Related Equipment

SKL
NCK
SCK
FCK
FJ
FK

Cylinder
Switch

Ending

NCK

Shock Absorber, Fixed Type

Related Components

Overview

Compared to SCK, shock absorber NCK is an optimal shock absorbing device for stopping workpieces with thrust at medium and low speeds. Adopting the slit orifice method, which was considered difficult in structure, achieves high absorption capacity in the low-speed range, linear soft stopping, etc. Moreover, its compact and slim design allows it to function in FA system construction with space saving.

Features

Compatible with Thrust Energy

Demonstrates power in absorbing thrust energy from cylinders, etc. Stopping is also extremely soft touch.

Smooth absorption even at low speed

Particularly excellent for low speeds, enabling smooth shock absorption.

Large absorption capacity even though compact

Despite its compact and slim design, absorption energy is large. It is a space-efficient product.

Simple Mounting

Linear Soft Stopping

Wide Variety of Models

8 types available by absorption energy. Selectable according to application.

CONTENTS

Related Equipment

SKL
NCK
SCK
FCK
FJ
FK

Cylinder
Switch

Ending

NCK Series

●Max Absorbed Energy: 1 to 200 J

RoHS

Model Number Notation

NCK – 00 – 0.7 – N1

❶ Mounting type ❸ Option

Model No. ❷ Series (Max Absorption Energy)

❶ Mounting type

Code	Content	
00	Basic type	
FA	Flange Type	

❷ Series (Max Absorption Energy)

Code	Content
0.1	1J
0.3	3J
0.7	7J
1.2	12J
2.6	26J
7	70J
12	120J
20	200J

❸ Option

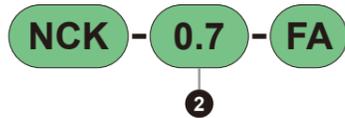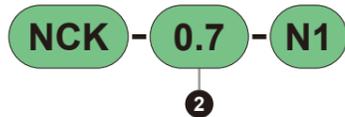| Code	Content	
Blank	Standard	
N1	With Stop Nut	
C	With Tip Cap	

*1: N1 specification products come with 3 Hexagon Nuts.
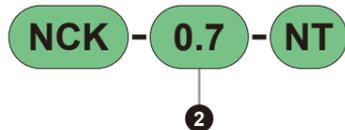
Accessory Parts Model No. Notation Method

● Flange Bracket (1 pc.)

NCK – 0.7 – FA
❷

● Stop Nut+Hexagon Nut (1 pc. each)

NCK – 0.7 – N1
❷

● Hexagon Nut (1 pc.)

NCK – 0.7 – NT
❷

| Rechargeable Battery Compatible Specification | (Catalog No. CC-1226AA)

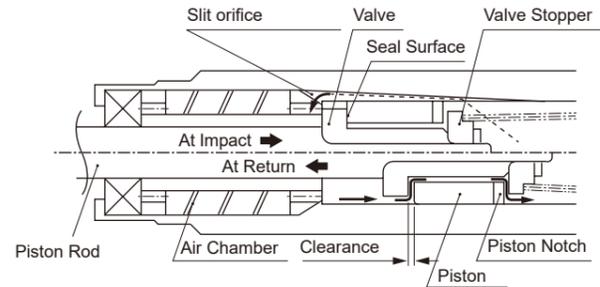●Structure usable in rechargeable battery manufacturing processes

NCK – ····· – P4*

* Please contact us for details.

Specifications

Item	NCK							
Series	0.1	0.3	0.7	1.2	2.6	7	12	20
Model / Classification	Without Adjuster							
	Spring Return Type							
Maximum absorption energy J	1	3	7	12	26	70	120	200
Outer diameter thread size mm	M8×0.75		M10×1.0	M12×1.0	M14×1.5	M20×1.5	M25×1.5	M27×1.5
Stroke mm	4.5	-	8	10	15	20	25	30
Per hour Max Absorption Energy kJ/hour	4.8	6.3	12.6	21.6	39.0	84.0	86.4	108.0
Max Impact Speed m/s	1.0	1.5		2.0		2.5	3.0	
Max Repetition Frequency cycles/min	80	35	30		25	20	12	9
Ambient Temperature °C	-10 to 80 (provided there is no freezing)							
Max Load (Resistance Force Value) N	525	1150	2010	2750	4000	7980	10950	15380
Return Time s	0.3 or less					0.4 or less		0.5 or less
Weight kg	0.009	0.012	0.02	0.04	0.07	0.2	0.3	0.45
Return Spring Force At Extension N	2.9		2.0	2.9	5.9	9.8	16.3	
At Compression N	4.5		4.3	5.9	11.8	21.6	33.3	33.9

Note: Shock absorber absorption capacity changes depending on speed and Ambient Temperature. The above specification values are at normal temperature.

Related Equipment
SKL
NCK
SCK
FCK
FJ
FK
Cylinder Switch
Ending
1392 CKD

Related Equipment
SKL
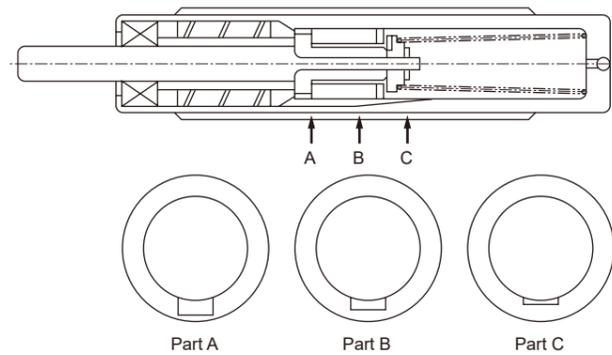NCK
SCK
FCK
FJ
FK
Cylinder Switch
Ending
CKD 1393

Operation Explanation

① At Impact

When the workpiece collides with the Piston Rod, the piston is simultaneously pushed in, pressurizing the oil in the tube. The pressurized oil passes through our company's unique slit orifice groove and flows towards the oil chamber with the air chamber. The piston is further pushed in by the cylinder thrust, workpiece self-weight, etc., but as the piston moves, the area of the slit orifice also gradually decreases, generating even higher resistance force. This series of operations is performed continuously, smoothly stopping the workpiece.

② At Return

When released from the workpiece, the piston attempts to return by the internal spring. At that time, since the piston moves from the seal surface side to the valve stopper side, the oil return flow path is opened by the piston notch. The oil passes through this flow path and slit orifice, returning to the state before workpiece impact. In this state, it will wait for the next workpiece impact.
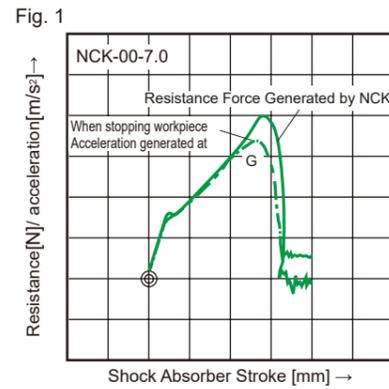
Slit orifice   Valve   Valve Stopper
Seal Surface
At Impact →
← At Return
Piston Rod   Air Chamber   Clearance   Piston Notch
Piston

Fig. 1

NCK-00-7.0

Resistance[N]/ acceleration[m/s²] →

Resistance Force Generated by NCK

When stopping workpiece Acceleration generated at

G

Shock Absorber Stroke [mm] →

● Characteristic wave form of slit orifice integrated with NCK Series

Fig. 2

Resistance[N]/ acceleration[m/s²] →

When stopping workpiece Acceleration generated at   G

Generated Effect

Shock Absorber Stroke [mm] →

● Characteristic waveform attained with conventional porous orifice

Structural Explanation

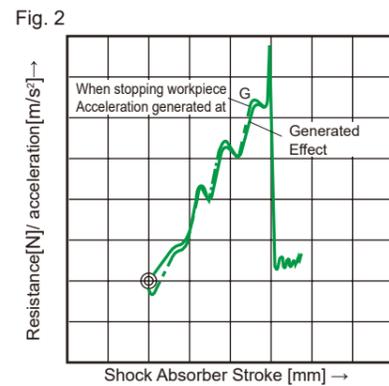A   B   C

Part A   Part B   Part C

1. The slit orifice has a structure in which the orifice area changes smoothly (decreases) with the movement of the piston as shown in the figure above. This structure was known to achieve an ideal "stop" for hydraulic dampers, but it had not been adopted in other companies' products until now due to manufacturing difficulties. Our company deliberately challenged this difficult problem and established linear stopping performance as shown in Figure 1.
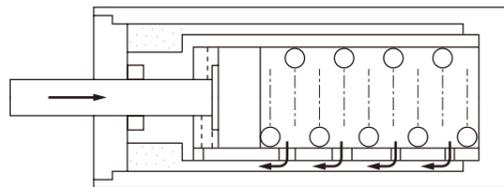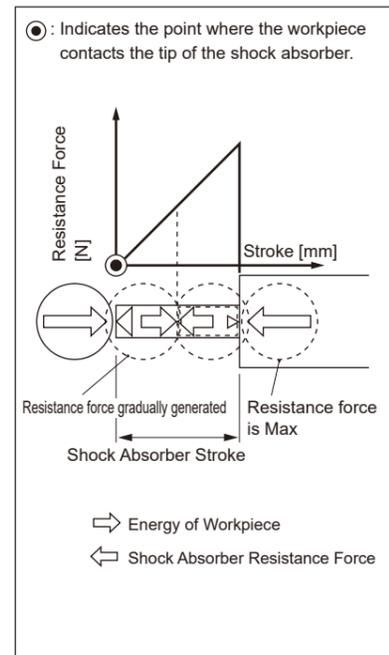
2. As a structure in which the orifice area changes with the movement of the piston, one using a double tube as shown in the figure above is common. Multiple small orifice holes are provided in the inner pipe, and the orifice holes are closed as the piston moves. In this structure, performance is greatly affected by hole position accuracy, and also, as shown in Figure 2, the resistance force changes for each orifice, resulting in characteristics lacking smoothness.

◉ : Indicates the point where the workpiece contacts the tip of the shock absorber.

Resistance Force [N]

Stroke [mm]

Resistance force gradually generated   Resistance force is Max

Shock Absorber Stroke

⇨ Energy of Workpiece

⇦ Shock Absorber Resistance Force

Dimensional Drawings

● Standard (NCK-□□-□□)

M   N (Threaded Part)
B   G
øK
J   F   F
C
A
LL
H
L

● Capped (NCK-□□-□□-C)

M'   N (Threaded Part)
B   G
øl   øK
J   F   F
E   C
A'
LL
H
L
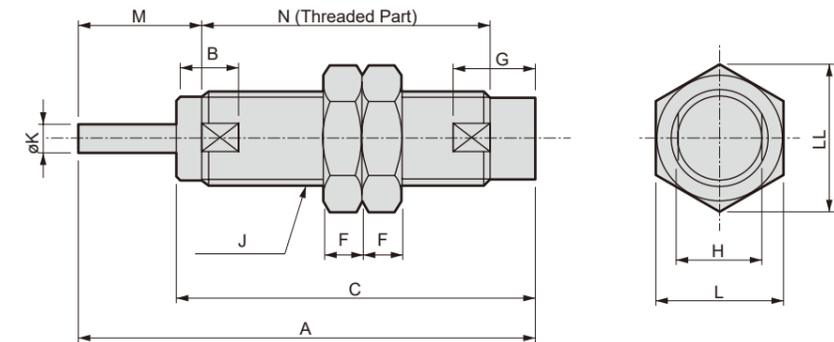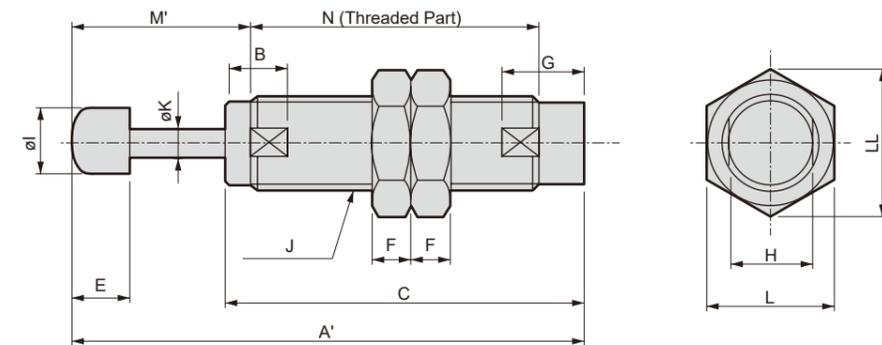
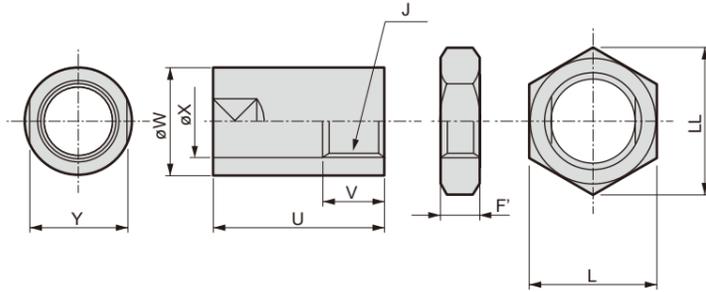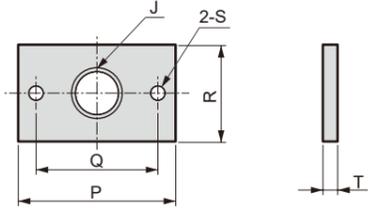| Code	Basic Type (00)														
Model No.	A	A'	B	C	E	F	G	H	I	J	K	L	LL	M	M'	N
NCK-00-0.1	34.5	40.5	4	29.5	6	4	7.5	7	6	M8×0.75	2.8	12	13.9	6	12	23
NCK-00-0.3	45.5	51.5	7.5	39	6	4	8	7	6	M8×0.75	2.8	12	13.9	11	16.5	29.0
NCK-00-0.7	50	57	7.5	41.5	7	4	9	9	8	M10×1.0	3	14	16.2	13	20	31
NCK-00-1.2	57.5	65	8.5	47	7.5	5	11	11	10	M12×1.0	3.5	17	19.6	15	22.5	35.5
NCK-00-2.6	86	96	10.5	70.5	10	5.5	14	13	12	M14×1.5	5	19	21.9	20	30	58
NCK-00-7	98.5	109.5	12.5	78	11	8	18	19	16	M20×1.5	6	27	31.2	25	36	63.5
NCK-00-12	129	142	15.5	103.5	13	10	23	24	22	M25x1.5	8	32	37	30	43	87
NCK-00-20	141	154	15.5	110.5	13	10	25	24	22	M27x1.5	8	32	37	35	48	92

Dimensional Drawings with Option

Flange (Mounting Bracket) Stop Nut

● NCK- 0.1 / 0.3 / 0.7 / 1.2 -□□

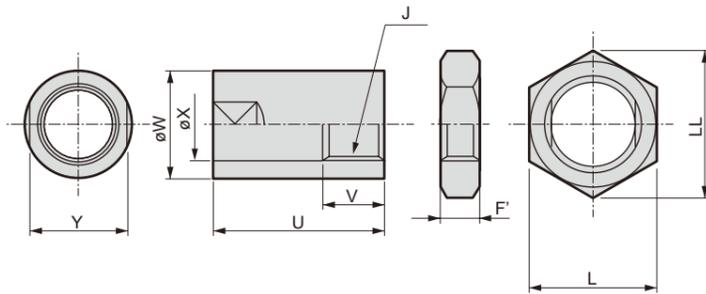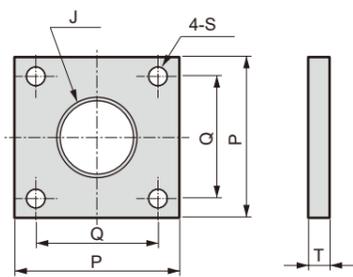Flange (FA)
Material: Steel

Stop Nut (N1)
Material: Steel

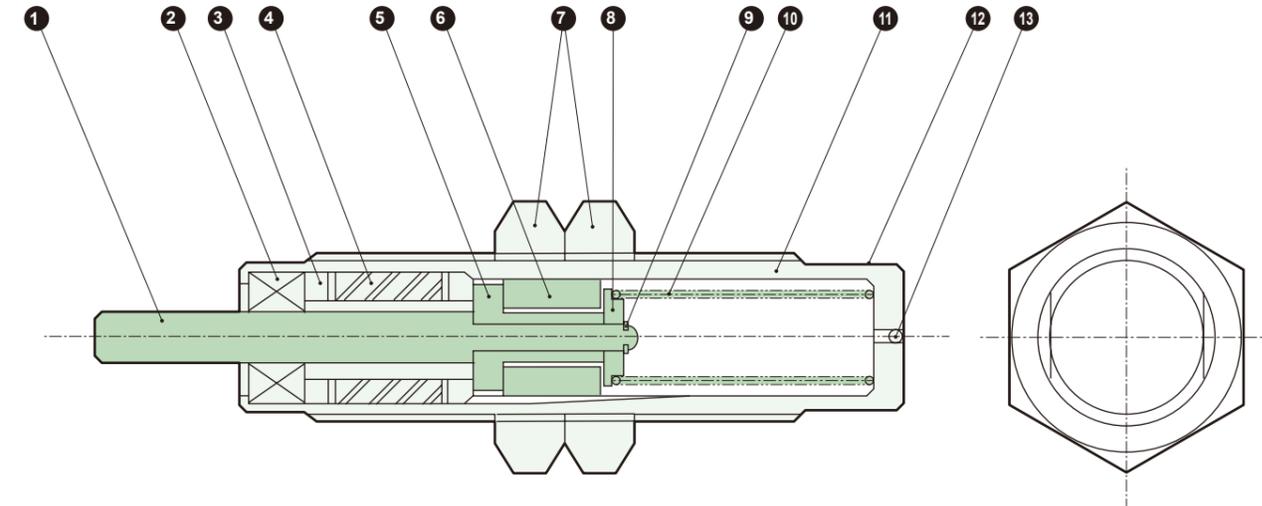● NCK- 2.6 / 7 / 12 / 20 -□□

Flange (FA)
Material: Steel

Stop Nut (N1)
Material: Steel

Internal Structure Diagram/Material

● Basic Type (Without Tip Cap)

● With Tip Cap

NCK-□□- 0.1 / 0.3 / 0.7 / 1.2 / 2.6 -C

NCK-□□- 7 / 12 / 20 -C

Do not disassemble

Code	Flange (FA)						Weight	Stop Nut (N1)									Weight
Model No.	J	P	Q	R	S	T	(g)	F'	J	L	LL	U	V	W	X	Y	(g)
NCK-0.1-□□	M8×0.75	42	30	20	5.5	2.3	14	4	M8×0.75	12	13.9	15	8	14	9	12	13
NCK-0.3-□□	M8×0.75	42	30	20	5.5	2.3	14	4	M8×0.75	12	13.9	15	8	14	9	12	13
NCK-0.7-□□	M10×1.0	42	30	20	5.5	2.3	14	4	M10×1.0	14	16.2	17	10	15	11	13	15
NCK-1.2-□□	M12×1.0	46	34	20	5.5	3.6	22	5	M12×1.0	17	19.6	23	10	19	13	17	34
NCK-2.6-□□	M14×1.5	52	38	−	6.5	6	115	5.5	M14×1.5	19	21.9	26.5	10	20	15	17	37
NCK-7-□□	M20×1.5	52	38	−	6.5	6	108	8	M20×1.5	27	31.2	36.5	15	26	21	24	77
NCK-12-□□	M25x1.5	52	38	−	6.5	6	100	10	M25x1.5	32	37	35	15	32	26	30	112
NCK-20-□□	M27x1.5	52	38	−	6.5	6	100	10	M27x1.5	32	37	45.5	15	35	28	32	155

Part No.	Part Name	Material	Remarks	Part No.	Part Name	Material	Remarks
1	Rod	Steel	Industrial Hard Chrome Plating	10	Spring	Piano Wire	
2	Oil Seal	Special Nitrile Rubber		11	Damper Case	Steel	Chromium plating
3	Rod Guide	Copper Alloy		12	Label	Polyester Film	
4	Air Chamber	Nitrile Rubber		13	Ball	Alloy Steel	
5	Valve	Steel		14	Damper Cushion	Polyamide	Black
6	Piston	Cast Iron		15	Damper Cushion	Polyester	Black
7	Hexagon Nut	Steel	Zinc Plating	16	Cushion Stopper	Steel	Zinc Plating
8	Valve Stopper	Steel		17	Hexagon Socket Set Screw	Steel	
9	E-type Retaining Ring	Steel	Zinc Plating				

Related Equipment

SKL
NCK
SCK
FCK
FJ
FK

Cylinder Switch

Ending

1396 CKD

CKD 1397

Shock Absorber Model Selection Guide (1)

Related Equipment

SKL

NCK

SCK

FCK

FJ

FK

Cylinder Switch

Ending

1 Clarify the equipment impact pattern

Horizontal Motion
- a. Simple Horizontal Impact
- b. Impact with Cylinder Thrust
- c. Impact with Motor Driving Force

Vertical Motion
- d. Impact due to Free Fall
- e. Impact with Cylinder Thrust (Lowering)
- f. Impact with Cylinder Thrust (Ascending)

Inclined Motion
- g. Impact due to Free Sliding
- h. Impact with Cylinder Thrust (Lowering)
- i. Impact with Cylinder Thrust (Ascending)

Oscillating Motion Rotation
- j. Impact due to Free Oscillation Fall
- k. Impact with Torque from Motor, etc. (Oscillation)
- l. Impact with Torque from Motor, etc. (Rotation)

Note: Refer to "Collision Pattern Diagram Examples".

2 Clarify conditions/items necessary for energy calculation

E = Total Absorption Energy (J)
E_1 = Kinetic Energy (J)
E_2 = Thrust / Self-weight Energy (J)

L = Impact Object Travel Distance (m)
(Inclined Free Fall)
R = Distance from Center of Rotation to Impact Point (m)
r = Distance from Center of Rotation to Center of Gravity (m)
G = Center of Gravity Position

M = Impact Weight (kg)
V = Impact Speed (m/s)
S = NCK Stroke (m)
F = Pushing Force (N)
g = Acceleration of Gravity 9.8 m/s²
ω = Angular Velocity (rad/s)
J = Moment of Inertia (kg·m²)
D = Diameter (m)
N = Rotational Speed (rpm)
Me = Equivalent Weight (kg)

H = Fall Height (m)
T = Torque (N·m)
Td = Motor Starting Torque (N·m)
K = Reduction Ratio
θ, α, β = Inclination Angle (deg)

Impact Pattern Diagram Examples

	Horizontal Impact			Vertical Impact		
	a. Simple Horizontal Impact	b. When there is cylinder pushing force	c. When there is motor pushing force	d. Free Fall	e. Cylinder Lower Limit Stopper	f. Cylinder Upper Limit Stopper
Usage Example						
Kinetic Energy E_1 (J)	$\frac{1}{2}\cdot M\cdot V^2$	$\frac{1}{2}\cdot M\cdot V^2$	$\frac{1}{2}\cdot M\cdot V^2$	$\frac{1}{2}\cdot M\cdot V^2$	$\frac{1}{2}\cdot M\cdot V^2$	$\frac{1}{2}\cdot M\cdot V^2$
Thrust/Self-weight Energy E_2 (J)	——	$F\cdot S$	$2\cdot\frac{K}{D}\cdot Td\cdot S$	$M\cdot g\cdot S$	$(M\cdot g+F)\cdot S$	$(F-M\cdot g)\cdot S$
Total Absorption Energy E (J)	$E=E_1$	$E=E_1+E_2$	$E=E_1+E_2$	$E=E_1+E_2$	$E=E_1+E_2$	$E=E_1+E_2$
Equivalent Weight Me (kg)	$Me=M$	$Me=\frac{2\cdot E}{V^2}$	$Me=\frac{2\cdot E}{V^2}$	$Me=\frac{2\cdot E}{V^2}$ $(V=\sqrt{2\cdot g\cdot H})$	$Me=\frac{2\cdot E}{V^2}$	$Me=\frac{2\cdot E}{V^2}$

	Inclined Impact			Oscillating Impact		Rotational Impact
	g. Free Fall	h. When there is cylinder pushing force	i. When there is cylinder pushing force	j. Free Fall	k. When there is torque from motor, etc.	l. When there is torque from motor, etc.
Usage Example						
Kinetic Energy E_1 (J)	$\frac{1}{2}\cdot M\cdot V^2$	$\frac{1}{2}\cdot M\cdot V^2$	$\frac{1}{2}\cdot M\cdot V^2$	$M\cdot g\cdot H$	$\frac{J\cdot\omega^2}{2}$ or $\frac{1}{2}\cdot M\cdot V^2$	$\frac{J\cdot\omega^2}{2}=\frac{M\cdot D^2\cdot\omega^2}{16}$
Thrust/Self-weight Energy E_2 (J)	$M\cdot g\cdot S\cdot\sin\theta$	$(M\cdot g\cdot\sin\theta+F)\cdot S$	$(F-M\cdot g\cdot\sin\theta)\cdot S$	$\frac{r}{R}\cdot M\cdot g\cdot S$	$\frac{T}{R}\cdot S$	$\frac{T}{R}\cdot S$
Total Absorption Energy E (J)	$E=E_1+E_2$	$E=E_1+E_2$	$E=E_1+E_2$	$E=E_1+E_2$	$E=E_1+E_2$	$E=E_1+E_2$
Equivalent Weight Me (kg)	$Me=\frac{2\cdot E}{V^2}$ $(V=\sqrt{2\cdot g\cdot L\cdot\sin\theta})$	$Me=\frac{2\cdot E}{V^2}$	$Me=\frac{2\cdot E}{V^2}$	$Me=\frac{2\cdot E}{V^2}$ $(V=\frac{R}{r}\sqrt{\frac{3\cdot g\cdot H}{2}})$	$Me=\frac{2\cdot E}{V^2}$ $(V=\omega\cdot R)$	$Me=\frac{2\cdot E}{V^2}$ $(V=\omega\cdot R, \omega=\frac{2\pi\cdot N}{60})$

3 Confirm items in shock absorber specification range

a. Max Repetition Frequency [times/min]   c. Ambient Temperature [°C]
b. Maximum collision speed [m/s]   d. Return time [s]

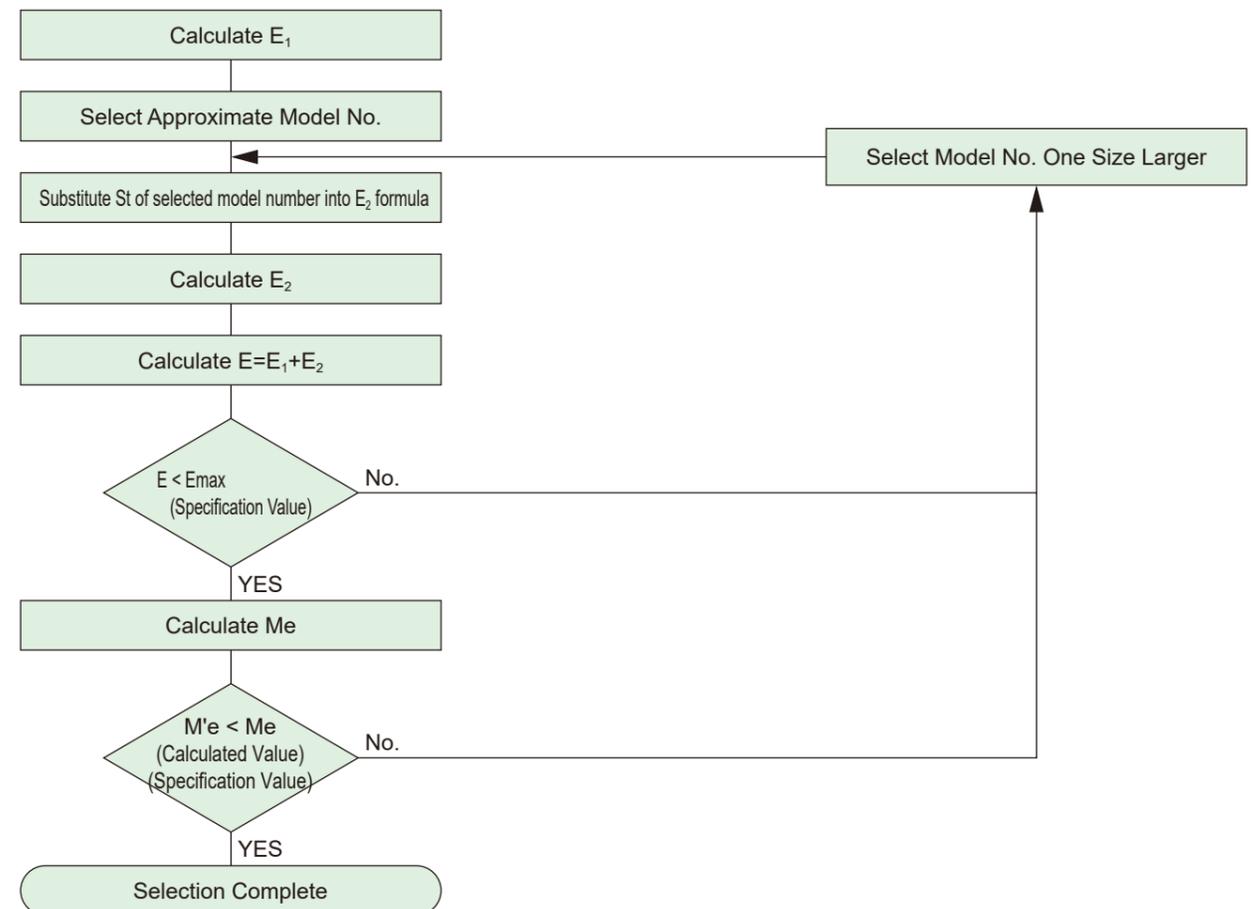Note: The value of energy that can be absorbed may change depending on the impact speed. Refer to P. 1401, Graph 5.

4 Actually calculate energy according to "Impact Pattern Diagram Examples"

● Code Explanation
E = Total Absorption Energy J
E_1 = Kinetic Energy J
E_2 = Thrust / Self-weight Energy J

a. Kinetic Energy ………………
b. Thrust/Self-weight Energy …

c. Total Absorption Energy ……

Calculate the value of E_1 according to the "Impact Pattern Diagram Examples". " Calculate the value of E_2 according to "Impact Pattern Diagram Examples.". For S (stroke of NCK) in the formula, select a model whose Max energy absorption exceeds E_1, and use S per model No.
If after that the calculation result exceeds Emax (Max energy absorption), select one size larger NCK than the previously selected model No., and recalculate. It is OK if the calculated value of E is less than the Emax of the model number selected here.

5 Confirm Equivalent Weight

Me = Equivalent Weight [kg]

Note: Equivalent mass corresponds to the mass of the workpiece when considering that even an object moving with thrust etc. is all kinetic energy only. Using only the energy calculation formula, the workpiece weight becomes abnormally large under very low speed conditions, so load limitation is performed using equivalent weight.

a. Calculate the value of Me according to the impact pattern diagram examples.
b. Based on the results of calculating Me (catalog value) and a for the model number selected in 4, it can be used if Me under these conditions is within the Me range of the selected model (calculated Me value < Me specification value).
c. If it exceeds the range of Me of the model selected in b, select an NCK one size larger and check in the same way.
Note) Equivalent weight (Me) is described on P. 1401 (Graph 4).

6 The calculation for 4 and 5 can be summarized as a flowchart as follows

Calculate E_1 → Select Approximate Model No. → Substitute St of selected model number into E_2 formula → Calculate E_2 → Calculate $E=E_1+E_2$ → E < Emax (Specification Value) — No → Select Model No. One Size Larger ; YES → Calculate Me → M'e < Me (Calculated Value) (Specification Value) — No → Select Model No. One Size Larger ; YES → Selection Complete

Related Equipment

SKL

NCK

SCK

FCK

FJ

FK

Cylinder Switch

Ending

# Shock Absorber Model Selection Guide (2)

In addition to the method of performing all calculations as in (1) for shock absorber model selection, there is also a method of determining by graph. If it is not necessary to grasp intermediate values such as energy values during calculation, using this graph allows for very efficient model selection.

Conditions of this diagram example: Horizontal collision with thrust

 m=50 kg, V=1.0 m/s

  Cylinder Bore ø50 Supply Pressure = 0.5 MPa

Energy Calculation Graph
● Thrust applies at the horizontal collision
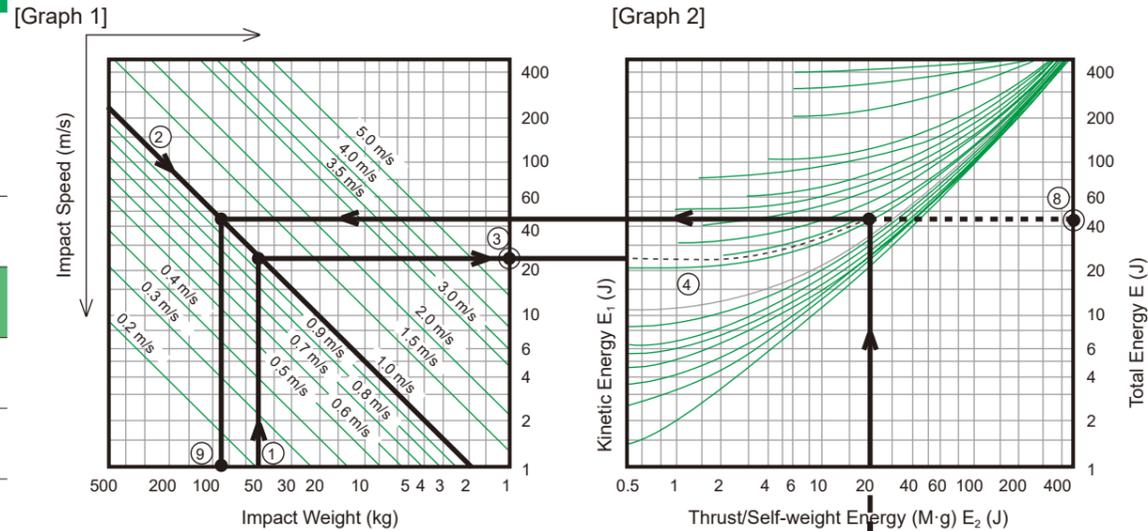
[Graph 1]

[Graph 2]

a) Determine the colliding weight M [kg]...①
b) Colliding speed V [m/s]...②
c) Point of intersection between M and V is kinetic energy E_1 [J]. ...③
d) Extend ③ to [Graph 2], and refer to the curve in the figure to draw a similar curve. (Dotted Line) ...④
e) Next, if thrust applies, determine thrust F [N] (from inner diameter and pressure of cylinder) by the right end chart of [Graph 3] ...⑤
f) Determine model No. of NCK according to stroke and Max energy absorption. ...⑥
  (Select a model number whose Max absorption energy exceeds E_1 obtained from ③.)
g) The point of intersection between F and NCK model No. shows the thrust/self-weight energy E_2 [J]. ...⑦
h) Extend point ⑧ and connect it with [Graph 2]; the intersection ⑧ with curve ④ is the total energy $E(=E_1+E_2)$[J]. ...⑧
  Here, if value E exceeds the selected NCK Emax (Max absorbed energy) at (f), select an NCK model No. one size larger again, and then find E with the same procedure.
i) Here, if "ⓒ" and ⑧ are extended to [Graph 1], the point of intersection ⑨ with V (m/s) represents the equivalent weight Me. ...⑨
  Here, confirm that the equivalent weight is within the range of the specified value) [Graph 4]. (If Me exceeds the specified value, return to (f) and repeat the same procedure.)

[Graph 3]

NCK Stroke (mm)
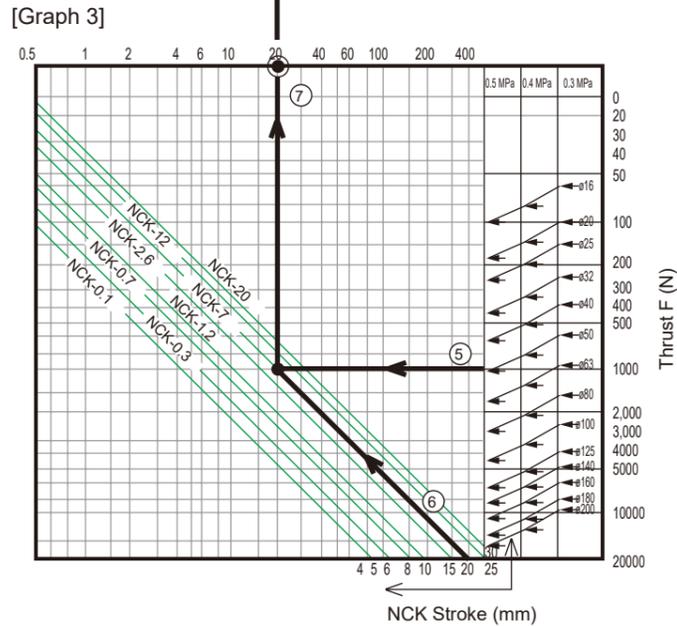
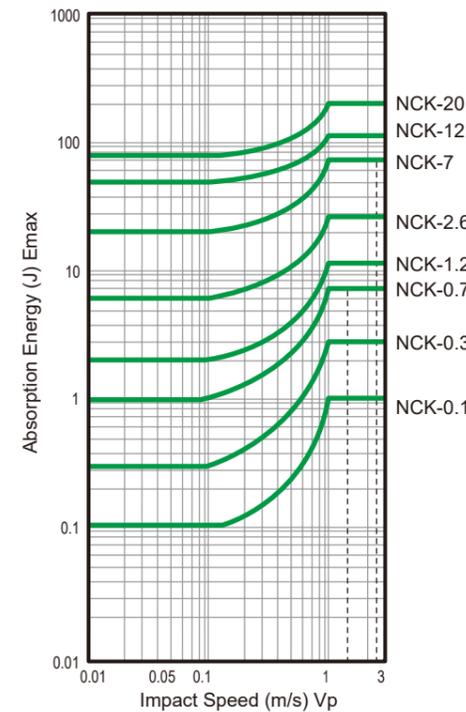# Selection Example

Let's try selecting a shock absorber using an actual example.

Example Problem Select a shock absorber that smoothly stops load M under the conditions shown in the left figure.

Frequency 10 cycle/Min (Refer to equipment indoors.)
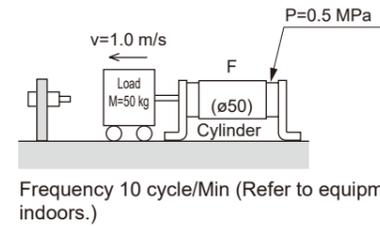
1 The equipment impact pattern corresponds to "b".

2 Summarize the conditions/items necessary for calculation.
a. Colliding object weight   M=50 kg
b. Colliding speed   V=1.0 m/s
c. Cylinder thrust $F=\pi/4 \times 50^2$ mm $\times 0.5$ MPa=981.7 N

3 Confirm the specification range.
a. Frequency 10 times/min .... NG because Max repetition frequency of NCK-20 is 9 times/min [This means it will be limited to models NCK-12 or less.]]
b. Impact Speed 1.0 m/s .... All models usable
c. Ambient Temperature: Indoor equipment … All models usable
d. Return Time: No specific restriction … All models usable

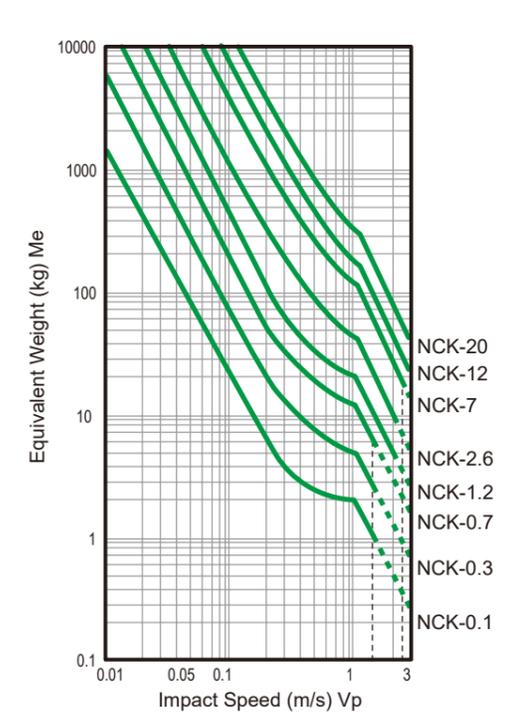## Equivalent Weight/Absorption Energy Impact Speed Characteristic Graph

[Graph 5]

Vp-Emax Characteristics (Impact Speed - Absorption Energy)

4 Actually calculate the energy.

● From pattern figure example "b"
a. Kinetic Energy: $E_1=\frac{1}{2} \cdot m \cdot V_2=\frac{1}{2} \times 50$ [kg] $\times 1.0^2$ [m/s] =25(J)
  Here, since E_1 alone was 25 J, NCK-2.6 [Emax=26J] (St = 15 mm) can be temporarily selected.
b. Thrust Energy: $E_2 = F \times S=981.7$ [N] $\times 0.015$ [m] = 14.7 [J]
c. Total Absorption Energy: $E=E_1+E_2=25$ [J] $+14.7$ [J] =39.7 [J]
  Recalculate with one size larger NCK-7, since this E = 39.7 [J] cannot be absorbed with the NCK-2.6 provisionally selected earlier.
b'. $E_2=F \times S=981.7$ [N] $\times 0.02$ [m] =19.6 [J]
c'. $E=E_1+E_2=25$ [J] $+19.6$ [J] =44.6 [J]
  The E = 44.6 [J] obtained here can be absorbed by NCK-7, so proceed to confirm the equivalent mass of the impact object.

5 Confirm the equivalent weight.

● From pattern figure example "b" the same as 4
a. Equivalent Weight $Me = \frac{2 \cdot E}{V^2} = \frac{2 \times 44.6 [J]}{1.0^2 [m/s]}$ =89.2 kg
b. NCK-7 Me is 150 [kg], larger than the calculated equivalent weight. Therefore, NCK-7 is OK for use under these conditions.

[Graph 4]

Vp-Me Characteristics (Impact Speed - Equivalent Weight)