

### Linear hydraulic motors of the ZH1 series

#### TECHNICAL DESCRIPTION – PRODUCT FUNCTION

The ZH1 linear hydraulic motor is the element that converts the pressure energy to the mechanical energy – to the axial power of the piston rod in both directions. They have – by their construction – no special demands for service and maintenance. It is necessary to obey the service and technical conditions for perfect and secure function of the motor. The ZH1 hydraulic motor is composed of the tube with precision worked inner diameter within the H8 allowance. On the tube there are welded the connection necks for inlet of the pressure oil with internal thread and the plug together with solid cylinder eye.

Both the cylinder eye and piston rod eye are equipped with the knuckle bearing. The lid for piston rod guidance with the sealing elements is screwed into the tube of cylinder cover. On the grinded – polished and chromed piston rod with the dimension tolerance f7 there is the connection eye welded from one side and the second end is equipped with the piston.

#### OPERATING CONDITIONS

The linear hydraulic motors of this kind do not require any special demands for service and maintenance.

- the mounting of LHM must be done under conditions preventing the damage of function parts and which secure the protection of inner space against penetration of impurities
- properly provide the connection of LHM to the pressure source (danger of oil pressure decrease) and the mounting of LHM into the kinematic system of the given machine/device
- the work position of LHM is optional if not otherwise specified
- radial load of the piston rod by external force or its rotation during working time are not allowed
- take care during the work to prevent the mechanical damages of the piston rod
- the hydraulic motor must not be loaded in the end positions by external force or by power of steady mass corresponding to 1,25 multiple of rated pressure
- when mounted into the machine’s mechanical parts (or into some device) the possibility of swiveling of hydraulic cylinder body must be secured in transverse direction in the area of allowed swiveling of knuckle bearing
- LHM must not be exposed to any aggressive agents, aggressiveness of which would exceed the guaranteed resistance value for the motor piston rod used. The resistance value is specified in technical conditions.

#### TECHNICAL CONDITIONS

Work liquid	- hydraulic mineral oil (OH-HM 32, OH-HM 46, OH-HM 64)
Required filtration	- min. 40 µm, we recommend 25 µm
Temperature scope	- liquid -20°C ÷ +80°C - ambient -20°C ÷ +70°C
Climatic stability	- temperate climate Wt
Rated pressure	- 16 MPa
Maximum pressure	- 20 MPa
Test pressure	- 25 MPa
Work speed	- maximum 0,5 m·s <sup>-1</sup>
The piston rod resistance value in the salt chamber pursuant to ISO 4540	- 120 hours

#### MARKING

Each hydraulic motor manufactured in our factory is marked with following data:

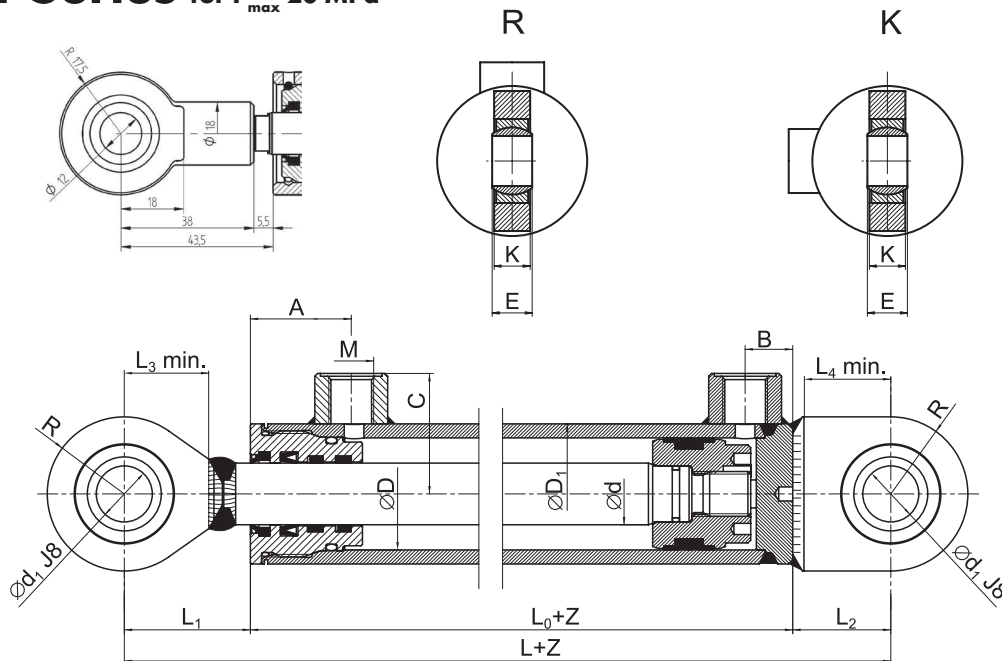
**HYDRAULICS SEHRADICE**  
**ZH1 D/d x Z R / K /**  
**MAX.OPERATING PRESSURE**  
**SERIAL NUMBER**

Part of the item delivery is the accompanying documentation containing

**ITEM SAFEGUARD and**  
**QUALITY CERTIFICATE** /document details see page no. 97-98/.

## ZH1 Series for $P_{max}$ 20 MPa

Position of the screws joint to the swing plane



ZH1

ØD	Ød	ØD <sub>1</sub>	Ød <sub>1</sub>	L	L <sub>0</sub>	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub> ±1	L <sub>4</sub> ±1	M	A	B	C	E	K	R	Maximum recom. lift acc. to selected Ød	Weight under given lift Z
25	12	35	12	142	80	44	18		23	10x1	36	15	29.5	10	9	17.5	90	0.70 + Z x 0.00656
25	14	35	12	142	80	44	18		23	10x1	36	15	29.5	10	9	17.5	150	0.72 + Z x 0.00656
32	18	42	20	170	90	45	35	32	31	12x1.5	36	17	39	16	14	27.5	210	1.50 + Z x 0.00656
32	20	42	20	170	90	45	35	32	31	12x1.5	36	17	39	16	14	27.5	270	1.60 + Z x 0.00703
40	22	50	20	170	90	45	35	32	31	16x1.5	36	17	43	16	14	27.5	260	2.00 + Z x 0.00853
40	25	50	20	170	90	45	35	32	31	16x1.5	36	17	43	16	14	27.5	360	2.00 + Z x 0.00940
50	25	60	25	190	102	50	38	33	33	16x1.5	43	16	48	20	18	32.5	260	3.10 + Z x 0.01063
50	28	60	25	190	102	50	38	33	33	16x1.5	43	16	48	20	18	32.5	360	3.00 + Z x 0.01161
63	32	75	25	215	116	57	42	37	37	16x1.5	50	23	55.5	20	18	35	360	5.00 + Z x 0.01652
63	36	75	25	215	116	57	42	37	37	16x1.5	50	23	55.5	20	18	35	480	5.00 + Z x 0.01820
70	36	85	30	235	125	65	45	45	39	22x1.5	54	25	60.5	22	20	42.5	410	7.35 + Z x 0.02232
70	40	85	30	235	125	65	45	45	39	22x1.5	54	25	60.5	22	20	42.5	540	7.20 + Z x 0.02419
80	40	95	30	240	130	65	45	45	39	22x1.5	59	25	65.5	22	20	42.5	450	8.00 + Z x 0.02604
80	45	95	30	240	130	65	45	45	39	22x1.5	59	25	65.5	22	20	42.5	610	9.00 + Z x 0.02806
90	45	105	35	275	140	80	55	54	49	22x1.5	64	27	70.5	25	25	47.5	510	12.00 + Z x 0.03051
90	50	105	35	275	140	80	55	54	49	22x1.5	64	27	70.5	25	25	47.5	660	12.40 + Z x 0.03344
100	50	120	40	300	155	85	60	57	54	27x2	73	31	82	28	25	52.5	570	17.00 + Z x 0.04254
100	55	120	40	300	155	85	60	57	54	27x2	73	31	82	28	25	52.5	720	17.20 + Z x 0.04580
110	55	130	45	345	185	95	65	67	57	27x2	78	38	87	32	30	60	620	23.60 + Z x 0.04824
110	63	130	45	345	185	95	65	67	57	27x2	78	38	87	32	30	60	860	23.90 + Z x 0.05406
125	63	145	50	417	242	105	70	70	62	33x2	95	50	94.5	30	35	62.5	700	36.60 + Z x 0.05700
125	70	145	50	417	242	105	70	70	62	33x2	95	50	94.5	30	35	62.5	920	37.60 + Z x 0.06300
140	70	160	60	457	252	115	90	78	80	33x2	95	61	102	44	40	80	780	51.90 + Z x 0.06700
140	80	160	60	457	252	115	90	78	80	33x2	95	61	102	44	40	80	1080	52.90 + Z x 0.07600
160	80	180	70	510	280	130	100	87	85	33x2	105	68	112	49	45	90	890	72.80 + Z x 0.08100
160	90	180	70	510	280	130	100	87	85	33x2	105	68	112	49	45	90	1200	74.20 + Z x 0.09200
180	90	210	90	547	262	155	130	113	113	42x2	100	75	130	60	55	110	1020	101.90 + Z x 0.12200
180	100	210	90	547	262	155	130	113	113	42x2	100	75	130	60	55	110	1320	107.50 + Z x 0.13400
200	100	240	100	602	302	160	140	123	123	42x2	120	85	145	70	60	120	1130	146.30 + Z x 0.17100
200	110	245	100	602	302	160	140	123	123	42x2	120	85	145	70	60	120	1440	147.80 + Z x 0.18400

Piston rod lift according to the customer's wish.

Lifts higher than maximum recommended need to be controlled for the ultimate strength.

The articulated bearing is designed also for lubrication with the pin.

The weights are informative within scope of ± 5% in kg.

Linear hydraulic motors

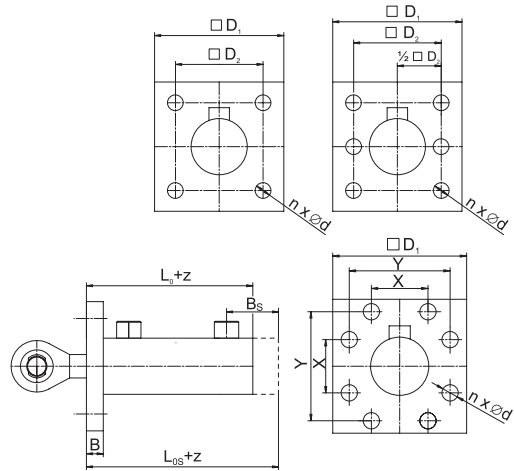
ZH1 Series hydraulic motors gripping

ZH1

Gripping ZH1-A

ZH1-AS

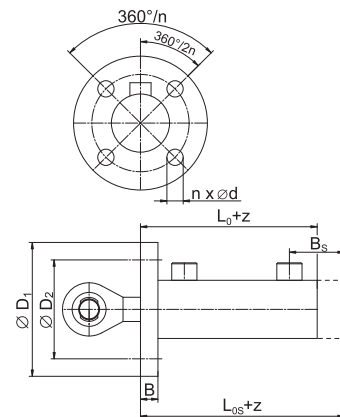
Cylinder	D <sub>1</sub>	D <sub>2</sub>	B	∅d	X	Y	n	L <sub>0</sub>	L <sub>os</sub>	B <sub>s</sub>
25	55	40	8	6.4			4	80		
32	67	50	10	8.4			4	90	115	42
40	98	80	12	8.4			6	90	115	42
50	113	95	13	10.5			6	102	137	51
63	138	115	15	13			6	116	153	60
70	148	120	15	13			6	125	162	62
80	168	140	18	15			6	130	174	69
90	178	150	20	15			6	140	187	74
100	200	170	20	17			6	155	207	83
110	210	180	22	17			6	185	243	96
125	240		25	17	90	180	8	242	294	102
140	265		28	21	90	210	8	252	294	103
160	280		28	25	120	230	8	280	319	107
180	295		35	25	130	250	8	262	307	120
200	350		35	31	150	290	8	302	347	130



Gripping ZH1-B

ZH1-BS

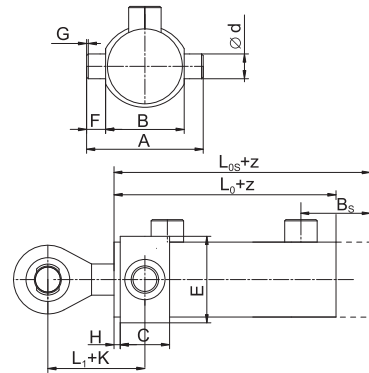
Cylinder	∅D <sub>1</sub>	∅D <sub>2</sub>	B	d	n	L <sub>0</sub>	L <sub>os</sub>	B <sub>s</sub>
25	75	60	8	6.4	4	80		
32	88	70	10	8.4	4	90	115	42
40	98	80	12	8.4	6	90	115	42
50	113	95	13	10.5	6	102	137	51
63	138	115	15	13	6	116	153	60
70	148	120	15	13	6	125	162	62
80	168	140	18	15	6	130	174	69
90	178	150	20	15	6	140	187	74
100	198	170	20	17	6	155	207	83
110	208	180	22	17	6	185	243	96
125	237	205	25	17	8	242	294	102
140	267	230	28	21	8	252	294	103
160	305	260	28	25	8	280	319	107
180	330	285	35	25	8	262	307	120
200	380	330	35	31	8	302	347	130



Gripping ZH1-C

ZH1-CS

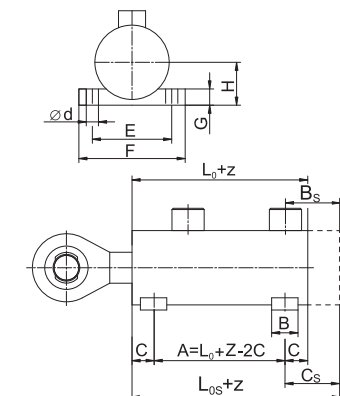
Cylinder	A	B h11	C	d f8	E	F	Gx45°	H	K	L <sub>0</sub>	L <sub>os</sub>	B <sub>s</sub>
25	70	45	23	15	45	12.5	1	5	17	80		
32	90	55	28	20	53	17.5	1	5	19	90	115	42
40	105	65	28	20	65	20	1	5	19	90	115	42
50	120	80	33	25	80	20	1	5	22	102	137	51
63	150	100	40	30	100	25	1.5	7	27	116	153	60
70	160	110	40	30	105	25	1.5	7	27	125	162	62
80	185	125	45	35	115	30	1.5	8	31	130	174	69
90	205	135	50	40	135	35	1.5	8	33	140	187	74
100	220	150	55	45	150	35	1.5	10	38	155	207	83
110	240	160	60	50	160	40	1.5	10	40	185	243	96
125	295	195	80	60	195	60	2	10	50	242	294	102
140	335	215	90	70	215	60	2	15	60	252	294	103
160	380	240	100	80	240	70	2	18	68	280	319	107
180	420	260	110	90	260	80	2	20	75	262	307	120
200	480	300	120	100	300	90	2	25	85	302	347	130



Gripping ZH1-D

ZH1-DS

Cylinder	B	C	∅d	E	F	G	H	L <sub>0</sub>	L <sub>os</sub>	C <sub>s</sub>	B <sub>s</sub>
25	20	15	8.4	55	73	10	23	80			
32	20	15	10.5	65	88	10	27	90	115	40	42
40	24	20	10.5	75	100	12	31	90	115	45	42
50	24	20	13	88	110	14	38	102	137	55	51
63	30	25	15	110	138	18	50	116	153	62	60
70	34	27	17	118	150	20	55	125	162	64	62
80	40	30	21	140	180	24	60	130	174	74	69
90	40	30	21	150	190	24	65	140	187	77	74
100	48	34	25	170	215	26	75	155	207	86	83
110	48	34	25	180	230	26	80	185	243	92	96



Dimensions LOS, BS and CS apply to the LHM design with a screwed plug.

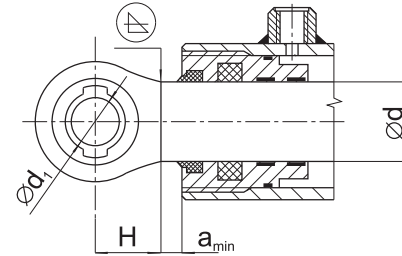
## Variants of piston rod end

Connection eye welded

**version 1**

$\varnothing d$	18	20	22	25	28	32	36	40	45	50	55	63	70	80	90	100	110
$a_{min}$	10	10	10	12	12	15	15	15	15	20	20	20	25	30	30	30	30

$\varnothing d_1$ . H - choose according to connection eye offer sheet (page 75+90)

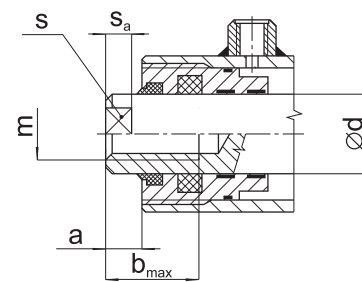


**ZH1**

internal thread

**version 2**

$\varnothing d$	20	22	25	28	32	36	40	45	50	55	63	70	80	90	100	110
$m$	14x1.5	16x1.5	18x1.5	20x1.5	24x1.5	24x1.5	27x2	27x2	30x2	36x2	42x2	42x2	60x2	68x2	75x2	75x2
$a$	12	12	15	17	17	20	20	20	25	25	30	30	35	40	45	45
$b_{max}$	40	40	56	56	60	70	70	70	80	90	90	100	100	110	110	110
$s$	18	19	22	24	28	30	36	38	41	46	55	60	70	80	90	100
$S_a$	8	8	10	12	12	15	15	15	18	18	20	20	25	30	35	35



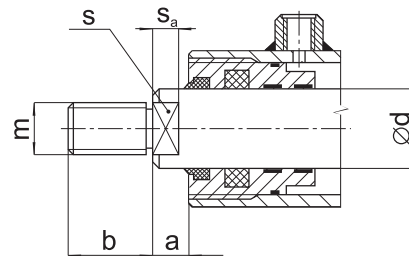
**ZH2**

**ZH2T**

external thread

**version 3**

$\varnothing d$	18	20	22	25	28	32	36	40	45	50	55	63	70	80	90	100	110
$m$	16x1.5	16x1.5	16x1.5	18x1.5	20x1.5	24x1.5	24x1.5	27x2	27x2	30x2	36x2	42x2	42x2	60x2	68x2	75x2	75x2
$a$	12	12	12	15	17	17	20	20	20	25	25	30	30	35	40	40	45
$b$	20	20	20	30	30	34	40	40	40	45	50	60	60	70	70	70	70
$s$	16	18	19	22	24	30	32	36	41	46	50	60	65	70	80	90	100
$S_a$	8	8	8	10	12	12	15	15	15	18	18	20	20	25	30	35	35



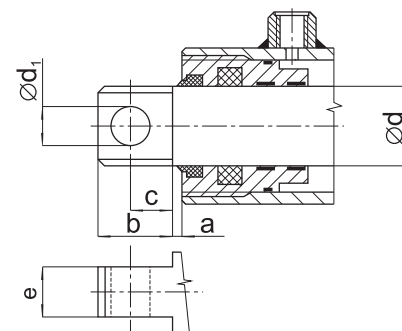
**ZH2RT**

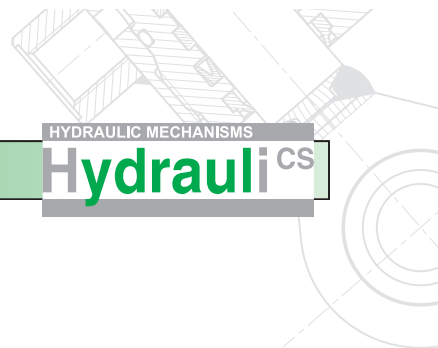
neck hole

**version 4**

$\varnothing d$	18	20	22	25	28	32	36	40	45	50	55	63	70
$d_1$	10	12	12	14	15	17	20	22	26	28	30	40	50
$a$	6	6	8	8	8	10	10	12	12	15	15	18	18
$b$	25	30	35	40	45	50	60	70	80	95	100	120	135
$c$	15	18	22	25	29	31	36	43	50	59	64	80	85
$e$	13	15	16	18	20	24	26	28	32	34	38	40	46

The highlighted dimensions are default.





# Linear hydraulic motors

## Ordering code

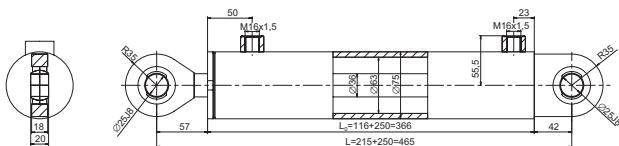
For standard linear hydraulic motors  
**ZH1, ZH1 - A až ZH2RT - D Series**  
Acc. to the table on page 15, 19, 23, 27.

And for linear hydraulic motors using the construction module  $L_0$  and another then standard piston rods ends and connection eyes ends.

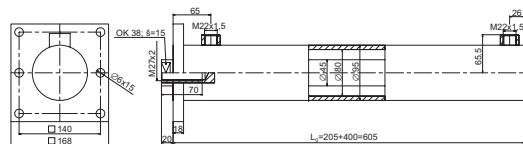
	/	X																				
<p>ZH1, ZH1-A, ZH1-AS ZH1-B, ZH1-BS ZH1-C, ZH1-CS ZH1-D, ZH1-DS ZH2, ZH2-A, ZH2-AS ZH2-B, ZH2-BS ZH2-C, ZH2-CS ZH2-D, ZH2-DS ZH2T, ZH2T-A, ZH2T-AS ZH2T-B, ZH2T-BS ZH2T-C, ZH2T-CS ZH2T-D, ZH2T-DS ZH2RT, ZH2RT-A, ZH2RT-AS ZH2RT-B, ZH2RT-BS ZH2RT-C, ZH2RT-CS ZH2RT-D, ZH2RT-DS</p>							<p><b>Cylinder cover eye marking</b> - (in case of not employing any eye from our catalogue fill in 0 to the code) - page 75÷90.</p> <p><b>Piston rod eye marking</b> - (in case of not employing any eye from our catalogue fill in 0 to the code) - page 75÷90.</p> <p><b>Piston rod end</b> - (for single solution without rod eye the highlighted dimensions are valid. In case of not employing any eye from our catalogue fill in 0 to the code) - page 29.</p> <p><b>The position of pressure inputs to welded-on eye on cylinder surface</b> (valid only for ZH1, ZH2, ZH2T, ZH2RT) - according to herein stated drawings.</p> <div style="text-align: center;"> </div> <p><b>Lift</b> - due to Your actual need - it is necessary to check the maximal possible lift because of the ultimate strength - the diagram of ultimate strength can be helpful according to Euler page 93.</p>															
				<p><b>Piston rod diameter</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>∅D</th> <th>∅d</th> <th>∅D<sub>1</sub></th> <th>∅d<sub>1</sub></th> <th>L</th> </tr> </thead> <tbody> <tr> <td>25</td> <td>14</td> <td>35</td> <td>12</td> <td>142</td> </tr> <tr> <td>25</td> <td>12</td> <td>35.1</td> <td>12</td> <td>142</td> </tr> </tbody> </table>				∅D	∅d	∅D <sub>1</sub>	∅d <sub>1</sub>	L	25	14	35	12	142	25	12	35.1	12	142
∅D	∅d	∅D <sub>1</sub>	∅d <sub>1</sub>	L																		
25	14	35	12	142																		
25	12	35.1	12	142																		
				<p><b>Rated diameter of cylinder</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>∅D</th> <th>∅d</th> <th>∅D<sub>1</sub></th> <th>∅d<sub>1</sub></th> <th>L</th> </tr> </thead> <tbody> <tr> <td>25</td> <td>14</td> <td>35</td> <td>12</td> <td>142</td> </tr> <tr> <td>25</td> <td>12</td> <td>35.1</td> <td>12</td> <td>142</td> </tr> </tbody> </table>				∅D	∅d	∅D <sub>1</sub>	∅d <sub>1</sub>	L	25	14	35	12	142	25	12	35.1	12	142
∅D	∅d	∅D <sub>1</sub>	∅d <sub>1</sub>	L																		
25	14	35	12	142																		
25	12	35.1	12	142																		

Example:

**ZH1 - 63/36 x 250 - R**



**ZH2T -A-80/45x400-2-0-0**



Customer's form

CUSTOMER'S FORM

Company  ID   
 Contact person  tel/fax/e-mail

**Linear hydraulic motor:**  piston diameter /  rod diameter /  lift

**Plunger** - without guided piston  - with piston rod pull-out end stop in cylinder   
 - with guided piston  - without end stop (with piston rod pull-out end stop on the construction)

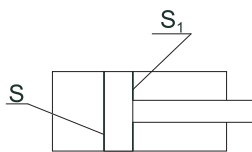
-piston rod return movement - mechanically - by external force   
 - by spring in the plunger

**Single acting linear hydraulic motor** - it is exactly double acting linear hydraulic motor where the pressure oil is in one chamber only - the second one is filled with air.

**Double acting linear hydraulic motor**

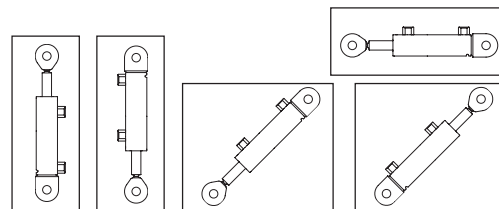
**Double acting linear hydraulic motor** - with continuous piston rod   
 - damping at end positions - no  - yes

without regulation   
 regulation of both positions   
 regulation on piston rod pull-out -  $S_1$    
 regulation on piston rod pull-in - S



**Operating parameters**

Pressure min. $S_1$	<input type="text"/> MPa	Piston rod pull-out speed	<input type="text"/> m/s
Pressure min. S	<input type="text"/> MPa	Piston rod pull-in speed	<input type="text"/> m/s
Operating pressure $S_1$	<input type="text"/> MPa	Oil temperature	<input type="text"/> °C
Operating pressure S	<input type="text"/> MPa	Ambient temperature	<input type="text"/> °C
Pressure max. $S_1$	<input type="text"/> MPa	Working medium	<input type="text"/>
Pressure max. S	<input type="text"/> MPa	Working position of the hydraulic motor	
Pressure peak $S_1$	<input type="text"/> MPa		
Pressure peak S	<input type="text"/> MPa		



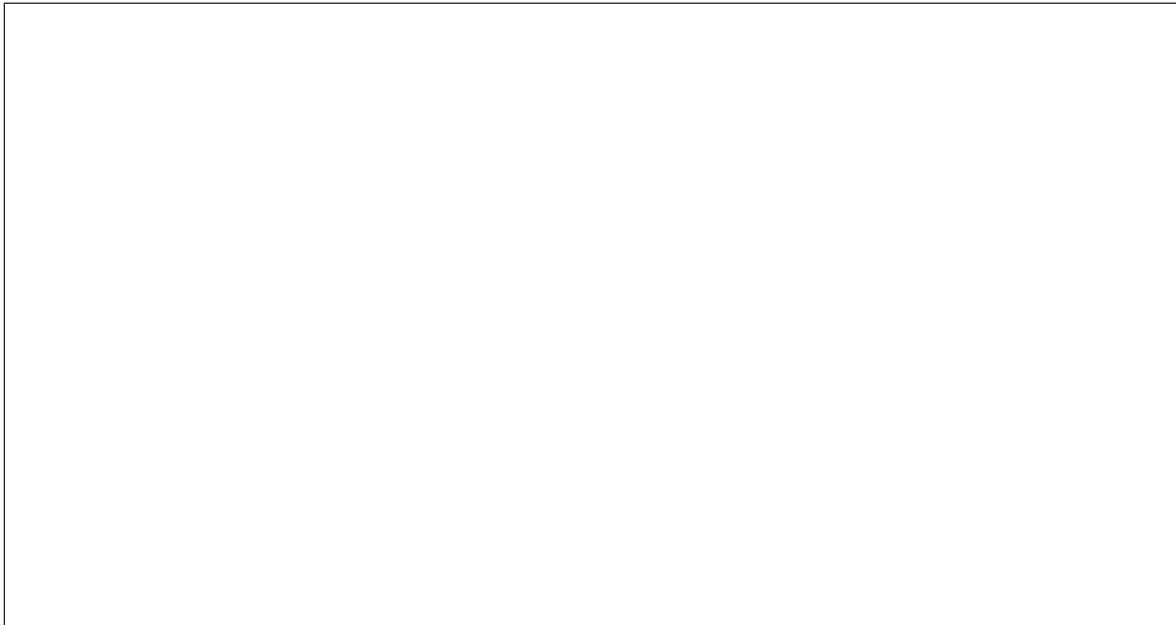
**Operating conditions**

Type of device   
 Function of the hydraulic motor   
 Work intensity  (cycles/hour, min, sec, ...)  
 Provoz  occasional  one-working  two-working  three-working  continual

**Operating environment**

Weather conditions  Dust  Clear  Water  chem. corrosive  Other

## Hydraulic motor drawing



## Technical parameters of used materials

## Commonly used types

**CYLINDER COVER** - the tube welded and calibrated within the inner diameter allowance  
H9 - Rm = 570 MPa - DIN 2393

- the tube cold-drawn and rolled or honed within the inner diameter allowance  
H8 - Rm = 570 MPa - DIN 2391

**BAR**

- 20MnV6 - bar with a chrome layer 20-30  $\mu\text{m}$  - Rm = 500 MPa

- 42CrMo4V - bar with a chrome layer 20-30  $\mu\text{m}$  - Rm = 900 MPa

- HIPERCHOM 200 - material 20MnV6 - bar with a chrome layer c. 50  $\mu\text{m}$  -  
Rm = 500 MPa - resistance in soil chamber 200 hours to defined damage

- NiCr 350 - material 20MnV6 - common bar with a chrome and nickel layers -  
Rm = 500 MPa - resistance in soil chamber 350 hours to defined damage

- Ck 45 or C50 - surface-hardened bar with a chrome layer 20-30  $\mu\text{m}$  - Rm = 500 MPa

- 42CrMo4V - IH - surface-hardened bar with a chrome layer 20-30  $\mu\text{m}$  - Rm = 900 MPa

- stainless steel rod with hardened chrome surface finish 20-30  $\mu\text{m}$



### HYDRAULIC MOTORS TESTS

Each LHM manufactured in Hydraulics company is tested before delivery to the customer via final inspection. It is separated to several levels:

- visual check
- check of construction and integration dimensions
- leak test (done on test stand using the pressure mineral oil HM32)

Inspection methodology is based on: ČSN 11 9008

ČSN 11 9372

ČSN 11 9373, resp. ISO 10 100

### SURFACE FINISH

In common order the surface adjustment is the final operation. As a standard it is done by painting with base synthetic colour S 2035 hue 0840 / red-brown/.

There are many ways of the surface adjustment:

- with other colour with other hue
- galvanization
  - zinc deposition
  - nickel plating
- with nitride
- without surface adjustment - pure metal

### GUARANTEE

Our products - linear hydraulic motors - are subject to warranty under the commercial code. During the warranty period, the manufacturer shall, free of charge, without any undue delays remedy all functional defects, which shall be duly claimed and which were not due to incorrect usage of the product or failure to adhere to technical conditions.

The warranty period is 12 months from the date of sale.

We must also keep an eye on the life cycle of the LHM. It is determined according to ČSN 11 9372 to minimum of  $10^6$  cycles (lifts) for hydraulic motor lift to 500 mm, or 1000 km of course under given parameters.

In some cases it is possible to determine different warranty conditions.

