Elasto-Fluid Shock Absorbers

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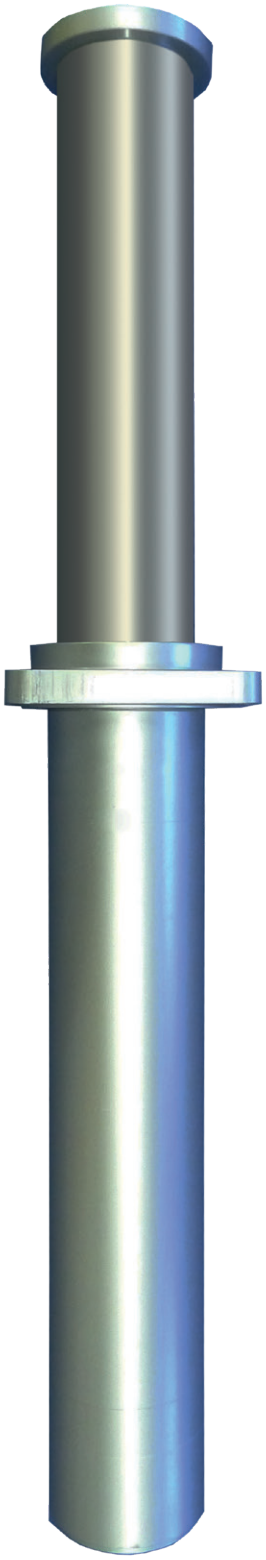
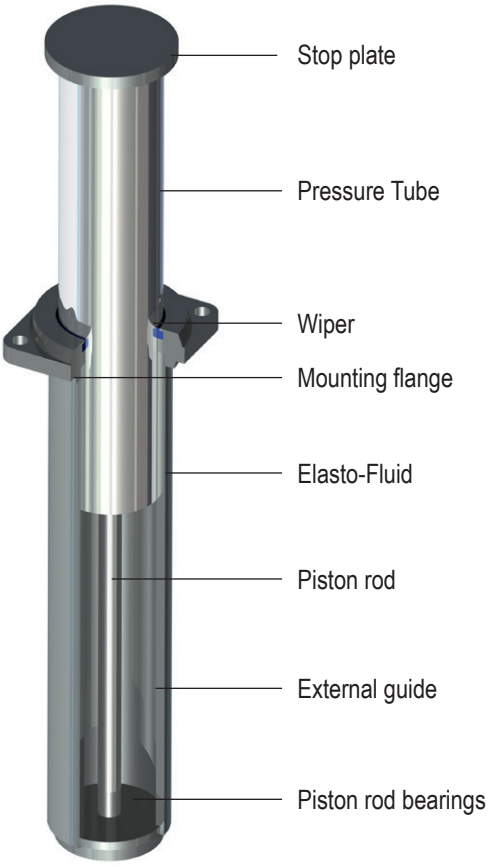
RANKIN
COMPONENTS THAT AUTOMATE

WES



Damping medium	High-viscosity elastomer
Energy absorption	Max. 1.000.000 Nm Max. 8850800 in lbs
Surface protection	Pressure tube zinc plated / Housing painted
Deceleration	Progressive, customer specific
Temperature	-10°C - +60°C (14°F - +140°F)
RoHS compliant	Directive 2002/95/EG
Applications	Sluices, Flight simulators, Metal industry

Operating Principle



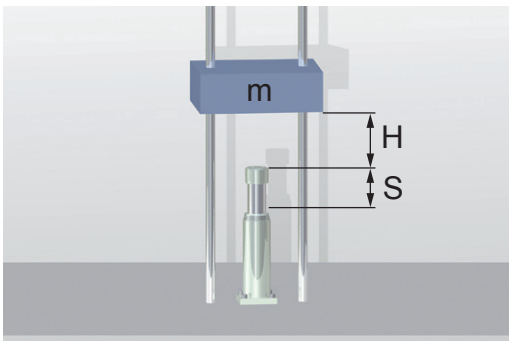
Shock absorbers and springs of series WES have been developed based on the principle of the hydrostatic compression of visco-elastic fluids. Two characteristics are taken advantage of: compressibility and viscosity - this means that in a product the dual function of a shock absorber and a spring can be used or each function can be used separately.

Shock absorber:
The weight is cushioned by the fluid friction in the throttling port of the piston head and/or in the annular clearance between piston and reservoir.

Spring:
The spring effect is generated by the compressibility of the visco-elastic fluid, which can amount to up to 15% on volume.

Resetting of the piston rod is effected by the slackening of the compressed visco-elastic fluid.

A FALLING MASS



Example

m = 5000 kg
H = 0,2 m
S_k = 0,105 m
X = 5/h
n = 1

Formulae & Calculation

$W_k = m \cdot g \cdot H = 9{,}81$ kNm
$W_A = m \cdot g \cdot S_k = 5{,}16$ kNm
$W_{kg} = W_k + W_A = 14{,}97$ kNm
$W_{kg/h} = W_{kg} \cdot X = 74{,}85$ kNm/h

WES-1 / WES-5

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}(0{,}03\ V_e + 0{,}24)}} + 1{,}36 - 1{,}17 \right) = 70 \text{ mm}$$

WES-6 / WES-8

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}(0{,}027\ V_e + 0{,}22)}} + 1{,}83 - 1{,}35 \right)$$

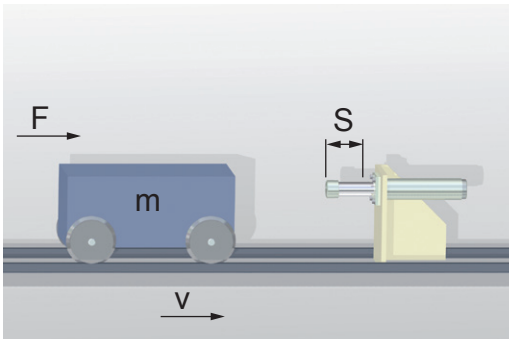
$$F_{Ge} = \left[\left(\frac{F_{Gmax} - F_{Gmin}}{S_k} \right) \times S_e + F_{Gmin} \right] (0{,}1\ V_e + 0{,}8) = 261 \text{ kN}$$

Selection

WES-5-25-105

B LOAD AGAINST SOLID STOP WITHOUT PROPELLING FORCE

C1 LOAD AGAINST SOLID STOP WITH PROPELLING FORCE



Example

m = 200 kg
v = 1,5 m/s
F = 2.000 N
S_k = 0,022 m
X = 10/h
n = 1

Formulae & Calculation

$$W_k = \frac{m \cdot v^2}{2} = 0{,}225 \text{ kNm}$$

with propelling force

$W_A = F \cdot S_k = 0{,}044$ kNm
$W_{kg} = (W_k + W_A) : n = 0{,}27$ kNm
$W_{kg/h} = W_{kg} \cdot X = 2{,}7$ kNm/h
$v_e = v$

WES-1 / WES-5

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}(0{,}03\ V_e + 0{,}24)}} + 1{,}36 - 1{,}17 \right) = 16 \text{ mm}$$

WES-6 / WES-8

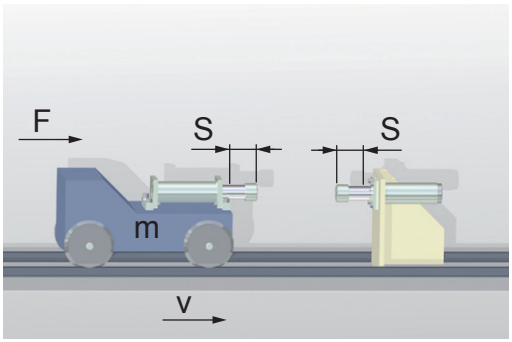
$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}(0{,}027\ V_e + 0{,}22)}} + 1{,}83 - 1{,}35 \right)$$

$$F_{Ge} = \left[\left(\frac{F_{Gmax} - F_{Gmin}}{S_k} \right) \times S_e + F_{Gmin} \right] (0{,}1\ V_e + 0{,}8) = 22{,}1 \text{ kN}$$

Selection

WES-1-35

J LOAD AGAINST SOLID STOP WITH SHOCK ABSORBERS



Example

m = 10.000 kg
v = 2,6 m/s
F = 4.000 N
X = 2/h
S_k = 0,2 m

Formulae & Calculation

$$W_k = \frac{m \cdot v^2}{2} : 2 = 16{,}9 \text{ kNm}$$

with propelling force

$W_A = F \cdot S_k = 0{,}8$ kNm
$W_{kg} = W_k + W_A = 17{,}7$ kNm
$W_{kg/h} = W_{kg} \cdot X = 35{,}4$ kNm/h
$v_e = v / 2 = 1{,}3$ m/s

WES-1 / WES-5

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}(0{,}03\ V_e + 0{,}24)}} + 1{,}36 - 1{,}17 \right)$$

WES-6 / WES-8

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}(0{,}027\ V_e + 0{,}22)}} + 1{,}83 - 1{,}35 \right) = 159 \text{ mm}$$

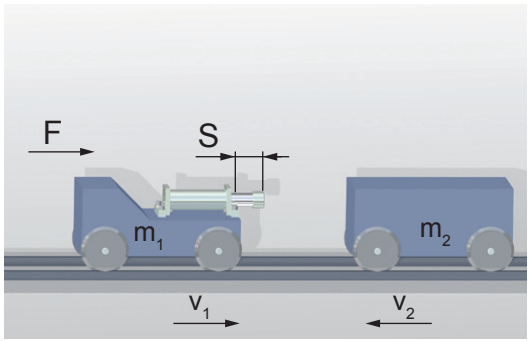
$$F_{Ge} = \left[\left(\frac{F_{Gmax} - F_{Gmin}}{S_k} \right) \times S_e + F_{Gmin} \right] (0{,}1\ V_e + 0{,}8) = 129 \text{ kN}$$

Selection

WES-6-25-200

Selection

K LOAD AGAINST LOAD WITH ONE SHOCK ABSORBER



Example

m1 = 20.000 kg
v1 = 1,7 m/s
m2 = 30.000 kg
v2 = 1,7 m/s
F = 20.000 N
X = 2/h
S_k = 0,4 m

Formulae & Calculation

$$W_k = \frac{(m1 \cdot m2) \cdot (v1 + v2)^2}{2\,(m1 + m2)} = 69{,}4\ \text{kNm}$$

with propelling force

$$W_A = F \cdot S_k = 8\ \text{kNm}$$

$$W_{kg} = W_k + W_A = 77{,}4\ \text{kNm}$$

$$W_{kg/h} = W_{kg} \cdot X = 154{,}8\ \text{Nm/h}$$

$$v_e = v1 + v2 = 3{,}4\ \text{m/s}$$

WES-1 / WES-5

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}\,(0{,}03\,V_e + 0{,}24)}} + 1{,}36 - 1{,}17 \right)$$

WES-6 / WES-8

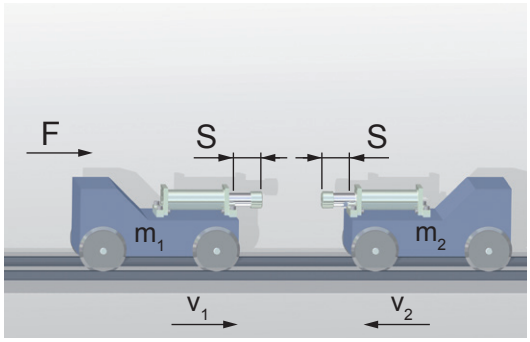
$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}\,(0{,}027\,V_e + 0{,}22)}} + 1{,}83 - 1{,}35 \right) = 291\ \text{mm}$$

$$F_{Ge} = \left[\left(\frac{F_{Gmax} - F_{Gmin}}{S_k} \right) x\, S_e + F_{Gmin} \right] (0{,}1\,V_e + 0{,}8) = 316\ \text{kN}$$

Selection

WES-8-100-400

L LOAD AGAINST LOAD WITH SHOCK ABSORBERS



Example

m1 = 5.000 kg
v1 = 1,2 m/s
m2 = 10.000 kg
v2 = 1,5 m/s
X = 2/h
S_k = 0,2 m

Formulae & Calculation

$$W_k = \frac{(m1 \cdot m2) \cdot (v1 + v2)^2}{4\,(m1 + m2)} = 6{,}1\ \text{kNm}$$

with propelling force

$$W_A = F \cdot S_k$$

$$W_{kg} = W_k + W_A$$

$$W_{kg/h} = W_{kg} \cdot X = 12{,}2\ \text{kNm/h}$$

$$v_e = (v1 + v2) / 2 = 1{,}35\ \text{m/s}$$

WES-1 / WES-5

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}\,(0{,}03\,V_e + 0{,}24)}} + 1{,}36 - 1{,}17 \right)$$

WES-6 / WES-8

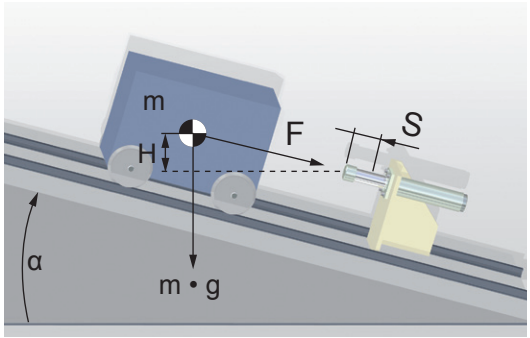
$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}\,(0{,}027\,V_e + 0{,}22)}} + 1{,}83 - 1{,}35 \right) = 120\ \text{mm}$$

$$F_{Ge} = \left[\left(\frac{F_{Gmax} - F_{Gmin}}{S_k} \right) x\, S_e + F_{Gmin} \right] (0{,}1\,V_e + 0{,}8) = 59\ \text{kN}$$

Selection

WES-6-12-200

F LOAD ON INCLINE



Example

m = 35.000 kg
H = 0,3 m
α = 10°
S_k = 0,5
X = 2/h
n = 1

Formulae & Calculation

$$W_k = m \cdot g \cdot H = 103\ \text{kNm}$$

$$W_A = m \cdot g \cdot \sin\alpha \cdot S_k = 29{,}8\ \text{kNm}$$

$$W_{kg} = W_k + W_A = 132{,}8\ \text{kNm}$$

$$W_{kg/h} = W_{kg} \cdot X = 265{,}6\ \text{kNm/h}$$

$$v = v_e = \sqrt{2 \cdot g \cdot H}$$

WES-1 / WES-5

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}\,(0{,}03\,V_e + 0{,}24)}} + 1{,}36 - 1{,}17 \right)$$

WES-6 / WES-8

$$S_e = S_k \left(\sqrt{\frac{W_{kg}}{W_{kk}\,(0{,}027\,V_e + 0{,}22)}} + 1{,}83 - 1{,}35 \right) = 435\ \text{mm}$$

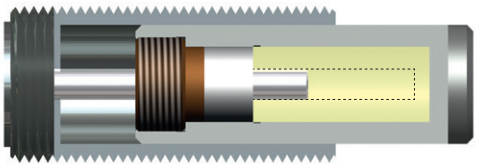
$$F_{Ge} = \left[\left(\frac{F_{Gmax} - F_{Gmin}}{S_k} \right) x\, S_e + F_{Gmin} \right] (0{,}1\,V_e + 0{,}8) = 371\ \text{kN}$$

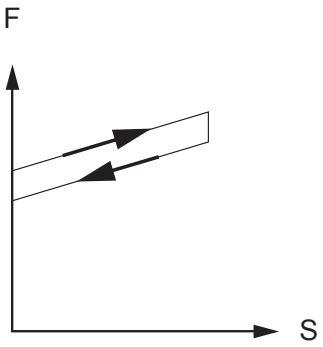
Selection

WES-8-150-500

Online calculation (imperial / metric) at www.weforma.com

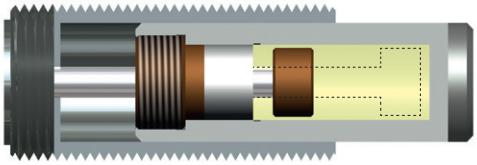
Pre-stressed elasto-fluid spring

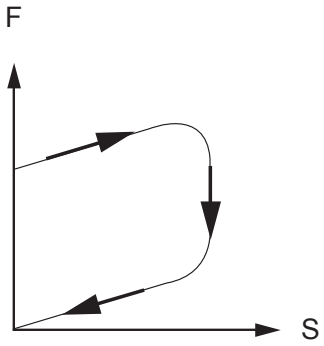




$F = F0 + KS$

Pre-stressed elasto-fluid damper and spring





$F = F0 + KS + CV^x$
$x: 0,1 < x < 0,2$

Shock absorber without resetting

$F = CV^x$
$x: 0,1 < x < 0,4$

F0	Static prestrain
K	Static rigidity
S	Stroke
C: kN (m/s)^x	Velocity coefficient
V	Velocity
X	0.1 to 0.4

LEGEND

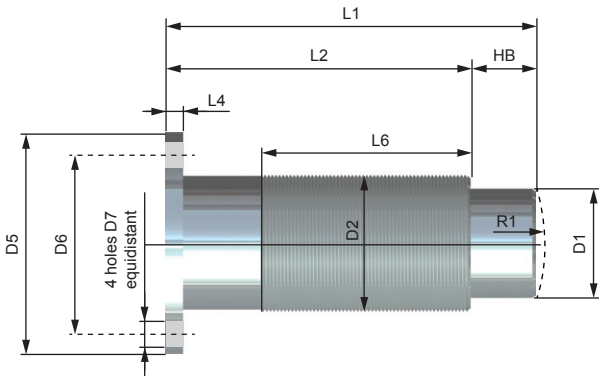
W_k	(kNm)	Kinetic energy
W_A	(kNm)	Propelling force energy
W_{kg}	(kNm)	Total energy / $W_k + W_A$
$W_{kg/h}$	(kNm/h)	Total energy per hour
W_{kk}	(kNm/h)	Energy absorption according to catalogue
m	(kg)	Mass
me	(kg)	Effective mass

v	(m/s)	Impact speed
v_e	(m/s)	Effective speed
X	(1/h)	Number of strokes per hour
S_k	(mm)	Stroke
S_e	(mm)	Effective stroke
F	(N)	Propelling force
H	(m)	Height

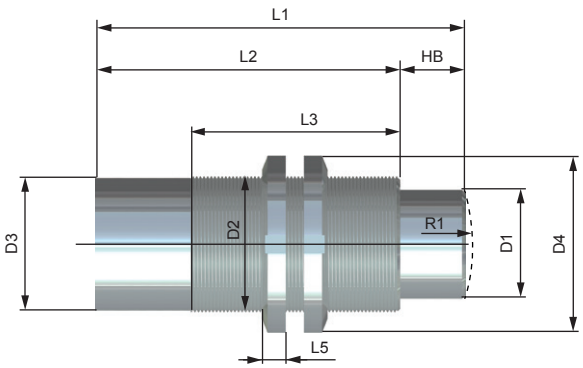
g	(m/s^2)	Accerelation due to gravity (9,81 m/s^2)
α	(°)	Angle
a	(m/s^2)	Acceleration/Deceleration
t	(s)	Deceleration time
$F_{G\,min}$	(kN)	Min counterforce according to catalogue
$F_{G\,max}$	(N)	Max counterforce according to catalogue
F_{Ge}	(N)	Effective counterforce

WES-1

WES with Flange: F



WES with lock nuts: Standard

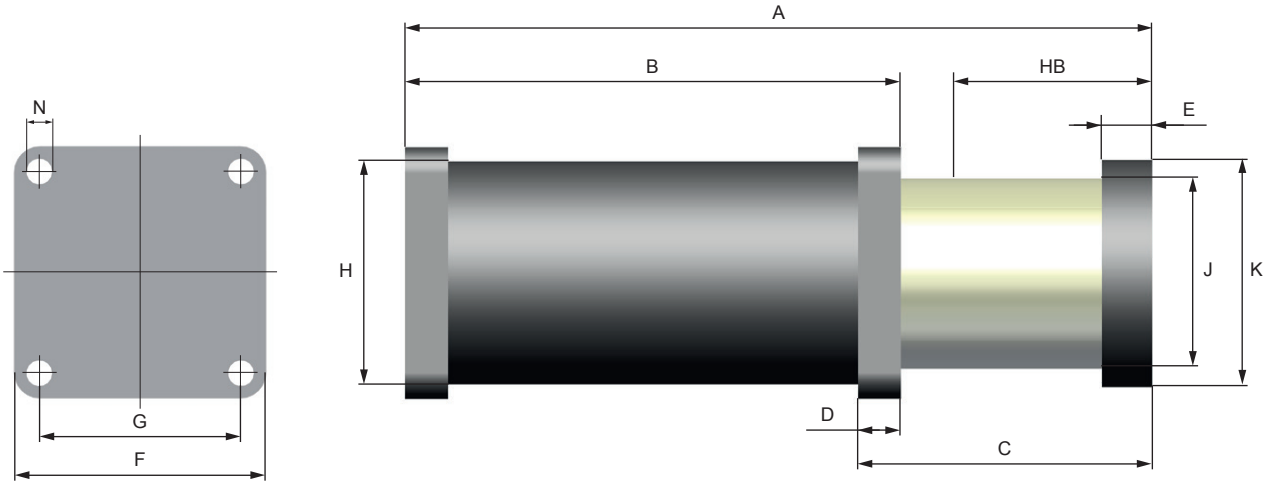


DIMENSIONS

	L1	L2	L3	L4	L5	L6	R1	Ø D1	D2	Ø D3	Ø D4	Ø D5	Ø D6	Ø D7
	mm (inch)													
WES-1-25	75 (2.95)	53 (2.09)	52 (2.05)	10 (0.39)	7 (0.28)	43 (1.69)	-	19 (0.75)	M25x1,5	20 (0.79)	38 (1.5)	57 (2.24)	41 (1.61)	7 (0.28)
WES-1-35	120 (4.72)	98 (3.86)	96 (3.78)	12 (0.47)	8 (0.31)	86 (3.39)	-	25 (0.98)	M35x1,5	32 (1.26)	52 (2.05)	80 (3.15)	60 (2.36)	9 (0.35)
WES-1-40	120 (4.72)	98 (3.86)	96 (3.78)	12 (0.47)	9 (0.35)	-	-	25 (0.98)	M40x1,5	32 (1.26)	56 (2.2)	-	-	-
WES-1-50-1	175 (6.89)	140 (5.51)	138 (5.43)	12 (0.47)	11 (0.43)	128 (5.04)	-	38 (1.5)	M50x1,5	45 (1.77)	70 (2.76)	90 (3.54)	70 (2.76)	9 (0.35)
WES-1-50-2	175 (6.89)	140 (5.51)	138 (5.43)	12 (0.47)	11 (0.43)	128 (5.04)	-	38 (1.5)	M50x1,5	45 (1.77)	70 (2.76)	106 (4.17)	85 (3.35)	11 (0.43)
WES-1-60	175 (6.89)	140 (5.51)	138 (5.43)	12 (0.47)	11 (0.43)	-	-	38 (1.5)	M60x2	45 (1.77)	81 (3.19)	-	-	-
WES-1-75	213 (8.39)	168 (6.61)	158 (6.22)	10 (0.39)	13 (0.51)	158 (6.22)	130 (5.12)	60 (2.36)	M75x2	72 (2.83)	98 (3.86)	122 (4.8)	100 (3.94)	11 (0.43)
WES-1-90	270 (10.63)	210 (8.27)	130 (5.12)	12 (0.47)	16 (0.63)	130 (5.12)	150 (5.91)	74,5 (2.93)	M90x2	90 (3.54)	120 (4.72)	150 (5.91)	120 (4.72)	13 (0.51)
WES-1-110	337 (13.27)	257 (10.12)	145 (5.71)	14 (0.55)	19 (0.75)	145 (5.71)	350 (13.78)	90 (3.54)	M110x2	110 (4.33)	145 (5.71)	175 (6.89)	143 (5.63)	18 (0.71)

PERFORMANCE

	Thread	Stroke (HB)	Energy absorption		Counterforce		V
		mm (inch)	kNm (lbf ft)	kNm / h (lbf ft / h)	FG min kN (FG min lbf)	FG max kN (FG max lbf)	max m/s (max ft/s)
WES-1-25	M 25x1,5	12 (0.47)	0,1 (74)	2,5 (1844)	6 (1349)	11 (2473)	2 (6.56)
WES-1-35	M 35x1,5	22 (0.87)	0,43 (317)	10,75 (7929)	14 (3147)	27 (6070)	4 (13.12)
WES-1-40	M 40x1,5	22 (0.87)	0,43 (317)	10,75 (7929)	14 (3147)	27 (6070)	5 (16.4)
WES-1-50-1 / WES-1-50-2	M 50x1,5	35 (1.38)	1,5 (1106)	37,5 (27659)	28 (6295)	60 (13489)	5 (16.4)
WES-1-60	M 60x2	35 (1.38)	1,5 (1106)	37,5 (27659)	28 (6295)	60 (13489)	5 (16.4)
WES-1-75	M 75x2	45 (1.77)	3,4 (2508)	85 (62693)	45 (10116)	100 (22481)	5 (16.4)
WES-1-90	M 90x2	60 (2.36)	7 (5163)	175 (129073)	90 (20233)	150 (33721)	5 (16.4)
WES-1-110	M 110x2	80 (3.15)	14 (10326)	350 (258147)	130 (29225)	230 (51706)	5 (16.4)



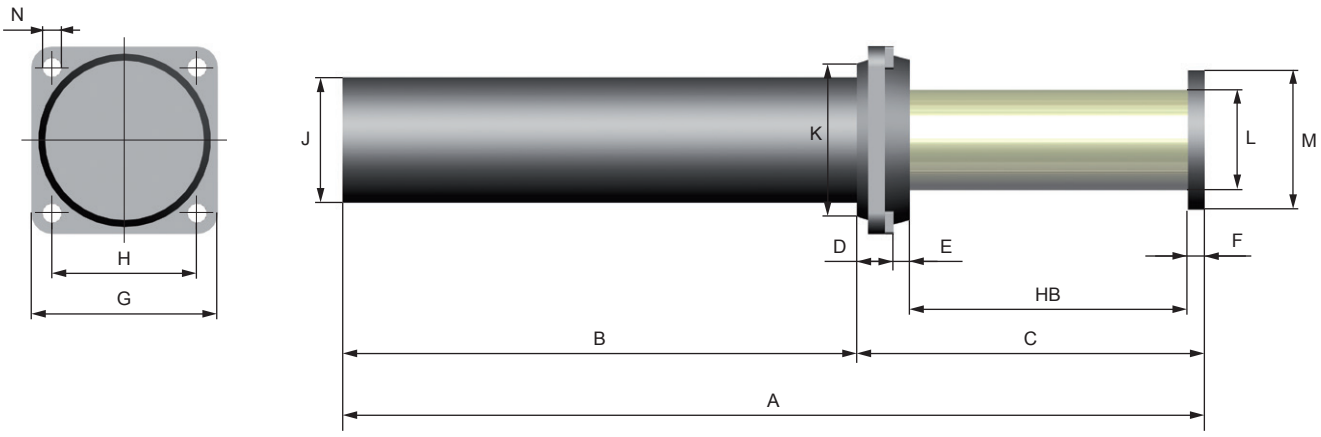
DIMENSIONS

	A	B	C	D	E	F	G	Ø H	Ø J	Ø K	Ø N
	mm (inch)										
WES-5-25-105	415 (16.34)	295 (11.61)	140 (5.51)	20 (0.79)	15 (0.59)	135 (5.31)	105 (4.13)	116 (4.57)	87 (3.43)	120 (4.72)	14 (0.55)
WES-5-50-120	500 (19.69)	350 (13.78)	175 (6.89)	25 (0.98)	30 (1.18)	155 (6.1)	125 (4.92)	142 (5.59)	115 (4.53)	138 (5.43)	15 (0.59)
WES-5-75-140	520 (20.47)	345 (13.58)	205 (8.07)	30 (1.18)	35 (1.38)	175 (6.89)	140 (5.51)	160 (6.3)	132 (5.2)	158 (6.22)	18 (0.71)
WES-5-100-160	585 (23.03)	385 (15.16)	235 (9.25)	35 (1.38)	40 (1.57)	215 (8.46)	170 (6.69)	180 (7.09)	153 (6.02)	185 (7.28)	22 (0.87)
WES-5-100-180	670 (26.38)	445 (17.52)	265 (10.43)	40 (1.57)	45 (1.77)	250 (9.84)	195 (7.68)	215 (8.46)	182 (7.17)	220 (8.66)	26 (1.02)

PERFORMANCE

	Stroke (HB)	Energy absorption		Counterforce		V	Weight
	mm (inch)	kNm (lbf ft)	kNm / h (lbf ft / h)	FG min kN (FG min lbf)	FG max kN (FG max lbf)	max m/s (max ft/s)	kg
WES-5-25-105	105 (4.13)	25 (18439)	475 (350342)	167 (37543)	310 (69691)	2 (6.56)	25 (55)
WES-5-50-120	120 (4.72)	50 (36878)	950 (700684)	310 (69691)	450 (101164)	4 (13.12)	40 (88)
WES-5-75-140	140 (5.51)	75 (55317)	1425 (1051026)	400 (89924)	700 (157366)	5 (16.4)	45 (99)
WES-5-100-160	160 (6.3)	100 (73756)	1900 (1401368)	470 (105660)	820 (184343)	5 (16.4)	73 (161)
WES-5-100-180	180 (7.09)	150 (110634)	2850 (2102052)	640 (143878)	1100 (247290)	5 (16.4)	117 (258)

WES-6

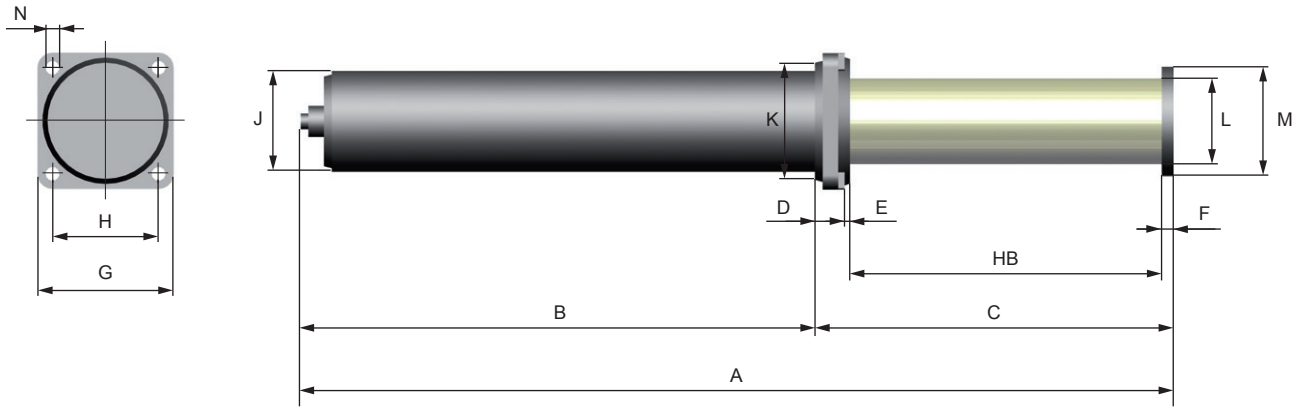


DIMENSIONS

	A	B	C	D	E	F	G	H	Ø J	Ø K	Ø L	Ø M	N
	mm (inch)												
WES-6-6-150	410 (16.14)	231 (9.09)	179 (7.05)	19 (0.75)	0 (0)	10 (0.39)	90 (3.54)	70 (2.76)	50 (1.97)	90 (3.54)	38 (1.5)	50 (1.97)	9 (0.35)
WES-6-12-150	480 (18.9)	285 (11.22)	195 (7.68)	18 (0.71)	15 (0.59)	12 (0.47)	110 (4.33)	85 (3.35)	75 (2.95)	90 (3.54)	57 (2.24)	80 (3.15)	11 (0.43)
WES-6-12-200	530 (20.87)	285 (11.22)	245 (9.65)	18 (0.71)	15 (0.59)	12 (0.47)	110 (4.33)	85 (3.35)	75 (2.95)	90 (3.54)	57 (2.24)	80 (3.15)	11 (0.43)
WES-6-25-200	620 (24.41)	370 (14.57)	250 (9.84)	20 (0.79)	18 (0.71)	12 (0.47)	135 (5.31)	105 (4.13)	90 (3.54)	110 (4.33)	72 (2.83)	100 (3.94)	14 (0.55)
WES-6-25-270	690 (27.17)	370 (14.57)	320 (12.6)	20 (0.79)	18 (0.71)	12 (0.47)	175 (6.89)	105 (4.13)	90 (3.54)	110 (4.33)	72 (2.83)	100 (3.94)	14 (0.55)
WES-6-50-275	855 (33.66)	520 (20.47)	335 (13.19)	25 (0.98)	20 (0.79)	15 (0.59)	175 (6.89)	140 (5.51)	110 (4.33)	150 (5.91)	87 (3.43)	120 (4.72)	18 (0.71)
WES-6-50-400	980 (38.58)	520 (20.47)	460 (18.11)	25 (0.98)	20 (0.79)	15 (0.59)	175 (6.89)	140 (5.51)	110 (4.33)	150 (5.91)	87 (3.43)	120 (4.72)	18 (0.71)
WES-6-100-400	1370 (53.94)	910 (35.83)	460 (18.11)	25 (0.98)	20 (0.79)	15 (0.59)	175 (6.89)	140 (5.51)	110 (4.33)	150 (5.91)	87 (3.43)	120 (4.72)	18 (0.71)
WES-6-100-600	1570 (61.81)	910 (35.83)	660 (25.98)	25 (0.98)	20 (0.79)	15 (0.59)	175 (6.89)	140 (5.51)	110 (4.33)	150 (5.91)	87 (3.43)	120 (4.72)	18 (0.71)
WES-6-150-800	2640 (103.94)	1780 (70.08)	860 (33.86)	25 (0.98)	20 (0.79)	15 (0.59)	175 (6.89)	140 (5.51)	110 (4.33)	150 (5.91)	87 (3.43)	120 (4.72)	18 (0.71)

PERFORMANCE

	Stroke (HB)	Energy absorption		Counterforce		V	Weight
	mm (inch)	kNm (lbf ft)	kNm / h (lbf ft / h)	FG min kN (FG min lbf)	FG max kN (FG max lbf)	max m/s (max ft/s)	kg (lbs)
WES-6-6-150	150 (5.91)	6 (4425)	60 (44254)	25 (5620)	50 (11240)	3 (9.84)	4,2 (9)
WES-6-12-150	150 (5.91)	12 (8851)	120 (88507)	66 (14837)	100 (22481)	3 (9.84)	11 (24)
WES-6-12-200	200 (7.87)	12 (8851)	120 (88507)	42 (9442)	78 (17535)	3 (9.84)	11 (24)
WES-6-25-200	200 (7.87)	25 (18439)	250 (184391)	95 (21357)	150 (33721)	3 (9.84)	20 (44)
WES-6-25-270	270 (10.63)	25 (18439)	250 (184391)	66 (14837)	112 (25179)	3 (9.84)	25 (55)
WES-6-50-275	275 (10.83)	50 (36878)	500 (368781)	118 (26527)	230 (51706)	3 (9.84)	40 (88)
WES-6-50-400	400 (15.75)	50 (36878)	500 (368781)	75 (16861)	150 (33721)	3 (9.84)	40 (88)
WES-6-100-400	400 (15.75)	100 (73756)	1000 (737562)	175 (39342)	320 (71939)	3 (9.84)	65 (143)
WES-6-100-600	600 (23.62)	100 (73756)	1000 (737562)	85 (19109)	230 (51706)	3 (9.84)	65 (143)
WES-6-150-800	800 (31,50)	150 (110634)	1500 (1106343)	80 (17985)	250 (56202)	3 (9.84)	115 (254)



DIMENSIONS

	A	B	C	D	E	F	G	H	Ø J	Ø K	Ø L	Ø M	N
	mm (inch)												
WES-8-100-400	1120 (44.09)	660 (25.98)	460 (18.11)	25 (0.98)	20 (0.79)	15 (0.59)	175 (6.89)	140 (5.51)	130 (5.12)	150 (5.91)	110 (4.33)	140 (5.51)	18 (0.71)
WES-8-150-500	1350 (53.15)	775 (30.51)	575 (22.64)	30 (1.18)	25 (0.98)	20 (0.79)	215 (8.46)	170 (6.69)	140 (5.51)	185 (7.28)	120 (4.72)	150 (5.91)	22 (0.87)
WES-8-220-400	1258 (49.53)	783 (30.83)	475 (18.7)	30 (1.18)	25 (0.98)	20 (0.79)	215 (8.46)	170 (6.69)	140 (5.51)	185 (7.28)	120 (4.72)	150 (5.91)	22 (0.87)
WES-8-250-650	1750 (68.9)	1025 (40.35)	725 (28.54)	30 (1.18)	25 (0.98)	20 (0.79)	215 (8.46)	170 (6.69)	155 (6.1)	185 (7.28)	135 (5.31)	170 (6.69)	22 (0.87)
WES-8-400-850	2185 (86.02)	1250 (49.21)	935 (36.81)	35 (1.38)	25 (0.98)	25 (0.98)	265 (10.43)	210 (8.27)	175 (6.89)	235 (9.25)	150 (5.91)	190 (7.48)	27 (1.06)
WES-8-600-1050	2555 (100.59)	1420 (55.91)	1135 (44.69)	35 (1.38)	25 (0.98)	25 (0.98)	265 (10.43)	210 (8.27)	200 (7.87)	235 (9.25)	175 (6.89)	215 (8.46)	27 (1.06)
WES-8-800-1200	2935 (115.55)	1630 (64.17)	1305 (51.38)	40 (1.57)	35 (1.38)	30 (1.18)	300 (11.81)	240 (9.45)	220 (8.66)	270 (10.63)	190 (7.48)	235 (9.25)	30 (1.18)
WES-8-1000-1300	3225 (126.97)	1820 (71.65)	1405 (55.31)	40 (1.57)	35 (1.38)	30 (1.18)	300 (11.81)	240 (9.45)	230 (9.06)	270 (10.63)	205 (8.07)	248 (9.76)	30 (1.18)

PERFORMANCE

	Stroke (HB)	Energy absorption		Counterforce		V	Weight
	mm (inch)	kNm (lbf ft)	kNm / h (lbf ft / h)	FG min kN (FG min lbf)	FG max kN (FG max lbf)	max m/s (max ft/s)	kg (lbs)
WES-8-100-400	400 (15.75)	100 (73756)	1000 (737562)	190 (42714)	310 (69691)	3 (9.84)	63 (139)
WES-8-150-500	500 (19.69)	150 (110634)	1500 (1106343)	200 (44962)	380 (85427)	3 (9.84)	90 (198)
WES-8-220-400	400 (15.75)	220 (162264)	2200 (1622637)	380 (85427)	685 (153994)	3 (9.84)	100 (220)
WES-8-250-650	650 (25.59)	250 (184391)	2500 (1843905)	270 (60698)	490 (110156)	3 (9.84)	135 (298)
WES-8-400-850	850 (33.46)	400 (295025)	4000 (2950240)	330 (74187)	600 (134885)	3 (9.84)	218 (481)
WES-8-600-1050	1050 (41.34)	600 (442537)	6000 (4425360)	370 (83179)	740 (166359)	3 (9.84)	295 (650)
WES-8-800-1200	1200 (47.24)	800 (590050)	8000 (5900480)	430 (96668)	860 (193336)	3 (9.84)	420 (926)
WES-8-1000-1300	1300 (51.18)	1000 (737562)	10000 (7375600)	500 (112404)	1000 (224809)	3 (9.84)	470 (1036)

WES-F

- Very small construction size
- Good reproducibility of characteristics
- Simple assembly
- No adjustment

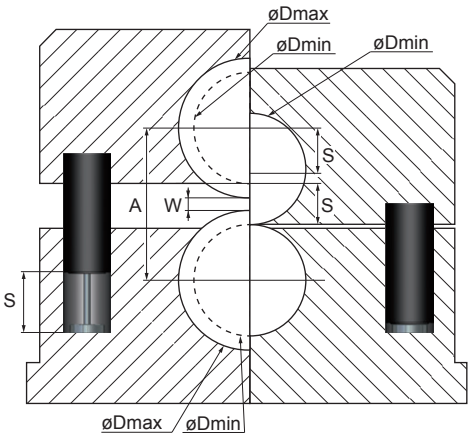
OPERATING PRINCIPLE

Elasto-Fluid springs of production series WES-F take advantage of the compressibility of the pre-stressed Elasto-Fluid.

If an Elasto-Fluid spring is loaded with an axial force F, the piston rod and/or the piston penetrates into the pre-stressed Elasto-Fluid. This further increases the pressure. If force F is reduced, the Elasto-Fluid relaxes and returns the piston / piston rod to the starting position.

This technique is used among other things in the rolling mills of cold and hot steel mills. The upper roller inc. attachments is borne by 2 and/ or 4 Elasto-Fluid springs of production series WES-F. With the help of hydraulics, the upper roller can be lowered to the desired roll gap. The Elasto-Fluid springs retract accordingly and hold the upper roller in position. If the upper roller is unburdened, the Elasto-Fluid relaxes and returns the roller to the starting position.

As an additional function, the Elasto-Fluid springs can serve as pistons and be used for roller bending. Elasto-Fluid springs of production series WES-F are based on standard designs, modified and adapted to meet customer requirements.



STROKE CALCULATION

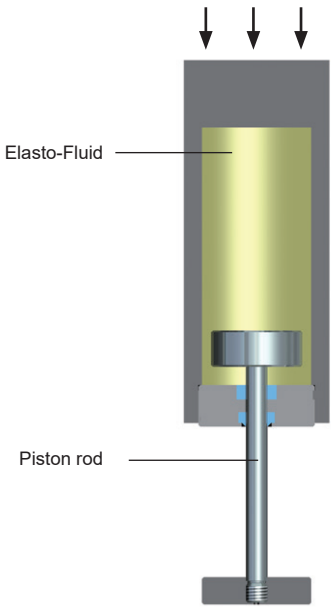
S = A - Dmin + Reserve (reserve)

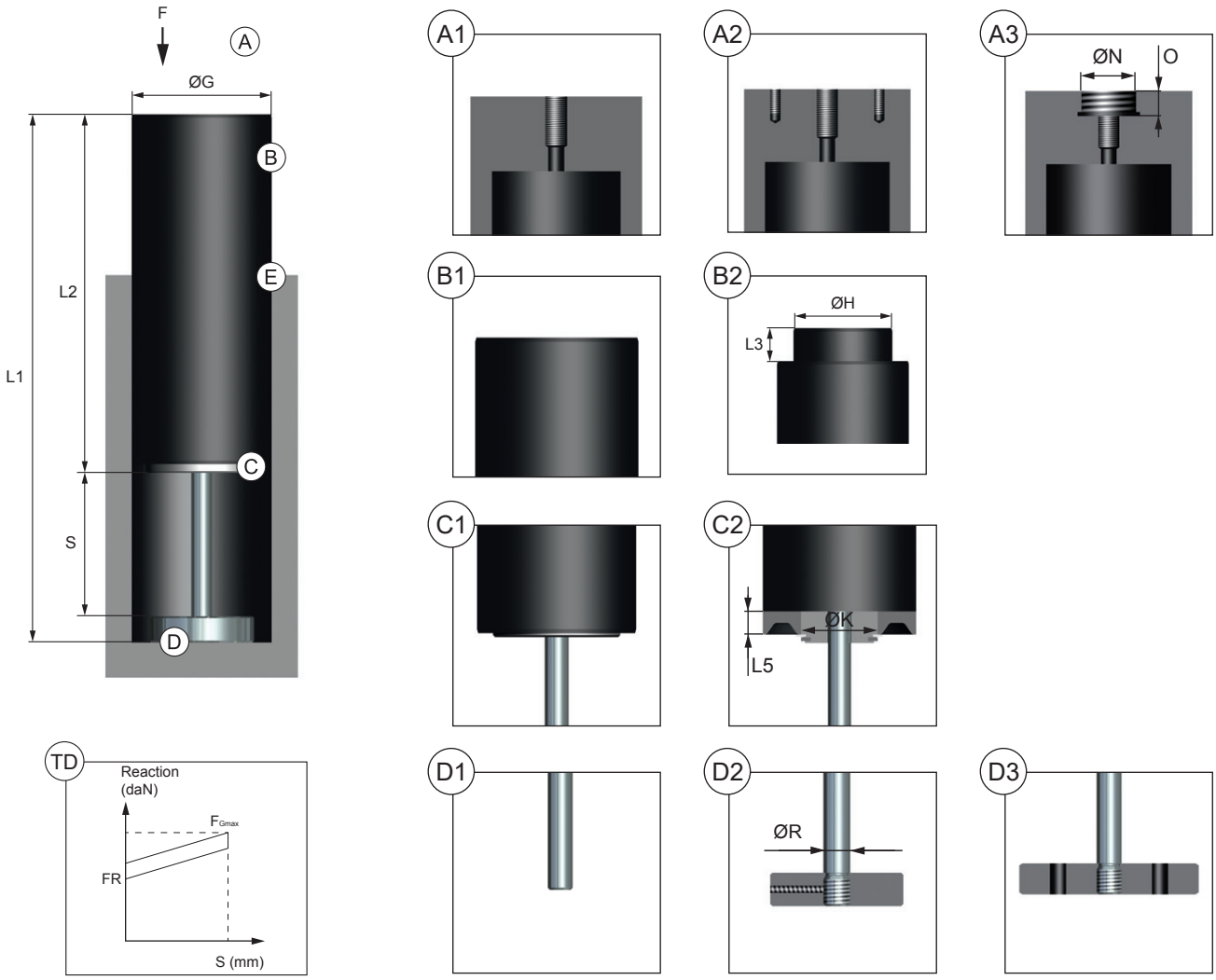
S = Dmax - Dmin + W + Reserve (reserve)

RETURN FORCE CALCULATION

F_R = F/n x 1,1

S	(mm)	Stroke
A	(mm)	Axis center distance
F	(kN)	Weight of the total upper roll construction
W	(mm)	Roll gap
n		Numbers of springs per roll stand
F_R	(kN)	Return force per sping
D_{max}	(mm)	Roll fully extended
D_{min}	(mm)	Roll total compressed





Information required from the customer

A	Housing bottom		Example
A1	Standard filling port		A1
	Connection thread	N	
	Depth	O	
A2	Filling port + Tapped bores		
A3	Filling port + Tapping		

B	Housing design		
B1	Housing (standard)		
B2	Housing with connection		B2
	Connection height	L3	210
	Connection diameter	ØH	62

C	Housing front design		
C1	Standard		C1
C2	Seals for hydraulic connection		
	Connectin heigth	L5	
	Connection diameter	ØK	

D	Piston rod design		
D1	Standard		D1
D2	Additional use as hydraulic cylinder	ØR	
D3	Additional use as hydraulic cylinder		

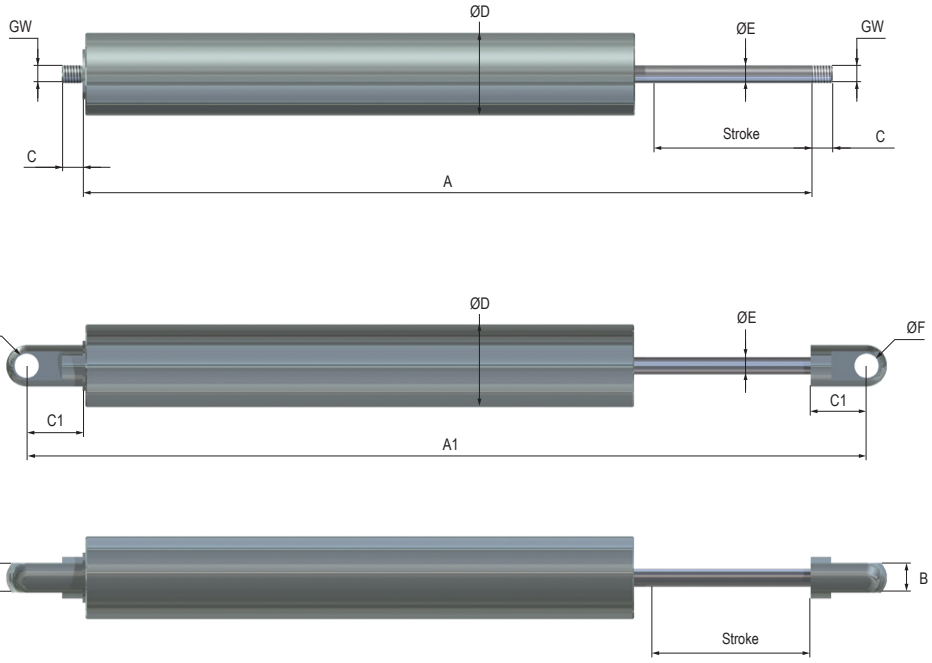
E	Surface protection for the housing		
E1	No protection (standard)		E1
E2	Zinc plated		
E3	Hard chrome plated		

Final Design Data - for confirmation by Weforma

	Dimensions		Example
	Total length (mm)	L1	350
	Housing length (mm)	L2	320
	Housing diameter (mm)	ØG	70
TD	Technical data		
	Return force (kN)	FR	15
	Max. Counterforce (FG kN)	FG	23
	Stroke (mm)	S	30

WES-G

Damping medium	Elasto-Fluid
High extension force	up to 6400 N up to 1438 lbs
Extended Life Time	Housing: zinc plated Piston rod: stainless steel
RoHS compliant	Directive 2002/95/EG
Applications	Heavy flaps, covers and lids Extension to gas spring WM-G28



DIMENSIONS

	GW	A	A1	B	C	C1	ØD	ØE	ØF
		mm (inch)							
WES-G28-20-K0G0	M6	132 (5.2)	-	-	7 (0.28)	-	28 (1.1)	6 (0.24)	-
WES-G28-40-K0G0	M6	197 (7.76)	-	-	7 (0.28)	-	28 (1.1)	6 (0.24)	-
WES-G28-60-K0G0	M6	262 (10.31)	-	-	7 (0.28)	-	28 (1.1)	6 (0.24)	-
WES-G28-80-K0G0	M6	327 (12.87)	-	-	7 (0.28)	-	28 (1.1)	6 (0.24)	-
WES-G28-20-K1G1	-	-	155,5 (6.12)	10 (0.39)	-	19 (0.75)	28 (1.1)	6 (0.24)	8,1 (0.32)
WES-G28-40-K1G1	-	-	220,5 (8.68)	10 (0.39)	-	19 (0.75)	28 (1.1)	6 (0.24)	8,1 (0.32)
WES-G28-60-K1G1	-	-	285,5 (11.24)	10 (0.39)	-	19 (0.75)	28 (1.1)	6 (0.24)	8,1 (0.32)
WES-G28-80-K1G1	-	-	350,5 (13.8)	10 (0.39)	-	19 (0.75)	28 (1.1)	6 (0.24)	8,1 (0.32)

PERFORMANCE

	Stroke	Force		Initial force	Progression
	mm	N min	N max	max. N	
WES-G28-20	20 (0.79)	2200 (494.58)	6400 (1438.78)	3600 (809.32)	100 - 400 %
WES-G28-40	40 (1.57)	2200 (494.58)	6400 (1438.78)	3600 (809.32)	100 - 400 %
WES-G28-60	60 (2.36)	2200 (494.58)	6400 (1438.78)	3600 (809.32)	100 - 400 %
WES-G28-80	80 (3.15)	2200 (494.58)	6400 (1438.78)	3600 (809.32)	100 - 400 %