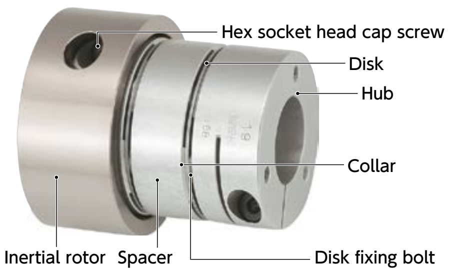
XGHW-C Flexible Couplings - The Vibration - Absorption Capable Disk Type Patented Registered Design

Zero Backlash · High gain supported · High torque · High Rigidity · Vibration absorption

Structure

● Clamping Type ➡ P.xxxx

XGHW-C



● Material/Finish RoHS

	XGHW-C
Hub	A2017 Anodized*1
Spacer	A2017 Anodized
Disk Fixing Bolt	SCM435 Ferrosoferric Oxide Film (Black)
Disk	SUS304
Collar	SUS304
Hex Socket Head Cap Screw	SCM435 Ferrosoferric Oxide Film (Black)
Inertial Rotor	S45C Electroless Nickel Plating
Elastic Body	FKM

*1 : Due to manufacturing process requirements, couplings may have bores with or without surface treatment. This does not affect the performance of the couplings.

● Application

Actuator / Surface-mount machine / High precision XY stage / Index table

⚠ Precautions for Use

When installing, be careful not to apply excessive torque, loads or forces to the inertial body. Doing so may result in the inertial body detaching.

● Applicable motors

	XGHW-C
Servomotor	◎
Stepping Motor	◎
General-purpose Motor	●

◎: Excellent ●: Available

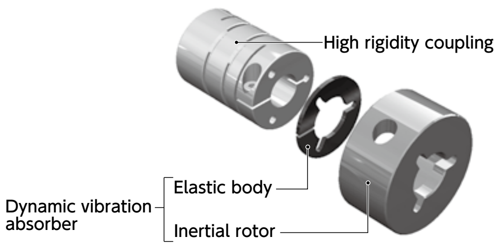
● Property

	XGHW-C
Zero Backlash	◎
High-gain Supported	◎
High Torque	◎
High Torsional Stiffness	◎
Allowable Misalignment	○
Vibration Absorption Characteristics	◎
Allowable Operating Temperature	−10℃ to 60℃

◎: Excellent ○: Very good

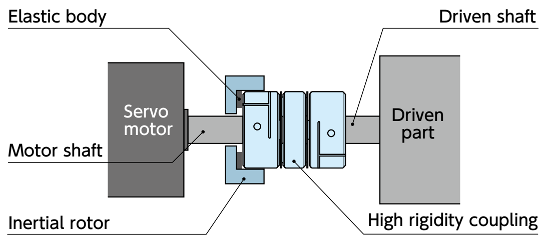
● Flexible couplings with vibration absorption function added to high rigidity couplings.

● A structure with both high rigidity and vibration absorption. The individual dynamic vibration absorber*1 is separate from the inertial rotor and elastic body in order to achieve vibration absorption.



*1 : The mechanism for suppressing resonant vibration phenomena is achieved by connecting the dynamic vibration absorber to the auxiliary inertial body via the elastic body.

● Does not use resin elastic materials for the rotation transmission system from the motor shaft hub to the driven shaft hub, for high rigidity.



The inertial rotor/elastic body is shown in the cross sectional diagram

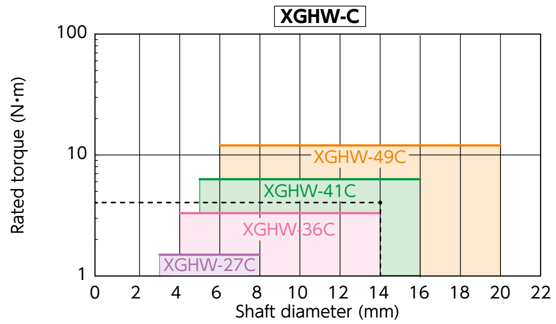
● Achieves high positioning accuracy under high loads, in addition to high servomotor gain.

Additional Keyway at Shaft Hole ➡ P.xxxx	Cleanroom Wash & Packaging ➡ P.xxxx	Change to Stainless Steel Screw ➡ P.xxxx
Please feel free to contact us	Not Available	Please feel free to contact us

Selection

● Selection Based on Shaft Diameter and Rated Torque

The area bounded by the shaft diameter and rated torque indicates the selection size.



● Selection Example

In case of selected parameters of shaft diameter of ϕ 14 and load torque of 3 N•m, the selected size is XGHW-41C.

● Selection Based on the Rated Output of the Servomotor

Rated Output (W)	Servomotor Specifications*1			Selection Size
	Diameter of Motor Shaft (mm)	Rated Torque (N•m)	Instantaneous Max. Torque (N•m)	XGHW-C
50	6 - 8	0.16	0.48	27C
100	8	0.32	1.1	27C
200	9 - 14	0.64	2.2	36C
400	14	1.3	4.5	41C
750	16 - 19	2.4	8.4	49C

*1 : Motor specifications are based on general values. For details, see the motor manufacturer's catalogs. This is the size for cases where devices such as reduction gears are not used.

● Part number specification

XGHW - 27C - 6-8 J

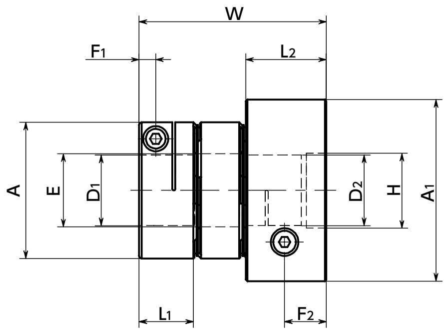
Product Code · Size · Bore Diameter · Inertial Rotor Side Identification Code

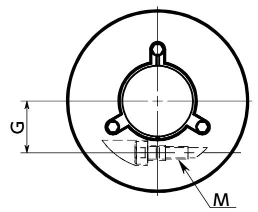
Please refer to dimensional table for part number specification.
Append J to the bore diameter of the inertial rotor.

XGHW-C Flexible Couplings - The Vibration - Absorption Capable Disk Type Patented Registered Design

Zero Backlash High gain supported High torque High Rigidity Vibration absorption

XGHW-C





Dimensions

Unit : mm

Part Number 1	A	A1	L1	L2	W	E	H	F1	F2	G	M	Screw Tightening Torque (N・m)
XGHW-27C	19	27	9.2	13.2	29.7	8.5	10	2.6	6.6	7	M2	0.5
XGHW-36C	27	36	11	16	37.2	14.5	15	3.3	8.3	10.25	M2.5	1
XGHW-41C	34	41	12.5	18.5	42.8	16.5	18	3.75	9.75	13	M3	1.5
XGHW-49C	39	49	15.5	22.5	53.6	20.5	22	4.5	11.5	14.5	M4	3.5

Part Number	Standard Bore Diameter D1 2																	Standard Bore Diameter D2 3							
	3	4	5	6	6.35	8	9.525	10	11	12	14	15	16	17	18	19	20	5	6	8	10	11	14	16	19
XGHW-27C	●	●	●	●	●	●												●	●	●					
XGHW-36C		●	●	●	●	●	●	●	●	●	●									●	●	●	●		
XGHW-41C			●	●	●	●	●	●	●	●	●	●	●							●	●	●	●	●	
XGHW-49C				●	●	●	●	●	●	●	●	●	●	●	●	●	●						●	●	●

- All products are provided with hex socket head cap screw.
- Recommended tolerance for shaft diameters is h6 and h7.
- Bore and keyway modifications are available on request for D1 only. Please take advantage of our modification services.
- In case of mounting on D-cut shaft, be careful about the position of the D-cut surface of the shaft.
- For the shaft insertion amount to the coupling, see Mounting/maintenance.

⚠ Precautions for Use

Do not apply excessive shock or torque to the inertia body. Doing so may result in the inertial body detaching.

Additional Keyway at Shaft Hole ➡ P.xxxx	Cleanroom Wash & Packaging ➡ P.xxxx	Change to Stainless Steel Screw ➡ P.xxxx
Please feel free to contact us	Not Available	Please feel free to contact us

Performance

Part Number	Max. Bore Diameter (mm)	Rated Torque *1 (N・m)	Max. Rotational Frequency (min⁻¹)	Moment of Inertia *2 (kg・m²)	Static Torsional Stiffness (N・m/rad)	Max. Lateral Misalignment (mm)	Max. Angular Alignment (°)	Allowable End-Play (mm)	Mass *2 (g)
XGHW-27C	8	1.5	23000	4.6×10^{-6}	300	0.12	2	±0.2	45
XGHW-36C	14	3.3	17000	1.8×10^{-5}	1400	0.15	2	±0.4	97
XGHW-41C	16	6.3	15000	3.4×10^{-5}	2500	0.2	2	±0.5	144
XGHW-49C	20	12	12000	8.9×10^{-5}	4700	0.25	2	±0.5	260

*1 : Correction of rated torque due to load fluctuation is not required.
The shaft's slip torque may be smaller than the coupling's rated torque depending on the shaft bore. ➡ P.xxxx

*2 : These are values with max. bore diameter.

● Part number specification

XGHW-27C-6 - 8 J

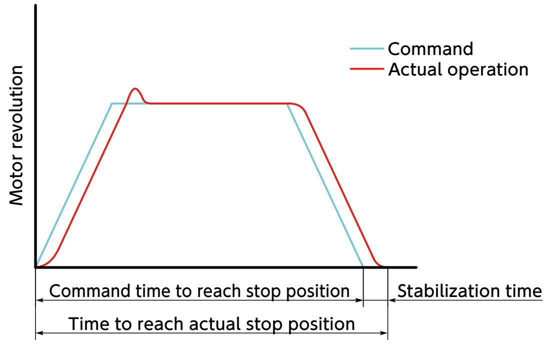
1 D1 2 D2 3 D2 Side Identification Code

Append J to the bore diameter of D2 (inertial rotor).

Technical Information

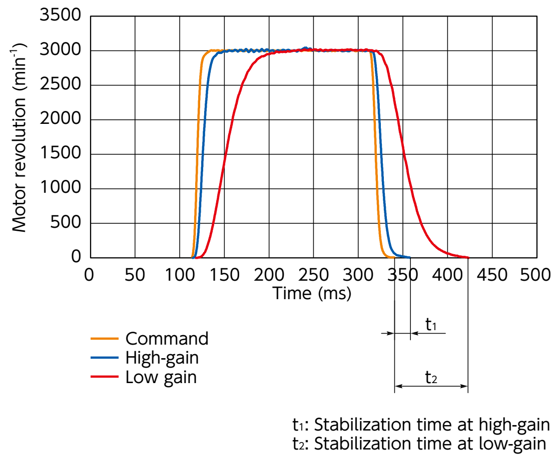
● Productivity and stabilization time

In a production facility which uses servomotors, single-axis actuators and ball screws, the key to improved productivity is operating these components accurately, as directed by a program. However, occasionally the command execution may be delayed.
For example, when trying to stop the actuator at a predetermined position, sometimes it will stop later than the command, which we refer to as a delay in stabilization time. Since the operation does not shift to the next process until the actuator completely stops, it is important to shorten stabilization time and thereby improve productivity.



● Gain and stabilization time of servomotor

This shows how the servomotor gain movement follows the command.
Increasing the gain helps to reduce stabilization time, but increasing it too far causes hunting, making servomotor control impossible.
Increasing the gain while suppressing hunting requires fine adjustment of the servomotor parameters.
However, when a servomotor is combined with a coupling with a metal disk type in the elastic segment, raising the gain tends to cause hunting, making it difficult to resolve the problem by fine adjustments to parameters.
When hunting occurs, it is generally recommended to change to a coupling with higher rigidity to increase the rigidity of the rotating system.
However, in reality, it may not be effective to increase the rigidity of the entire rotating system including the ball screw simply by increasing coupling rigidity.



● The Vibration-Absorption Capable Disk Type

The vibration-absorption capable disk type **XGHW-C** has a dynamic vibration absorber on the high rigidity disk. It enables vibration absorption and use of higher gain levels when compared to regular disk types, thereby also allowing a shorter stabilization time. The vibration absorption function reduces the amount of parameter adjustment work, and lowers the time required to find optimal parameters.

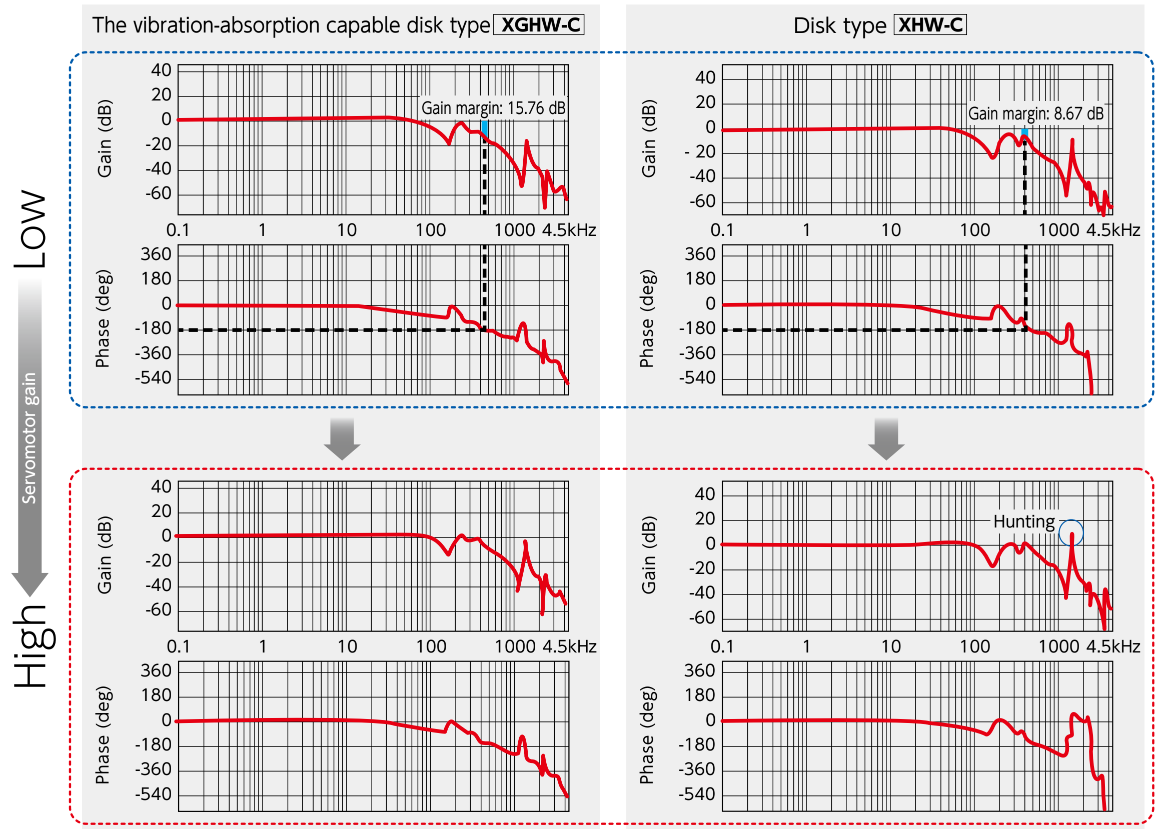
● Why can gain be increased even further with the vibration-absorption capable disk type XGHW-C when compared with the disk type XHW-C ?

The Bode plot clearly illustrates why **XGHW-C** can increase servomotor gain beyond the capacity of disk types **XHW-C**.
The width of the gain relative to 0 dB when the phase delay on the Bode plot is –180° is called the gain margin and the phase width relative to the frequency intersecting at 180° is called the phase margin.
General guidelines for servo systems call for setting the gain margin between 10 and 20 dB and the phase margin between 40° and 60°, but as the servomotor gain is increased, the gain margin decreases. When the gain margin falls below 10 dB, hunting tends to occur.
A comparison of the **XGHW-C** and **XHW-C** limit gain (upper limit of the gain in which coupling can be used without hunting) shows not only that **XGHW-C** features a larger gain margin, but that in fact the gain margin is over 10 dB. This is why the servomotor gain is greater in **XGHW-C** compared to **XHW-C**.

Gain margin at the disk type limit gain

XGHW-C	: 15.76dB
XHW-C	: 8.67dB

● Bode Plot



● Larger gain margin compared to **XHW-C**
● Allows higher servomotor gain settings

● Smaller gain margin compared to **XGHW-C** increases the risk of hunting

Technical Information

Comparison of The Vibration-Absorption Capable Disk Type and Disk Type

In tests using servomotors and actuators, the following information is confirmed.

- Stabilization Time

Increasing the gain enables the stabilization time to be shortened, and the gain can be set especially high with the vibration-absorption capable disk type when compared to the disk type.

- Positioning Accuracy/Repeated Positioning Accuracy

No differences attributable to factors such as gain or coupling were observed.

- Overshoot

Increasing the gain increases the overshoot, and the same gain resulted in no difference in the overshoot.

- Conclusion

The vibration-absorption capable disk type allows higher gain to be set than the disk type, enabling shorter stabilization time. The positioning accuracy, repetition positioning accuracy and overshoot did not differ due to coupling.
As a result, it was confirmed that the vibration-absorption capable disk type is effective for shortening the cycle time of devices and equipment.

- Test Devices

Actuator : KR30H Manufactured by THK (Co., Ltd.)
∗ Ball screw lead 10 mm
Servomotor : HG-KR13 Manufactured by Mitsubishi Electric Corporation

- Test Conditions

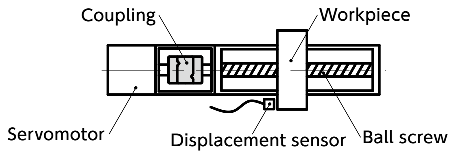
Motor revolution : 3000 min^{-1}
Acceleration/deceleration time : 50 ms
Workpiece load : 3.0 kg
Ratio of moment of inertia of load : 2.3

- Test Operation

Normal rotation (1 rev) → Stop (500 ms) → Reverse rotation (1 rev)

- Test Method

A displacement sensor is used to measure work movement, travel distance and stabilization time.

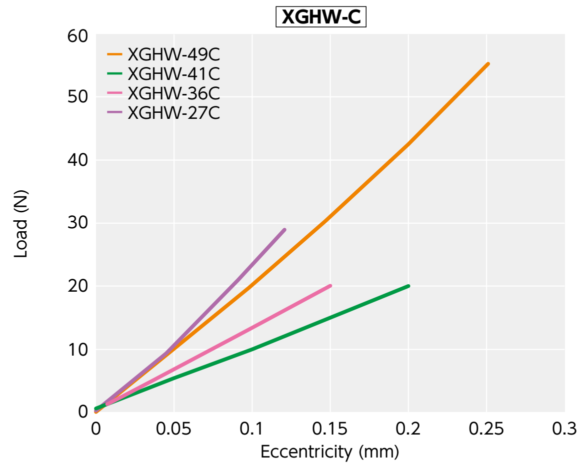


- Measurement of Stabilization Time, Positioning Accuracy and Overshoot

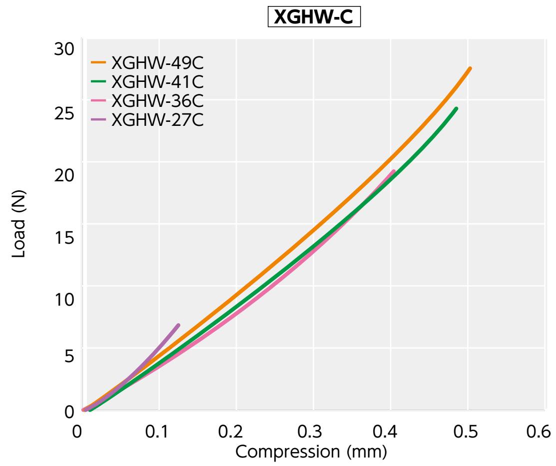
Gain∗1		The Vibration-Absorption Capable Disk Type	Disk Type	Consideration
23	Stabilization Time (ms)	35	32	This is the upper gain limit for the disk type. The vibration-absorption capable disk type can be used without any problems.
	Positioning Accuracy (mm)	0.014	0.014	
	Repeated Positioning Accuracy (mm)	±0.002	±0.002	
	Overshoot (μm)	1	1	
32	Stabilization Time (ms)	8	Occurrence of Hunting	This is the upper gain limit for the vibration-absorption capable disk type. The disk type is not usable due to hunting.
	Positioning Accuracy (mm)	0.016		
	Repeated Positioning Accuracy (mm)	±0.001		
	Overshoot (μm)	2		

∗1 : Values with all gains, such as position control gain and speed control gain, adjusted (Min: 1 - Max: 32)
Positioning Accuracy
: Positioning operation is performed and the absolute value of the difference between the target point and the actual stop position is determined. Max. value is found by performing this measurement from the home position at all positions within the max. stroke range.
Repeated Positioning Accuracy
: Positioning is repeated 7 times from the same direction of movement to a randomly-selected point, the stopping positions are measured, and the difference between the max. and minimum values of the stopping position is determined. This method of measurement is applied at positions at the middle and both ends of the max. stroke range, then the max. value becomes the measured value, halved and prefixed with ±.
- The values in the table vary depending on testing conditions.

Eccentric Reaction Force

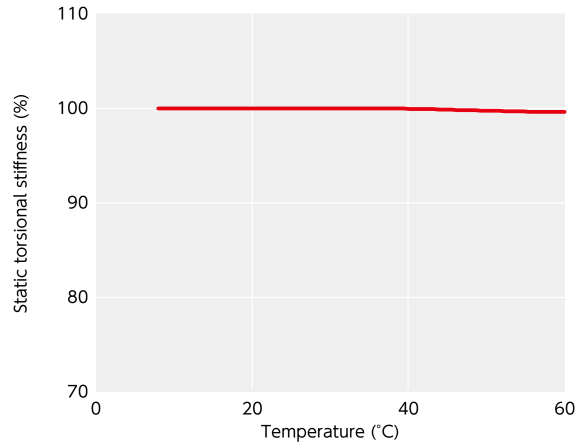


Thrust Reaction Force



Change in static torsional stiffness due to temperature

This is a value under the condition where the static torsional stiffness at 20℃ is 100%.
The change of XGHW-C in torsional stiffness due to temperature is small and the change in positioning accuracy is extremely small. If the unit is used under higher temperature, be careful about misalignment due to elongation or deflection of the shaft associated with thermal expansion.



Slip Torque

As in the table below, the clamping type XGHW-C has different slip torque according to the bore diameter. Take care during selection.

Unit : N・m

Outside Diameter	Bore Diameter (mm)								
	3	4	5	6	6.35	8	9.525	10	11
27	0.7	1.7	3						
36		2	2.9	4	4.2	5.8			
41			3.5	4.9	5.5	7.9	10	11	12
49				6	8	13	18	19	23

- These are test values based on the conditions of shaft dimensional allowance: h7, hardness: 34 - 40 HRC, and screw tightening torque of the values described in XGHW-C dimension tables. They are not guaranteed values.
- Slip torque changes with usage conditions. Carry out tests under conditions similar to actual conditions in advance.