An ISO 9001 Company

IPH$_T$ Series 4

Mounting dimensions for single rod cylinders, 25 MPa (250 bar) series

IPH$_T$ Series - 4 establishes metric mounting dimensions for medium series cylinders, 25 MPa [250 bar)], as required for interchangeability of commonly used hydraulic cylinders.

NOTE - IPH$_T$ Series 4 allows manufacturers of hydraulic equipment flexibility in the design of 25 MPa (250 bar) cylinders and does not restrict technical development; however, it does provide basic guidelines.

REFERENCES

The following referenced documents are applicable.

Sr No	Reference	Application
1	ISO 1179-1	Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing — Part 1: Threaded ports
2	ISO 3320	Fluid power systems and components — Cylinder bores and pistons rod diameters — Metric series
3	ISO 4395	Fluid power systems and components — Cylinders — Piston rod thread dimensions and types
4	ISO 5598	Fluid power systems and components — Vocabulary
5	ISO 6099	Fluid power systems and components — Cylinders — Identification code for mounting dimensions and mounting types
6	ISO 6149-1	Connections for hydraulic fluid power and general use — Ports and stud ends with ISO 261 metric threads and O-ring sealing — Part 1: Ports with truncated housing for O-ring seal
7	ISO 6162-1	Hydraulic fluid power — Flange connectors with split or one-piece flange clamps and metric or inch screws — Part 1: Flange connectors for use at pressures of 3,5 MPa (35 bar) to 35 MPa (350 bar), DN 13 to DN 127
8	ISO 6162-2	Hydraulic fluid power — Flange connectors with split or one-piece flange clamps and metric or inch screws — Part 2: Flange connectors for use at pressures of 35 MPa (350 bar) to 40 MPa (400 bar), DN 13 to DN 51
9	ISO 6164	Hydraulic fluid power — Four-screw, one-piece square-flange connections for use at pressures of 25 MPa and 40 MPa (250 bar and 400 bar)
10	ISO 8132	Hydraulic fluid power — Single rod cylinders, 16 MPa (160 bar) medium and 25 MPa (250 bar) series — Mounting dimensions for accessories

Tolerances for Mounting Dimensions On Stroke & Stroke tolerances

Table 8 — Tolerances for mounting dimensions that are dependent on stroke

Dimensions in millimetres

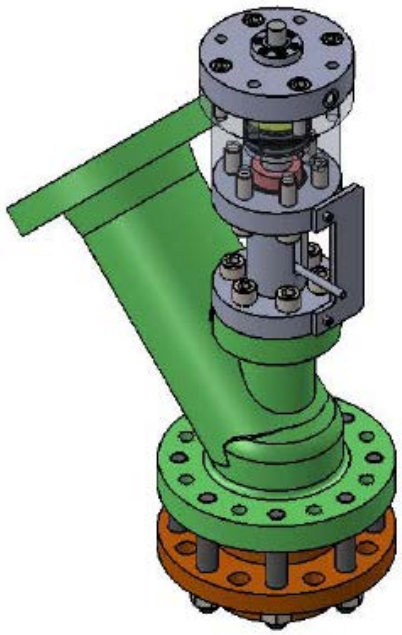
Code for mounting dimension	*ZJ*[a]	*WF*	*WC*	*ZP* or *ZF*[a]	*XC, XD, XO* or *XN*[a]	*XV*	*ZB*[a]	*W*	*XS*	*SS*[a]	*Y*	*PJ*[a]
Nominal stroke	**Tolerances**											
⩽ 1 250	± 1,5	± 2	± 2	± 1,5	± 1,5	± 2	max.	± 2	± 2	± 1,5	± 2	± 1,5
> 1 250 ⩽ 3 150	± 3	± 4	± 4	± 3	± 3	± 4		± 4	± 4	± 3	± 4	± 3
> 3 150 ⩽ 8 000	± 5	± 8	± 8	± 5	± 5	± 8		± 8	± 8	± 5	± 8	± 5

[a] Length including stroke. Stroke tolerances from Table 9 shall not be added to the tolerances in this table.

Table 9 — Tolerances on piston strokes

Dimensions in millimetres

Nominal stroke	Tolerance
⩽ 1 250	$^{+2}_{0}$
> 1 250 ⩽ 3 150	$^{+5}_{0}$
> 3 150 ⩽ 8 000	$^{+8}_{0}$



TECHNICAL INFORMATION

Sr No	Part	Construction Details
1	Barrel	ST-52, ASTM A-106 Gr. B Flanges are welded, machined and honed to 0.4 micron finish
2	Piston Rod	Made from medium Carbon Steel, ground, hard chrome plated and super finished
3	End Covers	Made from Steel IS 2062, Machined. CNC finish available for quantities
4	Gland	As three options, PB Bush, Cast or made from Steel directly. Bush is inserted for smooth operation of piston rod and for suitable guidance
5	Mounting	Multiple mountings are available and correspond to as per ISO 6022
6	Self-Aligning Cushioning Boss	Enable accurate movement inside cushioning chamber at the end of stroke
7	Cushioning Screws	For free adjustment is available as an option
8	Air Bleed	Screw provided for releasing trapped air in cylinder

MORE INFORMATION

Standards: The installation dimensions and mounting types of the cylinders comply with standards ISO 6022

Nominal pressure: 250 bar (25 MPa)
Static test pressure: 375 bar (35 MPa)
Higher operating pressures up to 450 bar on request.
Minimum pressure: Depending on the application, a certain minimum pressure is required to ensure proper operation of the cylinder. If no load is applied, we recommend a minimum pressure of 10 bar for single-rod cylinders.

Installation position: Optional
Hydraulic fluid: Mineral oils DIN 51524 (HL, HLP)

Hydraulic fluid temperature range: –20 °C to +80 °C
Ambient temperature range: –20 °C to +80 °C
Viscosity range: 2.8 to 380 mm2/s

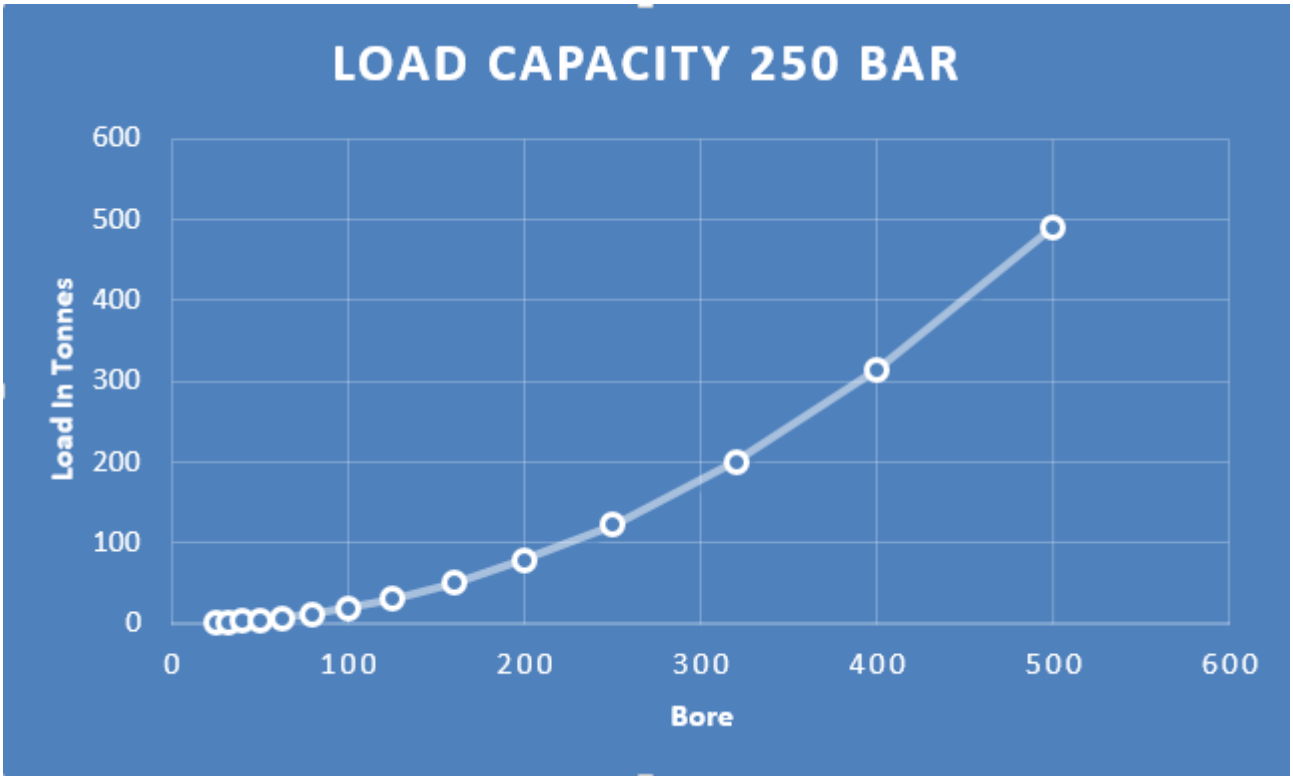
Permissible maximum degree of contamination of the hydraulic fluid to ISO 4406 (c) class 20/18/15.
Primer coating: As a standard, hydraulic cylinders are primed with one coating in a thickness max. 80 µm.

SEALS

Sr No	Seal Type	Description
1	Piston Seal	Based on ISO 7425-1 and ISO 10766
2	Piston Seal	DAS™ variation for holding power
3	Gland Seal	Dimensions correspond generally to RU3 ISO 5597
4	Wiper	Dimensions correspond generally to ISO 6195. Metallic Wipers available for high temperature (+80C).
5	Static	Nitrile Rubber 'O' Rings

Viton based variations are available for high temperature (> 80 degrees or > 176 Fahrenheit) applications

Load Capacity Chart



CUSHIONING (OPTIONAL)

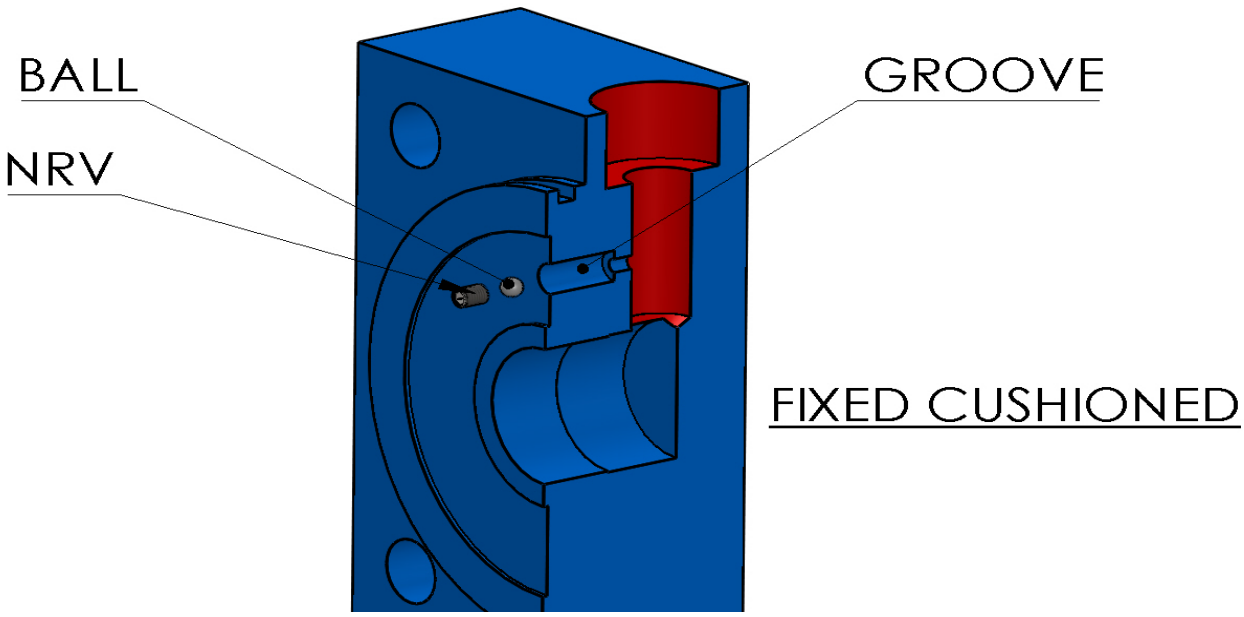
Cushioned cylinders are used when the piston is required to move heavy loads or travel at high speeds. Under these conditions, the piston will collide with the head and cap causing heavy damage to the piston and the cap/head. To reduce these effects, a resisting force must be built up inside the cylinder to bring the piston to a safe and smooth stop during the last portion of its stroke. Cushions built into the cylinder perform exactly this function.

The ability of cylinder to decelerate and stop inertia loads is dependent on : (a) the volume of cushion chamber which is proportional to the length of cushion stroke for a given size of cylinder; (b) pressure developed in cushion chamber; (c) the efficiency with which the fluid is metered.
For normal applications, standard length cushions are sufficient. Where extremely fast moving loads are involved, special cushions are to be devised to bring load to a stop without bounce.

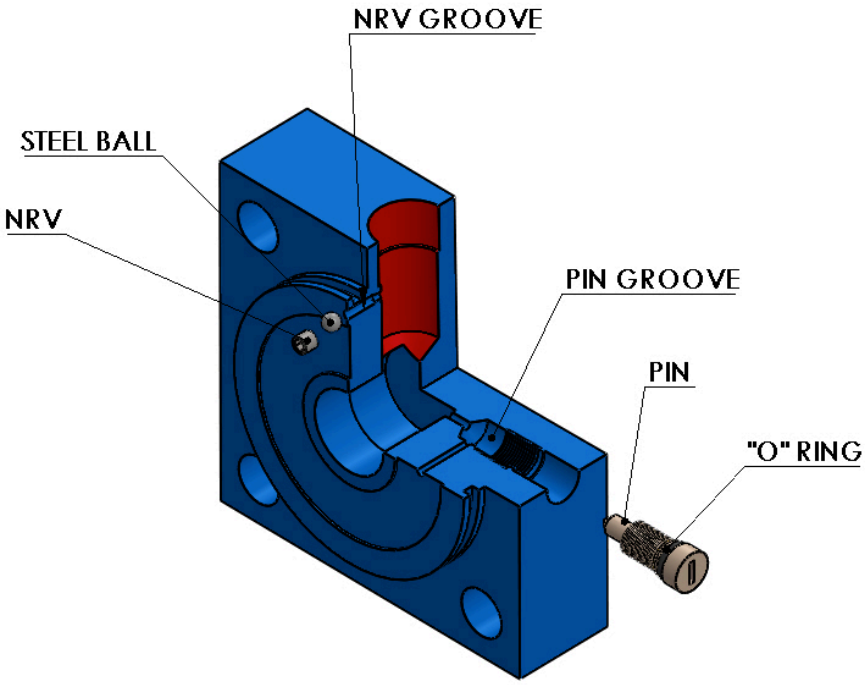
Cushions need not be specified when

1. Light loads are moving at low speeds;
2. external stops are provided thus eliminating the possibility of piston striking the cylinder head and cap;
3. for short stroke (50 mm or less) cylinders, because the short stroke does not allow piston speed to build up enough to sufficiently offset the back pressure built up by the cushion.

Cushioning is available in two variations, Variable and Fixed. Figure below shows construction of Variable Cushioning in IPH$_T$ Cylinders. The Cushioning pin allows cushioning adjustment



FIXED CUSHIONING (ABOVE) & VARIABLE CUSHIONING WITH ADJUSTABLE PIN BELOW[1]



VARIABLE CUSHIONING

[1] IPH may change designs without notice. Please contact us directly for latest formats. Images shown above may not be part of this series but show a general idea

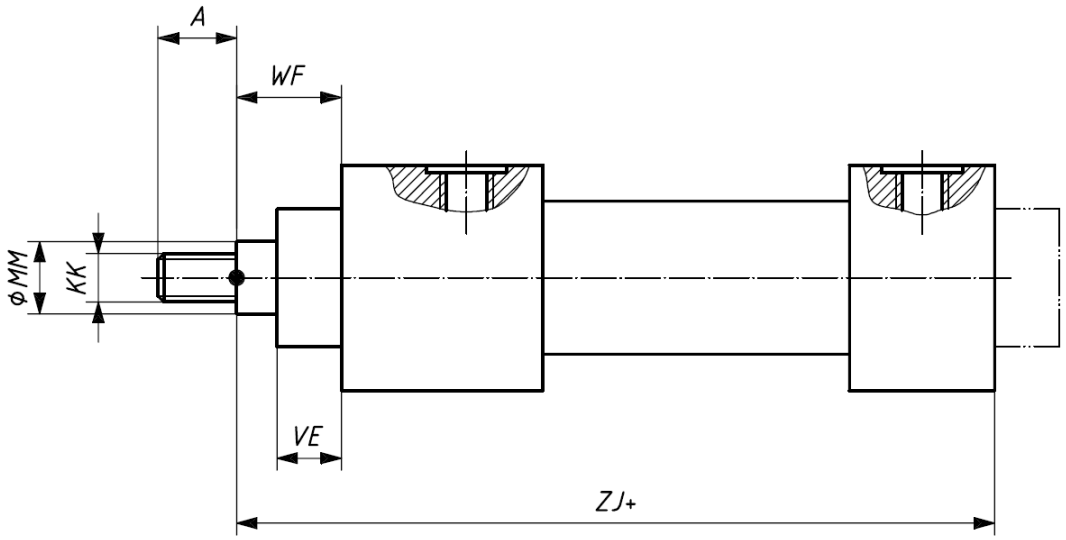
MOUNTING TYPES

This part of IPH. Series 4 includes the following mounting types, identified in accordance with ISO 6099:2001

Sr No	Code	Type	Image
1	MF 1	Head, rectangular flange	
2	MF 2	Cap, rectangular flange	
3	MF 3	Head, circular flange	
4	MF 4	Cap, circular flange	
5	MP 3 MP 4 MP 5 MP 6	- Cap, fixed plain eye - Cap, detachable plain eye - Cap, fixed eye with spherical bearing - Cap, detachable eye with spherical bearing	
6	MS 2	Side lugs	
7	MT 4	Intermediate fixed or movable trunnion (male)	

PISTON ROD CHARACTERISTICS

1. En8 or C-45 material is machined, ground and plated for maximum durability. Plating thickness kept at least 23 microns.
2. IPH. Series 4 covers piston rods that have a shouldered male thread end; see Figure 1 and Table 1 for basic dimensions.
3. Rod end types based on ISO 4395.
4. Accessory mounting dimensions in accordance with ISO 8132.



For rod end types, see ISO 4395.

Figure 1 — General dimensions

General Dimensions

Dimensions in millimetres

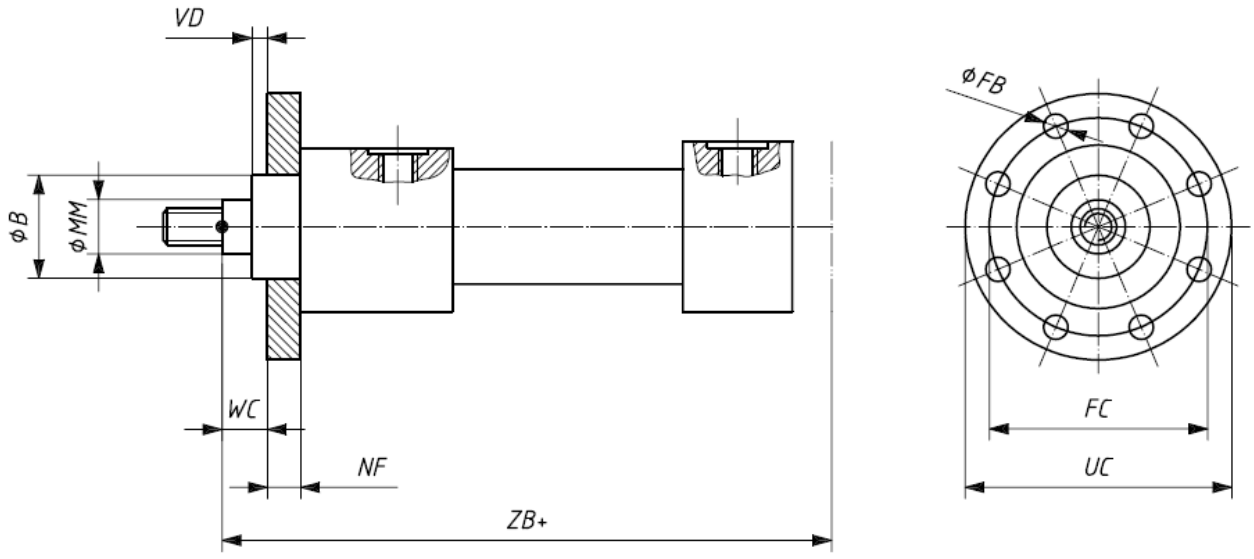
Bore	MM [a]	ZJ [b]	KK [a] 6g	A max.	VE max.	WF [b]
50	32 36	240	M27 × 2	36	29	47
63	40 45	270	M33 × 2	45	32	53
80	50 56	300	M42 × 2	56	36	60
100	63 70	335	M48 × 2	63	41	68
125	80 90	390	M64 × 3	85	45	76
140	90 100	425	M72 × 3	90	48	76
160	100 110	460	M80 × 3	95	50	85
180	110 125	497	M90 × 3	106	55	95
200	125 140	540	M100 × 3	112	61	101
250	160 180	640	M125 × 4	125	71	113
320	200 220	750	M160 × 4	160	88	136

[a] If other piston rod diameters or other threads are required, use those identified in ISO 3320 and ISO 4395.

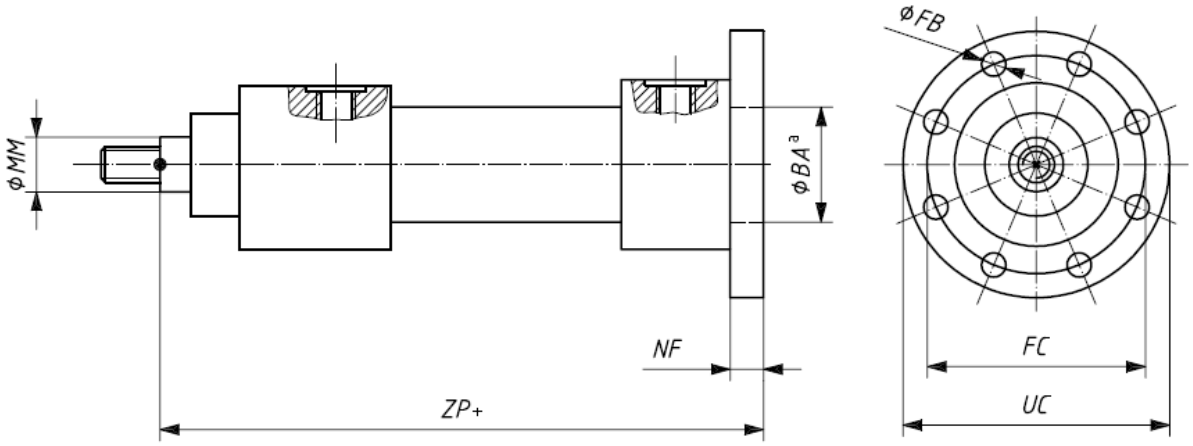
[b] Tolerances for dimensions ZJ and WF are dependent on stroke; see Table 6.

IMPORTANT PISTON AREA RATIOS

Piston	Piston rod	Area ratio	Areas			Force at 160 bar		
			Piston	Areas Rod	Annulus	Pressure	Diff	Pulling
AL Ømm	MM Ømm	φ A1/A3	A1 cm2	A2 cm2	A3 cm2	F1 kN	F2 kN	F3 kN
25	14	1.46	4.91	1.54	3.37	7.85	2.44	5.37
	18	2.08		2.54	2.36		4.07	3.76
32	18	1.46	8.04	2.54	5.5	12.8	4.07	8.78
	22	1.9		3.8	4.24		6.08	6.76
40	22	1.43	12.56	3.8	8.76	20	6.08	14.03
	28	1.93		6.16	6.41		9.82	10.24
50	28	1.46	19.63	6.16	13.47	31.3	9.82	21.55
	36	2.08		10.18	9.46		16.29	15.1
63	36	1.48	31.17	10.18	20.99	49.8	16.29	33.56
	45	2.04		15.9	15.27		25.4	24.41
80	45	1.46	50.26	15.9	34.36	80.3	25.4	54.96
	56	1.96		24.63	25.63		39.3	40.99
100	56	1.46	78.54	24.63	53.91	125	39.3	86.22
	70	1.96		38.48	40.06		61.57	64.04
125	70	1.46	122.72	38.48	84.24	196	61.57	134.7
	90	2.08		63.62	59.1		101.8	94.49
160	90	1.46	201.06	63.62	137	321	101.8	219.8
	110	1.9		95.06	106		152.1	169.5
200	110	1.43	314.16	95.06	219.09	502.6	152.1	350.6
	140	1.96		153.94	160.2		246.3	256.3
250	140	1.46	490.87	153.94	336.93	785.39	246.3	539.08
	180	2.076		254.47	236.4		407.15	378.24
320	180	1.46	804.25	254.47	549.78	1286.8	407.15	879.64
	220	1.9		380.13	424.12		608.2	678.59
400	220	1.43	1256.6	380.13	876.47	2010.56	608.2	1402.35
	280	1.96		615.75	640.85		985.2	1025.36
500	280	1.46	1963.5	615.75	1347.15	3141.6	985.2	2155.44
	360	2.08		1017.88	945.62		1628.6	1512.99



a) Head mounting



b) Cap mounting

[a] Optional.

Figure 2 — MF3 — Head, circular flange and MF 4 — Cap, circular flange

Table 2 — Dimensions of circular flange mountings MF3 and MF4

Dimensions in millimetres

Bore	*FB* H13	*FC* js13	*VD* min.	*WC* [a]	*ZP* [a]	*ZB* max.	*B, BA* H8 / f8	*UC* max.	*NF* js13
50	8 × ∅13,5	132	4	22	265	244	63	160	25
63	8 × ∅13,5	150	4	25	298	274	75	180	28
80	8 × ∅17,5	180	4	28	332	305	90	215	32
100	8 × ∅22	212	5	32	371	340	110	260	36
125	8 × ∅22	250	5	36	430	396	132	300	40
140	8 × ∅26	285	5	36	465	430	145	340	40
160	8 × ∅26	315	5	40	505	467	160	370	45
180	8 × ∅33	355	5	45	550	505	185	425	50
200	8 × ∅33	385	5	45	596	550	200	455	56
250	8 × ∅39	475	8	50	703	652	250	545	63
320	8 × ∅45	600	8	56	830	764	320	680	80

[a] Tolerances for dimensions *WC* and *ZP* are dependent on stroke; see Table 6.

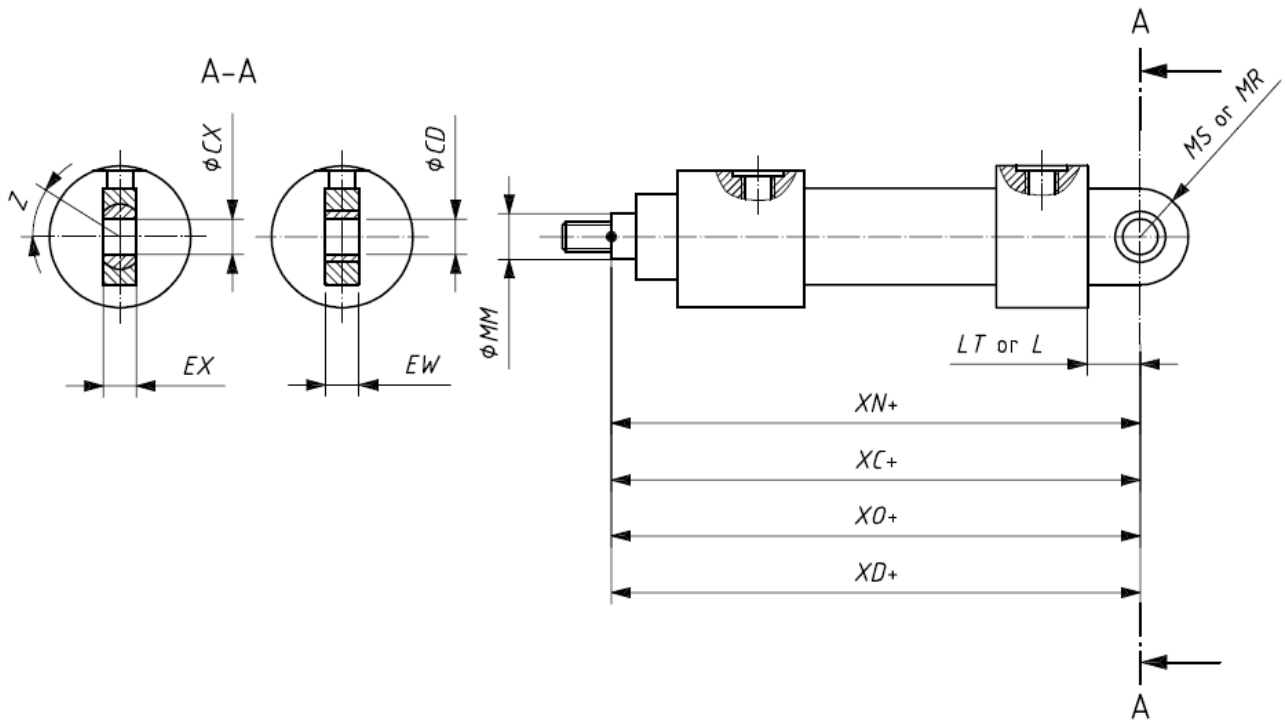


Figure 3 — MP3 — Cap, fixed plain eye, MP4 — Cap, detachable plain eye, MP5 — Cap, fixed eye with spherical bearing and MP6 — Cap, detachable eye with spherical bearing

Table 3 — Dimensions of cap eye mountings MP3, MP4, MP5 and MP6

Dimensions in millimetres

Bore	*CD* [a]	*CX* [b]	*EW* [a] **or** *EX* [b]	*L* [a] **or** *LT* [b]	*MR* [a] **or** *MS* [b]	*XC*, *XD*, *XO* **or** *XN* [c,d]	**Tilting angle** *Z*
	H9	H7	h12	min.	max.		min.
50	32	32	32	40	40	305	4°
63	40	40	40	50	50	348	4°
80	50	50	50	63	63	395	4°
100	63	63	63	71	71	442	4°
125	80	80	80	90	90	520	4°
140	90	90	90	113	113	580	4°
160	100	100	100	112	112	617	4°
180	110	110	110	135	135	690	4°
200	125	125	125	160	160	756	4°
250	160	160	160	200	200	903	4°
320	200	200	200	250	250	1080	4°

[a] The dimensions *CD*, *EW*, *L* and *MR* are valid for mounting types MP3 and MP4.

[b] The dimensions *CX*, *EX*, *LT* and *MS* are valid for mounting types MP5 and MP6.

[c] Tolerances for dimensions *XC*, *XD*, *XO* or *XN* are dependent on stroke; see Table 6.

[d] The dimension *XC* is valid for mounting type MP3, the dimension *XD* is valid for mounting type MP4, the dimension *XO* is valid for mounting type MP5 and the dimension *XN* is valid for mounting type MP6.

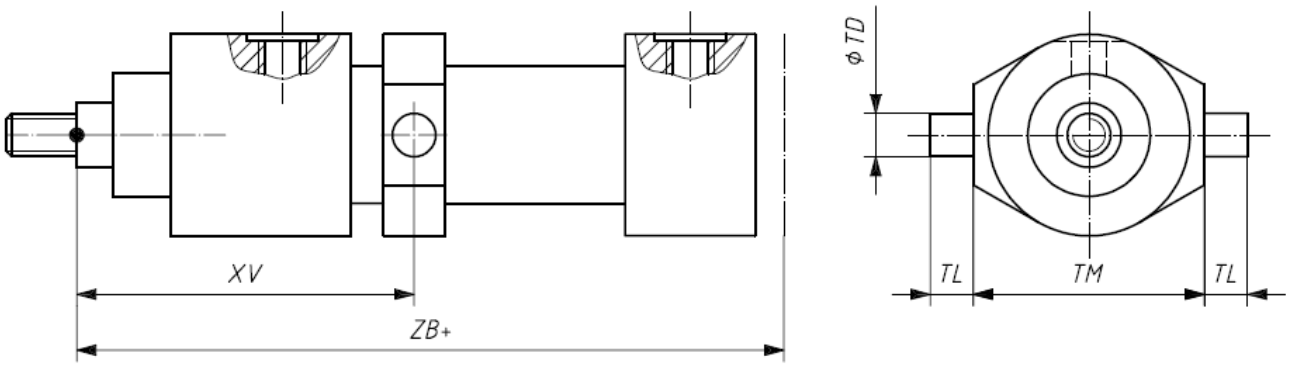


Figure 4 — MT4 — Intermediate fixed or movable trunnion (male)

Table 4 — Dimensions of intermediate male trunnion mounting MT4

Dimensions in millimetres

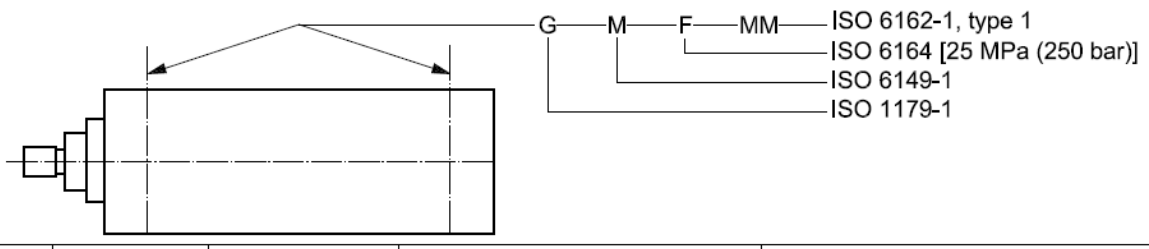
Bore	*TD* f8	*TL* js13	*TM* h12	*XV* [a]	*ZB* max.
50	32	25	112	Variable. Users should consult the manufacturer for minimum and maximum values	244
63	40	32	125		274
80	50	40	150		305
100	63	50	180		340
125	80	63	224		396
140	90	70	265		430
160	100	80	280		467
180	110	90	320		502
200	125	100	335		550
250	160	125	425		652
320	200	160	530		764

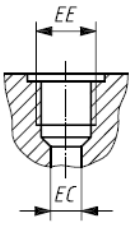
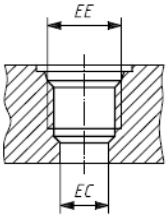
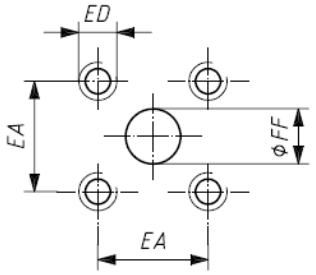
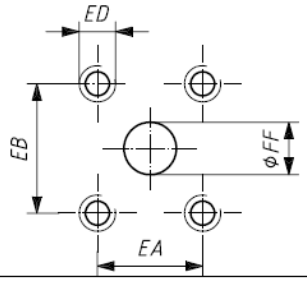
[a] Tolerances for dimensions *XV* are dependent on stroke; see Table 6.

Port & Flange Sizes

Table 5 — Port and flange sizes

Dimensions in millimetres



Bore	ISO 1179-1 port		ISO 6149-1 port		ISO 6164 Square flange				ISO 6162-1 Rectangular flange				
													
	G		M		F				MM				
	EE	*EC*	*EE*	*EC*	Nominal flange size DN	*FF*	*EA*	*ED*	Nominal flange size DN	*FF*	*EA*	*EB*	*ED*
	6g	min.	6g	min.		0 −1,5	±0,25	6g		0 −1,5	±0,25	±0,25	6g
50	G 1/2	14	M22 × 1,5	14	—	—	—	—	—	—	—	—	—
63 80	G 3/4	18	M27 × 2	18	13	15	29,7	M8	13	12,7	17,5	38,1	M8
100 125	G 1	23	M33 × 2	23	19	20	35,4	M8	19	19,1	22,3	47,6	M10
140 160 180 200	G 1¼	30	M42 × 2	30	25	25	43,8	M10	25	25,4	26,2	52,4	M10
250 320	G 1 ½	32	M60 × 2	32	32	32	51,6	M12	32	31,8	30,2	58,7	M10

CAUTION — When selecting the largest diameter piston rod in a given bore size in connection with hydraulic systems where pull loads and/or pressure intensification effects may be generated, the pressure in the piston rod cavity of the cylinder can be two or more times the working pressure of the hydraulic system. In these cases, flange ports in accordance with ISO 6162-1 or ISO 6164, as shown in this table, may not have sufficient pressure ratings. When flange ports with a higher pressure rating are needed, they can be selected from the higher pressure series in ISO 6162-2 and ISO 6164.

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