VULKAN
DRIVE TECH
reliable industrial drives

HIGH SPEED BACKSTOPS

2009/09

FUNCTIONING

Freewheel functions

Freewheels are power transmission components with particular characteristics:

-- In one direction of rotation there is no transmission between the inner and outer rings; the freewheel is in freewheeling operation.
- In the other direction of rotation there is transmission between the inner and outer rings; in this direction it is possible to transmit high torque.

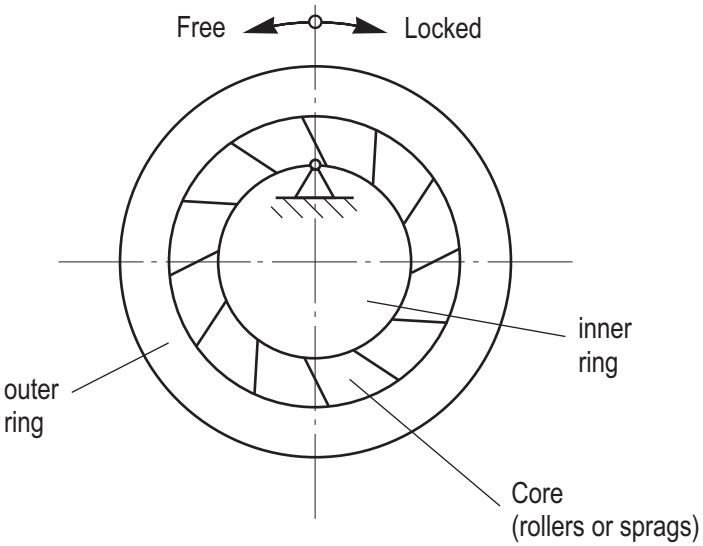
These features allow freewheels to perform various functions completely automatically in the most diverse machines. No mechanical or hydraulic operating equipment is required to command them, such as in brakes and clutches.

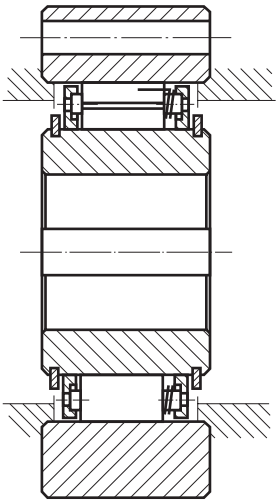
Freewheels are used as:

- indexing freewheels (advance)
- overrunning clutches
- backstops

RINGSPANN freewheels are an indispensable design element in the automobile and machine industries, as well as in aerospace technology. The freewheel, as an automatic driving element, is preferred to conventional solutions because it offers significant advantages, such as:
- operating safety
- economy
- a high degree of automation

In no way do such advantages increase costs; on the contrary, applying freewheels reduces costs compared to alternatives that involve couplings or commanded brakes, since in the case of freewheels, there is no additional costs related to these commands. For some equipment, applying the freewheel is the only economically feasible solution. As example, we cite automatic vehicle transmission with hydrodynamic torque converter coupled to a planetary gear reducer. In this catalogue, we present freewheels for exclusive application, such as backstops. For other application types, please consult us.



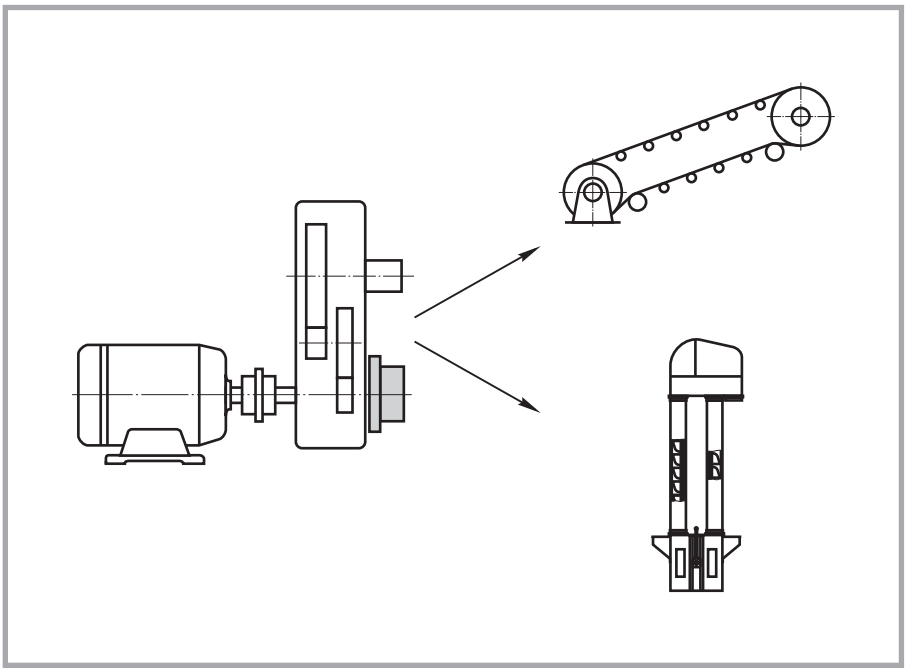


APPLICATION AS BACKSTOP

RINGSPANN freewheels are used to prevent reverse rotation of the operating direction. Due to functional and safety issues, many equipment must work in just one specified direction of rotation.

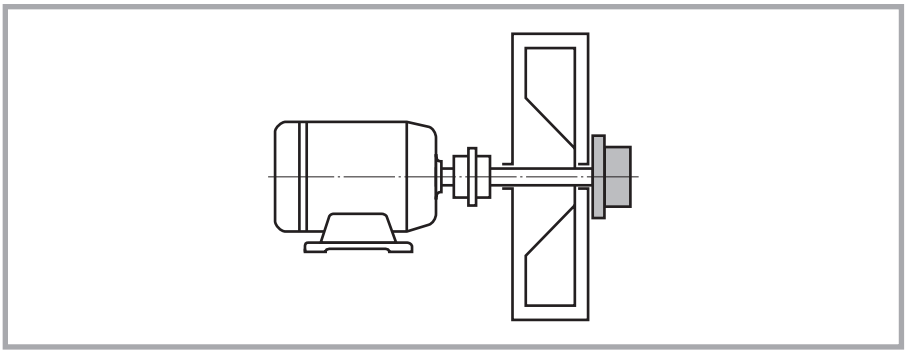
To exemplify, there are regulations preventing the application of mechanical safety devices in conveyor systems. In pumping equipments, a reverse rotation (due to the backflow caused by the opposite pressure of the pumped fluid) must be avoided at all costs, otherwise, the pump working as a turbine will cause a high rotation of the motor pump assembly, resulting in damages to both. In this case as also in others cases, as shown in this catalogue, automatic blocking by the backstop is guaranteed since it operates as an automatic driving element. When the equipment is in normal operation, the backstop will be turning freely; the torque (blocking) will be transmitted when the rotation speed is equal to zero. The automatic and immediate locking action, free of shock, guarantees the necessary operating safety.

Inclined conveyors
Elevators
Gear units
Electric motors
Gear motors



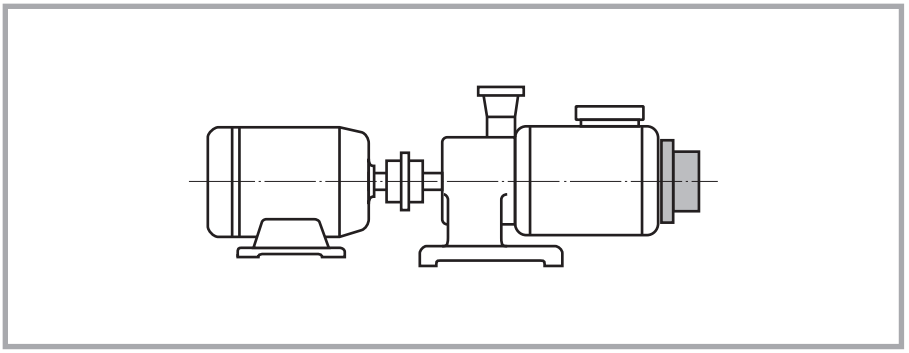
The backstop prevents reverse rotation of the conveyor belt or elevator in case of a power failure or when the motor is turned off.

Fans
Ventilators



The backstop prevents reverse rotation in case of fluid backflow.

Pumps
Compressors



The backstop prevents reverse drive of the equipment.

SELECTION

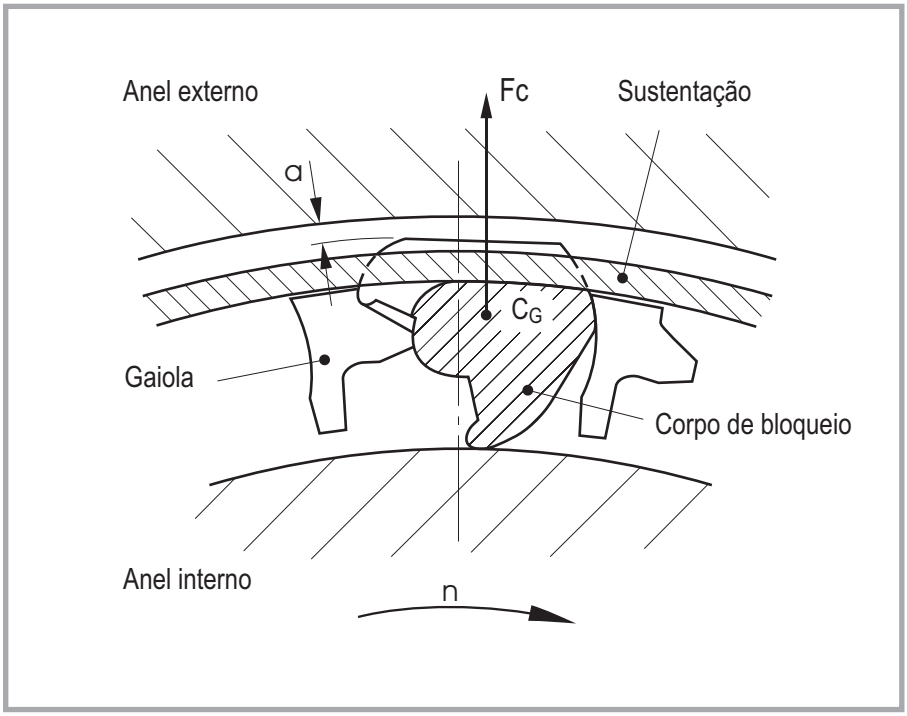
Sprag lift-off X

Sprags with tilted blocking by centrifugal force

Tilting by action of the centrifugal force (lift-off X patented in Germany and other countries) is used in backstops when the inner ring (connected to the axle) turns freely and in high rotation. In this condition, centrifugal force Fc acting on the sprag causes its tilting so as to distance it from the inner track of the outer ring, promoting a frictionless operation consequently without wear or energy dissipation.

The figure on the right shows a RINGSPANN freewheel with lift-off X turning freely. The sprags and cage containing them turn together with the inner ring. The centrifugal force Fc tilted the sprags counterclockwise, until the sprags are collected in the support ring. A gap was thus created between the sprags and outer track. The freewheel is operating without any friction.

When the rotation of the inner ring sufficiently reduces the intensity of the centrifugal force to a value less than the force of the springs, the sprags return to the position of contact with the outer track and the freewheel is again ready for the locking function.



Selecting the backstop size

The stop of an inclined conveyor belt or loaded elevator, for example, of a pump, is a highly dynamic process during which there are torque peaks. These torque peaks are determinant factors in selecting the backstop size.

The most reliable method to predict torques acting during the instant of locking action involves oscillatory calculation of the complete system, which requires knowledge of parameters like: rotating masses, rigidity of components, etc. Therefore, in most practical cases, oscillatory calculation is not viable. As alternative, we use the traditional and reliable method to determine the selection torque M_A, as shown below:

$M_A = 1{,}75 \; . \quad . M_L$

In many cases, only the nominal power of the motor Po (KW) is known. In this case, apply the following calculation:

$M_A = 1{,}75 \; . \; 9550 \; . \quad ^2 . P_o / n_{sp}$

where:

M_A = Bending moment to select backstop (Nm).

M_L = $9550 \; . \; P_L / n_{sp}$ = Bending moment of the load or static bending moment of load reverse reflected on the backstop axle (Nm).

P_L = Conveyor lifting power at full load (kW), resulting from the lifting height (m) multiplied by the load to be transported per second (kN/s).

P_o = Nominal power of the motor (kW)

n_{sp} = Rotations per minute of the axle on which the backstop will be applied.

= Yield of the installation

$$= \frac{\text{lifting power}}{\text{lifting power + power loss}}$$

After calculating MA, the backstop size is selected according to this catalogue's tables to meet the following condition:

$M_N \quad M_A$

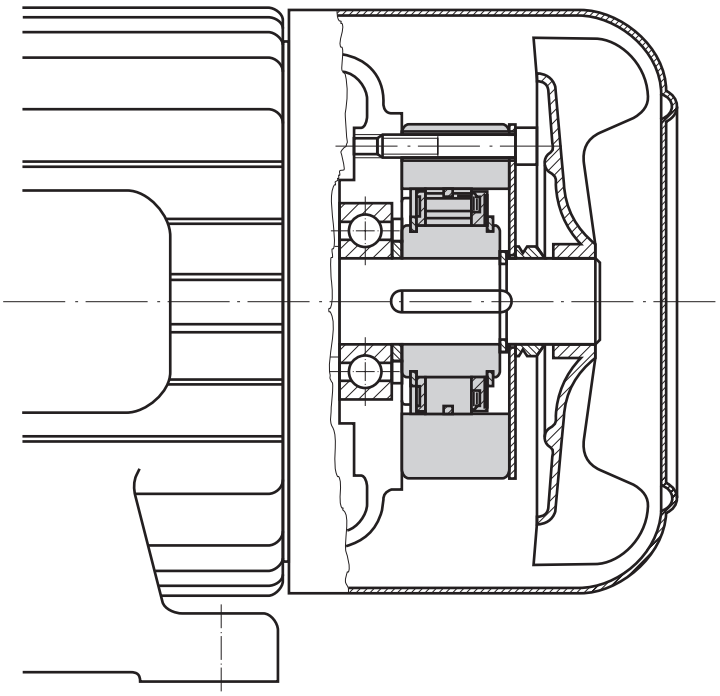
M_N = Nominal bending moment of the backstop [Nm] according to this catalogue's tables.

Approximate values of :

Installation type		^{2}
Conveyor belt, inclined up to 6º	0,71	0,50
Conveyor belt, inclined up to 8º	0,78	0,61
Conveyor belt, inclined up to 10º	0,83	0,69
Conveyor belt, inclined up to 12º	0,86	0,74
Conveyor belt, inclined up to 15º	0,89	0,79
Fuse pumps	0,93	0,87
Ball mills, rotary kilns	0,85	0,72
Cup conveyor, elevators	0,92	0,85
Hammer mill	0,93	0,87

In case of doubts, consult us or send us the questionnaire contained in this dialogue.

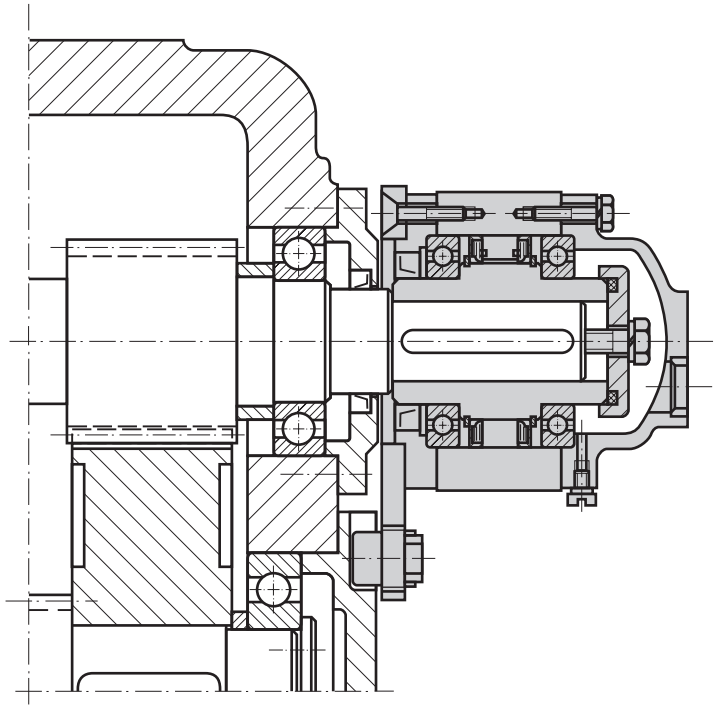
TYPES



Backstops without bearing support

Backstops as machine design elements integrated to gear units, electric motors, pumps, etc. These backstops, due to lacking bearing support, should be assembled in order to guarantee concentricity between the outer and inner rings (hub).

The use of core with sprags tilted by the centrifugal force waives the need for lubrication. They operate free of maintenance.



Backstops with incorporated bearings and bending arm

Encapsulated backstops with bearing support and inner lubrication enable connection to gear units, conveyors, elevators and fans, etc. independently. It is possible to turn the axle in both rotation directions, releasing the bending arm of the structure. The reaction to the blocking bending moment occurs through the bending arm anchored in the equipment structure.

FXM PROFILE

Backstops for high bending moments and high rotations with sprag lift-off X

Type Size	Theoretical bending moment ⌀ 0 A Nm	Bending moment in function of concentricity (radial runout) ⌀ 0,1 A Nm	⌀ 0,2 A Nm	⌀ 0,3 A Nm	⌀ 0,4 A Nm	⌀ 0,5 A Nm	⌀ 0,8 A Nm	Min. rotation (Tilting) rpm	Max. Rotation rpm
•FXM 31 - 17 DX	100	100	95	-	-	-	-	890	5000
•FXM 38 - 17 DX	150	140	130	-	-	-	-	860	5000
•FXM 46 - 25 DX	390	380	350	-	-	-	-	820	5000
•FXM 51 - 25 DX	480	470	420	-	-	-	-	750	5000
FXM 56 - 25 DX	580	570	490	-	-	-	-	730	5000
•FXM 61 - 19 DX	420	410	370	-	-	-	-	750	5000
•FXM 66 - 25 DX	800	780	700	-	-	-	-	700	5000
•FXM 76 - 25 DX	1050	1040	890	-	-	-	-	670	5000
•FXM 86 - 25 DX	1350	1300	1030	-	-	-	-	630	5000
FXM 101 - 25 DX	1700	1600	1400	-	-	-	-	610	5000
•FXM 85 - 40 SX	1900	1900	1800	1800	1700	1600	-	430	6000
•FXM 100 - 40 SX	2700	2600	2500	2400	2200	2000	-	400	4500
•FXM 120 - 50 SX	6500	6300	5800	4800	4400	3600	-	320	4000
•FXM 140 - 50 SX	8700	8500	7900	6700	5500	5400	-	320	3000
•FXM 170 - 63 SX	20000	19000	16000	14000	13000	12000	-	250	2700
•FXM 200 - 63 SX	26000	23000	20500	17500	15500	14000	-	240	2100
•FXM 240 - 63 UX	31000	30500	30000	29000	26000	24000	19500	220	3000
FXM 240 - 96 UX	52050	51000	49000	47500	46000	44000	35000	220	2500
FXM 260 - 63 UX	38500	38000	37000	36500	33000	29000	25000	210	2500
FXM 290 - 70 UX	59500	59000	56000	50000	47000	45000	37000	200	2500
FXM 290 - 96 UX	91000	90000	82500	77500	70000	62500	55000	200	2500
FXM 310 - 70 UX	69000	68000	64500	60000	55000	49000	43000	195	2500
FXM 310 - 96 UX	107000	105000	99000	85500	81000	74000	68000	195	2100
FXM 320 - 70 UX	76500	73000	67000	62000	56500	49500	43000	195	2000
FXM 360 - 100 UX	149000	139500	128000	119500	103500	90000	80500	180	1800
FXM 410 - 100 UX	193000	179500	167000	154500	137000	121500	111500	170	1500
FXM 2.410 - 100 UX	364000	350000	315000	296500	277500	266000	223500	210	1500

The bending moments informed are nominal and contain a service factor 2. The theoretical bending moment presumes perfect concentricity between inner and outer rings. In practice, the concentricity is affected by the gaps of the bearings and machining deviations of the adjacent parts. For this reason, the nominal bending moments of the table consider the radial runout present. For higher rotations, please consult us. The sizes and holes marked with (*) are preferential in Vulkan do Brasil's supply program.

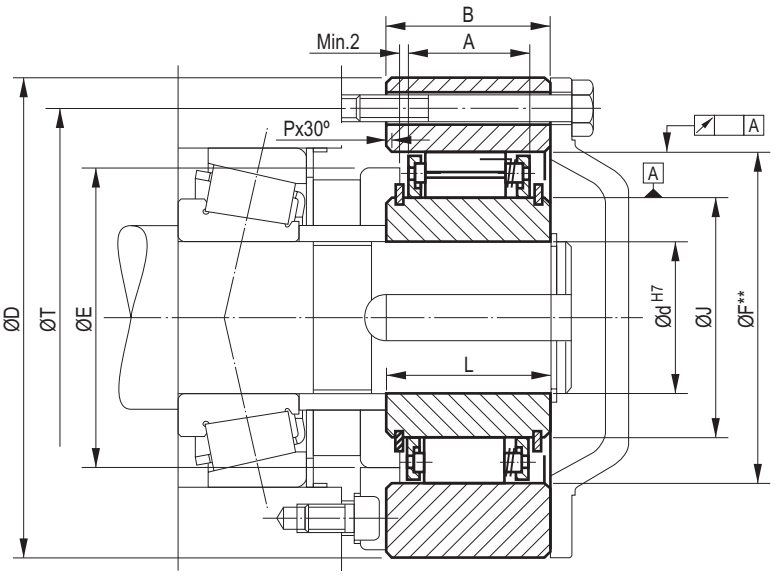
Features:

Robust, high-performance backstop. The capacity to operate with high radial run outs enables application, without problem, even in axles supported on conical roller bearings or slide bearings. Sprags with centrifugal tilting assure long lastingness. It does not require special lubrication when operating above the centrifugal tilting. The thin film of lubricant applied during the assembly is enough for the operation (see page 7). This backstop does not need maintenance. The transmissible torque capacity depends on the concentricity between the inner and outer rings of the backstop.

FXM PROFILE

Backstops for high bending moments and high rotations with sprag lift-off X

Tolerance for Ø F**	Type
0 for + 0,02 mm	DX
0 for + 0,05 mm	SX
0 for + 0,05 mm	UX



Z = number of fastening holes for G bolts in circumference T

Type Size	Hole d Std mm						Max. mm	A mm	B mm	D mm	E mm	F Min. mm	G	J mm	L mm	P mm	T mm	U mm	V mm	W mm	Z
•FXM 31 - 17 DX	* 20	-	-	-	-	-	* 20	17	25	85	41	55	M6	31	24	1	70	15	6	21	6
•FXM 38 - 17 DX	* 25	-	-	-	-	-	* 25	17	25	90	48	62	M6	38	24	1	75	15	6	21	6
•FXM 46 - 25 DX	25	-	-	-	-	-	30	25	35	95	56	70	M6	46	35	1	82	15	6	21	6
•FXM 51 - 25 DX	25	• 30	35	-	-	-	36	25	35	105	62	75	M6	51	35	1	90	15	6	21	6
FXM 56 - 25 DX	35	-	-	-	-	-	40	25	35	110	66	80	M6	56	35	1	96	15	6	21	8
•FXM 61 - 19 DX	30	35	40	-	-	-	* 45	19	27	120	74	85	M8	61	25	1	105	15	6	21	6
•FXM 66 - 25 DX	• 35	• 40	• 45	-	-	-	* 48	25	35	132	78	90	M8	66	35	1	115	15	8	23	8
•FXM 76 - 25 DX	45	55	-	-	-	-	55	25	35	140	90	100	M8	76	35	1	125	15	8	23	8
•FXM 86 - 25 DX	• 40	45	• 50	60	65	-	70	25	40	150	100	110	M8	86	40	1	132	15	8	23	8
FXM 101 - 25 DX	55	70	-	-	-	-	75	25	50	175	116	125	M10	101	50	1	155	20	8	28	8
•FXM 85 - 40 SX	45	50	• 60	65	-	-	65	40	50	175	100	125	M10	85	60	1	155	20	8	28	8
•FXM 100 - 40 SX	45	50	55	60	70	75	75	40	50	190	116	140	M10	100	60	1.5	165	25	10	35	12
•FXM 120 - 50 SX	60	• 65	70	75	80	95	95	50	60	210	140	160	M10	120	70	1.5	185	25	10	35	12
•FXM 140 - 50 SX	65	90	• 95	• 100	• 110	-	110	50	70	245	162	180	M12	140	70	2	218	25	12	35	12
•FXM 170 - 63 SX	70	85	100	• 120	-	-	130	63	80	290	193	210	M16	170	80	2	258	28	12	38	12
•FXM 200 - 63 SX	•130	-	100	-	-	-	155	63	80	310	225	240	M16	200	80	2	278	32	12	42	12
•FXM 240 - 63 UX	-	-	-	-	-	-	185	63	80	400	280	310	M20	240	90	2	360	48	12	60	12
FXM 240 - 96 UX	-	-	-	-	-	-	185	96	125	420	280	310	M24	240	120	2	370	48	15	60	16
FXM 260 - 63 UX	-	-	-	-	-	-	205	63	80	430	300	330	M20	260	105	2	380	48	18	60	16
FXM 290 - 70 UX	-	-	-	-	-	-	230	70	80	460	330	360	M20	290	105	2	410	48	18	60	16
FXM 290 - 96 UX	-	-	-	-	-	-	230	96	110	460	330	360	M20	290	120	2	410	48	18	60	16
FXM 310 - 70 UX	-	-	-	-	-	-	240	70	125	497	360	380	M20	310	110	3	450	48	18	60	24
FXM 310 - 96 UX	-	-	-	-	-	-	240	96	125	497	360	380	M20	310	120	3	450	48	18	60	24
FXM 320 - 70 UX	-	-	-	-	-	-	250	70	80	490	360	390	M24	320	105	3	440	55	20	68	16
FXM 360 - 100 UX	-	-	-	-	-	-	280	100	120	540	400	430	M24	360	125	3	500	55	20	68	24
FXM 410 - 100 UX	-	-	-	-	-	-	320	100	120	630	460	480	M24	410	125	3	560	55	20	68	24
FXM 2.410 - 100 UX	-	-	-	-	-	-	320	200	220	630	460	480	M30	410	220	3	560	55	20	68	24

Keyways according to DIN 6885/1. The holes marked with (*) have key according to DIN 6885/3. Keyway width tolerance according to IT 10. The sizes and holes marked with (*) are preferential in Vulkan do Brasil's supply program.

Scope of supply

The cover, shown in the figure above, is supplied optionally upon request. please indicate separately in the order.

Installation cares

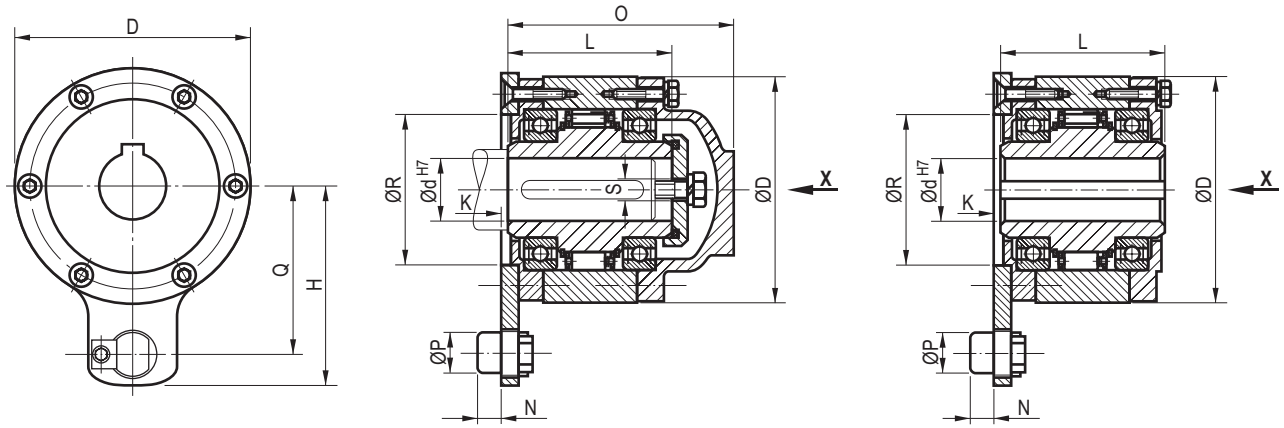
The backstop does not have inner bearings. Therefore, the outer ring should be mounted concentrically to the inner ring. Note the radial runout limits informed in the previous page. The axle tolerance should be ISO h6, j6 or k6.

Lubrication

See page 7.

BA & BC PROFILE

Backstops with inner bearings and bending arm with sprag lift-off X grease-lubricated



BA PROFILE **BC PROFILE**

*Preferential profile

Size BA or BC Profile	Bending moment Nm	Rotation Min. rpm	Rotation Max. rpm	Hole d Std mm		Hole d Max. mm	D mm	H mm	K mm	L mm	N mm	O mm	P mm	Q mm	R mm	S for threa mm
BA/BC 20 DXG	400	750	2500	• 25	30	30	106	80	2,5	77	11	104	19.5	65	70	M10
BA/BC 25 DXG	650	700	2350	• 35	40	40	126	90	2,5	93	11	125	19.5	75	80	M12
BA/BC 30 DXG	1100	650	2350	• 45	-	50	151	120	3,5	102	16	140	27.5	95	100	M16
BA/BC 40 DXG	1400	610	2200	• 55	-	60	181	160	5,5	116	22	160	37.5	130	120	M16
BA/BC 45 SXG	2300	400	2200	• 65	-	70	196	175	7	130	26	176	41.5	140	130	M16
BA/BC 52 SXG	4900	320	2200	-	• 80	80	216	200	4,5	150	26	208	41.5	160	150	M20
BA/BC 55 SXG	6500	320	2000	-	• 90	90	246	210	3,5	170	29	228	49.5	170	160	M20
BA/BC 60 SXG	14500	250	1800	• 100	-	105	291	250	8,5	206	35	273	60	200	190	M24
BA/BC 70 SXG	21000	240	1650	-	• 120	120	321	280	14	215	39	291	65	225	210	M24
BA/BC 100 SXG	42500	210	1450	-	• 150	150	411	345	31,5	276	60	372	80	280	270	M30

Keyways according to DIN 6885/1. The keyway width tolerance is JS10. Torques informed are nominal and contain a service factor 2. The holes marked (*) are preferential in the Vulkan do Brasil's supply program.

Features

BA Profile: Backstop for assembly at tip of floating axle with axial fastening.
BC Profile: Backstop for assembly in pass-through axle. Axial fastening required.
Anchoring of the bending moment occurs through a lock pin threaded in the bending arm.
By unthreading it, the bending arm is freed, allowing turning of the axle in both directions.

Lubrication

The bearings of the BA and BC profile backstops are invariably shielded roller bearings, pre-lubricated in the plant, which do not require re-lubrication. The core, of the type with sprag lift-off X, does not require lubrication, except for a thin layer of oil or grease to protect against oxidation and corrosion.

NOTE: Do not use lubricant containing molybdenum disulfide (MoS2) or other solid additives capable of reducing the coefficient of friction (EP additives in general).

Installation Instructions

The lock pin of the bending arm should be housed inside a keyway or hole in the machine structure, leaving a radial and axial gap of 0.5 to 2 mm (see page 8).
In both constructive profiles, the hub must be fixed axially. The retention disk and bolt (BA profile) can be supplied optionally upon request.
The axle tolerance should be ISO h6 or j6.
Before assembling the backstop in the machine, observe in detail the topics related to installation and lubrication contained in the general instructions that accompanies the equipment.

Direction of rotation

Please inform in the order:
- direction of rotation of the backstop axle/hub when seen through X.

The direction of rotation of the backstop is altered when the assembly position of the arm, bolts and cover(s) are inverted.

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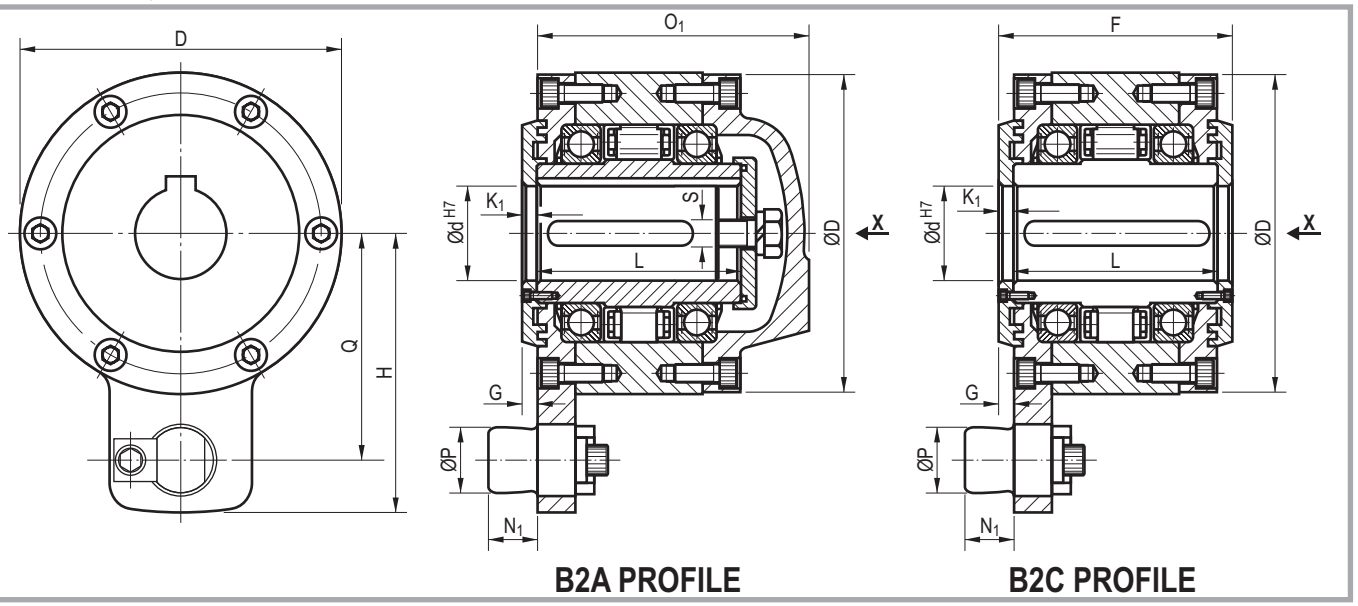
B2A & B2C PROFILE

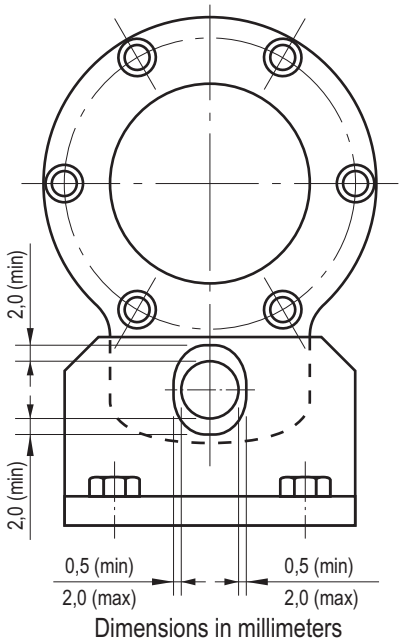
Backstops with inner bearings and bending arm with sprag lift-off X grease-lubricated - Incorporate reinforced sealing to operate in dusty environments



B2A PROFILE B2C PROFILE

Size B2A or B2C Profile	Bending moment Nm	Rotation Min. rpm	Rotation Max. rpm	Hole d Std mm		Hole d Max. mm	D mm	H mm	K_1 mm	L mm	G mm	N_1 mm	O_1 mm	P mm	Q mm	F mm	S for threa mm
20 DXG	400	750	2500	• 25	• 30	30	106	80	5	77	6,5	15	109	19,5	65	87	M10
25 DXG	650	700	2350	• 35	• 40	40	126	90	6	93	7,5	15	131	19,5	75	105	M12
30 DXG	1100	650	2350	• 45	-	50	151	120	8	102	9,5	21	148	27,5	95	118	M16
40 DXG	1400	610	2200	• 55	-	60	181	160	8	116	9,5	29	168	37,5	130	132	M16
45 SXG	2300	400	2200	65	-	70	196	175	8	130	10	35	184	41,5	140	146	M16
52 SXG	4900	320	2200	-	80	80	216	200	10	150	12	33	218	41,5	160	170	M20
55 SXG	6500	320	2000	-	90	90	246	210	10	170	12	35	238	49,5	170	190	M20
60 SXG	14500	250	1800	100	-	105	291	250	12	206	14	46	285	60	200	230	M24
70 SXG	21000	240	1650	-	120	120	321	280	12	215	14,5	55	303	65	225	239	M24
100 SXG	42500	210	1450	-	150	150	411	345	15	276	17,5	75	387	80	280	306	M30

Keyways according to DIN 6885/1. The keyway width tolerance is JS10. Torques informed are nominal and contain a service factor 2. The holes marked (*) are preferential in the Vulkan do Brasil's supply program.



Dimensions in millimeters

Features

The B2A and B2C constructive profiles are similar to the BA and BC profiles. The installation, lubrication, and direction of rotation recommendations are the same, with some additional construction and installation/lubrication observations.

Construction

Axial labyrinths were incorporated that, once filled with grease, becomes an effective barrier to protect against entrance of harmful dust and contaminants. This way, the bending arm turned together with the cover, forming with it a single part.

Installation/Lubrication

During installation, apply grease with consistency 2, calcium-based soap (resistant to humidity) in the parts that delimit the axial labyrinth, so that this space is completely filled with grease, thus preventing penetration of contaminants inside the backstop. The labyrinth closing covers, as of size 45 SXG (inclusive), have axial fastening bolts in the hub. Support stops and inner (B2A profile) or external axial locks (B2C profile) should be provided in the installation.

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Questionnaire for selection of backstops

To photocopy

TFax to: (011) 4195-1569

Company: _____

Address: _____

City/Zip Code: _____

Phone: _____

Fax: _____

Name: _____

Department: _____

Consultation reference: _____

Date: _____

Vulkan do Brasil Ltda.
Av. Tamboré, 1113 Alphaville
Barueri SP CEP [zip code] 06460-915
Phone: (011) 4166-6600
Email: acionamentos@vulkan-brasil.com.br

1. Where will the backstop be applied?

1.1. Machine type: _____ In case of conveyor belt: highest inclination: _____ º

1.2. Where will it be installed: ☐ gear unit ☐ Motor ☐ Others: _____

1.3. Location: ☐ tip of axle Diameter: _____ mm Length: _____ mm

☐ middle of axle Diameter: _____ mm

☐ in pulley ☐ In gearing/chain wheel ☐ in another location: _____ mm

1.4. If possible, annex specifications, datasheet, drawing or sketch with the dimensions available of the assembly location.

2. Installation data

2.1. Rotation of the machine axle in which the backstop will be mounted n_{sp}: _____ rpm
Is it possible to mount the backstop in a high rotation axle? (highest rotation = lowest bending moment = lowest backstop).
If possible, give details through drawing/sketch.

2.2. Nominal potential of the driving machine P_o: _____ kW

2.3. Should the backstop be able to absorb the resulting overload of an eventual motor start in the opposite direction? (If yes, the backstop must be considerably over sized).

Yes ☐ No ☐

2.4. Maximum reverse bending moment $M_{Rmáx.}$: _____ Nm

2.5. Yield of the machine between motor and backstop : _____

2.6. Load moment of the driven machine M_L: _____ Nm

2.7. Daily period of operation: _____ Hours

3. Environmental working conditions

3.1. ☐ open, outdoor
☐ open, indoor
☐ closed, inside a machine housing

3.2. ☐ Lubrication by oil splash, oil mist inside a machine housing

☐ Is it possible to connect to a central lubrication system?
Lubricant identification: _____
Viscosity: _____ $mm^2/sec.$ _____ ºC

3.3. Does the backstop mechanism need to be released?

☐ No ☐ Yes, in emergency ☐ Yes, often

3.4. ☐ Room temperature
From _____ ºC to _____ ºC

3.5. Other observations (for example: accessibility, dust and other environmental factors that might be relevant).

_____

3.6. Is there any elastic component located between the backstop and equipment to be blocked? (elastic couplings can generate high peaks of bending moments during blocking).

☐ Yes ☐ No

4. Estimated demand

_____ parts (sporadic) _____ Parts/month _____ Parts/year

5. Annexes

☐ Specification ☐ Datasheet ☐ Sketch/drawing ☐ Others _____

SKETCH OF THE APPLICATION

VULKAN
DRIVE TECH
reliable industrial drives

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