FCK

Shock absorber/adjustable

Related products

Overview

An extensive product lineup of 32 types is available in three levels: low speed of 1 m/s, medium speed of 2 m/s, and high speed of 3 m/2. Shock absorbers allow selection of the ideal model.



CONTENTS

Series variation	1809
Product introduction	1840
● FCK-L low speed (max. absorbed energy 1.5 to 79.3 J)	1842
● FCK-M medium speed (max. absorbed energy 1.8 to 720 J)	1842
● FCK-H high speed (max. absorbed energy 1.8 to 720 J)	1842
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▲Safety precautions	1859

SCP*3

CMK2

CMA2

SCM

SCG

SCA2

SCS2

CKV2

CAV2/

COVP/N2 SSD2

SSG

SSD

CAT

MDC2

MVC

SMG

MSD/

MSDG

FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

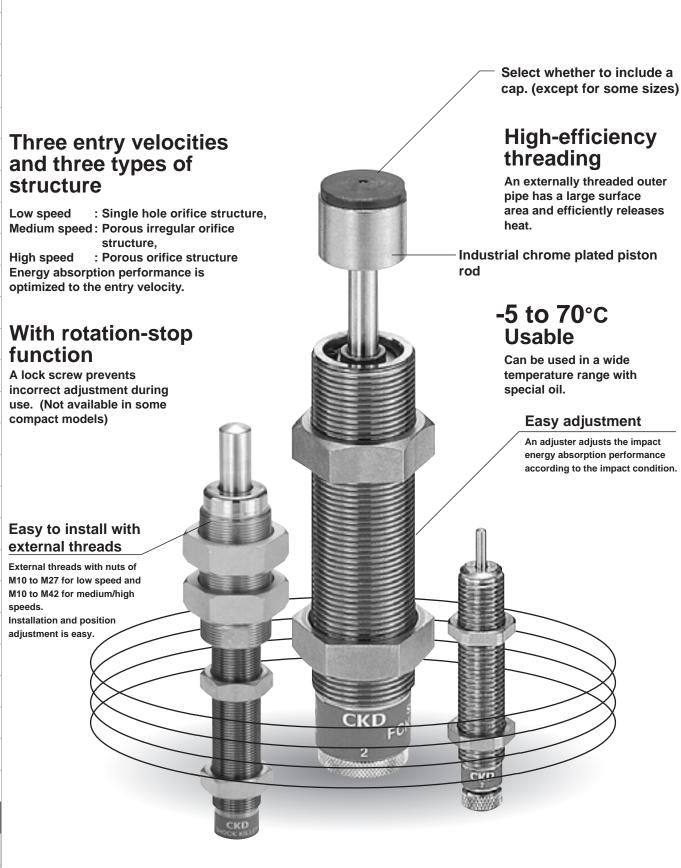
ShkAbs

FJ

FK

Spd Contr

Choose from low, medium and high speeds.



SHOCK

SCP*3

CMK2

CMA2

SCM

SCG

SCA2

SCS2

CKV2

CAV2/

COVP/N2

SSD2

SSG

SSD

CAT

MDC2

MVC

SMG MSD/ MSDG

FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FK

Spd Contr 32

New shock absorber models in FCK Series.

Optimum selection of energy absorption performance according to the impact condition and characteristics.

0.3 to

1

m/s, 8 models for low speed.



0.3 to

m/s, 12 models for medium speed.

0.7 to

3

m/s, 12 models for high speed.



5 benefits of

shock absorbers

- (1) Safely stops the colliding object.
- (2) Shortens the manufacturing cycle time.
- (3) Improves the service life of machinery.
- (4) Reduces noise and improves the environment around machinery.
- (5) Prevents failure of machinery.

ABSORBER

SCP*3

CMK2

CMA2

SCM

SCG

SCA2

SCS2

CKV2

COVP/N2

SSD2

SSG

SSD

CAT

MDC2

MVC

SMG

MSD/ MSDG

FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

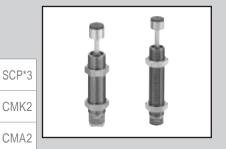
SM-25

ShkAbs

FJ

FK

Spd Contr



Shock absorber

FCK Series

Max. energy absorption: 1.5 to 720 J





Specifications

SCM

SCG

SCA₂

SCS₂

CKV2
CAV2/
COVP/N2
SSD2

SSG

SSD

CAT

MDC2

MVC

SMG MSD/ MSDG FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

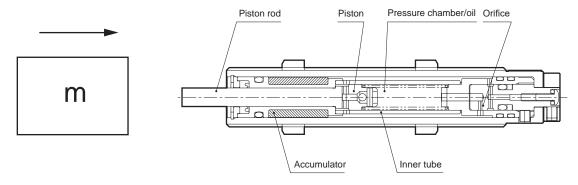
FJ

FK

Spd

Item										FCK							
Series			0.15	0.18	0.3	0.5	0.4	0.6	1	3	5	6.5	8.1	20	40	45	73.5
Type/Classification				Spring return with adjuster													
Max. energy ab	sorption	J	1.5	1.8	2.9	4.9	3.9	5.9	9.8	29.4	49	63.7	79.3	196	392	441	720
O.D. thread size	e m	nm	M10	x1.0	M12	2x1.0	M14	x1.5	M16x1.5	M20x1.5	M25	x1.5	M27x1.5	M30x1.5	M36x1.5	M42	x1.5
Stroke	n	nm	8	3		1	0		12	16	30	40	25	35	5	0	80
Max. absorbed en	nergy kJ	/hr	3	.5	5	.9	8	.8	14.1	20.6	29.4	38.2	32.3	70.5	141.1	164.6	264.6
Max. colliding	Ln	n/s	0.3 to 1	_	0.3 to 1	_	0.3 to 1	_			0.3 to 1			_	_	_	
speed	M n	n/s		0.3 to 2		0.3 to 2		0.3 to 2			0.3 to 2				0.3	to 2	
	H m	n/s	_	0.7 to 3		0.7 to 3		0.7 to 3			0.7 to 3				0.7	to 3	
Max. operating frequency	. , ,	\rightarrow						60						3	0	10	6
Ambient tempe		°C						-	-5 (23°F	F) to 70	,		1	1			
Max. load	L	N									4,900		ļ				
(resistance)	М	N	63	37	1,4	170	1,8	313	2,646	3,528	3,9	920	6,370	16,660	23,520	27,	028
	Н	N															
Return time		S					_	.5 or les						1 or		2 or	less
Weight	Without car			5.5	-	4		8	108	180	406	_	411	710	1300		
	With cap	g	2	7	4	7	7	3	117	202	436	459	460	760	1410	1560	2010
Return spring	When extended	l N	2	.9	4	.9	4	.5	5.4	12.0	16.6	23.8	16.2	19.6	22.5	24	.5
force	When compresse	ed N	5	.9		9	.8		14.7	18.0	33.1	71.4	27.2	44.1	68.6	83.3	98.0

Operational principle



If an object collides with the piston rod, that action is transmitted to the oil in the pressure chamber enclosed by the piston and inner tube.

Oil in pressure chamber flows out from orifice provided in inner tube.

Resistance F shown by following formula occurs at that time.

 $F = av^2 + bv + cx$ (v is colliding speed, and x is moving stroke. a, b, and c are constants.)

No. 1 shows the speed square resistance, which is a significant part of the resistance as a whole.

No. 2 shows the viscosity resistance, which is a significant part of the resistance if the colliding speed is low.

Item 3 shows return force of piston rod. (Can usually be ignored, as the value is miniscule compared to Items 1 and 2.) The product of resistance generated at this time and the piston rod stroke is the shock absorber absorption energy.

The shock absorber realizes ideal impact absorption by controlling Items 1 and 2.

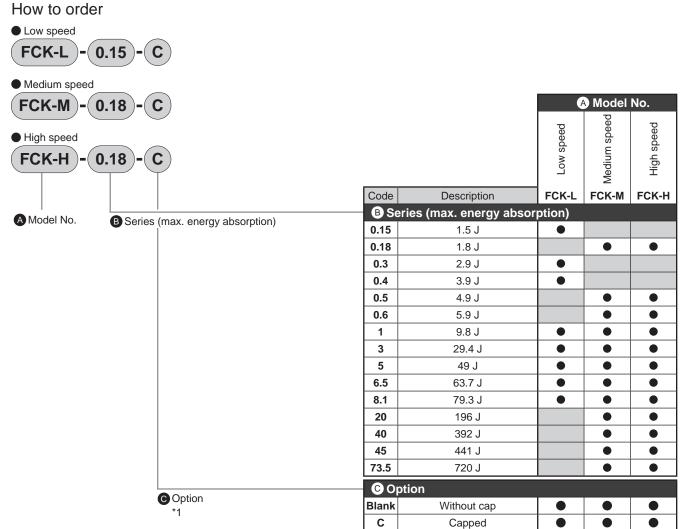
Ending

Contr



1842





* 1: No cap is not available for 6.5 (63.7 J), 45 (441 J), 73.5 (720 J).

is not available.

[Example of model No.]

FCK-M-0.18-C

A Model No. : Shock absorber medium speed B Series : Max. energy absorption 1.8 J

© Option : Capped

Specifications for rechargeable battery (Catalog No. CC-1226A)

FCK - ... -(

 Design compatible with rechargeable battery manufacturing process

SCP*3

CMK2

CMA2

SCM

SCG

SCA₂

SCS₂

CKV2 CAV2/

COVP/N2 SSD2

SSG

SSD

CAT

MDC2

MVC

SMG

MSD/

MSDG

FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FK

Spd Contr

^{*} Contact CKD for details.

Internal structure and parts list

● FCK-*-*

SCP*3

CMK2

CMA2

SCM

SCG

SCA2

SCS2

CKV2 CAV2/ COVP/N2 SSD2

SSG

SSD

CAT

MDC2

MVC

SMG MSD/ MSDG

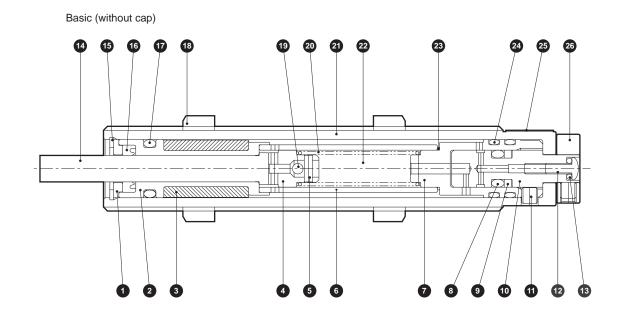
FC*

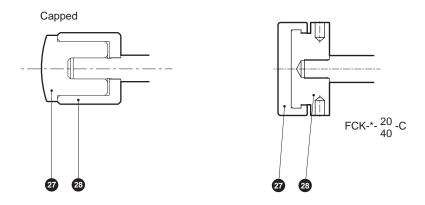
STK

SRL3

SRG3

FΚ Spd





Cannot be disassembled

Parts list

SRM3	Part	s list				
	No.	Part name	Material	No.	Part name	Material
SRT3	1	Packing seal retainer	Copper alloy	15	Snap ring	Steel
	2	Guide	Copper alloy	16	U packing	Nitrile rubber
MRL2	3	Accumulator	Nitrile rubber	17	O-ring	Nitrile rubber
	4	Piston	Copper alloy	18	Hexagon nut	Steel
MRG2	5	Spring pin	Stainless steel	19	Steel ball	Bearing steel
	6	Inner tube	Steel	20	Spring	Piano wire
SM-25	7	Bottom	Copper alloy	21	Outer tube	Steel
011.41	8	O-ring	Nitrile rubber	22	Oil	Oil
ShkAbs	9	Back up ring	Resin	23	Spacer	Nitrile rubber
	10	Adjusting shaft	Copper alloy	24	O-ring	Nitrile rubber
FJ	11	Hexagon socket set screw	Alloy steel	25	Product name plate	
- FIZ	12	Cross-recessed set screw	Alloy steel	26	Knob	Copper alloy
FK	13	O-ring	Nitrile rubber	27	Rod cap	Resin *2
Spd	14	Piston rod	Alloy steel	28	Reinforcement ring	Steel

^{*1:} Structures differ to some extent by model.

Ending

Contr



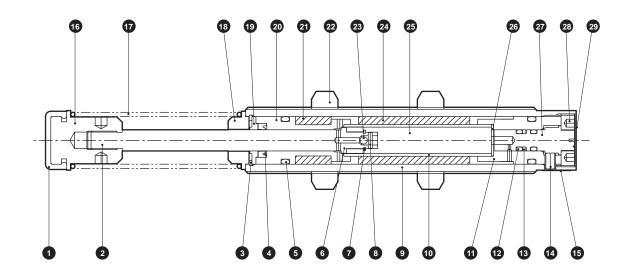
^{*2:} For sizes 20 and 40, urethane rubber is used.



Internal structure and parts list

Internal structure and parts list

6.5 ● FCK-*- 45 -C (Capped) 73.5



Cannot be disassembled

Parts list

No.	Part name	Material	No.	Part name	Material
1	Rod cover	Urethane rubber (*2)	16	Spring guide	Steel
2	Piston rod	Alloy steel	17	Spring	Piano wire
3	Snap ring (round R)	Steel	18	Spring guide	Steel
4	U packing	Nitrile rubber	19	Packing seal retainer	Copper alloy
5	O-ring	Nitrile rubber	20	Guide	Copper alloy
6	Piston	Copper alloy	21	Accumulator	Nitrile rubber
7	Snap ring (E)	Steel	22	Hexagon nut	Steel
8	Spring pin	Stainless steel	23	Steel ball	Bearing steel
9	Outer tube	Steel pipe	24	Accumulator	Nitrile rubber
10	Inner tube	Steel pipe	25	Oil	Oil
11	Bottom	Copper alloy	26	Washer	Steel
12	O-ring	Nitrile rubber	27	Adjusting shaft	Copper alloy
13	Back up ring	Resin	28	Holding screw	Steel
14	Hexagon socket set screw	Alloy steel	29	Label for adjustment	Steel
15	Product name plate				

^{*1:} Structures differ to some extent by model.

SCP*3

CMK2

CMA2

SCM

SCG

SCA2

SCS2

CKV2

CAV2/ COVP/N2

SSD2

SSG

SSD

CAT

MDC2

SMG

MSD/

MSDG FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FK

Spd Contr

 $^{^{\}star}2$: The rod cover (resin) cap cannot be attached to the 45 and 73.5 sizes.

Dimensions

CAD

Standard (FCK-*-*) CMK2

SCP*3

CAT

MDC2

MSD/

FC*

MRL2

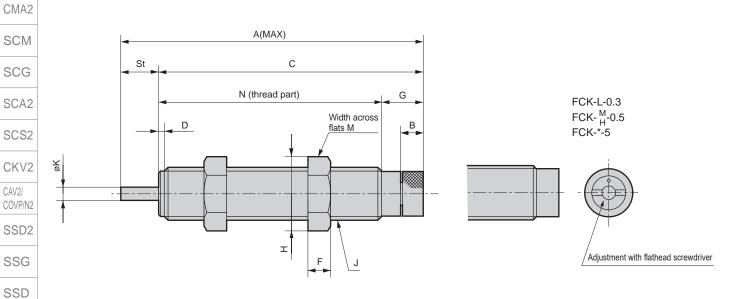
MRG2

SM-25

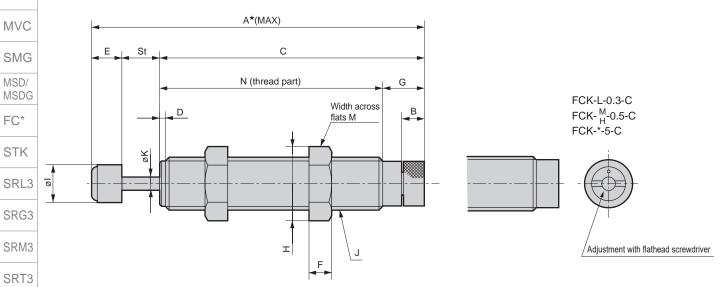
ShkAbs

FJ

FΚ Spd



Capped (FCK-*-*-C)



Model No.	Α	A*	В	С	St	D	E	F	G	Н	- 1	J	K	N	М
FCK-L-0.15	58.9	65.2	3.5	50.9	8	1.5	6.3	3	8.7	14.2	6	M10x1	2.4	42.2	13
FCK- M-0.18	56.9	65.2	3.5	50.9	0	1.5	0.3	3	0.7	14.2	6	IVITUXT	2.4	42.2	13
FCK-L-0.3	76	84	_	66	10	1.5	8	4	5	16.2	8	M12x1	3.5	61	14
FCK- M-0.5	70	04		00	10	1.5	0	4	3	10.2	8	IVITZXT	3.3	01	14
FCK-L-0.4	80	88	6	70	10	1.5	8	6	11	19.6	10	M14x1.5	3.5	59	17
FCK- M-0.6	00	00	0	70	10	1.5	0	0	'''	13.0	10	1011471.5	5.5	33	17
FCK-*-1	102	117	4.5	90	12	_	15	6	14.5	20	13.5	M16x1.5	5	75.5	19
FCK-*-3	110	127	4	94	16		17	8	18	27.7	18	M20x1.5	6	76	24
FCK-*-5	155	173	_	125	30	_	18	10	15	37	22	M25x1.5	8	110	32
FCK-*-8.1	136	156	5	111	25	_	20	10	20	37	24	M27x1.5	8	91	32
FCK- M-20	188	206.5	5	153	35	_	18.5	14	25	41.6	27	M30x1.5	10	128	36
FCK- M-40	235	254.5	5	185	50		19.5	15	25	53.1	33	M36x1.5	12	160	46

Note: The above table * shows low speed (L), medium speed (M), and high speed (H).

Contr Ending

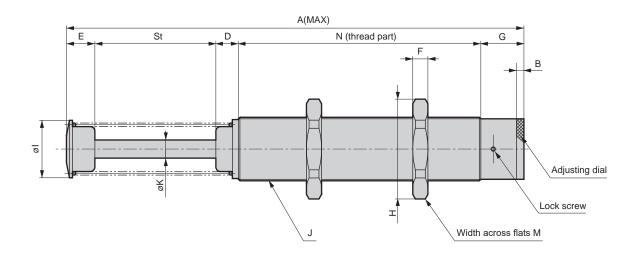


Dimensions

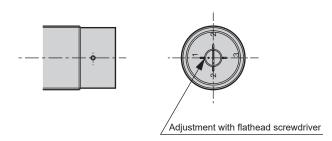
Dimensions



6.5 ● FCK-*- 45 -C 73.5



FCK-*-6.5-C FCK- M-45-C



Model No.	Α	В	St	D	E	F	G	Н	1	J	K	N	M	r
FCK-*-6.5-C	200.5	-	40	6.5	29	10	15	37	22	M25x1.5	8	110	32	1
FCK- M-45-C	212.5	-	50	7	19	25	23	66	38	M42x1.5	12	113.5	60	H
FCK- M-73.5-C	302.5	5	80	15	19	25	28.5	66	38	M42x1.5	12	160	60	1

Note: The above table * shows low speed (L), medium speed (M), and high speed (H).

SCP*3

CMK2

CMA2

SCM

SCG

SCA2

SCS2

CKV2

CAV2/ COVP/N2

SSD2

SSG

SSD

CAT

MDC2

 MVC

SMG

MSD/

MSDG

FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FK

Spd Contr

SCP*3 CMA2 Shock absorber FCK Series Option parts

FCK-*-N1/FCK-*-C-N1

(Stopper nut)





Dimensions

CMK2

SCM

SCG

SCA₂

SCS₂

CKV2 CAV2/ COVP/N2 SSD2

SSG

SSD

CAT

MDC2

MVC

SMG MSD/ **MSDG** FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FK

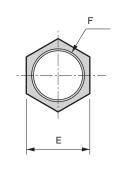
Spd

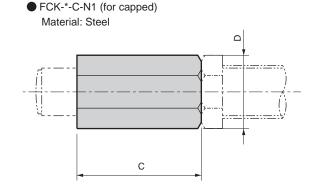
Contr



● FCK-*-N1 (for standard) Material: Steel

Δ





(For standard)

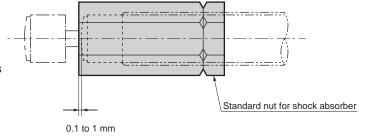
(For capped type)

Model No.	Compatible model	Α	В	Weight (g)
FCK-0.18-N1	FCK-L-0.15 FCK-M-0.18 FCK-H-0.18	10	15	5
FCK-0.5-N1	FCK-L-0.3 FCK-M-0.5 FCK-H-0.5	12	16.2	5
FCK-0.6-N1	FCK-L-0.4 FCK-M-0.6 FCK-H-0.6	12	19.6	9
FCK-1-N1	FCK-L-1 FCK-M-1 FCK-H-1	15	21.9	13
FCK-3-N1	FCK-L-3 FCK-M-3 FCK-H-3	30	27.7	43
FCK-5-N1	FCK-L-5 FCK-M-5 FCK-H-5	20	37	62
FCK-8.1-N1	FCK-L-8.1 FCK-M-8.1 FCK-H-8.1	35	37	86
FCK-20-N1	FCK-M-20 FCK-H-20	38	41.6	123
FCK-40-N1	FCK-M-40 FCK-H-40	45	53.1	286

	` ''	,					
g)	Model No.	Compatible model	С	D	Е	F	Weight (g)
	FCK-0.18-C-N1	FCK-L-0.15-C FCK-M-0.18-C FCK-H-0.18-C	16	15	13	M10x1	8
	FCK-0.5-C-N1	FCK-L-0.3-C FCK-M-0.5-C FCK-H-0.5-C	16	16.2	14	M12x1	7
	FCK-0.6-C-N1	FCK-L-0.4-C FCK-M-0.6-C FCK-H-0.6-C	20	19.6	17	M14x1.5	15
	FCK-1-C-N1	FCK-L-1-C FCK-M-1-C FCK-H-1-C	30	21.9	19	M16x1.5	26
	FCK-3-C-N1	FCK-L-3-C FCK-M-3-C FCK-H-3-C	47	27.7	24	M20x1.5	68
	FCK-5-C-N1	FCK-L-5-C FCK-M-5-C FCK-H-5-C	32	37	32	M25x1.5	99
	FCK-6.5-C-N1	FCK-L-6.5-C FCK-M-6.5-C FCK-H-6.5-C	50	37	32	M25x1.5	154
_	FCK-8.1-C-N1	FCK-L-8.1-C FCK-M-8.1-C FCK-H-8.1-C	55	37	32	M27x1.5	135
_	FCK-20-C-N1	FCK-M-20-C FCK-H-20-C	58	41.6	36	M30x1.5	188
	FCK-40-C-N1	FCK-M-40-C FCK-H-40-C	65	53.1	46	M36x1.5	413

1 When using stopper nut, note the following points.

- For types without cap, attach the stopper nut so that it protrudes 0.1 mm to 1 mm outward along the piston rod from the shock absorber body (cylinder top). For capped types, attach the stopper nut so that it protrudes 0.5 mm to 1 mm plus the cap length outward along the piston rod from the shock absorber body (cylinder section).
- Fix with the standard nut for shock absorber after installing the stopper nut.



Cannot be used with a deflection angle adaptor.



Shock absorber **FCK Series** Option parts

FCK-*-A

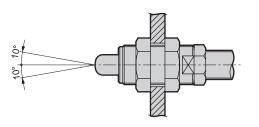
(Deflection angle adaptor)





Specifications

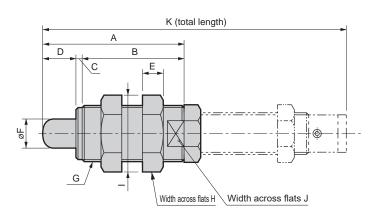
Max. working deflection angle ± 10°





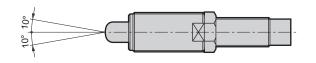
CAD

● FCK-*-A



Model No.	Compatible model	Α	В	С	D	E	F	G	Н	ı	J	K	End section material	Weight (g)	(
FCK-0.18-A	FCK-L-0.15 FCK-M-0.18 FCK-H-0.18	38	28	2	8	6	8	M16x1.5	19	20	13	75.7		37	N
FCK-0.5-A	FCK-L-0.3 FCK-M-0.5 FCK-H-0.5	48	35	3	10	5	10	M18x1.5	21	24.3	14	97.8	Plastic	49	1
FCK-0.6-A	FCK-L-0.4 FCK-M-0.6 FCK-H-0.6	51	38	3	10	7	11	M22x1.5	24	27.7	19	103	(POM)	83	1
FCK-1-A	FCK-L-1 FCK-M-1 FCK-H-1	60	45	3	12	7	12	M22x1.5	24	27.7	19	129		81	F
FCK-3-A	FCK-L-3 FCK-M-3 FCK-H-3	68	49	3	16	10	14	M27x1.5	32	37	24	146		214	3
FCK-5-A	FCK-L-5 FCK-M-5 FCK-H-5	107.5	67.5	10	30	15	16	M36x1.5	46	53.1	32	212		630	5
FCK-8.1-A	FCK-L-8.1 FCK-M-8.1	97	62	10	25	15	16	M36x1.5	46	53.1	32	188	Iron	582	3
	FCK-H-8.1	97	02	10	25	15	16	C. I XOCIVI	40	33.1	32	100		302	5
FCK-20-A	FCK-M-20 FCK-H-20	127	82	10	35	15	18	M40x1.5	50	57.7	36	255		838	-
FCK-40-A	FCK-M-40 FCK-H-40	167	107	10	50	15	20	M45x1.5	55	63.5	41	322		1265	-

- When using deflection angle adaptor, note the following points.
- Keep the angle within ±10° of the center line of the deflection angle adaptor cap.
- Cannot be used with stopper nut.
- Cannot be used with capped.



SCP*3

CMK2

CMA2

SCM

SCG

SCA2

SCS2

CKV2

CAV2/ COVP/N2

SSD2

SSG

SSD

CAT MDC2 MVC SMG

MSD/ MSDG FC*

STK SRL3

SRG3

SRM3 SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FΚ

Spd Contr



CAV2/

CAT

FC*

Selection guide flow chart SCP*3 Colliding pattern confirmation CMK2 CMA2 Collision conditions confirmation SCM Obtain the kinetic energy E₁ SCG SCA2 Can thrust/self-weight function? SCS₂ Yes CKV2 Determine the temporary stroke S' according to kinetic energy E1 (refer to Fig. 1) E=EI COVP/N2 Me=M SSD2 Calculate the added energy E2 to determine the energy per cycle $E = E_1 + E_2$ SSG SSD Select orifice according to speed Vo and energy ratio E₂/E₁ in Fig. 2 MDC2 Select model provisionally MVC Calculate E-Me and max. energy absorption Et per minute according to stroke of SMG provisionally selected model MSD/ MSDG Recalculate with one size larger model Is E-Me in accordance with specifications? STK Recalculate with one SRL3 size larger model Is Et in accordance with specifications? SRG3 Yes SRM3 End of selection SRT3 MRL2 MRG2 SM-25 Code **Working conditions** Unit Absorbed energy J Εı Kinetic energy ShkAbs E2 Thrust/self-weight energy G Position of center of gravity S FCK stroke m Gravity acceleration (9.8) m/s²

Example of colliding pattern

	avizantal aallidin	
a. Simple horizontal colliding	orizontal collidin b. With cylinder thrust	g c. With motor drive force
Applications M	b. With cylinder timus.	Td V
Kinetic energy $E_1 = \frac{1}{2} \cdot M \cdot V^2$	$E_1 = \frac{1}{2} \cdot M \cdot V^2$	$E_1 = \frac{1}{2} \cdot M \cdot V^2$
Thrust/self energy E ₂ (J)	$E_2 = F \cdot S$	$E_2 = 2 \cdot \frac{K}{D} \cdot Td \cdot S$
All absorbed energy E(J) E=E ₁	E=E1+E2	E=E1+E2
Equivalent weight Me (kg)	$Me = \frac{2 \cdot E}{V^2}$	$Me = \frac{2 \cdot E}{V^2}$
Absorbed energy per hour $Et(J/h)$ $Et=60 \cdot E \cdot n$	$E_t = 60 \cdot E \cdot n$	Et = 60∙E∙n
	Vertical colliding	kan na na
Applications d. Free fall	e. Cylinder lower limits stopper	f. Cylinder upper limit stopper
Kinetic energy $E_1(J)$ $E_1 = \frac{1}{2} \cdot M \cdot V^2$	$E_1 = \frac{1}{2} \cdot M \cdot V^2$	$E_1 = \frac{1}{2} \cdot M \cdot V^2$
Thrust/self energy $E_2(J)$ $E_2 = M \cdot g \cdot S$	$E_2 = (M \cdot g + F) \cdot S$	$E_2 = (F-M \cdot g) \cdot S$
All absorbed energy E(J) E=E ₁ +E ₂	E=E1+E2	E=E1+E2
Equivalent weight Me (kg) Me = $\frac{2 \cdot E}{V^2} (V = \sqrt{2/g/H})$	$Me = \frac{2 \cdot E}{V^2}$	$Me = \frac{2 \cdot E}{V^2}$
Absorbed energy per hour $Et(J/h)$ $E_t = 60 \cdot E \cdot n$	$E_t = 60 \cdot E \cdot n$	Et = 60·E·n
	Slope colliding	
g. Free fall	h. With cylinder thrust	i. With cylinder thrust
g. Free fall Applications		i. With cylinder thrust
14	h. With cylinder thrust	i. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$
Applications Kinetic energy $E_1 = \frac{1}{2} \cdot M \cdot V^2$	h. With cylinder thrust	E NO BO
Applications Kinetic energy $E_1(J)$ $E_1 = \frac{1}{2} \cdot M \cdot V^2$ Thrust/self energy $E_2 = M \cdot q \cdot S \cdot \sin \theta$	h. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$	$E_1 = \frac{1}{2} \cdot M \cdot V^2$
Applications Kinetic energy $E_1(J)$ $E_1 = \frac{1}{2} \cdot M \cdot V^2$ Thrust/self energy $E_2(J)$ All absorbed energy $E_2 = E_1 + E_2$	h. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (M \cdot g \cdot \sin\theta + F) \cdot S$	$E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (F - M \cdot g \cdot \sin\theta) \cdot S$
Applications Kinetic energy $E_1(J)$ $E_1 = \frac{1}{2} \cdot M \cdot V^2$ Thrust/self energy $E_2(J)$ All absorbed energy $E(J)$ Equivalent weight Me (kg) Absorbed energy $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = M \cdot g \cdot S \cdot \sin\theta$ $E = E_1 + E_2$	h. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (M \cdot g \cdot \sin\theta + F) \cdot S$ $E = E_1 + E_2$ $Me = \frac{2 \cdot E}{V^2}$ $E_1 = 60 \cdot E \cdot n$	$E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (F - M \cdot g \cdot \sin \theta) \cdot S$ $E = E_1 + E_2$
Applications Kinetic energy $E_1(J)$ Thrust/self energy $E_2(J)$ All absorbed energy $E(J)$ Equivalent weight Me (kg) Absorbed energy $E_1(J)$ Absorbed energy $E_2(J)$ Equivalent $E_2(J)$ Absorbed energy $E_3(J)$ Absorbed energy $E_3(J)$ $E_3(J)$ $E_4(J)$ $E_5(J)$ $E_7(J)$	h. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (M \cdot g \cdot \sin\theta + F) \cdot S$ $E = E_1 + E_2$ $Me = \frac{2 \cdot E}{V^2}$ $E_1 = 60 \cdot E \cdot n$ colliding	$E_{1} = \frac{1}{2} \cdot M \cdot V^{2}$ $E_{2} = (F - M \cdot g \cdot \sin \theta) \cdot S$ $E = E_{1} + E_{2}$ $Me = \frac{2 \cdot E}{V^{2}}$ $E_{1} = 60 \cdot E \cdot n$ Rotation colliding
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Applications Kinetic energy $E_1(J)$ Thrust/self energy $E_2(J)$ All absorbed energy $E(J)$ Equivalent weight Me (kg) Absorbed energy per hour $E(J/h)$ Applications $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = M \cdot g \cdot S \cdot \sin\theta$ $E_2 = M \cdot g \cdot S \cdot \sin\theta$ $E_3 = M \cdot g \cdot S \cdot \sin\theta$ $E_4 = \frac{1}{2} \cdot M \cdot V^2$ $E_5 = M \cdot g \cdot S \cdot \sin\theta$ $E_7 = \frac{1}{2} \cdot M \cdot V^2$	h. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (M \cdot g \cdot \sin\theta + F) \cdot S$ $E = E_1 + E_2$ $Me = \frac{2 \cdot E}{V^2}$ $E_1 = 60 \cdot E \cdot n$ colliding k. With torque of motor, etc.	$E_{1} = \frac{1}{2} \cdot M \cdot V^{2}$ $E_{2} = (F - M \cdot g \cdot \sin \theta) \cdot S$ $E = E_{1} + E_{2}$ $Me = \frac{2 \cdot E}{V^{2}}$ $E_{1} = 60 \cdot E \cdot n$ Rotation colliding I. With torque of motor, etc.
Kinetic energy $E_1(J)$ $E_1 = \frac{1}{2} \cdot M \cdot V^2$ Thrust/self energy $E_2(J)$ $E_2 = M \cdot g \cdot S \cdot \sin \theta$ All absorbed energy $E(J)$ $E = E_1 + E_2$ Equivalent weight Me (kg) Absorbed energy per hour $E(J/h)$ $E_1 = 60 \cdot E \cdot n$ Oscillation j. Free fall Kinetic energy $E_1(J)$ $E_2 = M \cdot g \cdot H$ Thrust/self energy $E_2 = \frac{I}{I} \cdot M \cdot g \cdot S$	h. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (M \cdot g \cdot \sin\theta + F) \cdot S$ $E = E_1 + E_2$ $Me = \frac{2 \cdot E}{V^2}$ $E_1 = 60 \cdot E \cdot n$ colliding k. With torque of motor, etc.	$E_{1} = \frac{1}{2} \cdot M \cdot V^{2}$ $E_{2} = (F - M \cdot g \cdot \sin \theta) \cdot S$ $E = E_{1} + E_{2}$ $Me = \frac{2 \cdot E}{V^{2}}$ $E_{1} = 60 \cdot E \cdot n$ Rotation colliding I. With torque of motor, etc. $E_{1} = \frac{J \cdot \omega^{2}}{2} = \frac{M \cdot D^{2} \cdot \omega^{2}}{16}$
$\begin{array}{c c} \text{Kinetic energy} & E_1 = \frac{1}{2} \cdot \text{M} \cdot \text{V}^2 \\ E_1(J) & E_2 = M \cdot g \cdot S \cdot \sin\theta \\ E_2(J) & E_2 = M \cdot g \cdot S \cdot \sin\theta \\ E_2(J) & E_3 = M \cdot g \cdot S \cdot \sin\theta \\ E_3(J) & E_4 = M \cdot g \cdot S \cdot \sin\theta \\ E_4(J) & E_5 = M \cdot g \cdot S \cdot \sin\theta \\ E_5 = E_5 + E_2 & E_5 = E_5 + E_5 \\ E_6 = E_5 + E_2 & E_5 = E_5 + E_5 \\ E_7 = E_7 = E_7 \cdot G \cdot $	h. With cylinder thrust $E_1 = \frac{1}{2} \cdot M \cdot V^2$ $E_2 = (M \cdot g \cdot \sin \theta + F) \cdot S$ $E = E_1 + E_2$ $Me = \frac{2 \cdot E}{V^2}$ $E_1 = 60 \cdot E \cdot n$ Colliding k. With torque of motor, etc. $E_1 = \frac{J \cdot \omega^2}{2} \text{ or } \frac{1}{2} \cdot M \cdot V^2$ $E_2 = \frac{T}{R} \cdot S$ $E = E_1 + E_2$	$E_{1} = \frac{1}{2} \cdot M \cdot V^{2}$ $E_{2} = (F - M \cdot g \cdot sin\theta) \cdot S$ $E = E_{1} + E_{2}$ $Me = \frac{2 \cdot E}{V^{2}}$ $E_{1} = 60 \cdot E \cdot n$ Rotation colliding 1. With torque of motor, etc. $E_{1} = \frac{J \cdot \omega^{2}}{2} = \frac{M \cdot D^{2} \cdot \omega^{2}}{16}$ $E_{2} = \frac{T}{R} \cdot S$

Rotation speed

Equivalent weight

Motor start torque

Reduction ratio

rpm

kg

 $N \cdot m$

Ν

Ме

Td

K

FJ

FΚ

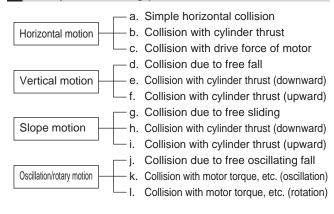
Spd

Contr



Shock absorber selection guide

1 Clarify the colliding pattern of the device



^{*1:} Refer to "Example of colliding pattern".

Example of selection

Clarifies colliding pattern of device

	Vertical colliding
Applications	e. Cylinder lower limit stopper
Kinetic energy E ₁ (J)	$E_1 = \frac{1}{2} \cdot M \cdot V^2$
Thrust/gravity energy E ₂ (J)	$E_2 = (Mg+F)\cdot S$
All absorbed energy E(J)	E=E1+E2
Equivalent weight Me(kg)	$Me = \frac{2 \cdot E}{V^2}$
Absorbed energy per hour Et(J/h)	$E_t = 60 \cdot E \cdot n$

2 Make required conditions/descriptions clear to calculate energy

Horizontal collision

Code	Working conditions	Unit
M	Colliding object weight	kg
V	Colliding speed	m/s
F	Pushing force	N
n	Frequency	Cycle/min.
t	Ambient temperature	°C
Rt	Return time	s

Slope colliding

Code	Working conditions	Unit
M	Colliding object weight	kg
V	Colliding speed	m/s
F	Pushing force	N
n	Frequency	Cycle/min.
t	Ambient temperature	°C
Rt	Return time	S
L	Distance moved from collision	m
θ	Slope angle	deg

Vertical colliding

Code	Working conditions	Unit
М	Colliding object weight	kg
V	Colliding speed	m/s
F	Pushing force	Ν
n	Frequency	Cycle/min.
t	Ambient temperature	°C
Rt	Return time	s
Н	Drop height	m

Vibration/rotation colliding

Code	Working conditions	Unit
М	Colliding object weight	Kg
V	Colliding speed	m/s
Т	Torque	N∙m
n	Frequency	Cycle/min.
t	Ambient temperature	°C
Rt	Return time	S
ω	Angular speed	rad/s
J	Moment of inertia	kg·m²
R	Distance of rotational axis to colliding point	m
r	Distance of rotational axis to CG	m
α·β	Slope angle	deg
Н	Drop height	m
D	Rotor diameter	m

Colliding object weight: M=15 kg
Colliding speed: V=1.42 m/s
Pushing force: F=245.5N
Frequency: n = 10 cycle/min.

Ambient temperature : t=23°C

Return time : Rt = 2s (time up to re-collision)

 Calculate kinetic energy E₁ according to "Example of colliding pattern" (page 1850).

$$E = \frac{1}{2}M \cdot V^2 = \frac{1}{2} \times 15 \times 1.42^2$$
$$= 15.1 \text{ J}$$

4 Select temporary stroke according to temporary selection graph

From Fig. 1 (page 1853), select the temporary stroke.

S' = 30

CKD

CMK2

SCP*3

CMA2

SCM

SCA2 SCS2

CKV2

CAV2/ COVP/N2 SSD2

SSG

SSD

CAT

MDC2

MVC

MSD/ MSDG

FC*

STK SRL3

SRG3

SRM3

SRT3 MRL2

MRG2

WITCOZ

SM-25

ShkAbs

FJ

FK Spd Contr

SCP*3

CMK2

CMA2

SCM

SCG

SCA2

CKV2

SCS2

CAV2/ COVP/N2 SSD2

SSG

SSD

CAT

MDC2

MVC

SMG MSD/

MSDG

FC*

STK

SRL3

SRG3 SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FK

Spd Contr 5 Calculate absorbed energy E according to "Example of colliding pattern"

■ Calculate thrust/self-weight energy E₂ according to "Example of colliding pattern".

Calculate S (stroke of FCK) as temporary stroke S' selected in Step 4.

Calculate absorbed energy E according to "Example of colliding pattern".

6 Shock absorber temporary selection

- Select orifice according to energy ratio (thrust/self-weight energy, kinetic energy) and colliding speed on Fig. 2 (page 1853), then select a model provisionally according to calculated absorbed energy E.
 - *1: Allowable energy absorption may vary depending on colliding speed. Refer to pages 1854 and 1855.
- 7 Re-calculate absorbed energy E with temporary selected model
- Calculate absorbed energy E₂ according to "Example of collision pattern". Calculate S (stroke of FCK) as model stroke selected in Step 6.
- Calculate absorbed energy E according to "Example of colliding pattern".

8 Calculate energy Et per hour

 Calculate energy per hour Et according to "Example of colliding pattern".

9 Confirm the equivalent weight M

Calculate equivalent weight M according to "Example of colliding pattern".

10 Selection confirmation

- If calculated absorbed energy, energy per hour, equivalent weight, frequency of usage, ambient temperature and return time are in accordance with specifications of the selected shock absorber, there is no problem. If exceeding specifications range, select one size larger shock absorber according to model, selected before, then recalculate conditions.
 - *1:The specified equivalent weight depends on the speed. Refer to pages 1854 and 1855 for details.

Example of selection

 $E_2 = (M \cdot g + F) \cdot S = (15x9.8 + 245.5)x0.03$ = 11.8 J $E = E_1 + E_2 = 15.1 + 11.8 = 26.9$ J

$$\frac{E_2}{E_1} = \frac{11.8}{15.1} = 0.8$$

Provisionally select porous orifice (FCK-H-3) from models of E = 26.9 and higher.

E₂=(15x9.8+245.5)x0.016=6.28 J E=15.1+6.28=21.4 J

Et = $60 \cdot E \cdot n = 60 \times 21.4 \times 10 = 1284 J/h$

$$Me = \frac{2E}{V^2} = \frac{2x21.4}{1.42^2} = 21.2 \text{ kg}$$

		Calculated value	FCK-H-3 specification values	Judgment
Е	J	21.4	29.4 or less	OK
Et	J/h	1284	20580 or less	OK
Me	kg	21.2	29 or less	OK
n	Cycle/min.	10	60 or less	OK
t	°C	23	-5 to 70	OK
Rt	S	2	0.5 or more	OK

CAUTION]

Use speed just before colliding into shock absorber to select shock absorber by calculation. This speed differs from average speed (cylinder stroke/travel time).

Calculate or measure speed just before collision, or use 1.5 to 2 times the average speed when making calculations for selection.



SCP*3

CAT

MDC2

MVC

SMG MSD/ MSDG FC*

STK

SRL3

SRG3

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FΚ Spd Contr

Ending

Fig.1 Temporary selection graph

Obtain temporary stroke S' from kinetic energy E₁.

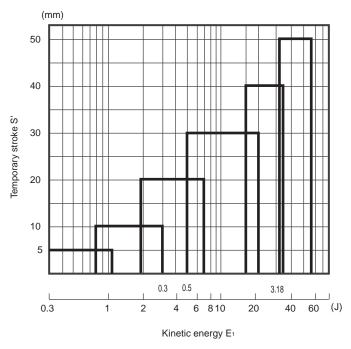
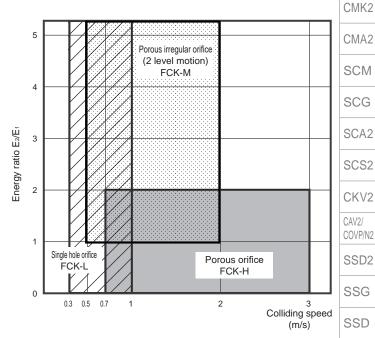


Fig. 2. Energy ratio (thrust/self-weight energy E₂, inertia energy E₁) Refer to the following figure to select the orifice.



Abs	Absorbing characteristics structure				
Constant orifice	Single hole orifice structure	FCK-L	00000	Single hole orifice structure includes a dash pot structure that uses the clearance between the piston and cylinder tube, a single tube structure with an orifice on the piston, and a double tube single hole orifice structure (adjustable). Each type has similar resistance characteristics. The common single tube structure is explained here. The piston, which has a single hole orifice, slides in the cylinder tube filled with oil. Since the orifice area is constant throughout the full stroke, resistance increases immediately after collision, and decreases as the stroke advances and speed declines.	F
spendent orifice	Porous orifice structure	FCK-H		This orifice has a double structure consisting of an outer and inner tube. The piston slides along the inner wall of the inner tube. This inner tube has several orifices set in the direction of the stroke. The orifice area gradually decreases as the stroke advances and speed drops. Resistance thus fluctuates in a wave, but max. resistance is suppressed at a low level. Based on orifice design, absorption characteristics are matched to individual collision conditions.	F
Displacement dependent orifice	orous irregular orifice structure	FCK-M		Structurally, this type is basically the same as the multiple orifice above, but by changing the orifice, energy is absorbed based on the purpose instead of with constant attenuation force. For example, the orifice in the FCK-M Series absorbs kinetic energy with the first half of the stroke and controls speed with the second half. Energy is absorbed ideally for cylinder thrust.	F

CKD

Equivalent weight/colliding speed characteristics graph

Equivalent weight: CMA2

SCP*3

CMK2

SCM

SCG

SCA₂

SCS₂

CKV2

COVP/N2 SSD2

SSG

SSD

FC*

SRM3

SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FK

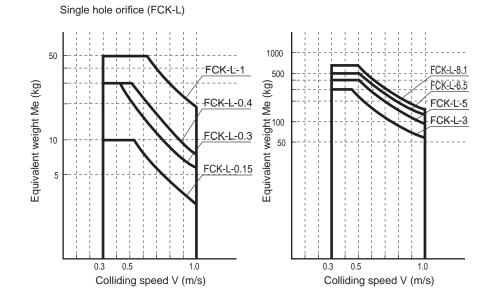
Weight obtained by calculating all cylinder thrust and weight mass as inertial energy.

$$\frac{1}{2}MV^2 + F \cdot S = E = MeV^2$$

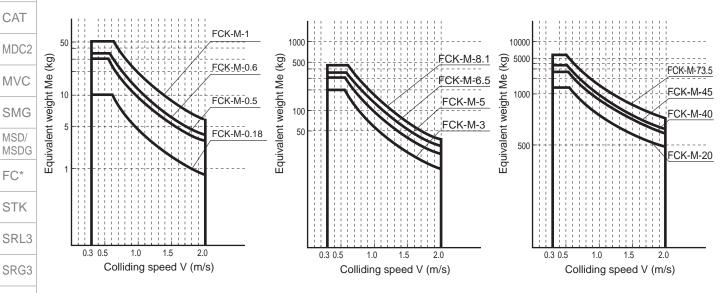
M: Colliding object weight

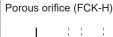
F: Self weight of cylinder thrust or weight

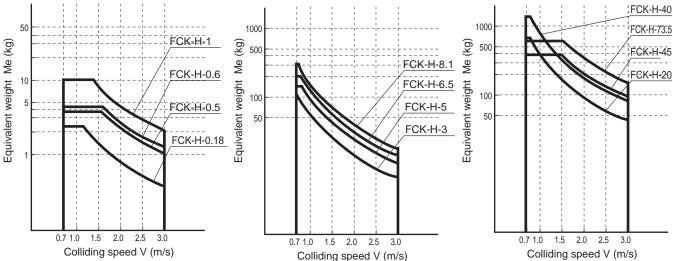
Me: Equivalent weight



Porous irregular orifice (FCK-M)





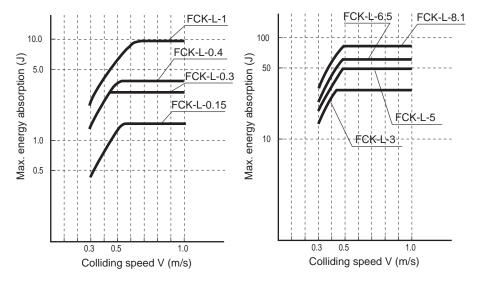


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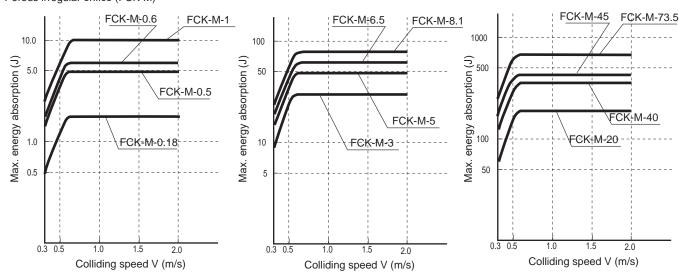


Absorbed energy/colliding speed characteristics graph

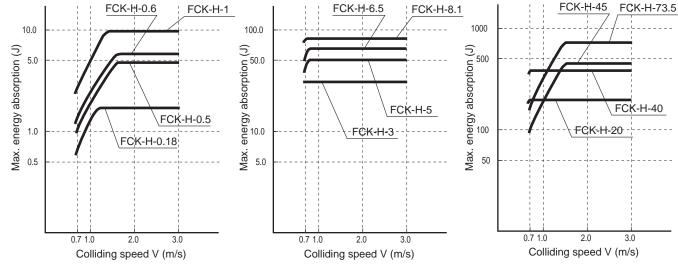
Single hole orifice (FCK-L)



Porous irregular orifice (FCK-M)



Porous orifice (FCK-H)



CKD

1855

CMK2

SCP*3

SCM

SCG

SCA2

SCS2 CKV2

CAV2/ COVP/N2 SSD2

SSG

SSD

CAT

MDC2 MVC

SMG MSD/ MSDG

FC*

STK SRL3

SRG3

SRM3 SRT3

MRL2

MRG2

SM-25

ShkAbs

FJ

FK

Spd Contr

Ending

4055

Selection calculation example	ķ
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SCP*3	Selection calculation example				
		Selection example 1	Selection example 2		
CMK2	1. Applications	Horizontal collision with cylinder thrust	Horizontal collision with motor drive force		
CMA2		_ <u> </u>	Td ∨ .		
SCM		M	M =		
SCG		Cylinder bore size = ø40	Motor start torque Td = 0.196 N⋅m		
SCA2		Pressure = 0.5 MPa	Wheel diameter of carriage D = 50 mm Reduction ratio of carriage K = 10		
SCS2	2. Collision	M = 30 kg	M = 150 kg		
CKV2	conditions	V = 0.6 m/s F = 628.3 N	V = 0.785 m/s F = 78.4 N		
CAV2/ COVP/N2		$(F = \frac{\pi}{4} \times 40^2 \times 0.5 = 628.4 \text{ N})$ n = 20 cycle/min.	$(F = 2 \cdot \frac{K}{D} \cdot Td = 2 \times \frac{10}{0.05} \times 0.196 = 78.4 \text{ N})$ n = 5 cycle/min.		
SSD2		t = 23°C	t = 23°C		
SSG		Rt = 3S	Rt = 2S		
SSD					
CAT	3. Kinetic energy	$E_1 = \frac{1}{2}MV^2 = \frac{1}{2} \times 30 \times 0.6^2 = 5.4 \text{ J}$	$E_1 = \frac{1}{2}MV^2 = \frac{1}{2}x150 \times 0.785^2 = 46.2 \text{ J}$		
MDC2	E ₁	2 2	2 2		
MVC					
SMG	4. Temporary stroke S'	S' = 20mm from Fig.1	S' = 50mm from Fig.1		
MSD/ MSDG					
FC*	5. Thrust/self- weight	$E_2 = F \cdot S = 628.3 \times 0.02 = 12.57 J$	$E_2 = 2 \cdot \frac{K}{D} \cdot \text{TdS} = 2 \times \frac{10}{0.05} \times 0.196 \times 0.05$		
STK	energy E ₂ Absorbed energy E	$E = E_1 + E_2 = 5.4 + 12.57 = 17.97 J$	= 3.92 J E = $E_1 + E_2 = 46.2 + 3.92 = 50.12 \text{ J}$		
SRL3	6. Temporary	$\frac{E_2}{E_4} = \frac{12.57}{5.4} = 2.3$	$\frac{E_2}{F_1} = \frac{3.92}{46.2} = 0.08$		
SRG3	selection	21 0.4			
SRM3		Select porous irregular orifice (FCK-M-3) temporarily	Select porous orifice (FCK-H-6.5) temporarily		
SRT3	7. Absorbed energy recalculation	$E_2 = F \cdot S = 628.3 \times 0.016 = 10.05J$ $E = E_1 + E_2 = 15.45 J$	$E_2 = 2 \cdot \frac{K}{D} \cdot TdS = 2 \times \frac{10}{0.05} \times 0.196 \times 0.04$ = 3.14 J		
MRL2	rosaioaiation		$E = E_1 + E_2 = 49.34 \text{ J}$		
MRG2	8. Energy per hour Et	Et = 60·E·n = 60 x 15.45 x 20 = 18540 J/h	Et = 60 x E·n = 60 x 49.34 x 5 = 14802J/h		
SM-25	ps:a.				
ShkAbs	9. Equivalent	$Me = \frac{2E}{V^2} = 85.8 \text{ kg}$	$Me = \frac{2E}{V^2} = \frac{2x49.34}{0.785^2} = 160 \text{ kg}$		
FJ	weight Me	V	V- 0.785 ²		
FK					
Spd Contr	10. Confirmation	E, Et, Me, n, t and Rt are all OK Determined at FCK-M-3	E, Et, Me, n, t and Rt are all OK Determined at FCK-H-6.5		
Ending					



	3	
		SCP*3
Selection example 3	Selection example 4	CMK2
Carriage falling down slope	Object performing rotational free fall	CMA2
I And The Control of	H G	SCM
θ(L=1 m		SCG
θ=2°	$\alpha = 15^{\circ}$ $\beta = 5^{\circ}$	SCA2
M = 100 kg	M = 2 kg	SCS2
V = 0.83 m/s	R = 0.5 m	CKV2
$(V = \sqrt{2 \cdot g \cdot L \cdot sin\theta} = \sqrt{2 \times 9.8 \times 1 \times sin2^{\circ}} = 0.83 \text{ m/s})$ n = 10 cycle/min.	H = 0.1 m r = 0.3 m R / 2 a H	CAV2/ COVP/N2
t = 23°C Rt = 5 S		SSD2
	t = 20°C Rt = 0.6S	SSG
		SSD
		CAT
$E_1 = \frac{1}{2} \cdot M \cdot V^2 = \frac{1}{2} \times 100 \times 0.83^2 = 34.4J$	$E_1 = M \cdot g \cdot H = 2 \times 9.8 \times 0.1 = 1.96J$	MDC2
		MVC
S' = 50mm from Fig.1	S' = 10 mm from Fig.1	SMG
		MSD/ MSDG
$E_2 = M \cdot g \cdot S \cdot \sin\theta = 100 \times 9.8 \times 0.05 \times \sin^2\theta = 1.71 J$	$E_2 = \frac{\Gamma}{R} \cdot M \cdot g \cdot S \cdot \cos \beta = \frac{\Gamma}{R} \times 2 \times 9.8 \times 0.01 \times \cos 5^{\circ} C = 0.11 J$	FC*
$E = E_1 + E_2 = 34.4 + 1.71 = 36.1 J$	$E = E_1 + E_2 = 1.96 + 0.11 = 2.07 J$	STK
F ₂ 171 0.05	E ₂ 0.11 0.00	SRL3
$\frac{E^2}{E_1} = \frac{1.71}{34.4} = 0.05$	$\frac{E_2}{E_1} = \frac{0.11}{1.96} = 0.06$	SRG3
Select porous orifice (FCK-H-5) temporarily	Select porous orifice (FCK-H-0.5) temporarily	SRM3
$E_2 = M \cdot g \cdot S \cdot \sin\theta = 100 \times 9.8 \times 0.03 \times \sin^2\theta = 1.03J$ $E = E_1 + E_2 = 35.4 \text{ J}$	$E_2 = \frac{r}{R} \cdot M \cdot g \cdot S \cdot \cos \beta = 0.11J$	SRT3
L - L1 + L2 - 33.4 3	$E = E_1 + E_2 = 1.96 + 0.11 = 2.07 J$	MRL2
Et = 60·E·n = 60 x 35.4 x 10 = 21240J/h	Et = 60·E·n = 60 x 2.07 x 50 = 6210J/h	MRG2
		SM-25
Mo 2E 2 2x35.4 - 102 7 kg	Mo 2E _ 2x2.07 _ 1.0 kg	ShkAbs
Me = $\frac{2E}{V^2} = \frac{2x35.4}{0.83^2} = 102.7 \text{ kg}$	Me = $\frac{2E}{V^2} = \frac{2x2.07}{2.02^2} = 1.0 \text{ kg}$	FJ
		FK
E, Et, Me, n, t and Rt are all OK Determined at FCK-H-5	E, Me, n, t and Rt are OK. However, recalculate with one size larger FCK-H-	Spd Contr
	0.6, since Et is too high.	Ending

SCP*3	Selection example 5	Selection example 6
CMK2	Object falling down slope	Horizontal rotational collision with torque
CMA2	In the	T we'l
SCM		
SCG	L = 0.45 m	
SCA2	θ = 5°	
SCS2	M = 1.0 kg V = 0.88 m/s	$J = 204.1 \text{ kgm}^2$ $\omega = 0.6 \text{ rad/s}$
CKV2	$(V = \sqrt{2 \cdot g \cdot L \cdot \sin\theta} = \sqrt{2 \times 9.8 \times 0.45 \times \sin 5^{\circ}} = 0.88 \text{ m/s})$ n = 15 cycle/min.	R = 1.25 m n = 10 cycle/min.
CAV2/ COVP/N2	t = 23°C	T = 68.6 N⋅m
SSD2	Rt = 2S	t = 20°C Rt = 3s
SSG		
SSD		2 2244 223
CAT	$E_1 = \frac{1}{2} - M \cdot V^2 = \frac{1}{2} \times 1.0 \times 0.88^2 = 0.387J$	$E_1 = \frac{J \cdot \omega^2}{2} = \frac{204.1 \times 0.6^2}{2} = 36.7 \text{ J}$
MDC2		
MVC	S' = 5mm from Fig.1	S' = 50mm from Fig.1
SMG		
MSD/ MSDG	$E_2 = M \cdot g \cdot S \cdot \sin\theta = 1 \times 9.8 \times 0.005 \times \sin5^\circ = 0.004J$	$E_2 = \frac{T}{R} \cdot S = \frac{68.6}{1.25} \times 0.05 = 2.74J$
FC*	$E = E_1 + E_2 = 0.387 + 0.004 = 0.391 \text{ J}$	
STK		$E = E_1 + E_2 = 36.7 + 2.74 = 39.44 J$
SRL3	$\frac{E_2}{E_1} = \frac{0.004}{0.387} = 0.01$	$\frac{E_2}{E_1} = \frac{2.74}{36.7} = 0.07$
SRG3	Select single hole orifice (FCK-L-0.15) temporarily	$V = \omega \cdot R = 0.6 \times 1.25 = 0.75 \text{ m/s}$ Select porous orifice (FCK-H-5) temporarily
SRM3	$E_2 = M \cdot g \cdot S \cdot \sin \theta = 1 \times 9.8 \times 0.008 \times \sin 5^\circ = 0.007 J$	$E_2 = \frac{T}{R} \cdot S = \frac{68.6}{1.25} \times 0.03 = 1.65J$
SRT3	$E = E_1 + E_2 = 0.394 J$	$E = E_1 + E_2 = 38.6 \text{ J}$
MRL2	Et = 60·E·n = 60 x 0.394 x 15 = 354.6J/h	Et = 60·E·n = 60 x 38.6 x 10 = 23160J/h
MRG2		
SM-25	25 2v0 204	25 2729.6
ShkAbs	$Me = \frac{2E}{V^2} = \frac{2x0.394}{0.88^2} = 1.02 \text{ kg}$	Me = $\frac{2E}{V^2} = \frac{2x38.6}{0.75^2} = 137.2 \text{ kg}$
FJ		
FK	E, Et, Me, n, t and Rt are all OK Determined at FCK-L-0.15	E, Et, Me, n, t and Rt are OK. Determined at FCK-H-5.
Spd Contr		