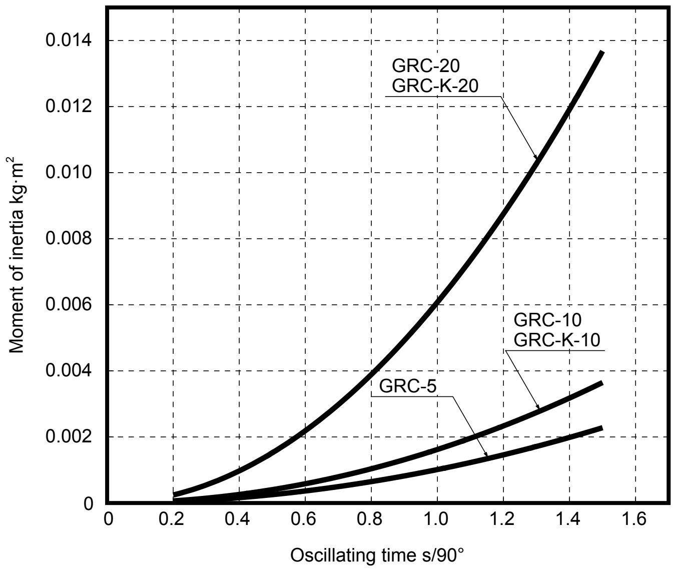
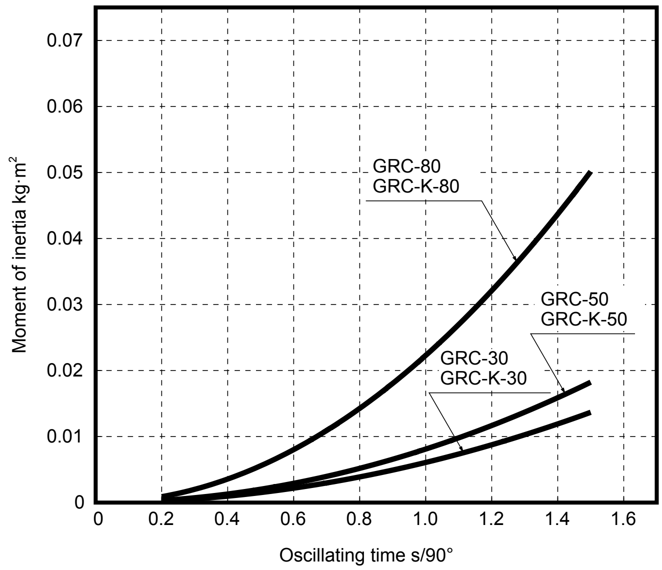
1. Energy absorbing performance and oscillating time

(1) For rubber cushion, relations between moment of inertia and oscillating time are shown in the line graph below. Always use within the lower right range of the graph as the shaft, etc., could break. Use for selection reference, etc.

● Basic/high accuracy



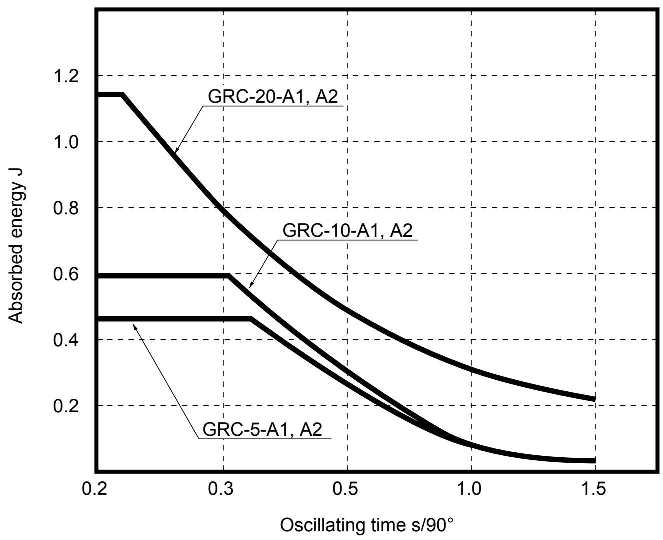
Size 5, 10, 20



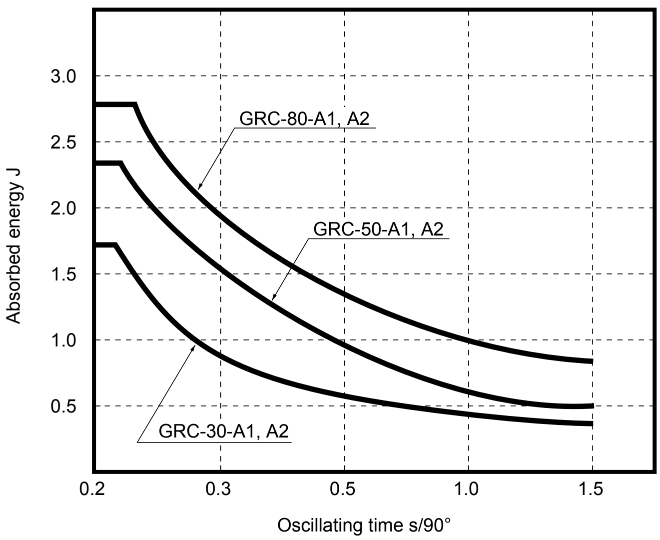
Size 30, 50, 80

(2) The relation of the absorbed energy and oscillating time when an external shock absorber is installed is shown with the following line graph. Always use within the lower left range of the graph since the shaft, etc., could break. Use for selection reference, etc.

● Absorbed energy and oscillating time



Size 5, 10, 20

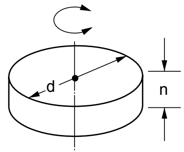
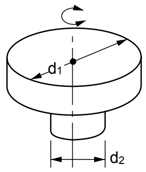
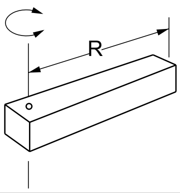
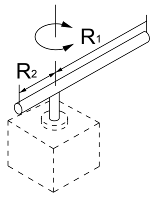
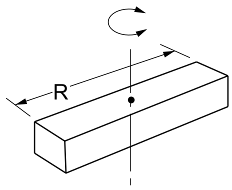
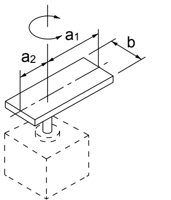
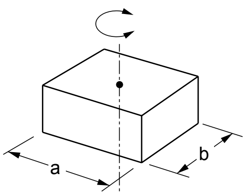


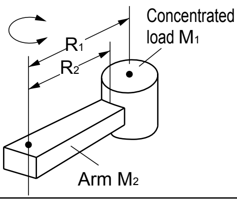
Size 30, 50, 80

LCM
LCR
LCG
LCW
LCX
STM
STG
STS/STL
STR2
UCA2
ULK*
JSK/M2
JSG
JSC3/JSC4
USSD
UFCD
USC
UB
JSB3
LMB
LML
HCM
HCA
LBC
CAC4
UCAC2
CAC-N
UCAC-N
RCS2
RCC2
PCC
SHC
MCP
GLC
MFC
BBS
RRC
GRC
RV3*
NHS
HRL
LN
Hand
Chuk
MecHnd/Chuk
ShkAbs
FJ
FK
SpdContr
Ending

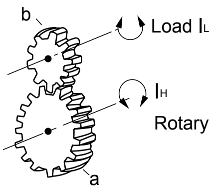
2. Figure for moment of inertia calculation

When rotary shaft passes through the workpiece

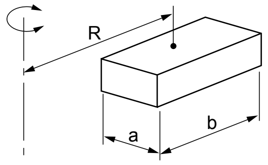
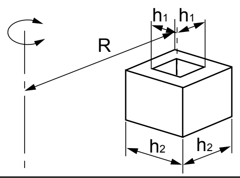
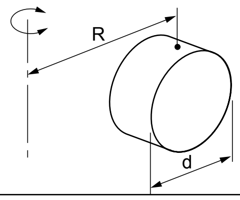
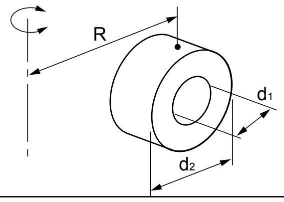
Shape	Sketch	Requirements	Moment of inertia I kg·m²	Radius of rotation K_1^2	Remarks
Dial plate		● Diameter d (m) ● Weight M (kg)	$I=\frac{Md^2}{8}$	$\frac{d^2}{8}$	● No mounting direction ● For sliding use, contact CKD.
Circular stepped plate		● Diameter d_1 (m), d_2 (m) ● Weight d_1 section M_1 (kg) d_2 section M_2 (kg)	$I=\frac{1}{8}(M_1d_1^2+M_2d_2^2)$	$\frac{d_1^2+d_2^2}{8}$	● Ignore when the d_2 section is extremely small compared to the d_1 section
Bar (center of rotation at end)		● Bar length R (m) ● Weight M (kg)	$I=\frac{MR^2}{3}$	$\frac{R^2}{3}$	● Mounting direction is horizontal ● Oscillating time changes when the mounting direction is vertical
Thin rod		● Bar length R_1, R_2 ● Weight M_1, M_2	$I=\frac{M_1/R_1^2}{3}+\frac{M_2/R_2^2}{3}$	$\frac{R_1^2+R_2^2}{3}$	● Mounting direction is horizontal ● Oscillating time changes when the mounting direction is vertical
Bar (center of rotation at center of gravity)		● Bar length R (m) ● Weight M (kg)	$I=\frac{MR^2}{12}$	$\frac{R^2}{12}$	● No mounting direction
Thin rectangle plate (rectangular parallelepiped)		● Plate length a_1, a_2 ● Side length b ● Weight M_1, M_2	$I=\frac{M_1}{12}(4a_1^2+b^2)+\frac{M_2}{12}(4a_2^2+b^2)$	$\frac{(4a_1^2+b^2)+(4a_2^2+b^2)}{12}$	● Mounting direction is horizontal ● Oscillating time changes when the mounting direction is vertical
Rectangular parallelepiped		● Side length a(m), b(m) ● Weight M(kg)	$I=\frac{M}{12}(a^2+b^2)$	$\frac{a^2+b^2}{12}$	● No mounting direction ● For sliding use, contact CKD.

Shape	Sketch	Requirements	Moment of inertia I kg·m²	Radius of rotation K_1^2	Remarks
Concentrated load		● Shape of concentrated load ● Length to center of gravity of concentrated load R_1 ● Arm length R_2(m) ● Concentrated load weight M_1(kg) ● Arm weight M_2(kg)	$I=M_1(R_1^2+k_1^2)+\frac{M_2R_2^2}{3}$	Calculate k_1^2 according to shape of concentrated load	● Mounting direction is horizontal ● When M_2 is extremely small compared to M_1, it may be calculated as M_2 = 0

How to convert load J_L to rotary actuator shaft rotation when using with gear

Shape	Sketch	Requirements	Moment of inertia I kg·m²	Radius of rotation K_1^2	Remarks
Gear		● Gear Rotary side (tooth number) a Load side (geartooth number) b ● Load inertia moment N·m	Load moment of inertia for the rotary actuator's shaft rotation $I_H=\left(\frac{a}{b}\right)^2 I_L$		● When gear shape is larger, gear moment of inertia should be considered.

● Rotary shaft offsets from workpiece

Shape	Sketch	Requirements	Moment of inertia I kg·m²	Remarks
Rectangular parallelepiped		● Side length a(m) b(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I=\frac{M}{12}(a^2+b^2)+MR^2$	● Same for cube
Hollow rectangular parallelepiped		● Side length h_1(m) h_2(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I=\frac{M}{12}(h_1^2+h_2^2)+MR^2$	● Cross section is for cube only
Cylinder		● Diameter d(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I=\frac{Md^2}{16}+MR^2$	
Hollow cylinder		● Diameter d_1(m) d_2(m) ● Distance from rotary shaft to load center R(m) ● Weight M(kg)	$I=\frac{M}{16}(d_1^2+d_2^2)+MR^2$	

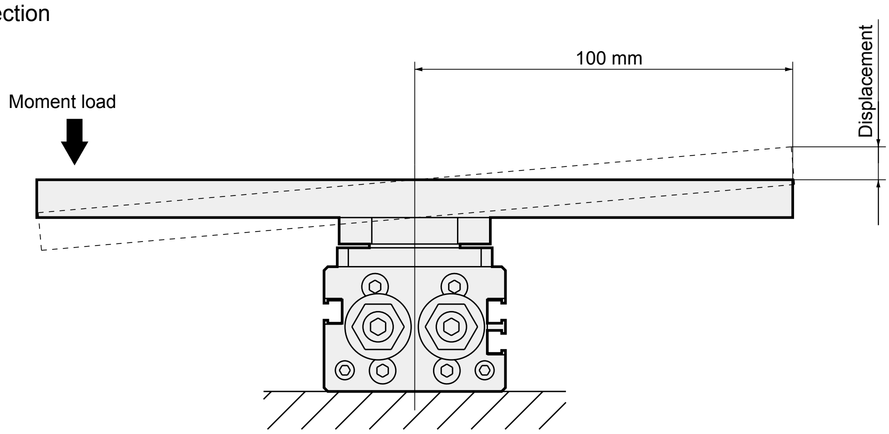
* To find moment of inertia, first convert load, jig, etc., to simple shapes with modeling, then calculate values. For the combined load, calculate each inertial moment and their total.

3. Table deflection (reference value)

Displacement (reference value) of table at 100 mm away from center of rotation when moment load is applied to GRC is shown below. (It is assumed that the table is in a non-rotating stationary state.)

Measuring method

Table deflection



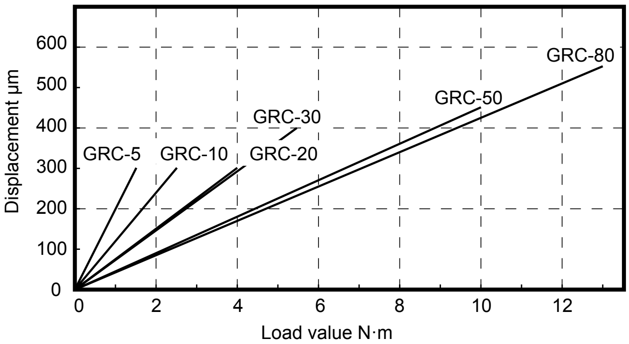


Table deflection of GRC (basic)

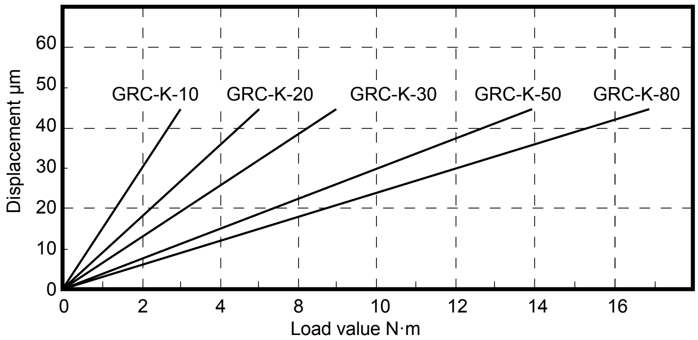
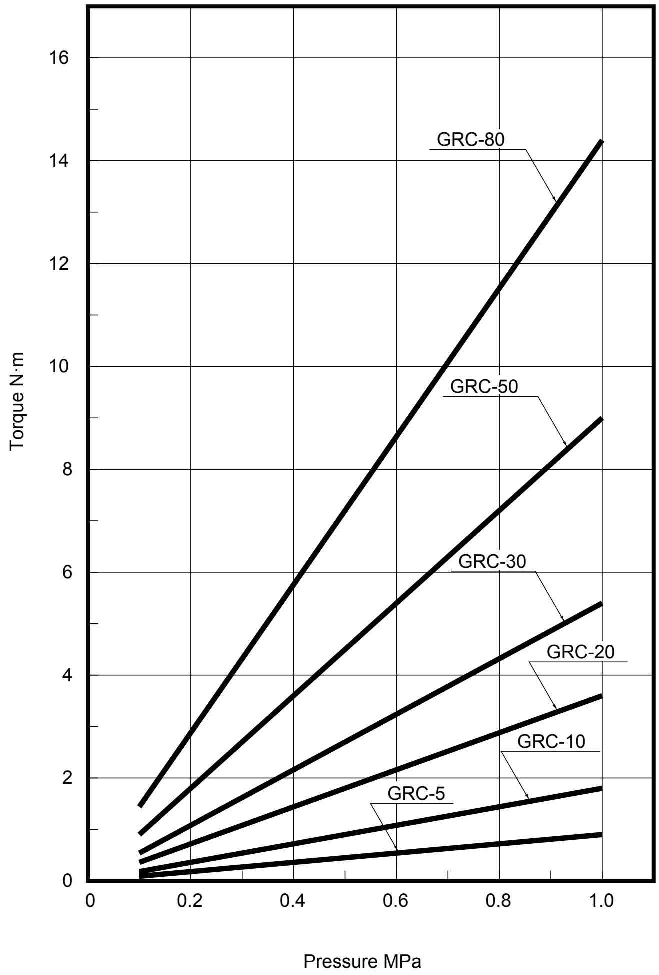


Table deflection of GRC-K (high accuracy)

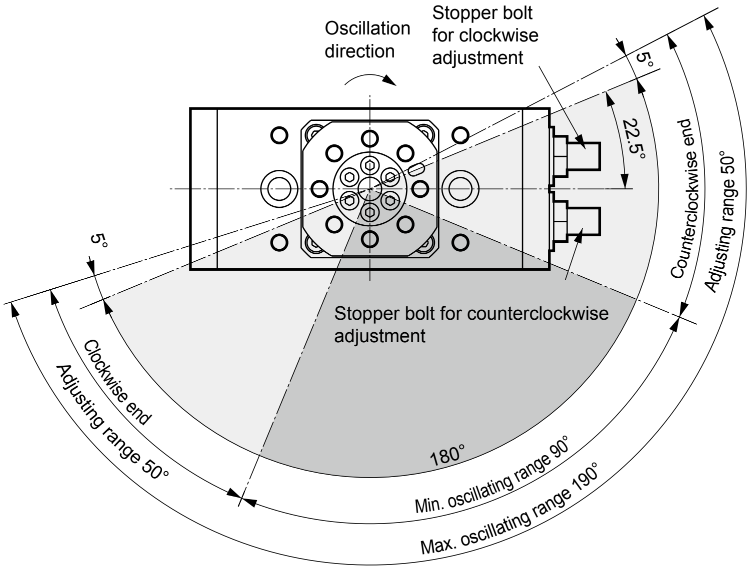
4. Effective torque diagram

Note that torque at oscillation end is half of the value in the graph below.
(The torque is as shown in the table when the end stopper is an external stopper (shock absorber, etc.).)

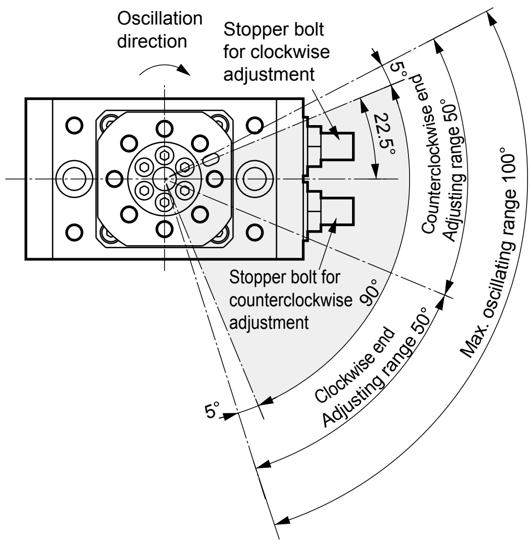


5. Oscillating angle adjustment method

● Basic/high accuracy

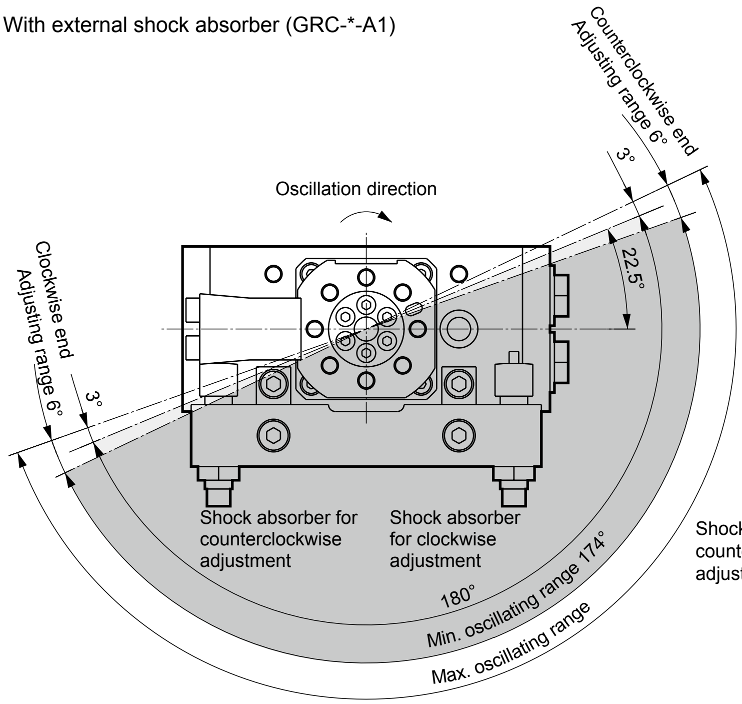


180° specifications

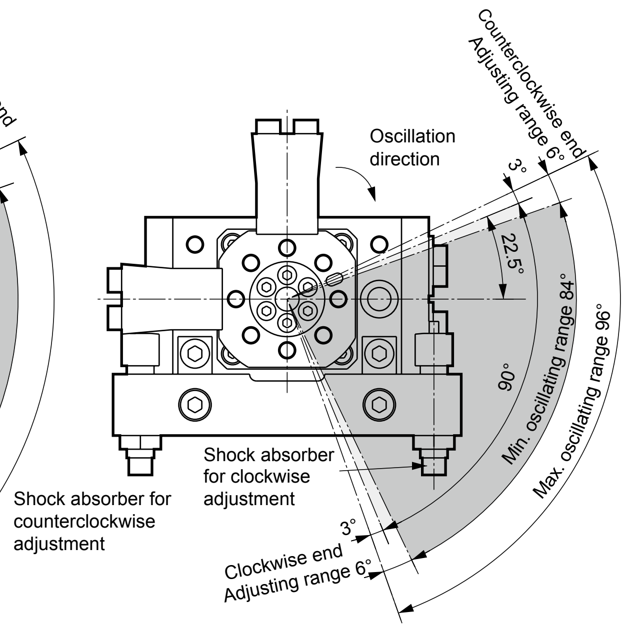


90° specifications

● With external shock absorber (GRC-*-A1)



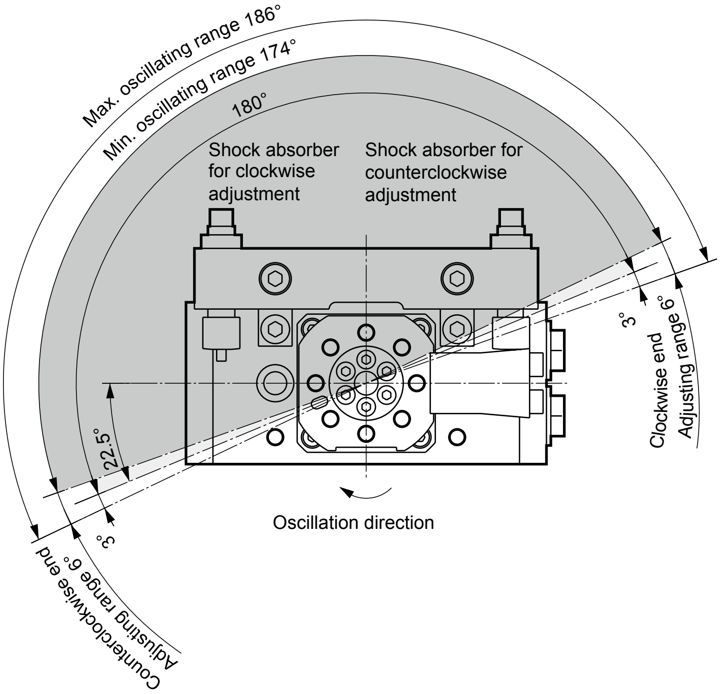
180° specifications



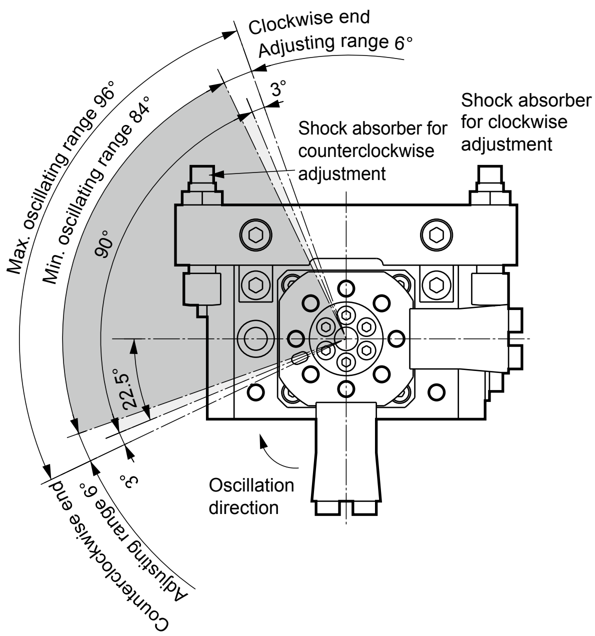
90° specifications

LCM
LCR
LCG
LCW
LCX
STM
STG
STS/STL
STR2
UCA2
ULK*
JSK/M2
JSG
JSC3/JSC4
USSD
UFCD
USC
UB
JSB3
LMB
LML
HCM
HCA
LBC
CAC4
UCAC2
CAC-N
UCAC-N
RCS2
RCC2
PCC
SHC
MCP
GLC
MFC
BBS
RRC
GRC
RV3*
NHS
HRL
LN
Hand
Chuk
MecHnd/Chuk
ShkAbs
FJ
FK
SpdContr
Ending

● With external shock absorber (GRC-*-A2)



180° specifications



90° specifications