ABSSAC
PRECISION MOTION SINCE 1982

Compact design spring-actuated brakes

MODEL BXW

Compact design spring-actuated brakes

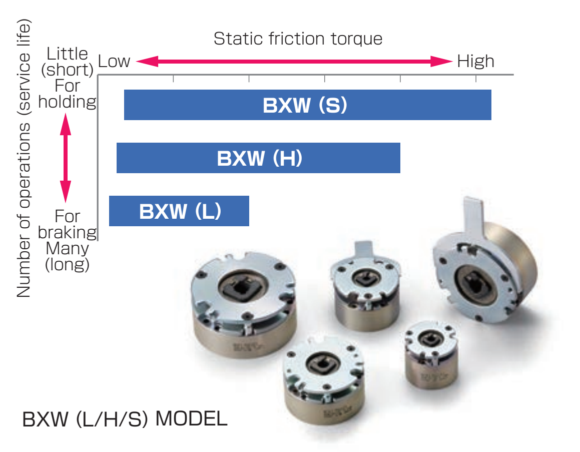
These are electromagnetic brakes that are actuated by the force of a spring when electricity is not flowing. They provide excellent performance in emergency braking when power goes out, holding stopped positions for long periods of time, preventing machinery from coasting down, and the like.

Four types are available: three types with the same dimensions but different load torques and one type with specifications and dimensions matched to compact servo motors. Select the one that best matches your application and life cycle.

Adapted to the RoHS

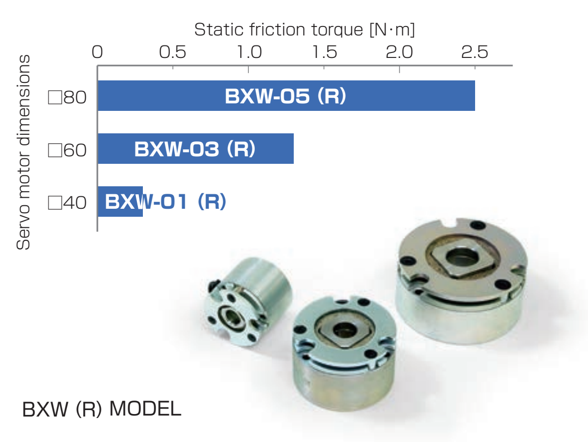
Three types with the same dimensions but different load torques and one type matched to compact servo motors

Optimum selection can be made according to usage and life cycle.



BXW (L/H/S) MODEL

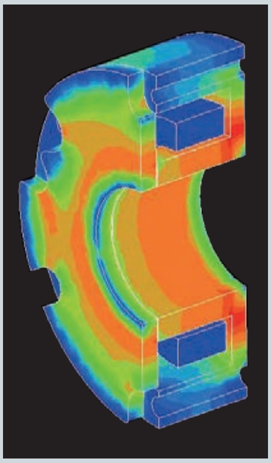
These have dedicated designs matched for specifications and dimensions for □40, □60, and □80 small servo motors.

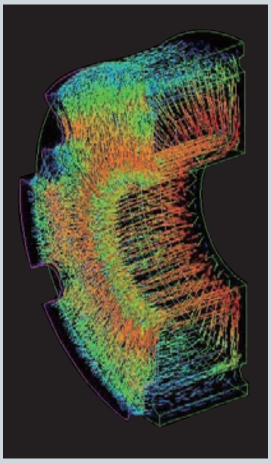


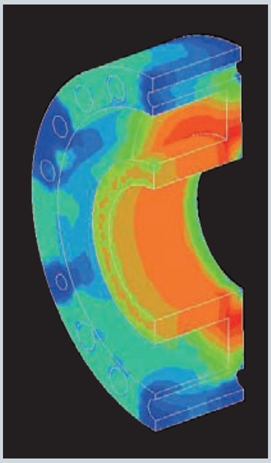
BXW (R) MODEL

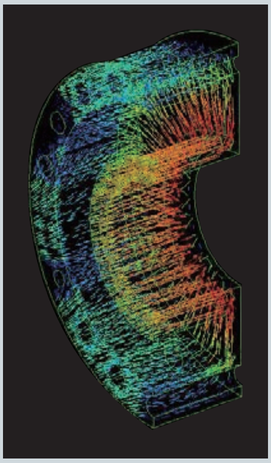
Optimum design by 3D-CAD and FEM

It was the best designed using a finite element method (FEM) for magnetic field analysis of the electromagnetic brake.





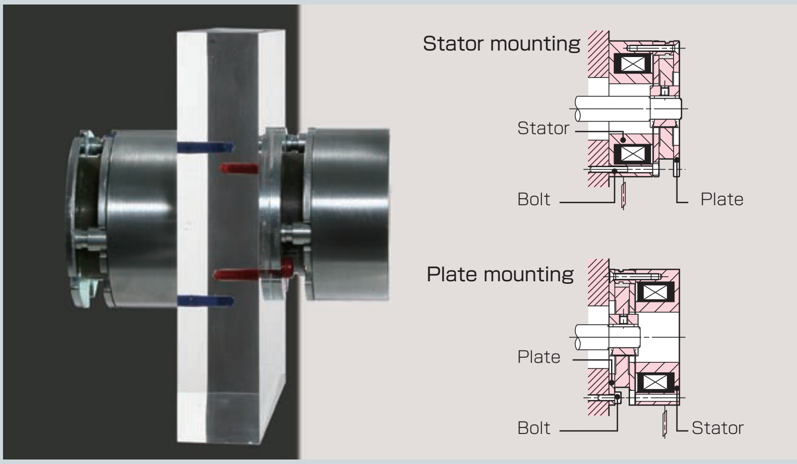




It corresponds to the diverse needs

* It is a correspondence in BXW (L/H/S).

The stator (a heat source) can be mounted facing either inwards or outwards.

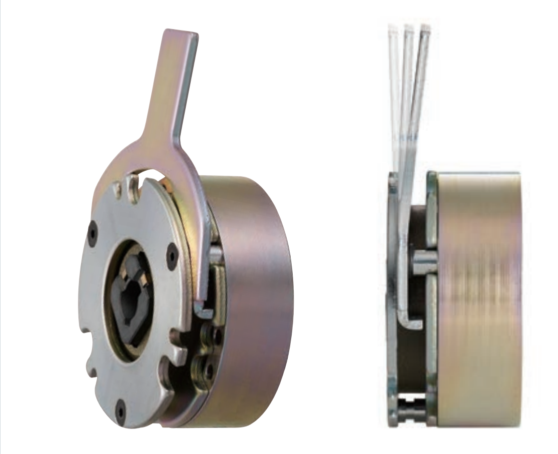


The anti-noise spring reduces a clattering sound generated by fine vibration during rotations.

Option of enhancement

* It is a correspondence in BXW (L/H/S).

Manual release levers are available. (Made to order)



Dust covers are available. (Sold separately)

SPRING-ACTUATED BRAKES

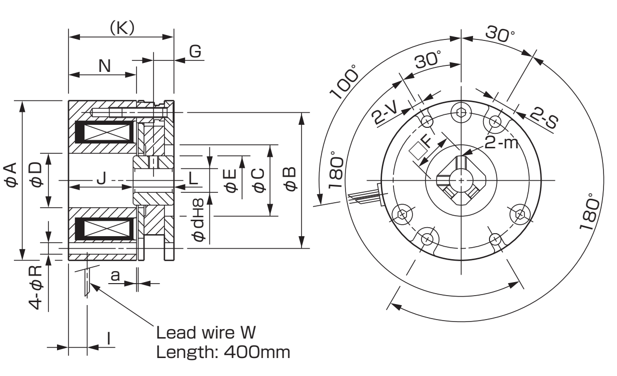
BXW (L) Model Braking use

Specifications

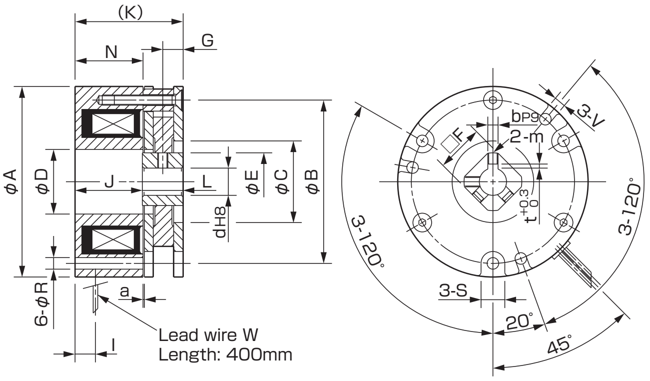
Model	Size	Static friction torque T_S[N·m]	Coil (at20℃)				Heat-resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J[kg·m²]	Allowable braking energy rate $P_{baℓ}$[W]	Total braking energy E_T[J]	Armature pull in time t_a[s]	Armature release time t_{ar}[s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXW-01-10L	01	0.12	12	5.0	0.417	28.8	F	5000	$0.6×10^{-6}$	2.5	$1.5×10^6$	0.008	0.015	0.2
			24	5.0	0.208	115								
			45	5.0	0.111	405								
			90	5.0	0.056	1622								
			180	5.0	0.028	6486								
BXW-02-10L	02	0.25	12	6.6	0.550	21.8	F	5000	$1.9×10^{-6}$	5.0	$3.0×10^6$	0.008	0.015	0.3
			24	6.6	0.275	87.3								
			45	6.6	0.147	307								
			90	6.6	0.073	1228								
			180	6.6	0.037	4912								
BXW-03-10L	03	0.50	12	9.0	0.750	16.0	F	5000	$3.8×10^{-6}$	10.0	$4.5×10^6$	0.025	0.025	0.4
			24	9.0	0.375	64.0								
			45	8.2	0.182	247								
			90	8.2	0.091	988								
			180	8.2	0.046	3954								
BXW-04-10L	04	1.00	12	11.5	0.958	12.5	F	5000	$12.0×10^{-6}$	20.0	$7.0×10^6$	0.030	0.030	0.6
			24	11.5	0.479	50.1								
			45	10.0	0.222	203								
			90	10.0	0.111	810								
			180	10.0	0.056	3241								
BXW-05-10L	05	2.00	12	13.0	1.083	11.1	F	5000	$23.0×10^{-6}$	30.0	$12.0×10^6$	0.035	0.035	0.8
			24	13.0	0.542	44.3								
			45	13.0	0.289	156								
			90	13.0	0.144	623								
			180	13.0	0.072	2492								

* Models with 12V and 180V voltage specifications are made to order. * For the armature pull in time and release time in the case of alternating-current side switching.

Dimensions



Size 01, 02



Size 03, 04, 05

Model	Size	Radial dimensions [mm]											Axial direction dimensions [mm]							Bore dimensions [mm]		
		A	B	C	D	E	S	V	R	F	W	m	G	l	J	K	L	N	a	d	b	t
BXW-01-10L	01	37	32	18	13.5	12.0	6	3	3	10	AWG26	M3	4.5	5.0	22.5	32	9	22.5	0.10	5 6	-	-
BXW-02-10L	02	47	40	21	16.0	14.5	7	3.4	3.4	12	AWG26	M3	6.0	5.5	19.2	32	12	20.0	0.10	6 7	-	-
BXW-03-10L	03	56	48	24	19.0	17.0	7	3.4	3.4	14	AWG26	M3	6.0	6.0	19.9	32	12	20.0	0.15	8	-	-
BXW-04-10L	04	65	58	35	24.0	22.0	7	3.4	3.4	18	AWG22	M4	7.0	7.0	19.9	34	14	21.0	0.15	10	3	1.2
BXW-05-10L	05	75	66	36	28.0	26.5	9	4.5	4.5	22	AWG22	M4	7.0	7.0	22.1	36	14	21.5	0.15	12	4	1.5

How to Place an Order

BXW-01-10L-24V-5

Size

Release lever
10: Not included
12: Included

Bore diameter (Dimensional symbol d)

Voltage (Refer to the specifications table)

Application
L: Braking use H: Holding and braking use S: Holding use

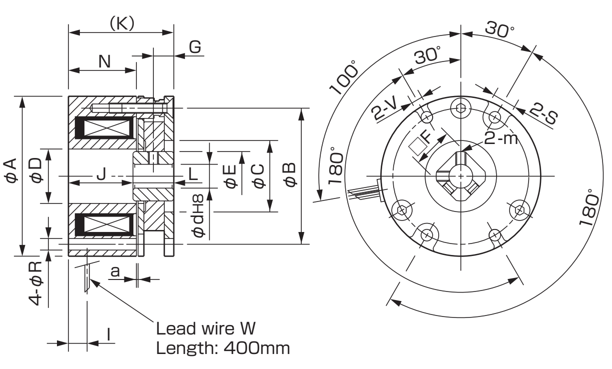
BXW (H) Model Holding and braking use

Specifications

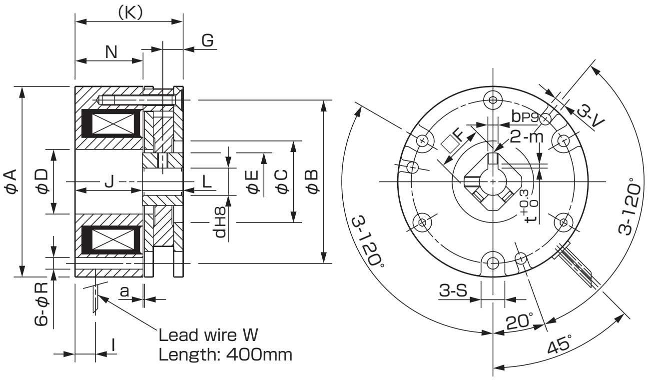
Model	Size	Static friction torque T_S[N·m]	Coil (at20℃) Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]	Heat-resist-ance class	Max. rotation speed $[min^{-1}]$	Rotating part moment of inertia J[kg·m²]	Allowable braking energy rate $P_{baℓ}$[W]	Total braking energy E_T[J]	Armature pull in time t_a[s]	Armature release time t_{ar}[s]	Mass [kg]
BXW-01-10H	01	0.24	12	5.0	0.417	28.8	F	5000	0.6×10^{-6}	0.5	0.2×10^{6}	0.010	0.010	0.2
			24	5.0	0.208	115								
			45	5.0	0.111	405								
			90	5.0	0.056	1622								
			180	5.0	0.028	6486								
BXW-02-10H	02	0.50	12	6.6	0.550	21.8	F	5000	1.9×10^{-6}	1.0	0.3×10^{6}	0.010	0.010	0.3
			24	6.6	0.275	87.3								
			45	6.6	0.147	307								
			90	6.6	0.073	1228								
			180	6.6	0.037	4912								
BXW-03-10H	03	1.00	12	9.0	0.750	16.0	F	5000	3.8×10^{-6}	2.0	0.5×10^{6}	0.035	0.020	0.4
			24	9.0	0.375	64.0								
			45	8.2	0.182	247								
			90	8.2	0.091	988								
			180	8.2	0.046	3954								
BXW-04-10H	04	2.00	12	11.5	0.958	12.5	F	5000	12.0×10^{-6}	4.0	1.0×10^{6}	0.040	0.025	0.6
			24	11.5	0.479	50.1								
			45	10.0	0.222	203								
			90	10.0	0.111	810								
			180	10.0	0.056	3241								
BXW-05-10H	05	4.00	12	13.0	1.083	11.1	F	5000	23.0×10^{-6}	6.0	2.0×10^{6}	0.045	0.030	0.8
			24	13.0	0.542	44.3								
			45	13.0	0.289	156								
			90	13.0	0.144	623								
			180	13.0	0.072	2492								

* Models with 12V and 180V voltage specifications are made to order. * For the armature pull in time and release time in the case of alternating-current side switching.

Dimensions



Size 01, 02



Size 03, 04, 05

Model	Size	Radial dimensions [mm]										Axial direction dimensions [mm]							Bore dimensions [mm]		
		A	B	C	D	E	S	V	R	F	W	m	G	I	J	K	L	N	a	d	b	t
BXW-01-10H	01	37	32	18	13.5	12.0	6	3	3	10	AWG26	M3	4.5	5.0	22.5	32	9	22.5	0.10	5 6	-	-
BXW-02-10H	02	47	40	21	16.0	14.5	7	3.4	3.4	12	AWG26	M3	6.0	5.5	19.2	32	12	20.0	0.10	6 7	-	-
BXW-03-10H	03	56	48	24	19.0	17.0	7	3.4	3.4	14	AWG26	M3	6.0	6.0	19.9	32	12	20.0	0.15	8	-	-
BXW-04-10H	04	65	58	35	24.0	22.0	7	3.4	3.4	18	AWG22	M4	7.0	7.0	19.9	34	14	21.0	0.15	10	3	1.2
BXW-05-10H	05	75	66	36	28.0	26.5	9	4.5	4.5	22	AWG22	M4	7.0	7.0	22.1	36	14	21.5	0.15	12	4	1.5

How to Place an Order

BXW-01-10H-24V-5

Size
Release lever
10: Not included
12: Included
Bore diameter (Dimensional symbol d)
Voltage (Refer to the specifications table)
Application
L: Braking use H: Holding and braking use S: Holding use

SPRING-ACTUATED BRAKES

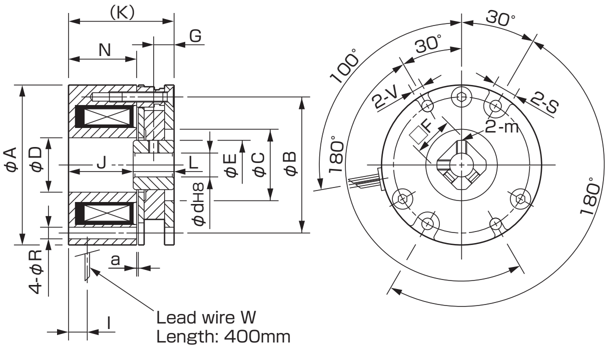
BXW (S) Model Holding use

Specifications

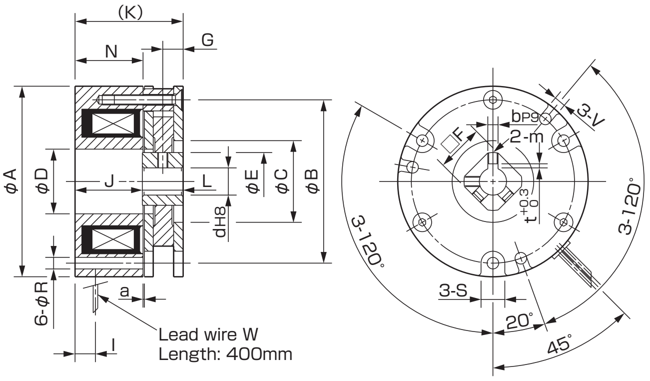
Model	Size	Static friction torque T_S[N·m]	Coil (at20℃) Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]	Heat-resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J[kg·m²]	Allowable braking energy rate $P_{baℓ}$[W]	Total braking energy E_T[J]	Armature pull in time t_a[s]	Armature release time t_{ar}[s]	Mass [kg]
BXW-01-10S	01	0.36	24	5.0	0.208	115	F	5000	0.6×10^{-6}	-	-	0.025	0.010	0.2
BXW-02-10S	02	0.75	24	6.6	0.275	87.3	F	5000	1.9×10^{-6}	-	-	0.030	0.010	0.3
BXW-03-10S	03	1.50	24	9.0	0.375	64.0	F	5000	3.8×10^{-6}	-	-	0.035	0.020	0.4
BXW-04-10S	04	2.60	24	11.5	0.479	50.1	F	5000	12.0×10^{-6}	-	-	0.040	0.025	0.6
BXW-05-10S	05	5.20	24	13.0	0.542	44.3	F	5000	23.0×10^{-6}	-	-	0.045	0.030	0.8

* For the armature pull in time and release time in the case of alternating-current side switching.

Dimensions



Size 01, 02



Size 03, 04, 05

Model	Size	Radial dimensions [mm] A	B	C	D	E	S	V	R	F	W	m	Axial direction dimensions [mm] G	I	J	K	L	N	a	Bore dimensions [mm] d	b	t
BXW-01-10S	01	37	32	18	13.5	12.0	6	3	3	10	AWG26	M3	4.5	5.0	22.5	32	9	22.5	0.10	5 6	-	-
BXW-02-10S	02	47	40	21	16.0	14.5	7	3.4	3.4	12	AWG26	M3	6.0	5.5	19.2	32	12	20.0	0.10	6 7	-	-
BXW-03-10S	03	56	48	24	19.0	17.0	7	3.4	3.4	14	AWG26	M3	6.0	6.0	19.9	32	12	20.0	0.15	8	-	-
BXW-04-10S	04	65	58	35	24.0	22.0	7	3.4	3.4	18	AWG22	M4	7.0	7.0	19.9	34	14	21.0	0.15	10	3	1.2
BXW-05-10S	05	75	66	36	28.0	26.5	9	4.5	4.5	22	AWG22	M4	7.0	7.0	22.1	36	14	21.5	0.15	12	4	1.5

How to Place an Order

BXW-01-10S-24V-5

Size

Release lever
10: Not included
12: Included

Bore diameter (Dimensional symbol d)

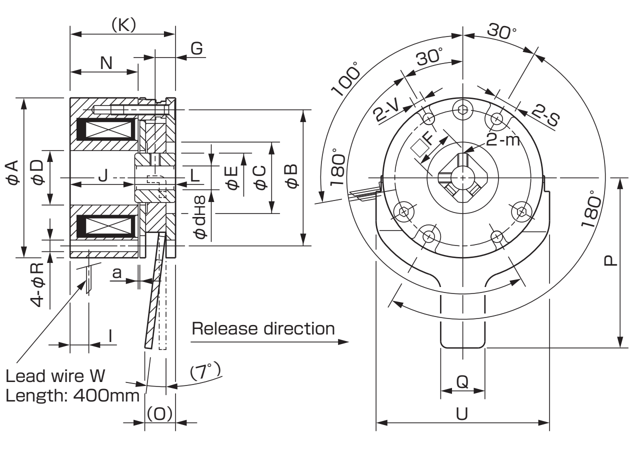
Voltage (Refer to the specifications table)

Application
L: Braking use H: Holding and braking use S: Holding use

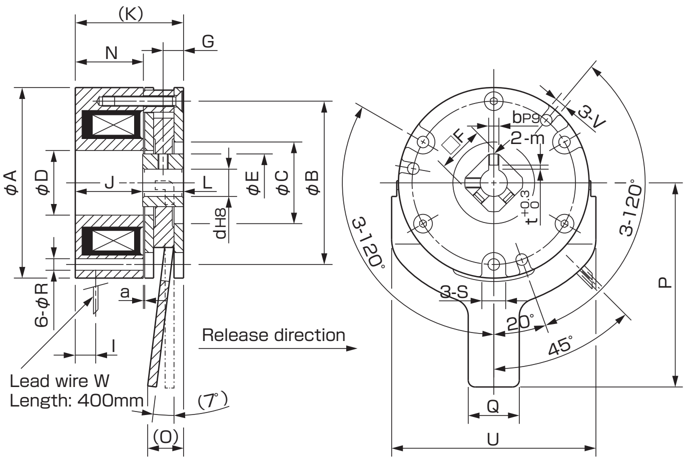
Option & Sold separately

The BXW (L/H/S) model comes with a release lever which causes the brake to release when it is not energized. Also, it can be provided with a dust cover (must be purchased separately) which prevents ingress of foreign matter in a poor environment.

Release lever (Made to order)



Size 02



Size 03, 04, 05

Model	Size	Radial dimensions [mm]											Axial direction dimensions [mm]							Lever dim. [mm]				Bore dim. [mm]		
		A	B	C	D	E	S	V	R	F	W	m	G	I	J	K	L	N	a	O	P	Q	U	d	b	t
BXW-02-12□	02	47	40	21	16.0	14.5	7	3.4	3.4	12	AWG26	M3	6.0	5.5	19.2	32	12	20.0	0.10	9	50	13	51	6 7	-	-
BXW-03-12□	03	56	48	24	19.0	17.0	7	3.4	3.4	14	AWG26	M3	6.0	6.0	19.9	32	12	20.0	0.15	11	60	15	60	8	-	-
BXW-04-12□	04	65	58	35	24.0	22.0	7	3.4	3.4	18	AWG22	M4	7.0	7.0	19.9	34	14	21.0	0.15	12	70	15	70	10	3	1.2
BXW-05-12□	05	75	66	36	28.0	26.5	9	4.5	4.5	22	AWG22	M4	7.0	7.0	22.1	36	14	21.5	0.15	14	80	20	80	12	4	1.5

* See page of each model for specifications * There is no release lever option for size 01.

How to Place an Order

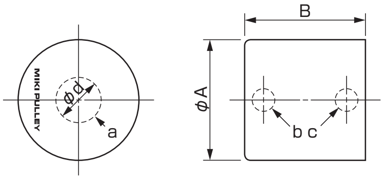
BXW-02-12H-24V-7

Size
Release lever
12: Included
10: Not included
Application
L: Braking use H: Holding and braking use S: Holding use
Voltage (Refer to the specifications table)
Bore diameter (Dimensional symbol d)

Dust cover (Sold separately)

Material	Ethylene propylene diene monomer (EPDM) rubber
Temperature range	−40℃ to 140℃
Exterior color	Black
Applicable brake models	L type, H type, S type BXW models
Applicable specification voltage	12V DC, 24V DC, 45V DC, 90V DC, 180V DC

* This temperature range is for dust cover materials. The operating temperature for BXW models is −10℃ to 40℃. * Cannot be mounted on BXW models with release levers or R type BXW models.



Shape No.	a	b	c
01	×	×	×
02	×	×	○
03	×	○	×
04	○	×	×
05	○	×	○
06	○	○	×

Model	φA [mm]	B [mm]	φd [mm]
BXW-01-C□	41	33	16
BXW-02-C□	51	33	21
BXW-03-C□	60	33.5	24
BXW-04-C□	69	35.5	30
BXW-05-C□	79	37.5	30

* Symbol a indicates a hole made for brakes with shafts passing through; symbol b indicates a hole made for lead wire exit when mounted on a plate; symbol c indicates a hole made for lead wire exit when mounted on a stator. * Shape No. 01 and 04 require that a hole be made separately for leads wire to exit.

How to Place an Order

BXW-01-C02

Applicable brake size
01, 02, 03, 04, 05
Shape No.
01, 02, 03, 04, 05, 06

SPRING-ACTUATED BRAKES

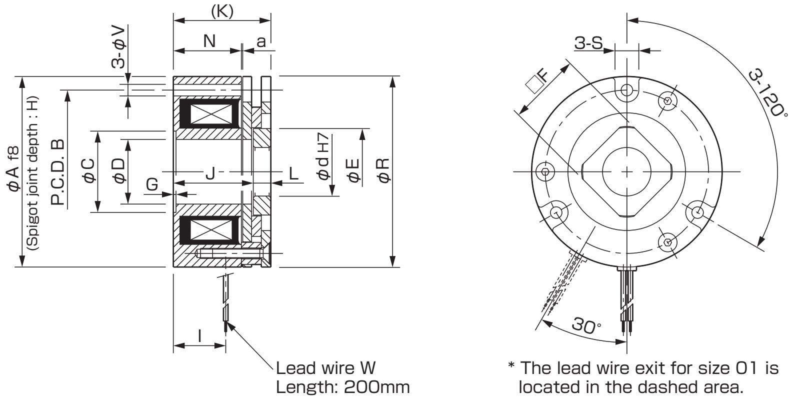
BXW (R) Model For servo motors

Specifications

Model	Size	Static friction torque T_S[N·m]	Coil (at20℃)				Heat-resistance class	Max. rotation speed [min^{-1}]	Rotating part moment of inertia J[kg·m^2]	Allowable braking energy $E_{baℓ}$[W]	Total braking energy E_T[J]	Armature pull in time t_a[s]	Armature release time t_{ar}[s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXW-01-10R	01	0.3	24	6.1	0.254	94.4	F	6000	1.36×10^{-7}	15	3000	0.035	0.020	0.1
BXW-03-10R	03	1.3	24	7.2	0.300	80.0	F	6000	1.17×10^{-6}	87	17000	0.050	0.020	0.3
BXW-05-10R	05	2.5	24	8.0	0.333	72.0	F	6000	3.68×10^{-6}	200	40000	0.060	0.020	0.5

* For the armature pull in time and release time in the case of alternating-current side switching.

Dimensions



* The lead wire exit for size 01 is located in the dashed area.

Model	Size	Radial dimensions [mm]										Axial direction dimensions [mm]								Bore dim. [mm]	
		A	B	C	D	E	S	V	R	F	W	G	H	I	J	K	L	N	a	d	d max.
BXW-01-10R	01	33	26.5	16	9	14	7	3.4	32.5	12	AWG26	0.2	4	19	26	30	4	22.8	0.1	8.5	8.5
BXW-03-10R	03	48	42	26	14	23	8	3.4	47.5	19	AWG22	0.2	4	18	26	30	4	22.6	0.1	11	15
BXW-05-10R	05	64	56	28	22	31	8	4.5	63.5	25	AWG22	0.2	4	16	25.5	30	4.5	21.3	0.1	16	20

How to Place an Order

BXW-01-10R-24V-8.5

Size

Bore diameter (Dimensional symbol d)

Voltage (Refer to the specifications table)

Application R: Servo motor use

Items Checked for Design Purposes

■ Precautions for handling

■ Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

■ Lead wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

■ Frictional surface

Since these are dry brakes, they must be used with the frictional surface dry. Keep water and oil off of the frictional surfaces when handling the brakes.

■ Precautions for mounting

■ Mounting orientation

BXW models can be mounted with the stator facing inwards (stator mounted) or outwards (plate mounted). Select your mounting orientation as the application dictates. Be aware, however, that the BXW (R) type is only compatible with stator centering-mark mounting. Your understanding is appreciated.

■ Affixing the rotor hub

Affix the rotor hub to the shaft with hex-socket-head set screws such that the rotor hub does not touch the armature or stator. If you are applying adhesive to the hex-socket-head set screws, be careful that the adhesive does not come out onto the rotor hub surface. Note also that since the BXW (R) type is constructed so that the rotor hub does not go through the stator, affix it by press-fitting it onto the shaft at a position that does not touch the armature (see dimension J) when they are assembled.

■ Bolts and screws

Implement screw-locking measures such as use of an adhesive threadlocking compound to bolts and screws used to install brakes.

■ Shafts

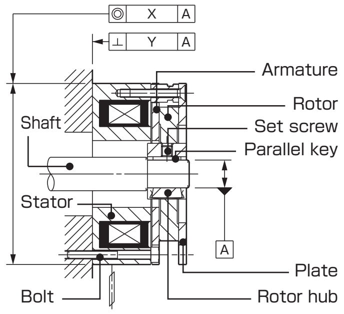
The shaft tolerance should be h7 class (JIS B 0401). Be aware that the harder the material used for the shaft, the lower the effect of the hex-socket-head set screws.

■ Accuracy of brake attachment surfaces

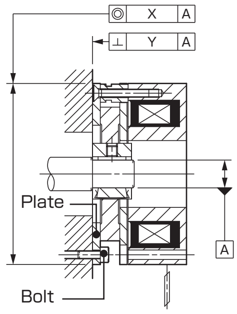
Make sure that concentricity (X) and perpendicularity (Y) do not exceed the allowable values of the table below.

Model	Size	Concentricity (X) T.I.R. [mm]	Perpendicularity (Y) T.I.R. [mm]
BXW-01, 02	01, 02	0.05	0.02
BXW-03, 04, 05	03, 04, 05	0.10	0.02

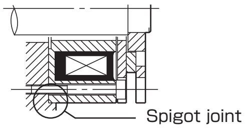
■ Stator mounted



■ Plate mounted



■ Stator mounted of BXW (R) type



■ Precautions for use

■ Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

■ Operating temperature

The operating temperature range is −10℃ to 40℃. If you will use the product at other temperatures, consult MIKI PULLEY.

■ Power supply voltage fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ± 10% of the rated voltage value.

■ Air gap adjustment

BXW models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory.

■ Circuit protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

■ Recommended power supplies and circuit protectors

■ Recommended power supplies

Input AC power	Brake voltage	Rectification method	Recommended power supply model
AC 100V 50/60Hz	DC 24V	Single-phase, full-wave	BES-20-71-1
AC 100V 50/60Hz	DC 45V	Single-phase, half-wave	BEW-1R
AC 100V 50/60Hz	DC 90V	Single-phase, full-wave	BEW-1R
AC 200V 50/60Hz	DC 24V	Single-phase, full-wave	BES-20-71
AC 200V 50/60Hz	DC 90V	Single-phase, half-wave	BEW-2R
AC 200V 50/60Hz	DC 180V	Single-phase, full-wave	BEW-2R
AC 400V 50/60Hz	DC 180V	Single-phase, half-wave	BEW-4R

* A DC power supply such as a battery can also be used to supply the 24 V DC required for the brake voltage.

■ Recommended circuit protectors

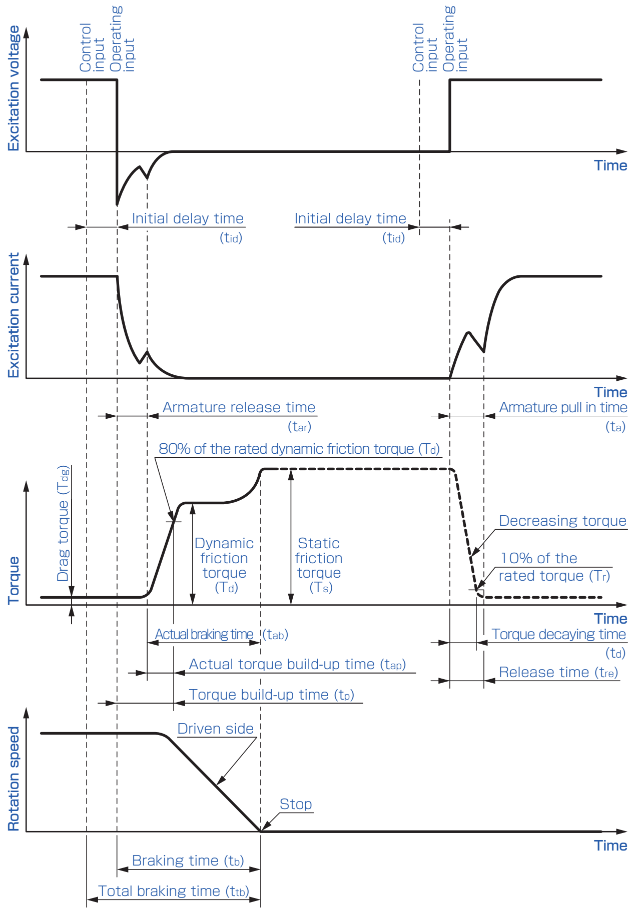
Input voltage	Brake voltage	Recommended circuit protector (varistor)
DC 24V	DC 24V	NVD07SCD082 or an equivalent
AC 100V 50/60Hz	DC 45V	NVD07SCD220 or an equivalent
AC 100V 50/60Hz	DC 90V	NVD07SCD220 or an equivalent
AC 200V 50/60Hz	DC 90V	NVD07SCD470 or an equivalent
AC 200V 50/60Hz	DC 180V	NVD07SCD470 or an equivalent
AC 400V 50/60Hz	DC 180V	NVD14SCD820 or an equivalent

* NVD □ SCD □ parts are manufactured by KOA Corporation. * DC24V indicates a product recommended with a stepdown transformer or the like. * BXW models do not come with circuit protectors.

Items Checked for Design Purposes

Operating characteristics

Operating time



t_{ar} : Armature release time

The time from when current shuts off until the armature returns to its position prior to being pulled in and torque begins to be generated

t_{ap} : Actual torque build-up time

The time from when torque first begins to be generated until it reaches 80% of rated torque

t_p : Torque build-up time

The time from when current flow is shut off until torque reaches 80% of rated torque

t_a : Armature pull in time

The time from when current flow first starts until the armature is pulled in and torque disappears

t_{id} : Initial delay time

The time from start of command input to actuation input or release input to the main brake body

Size	BXW (L)		BXW (H)		BXW (S)		BXW (R)	
	tar [s]	ta [s]	tar [s]	ta [s]	tar [s]	ta [s]	tar [s]	ta [s]
01	0.015	0.008	0.010	0.010	0.010	0.025	0.020	0.035
02	0.015	0.008	0.010	0.010	0.010	0.030	-	-
03	0.025	0.025	0.020	0.035	0.020	0.035	0.020	0.050
04	0.030	0.030	0.025	0.040	0.025	0.040	-	-
05	0.035	0.035	0.030	0.045	0.030	0.045	0.020	0.060

* DC-side switching

Selection procedure for brakes for braking

1 Consideration of required torque to brake loads

To select the appropriate brake size, you must find the torque required for braking T, and then select a size of brake that delivers a greater torque than T.

■ Consideration of cases when load conditions are not clearly known

When load conditions are clearly known, assuming that the motor has been selected correctly for the load, a guideline for torque can be obtained from motor output using the following equation.

$$T_M = \frac{9550 \times P}{n_r} \times \eta \ [\mathrm{N{\cdot}m}]$$

P : Motor output [kW]
n_r : Brake shaft rotation speed [min^{-1}]
η : Transmission efficiency from motor to brake

■ Consideration when load conditions can be clearly ascertained

When load conditions can be clearly ascertained, the torque T required for braking can be found using the following equation.

$$T = \left(\frac{J \times n}{9.55 \times t_{ab}} \pm T_\ell \right) \times K \ [\mathrm{N{\cdot}m}]$$

J : Total moment of inertia of load side [$\mathrm{kg{\cdot}m^2}$]
n : Rotation speed [min^{-1}]
t_{ab} : Actual braking time [s]
T_ℓ : Load torque [N·m]
K : Safety factor (see table below)

The sign of load torque T_ℓ is minus when the load works in the direction that assists braking and plus when it works in the direction that hinders braking. The actual braking time tab is the time required from the start of braking torque generation until braking is complete. When this is not clearly known at the selection stage, a guideline value is used that factors in service life and the like.

Load state	Factor
Low-inertia/low-frequency constant load	1.5
Ordinary use with normal inertia	2
High-inertia/high-frequency load fluctuation	3

2 Provisional size selection

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_b > T \ (\text{or } T_M) \ [\mathrm{N{\cdot}m}]$$

T_b : Brake torque [N·m]
* For brake torque, treat T_s as equaling T_b.
(T_s: Static friction torque from specifications table)

3 Consideration of energy

When the load required for braking is sufficiently small, the size can be selected considering only torque T as described above. Given the effects of heat generated by braking, however, the following equation must be used to confirm that the operation frequency per unit time and the total number of operations (service life) meet the required specifications.

Use the following equation to find the energy E_b required for a single braking operation.

$$E_b = \frac{J \times n^2}{182} \times \frac{T_b}{T_b \pm T_\ell} \; [J]$$

The sign of load torque T_ℓ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

■ Confirm the frequency S of operations that can be performed per minute

Find the frequency of operations that can be performed per minute using the equation at right to confirm that the desired operation frequency is sufficiently smaller than the value found.

$$S = \frac{60 \times P_{ba\ell}}{E_b} \; [\text{times/min}]$$

$P_{ba\ell}$: Allowable braking energy rate [W]
E_b : Energy required for one braking operation [J]

■ Confirm the total number of operations (service life)

Find the total number of operations (service life) using the equation at right, and then check that it meets the desired service life.

$$L = \frac{E_T}{E_b} \; [\text{times}]$$

E_T : Total braking energy [J]

4 Consideration of braking time

When there are limits on the time required to decelerate or stop the load, use the equation at right to confirm that the total braking time t_{tb} satisfies requirements.

$$t_{tb} = t_{id} + t_{ar} + t_{ab} \; [s]$$

t_{ar} : Armature release time [s]
t_{id} : Initial delay time [s]

Here, actual braking time tab is the time from the start of braking torque generation to the completion of braking. Find it with the following equation.

$$t_{ab} = \frac{J \times n}{9.55 \times (T_b \pm T_\ell)} \; [s]$$

The sign of load torque T_ℓ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

5 Consideration of stopping precision

To confirm stopping precision, find the stopping angle (rotation) using the following equation.

$$\theta = 6 \times n \times (t_{id} + t_{ar} + \frac{1}{2} t_{ab}) \; [°]$$

t_{ar} : Armature release time [s]
t_{id} : Initial delay time [s]

The variation in stopping precision--i.e., stopping precision $\Delta\theta$ --can be found empirically with the following equation and used as a guide.

$$\Delta\theta = \pm 0.15 \times \theta \; [°]$$

■ Selection procedure for brakes for holding

1 Consideration of required torque to hold loads

Use the following equation to find the torque T required to hold a load while stationary.

$$T = T_{\ell max} \times K \; [N{\cdot}m]$$

$T_{\ell max}$: Maximum load torque [N·m]
K : Safety factor (refer to the table below)

Load state	Factor
Low inertia / small load fluctuations	1.5
Ordinary use with normal inertia	2
Hi inertia / large load fluctuations	3

2 Provisional selection of size

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_s > T \; [N{\cdot}m]$$

T_s : Static friction torque of brake [N·m]

3 Consideration of energy

When considering a brake with the objective of holding loads, braking is limited to emergency braking.

Use the following equation to find the braking energy E_b for a single operation required for emergency braking. You must confirm that this result is sufficiently smaller than the allowable braking energy $E_{ba\ell}$ of the selected brake.

$$E_b = \frac{J \times n^2}{182} \times \frac{T_b}{T_b \pm T_{\ell max}} \; [J]$$

J : Total moment of inertia on load side [kg·m²]
n : Rotation speed [min⁻¹]
T_b : Brake torque [N·m]
$T_{\ell max}$: Maximum load torque [N·m]

The sign of maximum load torque $T_{\ell max}$ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

$$E_b \ll E_{ba\ell} \; [J]$$

When using brakes for both holding and braking and the specification is indicated by allowable braking energy rate $P_{ba\ell}$, check under the following conditions.

$$E_b \ll 60 \times P_{ba\ell} \; [J]$$

4 Consideration of number of operations

The total number of braking operations (service life) when performing emergency braking L must be found using the following equation to confirm that required specifications are satisfied.

$$L = \frac{E_T}{E_b} \; [\text{times}]$$

E_T : Total braking energy [J]

Note that the frequency of emergency braking will also vary with operating environment; however, it should be about once per minute or better. When the braking energy of a single operation E_b is 70% or more of the allowable braking energy $E_{ba\ell}$, however, allow the brake to cool sufficiently after emergency braking before resuming use.

Ultraslim design spring-actuated brakes

MODEL BXR

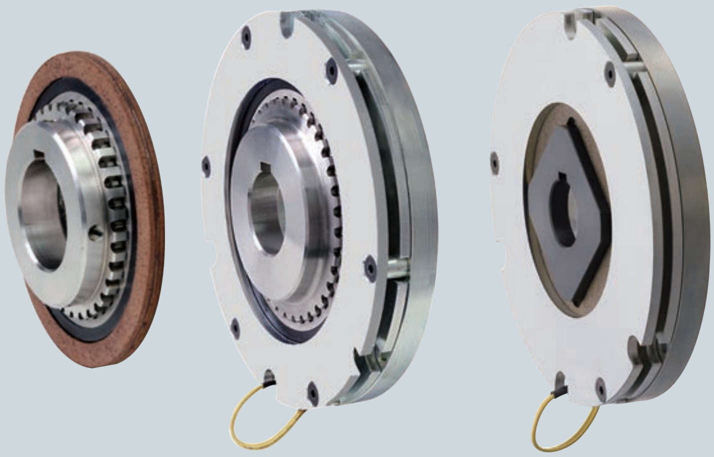
Ultraslim design spring-actuated brakes

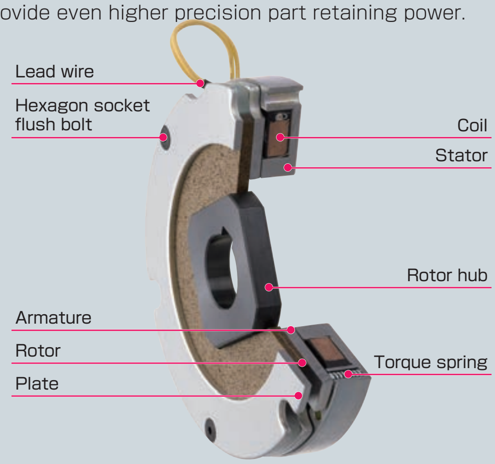
The spring actuated type brake BXR model is an electromagnetic brake actuated by spring force in the non-energized state that is used for retention and panic braking. It plays the role of retaining the halting state of a rotating body or moving body by braking operation. The shape is an ultra-slim design that is 2/3 that of our conventional models. It is best suited to embedding into a servo motor or robot due to low idle abrasion and low inertia achieved by utilizing the light-weight rotor.

Adapted to the RoHS

Spline hub models added to the lineup

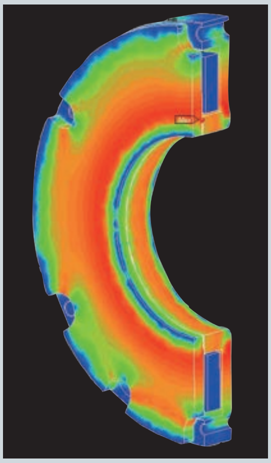
Spline hub models with low backlash have been added to the lineup, joining the original models that use square hubs for the rotor hub used to connect the rotating body and rotor together. These spline hub models provide even higher precision part retaining power.

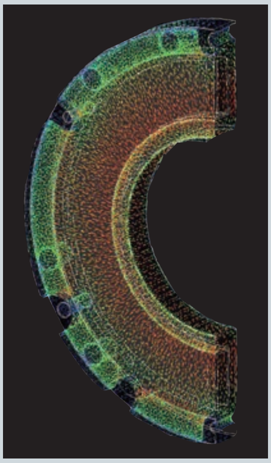


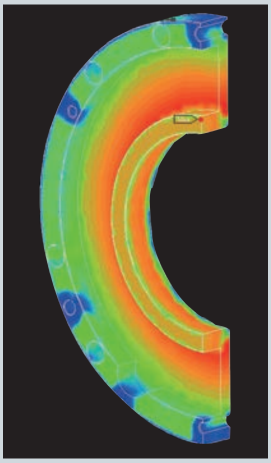


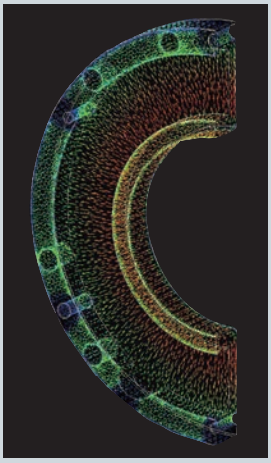
Optimum design by 3D-CAD and FEM

The up-to-date CAE system was adopted in the starting stage of design.
Additionally, the low-capacity design saves energy. Heat generation of coil caused by temperature rise is also reduced.



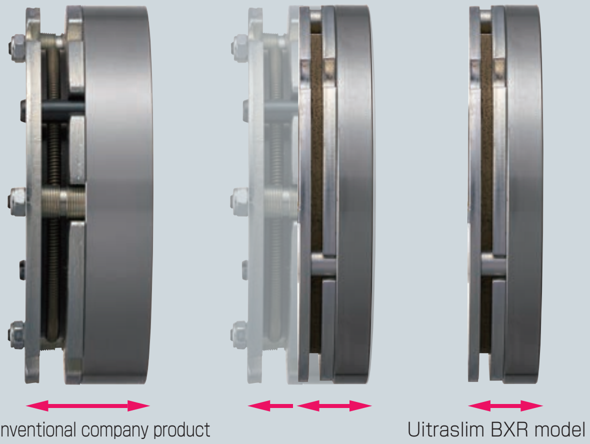




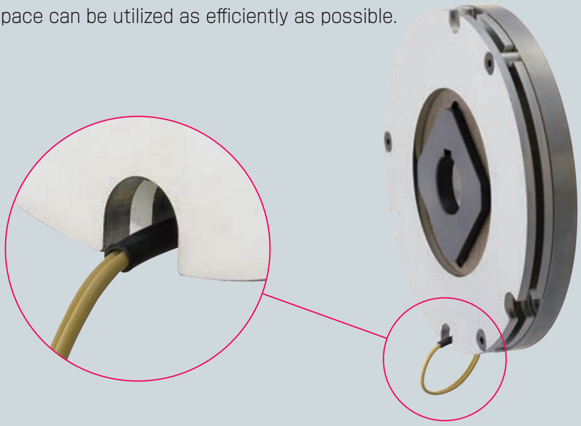


Ultraslim design with 2/3 of thickness compared with the conventional company product

Compared with BX series, which is the conventional company product, the thickness has been reduced to 2/3.



The lead wire that was taken from the outside diameter can be taken in the direction of the shaft of the reverse mounting surface. The limited space can be utilized as efficiently as possible.



Thorough reduction of rotor weight

High-intensity glass cloth has been adopted for the core material of the rotor to secure sufficient strength and to actualize overwhelming lighter weight.

SPRING-ACTUATED BRAKES

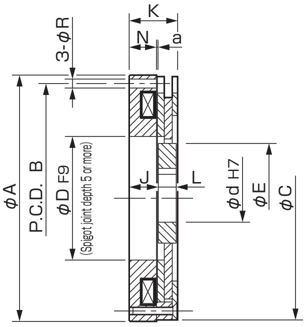
BXR (-10) Model Square hub

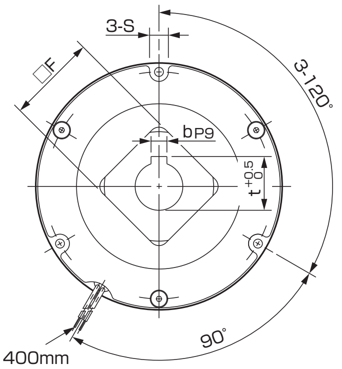
Specifications

Model	Size	Static friction torque Ts[N·m]	Coil (at20℃)				Heat-resist-ance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J[kg·m²]	Allowable braking energy Ebaℓ[J]	Total braking energy ET[J]	Armature pull in time ta[s]	Armature release time tar[s]	Backlash [°]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]									
BXR-06-10-005	06	5	24	17.6	0.73	32.7	F	5000	2.35×10^{-5}	500	2.0×10^{5}	0.050	0.020	1.2	0.9
BXR-08-10-012	08	12	24	19.4	0.81	29.7	F	5000	3.45×10^{-5}	800	2.0×10^{5}	0.080	0.020	1.2	1.2
BXR-10-10-016	10	16	24	21.5	0.90	26.8	F	5000	1.12×10^{-4}	1500	2.2×10^{6}	0.110	0.050	0.9	1.3
BXR-12-10-030	12	30	24	23.7	0.99	24.3	F	5000	1.88×10^{-4}	1500	2.5×10^{6}	0.120	0.030	0.8	2.3
BXR-14-10-038	14	38	24	31.0	1.29	18.6	F	3600	4.22×10^{-4}	1800	3.0×10^{6}	0.120	0.030	0.5	3.0
BXR-16-10-055	16	55	24	19.0	0.79	30.3	F	3600	7.10×10^{-4}	2000	3.0×10^{6}	0.220	0.100	0.5	3.6

* For the armature pull in time and release time in the case of alternating-current side switching .* The backlash values given are for between the rotor and rotor hub.

Dimensions





Lead wire length: 400mm
* Lead wire pullout position for size 14 is at 60°

Model	Size	Radial dimensions [mm]								Axial direction dimensions [mm]					Bore dimensions [mm]			
		A	B	C	D	E	F	R	S	J	L	N	K	a	d	b	t	d max.
BXR-06-10-005	06	83.5	76	82	47	42	35	4.5	9	17	7	14.7	25.0	0.10	20	6	22.5	25
BXR-08-10-012	08	93.5	85	92	49	42	35	4.5	10	19	7	15.7	27.0	0.10	20	6	22.5	25
BXR-10-10-016	10	123.5	115	122	62	55	45	4.5	9.5	14.6	9	13.7	24.3	0.10	24	8	27	28
BXR-12-10-030	12	137.5	130	136	65	62	50	4.5	12	15.4	9	12.5	25.0	0.15	24	8	27	30
BXR-14-10-038	14	167.5	158	166	80	74	60	5.5	12	16	9	12.0	25.0	0.15	28	8	31	38
BXR-16-10-055	16	185	175	184	100	86	65	5.5	12.5	21.3	11.5	19.4	32.8	0.20	28	8	31	45

How to Place an Order

BXR-14-10-038-24V-28DIN

Size
Shape fitting
10: Square
Bore diameter (Dimensional symbol d)
Voltage (Refer to the specifications table)
Static friction torque [N · m]
(Refer to the specifications table. On the three-digits code)

SPRING-ACTUATED BRAKES

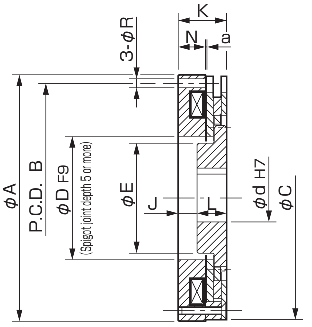
BXR (-20) Model Spline hub

Specifications

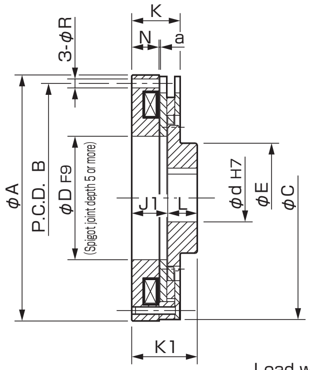
Model	Size	Static friction torque Ts[N·m]	Coil (at20℃)				Heat-resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J[kg·m²]	Allowable braking energy Ebaℓ[J]	Total braking energy ET[J]	Armature pull in time ta[s]	Armature release time tar[s]	Backlash [°]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]									
BXR-06-20-005	06	5	24	17.6	0.73	32.7	F	5000	3.43×10^{-5}	500	2.0×10^{5}	0.050	0.020	0.2	1.0
BXR-08-20-012	08	12	24	19.4	0.81	29.7	F	5000	6.75×10^{-5}	800	2.0×10^{5}	0.080	0.020	0.4	1.3
BXR-10-20-016	10	16	24	21.5	0.90	26.8	F	5000	2.32×10^{-4}	1500	2.2×10^{6}	0.110	0.050	0.3	1.5
BXR-12-20-030	12	30	24	23.7	0.99	24.3	F	5000	3.02×10^{-4}	1500	2.5×10^{6}	0.120	0.030	0.3	2.5
BXR-14-20-038	14	38	24	31.0	1.29	18.6	F	3600	9.41×10^{-4}	1800	3.0×10^{6}	0.120	0.030	0.2	3.4
BXR-16-20-055	16	55	24	19.0	0.79	30.3	F	3600	15.2×10^{-4}	2000	3.0×10^{6}	0.220	0.100	0.2	4.0

* For the armature pull in time and release time in the case of alternating-current side switching .* The backlash values given are for between the rotor and rotor hub.

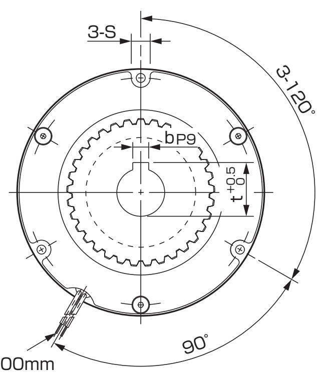
Dimensions



Assembly A



Assembly B



Lead wire length: 400mm
* Lead wire pullout position for size 14 is at 60°

Model	Size	Radial dimensions [mm]								Axial direction dimensions [mm]							Bore dimensions [mm]			
		A	B	C	D	E	F	R	S	J	J1	L	N	K	K1	a	d	b	t	d max
BXR-06-20-005	06	83.5	76	82	47	36	35	4.5	9	10.5	18	12.5	14.7	25.0	30.5	0.10	20	6	22.5	25
BXR-08-20-012	08	93.5	85	92	49	42	35	4.5	10	11.5	20	13.5	15.7	27.0	33.5	0.10	20	6	22.5	30
BXR-10-20-016	10	123.5	115	122	62	56	45	4.5	9.5	9	18.2	15	13.7	24.3	33.2	0.10	24	8	27	40
BXR-12-20-030	12	137.5	130	136	65	61	50	4.5	12	8.8	17.8	15	12.5	25.0	32.8	0.15	24	8	27	45
BXR-14-20-038	14	167.5	158	166	80	75	60	5.5	12	7.2	17.2	16	12.0	25.0	33.2	0.15	28	8	31	55
BXR-16-20-055	16	185	175	184	100	82	65	5.5	12.5	13.6	24.6	18	19.4	32.7	42.6	0.20	28	8	31	65

How to Place an Order

BXR-14-20-038-24V-28DIN

Size
Shape fitting
20: Spline

Bore diameter (Dimensional symbol d)
Voltage (Refer to the specifications table)
Static friction torque [N · m]
(Refer to the specifications table. On the three-digits code)

Items Checked for Design Purposes

■ Precautions for handling

■ Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

■ Lead wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

■ Frictional surface

Since these are dry brakes, they must be used with the frictional surface dry. Keep water and oil off of the frictional surfaces when handling the brakes.

■ Precautions for mounting

■ Affixing the rotor hub

Affix the rotor hub to the shaft with bolts, snap rings, or the like such that the rotor hub does not touch the armature or stator.
Leave at least dimension J or J1 on spline hub types, since the rotor hub may contact the armature.

■ Bolts

Implement screw-locking measures such as use of an adhesive threadlocking compound to bolts used to install brakes.

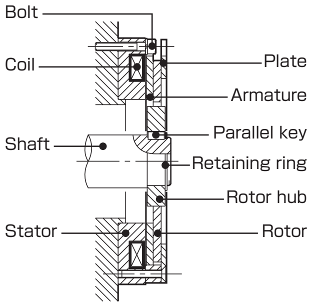
■ Shafts

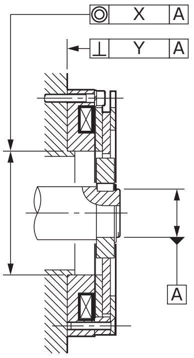
The shaft tolerance should be h7 class (JIS B 0401).

■ Accuracy of brake attachment surfaces

Make sure that concentricity (X) and perpendicularity (Y) do not exceed the allowable values of the table below.

Model	Size	Concentricity (X) T.I.R. [mm]	Perpendicularity (Y) T.I.R. [mm]
BXR-06	06	0.3	0.04
BXR-08	08	0.3	0.05
BXR-10	10	0.4	0.05
BXR-12	12	0.4	0.06
BXR-14	14	0.6	0.06
BXR-16	16	0.6	0.07





■ Precautions for use

■ Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

■ Operating temperature

The operating temperature range is −10℃ to 40℃. If you will use the product at other temperatures, consult MIKI PULLEY.

■ Power supply voltage fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ± 10% of the rated voltage value.

■ Air gap adjustment

BXR models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory.

■ Circuit protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

■ Recommended circuit protectors

Input voltage	Brake voltage	Recommended circuit protector (varistor)
DC 24V	DC 24V	NVD07SCD082 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.
* DC24V indicates a product recommended with a stepdown transformer or the like.

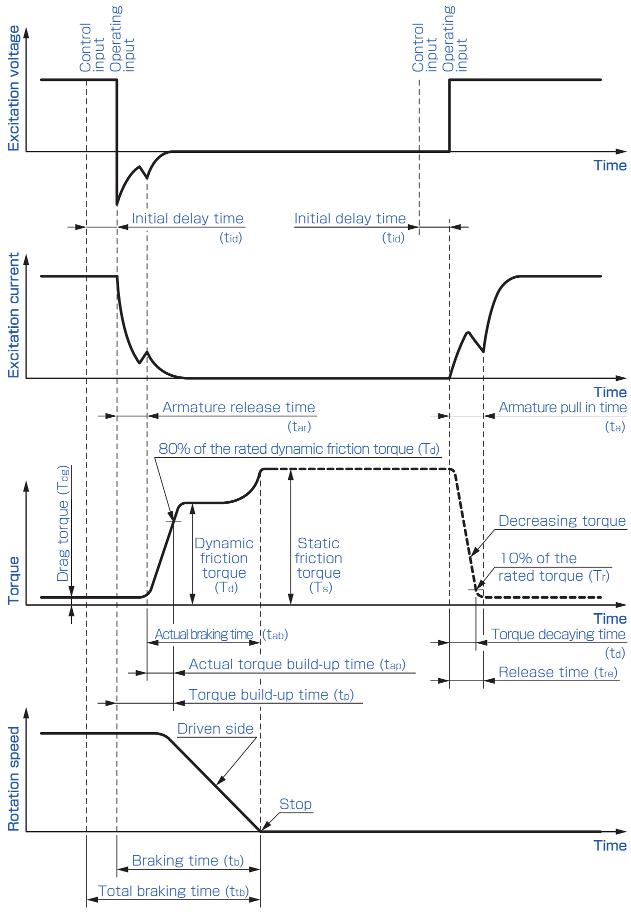
■ Included varistor

Brake voltage	Included varistor
DC 24V	NVD07SCD082 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.

Operating characteristics

Operating time



t_{ar} : Armature release time

The time from when current shuts off until the armature returns to its position prior to being pulled in and torque begins to be generated

t_{ap} : Actual torque build-up time

The time from when torque first begins to be generated until it reaches 80% of rated torque

t_p : Torque build-up time

The time from when current flow is shut off until torque reaches 80% of rated torque

t_a : Armature pull in time

The time from when current flow first starts until the armature is pulled in and torque disappears

t_{id} : Initial delay time

The time from start of command input to actuation input or release input to the main brake body

Model	Size	Voltage [V]	Switching	tar [s]	ta [s]
BXR-06	06	24	DC side	0.020	0.050
BXR-08	08	24	DC side	0.020	0.080
BXR-10	10	24	DC side	0.050	0.110
BXR-12	12	24	DC side	0.030	0.120
BXR-14	14	24	DC side	0.030	0.120
BXR-16	16	24	DC side	0.100	0.220

Selection

1 Consideration of required torque to hold loads

Use the following equation to find the torque T required to hold a load while stationary.

$$T = T_{\ell max} \times K\ [N \cdot m]$$

$T_{\ell max}$: Maximum load torque [N·m]
K : Safety factor (refer to the table below)

Load state	Factor
Low inertia / small load fluctuations	1.5
Ordinary use with normal inertia	2
Hi inertia / large load fluctuations	3

2 Provisional selection of size

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_s > T\ [N \cdot m]$$

T_s : Static friction torque of brake [N·m]

3 Consideration of energy

When considering a brake with the objective of holding loads, braking is limited to emergency braking.

Use the following equation to find the braking energy E_b for a single operation required for emergency braking. You must confirm that this result is sufficiently smaller than the allowable braking energy $E_{ba\ell}$ of the selected brake.

$$E_b = \frac{J \times n^2}{182} \times \frac{T_b}{T_b \pm T_{\ell max}}\ [J]$$

J : Total moment of inertia on load side [kg·m²]
n : Rotation speed [min⁻¹]
T_b : Brake torque [N·m]
$T_{\ell max}$: Maximum load torque [N·m]

The sign of maximum load torque $T_{\ell max}$ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

$$E_b \ll E_{ba\ell}\ [J]$$

4 Consideration of number of operations

The total number of braking operations (service life) when performing emergency braking L must be found using the following equation to confirm that required specifications are satisfied.

$$L = \frac{E_T}{E_b}\ [times]$$

E_T : Total braking energy [J]

Note that the frequency of emergency braking will also vary with operating environment; however, it should be about once per minute or better. When the braking energy of a single operation E_b is 70% or more of the allowable braking energy $E_{ba\ell}$, however, allow the brake to cool sufficiently after emergency braking before resuming use.

Spring-actuated brake and P.W.M. controller

MODEL BXR LE

SPRING-ACTUATED BRAKE AND CONTROLLER

Ultra-compact design spring-actuated brakes

A spring-actuated brake is a brake that is operated by the push force of a built-in spring in the event of a power failure or when the power is cut off in an emergency. In other words, when a machine is running it continuously consumes electric power in order to maintain the brake in a released condition. However, the necessary electrical energy consumed by a spring-actuated brake when the brake starts to release differs greatly from the energy required to maintain the brake in a released condition. Intrinsically, only a very small electrical energy was necessary to hold the brake in a released condition.

A variety of merits

By incorporating a dedicated controller in the spring-actuated brake, a variety of merits can be obtained.

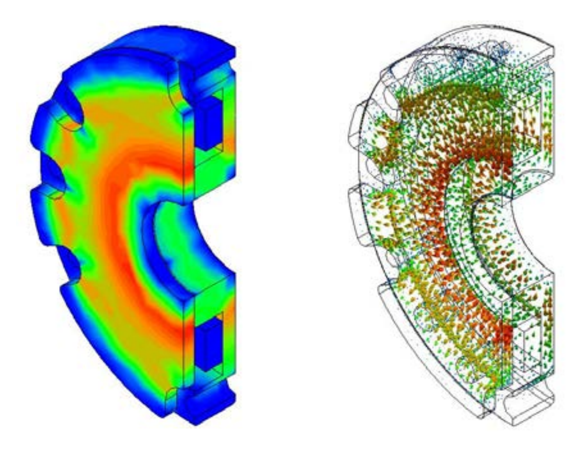
Compact design
which reduces the thickness of the brake to 1/2

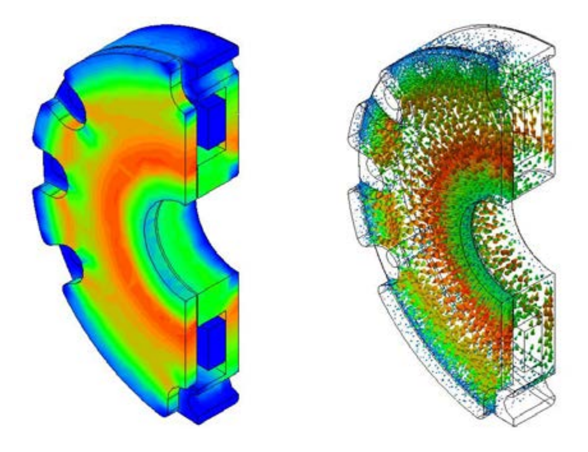
High torque design
which doubles the torque

Long life design
which doubles the life of the brake

Optimum design by 3D-CAD and FEM

It was the best designed using a finite element method (FEM) for magnetic field analysis of the electromagnetic brake.

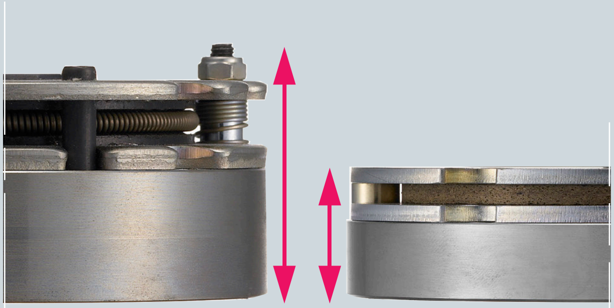




Accordingly, a variety of merits can be obtained by designing a spring-actuated brake based on the assumption that it will incorporate a dedicated controller to control the necessary electrical energy for overcoming the push force of the spring when the brake starts to release and also the necessary electrical energy for keeping the brake in a released condition.

Ultra-compact design with 1/2 of thickness compared with the conventional company product

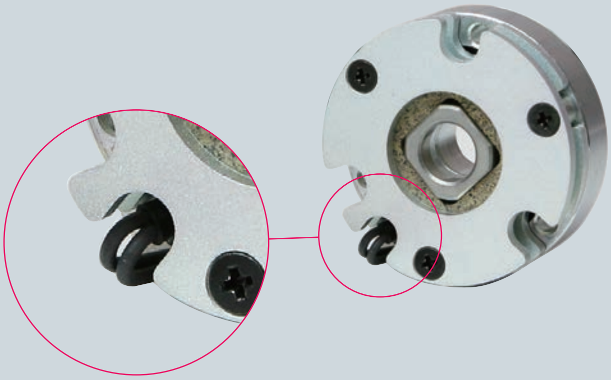
Compared with BX series, which is the conventional company product, the thickness has been reduced to 1/2.



Conventional company product

Ultra-compact brake

The lead wire that was taken from the outside diameter can be taken in the direction of the shaft of the reverse mounting surface. The limited space can be utilized as efficiently as possible.



Thorough reduction of rotor weight

High-intensity glass cloth has been adopted for the core material of the rotor to secure sufficient strength and to actualize overwhelming lighter weight.

SPRING-ACTUATED BRAKE & CONTROLLER

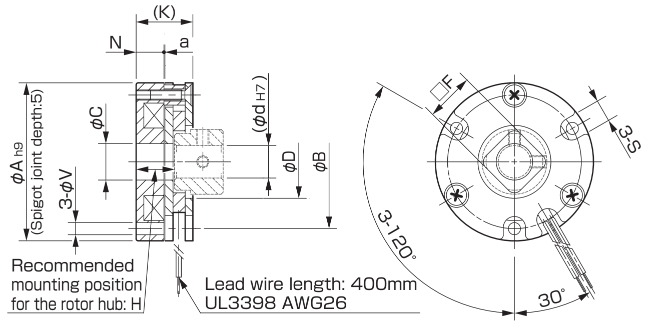
BXR LE Model Holding use

Brake part

Specifications

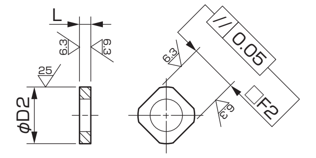
Model	Size	Static friction torque Ts [N·m]	Coil (at20℃)								Heat-resist-ance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Allowable braking energy Ebaℓ [J]	Total braking energy ET [J]	Armature pull-in time (DC24V) ta [s]	Armature release time (DC7V) tar [s]	Mass [kg]
			Over excitation output				Constant excitation output											
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]	Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXR-015-10LE	015	0.06	24	16.5	0.688	35	7	1.4	0.200	35	F	6000	3.34×10^{-8}	5	1000	0.020	0.020	0.03
BXR-020-10LE	020	0.14	24	16.5	0.688	35	7	1.4	0.200	35	F	6000	5.56×10^{-8}	15	3000	0.035	0.020	0.06
BXR-025-10LE	025	0.32	24	16.5	0.688	35	7	1.4	0.200	35	F	6000	1.56×10^{-7}	15	3000	0.035	0.020	0.08
BXR-035-10LE	035	0.62	24	16.5	0.688	35	7	1.4	0.200	35	F	6000	4.83×10^{-7}	87	17000	0.050	0.020	0.12
BXR-040-10LE	040	1.32	24	16.5	0.688	35	7	1.4	0.200	35	F	6000	6.32×10^{-7}	87	17000	0.060	0.020	0.16
BXR-050-10LE	050	3.20	24	16.5	0.688	35	7	1.4	0.200	35	F	6000	1.51×10^{-6}	200	40000	0.060	0.020	0.40

Dimensions



Recommended mounting position for the rotor hub: H

Lead wire length: 400mm
UL3398 AWG26



Processing dimension of the rotor hub

* The rotor hub which connects the shaft to the rotor must either be obtained by you while referring to the above figure, or selected from the options shown on the right page.
We can also manufacture a rotor hub of a profile that matches your requirements. Please contact us for details.

Model	Size	Radial dimensions [mm]									Axial direction dim. [mm]			Processing dim. of the rotor hub [mm]		
		φA	φB	φC	φD	φd max.	□F	S	φV	H	K	N	a	L	φD2	□F2
BXR-015-10LE	015	26	22	7	12	5	8	4.3	2.3	9.5 ~ 10.0	14.0	7.0	0.1	4 or more	$10^{\ 0}_{-0.1}$	$8^{\ 0}_{-0.07}$
BXR-020-10LE	020	32	28	9	16	8	12	5.0	2.3	9.5 ~ 10.0	14.0	7.0	0.1	4 or more	$14^{\ 0}_{-0.1}$	$12^{\ 0}_{-0.07}$
BXR-025-10LE	025	39	33	9	18	8	12	5.5	3.0	9.5 ~ 10.0	14.0	7.0	0.1	4 or more	$14^{\ 0}_{-0.1}$	$12^{\ 0}_{-0.07}$
BXR-035-10LE	035	48	42	15	28	14	19	5.5	3.0	9.5 ~ 10.0	14.0	7.0	0.1	4 or more	$23^{\ 0}_{-0.1}$	$19^{\ 0}_{-0.07}$
BXR-040-10LE	040	56	50	15	27	14	19	6.5	3.4	9.9 ~ 10.4	14.5	7.4	0.1	4 or more	$23^{\ 0}_{-0.1}$	$19^{\ 0}_{-0.07}$
BXR-050-10LE	050	71	65	22	37	20	25	8.0	4.4	14.0 ~ 14.4	19.0	10.5	0.1	4.5 or more	$31^{\ 0}_{-0.1}$	$25^{\ 0}_{-0.07}$

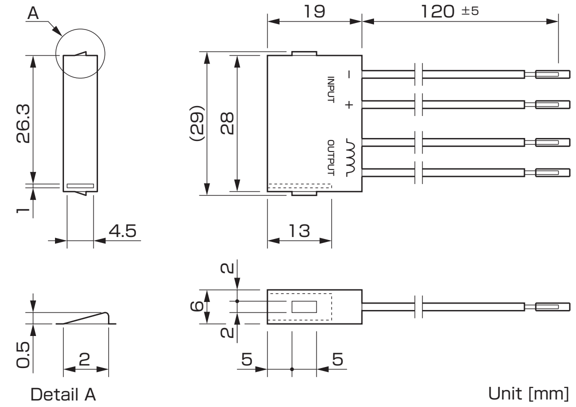
Controller part

Specifications

Model	BEM-24ESN7-120N
Input voltage	DC24V ±10% Smoothing power supplies
Output voltage	Over excitation DC24V (0.2s), Constant excitation DC7V (±10%) · PWM control * When the input voltage is 21 VDC or less, the output voltage is interrupted.
Max. output current	DC1.0A (at 20℃) · DC0.8A (at 60℃)
Time rating	Continuous
Insulating resistance	DC500V, 100MΩ with Megger (Between lead wire and case)
Dielectric strength voltage	AC1000V 50/60Hz 1min (Between lead wire and case)
Ambient environment	−20 to 60℃ 5 to 95%RH, With no condensation, freezing
Mass	0.02kg

Lead wire	Function	Function description	Specification
Red	Input (+)	Connector for a smoothing power DC24V (+)	UL3398 AWG26
Black	Input (−)	Connector for a smoothing power DC24V (−)	UL3398 AWG26
Yellow	Output	Connector for a brake (Regardless of polarity)	UL3398 AWG26
Yellow	Output	Connector for a brake (Regardless of polarity)	UL3398 AWG26

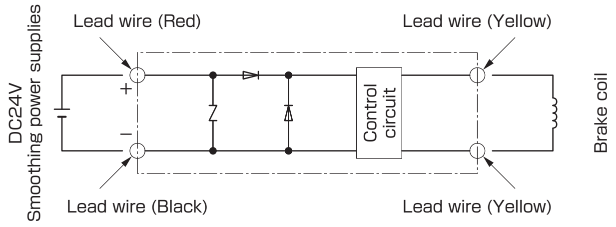
Dimensions



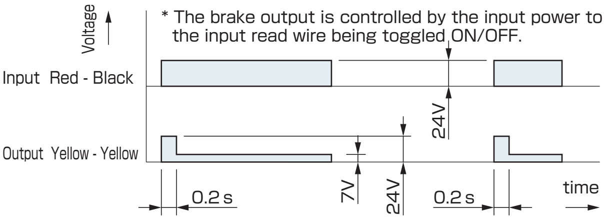
Unit [mm]

*Case : PBT(UL94V-0) , Mold : Epoxy(UL94V-0)

Structure



Timing charts

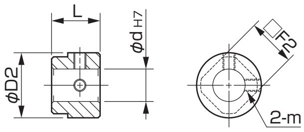


* The brake output is controlled by the input power to the input read wire being toggled ON/OFF.

Adapted to the RoHS

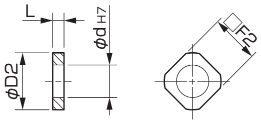
Option Rotor hub

Set screw type (C)



Model	Size	L [mm]	D2 [mm]	□F2 [mm]	m Nominal dia.	d [mm]	d max. [mm]
BXR-015-10LE	015	10	10	$8^{0}_{-0.07}$	M2.5	5	5
BXR-020-10LE	020	10	14	$12^{0}_{-0.07}$	M3	8	8
BXR-025-10LE	025	10	16	$12^{0}_{-0.07}$	M3	8	8
BXR-035-10LE	035	12	26	$19^{0}_{-0.07}$	M4	14	14
BXR-040-10LE	040	12	26	$19^{0}_{-0.07}$	M4	14	14
BXR-050-10LE	050	15	35	$25^{0}_{-0.07}$	M5	20	20

Press-fitting type (P)



Model	Size	L [mm]	D2 [mm]	□F2 [mm]	d [mm]	d max. [mm]
BXR-015-10LE	015	4	10	$8^{0}_{-0.07}$	5	5
BXR-020-10LE	020	4	14	$12^{0}_{-0.07}$	8	8
BXR-025-10LE	025	4	14	$12^{0}_{-0.07}$	8	8
BXR-035-10LE	035	4	23	$19^{0}_{-0.07}$	14	14
BXR-040-10LE	040	4	23	$19^{0}_{-0.07}$	14	14
BXR-050-10LE	050	4.5	31	$25^{0}_{-0.07}$	20	20

How to Place an Order

BXR-015-10LE-006-C5

Size

Brake with P.W.M. controller type

Nominal static friction torque
(Refer to the Specifications table for details on the three-digit code.)

Bore dia. (Dimensional symbol d)

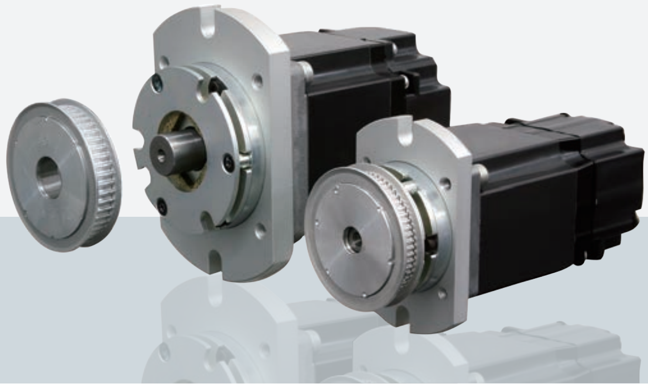
Option (Rotor hub) Blank : With out rotor hub
C : Set screw type
P : Press-fitting type

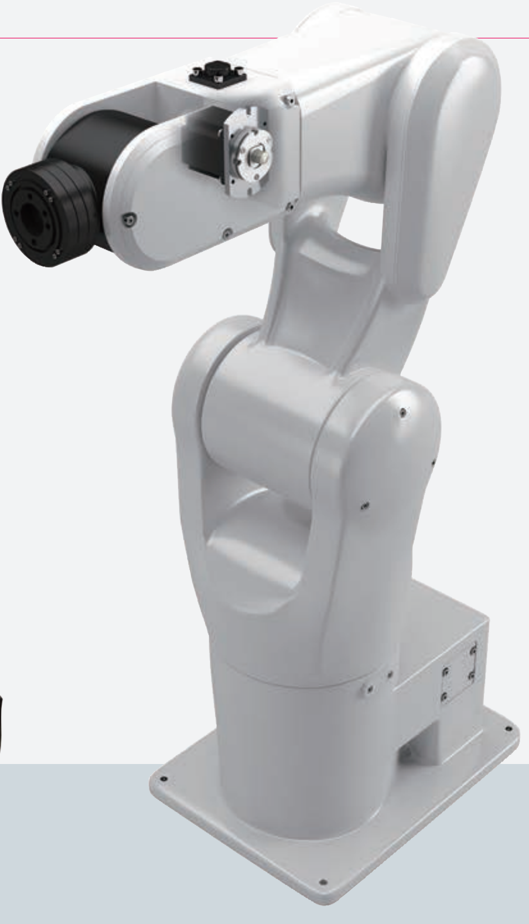
Application

Example of mounting on the output shaft of a servo-motor

The photograph at right shows an example of an integrated construction in which an ultra-compact spring-actuated brake is installed on the output shaft of a servo motor and a rotor hub is machined onto the timing pulley.

It is possible to make the total length shorter than the length of a built-in servo motor that has a brake, making a machine more compact.





Items Checked for Design Purposes

Precautions for handling

Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

Lead wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

Frictional surface

Since these are dry brakes, they must be used with the frictional surface dry. Keep water and oil off of the frictional surfaces when handling the brakes.

Precautions for mounting

Fixing the rotor hub

Use a design and fixing method that prevent the rotor hub from touching the armature or the stator. When employing a fixing method involving the use of a general hex socket head bolt and adhesive, take care that the adhesive does not get onto the surface of the rotor hub.

Bolts and screws

Implement screw-locking measures such as use of an adhesive thread locking compound to bolts used to install brakes.

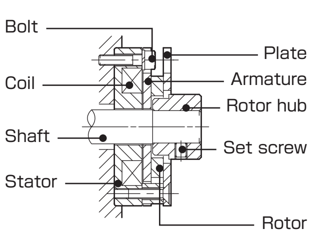
Shafts

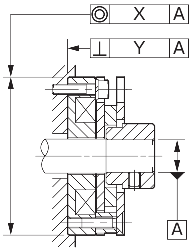
The shaft tolerance should be h7 class (JIS B 0401). When using an optional press-fitting type rotor hub, consider using the press-fitting tolerance.

Accuracy of brake attachment surfaces

Make sure that concentricity (X) and perpendicularity (Y) do not exceed the allowable values of the table below.

Model	Size	Concentricity (X) T.I.R. [mm]	Perpendicularity (Y) T.I.R. [mm]
BXR-015-10LE	015	0.05	0.02
BXR-020-10LE	020	0.05	0.02
BXR-025-10LE	025	0.05	0.02
BXR-035-10LE	035	0.05	0.02
BXR-040-10LE	040	0.10	0.02
BXR-050-10LE	050	0.10	0.02





Precautions for use

Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

Operating temperature

The operating temperature range of brake part is −10℃ to 40℃ and controller part is −20℃ to 60 ℃. If you will use the product at other temperatures, consult MIKI PULLEY.

Power supply voltage fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ± 10% of the rated voltage value.

Air gap adjustment

BXR LE models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory.

Circuit protectors

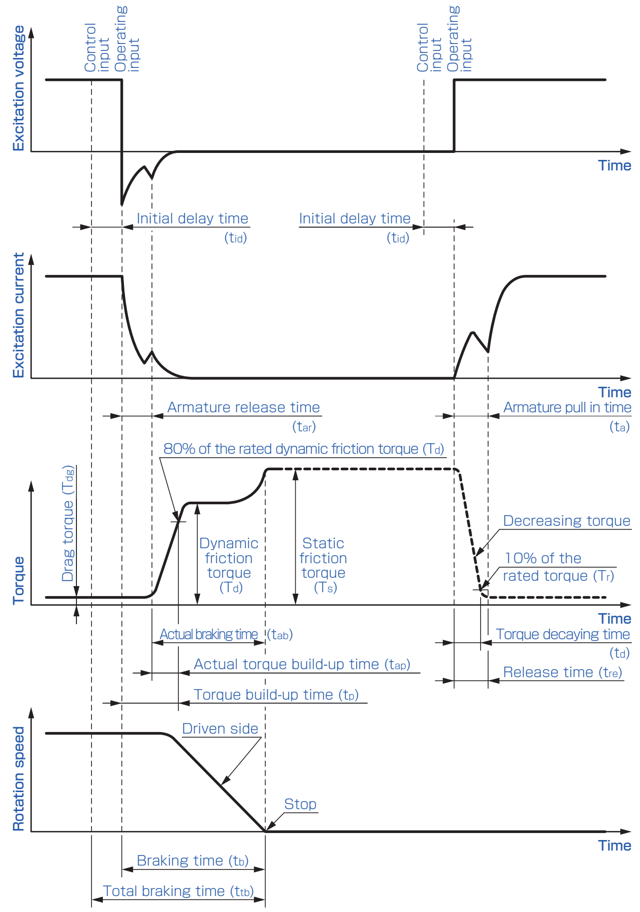
A circuit protector is built into a dedicated controller, so do not connect another circuit protector to the controller.

Control using the controller

The control function operates as a result of the change in the ON/OFF status at the input side, so carry out switching at the input side of the dedicated controller.

Operating characteristics

Operating time



t_{ar} : Armature release time

The time from when current shuts off until the armature returns to its position prior to being pulled in and torque begins to be generated

t_{ap} : Actual torque build-up time

The time from when torque first begins to be generated until it reaches 80% of rated torque

t_p : Torque build-up time

The time from when current flow is shut off until torque reaches 80% of rated torque

t_a : Armature pull in time

The time from when current flow first starts until the armature is pulled in and torque disappears

t_{id} : Initial delay time

The time from start of command input to actuation input or release input to the main brake body

Model	Size	t_{ar} [s] (DC7V)	t_a [s] (DC24V)
BXR-015-10LE	015	0.020	0.020
BXR-020-10LE	020	0.020	0.035
BXR-025-10LE	025	0.020	0.035
BXR-035-10LE	035	0.020	0.050
BXR-040-10LE	040	0.020	0.060
BXR-050-10LE	050	0.020	0.060

Selection

1 Consideration of required torque to hold loads

Use the following equation to find the torque T required to hold a load while stationary.

$$T = T_{\ell max} \times K \ [N\cdot m]$$

$T_{\ell max}$: Maximum load torque [N·m]
K : Safety factor (refer to the table below)

Load state	Factor
Low inertia / small load fluctuations	1.5
Ordinary use with normal inertia	2
Hi inertia / large load fluctuations	3

2 Provisional selection of size

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_s > T \ [N\cdot m]$$

T_s : Static friction torque of brake [N·m]

3 Consideration of energy

When considering a brake with the objective of holding loads, braking is limited to emergency braking.

Use the following equation to find the braking energy E_b for a single operation required for emergency braking. You must confirm that this result is sufficiently smaller than the allowable braking energy $E_{ba\ell}$ of the selected brake.

$$E_b = \frac{J \times n^2}{182} \times \frac{T_b}{T_b \pm T_{\ell max}} \ [J]$$

J : Total moment of inertia on load side [kg·m²]
n : Rotation speed [min⁻¹]
T_b : Brake torque [N·m]
$T_{\ell max}$: Maximum load torque [N·m]

The sign of maximum load torque $T_{\ell max}$ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

$$E_b \ll E_{ba\ell} \ [J]$$

4 Consideration of number of operations

The total number of braking operations (service life) when performing emergency braking L must be found using the following equation to confirm that required specifications are satisfied.

$$L = \frac{E_T}{E_b} \ [\text{times}]$$

E_T : Total braking energy [J]

Note that the frequency of emergency braking will also vary with operating environment; however, it should be about once per minute or better. When the braking energy of a single operation E_b is 70% or more of the allowable braking energy $E_{ba\ell}$, however, allow the brake to cool sufficiently after emergency braking before resuming use.

SPRING-ACTUATED BRAKES

Application	Motors, articulated robots, actuators, machine tools, forklifts, aerial vehicles, hoists, electric carts, electric shutters, medical equipment, wind turbine generators

Provides Excellent Performance in Emergency Braking When Power Goes Out and in Long-term Holding

These are electromagnetic brakes actuated by the force of springs when not energized. These standard brakes boast a variety of advantages, including quiet operation, long service life, slim form factors, high torque in a compact package, stable braking force, and the ability to release manually. We can create custom designs for you based on these standard products.

Available Models

Series	Application	Features	Lineup
SPRING-ACTUATED BRAKE	Holding use	Compact, dual side mounting	**BXW-S** » P.338
		For compact servo motors	**BXW-R** » P.340
		Double plate, slim form factor	**BXR** » P.342
	Braking use	Compact, dual side mounting	**BXW-L** » P.338
		Double plate	**BXL** » P.346
		Double plate	**BXL-N** » P.354
	Holding and braking use	Compact, dual side mounting	**BXW-H** » P.338
		Double plate	**BXH** » P.350

For details on selection, see P.356 to 361.

Model Selection

Models/ Type	Mounting method	Torque [N·m] (0.1 – 1 – 10 – 100 – 1000)	Release lever	Dust cover	Slim	Quiet mechanism		
						Reduced aperiodic noise	Reduced armature pull-in noise	Reduced braking noise
BXW-L/H/S	Stator/ flange	0.12 ～ 5.20	Option	Option	Customization	Std.	Customization	Customization
BXW-R	Stator	0.30 ～ 2.50	—	—	Customization	Customization	Customization	Customization
BXR	Stator	5 ～ 55	—	—	Std.	Customization	Customization	Customization
BXL	Stator	2 ～ 22	Option	—	Customization	Option	Option	Std.
BXH	Stator	4 ～ 44	Option	—	Customization	Option	Customization	Customization
BXL-N	Stator	2 ～ 80	—	—	Customization	Option	Option	Std.

COUPLINGS
ETP BUSHINGS
ELECTROMAGNETIC CLUTCHES & BRAKES
SPEED CHANGERS & REDUCERS
INVERTERS
LINEAR SHAFT DRIVES
TORQUE LIMITERS
ROSTA

SERIES
ELECTROMAGNETIC-ACTUATED CLUTCHES AND BRAKES
ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
ELECTROMAGNETIC CLUTCH & BRAKE UNITS
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES

MODELS
BXW
BXR
BXL
BXH
BXL-N

Product Lineup

BXW-L/H/S

For holding and braking
2-way mounting
Quiet
Long service life
No break-in needed
RoHS

» P.338

Three types for various applications

The line-up includes three types: the S type for holding, the L type for braking, and the H type for both holding and braking. Select the one that best matches your application and life cycle.

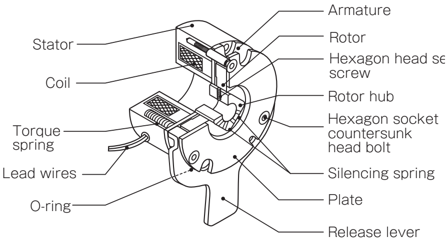
2-way mounting

The stator (a heat source) can be mounted facing either inwards or outwards.

Brake type		BXW-□-□L	BXW-□-□H	BXW-□-□S
Brake torque	[N·m]	0.12～2.00	0.24～4.00	0.36～5.20
Operating temperature	[℃]	−10～+40	−10～+40	−10～+40
Backlash		Extremely small size	Extremely small size	Extremely small size

Structure

Has release lever



BXW-R

Dedicated for holding
High torque
Low inertia
No break-in needed
RoHS

» P.340

Dedicated design for small servo motors

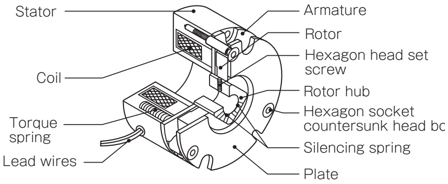
These have dedicated designs matched for specifications and dimensions for □40, □60, and □80 small servo motors.

Low-inertia rotor

We succeeded in dramatically reducing both mass and drag wear while ensuring adequate strength.

Brake torque	[N·m]	0.30～2.50
Operating temperature	[℃]	−10～+40
Backlash		Extremely small size

Structure



BXR

Dedicated for holding
Ultra-slim
Low inertia
Spline
No break-in needed
RoHS

» P.342

Ultra-slim

This ultra-slim design is two-thirds the thickness of our previous design. We also improved the lead exits to remove projections. This helps make your devices more compact.

Low-inertia rotor

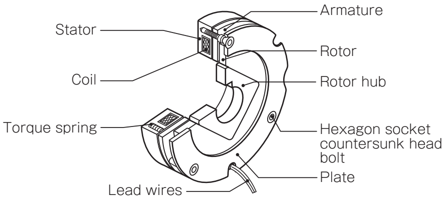
We succeeded in dramatically reducing both mass and drag wear while ensuring adequate strength.

Extremely small backlash

The backlash of the spline hub type is 0.2° to 0.5°.

Brake torque	[N·m]	5~55
Operating temperature	[℃]	−10～+40
Backlash		Extremely small size

Structure



BXL

Dedicated for braking · Quiet · Stable braking · Long service life · RoHS

» P.346

Low noise

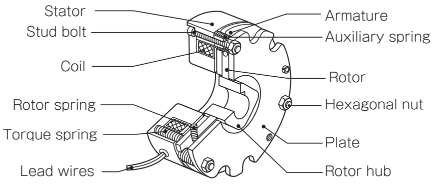
These reduce annoying high-frequency friction noise during braking. Products that reduce aperiodic noise or armature pull-in noise are also available.

Stable braking

With low torque fluctuation, these brake loads instantly even when malfunctions occur.

Brake torque	[N·m]	2～22
Operating temperature	[℃]	－10～＋40
Backlash		Extremely small size

Structure



BXH

For holding and braking · High torque · Quiet · No break-in needed · RoHS

» P.350

For both holding and braking

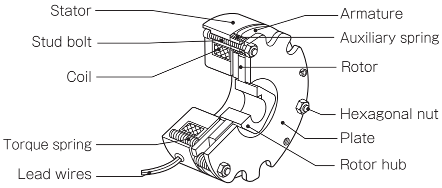
These brakes ensure sufficient torque for holding applications while also being usable as emergency brakes.

High torque

Provide twice the torque with the same dimensions as BXL models.

Brake torque	[N·m]	4~44
Operating temperature	[℃]	－10～＋40
Backlash		Extremely small size

Structure



BXL-N

Dedicated for braking · Quiet · Stable braking · Long service life

» P.354

Low noise

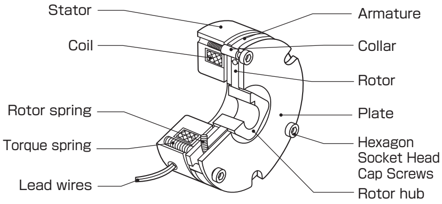
These reduce annoying high-frequency friction noise during braking. Products that reduce aperiodic noise or armature pull-in noise are also available.

Variety of torques

Two to three different kinds of braking torque for the same outer diameter are available to permit the most suitable design for the application at hand.

Brake torque	[N·m]	2～80
Operating temperature	[℃]	0～＋40
Backlash		Extremely small size

Structure



COUPLINGS
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ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES
MODELS
BXW
BXR
BXL
BXH
BXL-N

Customization Examples

BXW Large Type

This is a large version of the BXW with static friction torque of 300 N•m. Backlash is kept extremely small by locking the rotor hub to the rotor via a disc spring.

BXW Slim Type

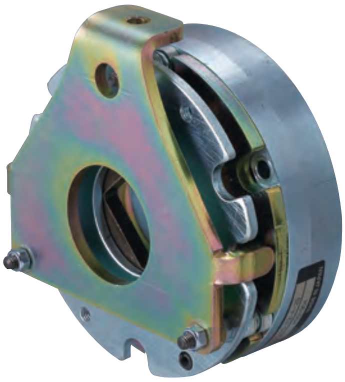
Ultra-slim types 15 mm thick or less are available to fit the space in your device. Power consumption can also be kept to one-third the level of our standard products by using our dedicated controllers.

Types with Integrated Flanges

Mounting flanges and brake stators can be integrated. This helps reduce the number of components and saves space.

Special Release Levers

Release levers can also be designed for specific units to match the device construction.



FAQ

Q1 I don't see anything with the torque and response I need in your standard products. Can you customize something for me?

A We can customize units in many ways: outfitting them for overexcitation power supplies or use of inrush current at motor startup, changing the frictional material, boosting torque, increasing response, extending the total energy (service life), suppressing heat generation, and more. Consult Miki Pulley for details.

Overexcitation power supply
BEW-2FH

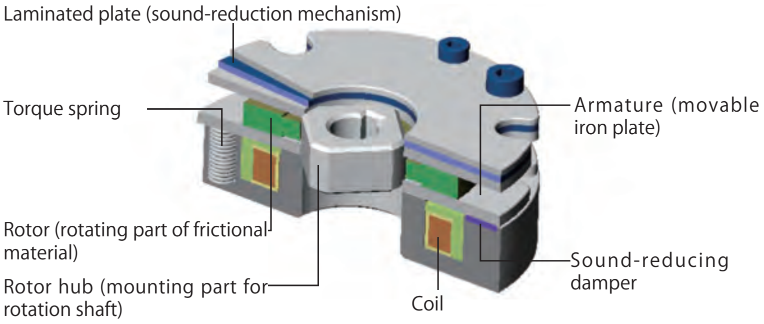
Q2 Can you handle cases in which standard products cannot be installed due to dimensional constraints?

A Yes, we can. For example, we have a long track record creating slimmer units that deliver the same torque. These units can provide the same torque while being only about half as thick as the standard product, although this will vary with your conditions. Consult Miki Pulley for details.

Q3 What do you have for dealing with noise issues?

A Spring-actuated brakes have a number of types of noises, such as (1) rattling generated by microvibrations during rotating, (2) armature pull-in and release noise, (3) friction noise (chirping) during braking, and (4) grinding noise under drive (when the brake is released). We have ways of reducing all of these. The figure below shows an example.

To reduce pull-in/release noise: Special plate specification



To reduce grinding noise: Single-side braking specification

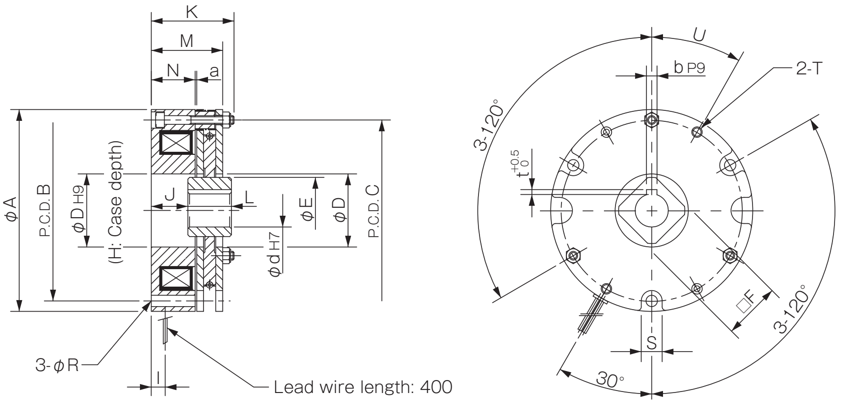
BXL Models

Specifications

Model	Size	Static friction torque T_s [N·m]	Coil (at 20℃)				Heat resistance class	Max. rotation speed [min⁻¹]	Rotating part moment of inertia J [kg·m²]	Allowable braking energy rate $P_{ba\ell}$ [W]	Total braking energy E_T [J]	Armature pull-in time t_a [s]	Armature release time t_{ar} [s]	Mass [kg]
			Voltage [V]	Wattage [W]	Current [A]	Resistance [Ω]								
BXL-06-10	06	2	DC24	15	0.63	38.4	F	5000	3.75×10^{-5}	58.3	2.0×10^7	0.035	0.020	0.9
			DC45	12	0.27	169	F							
			DC90	12	0.13	677	F							
BXL-08-10	08	4	DC24	23	0.94	25.6	F	5000	6.25×10^{-5}	91.7	3.5×10^7	0.040	0.020	1.3
			DC45	18	0.41	110	F							
			DC90	18	0.21	440	F							
BXL-10-10	10	8	DC24	27	1.14	21.1	F	4000	13.75×10^{-5}	108.3	6.2×10^7	0.050	0.025	2.3
			DC45	25	0.54	83.0	F							
			DC90	25	0.27	331	F							
BXL-12-10	12	16	DC24	35	1.46	16.2	F	3600	33.75×10^{-5}	133.3	9.0×10^7	0.070	0.030	3.4
			DC90	30	0.33	271	F							
BXL-16-10	16	22	DC24	39	1.64	14.6	F	3000	7.35×10^{-4}	183.3	11.4×10^7	0.100	0.035	5.4
			DC90	39	0.43	207	F							

* The armature pull-in time and armature release time are taken during DC switching.
* See the operating characteristics page for the armature pull-in time and release time during AC-side switching (half-wave rectified).

Dimensions



Unit [mm]

Size	A	B	C	D	E	F	H	I	J	K	L	M	N	R	S	T	U	a	d	b	t
06	83	73	73	28	26.5	22	3	10	20.5	39.5	14	33.6	20	4.5	9	2 − M5	30°	0.15	11	4	1.5
08	96	86	86	35	32	25	3	12	20	41	17	35	20.8	5.5	10	2 − M5	30°	0.15	14	5	2
10	116	104	104	42	38	30	3	9.5	21	47.5	25	41	25.3	6.5	12	2 − M6	30°	0.2	19	6	2.5
12	138	124	124	50	45	35	4	12	19	49.8	30	43.5	23.3	6.5	12	2 − M6	30°	0.2	24	8	3
16	158	142	143	59	55	45	4	14	22.5	57.5	35	51	27.7	9	15	2 − M8	40°	0.25	28	8	3

How to Place an Order

BXL-06-10G 24V 11DIN

Size
Option number
10: Standard
Voltage (Specifications table)
Bore diameter (dimensional symbol d)

*Contact Miki Pulley for assistance with bore diameters, d, not listed in the Dimensions tales and voltages not listed in the Specifications table.

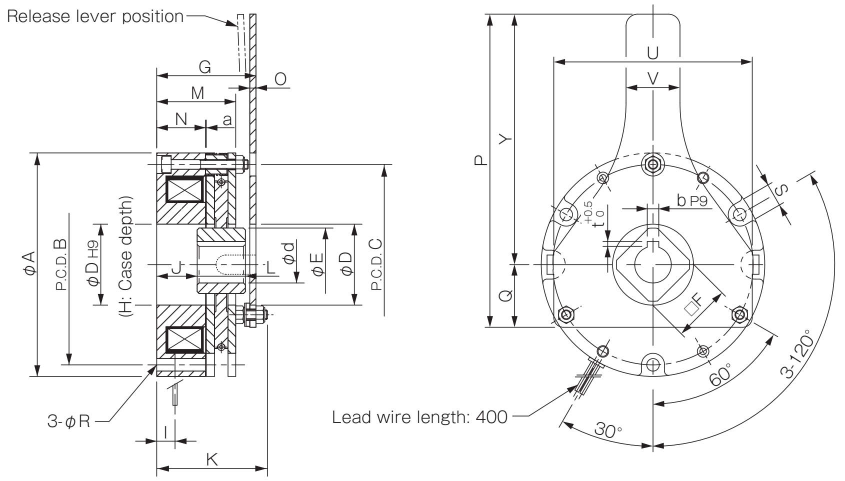
Option

Made to Order

Release Lever

Option No.: 12

In addition to the manual release tap of the standard product, we also offer an optional manual release lever. See the dimensions table below for the dimensions of brakes with release levers. Other specifications are the same as the standard specifications.



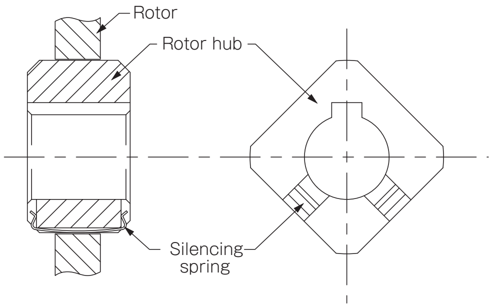
Unit [mm]

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Y	U	V	S	a	d	b	t
BXL-06-12	83	73	73	28	26.5	22	42.8	3	10	20.5	49.5	14	33.7	20	2.6	88	24	4.5	64	73	16	9	0.15	11	4	1.5
BXL-08-12	96	86	86	35	32	25	44.4	3	12	20	51	17	35	20.8	2.9	122	27	5.5	95	85	20	10	0.15	14	5	2
BXL-10-12	116	104	104	42	38	30	51.5	3	9.5	21	57.5	25	41	25.3	3.2	162.5	32.5	6.5	130	103	28	12	0.2	19	6	2.5
BXL-12-12	138	124	124	50	45	35	55.7	4	12	19	64.8	30	43.5	23.3	5	200	40	6.5	160	121	36	12	0.2	24	8	3
BXL-16-12	158	142	143	59	55	45	64.2	4	14	22.5	72.5	35	51	27.7	6	230	44	9	186	140	36	15	0.25	28	8	3

Quiet Mechanism (Silencing Spring)

Option No.: S1

There is a extremely small structural backlash (see figure on the right) between the rotor and the rotor hub. In applications that are prone to microvibrations of the drive shaft such as single-phase motors, this backlash may produce rattling (banging). The silencing spring for the rotor hub reduces this rattling.



Quiet Mechanism (Pull-in Noise Reduction Mechanism)

Option No.: S2

When the brake is energized, a magnetic circuit is formed, and the armature is pulled to the stator by that magnetic force. At that time, the armature touches the magnetic pole of the stator and a noise is produced. This sound (pull-in noise) is reduced by putting shock absorbing material in the stator's magnetic pole part.

In option S2, in addition to the pull-in noise reduction mechanism, the silencing spring (option S1) is also supplemented.

List of Option Numbers

Description of options	No quiet mechanism	Silencing spring	Silencing spring + Pull-in noise reduction mechanism
No release lever	10	10S1	10S2
Has release lever	12	12S1	12S2

* Option 10 uses standard specifications.

BXL-06-12S1G 24V 11DIN

Option no.

BXL Models

Items Checked for Design Purposes

Precautions for Handling

Brakes

Most electromagnetic braking systems are made using flexible materials. Be careful when handling such parts and materials as striking or dropping them or applying excessive force could cause them to become damaged or deformed.

Lead Wires

Be careful not to pull excessively on the brake lead wires, bend them at sharp angles, or allow them to hang too low.

Precautions for Mounting

Affixing the Rotor Hub

Affix the rotor hub to the shaft with bolts, snap rings, or the like such that the rotor hub does not touch the armature or stator.

Bolts and Screws

Implement screw-locking measures such as use of an adhesive thread-locking compound to bolts and screws used to install brakes.

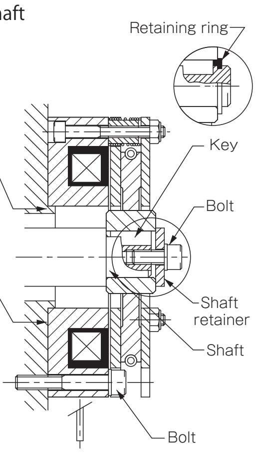
Shafts

The shaft tolerance should be h6 or js6 class (JIS B 0401).

Accuracy of Brake Attachment Surfaces

Ensure that the concentricity of the centering mark and shaft and the perpendicularity of the brake mounting surface and shaft do not exceed the following allowable values.

- Concentricity of centering mark and shaft
  - BXL-06: 0.4 T.I.R. or below
  - BXL-08: 0.4 T.I.R. or below
  - BXL-10: 0.4 T.I.R. or below
  - BXL-12: 0.6 T.I.R. or below
  - BXL-16: 0.6 T.I.R. or below
- Perpendicularity of stator mounting surface
  - BXL-06: 0.04 T.I.R. or below
  - BXL-08: 0.05 T.I.R. or below
  - BXL-10: 0.05 T.I.R. or below
  - BXL-12: 0.06 T.I.R. or below
  - BXL-16: 0.07 T.I.R. or below



Precautions for Use

■ Environment

These brake units are dry braking systems, meaning that the torque will drop if oil residue, moisture, or other liquids get onto friction surfaces. Attach the protective cover when working in areas with oil, moisture, dust, and other particles that could affect the braking system.

■ Power Supply Voltage Fluctuations

Full braking performance may not be guaranteed with extreme changes in power supply voltage. Make sure to keep power supply voltage to within ± 10% of the rated voltage value.

■ Operating Temperature

The operating temperature is -10° C to 40° C (no freezing or condensation). If you will use the product at other temperatures, consult Miki Pulley.

■ Manual Release

BXL models can be released manually.
Alternately tighten screws in two or three of the tap holes on the plate to press the armature.
The screw tips will push against the armature and release it with about a 90° rotation. Do not force the screws in more than that.

■ Air Gap Adjustment

BXL models do not require air gap adjustment. The brake air gap is adjusted when the braking system is shipped from the factory. When first used, no gap adjustment is needed, so do not rotate the nut.

■ Initial Torque

The torque may be lower than the indicated value at initial use. In such cases, run it to break in the frictional surface before use.

■ Circuit Protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake.

Recommended Power Supplies and Circuit Protectors

Recommended power supplies

Input AC power	Brake voltage	Rectification method	Brake size	Recommended power supply model
AC100V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71-1
AC100V 50/60Hz	DC24V	Single-phase, full-wave	12,16	BES-20-72-1
AC100V 50/60Hz	DC45V	Single-phase, half-wave	06,08,10	BEW-1R
AC100V 50/60Hz	DC90V	Single-phase, full-wave	06,08,10,12,16	BEW-1R
AC200V 50/60Hz	DC24V	Single-phase, full-wave	06,08,10	BES-20-71
AC200V 50/60Hz	DC24V	Single-phase, full-wave	12,16	BES-20-72
AC200V 50/60Hz	DC90V	Single-phase, half-wave	06,08,10,12,16	BEW-2R
AC200V 50/60Hz	DC90V	Single-phase, half-wave	06,08,10,12,16	BEW-2R

* A DC power supply such as a battery can also be used to supply the 24 V DC required for the brake voltage.

Recommended circuit protectors

Input voltage	Brake voltage	Rectification method	Recommended circuit protector (varistor)
DC24V	DC24V	—	NVD07SCD082 or an equivalent
AC100V 50/60Hz	DC45V	Single-phase, half-wave	NVD07SCD220 or an equivalent
AC100V 50/60Hz	DC90V	Single-phase, full-wave	NVD07SCD220 or an equivalent
AC200V 50/60Hz	DC90V	Single-phase, half-wave	NVD07SCD470 or an equivalent

* NVD□SCD□ parts are manufactured by KOA Corporation.
* DC24V indicates a product recommended with a stepdown transformer or the like.

Included varistors

Brake voltage	Included varistors
DC24V	NVD07SCD082 or an equivalent
DC45V	No varistor provided
DC90V	No varistor provided

Selection Procedure for Brakes for Braking

1 Consideration of Required Torque to Brake Loads

To select the appropriate brake size, you must find the torque required for braking T, and then select a size of brake that delivers a greater torque than T.

- **Consideration of cases when load conditions are not clearly known**

  When load conditions are clearly known, assuming that the motor has been selected correctly for the load, a guideline for torque can be obtained from motor output using the following equation.

$$T_M = \frac{9550 \times P}{n_r} \times \eta \ [N \cdot m]$$

P: Motor output [kW]
n_r: Brake shaft rotation speed [min^{-1}]
η : Transmission efficiency from motor to brake

- **Consideration when load conditions can be clearly ascertained**

  When load conditions can be clearly ascertained, the torque T required for braking can be found using the following equation.

$$T = \left(\frac{J \times n}{9.55 \times t_{ab}} \pm T_\ell \right) \times K \ [N \cdot m]$$

J: Total moment of inertia of load side [kg·m^2]
n: Rotation speed [min^{-1}]
t_{ab}: Actual braking time [s]
T_ℓ: Load torque [N•m]
K: Safety factor (see table below)

The sign of load torque T_ℓ is minus when the load works in the direction that assists braking and plus when it works in the direction that hinders braking. The actual braking time t_{ab} is the time required from the start of braking torque generation until braking is complete. When this is not clearly known at the selection stage, a guideline value is used that factors in service life and the like.

Load state	Factor
Low-inertia/low-frequency constant load	1.5
Ordinary use with normal inertia	2
High-inertia/high-frequency load fluctuation	3

Provisional Size Selection

Select a brake of a size for which the torque T found in the equation of step 1 satisfies the following equation.

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_b > T \ (\text{or } T_M) \ [N \cdot m]$$

T_b: Brake torque [N•m]

* For brake torque, treat T_s as equaling T_b. (T_s: Static friction torque from specifications table)

3 Consideration of Energy

When the load required for braking is sufficiently small, the size can be selected considering only torque T as described above. Given the effects of heat generated by braking, however, the following equation must be used to confirm that the operation frequency per unit time and the total number of operations (service life) meet the required specifications.

Use the following equation to find the energy E_b required for a single braking operation.

$$E_b = \frac{J \times n^2}{182} \times \frac{T_b}{T_b \pm T_\ell} \ [J]$$

The sign of load torque T_ℓ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

- **Confirm the frequency S of operations that can be performed per minute**

  Find the frequency of operations that can be performed per minute using the equation at right to confirm that the desired operation frequency is sufficiently smaller than the value found.

$$S = \frac{60 \times P_{ba\ell}}{E_b} \ [\text{times/min}]$$

$P_{ba\ell}$: Allowable braking energy rate [W]
E_b : Energy required for one braking operation [J]

- **Confirm the total number of operations (service life)**

  Find the total number of operations (service life) using the equation at right, and then check that it meets the desired service life.

$$L = \frac{E_T}{E_b} \ [\text{times}]$$

E_T: Total braking energy [J]

4 Consideration of Braking Time

When there are limits on the time required to decelerate or stop the load, use the equation at right to confirm that the total braking time t_{tb} satisfies requirements.

$$t_{tb} = t_{id} + t_{ar} + t_{ab}$$

t_{ar}: Armature release time [s]
t_{id}: Initial delay time [s]

Here, actual braking time t_{ab} is the time from the start of braking torque generation to the completion of braking. Find it with the following equation.

$$t_{ab} = \frac{J \times n}{9.55 \times (T_b \pm T_\ell)} \ [s]$$

The sign of load torque T_ℓ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

5 Consideration of Stopping Precision

To confirm stopping precision, find the stopping angle (rotation) using the following equation.

$$\theta = 6 \times n \times \left(t_{id} + t_{ar} + \frac{1}{2} t_{ab} \right) \ [^\circ]$$

t_{ar}: Armature release time [s]
t_{id}: Initial delay time [s]

The variation in stopping precision--i.e., stopping precision $\Delta\theta$ --can be found empirically with the following equation and used as a guide.

$$\Delta\theta = \pm 0.15 \times \theta \ [^\circ]$$

Selection Procedure for Brakes for Holding

1

Consideration of Required Torque to Hold Loads

Use the following equation to find the torque T required to hold a load while stationary.

$$T=T_{\ell\ max} \times K\ [\mathrm{N{\bullet}m}]$$

$T_{\ell\ max}$: Max. load torque [N•m]
K: Safety factor (see table at right)

Load state	Factor
Low inertia/small load fluctuations	1.5
Ordinary use with normal inertia	2
High inertia/large load fluctuations	3

2

Provisional Selection of Size

A brake of a size for which torque T found from the equations above satisfies the following equation must be selected.

$$T_s > T\ [\mathrm{N{\bullet}m}]$$

T_s: Static friction torque of brake [N•m]

3

Consideration of Energy

When considering a brake with the objective of holding loads, braking is limited to emergency braking.
Use the following equation to find the braking energy E_b for a single operation required for emergency braking. You must confirm that this result is sufficiently smaller than the allowable braking energy $E_{ba\ell}$ of the selected brake.

$$E_b=\frac{J\times n^2}{182}\times\frac{T_b}{T_b\pm T_\ell}\ [\mathrm{J}]$$

J: Total moment of inertia on load side [kg·m²]
n: Rotation speed [min⁻¹]
T_b: Brake torque [N·m]
$T_{\ell\ max}$: Max. load torque [N•m]

The sign of maximum load torque $T_{\ell\ max}$ is plus when the load works in the direction that assists braking and minus when it works in the direction that hinders braking.

$$E_b \ll E_{ba\ell}\ [\mathrm{J}]$$

When using brakes for both holding and braking and the specification is indicated by allowable braking energy rate $P_{ba\ell}$, check under the following conditions.

$$E_b \ll 60 \times P_{ba\ell}\ [\mathrm{J}]$$

4

Consideration of Number of Operations

The total number of braking operations (service life) when performing emergency braking L must be found using the following equation to confirm that required specifications are satisfied.

$$L=\frac{E_T}{E_b}\ [\mathrm{times}]$$

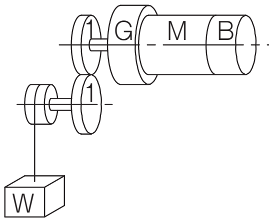
E_T: Total braking energy [J]

Note that the frequency of emergency braking will also vary with operating environment; however, it should be about once per minute or better. When the braking energy of a single operation E_b is 70% or more of the allowable braking energy $E_{ba\ell}$, however, allow the brake to cool sufficiently after emergency braking before resuming use.

BXW/BXR/BXL/BXH Models

Selection Example 1

Braking Brakes Used in Raising Loads



Selection of a brake to brake the load is as follows, as the above figure illustrates.

Motor (brake shaft) rotation speed	n	1800 [min^{-1}]
Load shaft rotation speed	n_1	60 [min^{-1}]
Moment of inertia of motor-side gear	J_1	1.5×10^{-2} [kg·m^2]
Moment of inertia of load-side gear	J_2	1.5×10^{-2} [kg•m^2]
Moment of inertia of load-side drum	J_3	4.30 [kg·m^2]
Moment of inertia of motor with speed reducer	J_M	6×10^{-3} [kg•m^2]
Moment of inertia of load	J_A	15.67 [kg·m^2]
Load-side torque	T	62.5 [N•m]
Number of braking operations of brake	L	53,000 cycles or more
Brake operating frequency	S	0.1 [cycles/min]

* The number of braking operations and operation frequency treat one ascending operation and one descending operation together as one cycle.

* The number of braking operations of the brake is treated as 6 (operations/h) × 8 (h/day) × 365 (days/year) × 3 (years).

■ Consideration of Torque

The torque required for braking is calculated from the above specifications, compared to the dynamic friction torque in the catalog, and the appropriate brake size is selected.

- Calculating the inertial moment converted to brake shaft inertial moment J_B
  We use the following equation to calculate the moment of inertia converted to the brake shaft (motor shaft) moment of inertia J_B[kg•m^2]. Here, R represents the ratio of the motor rotation speed to the load shaft rotation speed.

$$J_B=J_M+(J_1+J_2+J_3+J_A)\ \times R^2\ [\mathrm{kg \cdot m^2}]$$

$$J_B=6\times10^{-3}+(1.5\times10^{-2}+1.5\times10^{-2}+4.30+15.67)$$
$$\times(60/1800)^2$$
$$\fallingdotseq 2.8\times10^{-2}[\mathrm{kg \cdot m^2}]$$

- Calculating the load torque converted to brake shaft load torque T_ℓ
  We use the following equation to calculate the load torque converted to the brake shaft (motor shaft) load torque T_ℓ [N•m]. However, η indicates the transmission efficiency, which is 0.85 in this selection.

$$T_\ell=R\times T/\eta\ [\mathrm{N \cdot m}]$$

$$T_\ell=60/1800\times62.5/0.85\fallingdotseq2.45\ [\mathrm{N \cdot m}]$$

- Calculating the torque required for braking T
  Use the following equation to calculate the torque required for braking T [N•m].
  Here, the conditions are set as follows.

* The guideline for actual braking time t_{ab} is 2.0 [s].

* The sign of load torque T_R is minus when ascending because the load works in the direction that assists braking and plus when descending because the load works in the direction that hinders braking.

* Select a safety factor K of 3.0, based on operating conditions.

Ascending

$$T_{up}=\left(\frac{J_B\times n}{9.55\times t_{ab}}-T_\ell\right)\times K$$

$$T_{up}=\left(\frac{2.8\times10^{-2}\times1800}{9.55\times2.0}-2.45\right)\times3.0\fallingdotseq0.57\,[\mathrm{N \cdot m}]$$

Descending

$$T_{DOWN}=\left(\frac{J_B\times n}{9.55\times t_{ab}}+T_\ell\right)\times K$$

$$T_{DOWN}=\left(\frac{2.8\times10^{-2}\times1800}{9.55\times2.0}+2.45\right)\times3.0\fallingdotseq15.3\,[\mathrm{N \cdot m}]$$

Since the result of the above shows that required torque is 15.3 [N•m], check the specifications in the catalog and select size 12 (dynamic friction torque of 16.0 [N•m]) of the BXL models of brakes for braking.

■ Consideration of Energy

Confirm that the brake selected based on required torque satisfies the required specifications for number of braking operations and braking frequency.

- Calculating the total moment of inertia J
  Adding the inertial moment converted to brake shaft inertial moment J_B that was just calculated to the inertial moment of the rotating parts of the provisionally selected BXL-12 (catalog value of 33.75 × 10^{-5}), we arrive at the total moment of inertia.

$$J = 2.8\times10^{-2} + 33.75\times10^{-5}$$
$$\fallingdotseq 2.83\times10^{-2}[\mathrm{kg\cdot m^2}]$$

- Calculating the amount of energy required for one braking operation E_b
  The calculated total moment of inertia is used to calculate the energy required by a single braking operation. Here, the sign of load torque T_ℓ is plus when ascending because the load works in the direction that assists braking and minus when descending because the load works in the direction that hinders braking.

Ascending

$$E_{bup}=\frac{J\times n^2}{182}\times\frac{T_b}{T_b+T_\ell}$$

$$E_{bup}=\frac{2.83\times10^{-2}\times1800^2}{182}\times\frac{16.0}{16.0+2.45}$$

$$\fallingdotseq 437\,[\mathrm{J}]$$

Descending

$$E_{bDOWN}=\frac{J\times n^2}{182}\times\frac{T_b}{T_b-T_\ell}$$

$$E_{bDOWN}=\frac{2.83\times10^{-2}\times1800^2}{182}\times\frac{16.0}{16.0-2.45}$$

$$\fallingdotseq 595\,[\mathrm{J}]$$

- Confirm the frequency S of operations that can be performed per minute
  Substitute the energy required for a single braking E_b calculated above and the allowable braking energy rate $P_{ba\ell}$ for the BXL-12 (catalog value 133.3 W) into the following equation and calculate the frequency S of operations that can be performed per minute.

Ascending

$$S_{up}=\frac{60\times P_{ba\ell}}{E_{bup}}$$

$$S_{up}=\frac{60\times133.3}{437}$$

$$\fallingdotseq 18.3\ [\text{times/min.}]$$

Descending

$$S_{DOWN}=\frac{60\times P_{ba\ell}}{E_{bDOWN}}$$

$$S_{DOWN}=\frac{60\times133.3}{595}$$

$$\fallingdotseq 13.4\ [\text{times/min.}]$$

The desired operation frequency is sufficiently smaller than the calculated operation frequency, so the specification is satisfied. Note that the braking energy rate (catalog value) used in the calculation is the value under ideal conditions, so the desired operation frequency needs to be sufficiently small.

$$13.4\ [\text{times/min.}] \gg 0.1\ [\text{times/min.}]$$

- Calculating the total number of operations (service life)
  Substituting in the just-calculated energy required for a single braking E_b and the BXL-12 total frictional energy E_T (catalog value of 9.0 × 10^7 [J]), we arrive at the total number of operations L.

If the energy of a single cycle of ascending and descending E_b is:

$$E_b=E_{bup}+E_{bDOWN}$$
$$E_b=1032\,[\mathrm{J}]$$

The total number of operations L is:

$$L=\frac{E_T}{E_b}$$

$$L=\frac{9.0\times10^7}{1032}$$

$$\fallingdotseq 87209\ [\text{cycles}]$$

The desired total number of operations is fewer than the calculated total number of operations (service life), so the specification is satisfied.

$$87{,}209\ [\text{cycles}] > 53{,}000\ [\text{cycles}]$$

■ Consideration of Braking Time

Total braking time t_{tb} is calculated as the sum of actual braking time t_{ab}, armature release time t_{ar}, and the initial delay time from start of command input to start of operating input t_{id}.
Here, the actual braking time is expected to be greater in the descending direction, so only the case of descending is considered. The sign of the load torque T_ℓ is minus, since it is in the direction that impedes braking.

$$t_{ab}=\frac{J\times n}{9.55\times(T_b-T_\ell)}$$

$$t_{ab}=\frac{2.83\times10^{-2}\times1800}{9.55\times(16.0-2.45)}$$

$$\fallingdotseq 0.39[\mathrm{s}]$$

Here, the armature release time t_{ar} of the BXL-12 from the catalog is 0.03 [s]. The initial delay time t_{id} is the delay of the operation of relays and the like, so we use 0.025 [s], the typical relay operation time. Thus, the total braking time t_{tb} is:

$$t_{tb}=0.025+0.030+0.39$$
$$\fallingdotseq 0.445\,[\mathrm{s}]$$

■ Consideration of Stopping Precision

When stopping precision (stopping distance) is restricted, calculate stopping precision using the following equations.

$$\theta=6\times n\times(t_{id}+t_{ar}+1/2\times t_{ab})$$
$$=2700[^\circ\ ]$$

The variation in stopping precision--i.e., stopping precision $\varDelta\theta$ --can be found empirically with the following equation and used as a guide.

$$\varDelta\theta=\pm0.15\times\theta$$
$$=\pm405[^\circ\ ]$$

This angle is the angle at the brake shaft, so when the stopping precision θ max is 2700 + 405 = 3105 [°] and the drum diameter D_d is 0.5 [m], the braking distance B_d of load W is:

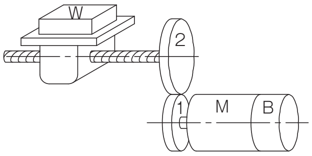
$$B_d=\theta\max/360\times R\times\pi\times D_d$$
$$=(3105/360)\times(60/1800)\times\pi\times0.5$$
$$=0.45[\mathrm{m}]$$

If there is no problem with the braking time and stopping precision, BXL-12 can be selected.

BXW/BXR/BXL/BXH Models

Selection Example 2

Holding Brakes Used in Ball Screw Drive of Loads



Selection of a brake to brake the load is as follows, as the above figure illustrates.

Motor (brake shaft) rotation speed	n	1800 [min^{-1}]
Load shaft rotation speed	n_l	900 [min^{-1}]
Moment of inertia of motor	J_M	0.001 [kg·m^2]
Mass of load	M	500 [kg]
Lead of feed screw	P	0.01 [m]
Shaft diameter of feed screw	D	0.05 [m]
Length of feed screw	l	1 [m]
Friction coefficient of feed screw	μ	0.2

Consideration of Torque

The torque required for holding is calculated from the specifications at left, compared to the static friction torque in the catalog, and the appropriate brake size is selected.

- Calculating load torque converted to brake shaft load torque T_ℓ

  Use the following equation to calculate the load torque T_ℓ [N•m]. Here, there is no external force F [N•m], gravitational acceleration g [m/s^2] is 9.8 [m/s^2], R is the ratio of motor rotation speed to load shaft rotation speed, and η is transmission efficiency, which in this selection is 0.85.

$$T_\ell = R \times 1/2\pi \times P \times (F + \mu M_g) / \eta \ [\text{N·m}]$$

$$T_\ell = (900/1800) \times 1/2\pi \times 0.01 \times (0 + 0.2 \times 500 \times 9.8) / 0.85$$

$$\fallingdotseq 0.92 [\text{N·m}]$$

- Calculating the required holding torque T

  Use the following equation to calculate the required holding torque T. Here, safety factor K is 2.

$$T = T_\ell \times K [\text{N·m}]$$
$$T = 0.92 \times 2$$

$$\fallingdotseq 1.84 [\text{N·m}]$$

Since the result of the above shows that required torque is 1.84 [N•m], check the specifications in the catalog and select size 06 (static friction torque of 4.0 [N•m]) of the BXH models of brakes for holding.

■ Consideration of Energy During Emergency Braking

Brakes selected based on required holding torque are designed primarily for holding, so their braking operations are limited to emergency braking and the like. It is therefore necessary to check that the braking energy per braking operation E_b during emergency braking does not exceed the allowable braking energy $E_{ba\ell}$.

- Calculating the moment of inertia of feed screws

  Given a feed screw whose shaft has a length of 1 [m], diameter of 0.05 [m], and specific gravity of 7.8, the feed screw moment of inertia J_A [kg•m²] is:

$$J_A=\frac{1}{8}\times M\times D^2$$

$$=\frac{1}{8}\times(0.025^2\times\pi\times1\times7.8\times1000)\ \times0.05^2$$

$$\fallingdotseq 0.0048[\mathrm{kg}\cdot\mathrm{m}^2]$$

- Calculating the moment of inertia of a linearly moving object

  Use the following equation to calculate the moment of inertia Jx [kg•m²] of a linearly moving object.

$$J_X=J_A+\frac{M\bullet P^2}{4\pi^2}$$

$$=0.0048+\frac{500\times0.01^2}{4\times\pi^2}$$

$$\fallingdotseq 6.1\times10^{-3}[\mathrm{kg}\cdot\mathrm{m}^2]$$

- Calculating the total inertial moment converted to brake shaft inertial moment

  The moment of inertia Jx [kg•m²] of a linearly moving object found above is added to the moment of inertia of the rotating parts of the provisionally selected BXH-06 (catalog value of 3.25 × 10⁻⁵ kg•m²) and the motor's moment of inertia J_M [kg•m²] to calculate the total moment of inertia. Here, R represents the ratio of the motor rotation speed to the load shaft rotation speed.

$$J=J_x\times R^2+J_M+J_B[\mathrm{kg}\cdot\mathrm{m}^2\,]$$

$$=6.1\times10^{-3}\times\left(\frac{1}{2}\right)^2+0.001+3.25\times10^{-5}$$

$$=2.56\times10^{-3}[\mathrm{kg}\cdot\mathrm{m}^2\,]$$

- Consideration of energy

  We calculate the braking energy per braking Eb required for emergency braking using the following equation. Here, the brake torque T_b [N•m] is the catalog value of 4.0 [N•m] and the sign of the load torque T_ℓ is plus, since it works in the direction that assists braking.

$$E_b=\frac{J\bullet n^2}{182}\times\frac{T_b}{T_b+T_\ell}$$

$$E_b=\frac{2.56\times10^{-3}\times1800^2}{182}+\frac{4.0}{4.0+0.92}$$

$$\fallingdotseq 37.1[\mathrm{J}\,]$$

Since the calculated braking energy E_b does not exceed the BXH-06's allowable braking energy $E_{ba\ell}$ (catalog value of 700 [J]), the specification is satisfied.

$$37.1\ [\mathrm{J}] < 700\ [\mathrm{J}]$$

■ Consideration of Number of Operations

The total number of braking operations (service life) L when doing emergency braking can be found using the following equation. Here, the BXH-06's total braking energy E_T is the catalog value of 2.0 × 10⁶ [J].

$$L=\frac{E_T}{E_b}$$

$$L=\frac{2.0\times10^6}{37.1}$$

$$\fallingdotseq 53908\ [\mathrm{times}]$$

With these specifications, BXH-06 can be selected.

Note that the frequency of emergency braking has a major impact on service life, so it should be about once per minute or better.

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ELECTROMAGNETIC-ACTUATED MICRO CLUTCHES & BRAKES
ELECTROMAGNETIC-ACTUATED CLUTCHES & BRAKES
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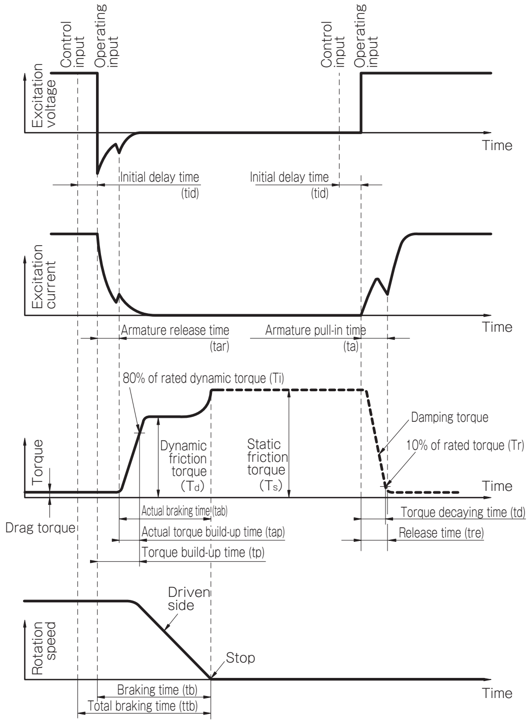
SPRING-ACTUATED BRAKE
ELECTROMAGNETIC TOOTH CLUTCHES
BRAKE MOTORS
POWER SUPPLIES
MODELS
BXW
BXR
BXL
BXH
BXL-N

BXW/BXR/BXL/BXH Models

Operating Characteristics

Operating Time



t_{ar}: Armature release time

The time from when current shuts off until the armature returns to its position prior to being pulled in and torque begins to be generated

t_{ap}: Actual torque build-up time

The time from when torque first begins to be generated until it reaches 80% of rated torque

t_p: Torque build-up time

The time from when current flow is shut off until torque reaches 80% of rated torque

t_a: Armature pull-in time

The time from when current flow first starts until the armature is pulled in and torque disappears

t_{id}: Initial delay time

The time from start of command input to actuation input or release input to the main brake body

BXW Models

Unit [s]

Type	Voltage	Size	Switching	t_{ar}	t_a
L type (Braking use)	12V	01	DC side	0.015	0.008
	24V	02		0.015	0.008
	45V	03		0.025	0.025
	90V	04		0.030	0.030
	180V	05		0.035	0.035
H type (Holding and braking use)	12V	01	DC side	0.010	0.010
	24V	02		0.010	0.010
	45V	03		0.020	0.035
	90V	04		0.025	0.040
	180V	05		0.030	0.045
S type (Holding use)	24V	01	DC side	0.010	0.025
		02		0.010	0.030
		03		0.020	0.035
		04		0.025	0.040
		05		0.030	0.045
R type (For servo motors)	24V	01	DC side	0.035	0.020
		03		0.050	0.020
		05		0.060	0.020

BXR Models (Holding use)

Unit [s]

Voltage	Size	Switching	t_{ar}	t_a
24V	06	DC side	0.02	0.05
	08		0.02	0.08
	10		0.05	0.11
	12		0.03	0.12
	14		0.03	0.12
	16		0.10	0.22

BXL Models (Braking use)

Unit [s]

Voltage	Size	Switching	t_{ar}	t_{ap}	t_p	t_a
24V 45V 90V	06	DC side	0.020	0.015	0.035	0.035
	08		0.020	0.015	0.035	0.040
	10		0.025	0.020	0.045	0.050
	12		0.030	0.025	0.055	0.070
	16		0.035	0.030	0.065	0.100
45V 90V	06	AC side	0.110	0.035	0.145	0.035
	08		0.110	0.040	0.150	0.040
	10		0.150	0.060	0.210	0.050
	12		0.180	0.095	0.275	0.070
	16		0.180	0.100	0.280	0.100

BXH Models (Holding use)

Unit [s]

Voltage	Size	Switching	t_{ar}	t_a
24V 45V 90V	06	DC side	0.020	0.040
	08		0.020	0.045
	10		0.025	0.070
	12		0.025	0.090
	16		0.030	0.125
45V 90V	06	AC side	0.070	0.040
	08		0.080	0.045
	10		0.090	0.070
	12		0.120	0.090
	16		0.140	0.125

BXL-N Models (Braking use)

Unit [s]

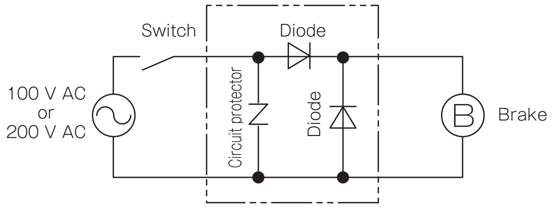
Voltage	Size	Switching	t_{ar}	t_a
24V 99V 171V	08-10N-002	DC side	0.050	0.030
	08-10N-004		0.040	0.040
	10-10N-008		0.050	0.050
	10-10N-015		0.030	0.070
	12-10N-022		0.060	0.080
	12-10N-030		0.030	0.100
	16-10N-040		0.070	0.100
	16-10N-060		0.050	0.100
	16-10N-080		0.030	0.100

Control Circuits

45 V, 90 V, and 96 V Specifications for BXW, BXR, BXL, and BXH Models (Single-phase Half-wave Rectified)

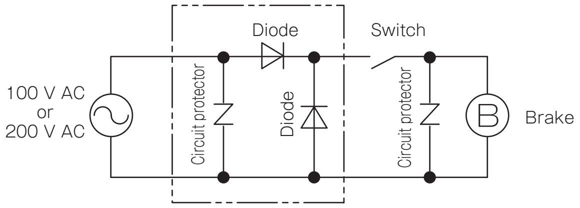
■ AC-side Switching

This is the usual switching method. Connection is simple.



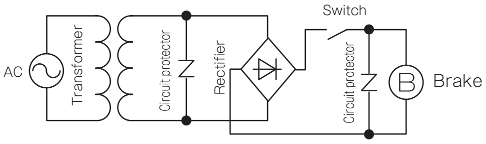
■ DC-side Switching

This method achieves even faster operational characteristics than AC-side switching.



12 V and 24 V Specifications for BXW, BXR, BXL, and BXH Models (Single-phase Full-wave Rectified)

■ DC-side Switching



■ Circuit Protectors

If using a power supply that is not equipped with a circuit protector for DC switching, make sure to connect the recommended circuit protector device in parallel with the brake. However, with some circuit protectors, operation times may lengthen. In such cases, we recommend use of varistors.

Select varistors from the following table based on brake size and AC voltage before rectification.

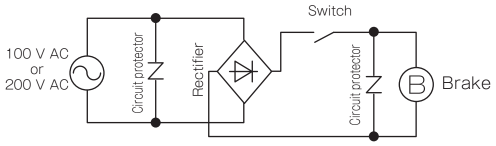
Note that the 24 V specifications of BXL and BXH as well as all BXR models are supplied with varistors. See Included varistors for each model.

Brake size	Pre-rectification voltage [V]	Recommended varistor model
01 ～ 18	AC 30 or below	NVD07SCD082 or an equivalent
	Over AC 30 to AC 110 or below	NVD07SCD220 or an equivalent
	Over AC 110 to AC 220 or below	NVD07SCD470 or an equivalent
	Over AC 220 to AC 460 or below	NVD14SCD820 or an equivalent
20 ～ 25	AC 30 or below	NVD14SCD082 or an equivalent
	Over AC 30 to AC 110 or below	NVD14SCD220 or an equivalent
	Over AC 110 to AC 220 or below	NVD14SCD470 or an equivalent
	Over AC 220 to AC 460 or below	NVD14SCD820 or an equivalent

* NVD☐SCD☐ parts are manufactured by KOA Corporation.

90 V, 96 V, 180 V, and 190 V Specifications for BXW Models (Single-phase Full-wave Rectified)

■ DC-side Switching



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