Low Speed Backstops
Introduction to Low Speed Backstops

Advantages:

1. Over 50 years of German brake expertise combined with almost 20 years of Chinese backstop experience.
2. Robust designs produced from modeling with CATIA (product lifecycle management software) and finite element analysis.
3. Precision testing and machining guarantees quality and consistency.
4. Superior material selection, heat treatment and surface hardening technology ensure resistance to wear and long service life.
5. High quality sealants prevent leakage.
6. The patented ARTC backstop with its unique cooling feature is designed to operate in high temperature environments.
7. SIBRE Germany's quality control system used throughout the production process guarantees reliability and an extended lifecycle.
8. SIBRE’s global service network combined with a quality product ensures countless years of trouble-free operation.
Low Speed Backstops

Applications:
SIBRE-SYZK ART backstops prevent reversal of inclined conveyors and vertical bucket elevators. Backstops are normally installed on low-speed drive shafts to prevent system reversal as a result of gravity.

- Backstops are used in:
  - Belt conveyors
  - Bucket elevators
  - Scraper conveyors
  - Wind turbines
  - Rotary kilns
  - Other equipment that requires backstop action

Backstops are widely used in belt conveyor systems found in:
- Coal mines
- Cement plants
- Iron mines
- Nonferrous metal mines
- Power plants
- Petrochemical plants
- Grain processing facilities
- Building industry

Working Principle:
Cams are arranged between an outer ring and inner ring. When the inner ring rotates in the intended direction, Cams move freely with the outer ring and inner ring. When the inner ring rotates in the opposite direction, Cams driven by spring force, wedge between the outer ring and inner ring to afford backstop torque.
Low Speed Backstops

Type Description:

- Length of moment arm – H (mm)
- Diameter of shaft hole (mm)
- Rotating direction of inner ring: S – clockwise; N – counter-clockwise
- Mounting type: A – Moment arm locked by double-side steel wall; B – Moment arm locked by pin
- Nominal torque of backstop – KN•m
- Option C: Backstop with cooling feature – Recommended if ambient temperature exceeds 40 degrees centigrade, or the backstop is mounted on the output shaft of the gear box.
- ART – A ROBUST backstop

For instance:
ART 1000-A-S-500mm; ARTC 1000-A-S-500mm-2200mm ARTC - A
ROBUST backstop with cooling feature

ART and ARTC Engineering Data:

<table>
<thead>
<tr>
<th>Backstop size</th>
<th>Rated Torque KNm</th>
<th>Max RPM r/min</th>
<th>Max Bore d mm</th>
<th>Running Resistance N-m</th>
<th>Max. Weight Kg</th>
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<tr>
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<td>100</td>
<td>1100</td>
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<td>50</td>
<td>620</td>
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</table>
Low Speed Backstops

ART Backstop Dimensions:

<table>
<thead>
<tr>
<th>Backstop type</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A  B  C  D   E   F   H   h   L   ARTC</td>
</tr>
<tr>
<td></td>
<td>Lc  Dc</td>
</tr>
<tr>
<td>ART11</td>
<td>-  100  68  270  -  -  650  -  115  165  320</td>
</tr>
<tr>
<td>ART16</td>
<td>-  126  74  320  -  -  750  -  135  185  370</td>
</tr>
<tr>
<td>ART25</td>
<td>-  140  80  360  -  -  800  -  150  200  410</td>
</tr>
<tr>
<td>ART38</td>
<td>-  160  88  430  -  -  850  -  160  210  480</td>
</tr>
<tr>
<td>ART55</td>
<td>-  200  102 500  -  -  1000  -  240  290  560</td>
</tr>
<tr>
<td>ART95</td>
<td>-  250  120 600  -  -  1200  -  290  340  660</td>
</tr>
<tr>
<td>ART130</td>
<td>40  280  120 650  120  60  1100  80  290  340  710</td>
</tr>
<tr>
<td>ART200</td>
<td>45  320  130 780  135  60  1300  80  290  340  850</td>
</tr>
<tr>
<td>ART280</td>
<td>50  360  140 850  150  70  1500  100  320  380  920</td>
</tr>
<tr>
<td>ART350</td>
<td>55  400  140 930  160  70  1600  100  360  420  1000</td>
</tr>
<tr>
<td>ART420</td>
<td>55  450  150 990  180  80  1700  120  380  440  1060</td>
</tr>
<tr>
<td>ART550</td>
<td>60  450  150 1030  180  80  1800  120  450  510  1100</td>
</tr>
<tr>
<td>ART750</td>
<td>70  500  160 1090  210  100  2000  120  480  540  1170</td>
</tr>
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<td>ART1000</td>
<td>80  560  170 1200  230  110  2200  150  500  560  1300</td>
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<tr>
<td>ART1300</td>
<td>80  630  180 1300  230  110  2400  150  500  560  1400</td>
</tr>
<tr>
<td>ART1800</td>
<td>90  700  180 1450  250  120  2500  180  650  710  1550</td>
</tr>
</tbody>
</table>

Type Selection:

For example: ART 1000-A-S-500mm-2200mm; ARTC 1000-A-S-500mm-2200mm

(ARTC - ART backstop with cooling feature)

The ARTC backstop has two different dimensions compared to the ART backstop: Lc (maximum width) and Dc (maximum diameter)

Type Selection Guide:

The type of backstop required is determined by nominal torque. Nominal backstop torque should be larger than the total required backstop torque.

Rotating shaft speed should be less than the maximum rotating speed of the inner ring.

The rotating direction of the inner ring is indicated by S - clockwise; N - counter-clockwise.

There are two types of moment arms: one is locked by a double-side steel wall; the other moment arm is locked by a pin.
Low Speed Backstops

Type A: Moment arm locked by double side steel wall

Type B: Moment arm locked by pin
Mounting Position:

SIBRE recommends the backstop be mounted on the low speed drive shaft. When needed, backstop torque will act on the low speed drive shaft and take effect immediately before system reversal occurs. This will protect the gearbox.

If possible, it is best to mount the backstop between the roller and the gearbox. This way there is no load on the drive system when backstopping occurs. In addition, mounting the backstop on the low speed drive shaft allows easy access to maintain the backstop and change the motor, gearbox and high-speed coupling, when required.

If the backstop is mounted on the double extension shaft, SIBRE recommends using the ARTC backstop with the unique cooling feature due to possible high temperature situations.

Several typical layouts of backstop in the belt conveyor system:
Priority:
1. ART backstop, SIBLE recommends using ARTC backstop with the unique cooling feature.
2. SHI emergency brake
3. SIBLE recommends a low speed coupling such as CRA chain coupling, LC articulating multi-misalignment coupling or GIICL crown gear coupling.
4. SIBLE recommends a high speed coupling such as AFC elastic spider coupling, ZXC elastic pin coupling or GIICL crown gear coupling.

SIBLE also offers SHI, USB, TEXU and TE brakes used on the high speed shaft of belt conveyor systems.
Low Speed Backstops

Calculation for Type Selection:

1. Selection acc. driving power:

   ◦ Formula for selection acc. driving power

   \[ T_N \geq T_C = \frac{P \times 9550 \times f}{r} \]

   \( T_N \) = Nominal torque of backstop
   \( T_C \) = Calculating torque (maximum backstop torque produced by backstop)
   \( P \) = Motor rated power (Kw)
   \( f \) = Working factor or safety factor > 1.5 - 4
   \( r \) = Rotating speed of shaft mounted with backstop (r/min)

   Working factor or safety factor is determined by maximum stalling torque, angle of slope of the conveyor, quantity of backstops in the system and layout of backstops.

2. Selection acc. carrying capacity of conveyor:

   ◦ Formula for selection acc. carrying capacity of conveyor

   \[ T_N \geq T_C = \frac{9.8Q \times L \times D \times K}{3.6 \times V \times 2} \times f \]

   \( T_N \) = Nominal torque of backstop
   \( T_C \) = Calculating torque (maximum backstop torque produced by backstop)
   \( Q \) = Carrying capacity of conveyor (ton/ hr)
   \( L \) = Slope length (m)
   \( D \) = Roller diameter (m)
   \( V \) = Belt speed (m/s)
   \( K \) = Slope factor

   Working factor or safety factor is determined by maximum stalling torque, angle of slope of the conveyor, quantity of backstops in the system and layout of backstops.

<table>
<thead>
<tr>
<th>Slope K</th>
<th>5°</th>
<th>8°</th>
<th>10°</th>
<th>12°</th>
<th>14°</th>
<th>16°</th>
<th>18°</th>
<th>20°</th>
<th>25°</th>
<th>30°</th>
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<tbody>
<tr>
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<td>0.309</td>
<td>0.342</td>
<td>0.4226</td>
<td>0.5</td>
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</table>

f = Working factor or safety factor > 1.5 - 4

Working factor or safety factor is determined by maximum stalling torque, angle of slope of the conveyor, quantity of backstops in the system and layout of the backstops.
Selection of Shaft:

The shaft must be strong enough to withstand maximum backstop load. SIBRE customarily supplies according to the fitting tolerance of shaft hole and shaft to F7/h7 (ISO 286).

Selection of Key and Key Way:

It is important the key properly fits into the key way. There must be clearance between the surface of the key and the inner ring of the backstop. See illustration below.

Attention: A gib-headed key cannot be used to connect the shaft and shaft hole. Doing this will deform the backstop inner ring and could cause the backstop to fail.
Design of Moment Arm Lock:

The moment arm must be locked. This lock must be strong enough to withstand the shearing moment transmitted by the moment arm of the backstop. The shearing moment will be different depending on the length of the moment arm. The calculation to determine the lock is shown below

\[ F = \frac{1.5 \times Tn}{H1} \]

- **F** = Shearing force on lock - N
- **Tn** = Nominal torque of backstop - Nm
- **H1** = Distance between pressure point and center of inner ring – m

Attention:

1. There must be clearance between the moment arm and the lock.

2. SIBRE recommends protecting the moment arm and lock with a dust cover. A dust cover will prevent the accumulation of dirt and other foreign materials and ensure normal operation of the moment arm.

3. When the moment arm is locked by a pin, the pin opening on the lock should be an increasing circular bore. The direction of the increasing circular bore should be the same as the moment arm which will prevent the outer ring of the backstop from rotating. The diameter of the pin should be 8mm to 10mm less than the diameter of the pin opening. The pin will not be used during backstop activation. It only will function to prevent a reversal when the backstop is running in the intended direction.
Low Speed Backstops

Clearance: 8-12mm

Working direction of inner ring

Clearance: 8-12mm
Installation and Maintenance

Instructions: Notice:

1. Check all parts in shipment against the packing list.
2. Ensure the rotating direction of the shaft is the same as the working direction of the inner ring of the backstop to prevent a serious accident.
3. Use a hoist to position the backstop when installing it.
4. Moment arm cannot be connected to the lock. (For example, the moment arm cannot be welded together with the lock.)
5. The drive shaft should be recessed 2mm to 3mm into the inner ring of the backstop. A shoulder ring can be used to fasten the backstop to the drive shaft.
6. The lock, shoulder ring, bolts and washers can be ordered along with the backstop.

Installation Steps:

1. Clean and de-burr the drive shaft extension. Ensure the backstop inner ring is clean.
2. Lubricate the drive shaft extension.
3. Hoist the backstop into position and drive the inner ring onto the drive shaft extension. Fasten the backstop in place with the shoulder ring. Note: Use only a mallet with a plastic head to drive the inner ring onto the drive shaft. Do not heat the inner ring to expand it during the installation process.
4. Rotate the moment arm to the installation angle and lock it in place.
5. If the backstop is lubricated with oil, mount the oil level indicator and filter after installation. The oil level indicator should be mounted vertically and the filter should be mounted on top of the backstop.
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Maintenance:

1. Backstops using grease for lubrication will be filled before delivery. If there is more than 6 months between production and installation, the grease will need to be topped off. Grease volume is 1/5 to 1/3 of total volume, not to exceed 1/2 of total volume. Do not use grease containing dangerous compounds such as lead, molybdenum disulfide, etc.

   The following brands of grease are recommended for lubrication:
   - Mobile: UNIREX N2 / Arapen RB320
   - SHELL: GADUS S1 V100 / S5 T100
   - KLUBER: Klubersynth GH6 / GEM2 / 4 UH1-… N series

2. Check the backstop if there is excessive noise or an abnormal temperature rise during operation.

3. Periodically check the bolts on the lock to ensure they are not loose.

4. The backstop operational temperature range is -40°C to 50°C. A cooling device is required for operating temperatures above 40°C. A sunshade should be installed for outdoor applications. For operations at temperatures in excess of 50°C, check the lubrication daily. Cease operating the backstop at temperatures in excess of 85°C. If the backstop is mounted on the gear box shaft extension, periodically check the gear box during high temperature operations.

5. Exposing the backstop to chlorine, carbon tetrachloride, potash, etc. will shorten the life of the backstop ring seal.
INDUSTRIAL CLUTCH PARTS

Telephone: +44 (0) 1663 734 627
Fax: +44 (0) 1663 733 023
Email: sales@icpltd.co.uk
Website: www.industrialclutch.com

Industrial Clutch Parts, Bingswood Industrial Estate, Whaley Bridge, High Peak, United Kingdom SK23 7LY