200						6660	24

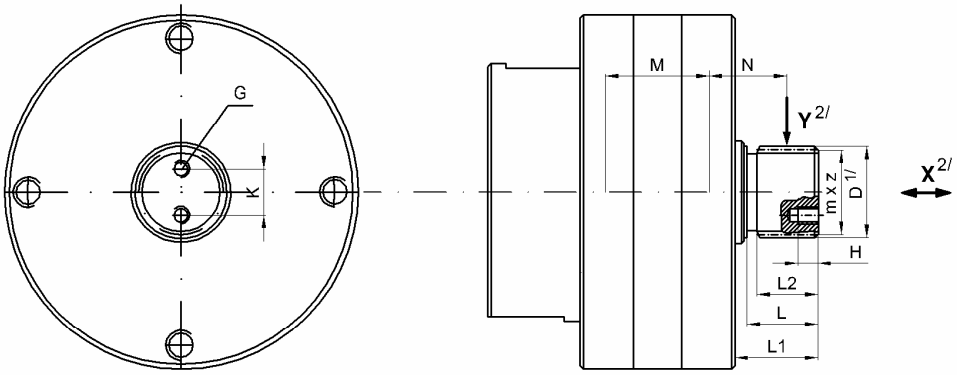
8.3 Splined shaft of involute teeth $\alpha = 20^{\circ}$ - version "2"



1. Teeth in accordance with PN-69/M-88522-01. Nominal angle of tooth contact $\alpha = 20^{\circ}$.
   Coefficient of tooth height y = 1. Coefficient of displacement of tooth contact x = 0.
   Class of execution 7.
2. Forces "X" and "Y" calculation is shown in Chapter 8.1.

Size	L	L1	L2	mxz	D	G	H	K	M	N	No. of rolled bearing	Dynamic load capacity C_1	No. of longitudinal ball bearing	Dynamic load capacity C_2	F	Mass
	mm											N		N	mm^2	kg
63	36	39	21	1,25x32	42,5	M8	12	20	54	45	RUN207E	48400	51109	28000	600	1,5
100									68						900	1,8
160	36	40	21	1,5x36	57	M12	16	30	68	45	RUN210E	64000	51113	43500	1080	3,1
250									85		RUN2210E	78000			1680	3,7
400	41	45	23	2x36	76	M12	16	40	92	50	RUN2213E	150000	51117	46000	2200	7,1
630									135				51216	83000	3460	8,7
1000	54	59	34	2,5x38	100	M16	20	50	150	65	RUN2217E	216000	51122	87000	4100	16,5
1600									200						6660	20,7

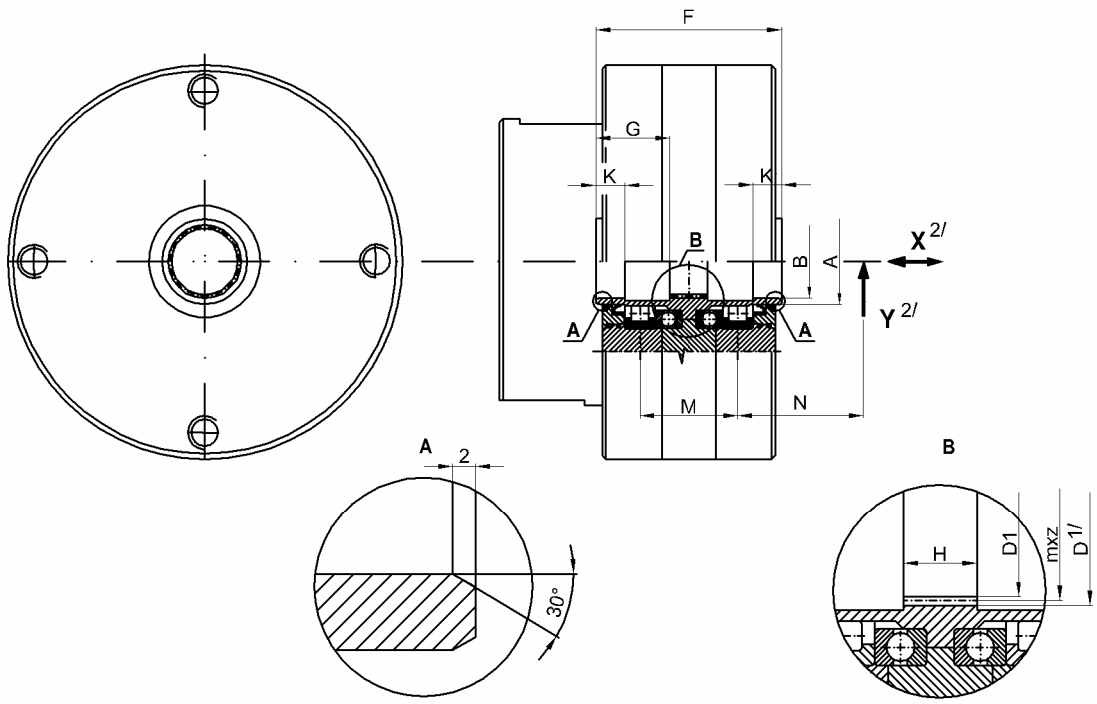
8.4. Splined shaft of involute teeth $\alpha = 30^{\circ}$ - version "3"



1. Teeth in accordance with PN-ISO 4156+A1:1999. Nominal angle of tooth contact $\alpha = 30^{\circ}$.
2. Forces "X" and "Y" calculation is shown in Chapter 8.1.

Size	L	L1	L2	Teeth mark D	mxz	G	H	K	M	N	No. of rolled bearing	Dynamic load capacity C_1	No. of longitudial ball bearing	Dynamic load capacity C_2	F	Mass
	mm											N		N	mm^2	kg
63	36	39	21	W40x2x7h	2x18	M8	12	62	54	45	RUN207E	48400	51109	28000	600	1,5
100									68						900	1,8
160	36	42	23	W55x2x7h	2x26	M12	16	70	68	46	RUN210E	64000	51113	43500	1080	3,1
250									85		RUN2210E	78000			1680	3,7
400	41	45	23	W78x3x7h	3x24	M12	16	92	92	50	RUN2213E	150000	51117	46000	2200	7,1
630									135				51216	83000	3460	8,7
1000	54	59	34	W100x3x7h	3x32	M16	20	100	150	65	RUN217E	2160000	51122	87000	4100	16,5
1600									200						6660	20,7

8.5 Hollow shaft of involute teeth α=30° - version "7"



1. Teeth in accordance with PN-ISO 4156+A1:1999. Nominal angle of tooth contact α= 30°.
2. Forces "X" and "Y" calculation is shown in Chapter 8.1.

Size	Teeth mark D	D1	mxz	A (h8)	B (H7)	F	G	H	K	M	No. of rolled transverse bearing	Dynamic load capacity C_1	No. of longitudial ball bearing	Dynamic load capacity C_2	F	Mass
	mm											N		N	mm^2	kg
63	N35X2X9H	31	2x16	42	34,6	102	43,5	15	15	54	RUN207E	48400	51109	28000	600	0,6
100						116	46,0	24	15	68					900	0,8
160	N48X2X9H	44	2x22	58	47,6	122	50,0	22	20	68	RUN210E	64000	51113	43500	1080	1,2
250						143	54,0	35	25	85	RUN2210E	78000			1680	1,5
400	N62X2X9H	58	2x30	78	61,6	165	65,0	35	25	92	RUN2213E	150000	51117	46000	2200	2,8
630						200	74,0	52	30	135			51216	83000	3460	3,6
1000	N80X3X9H	74	3x25	100	97,4	226	83,0	60	35	150	RUN2217E	216000	51122	87000	4100	6,3
1600						276	90,5	95	40	200					6660	8,6

NOTES:

Manufacturer:
HYDROSTER Ltd.
Na Ostrowiu Str. 1
80-958 Gdańsk
ph.: (48 58) 307-12-90 fax (48 58) 307-12-92 e - mail: market@hydroster.com.pl