Flexible Couplings and Hub-shaft Connections

COUPLINGS

mikipulley

High-reliability Metal Plate Spring Format Realizing Its Best Shape Through Finite Element Analysis

SERVO FLEX is an ultrahigh-rigidity flexible coupling derived from Miki Pulley's unique development capability. It has gained high reliability by its layered plate spring format as its best shape, which is rigid in the torsional direction and flexible in the bending asymmetrical and axial directions.
SERVO FLEX is also available in a variety of models to cover a wide range of fields and purposes, and this full selection contributes to the higher precision and efficiency of instruments.

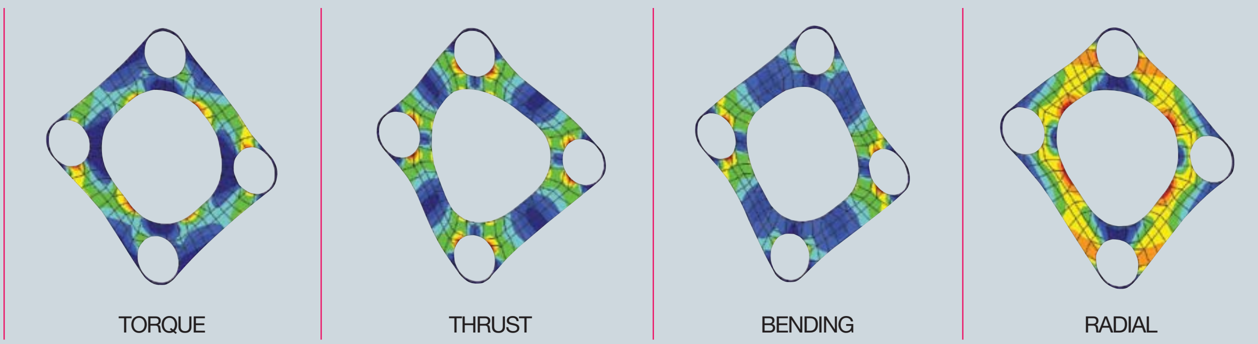
SERVOFLEX

High-reliability Metal Plate Spring Format

When jointing a shaft to another shaft, it is extremely difficult to precisely center these two shafts.
It is even more difficult to maintain the centering due to problems such as shaft deflection and shaft thermal expansion as a result of operating machine equipment, support block distortion after long hours of use, abrasion of the bearing, and for other reasons. The role of flexible couplings is not only simply to joint the driving shaft and driven shaft but also to resolve the above problems by selecting appropriate flexible couplings suitable for each purpose.

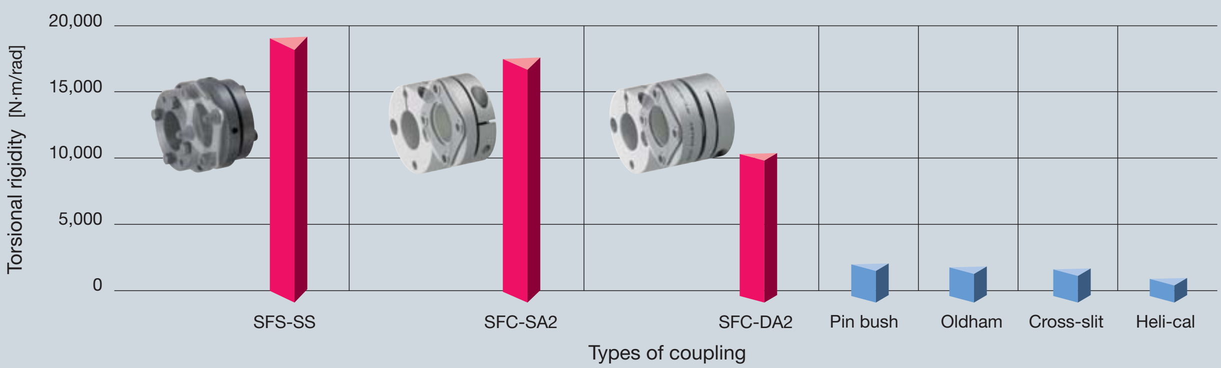
Optimal Design by 3D-CAD and FEM

An optimal design using the advanced finite element method (FEM) is applied for the plate spring shape and strength design of each model, which are important for the performance of the couplings, and thorough model analysis is performed by 3D-CAD.



Ultrahigh-rigidity Metal Plate Spring Flexible Couplings

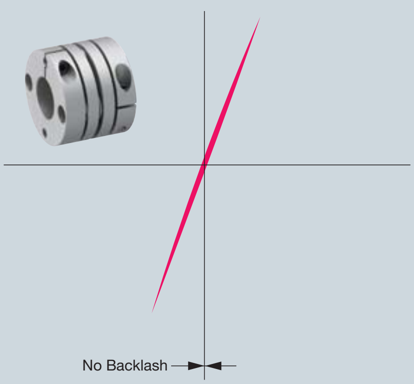
A layered metal plate spring is adopted for the power transmission part of SERVO FLEX, enabling ideal performance of the flexible coupling, which is rigid in the torsional direction and flexible in the bending asymmetrical and axial directions.



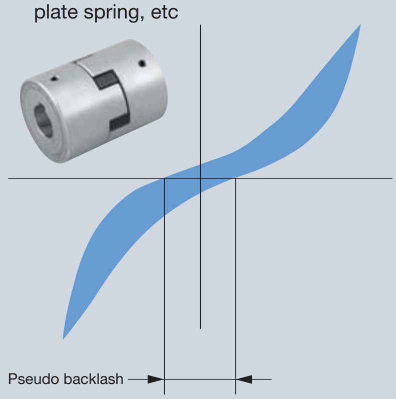
No Backlash

The power transmission of SERVO FLEX is performed entirely by a friction lock, enabling no backlash, accurate shaft rotation, and ultraprecision control operation.

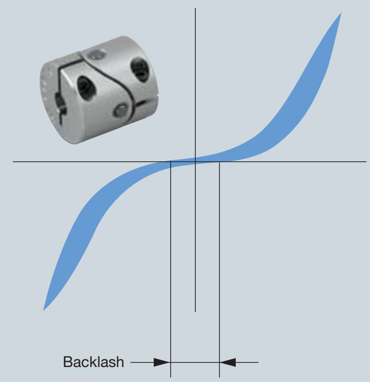
1. Elastic (metal) coupling
   Metal plate spring: SERVOFLEX



2. Elastic (rubber and resin) coupling
   Rubber, resin compression and resin plate spring, etc

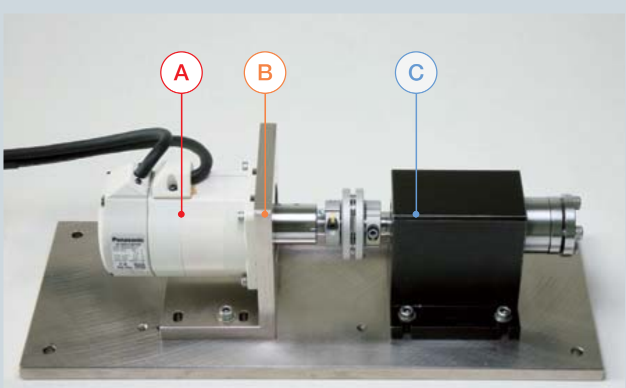


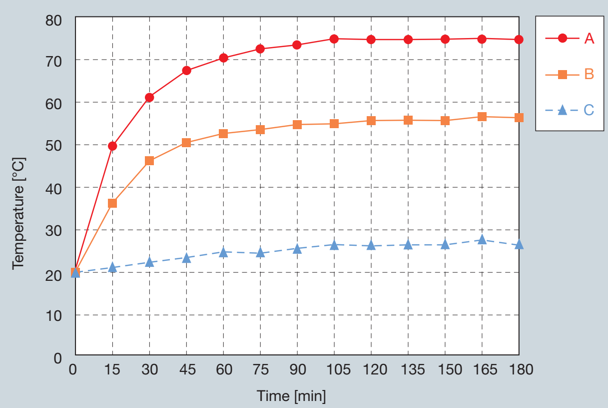
3. Corrected coupling
   Oldham, pin bush, etc.



Heat Rejection

The stainless-steel plate spring reduces thermal conduction from a servo motor to the driven shaft, which also reduces variations in accuracy caused by thermal expansion.





Full Selection

SFC MODEL

- Superbly strong high-strength aluminum alloy adopted
- Low inertia achieved by the shaft diameter interlock-type hub outer diameter
- No hazardous substances used, RoHS Directive compliant
- High-rigidity single element
- High-flexibility double element
- Taper shaft-compatible adapter
- Clamp mounting only with one bolt

SFS MODEL

- Wide selection
- High-rigidity single element
- High-flexibility double element
- Floating shaft suitable for long shaft intervals
- Taper shaft-compatible hub
- Selectable from finished-assembly products and parts-delivered products
- Shaft bore design freely made from a pilot bore and a simple, strong friction lock

SFF·SFM MODEL

- SFM for the machine tool main shaft, SFF for the feed shaft
- The main shaft-compatible type allows a maximum rotation speed of 20000 min^{-1}.
- High-precision mounting by using an excellent centering mechanism
- Irregularity removed to the extent possible and wind roar lowered during high-speed rotation
- High-rigidity single element
- High-flexibility double element

SFH MODEL

- Ultrahigh torque transmission of 8000 N·m
- Unique plate spring shape in order to equally combine high torque transmission and flexibility
- High-rigidity single element
- High-flexibility floating shaft
- Shaft bore design freely made from a pilot bore

SFC MODEL

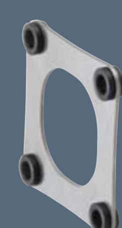
SERVO FLEX: A Wide Selection of Metal Plate Spring Couplings Made of High-power Aluminum Alloy

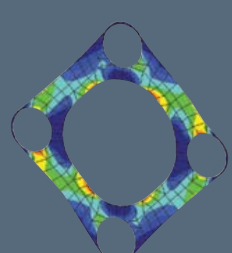
Two types of couplings, either a rigid type with one element or a flexible type with two elements using a spacer, can be selected.
The clamp method, an easy and exact installation method with no backlash, is adopted for the shaft installation method.
Moreover, it is compatible with the taper shaft by using an adapter.
It also complies with the EU Restriction of Hazardous Substances Directive, "RoHS Directive" that prohibits six hazardous substances such as mercury, lead, and others.

PLATE SPRING OF IDEAL FORM

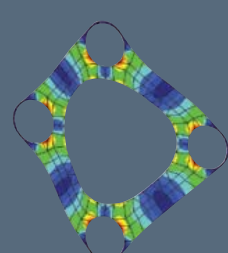
High Rigidity, High Flexibility

An ideal-shaped plate spring, designed based on thorough analysis using the advanced finite element method (FEM) is applied for the element.
Two types of couplings, either a high-rigidity type with one element or a high-flexibility type with two elements using a spacer, can be selected.

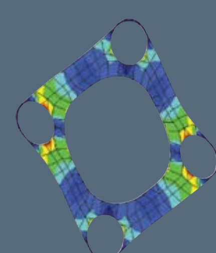




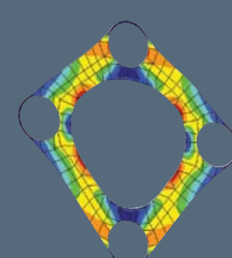
TORQUE



THRUST



BENDING



RADIAL

A Wide Range of Installation Methods

- By adoption of the clamp method, installation is easy and exact.
- The servo motor taper shaft can be optionally supported.

SFC MODEL

SFC MODEL

High-strength aluminum alloy hub SFC

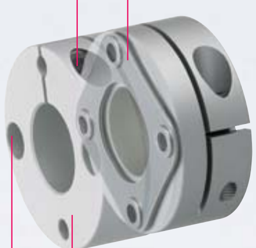
- Clamp lock
  - High-rigidity single element → **SFC-□SA2-□B-□B**
  - High-flexibility double element → **SFC-□DA2-□B-□B**
- + Taper shaft compatible
  - High-rigidity single element → **SFC-□SA2-□B-□BC**
  - High-flexibility double element → **SFC-□DA2-□B-□BC**

Structure and Material

SFC-SA2

Clamp bolt material: SCM435
Surface treatment: Solid lubricant film treatment

Element material: Plate spring SUS304
Collar SUS304*1



Clamp hub material: High-strength aluminum alloy
Surface treatment: Anodic coating film treatment

Bolt material: SCM435
Surface treatment: Trivalent chromate treatment*2

SFC-DA2

Clamp bolt material: SCM435
Surface treatment: Solid lubricant film treatment

Element material: Plate spring SUS304
Collar SUS304*1

Clamp hub material:
High-strength aluminum alloy
Surface treatment:
Anodic coating film treatment

Spacer material: High-strength aluminum alloy
Surface treatment: Anodic coating film treatment

Bolt material: SCM435
Surface treatment: Trivalent chromate treatment *2

SFC-SA2/DA-BC

Clamp bolt material: SCM435
Surface treatment: Solid lubricant film treatment

Element material: Plate spring SUS304
Collar SUS304

Clamp hub material: High-strength
aluminum alloy
Surface treatment: Anodic coating film treatment

Bolt material: SCM435
Surface treatment: Trivalent chromate treatment

Taper adapter material: Equivalent of S45C
Surface treatment: Black oxide finish

* The collar material of the items marked with *1 is S45C from size #080 to size #100, using trivalent chromium for the surface treatment.
* The bolt surface treatment of the items marked with *2 is antirust coating from size #080 to size #100.

Wide Range of Installation Methods

The clamp method is adopted for the method of mounting on the shaft, so it is easy to finish only by tightening the right and left sides.
Power transmission is performed entirely by a friction lock. There is no backlash.
A specialized jig is used for assembling couplings, so high-precision concentricity is ensured.
It is also compatible with the servo motor taper shaft by installing a taper adapter.

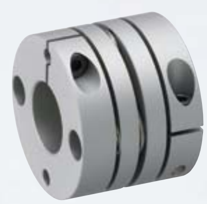
Taper adapter option

Ultralow Inertia

The outer diameter of the clamp hub is designed so the outer diameter dimension interlocks with the bore diameter that customers adopt. By using a small bore diameter to shrink the outer diameter, it is possible to keep the inertia to the minimum required. One of three pattern shapes is determined automatically according to the combination of bore diameters to be adopted.

TYPE A

TYPE B



TYPE C

SFC MODEL

SFC MODEL

SFC-SA2

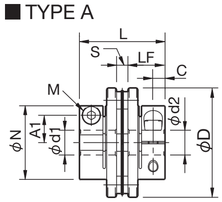
Specification

Model	Permissible tourque [N·m]	Max. permissible misalignment: Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]	Max. rotation speed [min^{-1}]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Shape TYPE	Moment of inertia [kg·m²]	Mass [kg]	Price
SFC-005SA2	0.6	0.02	0.5	±0.05	10000	500	140	C	0.25×10^{-6}	0.007	–
SFC-010SA2	1.0	0.02	1	±0.1	10000	1400	140	C	0.58×10^{-6}	0.011	–
SFC-020SA2	2.0	0.02	1	±0.15	10000	3700	64	C	2.36×10^{-6}	0.025	–
SFC-030SA2	5.0	0.02	1	±0.2	10000	8000	64	A	4.00×10^{-6}	0.033	–
								B	6.06×10^{-6}	0.041	–
								C	8.12×10^{-6}	0.049	–
SFC-035SA2	8.0	0.02	1	±0.25	10000	18000	112	C	18.43×10^{-6}	0.084	–
SFC-040SA2	10	0.02	1	±0.3	10000	20000	80	A	16.42×10^{-6}	0.076	–
								B	22.98×10^{-6}	0.090	–
								C	29.53×10^{-6}	0.105	–
SFC-050SA2	25	0.02	1	±0.4	10000	32000	48	A	54.88×10^{-6}	0.156	–
								B	77.10×10^{-6}	0.185	–
								C	99.33×10^{-6}	0.214	–
SFC-060SA2	60	0.02	1	±0.45	10000	70000	76.4	A	143.7×10^{-6}	0.279	–
								B	206.1×10^{-6}	0.337	–
								C	268.5×10^{-6}	0.396	–
SFC-080SA2	100	0.02	1	±0.55	10000	140000	128	C	709.3×10^{-6}	0.727	–
SFC-090SA2	180	0.02	1	±0.65	10000	100000	108	C	1227×10^{-6}	0.959	–
SFC-100SA2	250	0.02	1	±0.74	10000	120000	111	C	1858×10^{-6}	1.181	–

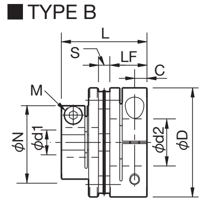
* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The torsional stiffness indicates the actual measurement value of element.

Dimensions

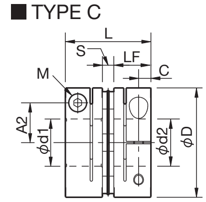
■ TYPE A

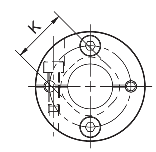


■ TYPE B



■ TYPE C





CAD

Unit [mm]

Model	d1*1 Min.	d1*1 Max.	d2*1 Min.	d2*1 Max.	D	N	L	LF	S	A1	A2	C	K	M	Tightening torque [N·m]	Shape TYPE	CAD file No.
SFC-005SA2	4	6	4	6	16	–	16.7	7.85	1.0	–	4.8	2.5	6.5	2-M2	0.4 to 0.5	C	C005S2B1
SFC-010SA2	4	8	4	8	19	–	19.35	9.15	1.05	–	5.8*2	3.15	8.5	2-M2.5*3	1.0 to 1.1*3	C	C010S2B1
SFC-020SA2	5	10	5	10	26	–	23.15	10.75	1.65	–	9.5	3.3	10.6	2-M2.5	1.0 to 1.1	C	C020S2B1
SFC-030SA2	5	10	5	10	34	21.6	27.3	12.4	2.5	8	–	3.75	14.5	2-M3	1.5 to 1.9	A	C030S2B1
	5	10	Over10	14						8	12.5					B	C030S2B2
	Over 10	14	Over10	14		–				–	12.5					C	C030S2B3
SFC-035SA2	8	16	8	16	39	–	34.0	15.5	3.0	–	14.0	4.5	17	2-M4	3.4 to 4.1	C	C035S2B1
SFC-040SA2	8	15	8	15	44	29.6	34.0	15.5	3.0	11	–	4.5	19.5	2-M4	3.4 to 4.1	A	C040S2B1
	8	15	Over 15	19						11	17.0					B	C040S2B2
	Over 15	19	Over 15	19		–				–	17.0					C	C040S2B3
SFC-050SA2	10	19	10	19	56	38	43.4	20.5	2.4	14.5	–	6	26	2-M5	7.0 to 8.5	A	C050S2B1
	10	19	Over 19	25						14.5	22.0					B	C050S2B2
	Over 19	25	Over 19	25		–				–	22.0					C	C050S2B3
SFC-060SA2	12	24	12	24	68	46	53.6	25.2	3.2	17.5	–	7.75	31	2-M6	14 to 15	A	C060S2B1
	12	24	Over 24	30						17.5	26.5					B	C060S2B2
	Over 24	30	Over 24	30		—				–	26.5					C	C060S2B3
SFC-080SA2	20	35	20	35	82	–	68	30	8	–	28	9	38	2-M8	27 to 30	C	C080S2B1
SFC-090SA2	25	40	25	40	94	–	68.3	30	8.3	–	34	9	42	2-M8	27 to 30	C	C090S2B1
SFC-100SA2	35	45	35	45	104	–	69.8	30	9.8	–	39	9	48	2-M8	27 to 30	C	C100S2B1

* *1 The torque permitted could be limited depending on the bore diameter. Refer to the "Standard bore diameter" on page15.
* *2 indicates the value when d1 or d2 is ⌀4 to ⌀7. It will be 0.6 if d1 or d2 is ⌀8.
* *3 indicates the value when d1 or d2 is ⌀4 to ⌀7. It will be M2 if d1 or d2 is ⌀8. The tightening torque of M2 is 0.4 to 0.5N·m.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ⌀35, the tolerance is $^{+0.010}_{-0.025}$. Contact us for tolerances other than h7.

Standard bore diameter

Model	Standard bore diameter d1·d2 [mm]																												
	4	5	6	6.35	7	8	9	9.525	10	11	12	14	15	16	17	18	19	20	22	24	25	28	30	32	35	38	40	42	45
SFC-005SA2	●	●	●																										
SFC-010SA2	●	●	●	●	●	●																							
SFC-020SA2		1.2	●	●	●	●	●	●	●																				
SFC-030SA2		2.8	3.4	●	●	●	●	●	●	●	●	●																	
SFC-035SA2						●	●	●	●	●	●	●	●	●															
SFC-040SA2						9	●	●	●	●	●	●	●	●	●	●	●												
SFC-050SA2									22	●	●	●	●	●	●	●	●	●	●	●	●								
SFC-060SA2											51	●	●	●	●	●	●	●	●	●	●	●	●						
SFC-080SA2																		●	●	●	●	●	●	●	●				
SFC-090SA2																					●	●	●	●	●	●	●		
SFC-100SA2																									●	●	●	●	●

* The bore diameters with value or marked ● are supported as standard bore diameter.
* The permissible torque of small bore diameter indicated in the column with value is limited by the shaft locking mechanism. The value indicates its operating torque [N·m].
* For bore diameters other than those above, processing cost is added to the standard price.

Optional: Taper shaft compatible

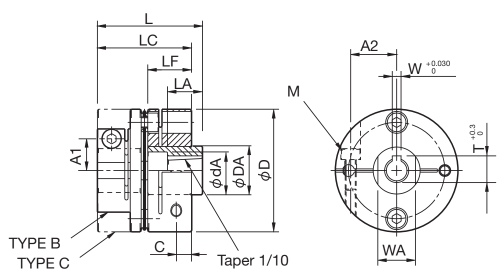
Specification

SFC-□SA2-□B-□BC

Model	Moment of inertia [kg·m²]		Mass [kg]		Price
	Shape TYPE B	Shape TYPE C	Shape TYPE B	Shape TYPE C	
SFC-050SA2-□B-11BC	81.52×10^{-6}	103.7×10^{-6}	0.237	0.266	–
SFC-050SA2-□B-14BC	87.34×10^{-6}	109.6×10^{-6}	0.268	0.297	–
SFC-050SA2-□B-16BC	94.16×10^{-6}	116.4×10^{-6}	0.306	0.335	–
SFC-060SA2-□B-16BC	225.3×10^{-6}	287.8×10^{-6}	0.469	0.528	–

Dimensions

SFC-□SA2-□B-□BC



CAD

Model	CAD file No.	
	Shape TYPE B	Shape TYPE C
SFC-050SA2-□B-11BC	C050S2C1	C050S2C2
SFC-050SA2-□B-14BC	C050S2C3	C050S2C4
SFC-050SA2-□B-16BC	C050S2C5	C050S2C6
SFC-060SA2-□B-16BC	C060S2C1	C060S2C2

Unit [mm]

Model	W	T	WA	LA	dA	DA	L	D	LC	LF	C	A1	A2	M
SFC-050SA2-□B-11BC	4	12.2	18	16	17	22	48.4	56	43.4	20.5	6	14.5	22	2-M5
-□B-14BC	4	15.1	24	19	22	28	53.4							
-□B-16BC	5	17.3	24	29	26	30	63.4							
SFC-060SA2-□B-16BC	5	17.3	24	29	26	30	69.6	68	53.6	25.2	7.75	17.5	26.5	2-M6

* The shape type is either TYPE B or TYPE C.

Ordering Information

SFC - 040 - SA2 - 14 B - 15 B

- 040: Size
- SA2: Type: SA2 Single element, aluminum hub
- 14 B - 15 B: Bore diameter: d1-d2
  B: Clamp hub
  BC: Taper adapter

SFC MODEL

SFC-DA2

SERVO FLEX
SFC

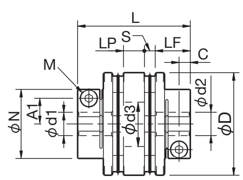
Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min^{-1}]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Shape TYPE	Moment of inertia [kg·m²]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]							
SFC-005DA2	0.6	0.05	0.5 (one side)	±0.1	10000	250	70	C	0.36×10^{-6}	0.010	–
SFC-010DA2	1.0	0.11	1 (one side)	±0.2	10000	700	70	C	0.79×10^{-6}	0.015	–
SFC-020DA2	2.0	0.15	1 (one side)	±0.33	10000	1850	32	C	3.40×10^{-6}	0.035	–
SFC-030DA2	5.0	0.18	1 (one side)	±0.4	10000	4000	32	A	7.33×10^{-6}	0.053	–
								B	9.39×10^{-6}	0.061	–
								C	11.45×10^{-6}	0.069	–
SFC-035DA2	8.0	0.24	1 (one side)	±0.5	10000	9000	56	C	26.78×10^{-6}	0.123	–
SFC-040DA2	10	0.24	1 (one side)	±0.6	10000	10000	40	A	29.49×10^{-6}	0.122	–
								B	36.05×10^{-6}	0.136	–
								C	42.61×10^{-6}	0.151	–
SFC-050DA2	25	0.28	1 (one side)	±0.8	10000	16000	24	A	96.94×10^{-6}	0.246	–
								B	119.2×10^{-6}	0.275	–
								C	141.4×10^{-6}	0.304	–
SFC-060DA2	60	0.34	1 (one side)	±0.9	10000	35000	38.2	A	252.4×10^{-6}	0.440	–
								B	314.8×10^{-6}	0.498	–
								C	377.3×10^{-6}	0.556	–
SFC-080DA2	100	0.52	1 (one side)	±1.10	10000	70000	64	C	1034×10^{-6}	1.051	–
SFC-090DA2	180	0.52	1 (one side)	±1.30	10000	50000	54	C	1776×10^{-6}	1.373	–
SFC-100DA2	250	0.52	1 (one side)	±1.48	10000	60000	55.5	C	2704×10^{-6}	1.707	–

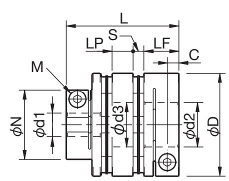
* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The torsional stiffness indicates the actual measurement value of element.

Dimensions

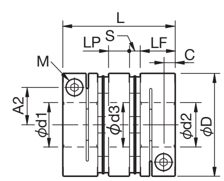
■ TYPE A

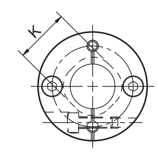


■ TYPE B



■ TYPE C





Unit [mm]

Model	d1[*1]		d2[*1]		D	N	L	LF	LP	S	A1	A2	C	d3	K	M	Tightening torque [N·m]	Shape TYPE	CAD file No.
	Min.	Max.	Min.	Max.															
SFC-005DA2	4	6	4	6	16	–	23.2	7.85	5.5	1.0	–	4.8	2.5	6.5	6.5	2-M2	0.4 to 0.5	C	C005D2B1
SFC-010DA2	4	8	4	8	19	–	25.9	9.15	5.5	1.05	–	5.8[*2]	3.15	8.5	8.5	2-M2.5[*3]	1.0 to 1.1[*3]	C	C010D2B1
SFC-020DA2	5	10	5	10	26	–	32.3	10.75	7.5	1.65	–	9.5	3.3	10.6	10.6	2-M2.5	1.0 to 1.1	C	C020D2B1
SFC-030DA2	5	10	5	10	34	21.6	37.8	12.4	8	2.5	8	–	3.75	15	14.5	2-M3	1.5 to 1.9	A	C030D2B1
	5	10	Over 10	14							8	12.5						B	C030D2B2
	Over 10	14	Over 10	14		–					–	12.5						C	C030D2B3
SFC-035DA2	8	16	8	16	39	–	48	15.5	11	3	–	14.0	4.5	17	17	2-M4	3.4 to 4.1	C	C035D2B1
SFC-040DA2	8	15	8	15	44	29.6	48	15.5	11	3	11	–	4.5	20	19.5	2-M4	3.4 to 4.1	A	C040D2B1
	8	15	Over 15	19							11	17.0						B	C040D2B2
	Over 15	19	Over 15	19		–					–	17.0						C	C040D2B3
SFC-050DA2	10	19	10	19	56	38	59.8	20.5	14	2.4	14.5	–	6	26	26	2-M5	7.0 to 8.5	A	C050D2B1
	10	19	Over 19	25							14.5	22.0						B	C050D2B2
	Over 19	25	Over 19	25		–					–	22.0						C	C050D2B3
SFC-060DA2	12	24	12	24	68	46	73.3	25.2	16.5	3.2	17.5	–	7.75	31	31	2-M6	14 to 15	A	C060D2B1
	12	24	Over 24	30							17.5	26.5						B	C060D2B2
	Over 24	30	Over 24	30		–					–	26.5						C	C060D2B3
SFC-080DA2	20	35	20	35	82	–	98	30	22	8	–	28	9	40	38	2-M8	27 to 30	C	C080D2B1
SFC-090DA2	25	40	25	40	94	–	98.6	30	22	8.3	–	34	9	47	42	2-M8	27 to 30	C	C090D2B1
SFC-100DA2	35	45	35	45	104	–	101.6	30	22	9.8	–	39	9	50	48	2-M8	27 to 30	C	C100D2B1

* *1 Permissible torque could be limited depending on the bore diameter. Refer to the “Standard bore diameter” on page 17.
* *2 indicates the value when d1 or d2 is ø4 to ø7. It will be 6.0 if d1 or d2 is ø8.
* *3 indicates the value when d1 or d2 is ø4 to ø7. It will be M2 if d1 or d2 is ø8. The tightening torque of M2 is 0.4 to 0.5N·m.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ø35, the tolerance is $^{+0.010}_{-0.025}$. Contact us for tolerances other than h7.

Standard bore diameter

Model	Standard bore diameter d1·d2 [mm]																												
	4	5	6	6.35	7	8	9	9.525	10	11	12	14	15	16	17	18	19	20	22	24	25	28	30	32	35	38	40	42	45
SFC-005DA2	●	●	●																										
SFC-010DA2	●	●	●	●	●	●																							
SFC-020DA2		1.2	●	●	●	●	●	●	●																				
SFC-030DA2		2.8	3.4	●	●	●	●	●	●	●	●	●																	
SFC-035DA2						●	●	●	●	●	●	●	●	●															
SFC-040DA2						9	●	●	●	●	●	●	●	●	●	●	●												
SFC-050DA2									22	●	●	●	●	●	●	●	●	●	●	●	●								
SFC-060DA2											51	●	●	●	●	●	●	●	●	●	●	●	●						
SFC-080DA2																		●	●	●	●	●	●	●	●				
SFC-090DA2																					●	●	●	●	●	●	●		
SFC-100DA2																									●	●	●	●	●

* The bore diameters with value or marked ● are supported as standard bore diameter.
* The permissible torque of small bore diameter indicated in the column with value is limited by the shaft locking mechanism. The value indicates its operating torque [N·m].
* For bore diameters other than those above, processing cost is added to the standard price.

Optional: Taper shaft compatible

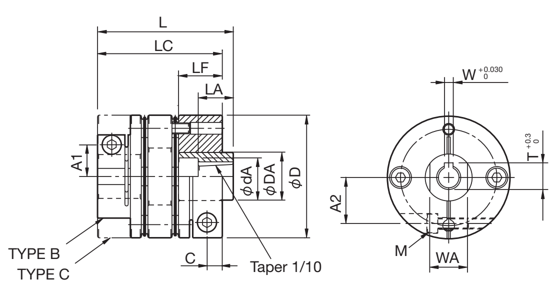
Specification

SFC-□DA2-□B-□BC

Model	Moment of inertia [kg·m²]		Mass [kg]		Price
	Shape TYPE B	Shape TYPE C	Shape TYPE B	Shape TYPE C	
SFC-050DA2-□B-11BC	123.6×10^{-6}	145.8×10^{-6}	0.327	0.356	–
SFC-050DA2-□B-14BC	129.4×10^{-6}	151.6×10^{-6}	0.358	0.386	–
SFC-050DA2-□B-16BC	136.2×10^{-6}	158.4×10^{-6}	0.396	0.424	–
SFC-060DA2-□B-16BC	334.1×10^{-6}	396.5×10^{-6}	0.630	0.688	–

Dimensions

SFC-□DA2-□B-□BC



Model	CAD file No.	
	Shape TYPE B	Shape TYPE C
SFC-050DA2-□B-11BC	C050D2C1	C050D2C2
SFC-050DA2-□B-14BC	C050D2C3	C050D2C4
SFC-050DA2-□B-16BC	C050D2C5	C050D2C6
SFC-060DA2-□B-16BC	C060D2C1	C060D2C2

Unit [mm]

Model	W	T	WA	LA	dA	DA	L	D	LC	LF	C	A1	A2	M
SFC-050DA2-□B-11BC	4	12.2	18	16	17	22	64.8	56	59.8	20.5	6	14.5	22	2-M5
-□B-14BC	4	15.1	24	19	22	28	69.8							
-□B-16BC	5	17.3	24	29	26	30	79.8							
SFC-060DA2-□B-16BC	5	17.3	24	29	26	30	89.3	68	73.3	25.2	7.75	17.5	26.5	2-M6

* The shape type is either TYPE B or TYPE C.

Ordering Information

SFC - 040 - DA2 - 14 B - 15 B

- 040: Size
- DA2: Type: DA2 Double element, aluminum hub
- 14 B - 15 B: Bore diameter: d1-d2
  - B: Clamp hub
  - BC: Taper adapter

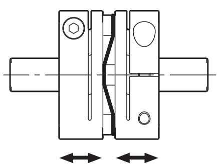
SFC MODEL

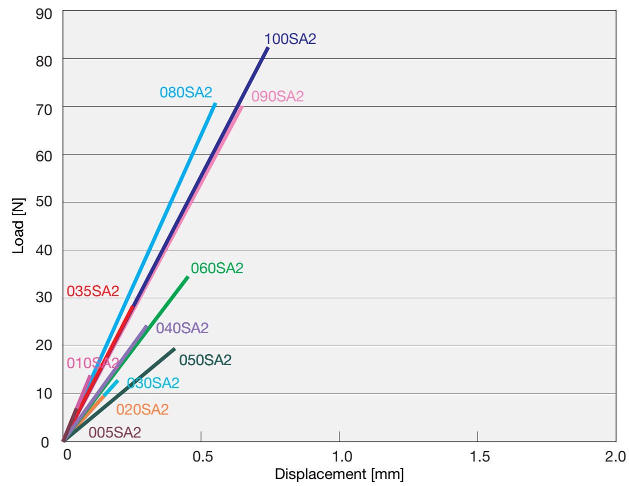
Design Check Items

Spring characteristics

● Axial Load and Displacement Amount

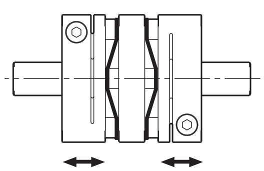
SFC-□SA2

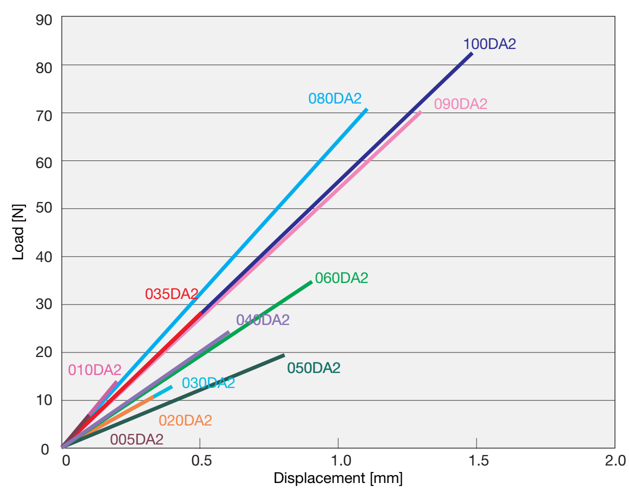




● Axial Load and Displacement Amount

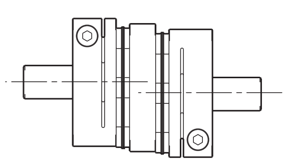
SFC-□DA2

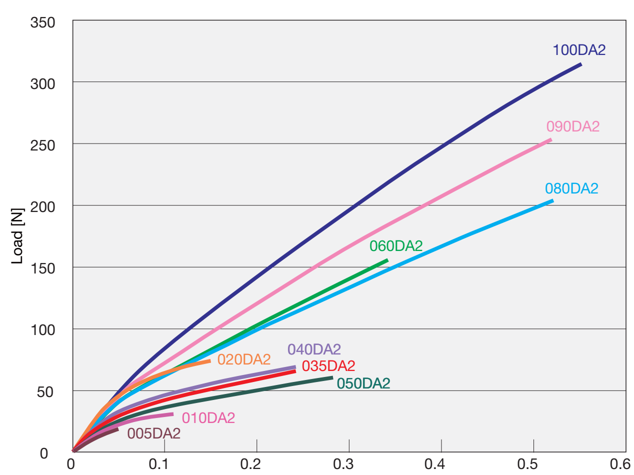




● Parallel Offset Direction Load and Displacement Amount

SFC-□DA2





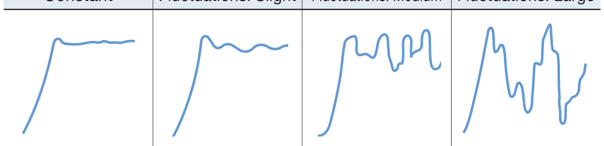
Selection procedure

(1) Calculate torque Ta applied to the coupling based on the motor output P and coupling operating rotation speed n.

$$Ta\ [N{\cdot}m] = 9550 \times \frac{P\ [kW]}{n\ [min^{-1}]}$$

(2) Calculate corrected torque Td applied to the coupling after deciding the service factor K based on load conditions.

$$Td = Ta \times K \text{ (see below)}$$

Load character			
Constant	Fluctuations: Slight	Fluctuations: Medium	Fluctuations: Large
			
1.0	1.25	1.75	2.25

In servo motor drive, multiply the service factor K=1.2 to 1.5 by the maximum torque of servo motor Ts.

$$Td = Ts \times (1.2 \text{ to } 1.5)$$

(3) Select a coupling size with permissible torque Tn that becomes equal or greater than the corrected torque Td.

$$Tn \geq Td$$

(4) Depending on the bore diameters, the coupling permissible torque may be limited. Refer to the "Specification" and "Standard bore diameter".

(5) Confirm if the required shaft diameter does not exceed the maximum bore diameter of the selected size.

For machines whose load torques periodically fluctuate drastically, contact us.

Simplified selection

The table indicates suitable sizes based on the rated output, rated torque and maximum torque of general-purpose servo motors. Since torque characteristics of servo motors differ depending on the manufacturer, select the coupling size after confirming the specification of the manufacturer.

Servo motor specification					Compatible coupling specification		
Rated output [kW]	Rated revolution [min^{-1}]	Rated torque [N·m]	Max. torque [N·m]	Shaft dia. [mm]	Single element Model (SFC-□SA2)	Double element Model (SFC-□DA2)	Max. bore dia. [mm]
0.05	3000	0.16	0.48	8	010SA2	010DA2	8
0.1	3000	0.32	0.95	8	020SA2	020DA2	10
0.2	3000	0.64	1.90	14	030SA2	030DA2	14
0.4	3000	1.30	3.80	14	035SA2	035DA2	16
0.5	2000	2.39	7.16	24	050SA2	050DA2	25
0.5	3000	1.59	4.77	24	050SA2	050DA2	25
0.75	2000	3.58	10.7	22	050SA2	050DA2	25
0.75	3000	2.40	7.20	19	040SA2	040DA2	19
0.85	1000	8.12	24.4	24	060SA2	060DA2	30
1	2000	4.78	14.4	24	050SA2	050DA2	25
1	3000	3.18	9.55	24	050SA2	050DA2	25
1.2	1000	11.5	34.4	35	080SA2	080DA2	35
1.5	2000	7.16	21.6	28	060SA2	060DA2	30
1.5	3000	4.78	14.3	24	050SA2	050DA2	25
2	2000	9.55	28.5	35	080SA2	080DA2	35
2	3000	6.37	15.9	24	050SA2	050DA2	25
3	1000	28.60	85.9	35	090SA2	090DA2	35
3.5	2000	16.70	50.1	35	080SA2	080DA2	35
3.5	3000	11.10	27.9	28	060SA2	060DA2	30
5	2000	23.90	71.6	35	080SA2	080DA2	35
5	3000	15.90	39.7	28	060SA2	060DA2	30
7	2000	33.40	100	35	090SA2	090DA2	35

Design Check Items

Feed-screw systems

(1) Oscillation phenomena of servo motors
If the eigenfrequency of the entire feed-screw system is under 400 to 500Hz, oscillation may occur depending on the gain adjustment of the servo motor.
The problems can be avoided by raising the eigenfrequency of the mechanical system or adjusting the tuning function (filter function) of the servo motor.

Contact us for unclear points concerning oscillation phenomena of servo motors.

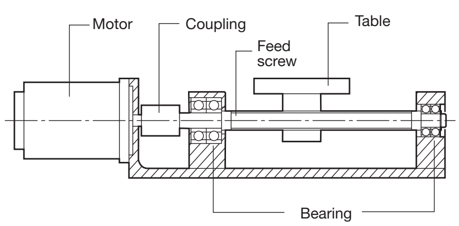
(2) Resonance caused by stepping motors
Resonance can occur within a certain speed range due to the pulsation frequency of the stepping motor and the eigenfrequency of the entire system. Resonance can be avoided by not applying the resonant rotation speed, or by reviewing the eigenfrequency in the design phase.

Contact us for unclear points concerning resonance of stepping motors.

How to evaluate the eigenfrequency of feed-screw system

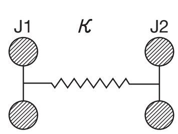
(1) Select the coupling according to the normal operating torque and maximum torque of the servo motor/stepping motor.

(2) In the following feed-screw system, evaluate the entire eigenfrequency: Nf from the torsional stiffness: ***k*** of the coupling and feed screw, the moment of inertia: J1 of the driving side and the moment of inertia: J2 of the driven side.



$$Nf=\frac{1}{2\pi}\sqrt{\kappa\left(\frac{1}{J1}+\frac{1}{J2}\right)}$$

Nf: Eigenfrequency of the entire feed-screw system [Hz]
k: Torsional stiffness of the coupling and feed screw [N·m/rad]
J1: Moment of inertia of the driving side
J2: Moment of inertia of the driven side



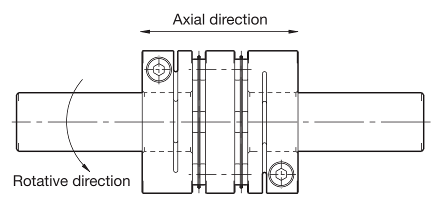
Mounting

The concentricity of the right and left bore diameters is ensured by adjusting with an specialized jig. However, the assembly accuracy may be disturbed if a strong impact is given to the product. Please handle it with care.

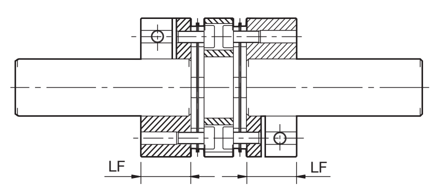
(1) Confirm the clamping bolts are loosened. Remove the rust, dust and oil content on the inside diameter surface of the shaft and coupling. (Wipe off the oil content completely with a waste cloth, etc.)

(2) Insert the coupling into the shaft. At this time, do not apply more than necessary force such as compression or pulling to the element part of the coupling.
After the coupling is mounted into the motor, do not apply excessive compression when inserting the coupling into the mating shaft.

(3) Confirm the two clamping bolts are loosened and the coupling is movable to the axial and rotative directions.
If it does not move smoothly, adjust centering of both shafts again.
If the concentricity can not be confirmed with the method described above, confirm the mounting accuracy by other measures.



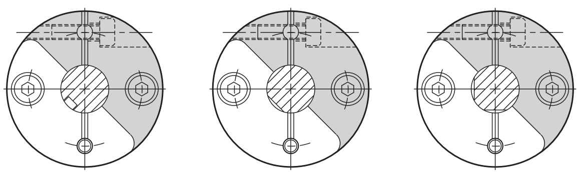
(4) Make sure that the insertion length of the coupling into the shaft is kept in the position so that the target shaft is in contact with the entire length of the flange (LF dimension) as illustrated below.



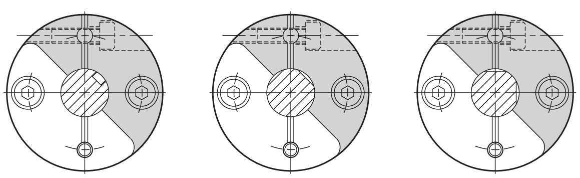
Size	LF dimension [mm]
005	7.85
010	9.15
020	10.75
030	12.4
035	15.5
040	15.5
050	20.5
060	25.2
080	30
090	30
100	30

(5) As a principle, the target shaft is a circular shaft. However, if shafts other than a circular shaft have to be used for a certain reason, be careful with the shaft installation position as illustrated below. (Note that key slot, D-cut, etc. must not be processed on the filling side of the ■ part.)
Certain shaft installation positioning may result in damage to the coupling itself and lowering of shaft-retaining force. It is recommended to use a circular shaft for fully satisfactory coupling performance.

● Example of Good Mounting



● Example of Bad Mounting



(6) After checking that no force such as compression, tension, etc. is applied to the axial direction, the shaft is retained so that the whole length of the clamp hub is in contact with both shafts, and two clamp bolts are tightened at an appropriate torque value.
To tighten the clamp bolts, a calibrated torque wrench is used within the range of the clamp bolt-tightening torque as shown in the table below.

Size	Clamp bolt	Tightening torque [N·m]
005	M2	(0.4 to 0.5)
010	M2	(0.4 to 0.5)
010	M2.5	(1.0 to 1.1)
020	M2.5	(1.0 to 1.1)
030	M3	(1.5 to 1.9)
035	M4	(3.4 to 4.1)
040	M4	(3.4 to 4.1)
050	M5	(7.0 to 8.5)
060	M6	(14 to 15)
080	M8	(27 to 30)
090	M8	(27 to 30)
100	M8	(27 to 30)

* If the bore diameter is ø8, size 010 will be M2.
* For the above tightening torque, solid lubricant film treatment is applied to the bolt and the torque coefficient is 0.18.
* The value of the tightening torque is between the minimum and the maximum values. The bolts should be tightened by the tightening torque within this range.

● Solid lubricant film treatment is applied to the clamp bolt, so make sure that Miki Pulley's specified clamp bolt is used and no coatings such as oil, etc. are applied. If any coating is applied to the surface, the clamp bolt, the coupling itself, and other parts might be damaged due to excessive shaft force.

Coupling bore diameter surface treatment

For the SERVO FLEX SFC model, depending on the process, although there are two types of parts, one with bore diameter surface treatment such as additional processing and key slot processing and the other without surface treatment, there is no problem in terms of performance of the couplings. Contact us for advice regarding whether bore diameter surface treatment should be used according to the customers' conditions of use.

SFS MODEL

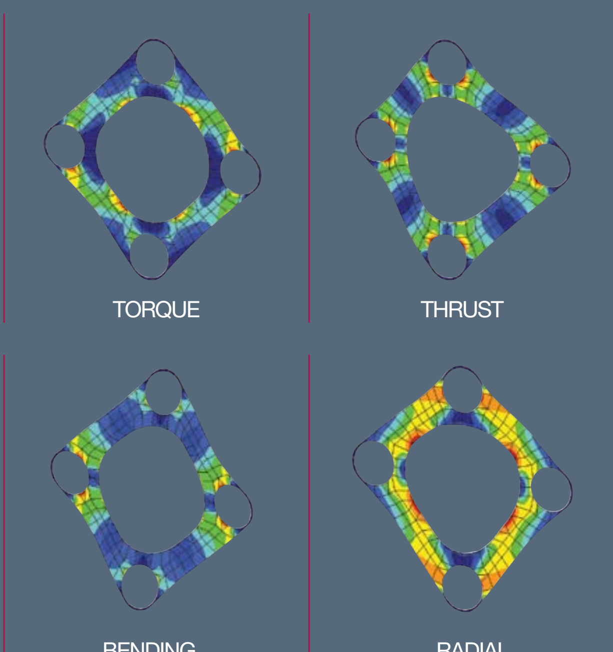
SERVO FLEX: A Wide Selection of Metal Plate Spring Couplings Made of Steel

Three types of couplings, either a high-rigidity type with one element, a high-flexibility type with two elements using a spacer, or a floating shaft with configurable spacer length can be selected.
A variety of methods are available for mounting on a shaft such as a friction lock compatible with a large diameter, a high-precision friction lock, a taper shaft-compatible method, and others.
The pilot bore item has also been standardized, enabling methods such as the key/set screw method, shrink fit-compatible method, and others.

PLATE SPRING OF IDEAL FORM

High Rigidity, High Flexibility

An ideal-shaped plate spring, designed based on thorough analysis using the advanced finite element method (FEM), is applied for the element.
Three types of couplings, either a high-rigidity type with one element, a high-flexibility type with two elements using a spacer, or a floating shaft with configurable spacer length can be selected.



Available to Assemble in Parts

- The product can be delivered in parts, so that this can be used even for designs where parts cannot be mounted on the finished item.
  S, W, and G types
- A finished-assembly product is also available as a standard.
  SS and DS types

SFS MODEL

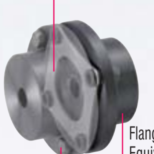
SFS MODEL

General-purpose steel hub SFS

Hub type	Element type	Model
Pilot bore	High-rigidity single element	SFS-☐S
	High-flexibility double element	SFS-☐W
	Double-element floating shaft	SFS-☐G
Key/set screw item	High-rigidity single element	SFS-☐S-☐H-☐H
	High-flexibility double element	SFS-☐W-☐H-☐H
	Double-element floating shaft	SFS-☐G-☐H-☐H
High-precision friction lock	High-rigidity single element	SFS-☐S-☐M-☐M
	High-flexibility double element	SFS-☐W-☐M-☐M
	Double-element floating shaft	SFS-☐G-☐M-☐M
+ Taper shaft supporting	High-rigidity single element	SFS-☐S-☐M-☐C
	High-flexibility double element	SFS-☐W-☐M-☐C
	Double-element floating shaft	SFS-☐G-☐M-☐C
Large-diameter friction lock	High-rigidity single element	SFS-☐SS-☐K-☐K
	High-flexibility double element	SFS-☐DS-☐K-☐K

Structure and Material

SFS-S



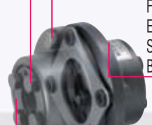
SFS-W

SFS-SS

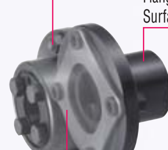
SFS-DS

SFS-G

SFS-S-M-M



SFS-S-M-C



Installing the Shaft on the Coupling

A variety of methods are available for mounting on a shaft such as the friction lock compatible with a large diameter, a high-precision friction lock, a taper shaft-compatible method, and others. The pilot bore item has also been standardized, enabling designs freely by customers such as the key/set screw method, shrink fit-compatible method, and others.

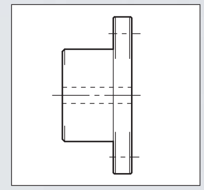
High-Precision Friction Lock Type + High-Precision Friction Lock Type
SFS-☐S-☐M-☐M

High-Precision Friction Lock Type + Taper Shaft Type
SFS-☐S-☐M-☐C

Large-Diameter Shaft-Supporting Friction Lock Type + Large-Diameter Shaft-Supporting Friction Lock Type
SFS-☐SS-☐K-☐K

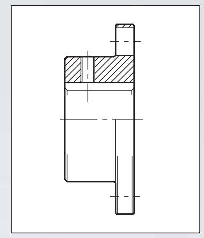
Pilot Bore Type

Bore processing can be performed freely because the product is provided only with a drilled hole.



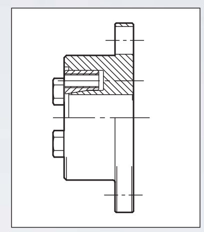
Key/Set Screw Type

This is a finished product using key slot processing, bore processing, and set screw processing based on Miki Pulley's standard bore processing specifications. The parts can be assembled immediately after delivery to the customer.
Target model: SFS-☐S, SFS-☐W, SFS-☐G
* Indicate the nominal bore diameter (blank, H, N) after the model.
E.g.) SFS-☐S-☐H-☐N



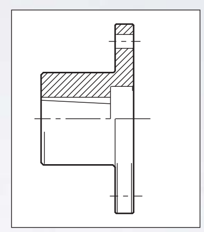
High-Precision Friction Lock Type

A double-taper lock part is allocated to the coupling, so high-precision installation is achieved by high locking force and rigidity with the shaft.
Target model: SFS-☐S, SFS-☐W, SFS-☐G
* Indicate the nominal bore diameter (M) after the model.
E.g.) SFS-☐S-☐M-☐M



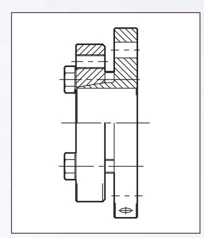
Taper Shaft Type

Direct installation on the servo motor taper shaft is achieved.
Target model: SFS-☐S, SFS-☐W, SFS-☐G
* Indicate the nominal bore diameter (C) after the model.
E.g.) SFS-☐S-☐M-☐C



Large Diameter-Supporting Friction Lock Type

Locking force is high as a result of the single-taper lock method. Shafts larger than the size of the coupling are also compatible.
Target model: SFS-☐SS, SFS-☐DS
* Indicate the nominal bore diameter (K) after the model.
E.g.) SFS-☐SS-☐K-☐K



SFS MODEL

SFS-S

Specification

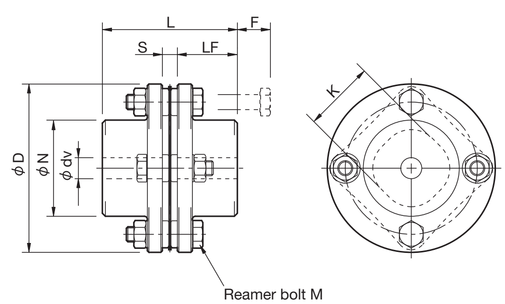
Model	Permissible torque [N·m]	Max. permissible misalignment		Max. rotation speed [min⁻¹]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m2]	Mass [kg]	Price
		Angular misalignment [°]	Axial displacement [mm]						
SFS-05S	20	1	±0.6	25000	16000	43	$0.11×10^{-3}$	0.30	–
SFS-06S	40	1	±0.8	20000	29000	45	$0.30×10^{-3}$	0.50	–
SFS-06S-□M-□M	40	1	±0.8	5000	29000	45	$0.30×10^{-3}$	0.70	–
SFS-06S-□M-11C	40	1	±0.8	5000	29000	45	$0.29×10^{-3}$	0.60	–
SFS-06S-□M-16C	40	1	±0.8	5000	29000	45	$0.34×10^{-3}$	0.70	–
SFS-08S	80	1	±1.0	17000	83000	60	$0.87×10^{-3}$	1.00	–
SFS-08S-□M-□M	80	1	±1.0	5000	83000	60	$0.93×10^{-3}$	1.30	–
SFS-08S-□M-16C	80	1	±1.0	5000	83000	60	$0.84×10^{-3}$	1.20	–
SFS-09S	180	1	±1.2	15000	170000	122	$1.60×10^{-3}$	1.40	–
SFS-09S-□M-□M	180	1	±1.2	5000	170000	122	$1.80×10^{-3}$	1.80	–
SFS-09S-□M-16C	180	1	±1.2	5000	170000	122	$1.50×10^{-3}$	1.60	–
SFS-10S	250	1	±1.4	13000	250000	160	$2.60×10^{-3}$	2.10	–
SFS-10S-□M-□M	250	1	±1.4	5000	250000	160	$2.70×10^{-3}$	2.30	–
SFS-12S	450	1	±1.6	11000	430000	197	$6.50×10^{-3}$	3.40	–
SFS-12S-□M-□M	450	1	±1.6	5000	430000	197	$6.80×10^{-3}$	4.10	–
SFS-14S	800	1	±1.8	9500	780000	313	$9.90×10^{-3}$	4.90	–
SFS-14S-35M-35M	580	1	±1.8	5000	780000	313	$14.01×10^{-3}$	6.40	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The price of SFS-□S is applied to the case of the pilot bore.

Dimensions

SFS-□S

CAD



Unit [mm]

Model	d1·d2			D	N	L	LF	S	F	K	M	CAD file No.
	Pilot bore	Min.	Max.									
SFS-05S	7	8	20	56	32	45	20	5	11	24	4-M5×22	SFS-S1
SFS-06S	7	8	25	68	40	56	25	6	10	30	4-M6×25	SFS-S2
SFS-08S	12	14	35	82	54	66	30	6	11	38	4-M6×29	SFS-S3
SFS-09S	12	14	38	94	58	68	30	8	21	42	4-M8×36	SFS-S4
SFS-10S	20	22	42	104	68	80	35	10	16	48	4-M8×36	SFS-S5
SFS-12S	20	22	50	126	78	91	40	11	23	54	4-M10×45	SFS-S6
SFS-14S	20	22	60	144	88	102	45	12	31	61	4-M12×54	SFS-S7

* For additional processing, refer to the "Standard bore processing specification" on page 32.
* Pilot bores are drilled bores.

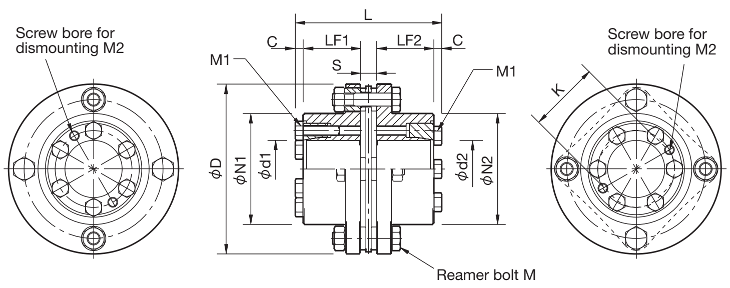
Ordering Information

SFS - 10 S - 25 H - 30 H

- Size (10)
- Type: S — Single element
- Bore diameter: d1- d2 with standard bore processing
  - Blank: Previous edition JIS (Class 2) compliant
  - H: New JIS compliant
  - N: New standard motor compatible
  - * Blank if bore processing is not required

Dimensions

SFS-□S-□M-□M



Model	CAD file No.			
SFS-06S	12M	14M	15M	–
	SFS-M11	SFS-M12	SFS-M13	–
SFS-08S	15M	16M	20M	22M
	SFS-M14	SFS-M15	SFS-M16	SFS-M17
SFS-09S	25M	28M	35M	–
	SFS-M18	SFS-M19	SFS-M110	–
SFS-10S	25M	28M	30M	35M
	SFS-M21	SFS-M22	SFS-M23	SFS-M24
SFS-12S	30M	35M	–	–
	SFS-M25	SFS-M26	–	–
SFS-14S	35M	–	–	–
	SFS-M27	–	–	–

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Unit [mm]

Model	Bore dia.	d1	d2	D	N1	N2	L	LF1	LF2	S	C	K	M	M1	M2
SFS-06S	□M-□M	12 · 14 · 15	12 · 14 · 15	68	40	40	65.6	25	25	6	4.8	30	4-M6×25	4-M5	2-M5
SFS-08S	□M-□M	15 · 16 · 20 · 22	15 · 16 · 20 · 22	82	54	54	75.6	30	30	6	4.8	38	4-M6×29	4-M6	2-M6
SFS-09S	□M-□M	25 · 28	25 · 28	94	58	58	77.6	30	30	8	4.8	42	4-M8×36	6-M6	2-M6
	□M-35M	25 · 28	35			68	85.6		38						
SFS-10S	□M-□M	25 · 28 · 30 · 35	25 · 28 · 30 · 35	104	68	68	89.6	35	35	10	4.8	48	4-M8×36	6-M6	2-M6
SFS-12S	□M-□M*1	30 · 35	30 · 35	126	78	78	101.6	40	40	11	5.3	54	4-M10×45	4-M8	2-M8
SFS-14S	35M-35M	35	35	144	88	88	112.6	45	45	12	5.3	61	4-M12×54	6-M8	2-M8

* *1 The permissible torque of SFS-12S-30M-□M is limited by the shaft locking mechanism of ø30 and will be 380N·m.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ø35, the tolerance is $^{+0.010}_{-0.025}$.

Ordering Information

SFS - 10 S - 25 M - 30 M

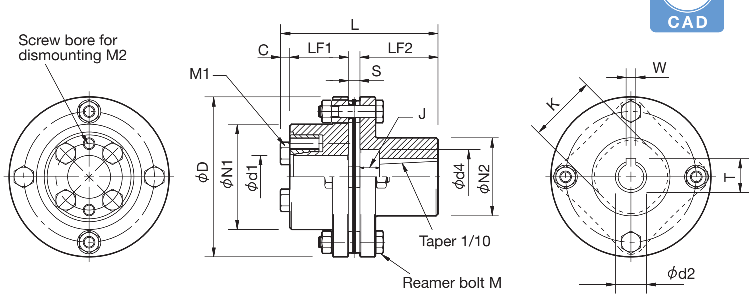
Size

Type: S
Single element

Bore diameter: d1- d2
M: Friction locking

Dimensions

SFS-□S-□M-□C



Model	CAD file No.				
SFS-06S	12M	14M	15M	11C	16C
	SFS-M11	SFS-M12	SFS-M13	SFS-C1	SFS-C2
SFS-08S	15M	16M	20M	22M	16C
	SFS-M14	SFS-M15	SFS-M16	SFS-M17	SFS-C3
SFS-09S	25M	28M	16C	–	–
	SFS-M18	SFS-M19	SFS-C4	–	–

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Unit [mm]

Model	Bore dia.	d1	d2	W $^{+0.030}_{0}$	T $^{+0.3}_{0}$	d4	J	D	N1	N2	L	LF1	LF2	S	C	K	M	M1	M2
SFS-06S	□M-11C	12 · 14 · 15	11	4	12.2	18	9	68	40	30	60.8	25	25	6	4.8	30	4-M6×25	4-M5	2-M5
	□M-16C	15	16	5	17.3	28	10			40	75.8		40						
SFS-08S	□M-16C	15 · 16 · 20 · 22	16	5	17.3	28	10	82	54	40	80.8	30	40	6	4.8	38	4-M6×29	4-M6	2-M6
SFS-09S	□M-16C	25 · 28	16	5	17.3	28	10	94	58	40	82.8	30	40	8	4.8	42	4-M8×36	6-M6	2-M6

* The dimensional tolerance of the target shaft of the friction lock-side hub is h7.

Ordering Information

SFS - 08 S - 20 M - 16 C

Size

Type: S
Single element

Bore diameter: d1- d2
M: Friction locking
C: Taper shaft compatible

SFS MODEL

SFS-W

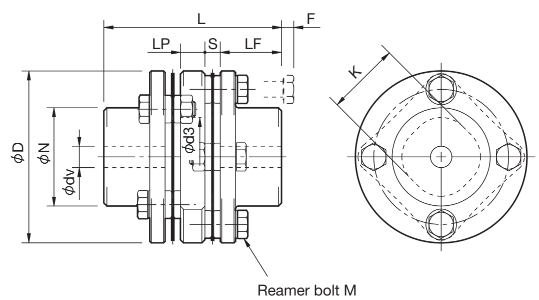
Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min^{-1}]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m^2]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFS-05W	20	0.2	1 (one side)	±1.2	10000	8000	21	0.14×10^{-3}	0.40	–
SFS-06W	40	0.3	1 (one side)	±1.6	8000	14000	22	0.41×10^{-3}	0.70	–
SFS-06W-□M-□M	40	0.3	1 (one side)	±1.6	5000	14000	22	0.41×10^{-3}	0.90	–
SFS-06W-□M-11C	40	0.3	1 (one side)	±1.6	5000	14000	22	0.40×10^{-3}	0.80	–
SFS-06W-□M-16C	40	0.3	1 (one side)	±1.6	5000	14000	22	0.45×10^{-3}	0.90	–
SFS-08W	80	0.3	1 (one side)	±2.0	6800	41000	30	1.10×10^{-3}	1.30	–
SFS-08W-□M-□M	80	0.3	1 (one side)	±2.0	5000	41000	30	1.16×10^{-3}	1.60	–
SFS-08W-□M-16C	80	0.3	1 (one side)	±2.0	5000	41000	30	1.07×10^{-3}	1.50	–
SFS-09W	180	0.5	1 (one side)	±2.4	6000	85000	61	2.20×10^{-3}	2.10	–
SFS-09W-□M-□M	180	0.5	1 (one side)	±2.4	5000	85000	61	2.40×10^{-3}	2.50	–
SFS-09W-□M-16C	180	0.5	1 (one side)	±2.4	5000	85000	61	2.10×10^{-3}	2.30	–
SFS-10W	250	0.5	1 (one side)	±2.8	5200	125000	80	3.60×10^{-3}	2.80	–
SFS-10W-□M-□M	250	0.5	1 (one side)	±2.8	5000	125000	80	3.70×10^{-3}	3.00	–
SFS-12W	450	0.6	1 (one side)	±3.2	4400	215000	98	9.20×10^{-3}	4.90	–
SFS-12W-□M-□M	450	0.6	1 (one side)	±3.2	4400	215000	98	9.50×10^{-3}	5.60	–
SFS-14W	800	0.7	1 (one side)	±3.6	3800	390000	156	15.00×10^{-3}	7.10	–
SFS-14W-35M-35M	580	0.7	1 (one side)	±3.6	3800	390000	156	19.11×10^{-3}	8.60	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The price of SFS-□W is applied to the case of the pilot bore.

Dimensions

SFS-□W



Unit [mm]

Model	d1·d2			D	N	L	LF	LP	S	F	d3	K	M	CAD file No.
	Pilot bore	Min.	Max.											
SFS-05W	7	8	20	56	32	58	20	8	5	4	20	24	8-M5×15	SFS-W1
SFS-06W	7	8	25	68	40	74	25	12	6	3	24	30	8-M6×18	SFS-W2
SFS-08W	12	14	35	82	54	84	30	12	6	2	28	38	8-M6×20	SFS-W3
SFS-09W	12	14	38	94	58	98	30	22	8	12	32	42	8-M8×27	SFS-W4
SFS-10W	20	22	42	104	68	110	35	20	10	7	34	48	8-M8×27	SFS-W5
SFS-12W	20	22	50	126	78	127	40	25	11	10	40	54	8-M10×32	SFS-W6
SFS-14W	20	22	60	144	88	144	45	30	12	15	46	61	8-M12×38	SFS-W7

* For additional processing, refer to the “Standard bore processing specification” on page 32.
* Prepared bores are drilled bores.

Ordering Information

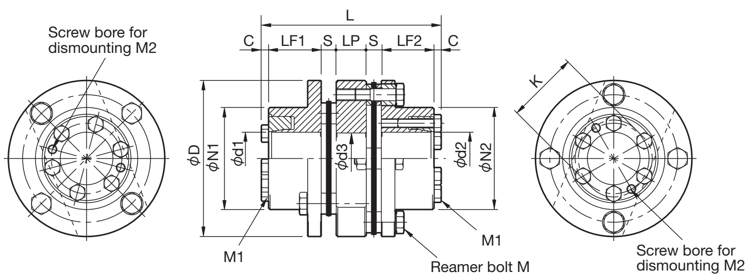
SFS - 10 W - 25 H - 30 H

- 10 — Size
- W — Type: W Double element
- 25 H - 30 H — Bore diameter: d1- d2 with standard bore processing
  - Blank: Previous edition JIS (Class 2) compliant
  - H: New JIS compliant
  - N: New standard motor compatible
  - * Blank if bore processing is not required

Dimensions

SFS-□W-□M-□M

CAD



Model	CAD file No.				
SFS-06W	Spacer	12M	14M	15M	–
	SFS-W8	SFS-M11	SFS-M12	SFS-M13	–
SFS-08W	Spacer	15M	16M	20M	22M
	SFS-W9	SFS-M14	SFS-M15	SFS-M16	SFS-M17
SFS-09W	Spacer	25M	28M	35M	–
	SFS-W10	SFS-M18	SFS-M19	SFS-M110	–
SFS-10W	Spacer	25M	28M	30M	35M
	SFS-W11	SFS-M21	SFS-M22	SFS-M23	SFS-M24
SFS-12W	Spacer	30M	35M	–	–
	SFS-W12	SFS-M25	SFS-M26	–	–
SFS-14W	Spacer	35M	–	–	–
	SFS-W13	SFS-M27	–	–	–

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Unit [mm]

Model	Bore dia.	d1	d2	D	N1	N2	L	LF1	LF2	LP	S	C	d3	K	M	M1	M2
SFS-06W	□M-□M	12 · 14 · 15	12 · 14 · 15	68	40	40	83.6	25	25	12	6	4.8	24	30	8-M6×18	4-M5	2-M5
SFS-08W	□M-□M	15 · 16 · 20 · 22	15 · 16 · 20 · 22	82	54	54	93.6	30	30	12	6	4.8	28	38	8-M6×20	4-M6	2-M6
SFS-09W	□M-□M	25 · 28	25 · 28	94	58	58	107.6	30	30	22	8	4.8	32	42	8-M8×27	6-M6	2-M6
	□M-35M	25 · 28	35			68	115.6		38								
SFS-10W	□M-□M	25 · 28 · 30 · 35	25 · 28 · 30 · 35	104	68	68	119.6	35	35	20	10	4.8	34	48	8-M8×27	6-M6	2-M6
SFS-12W	□M-□M*1	30 · 35	30 · 35	126	78	78	137.6	40	40	25	11	5.3	40	54	8-M10×32	4-M8	2-M8
SFS-14W	35M-35M	35	35	144	88	88	154.6	45	45	30	12	5.3	46	61	8-M12×38	6-M8	2-M8

* *1 The permissible torque of SFS-12W-30M-□M is limited by the shaft fixing mechanism of ø30 and will be 380N·m.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ø35, the tolerance is $^{+0.010}_{-0.025}$.

Ordering Information

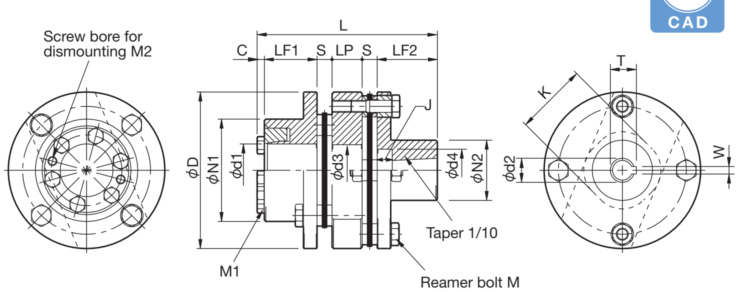
SFS - 10 W - 25 M - 30 M

- 10: Size
- W: Type: W Double element
- 25 M - 30 M: Bore diameter: d1- d2, M: Friction locking

Dimensions

SFS-□W-□M-□C

CAD



Model	CAD file No.				
SFS-06W	Spacer	12M	14M	15M	11C	16C
	SFS-W8	SFS-M11	SFS-M12	SFS-M13	SFS-C1	SFS-C2
SFS-08W	Spacer	15M	16M	20M	22M	16C
	SFS-W9	SFS-M14	SFS-M15	SFS-M16	SFS-M17	SFS-C3
SFS-09W	Spacer	25M	28M	16C	–	–
	SFS-W10	SFS-M18	SFS-M19	SFS-C4	–	–

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Unit [mm]

Model	Bore dia.	d1	d2	W $^{+0.030}_{0}$	T $^{+0.3}_{0}$	d4	J	D	N1	N2	L	LF1	LF2	LP	S	C	d3	K	M	M1	M2
SFS-06W	□M-11C	12 · 14 · 15	11	4	12.2	18	9	68	40	30	78.8	25	25	12	6	4.8	24	30	8-M6×18	4-M5	2-M5
	□M-16C	15	16	5	17.3	28	10			40	93.8		40								
SFS-08W	□M-16C	15 · 16 · 20 ·22	16	5	17.3	28	10	82	54	40	98.8	30	40	12	6	4.8	28	38	8-M6×20	4-M6	2-M6
SFS-09W	□M-16C	25 · 28	16	5	17.3	28	10	94	58	40	112.8	30	40	22	8	4.8	32	42	8-M8×27	6-M6	2-M6

* The dimensional tolerance of the target shaft of the friction lock-side hub is h7.

Ordering Information

SFS - 08 W - 20 M - 16 C

- 08: Size
- W: Type: W Double element
- 20 M - 16 C: Bore diameter: d1- d2, M: Friction locking, C: Taper shaft compatible

SFS MODEL

SFS-G

Specification

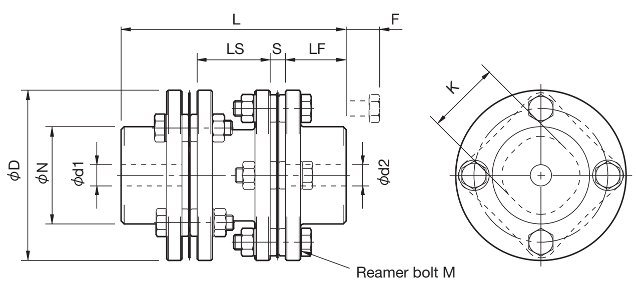
Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min^{-1}]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m^2]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFS-05G	20	0.5	1 (one side)	±1.2	20000	8000	21	0.20×10^{-3}	0.50	–
SFS-06G	40	0.5	1 (one side)	±1.6	16000	14000	22	0.55×10^{-3}	0.90	–
SFS-06G-□M-□M	40	0.5	1 (one side)	±1.6	5000	14000	22	0.55×10^{-3}	1.10	–
SFS-06G-□M-11C	40	0.5	1 (one side)	±1.6	5000	14000	22	0.54×10^{-3}	1.00	–
SFS-06G-□M-16C	40	0.5	1 (one side)	±1.6	5000	14000	22	0.59×10^{-3}	1.10	–
SFS-08G	80	0.5	1 (one side)	±2.0	13000	41000	30	1.50×10^{-3}	1.70	–
SFS-08G-□M-□M	80	0.5	1 (one side)	±2.0	5000	41000	30	1.56×10^{-3}	2.00	–
SFS-08G-□M-16C	80	0.5	1 (one side)	±2.0	5000	41000	30	1.47×10^{-3}	1.90	–
SFS-09G	180	0.6	1 (one side)	±2.4	12000	85000	61	2.90×10^{-3}	2.40	–
SFS-09G-□M-□M	180	0.6	1 (one side)	±2.4	5000	85000	61	3.10×10^{-3}	2.80	–
SFS-09G-□M-16C	180	0.6	1 (one side)	±2.4	5000	85000	61	2.80×10^{-3}	2.60	–
SFS-10G	250	0.6	1 (one side)	±2.8	10000	125000	80	4.60×10^{-3}	3.30	–
SFS-10G-□M-□M	250	0.6	1 (one side)	±2.8	5000	125000	80	4.70×10^{-3}	3.50	–
SFS-12G	450	0.8	1 (one side)	±3.2	8000	215000	98	11.80×10^{-3}	5.80	–
SFS-12G-□M-□M	450	0.8	1 (one side)	±3.2	5000	215000	98	12.10×10^{-3}	6.50	–
SFS-14G	800	0.9	1 (one side)	±3.6	7000	390000	156	21.20×10^{-3}	8.60	–
SFS-14G-35M-35M	580	0.9	1 (one side)	±3.6	5000	390000	156	25.31×10^{-3}	10.10	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The price of SFS-□G is applied to the case of the pilot bore.

Dimensions

SFS-□G

CAD



Unit [mm]

Model	d1·d2			D	N	L	LF	LS	S	F	K	M	CAD file No.
	Pilot bore	Min.	Max.										
SFS-05G	7	8	20	56	32	74	20	24	5	11	24	8-M5×22	SFS-G1
SFS-06G	7	8	25	68	40	86	25	24	6	10	30	8-M6×25	SFS-G2
SFS-08G	12	14	35	82	54	98	30	26	6	11	38	8-M6×29	SFS-G3
SFS-09G	12	14	38	94	58	106	30	30	8	21	42	8-M8×36	SFS-G4
SFS-10G	20	22	42	104	68	120	35	30	10	16	48	8-M8×36	SFS-G5
SFS-12G	20	22	50	126	78	140	40	38	11	23	54	8-M10×45	SFS-G6
SFS-14G	20	22	60	144	88	160	45	46	12	31	61	8-M12×54	SFS-G7

* Specify the required LS dimensions when requesting products other than the above LS dimensions. Contact us if the LS is equal or greater than 1000.
* Pilot bores are drilled bores. For additional processing, refer to the "Standard bore processing specification" on page 32.

Ordering Information

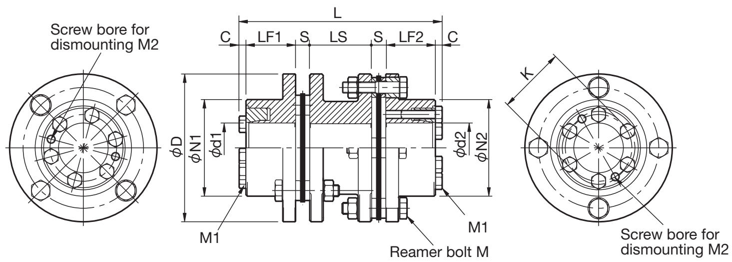
SFS - 10 G - 25 H - 30 H LS=500

- 10 — Size
- G — Type: G
  Double element
  Floating shaft
- 25 H - 30 H — Bore diameter: d1- d2 with standard bore processing
  Blank: Previous edition JIS (Class 2) compliant
  H: New JIS compliant
  N: New standard motor compatible
  * Blank if bore processing is not required
- LS=500 — Length of spacer
  * Blank if standard spacer

Dimensions

SFS-□G-□M-□M

CAD



Model	CAD file No.				
SFS-06G	Spacer	12M	14M	15M	–
	SFS-G8	SFS-M11	SFS-M12	SFS-M13	–
SFS-08G	Spacer	15M	16M	20M	22M
	SFS-G9	SFS-M14	SFS-M15	SFS-M16	SFS-M17
SFS-09G	Spacer	25M	28M	35M	–
	SFS-G10	SFS-M18	SFS-M19	SFS-M110	–
SFS-10G	Spacer	25M	28M	30M	35M
	SFS-G11	SFS-M21	SFS-M22	SFS-M23	SFS-M24
SFS-12G	Spacer	30M	35M	–	–
	SFS-G12	SFS-M25	SFS-M26	–	–
SFS-14G	Spacer	35M	–	–	–
	SFS-G13	SFS-M27	–	–	–

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Unit [mm]

Model	Bore dia.	d1	d2	D	N1	N2	L	LF1	LF2	LS	S	C	K	M	M1	M2
SFS-06G	□M-□M	12 · 14 · 15	12 · 14 · 15	68	40	40	95.6	25	25	24	6	4.8	30	8-M6×18	4-M5	2-M5
SFS-08G	□M-□M	15 · 16 · 20 · 22	15 · 16 · 20 · 22	82	54	54	107.6	30	30	26	6	4.8	38	8-M6×20	4-M6	2-M6
SFS-09G	□M-□M	25 · 28	25 · 28	94	58	58	115.6	30	30	30	8	4.8	42	8-M8×27	6-M6	2-M6
	□M-35M	25 · 28	35			68	123.6		38							
SFS-10G	□M-□M	25 · 28 · 30 · 35	25 · 28 · 30 · 35	104	68	68	129.6	35	35	30	10	4.8	48	8-M8×27	6-M6	2-M6
SFS-12G	□M-□M*1	30 · 35	30 · 35	126	78	78	150.6	40	40	38	11	5.3	54	8-M10×32	4-M8	2-M8
SFS-14G	35M-35M	35	35	144	88	88	170.6	45	45	46	12	5.3	61	8-M12×38	6-M8	2-M8

* *1 The permissible torque of SFS-12G-30M-□M is limited by the shaft locking mechanism of ø30 and will be 380N·m.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ø35, the tolerance is $^{+0.010}_{-0.025}$.
* Specify the required LS dimensions when requesting products other than the above LS dimensions. Contact us if the LS is equal or greater than 1000.

Ordering Information

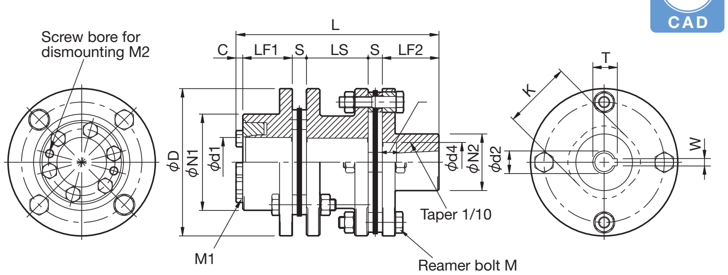
SFS - 10 G - 25 M - 6 M LS=500

Size
Type: G
Double element, Floating shaft
Bore diameter: d1- d2
M: Friction locking
Length of spacer
* Blank if standard spacer

Dimensions

SFS-□G-□M-□C

CAD



Model	CAD file No.					
SFS-06G	Spacer	12M	14M	15M	11C	16C
	SFS-G8	SFS-M11	SFS-M12	SFS-M13	SFS-C1	SFS-C2
SFS-08G	Spacer	15M	16M	20M	22M	16C
	SFS-G9	SFS-M14	SFS-M15	SFS-M16	SFS-M17	SFS-C3
SFS-09G	Spacer	25M	28M	16C	–	–
	SFS-G10	SFS-M18	SFS-M19	SFS-C4	–	–

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Unit [mm]

Model	Bore dia.	d1	d2	W $^{+0.030}_{0}$	T $^{+0.3}_{0}$	d4	J	D	N1	N2	L	LF1	LF2	LS	S	C	K	M	M1	M2
SFS-06G	□M-11C	12 · 14 · 15	11	4	12.2	18	9	68	40	30	90.8	25	25	24	6	4.8	30	8-M6×18	4-M5	2-M5
	□M-16C	15	16	5	17.3	28	10			40	105.8		40							
SFS-08G	□M-16C	15 · 16 · 20 · 22	16	5	17.3	28	10	82	54	40	112.8	30	40	26	6	4.8	38	8-M6×20	4-M6	2-M6
SFS-09G	□M-16C	25 · 28	16	5	17.3	28	10	94	58	40	120.8	30	40	30	8	4.8	42	8-M8×27	6-M6	2-M6

* The dimensional tolerance of the target shaft of the friction lock-side hub is h7.
* Specify the required LS dimensions when requiring products other than the above LS dimensions. (Ex: SFS-10G LS=500) Contact us if the LS is greater than or equal to 1000.

Ordering Information

SFS - 08 G - 20 M - 16 C LS=500

Size
Type: G
Double element, Floating shaft
Bore diameter: d1- d2
M: Friction locking
C: Taper shaft compatible
Length of spacer
* Blank if standard spacer

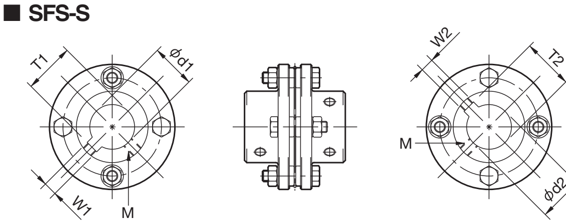
SFS MODEL

Standard Bore Processing Specification

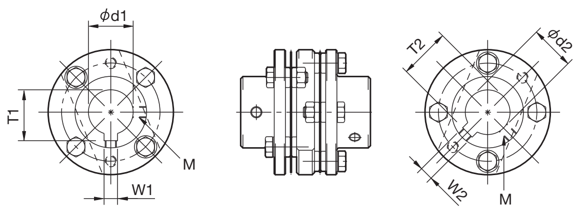
Dimensions

- Bore processing is available upon request. Products are stored with pilot bores.
- Bores are machined based on the following specification.
- Assign as described below when ordering.
  E.g.) SFS-10W 32H-38H
- The positions of set screws will not be on the same plane.
- For the standardized sizes other than described below, refer to the technical data at the end of the catalog.

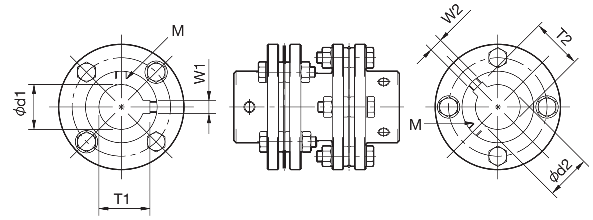
SFS-S



SFS-W



SFS-G



Unit [mm]

Previous edition JIS (Class 2) compliant					New JIS compliant					New standard motor compatible				
Nominal bore dia.	Bore diameter (d1-d2)	Key slot width (W1·W2)	Key slot height (T1·T2)	Set screw bore (M)	Nominal bore dia.	Bore diameter (d1-d2)	Key slot width (W1·W2)	Key slot height (T1·T2)	Set screw bore (M)	Nominal bore dia.	Bore diameter (d1-d2)	Key slot width (W1·W2)	Key slot height (T1·T2)	Set screw bore (M)
Tolerance	H7, H8	E9	$^{+0.3}_{0}$	—	Tolerance	H7	H9	$^{+0.3}_{0}$	—	Tolerance	G7,F7	H9	$^{+0.3}_{0}$	—
8	$8^{+0.022}_{0}$	—	—	2-M4	—	—	—	—	—	—	—	—	—	—
9	$9^{+0.022}_{0}$	—	—	2-M4	—	—	—	—	—	—	—	—	—	—
10	$10^{+0.022}_{0}$	—	—	2-M4	—	—	—	—	—	—	—	—	—	—
11	$11^{+0.018}_{0}$	—	—	2-M4	—	—	—	—	—	—	—	—	—	—
12	$12^{+0.018}_{0}$	$4^{+0.050}_{+0.020}$	13.5	2-M4	12H	$12^{+0.018}_{0}$	$4^{+0.030}_{0}$	13.8	2-M4	—	—	—	—	—
14	$14^{+0.018}_{0}$	$5^{+0.050}_{+0.020}$	16.0	2-M4	14H	$14^{+0.018}_{0}$	$5^{+0.030}_{0}$	16.3	2-M4	14N	$14^{+0.024}_{+0.006}$	$5^{+0.030}_{0}$	16.3	2-M4
15	$15^{+0.018}_{0}$	$5^{+0.050}_{+0.020}$	17.0	2-M4	15H	$15^{+0.018}_{0}$	$5^{+0.030}_{0}$	17.3	2-M4	—	—	—	—	—
16	$16^{+0.018}_{0}$	$5^{+0.050}_{+0.020}$	18.0	2-M4	16H	$16^{+0.018}_{0}$	$5^{+0.030}_{0}$	18.3	2-M4	—	—	—	—	—
17	$17^{+0.018}_{0}$	$5^{+0.050}_{+0.020}$	19.0	2-M4	17H	$17^{+0.018}_{0}$	$5^{+0.030}_{0}$	19.3	2-M4	—	—	—	—	—
18	$18^{+0.018}_{0}$	$5^{+0.050}_{+0.020}$	20.0	2-M4	18H	$18^{+0.018}_{0}$	$6^{+0.030}_{0}$	20.8	2-M5	—	—	—	—	—
19	$19^{+0.021}_{0}$	$5^{+0.050}_{+0.020}$	21.0	2-M4	19H	$19^{+0.021}_{0}$	$6^{+0.030}_{0}$	21.8	2-M5	19N	$19^{+0.028}_{+0.007}$	$6^{+0.030}_{0}$	21.8	2-M5
20	$20^{+0.021}_{0}$	$5^{+0.050}_{+0.020}$	22.0	2-M4	20H	$20^{+0.021}_{0}$	$6^{+0.030}_{0}$	22.8	2-M5	—	—	—	—	—
22	$22^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	25.0	2-M6	22H	$22^{+0.021}_{0}$	$6^{+0.030}_{0}$	24.8	2-M5	—	—	—	—	—
24	$24^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	27.0	2-M6	24H	$24^{+0.021}_{0}$	$8^{+0.036}_{0}$	27.3	2-M6	24N	$24^{+0.028}_{+0.007}$	$8^{+0.036}_{0}$	27.3	2-M6
25	$25^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	28.0	2-M6	25H	$25^{+0.021}_{0}$	$8^{+0.036}_{0}$	28.3	2-M6	—	—	—	—	—
28	$28^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	31.0	2-M6	28H	$28^{+0.021}_{0}$	$8^{+0.036}_{0}$	31.3	2-M6	28N	$28^{+0.028}_{+0.007}$	$8^{+0.036}_{0}$	31.3	2-M6
30	$30^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	33.0	2-M6	30H	$30^{+0.021}_{0}$	$8^{+0.036}_{0}$	33.3	2-M6	—	—	—	—	—
32	$32^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	35.5	2-M8	32H	$32^{+0.025}_{0}$	$10^{+0.036}_{0}$	35.3	2-M8	—	—	—	—	—
35	$35^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	38.5	2-M8	35H	$35^{+0.025}_{0}$	$10^{+0.036}_{0}$	38.3	2-M8	—	—	—	—	—
38	$38^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	41.5	2-M8	38H	$38^{+0.025}_{0}$	$10^{+0.036}_{0}$	41.3	2-M8	38N	$38^{+0.050}_{+0.025}$	$10^{+0.036}_{0}$	41.3	2-M8
40	$40^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	43.5	2-M8	40H	$40^{+0.025}_{0}$	$12^{+0.043}_{0}$	43.3	2-M8	—	—	—	—	—
42	$42^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	45.5	2-M8	42H	$42^{+0.025}_{0}$	$12^{+0.043}_{0}$	45.3	2-M8	42N	$42^{+0.050}_{+0.025}$	$12^{+0.043}_{0}$	45.3	2-M8
45	$45^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	48.5	2-M8	45H	$45^{+0.025}_{0}$	$14^{+0.043}_{0}$	48.8	2-M10	—	—	—	—	—
48	$48^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	51.5	2-M8	48H	$48^{+0.025}_{0}$	$14^{+0.043}_{0}$	51.8	2-M10	48N	$48^{+0.050}_{+0.025}$	$14^{+0.043}_{0}$	51.8	2-M10
50	$50^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	53.5	2-M8	50H	$50^{+0.025}_{0}$	$14^{+0.043}_{0}$	53.8	2-M10	—	—	—	—	—
55	$55^{+0.030}_{0}$	$15^{+0.075}_{+0.032}$	60.0	2-M10	55H	$55^{+0.030}_{0}$	$16^{+0.043}_{0}$	59.3	2-M10	55N	$55^{+0.060}_{+0.030}$	$16^{+0.043}_{0}$	59.3	2-M10
56	$56^{+0.030}_{0}$	$15^{+0.075}_{+0.032}$	61.0	2-M10	56H	$56^{+0.030}_{0}$	$16^{+0.043}_{0}$	60.3	2-M10	—	—	—	—	—
60	$60^{+0.030}_{0}$	$15^{+0.075}_{+0.032}$	65.0	2-M10	60H	$60^{+0.030}_{0}$	$18^{+0.043}_{0}$	64.4	2-M10	60N	$60^{+0.060}_{+0.030}$	$18^{+0.043}_{0}$	64.4	2-M10

* Below ø11 of New JIS compliant and below ø11 of New standard motor compatible have the same contents as Previous JIS compatible (Class 2).

Distance from the edge surface of set screw

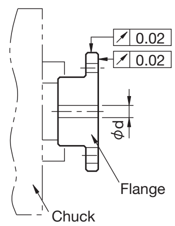
Size	05	06	08	09	10	12	14
Distance [mm]	7	9	10	10	12	12	15

Centering and finishing in flange bore drilling

If customers are planning to apply bore diameter processing using pilot bore items by themselves, the instructions below should be followed:

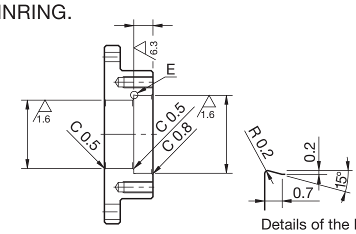
● Centering

According to Figure A, check the center run-out of each size by the flange hub outer diameter. Adjust the chuck to achieve the following accuracy and finish the inner diameter.



● SHPANNRING specification

Finish as illustrated in Figure B when processing to apply the locking method according to SPANNRING.



Combination of standard bore diameter

A type using a friction lock for mounting on the shaft
The combinations of the standard bore diameter of (SFS-□S/W/G-□M-□M) are as follows:

SFS-06		Standard bore diameter d2 [mm]									
		12M	14M	15M	16M	20M	22M	25M	28M	30M	35M
Standard bore diameter d1 [mm]	12M	●	●	●							
	14M		●	●							
	15M			●							

SFS-08		Standard bore diameter d2 [mm]									
		12M	14M	15M	16M	20M	22M	25M	28M	30M	35M
Standard bore diameter d1 [mm]	15M			●	●	●	●				
	16M				●	●	●				
	20M					●	●				
	22M						●				

SFS-09		Standard bore diameter d2 [mm]									
		12M	14M	15M	16M	20M	22M	25M	28M	30M	35M
Standard bore diameter d1 [mm]	25M							●	●		●
	28M								●		●

SFS-10		Standard bore diameter d2 [mm]									
		12M	14M	15M	16M	20M	22M	25M	28M	30M	35M
Standard bore diameter d1 [mm]	25M							●	●	●	●
	28M								●	●	●
	30M									●	●
	35M										●

SFS-12		Standard bore diameter d2 [mm]									
		12M	14M	15M	16M	20M	22M	25M	28M	30M	35M
Standard bore diameter d1 [mm]	30M									380	380
	35M										●

SFS-14		Standard bore diameter d2 [mm]									
		12M	14M	15M	16M	20M	22M	25M	28M	30M	35M
Standard bore diameter d1 [mm]	35M										●

* The bore diameters with value or marked ● are supported as standard bore diameter.
* The permissible torque of small bore diameter indicated in the column with value is limited by the shaft locking mechanism. The value indicates its operating torque [N·m].

SFS MODEL

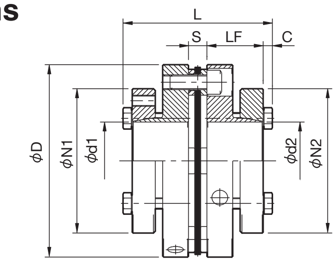
SFS-SS

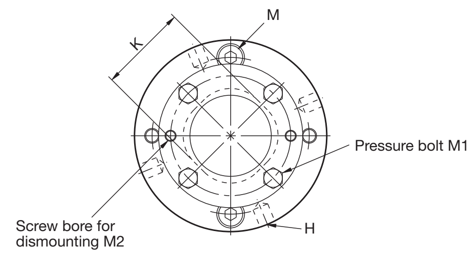
Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min⁻¹]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m²]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFS-080SS	100	0.02	1	±0.55	15000	83000	60	1.24×10^{-3}	1.38	–
SFS-090SS	180	0.02	1	±1.2	15000	170000	122	2.08×10^{-3}	1.70	–
SFS-100SS	250	0.02	1	±1.4	15000	250000	160	3.58×10^{-3}	2.30	–
SFS-120SS	450	0.02	1	±1.6	15000	430000	197	6.32×10^{-3}	3.02	–
SFS-140SS	800	0.02	1	±1.8	15000	780000	313	11.30×10^{-3}	4.47	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.

Dimensions





CAD

Unit [mm]

Model	D	L	d1·d2	N1·N2	LF	S	C	K	H	M	M1	M2
SFS-080SS	82	71	22	58	26.5	8	5	38	4-5.1 drill	M8	4-M6	2-M6
			25	63								
			28 · 30 · 32	68								
			35	73								
SFS-090SS	94	71	32	68	26.5	8	5	42	4-6.8 drill	M8	4-M6	2-M6
			35	73								
			38 · 40 · 42	78								
			45	83								
			48	88								
SFS-100SS	104	81	35	73	30.5	10	5	48	4-8.6 drill	M8	4-M6	2-M6
			38 · 40 · 42	78								
			45	83								
			48 · 50 · 52	88								
			55 · 60	98								
SFS-120SS	122	82	38 · 40 · 42	78	30.5	11	5	54	4-8.6 drill	M10	4-M6	2-M6
			45	83								
			48 · 50 · 52	88								
			55 · 60 · 62	98								
			65 · 70	108								
SFS-140SS	144	96	45 · 48	98	36.5	12	5.5	61	4-8.6 drill	M12	6-M8	2-M8
			50 · 52 · 55	108							6-M8	
			60	118							4-M8	
			62 · 65 · 70	128							4-M8	
			75 · 80	138							4-M8	

* The combination of d1 and d2 is not available if both bore diameters are equal or greater than the dimension K. Refer to the “Combination of standard bore diameters”.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ø35, the tolerance is $^{+0.010}_{-0.025}$.

Model	CAD file No.											
SFS-080SS	ø22	ø25	ø28	ø30	ø32	ø35	–	–	–	–	–	–
	SFS-SS01	SFS-SS02	SFS-SS03	SFS-SS04	SFS-SS05	SFS-SS06	–	–	–	–	–	–
SFS-090SS	ø32	ø35	ø38	ø40	ø42	ø45	ø48	–	–	–	–	–
	SFS-SS07	SFS-SS08	SFS-SS09	SFS-SS10	SFS-SS11	SFS-SS12	SFS-SS13	–	–	–	–	–
SFS-100SS	ø35	ø38	ø40	ø42	ø45	ø48	ø50	ø52	ø55	ø60	–	–
	SFS-SS14	SFS-SS15	SFS-SS16	SFS-SS17	SFS-SS18	SFS-SS19	SFS-SS20	SFS-SS21	SFS-SS22	SFS-SS23	–	–
SFS-120SS	ø38	ø40	ø42	ø45	ø48	ø50	ø52	ø55	ø60	ø62	ø65	ø70
	SFS-SS24	SFS-SS25	SFS-SS26	SFS-SS27	SFS-SS28	SFS-SS29	SFS-SS30	SFS-SS31	SFS-SS32	SFS-SS33	SFS-SS34	SFS-SS35
SFS-140SS	ø45	ø48	ø50	ø52	ø55	ø60	ø62	ø65	ø70	ø75	ø80	–
	SFS-SS36	SFS-SS37	SFS-SS38	SFS-SS39	SFS-SS40	SFS-SS41	SFS-SS42	SFS-SS43	SFS-SS44	SFS-SS45	SFS-SS46	–

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Combination of standard bore diameter

SFS-080SS	Standard bore diameter d2 [mm]																			
Standard bore diameter d1 [mm]	22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
22	●	●	●	●	●	●														
25		●	●	●	●	●														
28			●	●	●	●														
30				●	●	●														
32					●	●														
35						●														

SFS-090SS	Standard bore diameter d2 [mm]																			
Standard bore diameter d1 [mm]	22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
32					●	●	●	●	●	●	●									
35						●	●	●	●	●	●									
38							●	●	●	●	●									
40								●	●	●	●									

SFS-100SS	Standard bore diameter d2 [mm]																			
Standard bore diameter d1 [mm]	22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
35						●	●	●	●	●	●	●	●	●	●					
38							●	●	●	●	●	●	●	●	●					
40								●	●	●	●	●	●	●	●					
42									●	●	●	●	●	●	●					
45										●	●	●	●	●	●					

SFS-120SS	Standard bore diameter d2 [mm]																			
Standard bore diameter d1 [mm]	22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
38							300	300	300	300	300	300	300	300	300	300	300	300		
40								315	315	315	315	315	315	315	315	315	315	315		
42									330	330	330	330	330	330	330	330	330	330		
45										350	350	350	350	350	350	350	350	350		
48											370	370	370	370	370	370	370	370		
50												390	390	390	390	390	390	390		
52													410	410	410	410	410	410		

SFS-140SS	Standard bore diameter d2 [mm]																			
Standard bore diameter d1 [mm]	22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
45										●	●	●	●	●	●	●	●	●	●	●
48											●	●	●	●	●	●	●	●	●	●
50												●	●	●	●	●	●	●	●	●
52													●	●	●	●	●	●	●	●
55														●	●	●	●	●	●	●
60															●	●	●	●	●	●

* The bore diameters with value or marked ● are supported as standard bore diameter.
* The permissible torque of small bore diameter indicated in the column with value is limited by the shaft locking mechanism. The value indicates its operating torque [N·m].

Ordering Information

SFS - 080 SS - 25 K - 30 K

- 080: Size
- SS: Type: SS Single element
- 25 K - 30 K: Bore diameter: d1- d2; K: Friction locking

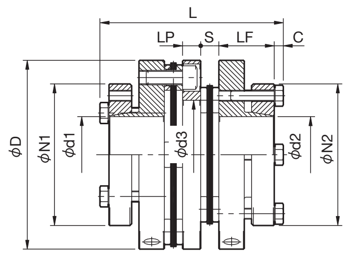
SFS-DS

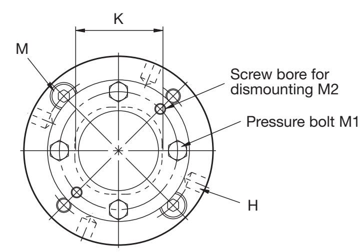
Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min^{-1}]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m^2]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFS-080DS	100	0.3	1 (one side)	±1.1	10000	41000	30	1.61×10^{-3}	1.74	–
SFS-090DS	180	0.3	1 (one side)	±2.4	10000	85000	61	2.71×10^{-3}	2.16	–
SFS-100DS	250	0.3	1 (one side)	±2.8	10000	125000	80	4.53×10^{-3}	2.86	–
SFS-120DS	450	0.4	1 (one side)	±3.2	10000	215000	98	7.93×10^{-3}	4.18	–
SFS-140DS	800	0.4	1 (one side)	±3.6	10000	390000	156	16.60×10^{-3}	6.16	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.

Dimensions





Unit [mm]

Model	D	L	d1·d2	N1·N2	LF	LP	S	C	d3	K	H	M	M1	M2
SFS-080DS	82	89	22	58	26.5	10	8	5	40	38	4-5.1 drill	M8	4-M6	2-M6
			25	63										
			28 · 30 · 32	68										
			35	73										
SFS-090DS	94	89	32	68	26.5	10	8	5	50	42	4-6.8 drill	M8	4-M6	2-M6
			35	73										
			38 · 40 · 42	78										
			45	83										
			48	88										
SFS-100DS	104	101	35	73	30.5	10	10	5	60	48	4-8.6 drill	M8	4-M6	2-M6
			38 · 40 · 42	78										
			45	83										
			48 · 50 · 52	88										
			55 · 60	98										
SFS-120DS	122	107	38 · 40 · 42	78	30.5	14	11	5	62	54	4-8.6 drill	M10	4-M6	2-M6
			45	83										
			48 · 50 · 52	88										
			55 · 60 · 62	98										
			65 · 70	108										
SFS-140DS	144	122	45 · 48	98	36.5	14	12	5.5	70	61	4-8.6 drill	M12	6-M8	2-M8
			50 · 52 · 55	108									6-M8	
			60	118									4-M8	
			62 · 65 · 70	128									4-M8	
			75 · 80	138									4-M8	

* The combination of d1 and d2 is not available if both bore diameters are equal or greater than the dimension K. Refer to the “Combination of standard bore diameters”.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ø35, the tolerance is $^{+0.010}_{-0.025}$.

Model	CAD file No.												
SFS-080DS	Spacer	ø22	ø25	ø28	ø30	ø32	ø35						
	SFS-DS01	SFS-SS01	SFS-SS02	SFS-SS03	SFS-SS04	SFS-SS05	SFS-SS06						
SFS-090DS	Spacer	ø32	ø35	ø38	ø40	ø42	ø45	ø48					
	SFS-DS02	SFS-SS07	SFS-SS08	SFS-SS09	SFS-SS10	SFS-SS11	SFS-SS12	SFS-SS13					
SFS-100DS	Spacer	ø35	ø38	ø40	ø42	ø45	ø48	ø50	ø52	ø55	ø60		
	SFS-DS03	SFS-SS14	SFS-SS15	SFS-SS16	SFS-SS17	SFS-SS18	SFS-SS19	SFS-SS20	SFS-SS21	SFS-SS22	SFS-SS23		
SFS-120DS	Spacer	ø38	ø40	ø42	ø45	ø48	ø50	ø52	ø55	ø60	ø62	ø65	ø70
	SFS-DS04	SFS-SS24	SFS-SS25	SFS-SS26	SFS-SS27	SFS-SS28	SFS-SS29	SFS-SS30	SFS-SS31	SFS-SS32	SFS-SS33	SFS-SS34	SFS-SS35
SFS-140DS	Spacer	ø45	ø48	ø50	ø52	ø55	ø60	ø62	ø65	ø70	ø75	ø80	
	SFS-DS05	SFS-SS36	SFS-SS37	SFS-SS38	SFS-SS39	SFS-SS40	SFS-SS41	SFS-SS42	SFS-SS43	SFS-SS44	SFS-SS45	SFS-SS46	

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Combination of standard bore diameter

SFS-080DS		Standard bore diameter d2 [mm]																			
		22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	22	●	●	●	●	●	●														
	25		●	●	●	●	●														
	28			●	●	●	●														
	30				●	●	●														
	32					●	●														
	35						●														

SFS-090DS		Standard bore diameter d2 [mm]																			
		22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	32					●	●	●	●	●	●	●									
	35						●	●	●	●	●	●									
	38							●	●	●	●	●									
	40								●	●	●	●									

SFS-100DS		Standard bore diameter d2 [mm]																			
		22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	35						●	●	●	●	●	●	●	●	●	●					
	38							●	●	●	●	●	●	●	●	●					
	40								●	●	●	●	●	●	●	●					
	42									●	●	●	●	●	●	●					
	45										●	●	●	●	●	●					

SFS-120DS		Standard bore diameter d2 [mm]																			
		22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	38							300	300	300	300	300	300	300	300	300	300	300	300		
	40								315	315	315	315	315	315	315	315	315	315	315		
	42									330	330	330	330	330	330	330	330	330	330		
	45										350	350	350	350	350	350	350	350	350		
	48											370	370	370	370	370	370	370	370		
	50												390	390	390	390	390	390	390		
	52													410	410	410	410	410	410		

SFS-140DS		Standard bore diameter d2 [mm]																			
		22	25	28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	45										●	●	●	●	●	●	●	●	●	●	●
	48											●	●	●	●	●	●	●	●	●	●
	50												●	●	●	●	●	●	●	●	●
	52													●	●	●	●	●	●	●	●
	55														●	●	●	●	●	●	●
	60															●	●	●	●	●	●

* The bore diameters with value or marked ● are supported as standard bore diameter.
* The permissible torque of small bore diameter indicated in the column with value is limited by the shaft locking mechanism. The value indicates its operating torque [N·m].

Ordering Information

SFS - 090 DS - 35 K - 48 K

- 090: Size
- DS: Type: DS Double element
- 35 K - 48 K: Bore diameter: d1- d2, K: Friction locking

Design Check Items

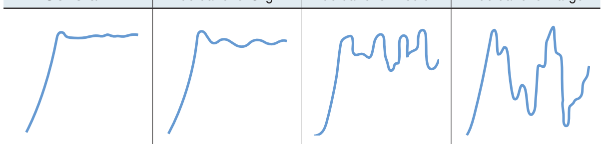
Selection procedure

(1) Calculate torque Ta applied to the coupling based on the motor output P and coupling operating rotation speed n.

$$Ta\ [N{\cdot}m] = 9550 \times \frac{P\ [kW]}{n\ [min^{-1}]}$$

(2) Calculate corrected torque Td applied to the coupling after deciding the service factor K based on load conditions.

$$Td = Ta \times K \text{ (see below)}$$

Load character			
Constant	Fluctuations: Slight	Fluctuations: Medium	Fluctuations: Large
			
1.0	1.25	1.75	2.25

In servo motor drive, multiply the service factor K=1.2 to 1.5 by the maximum torque of servo motor Ts.

$$Td = Ts \times (1.2 \text{ to } 1.5)$$

(3) Select the size in order that the coupling permissible torque Tn becomes equal or greater than the corrected torque Td.

$$Tn \geq Td$$

(4) Depending on the bore diameters, the coupling permissible torque may be limited. Refer to the “Specification” and “Standard bore diameter.”

(5) Confirm if the required shaft diameter does not exceed the maximum bore diameter of the coupling.

For machines whose load torques periodically fluctuate drastically, contact us.

Feed-screw systems

- Oscillation phenomena of servo motors
  If the eigenfrequency of the entire feed-screw system is under 400 to 500Hz, oscillation may occur depending on the gain adjustment of the servo motor. An oscillation phenomenon of a servo motor occurs mainly by the problem of the eigenfrequency of the entire feed-screw system and the electric control system.
  These problems can be avoided by raising the eigenfrequency of the mechanical system from the design phase or adjusting the tuning function (filter function) of the servo motor.

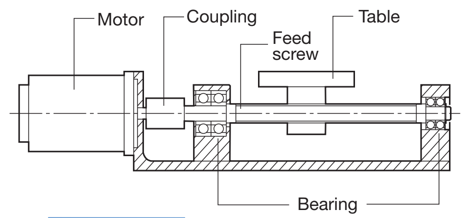
- Resonance caused by stepping motors
  It is a phenomenon that occurs within a certain rotation speed range by the pulsation frequency of the stepping motor and the eigenfrequency of the entire system. Resonance can be avoided by not applying the resonant rotation speed, or by reviewing the eigenfrequency in the design phase.

Contact us for unclear points concerning ocsillation phenomena of servo motors and resonance of stepping motors.

How to evaluate the eigenfrequency of feed-screw system

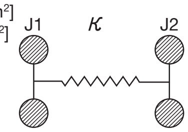
(1) Select the coupling according to the normal operating torque and maximum torque of the servo motor/stepping motor. (Refer to the selection procedure on the left.)

(2) In the following feed-screw system, evaluate the entire eigenfrequency: Nf from the torsional stiffness: K of the coupling and feed screw, the moment of inertia: J1 of the driving side and the moment of inertia: J2 of the driven side.



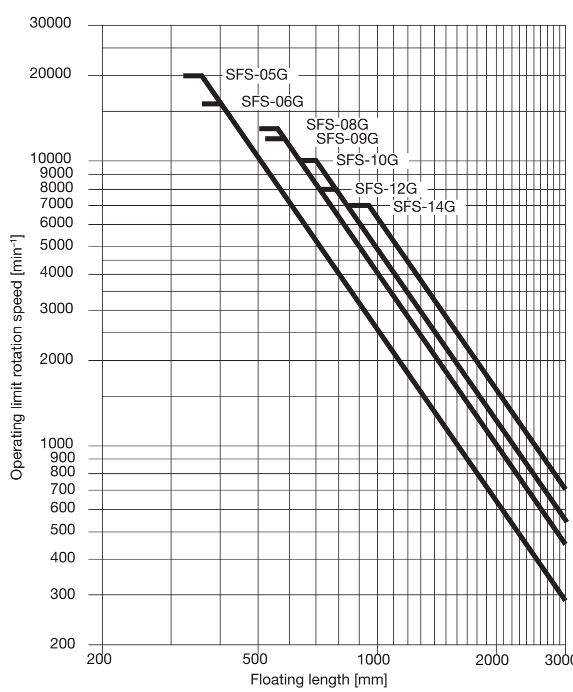
$$Nf = \frac{1}{2\pi}\sqrt{\kappa\left(\frac{1}{J1}+\frac{1}{J2}\right)}$$

Nf: Eigenfrequency of the entire feed-screw system [Hz]
k: Torsional stiffness of the coupling and feed screw [N·m/rad]
J1: Moment of inertia of the driving side [$kg{\cdot}m^2$]
J2: Moment of inertia of the driven side [$kg{\cdot}m^2$]



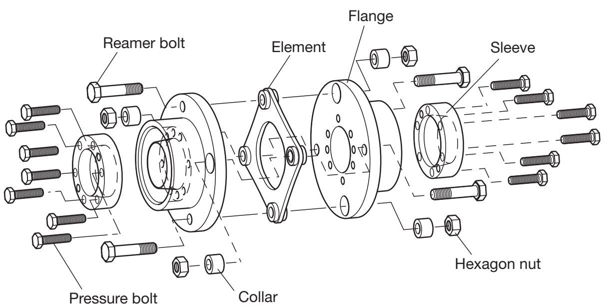
Operating limit rotation speed

For the SFS-G long spacer type, the rotation speed at which it can be operated differs according to the spacer length selected. Check the table below and make sure that the rotation speed to be used is lower than or equal to the operating limit rotation speed.
If the maximum rotation speed is specified by type, this specified rotation speed will be used as the upper limit.



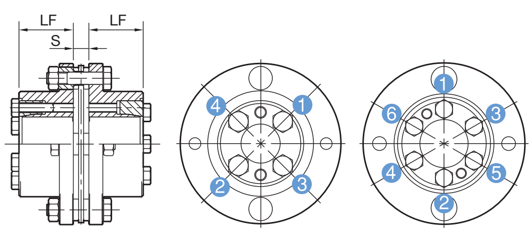
Mounting (SFS-S/W/G-M-M type)

SFS-S/W/G types are parts-delivered products. Shafts are linked after installing the flange hub on each shaft, centering the flange hub, and finally installing the element (spacer). SFS-S/W/G-M-M type can even insert shafts after assembling couplings by installing elements on the flange hub and centering them. When doing so, see mounting method of SFS-SS/DS models.



(1) Tighten the pressure bolts of the flange, and make sure that the sleeve is free. Remove dust, dirt, and oil, etc. from the shaft and the inner diameter of the coupling. (Grease should be wiped away with a waste cloth, etc. or by degreasing as required.)

(2) Make sure that the insertion length of the coupling into the shaft is kept in the position so that the target shaft is in contact with the entire length of the flange (LF dimension) as illustrated below. After this, refer to the following drawing for the sequence to tighten the pressure bolts, and make sure that the bolts are tightened equally little by little diagonally.



(3) Install the other flange on the target shaft as in (1) and (2).

(4) Make sure that the dimension between flange hub parts (S dimension) is kept within the axial displacement tolerance set for the basic value. However, this value is a permissible value assuming that both parallel offset and angular misalignment values are zero. Adjust the value to be as small as possible.

Coupling size	05	06	08	09	10	12	14
S dimension [mm]	5	6	6	8	10	11	12

(5) Insert an element into the space between the two flanges and mount it with the reamer bolts for element fixing. Check that element is not deformed. If any deformation is found, the following can be considered: unnecessary force has been applied in the axial direction or there is a lack of lubrication among the collar, bolts, and plate spring. Adjust the deformation so that it is corrected to normal. On the reamer bolt-bearing surface, this might be improved by coating a small amount of machine oil. However, do not use oils such as those containing molybdic extreme-pressure agents.

(6) To tighten reamer bolts and pressure bolts, use a calibrated torque wrench at the tightening torque as shown in the table below for all the bolts.

Coupling size	05	06	08	09	10	12	14
Reamer bolt	M5	M6	M6	M8	M8	M10	M12
Tightening torque [N·m]	8	14	14	34	34	68	118
Pressure bolt	M5	M6	M6	M6	M6	M8	M8
Tightening torque [N·m]	8	14	14	14	14	34	34

Mounting (SFS-SS/DS type)

SFS-SS/DS types are finished-assembly products. The concentricity of the right and left inner diameters of the coupling is set by assembling the parts with high precision using a specialized jig.
Be careful when handling the product in case of a strong shock to the coupling because it might be damaged during use due to the assembly accuracy cannot be maintained.

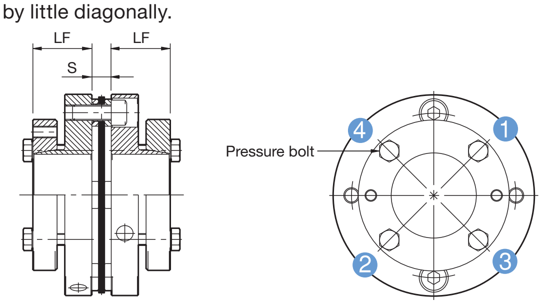
(1) Make sure that the pressure bolts of the coupling are loosened, and remove dust, dirt, and oil, etc. from the shaft and the inner diameter of the coupling. (Grease should be wiped away with a cloth, etc. or by degreasing as required.)

(2) When inserting the coupling into the shaft, make sure that no excessive force such as compression, tension, etc. is applied to the element.
Especially when inserting the coupling into the target shaft after installing on the other shaft, be careful because excessive compression force might be applied by mistake.

(3) Confirm if the pressure bolts are loosened and the coupling is movable to the axial and rotative directions. If it does not move smoothly, adjust centering of both shafts again.

(4) Make sure that the dimension between flange hub parts (S dimension) is kept within the axial displacement tolerance set for the basic value. However, this value is a permissible value assuming that both parallel offset and angular misalignment values are zero. Adjust the value to be as small as possible.

(5) Make sure that the insertion length of the coupling into the shaft is kept in the position so that the target shaft is in contact with the entire length of the flange hub of the coupling (LF dimension) as illustrated below. After this, refer to the following drawing for the sequence to tighten the pressure bolts, and make sure that the bolts are tightened equally little by little diagonally.



Coupling size	080	090	100	120	140
S dimension [mm]	8	8	10	11	12
LF dimension [mm]	26.5	26.5	30.5	30.5	36.5

(6) A calibrated torque wrench is used to tighten the pressure bolts, and the following appropriate tightening torques are used for tightening all the pressure bolts.

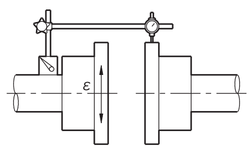
Coupling size	080	090	100	120	140
Pressure bolt	M6	M6	M6	M6	M8
Tightening torque [N·m]	14	14	14	14	34

Design Check Items

Centering method

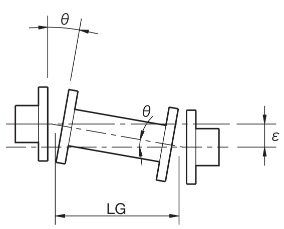
● Parallel Offset (ε)

Fix the dial gauge on one side of the shaft and read the run-out of the outer periphery of the other flange while rotating the shaft. The models (SFS-S and SS types) with one pair of elements (plate springs) do not allow parallel offset and should be moved close to 0. For Models whose full length can be set freely (SFS-G type), use the following formula to calculate the permissible parallel offset values.



$$\varepsilon = \tan\theta \times LG$$

ε: Permissible parallel offset
θ: 1°

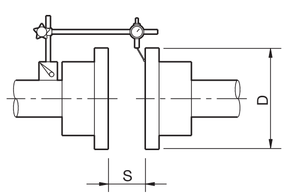


$$LS = LS + S$$

LS: Full length of space
S : Dimension between flange on one side and spacer

● Angular Misalignment (θ)

Fix the dial gauge on one side of the shaft and read the run-out of the end surface near the outer periphery of the other flange while rotating the shaft.
Adjust run-out B so that ($\theta \leq 1°$) can be accomplished.



$$B = D \times \tan\theta$$

B: Run-out
D: Flange outer diameter
θ: 1°

● Axial Displacement (S)

The face-to-face dimension between flange hubs (S) must be within the permissible error of the axial displacement in the basic value. However, the value is allowable when the parallel offset and angular misalignment are assumed to be 0 (zero). Adjust to achieve them to be as small as possible.

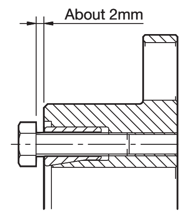
* The S dimension of SFS-S/SS is a dimension between two flange hubs. The S dimension of SFS-W/G/DS is a dimension between a flange and a spacer.

Dismounting

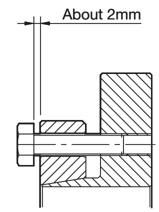
(1) Confirm if any torque or axial direction load does not act on the coupling. (Torque may be applied to the coupling when a safety break control system is activated. Make sure no torque is applied to the coupling.)

(2) Loosen all the pressure bolts about 2mm from the bearing surface.

■ SFS-S/W/G type



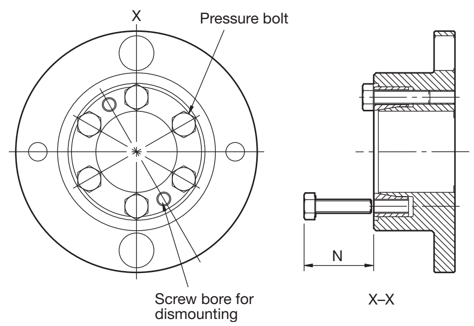
■ SFS-SS/DS type



In the tapered shaft fastening method that tightens the pressure bolts from the axial direction, the sleeve has a self-locking mechanism so that loosening the bolts does not release fastening of the flange hub and shaft. (In some cases, fastening power could be released by just loosening the pressure bolts.) Therefore, a space for inserting a dismounting screw must be considered in the coupling design phase. If there is no space in the axial direction, contact us for further information.

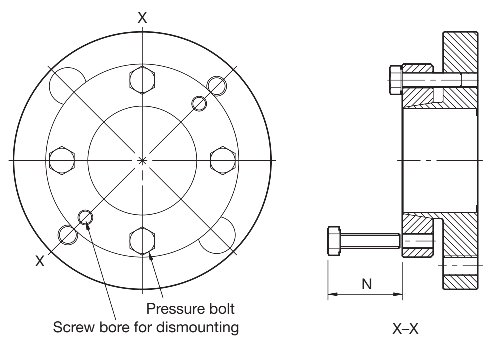
(3) Remove two pressure bolts loosened in (2) and insert them into the two screw bores for dismounting located on the sleeve. Tighten them alternately little by little. Fastening of the flange hub and shaft will be released.

■ SFS-S/W/G type



Coupling size	06	08	09	10	12	14
Pressure bolt nominal desig. × length	M5×20	M6×24	M6×24	M6×24	M8×25	M8×25
Recommended N dimensions [mm]	26	30	30	30	31.5	31.5

■ SFS-SS/DS type

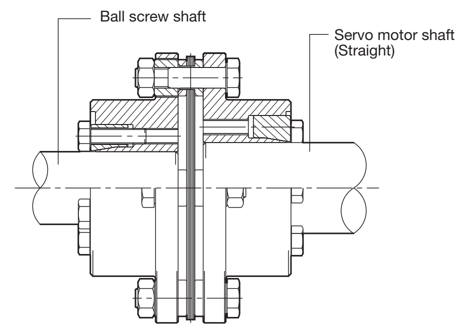


Coupling size	080	090	100	120	140
Pressure bolt nominal desig. × length	M6×22	M6×22	M6×24	M6×24	M8×35
Recommended N dimensions [mm]	28	28	30	30	40.5

■ Example of mounting

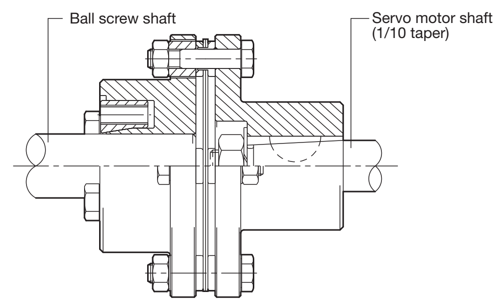
● SFS-S-M-M

This is a combination of high-precision friction lock flanges. In this case, shafts can be jointed together after finishing the coupling.



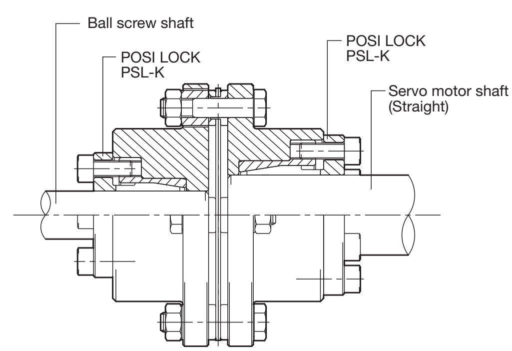
● SFS-S-M-C

This is a combination of a high-precision friction lock flange and taper shaft-compatible flange. They are assembled by tightening the servo motor shaft ends with nuts.



● SFS-S

This is an example of a pilot bore-type flange hub processed for Miki Pulley's shaft lock, POSI LOCK PSL-K, and jointed with a straight shaft.



SFF · SFM MODEL

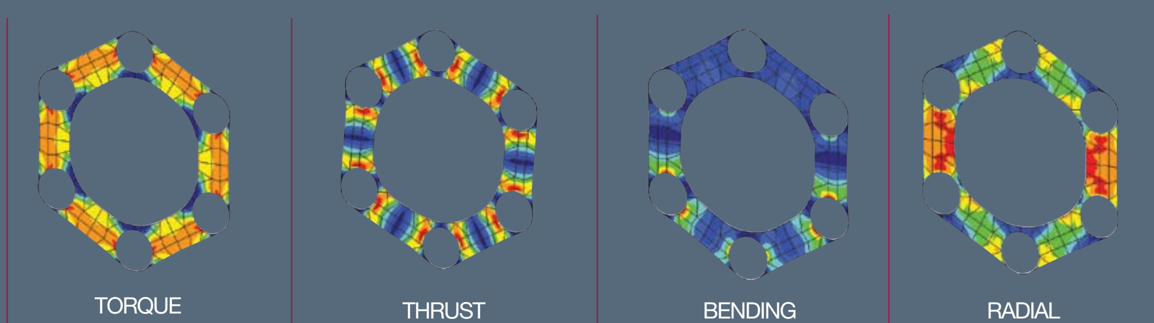
Two Standardized Models Durable under the Harsh Specifications Required for Machine Tools

A selection of SFF models is available for use by the feed shaft, and a selection of SFM models is available for use by the main shaft.
Two types of couplings, either a high-rigidity type with one element or a high-flexibility type with two elements using a spacer, can be selected respectively.
In particular, the SFM model that has been developed for the main shaft of machine tools allows a maximum rotation speed of 20,000 min^{-1} and is capable of substantially lowering wind roar during high-speed rotation by the design that lowers the coupling circumference or edge irregularity to the extent possible.
It is mounted by a high-reliability friction lock. Extremely high-precision mounting is realized by using a centering mechanism.

PLATE SPRING OF IDEAL FORM

High Rigidity, High Flexibility

A plate spring with an ideal shape through design based on thorough analysis using the advanced finite element method (FEM) is applied for the element.
This is available with a choice between the high-rigidity type with one element and the high-flexibility type with two elements using a spacer.



High-speed Rotation, High-precision Positioning

- The coupling specially designed for high-speed applications allows a maximum rotation speed of 20,000 min^{-1}.
  SFM model
- Centering mechanisms are set for both the flange and pressure flange to achieve high-precision positioning.
  SFM model

SFF · SFM MODEL

SFF · SFM MODEL

SERVO FLEX for machine tools

SFF for the feed shaft	Friction lock	High-rigidity single element	**SFF-□SS-□K-□K**
		High-flexibility double element	**SFF-□DS-□K-□K**
SFM for the main shaft	High-precision friction lock	High-rigidity single element	**SFM-□SS-□K-□K**
		High-flexibility double element	**SFM-□DS-□K-□K**

The Maximum Rotation Speed of 20,000 min^{-1} Realized

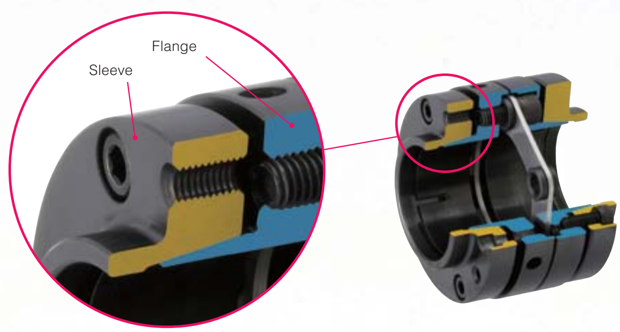
The coupling specially designed for high-speed applications allows a maximum rotation speed of 20,000 min^{-1}.
Stable power transmission at high-speed rotation is ensured.
SFM model

Low Noise

The outer circumference of the plate spring is covered with a flange and pressure bolts are installed on the pressure flange to reduce irregularities of shape to the extent possible. Wind roar during high-speed rotation can be dramatically reduced.
SFM model

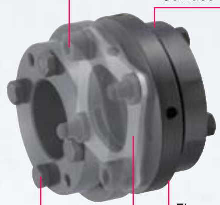
High-precision Positioning

Centering mechanisms are set for both the flange and pressure flange to achieve high-precision positioning.
SFM model



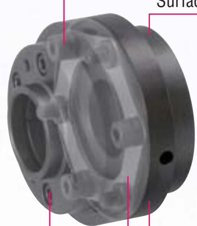
Structure and Material

SFF-SS



SFF-DS

SFM-SS



SFM-DS

SFF · SFM MODEL

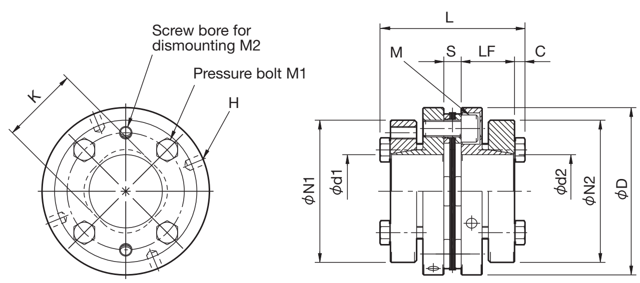
SFF-SS

Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min⁻¹]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m²]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Radial displacement [mm]						
SFF-070SS	70	0.02	1	±0.5	18000	60000	105	$0.68×10^{-3}$	0.93	–
SFF-080SS	130	0.02	1	±0.5	17000	64000	96	$1.03×10^{-3}$	1.22	–
SFF-090SS	200	0.02	1	±0.6	15000	140000	320	$2.06×10^{-3}$	1.63	–
SFF-100SS	300	0.02	1	±0.7	13000	160000	360	$2.99×10^{-3}$	1.81	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The torsional stiffness indictes the value of element.

Dimensions



Unit [mm]

Model	D	L	d1·d2	N1·N2	LF	S	C	K	H	M	M1	M2
SFF-070SS	70	63.5	18 · 19	53	23.5	6.5	5	31	4-5.1	M6	4-M6	2-M6
			20 · 22 · 24 · 25	58								
			28 · 30	63								
			32 · 35	68								
SFF-080SS	80	69.3	22 · 24 · 25	58	25.5	8.3	5	37	4-5.1	M8	4-M6	2-M6
			28 · 30	63								
			32 · 35	68								
SFF-090SS	90	68.7	28	68	25.5	7.7	5	50	3-6.8	M8	6-M6	3-M6
			30 · 32 · 35	73								
			38 · 40	78								
			42 · 45	83								
			48	88								
SFF-100SS	100	69.0	32 · 35	73	25.5	8	5	58	3-6.8	M8	6-M6	3-M6
			38 · 40	78								
			42 · 45	83								
			48 · 50 · 52	88								
			55	93								
			60	98								

* The combination of d1 and d2 is not available if both bore diameters are greater than the dimension K. Refer to the “Combination of standard bore diameters”.

Model	CAD file No.										
SFF-070SS	ø18	ø19	20	ø22	ø24	ø25	ø28	ø30	ø32	ø35	–
	SFF-SS01	SFF-SS02	SFF-SS03	SFF-SS04	SFF-SS05	SFF-SS06	SFF-SS07	SFF-SS08	SFF-SS09	SFF-SS10	–
SFF-080SS	ø22	ø24	ø25	ø28	ø30	ø32	ø35	–	–	–	–
	SFF-SS11	SFF-SS12	SFF-SS13	SFF-SS14	SFF-SS15	SFF-SS16	SFF-SS17	–	–	–	–
SFF-090SS	ø28	ø30	ø32	ø35	ø38	ø40	ø42	ø45	ø48	–	–
	SFF-SS18	SFF-SS19	SFF-SS20	SFF-SS21	SFF-SS22	SFF-SS23	SFF-SS24	SFF-SS25	SFF-SS26	–	–
SFF-100SS	ø32	ø35	ø38	ø40	ø42	ø45	ø48	ø50	ø52	ø55	ø60
	SFF-SS27	SFF-SS28	SFF-SS29	SFF-SS30	SFF-SS31	SFF-SS32	SFF-SS33	SFF-SS34	SFF-SS35	SFF-SS36	SFF-SS37

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Combination of standard bore diameter

SFF-070SS		Standard bore diameter d2 [mm]																		
		18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
Standard bore diameter d1 [mm]	18	●	●	●	●	●	●	●	●	●	●									
	19		●	●	●	●	●	●	●	●	●									
	20			●	●	●	●	●	●	●	●									
	22				●	●	●	●	●	●	●									
	24					●	●	●	●	●	●									
	25						●	●	●	●	●									
	28							●	●	●	●									
	30								●	●	●									

SFF-080SS		Standard bore diameter d2 [mm]																		
		18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
Standard bore diameter d1 [mm]	22				●	●	●	●	●	●	●									
	24					●	●	●	●	●	●									
	25						●	●	●	●	●									
	28							●	●	●	●									
	30								●	●	●									
	32									●	●									
	35										●									

SFF-090SS		Standard bore diameter d2 [mm]																		
		18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
Standard bore diameter d1 [mm]	28							●	●	●	●	●	●	●	●	●				
	30								●	●	●	●	●	●	●	●				
	32									●	●	●	●	●	●	●				
	35										●	●	●	●	●	●				
	38											●	●	●	●	●				
	40												●	●	●	●				
	42													●	●	●				
	45														●	●				
	48															●				

SFF-100SS		Standard bore diameter d2 [mm]																		
		18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
Standard bore diameter d1 [mm]	32									●	●	●	●	●	●	●	●	●	●	●
	35										●	●	●	●	●	●	●	●	●	●
	38											●	●	●	●	●	●	●	●	●
	40												●	●	●	●	●	●	●	●
	42													●	●	●	●	●	●	●
	45														●	●	●	●	●	●
	48															●	●	●	●	●
	50																●	●	●	●
	52																	●	●	●
	55																		●	●

Ordering Information

SFF - 080 S S - 25 K K - 30 K K

- Size
- Type
  S: Single element type
- Material
  S: Steel
- Bore dia. 1
- Locking method
  K: Friction locking
- Mating shaft tolerance
  Blank: h7
  K: k6
  M: m6
  J: j6
  S: 35 $^{+0.010}_{0}$
- Bore dia. 2
- Locking method
  K: Friction locking
- Mating shaft tolerance
  Blank: h7
  K: k6
  M: m6
  J: j6
  S: 35 $^{+0.010}_{0}$

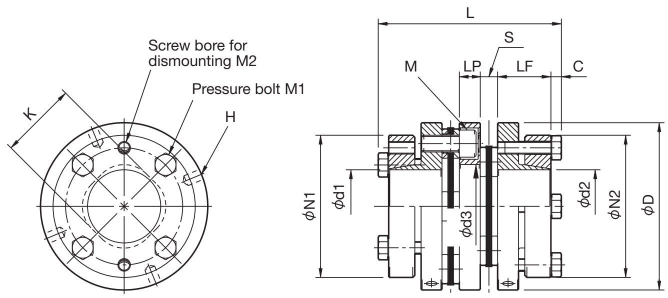
SFF-DS

Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min⁻¹]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m²]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFF-070DS	70	0.25	1 (one side)	±1.0	14000	30000	53	0.83×10^{-3}	1.14	–
SFF-080DS	130	0.31	1 (one side)	±1.0	13000	32000	48	1.36×10^{-3}	1.57	–
SFF-090DS	200	0.30	1 (one side)	±1.2	12000	70000	160	2.58×10^{-3}	2.03	–
SFF-100DS	300	0.31	1 (one side)	±1.4	10000	80000	180	3.76×10^{-3}	2.27	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The torsional stiffness indictes the value of element.

Dimensions



Unit [mm]

Model	D	L	d1·d2	N1·N2	LF	LP	S	C	d3	K	H	M	M1	M2
SFF-070DS	70	78	18 · 19	53	23.5	8	6.5	5	35	31	4-5.1	M6	4-M6	2-M6
			20 · 22 · 24 · 25	58										
			28 · 30	63										
			32 · 35	68										
SFF-080DS	80	87.6	22 · 24 · 25	58	25.5	10	8.3	5	40	37	4-5.1	M8	4-M6	2-M6
			28 · 30	63										
			32 · 35	68										
SFF-090DS	90	86.4	28	68	25.5	10	7.7	5	50	50	3-6.8	M8	6-M6	3-M6
			30 · 32 · 35	73										
			38 · 40	78										
			42 · 45	83										
			48	88										
SFF-100DS	100	87	32 · 35	73	25.5	10	8	5	60	58	3-6.8	M8	6-M6	3-M6
			38 · 40	78										
			42 · 45	83										
			48 · 50 · 52	88										
			55	93										
			60	98										

* The combination of d1 and d2 is not available if both bore diameters are equal or greater than the dimension K. Refer to the “Combination of standard bore diameters”.

Model	CAD file No.										
SFF-070DS	Spacer	ø18	ø19	ø20	ø22	ø24	ø25	ø28	ø30	ø32	ø35	–
	SFF-DS01	SFF-SS01	SFF-SS02	SFF-SS03	SFF-SS04	SFF-SS05	SFF-SS06	SFF-SS07	SFF-SS08	SFF-SS09	SFF-SS10	–
SFF-080DS	Spacer	ø22	ø24	ø25	ø28	ø30	ø32	ø35	–	–	–	–
	SFF-DS02	SFF-SS11	SFF-SS12	SFF-SS13	SFF-SS14	SFF-SS15	SFF-SS16	SFF-SS17	–	–	–	–
SFF-090DS	Spacer	ø28	ø30	ø32	ø35	ø38	ø40	ø42	ø45	ø48	–	–
	SFF-DS03	SFF-SS18	SFF-SS19	SFF-SS20	SFF-SS21	SFF-SS22	SFF-SS23	SFF-SS24	SFF-SS25	SFF-SS26	–	–
SFF-100DS	Spacer	ø32	ø35	ø38	ø40	ø42	ø45	ø48	ø50	ø52	ø55	ø60
	SFF-DS04	SFF-SS27	SFF-SS28	SFF-SS29	SFF-SS30	SFF-SS31	SFF-SS32	SFF-SS33	SFF-SS34	SFF-SS35	SFF-SS36	SFF-SS37

* CAD data is provided for one flange for each bore diameter. Use the data in combination.

Combination of standard bore diameter

SFF-070DS	Standard bore diameter d2 [mm]																		
Standard bore diameter d1 [mm]	18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
18	●	●	●	●	●	●	●	●	●	●									
19		●	●	●	●	●	●	●	●	●									
20			●	●	●	●	●	●	●	●									
22				●	●	●	●	●	●	●									
24					●	●	●	●	●	●									
25						●	●	●	●	●									
28							●	●	●	●									
30								●	●	●									

SFF-080DS	Standard bore diameter d2 [mm]																		
Standard bore diameter d1 [mm]	18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
22				●	●	●	●	●	●	●									
24					●	●	●	●	●	●									
25						●	●	●	●	●									
28							●	●	●	●									
30								●	●	●									
32									●	●									
35										●									

SFF-090DS	Standard bore diameter d2 [mm]																		
Standard bore diameter d1 [mm]	18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
28							●	●	●	●	●	●	●	●	●				
30								●	●	●	●	●	●	●	●				
32									●	●	●	●	●	●	●				
35										●	●	●	●	●	●				
38											●	●	●	●	●				
40												●	●	●	●				
42													●	●	●				
45														●	●				
48															●				

SFF-100DS	Standard bore diameter d2 [mm]																		
Standard bore diameter d1 [mm]	18	19	20	22	24	25	28	30	32	35	38	40	42	45	48	50	52	55	60
32									●	●	●	●	●	●	●	●	●	●	●
35										●	●	●	●	●	●	●	●	●	●
38											●	●	●	●	●	●	●	●	●
40												●	●	●	●	●	●	●	●
42													●	●	●	●	●	●	●
45														●	●	●	●	●	●
48															●	●	●	●	●
50																●	●	●	●
52																	●	●	●
55																		●	●

Ordering Information

SFF - 080 D S - 25 K K - 30 K K

- Size: 080
- Type: D: Double element type
- Material: S: Steel
- Bore dia. 1: 25
- Locking method: K: Friction locking
- Mating shaft tolerance: Blank: h7, K: k6, M: m6, J: j6, S: 35 $^{+0.010}_{0}$
- Bore dia. 2: 30
- Locking method: K: Friction locking
- Mating shaft tolerance: Blank: h7, K: k6, M: m6, J: j6, S: 35 $^{+0.010}_{0}$

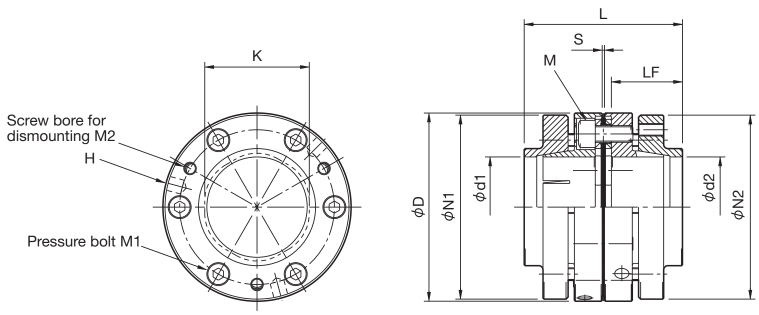
SFM-SS

Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min⁻¹]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m²]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFM-090SS	200	0.02	1	±0.6	20000	140000	320	1.87×10^{-3}	1.66	–
SFM-100SS	300	0.02	1	±0.7	20000	160000	360	3.56×10^{-3}	2.07	–
SFM-120SS	500	0.02	1	±0.8	20000	140000	360	6.65×10^{-3}	2.90	–
SFM-140SS	800	0.02	1	±1.0	20000	100000	360	16.9×10^{-3}	5.35	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The torsional stiffness indictes the value of element.

Dimensions



Unit [mm]

Model	D	L	d1·d2	N1·N2	LF	S	K	H	M	M1	M2	CAD file No.
SFM-090SS	90	75.7	28 · 30	73	34	1.1	50	3-6.8	M8	6-M6	3-M6	–
			32 · 35	78								
			38 · 40 · 42	83								
			45 · 48	88								
SFM-100SS	100	76	32 · 35	78	34	1	58	3-6.8	M8	6-M6	3-M6	–
			38 · 40 · 42	83								
			45 · 48	88								
			50 · 52	93								
			55	98								
			60	105								
SFM-120SS	120	82.2	38 · 40 · 42	83	36	1	68	3-8.6	M10	6-M6	3-M6	–
			45 · 48	88								
			50 · 52	93								
			55	98								
			60 · 62 · 65	105								
			70	115								
SFM-140SS	140	100.6	45	98	45	1	78	3-8.6	M12	6-M8	3-M8	–
			48 · 50 · 52	105								
			55	108								
			60 · 62	115								
			65	118								
			70 · 75	125								
			80	135								

* The combination of d1 and d2 is not available if both bore diameters are equal or greater than the dimension K. Refer to the “Combination of standard bore diameters”.

Combination of standard bore diameter

SFM-090SS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	28	●	●	●	●	●	●	●	●	●									
	30		●	●	●	●	●	●	●	●									
	32			●	●	●	●	●	●	●									
	35				●	●	●	●	●	●									
	38					●	●	●	●	●									
	40						●	●	●	●									
	42							●	●	●									
	45								●	●									
	48									●									

SFM-100SS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	32			●	●	●	●	●	●	●	●	●	●	●					
	35				●	●	●	●	●	●	●	●	●	●					
	38					●	●	●	●	●	●	●	●	●					
	40						●	●	●	●	●	●	●	●					
	42							●	●	●	●	●	●	●					
	45								●	●	●	●	●	●					
	48									●	●	●	●	●					
	50										●	●	●	●					
	52											●	●	●					
	55												●	●					

SFM-120SS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	38					●	●	●	●	●	●	●	●	●	●	●	●		
	40						●	●	●	●	●	●	●	●	●	●	●		
	42							●	●	●	●	●	●	●	●	●	●		
	45								●	●	●	●	●	●	●	●	●		
	48									●	●	●	●	●	●	●	●		
	50										●	●	●	●	●	●	●		
	52											●	●	●	●	●	●		
	55												●	●	●	●	●		
	60													●	●	●	●		
	62														●	●	●		
	65															●	●		

SFM-140SS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	45								●	●	●	●	●	●	●	●	●	●	●
	48									●	●	●	●	●	●	●	●	●	●
	50										●	●	●	●	●	●	●	●	●
	52											●	●	●	●	●	●	●	●
	55												●	●	●	●	●	●	●
	60													●	●	●	●	●	●
	62														●	●	●	●	●
	65															●	●	●	●
	70																●	●	●
	75																	●	●

SERVO FLEX SFF · SFM

Ordering Information

SFM - 090 S S - 28 K K - 30 K K - G 2.5 / 15000

- Size
- Type
  S: Single element type
- Material
  S: Steel
- Bore dia. 1
- Locking method
  K: Friction locking
- Mating shaft tolerance
  Blank: h6
  J: j6
  K: k6
  S: 35 $^{+0.010}_{0}$
  M: m6
- Bore dia. 2
- Locking method
  K: Friction locking
- Mating shaft tolerance
  Blank: h6
  J: j6
  K: k6
  S: 35 $^{+0.010}_{0}$
  M: m6
- Balance class
- Practical max. rotation speed (min^{-1})

* Balance class and practical max. rotation speed are options available on request.

The latest CAD data can be downloaded from our website. **http://www.mikipulley.co.jp/**

The CAD mark indicates that CAD data is available by CD-ROM.
The CAD file No. represents the file name in the CD-ROM.

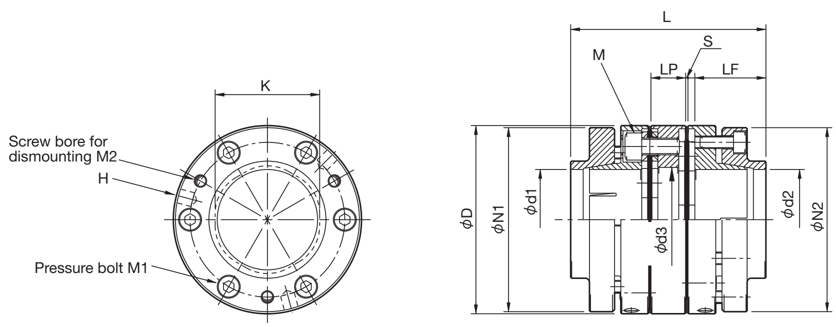
SFM-DS

Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min⁻¹]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m²]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFM-090DS	200	0.30	1 (one side)	±1.2	15000	70000	160	2.43×10^{-3}	2.08	–
SFM-100DS	300	0.31	1 (one side)	±1.4	15000	80000	180	4.39×10^{-3}	2.56	–
SFM-120DS	500	0.38	1 (one side)	±1.6	15000	70000	180	8.74×10^{-3}	3.76	–
SFM-140DS	800	0.44	1 (one side)	±2.0	15000	50000	180	21.5×10^{-3}	6.77	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The torsional stiffness indictes the value of element.

Dimensions



Unit [mm]

Model	D	L	d1·d2	N1·N2	LF	LP	S	d3	K	H	M	M1	M2	CAD file No.
SFM-090DS	90	93.4	28 · 30	73	34	16.6	1.1	50	50	3-6.8	M8	6-M6	3-M6	–
			32 · 35	78										
			38 · 40 · 42	83										
			45 · 48	88										
SFM-100DS	100	94	32 · 35	78	34	17	1	60	58	3-6.8	M8	6-M6	3-M6	–
			38 · 40 · 42	83										
			45 · 48	88										
			50 · 52	93										
			55	98										
			60	105										
SFM-120DS	120	104.4	38 · 40 · 42	83	36	21.2	1	72	68	3-8.6	M10	6-M6	3-M6	–
			45 · 48	88										
			50 · 52	93										
			55	98										
			60 · 62 · 65	105										
			70	115										
SFM-140DS	140	126.2	45	98	45	24.6	1	80	78	3-8.6	M12	6-M8	3-M8	–
			48 · 50 · 52	105										
			55	108										
			60 · 62	115										
			65	118										
			70 · 75	125										
			80	135										

* The combination of d1 and d2 is not available if both bore diameters are equal or greater than the dimension K. Refer to the “Combination of standard bore diameters”.
* The dimensional tolerance of the target shaft is h7. However, for a shaft diameter of ø35, the tolerance is $^{+0.010}_{-0.025}$.

Combination of standard bore diameter

SFM-090DS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	28	●	●	●	●	●	●	●	●	●									
	30		●	●	●	●	●	●	●	●									
	32			●	●	●	●	●	●	●									
	35				●	●	●	●	●	●									
	38					●	●	●	●	●									
	40						●	●	●	●									
	42							●	●	●									
	45								●	●									
	48									●									

SFM-100DS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	32			●	●	●	●	●	●	●	●	●	●	●					
	35				●	●	●	●	●	●	●	●	●	●					
	38					●	●	●	●	●	●	●	●	●					
	40						●	●	●	●	●	●	●	●					
	42							●	●	●	●	●	●	●					
	45								●	●	●	●	●	●					
	48									●	●	●	●	●					
	50										●	●	●	●					
	52											●	●	●					
	55												●	●					

SFM-120DS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	38					●	●	●	●	●	●	●	●	●	●	●	●		
	40						●	●	●	●	●	●	●	●	●	●	●		
	42							●	●	●	●	●	●	●	●	●	●		
	45								●	●	●	●	●	●	●	●	●		
	48									●	●	●	●	●	●	●	●		
	50										●	●	●	●	●	●	●		
	52											●	●	●	●	●	●		
	55												●	●	●	●	●		
	60													●	●	●	●		
	62														●	●	●		
	65															●	●		

SFM-140DS		Standard bore diameter d2 [mm]																	
		28	30	32	35	38	40	42	45	48	50	52	55	60	62	65	70	75	80
Standard bore diameter d1 [mm]	45								●	●	●	●	●	●	●	●	●	●	●
	48									●	●	●	●	●	●	●	●	●	●
	50										●	●	●	●	●	●	●	●	●
	52											●	●	●	●	●	●	●	●
	55												●	●	●	●	●	●	●
	60													●	●	●	●	●	●
	62														●	●	●	●	●
	65															●	●	●	●
	70																●	●	●
	75																	●	●

Ordering Information

SFM - 090 D S - 28 K K - 30 K K - G 2.5 / 15000

- Size: 090
- Type: D: Double-element type
- Material: S: Steel
- Bore dia. 1: 28
- Locking method: K: Friction locking
- Mating shaft tolerance: Blank: h6 / J: j6 / K: k6 / S: 35 $^{+0.010}_{0}$ / M: m6
- Bore dia. 2: 30
- Locking method: K: Friction locking
- Mating shaft tolerance: Blank: h6 / J: j6 / K: k6 / S: 35 $^{+0.010}_{0}$ / M: m6
- Balance class: G 2.5
- Practical max. rotation speed (min^{-1}): 15000

* Balance class and practical max. rotation speed are options available on request.

Design Check Items

Mounting

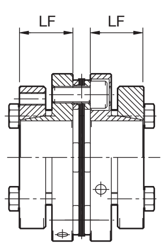
SFF/SFM models are finished-assembly products. The concentricity of the right and left inner diameters of the coupling is set by assembling the parts with high precision using a specialized jig.
Be careful when handling the product in the case of a strong shock to the coupling because it might be damaged during use due to assembly accuracy unable to be maintained.

(1) Make sure that the pressure bolts of the coupling are loosened, and remove dust, dirt, and oil, etc. from the shaft and the inner diameter part of the coupling. (Grease should be wiped away with a cloth, etc., or by degreasing as required.)

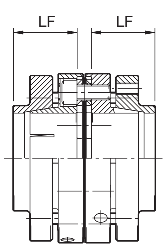
(2) When inserting the coupling into the motor shaft, make sure that no excessive force such as compression, tension, etc. is applied to the element.

(3) Make sure that the insertion length of the coupling into the motor shaft is kept in the position where the target shaft is in contact with the entire length of the flange hub of the coupling (LF dimension) as illustrated below.

■ SFF model



■ SFM model

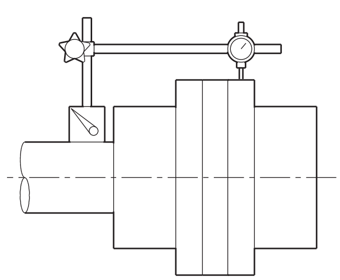


Size (SFF-SS/DS)	070	080	090	100
LF [mm]	23.5	25.5	25.5	25.5

Size (SFM-SS/DS)	090	100	120	140
LF [mm]	34	34	36	45

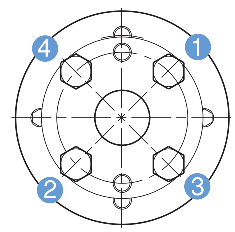
(4) Tighten the pressure bolts lightly diagonally by using a bore for rotation prevention.

(5) Apply a dial gauge to the flange edge or outer diameter of the motor side. While rotating the motor shaft lightly by hand, perform hammer adjustment on the flange periphery and edge so that the parallel offset will be reduced to as close as zero.

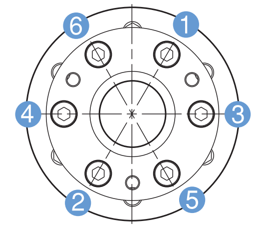


(6) While performing hammer adjustment, tighten the pressure bolts in sequence. Finally, use a calibrated torque wrench and tighten all the pressure bolts at the appropriate tightening torque as shown in the table below. Also, refer to the following drawing for the sequence to tighten the pressure bolts, and make sure that the bolts are tightened equally.

■ SFF model



■ SFM model



Coupling size (SFF-SS/DS)	070	080	090	100
Pressure bolt	M6	M6	M6	M6
Tightening torque [N·m]	10	10	10	10

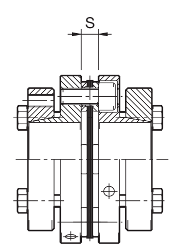
Coupling size (SFM-SS/DS)	090	100	120	140
Pressure bolt	M6	M6	M6	M8
Tightening torque [N·m]	14	14	14	34

(7) Confirm if the pressure bolts of the motor shaft side are tightened to the specified torque and the value of parallel offset is small enough.

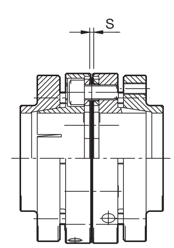
(8) Fix the motor mounted coupling in the machine. At this time, adjust the motor mounting position (inlay) while inserting the coupling into the spindle or feed screw. Check if there is no deformation of the plate spring. Also check if the insertion length of the mating shaft is the dimension LF of the dimension table.

(9) The space between flange hubs (S) must be within the permissible error of the axial displacement in the basic value table. However, the value is allowable when the parallel offset and angular misalignment are assumed to be 0 (zero). Adjust to achieve them to be as small as possible.

■ SFF model



■ SFM model



Size (SFF-SS/DS)	070	080	090	100
S dimensions [mm]	6.5	8.3	7.7	8.0

Size (SFM-SS/DS)	090	100	120	140
S dimensions [mm]	1.1	1.0	1.0	1.0

(10) As in the sequence for the pressure bolts on the motor shaft side, sequentially tighten the pressure bolts on either the spindle side or the feed screw side. Finally, tighten the bolts at the appropriate tightening torque.

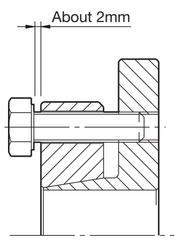
(11) As a countermeasure against initial loosening of the pressure bolts, it is recommended to additionally tighten the bolts with the appropriate tightening torque after a certain period of operation.

Dismounting

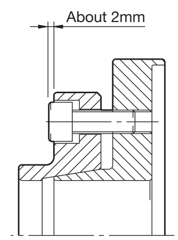
(1) Confirm if any torque or axial direction load does not act on the coupling. Torque may be applied to the coupling when a safety break control system is activated. Make sure no torque is applied to the coupling.

(2) Loosen all the bolts pressurizing the sleeve. For the SFM model, loosen the bolts about 2mm from the sleeve edge. For the SFF model, loosen the bolts about 2mm from the bearing surface.

■ SFF model

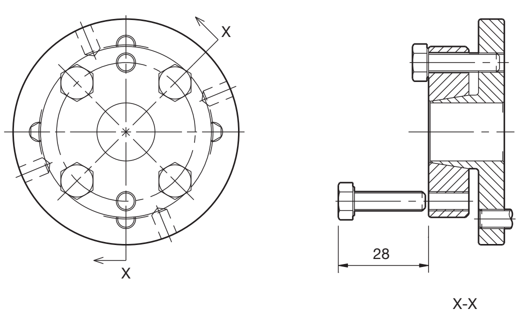


■ SFM model

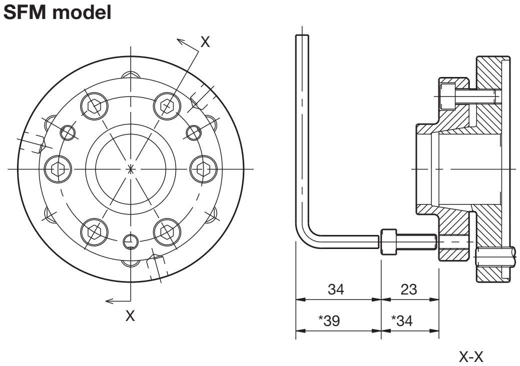


In the tapered shaft fastening method that tightens the pressure bolts from the axial direction, the sleeve has a self-locking mechanism so that loosening the bolts does not release locking of the flange hub and shaft. (In some cases, locking force could be released by just loosening the pressure bolts.) Therefore, a space for inserting a dismounting screw must be considered in the coupling design phase.

■ SFF model



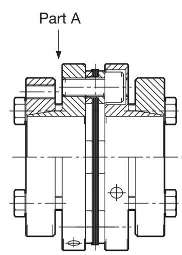
■ SFM model



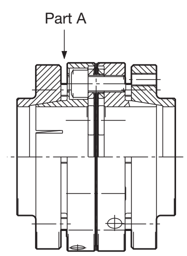
Note) In the case of SFM-140, apply dimension with *.

(3) Remove three pressure bolts loosened in (2) (two bolts for the sizes 070 and 080 of SFF model) and insert them into the screw bores for dismounting located on the sleeve. Tighten them alternately little by little. Locking of the flange hub and shaft will be released
For the SFM model, hexagon socket head cap screws are used as its pressure bolt. Therefore, a space for L wrench must be considered in the design phase. If there is not a space in the axial direction, insert a flat-head screwdriver into the A part and tap in a direction perpendicular to the shaft, or use the principle of leverage to release locking. At this time, take extra care not to damage the coupling or pressure bolt.

■ SFF model



■ SFM model



SFH MODEL

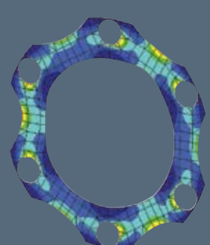
The Largest Model Among SERVO FLEX: Metal Plate Spring Couplings

The maximum flange outer diameter is ø262 mm and the permissible torque is 8000 N·m.
The most rigid S type has a torsional stiffness of 10,780,000 N·m/rad at maximum.
This series is available with the high-flexibility G type, where a high-rigidity single-element S type and two elements are positioned respectively and are jointed with a floating shaft at the middle part.
This is also available for length setting according to customers' requests.

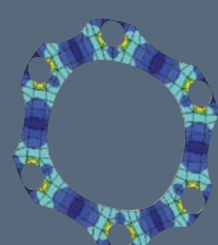
PLATE SPRING OF IDEAL FORM

High Rigidity, High Flexibility

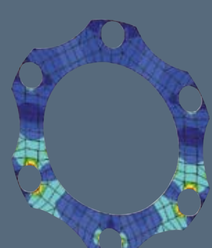
A high transmission torque has been realized by thorough analysis using the advanced finite element method (FEM) and torque transmission using six bolts.
This is available with a choice between the high-rigidity type with one element and the other type with a configurable spacer length.



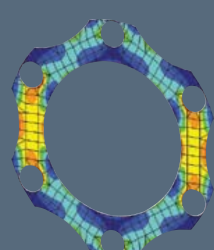
TORQUE



THRUST



BENDING



RADIAL

Specially Designed for Realizing High Transmission Torque

- High transmission torque has been realized by thorough analysis using the advanced finite element method and torque transmission using six bolts.
- The floating shaft type is also available with flexible length setting according to customers' requests. SFH-G type

SFH MODEL

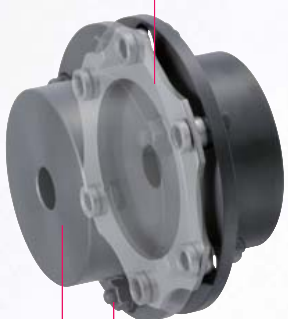
SFH MODEL

High-transmission-torque SFH

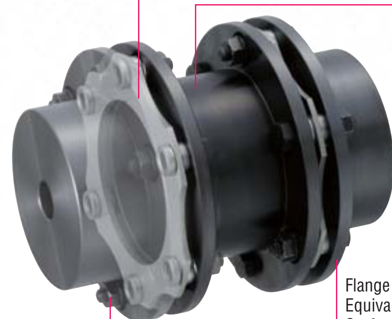
Pilot bore item	High-rigidity single element	SFH-□S
	High-flexibility double element	SFH-□G
	Floating shaft length indication	SFH-□G LS=□
+Key/set screw processing	High-rigidity single element	SFH-□S-□H-□H
	High-flexibility double element	SFH-□G-□H-□H
	Floating shaft length indication	SFH-□G-□H-□H LS=□

Structure and Material

SFH-S



SFH-G



Specially Designed for Realizing High Transmission Torque

A high transmission torque has been realized by thorough analysis using the advanced finite element method (FEM) and torque transmission using six bolts.

Available to Assemble in Parts

The product can be delivered in parts, so that this can be used even for designs where parts cannot be mounted on the finished item.

Freely Chosen Mounting Method

This can also be provided with pilot bore items. The mounting method can be selected freely from other than the key/set screw method such as the embedding friction lock element or shaft fixing using shrink fitting.

SFH MODEL

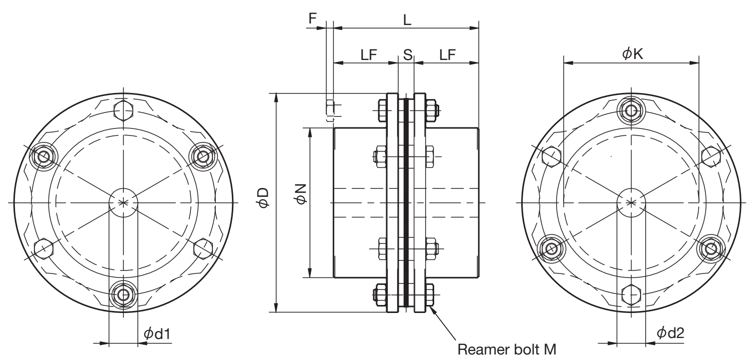
SFH-S

Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min^{-1}]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [$kg·m^2$]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFH-150S	700	–	1	±0.4	5900	1500000	244	$12.48×10^{-3}$	4.66	–
SFH-170S	1300	–	1	±0.5	5100	2840000	224	$26.88×10^{-3}$	7.49	–
SFH-190S	2000	–	1	±0.5	4700	3400000	244	$43.53×10^{-3}$	10.49	–
SFH-210S	4000	–	1	±0.55	4300	4680000	508	$67.87×10^{-3}$	13.65	–
SFH-220S	5000	–	1	±0.6	4000	5940000	448	$101.70×10^{-3}$	18.10	–
SFH-260S	8000	–	1	±0.7	3400	10780000	612	$232.54×10^{-3}$	29.46	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The price of SFH-☐S is applied to the case of the pilot bore.

Dimensions



Unit [mm]

Model	d1·d2			D	N	L	LF	S	F	K	M	CAD file No.
	Pilot bore	Min.	Max.									
SFH-150S	20	22	70	152	104	101	45	11	5	94	6-M8 x 36	–
SFH-170S	25	28	80	178	118	124	55	14	6	108	6-M10 x 45	–
SFH-190S	30	32	85	190	126	145	65	15	10	116	6-M12 x 55	–
SFH-210S	35	38	90	210	130	165	75	15	8	124	6-M16 x 60	–
SFH-220S	45	48	100	225	144	200	90	20	–2	132	6-M16 x 60	–
SFH-260S	50	55	115	262	166	223	100	23	11	150	6-M20 x 80	–

* Pilot bores are drilled bores. For additional processing, refer to the “Standard bore processing specification” on page 62.

Ordering Information

SFH - 150 S - 38 H - 38 H

Size: 150

Type: S — Single element

Bore diameter: d1- d2 with standard bore processing
Blank: Previous edition JIS (Class 2) compliant
H: New JIS compliant
N: New standard motor compatible
* Blank if bore processing is not required

SFH MODEL

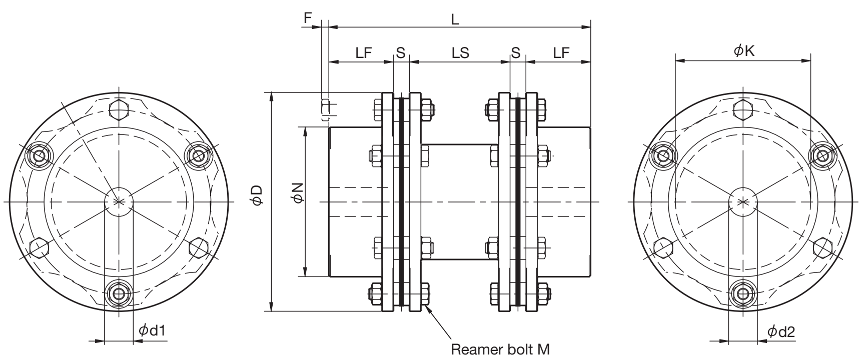
SFH-G

Specification

Model	Permissible torque [N·m]	Max. permissible misalignment			Max. rotation speed [min⁻¹]	Torsional stiffness [N·m/rad]	Radial displacement [N/mm]	Moment of inertia [kg·m²]	Mass [kg]	Price
		Parallel offset [mm]	Angular misalignment [°]	Axial displacement [mm]						
SFH-150G	700	1.4	1 (one side)	±0.8	5900	750000	122	21.74×10^{-3}	8.67	–
SFH-170G	1300	1.6	1 (one side)	±1.0	5100	1420000	112	51.24×10^{-3}	13.94	–
SFH-190G	2000	2.0	1 (one side)	±1.0	4700	1700000	122	81.25×10^{-3}	19.42	–
SFH-210G	4000	2.1	1 (one side)	±1.1	4300	2340000	254	124.70×10^{-3}	24.10	–
SFH-220G	5000	2.3	1 (one side)	±1.2	4000	2970000	224	175.84×10^{-3}	30.07	–
SFH-260G	8000	2.9	1 (one side)	±1.4	3400	5390000	306	432.03×10^{-3}	52.90	–

* The indicated values in the moment of inertia and mass are measured with the maximum bore diameter.
* The price of SFH-□G is applied to the case of the pilot bore.

Dimensions



Unit [mm]

Model	d1·d2			D	N	L	LF	LS	S	F	K	M	CAD file No.
	Pilot bore	Min.	Max.										
SFH-150G	20	22	70	152	104	182	45	70	11	5	94	12-M8 x 36	–
SFH-170G	25	28	80	178	118	218	55	80	14	6	108	12-M10 x 45	–
SFH-190G	30	32	85	190	126	260	65	100	15	10	116	12-M12 x 55	–
SFH-210G	35	38	90	210	130	290	75	110	15	8	124	12-M16 x 60	–
SFH-220G	45	48	100	225	144	335	90	115	20	–2	132	12-M16 x 60	–
SFH-260G	50	55	115	262	166	391	100	145	23	11	150	12-M20 x 80	–

* Specify the required LS dimensions when requiring products other than the above LS dimensions. Contact us if the LS is equal or greater than 1000.
* Pilot bores are drilled bores. For additional processing, refer to the "Standard bore processing specification" on page 62.

Ordering Information

SFH - 150 G - 38 H - 38 H LS=500

- 150: Size
- G: Type: G Double element Floating shaft
- 38 H - 38 H: Bore diameter: d1- d2 with standard bore processing
  Blank: Previous edition JIS (Class 2) compliant
  H: New JIS compliant
  N: New standard motor compatible
  * Blank if bore processing is not required
- LS=500: Length of spacer
  * Blank if standard spacer

SERVO FLEX SFH

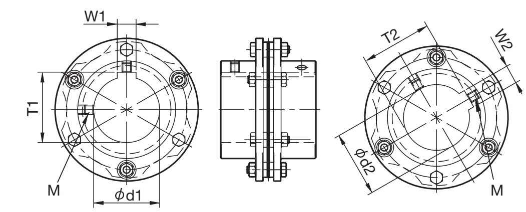
SFH MODEL

Standard Bore Pprocessing Specification

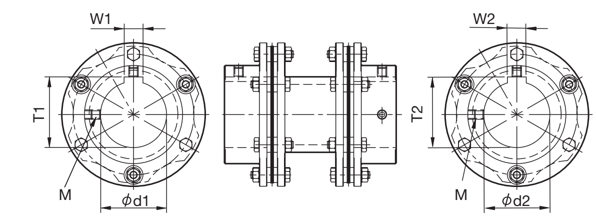
Dimensions

• Bore processing is available upon request. Products are stored with pilot bores.
• Bores are machined based on the following specification.
• Assign as described below when ordering.
E.g.) SFH-150S-32H-35H
• The positions of set screws will not be on the same plane.
• For the standardized sizes other than described below, refer to the technical data at the end of the catalog.

SFH-S



SFH-G



Unit [mm]

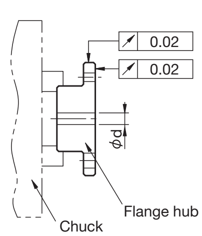
Previous edition JIS (Class 2) compliant					New JIS compliant					New standard motor compatible				
Nominal bore dia.	Bore diameter (d1-d2)	Key slot width (W1·W2)	Key slot height (T1·T2)	Set screw bore (M)	Nominal bore dia.	Bore diameter (d1-d2)	Key slot width (W1·W2)	Key slot height (T1·T2)	Set screw bore (M)	Nominal bore dia.	Bore diameter (d1-d2)	Key slot width (W1·W2)	Key slot height (T1·T2)	Set screw bore (M)
Tolerance	H7	E9	–	–	Tolerance	H7	H9	–	–	Tolerance	G7, F7	H9	–	–
22	$22^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	$25.0^{+0.3}_{0}$	2-M6	22H	$22^{+0.021}_{0}$	$6^{+0.030}_{0}$	$24.8^{+0.3}_{0}$	2-M5	–	–	–	–	–
24	$24^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	$27.0^{+0.3}_{0}$	2-M6	24H	$24^{+0.021}_{0}$	$8^{+0.036}_{0}$	$27.3^{+0.3}_{0}$	2-M6	24N	$24^{+0.028}_{+0.007}$	$8^{+0.036}_{0}$	$27.3^{+0.3}_{0}$	2-M6
25	$25^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	$28.0^{+0.3}_{0}$	2-M6	25H	$25^{+0.021}_{0}$	$8^{+0.036}_{0}$	$28.3^{+0.3}_{0}$	2-M6	–	–	–	–	–
28	$28^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	$31.0^{+0.3}_{0}$	2-M6	28H	$28^{+0.021}_{0}$	$8^{+0.036}_{0}$	$31.3^{+0.3}_{0}$	2-M6	28N	$28^{+0.028}_{+0.007}$	$8^{+0.036}_{0}$	$31.3^{+0.3}_{0}$	2-M6
30	$30^{+0.021}_{0}$	$7^{+0.061}_{+0.025}$	$33.0^{+0.3}_{0}$	2-M6	30H	$30^{+0.021}_{0}$	$8^{+0.036}_{0}$	$33.3^{+0.3}_{0}$	2-M6	–	–	–	–	–
32	$32^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	$35.5^{+0.3}_{0}$	2-M8	32H	$32^{+0.025}_{0}$	$10^{+0.036}_{0}$	$35.3^{+0.3}_{0}$	2-M8	–	–	–	–	–
35	$35^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	$38.5^{+0.3}_{0}$	2-M8	35H	$35^{+0.025}_{0}$	$10^{+0.036}_{0}$	$38.3^{+0.3}_{0}$	2-M8	–	–	–	–	–
38	$38^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	$41.5^{+0.3}_{0}$	2-M8	38H	$38^{+0.025}_{0}$	$10^{+0.036}_{0}$	$41.3^{+0.3}_{0}$	2-M8	38N	$38^{+0.050}_{+0.025}$	$10^{+0.036}_{0}$	$41.3^{+0.3}_{0}$	2-M8
40	$40^{+0.025}_{0}$	$10^{+0.061}_{+0.025}$	$43.5^{+0.3}_{0}$	2-M8	40H	$40^{+0.025}_{0}$	$12^{+0.043}_{0}$	$43.3^{+0.3}_{0}$	2-M8	–	–	–	–	–
42	$42^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	$45.5^{+0.3}_{0}$	2-M8	42H	$42^{+0.025}_{0}$	$12^{+0.043}_{0}$	$45.3^{+0.3}_{0}$	2-M8	42N	$42^{+0.050}_{+0.025}$	$12^{+0.043}_{0}$	$45.3^{+0.3}_{0}$	2-M8
45	$45^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	$48.5^{+0.3}_{0}$	2-M8	45H	$45^{+0.025}_{0}$	$14^{+0.043}_{0}$	$48.8^{+0.3}_{0}$	2-M10	–	–	–	–	–
48	$48^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	$51.5^{+0.3}_{0}$	2-M8	48H	$48^{+0.025}_{0}$	$14^{+0.043}_{0}$	$51.8^{+0.3}_{0}$	2-M10	48N	$48^{+0.050}_{+0.025}$	$14^{+0.043}_{0}$	$51.8^{+0.3}_{0}$	2-M10
50	$50^{+0.025}_{0}$	$12^{+0.075}_{+0.032}$	$53.5^{+0.3}_{0}$	2-M10	50H	$50^{+0.025}_{0}$	$14^{+0.043}_{0}$	$53.8^{+0.3}_{0}$	2-M10	–	–	–	–	–
55	$55^{+0.030}_{0}$	$15^{+0.075}_{+0.032}$	$60.0^{+0.3}_{0}$	2-M10	55H	$55^{+0.030}_{0}$	$16^{+0.043}_{0}$	$59.3^{+0.3}_{0}$	2-M10	55N	$55^{+0.060}_{+0.030}$	$16^{+0.043}_{0}$	$59.3^{+0.3}_{0}$	2-M10
56	$56^{+0.030}_{0}$	$15^{+0.075}_{+0.032}$	$61.0^{+0.3}_{0}$	2-M10	56H	$56^{+0.030}_{0}$	$16^{+0.043}_{0}$	$60.3^{+0.3}_{0}$	2-M10	–	–	–	–	–
60	$60^{+0.030}_{0}$	$15^{+0.075}_{+0.032}$	$65.0^{+0.3}_{0}$	2-M10	60H	$60^{+0.030}_{0}$	$18^{+0.043}_{0}$	$64.4^{+0.3}_{0}$	2-M10	60N	$60^{+0.060}_{+0.030}$	$18^{+0.043}_{0}$	$64.4^{+0.3}_{0}$	2-M10
65	$65^{+0.030}_{0}$	$18^{+0.075}_{+0.032}$	$71.0^{+0.3}_{0}$	2-M10	65H	$65^{+0.030}_{0}$	$18^{+0.043}_{0}$	$69.4^{+0.3}_{0}$	2-M10	65N	$65^{+0.060}_{+0.030}$	$18^{+0.043}_{0}$	$69.4^{+0.3}_{0}$	2-M10
70	$70^{+0.030}_{0}$	$18^{+0.075}_{+0.032}$	$76.0^{+0.3}_{0}$	2-M10	70H	$70^{+0.030}_{0}$	$20^{+0.052}_{0}$	$74.9^{+0.5}_{0}$	2-M10	–	–	–	–	–
75	$75^{+0.030}_{0}$	$19^{+0.011}_{+0.054}$	$81.0^{+0.5}_{0}$	2-M10	75H	$75^{+0.030}_{0}$	$20^{+0.052}_{0}$	$79.9^{+0.5}_{0}$	2-M10	75N	$75^{+0.060}_{+0.030}$	$20^{+0.052}_{0}$	$79.9^{+0.5}_{0}$	2-M10
80	$80^{+0.030}_{0}$	$20^{+0.097}_{+0.140}$	$86.0^{+0.5}_{0}$	2-M10	80H	$80^{+0.030}_{0}$	$22^{+0.052}_{0}$	$85.4^{+0.5}_{0}$	2-M12	–	–	–	–	–
85	$85^{+0.035}_{0}$	$21^{+0.183}_{+0.226}$	$93.0^{+0.5}_{0}$	2-M12	85H	$85^{+0.035}_{0}$	$22^{+0.052}_{0}$	$90.4^{+0.5}_{0}$	2-M12	85N	$85^{+0.071}_{+0.036}$	$22^{+0.052}_{0}$	$90.4^{+0.5}_{0}$	2-M12
90	$90^{+0.035}_{0}$	$22^{+0.269}_{+0.312}$	$98.0^{+0.5}_{0}$	2-M12	90H	$90^{+0.035}_{0}$	$25^{+0.052}_{0}$	$95.4^{+0.5}_{0}$	2-M12	–	–	–	–	–
95	$95^{+0.035}_{0}$	$23^{+0.355}_{+0.398}$	$103.0^{+0.5}_{0}$	2-M12	95H	$95^{+0.035}_{0}$	$25^{+0.052}_{0}$	$100.4^{+0.5}_{0}$	2-M12	95N	$95^{+0.071}_{+0.036}$	$25^{+0.052}_{0}$	$100.4^{+0.5}_{0}$	2-M12
100	$100^{+0.035}_{0}$	$24^{+0.441}_{+0.484}$	$109.0^{+0.5}_{0}$	2-M12	100H	$100^{+0.035}_{0}$	$28^{+0.052}_{0}$	$106.4^{+0.5}_{0}$	2-M12	–	–	–	–	–
115	$115^{+0.035}_{0}$	$25^{+0.527}_{+0.570}$	$125.0^{+0.5}_{0}$	2-M12	115H	$115^{+0.035}_{0}$	$32^{+0.052}_{0}$	$122.4^{+0.5}_{0}$	2-M12	–	–	–	–	–

Distance from the edge surface of set screw

Size	150	170	190	210	220	260
Distance [mm]	15	20	25	30	35	40

Centering and finishing in flange bore drilling

SFH model is a parts-delivered product. According to the figure right, check the center run-out of each size by the flange hub outer diameter. Adjust the chuck to achieve the following accuracy and finish the inner diameter.



Design Check Items

Selection procedure

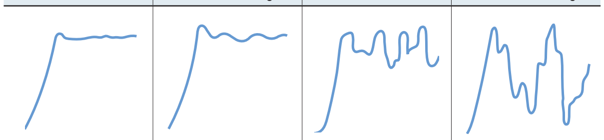
(1) Calculate torque Ta applied to the coupling based on the motor output P and coupling operating rotation speed n.

$$Ta\ [N\cdot m] = 9550 \times \frac{P\ [kW]}{n\ [min^{-1}]}$$

(2) Calculate corrected torque Td applied to the coupling after deciding the service factor K based on load conditions.

$$Td = Ta \times K \text{ (see below)}$$

Load character			
Constant	Fluctuations: Slight	Fluctuations: Medium	Fluctuations: Large
1.0	1.25	1.75	2.25



In servo motor drive, multiply the service factor K=1.2 to 1.5 by the maximum torque of servo motor Ts.

$$Td = Ts \times (1.2 \text{ to } 1.5)$$

(3) Select the size in order that the coupling permissible torque Tn becomes equal or greater than the corrected torque Td.

$$Tn \geq Td$$

(4) Depending on the bore diameters, the coupling permissible torque may be limited. Refer to the “Specification” and “Standard bore diameter.”

(5) Confirm if the required shaft diameter does not exceed the maximum bore diameter of the coupling.

For machines whose load torques periodically fluctuate drastically, contact us.

Feed-screw systems

- Oscillation phenomena of servo motors
  If the eigenfrequency of the entire feed-screw system is under 400 to 500Hz, oscillation may occur depending on the gain adjustment of the servo motor. An oscillation phenomenon of a servo motor occurs mainly by the problem of the eigenfrequency of the entire feed-screw system and the electric control system.
  These problems can be avoided by raising the eigenfrequency of the mechanical system from the design phase or adjusting the tuning function (filter function) of the servo motor.

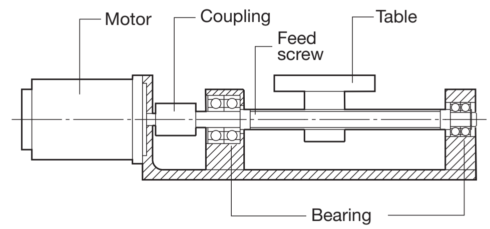
- Resonance caused by stepping motors
  It is a phenomenon that occurs within a certain rotation speed range by the pulsation frequency of the stepping motor and the eigenfrequency of the entire system. Resonance can be avoided by not applying the resonant rotation speed, or by reviewing the eigenfrequency in the design phase.

Contact us for unclear points concerning ocsillation phenomena of servo motors and resonance of stepping motors.

How to evaluate the eigenfrequency of feed-screw system

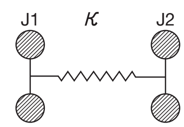
(1) Select the coupling according to the normal operating torque and maximum torque of the servo motor/stepping motor. (See the selection procedure on the left.)

(2) In the following feed-screw system, evaluate the entire eigenfrequency: Nf from the torsional stiffness: K of the coupling and feed screw, the moment of inertia: J1 of the driving side and the moment of inertia: J2 of the driven side.



$$Nf = \frac{1}{2\pi}\sqrt{\kappa\left(\frac{1}{J1}+\frac{1}{J2}\right)}$$

Nf: Eigenfrequency of the entire feed-screw system [Hz]
k : Torsional stiffness of the coupling and feed screw [N·m/rad]
J1: Moment of inertia of the driving side [kg·m²]
J2: Moment of inertia of the driven side [kg·m²]

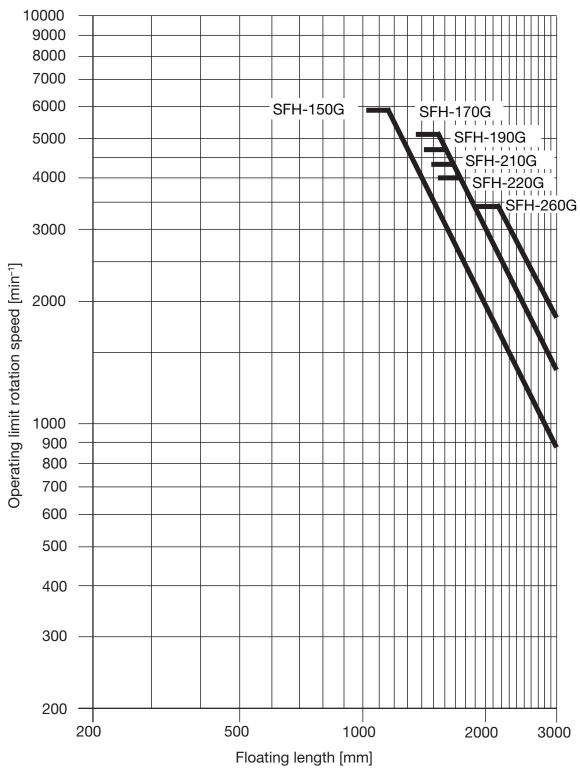


SERVO FLEX SFH

Design Check Items

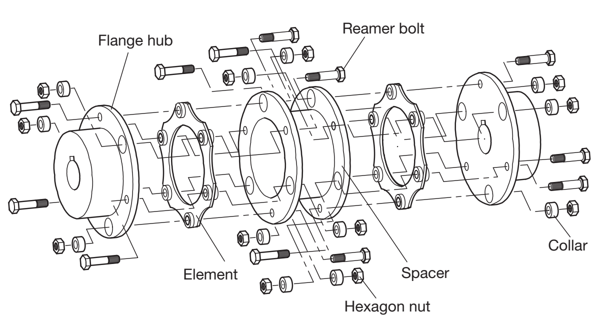
Operating limit rotation speed

For the SFH-G long spacer type, the rotation speed at which it can be operated differs according to the spacer length selected. Check the table below and make sure that the operating rotation speed is equal or lower than the operating limit rotation speed.



Mounting

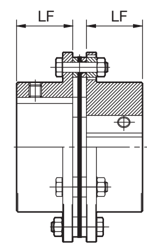
The SFH model is a parts-delivered product. Shafts are linked after installing the flange hub on each shaft, centering the flange hub, and finally installing the element (spacer). The SFH-S type can even insert shafts after assembling couplings by installing elements on the flange hub and centering them.



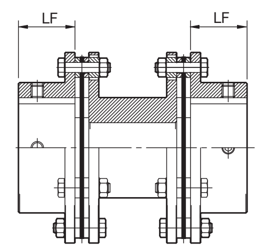
(1) Remove dust, dirt, and oil, etc. from the shaft and the inner-diameter part of the flange hub. (Grease should be wiped away with a waste cloth, etc. or by degreasing as required.)

(2) Insert a flange hub into the target shaft. Make sure that the insertion length of the coupling is maintained so that the target shaft is in contact with the entire length of the flange hub (LF dimension) as illustrated below.

■ SFH-S type



■ SFH-G type



Coupling size (SFH-S/G)	150	170	190	210	220	260
LF dimension [mm]	45	55	65	75	90	100

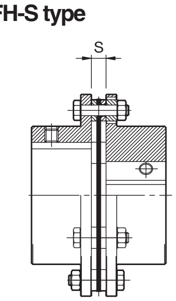
(3) Install the other flange hub on the target shaft as in (1) and (2).

(4) Center the shaft (parallel offset and angular misalignment) with the flange hub inserted and adjust the shaft intervals.

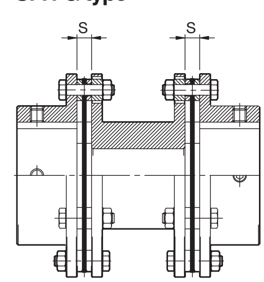
(5) For the SFH-S type, move the flange hub parallel to the shaft, insert an element between the two flange hubs, and temporarily assemble it using reamer bolts, a collar, and hexagon nuts. For the SFH-G type, insert reamer bolts into both flanges from the flange side and temporarily assemble it using hexagon nuts through the element and collar. After doing this, move the flange hub parallel to the shaft, insert a spacer between the two flange hubs, and temporarily assemble it using reamer bolts, a collar, and hexagon nuts.

(6) Make sure that the dimension between flange hub parts (S dimension) is kept within the axial displacement tolerance set for the basic value. However, this value is a permissible value assuming that both parallel offset and angular misalignment values are zero. Adjust the value to be as small as possible.

■ SFH-S type



■ SFH-G type



Coupling size (SFH-S/G)	150	170	190	210	220	260
S dimension [mm]	11	14	15	15	20	23

(7) Check that the element is not deformed. If any deformation is found, the following can be considered: unnecessary force has been applied in the axial direction or there is a lack of lubrication among the collar, bolts, and plate spring. Adjust the deformation so that it is corrected to normal. On the reamer bolt-bearing surface, this might be improved by coating a small amount of machine oil. However, do not use oils such as those containing molybdic extreme-pressure agents.

(8) To tighten reamer bolts, use a calibrated torque wrench at the appropriate tightening torque for all the bolts.

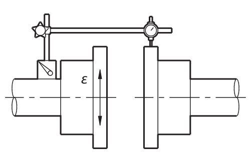
Coupling size (SFH-S/G)	150	170	190	210	220	260
Reamer bolt	M8	M10	M12	M16	M16	M20
Tightening torque [N·m]	34	68	118	300	300	570

(9) If key/set screw method is selected for mounting the flange hub to the shaft, fix the flange hub to the shaft with set screws.

Centering method

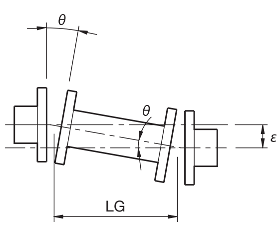
● Parallel Offset (ε)

Fix the dial gauge on one side of the shaft and read the run-out of the outer periphery of the other flange while rotating the shaft. The models (SFH-S type) with one pair of elements (plate springs) do not allow parallel offset and should be moved close to 0. For Models whose full length can be set freely (SFH-G type), use the following formula to calculate the permissible parallel offset values.



$$\varepsilon = \tan\theta \times LG$$

ε: Permissible parallel offset
θ: 1°

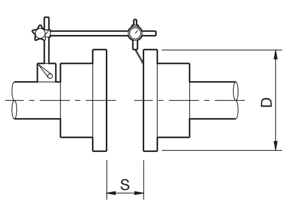


$$LS = LS + S$$

LS: Full length of space
S : Dimension between flange on one side and spacer

● Anglular Misalignment (θ)

Fix the dial gauge on one side of the shaft and read the run-out of the edge surface near the outer periphery of the other flange while rotating the shaft.
Adjust run-out B so that ($\theta \leq 1°$) can be accomplished.



$$B = D \times \tan\theta$$

B: Run-out
D: Flange outer diameter
θ: 1°

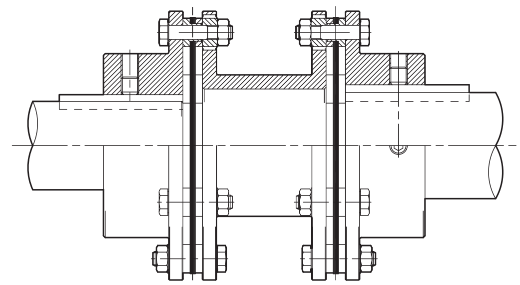
● Radial Displacement (S)

The face-to-face dimension between flange hubs (S) must be within the permissible error of the axial displacement in the basic value. However, the value is allowable when the parallel offset and angular misalignment are assumed to be 0 (zero). Adjust to achieve them to be as small as possible.
* The S dimension of SFH-S is a dimension between two flange hubs. The S dimension of SFH-G is a dimension between a flange hub and a spacer.

Example of mounting

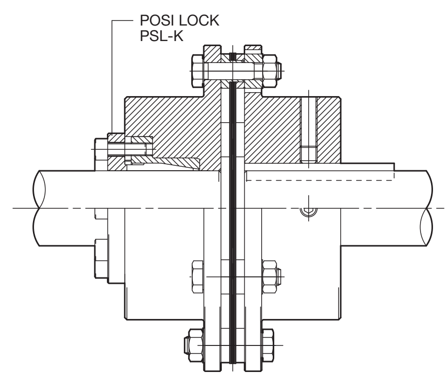
● SFH-G

This is a combination of standard bore processed items. Although processing can be performed by Miki Pulley, customers can also drill the pilot bore items freely.



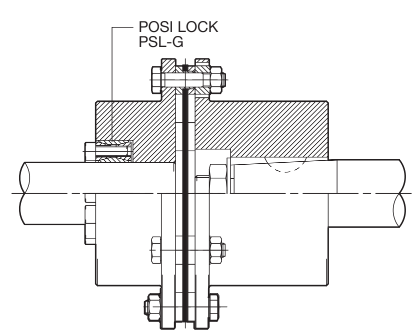
● SFH-S

This is an example where a pilot bore-type flange hub is processed for POSI LOCK PSL-K, one of Miki Pulley's shaft locks, and combined with the standard pilot drilled bore flange hub.



● SFH-S Special

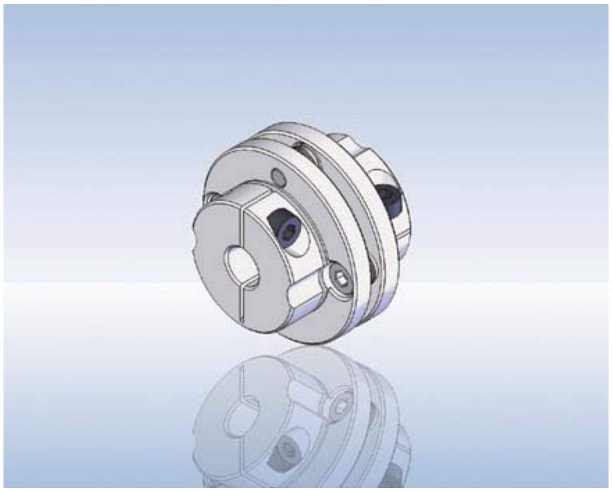
This is a combination of a flange hub processed for the servo motor taper shaft and a flange hub processed for Miki Pulley's shaft lock PSL-G.



Customize

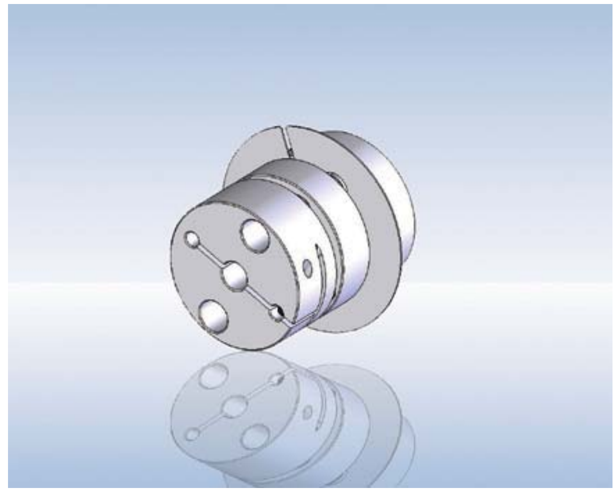
At Miki Pulley, customized products according to customer needs are also developed using a thorough system. Useful products will surely be delivered to customers even if they are not satisfied with the catalog specifications.

SFC model
Specification without anodic coating film



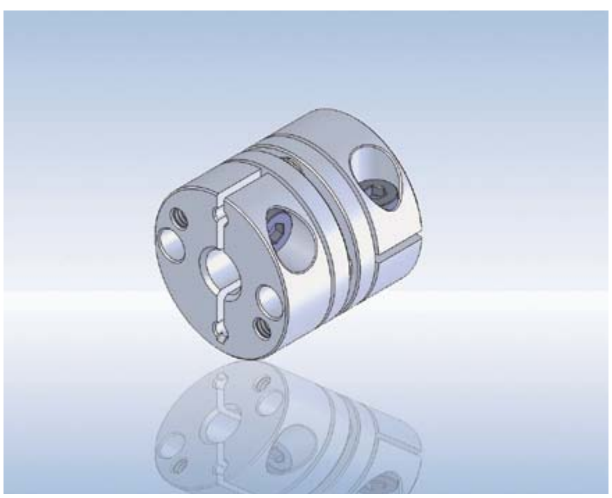
The standard-specification SFC model applies anodic coating on its main body. Without coating the surface, generation of gas under a vacuum environment is prevented. It is also suitable for use of equipment such as semiconductor-manufacturing machines, etc. under a vacuum environment.

SFC model
Specification for SERVO FLEX with a slit plate



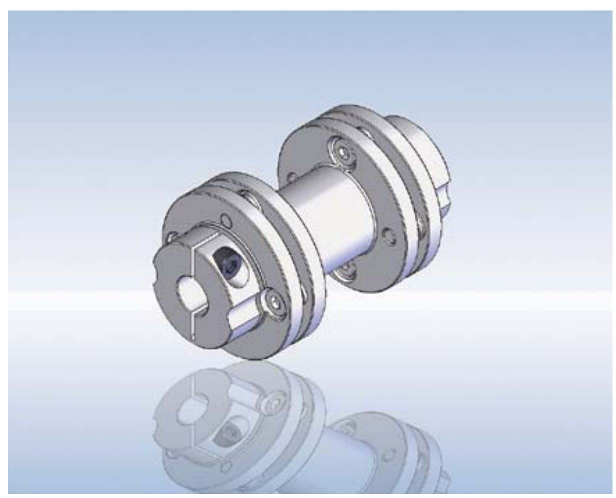
This specification supports position detection sensors such as encoders, photo sensors, etc. by installing a slit plate between hubs.

SFC model
Specification for SERVO FLEX with edge-part tap bores



By drilling tap bores on the hub edge, a position detection sensor such as slit plate, etc., can be installed.

SFC model
Specification for SERVO FLEX with a long spacer



This is a specification for long intervals between installation shafts. It is also available for synchronization of the gantry mechanism, etc.

SFC model
Assembly specification

This is a special-order specification-assembled SERVO FLEX SFC model with POS LOCK (shaft lock) PSL-K, a timing pulley, and shaft.

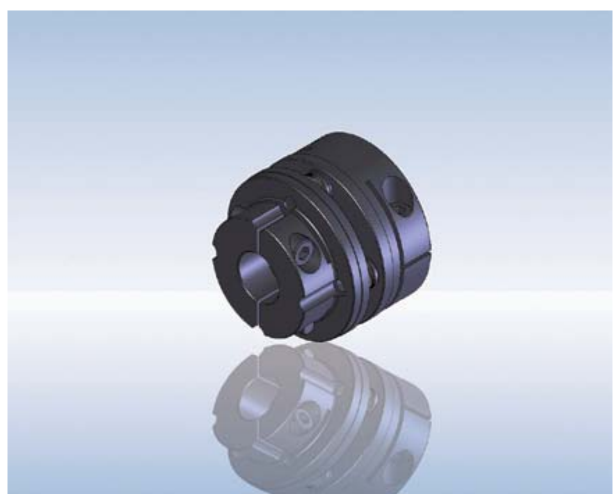
SFS-G type

This is a long spacer specification extending the standard SFS-G-type spacer. This specification is for long intervals between installation shafts.
It is especially used for printing machines with a line shaft specification.

SFS model
Electroless nickel plating specification

This is a specification with electroless nickel plating for the standard-specification SFS model. It is often requested under a clean environment. It is especially used for liquid crystal equipment, printing machines (film coaters), etc.

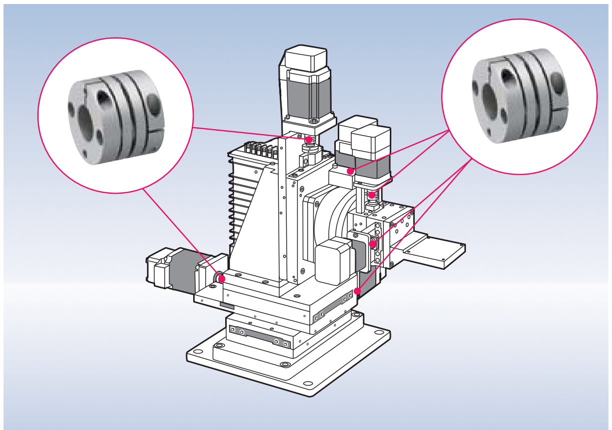
SFF model
W clamp specification



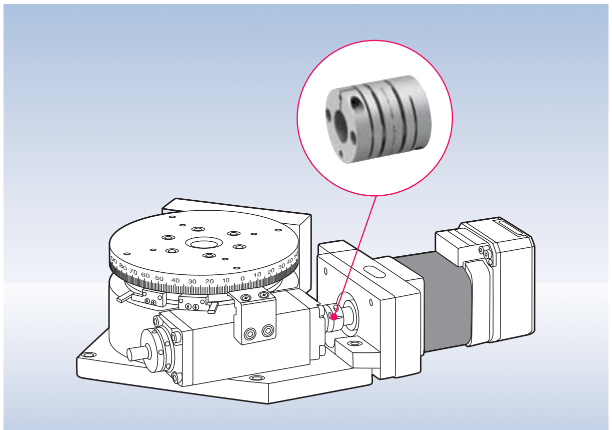
The SFF model for machine tools normally uses friction locking by tightening from the axial direction. If the clamp method is used, work such as installation and position adjustment will be easier. Also, the SFF model has high rigidity because iron is used as its material. It is suitable for the feed shaft of machine tools.

Application

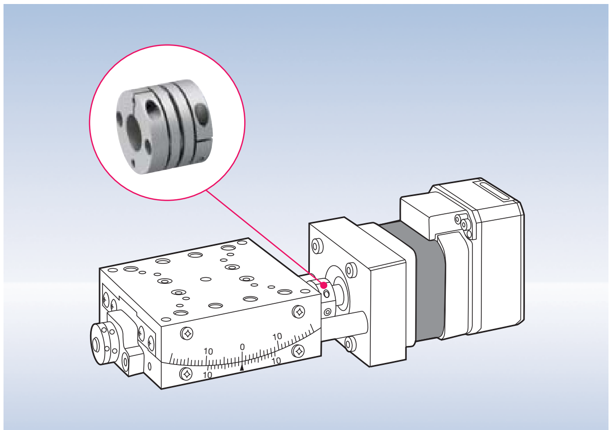
SERVO FLEX SFC model for the 6-axis stage system



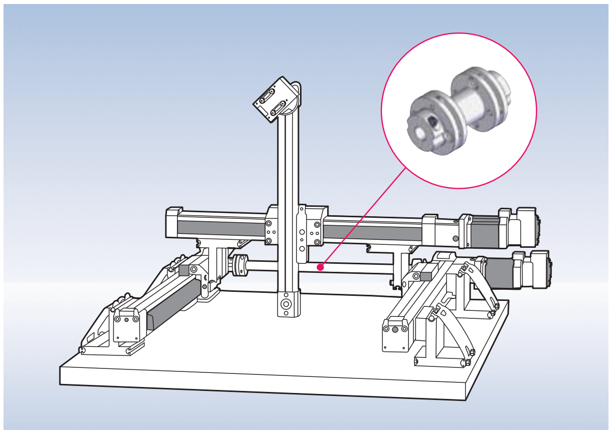
SERVO FLEX SFC model for the θ-axis rotation stage



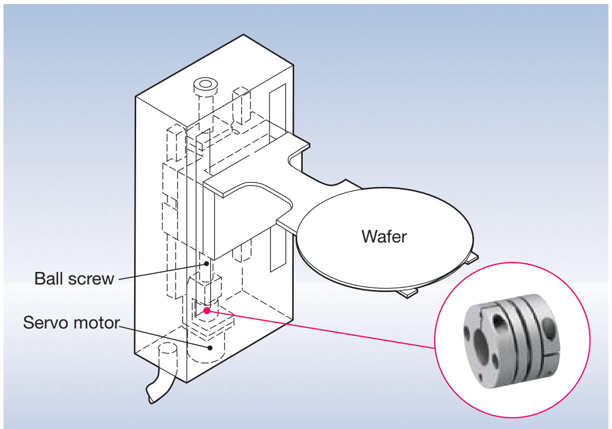
SERVO FLEX SFC model for the θ-axis swivel stage



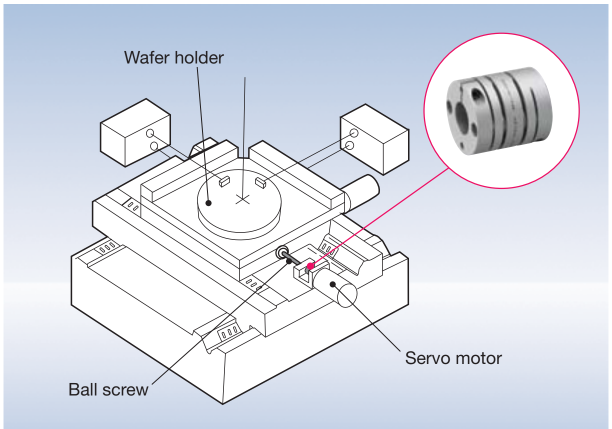
SERVO FLEX SFC model for the gantry mechanism



SERVO FLEX SFC model for the semiconductor wafer-lifting shaft

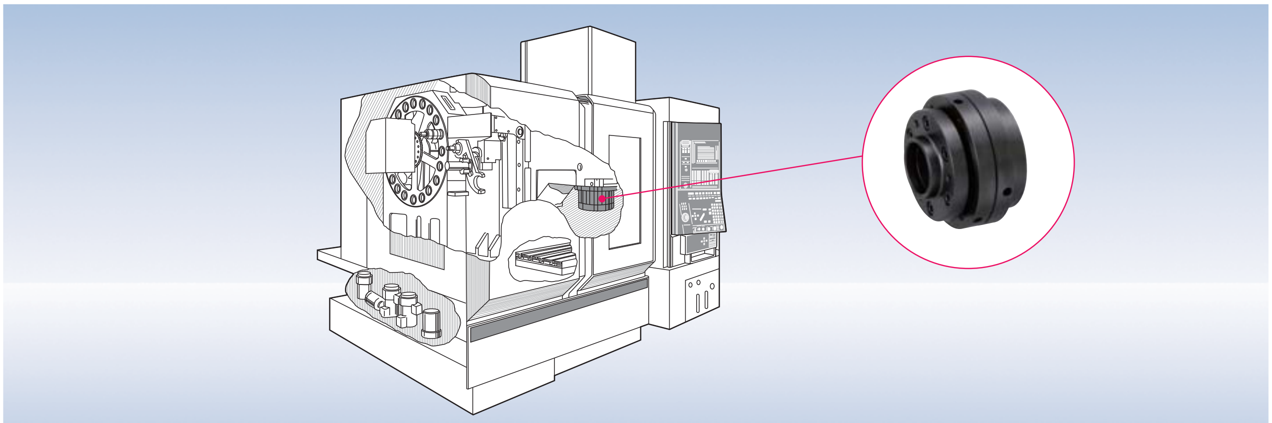


SERVO FLEX SFC model wafer stage X-axis with a semiconductor-manufacturing machine stepper for the Y-axis

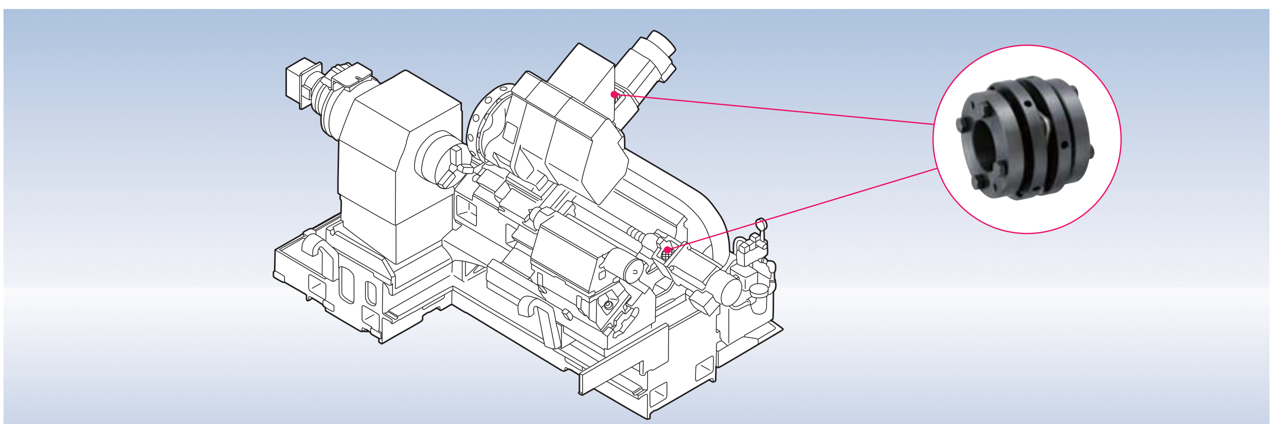


SERVO FLEX
Application

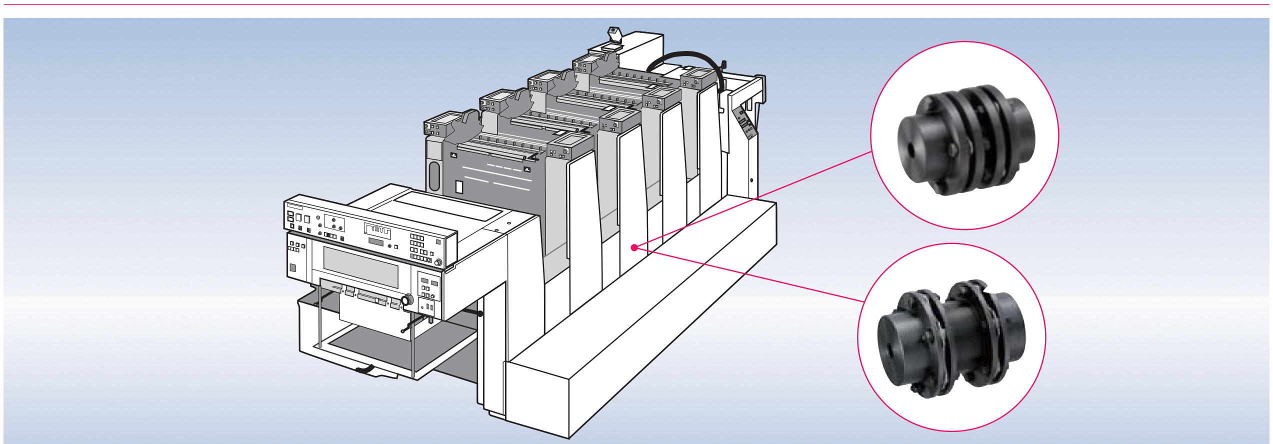
SERVO FLEX SFM model for machine tools for the machining center main shaft



SERVO FLEX SFF model for machine tools for the feed shaft of the X- and Z-axes on the numeric value control disk



SERVO FLEX SFS-G type and SFH-G type for printing machines with line shaft specifications



Safety Precautions (Please read prior to use)

Please read carefully through the instruction manual and the technical information for proper use and safety. In this manual, safety precautions are classified by "DANGER" and "CAUTION".

⚠ DANGER
● When death or serious injury may result by mishandling

⚠ CAUTION
● When disability or only physical damage may result by mishandling

Equipment use (atomic energy, aerospace, medical treatment,transportation, or various safety devices) that may result in serious bodily injury or loss of life directly by mechanical failure or mishandling, careful examination is necessary. Contact us for further information.
The company has taken all possible measures to produce a quality product; however, continuous rotational states when the clutch can not be disengaged or coasting of the machine when the brakes went off is envisioned as emergency. Please pay attention to safety measures in case anything goes wrong.

1. Structural precautions

⚠ DANGER ● Use a safety cover.

Touching the product during operation could cause injury. Place a safety cover to avoid any accident.
Additionally, set up a safety mechanism for quick stop of the product when opening the cover.

⚠ DANGER ● Do not use the product in the presence of fire and explosive hazards.

Do not use the product near flammable liquids or in the presence of gas and other explosive air particles.

⚠ DANGER ● Set up a safety mechanism

The driven and driving sides could be completely detached when the product is damaged.
Set up a safety mechanism such as a safety brake to avoid any danger.

2. Mounting precautions

⚠ DANGER ● Tighten bolts or screws completely.

Depending on the tightening adjustment of bolt or screw, exceptionally dangerous situations such as product damage or performance degradation could occur. Always use a calibrated torque wrench and clamp at the tightening torque specified by Miki Pulley.

⚠ DANGER ● Do not turn on the power of the equipment.

It is very dangerous if the driving part starts by accident while mounting the product. Be sure that the main power of the equipment is turned off.

⚠ CAUTION ● Use the product within the specified maximum permissible misalignment.

The installation of the product must be performed within the specified maximum permissible error.
Using the product with more than the maximum permissible error could cause damage or adverse effect on the equipment.

⚠ CAUTION ● Do not use any unspecified bolt or screw.

Using a bolt or screw that is not specified by our company could damage the product. Do not use any bolt or screw unspecified.

⚠ CAUTION ● Wear protective equipment.

To avoid any injury by stripping, spring pin or keyway, make sure to wear protective equipment such as safety glasses or gloves.

⚠ CAUTION ● Carry and mount the product by using a hoist.

Lifting of a heavy weight could cause back injury.
Use a hoist when carrying or mounting the product.

3. Cautions during operation

⚠ DANGER ● Do not exceed the permissible rated speed

If the product is used in excess of more than its maximum rated permissible speed, very dangerous product damage could occur by a large vibration.

⚠ DANGER ● Do not touch the product during operation.

Due to the exposed rotor, touching the product during operation may cause injury.
Make sure not to touch the product during operation.

⚠ CAUTION ● Do not use the product with more than the specified permissible transmission torque.

Using the product with more than the specified permissible transmissing torque could cause damage or adverse effect on the equipment.

⚠ CAUTION ● When abnormal noises or vibrations occur, stop operation immediately.

If abnormal noises or vibrations occur during operation, improper mounting should be considered. Do not leave the situation as it is. It may cause damage to the equipment itself. Also, for reasons other than above, the belts and other screws may loosen or become defective even if the product is mounted correctly.

⚠ CAUTION ● Do not use the product in an environment that could cause harmful effects.

Do not use the product in an environment where chemicals may spill, humidity is high, or in hot or cold temperature.

⚠ CAUTION ● Do not use the product when the locing part is in a slip condition.

Using the product when the locking part is in a slip condition could over heat the product, which could cause damage to the equipment.

⚠ CAUTION ● Make sure to operate the product within the specified “maximum permissible misalignment.”

Using the product with more than the "maximum permissible misalignment" could cause damage or adverse effect on the equipment. Always operate the product within the specified "maximum permissible misalignment."

4. Cautions for maintenance and inspection

⚠ DANGER ● Do not turn on the power of the equipment.

It is extremely dangerous if the driving part starts operating by accident while dismounting the product. Make sure that the main power of the equipment is off.

⚠ DANGER ● Do not dismantle the product.

We will refuse to take responsibility as to the damaged product that is dismantled, remodeled or repaired by a third party except our company and the designated company. Therefore, for the product that the assembly process or procedure of dismantlement is described in the manual, we will not be responsible as well. Please use our service network for repair and dismantlement.

5. Cautions for disposal

⚠ DANGER ● Do not leave the product around where young children may play.

⚠ CAUTION ● Call for a waste-control-collection company for disposal.

Please note that this safety precautions and specification described in each manual may be changed without prior notice.
Contact Miki Pulley for additional information or questions on these precautions.

Technical Data

Miki Pulley Couplings Standard Bore Processing Specification

This standard bore processing specification is applicable to bore processing for SERVO FLEX (except SFC model), SPR FLEX, BAUMANN FLEX (except ZG and LM models), and CENTA FLEX of bore diameter 6mm to 65mm. However, other standard bore processing specifications set to each model respectively will have precedence if they exist, and may differ from this specification.

● Bore Processing Tolerances for Mating Shaft Tolerances

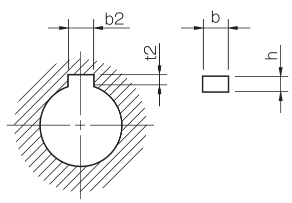
Unless there is a special order, it is processed by H7. For bore processing below 10mm, it will be H8.
Tolerances other than H7 require consultation. When pilot bores are additionally processed, the surface treatment of the processed portion is shaved. If an additional surface treatment after bore processing is required, contact us.

Shaft tolerance	Recommended bore tolerance
h6 to h9	H7
j6	G7
k6	F7
m6	F7

* The j6, k6 and m6 are adopted as new standard motor shafts.

● Key Slot Dimensions for Bore Diameters (following table)

Unless there is a special order, it is processed by the former JIS (second class). For bore diameters under 12mm, key slots are not processed.



Previous edition JIS (Class 2) compliant

Unit [mm]

Bore dia.	b2		t2		Keyway dimension b×h
	Basic dimension	Tolerance (E9)	Basic dimension	Tolerance	
12 or more, 13 or less	4	+ 0.050 + 0.020	1.5	+ 0.3 0	4× 4
Over 13, 20 or less	5		2.0		5× 5
Over 20, 30 or less	7	+ 0.061 + 0.025	3.0	+ 0.3 0	7× 7
Over 30, 40 or less	10		3.5		10× 8
Over 40, 50 or less	12	+ 0.075 + 0.032			12× 8
Over 50, 60 or less	15		5.0		15×10
Over 60, 65 or less	18		6.0		18×12

New JIS compliant

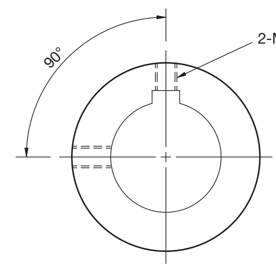
Unit [mm]

Bore dia.	b2		t2		Keyway dimension b×h
	Basic dimension	Tolerance (H9)	Basic dimension	Tolerance	
12	4	+ 0.030 0	1.8	+ 0.3 0	4× 4
Over 12, 17 or less	5		2.3		5× 5
Over 17, 22 or less	6		2.8		6× 6
Over 22, 30 or less	8	+ 0.036 0	3.3	+ 0.3 0	8× 7
Over 30, 38 or less	10				10× 8
Over 38, 44 or less	12	+ 0.043 0			12× 8
Over 44, 50 or less	14		3.8		14× 9
Over 50, 58 or less	16		4.3		16×10
Over 58, 65 or less	18		4.4		18×11

● Nominal Set Screw Diameters for Key Slot

Key slot Basic dimension b2	Set screw nominal diameter
4	M4
5	M4
6	M5
7	M6
8	M6
10	M8
12	M8
14	M10
15	M10
16	M10
18	M10

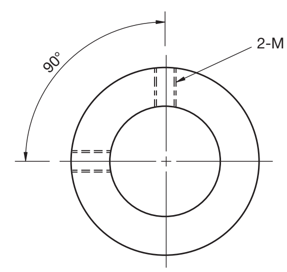
* If this is not a special order, the positions of set screws will be 2 points, 90° apart from each other.
* The positions for set screws may vary for some products. For more information, see the standard bore processing specification for each product.



● Nominal Set Screw Diameters for Bore Diameters (without key slot)

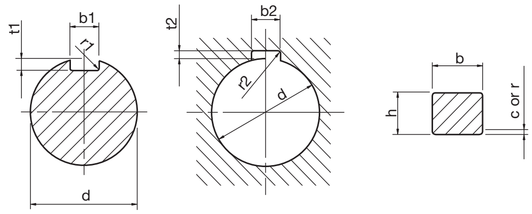
Bore dia.	Set screw nominal diameter
6 or more, less than 12	M4

* If this is not a special order, the positions of set screws will be 2 points, 90° apart from each other.
* The positions for set screws may vary for some products. For more information, see the standard bore processing specification for each product.



Technical Data

Dimensions and Tolerances of Parallel Keys and Key Slots



Cross section of shaft | Cross section of bore | Cross section of key

● JIS (Excerpts from JIS B 1301-1996)

Unit [mm]

Nominal key dimension b×h	Applicable shaft diameter d	Key dimension b Basic dimension	Key dimension b Tolerance (h9)	Key dimension h Basic dimension	Key dimension h Tolerance		Key dimension c or r	Key slot Basic dimension of b1 and b2	Locking type Tolerance of b1 and b2 (P9)	Normal type b1 Tolerance (N9)	Normal type b1 Tolerance (Js9)	r1 and r2	t1 Basic dimension	t1 Tolerance	t2 Basic dimension	t2 Tolerance
2× 2	6 to 8	2	0 −0.025	2	0 −0.025	h9	0.16 to 0.25	2	−0.006 −0.031	−0.004 −0.029	±0.0125	0.08 to 0.16	1.2	+ 0.1 0	1.0	+ 0.1 0
3× 3	8 to 10	3		3				3					1.8		1.4	
4× 4	10 to 12	4	0 −0.030	4	0 −0.030			4	−0.012 −0.042	0 −0.030	±0.0150		2.5		1.8	
5× 5	12 to 17	5		5			0.25 to 0.40	5				0.16 to 0.25	3.0		2.3	
6× 6	17 to 22	6		6				6					3.5		2.8	
8× 7	22 to 30	8	0 −0.036	7	0 −0.090	h11		8	−0.015 −0.051	0 −0.036	±0.0180		4.0	+ 0.2 0	3.3	+ 0.2 0
10× 8	30 to 38	10		8			0.40 to 0.60	10					5.0		3.3	
12× 8	38 to 44	12	0 −0.043	8				12	−0.018 −0.061	0 −0.043	±0.0215	0.25 to 0.40	5.0		3.3	
14× 9	44 to 50	14		9				14					5.5		3.8	
16×10	50 to 58	16		10				16					6.0		4.3	
18×11	58 to 65	18		11	0 −0.110			18					7.0		4.4	
20×12	65 to 75	20	0 −0.052	12			0.60 to 0.80	20	−0.022 −0.074	0 −0.052	±0.0260	0.40 to 0.60	7.5		4.9	
22×14	75 to 85	22		14				22					9.0		5.4	
25×14	85 to 95	25		14				25					9.0		5.4	
28×16	95 to 110	28		16				28					10.0		6.4	
32×18	110 to 130	32	0 −0.062	18				32	−0.026 −0.088	0 −0.062	±0.0310		11.0		7.4	

● Previous JIS First Class (Excerpts form JIS B 1301-1959)

Unit [mm]

Nominal key dimension b×h	Applicable shaft diameter d	Key dimension b Basic dimension	Key dimension b Tolerance (p7)	Key dimension h Basic dimension	Key dimension h Tolerance (h9)	Key dimension c or r	Key slot Basic dimension of b1 and b2	b1 Tolerance (H8)	b2 Tolerance (F7)	r1 and r2	t1 Basic dimension	t1 Tolerance	t2 Basic dimension	t2 Tolerance
4× 4	10 or more, 13 or less	4	+ 0.024 + 0.012	4	0 −0.030	0.5	4	+ 0.018 0	+ 0.022 + 0.010	0.4	2.5	+ 0.05 0	1.5	+ 0.05 0
5× 5	Over 13, 20 or less	5		5			5				3		2	
7× 7	Over 20, 30 or less	7	+ 0.030 + 0.015	7	0 −0.036		7	+ 0.022 0	+ 0.028 + 0.013		4		3	
10× 8	Over 30, 40 or less	10		8		0.8	10			0.6	4.5		3.5	
12× 8	Over 40, 50 or less	12	+ 0.036 + 0.018	8			12	+ 0.027 0	+ 0.034 + 0.016		4.5		3.5	
15×10	Over 50, 60 or less	15		10			15				5		5	
18×12	Over 60, 70 or less	18		12	0 −0.043	1.2	18			1.0	6		6	
20×13	Over 70, 80 or less	20	+ 0.043 + 0.022	13			20	+ 0.033 0	+ 0.041 + 0.020		7		6	
24×16	Over 80, 95 or less	24		16			24				8		8	
28×18	Over 95, 110 or less	28		18			28				9		9	
32×20	Over 110, 125 or less	32	+ 0.051 + 0.026	20	0 −0.052	2	32	+ 0.039 0	+ 0.050 + 0.025	1.6	10		10	

● Previous JIS Second Class (Excerpts from JIS B 1301-1959)

Unit [mm]

Nominal key dimension b×h	Applicable shaft diameter d	Key dimension b Basic dimension	Key dimension b Tolerance (h8)	Key dimension h Basic dimension	Key dimension h Tolerance (h10)	Key dimension c or r	Key slot Basic dimension of b1 and b2	b1 Tolerance (H9)	b2 Tolerance (E)	r1 and r2	t1 Basic dimension	t1 Tolerance	t2 Basic dimension	t2 Tolerance
4× 4	10 or more, 13 or less	4	0 −0.018	4	0 −0.048	0.5	4	+ 0.030 0	+ 0.050 + 0.020	0.4	2.5	+ 0.1 0	1.5	+ 0.1 0
5× 5	Over 13, 20 or less	5		5			5				3		2	
7× 7	Over 20, 30 or less	7	0 −0.022	7	0 −0.058		7	+ 0.036 0	+ 0.061 + 0.025		4		3	
10× 8	Over 30, 40 or less	10		8		0.8	10			0.6	4.5		3.5	
12× 8	Over 40, 50 or less	12	0 −0.027	8			12	+ 0.043 0	+ 0.075 + 0.032		4.5		3.5	
15×10	Over 50, 60 or less	15		10			15				5		5	
18×12	Over 60, 70 or less	18		12	0 −0.070	1.2	18			1.0	6		6	
20×13	Over 70, 80 or less	20	0 −0.033	13			20	+ 0.052 0	+ 0.092 + 0.040		7		6	
24×16	Over 80, 95 or less	24		16			24				8		8	
28×18	Over 95, 110 or less	28		18			28				9		9	
32×20	Over 110, 125 or less	32	0 −0.039	20	0 −0.084	2	32	+ 0.062 0	+ 0.112 + 0.050	1.6	10		10	

Permissible Dimensional Deviation of Shafts
(Excerpts from JIS B 0401)

Unit [μm]

Measurement Classification [mm]		d		e			f			g		h					js			j		k		m		n	p	r
Beyond	Below	d8	d9	e7	e8	e9	f6	f7	f8	g5	g6	h5	h6	h7	h8	h9	js5	js6	js7	j5	j6	k5	k6	m5	m6	n6	p6	r6
3	6	− 30 − 48	− 30 − 60	− 20 − 32	− 20 − 38	− 20 − 50	− 10 − 18	− 10 − 22	− 10 − 28	− 4 − 9	− 4 − 12	0 − 5	0 − 8	0 − 12	0 − 18	0 − 30	± 2.5	± 4	± 6	+ 3 − 2	+ 6 − 2	+ 6 + 1	+ 9 + 1	+ 9 + 4	+ 12 + 4	+ 16 + 8	+ 20 + 12	+ 23 + 15
6	10	− 40 − 62	− 40 − 76	− 25 − 40	− 25 − 47	− 25 − 61	− 13 − 22	− 13 − 28	− 13 − 35	− 5 − 11	− 5 − 14	0 − 6	0 − 9	0 − 15	0 − 22	0 − 36	± 3	± 4.5	± 7.5	+ 4 − 2	+ 7 − 2	+ 7 + 1	+ 10 + 1	+ 12 + 6	+ 15 + 6	+ 19 + 10	+ 24 + 15	+ 28 + 19
10	14	− 50 − 77	− 50 − 93	− 32 − 50	− 32 − 59	− 32 − 75	− 16 − 27	− 16 − 34	− 16 − 43	− 6 − 14	− 6 − 17	0 − 8	0 − 11	0 − 18	0 − 27	0 − 43	± 4	± 5.5	± 9	+ 5 − 3	+ 8 − 3	+ 9 + 1	+ 12 + 1	+ 15 + 7	+ 18 + 7	+ 23 + 12	+ 29 + 18	+ 34 + 23
14	18																											
18	24	− 65 − 98	− 65 − 117	− 40 − 61	− 40 − 73	− 40 − 92	− 20 − 33	− 20 − 41	− 20 − 53	− 7 − 16	− 7 − 20	0 − 9	0 − 13	0 − 21	0 − 33	0 − 52	± 4.5	± 6.5	± 10.5	+ 5 − 4	+ 9 − 4	+ 11 + 2	+ 15 + 2	+ 17 + 8	+ 21 + 8	+ 28 + 15	+ 35 + 22	+ 41 + 28
24	30																											
30	40	− 80 − 119	− 80 − 142	− 50 − 75	− 50 − 89	− 50 − 112	− 25 − 41	− 25 − 50	− 25 − 64	− 9 − 20	− 9 − 25	0 − 11	0 − 16	0 − 25	0 − 39	0 − 62	± 5.5	± 8	± 12.5	+ 6 − 5	+ 11 − 5	+ 13 + 2	+ 18 + 2	+ 20 + 9	+ 25 + 9	+ 33 + 17	+ 42 + 26	+ 50 + 34
40	50																											
50	65	− 100 − 146	− 100 − 174	− 60 − 90	− 60 − 106	− 60 − 134	− 30 − 49	− 30 − 60	− 30 − 76	− 10 − 23	− 10 − 29	0 − 13	0 − 19	0 − 30	0 − 46	0 − 74	± 6.5	± 9.5	± 15	+ 6 − 7	+ 12 − 7	+ 15 + 2	+ 21 + 2	+ 24 + 11	+ 30 + 11	+ 39 + 20	+ 51 + 32	+ 60 + 41
65	80																											+ 62 + 43
80	100	− 120 − 174	− 120 − 207	− 72 − 107	− 72 − 126	− 72 − 159	− 36 − 58	− 36 − 71	− 36 − 90	− 12 − 27	− 12 − 34	0 − 15	0 − 22	0 − 35	0 − 54	0 − 87	± 7.5	± 11.5	± 17.5	+ 6 − 9	+ 13 − 9	+ 18 + 3	+ 25 + 3	+ 28 + 13	+ 35 + 13	+ 45 + 23	+ 59 + 37	+ 73 + 51
100	120																											+ 76 + 54
120	140	− 145 − 208	− 145 − 245	− 85 − 125	− 85 − 148	− 85 − 185	− 43 − 68	− 43 − 83	− 43 − 106	− 14 − 32	− 14 − 39	0 − 18	0 − 25	0 − 40	0 − 63	0 − 100	± 9	± 12.5	± 20	+ 7 − 11	+ 14 − 11	+ 21 + 3	+ 28 + 3	+ 33 + 15	+ 40 + 15	+ 52 + 27	+ 68 + 43	+ 88 + 63
140	160																											+ 90 + 65
160	180																											+ 93 + 68
180	200	− 170 − 242	− 170 − 285	− 100 − 146	− 100 − 172	− 100 − 215	− 50 − 79	− 50 − 96	− 50 − 122	− 15 − 35	− 15 − 44	0 − 20	0 − 29	0 − 46	0 − 72	0 − 115	± 10	± 14.5	± 23	+ 7 − 13	+ 16 − 13	+ 24 + 4	+ 33 + 4	+ 37 + 17	+ 46 + 17	+ 60 + 31	+ 79 + 50	+ 106 + 77
200	225																											+ 109 + 80
225	250																											+ 113 + 84
250	280	− 190 − 271	− 190 − 320	− 110 − 162	− 110 − 191	− 110 − 240	− 56 − 88	− 56 − 108	− 56 − 137	− 17 − 40	− 17 − 49	0 − 23	0 − 32	0 − 52	0 − 81	0 − 130	± 11.5	± 16	± 26	+ 7 − 16	± 16	+ 27 + 4	+ 36 + 4	+ 43 + 20	+ 52 + 20	+ 66 + 34	+ 88 + 56	+ 126 + 94
280	315																											+ 130 + 98
315	355	− 210 − 299	− 210 − 350	− 125 − 182	− 125 − 214	− 125 − 265	− 62 − 98	− 62 − 119	− 62 − 151	− 18 − 43	− 18 − 54	0 − 25	0 − 36	0 − 57	0 − 89	0 − 140	± 12.5	± 18	± 28.5	+ 7 − 18	± 18	+ 29 + 4	+ 40 + 4	+ 46 + 21	+ 57 + 21	+ 73 + 37	+ 98 + 62	+ 144 + 108
355	400																											+ 150 + 114
400	450	− 230 − 327	− 230 − 385	− 135 − 198	− 135 − 232	− 135 − 290	− 68 − 108	− 68 − 131	− 68 − 165	− 20 − 47	− 20 − 60	0 − 27	0 − 40	0 − 63	0 − 97	0 − 155	± 13.5	± 20	± 31.5	+ 7 − 20	± 20	+ 32 + 5	+ 45 + 5	+ 50 + 23	+ 63 + 23	+ 80 + 40	+ 108 + 68	+ 166 + 126
450	500																											+ 172 + 132

* The upper value in each column indicates the upper deviation, and the lower value in each column indicates the lower deviation.

Technical Data

Permissible Dimensional Deviation of Bores

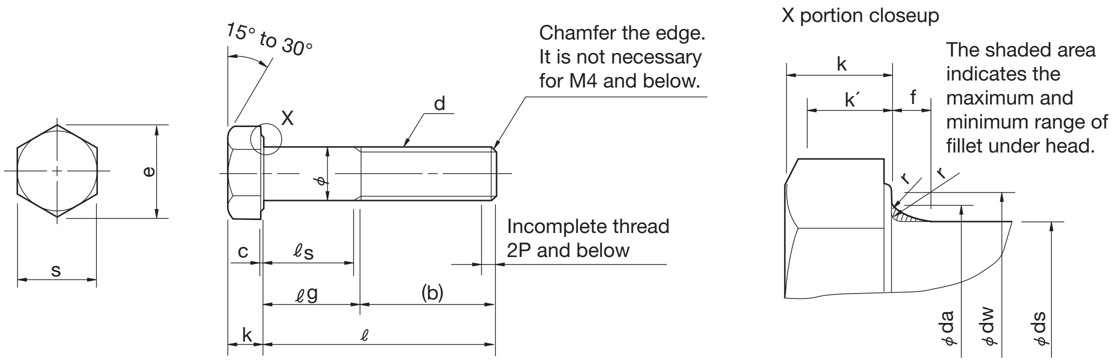
(Excerpts from JIS B 0401)

Unit [μm]

Measurement Classification [mm]		E			F			G		H						Js		J		K		M		N		P	R
Beyond	Below	E7	E8	E9	F6	F7	F8	G6	G7	H5	H6	H7	H8	H9	H10	Js6	Js7	J6	J7	K6	K7	M6	M7	N6	N7	P7	R7
3	6	+ 32 + 20	+ 38 + 20	+ 50 + 20	+ 18 + 10	+ 22 + 10	+ 28 + 10	+ 12 + 4	+ 16 + 4	+ 5 0	+ 8 0	+ 12 0	+ 18 0	+ 30 0	+ 48 0	± 4	± 6	+ 5 − 3	± 6	+ 2 − 6	+ 3 − 9	− 1 − 9	0 − 12	− 5 − 13	− 4 − 16	− 8 − 20	− 11 − 23
6	10	+ 40 + 25	+ 47 + 25	+ 61 + 25	+ 22 + 13	+ 28 + 13	+ 35 + 13	+ 14 + 5	+ 20 + 5	+ 6 0	+ 9 0	+ 15 0	+ 22 0	+ 36 0	+ 58 0	± 4.5	± 7.5	+ 5 − 4	+ 8 − 7	+ 2 − 7	+ 5 − 10	− 3 − 12	0 − 15	− 7 − 16	− 4 − 19	− 9 − 24	− 13 − 28
10	14	+ 50 + 32	+ 59 + 32	+ 75 + 32	+ 27 + 16	+ 34 + 16	+ 43 + 16	+ 17 + 6	+ 24 + 6	+ 8 0	+ 11 0	+ 18 0	+ 27 0	+ 43 0	+ 70 0	± 5.5	± 9	+ 6 − 5	+ 10 − 8	+ 2 − 9	+ 6 − 12	− 4 − 15	0 − 18	− 9 − 20	− 5 − 23	− 11 − 29	− 16 − 34
14	18																										
18	24	+ 61 + 40	+ 73 + 40	+ 92 + 40	+ 33 + 20	+ 41 + 20	+ 53 + 20	+ 20 + 7	+ 28 + 7	+ 9 0	+ 13 0	+ 21 0	+ 33 0	+ 52 0	+ 84 0	± 6.5	± 10.5	+ 8 − 5	+ 12 − 9	+ 2 − 11	+ 6 − 15	− 4 − 17	0 − 21	− 11 − 24	− 7 − 28	− 14 − 35	− 20 − 41
24	30																										
30	40	+ 75 + 50	+ 89 + 50	+ 112 + 50	+ 41 + 25	+ 50 + 25	+ 64 + 25	+ 25 + 9	+ 34 + 9	+ 11 0	+ 16 0	+ 25 0	+ 39 0	+ 62 0	+ 100 0	± 8	± 12.5	+ 10 − 6	+ 14 − 11	+ 3 − 13	+ 7 − 18	− 4 − 20	0 − 25	− 12 − 28	− 8 − 33	− 17 − 42	− 25 − 50
40	50																										
50	65	+ 90 + 60	+ 106 + 60	+ 134 + 60	+ 49 + 30	+ 60 + 30	+ 76 + 30	+ 29 + 10	+ 40 + 10	+ 13	+ 19 0	+ 30 0	+ 46 0	+ 74 0	+ 120 0	± 9.5	± 15	+ 13 − 6	+ 18 − 12	+ 4 − 15	+ 9 − 21	− 5 − 24	0 − 30	− 14 − 33	− 9 − 39	− 21 − 51	− 30 − 60
65	80																										− 32 − 62
80	100	+ 107 + 72	+ 126 + 72	+ 159 + 72	+ 58 + 36	+ 71 + 36	+ 90 + 36	+ 34 + 12	+ 47 + 12	+ 15 0	+ 22 0	+ 35 0	+ 54 0	+ 87 0	+ 140 0	± 11	± 17.5	+ 16 − 6	+ 22 − 13	+ 4 − 18	+ 10 − 25	− 6 − 28	0 − 35	− 16 − 38	− 10 − 45	− 24 − 59	− 38 − 73
100	120																										− 41 − 76
120	140	+ 125 + 85	+ 148 + 85	+ 185 + 85	+ 68 + 43	+ 83 + 43	+ 106 + 43	+ 39 + 14	+ 54 + 14	+ 18 0	+ 25 0	+ 40 0	+ 63 0	+ 100 0	+ 160 0	± 12.5	± 20	+ 18 − 7	+ 26 − 14	+ 4 − 21	+ 12 − 28	− 8 − 33	0 − 40	− 20 − 45	− 12 − 52	− 28 − 68	− 48 − 88
140	160																										− 50 − 90
160	180																										− 53 − 93
180	200	+ 146 + 100	+ 172 + 100	+ 125 + 100	+ 79 + 50	+ 96 + 50	+ 122 + 50	+ 44 + 15	+ 61 + 15	+ 20 0	+ 29 0	+ 46 0	+ 72 0	+ 115 0	+ 185 0	± 14.5	± 23	+ 22 − 7	+ 30 − 16	+ 5 − 24	+ 13 − 33	− 8 − 37	0 − 46	− 22 − 51	− 14 − 60	− 33 − 79	− 60 − 106
200	225																										− 63 − 109
225	250																										− 67 − 113
250	280	+ 162 + 110	+ 191 + 110	+ 240 + 110	+ 88 + 56	+ 108 + 56	+ 137 + 56	+ 49 + 17	+ 69 + 17	+ 23 0	+ 32 0	+ 52 0	+ 81 0	+ 130 0	+ 210 0	± 16	± 26	+ 25 − 7	+ 36 − 16	+ 5 − 27	+ 16 − 36	− 9 − 41	0 − 52	− 25 − 57	− 14 − 66	− 33 − 88	− 74 − 126
280	315																										− 78 − 130
315	355	+ 182 + 125	+ 214 + 125	+ 265 + 125	+ 98 + 62	+ 119 + 62	+ 151 + 62	+ 54 + 18	+ 75 + 18	+ 25 0	+ 36 0	+ 57 0	+ 89 0	+ 140 0	+ 230 0	± 18	± 28.5	+ 29 − 7	+ 39 − 18	+ 7 − 29	+ 17 − 40	− 10 − 46	0 − 57	− 26 − 62	− 16 − 73	− 41 − 98	− 87 − 144
355	400																										− 93 − 150
400	450	+ 198 + 135	+ 232 + 135	+ 290 + 135	+ 108 + 68	+ 131 + 68	+ 165 + 68	+ 60 + 20	+ 83 + 20	+ 27 0	+ 40 0	+ 63 0	+ 97 0	+ 155 0	+ 250 0	± 20	± 31.5	+ 33 − 7	+ 43 − 20	+ 8 − 32	+ 18 − 45	− 10 − 50	0 − 63	− 27 − 67	− 17 − 80	− 45 − 108	− 103 − 166
450	500																										− 109 − 172

* The upper value in each column indicates the upper deviation, and the lower value in each column indicates the lower deviation.

Configuration and Dimension of Hexagon Bolts (Parts grade A) (Excerpts from JIS B 1180-1985)



Unit [mm]

Nominal designation of screw (d)		M3	M4	M5	M6	M8	M10	M12	(M14)	M16	M20	M24
Pitch of screw (P)		0.5	0.7	0.8	1	1.25	1.5	1.75	2	2	2.5	3
b (Reference)	ℓ≤125	12	14	16	18	22	26	30	34	38	46	54
	125<ℓ≤150	—	—	—	—	—	—	—	40	44	52	60
c	Minimum	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.2	0.2	0.2
	Maximum	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8
da	Maximum	3.6	4.7	5.7	6.8	9.2	11.2	13.7	15.7	17.7	22.4	26.4
ds	Max. (Basic dimension)	3	4	5	6	8	10	12	14	16	20	24
	Minimum	2.86	3.82	4.82	5.82	7.78	9.78	11.73	13.73	15.73	19.67	23.67
dw	Minimum	4.57	5.88	6.88	8.88	11.63	14.63	16.63	19.64	22.49	28.19	33.61
e	Minimum	6.01	7.66	8.79	11.05	14.38	17.77	20.03	23.36	26.75	33.53	39.98
f	Maximum	1	1.2	1.2	1.4	2	2	3	3	3	4	4
k	Nominal disig. (Basic dimension)	2	2.8	3.5	4	5.3	6.4	7.5	8.8	10	12.5	15
	Minimum	1.875	2.675	3.35	3.85	5.15	6.22	7.32	8.62	9.82	12.285	14.785
	Maximum	2.125	2.925	3.65	4.15	5.45	6.58	7.68	8.98	10.18	12.715	15.215
k'	Minimum	1.31	1.87	2.35	2.7	3.61	4.35	5.12	6.03	6.87	8.6	10.35
r	Minimum	0.1	0.2	0.2	0.25	0.4	0.4	0.6	0.6	0.6	0.8	0.8
s	Max. (Basic dimension)	5.5	7	8	10	13	16	18	21	24	30	36
	Minimum	5.32	6.78	7.78	9.78	12.73	15.73	17.73	20.67	23.67	29.67	35.38

* The nominal diameter in parentheses is preferably not to be used.

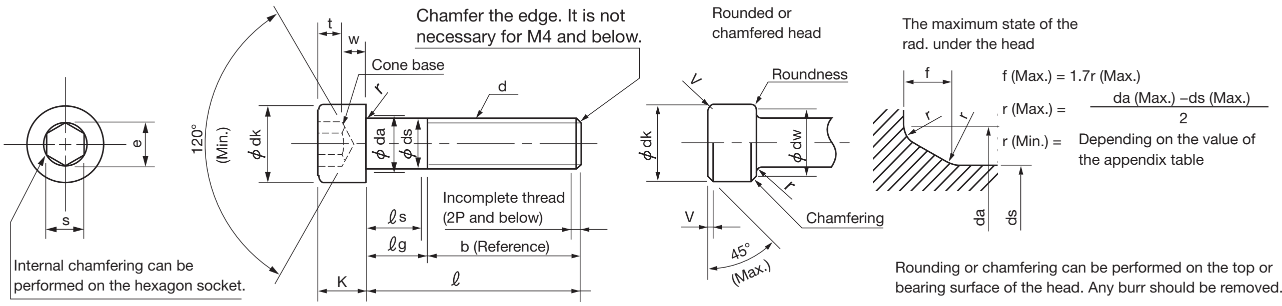
Unit [mm]

Nominal designation of screw			M3		M4		M5		M6		M8		M10		M12		(M14)		M16		M20		M24	
ℓ			ℓs and ℓg																					
Nominal length (basic dimension)	Min.	Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.
20	19.58	20.42	5.5	8																				
25	24.58	25.42	10.5	13	7.5	11	5	9																
30	29.58	30.42	15.5	18	12.5	16	10	14	7	12														
35	34.5	35.5			17.5	21	15	19	12	17														
40	39.5	40.5			22.5	26	20	24	17	22	11.75	18												
45	44.5	45.5					25	29	22	27	16.75	23	11.5	19										
50	49.5	50.5					30	34	27	32	21.75	28	16.5	24	11.25	20								
55	54.4	55.6							32	37	26.75	33	21.5	29	16.25	25								
60	59.4	60.6							37	42	31.75	38	26.5	34	21.25	30	16	26						
65	64.4	65.6									36.75	43	31.5	39	26.25	35	21	31	17	27				
70	69.4	70.6									41.75	48	36.5	44	31.25	40	26	36	22	32				
80	79.4	80.6									51.75	58	46.5	54	41.25	50	36	46	32	42	21.5	34		
90	89.3	90.7											56.5	64	51.25	60	46	56	42	52	31.5	44	21	36
100	99.3	100.7											66.5	74	61.25	70	56	66	52	62	41.5	54	31	46
110	109.3	110.7													71.25	80	66	76	62	72	51.5	64	41	56
120	119.3	120.7													81.25	90	76	86	72	82	61.5	74	51	66
130	129.2	130.8															80	90	76	86	65.5	78	55	70
140	139.2	140.8															90	100	86	96	75.5	88	65	80
150	149.2	150.8																	96	106	85.5	98	75	90

* The gray portion indicates the recommended nominal length (ℓ).

Technical Data

Configuration and Dimension of Hexagon Socket Head Cap Screws (Excerpts from JIS B 1176-1988)



Unit [mm]

Nominal designation of screw (d)		M1.6	M2	M2.5	M3	M4	M5	M6	M8	M10	M12	(M14)	M16	(M18)	M20
Pitch of screw (P)		0.35	0.4	0.45	0.5	0.7	0.8	1	1.25	1.5	1.75	2	2	2.5	2.5
b	Reference	15	16	17	18	20	22	24	28	32	36	40	44	48	52
dk	Max. (Basic dimension)*1	3	3.8	4.5	5.5	7	8.5	10	13	16	18	21	24	27	30
	Maximum *2	3.14	3.98	4.68	5.68	7.22	8.72	10.22	13.27	16.27	18.27	21.33	24.33	27.33	30.33
	Minimum	2.86	3.62	4.32	5.32	6.78	8.28	9.78	12.73	15.73	17.73	20.67	23.67	26.67	29.67
da	Maximum	2	2.6	3.1	3.6	4.7	5.7	6.8	9.2	11.2	13.7	15.7	17.7	20.2	22.4
ds	Max. (Basic dimension)	1.6	2	2.5	3	4	5	6	8	10	12	14	16	18	20
	Minimum	1.46	1.86	2.36	2.86	3.82	4.82	5.82	7.78	9.78	11.73	13.73	15.73	17.73	19.67
e	Minimum	1.73	1.73	2.30	2.87	3.44	4.58	5.72	6.86	9.15	11.43	13.72	16.00	16.00	19.44
f	Maximum	0.34	0.51	0.51	0.51	0.60	0.60	0.68	1.02	1.02	1.45	1.45	1.45	1.87	2.04
k	Max. (Basic dimension)	1.6	2	2.5	3	4	5	6	8	10	12	14	16	18	20
	Minimum	1.46	1.86	2.36	2.86	3.82	4.82	5.70	7.64	9.64	11.57	13.57	15.57	17.57	19.48
r	Minimum	0.1	0.1	0.1	0.1	0.2	0.2	0.25	0.4	0.4	0.6	0.6	0.6	0.6	0.8
s	Nominal disig. (Basic dimension)	1.5	1.5	2	2.5	3	4	5	6	8	10	12	14	14	17
	Minimum	1.52	1.52	2.02	2.52	3.02	4.02	5.02	6.02	8.025	10.025	12.032	14.032	14.032	17.050
	Maximum Column 1	1.560	1.560	2.060	2.580	3.080	4.095	5.140	6.140	8.175	10.175	12.212	14.212	14.212	17.230
	Maximum Column 2	1.545	1.545	2.045	2.560	3.080	4.095	5.095	6.095	8.155	10.115	12.142	14.142	14.142	17.230
t	Minimum	0.7	1	1.1	1.3	2	2.5	3	4	5	6	7	8	9	10
v	Maximum	0.16	0.2	0.25	0.3	0.4	0.5	0.6	0.8	1	1.2	1.4	1.6	1.8	2
dw	Minimum	2.72	3.40	4.18	5.07	6.53	8.03	9.38	12.33	15.33	17.23	20.17	23.17	25.87	28.87
w	Minimum	0.55	0.55	0.85	1.15	1.4	1.9	2.3	3.3	4	4.8	5.8	6.8	7.7	8.6

* Knurl the side surface of the head. In this case, the dk (Maximum) shall be the values marked *2. For side surfaces with no knurling, the dk shall be the values marked *1.
* The column 1 of S (Maximum) is used for the strength class 8.8 and 10.9, and for the property class A2-50 and A2-70. The column 2 is applied to the strength class 12.9. The column 1 can be applied to the strength class 12.9 by agreement of the parties concerned.
* The nominal diameters in parentheses are preferably not to be used.

Unit [mm]

Nominal designation of screw			M1.6		M2		M2.5		M3		M4		M5		M6		M8		M10		M12		(M14)		M16		(M18)		M20	
ℓ			ℓs and ℓg																											
Nominal length	Min.	Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.
2.5	2.30	2.70																												
3	2.80	3.20																												
4	3.76	4.24																												
5	4.76	5.24																												
6	5.76	6.24																												
8	7.71	8.29																												
10	9.71	10.29																												
12	11.65	12.35																												
16	15.65	16.35																												
20	19.58	20.42			2	4																								
25	24.58	25.42					5.75	8	4.5	7																				
30	29.58	30.42							9.5	12	6.5	10	4	8																
35	34.5	35.5									11.5	15	9	13	6	11														
40	39.5	40.5									16.5	20	14	18	11	16	5.75	12												
45	44.5	45.5											19	23	16	21	10.75	17	5.5	13										
50	49.5	50.5											24	28	21	26	15.75	22	10.5	18	5.25	14								
55	54.4	55.6													26	31	20.75	27	15.5	23	10.25	19								
60	59.4	60.6													31	36	25.75	32	20.5	28	15.25	24	10	20	6	16				
65	64.4	65.6															30.75	37	25.5	33	20.25	29	15	25	11	21	4.5	17		
70	69.4	70.6															35.75	42	30.5	38	25.25	34	20	30	16	26	9.5	22	5.5	18
80	79.4	80.6															45.75	52	40.5	48	35.25	44	30	40	26	36	19.5	32	15.5	28
90	89.3	90.7																	50.5	58	45.25	54	40	50	36	46	29.5	42	25.5	38
100	99.3	100.7																	60.5	68	55.25	64	50	60	46	56	39.5	52	35.5	48
110	109.3	110.7																			65.25	74	60	70	56	66	49.5	62	45.5	58
120	119.3	120.7																			75.25	84	70	80	66	76	59.5	72	55.5	68
130	129.2	130.8																					80	90	76	86	69.5	82	65.5	78
140	139.2	140.8																					90	100	86	96	79.5	92	75.5	88
150	149.2	150.8																							96	106	89.5	102	85.5	98
160	159.2	160.8																							106	116	99.5	112	95.5	108
180	179.2	180.8																									119.5	132	115.5	128
200	199.05	200.95																											135.5	148

* The gray portion indicates the recommended nominal length (ℓ). The nominal length (ℓ) that is shorter than the dashed line position indicates a complete thread. The incomplete thread length under head is about 3P.

Technical Data

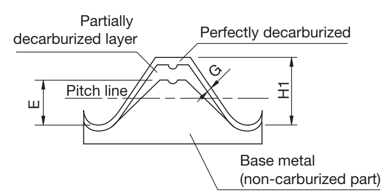
Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel (Excerpts from JIS B 1051-2000)

● Mechanical Properties of Strength Category

Mechanical properties			Strength category										
			3.6	4.6	4.8	5.6	5.8	6.8	8.8 d≤16*1	8.8 d>16*1	9.8*2	10.9	12.9
Tensile strength Rm*3 *4 [N/mm²]		Nominal	300	400		500		600	800	800	900	1,000	1,200
		Min.	330	400	420	500	520	600	800	830	900	1,040	1,220
Hardness: Vickers hardness HV		Min.	95	120	130	155	160	190	250	255	290	320	385
		Max.	220*5					250	320	335	360	380	435
Hardness: Brinell hardness HB		Min.	90	114	124	147	152	181	238	242	276	304	366
		Max.	209*5					238	304	318	342	361	414
Hardness: Rockwell hardness	HRB	Min.	52	67	71	79	82	89	–	–	–	–	–
		Max.	95.0*5					99.5	–	–	–	–	–
	HRC	Min.	–	–	–	–	–	–	22	23	28	32	39
		Max.	–						32	34	37	39	44
Surface hardness HV0.3		Max.	–						*6				
Lower yield point ReL*7 [N/mm²]		Nominal	180	240	320	300	400	480	–				
		Min.	190	240	340	300	420	480	–				
0.2% bearing force Rp0.2*8 [N/mm²]		Nominal	–						640	640	720	900	1,080
		Min.	–						640	660	720	940	1,100
Proof load stress		Stress ratio	0.94	0.94	0.91	0.93	0.90	0.92	0.91	0.91	0.90	0.88	0.88
		[N/mm²]	180	225	310	280	380	440	580	600	650	830	970
Total elongation %		Min.	25	22	–	20	–	–	12	12	10	9	8
Wedge tensile strength			Must not be smaller than the minimum tensile strength										
Impact strength [J]		Min.	–			25	–		30	30	25	20	15
Head percussion strength			Must not be fractured										
Height of non-carburized part of screw thread E		Min.	–						1/2H1			2/3H1	3/4H1
Depth of completely carburized part G [mm]		Max.	–						0.015				

* *1: Bolts for steel structures of strength category 8.8 are categorized by nominal screw diameter of 12mm.
* *2: Strength category 9.8 is applicable only to screws whose nominal diameter is 16mm or less.
* *3: Minimum tensile strength is applicable to a nominal length of 2.5d or more. Minimum hardness is applied where the nominal length is smaller than 2.5d or where a tensile test cannot be conducted such as the head has a special profile.
* *4: Tensile loads in tests conducted in a product state shall be the values calculated based on minimum tensile strength Rm min.
* *5: The hardness of the tip of threaded parts of bolts, screws and studs shall be 250HV, 238HB or 99.5HRB or less.
* *6: The surface hardness of products of 8.8 to 12.9 in strength category must not produce a difference of more than 30 points at Vickers hardness HV0.3 compared with inner hardness. The surface hardness of products of 10.9 in strength category must not exceed 390HV.
* *7: Where the lower yield point ReL cannot be measured, 0.2% bearing force Rp0.2 shall be used. ReL values for strength categories 4.8, 5.8 and 6.8 are for calculation purposes only and are not values for testing.
* *8: The yield stress ratio and minimum 0.2% bearing force Rp0.2 in accordance with the method for expressing strength categories shall be used in tests of cut test pieces. These values may vary when products themselves are tested to obtain these values, due to the manufacturing method of the products, nominal screw diameter, or other factor.

■Evaluation of Condition of Carbon on Surface



H1: Height of screw thread in a maximum substantive condition

Values of H1 and E (Minimum)

Unit [mm]

Pitch of screw (P)			0.5	0.6	0.7	0.8	1	1.25	1.5	1.75	2	2.5	3	3.5	4
H1			0.307	0.368	0.429	0.491	0.613	0.767	0.920	1.074	1.227	1.534	1.840	2.147	2.454
E (Min.)	Strength category	8.8,9.8	0.154	0.184	0.215	0.245	0.307	0.384	0.460	0.537	0.614	0.767	0.920	1.074	1.227
		10.9	0.205	0.245	0.286	0.327	0.409	0.511	0.613	0.716	0.818	1.023	1.227	1.431	1.636
		12.9	0.230	0.276	0.322	0.368	0.460	0.575	0.690	0.806	0.920	1.151	1.380	1.610	1.841

● Mechanical Properties and Maximum Tightening Torque of Hexagon Socket Head Cap Screw (For coarse pitch thread of strength categories of 10.9 and 12.9)

Supplementary information

Nominal d	Effective sectional area [mm2]	Minimum tensile load [N]		Yield load [N]		Proof load [N]		Permissible maximum axial force F [N]		(Tf max.) Maximum tightening torque [N·m] When K=0.17		When K=0.25	
		10.9	12.9	10.9	12.9	10.9	12.9	10.9	12.9	10.9	12.9	10.9	12.9
M1.6	1.27	1,320	1,550	1,190	1,390	1,050	1,230	832	976	0.23	0.27	0.33	0.39
M2	2.07	2,150	2,530	1,940	2,270	1,720	2,010	1,360	1,590	0.46	0.54	0.68	0.80
M2.5	3.39	3,530	4,140	3,170	3,720	2,810	3,290	2,220	2,610	0.94	1.11	1.39	1.63
M3	5.03	5,230	6,140	4,710	5,520	4,180	4,880	3,300	3,870	1.68	1.97	2.47	2.90
M4	8.78	9,130	10,700	8,220	9,640	7,290	8,520	5,750	6,750	3.91	4.59	5.75	6.75
M5	14.2	14,800	17,300	13,300	15,600	11,800	13,800	9,300	10,900	7.91	9.28	11.6	13.6
M6	20.1	20,900	24,500	18,800	22,100	16,700	19,500	13,200	15,400	13.4	15.8	19.8	23.2
M8	36.6	38,100	44,600	34,300	40,200	30,400	35,500	24,000	28,100	32.6	38.3	48	56.3
M10	58.0	60,300	70,800	54,300	63,700	48,100	56,300	38,000	44,600	64.6	75.8	95	111
M12	84.3	87,700	103,000	78,900	92,600	70,000	81,800	55,200	64,800	113	132	166	194
M14	115	120,000	140,000	108,000	126,000	95,500	112,000	75,300	88,400	179	210	264	309
M16	157	163,000	192,000	147,000	172,000	130,000	152,000	103,000	121,000	280	328	411	483
M18	192	200,000	234,000	180,000	211,000	159,000	186,000	126,000	148,000	385	452	566	664
M20	245	255,000	299,000	229,000	269,000	203,000	238,000	161,000	188,000	546	640	803	942
M22	303	315,000	370,000	284,000	333,000	252,000	294,000	199,000	233,000	742	871	1,090	1,280
M24	353	367,000	431,000	330,000	388,000	293,000	342,000	231,000	271,000	944	1,110	1,390	1,630
M27	459	477,000	560,000	430,000	504,000	381,000	445,000	301,000	353,000	1,380	1,620	2,030	2,380
M30	561	583,000	684,000	525,000	616,000	466,000	544,000	368,000	431,000	1,870	2,200	2,760	3,230

K: Torque coefficient

Remarks

1. The minimum tensile load and proof load given in the above table are derived from JIS B 1051-2000.
2. Yield load = Bearing force (lower yield point) × Effective sectional area
3. Value calculated by permissible maximum axial force
   ≈ 0.7 × Yield stress, maximum tightening torque (Tfmax) = Torque coefficient (K) × Permissible maximum axial force (F) × Nominal diameter (d)
4. Value of torque coefficient
   Value of K = 0.17
   For oil lubrication, clamped material SS400, finish of clamped surface about 25S, internal thread material SS400, internal thread accuracy 6g or class 2
   Value of K = 0.25
   For electrogalvanizing, clamped material SS400, finish of clamped surface about 25S, internal thread material SCM, internal thread accuracy 6g or class 2
   Supplementary information
   Value of K = 0.35 will result in the table shown above if the internal thread material is SS400.

Recommended tightening torque (Tf)

Recommended tightening torque (Tf) varies due to dispersion of the initial tightening force depending on the tool used.
Recommended tightening torque (Tf) = Value for each tool × Maximum tightening torque (Tfmax)

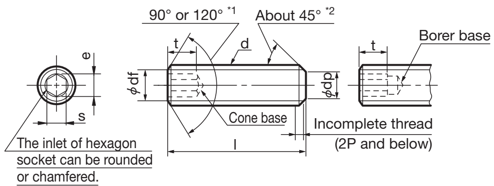
Value for each tool

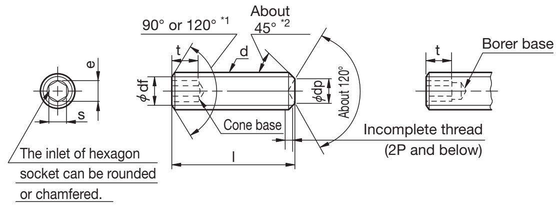
1) When clamped by hand	: 0.65 Tfmax.	3) By a torque wrench or by a wrench with limit on torque	: 0.85 Tfmax.
2) By an impact driver or an electric driver	: 0.75 Tfmax.	4) By a torque wrench	: 0.9 Tfmax.

Note: The foregoing values are for reference purposes only. When in use, calculate an appropriate tightening torque in accordance with JIS B 1083, JIS B 1084 or other standard.

Technical Data

Configuration and Dimension of Hexagon Socket Set Screw (Excerpts from JIS B 1177-1997)





Nominal designation of screw (d)		M1.6	M2	M2.5	M3	M4	M5	M6	M8	M10	M12	M16	M20	M24
Pitch (P)		0.35	0.4	0.45	0.5	0.7	0.8	1	1.25	1.5	1.75	2	2.5	3
dp	Maximum	0.80	1.00	1.5	2.00	2.50	3.5	4	5.5	7.00	8.50	12.00	15.00	18.00
	Minimum	0.55	0.75	1.25	1.75	2.25	3.2	3.7	5.2	6.64	8.14	11.57	14.57	17.57
dz	Maximum	0.80	1.00	1.20	1.40	2.00	2.50	3.00	5.0	6.0	8.00	10.00	14.00	16.00
	Minimum	0.55	0.75	0.95	1.15	1.75	2.25	2.75	4.7	5.7	7.64	9.64	13.57	15.57
df		Almost the diameter of screw groove												
e*3	Minimum	0.803	1.003	1.427	1.73	2.3	2.87	3.44	4.58	5.72	6.86	9.15	11.43	13.72
s*4	Designation	0.7	0.9	1.3	1.5	2	2.5	3	4	5	6	8	10	12
	Maximum	0.724	0.902	1.295	1.545	2.045	2.560	3.071	4.084	5.084	6.095	8.115	10.115	12.142
	Minimum	0.711	0.889	1.270	1.520	2.020	2.520	3.020	4.020	5.020	6.020	8.025	10.025	12.032
t	Minimum*5	0.7	0.8	1.2	1.2	1.5	2	2	3	4	4.8	6.4	8	10
	Minimum*6	1.5	1.7	2	2	2.5	3	3.5	5	6	8	10	12	15

	Nominal length	ℓ Min.	ℓ Max.	(Reference) Outline mass per 1000 units / kg (Density:$7.85kg/dm^3$)												
Flat point	2	1.8	2.2	0.021	0.029	0.05	0.059									
	2.5	2.3	2.7	0.025	0.037	0.063	0.08	0.099								
	3	2.8	3.2	0.029	0.044	0.075	0.1	0.14	0.2							
	4	3.76	4.24	0.037	0.059	0.1	0.14	0.22	0.32	0.41						
	5	4.76	5.24	0.046	0.074	0.125	0.18	0.3	0.44	0.585	0.945					
	6	5.76	6.24	0.054	0.089	0.15	0.22	0.38	0.56	0.76	1.26	1.77				
	8	7.71	8.29	0.07	0.119	0.199	0.3	0.54	0.8	1.11	1.89	2.78	4			
	10	9.71	10.29		0.148	0.249	0.38	0.7	1.04	1.46	2.52	3.78	5.4	8.5		
	12	11.65	12.35			0.299	0.46	0.86	1.28	1.81	3.15	4.78	6.8	11.1	15.8	
	16	15.65	16.35				0.62	1.18	1.76	2.51	4.41	6.78	9.6	16.3	24.1	30
	20	19.58	20.42					1.49	2.24	3.21	5.67	8.76	12.4	21.5	32.3	42
	25	24.58	25.42						2.84	4.09	7.25	11.2	15.9	28	42.6	57
	30	29.58	30.42							4.94	8.82	13.7	19.4	34.6	52.9	72
	35	34.5	35.5								10.4	16.2	22.9	41.1	63.2	87
	40	39.5	40.5								12	18.7	26.4	47.7	73.5	102
	45	44.5	45.5									21.2	29.9	54.2	83.8	117
	50	49.5	50.5									23.7	33.4	60.7	94.1	132
	55	54.4	55.6										36.8	67.3	104	147
	60	59.4	60.6										40.3	73.7	115	162
Con-cave point	2	1.8	2.2	0.019	0.029	0.05										
	2.5	2.3	2.7	0.025	0.037	0.063	0.079									
	3	2.8	3.2	0.029	0.044	0.075	0.1	0.155								
	4	3.76	4.24	0.037	0.059	0.1	0.14	0.23	0.3							
	5	4.76	5.24	0.046	0.074	0.125	0.18	0.305	0.42	0.565						
	6	5.76	6.24	0.054	0.089	0.15	0.22	0.38	0.54	0.74	1.25					
	8	7.71	8.29	0.07	0.119	0.199	0.3	0.53	0.78	1.09	1.88	2.71				
	10	9.71	10.29		0.148	0.249	0.38	0.68	1.02	1.44	2.51	3.72	5.3			
	12	11.65	12.35			0.299	0.46	0.83	1.26	1.79	3.14	4.73	6.7	10.5		
	16	15.65	16.35				0.62	1.13	1.74	2.49	4.4	6.73	9.5	15.7	22.9	
	20	19.58	20.42					1.42	2.22	3.19	5.66	8.72	12.3	20.9	31.1	40.2
	25	24.58	25.42						2.82	4.07	7.24	11.2	15.8	27.4	41.4	55.2
	30	29.58	30.42							4.94	8.81	13.7	19.3	33.9	51.7	70.3
	35	34.5	35.5								10.4	16.2	22.7	40.4	62	85.3
	40	39.5	40.5								12	18.7	26.2	46.9	72.3	100
	45	44.5	45.5									21.2	29.7	53.3	82.6	115
	50	49.5	50.5									23.6	33.2	59.8	92.6	130
	55	54.4	55.6										36.6	66.3	103	145
	60	59.4	60.6										40.1	72.8	114	160

**1 For the nominal length (ℓ) that is shorter than the stepped double line, perform a 120° of chamfering.
**2 The angle of approx. 45o corresponds to the slope portion below the core diameter.
**3 e minimum= 1.14 x s minimum. Nominal diameter M1.6, M2 and M2.5 are excluded.
**4 For s, use the specified hexagon socket gauge to examine.

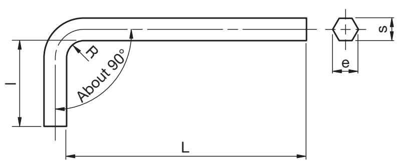
* The upper value of *5 t minimum is applicable to the nominal length (ℓ) shorter than the stepped double line.
* The lower value of *6 t minimum is applicable to the nominal length (ℓ) longer than the stepped double line.

Remarks

1. The recommended nominal length (ℓ) for nominal designation is indicated within the gray portion.
2. Dimensional symbols correspond to the JIS B 0143.
3. The configuration of hexagon socket base can be either cone or borer base. For a borer base, the bore depth must not be 1.2 times or more than the hexagon socket depth t.

Technical Data

Configuration and Dimension of Hexagon Bar Wrench (Spanner) (Excerpts from JIS B 4648-1994)



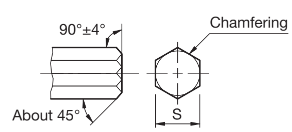
Nominal designation of spanner	Configuration/Dimension [mm]							Mechanical properties		
	s		e		L	l	R	Hardness (Min.)*1		Proof torque*2 [N·m]
	Max.	Min.	Max.	Min.	About	About	About	Rockwell hardness	Vickers hardness	
0.7	0.711	0.698	0.79	0.76	32	6	1.5	52HRC	545HV	0.08
0.9	0.889	0.876	0.99	0.96	32	10	1.5			0.18
1.3	1.270	1.244	1.42	1.37	40	12	1.5			0.53
1.5	1.500	1.475	1.68	1.63	45	14	1.5			0.82
2	2.00	1.960	2.25	2.18	50	16	2			1.9
2.5	2.50	2.460	2.82	2.75	56	18	2.5			3.8
3	3.00	2.960	3.39	3.31	63	20	3			6.6
4	4.00	3.952	4.53	4.44	70	25	4			16
5	5.00	4.952	5.67	5.58	80	28	5			30
6	6.00	5.952	6.81	6.71	90	32	6			52
8	8.00	7.942	9.09	8.97	100	36	8	50HRC	513HV	120
10	10.00	9.942	11.37	11.23	112	40	10	48HRC	485HV	220
12	12.00	11.89	13.65	13.44	125	45	12			370
14	14.00	13.89	15.93	15.70	140	56	14			590
17	17.00	16.89	19.35	19.09	160	63	17	45HRC	446HV	980
19	19.00	18.87	21.63	21.32	180	70	19			1360
22	22.00	21.87	25.05	24.71	200	80	22			2110
24	24.00	23.87	27.33	26.97	224	90	24			2750
27	27.00	26.87	30.75	30.36	250	100	27			3910
32	32.00	31.84	36.45	35.98	315	125	32			6510
36	36.00	35.84	41.01	40.50	355	140	36			9260

**1 The hardness corresponds to either Rockwell hardness or Vickers hardness.
**2 A spanner will not be damaged by the torque or below. Avoid any abnormality such as unendurable torsion, deformation of hexagon shape or bending.

Remarks

Chamfering of spanner edge is not necessary if it can be inserted easily into the hexagon socket. If chamfering is required, leave the width across bolt (s) as shown in the right figure. Besides, the side surfaces of long and short shafts are at right angle to respective shafts.
Therefore, it must not lean more than ±4°. (Refer to the right figure.)

Chamfering of spanner edge



Proof torque of strength class 45H (Reference)

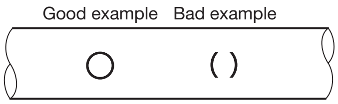
Nominal designation of screw (d)	Proof torque [N·m]	Recommended tightening torque [N·m]	Spanner size
M1.6	0.07	0.04	0.7
2	0.15	0.09	0.9
2.5	0.44	0.26	1.3
(2.6)	0.44	0.26	1.3
3	1.17	0.69	1.5
4	2.74	1.67	2
5	5.88	3.53	2.5
6	9.8	5.9	3
8	23.5	14.2	4
10	45.1	27.5	5
12	77.5	47.1	6
(14)	88.3	53.0	6
16	186	118	8
(18)	211	128	8
20	363	216	10

How to Use Hexagon Socket Set Screws

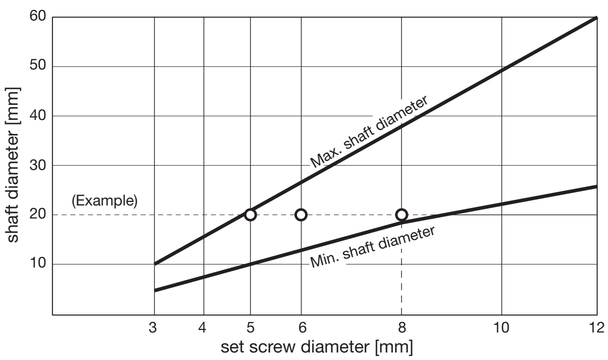
● Shaft Diameter and Set Screw Size

The impression of screw tip should clearly appear on the shaft cylinder surface. A correlation between non-tightening shaft diameter and set screw is shown as below.

Screw tip impression



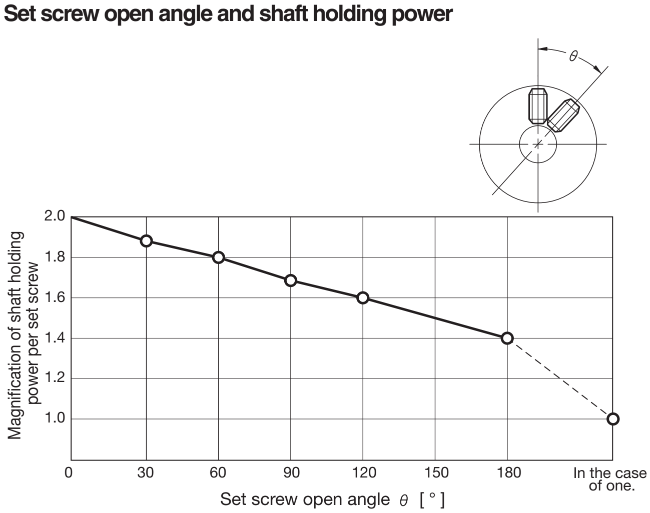
Correlation between set screw and shaft diameter



● If the Size of Set Screw Cannot be Enlarged

Two set screws are sometimes used when a large shaft holding power is required. However, using two set screws does not necessarily mean that the shaft holding power becomes double. This is because shaft holding power is different depending on the open angle (alignment) between two set screws. The following diagram indicates the relationship between set screw open angle and shaft holding power.

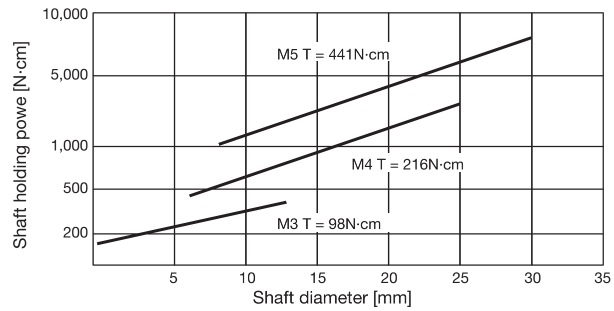
Set screw open angle and shaft holding power



● Shaft Diameter and Shaft Holding Power

The fixation limit (shaft holding power) of shaft and hub or flange is related to the friction factor between the tip of set screw and shaft. The fixation limit based on the data of examination results is described below.

Non-tightening shaft diameter and shaft holding power (concave point)

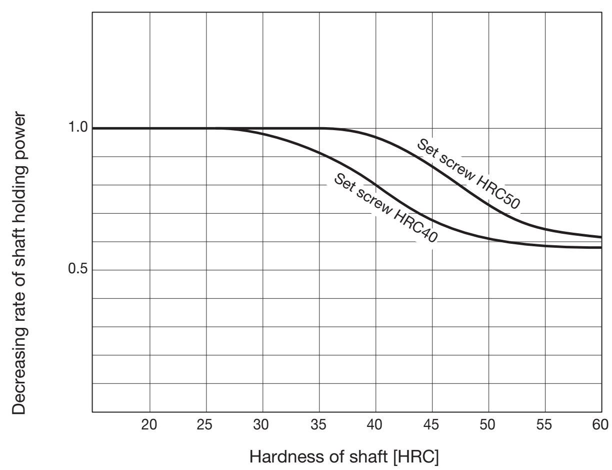


* Shaft holding power of set screw is related to the size of non-tightening shaft diameter.

● Hardness and Shaft Holding Power

Shaft holding power decreases as hardness of non-tightening shaft increases. The relationship between hardness and shaft holding power is described below.

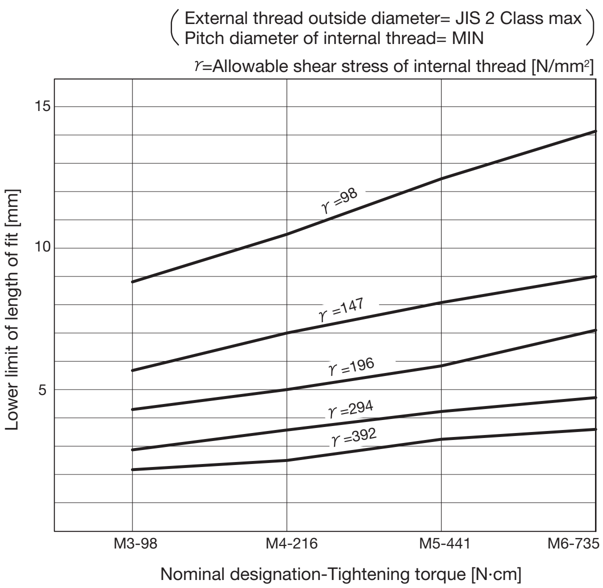
Set screw and shaft hardness and shaft holding power



● Set Screw and Length of Fit

Because of the widespread use of zinc die casting or iron sintered alloy as internal thread material, the allowable load of internal thread decreases, and which can be a source of trouble. However, it can be solved by increasing the thickness of internal thread part. The relationship between length of fit and material strength is described below.

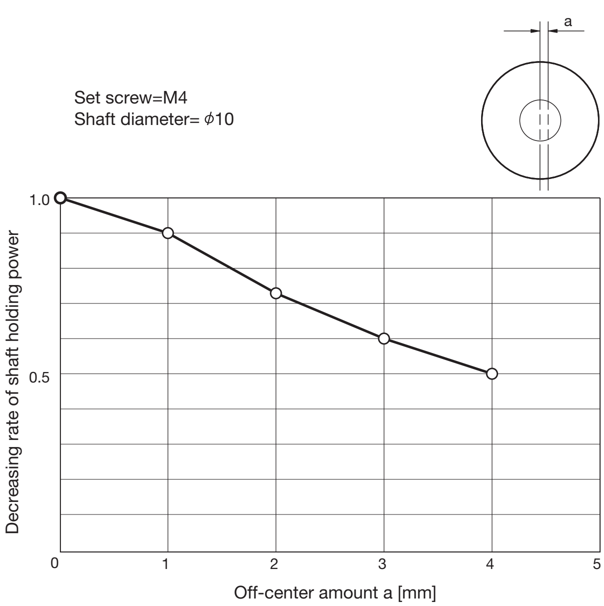
Strength of internal thread and set screw length of fit



● Off-center Amount of Internal Thread Bore

If the internal thread bore is not centered from the shaft center, the shaft holding power may decrease. The following is the examination results using M4 set screw.

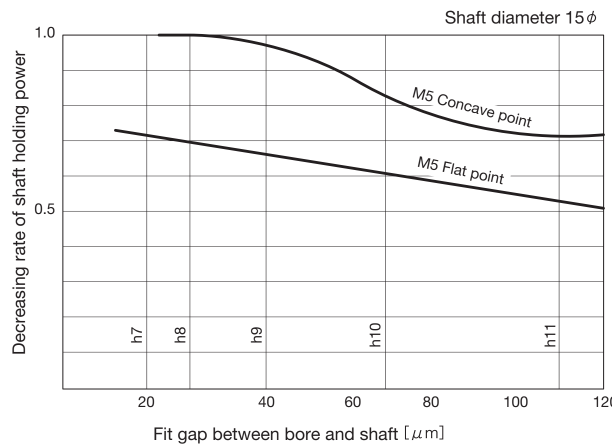
Off-center amount of set screw bore and shaft holding power



● Accuracy of Fit Between Shaft and Hub or Flange Bore

As indicated below, shaft holding power does not decrease until shaft accuracy of h9. However, the effect of fit accuracy is expected in the actual use environment.

Fit accuracy with bush bore and shaft holding power



Reference: Socket screw group technology
"How to select and use hexagon socket set screw"

Technical data

Technical Data

Torque Wrench

● SFC-☐ SA2/DA2 (Clamp bolt)

Nominal bolt size	Tightening torque [N·m]	Torque driver (preset type)	Hexagon bit	Coupling size
M2	0.4 to 0.5	N6LTDK	SB 1.5mm	005,010
M2.5	1.0 to 1.1	N12LTDK	SB 2mm	010,020
M3	1.5 to 1.9	N20LTDK	SB 2.5mm	030
M4	3.4 to 4.1	N50LTDK	SB 3mm	035,040
M5	7.0 to 8.5	N100LTDK	SB 4mm	050
Nominal bolt size	Tightening torque [N·m]	Torque wrench (preset type)	Hexagon head	Coupling size
M6	14 to 15	N230LCK	230HCK 5mm	060
M8	27 to 30	N450LCK	450HCK 6mm	080,090,100

● SFS-☐ S/W/G (Pressure bolt)

Nominal bolt size	Tightening torque [N·m]	Torque wrench (single function type)	Spanner head	Coupling size
M5	8	N120SPCK×8N·m	230SCK 8mm	05
M6	14	N230SPCK×14N·m	230SCK 10mm	06,08,09,10
M8	34	N450SPCK×34N·m	450SCK 13mm	12,14

● SFS-☐ S/W/G (Reamer bolt)

Nominal bolt size	Tightening torque [N·m]	Torque wrench (single function type)	Spanner head	Coupling size
M5	8	N120SPCK×8N·m	230SCK 8mm	05
M6	14	N230SPCK×14N·m	230SCK 10mm	06,08
M8	34	N450SPCK×34N·m	450SCK 13mm	09,10
M10	68	N900SPCK×68N·m	900SCK 17mm	12
M12	118	N1800SPCK×118N·m	1800SCK 19mm	14

● SFS-☐ SS/DS (Pressure bolt)

Nominal bolt size	Tightening torque [N·m]	Torque wrench (single function type)	Spanner head	Coupling size
M6	14	N230SPCK×14N·m	230SCK 10mm	080,090,100,120
M8	34	N450SPCK×34N·m	450SCK 13mm	140

● SFF-☐ SS/DS (Pressure bolt)

Nominal bolt size	Tightening torque [N·m]	Torque wrench (single function type)	Spanner head	Coupling size
M6	10	N120SPCK×10N·m	230SCK 10mm	070,080,090,100

● SFM—☐ SS/DS (Pressure bolt)

Nominal bolt size	Tightening torque [N·m]	Torque wrench (single function type)	Hexagon head	Coupling size
M6	14	N230SPCK×14N·m	230HCK 5mm	090,100,120
M8	34	N450SPCK×34N·m	450HCK 6mm	140

● SFH-☐ S/G (Reamer bolt)

Nominal bolt size	Tightening torque [N·m]	Torque wrench (single function type)	Spanner head	Coupling size
M8	34	N450SPCK×34N·m	450SCK 13mm	150
M10	68	N900SPCK×68N·m	900SCK 17mm	170
M12	118	N1800SPCK×118N·m	1800SCK 19mm	190
M16	300	N4400SPCK×300N·m	4400SCK 24mm	210,220
Nominal bolt size	Tightening torque [N·m]	Torque wrench (preset type)	Spanner head	Coupling size
M20	570	N7000LCK	7000SCK 30mm	260

● ALS-□ R/Y/B (Set screw)

Nominal set screw size	Tightening torque [N·m]	Torque driver (preset type)	Hexagon bit	Coupling size
M3	0.7	N12LTDK	SB 1.5mm	–
M4	1.7	N20LTDK	SB 2mm	–
M5	3.6	N50LTDK	SB 2.5mm	–
M6	6.0	N100LTDK	SB 3mm	–
Nominal set screw size	**Tightening torque [N·m]**	**Torque wrench (preset type)**	**Hexagon head**	**Coupling size**
M8	14.5	N230LCK	230HCK 4mm	–
M10	28.0	N450LCK	450HCK 5mm	–

● ALS-□ R/Y/B (Clamp bolt)

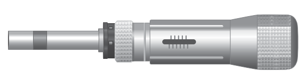
Nominal bolt size	Tightening torque [N·m]	Torque driver (preset type)	Hexagon bit	Coupling size
M2	0.4	N6LTDK	SB 1.5mm	014
M2.5	1.0	N12LTDK	SB 2mm	020
M3	1.5	N20LTDK	SB 2.5mm	030
M5	7.0	N100LTDK	SB 4mm	040
Nominal bolt size	**Tightening torque [N·m]**	**Torque wrench (preset type)**	**Hexagon head**	**Coupling size**
M6	14.0	N230LCK	230HCK 5mm	055
M8	30.0	N450LCK	450HCK 6mm	065,080

● PSL-G · G-C (Clamp bolt)

Nominal bolt size	Tightening torque [N·m]	Torque wrench (preset type)	Hexagon head	Applicable size
M6	17.0	N230LCK	230HCK 5mm	19 to 40
M8	41.0	N450LCK	450HCK 5mm	42 to 65
M10	82.0	N900LCK	900HCK 5mm	70 to 95
M12	142.0	N1800LCK	1800HCK 5mm	100 to 120

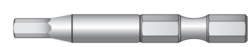
● Torque driver (preset type)

■ N-LTDK



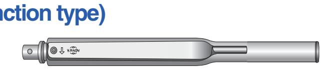
● Bit

■ SB



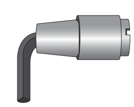
● Torque wrench (single function type)

■ N-SPCK



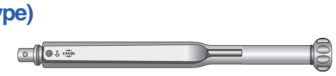
● Hexagon head

■ HCK



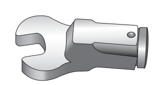
● Torque wrench (preset type)

■ N-LCK



● Spanner head

■ SCK



Technical Data

Physical and Mechanical Property of Metals

Physical Property

Metal material	Ratio	Longitudinal elastic modulus ×10^3 [N/mm^2]	Rigidity modulus ×10^3 [N/mm^2]	Thermal conductivity [W/(M·k)]	Thermal expansion ×10^{-6} [1/k]
Low-carbon steel (0.08C to 0.12C)	7.86	206	79	57 to 60	11.3 to 11.6
Medium carbon steel (0.40C to 0.50C)	7.84	205	82	44	10.7
High-carbon steel (0.8C to 1.6C)	7.81 to 7.83	196 to 202	80 to 81	37 to 43	9.6 to 10.9
Chrome steel (SCr430)	7.84	—	—	44.8	12.6 (300 to 470k)
Chrome-molybdenum steel (SCM440)	7.83	—	—	42.7	12.3
Martensitic stainless steel (SUS410)	7.80	200	—	24.9	9.9
Austenitic stainless steel (SUS304)	8.03	197	73.7	15	17.3
Tool steel (SKD6)	7.75	206	82	42.2 (373k)	10.8
Gray iron (FC)	7.05 to 7.3	73.6 to 127.5	28.4 to 39.2	44 to 58.6	9.2 to 11.8
Nodular graphite cast iron (FCD)	7.10	161	78	33.5 to 37.7	10
Duralumin (A2017-T4)	2.79	69	—	201	23.4
Super duralumin (A2024-T4)	2.77	74	29	121	23.2
Extra super duralumin (A7075-T6)	2.80	72	28	130	23.6
Lautan (AC2A-T6)	2.79	72	—	121	24.0
Silumin (AC3A-F)	2.66	71	—	121	20.4
Aluminum casting alloy (AC4CH-T6)	2.68	72	—	151	21.5
Aluminum die casting alloy (ADC12)	2.70	72	—	100	21.0
Zinc die casting alloy (ZDC-2)	6.60	89	—	113	27.4

Mechanical Property

Metal material	Yield point [N/mm^2]	Tensile strength [N/mm^2]	Hardness [HB]
S20C-N	245	402	116 to 174
S30C-N	284	471	137 to 197
S30C-H	333	539	152 to 212
S45C-N	343	569	167 to 229
S45-H	490	686	201 to 269
SS400	216	402 to 510	—
SCM420	—	932	262 to 352
SCM435	785	932	269 to 331
SUS303	206	520	187 or less
SUS304	206	520	200 or less
FC200	—	200	223 or less
FC250	—	250	241 or less
FC300	—	300	262 or less
FC350	—	350	277 or less
FCD400	250	400	201 or less
FCD450	280	450	143 to 217
FCD500	320	500	170 to 241
A2014-T4	245	412	—
A2017-T4	196	353	—
A7075-T6	471	539	—

● Approximate Converted Values of Steels to Rockwell Hardness of C Scale

Rockwell C scale hardness (HRC)	Vickers hardness (HV)	Brinell hardness (HB) 10mm sphere Load 3000kgf		Rockwell hardness			Rockwell superficial hardness Diamond conical penetrator			Shore hardness (HS)	Tensile strength [MPa] Approximate value) 1MPa= $1N/mm^2$	Rockwell C scale hardness (HRC)
		Standard sphere	Tungsten carbide sphere	A scale (HRA) Load 60kgf Diamond conical penetrator	B scale (HRB) Load 100kgf Diameter 1.6mm (1/16in) sphere	D scale (HRD) Load 100kgf Diamond conical penetrator	15-N scale Load 15kgf	30-N scale Load 30kgf	45-N scale Load 45kgf			
68	940	–	–	85.6	–	76.9	93.2	84.4	75.4	97	–	68
67	900	–	–	85.0	–	76.1	92.9	83.6	74.2	95	–	67
66	865	–	–	84.5	–	75.4	92.5	82.8	73.3	92	–	66
65	832	–	(739)	83.9	–	74.5	92.2	81.9	72.0	91	–	65
64	800	–	(722)	83.4	–	73.8	91.8	81.1	71.0	88	–	64
63	772	–	(705)	82.8	–	73.0	91.4	80.1	69.9	87	–	63
62	746	–	(688)	82.3	–	72.2	91.1	79.3	68.8	85	–	62
61	720	–	(670)	81.8	–	71.5	90.7	78.4	67.7	83	–	61
60	697	–	(654)	81.2	–	70.7	90.2	77.5	66.6	81	–	60
59	674	–	(634)	80.7	–	69.9	89.8	56.6	65.5	80	–	59
58	653	–	615	80.1	–	69.2	89.3	75.7	64.3	78	–	58
57	633	–	595	79.6	–	68.5	88.9	74.8	63.2	76	–	57
56	613	–	577	79.0	–	67.7	88.3	73.9	62.0	75	–	56
55	595	–	560	78.5	–	66.9	87.9	73.0	60.9	74	2075	55
54	577	–	543	78.0	–	66.1	87.4	72.0	59.8	72	2015	54
53	560	–	525	77.4	–	65.4	86.9	71.2	58.5	71	1950	53
52	544	(500)	512	76.8	–	64.6	86.4	70.2	57.4	69	1880	52
51	528	(487)	496	76.3	–	63.8	85.9	69.4	56.1	68	1820	51
50	513	(475)	481	75.9	–	63.1	85.5	68.5	55.0	67	1760	50
49	498	(464)	469	75.2	–	62.1	85.0	67.6	53.8	66	1695	49
48	484	451	455	74.7	–	61.4	84.5	66.7	52.5	64	1635	48
47	471	442	443	74.1	–	60.8	83.9	65.8	51.4	63	1580	47
46	458	432	432	73.6	–	60.0	83.5	64.8	50.3	62	1530	46
45	446	421	421	73.1	–	59.2	83.0	64.0	49.0	60	1480	45
44	434	409	409	72.5	–	58.5	82.5	63.1	47.8	58	1435	44
43	423	400	400	72.0	–	57.7	82.0	62.2	46.7	57	1385	43
42	412	390	390	71.5	–	56.9	81.5	61.3	45.5	56	1340	42
41	402	381	381	70.9	–	56.2	80.9	60.4	44.3	55	1295	41
40	392	371	371	70.4	–	55.4	80.4	59.5	43.1	54	1250	40
39	382	362	362	69.9	–	54.6	79.9	58.6	41.9	52	1215	39
38	372	353	353	69.4	–	53.8	79.4	57.7	40.8	51	1180	38
37	363	344	344	68.9	–	53.1	78.8	56.8	39.6	50	1160	37
36	354	336	336	68.4	(109.0)	52.3	78.3	55.9	38.4	49	1115	36
35	345	327	327	67.9	(108.5)	51.5	77.7	55.0	37.2	48	1080	35
34	336	319	319	67.4	(108.0)	50.8	77.2	54.2	36.1	47	1055	34
33	327	311	311	66.8	(107.5)	50.0	76.6	53.3	34.9	46	1025	33
32	318	301	301	66.3	(107.0)	49.2	76.1	52.1	33.7	44	1000	32
31	310	294	294	65.8	(106.0)	48.4	75.6	51.3	32.7	43	980	31
30	302	286	286	65.3	(105.5)	47.7	75.0	50.4	31.3	42	950	30
29	294	279	279	64.7	(104.5)	47.0	74.5	49.5	30.1	41	930	29
28	286	271	271	64.3	(104.0)	46.1	73.9	48.6	28.9	41	910	28
27	279	264	264	63.8	(103.0)	45.2	73.3	47.7	27.8	40	880	27
26	272	258	258	63.3	(102.5)	44.6	72.8	46.8	26.7	38	860	26
25	266	253	253	62.8	(101.5)	43.8	72.2	45.9	25.5	38	840	25
24	260	247	247	62.4	(101.0)	43.1	71.6	45.0	24.3	37	825	24
23	254	243	243	62.0	100.0	42.1	71.0	44.0	23.1	36	805	23
22	248	237	237	61.5	99.0	41.6	70.5	43.2	22.0	35	785	22
21	243	231	231	61.0	98.5	40.9	69.9	42.3	20.7	35	770	21
20	238	226	226	60.5	97.8	40.1	69.4	41.5	19.6	34	760	20
(18)	230	219	219	–	96.7	–	–	–	–	33	730	(18)
(16)	222	212	212	–	95.5	–	–	–	–	32	705	(16)
(14)	213	203	203	–	93.9	–	–	–	–	31	675	(14)
(12)	204	194	194	–	92.3	–	–	–	–	29	650	(12)
(10)	196	187	187	–	90.7	–	–	–	–	28	620	(10)
(8)	188	179	179	–	89.5	–	–	–	–	27	600	(8)
(6)	180	171	171	–	87.1	–	–	–	–	26	580	(6)
(4)	173	165	165	–	85.5	–	–	–	–	25	550	(4)
(2)	166	158	158	–	83.5	–	–	–	–	24	530	(2)
(0)	160	152	152	–	81.7	–	–	–	–	24	515	(0)

* Boldface figures are derived from ASTM E 140. (Adjusted jointly by SAE, ASM and ASTM)
* The figures in parentheses ( ) in the table are the ranges that are not frequently used and are shown for reference purposes only.

Technical Data

Balance Quality of Rotation Equipment

According to JIS B 0513-1985, balance quality is defined as a "quantity that shows the balance of a rigid rotor and is a product between a specific unbalance and specified angular velocity."

● Procedure for Deciding a Permissible Unbalance

The following information (numerical values) on the rotor is required to determine a permissible unbalance.

- ● Maximum rotation speed at which the rotor will be used n_{max}
- ● Rotor mass m
- ● Rotor bearing position
- ● Position of balancing plane

For more detailed calculations:

- ● Position of rotor mass center (center of gravity) is required.

1. A grade for balance quality is set based on the rotor type. The smaller the grade for balance quality, the higher the balancing accuracy. As explained in JIS, however, G1 and G0.4 require particular caution.
2. The permissible specific residual unbalance e_{per} is calculated based on the maximum rotation speed at which the rotor will actually be used. e_{per} can be calculated from the following calculation formula or from the diagram on the right.

Balance quality = $e \cdot \omega$

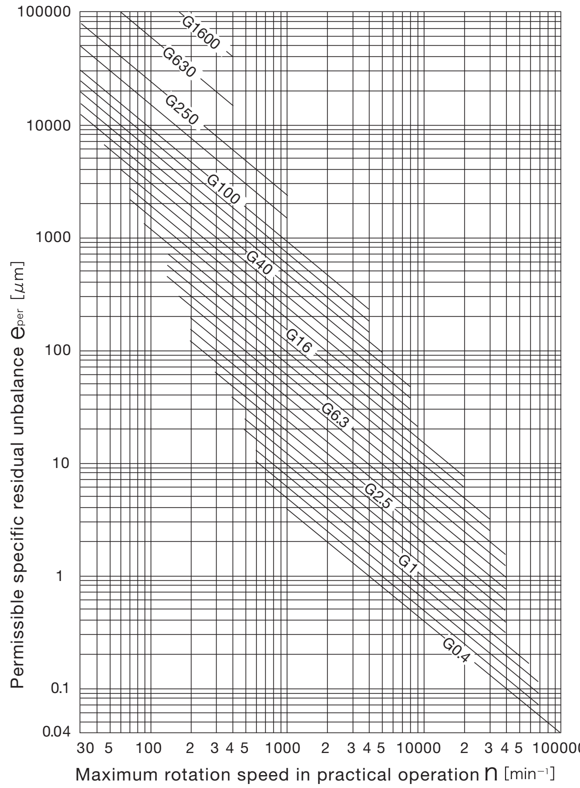
$\omega = 2\pi n/60 = n/9.55$

n [min⁻¹]

ω [rad/s]

Balance quality = $\dfrac{e \cdot n}{9.55}$

3. The permissible specific residual unbalance is calculated based on the permissible specific residual unbalance and rotor mass.
   Permissible specific residual unbalance $U_{per} = e_{per} m$ [g · mm]
4. Distribute actually the permissible specific residual unbalance to the unbalance of the balancing plane. (The distribution calculation method varies in accordance with the relationship among the bearing position, position and mass of balancing plane and position of the center of mass. For more information, refer to the explanation in JIS.)



● Recommended Grade for Balance Quality for Various Rotating Machines (JIS B 0905-1992)

Balance quality grade	Upper limit of balance quality mm/s ($e_{per} \times \omega$)	Examples of rotor type
G4000	4000	● Rigidly-supported crank shafting*2 of low-speed diesel engine for ship*1 with odd number of cylinders
G1600	1600	● Rigidly-supported crank shafting*2 of large two-cycle engine
G630	630	● Rigidly-supported crank shafting*2 of large four-cycle engine ● Rigidly-supported crank shafting*2 of diesel engine for ship*1
G250	250	● Rigidly-supported crank shafting*2 of high-speed four-cylinder diesel engine*1
G100	100	● Crank shafting of high-speed diesel engine*1 with 6 cylinders or more for completed products of engines for automobiles, trucks and rolling stock (gasoline or diesel).
G40	40	● Automotive wheels, rims, wheel sets and drive shafts ● Rigidly-supported high-speed four-cycle diesel engines*1 with 6 cylinders or more ● Crank shafting*2 of (gasoline or diesel) engines ● Crank shafting for automotive, truck and rolling stock engines*2
G16	16	● Drive shafts with special requirement (propeller shaft, Cardan shaft) ● Crusher parts ● Parts for agricultural machinery ● Parts for engines (gasoline and diesel) for automobiles, trucks and rolling stock and crank shafting*2 with 6 cylinders or more with special requirement
G6.3	6.3	● Equipment for process plants ● Main-engine turbine wheels for ships (For merchant marine) ● Centrifugal separator drums ● Papermaking rolls, printing rolls ● Fans ● Aircraft gas turbine rollers after assembly ● Flywheels ● Pump impellers ● Parts for machine tools and general machinery ● Medium and large armatures of motors with a shaft center height of at least 80cm or more without special requirement ● Small armatures mainly for high-volume production for use in an environment less sensitive to vibration or with vibration isolation ● Parts for engines with special requirement
G2.5	2.5	● Gas turbines, steam turbines and main turbines for ships (For merchant marine) ● Rigid turbo generator rotors ● Memory drums for computers and disc turbo compressors ● Main shafts for machine tools ● Medium and large armatures with special requirement ● Small armatures (Except for G6.3 and G1 conditions) ● Turbine drive pumps
G1	1	● Rotating parts of tape recorders and acoustic equipment ● Abrasive wheel shafts of grinding machines ● Small armatures with special requirement
G0.4	0.4	● Abrasive wheel shafts, abrasive wheels and armatures of precision grinding machines ● Gyroscopes

* *1: Low-speed diesel engines are engines with a piston speed of 9m/s or less. High-speed diesel engines are engines with a piston speed of 10m/s or more.
* *2: Crank shafting is an entire unit consisting of a crank shaft, flywheel, clutch, pulley, damper, rotating part of a connecting rod and other parts.
*: The rotor mass of a completed engine product is the total mass of the entire crank shafting.

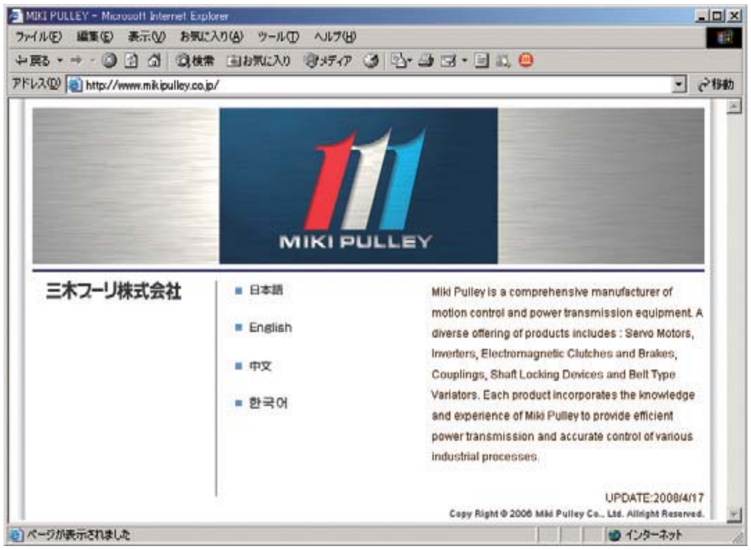
Please Consult Our Website.

More information on new products and on events such as tradeshows

01 Multilingual Website (4 languages)

Japanese, English, Chinese (simplified characters) and Korean.

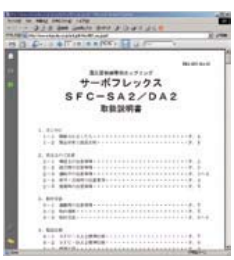
* Some product information is available in Japanese only.



01 Top page

02 Downloading

Latest information including a catalog, instruction manual and CAD data can be downloaded.



05 Instruction manual PDF page

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02 Page for introduction of products

08 International network information page

03 Enriched content

Abundant information other than product information also provided.

07 Tradeshow information page

06 Advertisement and self-introduction page

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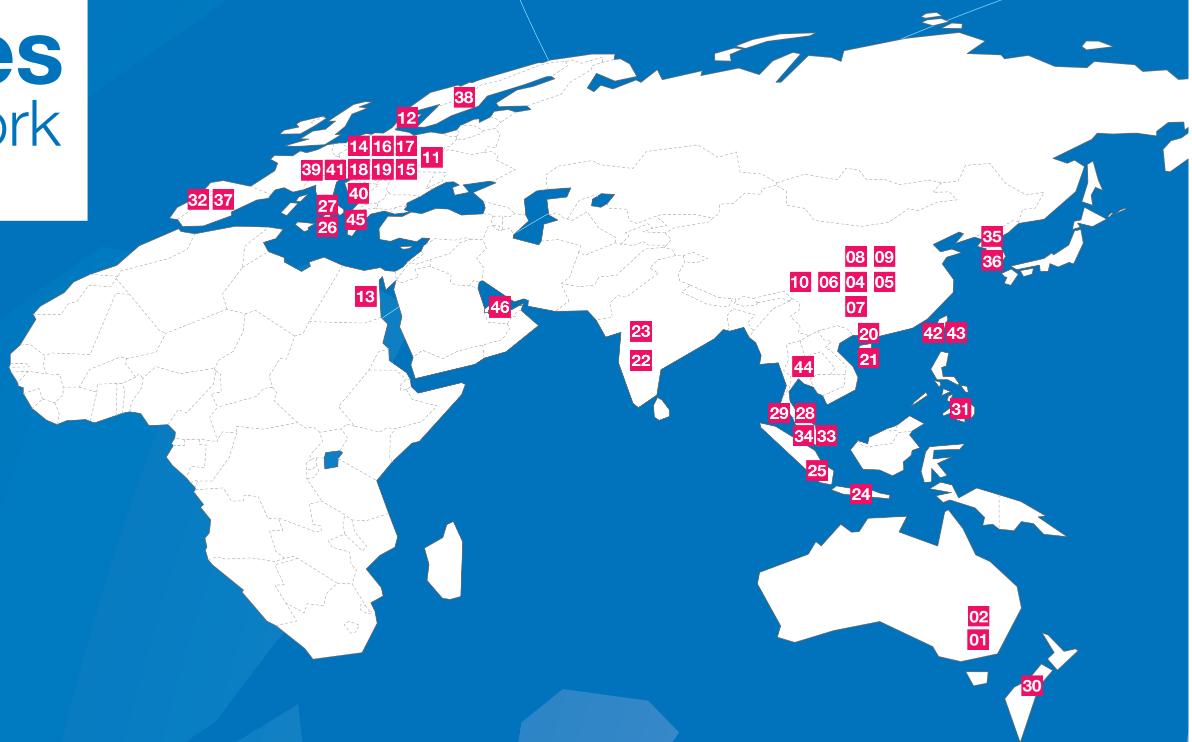

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