ARC

Damping Technologies

We Safely Decelerate Moving Masses.

- Miniature Shocks
- Medium Shocks
- Large Shocks
- Hydraulic Dampers
- Viscoelastic Dampers
- Single Use Damper

IIT Mandi CATALYST

ARC DAMPERS

With more than 10 years of international experience in industrial damping equipment's ARC Dampers is a quality provider in the design and manufacture of standard and custom energy absorption product solutions within the Industrial, Aerospace, Defence, Marine and Rail markets. Product ranges include multiple variety customized shock absorbers specially developed for the application and customers. With strong ability to design, develop, manufacture and implement customized shock absorbers we partnership with our vast global sector of industries, ARC continues to strengthen its presence within marketplace.

We pride ourselves in providing uniquely designed, high quality, long life damping solution to our customers in order to improve machine efficiency and protect aftermarket cheap replacements that can harm machine characteristics. With a team of professionals in engineering, flexible manufacturing and marketing our employees provide our customers the very best in service.

THE SHOCK ABSORBER

"A shock absorber is a device which produces a dissipative (non-recoverable) force over a given displacement to absorb energy and remove it from a system. Includes a reset or restoring means to re-position it after it has absorbed energy, the reset means being such that its resetting energy is much smaller than the absorption capacity of the device."

The advent of high speed equipment and machinery has brought with it numerous problems associated with slowing and stopping masses of various forms. The hydraulic shock absorber has proven itself to be one of the most efficient means of solving these problems.

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Industrial shock absorbers (Linear decelerators)

Introduction

Springs and buffers cannot match the performance of linear decelerators (the correct name for industrial shock absorbers). A decelerator acts just like your hand does when you catch a ball. The linear deceleration characteristics match the speed and mass of the moving object and brings it smoothly to rest. The energy is released harmlessly, mostly as heat.

Springs and buffers act differently. They store energy rather than dissipate. So although they stop the moving object, it bounces back. Dash-pots when misused are not much better. Their peak resistance comes at the beginning of the stroke, and then falls away quickly. This causes greater resisting forces than necessary.

Principles of operation

Virtually all manufacturing processes involve movement of some kind. In production machinery this can involve linear transfers, rotary index motions, fast feeds, etc. At some point these motions change direction or come to a stop. Any moving object possesses kinetic energy as a result of its motion and if the object changes direction or is brought to rest, the dissipation of the kinetic energy can result in destructive shock forces within the structural and operating members of the machine or equipment. Kinetic energy increases with the square of the speed and as operating speeds rise under continual demand for higher productivity, shock damage to equipment becomes an increasingly serious problem, resulting in costly downtime and loss of production.

An increase in production rates is therefore only possible by dissipating kinetic energy and thereby eliminating the destructive deceleration forces.

Kinetic energy can be dissipated by using friction, as in a car whose energy is changed into heat energy by friction at its brake surfaces. It can also be dissipated by mechanically deforming another object such as a spring or rubber bumper. In practice such devices are unsatisfactory as they only store energy and bounce it back into the system causing fatigue and premature structural failure.

Another device which is often misapplied in energy dissipation is the dash pot or cylinder cushion. The true function of a dash pot is to provide a constant velocity to a moving part and if used to absorb energy it gives rise to high force peaks at the beginning of its stroke.

Most common energy absorbing devices contribute to shock rather than reduce it because they do not dissipate kinetic energy at a uniform rate.

Due to this non-linear deceleration the object being stopped is subjected to destructively high force levels (shock) either at the beginning or the end of the deceleration stroke. The ideal solution for this problem is achieved when the energy of the object is linearly absorbed. That means the required deceleration force is evenly distributed over the entire stroke length to give constant or linear deceleration.

Shock absorbers stop moving objects safely and effectively, without shock, by achieving controlled linear deceleration.

- **Increase production rates**
- **Extend machine life**
- **Reduce construction costs**
- **Reduce maintenance**
- **Reduce noise pollution.**

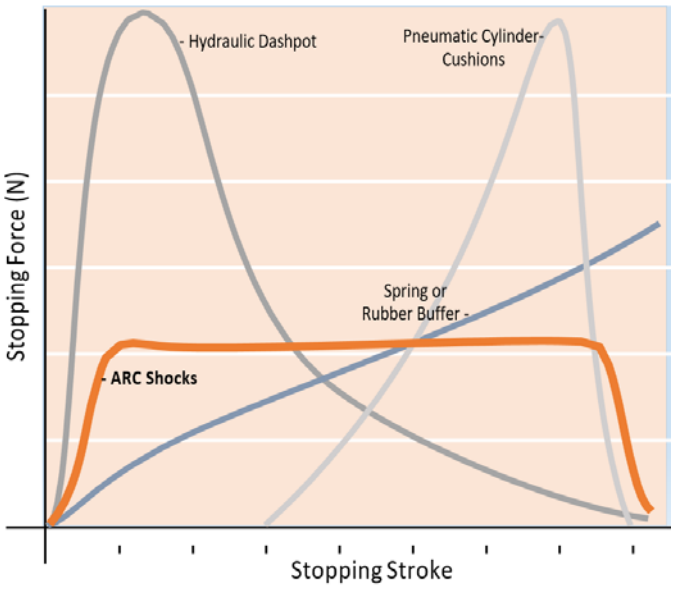
COMPARISION

1. Hydraulic Dashpot (High stopping force at start of the stroke).
With only one metering orifice the moving load is abruptly slowed down at the start of the stroke. The braking force rises to a very high peak at the start of the stroke (giving high shock loads) and then falls away rapidly.

2. Springs and Rubber Buffrs (High stopping forces at end of stroke).
At full compression. Also they store energy rather than dissipating it, causing the load to rebound back again.

3. Air Buffers, Pneumatic Cylinder Cushions (High stopping force at end of stroke).
Due to the compressibility of air these have a sharply rising force characteristic towards the end of the stroke. The majority of the energy is absorbed near the end of the stroke.

4. ARC Industrial Shock Absorbers (Uniform stopping force through the entire stroke).
The moving load is smoothly and gently brought to rest by a constant resisting force throughout the entire shock absorber stroke. The load is decelerated with the lowest possible force in the shortest possible time eliminating damaging force peaks and shock damage to machines and equipment. This is a linear deceleration force stroke curve and is the curve provided by ARC industrial shock absorbers. In addition they considerably reduce noise pollution



Benefits of ARC Shock Absorber

1. Improve machine operation
2. More products manufactured per hour
3. Accurate product positioning
4. Improve machine perception / quality
5. Uniform stopping force
6. Reduce machine weight
7. Minimise machine structure
8. Improve machine operation
9. More products manufactured per hour
10. Accurate product positioning
11. Improve machine perception / quality
12. Uniform stopping force
13. Reduce machine weight
14. Minimize machine structure
15. Lifetime warranty against material and workmanship
16. Most of the models are repairable after life.

Types ARC Shock Absorber

ARC Self-compensating / Non Adjustable shock absorbers

In cases where non-adjust ability is beneficial but the features of an adjustable shock absorber are required, self-compensating models meet both needs. With a wide range of effective weight, a self-compensating shock absorber will provide acceptable deceleration despite changing energy conditions.

The orifice profile, designed by a computer that constantly arranges the size and location of each orifice while inputting changing effective weights, neutralizes the effect of changing fluid coefficients, weight, velocity, temperature and fluid compressibility.

ARC Adjustable shock absorbers

The adjustable shock absorber offers flexibility in application design and selection procedure. With the widest range of effective weight. One model can cover many applications. By simply 'tuning in' another orifice when an effective weight change is necessary, the total orifice area changes providing the required constant force.

ARC Smart 4.0 shock absorbers

We at ARC will be designing, develop and manufacture new generation intelligent industrial shock absorbers which can automatically adjust its damping characteristics as per the load parameters, give real-time feedback information to machine controller, its working conditions and generate warning alarms in case of preventive maintenance or failure. It will be commercially available from June 2021.

APPLICATIONS

Virtually all manufacturing processes involve movement of some kind. In production machinery this can involve linear transfers, rotary index motions, fast feeds etc. At some point these motions change direction or come to a stop. Any moving object possesses kinetic energy as a result of its motion and if the object changes direction or is brought to rest, the dissipation of this kinetic energy can result in destructive impact forces within the structural and operating parts of the machine.

Kinetic energy increases as the square of the speed and the heavier the object, or the faster it travels, the more energy it has. An increase in production rates is only possible by dissipating this kinetic energy smoothly and thereby eliminating destructive deceleration forces.

Older methods of energy absorption such as rubber buffers, springs, hydraulic dashpots and cylinder cushions do not provide this required smooth deceleration characteristic they are non-linear and produce high peak forces at some point during their stroke.

The optimum solution is achieved by an ARC industrial shock absorber. This utilizes a series of metering orifices spaced throughout its stroke length and provides a constant linear deceleration with the lowest possible reaction force in the shortest stopping time

How to select an ARC Shock Absorber

Effective weight is an important factor in selecting shock absorbers. A shock absorber 'sees' the impact of an object in terms of weight and velocity only; it does not 'see' any propelling force. The effective weight can be thought of as the weight that the shock absorber 'sees' on impact. Effective weight includes the effect of the propelling force on the performance of the shock absorber.

Failing to consider the effective weight may result in improper selection and poor performance of a shock absorber. Under extreme conditions an effective weight that is too low for the shock absorber may result in high forces at the start of stroke (high on-se t force). Conversely an effective weight that is too high for the shock absorber may cause high forces at the end of stroke (high set-down force).

Consider the following examples: -

1) A mass of 4kg travelling at 4 meters per second has 32 Newton meters of kinetic energy. On this basis alone a Model VS M20x1.5H2 shock absorber would be selected. However, because there is no propelling force on the application the calculated effective weight is 4kg. This is below the minimum effective weight range of 20kg min to 200kg max. If this model were used the result would be a high on-set force at the beginning of the stroke (like dash pot). The solution in this case would be to use a specially orifice shock absorber to handle the low weight/high speed combination or alternatively to use the self- compensating model VS M20x1.5 H1.

2) A mass of 500kg has an impact velocity of 0.4 meters per second and is driven by a propelling force of 2000 Newton's. Total impact energy is 82Nm and again a model END 25xH3 would be selected based just on the energy to be absorbed. However, the effective weight calculates to 1025kg which is well above the maximum for a standard model END 25xH3. If this s shock absorber was used, high set-down forces at the end of stroke would result. The solution in this case is to use a model VS M25x1.5 H4 which is designed to work in low velocity, high effective weight applications such as this.

Formulae and calculations

ARC shock absorbers provide linear deceleration and are therefore superior to other kinds of damping element. It is easy to calculate around 90% of applications knowing only the following 4 parameters:

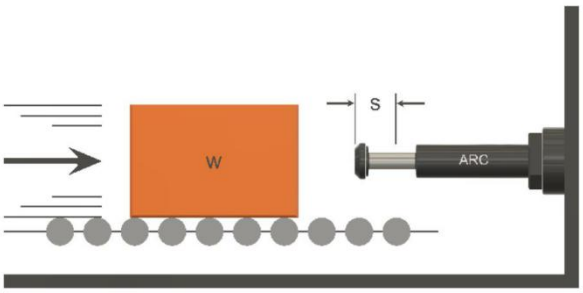
1. Mass to be decelerated (weight)
2. Impact Velocity
3. Propelling Force
4. Cycles per hour

SYMBOLS USED

E1	Kinetic energy per cycle	Nm	M	Propelling torque	Nm
E2	Propelling force energy per cycle	Nm	I	Moment of Inertia	kgm^2
E3	Total energy per cycle (E1 + W2)	Nm	g	Acceleration due to gravity = 9.81	m/s^2
E4	Total energy per hour (E3*c)	Nm/hr	h	Drop height (excl. shock stroke)	m
We	Effective weight	Kg	s	Shock absorber stroke	m
W	Mass to be decelerated	Kg	L/R/r	Radius	m
n	Number of shock absorbers (in parallel)		Q	Reaction force	N
ω	Angular velocity at impact	rad/s	μ	Coefficient of friction	
F	Propelling force	N	t	Deceleration time	s
c	Cycles per hour	1/hr	d	Deceleration	m/s^2
P	Motor power	kW	α	Side load angle	°deg
v	Velocity at impact	m/s	a	Angle of incline	°deg
$\mathbf{v_D}$	Impact velocity at shock absorber	m/s	**ST**	Stall torque factor (normally 2.5)	1 to 3

v or v_D *is the final impact velocity of the mass. With accelerating motion the final impact velocity can be 1.5 to 2 times higher than the average. Please take this into account when calculating kinetic energy.* ***ST*** *= relation between starting torque and running torque of the*

1. Mass without propelling force.

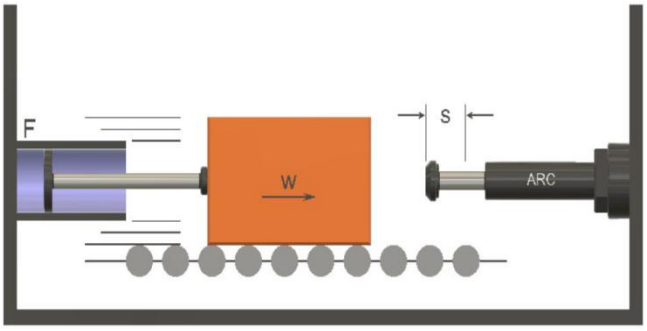


Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2} [\mathbf{Nm}]$
Since no propelling force is in effect, the propelling energy to be absorbed	$\mathbf{E2} = \mathbf{0} [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2} [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c} [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V} [\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2} [\mathbf{kg}]$

2. Mass with propelling force

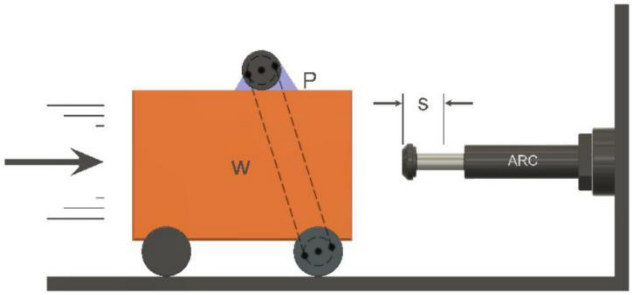


Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Propelling force F [N]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2} [\mathbf{Nm}]$
The external propelling force F acts through stroke s of the shock absorber.	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times \boldsymbol{F} \times \boldsymbol{s} [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2} [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c} [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V} [\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2} [\mathbf{kg}]$

3. Mass with motor drive

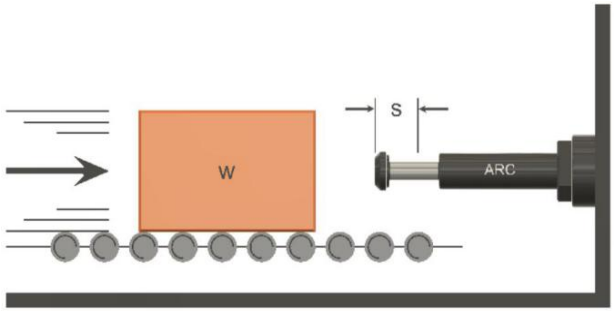


Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Motor Output P [kW]*
6. *Stall Torque Factor ST (generally 2.5)*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2} [\mathbf{Nm}]$
The external propelling force acts through stroke s of the shock absorber.	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times \frac{1000 \times P \times ST \times s}{V} [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2} [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c} [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V} [\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2} [\mathbf{kg}]$

4. Mass on driven rollers

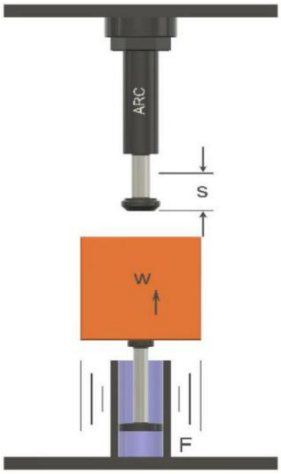


Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Coefficient of friction μ*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2} [\mathbf{Nm}]$
The propelling force from rolling friction between the mass and the rollers.	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times \mu \times \boldsymbol{W} \times \boldsymbol{g} \times \boldsymbol{s} [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2} [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c} [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V} [\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2} [\mathbf{kg}]$

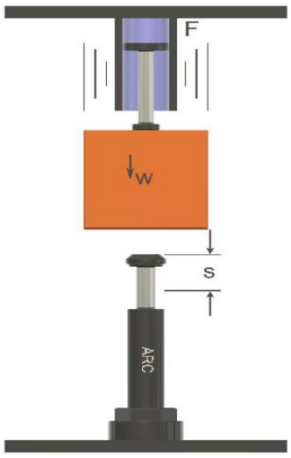
5. Mass with propelling force up



Input data:
1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Propelling force F [N]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2} [\mathbf{Nm}]$
Force F acts as a propelling force on the shock absorber, minus the weight	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times (\boldsymbol{F} - \boldsymbol{Wg}) \times \boldsymbol{s}\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times E_3}{V^2}\ [\mathbf{kg}]$

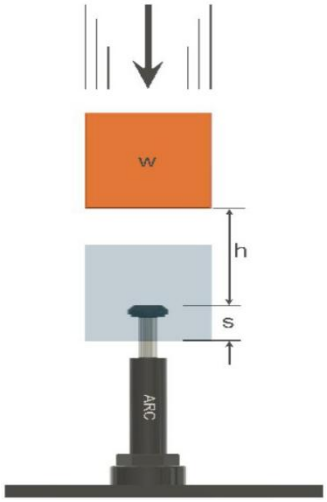
6. Mass with propelling force down



Input data:
1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Propelling force F [N]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2} [\mathbf{Nm}]$
Force F acts as a propelling force on the shock absorber, plus the weight	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times (\boldsymbol{F} + \boldsymbol{Wg}) \times \boldsymbol{s}\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2}\ [\mathbf{kg}]$

7. Free falling mass

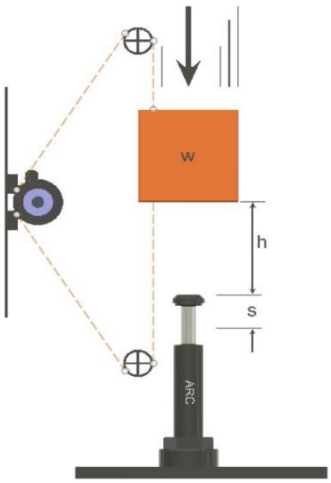


Input data:

1. *Moving mass W[kg]*
2. *Drop height H [m]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \mathbf{W} \times \mathbf{g} \times \mathbf{H}\ [\mathbf{Nm}]$
Propelling force corresponds to the weight force of the moving mass.	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times \boldsymbol{W} \times \boldsymbol{g} \times \boldsymbol{s}\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \sqrt{2\boldsymbol{gH}}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{\boldsymbol{V_d^2}}[\mathbf{kg}]$

8. Mass lowered at controlled speed

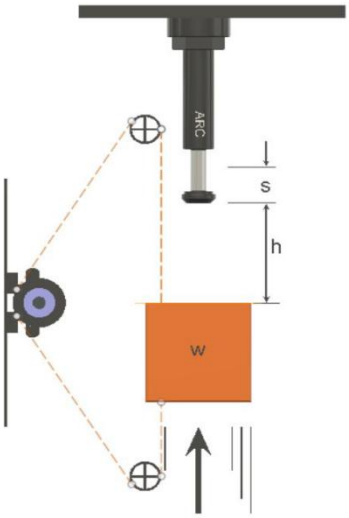


Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Motor Output P [kW]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2}[\mathbf{Nm}]$
Propelling force corresponds to the weight force of the moving mass.	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times (\frac{1000 \times \boldsymbol{P}}{\boldsymbol{V}} + \boldsymbol{Wg}) \times \boldsymbol{s}\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{\boldsymbol{V_d^2}}[\mathbf{kg}]$

9. Mass raised at controlled speed

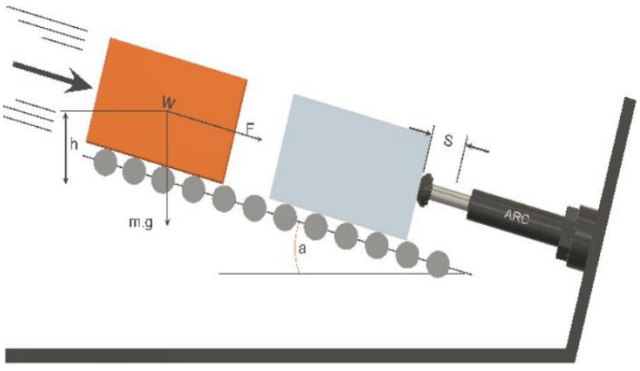


Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Motor Output P [kW]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{W} \times \mathbf{v^2} [\mathbf{Nm}]$
Propelling force corresponds to the weight force of the moving mass.	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times (\frac{1000 \times P}{V} - \boldsymbol{Wg}) \times \boldsymbol{s}\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2} [\mathbf{kg}]$

10. Mass rolling/sliding down incline

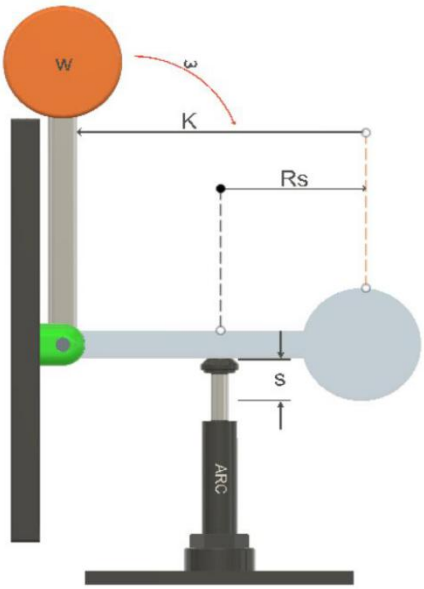


Input data:

1. *Moving mass W[kg]*
2. *Initial speed v_0[m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n*
5. *Height of fall H [m]*
6. *Angle of inclination a [°deg]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times (\frac{1}{2}\mathbf{Wv^2} + \mathbf{WgH})\ [\mathbf{Nm}]$
The propelling force corresponds to the component of the weight force	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times \boldsymbol{W} \times \boldsymbol{g} \times \boldsymbol{s} \times \sin \boldsymbol{a}\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{V}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2} [\mathbf{kg}]$

11. Falling mass about pivot point

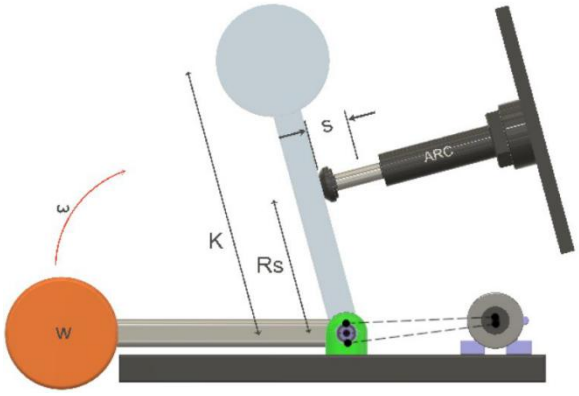


Input data:

1. *Moving mass W[kg]*
2. *Fall Height H [m/s]*
3. *Cycles per hour c [1/h]*
4. *Number of parallel shock absorbers n [-]*
5. *Shock absorber radius R_s [m]*
6. *Mass radius K [m]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \mathbf{W} \times \mathbf{g} \times \mathbf{H}\ [\mathbf{Nm}]$
The propelling force corresponds to the component of the weight force	$\mathbf{E2} = \frac{1}{\mathbf{n}} \times \mathbf{W} \times \mathbf{g} \times \frac{K}{K-Rs}\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{Rs} \times \boldsymbol{\omega}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2}\ [\mathbf{kg}]$

12. Swinging mass with propelling torque

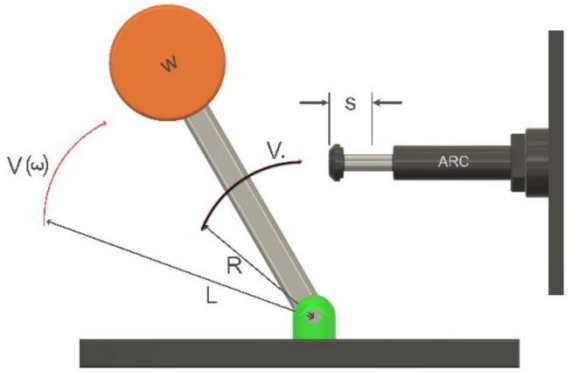


Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Mass moment of inertia I [kgm²]*
4. *Impact angular velocity ω [1/s]*
5. *Cycles per hour c [1/h]*
6. *Number of parallel shock absorbers n [-]*
7. *Propelling torque M [Nm]*
8. *Shock absorber radius R_s [m]*
9. *Mass radius K [m]*

Upon impact on the shock absorber the moving mass has kinetic energy	$\mathbf{E1} = \frac{1}{\mathbf{n}} \times \frac{1}{2} \times \mathbf{I} \times \boldsymbol{\omega}^2 [\mathbf{Nm}]$
The propelling force corresponds to the component of the weight force	$\mathbf{E2} = \frac{(\mathbf{M} - (W \times K \times \sin a)}{n \times Rs} \times s\ [\mathbf{Nm}]$
Every shock absorber must be able to absorb	$\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$
Total Energy	$\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$
Impact Speed	$\mathbf{V_d} = \mathbf{Rs} \times \boldsymbol{\omega}[\mathbf{m/s}]$
Effective Weight	$\mathbf{W_e} = \frac{2 \times \mathbf{E_3}}{V_d^2}\ [\mathbf{kg}]$

13. Swinging mass with propelling force



Input data:

1. *Moving mass W[kg]*
2. *Impact speed v [m/s]*
3. *Mass moment of inertia I [kgm²]*
4. *Impact angular velocity ω [1/s]*
5. *Cycles per hour c [1/h]*
6. *Number of parallel shock absorbers n [-]*
7. *Propelling force M [Nm]*
8. *Shock absorber radius R_s [m]*
9. *Propelling force radius K [m]*

Upon impact on the shock absorber the moving mass has kinetic energy $\mathbf{E1} = \frac{1}{n} \times \frac{1}{2} \times \mathbf{I} \times \boldsymbol{\omega}^2 [\mathbf{Nm}]$

The propelling force corresponds to the component of the weight force $\mathbf{E2} = \frac{1}{n} \times \frac{K}{Rs} \times \mathbf{M} \times \boldsymbol{s}\ [\mathbf{Nm}]$

Every shock absorber must be able to absorb $\mathbf{E3} = \mathbf{E1} + \mathbf{E2}\ [\mathbf{Nm}]$

Total Energy $\mathbf{E4} = \mathbf{E3} \times \mathbf{c}\ [\mathbf{Nm/h}]$

Impact Speed $\mathbf{V_d} = \mathbf{Rs} \times \boldsymbol{\omega} [\mathbf{m/s}]$

Effective Weight $\mathbf{W_e} = \frac{2 \times E_3}{V_d^2} [\mathbf{kg}]$

Versatile Impact Reduction and Absorption Module

VIRAM Series

ARC VIRAM Series small shock absorbers are versatile maintenance free, long life hydraulic components. These specially designed shock absorbers are easily changeable and can work in almost every kind of industrial application with effective weight varying from 1Kg to 4000Kgs by selecting proper model .All models have integral positive stop to ensure a proper positioning.

ARC VIRAM Series shock absorbers can be specially designed to control velocity low as 0.1m/sup to 6m/s. internal orifice design provides deceleration with the most efficient damping characteristics, resulting in the lowest reaction forces in the industry.

ARC VIRAM Series shock absorbers are available in both Self Adjusting and Adjustable series. On models VA25 up to VA100, shock absorption characteristic can be adjusted by turning screw at rear. After installation, cycle the machine a few times and turn the adjustment system until optimum deceleration is achieved (i.e. smooth deceleration throughout stroke).

With a huge range of outer threading and thick shaft, **ARC VIRAM Series shock absorbers** avoid the use of multiple accessories.

Successfully lab tested more than 10 million impacts and still going on.

Features and Benefits

- **ARC VIRAM Series shock absorbers** are fully field repairable units.
- Complete threaded cylinders provide mounting flexibility and increased surface area for improved heat dissipation.
- **VIRAM** custom design orifice and outer body threads can be engineered to meet specific application requirements.
- Environmentally friendly materials: ROHS Compliant materials and Bio-degradable hydraulic oil
- Jam Nut included with every shock absorber.
- Food grade options available
- ISO quality standards result in reliable, long-life operation.
- Tamper-proof design ensures repeatable performance.
- Wrench flats promote ease of mounting
- Capability to mount into pressure or vacuum chambers
- Integrated positive stopping capabilities up to 7 bars (100 psi).
- Working temperature range from 0°C to 70°C
- Special materials and finishes can be designed to meet specific customer requirements

ARC Dampers: Sales Office: 114, New Rajdhani Enclave, Pin: 110092, New Delhi.
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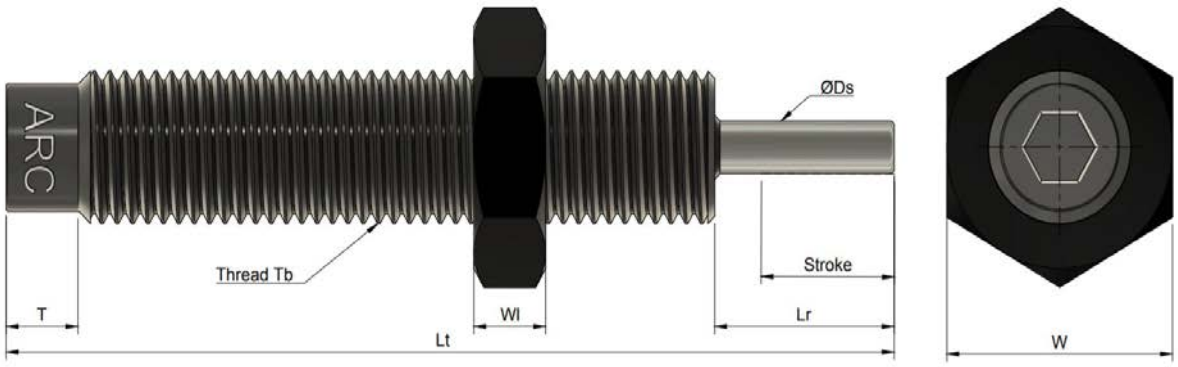
VIRAM Series Self-Adjusting Type

Dimensional Specifications: VIRAM Series VS25



Series	Standard Thread D_C	Stroke S	Diameter Shaft D_S	Rod Length L_R	Total Length L_T	Locknut Width W_L
VS 25	*M14x1.5	12	6	17	82	6

***Refer to Ordering options for more options**

Technical Specifications: VIRAM Series VS25

Order Code	Max Energy		Effective Weight		Return Force	Reset time	Weight
	E3 (Nm)	E4 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	(N)	(s)	(Kg)
VS M14x1.5 H1	20	30000	1	10	6	0.4	.07
VS M14x1.5 H2	20	30000	10	80	6	0.4	.07
VS M14x1.5 H3	20	30000	70	200	6	0.4	.07
VS M14x1.5 H4	20	30000	180	400	6	0.4	.07

Ordering options: On special orders VIRAM VS25 Series can be custom made with following configuration:
Outer Body Metal: *Steel (standard), Anodized Aluminium with colour variations and Stainless Steel.*
Outer Body Threading: *M14x1.5 (standard), M14x1, M14x2, 9/16-18UNF, M15x1, M15x1.5, M15x2, 5/8-18UNF, M16x1, M16x1.5, M16x2*
Corrosion Protection: *Black oxide (standard), Zinc plating (silver).*
Custom Damping Characteristic: *As per the specific application.*
Custom Accessories: *As per the specific application.*

For any further query, please contact us.
We will be happy to assist you in developing a unique solution.

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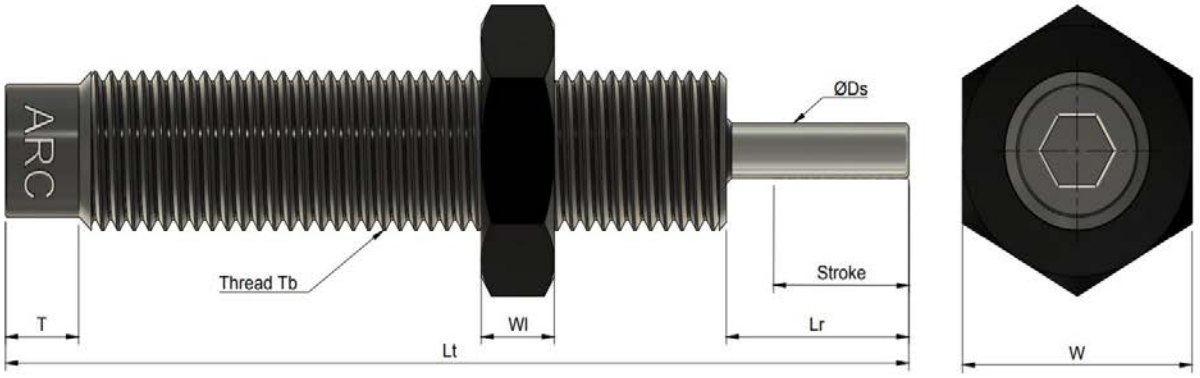
Dimensional Specifications: VIRAM Series VS50



Series	Standard Thread D_C	Stroke S	Diameter Shaft D_S	Rod Length L_R	Total Length L_T	Locknut Width W_L
VS 50	*M20x1.5	12	8	17	92	8

*Refer to Ordering options for more options

Technical Specifications: VIRAM Series VS50

Order	Max Energy		Effective Weight		Return Force	Reset time	Weight
Code	E3 (Nm)	E4 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	(N)	(s)	(Kg)
VS M20x1.5 H1	40	40000	2	25	6	0.4	.16
VS M20x1.5 H2	40	40000	20	230	6	0.4	.16
VS M20x1.5 H3	40	40000	180	900	6	0.4	.16
VS M20x1.5 H4	40	40000	800	1800	6	0.4	.16

Ordering options: On special orders VIRAMVS50 Series can be custom made with following configuration:
Outer Body Metal: *Steel (standard), Anodized Aluminium with colour variations, Stainless Steel.*
Outer Body Threading: *M20X1.5 (standard), M20X2, M20x1, M20X1.5, M22X1.5, 3/4-16 UNF*
Corrosion Protection: *Black oxide (standard), Zinc plating (silver).*
Custom Damping Characteristic: *As per the specific application.*
Custom Accessories: *As per the specific application.*

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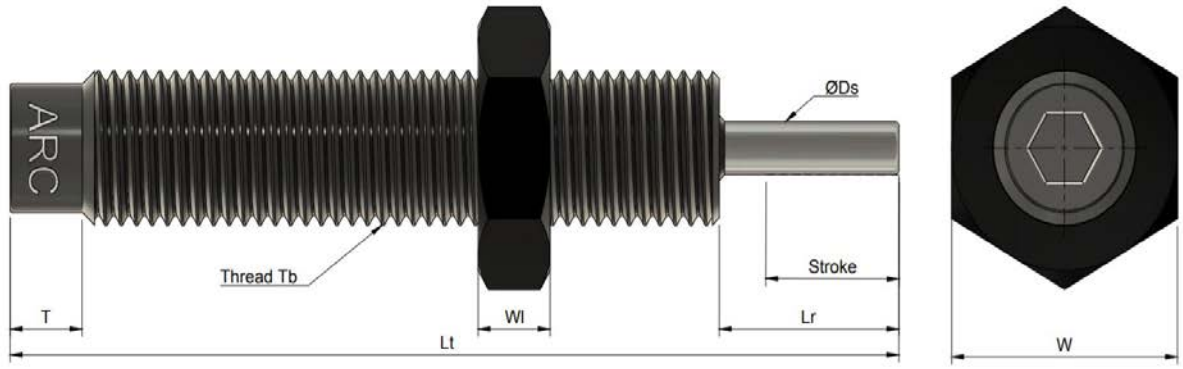
Dimensional Specifications: VIRAM Series VS100



Series	Standard Thread D_C	Stroke S	Diameter Shaft D_S	Rod Length L_R	Total Length L_T	Locknut Width W_L
VS 100	*M25x1.5	24.5	8	30	125	10

*Refer to Ordering options for more options

Technical Specifications: VIRAM Series VS100

Order	Max Energy		Effective Weight		Return Force	Reset time	Weight
Code	E3 (Nm)	E4 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	(N)	(s)	(Kg)
VS M25x1.5 H1	140	60000	10	140	8	0.4	.25
VS M25x1.5 H2	140	60000	120	1100	8	0.4	.25
VS M25x1.5 H3	140	60000	400	2300	8	0.4	.25
VS M25x1.5 H4	140	60000	2200	4500	8	0.4	.25

Ordering options: On special orders VIRAMVS100 Series can be custom made with following configuration:
Outer Body Metal: *Steel (standard), Anodized Aluminium with colour variations, Stainless Steel.*
Outer Body Threading: *M25X1.5 (standard), M24X1.5, M24X1.25, M25X2, M26X1.5, M27X2, M27X1.5, M27X3, 1-12 UNF,*
Corrosion Protection: *Black oxide (standard), Zinc plating (silver).*
Custom Damping Characteristic: *As per the specific application.*
Custom Accessories: *As per the specific application.*

For any further query, please contact us.
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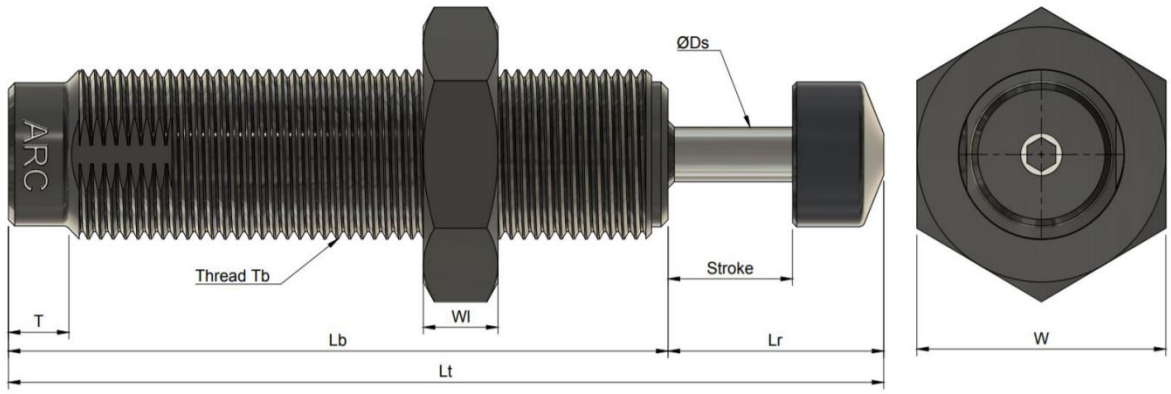
VIRAM Series Adjusting Type

Dimensional Specifications: VIRAM Series VA25 to VA100



Series	Standard Thread D_C	Stroke L_S	Diameter Shaft D_S	Rod Length L_x	Total Length L_T	Locknut Width W_L
VA 25	*M14x1.5	12	6	5	87	6
VA 50	*M20x1.5	12	8	5	97	8
VA 100	*M25x1.5	24	8	6	130	10

*Refer to Ordering options for more options

Technical Specifications: VIRAM Series VS100

Order Code	Max Energy		Effective Weight		Return Force	Reset time	Weight
	E3 (Nm)	E4 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	(N)	(s)	(Kg)
VA25	20	30000	2	200	8	0.4	.25
VA50	40	40000	2	1100	8	0.4	.25
VA100	100	65000	10	2500	8	0.4	.25

Ordering options: On special orders VIRAM Adjustable Series can be made with following configuration:
Outer Body Metal: *Steel (standard), Anodized Aluminium with colour variations, Stainless Steel.*
Corrosion Protection: *Black oxide (standard), Zinc plating (silver).*
Custom Damping Characteristic: *As per the specific application.*
Custom Accessories: *As per the specific application.*
Outer Body Threading VA25: *M14x1.5 (standard), M14x1, M14x2, 9/16-18UNF, M15x1, M15x1.5, M15x2, 5/8-18UNF, M16x1, M16x1.5, M16x2*
Outer Body Threading for VA50: *M20X1.5 (standard), M20X2, M20x1, M20X1.5, M22X1.5, 3/4-16 UNF*
Outer Body Threading for VA100: *M24X1.5 (standard), M24X1.25, M25X2, M25X1.5, M26X1.5, M27X2, M27X1.5, M27X3, 1-12 UNF,*
For any further query, please contact us. We will be happy to assist you in developing a unique solution.

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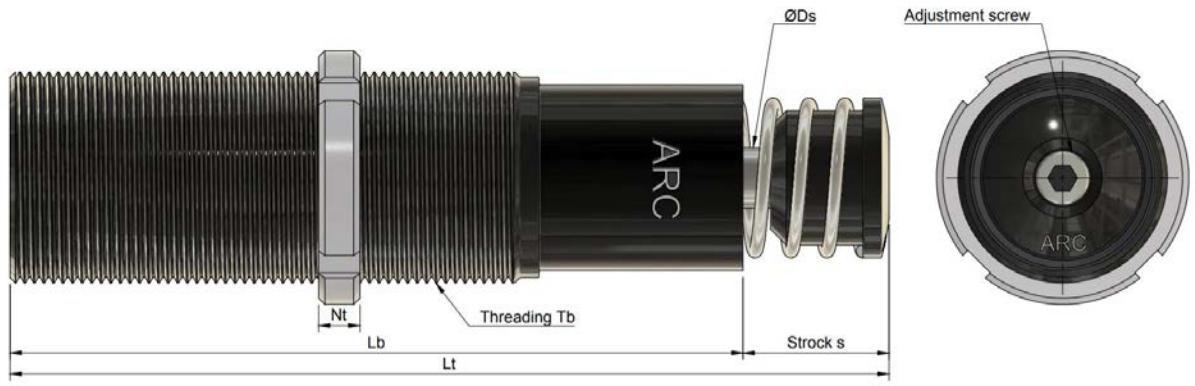
ARC Medium Shock Absorber M33

These are versatile maintenance free, long life hydraulic components. These specially designed shock absorbers are easily changeable and can work in almost every kind of industrial application with effective weight varying from 3kg to 80000Kgs by selecting proper model.

All models have integral positive stop to ensure a proper positioning. ARC Medium and Heavy Shocks can be designed to control velocity as low as 0.1m/s to up to 6m/s. internal orifice design provides a deceleration with the most efficient damping characteristic resulting in lowest reaction force. Available in both Self Adjusting and Adjustable models ARC offer following:

Dimensional Specifications M33



Model	Stroke L_S	Diameter Rod Ds	Length Body L_B	Total Length L_T
ARCM33x1.5	25/50 mm	10 mm	115/140 mm	140/190 mm

Technical Specifications: M33x1.5 Self Adjusting

Order Code	Max Energy		Effective Weight (Hardness)					Return Force (N)	Reset time (s)	Weight (Kg)
	E3 (Nm)	E4 (Nm/hr)	1	2	3	4	5			
ARCSM33x1.5 S25	**160**	**77500**	**3-10**	**10-40**	**35-110**	**100-400**	**350-1400**	**50**	**0.4**	**.5**
ARCSM33x1.5 S50	**320**	**87500**	**5-20**	**20-70**	**60-240**	**220-800**	**700-2800**	**50**	**0.4**	**.6**

Technical Specifications: M33x1.5 Adjustable

Order	Max Energy		Effective Weight		Return Force	Reset time	Weight
Code	E3 (Nm)	E4 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	(N)	(s)	(Kg)
ARCAM33x1.5 S25	**175**	**80000**	**10**	**1700**	**50**	**0.4**	**.5**
ARCAM33x1.5 S50	**350**	**90000**	**15**	**2500**	**50**	**0.4**	**.6**
ARCLM33x1.5 S25	**175**	**80000**	**300**	**50000**	**50**	**0.4**	**.5**
ARCLM33x1.5 S50	**350**	**90000**	**500**	**80000**	**50**	**0.4**	**.6**

Each Shock Absorber is supplied with 2 locknuts.

ARC Dampers: Sales Office: 114, New Rajdhani Enclave, Pin: 110092, New Delhi.
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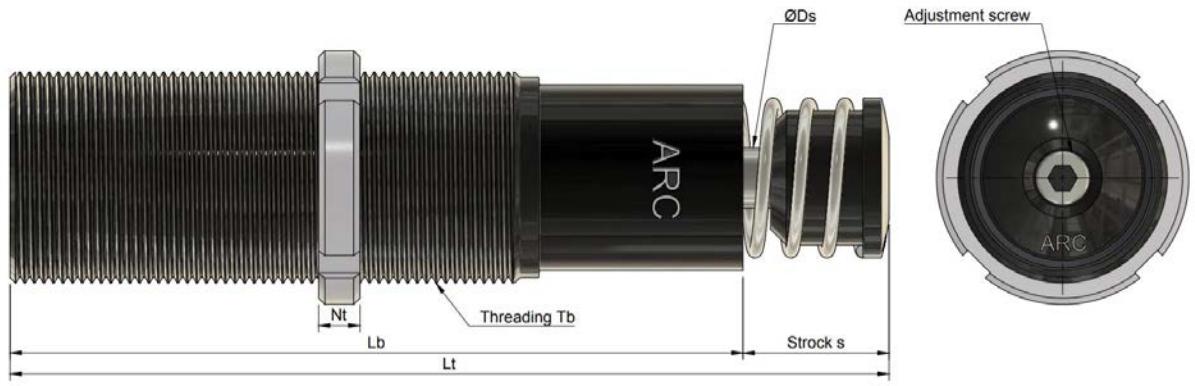
ARC Medium Shock Absorbers M45

These are versatile maintenance free, long life hydraulic components. These specially designed shock absorbers are easily changeable and can work in almost every kind of industrial application with effective weight varying from 10kg to 180000Kgs by selecting proper model.

All models have integral positive stop to ensure a proper positioning. ARC Medium and Heavy Shocks can be designed to control velocity as low as 0.1m/s to up to 6m/s. internal orifice design provides a deceleration with the most efficient damping characteristic resulting in lowest reaction force. Available in both Self Adjusting and Adjustable models ARC offer following:

Dimensional Specifications M45



Model	Stroke L_S	Diameter Rod Ds	Length Body L_B	Total Length L_T
ARCM45x1.5	25/50/75 mm	13 mm	125/150/175 mm	150/200/250 mm

Technical Specifications: M45x1.5 Self Adjusting

Order Code	Max Energy		Effective Weight (Hardness)					Return Force (N)	Reset time (s)	Weight (Kg)
	E3 (Nm)	E4 (Nm/hr)	1	2	3	4	5			
ARCS M45x1.5 S25	350	110000	10-25	20-100	80-300	260-1050	900-3500	60	0.4	1.2
ARCS M45x1.5 S50	700	115000	15-50	50-180	150-600	525-2100	2000-7000	60	0.4	1.4
ARCS M45x1.5 S75	1050	150000	25-80	75-275	250-900	800-3100	2700-10000	60	0.4	1.6

Technical Specifications: M45x1.5 Adjustable

Order Code	Max Energy		Effective Weight		Return Force	Reset time	Weight
	E3 (Nm)	E4 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	(N)	(s)	(Kg)
ARCAM45x1.5 S25	400	110000	50	10000	60	0.4	1.2
ARCAM45x1.5 S50	800	115000	75	14000	60	0.4	1.4
ARCAM45x1.5 S75	1200	150000	75	15000	60	0.4	1.6
ARCLM45x1.5 S25	400	110000	3000	110000	60	0.4	1.2
ARCLM45x1.5 S50	800	115000	5000	180000	60	0.4	1.4

Each Shock Absorber is supplied with 2 locknuts.

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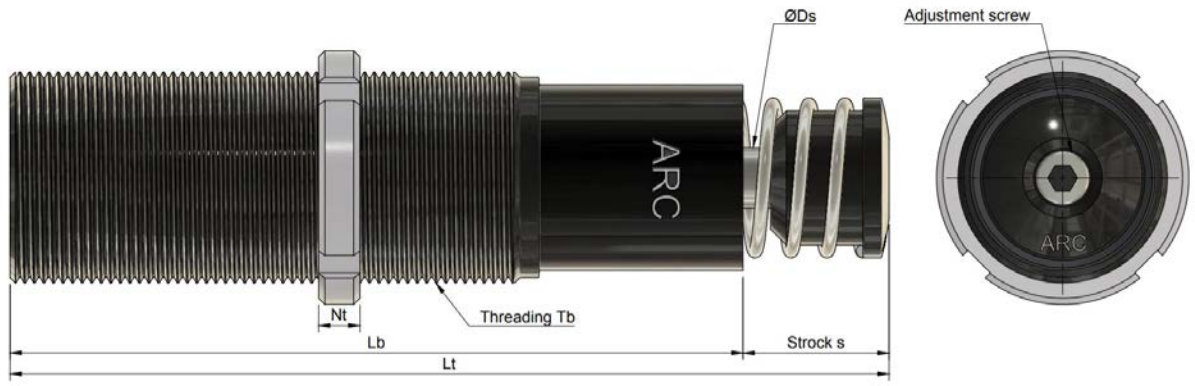
ARC Medium Shock Absorbers M64

These are versatile maintenance free, long life hydraulic components. These specially designed shock absorbers are easily changeable and can work in almost every kind of industrial application with effective weight varying from 40kg to 500000Kgs by selecting proper model.

All models have integral positive stop to ensure a proper positioning. ARC Medium and Heavy Shocks can be designed to control velocity as low as 0.1m/s to up to 6m/s. internal orifice design provides a deceleration with the most efficient damping characteristic resulting in lowest reaction force. Available in both Self Adjusting and Adjustable models ARC offer following:

Dimensional Specifications M64



Model	Stroke L_S	Diameter Rod Ds	Length Body Lb	Total Length L_T
ARCM64x2	25/50/100/150 mm	19 mm	165/180/230/300 mm	180/230/450/450mm

Technical Specifications: M64x2Self Adjusting

Order Code	Max Energy		Effective Weight (Hardness)					Return Force (N)	Reset time (s)	Weight (Kg)
	E3 (Nm)	E4 (Nm/hr)	1	2	3	4	5			
ARCS M64x2 S50	1750	150000	40-140	140-500	450-1800	1600-6000	5500-21000	90	0.4	3
ARCS M64x2 S100	3500	200000	75-275	275-1000	950-3600	3200-12000	11000-42000	90	0.4	4
ARCS M64x2 S150	5200	250000	100-450	420-1600	1400-5500	4800-18000	16000-63000	90	0.4	5

Technical Specifications: M64x2Adjustable

Order Code	Max Energy		Effective Weight		Return Force	Reset time	Weight
	E3 (Nm)	E4 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	(N)	(s)	(Kg)
ARCAM64x2 S50	1000	150000	250	50000	90	0.4	3
ARCAM64x2 S100	2000	200000	300	52000	90	0.4	4
ARCAM64x2 S150	3000	250000	350	80000	90	0.4	5
ARCLM64x2 S25	1000	125000	7000	300000	90	0.4	3
ARCLM64x2 S50	2000	150000	11000	500000	90	0.4	4

Each Shock Absorber is supplied with 2 locknuts.

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ARC SMALL & MEDIUM SHOCK ABSORBER CHART

Order Code	Max Energy E3 (Nm)	Max Energy E4 (Nm/hr)	Effective Weight $W_e$min (Kg)	Effective Weight $W_e$max (Kg)	Return Force(N)	Reset time (s)	Weight (Kg)
VS M14x1.5 H1	20	30000	1	10	6	0.4	.07
VS M14x1.5 H2	20	30000	10	80	6	0.4	.07
VS M14x1.5 H3	20	30000	70	200	6	0.4	.07
VS M14x1.5 H4	20	30000	180	400	6	0.4	.07
VS M20x1.5 H1	40	40000	2	25	6	0.4	.16
VS M20x1.5 H2	40	40000	20	230	6	0.4	.16
VS M20x1.5 H3	40	40000	180	900	6	0.4	.16
VS M20x1.5 H4	40	40000	800	1800	6	0.4	.16
VS M25x1.5 H1	140	60000	10	140	8	0.4	.25
VS M25x1.5 H2	140	60000	120	1100	8	0.4	.25
VS M25x1.5 H3	140	60000	400	2300	8	0.4	.25
VS M25x1.5 H4	140	60000	2200	4500	8	0.4	.25
VA25 (Adjustable)	20	30000	2	200	8	0.4	.25
VA50 (Adjustable)	25	40000	2	1100	8	0.4	.25
VA100 (Adjustable)	70	65000	10	2500	8	0.4	.25

Order Code	Max Energy E3 (Nm)	Max Energy E4(Nm /hr)	Effective Weight (Hardness) 1	2	3	4	5	Return Force (N)	Reset Time (s)	Weight (Kg)
ARCS M33x1.5 S25	160	77500	3-10	10-40	35-110	100-400	350-1400	50	0.4	.5
ARCS M33x1.5 S50	320	87500	5-20	20-70	60-240	220-800	700-2800	50	0.4	.6
ARCS M45x1.5 S25	350	110000	10-30	20-80	80-300	260-1050	900-3500	60	0.4	1.1
ARCS M45x1.5 S50	700	115000	15-55	50-180	150-500	525-3000	1800-7000	60	0.4	1.3
ARCS M45x1.5 S75	1050	150000	20-80	75-275	240-920	800-3100	2700-10000	60	0.4	1.5
ARCS M64x2 S50	1750	150000	40-150	145-550	470-1800	1600-6300	5300-21000	75	0.4	3
ARCS M64x2 S100	3500	195000	75-280	271-1100	950-3700	3200-12500	11000-42000	75	0.4	4
ARCS M64x2 S150	5000	250000	100-450	420-1650	1400-5600	4750-19000	16000-63000	75	0.4	5
ARCA M33x1.5 S25	175	80000	(Adjustable) 10 -1700					50	0.4	.5
ARCA M33x1.5 S50	350	90000	(Adjustable) 15 - 2500					50	0.4	.6
ARCL M33x1.5 S25	175	80000	(Adjustable) 300 - 50000					50	0.4	.5
ARCL M33x1.5 S50	350	90000	(Adjustable) 500 - 80000					50	0.4	.6
ARCA M45x1.5 S25	400	111000	(Adjustable) 50-10000					60	0.4	1.1
ARCA M45x1.5 S50	800	115000	(Adjustable) 75 - 14000					60	0.4	1.3
ARCA M45x1.5 S75	1200	150000	(Adjustable) 70 - 15000					60	0.4	1.5
ARCL M45x1.5 S25	400	111000	(Adjustable) 3000 -11000					60	0.4	1.1
ARCL 45x1.5 S50	800	115000	(Adjustable) 5000 - 180000					60	0.4	1.3
ARCA M64x2 S50	1050	150000	(Adjustable) 225 -50000					100	0.4	2.5
ARCA M64x2 S100	2100	200000	(Adjustable) 300 -52000					100	0.4	3
ARCA M64x2 S150	3150	250000	(Adjustable) 350 -80000					100	0.4	3.5
ARCL M64x2 S25	1050	125000	(Adjustable) 7000 -300000					100	0.4	2.5
ARCL M64x2 S50	2100	150000	(Adjustable) 11000 - 500000					100	0.4	3

ARC Dampers: Sales Office: 114, New Rajdhani Enclave, Pin: 110092, New Delhi.
Tel: +91 6264080095 Email: **info@arcdampers.com**

ARC Large & Heavy Duty Shock Absorbers

ARC Large Shock Absorbers are versatile maintenance free, long life hydraulic components. These specially designed shock absorbers are easily changeable and can work in almost every kind of industrial application with effective weight varying from 3000Kgs to 200000Kgs by selecting proper model. All models have integral positive stop to ensure a proper positioning. ARC Large Shock Absorbers can be specially designed to control velocity low as 0.1m/s up to 6m/s.

Internal orifice design provides deceleration with the most efficient damping characteristics, resulting in the lowest reaction forces in the industry. Shock absorption characteristic can be adjusted by turning screw at rear. After installation, cycle the machine a few times and turn the adjustment system until optimum deceleration is achieved (i.e. smooth deceleration throughout stroke). ARC Large Shock Absorbers are available in both Self Adjusting and Adjustable series.

Technical Specifications M100 – M200:

Energy capacity *3,500 Nm/Cycle to 126,000 Nm/Cycle*
Stroke *50 mm to 400 mm*
Impact velocity range *0.3 m/s to 5 m/s. Special speed customisation possible.*
Operating temperature range *- 12 °C to +66 °C. Other temperatures on request.*
Mounting *Front or Back flange*
Material *Outer body: steel corrosion-resistant coating; Piston rod: Stainless Steel / hard chrome plated steel; Rod end button: hardened steel and corrosion-resistant coating; Return spring: zinc plated steel*
Damping medium *as per the application.*
Application field *portal systems, machines and plants, conveyor systems, crane systems, loading and lifting equipment, shelf storage systems, heavy load applications, swivel units*

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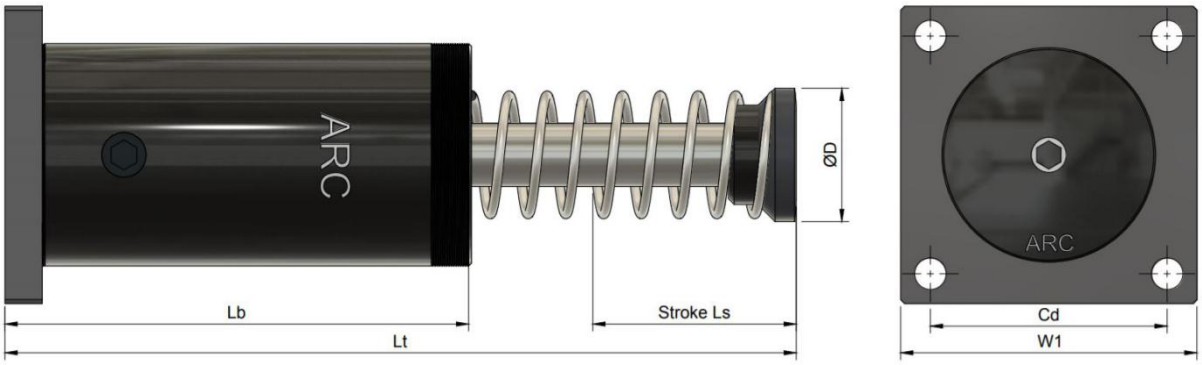
ARC Large M100 Self-Adjusting Series



Order	Stroke	Max Energy	Effective Weight		Return Force		Load Angle	Weight
Code	mm	E3 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	min(N)	max(N)	(°)	(Kg)
ARC M100x50H1	50	3500	700	2000	200	280	3	13
ARC M100x50H2	50	3500	1800	2200	200	280	3	13
ARC M100x50H3	50	3500	4500	13000	200	280	3	13
ARC M100x50H4	50	3500	11300	3500	200	280	3	13
ARC M100x100H1	100	7000	1400	4500	150	290	3	15
ARC M100x100H2	100	7000	3600	11000	150	290	3	15
ARC M100x100H3	100	7000	9100	27000	150	290	3	15
ARC M100x100H4	100	7000	22600	7000	150	290	3	15
ARC M100x150H1	150	10500	2200	6500	150	400	3	17
ARC M100x150H2	150	10500	5400	16500	150	400	3	17
ARC M100x150H3	150	10500	13600	40500	150	400	3	17
ARC M100x150H4	150	10500	34000	100000	150	400	3	17
ARC M100x200H1	200	14000	2900	8500	220	650	3	19
ARC M100x200H2	200	14000	7200	21500	220	650	3	19
ARC M100x200H3	200	14000	18100	54000	220	650	3	19
ARC M100x200H4	200	14000	45500	135000	220	650	3	19
ARC M100x250H1	250	17500	3600	11000	150	450	3	23
ARC M100x250H2	250	17500	9150	27000	150	450	3	23
ARC M100x250H3	250	17500	23000	68000	150	450	3	23
ARC M100x250H4	250	17500	57000	170000	150	450	3	23

For any dimensional related query please contact us at info@arcdampers.com, we will happy to share further details.

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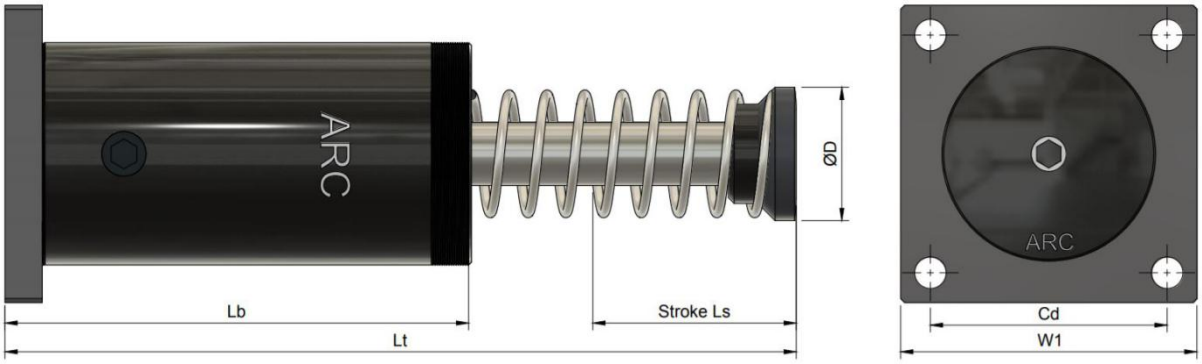
ARC Large M130 & M200 Self- Adjusting Series



Order	Stroke	Max Energy	Effective Weight		Return Force		Load Angle	Weight
Code	mm	E3 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	min(N)	max(N)	(°)	(Kg)
ARC M150x125H1	125	14000	3000	8500	260	700	3	29
ARC M150x125H2	125	14000	7500	21500	260	700	3	29
ARC M150x125H3	125	14000	18250	54000	260	700	3	29
ARC M150x125H4	125	14000	45500	136000	260	700	3	29
ARC M150x200H1	200	22000	4700	14000	280	750	3	34
ARC M150x200H2	200	22000	11600	34500	280	750	3	34
ARC M150x200H3	200	22000	29000	87000	280	750	3	34
ARC M150x200H4	200	22000	72500	217000	280	750	3	34
ARC M150x300H1	300	33500	7000	21000	260	740	3	41
ARC M150x300H2	300	33500	17500	52000	260	740	3	41
ARC M150x300H3	300	33500	43500	130000	260	740	3	41
ARC M150x300H4	300	33500	108700	35000	260	740	3	41
ARC M200x150H1	150	47000	3500	8500	450	1000	1.8	62
ARC M200x150H2	150	47000	8600	18500	450	1000	1.8	62
ARC M200x150H3	150	47000	18600	42500	450	1000	1.8	62
ARC M200x200H1	200	63000	5000	11000	300	1000	2.3	70
ARC M200x200H2	200	63000	11400	25000	300	1000	2.3	70
ARC M200x200H3	200	63000	25000	57000	300	1000	2.3	70
ARC M200x400H1	400	126000	10000	23000	300	1000	4	150
ARC M200x400H2	400	126000	23000	50000	300	1000	4	150
ARC M200x400H3	400	126000	50000	115000	300	1000	4	150

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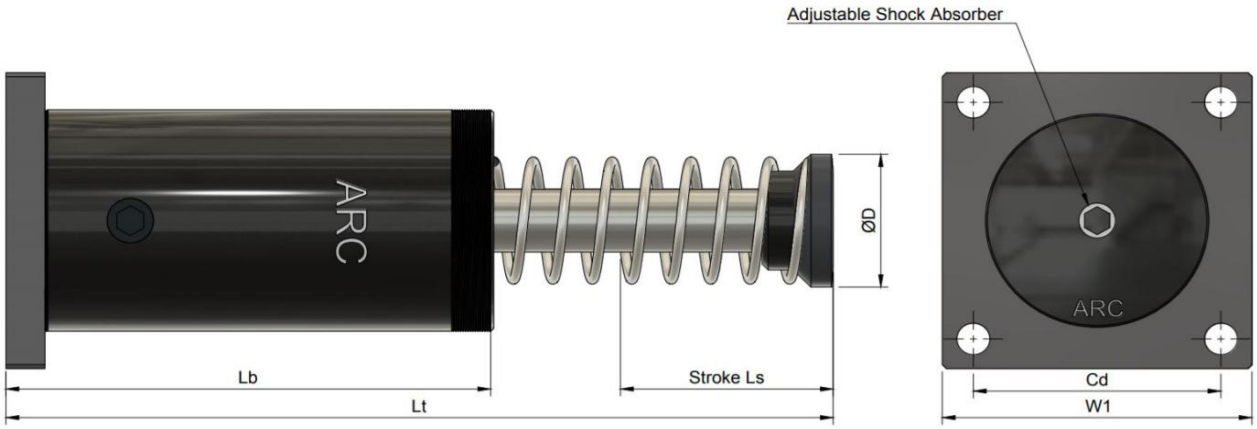
ARC Large Adjustable Shock Absorbers

If you prefer a fully adjustable shock absorber rather than a self-adjusting model on your application then this series provide a directly interchangeable alternative. ARC Large Adjustable Shock Absorbers are versatile maintenance free, long life hydraulic components. These specially designed shock absorbers are easily changeable and can work in almost every kind of industrial application with effective weight varying from 3000Kg to 200000Kgs by selecting proper model. All models have integral positive stop to ensure a proper positioning. ARC Large Shock Absorbers can be specially designed to control velocity low as 0.1m/s up to 6m/s. internal orifice design provides deceleration with the most efficient damping characteristics, resulting in the lowest reaction forces in the industry.

ARC Large A100 to A150 Adjustable Series



Order Code	Stroke mm	Max Energy E3 (Nm/hr)	Effective Weight $W_e$min (Kg)	Effective Weight $W_e$max (Kg)	Load Angle (°)	Weight (Kg)
ARC A100x50	50	3500	300	75000	3	15
ARC A100x100	100	8000	300	80000	3	16
ARC A100x150	150	12000	300	85000	3	19
ARC A100x200	200	18000	300	90000	3	22
ARC A100x250	250	20000	300	110000	3	26
ARC A150x125	100	15000	500	150000	3	35
ARC A150x150	150	28000	500	180000	3	40
ARC A150x200	200	43000	600	200000	3	45

Technical Specifications A100 – A150:

Energy capacity *3,500 Nm/Cycle to 43,000 Nm/Cycle*
Stroke *50 mm to 200 mm*
Impact velocity range *0.3 m/s to 5 m/s. Special speed customisation possible.*
Operating temperature range *- 12 °C to +66 °C. Other temperatures on request.*
Mounting *Front or Back flange*
Material *Outer body: steel corrosion-resistant coating; Piston rod: Stainless Steel / hard chrome plated steel; Rod end button: hardened steel and corrosion-resistant coating; Return spring: zinc plated steel*
Damping medium *as per the application.*
Application field *portal systems, machines and plants, conveyor systems, crane systems, loading and lifting equipment, shelf storage systems, heavy load applications, swivel units*

For any dimensional related query please contact us at info@arcdampers.com, we will happy to share further details.

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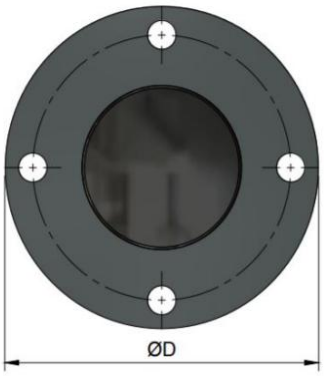
ARC Heavy Duty Shock Absorbers

The heavy duty industrial shock absorbers from ARC round off the top of the company's offers in damping technology. It offers emergency breaking safety to extreme heavy applications. It provides maximum energy absorption. The internal spring assembly in the piston tube ensures reliable extension of the piston rod following compression. Tailored to the relevant application, this shock absorber provides robustness and operational readiness.

ARC HD M90 to M210 Self- Adjusting Series



Order	Stroke	Max Energy	Effective Weight		Return Force		Load Angle	Weight
Code	mm	E3 (Nm/hr)	$W_e$min (Kg)	$W_e$max (Kg)	min(N)	max(N)	(°)	(Kg)
ARCHDM90-100	**100**	**15000**	**1550**	**125 000**	**700**	**6 500**	**3**	**14**
ARCHDM90-200	**200**	**30000**	**3100**	**250 000**	**750**	**9 000**	**3**	**17**
ARCHDM90-300	**300**	**45000**	**4650**	**350 000**	**800**	**10 000**	**2.5**	**22**
ARCHDM90-400	**400**	**60000**	**6150**	**500 000**	**600**	**10 500**	**2**	**26**
ARCHDM90-500	**500**	**75000**	**7750**	**600 000**	**650**	**11 500**	**1.5**	**30**
ARCHDM130-200	**200**	**75000**	**7750**	**600 000**	**1 150**	**8 500**	**4**	**43**
ARCHDM130-300	**300**	**110 000**	**11625**	**950 000**	**950**	**13 500**	**3**	**51**
ARCHDM130-400	**400**	**150 000**	**15475**	**1 250 000**	**1 150**	**16 000**	**3**	**60**
ARCHDM130-500	**500**	**185 000**	**19325**	**1 500 000**	**920**	**19 000**	**2.5**	**70**
ARCHDM130-600	**600**	**225 000**	**22900**	**1 750 000**	**1 150**	**21 500**	**2**	**77**
ARCHDM210-400	**400**	**225 000**	**22900**	**1 750 000**	**1 850**	**18 000**	**4**	**156**
ARCHDM210-600	**600**	**350 000**	**35 000**	**2 500 000**	**2 000**	**18 500**	**3**	**190**
ARCHDM210-800	**800**	**450 000**	**45 000**	**3 500 000**	**2 250**	**19 000**	**2**	**225**

Technical Specifications HD90 – HD210:

Energy capacity *15,000 Nm/Cycle to 450,000 Nm/Cycle*
Stroke *100 mm to 800 mm*
Impact velocity range *0.5 m/s to 4.6 m/s. Other speeds on request.*
Operating temperature range *-20 °C to +60 °C. Other temperatures on request.*
Material *Outer body: painted steel; Rod end button: steel; Piston tube: hard chrome plated steel*
Damping medium *as per application*
Application field *Railways, shelf storage systems, heavy load applications*

For any dimensional related query please contact us at info@arcdampers.com, we will happy to share further details.

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DELIVERY AND STORAGE

1. Please check the shock absorber for any damage upon delivery. In case of any damage please inform us and transport agency immediately.
2. Please remove the shock absorbers carefully from the packaging and make sure that is does not fall.
3. Shock absorbers can generally be stored in any position. But it is still recommended to keep it in a fully extended position i.e. piston rod facing outward.
4. Store it in a dust free and dry place to avoid oxidation for a maximum of 2 years without any inspection and service check.

MAINTENANCE AND CARE

Shock absorbers are sealed systems, if the shock absorber are in use regularly, then they should be checked every **two months**. And if they are not used regularly, they should be checked at least once a year.

Following checks are necessary during every inspection:

1) Piston rod resets to its fully extended position.
2) Signs of visible leakage.
3) Flanges are properly secured and are not damaged.
4) Sign of and wear or scratch on piston rod.
5) Removal of dust, if any from the lip of seal.

In case of any finding during inspection, please report it to the service department and email us with clear images and explanations so that immediate correct measure can be taken to resolve the issue as soon as possible.

DISMANTLING AND DISPOSAL

Shock absorbers are repairable systems and it is recommendable to send it to our service department in case of any repair or service. In case if it is not possible to send then kindly follow the repair manual supplied with the shock absorber.

Disposal of shock absorber and packaging material shall be done in an environmentally safe manner. The recycling of packaging saves raw materials and lowers the amount of waste.

SUPPLY OF SPARE

Current scope of spares are following:

1) **O-Rings**
2) **Wear Rings**
3) **Piston**
4) **Springs**
5) **Spring Spacer**
6) **Damping Oil**
7) **Sealing's**
8) **Button Head**

MOUNTING INSTRUCTIONS

Before installation check for the code on the shock absorber or on the package and make sure that the correct model is been installed.

Secure the moving masses. Shock absorber can be mounted in any direction, but customer has to make sure that the complete stroke is used and the total side load angle does not increase by$\pm 3°$. Shock absorber shall be properly tighten either through screw or the flanges provided.

Ambient fluids, gases and dirt particles may affect or damage the sealing system and lead to failure of the shock absorber. Piston rods and sealing systems must be protected against foreign substances.

Damage to the piston rod surface may destroy the sealing system. Do not grease, oil, etc. the piston rod and protect it from dirt particles.

Shock absorbers can break away on impact. The foundation on which the shock absorber is fitted has to be dimensioned in a way that it can withstand maximum forces.

After fitting the shock absorber kindle reassure: complete rod return, seal tightness and screw connection of mounting elements.

PRELIMINARY START-UP CHECKS

After correct mounting, first impacts on the shock absorber should only be tried with reduced impact speeds and if possible with reduced load. Differences between calculated and actual operating data can then be detected early on, and damage to system can be avoided.

After the initial trial check that the piston rod fully extends again and that there are no signs of oil leakage. Also check that the mounting hardware is still securely tightened. Make sure that no damage has occurred to the piston rod, the body, or the mounting hardware.

WARRANTY AND NOTICE OF DEFECTS

Obvious defects must be notified in writing to the seller immediately upon delivery, no later than within one week, but in any case, prior to processing or installation, otherwise assertion of a warranty claim is excluded. Timely sending is considered sufficient for adherence to the time limit.

The product has to be shipped back to the seller or if necessary the seller must be granted the opportunity for an on-site check-over. In case of a justified notice of defects, the seller shall provide at its own choice warranty through correction or compensation delivery. If the re-fulfilment fails, the purchaser can request at its own choice a reduction of payment (decrease) or rescission of the contract (withdrawal).

However, in the event of only a slight lack of conformity with the contract, the purchaser is not entitled to a right of withdrawal. Generally, only the seller's product description is agreed to for the condition of the goods.

The warranty period is generally of **two years** and begins upon successful dispatch of product. Any changes to the product generally lead to exclusion of warranty.

Life expectancy is not covered under warranty since it depends upon ambient working conditions which drastically affects the performance of seals.

ARC SHOCK ABSORBER CALCULATION FORM.

Company		**Name**	
Street		**Department**	
Zip code		**Telephone**	
City		**Machine**	

ARC Dampers design and calculation form. (Please fill all the data as per your application)		**W**	**v**	**c**	**n**	**F**	**ST**	**P**	**μ**	**M**	**L**	**R**	**r**	**a**	**H**
		Mass	Impact- velocity	Cycles per hour	Shocks parallel	Propelling force	Stall torque	Motor- power	Coefficient of friction	Propelling torque	Radius	Radius Shock	Radius Force	Angle	Drop height
		kg	m/s	1/h	-	N	-	kW	-	Nm	m	m	m	°	m
Case 1	Mass without propelling force														
Case 2	Mass with propelling force														
Case 3	Mass with propelling force up														
Case 4	Mass with propelling force down														
Case 5	Mass with motor drive														
Case 6	Mass on driven rollers														
Case 7	Swinging mass with propelling Force														
Case 8	Free falling mass														
Case 9	Mass rolling/sliding down incline														
Case 10	Rotary index table with propelling force														
Case 11	Swinging arm with propelling torque														
Case 12	Mass lowered at controlled speed														

PLEASE EMAIL US FILLED FORM AT mailto: info@arcdampers.com