



Shock Absorber

NRB Series

Self Compensating Model



Maximum Energy Absorption: 25~500 In.Lbs/Cycle

Resistant to Load Deviation

Six Sizes Available

Withstands Impact Speeds of 16 ft./sec.

Double Seal Enclosure Eliminates Oil Leakage

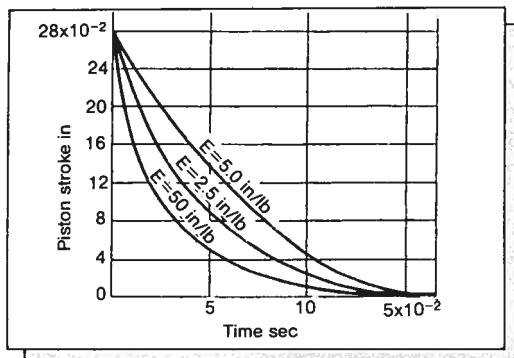
Impact absorption and noise damping to meet the high speed requirements of the modern world.

Shock Absorber Series NRB

Automatic adjustment to the most appropriate absorption performance

Specially designed orifice can absorb energy comprehensively and most appropriately in many different applications. These range from high speed low load, to low speed high load; without requiring additional adjustment of the shock absorber.

Piston stroke/displacement wave pattern
(Example : NRBC050)



Double seal enclosure ensures no oil leakage

Scraper and rod seal combine to form a double seal enclosure preventing oil leakage, thus maintaining the long life of the shock absorber.

Improved resistance against deviation of load

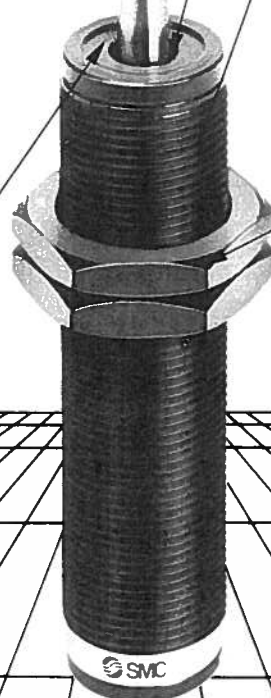
Due to a newly designed high load capability bearing, resistance against deviation of load is improved considerably.

Even more compact size realized

Due to the increase in tube strength and a considerable increase in energy absorption capability an even more compact size has been possible.

Absorption capability maintains its performance regardless of temperature change

The shock absorber will always maintain the most appropriate absorption performance within the temperature range specified.



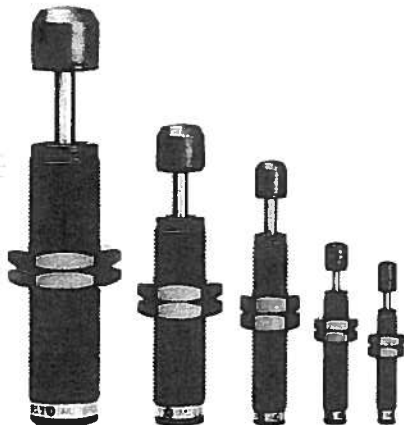
SMC Shock Absorber Series NRB



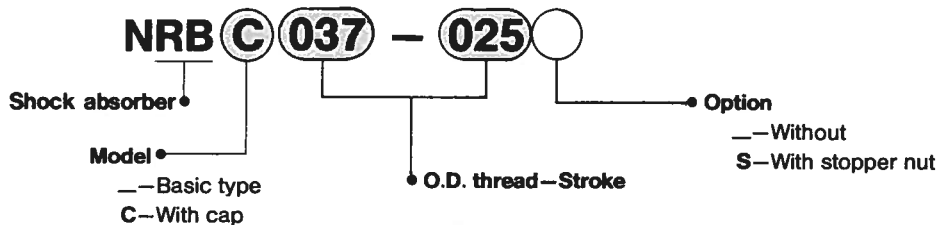
Specifications

Spec	Model	NRB031-025	NRB037-025	NRB050-030	NRB056-045	NRB075-045	NRB100-060
Capacity in. lb/cycle(kgf·m/cycle)		25(0.3)	25(0.3)	50(0.6)	170(2)	170(2)	500(6)
Stroke in. (mm)		0.26(6)	0.25(6)	0.30(7)	0.45(12)	0.45(12)	0.50(15)
Velocity ft/s(m/s)		16(5)					
Frequency cycle/min		80	80	70	45	45	25
Temperature °F(°C)		14 ~ 176(−10 ~ 80)					
Spring force lbs (kgf)	extended	0.77(0.35)	0.77(0.35)	1.43(0.65)	1.54(0.70)	1.54(0.70)	1.87(0.85)
	compressed	1.65(0.75)	1.65(0.75)	2.12(0.96)	3.59(1.63)	3.59(1.63)	4.59(2.08)
Weight lbs (gf)		0.03(15)	0.04(20)	0.08(35)	0.13(60)	0.26(120)	0.53(240)
Optional	Stop nut	NRB031S	NRB037S	NRB050S	NRB056S	NRB075S	NRB100S
	Mounting nuts (2)	STD	STD	STD	STD	STD	STD

How To Order



With cap



Cap type spare part numbers (outer cap only)

NRB **08** **C**

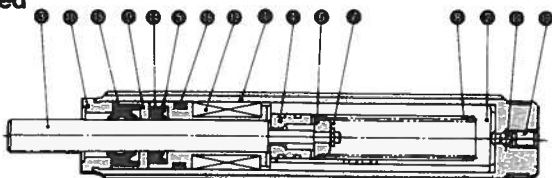
Applicable model •

Cap •

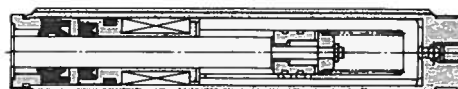
08—NRBC031/NRBC037
10—NRBC050
14—NRBC056/NRBC075
20—NRBC100

Construction / Parts List

Extended



Compressed



Parts List

No.	Description	Material	Note
①	Outer tube	Rolled steel	Black coating
②	Inner tube	Special steel	Heat treatment
③	Piston rod	Special steel	Hard chrome plating
④	Piston	Special steel	Heat treatment
⑤	Bearing	Special bearing material	
⑥	Spring guide	Rolled steel	Zinc chromate
⑦	Retaining ring	Stainless steel	
⑧	Return spring	Piano wire	Zinc chromate

No.	Description	Material	Note
⑨	Seal holder	Copper alloy	
⑩	Stopper	Carbon steel	Zinc chromate
⑪	Steel ball	Bearing steel	
⑫	Set screw	Special steel	
⑬	Accumulator	NBR	Foam rubber
⑭	Rod seal	NBR	
⑮	Scraper	NBR	
⑯	Gasket	NBR	

Series NRB

How To Select An Applicable Model

Steps of selection

1 Classification of impact

Cylinder with load (horizontal)
Cylinder with load (downward)
Cylinder with load (upward)
Free horizontal impact
Free falling impact
Rotational impact (with torque)

2 Details of applications

Symbol	Condition of application	Unit
W	Weight of object	lb
V	Impact velocity	in/sec
H	Dropping height	in
W	Angular Velocity	rad/sec
r	Radius of gyration	in
d	Bore size	in
P	Cylinder operation pressure	PSI
T	Torque	in·lbs
n	Operation cycle	cycle/min
t	Ambient temperature	°F

3 Specifications

Ensure that both the impact velocity and the ambient temperature fall within the specifications of the Shock Absorber.

4 Calculation of kinetic energy (E_1)

Calculate kinetic energy E_1 using the equation suitable for the classification of impact.

In the case of cylinder with load and free horizontal impact, substitute respective figures for graph (A) in order to calculate E_1 .

5 Calculation of work energy (E_2)

Select any shock absorber as a provisional model and calculate work energy E_2 .

In the case of work energy of cylinder, substitute respective figures for table (B) or graph (C).

6 Calculation of effective weight of object (We)

Energy absorption $E = E_1 + E_2$

Effective weight of object $We = \frac{2g}{V^2} \cdot E$

Substitute both energy absorption E and impact velocity V for graph (A) in order to calculate the effective weight of the impacting object.

7 Selection of applicable model

Taking into consideration the effective weight of the object (We) calculated using graph (D) and impact velocity (V), check provisional model compatibility with the condition of application.

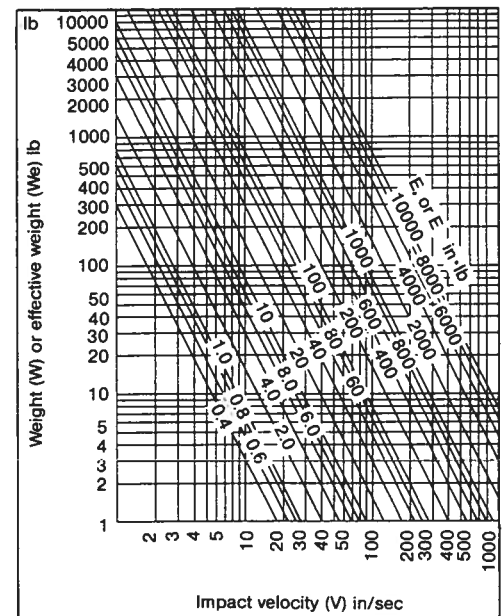
For added precaution, once again check the operational cycle/min(n).

<<Symbol table>>

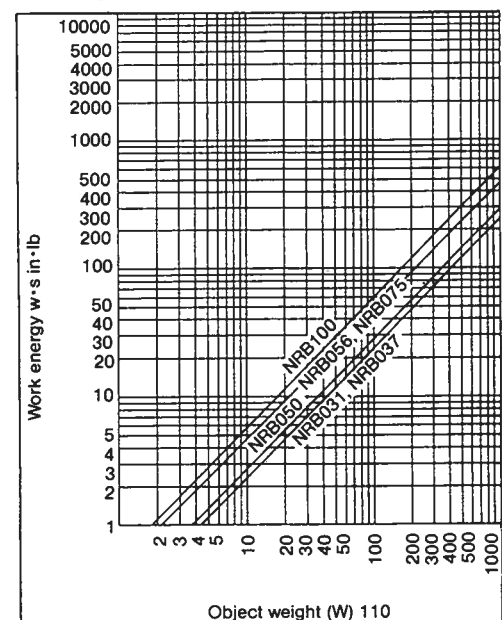
Symbol	Specifications	Unit
E	Total energy	in·lb
E1	Kinetic energy	in·lb
E2	Work energy	in·lb
F	Cylinder Force	lb
g	Acceleration of gravity	in/sec ²
J	Moment of inertia about the center of gravity	in·lb·sec ²

Symbol	Specifications	Unit
S	Shock absorber stroke	in
We	Effective weight	lb

Graph (A) Kinetic energy (E_1) or Total energy (E)



Graph (C) Work energy ($W \cdot S$)



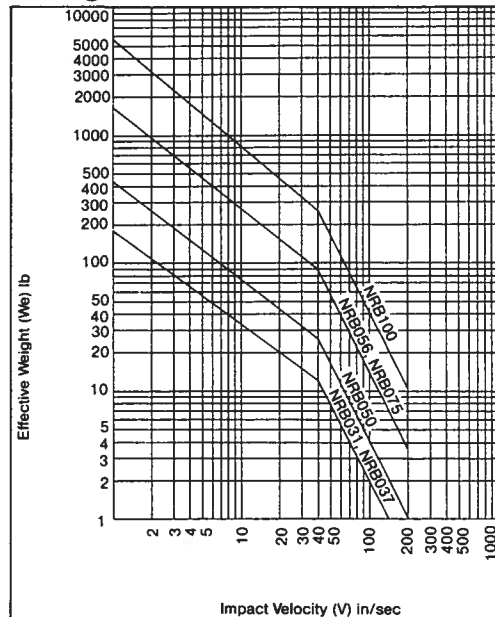
**Table ⑧ Work energy of cylinder (F·S)
in/lb (Operating pressure 80 psi)**

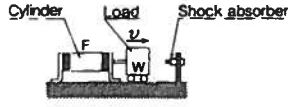
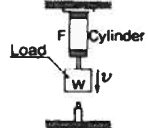
Model		NRB031-025 NRB037-025	NRB050-030	NRB056-045 NRB075-045	NRB100-060
Effective Stroke in		0.25	0.30	0.45	0.60
Bore	NCM	0.75	8.8	10.6	15.9
		0.88	12.2	14.6	21.9
		106	17.6	21.2	31.8
		125	24.5	29.5	44.2
	NCA1	150	35.3	42.4	63.6
		200	62.8	75.4	113
		250	98.2	118	177
		325	166	199	299
Bore	NCJ2	400	251	302	452
		6	0.88	1.05	1.58
		10	2.43	2.92	4.38
		12	3.51	4.21	6.31
	NCJP	15	5.48	6.57	9.86
		20	9.74	11.7	17.5
	NCQ2	25	15.2	18.3	27.4
		32	24.9	29.9	44.9
	NCY2	40	39.0	46.7	70.0
		50	60.9	73.0	109.6
	NCX2	63	96.6	116	174
		80	156	187	280
		100	243	292	438

**Operation pressure other than 80 PSI
:multiply by following coefficient**

Operating Pressure PSI	20	40	60	80	100	120	150	200	250
Coefficient	0.25	0.5	0.75	1	1.25	1.5	1.88	2.5	3.2

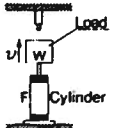
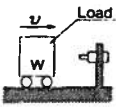
Graph ⑩ Operation Range

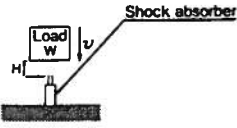
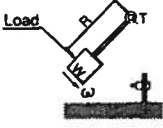


	Cylinder with load (Horizontal)	Cylinder with load (Downward)
① Classification of impact		
Impact Velocity Note 1) V	v	v
Kinetic energy E_1	$\frac{W}{2g} \cdot v^2$	$\frac{W}{2g} \cdot v^2$
Work energy E_2	$F \cdot S$	$F \cdot S + W \cdot S$
Total energy E	$E_1 + E_2$	$E_1 + E_2$
Effective Weight Note 2) We	$\frac{2g}{v^2} \cdot E$	$\frac{2g}{v^2} \cdot E$
② Details of applications	W=20 lb v=40 in/sec d=2 in p=60 psi n=30 cycle/min t=70°F	W=10 lbs v=120 in/sec d=2 in p=80 psi n=20 cycle/min t=70°F
③ Specifications	- Confirmation of specifications - v=>40<200 in/sec - t=>14<70<176°F YES	- Confirmation of specifications - v=>120<200 in/sec - t=>14<70<176°F YES
④ Calculation of kinetic energy E_1	- Kinetic Energy (E_1) - Use graph ⑩ and obtain E_1 using W=20 lbs and v=40 in/sec $E_1 \approx 45 \text{ in} \cdot \text{lbs}$	- Kinetic Energy (E_1) - Use graph ⑩ and obtain E_1 using W=10 lbs and v=120 in/sec $E_1 \approx 200 \text{ in} \cdot \text{lbs}$
⑤ Calculation of Work Energy E_2	- Work Energy (E_2) - Choose NRB056, based on E_1 - Use table ⑧ and obtain E_2 E_2 (80 psi)=113 in·lbs - Since operating pressure=60 psi $E_2=113 \times 0.75=85 \text{ in} \cdot \text{lbs}$ $E_2=85 \text{ in} \cdot \text{lbs}$	- Work Energy - Choose NRB100, based on E_1 - Use table ⑧ and graph ⑩ and obtain $F \cdot S$ and $W \cdot S$ $F \cdot S=151 \text{ in} \cdot \text{lbs}$ $W \cdot S=6 \text{ in} \cdot \text{lbs}$ $E_2=F \cdot S + W \cdot S=151+6=157 \text{ in} \cdot \text{lb}$ $E_2=157 \text{ in} \cdot \text{lbs}$
⑥ Calculation of effective weight of object We	- Effective Weight (We) - Total energy $E=E_1+E_2=45+85=130 \text{ in} \cdot \text{lbs}$ - Use graph ⑩ and obtain We using E and V. $We \approx 70 \text{ lbs}$	- Effective Weight (We) - Total energy $E=E_1+E_2=200+157=375 \text{ in} \cdot \text{lbs}$ - Use graph ⑩ and obtain We using E and V. $We \approx 22 \text{ lbs}$
⑦ Selection of applicable model	- Selection of applicable model - Using graph ⑩, substitute We and V to confirm initial choice is applicable YES Select NRB056	- Selection of applicable model - Using graph ⑩, substitute We and V to confirm initial choice is applicable YES Select NRB100

Note 1: Impacting object speed is momentary velocity at which object is impacting against shock absorber

Note 2: All energy of object being equal with all of kinetic energy, the weight of object is equal with corresponding weight of impacting object We , thus giving the equation. $E = \frac{We}{2g} \cdot v^2$

Cylinder with load (Upward)	Free horizontal impact	
		1 Classification of impact
v	v	Impact Velocity Note 1) V
$\frac{W}{2g} \cdot v^2$	$\frac{W}{2g} \cdot v^2$	Kinetic energy E_1
$F \cdot S - W \cdot S$	—	Work energy E_2
$E_1 + E_2$	E_1	Total energy E
$2g \cdot E$	$\frac{2g}{v^2} \cdot E = W$	Effective Weight Note 2) We
W=10 lb v=120 in/sec d=2 in p=80 psi n=20 cycle/min t=70°F	W=20 lb v=4 in/sec n=20 cycles/min t=70°F	2 Details of applications
• Confirmation of specifications v=>120<200 in/sec t=>14<70<176°F	• Confirmation of specifications v=>40<200 in/sec t=>14<70<176°F	3 Specifications
YES	YES	
• Kinetic Energy (E_1) Use graph A and obtain E_1 using W=10 lb and v=120 in/sec		4 Calculation of kinetic energy E_1
$E_1 \approx 200 \text{ in} \cdot \text{lbs}$		
• Work Energy (E_2) Choose NRB100, based on E_1 Use table B and graph C and obtain F·S and W·S F·S=151 in·lbs W·S=6 in·lbs $E_2 = F \cdot S - W \cdot S = 151 - 6 = 145 \text{ in} \cdot \text{lbs}$		5 Calculation of Work Energy E_2
$E_2 = 145 \text{ in} \cdot \text{lbs}$		
• Effective Weight (We) Total energy $E = E_1 + E_2 =$ 200+145=345 in·lbs Use graph A and obtain We using E and V.	• Effective Weight (We) $We = W = 20 \text{ lbs}$	6 Calculation of effective weight of object We
$We \approx 20 \text{ lbs}$	$We \approx 20 \text{ lbs}$	
• Selection of applicable model Using graph D, substitute We and V to confirm initial choice is applicable	• Selection of applicable model Using graph D, substitute $We=20 \text{ lb}$ and $V=40 \text{ in/sec}$, choose NRB050	7 Selection of applicable model
YES Select NRB100	YES Select NRB050	

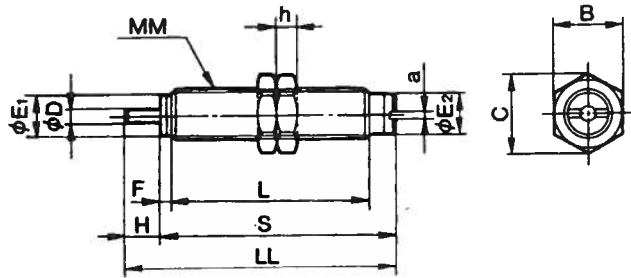
1 Classification of impact	Free Falling impact	Rotational Impact (With Torque)
		
Impact Velocity Note 1) V	$\sqrt{2gH}$	$\omega \cdot R$
Kinetic energy E ₁	$W \cdot H$	$\frac{J \cdot \omega^2}{2} = \frac{W \cdot v^2}{2g}$
Work energy E ₂	$W \cdot S$	$T \cdot \frac{S}{R}$
Total energy E	$E_1 + E_2$	$E_1 + E_2$
Effective Weight Note 2) We	$\frac{2g}{v^2} \cdot E$	$\frac{2g}{v^2} \cdot E$
2 Details of applications	W=50 lb H=8 in n=5 cycle/min t=>0°F	W=6 lbs ω=1 rad/sec r=20 in T=90 in·lbs n=10 cycle/min t=80°F
3 Specifications	- Confirmation of specifications $v = \sqrt{2gH} = \sqrt{2} \text{ (386 in/sec}^2\text{) (8 in)}$ $v = 80 \text{ in/sec}$ $v = >80 < 200 \text{ in/sec}$ $t = >14 < 70 < 176^\circ\text{F}$ YES	- Confirmation of specifications $v = \omega R = 20 \text{ inch} \times 1 \text{ rad/sec} = 20 \text{ in/sec}$ $v = >20 < 200 \text{ in/sec}$ $t = >14 < 80 < 176$ YES
4 Calculation of kinetic energy E ₁	- Kinetic Energy (E₁) $E_1 = W \cdot H = 50 \text{ lb (8 in)} = 400 \text{ in} \cdot \text{lbs}$ E₁=400 in·lbs	- Kinetic Energy (E₁) - Use graph Ⓐ and obtain E₁ using W=6 lbs and v=120 in/sec E₁=4 in·lbs
5 Calculation of Work Energy E ₂	- Work Energy (E₂) - Choose NRB100, based on E₁ - Use graphic Ⓒ and obtain W·S - W·S=30 in·lbs E₂=30 in·lbs	- Work Energy (E₂) - Choose NRB037, based on E₁ $E_2 = T \cdot \frac{S}{R} = 90 \text{ in} \cdot \text{lbs} \cdot \frac{25 \text{ in}}{20 \text{ in}} = 1.1 \text{ in} \cdot \text{lbs}$ E₂=1.1 in·lbs
6 Calculation of effective weight of object We	- Effective Weight (We) - Total energy $E = E_1 + E_2 = 400 + 30 \text{ in} \cdot \text{lbs}$ - Use graph Ⓐ and obtain We - using E=430 in·lbs and V=80 in/sec We ≈ 60 lbs	- Effective Weight (We) - Total energy $E = E_1 + E_2 = 4 + 1.1 = 5.1 \text{ in} \cdot \text{lbs}$ - Use graph Ⓐ and obtain We - using E and V. We ≈ 9 lbs
7 Selection of applicable model	- Selection of applicable model - Using graph Ⓓ substitute We and V to confirm initial choice is applicable YES Select NRB100	- Selection of applicable model - Using graph Ⓓ, substitute We and V to confirm initial choice is applicable YES Select NRB037

Series NRB

Dimensions

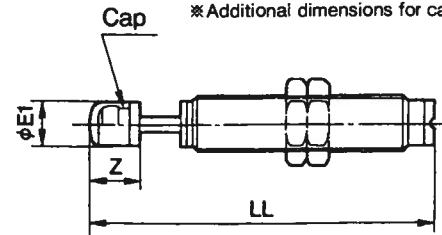
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Basic type / NRB031 • NRB037



With cap / NRBC031 • NRBC037

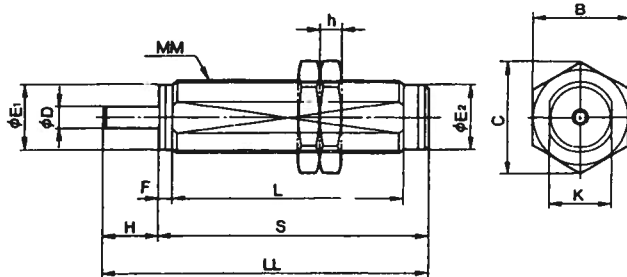
※ Additional dimensions for cap type.



Parts No.	Dimensions		
	ϕE_1	LL	Z
NRB031-025	.27	2.25	.41
NRB037-025	.27	2.25	.41

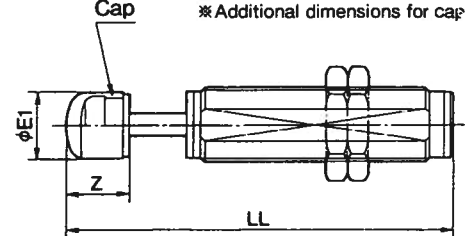
Model	Shock Absorber										Nut			
	A	ϕD	ϕE_1	ϕE_2	F	H	L	LL	MM	S	B	C	h	K
NRB031-025	0.06	0.11	0.27	0.27	0.09	0.25	1.31	1.85	$\frac{1}{16}$ -32 UNEF	1.60	$\frac{7}{16}$	0.55	0.09	—
NRB037-025	0.06	0.11	0.33	0.33	0.15	0.25	1.24	1.84	$\frac{3}{16}$ -32 UNEF	1.59	$\frac{1}{2}$	0.58	0.09	—

Basic type / NRB050 • NRB056



With cap / NRBC056 • NRBC075 • NRBC100

※ Additional dimensions for cap type.

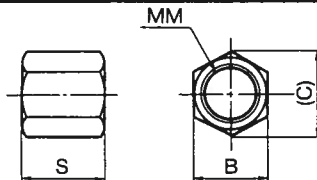


Parts No.	Dimensions		
	ϕE_1	LL	Z
NRB050-030	.31	2.50	.39
NRB056-045	.47	3.65	.53
NRB075-045	.47	3.65	.53
NRB100-060	.71	4.14	.67

Model	Shock Absorber									Nut				
	A	ϕD	ϕE_1	ϕE_2	F	H	L	LL	MM	S	B	C	h	K
NRB050-030	—	0.12	0.42	0.42	0.15	0.30	1.48	2.12	$\frac{1}{2}$ -20 UNF	1.82	$\frac{3}{4}$	0.86	0.20	0.43
NRB056-045	—	0.20	0.48	0.47	0.14	0.45	2.31	3.10	$\frac{9}{16}$ -18 UNF	2.65	$\frac{3}{4}$	0.86	0.24	0.49
NRB075-045	—	0.20	0.65	0.67	0.20	0.45	2.26	3.19	$\frac{3}{4}$ -16 UNF	2.74	$\frac{5}{16}$	1.08	0.24	0.68
NRB100-060	—	0.24	0.87	0.87	0.21	0.50	2.37	3.35	1-12 UNF	2.85	$1\frac{1}{16}$	1.51	0.31	0.87

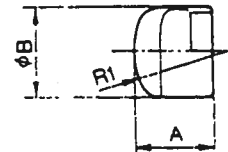
Option

Stopper Nut



Spare Parts

Cap



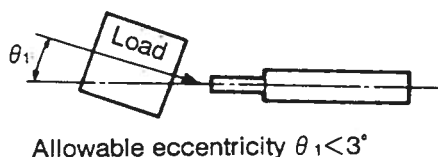
Material : Polyurethane

Part No.	Dimensions				Applicable Model
	B	C	S	MM	
NRB031S	$\frac{1}{16}$	(.51)	$\frac{1}{16}$	$\frac{1}{16}$ -32 UNEF	NRB031-025
NRB037S	$\frac{1}{2}$	(.56)	$1\frac{1}{4}$	$\frac{3}{8}$ -32 UNEF	NRB037-025
NRB050S	$\frac{3}{4}$	(.86)	$2\frac{7}{8}$	$\frac{1}{2}$ -20 UNF	NRB050-030
NRB056S	$\frac{3}{4}$	(.86)	$\frac{1}{2}$	$\frac{9}{16}$ -18 UNF	NRB056-045
NRB075S	$1\frac{1}{16}$	(1.08)	$\frac{5}{8}$	$\frac{3}{4}$ -16 UNF	NRB075-045
NRB100S	$\frac{1}{16}$	(1.51)	$\frac{3}{4}$	1-12 UNF	NRB100-060

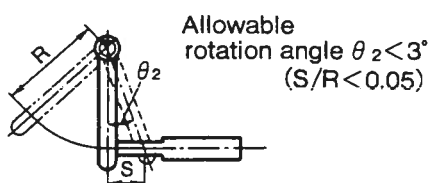
Parts No.	Dimensions		
	A	ϕB	R1
RB08C	.26	.27	.24
RB10C	.35	.34	.29
RB14C	.49	.47	.39
RB20C	.63	.71	.79

Precautions

- ① Load should always be aligned with the axis of piston rod.
(In the case of eccentricity of 3° or more, please contact SMC representative.)



- ② For rotational impact, load should always be aligned perpendicular to the axis of shock absorber and allowable rotation angle at stroke end should always be $\theta_2 < 3^\circ$
(In the case of rotation angle of 3° or more, please contact SMC agent.)



- ③ Shock absorber nut/tightening torque should be as follows.

Model	NRB031	NRB037	NRB050	NRB056	NRB075	NRB100
O.D. thread in	$\frac{5}{16}$ -32	$\frac{3}{4}$ -32	$\frac{1}{2}$ -20	$\frac{5}{8}$ -18	$\frac{3}{4}$ -16	1-12
Nut/Tightening torque in/lb	15	15	28	95	95	210

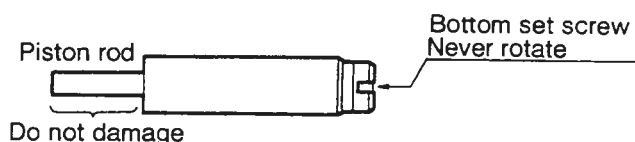
- ④ Load on mounting plate can be worked out as follows.

$$\text{Load on mounting plate lb} \sim 2 \frac{E (\text{Energy absorption in/lb})}{S (\text{Stroke in})}$$

- ⑤ Never rotate set screw on the bottom of body

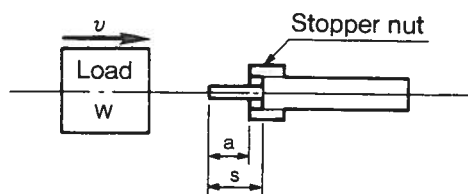
(Remember it is not a regulation set screw.)

Rotation can cause oil leakage.



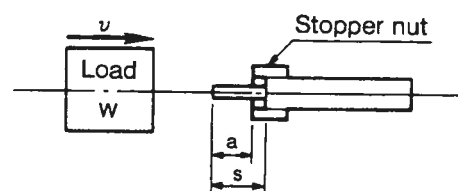
- ⑥ Make sure that the seal surface does not receive any kind of damage. Damage will reduce the durability of the piston rod and cause unsatisfactory operation.

- ⑦ Adjustment of the stopper nut (to adjust the length a) will control the suspension time of the impacting object.



S: Stroke of Shock absorber
(Figures specified on catalogue)

- ⑦ Adjustment of the stopper nut (to adjust the length a) will control the suspension time of the impacting object.



S: Stroke of Shock absorber
(Figures specified on catalogue)

- ⑧ Avoid applications where the shock absorber rod is in direct contact with cutting oil, water etc.

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