N371

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

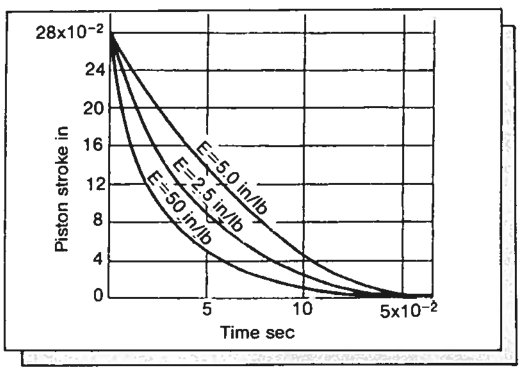
Impact absorption and noise damping to meet the high speed requirements of the modern world.

Shock Absorber Series NRB

Automatic adjustment to the most appropriate absorption performance

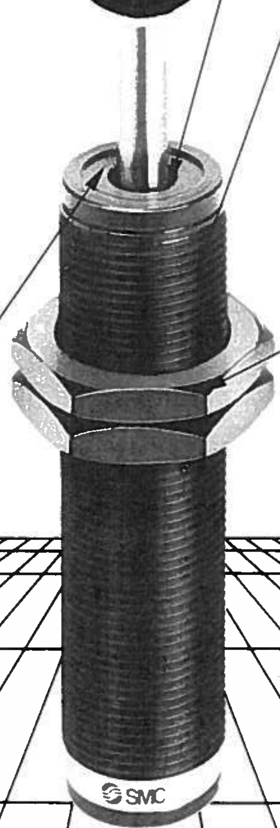
Specially designed orifice can absorb energy comprehensively and most appropriately in many different applications. These range from high speed low load, to low speed high load; without requiring additional adjustment of the shock absorber.

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.

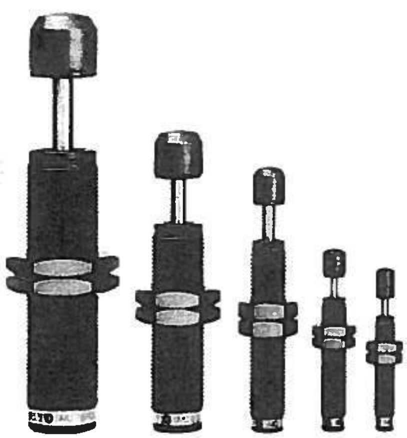
Absorption capability maintains its performance regardless of temperature change

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



With cap

How To Order

NRB C 037 − 025

- Shock absorber: NRB
- Model
  - _ — Basic type
  - C — With cap
- O.D. thread — Stroke
- Option
  - _ — Without
  - S — With stopper nut

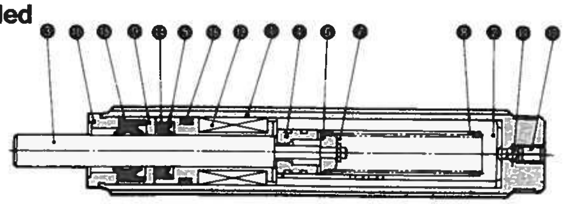
Cap type spare part numbers (outer cap only)

NRB 08 C

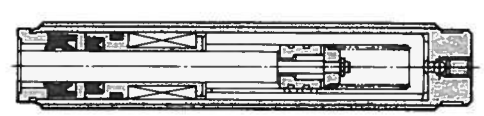
- Applicable model
  - **08** — NRBC031/NRBC037
  - **10** — NRBC050
  - **14** — NRBC056/NRBC075
  - **20** — NRBC100
- Cap

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	

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 Ⓐ 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 Ⓑ or graph Ⓒ.

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 Ⓐ in order to calculate the effective weight of the impacting object.

7 Selection of applicable model

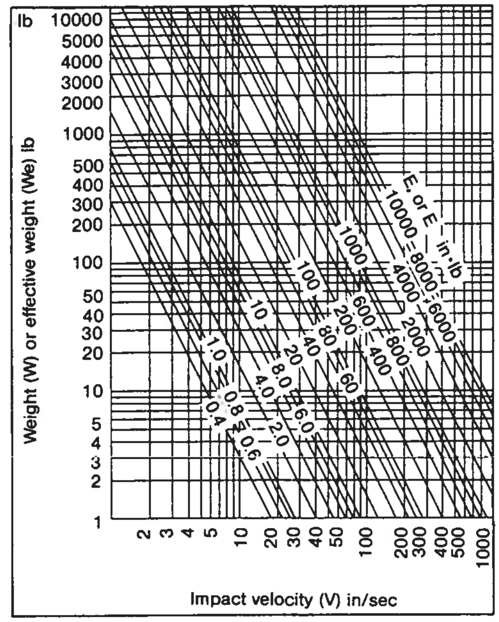
Taking into consideration the effective weight of the object (We) calculated using graph **D** and impact velocity (V), check provisional model compatibility with the condition of application.
For added precaution, once again check the operational cycle/min(n).

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



Graph Ⓒ Work energy (W•S)

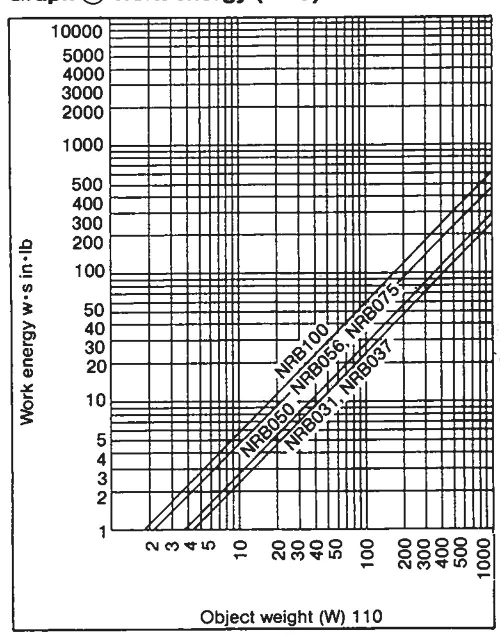


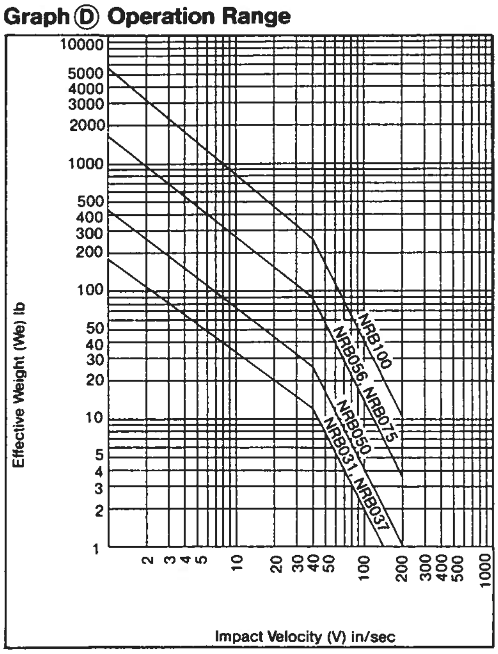
Table Ⓑ Work energy of cylinder (F•S) in/lb (Operating pressure 80 psi)

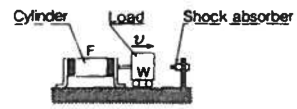
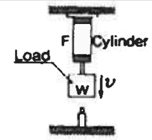
		Model	NRB031-025 NRB037-025	NRB050-030	NRB056-045 NRB075-045	NRB100-060
		Effective Stroke in	0.25	0.30	0.45	0.60
Bore	NCM	0.75	8.8	10.6	15.9	21.2
		0.88	12.2	14.6	21.9	29.2
		106	17.6	21.2	31.8	42.4
		125	24.5	29.5	44.2	58.9
		150	35.3	42.4	63.6	84.8
	NCA1	200	62.8	75.4	113	151
		250	98.2	118	177	236
		325	166	199	299	398
		400	251	302	452	603
Bore	NCJ2 NCJP NCQ2 NCY2 NCX2	6	0.88	1.05	1.58	2.10
		10	2.43	2.92	4.38	5.84
		12	3.51	4.21	6.31	8.41
		15	5.48	6.57	9.86	13.1
		20	9.74	11.7	17.5	23.4
		25	15.2	18.3	27.4	36.5
		32	24.9	29.9	44.9	59.8
		40	39.0	46.7	70.0	93.5
		50	60.9	73.0	109.6	146
		63	96.6	116	174	232
		80	156	187	280	374
		100	243	292	438	584

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

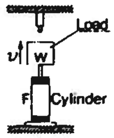
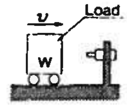
Graph Ⓓ Operation Range



	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•S	F•S+W•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 Ⓐ and obtain E_1 using W=20 lbs and v=40 in/sec **$E_1 \approx 45$ in•lbs**	● Kinetic Energy (E_1) Use graph Ⓐ and obtain E_1 using W=10 lbs and v=120 in/sec **$E_1 \approx 200$ in•lbs**
5 Calculation of Work Energy E_2	● Work Energy (E_2) Choose NRB056, based on E_1 Use table Ⓑ and obtain E_2 E_2 (80 psi)=113 in•lbs Since operating pressure=60 psi E_2=113x.75=85 in•lbs **E_2=85 in•lbs**	● Work Energy Choose NRB100, based on E_1 Use table Ⓑ and graph Ⓒ and obtai F•S and W•S F•S=151 in•lbs W•S=6 in•lbs E_2=F•S+W•S=151+6=157 in•lb **E_2=157 in•lbs**
6 Calculation of effective weight of object We	● Effective Weight (We) Total energy E=E_1+E_2= 45+85=130 in•lbs Use graph Ⓐ and obtain We using E and V. **We ≈ 70 lbs**	● Effective Weight (We) Total energy E=E_1+E_2= 200+157=375 in•lbs Use graph Ⓐ and obtain We using E and V. **We ≈ 22 lbs**
7 Selection of applicable model	● Selection of applicable model Using graph Ⓓ, substitute We and V to confirm initial choice is applicable **YES** **Select NRB056**	● Selection of applicable model Using graph Ⓓ, substitute We and \ to confirm initial choice is applicat **YES** **Select NRB100**

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

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 YES	● Confirmation of specifications v=>40<200 in/sec t=>14<70<176°F YES	3 Specifications
● Kinetic Energy (E_1) Use graph Ⓐ and obtain E_1 using W=10 lb and v=120 in/sec $E_1 \approx 200$ in·lbs		4 Calculation of kinetic energy E_1
● Work Energy (E_2) Choose NRB100, based on E_1 Use table Ⓑ and graph Ⓒ and obtain F·S and W·S F·S=151 in·lbs W·S=6 in·lbs E_2=F·S–W·S=151–6=145 in·lbs E_2=145 in·lbs		5 Calculation of Work Energy E_2
● Effective Weight (We) Total energy E=E_1+E_2= 200+145=345 in·lbs Use graph Ⓐ and obtain We using E and V. We ≈ 20 lbs	● Effective Weight (We) We=W=20 lbs We ≈ 20 lbs	6 Calculation of effective weight of object We
● 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=20 lb and V=40 in/sec, choose NRB050 YES **Select NRB050**	7 Selection of applicable model

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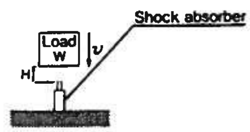
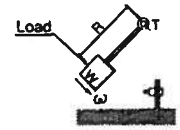
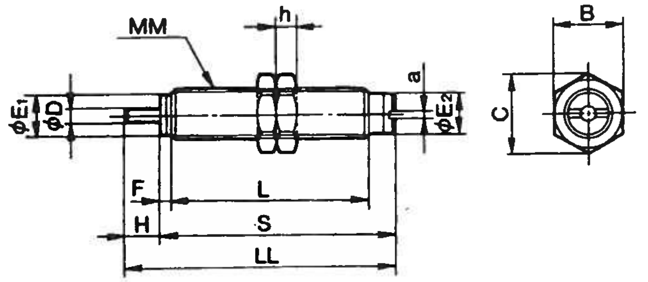
	Free Falling impact	Rotational Impact (With Torque)
1 Classification of impact		
Impact Velocity Note 1) V	$\sqrt{2gH}$	$\omega \cdot R$
Kinetic energy E_1	$W \cdot H$	$\frac{J \cdot \omega^2}{2} = \frac{W}{2g} \cdot v^2$
Work energy E_2	$W \cdot S$	$T \cdot \frac{S}{R}$
Total energy E	$E_1 + E_2$	$E_1 + E_2$
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 $v=\sqrt{2gH}=\sqrt{2\,(386\ in/sec^2)\,(8\ in)}$ v=80 in/sec v=>80<200 in/sec t=>14<70<176°F **YES**	● Confirmation of specifications v=ωR=20 inch x 1 rad/sec=20 in/sec v=>20<200 in/sec t=>14<80<176 **YES**
4 Calculation of kinetic energy E_1	● Kinetic Energy (E_1) E_1=W·H=50 lb (8 in)=400 in·lbs E_1=400 in·lbs	● Kinetic Energy (E_1) Use graph Ⓐ and obtain E_1 using W=6 lbs and v=120 in/sec E_1=4 in·lbs
5 Calculation of Work Energy E_2	● Work Energy (E_2) Choose NRB100, based on E_1 Use graphic Ⓒ and obtain W·S W·S=30 in·lbs E_2=30 in·lbs	● Work Energy (E_2) Choose NRB037, based on E_1 $E_2=T \cdot \frac{S}{R}=90\ in \cdot lbs \frac{.25\ in}{20\ in}=1.1\ in \cdot lbs$ E_2=1.1 in·lbs
6 Calculation of effective weight of object We	● Effective Weight (We) Total energy E=E_1+E_2= 400+30 in·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 in·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

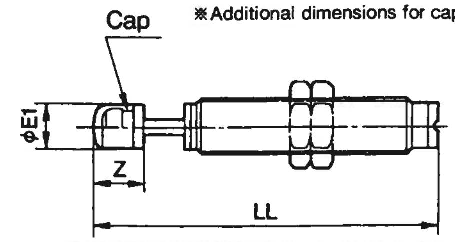
Dimensions (in)

Basic type / NRB031 • NRB037



With cap / NRBC031 • NRBC037

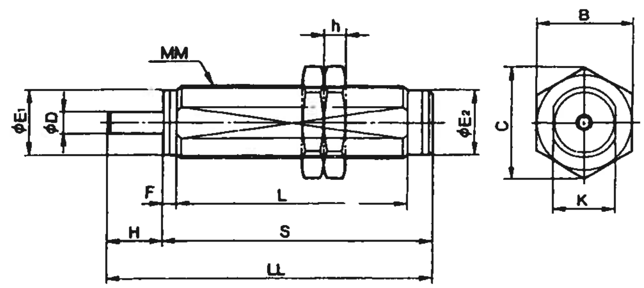
※Additional dimensions for cap type.



Parts No.	Dimensions		
	øE$_1$	LL	Z
NRB031-025	.27	2.25	.41
NRB037-025	.27	2.25	.41

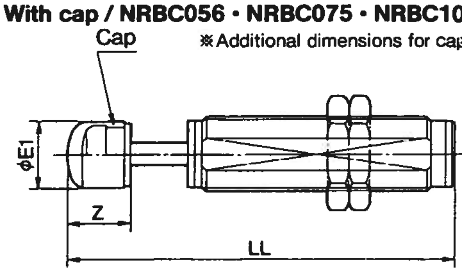
Model	Shock Absorber											Nut		
	A	øD	øE$_1$	&E$_2$	F	H	L	LL	MM	S	B	C	h	K
NRB031-025	0.06	0.11	0.27	0.27	0.09	0.25	1.31	1.85	5/16-32 UNEF	1.60	7/16	0.55	0.09	–
NRB037-025	0.06	0.11	0.33	0.33	0.15	0.25	1.24	1.84	3/8-32 UNEF	1.59	1/2	0.58	0.09	–

Basic type / NRB050 • NRB056



With cap / NRBC056 • NRBC075 • NRBC100

※Additional dimensions for cap type.

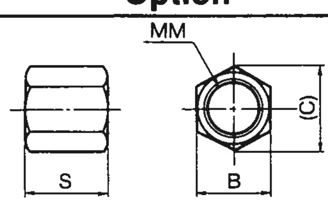


Parts No.	Dimensions		
	øE$_1$	LL	Z
NRB050-030	.31	2.50	.39
NRB056-045	.47	3.65	.53
NRB075-045	.47	3.65	.53
NRB100-060	.71	4.14	.67

Model	Shock Absorber											Nut		
	A	øD	øE$_1$	øE$_2$	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	1/2-20 UNF	1.82	3/4	0.86	0.20	0.43
NRB056-045	–	0.20	0.48	0.47	0.14	0.45	2.31	3.10	9/16-18 UNF	2.65	3/4	0.86	0.24	0.49
NRB075-045	–	0.20	0.65	0.67	0.20	0.45	2.26	3.19	3/4-16 UNF	2.74	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 5/16	1.51	0.31	0.87

Option

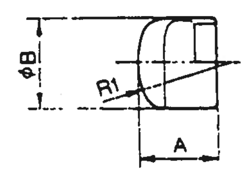
Stopper Nut



Part No.	Dimensions				Applicable Model
	B	C	S	MM	
NRB031S	7/16	(.51)	5/16	5/16-32 UNEF	NRB031-025
NRB037S	1/2	(.56)	19/64	3/8-32 UNEF	NRB037-025
NRB050S	3/4	(.86)	27/64	1/2-20 UNF	NRB050-030
NRB056S	3/4	(.86)	1/2	9/16-18 UNF	NRB056-045
NRB075S	15/16	(1.08)	5/8	3/4-16 UNF	NRB075-045
NRB100S	5/16	(1.51)	3/4	1-12 UNF	NRB100-060

Spare Parts

Cap

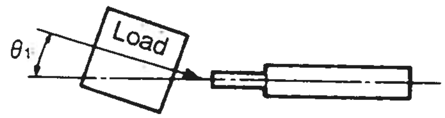


Material : Polyurethane

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

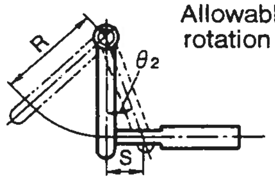
Precautions

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



Allowable eccentricity $\theta_1 < 3°$

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



Allowable rotation angle $\theta_2 < 3°$ $(S/R < 0.05)$

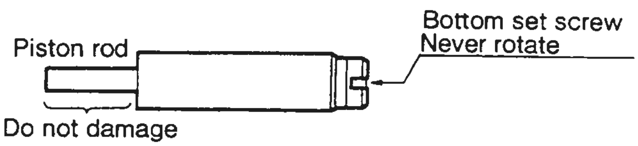
❸Shock absorber nut/tightening torque should be as follows.

Model	NRB031	NRB037	NRB050	NRB056	NRB075	NRB100
O.D. thread in	5/16-32	3/4-32	1/2-20	9/16-18	3/4-16	1-12
Nut/Tightening torque in/lb	15	15	28	95	95	210

❹Load on mounting plate can be worked out as follows.

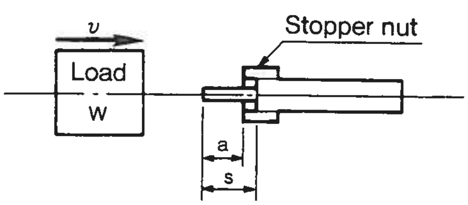
$$\text{Load on mounting plate lb} \sim 2\,\frac{\text{E (Energy absorption in/lb)}}{\text{S (Stroke in)}}$$

❺Never rotate set screw on the bottom of body
(Remember it is not a regulation set screw.)
Rotation can cause oil leakage.



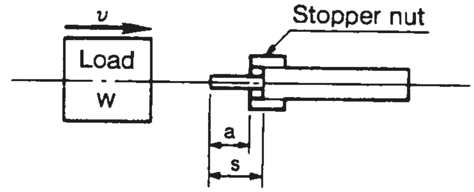
❻Make sure that the seal surface does not receive any kind of damage. Damage will reduce the durability of the piston rod and cause unsatisfactory operation.

❼Adjustment 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)

❼Adjustment 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 cataioaue)

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

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