Dyna Shock System

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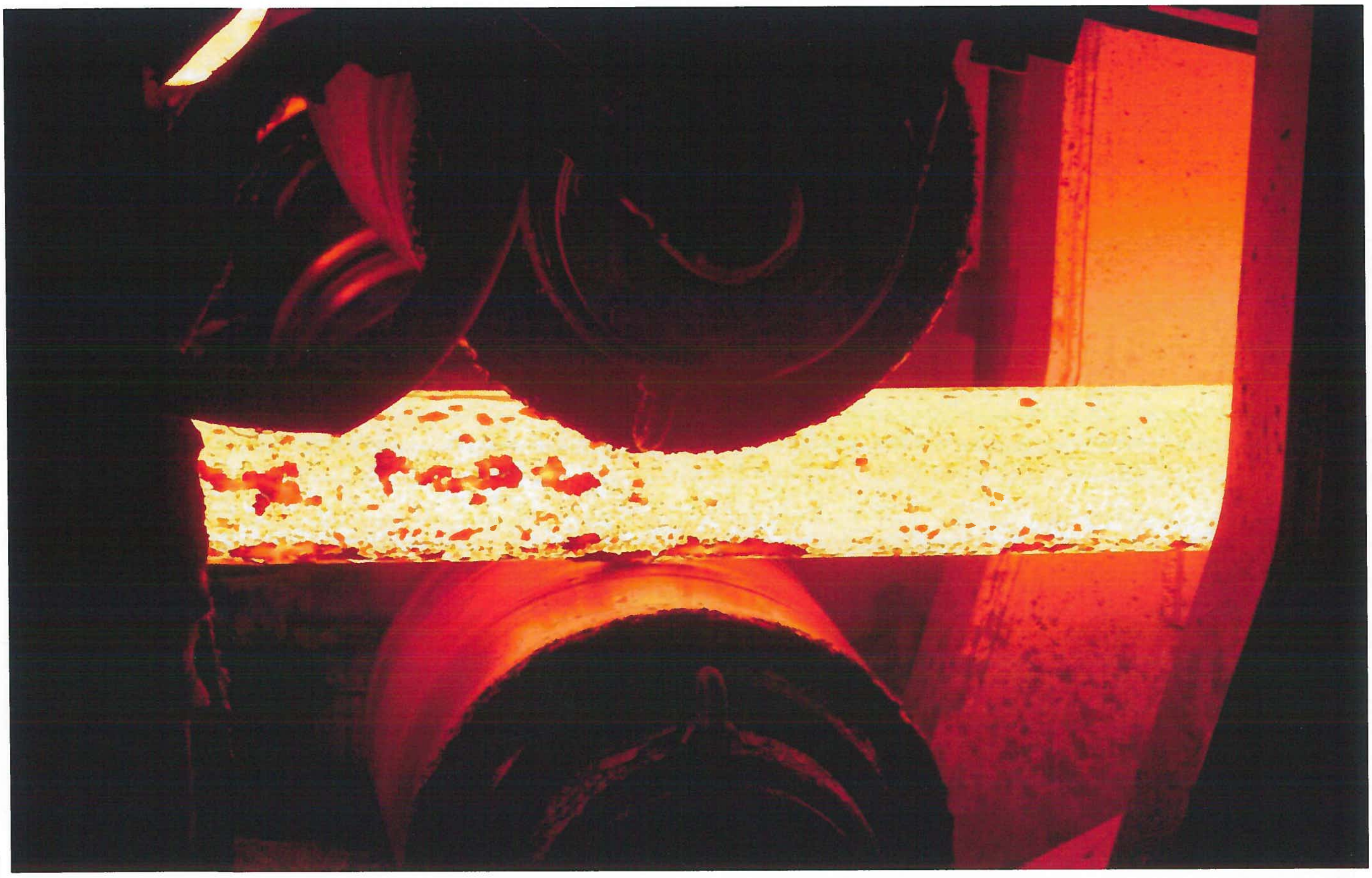
Motion systems and more

D2S SPRINGS
for
AUTOMATIC WORK ROLL CHOCK SEPARATION

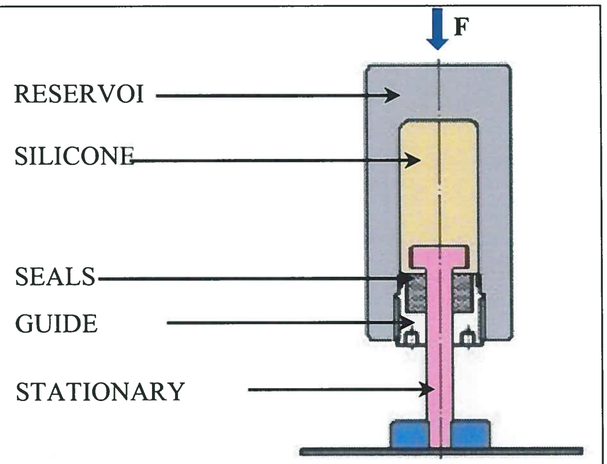


Dyna Shock System SAS

Introduction:

D2S devices are designed and built on the principle of the compression and the shear characteristics of specially formulated silicone compounds.
These characteristics enable the **D2S** device to be designed as an energy storing device (a spring) or an energy dissipating device (a shock absorber) or a combination of both by modifying the geometry of the unit and selecting an appropriate silicone compound, emphasis can be placed either on the energy storing function or on the energy dissipated function.

OPERATING CONDITIONS OF THE D2S SPRING



The load « **F** » forces the reservoir over the stationary piston. The silicone is compressed by the volume displacement of the stationary piston.

Advantages:

1- Extremely compact.
2- Dependable retention of initial characteristics, even after years of non-use.
3- Easy installation.
4- No maintenance.
5- No adjustment necessary in service.
6- Elimination of complementary devices for pre-loading, this being obtained directly by pre-stressing the silicone during initial charging.
7- Appreciable service life: in normal operating conditions it may reach 5 to 10 years.

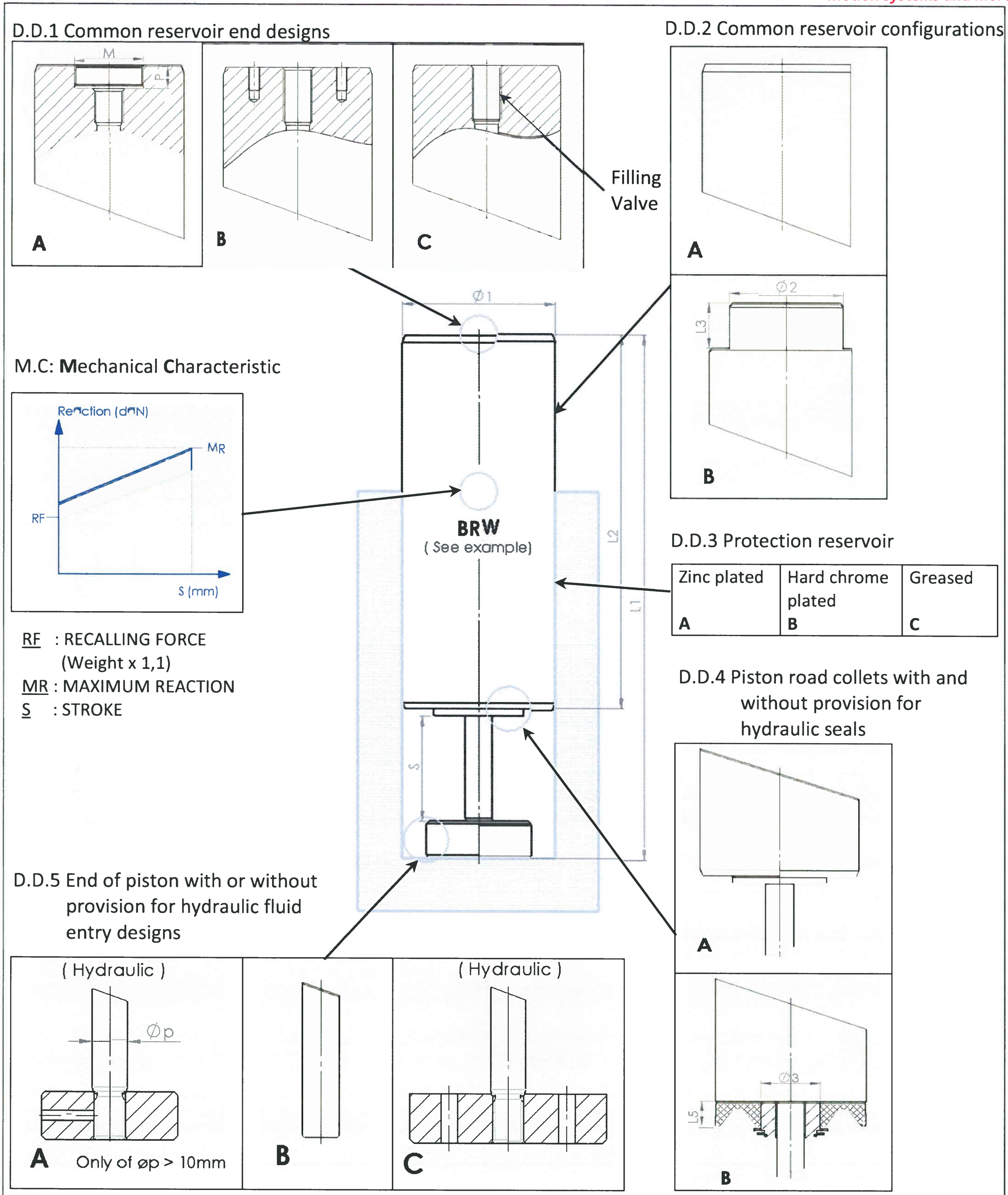
D2S SPRING FOR AUTOMATIC WORK ROLL CHOCK SEPARATION

The weight of the top work rolls and chock assembly is supported on two or four **D2S** springs. The units are pre-stressed to a load approximately 10% higher than the weight of the top roll assembly.
Consequently, when the top roll assembly is resting on the springs, there is no movement or compression. When the top back-up roll is forced down on the top work roll to the desired roll gap, the **D2S** units are compressed and remain in the compressed position during the rolling operation.
When the top back-up roll is removed the **D2S** units force the top work roll and chock assembly upwards to their fully extended position maintaining the two work rolls at a constant centre to centre distance.
The **D2S** Spring is located in a vertical cavity in the bottom work roll chock, with the piston facing down, resting on the bottom of the cavity or on a replaceable thrust plate.
The **D2S** device acts as a compact, high-quality dependable spring.

a) It maintains the top work roll assembly in an elevated position when the mill is not running.
b) The work rolls are maintained separated at a constant centre to centre distance during installation, removal and transfer of rolls.
c) The rolls are prevented from coming into contact with the each other, thereby avoiding damage to the roll surfaces.
d) The use of **D2S** Springs eliminated the need to jack up the top work roll and then block or latch for correct roll separation on fixed centres. In doing so it eliminates the need for additional shimming required for the safe and stable transportation of roll assemblies and obviates the need for troublesome latching mechanisms.
e) The use of **D2S** Springs "reduces the time required for roll changing" to one quarter of the time taken by conventional methods.
f) In some applications **D2S** Springs can be used for back-up roll counter balance.

By the use of hydraulic pressure under the **D2S** Springs, the top work roll assembly may be raised higher than the normal extended position the spring allows. This is achieved by the hydraulic pressure raising the complete spring off its seat in the base of the cavity. During rolling this hydraulic pressure may be used to create upward forces to correct roll bending, reduce work roll skidding or counterbalance the top back-up roll.

DATA REQUIERED TO SELECT A D2S SPRING



NOMENCLATURE

MC = **M**echanical **C**haracteristics
RF ; MR ; S

GC = **G**eometrical **C**haracteristics
L1 ; L2 ; L3 ; L4 ; L5 ; ø1 ; ø2 ; ø3 ; M ; P

DD = **D**etails of **D**esign
1(A,B,C) ; 2 (A;B) ; 3(A,B,C) ; 4(A,B,C,D) ; 5(A,B,C,D,E)

NOTE

- Example of nomenclature of D2S Spring Shown above.

MC: RF 11000 ; MR 33000 ; S 45
GC : L1 220 ; L2 152 ; ø1 80
DD : 1C ; 2A ; 3A ; 4A ; 5B

Stroke calculation :

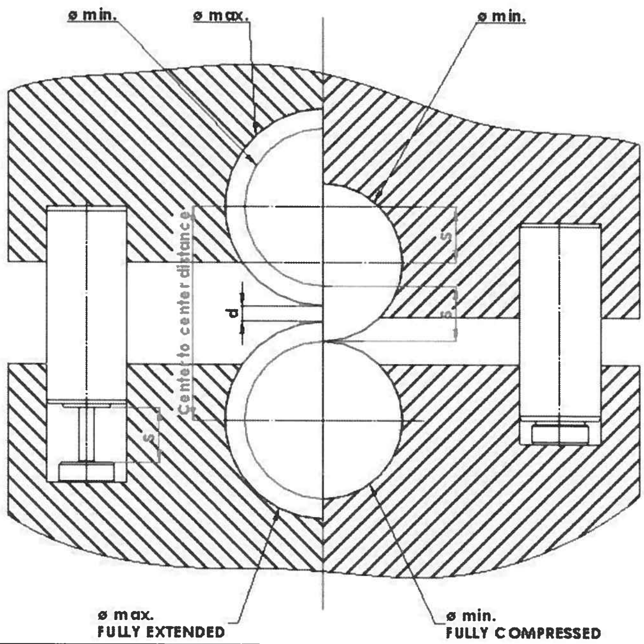
S= maximum diameter-minimum diameter
+ d + extra
S= centre to centre distance – minimum
diameter + extra

Load per D2S Spring calculation:

Top work roll chock assembly weight divided by total number of D2S Springs used (generally two per chock).

Note:

D2S Springs may also be used as plungers in combination with hydraulic pressure (as for roll bending, etc…)



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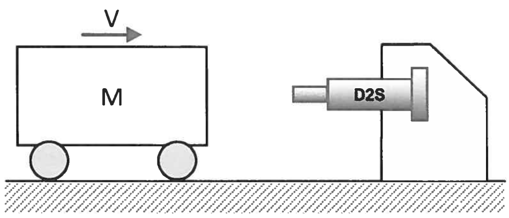
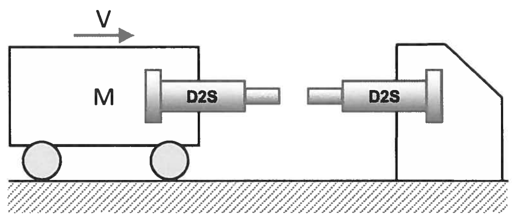
Sizing examples...

Case n° 1



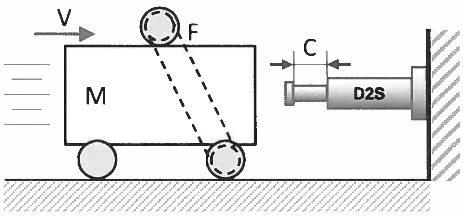
$E_T = E_C = 1/2 \times M \times V^2$

Case n° 2



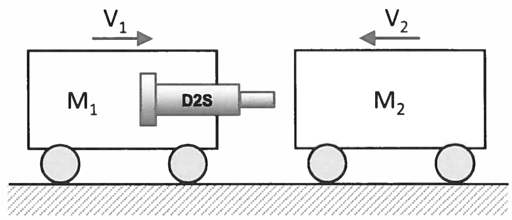
$E_T = E_C = 1/2 \times M \times V^2$

Case n° 3



$E_C = 1/2 \times M \times V^2$
$E_P = F \times C$
$E_T = E_C + E_P$

Case n° 4

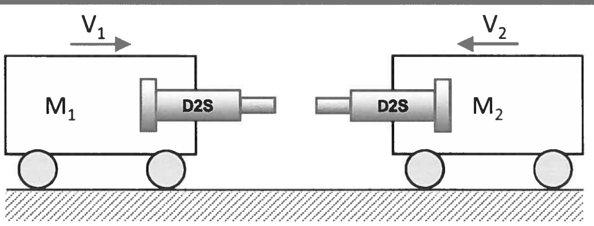


$E_T = E_C = 1/2 \times M_E \times V^2$

with: $M_E = \frac{M_1 \times M_2}{M_1 + M_2}$

and: $V = V_1 + V_2$

Case n° 5

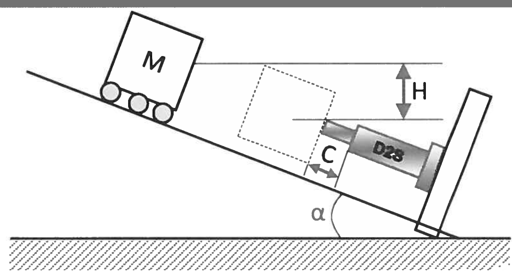


$E_T = E_C = 1/2 \times M_E \times V^2$

with: $M_E = \frac{M_1 \times M_2}{M_1 + M_2}$

and: $V = V_1 + V_2$

Case n° 6

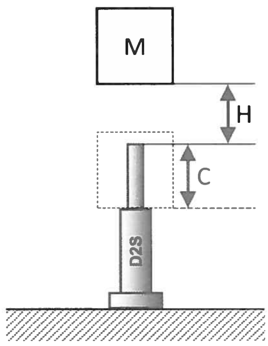


$E_C = g \times M \times H = 9{,}81 \times M \times H$
$F = g \times M \times \sin\alpha = 9{,}81 \times M \times \sin\alpha$
$E_P = F \times C$
$E_T = E_C + E_P$ et $V = \sqrt{2 \times g \times H}$

Definitions:

E_T = Total Energy (kJ)
E_C = Kinetic Energy (kJ)
E_P = Potential Energy (kJ)
M = Mass (t)
M_E = Effective Mass (t)
V = Impact Velocity (m/s)
F = Motive Force or Propelling Force (kN)
g = Acceleration (m/s²)
C = Stroke of the shock absorber (m)
H = Falling Height (m)

Case n° 7



$E_C = g \times M \times H = 9{,}81 \times M \times H$
$E_P = g \times M \times C = 9{,}81 \times M \times C$
$E_T = E_C + E_P$ et $V = \sqrt{2 \times g \times H}$

...

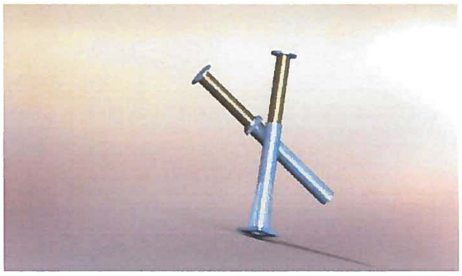
Dyna Shock System SAS

Dyna Shock System

VISCOELASTIC DEVICES WITH HYDROSTATIC COMPRESSION OF ELASTOMER

VISCOELASTIC SHOCK ABSORBERS / AUTOMATIC STROKE RETURN

BXLR range from 6 to 150 kJ



Technology

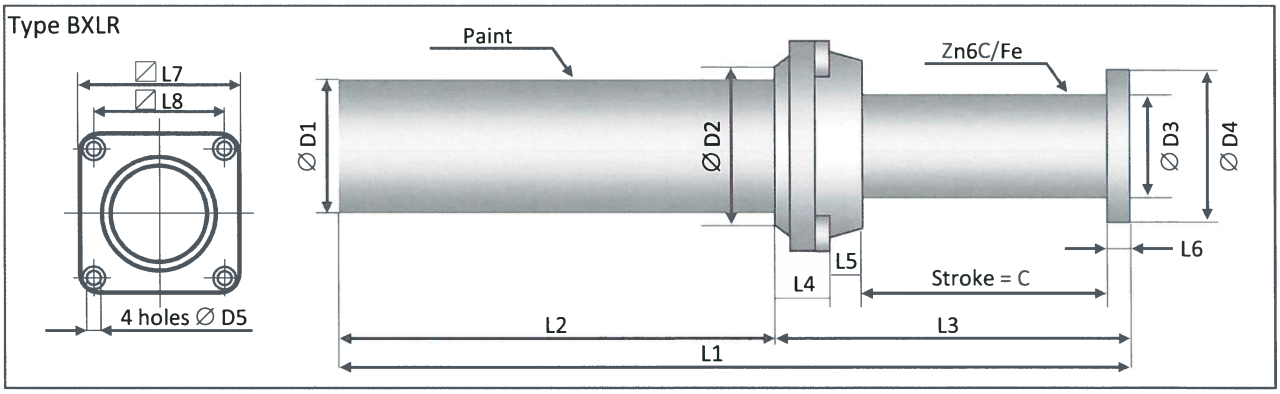
The shock absorbers are designed on the principal of compression of hydrostatic viscoelastic fluids. The viscosity and the compressibility of our fluids allow in one device to obtain both functions: a shock absorber and a spring, without the need of any additional rearming mechanism (gas or mechanical spring). The two functions can be used separately or in combination, in the same product.

Advantages

- Simple design – High reliability – Simple integration
- High damping coefficient
- Low sensitivity to temperature variances
- Security by integrated static preload

Applications

Protection against shocks in Industry, Material Handling, Rolling Mill, Railway, Defence, Waterways, Paper industry, ...



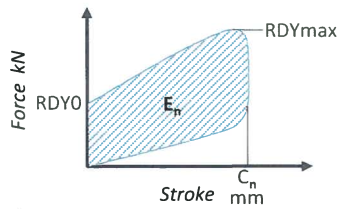
	DIMENSIONAL CHARACTERISTICS													
	L1 mm	L2 mm	L3 mm	L4 mm	L5 mm	L6 mm	L7 mm	L8 mm	D1 mm	D2 mm	D3 mm	D4 mm	D5 mm	Mass kg
BXLR6-150	410	231	179	19	0	10	∅ 90	∅ 70	50	∅ 90	38	50	9	4,2
BXLR12-150	480	285	195	18	15	12	110	85	75	90	57	80	11	11
**BXLR12-200*	*530*	*285*	*245*	*18*	*15*	*12*	*110*	*85*	*75*	*90*	*57*	*80*	*11*	*11*
BXLR25-200	620	370	250	20	18	12	135	105	90	110	72	100	14	20
**BXLR25-270*	*690*	*370*	*320*	*20*	*18*	*12*	*135*	*105*	*90*	*110*	*72*	*100*	*14*	*25*
BXLR50-275	855	520	335	25	20	15	175	140	110	150	87	120	18	40
**BXLR50-400*	*980*	*520*	*460*	*25*	*20*	*15*	*175*	*140*	*110*	*150*	*87*	*120*	*18*	*40*
BXLR100-400	1370	910	460	25	20	15	175	140	110	150	87	120	18	65
**BXLR100-600*	*1570*	*910*	*660*	*25*	*20*	*15*	*175*	*140*	*110*	*150*	*87*	*120*	*18*	*65*
**BXLR150-800*	*2640*	*1780*	*860*	*25*	*20*	*15*	*175*	*140*	*110*	*150*	*87*	*120*	*18*	*115*

- Mounting type on request
- Outside protection: paint and reservoir Zn6CFe

** Devices not available on stock (delivery from 12 to 16 weeks according to model and/or quantity)*

	MECHANICAL CHARACTERISTICS (1)			
	En kJ	Stroke mm	RDY0 kN	RDYmax kN
BXLR6-150	6	150	25	50
BXLR12-150	12	150	66	100
**BXLR12-200*	*12*	*200*	*42*	*78*
BXLR25-200	25	200	95	150
**BXLR25-270*	*25*	*270*	*66*	*112*
BXLR50-275	50	275	118	230
**BXLR50-400*	*50*	*400*	*75*	*150*
BXLR100-400	100	400	175	320
**BXLR100-600*	*100*	*600*	*85*	*230*
**BXLR150-800*	*150*	*800*	*80*	*250*

(1) Based on the following data:
- Impact speed: 2 m/s
- Operating temperature: -20°C to +40°C



Symbols:

E_n = nominal energy capacity
C_n = maximum stroke
RDY = dynamic reaction

- Impact speed: BXLR range shock absorbers are designed for impact velocities of 2 m/s. Higher velocities require custom modification.

Dyna Shock System

Dyna Shock System SAS

VISCOELASTIC DEVICES WITH HYDROSTATIC COMPRESSION OF ELASTOMER

VISCOELASTIC SHOCK ABSORBERS / AUTOMATIC STROKE RETURN

BALR range from 100 to 1000 kJ

Technology

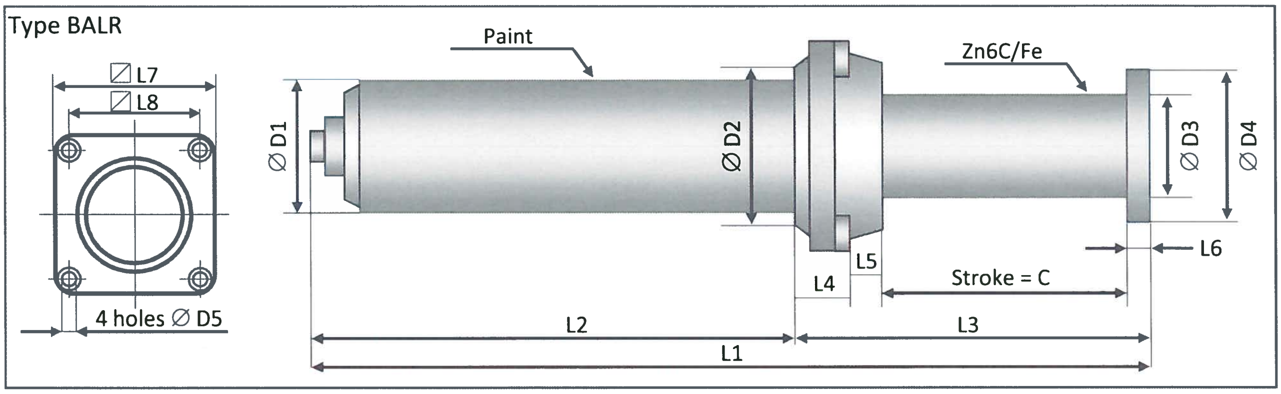
The shock absorbers are designed on the principal of compression of hydrostatic viscoelastic fluids. The viscosity and the compressibility of our fluids allow in one device to obtain both functions: a shock absorber and a spring, without the need of any additional rearming mechanism (gas or mechanical spring). The two functions can be used separately or in combination, in the same product.

Advantages

- Simple design – High reliability – Simple integration
- High damping coefficient
- Low sensitivity to temperature variances
- Security by integrated static preload

Applications

Protection against shocks in Industry, Material Handling, Rolling Mill, Railway, Defence, Waterways, Paper industry, ...



	DIMENSIONAL CHARACTERISTICS													
	L1 mm	L2 mm	L3 mm	L4 mm	L5 mm	L6 mm	L7 mm	L8 mm	D1 mm	D2 mm	D3 mm	D4 mm	D5 mm	Mass kg
**BALR-100*	*1120*	*660*	*460*	*25*	*20*	*15*	*175*	*140*	*130*	*150*	*110*	*140*	*18*	*63*
BALR-150	1350	775	575	30	25	20	215	170	140	185	120	150	22	90
BALR-220S	1258	783	475	30	25	20	215	170	140	185	120	150	22	100
BALR-250	1750	1025	725	30	25	20	215	170	155	185	135	170	22	135
**BALR-400*	*2185*	*1250*	*935*	*35*	*25*	*25*	*265*	*210*	*175*	*235*	*150*	*190*	*27*	*218*
**BALR-600*	*2555*	*1420*	*1135*	*35*	*25*	*25*	*265*	*210*	*200*	*235*	*175*	*215*	*27*	*295*
**BALR-800*	*2935*	*1630*	*1305*	*40*	*35*	*30*	*300*	*240*	*220*	*270*	*190*	*235*	*30*	*420*
**BALR-1000*	*3225*	*1820*	*1405*	*40*	*35*	*30*	*300*	*240*	*230*	*270*	*205*	*248*	*30*	*470*

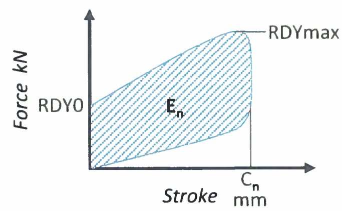
- Mounting type on request
- Outside protection: paint and reservoir Zn6CFe

** Devices not available on stock (delivery from 12 to 16 weeks according to model and/or quantity)*

	MECHANICAL CHARACTERISTICS (1)			
	En kJ	Stroke mm	RDY0 kN	RDYmax kN
**BALR-100*	*100*	*400*	*190*	*310*
BALR-150	150	500	200	380
BALR-220S	220	400	380	685
BALR-250	250	650	270	490
**BALR-400*	*400*	*850*	*330*	*600*
**BALR-600*	*600*	*1050*	*370*	*740*
**BALR-800*	*800*	*1200*	*430*	*860*
**BALR-1000*	*1000*	*1300*	*500*	*1000*

(1) Based on following data:

- Impact speed: 2 m/s
- Operating temperature: -20°C to +40°C



Symbols:

E_n = nominal energy capacity
C_n = maximum stroke
RDY = dynamic reaction

- Impact speed: BALR range shock absorbers are designed for impact velocities of 2 m/s. Higher velocities require custom modification.

Dyna Shock System

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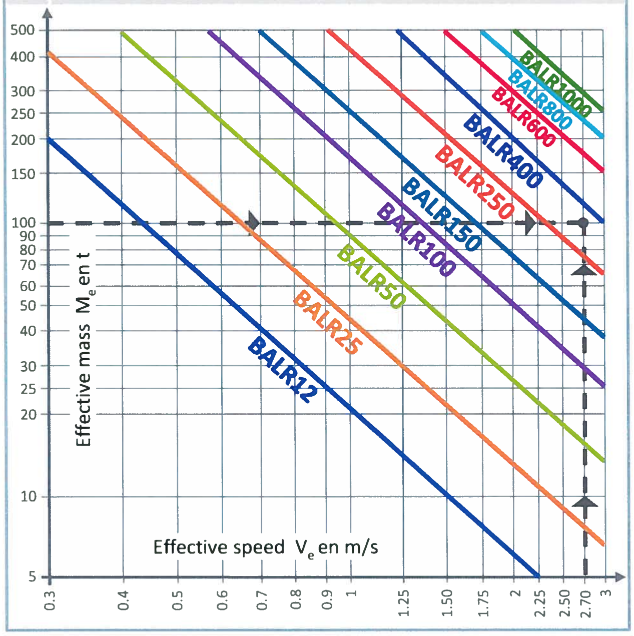
VISCOELASTIC DEVICES WITH HYDROSTATIC COMPRESSION OF ELASTOMER

SELECTION OF A STANDARD SHOCK ABSORBER
BXLR and BALR ranges

1 SELECTION CHART



2 EFFECTIVE ENERGY CALCULATION

$$E_e = ½ M_e V_e^2$$

3 ALLOWABLE IMPACT FREQUENCY

$$F < 8 \text{ x } \frac{E_n}{E_e} \text{ impacts/hour}$$

4 EFFECTIVE STROKE CALCULATION

$$C_e = C_n\left(\sqrt{\frac{E_e}{E_n(0.027V_e + 0.22)}} + 1.83 - 1.35\right)$$

5 EFFECTIVE REACTION Rdy_e CALCULATION

$$Rdy_e = \left[\left(\frac{Rdymax - Rdy0}{C_n}\right) xC_e + Rdy0\right](0.1V_e + 0.8)$$

6 APPLICATION EXAMPLE

Given data:
Shock to absorb with 1 horizontal shock absorber

- Effective mass = 100 t
- Effective speed = 2.7 m/s
- Impact frequency = 5 impacts/hour
- Maximum allowable structural load = 650 kN

① Selection chart gives BALR400.

The mechanical characteristics are:

- E_n = 400 kJ
- C_n = 850 mm
- Rdymax = 600 kN
- Rdy0 = 330 kN

② The energy to dissipate E_e per shock is 365 kJ.

③ Allowable impact frequency F is <8*400/365

$\Rightarrow$ 5 < 8.8 is convenient

④ The effective stroke C_e will be 743 mm.

$$850\left(\sqrt{\frac{365}{400(0.027 \text{x} 2.7 + 0.22)}} + 1.83 - 1.35\right)$$

⑤ The effective dynamic reaction Rdy_e will be 605 kN.

$$\left[(600 - 330) \text{ x } \frac{743}{850} + 330\right](0.1 \text{x} 2.7 + 0.8)$$

Rdy_e < 650 kN (resistance of the structure)

All performance characteristics can be modified.

Please advise us of your specific requirements.

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VISCOELASTIC DEVICES WITH HYDROSTATIC COMPRESSION OF ELASTOMER

VISCOELASTIC SHOCK ABSORBERS / AUTOMATIC STROKE RETURN

BA1 range from 0,1 to 14 kJ

Technology

The shock absorbers are designed on the principal of compression of hydrostatic viscoelastic fluids. The viscosity and the compressibility of our fluids allow in a same device to obtain both functions the one of a shock absorber and the one of a spring, without the need of any additional rearming mechanism (gas or mechanical spring). The two functions can be used separately or in combination, in the same product.

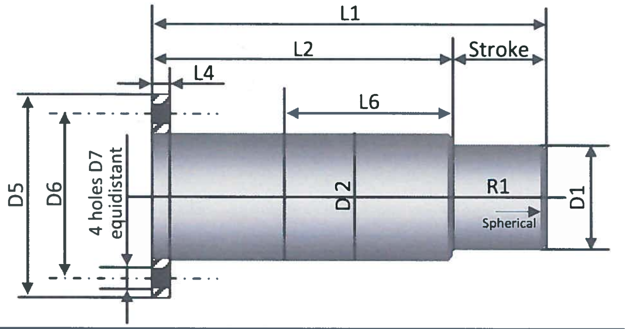
Advantages

- Simple design – High reliability
- High damping coefficient
- Low sensitivity to temperature variances
- Security by integrated static preload
- Simple integration

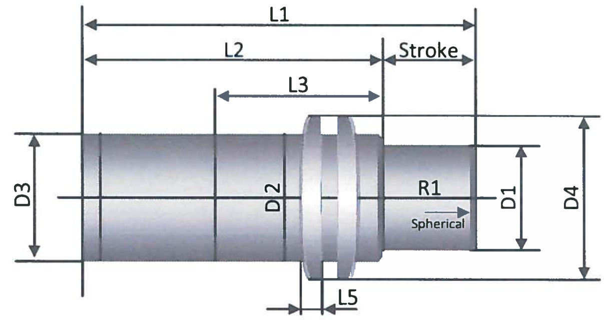
Applications

Protection against shocks in Industry, Material Handling, Rolling Mill, Railway, Defence, Waterways, Paper industry, ...

BA1: Rear flange mounting



BA1: Nuts mounting



	DIMENSIONAL CHARACTERISTICS													
	L1 mm	L2 mm	L3 mm	L4 mm	L5 mm	L6 mm	R1 mm	D1 mm	D2 mm	D3 mm	D4 mm	D5 mm	D6 mm	D7 mm	Mass kg
BA1ZN	75	53	52	10	7	43	/	∅ 19	M25 x 1,5	∅ 20	∅ 38	∅ 57	∅ 41	∅ 7	0,3
BA1BN	120	98	96	12	8	86	/	∅ 25	M35 x 1,5	∅ 32	∅ 52	∅ 80	∅ 60	∅ 9	0,7
**BA1BNM*	*120*	*98*	*96*	*12*	*9*	/	/	*∅25*	*M40 x 1,5*	*∅32*	*∅56*	/	/	/	*0,8*
BA1DN	175	140	138	12	11	128	/	∅ 38	M50 x 1,5	∅ 45	∅ 70	∅ 90 ∅ 106	∅ 70 ∅ 85	∅ 9 ∅ 11	1,9 2
**BA1DNM*	*175*	*140*	*138*	*12*	*11*	/	/	*∅38*	*M60 x 2*	*∅45*	*∅81*	/	/	/	*2*
BA1EN	213	168	158	10	13	158	R.130	∅ 60	M75 x 2	∅ 72	∅ 98	∅ 122	∅ 100	∅ 11	5
BA1FN	270	210	130	12	16	130	R.150	∅ 74,5	M90 x 2	∅ 90	∅ 120	∅ 150	∅ 120	∅ 13	10,5
BA1GN	337	257	145	14	19	145	R.350	∅ 90	M110 x 2	∅ 110	∅ 145	∅ 175	∅ 143	∅ 18	17

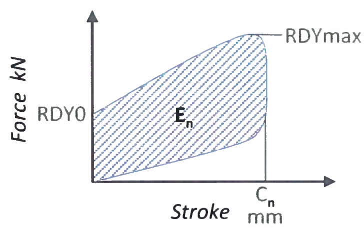
Outside protection: Zn6CFe

**Devices not available on stock (delivery from 8 to 10 weeks according to model and/or quantity)*

	MECHANICAL CHARACTERISTICS *			
	En kJ	Stroke mm	RDY0 kN	RDYmax kN
BA1ZN	0,1	12	6	11
BA1BN **BA1BNM*	0,43	22	14	27
BA1DN **BA1DNM*	1,5	35	28	60
BA1EN	3,4	45	45	100
BA1FN	7	60	90	150
BA1GN	14	80	130	230

* Based on following data:

- Impact speed: 2 m/s
- Operating temperature: -20°C to +40°C



Symbols:

E_n = nominal energy capacity
C_n = maximum stroke
RDY = dynamic reaction

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D2S Dyna Shock System

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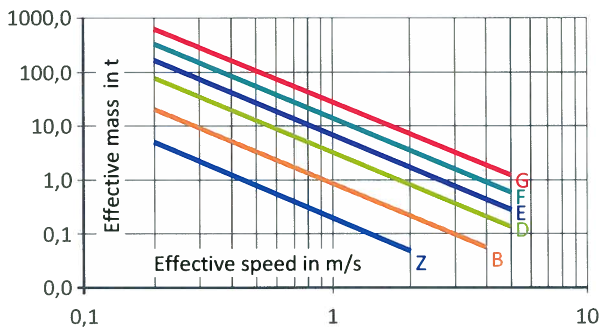
VISCOELASTIC DEVICES WITH HYDROSTATIC COMPRESSION OF ELASTOMER

SELECTION OF A STANDARD SHOCK ABSORBER

BA1 range

1 SELECTION CHART



2 EFFECTIVE ENERGY CALCULATION

$$E_e = ½\, M_e V_e^2$$

3 ALLOWABLE IMPACT FREQUENCY

$$F < 20 \times \frac{E_n}{E_e} \text{ impacts/hour}$$

4 EFFECTIVE STROKE CALCULATION

$$C_e = C_n\left(\sqrt{\frac{E_e}{E_n(0{,}03V_e + 0{,}24)} + 1{,}36} - 1{,}17\right)$$

5 EFFECTIVE REACTION Rdy_e CALCULATION

$$Rdy_e = \left[\left(\frac{Rdy\,max - Rdy0}{C_n}\right) x C_e + Rdy0\right](0{,}1V_e + 0{,}8)$$

6 APPLICATION EXAMPLE

Given data:

- Effective mass = 15 t
- Effective speed = 0,8 m/s
- Impact frequency = 25 impacts/hour

① Selection chart gives BA1FN.

The mechanical characteristics are:

- E_n = 7 kJ
- C_n = 60 mm
- Rdymax = 150 kN
- Rdy0 = 90 kN

② The energy E_e to dissipate per impact is 4,8 kJ.

③ The allowable impact frequency F is <20*7/4,8

④ The effective stroke C_e will be 49 mm

$$60\left(\sqrt{\frac{4{,}8}{7(0{,}03.0{,}8 + 0{,}24)} + 1{,}36} - 1{,}17\right)$$

⑤ Rdy_e = [(150-90)*(49/60)+90]*(0,1x0,8+0,8)=122 kN

All performance characteristics can be modified.

Please advise us of your specific requirements.

Dyna Shock System SAS

Motion systems and more

VISCOELASTIC DEVICES WITH HYDROSTATIC COMPRESSION OF ELASTOMER

VISCOELASTIC SHOCK ABSORBERS / AUTOMATIC STROKE RETURN

BA5 range from 25 to 150 kJ

Technology

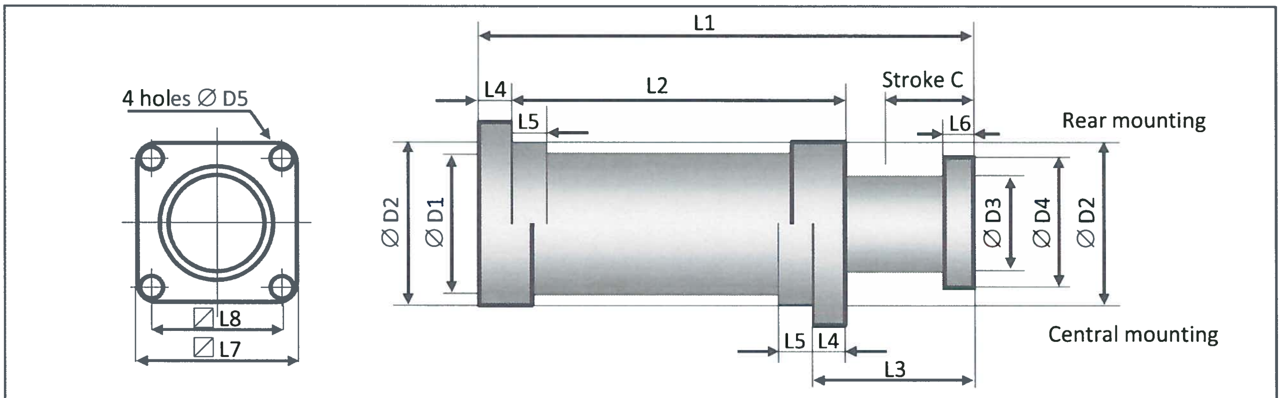
The shock absorbers are designed on the principal of compression of hydrostatic viscoelastic fluids. The viscosity and the compressibility of our fluids allow in a same device to obtain both functions the one of a shock absorber and the one of a spring, without the need of any additional rearming mechanism (gas or mechanical spring). The two functions can be used separately or in combination, in the same product.

Advantages

- Simple design – High reliability
- High damping coefficient
- Low sensitivity to temperature variances
- Security by integrated static preload
- Simple integration

Applications

Protection against shocks in Industry, Material Handling, Rolling Mill, Railway, Defence, Waterways, Paper industry, ...

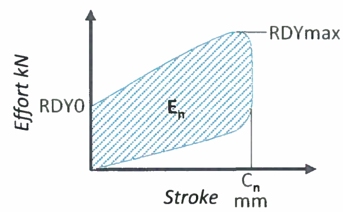


	DIMENSIONAL CHARACTERISTICS													
	L1 mm	L2 mm	L3 mm	L4 mm	L5 mm	L6 mm	L7 mm	L8 mm	D1 mm	D2 mm	D3 mm	D4 mm	D5 mm	Mass kg
BA5A-105	415	275	140	20	30	15	135	105	/	116	87	120	14	25
BA5B	500	325	175	25	33	30	155	125	142	142	115	138	15	40
BA5C	520	315	205	30	36	35	175	140	160	160	132	158	18	45
BA5D	585	350	235	35	40	40	215	170	180	180	153	185	22	73
BA5E	670	405	265	40	45	45	250	195	215	215	182	220	26	117

- **Impact speed**: BA5 series shock absorbers are designed for impact velocities up to 4 m/s. Higher velocities require custom modification.
- Outside protection: painting – Reservoir: Zn6CFe

	MECHANICAL CHARACTERISTICS *			
	En kJ	Stroke mm	RDY0 kN	RDYmax kN
BA5A-105	25	105	167	310
BA5B	50	120	310	540
BA5C	75	140	400	700
BA5D	100	160	470	820
BA5E	150	180	640	1100

* Based on following data:
- Impact speed: 2 m/s
- Operating temperature: -20°C to +40°C



Symbols:
E_n = nominal energy capacity
C_n = maximum stroke
RDY = dynamic reaction

Dyna Shock System SAS

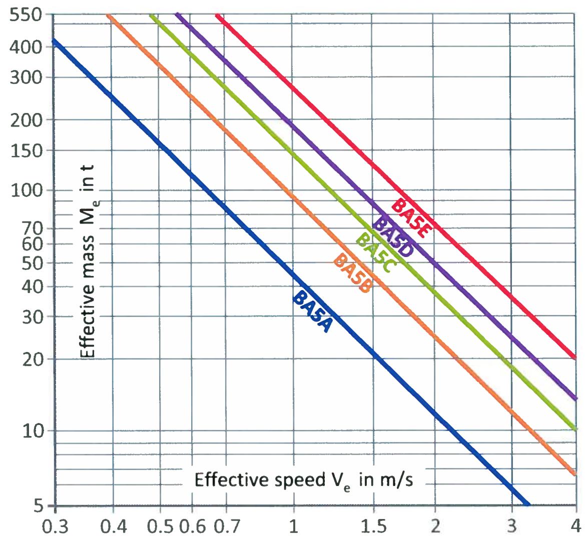
Dyna Shock System

VISCOELASTIC DEVICES WITH HYDROSTATIC COMPRESSION OF ELASTOMER

SELECTION OF A STANDARD SHOCK ABSORBER

BA5 range

1 SELECTION CHART



2 EFFECTIVE ENERGY CALCULATION

$$E_e = ½ M_e V_e^2$$

3 ALLOWABLE IMPACT FREQUENCY

$$F < 15 \times \frac{E_n}{E_e} \text{ impacts/hour}$$

4 EFFECTIVE STROKE CALCULATION

$$C_e = C_n\left(\sqrt{\frac{E_e}{E_n(0.03V_e + 0.24)}} + 1.36 - 1.17\right)$$

5 EFFECTIVE REACTION Rdy_e CALCULATION

$$Rdy_e = \left[\left(\frac{Rdymax - Rdy0}{C_n}\right) xC_e + Rdy0\right](0.1V_e + 0.8)$$

6 APPLICATION EXAMPLE

Given data:

Shock to absorb with 2 shock absorbers in series

- Effective mass = 300 t
- Effective speed = 1.2 m/s ⇒ 0.6 m/s / device
- Impact frequency = 15 impacts/hour
- Maximum allowable structural load = 1000 kN

① Selection chart gives BA5E.

The mechanical characteristics are:

- E_n = 150 kJ
- C_n = 180 mm
- Rdymax = 1100 kN
- Rdy0 = 640 kN

② The energy to dissipate per shock is 108 kJ.

③ The allowable impact frequency F is <15*150/108

④ The effective stroke C_e will be 156 mm.

$$180\left(\sqrt{\frac{108}{150(0.03 \times 0.6 + 0.24)}} + 1.36 - 1.17\right)$$

⑤ The effective dynamic reaction Rdy_e will be 893 kN.

$$\left[(1100 - 640) \times \frac{156}{180} + 640\right](0.1 \times 0.6 + 0.8)$$

Rdy_e < 1000 kN (resistance of the structure)

All performance characteristics can be modified.

Please advise us of your specific requirements.