ITT | Koni Enidine

Viscoelastic Springs for Automatic Work Roll Chock Separation

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ENIDINE

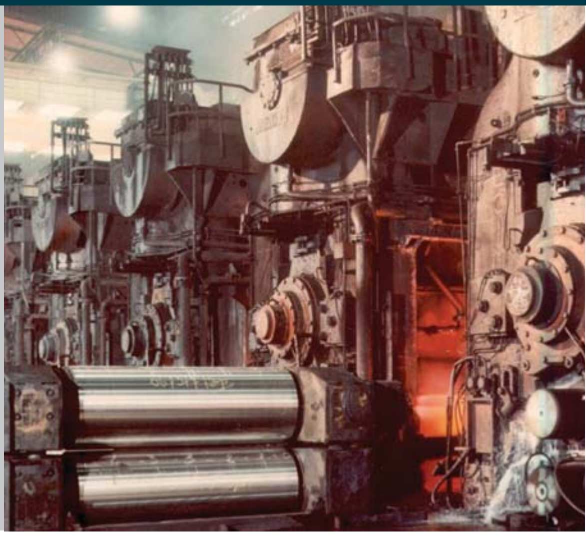
VISCOELASTIC SPRINGS FOR AUTOMATIC WORK ROLL CHOCK SEPARATION

Introduction:

Viscoelastic (VE) spring devices are designed and built on the principle of the compression and shear characteristics of specially formulated silicon compounds.

The characteristics of these compounds enable units to be designed as energy storing devices - or springs.

The use of this energy storing property, together with appropriate geometry design and silicon selection, enables springs to be specifically designed to provide support components suitable for incorporation in Top Roll assemblies in Mill Stands.



Features of Viscoelastic Springs:

- Very compact, cost effective alternative solution to mechanical systems
- Stable performance over time
- Ease of installation
- Zero maintenance required in service
- Zero adjustment necessary in service
- Elimination of the need for complementary devices for preloading
- Long service life - In normal operating conditions 5 to 10 years service life may be expected

Function:

Within the Mill Stand, the combined weights of the top work roll and chock assemblies may be supported on two or four springs. The design of the units to be installed is such that pre-stress levels exist within the components at a point higher than that of the weight of the top roll assembly. Consequently, when the top roll assembly is resting on the springs it remains fully supported. There is no movement or compression of the spring units.

During the production process the top back-up roll is forced down on the top work roll to provide the desired process roll gap. The spring units are compressed and remain in the compressed position during the rolling operation.

When the top back-up roll is removed – for example during Roll change - the springs force the top work roll and chock assemblies upwards to the fully extended stroke position of the units, thus maintaining the two work rolls at a constant centre to centre distance.

Springs are located in vertical cavities in the bottom work roll chocks, positioned with the piston facing down and resting on the bottom of the cavity - or on a replaceable thrust plate.

Benefits:

- Top work roll assemblies are maintained in an elevated position when the mill is not running.
- No interference with the rolling operation during the production process.
- Work rolls are maintained separated at constant center-to-center distance during installation, removal and transfer.
- Contact between rolls during maintenance is prevented, thereby avoiding damage to the roll surfaces.
- The requirement to jack up the top work roll and then block or latch for correct roll separation on fixed centres is eliminated.
- The need for additional shimming that may be required for the safe and stable transportation of roll assemblies is also eliminated.
- The time required for roll changing is reduced to approximately one-fourth of the time taken by conventional methods.
- Possibility exists for optional use of springs for back-up roll counter balance in certain applications.
- Silicone compounds used internally retain the performance properties of the product over a wide temperature range.
- With a coefficient of expansion greater than that of steel, a variation in temperature causes a change in force level. The following design limits apply to operating temperature conditions:

Allowable extremes:	-40°C to +70°C
Recommended limits:	-20°C to +50°C

- By the use of additional external system hydraulic pressure, the top work roll assembly may be raised higher than the fully extended position of the spring would normally allow.
- During rolling, hydraulic pressure may be used to create upward forces on the springs in order to correct roll bending, reduce work roll skidding or counterbalance the top back-up roll.

Customer References:

Austria:	Siemens VAI Metals Technologies GmbH & Co
Belgium:	Arcelor Steel Belgium NV.
Egypt:	EZDK – Al Ezz Dekheila Steel Company
Finland:	Rautanukki Oy
France:	Arcelor Packaging
	Siemens VAI Metals Technologies
Germany:	SMS Demag AG
	SMS Meer
	Arcelor Bremen
Italy:	MINO S.p.A.
	ILVA
Netherlands:	Corus Staal
Spain:	Danielli
	Voest-Alpine Industrieanlagenbau Cosim S.A.
	Grupo CELSA
UK:	Corus UK
	Novelis

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Main Application Parameters

Stroke Determination

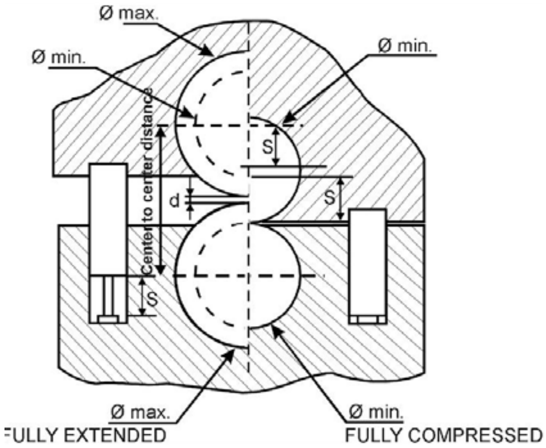


FIG. 1

Stroke Calculation:

$S = D_{max} - D_{min} + d + \text{Extra}$

$S = \text{Center to Center} - D_{min} + \text{Extra}$

Data Name		Value	Unit
Required Design Data to Establish Stroke (Fig. 2) - Customer Input:			
Dmax	Maximum New Roll Diameter/Center to Center Distance		mm
Dmin	Minimum Worn Rail Diameter		mm
Gap	Gap (d)		mm
Extra			

Force Determination

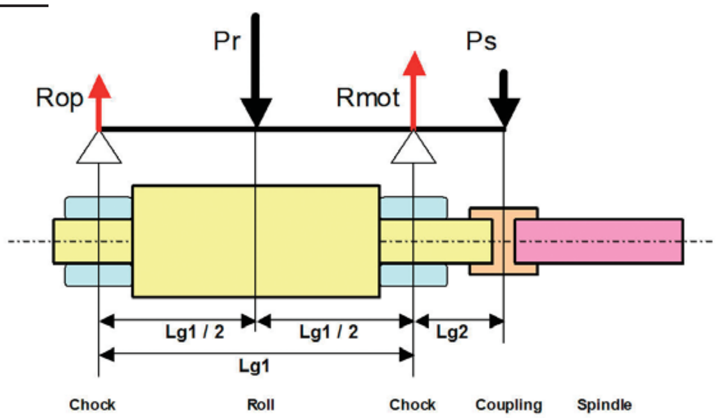


FIG. 2

Note: Further application parameters may be defined. Details are found on the following pages. Please highlight any data which is critical to your installation.

Not all options are defined.

Data Name	Description	Value	Unit
Required Design Data - Customer Input:			
Pr	Weight of Top RollWork Assembly		N
Ps	Weight of 1/2 Spindle/Coupling		N
Lg1	Distance between Spring/Coupling		m
Lg2	Distance between Spring/Coupling		m
Nb	Number of Springs		
Required Design Data - Enidine Input:			
Rop	Reaction Force Operator Side		N
Rmot	Reaction Force Motor Side		N
RF	Recall Force		
MR	Maximum Reaction		

Notes for Published Force Curves:
Theoretical static curves are at 20° C
Dynamic curves reflect unit hysterisis at approximately ± 5% on static curve.
Unit internal pressures will increase by 13 bars per degree C above 20° C

Other Viscoelastic Shock Absorber Products

The design of Jarret Industrial Shock Absorber utilizes the unique compression and shear characteristics of specially formulated silicone elastomers.

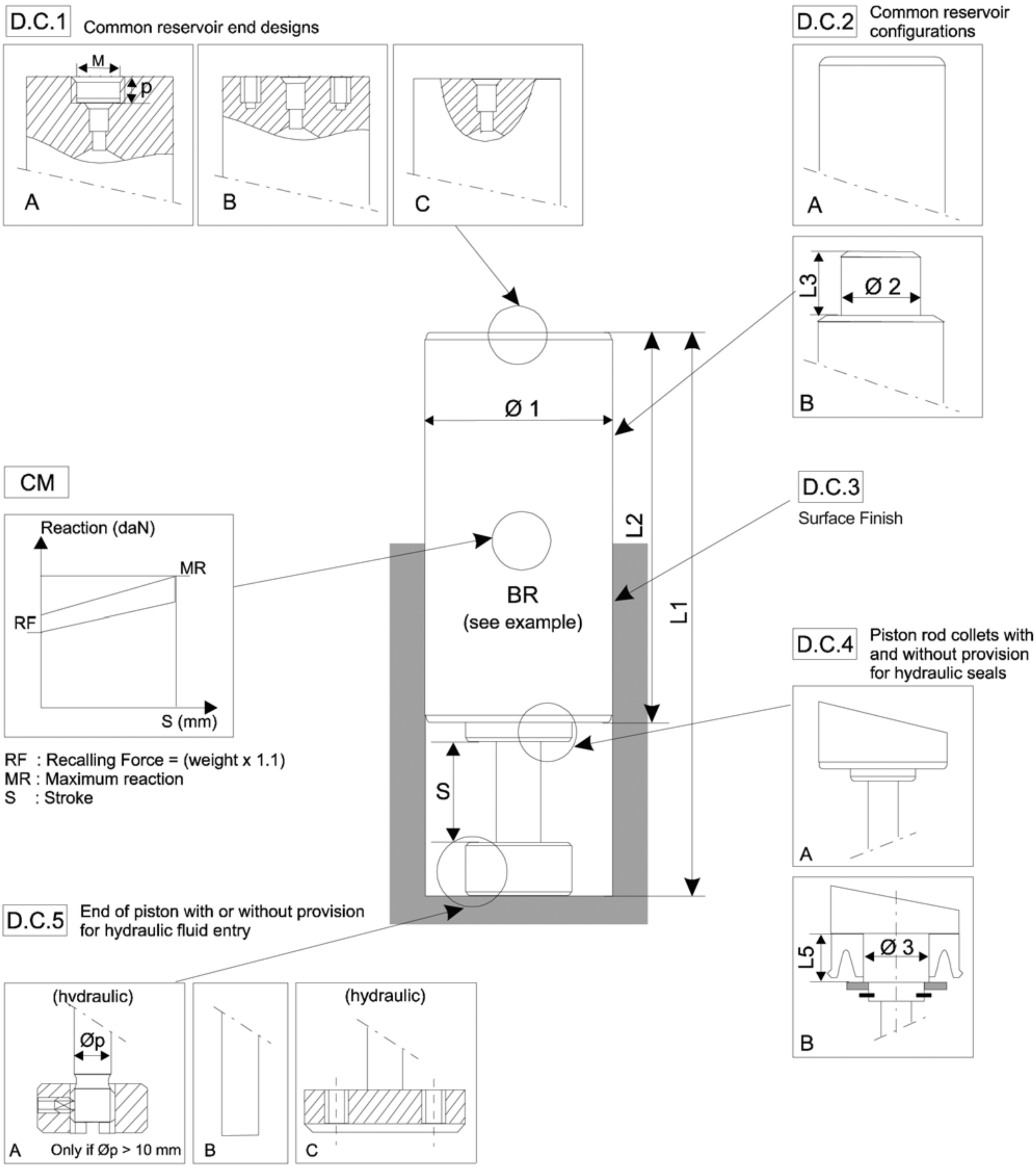
These characteristics allow the energy absorption and return spring functions to be combined into a single unit **without the need for an additional gas or mechanical spring stroke return mechanism.**

Applications:

Shock protection for all types of industries including: Defense, Automobile, Railroad, Materials Handling, Marine, Pulp/Paper, Metal Producing and Processing.

Advantages:

- Simple design - High reliability
- High damping coefficient
- Low sensitivity to temperature variances


D.C.1
Common reservoir end designs
M
p
A
B
C
D.C.2
Common reservoir configurations
A
L3
Ø 2
B
Ø 1
L2
L1
CM
Reaction (daN)
MR
RF
S (mm)
RF : Recalling Force = (weight x 1.1)
MR : Maximum reaction
S : Stroke
BR
(see example)
D.C.3
Surface Finish
D.C.4
Piston rod collets with and without provision for hydraulic seals
A
L5
Ø 3
B
S
D.C.5
End of piston with or without provision for hydraulic fluid entry
(hydraulic)
Øp
A
Only if Øp > 10 mm
B
(hydraulic)
C

Details of Design

Data Name	Option	Description		Notes
Required Design Data - Customer Input:				
D.C.1		**Reservoir End Designs**		
	A	Fill Port + Tapping		
		Tapping Diameter	M	
		Tapping Depth	P	
	B	Fill port + Tapped Holes		
		Tapping Diameter	M	
		Tapping Depth	P	
	C	Standard Fill Port		Standard Product Configuration
D.C.2		**Reservoir Configuration**		
	A	Plain		Standard Product Configuration
	B	With Boss		
		Boss Height	L3	
		Boss Diameter	ø2	
D.C.3		**Reservoir Surface Finish**		
	A	Zinc Plated		
	B	Hard Chromed		
	C	No Protection		Standard Product Configuration
D.C.4		**Hydraulic Seal Provision**		
	A	Without		Standard Product Configuration
	B	With		
		Collet Height	L5	
		Collet Diameter	ø3	
D.C.5		**Piston End Options**		
	A	Threaded Cap - Hydraulic*		
		Piston Diameter	øp	***Note:** Only if øp is > 10 mm
	B	Plain		Standard Product Configuration
	C	Ported - Hydraulic		
Final Design Data - Enidine to Confirm				
		Geometry Characteristics		
		Overall Length	L1	
		Reservoir Length	L2	
		Reservoir Diameter	Ø1	
CM		**Mechanical Characterisitics**		
		Recalling Force	RF	
		Maximum Reaction	MR	See Force and Stroke Determiniation on Page 3
		Stroke	S	

Notes:

[blue-grey box] Application Specific Criteria

[beige box] Customer may indicate desired Maximum Dimensions for **either** L1, L2 or ø1

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