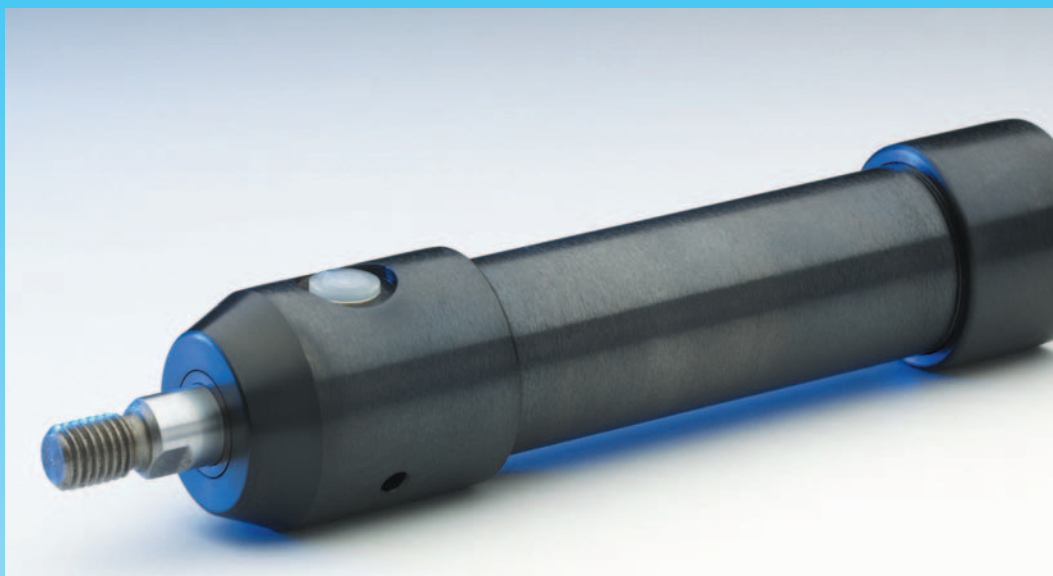


# ZU Series



## 100 bar universal cylinder

**Piston Ø 10-100 mm**

**Lengths of stroke at your option (take account of the buckling strength, see page 35)**

**Standard lengths of stroke**

- Round, compact design; black blued
- Piston rod hard chromium plated
- Particularly suited for installation into machines and appliances

### Determine your 100 bar universal cylinder:

Ordering example: **ZU-Fv 32/140 NHR16 D-H03 E11g G1/4" ES As4**

Cylinder type

① Mounting type

② Piston Ø

③ Length of stroke

Standard stroke series NHR

④ Functional type

⑤ Seal type

⑥ Options

End of piston rod

Connections

Vent screws

⑦ Cover design (for front mounting type)

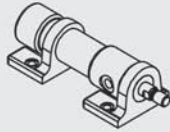
**Special versions upon request**

## 1 Mounting types

**A** Basic design



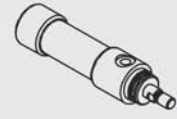
**Hw** Foot mounting



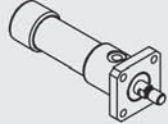
**G** Thread mounting



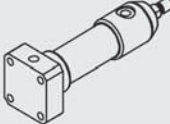
**Gz** Thread mounting with centering



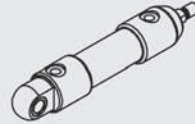
**Fv** Front flange



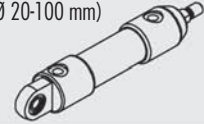
**Fh** Back flange



**Si** Swivelling support

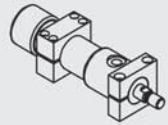


**Sk** Hinged support (piston-  
Ø 20-100 mm)

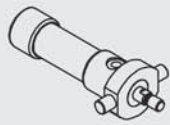


**Special mounting types:** (upon request)

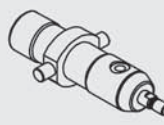
**KH** Clamping holder



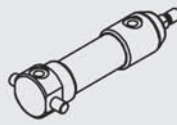
**Sv** Front support bolt



**Sm** Centered support bolt



**S** Back support bolt



## 2 Piston Ø

| Piston Ø (mm)                             | 10   | 12.5 | 16   | 20   | 25   | 32   | 40   | 50   | 56   | 63   | 70   | 80   | 90   | 100  |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Piston surface pushing (cm <sup>2</sup> ) | 0.78 | 1.23 | 2.00 | 3.14 | 4.90 | 8.05 | 12.5 | 19.6 | 23.7 | 31.1 | 38.5 | 50.2 | 63.6 | 78.5 |
| Piston surface pulling (cm <sup>2</sup> ) | 0.56 | 0.95 | 1.50 | 2.36 | 3.73 | 6.04 | 9.42 | 14.7 | 18.8 | 23.1 | 30.1 | 37.7 | 51.0 | 58.9 |

## 3 Length of stroke

**Lengths of stroke at your option:** We manufacture any length of stroke you desire.

**Standard stroke versions NHR:** With piston Ø 10-50 mm, a choice of 8 standard lengths of stroke for every piston Ø is available for short-time delivery.

● **Ordering example:** ZU-Fv 25/90 NHR15 D-H03 As1

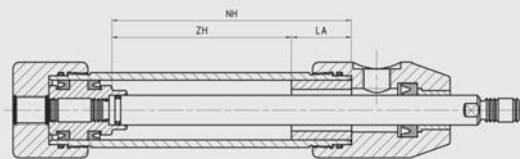
| Piston Ø | 10         | 12.5 | 16  | 20  | 25  | 32  | 40  | 50  |     |
|----------|------------|------|-----|-----|-----|-----|-----|-----|-----|
| Function | <b>NHR</b> |      |     |     |     |     |     |     |     |
| <b>D</b> | <b>11</b>  | 10   | 11  | 12  | 14  | 16  | 18  | 20  | 22  |
|          | <b>12</b>  | 20   | 22  | 25  | 28  | 32  | 36  | 40  | 45  |
|          | <b>13</b>  | 28   | 32  | 36  | 40  | 45  | 50  | 56  | 63  |
|          | <b>14</b>  | 40   | 44  | 50  | 56  | 64  | 72  | 80  | 90  |
|          | <b>15</b>  | 56   | 63  | 70  | 80  | 90  | 100 | 110 | 125 |
|          | <b>16</b>  | 80   | 90  | 100 | 110 | 125 | 140 | 160 | 180 |
|          | <b>17</b>  | 110  | 125 | 140 | 160 | 180 | 200 | 220 | 250 |
|          | <b>18</b>  | 160  | 180 | 200 | 220 | 250 | 280 | 320 | 360 |

### Intermediate strokes aNHR:

By inserting a stroke-limiting bushing (LA) any intermediate stroke (ZH) can be realized from a longer standard stroke (NH).

The length measurements L1 and L1c always correspond with the normal stroke.

● **Ordering example:** ZU-Fv 25/80 aNHR15 D-H03 As1



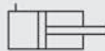
## 4 Functional types

**D** Double - effect



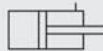
pushing and pulling

**E** Single - effect



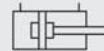
pushing

**Ez** Single - effect



pulling

**Dbb** Double - effect



with end position damping on both sides (piston-Ø 20-56 mm)

**Dbb** Double - effect



with end position damping on both sides (piston-Ø 63-100 mm)

**Special functional types:** (upon request)

**Dd** Double - effect



with through piston rod

**Dbv** Double - effect



with end position damping at the front

**Dbh** Double - effect



with end position damping at the back

**F** Single - effect



pushing with spring return mechanism

**Fz** Single - effect



pulling with spring return mechanism

## 5 Seal types

**Standard version: H00** für hydraulic fluid (mineral oil). Seal types für other pressure media upon request.

| Seal types   | H00 | H01 | H03 | H04 | H06 | H07 | H11 | H12 |
|--|-----|-----|-----|-----|-----|-----|-----|-----|
| Piston seal, PTFE gliding ring (piston Ø 10-16 mm)                     | ●   | ●   |     |     |     |     |     |     |
| Piston seal, grooved ring (piston Ø 20-100 mm)                         |     |     |     |     |     |     |     |     |
| Piston seal, PTFE gliding ring (min. piston Ø 20 mm with driving band) |     |     | ●   | ●   | ●   | ●   | ●   | ●   |
| Rod seal, grooved ring   | ●   | ●   | ●   | ●   |     |     |     |     |
| Rod seal, PTFE gliding ring  |     |     |     |     | ●   | ●   | ●   | ●   |
| Dust seal  |     | ●   |     | ●   |     | ●   |     | ●   |
| O-rings Nitril   | ●   | ●   | ●   | ●   | ●   | ●   |     |     |
| O-rings Viton  |     |     |     |     |     |     | ●   | ●   |
| <b>piston speed</b>  |     |     |     |     |     |     |     |     |
| max. 0.5 m/s   | ●   | ●   | ●   | ●   |     |     |     |     |
| max. 10 m/s  |     |     |     |     | ●   | ●   | ●   | ●   |
| <b>temperature range</b>   |     |     |     |     |     |     |     |     |
| -20/+100 °C  | ●   | ●   | ●   | ●   | ●   | ●   |     |     |
| -20/+200 °C  |     |     |     |     |     |     | ●   | ●   |

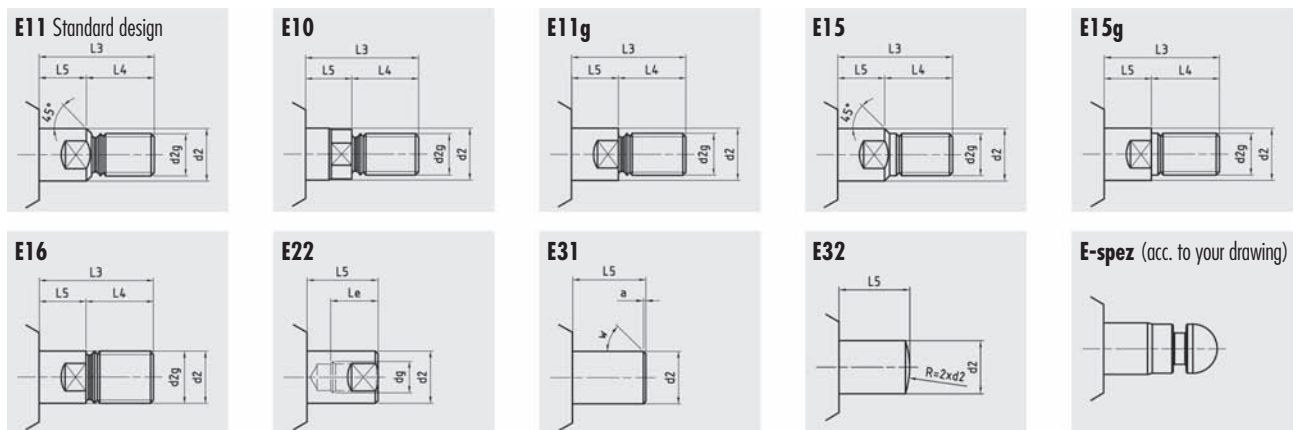
## 6 Options

### End of piston rod:

**standard version: E11**

Additional versions as shown in the illustrations are manufactured based on the catalog if not otherwise specified by the customer.

Tailor-made versions can be supplied upon request.



### Connections:

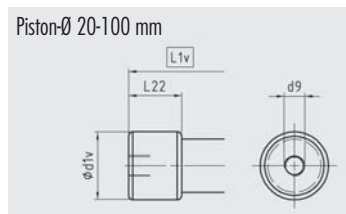
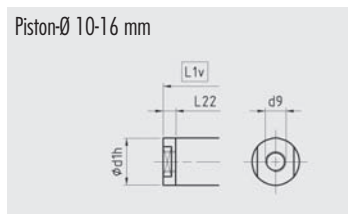
Are manufactured based on the catalog if not otherwise specified by the customer. The position of the connections can be customized. Larger and other (metric) connections are available upon request.

### Vent screws (ES):

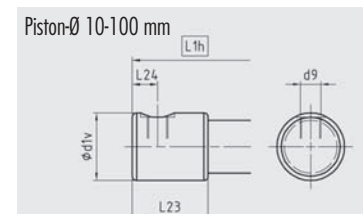
Are attached to order and in accordance with the position specification made by the customer.

## 7 Cover design (for mounting / fastening on the cylinder head)

**As1** Cover with axial connection (standard version)



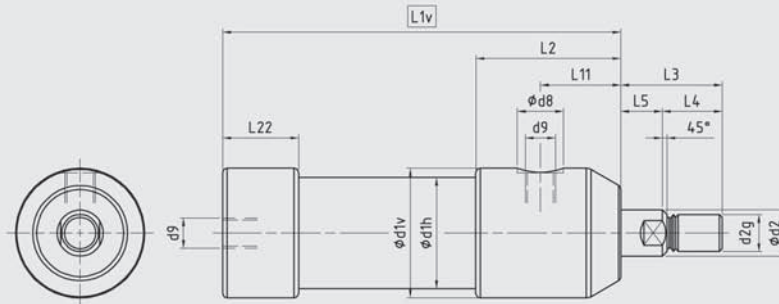
**As4** Cover with lateral connection (to order)



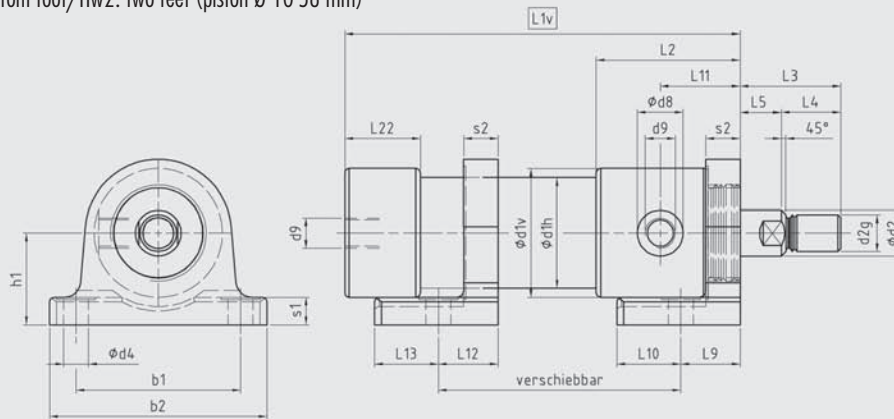
| Piston Ø | 10 | 12.5 | 16 | 20 | 25 | 32 | 40 | 50 | 56 | 63 | 70 | 80 | 90 | 100 |
|----------|----|------|----|----|----|----|----|----|----|----|----|----|----|-----|
| L22      | 6  | 6    | 6  | 25 | 26 | 31 | 33 | 38 | 39 | 43 | 46 | 52 | 55 | 60  |
| L23      | 16 | 16   | 16 | 36 | 37 | 40 | 48 | 51 | 52 | 54 | 57 | 67 | 70 | 71  |
| L24      | 8  | 8    | 8  | 12 | 12 | 12 | 15 | 15 | 16 | 16 | 16 | 19 | 19 | 19  |

# Dimension drawings/Dimensions

## A Basic design



## Hw/Hw2 Hw: front foot/Hw2: two feet (piston Ø 10-56 mm)

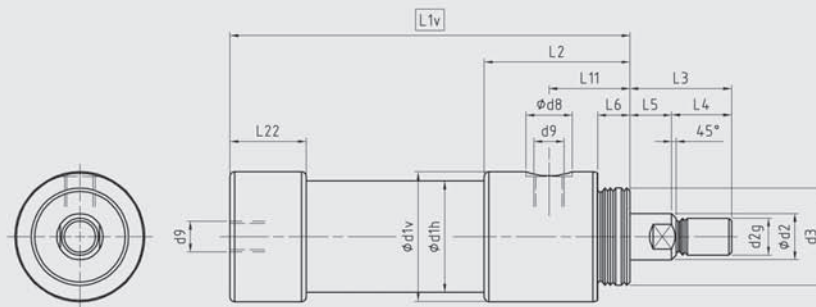


| Piston Ø | 10     | 12.5   | 16     | 20     | 25     | 32     | 40     | 50     | 56     | 63     | 70     | 80     | 90     | 100    |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| d1v      | 24     | 24     | 28     | 32     | 36     | 45     | 56     | 68     | 78     | 85     | 90     | 105    | 116    | 130    |
| d1h      | 16     | 18     | 22     | 25     | 30     | 38     | 48     | 60     | 68     | 75     | 80     | 90     | 105    | 115    |
| d2-f7    | 6      | 6      | 8      | 10     | 12     | 16     | 20     | 25     | 25     | 32     | 32     | 40     | 40     | 50     |
| d2g      | M5     | M5     | M6     | M8     | M10    | M14    | M16    | M20    | M20    | M24    | M24    | M33    | M33    | M42    |
| d4       | 4.5    | 4.5    | 4.5    | 5.5    | 7      | 9      | 11     | 13     | 13     | -      | -      | -      | -      | -      |
| d8       | 15     | 15     | 15     | 16     | 16     | 16     | 20     | 20     | 20     | 20     | 20     | 26     | 26     | 26     |
| d9       | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/4" | G 1/4" | G 1/4" | G 1/4" | G 1/4" | G 3/8" | G 3/8" | G 3/8" |
| b1       | 30     | 30     | 34     | 40     | 45     | 56     | 72     | 100    | 100    | -      | -      | -      | -      | -      |
| b2       | 42     | 42     | 46     | 50     | 60     | 72     | 95     | 125    | 125    | -      | -      | -      | -      | -      |
| h1±0,1   | 18     | 18     | 20     | 22     | 25     | 32     | 40     | 50     | 50     | -      | -      | -      | -      | -      |
| s1       | 6      | 6      | 6      | 8      | 8      | 10     | 12     | 15     | 15     | -      | -      | -      | -      | -      |
| s2       | 8      | 8      | 8      | 9      | 9      | 11     | 14     | 16     | 16     | 20     | 20     | 25     | 25     | 35     |
| L2       | 35     | 35     | 40     | 46     | 48     | 52     | 63     | 70     | 75     | 82     | 91     | 96     | 114    | 125    |
| L3       | 15     | 15     | 17     | 23     | 27     | 37     | 44     | 52     | 52     | 55     | 55     | 70     | 70     | 80     |
| L4       | 10     | 10     | 12     | 14     | 16     | 22     | 26     | 32     | 32     | 35     | 35     | 45     | 45     | 55     |
| L5       | 5      | 5      | 5      | 9      | 11     | 15     | 18     | 20     | 20     | 20     | 20     | 25     | 25     | 25     |
| L9       | 16     | 16     | 16     | 18     | 20     | 22     | 26     | 30     | 30     | -      | -      | -      | -      | -      |
| L10      | 19     | 19     | 20     | 20     | 22     | 24     | 28     | 35     | 35     | -      | -      | -      | -      | -      |
| L11      | 18     | 18     | 22.5   | 24.5   | 25.5   | 28.5   | 35     | 40     | 44.5   | 48     | 55     | 55     | 69     | 78     |
| L12      | 16     | 16     | 16     | 18     | 20     | 22     | 26     | 30     | 30     | -      | -      | -      | -      | -      |
| L13      | 19     | 19     | 20     | 20     | 22     | 24     | 28     | 35     | 35     | -      | -      | -      | -      | -      |
| L22      | 6      | 6      | 6      | 25     | 26     | 31     | 33     | 38     | 39     | 43     | 46     | 52     | 55     | 60     |

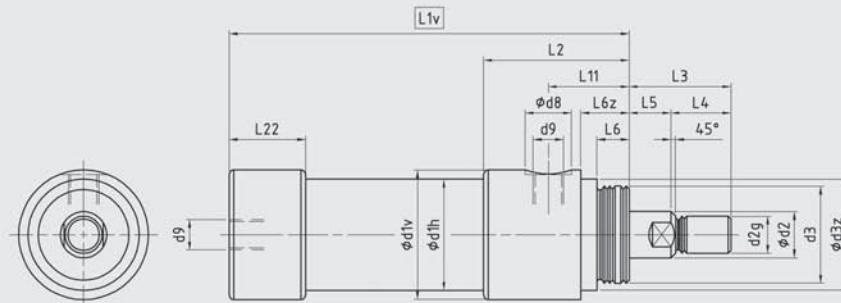
| Functional type                         | Length measurements L1v and length measurements L1h (with cover design As4) |      |      |    |     |     |     |     |     |     |     |     |     |     |     |
|---|---|------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>D</b>                                | L1v = Stroke +  | 52.5 | 55.5 | 62 | 66  | 73  | 82  | 93  | 104 | 112 | 119 | 125 | 133 | 148 | 166 |
|   | L1h = Stroke +  | 62.5 | 65.5 | 72 | 77  | 84  | 91  | 108 | 117 | 125 | 130 | 136 | 148 | 163 | 177 |
| <b>E/Ez</b>                             | L1v = Stroke +  | 52.5 | 55.5 | 54 | 58  | 63  | 70  | 80  | 90  | 97  | 104 | 110 | 118 | 133 | 154 |
|   | L1h = Stroke +  | 62.5 | 65.5 | 64 | 69  | 74  | 79  | 95  | 103 | 110 | 115 | 121 | 133 | 148 | 165 |
| <b>Dbb</b>                              | L1v = Stroke +  | -    | -    | -  | 100 | 113 | 130 | 147 | 165 | 169 | -   | -   | -   | -   | -   |
|   | L1h = Stroke +  | -    | -    | -  | 111 | 124 | 139 | 162 | 178 | 182 | 182 | 188 | 211 | 226 | 248 |
| Minimum length measurements L1v and L1h |   |      |      |    |     |     |     |     |     |     |     |     |     |     |     |
| L1v =                                   | -   | -    | -    | 72 | 75  | 84  | 97  | 109 | 115 | 126 | 138 | 149 | 170 | 186 |     |
| L1h =                                   | -   | -    | -    | 83 | 86  | 93  | 112 | 122 | 128 | 137 | 149 | 164 | 185 | 197 |     |

# Dimension drawings/Dimensions

## G Thread mounting



## Gz Thread mounting with centering

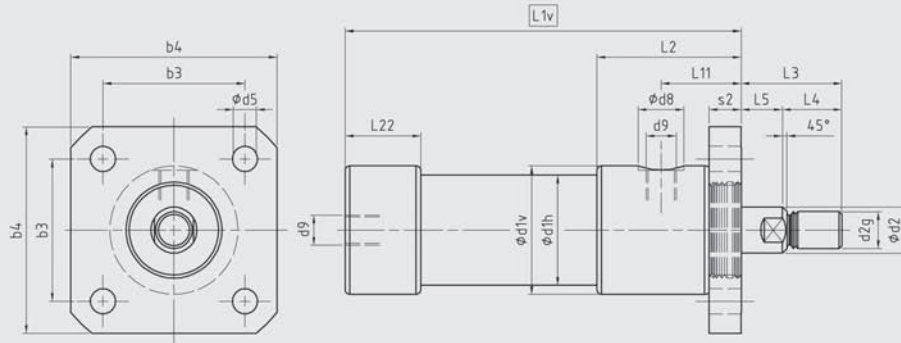


| Piston Ø | 10     | 12.5   | 16     | 20     | 25     | 32     | 40       | 50       | 56       | 63     | 70     | 80       | 90       | 100    |
|----------|--------|--------|--------|--------|--------|--------|----------|----------|----------|--------|--------|----------|----------|--------|
| d1v      | 24     | 24     | 28     | 32     | 36     | 45     | 56       | 68       | 78       | 85     | 90     | 105      | 116      | 130    |
| d1h      | 16     | 18     | 22     | 25     | 30     | 38     | 48       | 60       | 68       | 75     | 80     | 90       | 105      | 115    |
| d2-f7    | 6      | 6      | 8      | 10     | 12     | 16     | 20       | 25       | 25       | 32     | 32     | 40       | 40       | 50     |
| d2g      | M5     | M5     | M6     | M8     | M10    | M14    | M16      | M20      | M20      | M24    | M24    | M33      | M33      | M42    |
| d3       | M16x1  | M16x1  | M20x1  | G 1/2" | G 3/4" | G 1"   | G 1 1/4" | G 1 1/2" | G 1 1/2" | G 2"   | G 2"   | G 2 1/2" | G 2 1/2" | G 3"   |
| d3z-h7   | 20     | 20     | 24     | 25     | 28     | 40     | 48       | 60       | 60       | 75     | 75     | 90       | 90       | 115    |
| d8       | 15     | 15     | 15     | 16     | 16     | 16     | 20       | 20       | 20       | 20     | 20     | 26       | 26       | 26     |
| d9       | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/4"   | G 1/4"   | G 1/4"   | G 1/4" | G 1/4" | G 3/8"   | G 3/8"   | G 3/8" |
| L2       | 35     | 35     | 40     | 46     | 48     | 52     | 63       | 70       | 75       | 82     | 91     | 96       | 114      | 125    |
| L3       | 15     | 15     | 17     | 23     | 27     | 37     | 44       | 52       | 52       | 55     | 55     | 70       | 70       | 80     |
| L4       | 10     | 10     | 12     | 14     | 16     | 22     | 26       | 32       | 32       | 35     | 35     | 45       | 45       | 55     |
| L5       | 5      | 5      | 5      | 9      | 11     | 15     | 18       | 20       | 20       | 20     | 20     | 25       | 25       | 25     |
| L6       | 8      | 8      | 8      | 9      | 9      | 11     | 14       | 16       | 16       | 20     | 20     | 25       | 25       | 35     |
| L6z      | 11     | 11     | 12     | 13     | 13.5   | 16     | 21       | 23       | 23       | 30     | 30     | 35       | 35       | 49     |
| L11      | 18     | 18     | 22.5   | 24.5   | 25.5   | 28.5   | 35       | 40       | 44.5     | 48     | 55     | 55       | 69       | 78     |
| L22      | 6      | 6      | 6      | 25     | 26     | 31     | 33       | 38       | 39       | 43     | 46     | 52       | 55       | 60     |

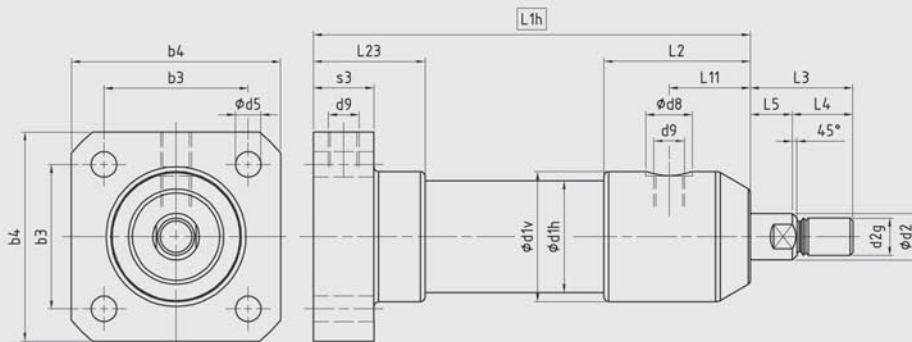
| Functional type |                | Length measurements L1v and length measurements L1h (with cover design As4) |      |    |     |     |     |     |     |     |     |     |     |     |     |
|-----------------|----------------|---|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| D               | L1v = stroke + | 52.5  | 55.5 | 62 | 66  | 73  | 82  | 93  | 104 | 112 | 119 | 125 | 133 | 148 | 166 |
|                 | L1h = stroke + | 62.5  | 65.5 | 72 | 77  | 84  | 91  | 108 | 117 | 125 | 130 | 136 | 148 | 163 | 177 |
| E/Ez            | L1v = stroke + | 52.5  | 55.5 | 54 | 58  | 63  | 70  | 80  | 90  | 97  | 104 | 110 | 118 | 133 | 154 |
|                 | L1h = stroke + | 62.5  | 65.5 | 64 | 69  | 74  | 79  | 95  | 103 | 110 | 115 | 121 | 133 | 148 | 165 |
| Dbb             | L1v = stroke + | -   | -    | -  | 100 | 113 | 130 | 147 | 165 | 169 | 182 | 188 | 211 | 226 | 248 |
|                 | L1h = stroke + | -   | -    | -  | 111 | 124 | 139 | 162 | 178 | 182 | 182 | 188 | 211 | 226 | 248 |
|                 |                | Minimum length measurements L1v and L1h                                     |      |    |     |     |     |     |     |     |     |     |     |     |     |
|                 | L1v =          | -   | -    | -  | 72  | 75  | 84  | 97  | 109 | 115 | 126 | 138 | 149 | 170 | 186 |
|                 | L1h =          | -   | -    | -  | 83  | 86  | 93  | 112 | 122 | 128 | 137 | 149 | 164 | 185 | 197 |

# Dimension drawings/Dimensions

## Fv Front flange



## Fh Back flange



| Piston Ø | 10     | 12.5   | 16     | 20     | 25     | 32     | 40     | 50     | 56     | 63     | 70     | 80     | 90     | 100    |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| d1v      | 24     | 24     | 28     | 32     | 36     | 45     | 56     | 68     | 78     | 85     | 90     | 105    | 116    | 130    |
| d1h      | 16     | 18     | 22     | 25     | 30     | 38     | 48     | 60     | 68     | 75     | 80     | 90     | 105    | 115    |
| d2-f7    | 6      | 6      | 8      | 10     | 12     | 16     | 20     | 25     | 25     | 32     | 32     | 40     | 40     | 50     |
| d2g      | M5     | M5     | M6     | M8     | M10    | M14    | M16    | M20    | M20    | M24    | M24    | M33    | M33    | M42    |
| d5       | 5.5    | 5.5    | 6      | 7      | 7      | 9      | 11     | 13     | 13     | 13     | 13     | 17     | 17     | 17     |
| d8       | 15     | 15     | 15     | 16     | 16     | 16     | 20     | 20     | 20     | 20     | 20     | 26     | 26     | 26     |
| d9       | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/4" | G 1/4" | G 1/4" | G 1/4" | G 1/4" | G 3/8" | G 3/8" | G 3/8" |
| b3       | 25     | 25     | 28     | 36     | 36     | 48     | 62     | 70     | 70     | 80     | 80     | 100    | 100    | 115    |
| b4       | 35     | 35     | 40     | 50     | 50     | 65     | 90     | 100    | 100    | 110    | 110    | 130    | 130    | 150    |
| s2       | 8      | 8      | 8      | 9      | 9      | 11     | 14     | 16     | 16     | 20     | 20     | 25     | 25     | 35     |
| s3       | 16     | 16     | 16     | 20     | 20     | 20     | 26     | 26     | 26     | 26     | 26     | 32     | 32     | 32     |
| L2       | 35     | 35     | 40     | 46     | 48     | 52     | 63     | 70     | 75     | 82     | 91     | 96     | 114    | 125    |
| L3       | 15     | 15     | 17     | 23     | 27     | 37     | 44     | 52     | 52     | 55     | 55     | 70     | 70     | 80     |
| L4       | 10     | 10     | 12     | 14     | 16     | 22     | 26     | 32     | 32     | 35     | 35     | 45     | 45     | 55     |
| L5       | 5      | 5      | 5      | 9      | 11     | 15     | 18     | 20     | 20     | 20     | 20     | 25     | 25     | 25     |
| L11      | 18     | 18     | 22.5   | 24.5   | 25.5   | 28.5   | 35     | 40     | 44.5   | 48     | 55     | 55     | 69     | 78     |
| L22      | 6      | 6      | 6      | 25     | 26     | 31     | 33     | 38     | 39     | 43     | 46     | 52     | 55     | 60     |
| L23      | 16     | 16     | 16     | 36     | 37     | 40     | 48     | 51     | 52     | 54     | 57     | 67     | 70     | 71     |

### Functional type

### Length measurements L1v and length measurements L1h (with cover design As4)

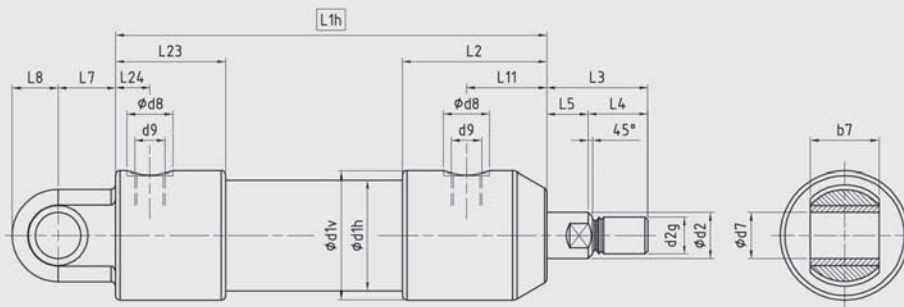
|             |                |      |      |    |     |     |     |     |     |     |     |     |     |     |     |
|-------------|----------------|------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>D</b>    | L1v = stroke + | 52.5 | 55.5 | 62 | 66  | 73  | 82  | 93  | 104 | 112 | 119 | 125 | 133 | 148 | 166 |
|             | L1h = stroke + | 62.5 | 65.5 | 72 | 77  | 84  | 91  | 108 | 117 | 125 | 130 | 136 | 148 | 163 | 177 |
| <b>E/Ez</b> | L1v = stroke + | 52.5 | 55.5 | 54 | 58  | 63  | 70  | 80  | 90  | 97  | 104 | 110 | 118 | 133 | 154 |
|             | L1h = stroke + | 62.5 | 65.5 | 64 | 69  | 74  | 79  | 95  | 103 | 110 | 115 | 121 | 133 | 148 | 165 |
| <b>Dbb</b>  | L1v = stroke + | -    | -    | -  | 100 | 113 | 130 | 147 | 165 | 169 | 182 | 188 | 211 | 226 | 248 |
|             | L1h = stroke + | -    | -    | -  | 111 | 124 | 139 | 162 | 178 | 182 | 182 | 188 | 211 | 226 | 248 |

### Minimum length measurements L1v and L1h

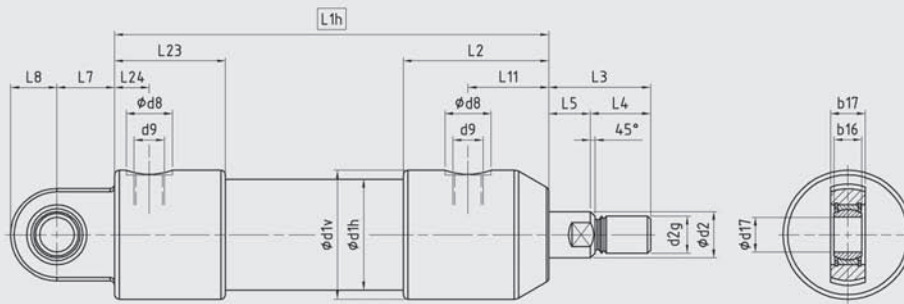
|       |   |   |   |    |    |    |     |     |     |     |     |     |     |     |
|-------|---|---|---|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|
| L1v = | - | - | - | 72 | 75 | 84 | 97  | 109 | 115 | 126 | 138 | 149 | 170 | 186 |
| L1h = | - | - | - | 83 | 86 | 93 | 112 | 122 | 128 | 137 | 149 | 164 | 185 | 197 |

## Dimension drawings/Dimensions

### Si Swivelling support with bronze sleeve



### Sk Hinged support with steel/steel swing bearing (piston $\varnothing$ 20-100 mm)



| Piston $\varnothing$   | 10                                     | 12.5   | 16     | 20     | 25     | 32     | 40     | 50     | 56     | 63     | 70     | 80     | 90     | 100    |     |
|------------------------|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|
| d1v                    | 24                                     | 24     | 28     | 32     | 36     | 45     | 56     | 68     | 78     | 85     | 90     | 105    | 116    | 130    |     |
| d1h                    | 16                                     | 18     | 22     | 25     | 30     | 38     | 48     | 60     | 68     | 75     | 80     | 90     | 105    | 115    |     |
| d2-f7                  | 6                                      | 6      | 8      | 10     | 12     | 16     | 20     | 25     | 25     | 32     | 32     | 40     | 40     | 50     |     |
| d2g                    | M5                                     | M5     | M6     | M8     | M10    | M14    | M16    | M20    | M20    | M24    | M24    | M33    | M33    | M42    |     |
| d7-H7                  | 7                                      | 7      | 8      | 10     | 12     | 16     | 20     | 25     | 25     | 32     | 32     | 40     | 40     | 50     |     |
| d8                     | 15                                     | 15     | 15     | 16     | 16     | 16     | 20     | 20     | 20     | 20     | 20     | 26     | 26     | 26     |     |
| d9                     | G 1/8"                                 | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/8" | G 1/4" | G 1/4" | G 1/4" | G 1/4" | G 1/4" | G 3/8" | G 3/8" | G 3/8" |     |
| d17-H7                 | -                                      | -      | -      | 8      | 10     | 12     | 15     | 20     | 20     | 25     | 25     | 35     | 35     | 40     |     |
| b7                     | 10                                     | 10     | 12     | 15     | 20     | 25     | 30     | 40     | 40     | 50     | 50     | 60     | 60     | 80     |     |
| b16                    | -                                      | -      | -      | 8      | 9      | 10     | 12     | 16     | 16     | 20     | 20     | 25     | 25     | 28     |     |
| b17                    | -                                      | -      | -      | 10     | 11     | 13     | 15     | 18     | 18     | 22     | 22     | 29     | 29     | 33     |     |
| L2                     | 35                                     | 35     | 40     | 46     | 48     | 52     | 63     | 70     | 75     | 82     | 91     | 96     | 114    | 125    |     |
| L3                     | 15                                     | 15     | 17     | 23     | 27     | 37     | 44     | 52     | 52     | 55     | 55     | 70     | 70     | 80     |     |
| L4                     | 10                                     | 10     | 12     | 14     | 16     | 22     | 26     | 32     | 32     | 35     | 35     | 45     | 45     | 55     |     |
| L5                     | 5                                      | 5      | 5      | 9      | 11     | 15     | 18     | 20     | 20     | 20     | 20     | 25     | 25     | 25     |     |
| L7                     | 10                                     | 10     | 12     | 14     | 17     | 20     | 25     | 30     | 30     | 40     | 40     | 50     | 50     | 60     |     |
| L8                     | 9                                      | 9      | 10     | 12     | 15     | 18     | 20     | 26     | 26     | 35     | 35     | 42     | 42     | 53     |     |
| L11                    | 18                                     | 18     | 22.5   | 24.5   | 25.5   | 28.5   | 35     | 40     | 44.5   | 48     | 55     | 55     | 69     | 78     |     |
| L23                    | 16                                     | 16     | 16     | 36     | 37     | 40     | 48     | 51     | 52     | 54     | 57     | 67     | 70     | 71     |     |
| L24                    | 8                                      | 8      | 8      | 12     | 12     | 12     | 15     | 15     | 16     | 16     | 16     | 19     | 19     | 19     |     |
| <b>Functional type</b> | <b>Length measurements L1h</b>         |        |        |        |        |        |        |        |        |        |        |        |        |        |     |
| <b>D</b>               | L1h = stroke +                         | 62.5   | 65.5   | 72     | 77     | 84     | 91     | 108    | 117    | 125    | 130    | 136    | 148    | 163    | 177 |
| <b>E/Ez</b>            | L1h = stroke +                         | 62.5   | 65.5   | 64     | 69     | 74     | 79     | 95     | 103    | 110    | 115    | 121    | 133    | 148    | 165 |
| <b>Dbb</b>             | L1h = stroke +                         | -      | -      | -      | 111    | 124    | 139    | 162    | 178    | 182    | 182    | 188    | 211    | 226    | 248 |
|                        | <b>Minimum length measurements L1h</b> |        |        |        |        |        |        |        |        |        |        |        |        |        |     |
|                        | L1h =                                  | -      | -      | -      | 83     | 86     | 93     | 112    | 122    | 128    | 137    | 149    | 164    | 185    | 197 |