izmac
Fluid Damping Technology

CESEHSA®
soluciones

Hydraulic Shock Absorbers & Buffers

info@cesehsa.com.mx | 01 800 237 3472 | cesehsa.com.mx

Best Engineered for Energy Absorption

OVERVIEW

As manufacturing process speeds up in every industry for better productivity and production size is getting larger, needs for high performance hydraulic shock absorber are increasing in the market. IZMAC has designed entirely new and innovative shock absorber, which achieved much higher output than a conventional shock absorber in rating by 200% upgrade and impact velocity up to 5m/sec. This new product is fully optimized for the best system performance and subjects to higher impact forces. This new design features a larger piston head diameter and a material balance to higher energy absorption. IZMAC will provide better solutions for energy absorption, longer life cycles and high quality products.

APPLICATIONS

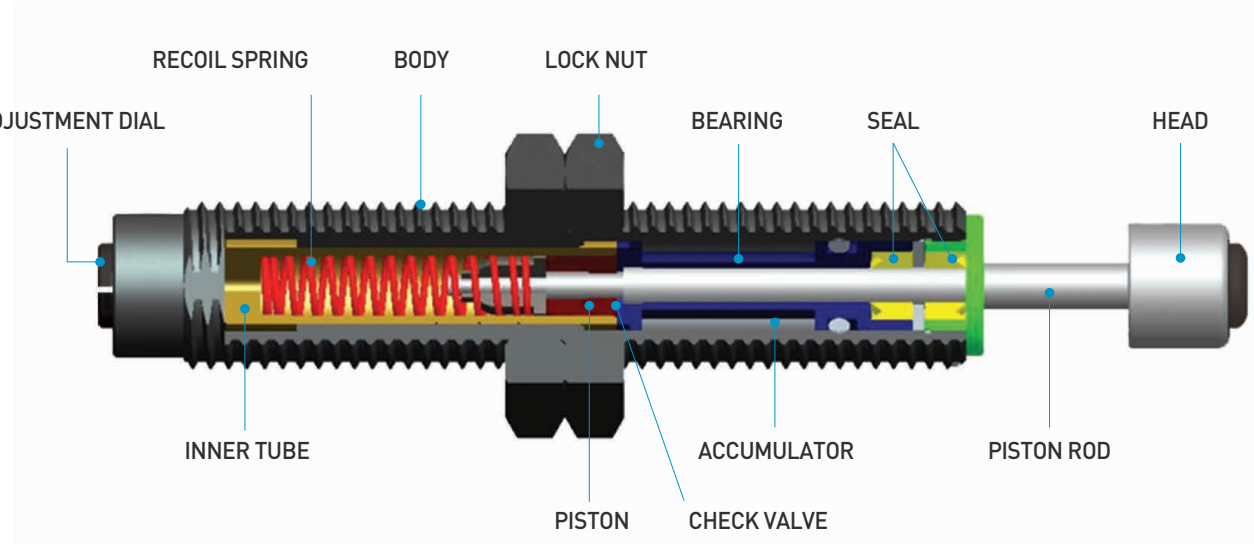
- Automotive robotics & Transfer lines
- Cranes : Bridge & Trolley, Container, Overheads
- Plastic bottle making
- Electronics and Semiconductor
- Glass forming equipments
- Pick & place robotics
- Assembling conveyors
- Material handling
- Printing machine
- Paper rolls
- Packing machinery
- Military
- Food and Beverage
- Textile
- Steel mills : Slab ingot, Crushing, Turntable
- Elevator
- Medical and Pharmaceutical equipments
- Automated storage and Retrieved system
- Aerospace
- Railway : Side & Front buffers
  Fixed rail end stop & Friction stop

SHOCK ABSORBER

Construction and principle

- Shock absorber consists of 5 major parts; Head, piston rod, body, adjustment dial and lock nut.
- Head is the direct contact part which is impacted by moving object and operated as a stopper to the body when cycle is completed.
- Piston rod transfers impact energy to the piston through the full stroke.
- Outside the body is fully threaded for easy installation at any position and for more heat dissipation.
- Adjustment dial is for the optimum operation by turning and setting knob to the various impact conditions.
- Lock nut is used to install and fix the shock absorbers tightly coupled with body thread on the machine.

The Inside of shock absorber consists of piston, check valve, inner tube, multiple orifices, accumulator, return spring and oil. On impact, the piston rod is inserting into inner tube which causes pressure to seat check ball and close the check valve, and forces the oil in the chamber to flow through the orifice, generating damping force, to the opposite piston and accumulator which is compressed to compensate the volume of the piston rod.



Energy absorption theory

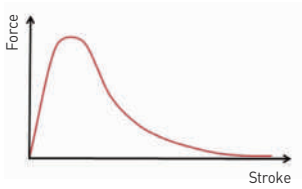
After impact, coil spring forces check ball unseated and open the check valve to pass the oil into the oil chamber and recoil piston head and rod to its original position.

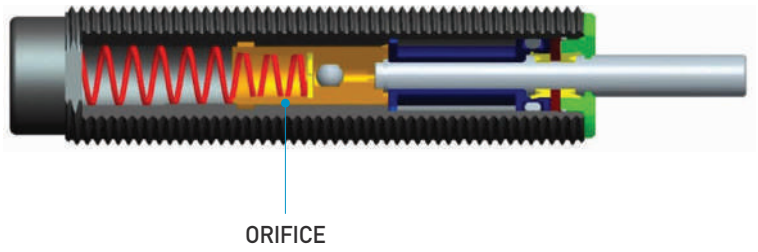
When oil passes through the orifice, the impact energy is converted to the heat energy and dissipated to the atmosphere.

ORIFICE CHARACTERISTIC

Single Orifice

- Single orifice type is called dashpot which has only one orifice on the piston as a hole or annular shape.
- At the beginning the shock force is very high and decreased rapidly.



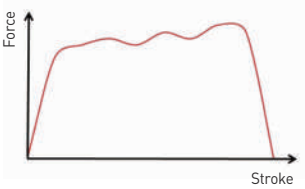


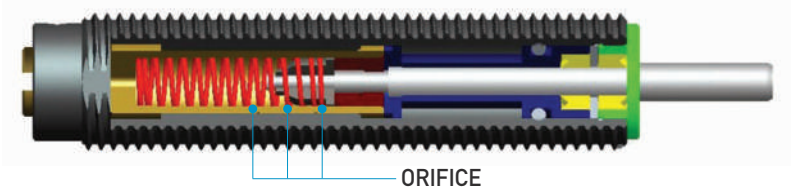
Multiple Orifices

Through the stroke, the piston head closes one by one, which provides constant linear deceleration.

■ ADJUSTMENT TYPE

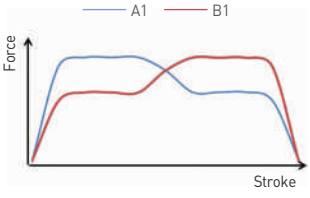
Adjustment type shock absorber is for the optimum deceleration to turn and set properly adjustment dial to the impact conditions.

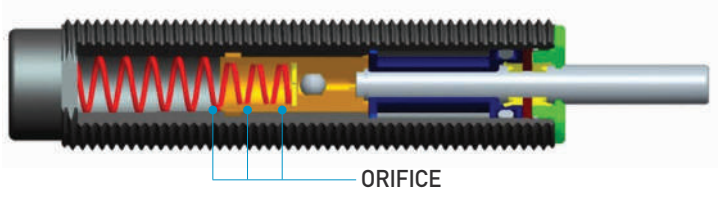




■ SELF-COMPENSATING TYPE

Self-compensating shock absorber is suitable for unvaried operating conditions and available in the range of effective weight for the best deceleration.
A1 is a diagram of high speed and low propelling force.
B1 is a diagram of low speed and high propelling force.





Hydraulic Shock Absorbers

▪ Symbols

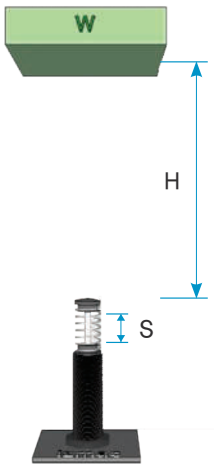
Symbol	Unit	Description	Symbol	Unit	Description
E_K	Nm	Kinetic energy	T	Nm	Torque
E_W	Nm	Work energy	H	m	Height
E_T	Nm	Total energy	W	kg	Weight
E_TC	Nm / h	Total energy per hour	P	bar	Operating pressure
F_S	N	Impact force	ω	rad / s	Angular velocity
F_P	N	Shock force	α	°	Angle of incline
W_E	kg	Effective weight	I	kgm²	Mass moment
C	Cycles / h	Cycles per hour	K	m	Radius of gyration
S	m	Stroke	R_S	m	Mounting distance from pivot point
V	m / s	Impact velocity	μ		Coefficient of friction
V_D	m / s	Mass velocity	g	m / s²	Gravitational acceleration
P_M	kW	Motor power	a	m / s²	Acceleration
D	mm	Inner diameter of cylinder	t	s	Time

▪ Useful Formulas

Description	Symbol	Formulas
Impact force	F_S	$= E_T / S / 0.8$
Motor power	F_P	$= 3000 \times P_M / V$
Cylinder power	F_P	$= 0.0785 \times D^2 \times P$
Effective weight	W_E	$= 2 \times E_T / V^2$
Velocity (free falling)	V	$=\sqrt{2 \times g \times H}$
Velocity (with acceleration)	V	$= 2 \times D / t$
Velocity (w/o acceleration)	V	$= D / t$
Deceleration	a	$= V^2 / 2 / S$
Stopping time	t	$= 2.6 \times S / V$

▪ Sizing Examples

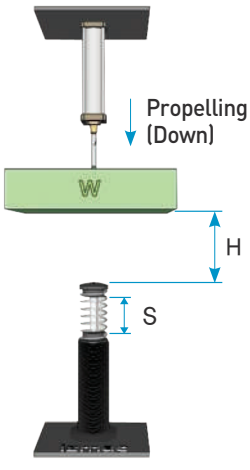
A. Free Falling Mass



- Weight — W = 600kg
- Height — H = 0.5m
- Cycles per hour — C = 60Cycles / h
- Gravitational acceleration — g = 9.81m / s²

$E_K = W \times g \times H$	600 X 9.81 X 0.5	2,943	Nm
	Select Model with E_K : MDA64 -100		
$E_W = W \times g \times S$	600 X 9.81 X 0.1	589	Nm
$E_T = E_K + E_W$	2,943 + 589	3,532	Nm
$V = \sqrt{2 \times g \times H}$	$\sqrt{2 \times 9.81 \times 0.5}$	3.13	m / s
$W_E = 2 \times E_T / V^2$	2 X 3,532 / 3.13²	720	kg
$E_TC = E_T \times C$	3,532 X 60	211,896	Nm / h
	Selected Model with E_K, E_TC & W_E : MDA64-100		

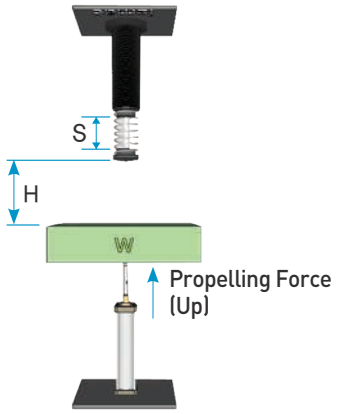
B. Down Mass with Propelling Force



- Weight — W = 1,200kg
- Impact velocity — V = 1.8m / s
- Inner diameter of cylinder — D = 140mm
- Operating pressure — P = 5bar
- Cycles per hour — C = 125Cycles / h

$E_K = W \times V^2 / 2$	1,200 X 1.8² / 2	1,944	Nm
	Select Model with E_K : MDA85-50		
$F_P = 0.0785 \times D^2 \times P + W \times g$	0.0785 X 140² X 5 +1,200 X 9.81	19,465	Nm
$E_W = F_P \times S$	19,465 X 0.05	973	Nm
$E_T = E_K + E_W$	1,944 + 973	2,917	Nm
$E_TC = E_T \times C$	2,917 X 125	364,656	Nm / h
$W_E = 2 \times E_T / V^2$	2 X 2,917 / 1.8²	1,801	kg
	Select Model with E_K, E_TC & W_E : MDA85-50		

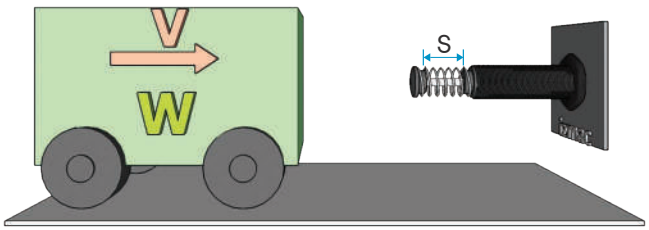
C. Up Mass with Propelling Force



- **Weight** W = 200kg
- **Impact velocity** V = 2.5m/s
- **Inner diameter of cylinder** D = 150mm
- **Operating pressure** P = 5bar
- **Cycles per hour** C = 180Cycles/h

$E_K = W \times V^2 / 2$	$200 \times 2.5^2 / 2$	625	Nm
	Select Model with E_K : MDA45-50		
$F_P = 0.0785 \times D^2 \times P - W \times g$	$0.0785 \times 150^2 \times 5 - 200 \times 9.81$	6,869	Nm
$E_W = F_P \times S$	$6,869 \times 0.05$	343	Nm
$E_T = E_K + E_W$	$625 + 343$	968	Nm
$E_TC = E_T \times C$	968×180	174,323	Nm/h
$W_E = 2 \times E_T / V^2$	$2 \times 968 / 2.5^2$	310	kg
	Select Model with E_K, E_TC & W_E : MDA45-50		

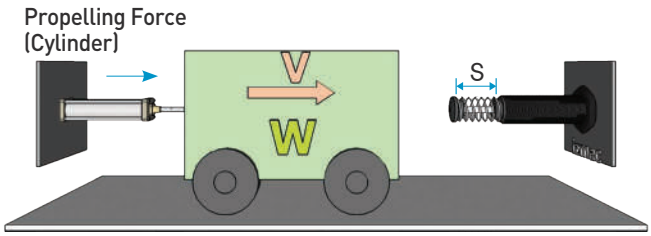
D. Horizontal Mass without Propelling Force



- **Weight** W = 100kg
- **Impact velocity** V = 1.5m/s
- **Cycles per hour** C = 600Cycles/h

$E_K = W \times V^2 / 2$	$100 \times 1.5^2 / 2$	113	Nm
$E_T = E_K + E_W$	$113 + 0$	113	Nm
$E_TC = E_T \times C$	113×600	67,800	Nm/h
$W_E = 2 \times E_T / V^2$	$2 \times 113 / 1.5^2$	100	kg
	Select Model with E_K, E_TC & W_E : SDA25-25		

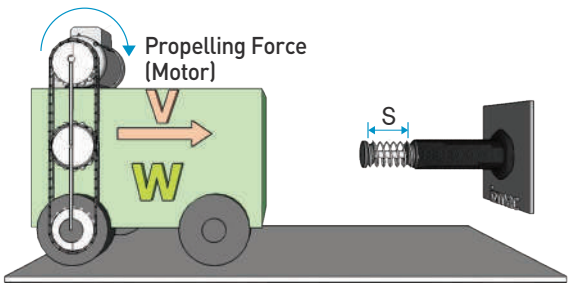
E. Horizontal Mass with Propelling Force [Cylinder]



- **Weight** W = 300kg
- **Impact velocity** V = 1.2m/s
- **Inner diameter of cylinder** D = 50mm
- **Operating pressure** P = 5bar
- **Cycles per hour** C = 300Cycles/h

$E_K = W \times V^2 / 2$	$300 \times 1.2^2 / 2$	216	Nm
	Select Model with E_K : SDA36-25		
$F_P = 0.0785 \times D^2 \times P$	$0.0785 \times 50^2 \times 5$	981	Nm
$E_W = F_P \times S$	981×0.025	25	Nm
$E_T = E_K + E_W$	$216 + 25$	241	Nm
$E_TC = E_T \times C$	241×300	72,300	Nm/h
$W_E = 2 \times E_T / V^2$	$2 \times 241 / 2.5^2$	334	kg
	Select Model with E_K, E_TC & W_E : SDA36-25		

F. Horizontal Mass with Propelling Force [Motor]

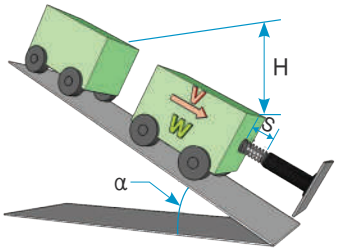


- **Weight** W = 1,300kg
- **Impact velocity** V = 1.6m/s
- **Motor power** P_M = 3kW
- **Cycles per hour** C = 100Cycles/h

$E_K = W \times V^2 / 2$	$1,300 \times 1.6^2 / 2$	1,664	Nm
	Select Model with Ek : MDA64-50		
$F_P = 3,000 \times P_M / V$	$3,000 \times 3 / 1.6$	5,625	N
$E_W = F_P \times S$	$5,625 \times 0.05$	281	Nm
$E_T = E_K + E_W$	$1,664 + 281$	1,945	Nm
$E_TC = E_T \times C$	$1,945 \times 100$	194,500	Nm/h
$W_E = 2 \times E_T / V^2$	$2 \times 1,945 / 1.6^2$	1,520	kg
	Select Model with E_K, E_TC & W_E : MDA64-50		

Hydraulic Shock Absorbers

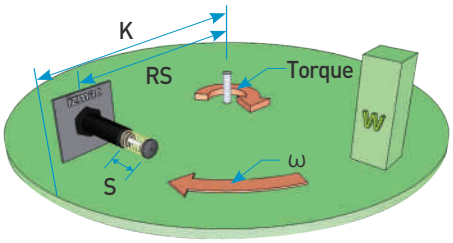
G. Sliding Down Mass without Propelling Force



- **Weight** W = 800kg
- **Angular of incline** α = 30°
- **Height** H = 0.7m
- **Cycles per hour** C = 100Cycles / h

$E_K = W \times H \times g$	800 X 0.7 X 9.81	5,494	Nm
	Select Model with E_k : MDA85-100		
$F_P = W \times \sin(\alpha) \times g$	800 X sin(30) X 9.81	3,922	N
$E_W = F_P \times S$	3,922 X 0.1	392	Nm
$E_T = E_K + E_W$	5,494 + 392	5,886	Nm
$V = \sqrt{2 \times g \times H}$	$\sqrt{2 \times 9.81 \times 0.7}$	3.7	m / s
$E_TC = E_T \times C$	5,886 X 100	588,600	Nm / h
$W_E = 2 \times E_T / V^2$	2 X 5,886 / 3.7^2	857	Nm / h
	Select Model with E_K, E_TC & W_E : MDA85-100		

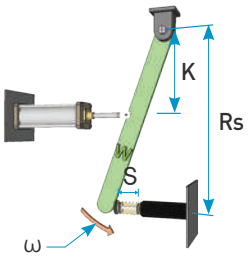
H. Rotary Table Mass with Propelling Force



- **Weight** W = 200kg
- **Angular velocity** ω = 2rad / s
- **Mounting distance from pivot point** Rs = 0.5m
- **Radius of gyration** K = 0.8m
- **Torque** T = 400Nm
- **Cycles per hour** C = 350Cycles / h

$I = W \times K^2$	200 X 0.8^2	128	kgm^2
$E_K = I \times \omega^2 / 2$	128 X 2^2 / 2	256	Nm
	Select Model with E_k : SDA36-25		
$F_P = T / Rs$	400 / 0.5	800	N
$E_W = F_P \times S$	800 X 0.025	20	Nm
$E_T = E_K + E_W$	256 + 20	276	Nm
$V = Rs \times \omega$	0.5 X 2	1	m / s
$E_TC = E_T \times C$	276 X 350	96,600	Nm / h
$W_E = 2 \times E_T / V^2$	2 X 276 / 1^2	552	kg
	Select Model with E_K, E_TC & W_E : SDA36-25		

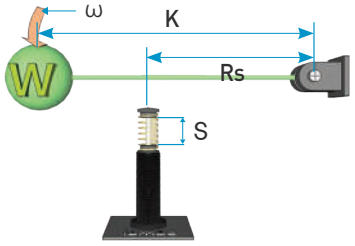
I. Swiveling Mass with Propelling Force



- **Weight** W = 50kg
- **Angular velocity** ω = 2.5rad / s
- **Mounting distance from pivot point** Rs = 0.8m
- **Radius of gyration** K = 0.5m
- **Inner diameter of cylinder** D = 40mm
- **Operating pressure** P = 5Bar
- **Cycles per hour** C = 1,000Cycles / h

$I = W \times K^2$	50 X 0.5^2	13	kgm^2
$E_K = I \times \omega^2 / 2$	13 X 2.5^2 / 2	39	Nm
	Select Model with E_k : SDA20-15		
$F_P = 0.0785 \times D^2 \times P \times K / Rs$	0.0785 X 40^2 X 5 X 0.5 / 0.8	393	N
$T = F_P \times Rs$	393 X 0.8	314	Nm
$E_W = F_P \times S$	393 X 0.015	6	Nm
$E_T = E_K + E_W$	39 + 6	45	Nm
$E_TC = E_T \times C$	45 X 1,000	45,000	Nm / h
$V = Rs \times \omega$	2.5 X 0.8	2	m / s
$W_E = 2 \times E_T / V^2$	2 X 45 / 2^2	22	kg
	Select Model with E_T, E_TC & W_E : SDA20-15		

J. Swiveling Mass without Propelling Force



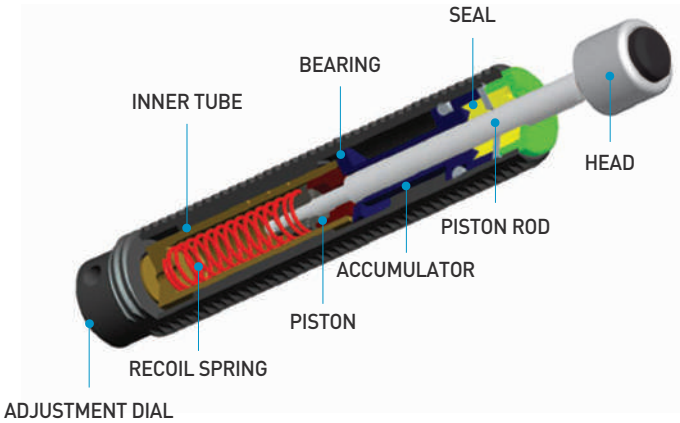
- **Weight** W = 200kg
- **Impact velocity** V = 2m / s
- **Angular velocity** ω = 2.5rad / s
- **Mounting distance from pivot point** Rs = 0.6m
- **Radius of gyration** K = 0.8m
- **Cycles per hour** C = 200Cycles / h

$I = W \times K^2$	200 X 0.8^2	128	kgm^2
$E_K = I \times \omega^2 / 2$	128 X 2.5^2 / 2	400	Nm
	Select Model with E_K : SDA36-50		
$F_P = W \times g \times K / Rs$	200 X 9.81 X 0.8 / 0.6	2,616	N
$E_W = F_P \times S$	2,616 X 0.05	131	Nm
$E_T = E_K + E_W$	400 + 131	531	Nm
$E_TC = E_T \times C$	531 X 200	106,200	Nm / h
$V_D = V \times Rs / K$	2 X 0.6 / 0.8	1.5	m / s
$W_E = 2 \times E_T / V_D^2$	2 X 531 / 1.5^2	472	kg
	Select Model with E_K, E_TC & W_E : SDA36-50		

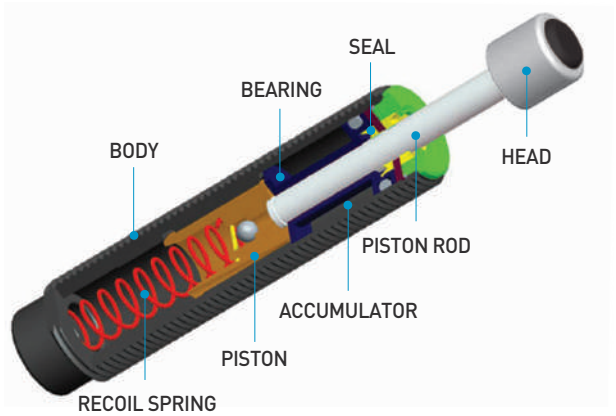
SDA & SDS Series

▪ Description

SDA Series have an adjustment dial which can set 12 finite steps according to the impact velocity condition with advanced wide damping control range.
SDS Series have an ability to adjust and control deceleration force by self compensating according to the impact velocity.
SDA & SDS Series have achieved 200% of energy absorption with expanded Effective Weight coverage compared with former products.



SDA series



SDS series

▪ Features

- All outside thread-type body surface enables easy installation by fixing nuts tightly. Heat energy dissipation is enabled efficiently by the increased body surface area.
- Zn-Ni body coating (black color) enables to improve anti-corrosiveness for a long time usage.
- Stop collar is unnecessary if you're using steel head. The impact noise will be much reduced by using poly pad or urethane cap.
- Bearing is designed to protect seal by using special material and it guarantees a long durability.
- Velocity range : Standard : 0.1 ~ 5m/s Low Speed : OPTION
- Temperature coverage : −10 ~ 80℃ Special : −40 ~ 120℃

▪ SDA & SDS Series Ordering Information

SDA 25 − 25 − CS

- CS : Stop Collar
- FR : Rectangular Flange
- LS : Side Load Adaptor
- MC : Clamp Mount

Stroke

Body Thread Size

SD : SERIES
A : Adjustable
S : Non-Adjustable

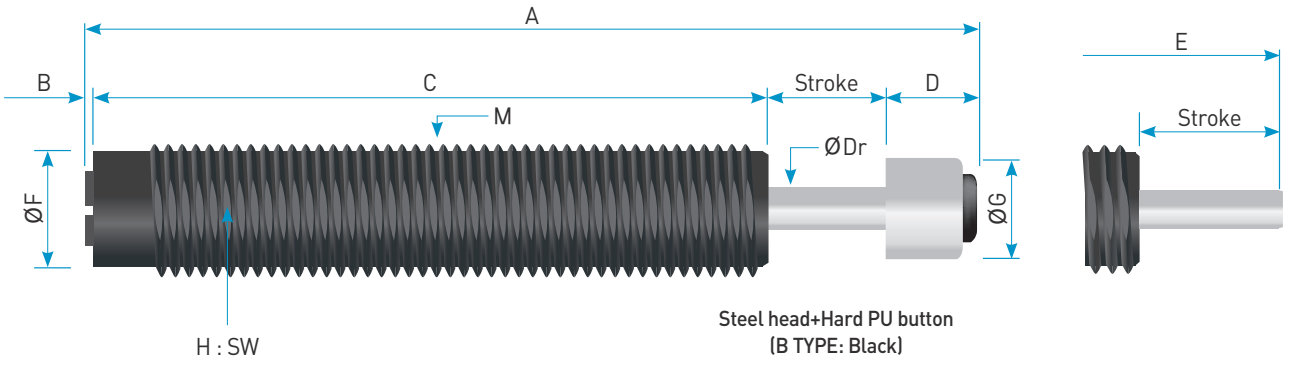
SDA 12/14 Series

▪ Engineering Data

Model	Stroke(mm)	Max.Energy / Cycle (Nm)	Max.Energy / Hour [Nm/h]	Effective Weight (kg)	Recoil Force (N) Ext.	Recoil Force (N) Com.	Weight (g)
SDA12-10(B)	10	16	30,500	1.5-333	3.6	9.8	55
SDA14-12(B)	12	18	38,000	1.8-400	4.9	11.4	80

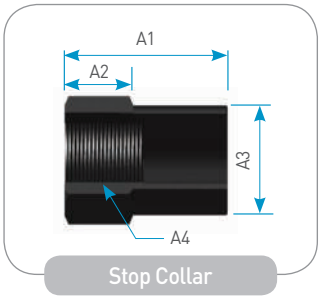
▪ Dimensions

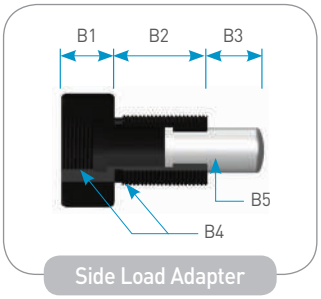
Model	Stroke	A	B	C	D	E	F	G	H	M	Dr
SDA12-10(B)	10	84	1.2	62.8	10	74	Φ10.3	Φ10.5	-	M12 X 1.0	Φ4
SDA14-12(B)	12	96	1.2	72.8	10	86	Φ12	Φ10.5	12.5	M14 X 1.5	Φ4

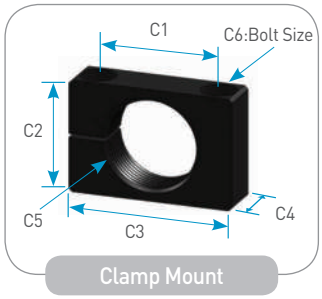


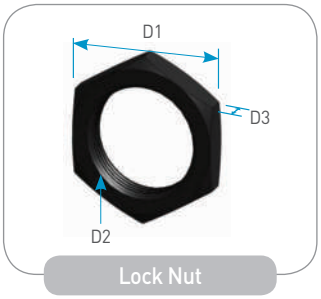
▪ Accessories

Model	Stop Collar				Side Load Adapter					Clamp Mount						Lock Nut		
	A1	A2	A3	A4	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D2	D3
SDA12-10(B)	20	8	Φ13.8	M12 X 1.0	12	17.5	10	M12 X 1.0	Φ5	20	16	32	12	M12 X 1.0	M5 X 18L	14	M12X1.0	4
SDA14-12(B)	27	12	Φ18	M14 X 1.5	14	19.5	12	M14 X 1.5	Φ6	20	20	32	12	M14 X 1.5	M5 X 25L	19	M14X1.5	5









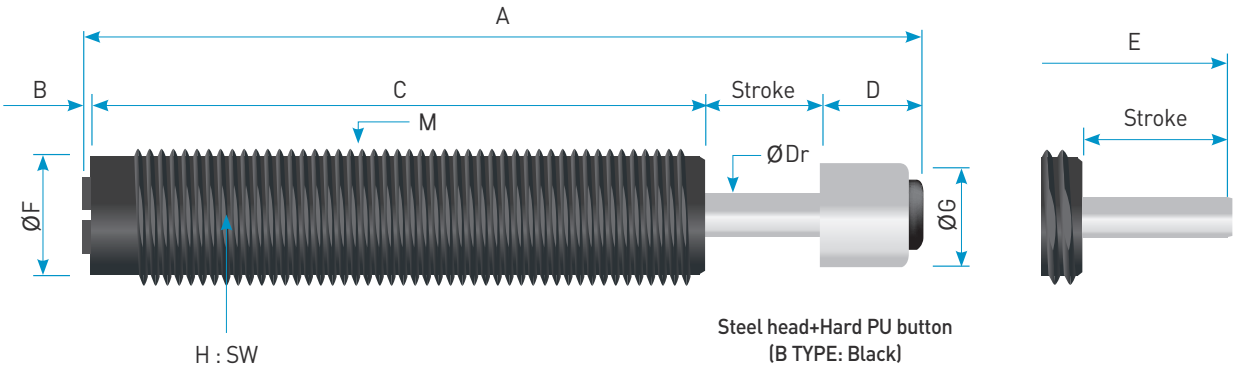
SDA 16/20/25/27 Series

▪ Engineering Data

Model	Stroke(mm)	Max.Energy / Cycle (Nm)	Max.Energy/Hour (Nm / h)	Effective Weight (kg)	Recoil Force (N) Ext.	Recoil Force (N) Comp.	Weight (g)
SDA16-12(B)	12	24	47,200	2-533	5	11.5	80
SDA20-15(B)	15	56	58,000	4.5-1,244	8	19.6	145
SDA25-25(B)	25	150	96,000	11.5-3,334	10.2	29.5	285
SDA27-25(B)	25	150	96,000	11.5-3,334	10.2	29.5	305

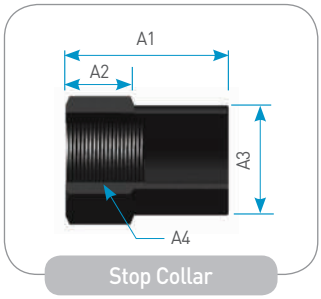
▪ Dimensions

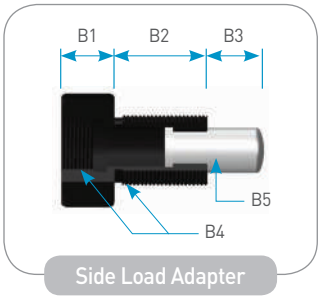
Model	Stroke	A	B	C	D	E	F	G	H	M	Dr
SDA16-12(B)	12	97	1.2	71.3	12.5	84.5	Φ13.6	Φ13.5	14.5	M16 X 1.5	Φ5
SDA20-15(B)	15	109	1.5	79	13.5	95.5	Φ17.6	Φ13.5	18.5	M20 X 1.5	Φ6
SDA25-25(B)	25	144	1.5	101	16.5	127.5	Φ22.6	Φ16	23	M25 X 1.5	Φ8
SDA27-25(B) SDA27-25F(B)	25	144	1.5	101	16.5	127.5	Φ22.6	Φ16	23	M27 X 3.0 M27 X 1.5	Φ8

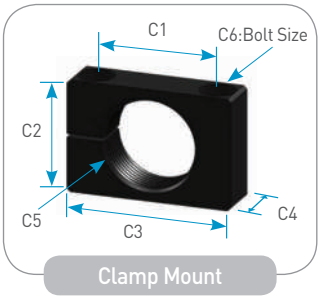


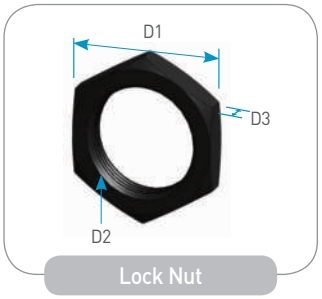
▪ Accessories

Model	Stop Collar				Side Load Adapter					Clamp Mount						Lock Nut		
	A1	A2	A3	A4	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D2	D3
SDA16-12(B)	27	12	Φ19	M16X1.5	19	22.8	12	M16X1.5	Φ8	24	22	36	16	M16X1.5	M6X25L	19	M16X1.5	6
SDA20-15(B)	36	15	Φ24	M20X1.5	20	34	15	M20X1.5	Φ12	28	25	40	20	M20X1.5	M6X30L	24	M20X1.5	6
SDA25-25(B)	42	18	Φ31.5	M25X1.5	20	42	25	M25X1.5	Φ16	32	32	46	25	M25X1.5	M6X35L	32	M25X1.5	8
SDA27-25(B) SDA27-25F(B)	42	18	Φ31.5	M27X3.0 M27X1.5	20	42	25	M27X3.0 M27X1.5	Φ16	35	32	48	25	M27X3.0 M27X1.5	M6X35L	32	M27X3.0 M27X1.5	8









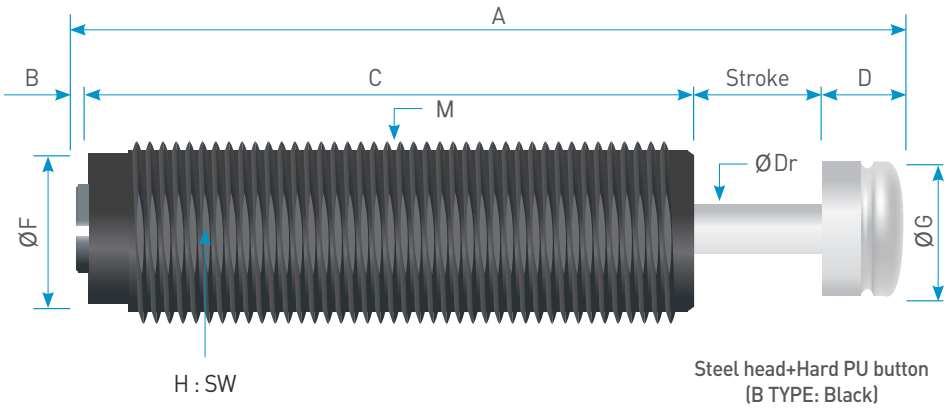
SDA 36 Series

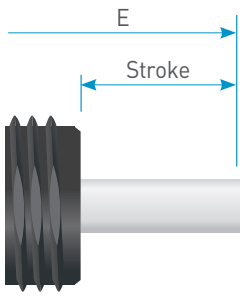
▪ Engineering Data

Model	Stroke(mm)	Max.Energy / Cycle (Nm)	Max.Energy / Hour [Nm / h]	Effective Weight (kg)	Recoil Force (N) Ext.	Recoil Force (N) Comp.	Weight (g)
SDA36-25(B)	25	300	108,000	24-6,667	25	56.2	725
SDA36-50(B)	50	615	142,000	49-13,667	22.5	60	885

▪ Dimensions

Model	Stroke	A	B	C	D	E	F	G	H	M	Dr
SDA36-25(B)	25	158.5	2	116	15.5	143	Φ31	Φ28	34	M36 X 1.5	Φ10
SDA36-50(B)	50	218	2	150.5	15.5	202.5	Φ31	Φ28	34	M36 X 1.5	Φ10

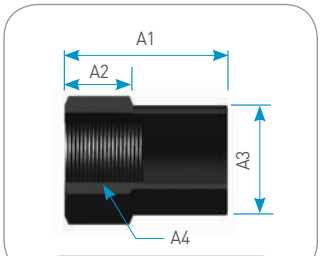




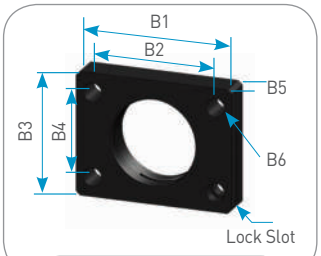
Steel head+Hard PU button
(B TYPE: Black)

▪ Accessories

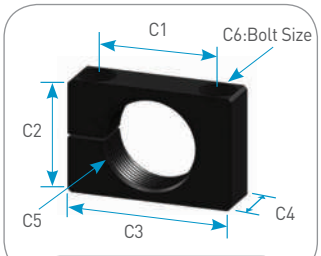
Model	Stop Collar				Rectangular Flange						Clamp Mount						Lock Nut		
	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D1	D2	D3
SDA36-25(B)	62	26	Φ45	M36 X 1.5	51	41	45	29	10	4–Φ20	45	42	61	25	M36 X 1.5	M6 X 45L	46	M36 X 1.5	10



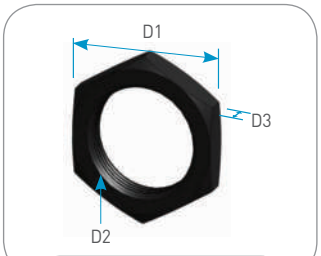
Stop Collar



Rectangular Flange



Clamp Mount



Lock Nut

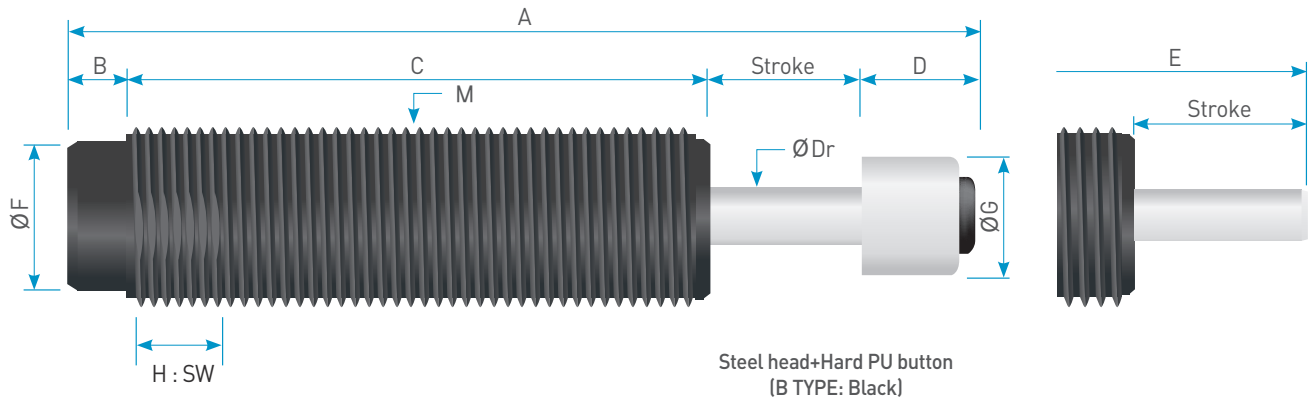
SDS 10/12/14 Series

▪ Engineering Data

Model	Stroke(mm)	Max.Energy / Cycle (Nm)	Max.Energy / Hour (Nm / h)	Effective Weight (kg) S	M	H	Recoil Force (N) Ext.	Comp.	Weight (g)
SDS10-08(B)	8	10	13,200	1.6-5.0	3.2-14	10.2-41	2.6	7	15
SDS12-10(B)	10	16	30,000	1.3-8	6.6-22	16-65	3.8	9.8	23
SDS14-15(B)	15	30	51,000	3.8-15	12-42	31-1,500	3.8	13	43

▪ Dimensions

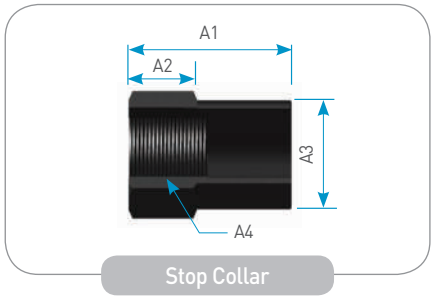
Model	Stroke	A	B	C	D	E	F	G	H	M	Dr
SDS10-08(B)	8	64.5	7.5	42	7	57.5	Φ8.6	Φ8.6	8	M10 X 1.0	Φ3
SDS12-10(B)	10	80.5	6.5	54	10	70.5	Φ10.8	Φ10.5	10	M12 X 1.0	Φ4
SDS14-15(B) SDS14-15F(B)	15	100.5	6.5	69	10	90.5	Φ11.8	Φ10.5	12	M14 X 1.0	Φ4



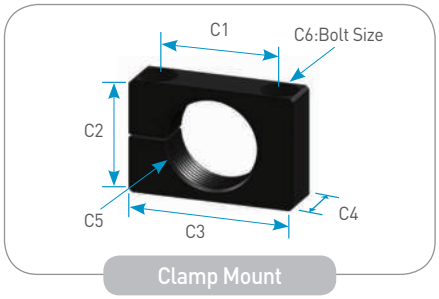
Steel head+Hard PU button
(B TYPE: Black)

▪ Accessories

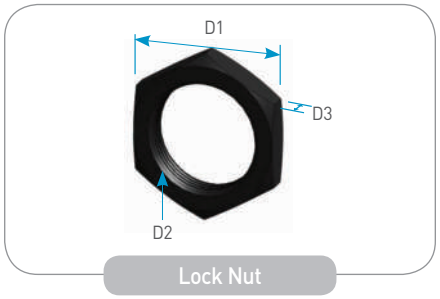
Model	Stop Collar A1	A2	A3	A4	Clamp Mount C1	C2	C3	C4	C5	C6	Lock Nut D1	D2	D3
SDS10-08(B)	20	8	Φ12.8	M10 X 1.0	16	14	25	10	M10 X 1.0	M4 X 16L	13	M10 X 1.0	4
SDS12-10(B)	20	8	Φ13.8	M12 X 1.0	20	16	32	12	M12 X 1.0	M5 X 18L	14	M12 X 1.0	4
SDS14-15(B) SDS14-15F(B)	27	12	Φ18	M14 X 1.5 M14 X 1.0	20	20	32	12	M14 X 1.5 M14 X 1.0	M5 X 25L	19	M14 X 1.5 M14 X 1.0	5



Stop Collar



Clamp Mount



Lock Nut

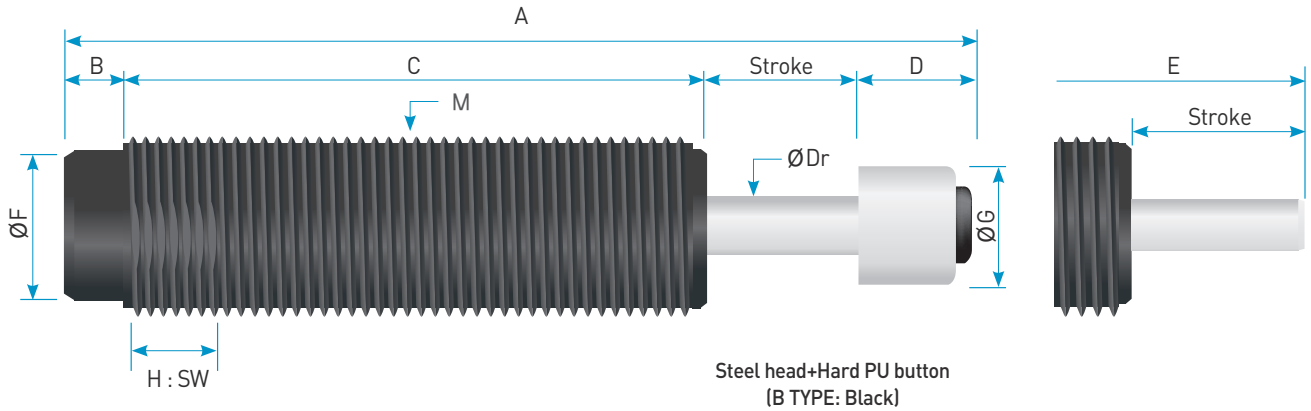
SDS 20/25 Series

▪ Engineering Data

Model	Stroke (mm)	Max.Energy / Cycle (Nm)	Max.Energy / Hour (Nm / h)	Effective Weight (kg) S	M	H	Recoil Force (N) Ext.	Comp.	Weight (g)
SDS20-20(B)	20	96	55,000	9-59	48-192	133-4,800	8.1	23	135
SDS25-25(B)	25	205	69,000	33-209	103-1,139	641-10,250	11	29	255

▪ Dimensions

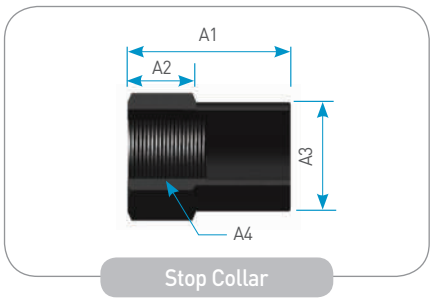
Model	Stroke	A	B	C	D	E	F	G	H	M	Dr
SDS20-20(B)	20	118.5	8	77	13.5	105	Φ17	Φ13.5	17	M20 X 1.5	Φ6
SDS25-25(B) SDS25-25F(B)	25	141.5	9	91	16.5	125	Φ22	Φ16	22	M25 X 2.0 M20 X 1.5	Φ8

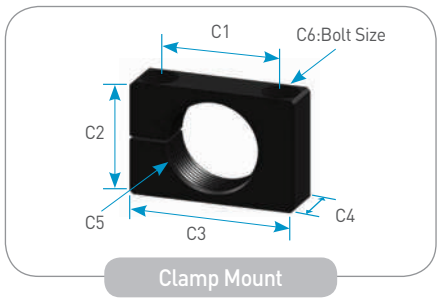


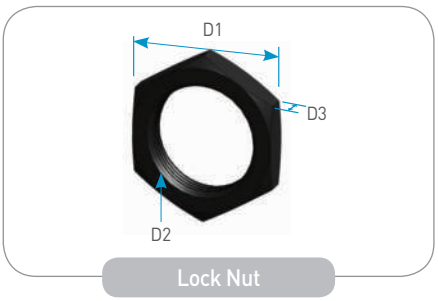
Steel head+Hard PU button
(B TYPE: Black)

▪ Accessories

Model	Stop Collar				Clamp Mount						Lock Nut		
	A1	A2	A3	A4	C1	C2	C3	C4	C5	C6	D1	D2	D3
SDS20-20(B)	36	15	Φ24	M20 X 1.5	28	25	40	20	M20 X 1.5	M6 X 30L	24	M20 X 1.5	6
SDS25-25(B) SDS25-25F(B)	42	18	Φ31.5	M25 X 2.0 M20 X 1.5	32	32	46	25	M25 X 2.0 M20 X 1.5	M6 X 35L	32	M25 X 2.0 M20 X 1.5	8



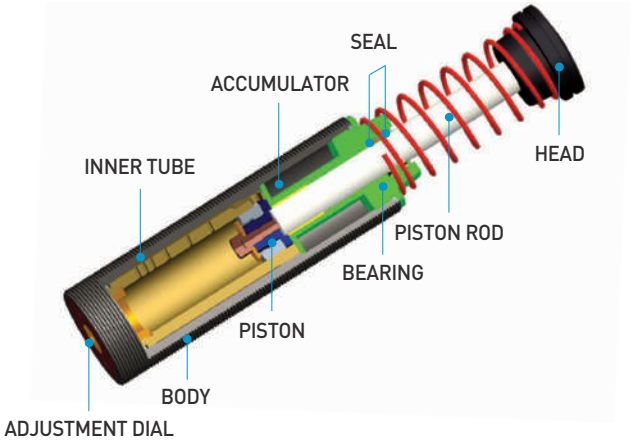




MDA Series

▪ Description

MDA Series is the medium & large size model. Piston is compressing the oil chamber as Piston Rod starts to move towards oil chamber when shock impact happens.
It makes oil to flow forcedly from oil chamber to the piston back side or Accumulator through the groove at inner tube. During this oil flow by compressing, deceleration force will occur as the kinetic energy is transformed to the heat energy. This heat energy will be dissipated through the threaded body surface efficiently.
After impact load is removed, recoil spring will operate to return the piston rod to the original position.



▪ Features

- MDA Series have an adjustment dial which can set 12 finite steps according to the impact velocity condition with an advanced wide damping control range.
- MDA Series have achieved 200% of energy absorption with an expanded effective weight coverage compared with former products.
- All outside thread-type body surface enables easy installation by fixing nuts tightly with it. Heat energy dissipation is enabled efficiently by the increased body surface area.
- Zn-Ni body coating (black color) enables to improve anti-corrosiveness for a long time usage.
- Stop collar is unnecessary if you're using steel head. The impact noise will be much reduced by using poly pad or urethane cap.
- Bearing is designed to protect seal by using special material and it guarantees a long durability.
- Velocity range : 0.3 ~ 5m/s Low Speed : OPTION
- Temperature coverage : Standard : -10 ~ 80℃ Special : -40 ~ 120℃

▪ MDA Series Ordering Information

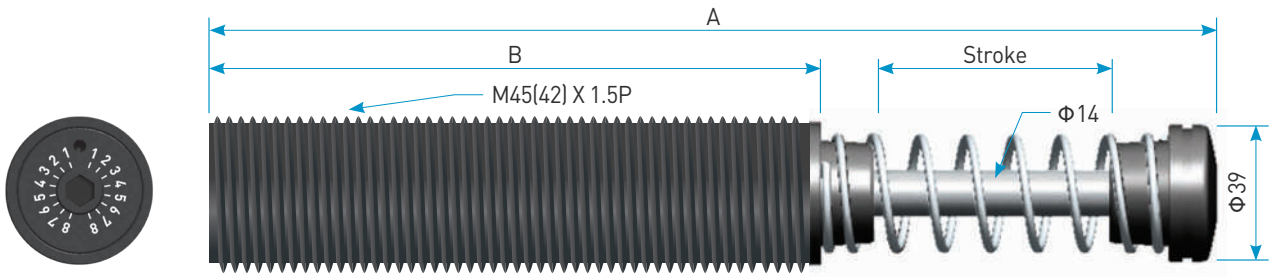
MDA 45 - 25 - CS

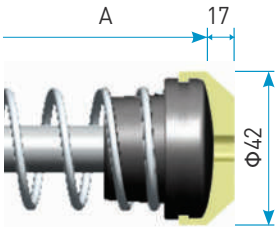
- MDA : MD : SERIES, A : Adjustable
- 45 : Body Thread Size
- 25 : Stroke
- CS : Stop Collar
  - CU : Urethane Cap
  - FS : Square Flang
  - CL : Lock Collar
  - CR : Rod Clevis
  - CE : End Clevis
  - MC : Clamp Mount

MDA 45 Series

▪ Engineering Data

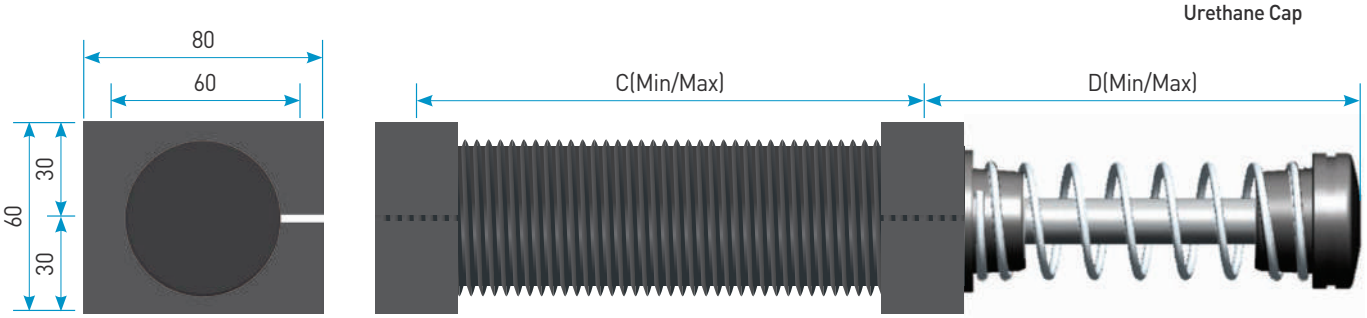
Model	Stroke(mm)	Max.Energy / Cycle (Nm)	Max.Energy / Hour (Nm / h)	Effective Weight (kg)	Recoil Force (N) Ext.	Recoil Force (N) Comp.	Weight (kg)
MDA45-25	25	570	170,000	46-12,667	50	83	1.1
MDA45-50	50	1,150	230,000	92-25,550	46	84	1.3
MDA45-75	75	1,750	263,000	140-38,890	44	86	1.5



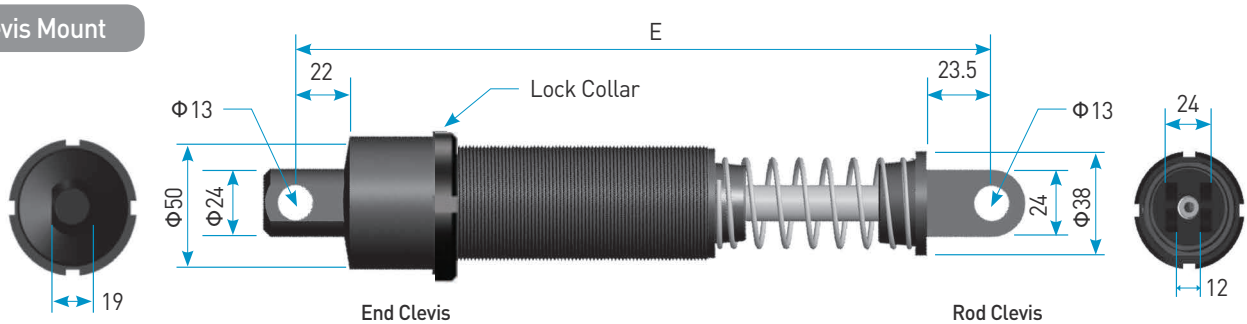


Urethane Cap

Clamp Mount



Clevis Mount



End Clevis

Rod Clevis

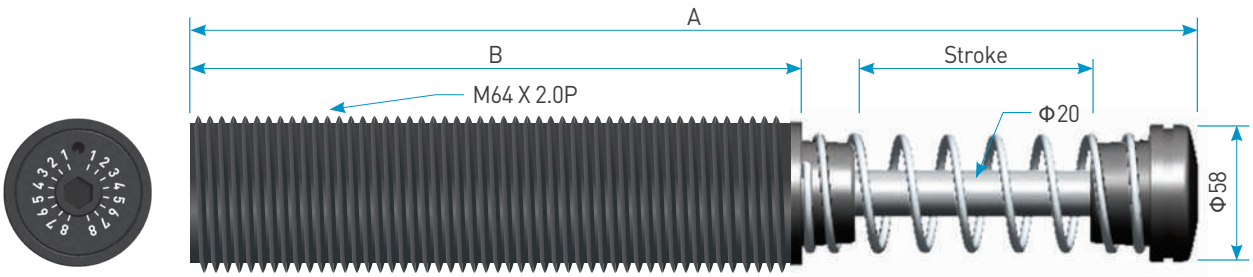
▪ Dimensions

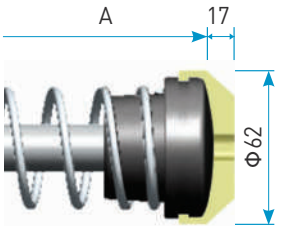
Model	Stroke	A	B	C	D	E
MDA45-25	25	159.5	93	25 / 68	79.5 / 100.5	206
MDA45-50	50	220.5	129	25 / 104	104 / 143.5	267
MDA45-75	75	292.5	168.5	25 / 143.5	129 / 170.75	339

MDA 64 Series

▪ Engineering Data

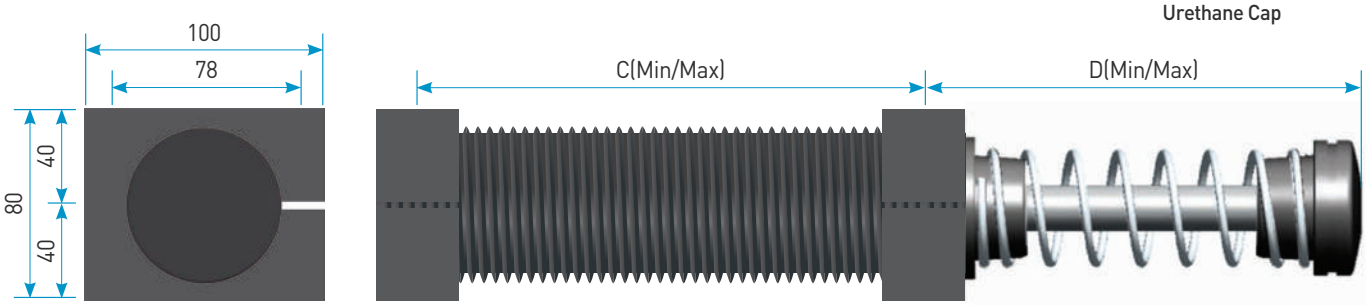
Model	Stroke(mm)	Max.Energy/Cycle (Nm)	Max.Energy/Hour (Nm/h)	Effective Weight (kg)	Recoil Force (N) Ext.	Recoil Force (N) Comp.	Weight (kg)
MDA64 - 50	50	2,220	215,000	178-49, 330	61	133	3.2
MDA64-100	100	4,400	316,000	352-97, 778	59	160	3.9
MDA64-150	150	6,800	408,000	554-151,110	51	167	8.8



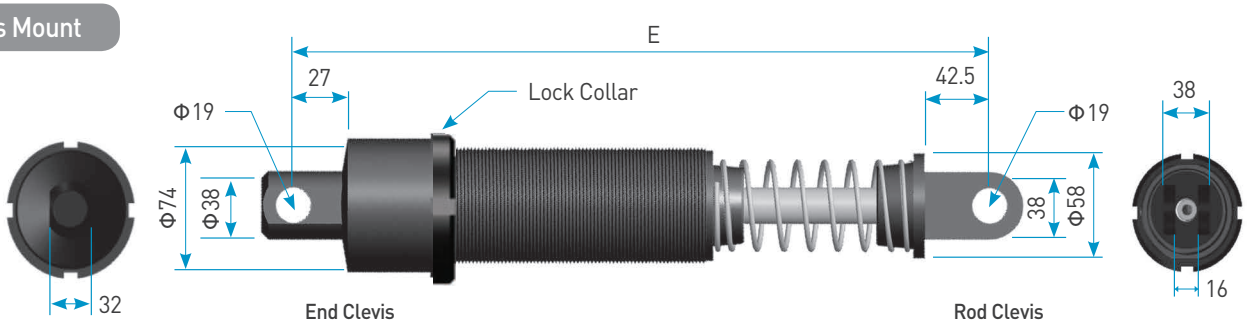


Urethane Cap

Clamp Mount



Clevis Mount



End Clevis

Rod Clevis

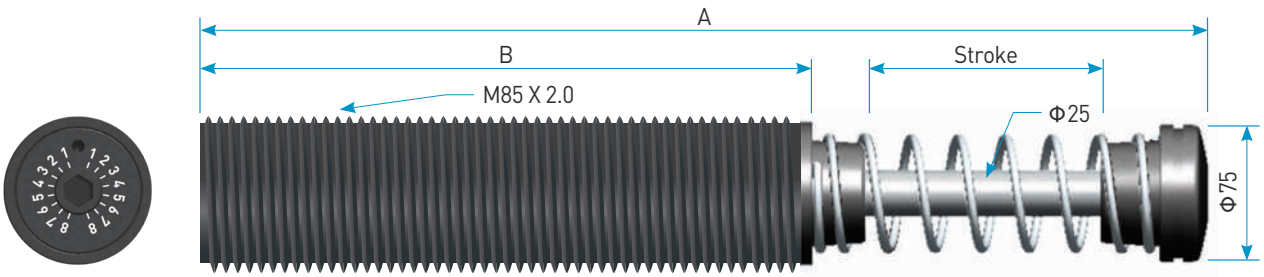
▪ Dimensions

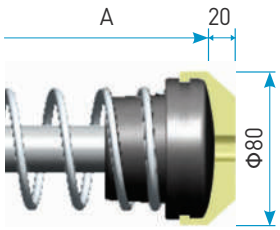
Model	Stroke	A	B	C	D	E
MDA64-50	50	239	135.5	25 / 110.5	117.5 / 160.25	303
MDA64-100	100	375	214.5	25 / 189.5	174.5 / 256.75	439
MDA64-150	150	518.5	294.5	25 / 269.5	238 / 360.25	-

MDA 85 Series

▪ Engineering Data

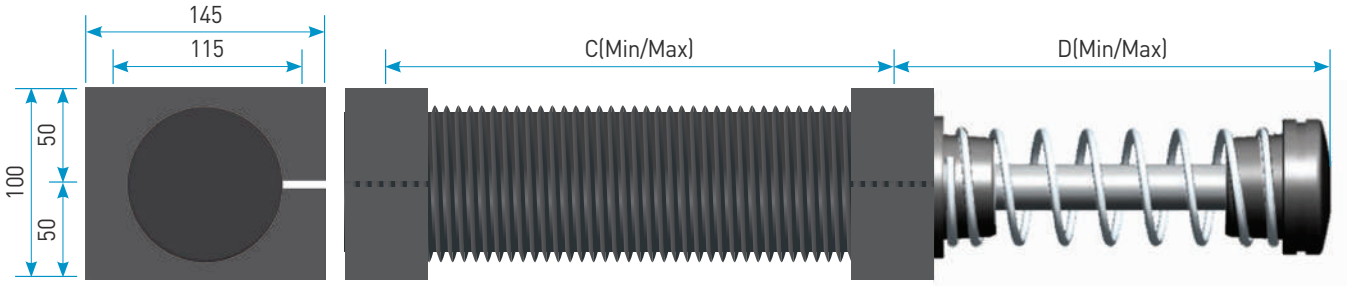
Model	Stroke(mm)	Max.Energy / Cycle (Nm)	Max.Energy / Hour [Nm / h]	Effective Weight (kg)	Recoil Force (N) Ext.	Recoil Force (N) Comp.	Weight (kg)
MDA 85 - 50	50	3,600	416,000	288-80,000	132	271	14
MDA 85 -100	100	7,200	745,000	576-160,000	125	327	20
MDA 85 -150	150	10,600	800,000	848-235,550	127	386	28



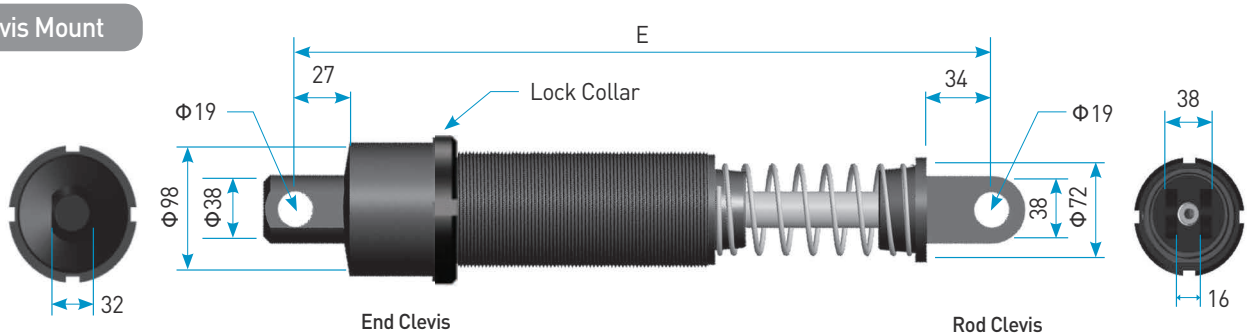


Urethane Cap

Clamp Mount



Clevis Mount



End Clevis

Rod Clevis

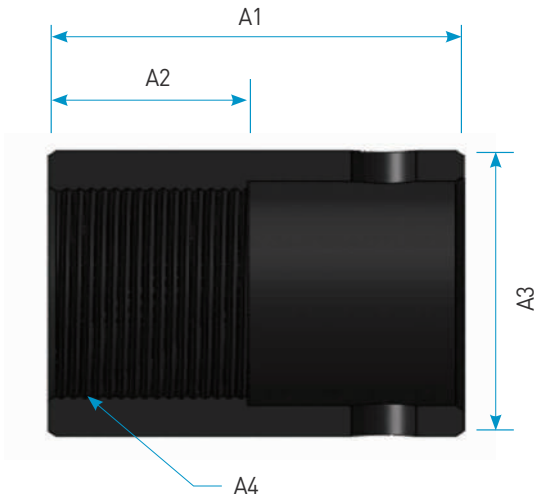
▪ Dimensions

Model	Stroke	A	B	C	D	E
MDA 85-50	50	251	145.5	25 / 114	120.5 / 162.5	312
MDA 85 -100	100	384.5	217	25 / 187	182.5 / 261	447
MDA 85 -150	150	513.5	292	25 / 262	236.5 / 352.2	-

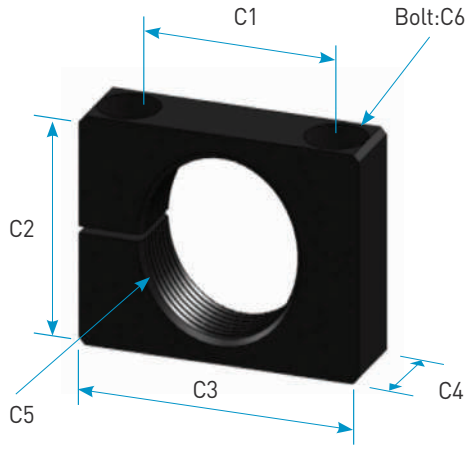
MDA Series

▪ Accessories

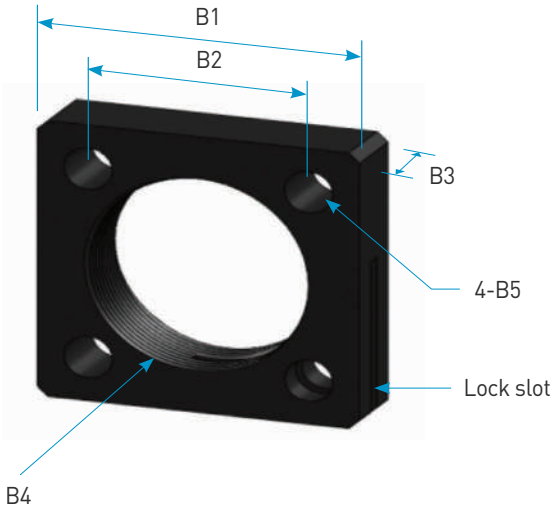
Stop Collar



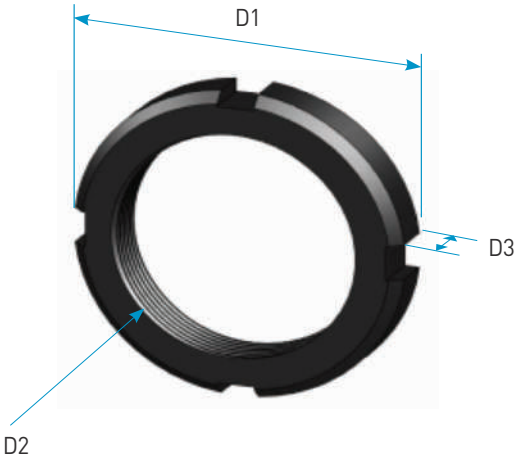
Clamp Mount



Square Flange



Lock Collar



▪ Dimensions

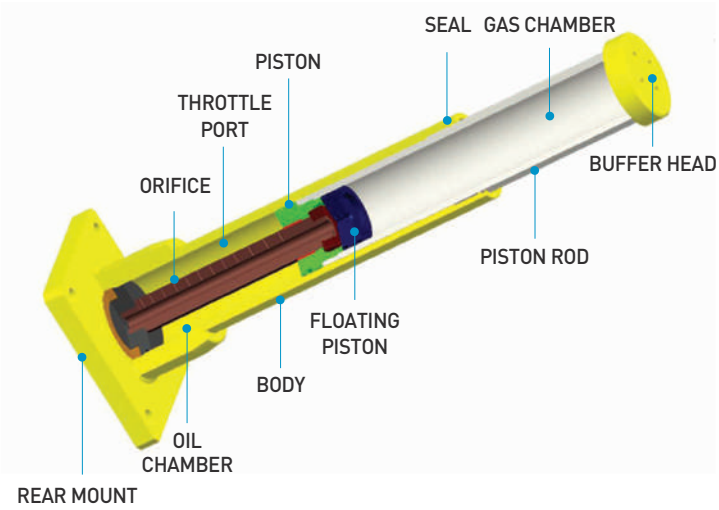
Model	Stop Collar				Square Flange					Clamp Mount						Lock Collar		
	A1	A2	A3	A4	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D2	D3
MDA45-Series	52	25	Φ56	M45 X 1.5P	□ 60	□41	14	M45 X1.5P	Φ9	60	60	80	25	M45 X 1.5P	M8 X 60L	Φ58	M45 X 1.5P	9
MDA64- Series	85	45	Φ75	M64 X 2.0P	□ 90	□70	16	M64 X 2.0P	Φ11	78	80	100	25	M64 X 2.0P	M10 X 80L	Φ80	M64 X 2.0P	11
MDA85-Series	95	45	Φ98	M85 X 2.0P	□104	□76	19	M85 X 2.0P	Φ13	115	100	145	30	M85 X 2.0P	M12 X 100L	Φ110	M85 X 2.0P	16

Hydraulic Buffers

▪ Description

HDS series hydraulic buffers protect personnel and equipment safely. The robust and large bore buffers are so Custom-orificed to suit any impact load and speed that it provides a smooth constant deceleration throughout the stroke. To optimize its performance, buffers are individually simulated for various operating conditions and manufactured with over 90% of efficiency.

Upon impact, the displacement of piston rod forces the oil through orifices on throttle port into the nitrogen chamber, generating oil pressure. The compressed nitrogen produces recoil force to extend piston rod to its original position.



▪ Features

- Deceleration : Custom – orificed design
- Piston Rod : Hardened, hard chrome plated
- Body : Epoxy painted
- Temperature : −20 ~ +80℃ Special : −40 ~ +10℃
- Standard : OSHA, AISE, CMMA, DIN, FEM

▪ HDS Series Ordering Information

HDS 120 – 200 – FR – BC

- BC: C : Safety Cable / CU : Urethane Cap / B : Bellows
- Mount Type: FR : Rear Flange Mount / FF : Front Flange Mount / CR : Rod Clevis / CE : End Clevis / TF : Front & Rear Flange Mount / RF : Rear Flange Front Foot Mount / FM : Front & Rear Foot Mount
- 200: Stroke : mm
- 120: Body Dia.
- HDS: HDS : Gas Return type

Hydraulic Buffers

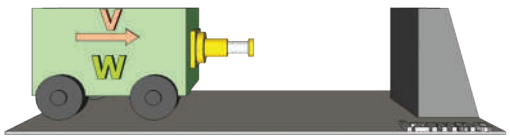
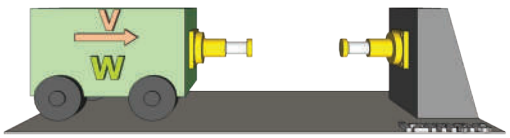
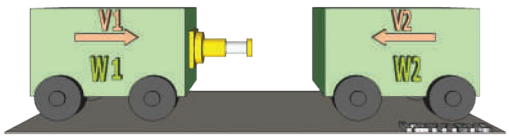
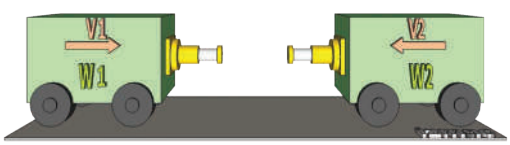
▪ Symbols

Symbol	Unit	Description	Symbol	Unit	Description
W	kg	Weight	r	m	Radius of rotation
W_E	kg	Designed weight	g	m/s^2	Gravitational acceleration
H	m	Height	d	m/s^2	Deceleration
S	m	Stroke	E_K	Nm	Kinetic energy
V	m/s	Impact velocity	E_W	Nm	Work energy
V_E	m/s	Designed velocity	E_T	Nm	Total energy
ω	rad/s	Angular velocity	F_D	N	Propelling force
I	Nms^2	Mass moment	F_S	N	Impact force
T	Nm	Torque	η		Efficiency rate

▪ Useful Formulas

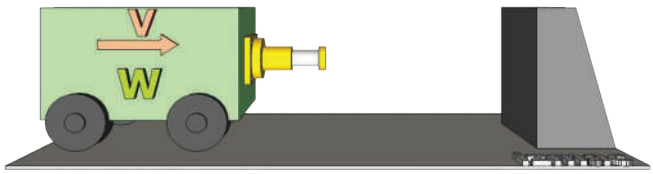
Maximum Shock Force	$F_S = E_T / S / 0.8 + F_D$
Stroke	$S = V^2 / 2 / d / 0.8$
Deceleration	$d = V^2 / 2 / S / 0.8$
Deceleration Time	$t = 2.6 \times S / V$

▪ Buffer Sizing

Arrangement	Design Speed (V_E)	Design Weight (W_E)
	V	W
	$\frac{V}{2}$	2W
	$V_1 + V_2$	$\frac{W_1 \times W_2}{W_1 + W_2}$
	$\frac{V_1 + V_2}{2}$	$\frac{2 \times W_1 \times W_2}{W_1 + W_2}$

Hydraulic Buffers

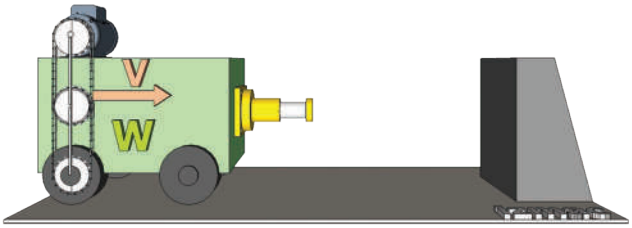
A. Horizontal Mass without Propelling Force



- **Weight** W = 100ton
- **Impact velocity** V = 0.5m/s

$E_K = W X V^2 / 2$	$100 X 0.5^2 / 2$	12.5	kNm
	Select Model with E_k : HDS65-200		
$E_T = E_K + E_W$	12.5 + 0	12.5	kNm
$F_S = E_T / (S x \eta) + F_D$	12.5 / (0.2 X 0.8) + 0	78.13	kN
	Select Model with E_T & F_S : HDS65-200		

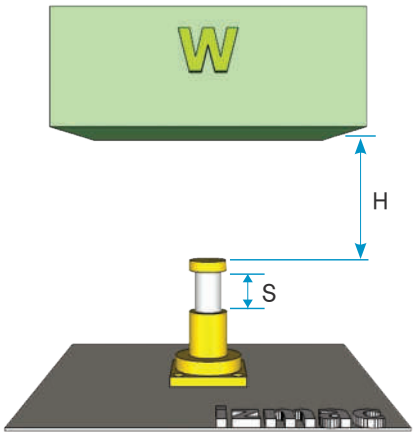
B. Horizontal Mass with Propelling Force [Motor]



- **Weight** W = 160ton
- **Propelling force** F_D = 20kN
- **Impact velocity** V = 1.5m/s

$E_K = W X V^2 / 2$	$160 X 1.5^2 / 2$	180	kNm
	Select Model with E_k : HDS140-400		
$E_W = F_D X S$	20 X 0.4	8	kNm
$E_T = E_K + E_W$	180 + 8	188	kNm
$F_S = E_T / (S x \eta) + F_D$	188 / (0.4 X 0.8) + 20	607.5	kN
	Select Model with E_T & F_S : HDS140-400		

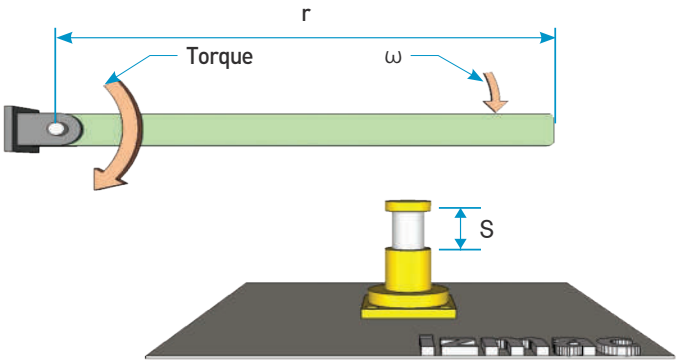
C. Free Falling Mass



- **Weight** W = 4ton
- **Height** H = 0.3m

$E_K = W X g X H$	4 X 9.81 X 0.3	11.772	kNm
	Select Model with E_k : HDS100-100		
$E_W = W X g X S$	4 X 9.81 X 0.1	3.924	kNm
$E_T = E_K + E_W$	11.772 + 3.924	15.696	kNm
$F_S = E_T / (S x \eta) + F_D$	15.696 / (0.1 X 0.8) + 0	196.2	kN
	Select Model with E_T & F_S : HDS100-100		

D. Swiveling Mass with Propelling Force



- **Torque** T = 200 Nm
- **Angular velocity** ω = 2 rad / s
- **Radius of rotation** r = 8 m
- **Mass moment** I = 35 Nms^2
- **Stroke** S = 0.2 m

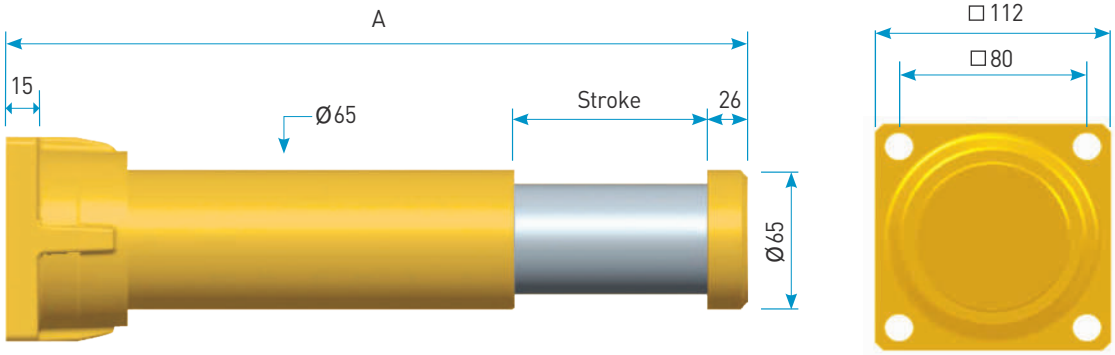
$E_K = I X \omega^2 / 2$	$35 X 2^2 / 2$	70	kNm
	Select Model with E_k : HDS120-200		
$E_W = T X S / r$	200 X 0.2 / 8	5	kNm
$E_T = E_K + E_W$	70 + 5	75	kNm
$F_S = E_T / (S x \eta) + F_D$	75 / (0.2 X 0.8) + 0	468.75	kN
	Select Model with E_T & F_S : HDS120-200		

HDS 65 Series

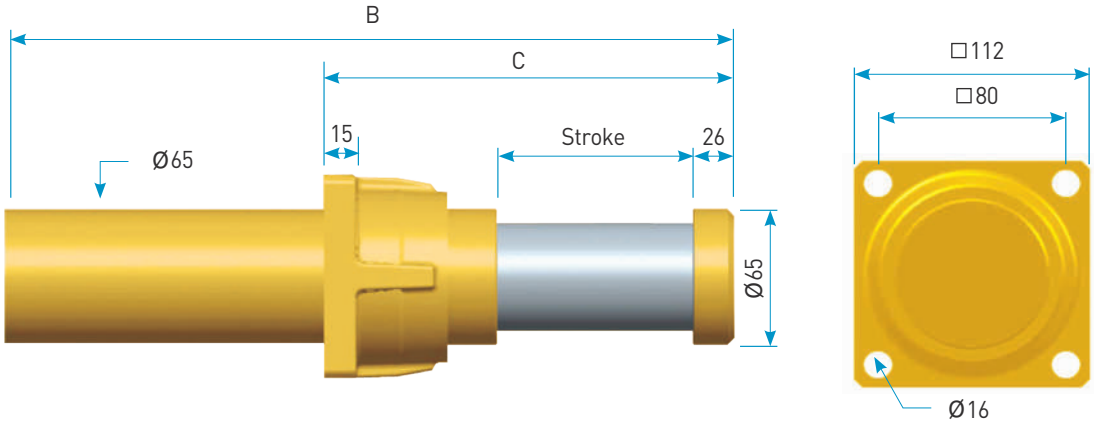
▪ Engineering Data

Model	Stroke(mm)	Max. Energy / Cycle (kNm)	Max. Shock Force (kN)	Recoil Force (kN) Ext.	Comp.	Weight (kg)
HDS65-50	50	3.8	95	1.0	3.5	6
-75	75	5.7	95	1.0	3.5	8
-100	100	7.5	95	1.0	3.5	9
-150	150	11	95	1.0	3.5	11
-200	200	14.7	95	1.0	3.5	12

Rear Mount



Front Mount



▪ Dimensions

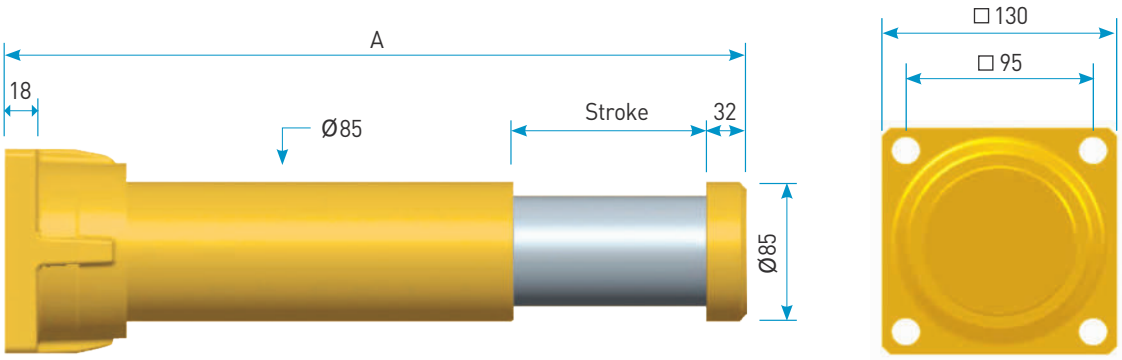
Model	Stroke(mm)	Rear Type A	Front Type B	C	Mounting Bolt Size
HDS65-50	50	312	300	151	
-75	75	372	360	176	
-100	100	432	420	231	14
-150	150	552	540	281	
-200	200	672	660	371	

HDS 85 Series

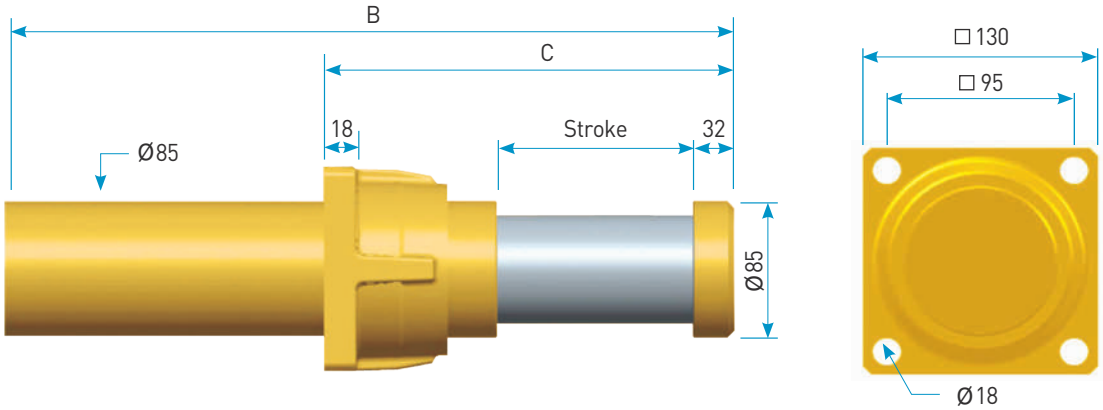
▪ Engineering Data

Model	Stroke(mm)	Max. Energy / Cycle (kNm)	Max. Shock Force (kN)	Recoil Force (kN) Ext.	Comp.	Weight (kg)
HDS85-50	50	7.5	188	1.5	13	12
-100	100	15	188	1.5	13	14
-150	150	22.5	188	1.5	20	17
-200	200	30	188	1.5	20	20
-250	250	37.5	188	1.5	20	22

Rear Mount



Front Mount



▪ Dimensions

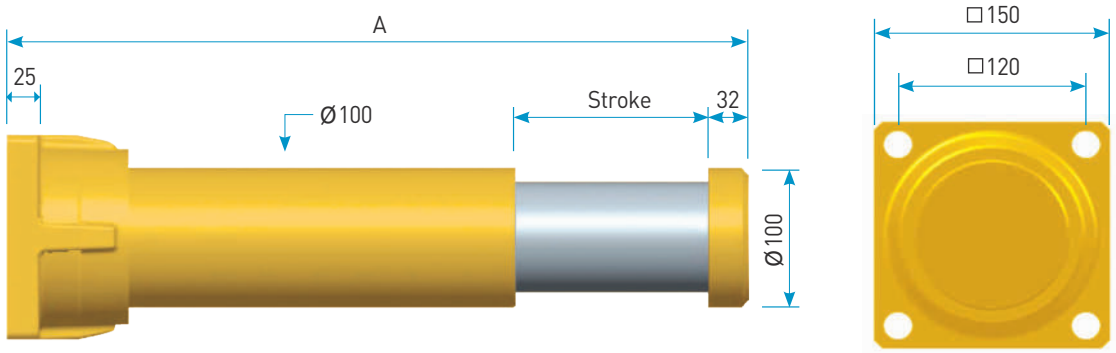
Model	Stroke(mm)	Rear Type A	Front Type B	C	Mounting Bolt Size
HDS85-50	50	323	310	183	16
-100	100	463	450	242	
-150	150	603	590	305	
-200	200	743	730	367	
-250	250	883	870	430	

HDS 100 Series

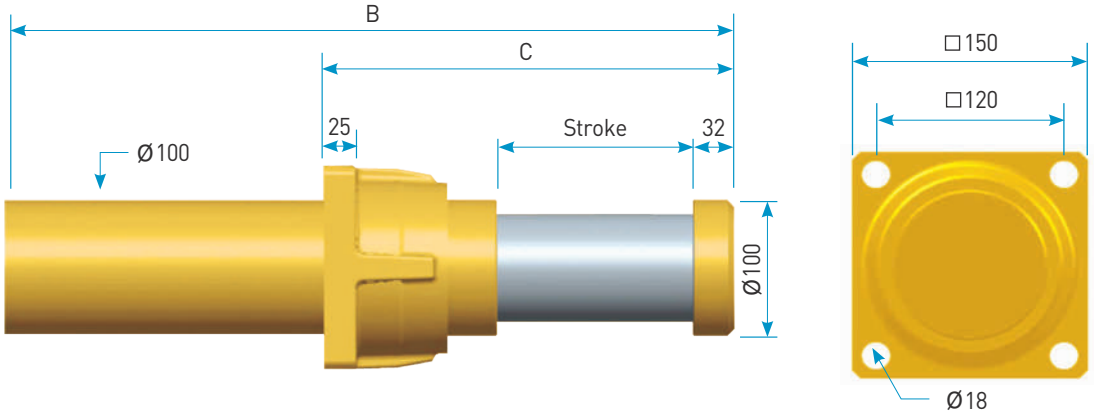
▪ Engineering Data

Model	Stroke(mm)	Max. Energy / Cycle (kNm)	Max. Shock Force (kN)	Recoil Force (kN) Ext.	Recoil Force (kN) Comp.	Weight (kg)
HDS100-80	80	16	250	2.4	16	20
-100	100	20	250	2.4	16	25
-150	150	30	250	2.4	20	28
-200	200	40	250	2.4	20	34
-250	250	50	250	2.4	25	39
-300	300	60	250	2.4	25	43

Rear Mount



Front Mount



▪ Dimensions

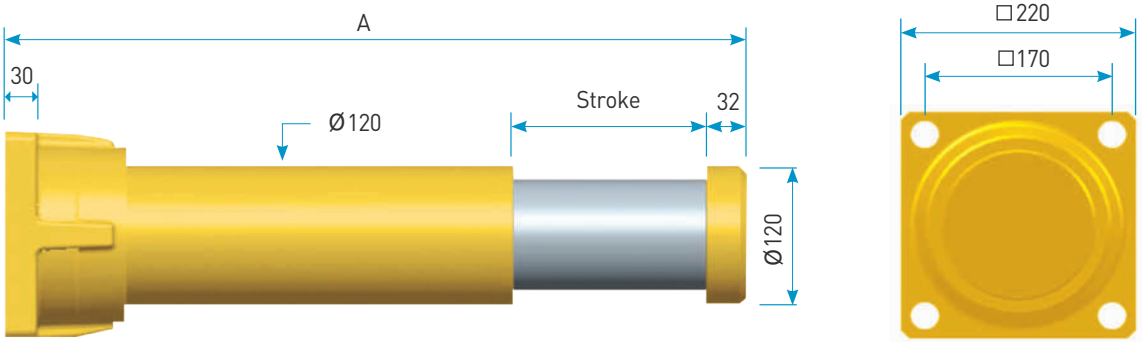
Model	Stroke(mm)	Rear Type A	Front Type B	Front Type C	Mounting Bolt Size
HDS100-80	80	423	403	215	16
-100	100	450	430	252	
-150	150	580	560	315	
-200	200	720	700	377	
-250	250	865	845	440	
-300	300	1010	990	502	

HDS 120 Series

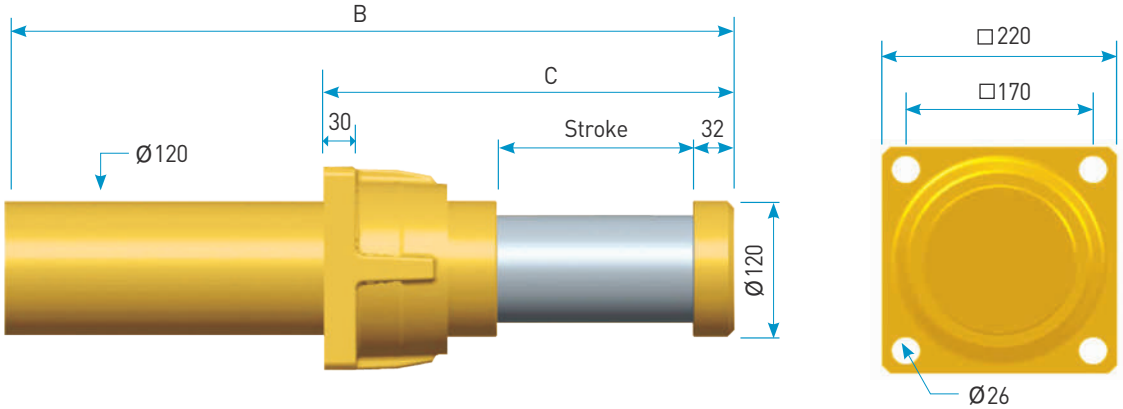
▪ Engineering Data

Model	Stroke(mm)	Max. Energy / Cycle (kNm)	Max. Shock Force (kN)	Recoil Force (kN) Ext.	Recoil Force (kN) Comp.	Weight (kg)
HDS120-100	100	40	500	3.5	40	41
-150	150	60	500	3.5	40	48
-200	200	80	500	3.5	40	58
-250	250	100	500	3.5	40	65
-300	300	120	400	3.5	40	72
-400	400	160	400	3.5	40	78
-500	500	180	400	3.5	40	86
-600	600	200	400	3.5	40	95
-800	800	240	375	3.5	40	112
-1000	1000	280	350	3.5	40	118

Rear Mount



Front Mount



▪ Dimensions

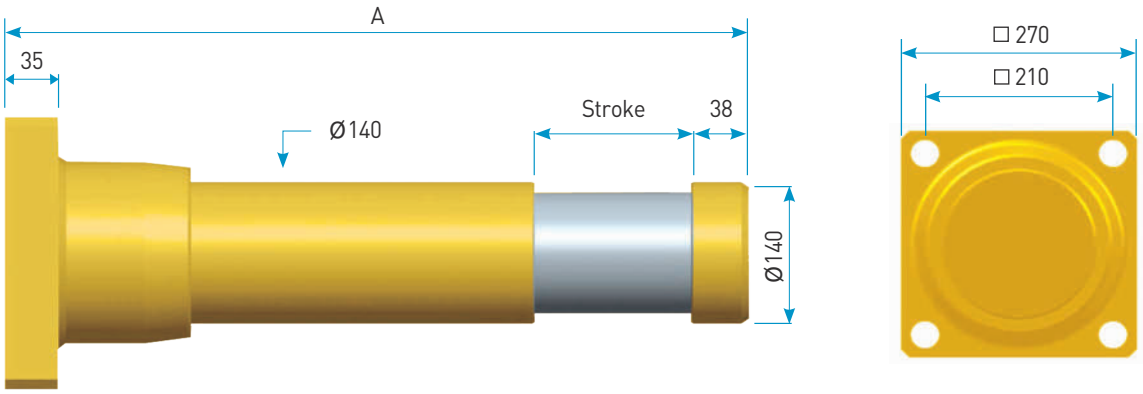
Model	Stroke(mm)	Rear Type A	Front Type B	Front Type C	Mounting Bolt Size
HDS120-100	100	470	450	277	24
-150	150	610	590	340	
-200	200	760	740	402	
-250	250	900	880	465	
-300	300	1050	1030	527	
-400	400	1340	1320	680	
-500	500	1620	1600	815	
-600	600	1920	1900	950	
-800	800	-	2400	1290	
-1000	1000	-	2960	1360	

HDS 140 Series

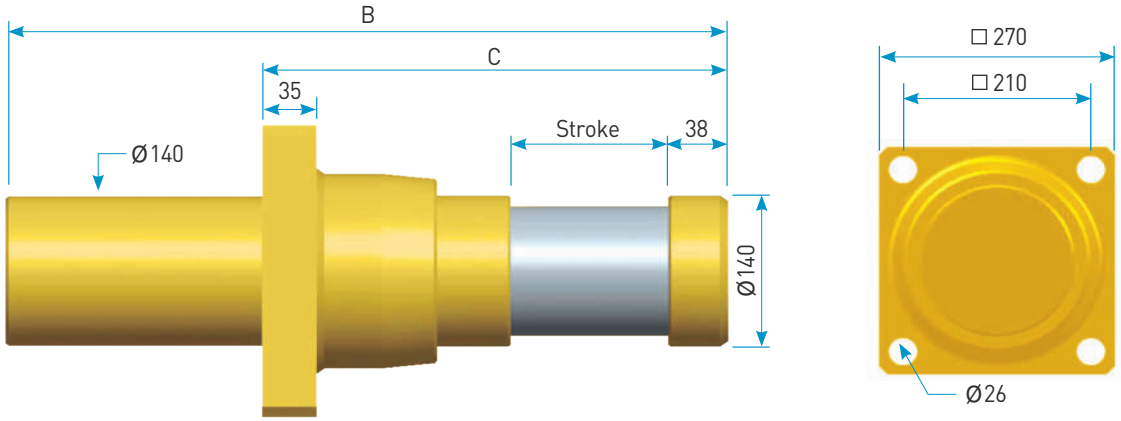
▪ Engineering Data

Model	Stroke(mm)	Max. Energy / Cycle (kNm)	Max. Shock Force (kN)	Recoil Force (kN) Ext.	Recoil Force (kN) Comp.	Weight (kg)
HDS140-100	100	55	688	6	70	60
-200	200	110	688	6	70	85
-300	300	165	688	6	70	110
-400	400	220	688	6	78	135
-500	500	270	680	6	78	150
-600	600	300	630	6	78	160
-800	800	325	510	6	78	185
-1000	1000	360	450	6	78	200

Rear Mount



Front Mount



▪ Dimensions

Model	Stroke(mm)	Rear Type A	Front Type B	Front Type C	Mounting Bolt Size
HDS140-100	100	480	460	297	24
-200	200	770	750	422	
-300	300	1060	1040	547	
-400	400	1350	1330	712	
-500	500	1630	1610	847	
-600	600	1930	1910	982	
-800	800	2350	2330	1252	
-1000	1000	-	2880	1595	

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