Metso

1st edition

Apron feeder handbook

Version 1.0

December 2025

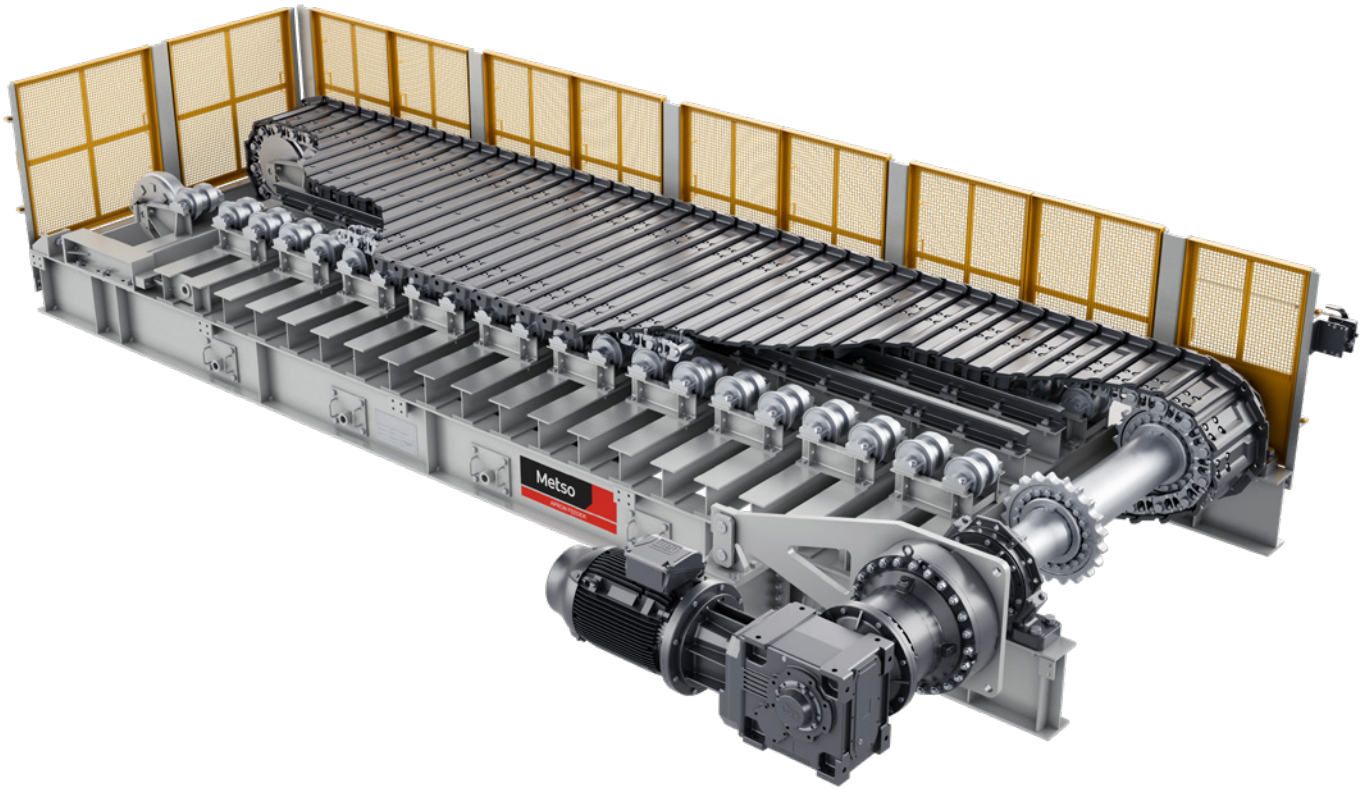
Preface to the First edition

The following handbook describes the fundamental components and uses for apron feeders as designed and sold by Metso.

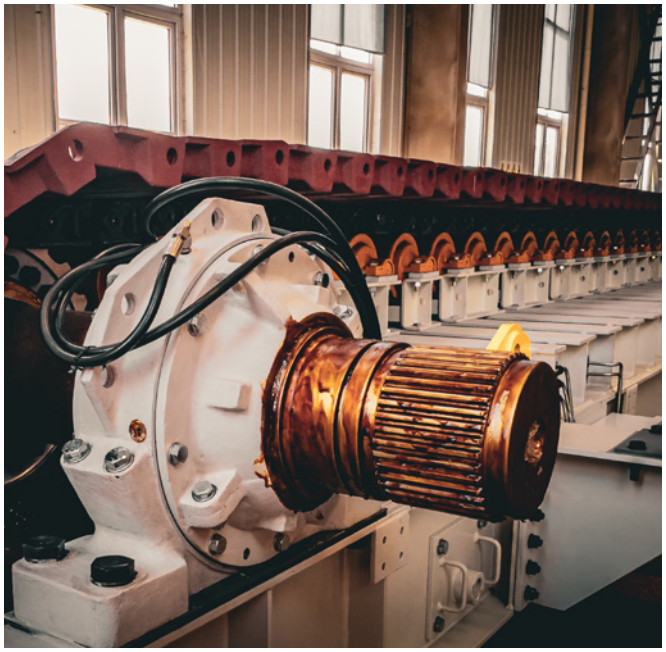
This handbook will serve as a technological resource for apron feeder owners, operators and maintenance personnel. It will help identify the different parts that comprise an apron feeder, the maintenance required for achieving high reliability from an apron feeder and some insight on more recent developments and improvements.

The information contained herein is general in nature and is not intended for specific construction, installation or application purposes. Predictions of actual performance of a given piece of equipment should take into account many variable field factors the machine is liable to encounter. Because of those factors, no warranty of any kind, expressed or implied, is extended by presenting the generalized data herein.

We reserve the right to make changes in specifications shown herein or add improvements at any time without notice or obligation.




Your partner for
positive change

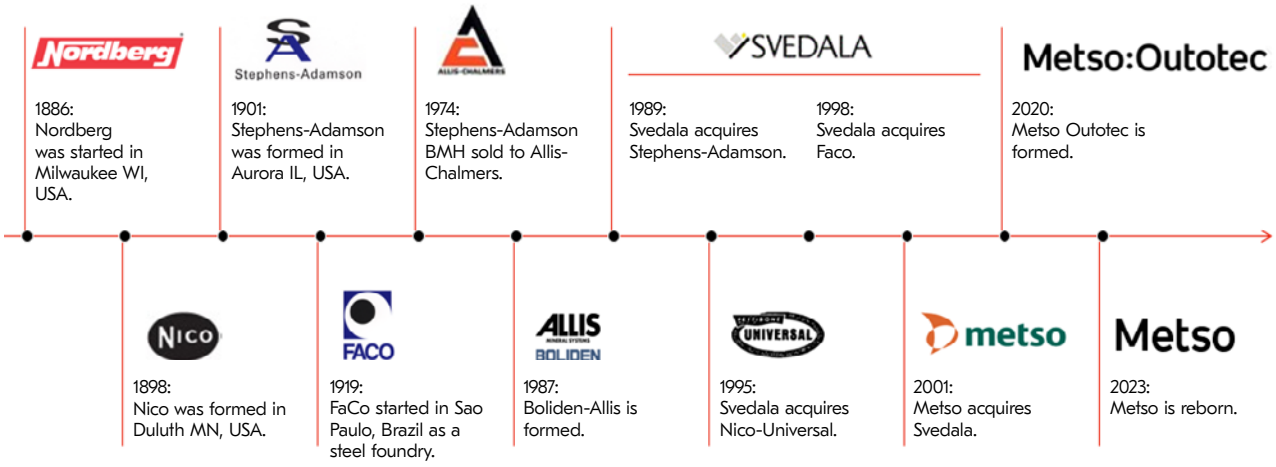


Contents

Developed over many decades of engineering excellence, our apron feeders meet your unique challenges

Apron feeder offering history

Apron feeder
Metso brand timeline



Metso's apron feeder product offering is built upon a rich legacy of engineering excellence, dating back over a century to two foundational companies: Stephens-Adamson and National Iron Company (NICO). Founded in 1901 in Aurora, Illinois, Stephens-Adamson quickly became a pioneer in conveyor idler technology, known for durable and precision-engineered components that revolutionized material handling systems. Meanwhile, NICO, established in 1898 in Duluth, Minnesota, brought deep expertise in heavy-duty feeder systems, laying the groundwork for robust apron feeder designs.

The consolidation journey began in 1974 when Stephens-Adamson's bulk material handling division was sold to Allis-Chalmers. This entity later became part of Boliden-Allis in 1987, and then Svedala Industries in 1989. Around the same time, NICO was acquired by Universal Engineering, which itself was integrated into Svedala in 1997.

The pivotal moment came in 2001 when Metso was officially formed through the merger of Valmet and Rauma, combining strengths in paper machinery, rock crushing, and flow control. Metso's apron feeder legacy was further reinforced with a 2016 standardization project to modernize and update our core apron feeder models to better serve the market with state-of-the-art apron feeders. A new apron feeder model was introduced a few years later.

This evolution has allowed Metso to integrate the technical heritage of Stephens-Adamson and NICO into a unified, globally recognized apron feeder offering that continues to serve the mining and aggregates industries with innovation and reliability.

Through our heritage, we have experience in apron feeder parts with multiple models and brands.

Legacy spotlight

Stephens-Adamson was founded in Aurora, Illinois, in 1901 to manufacture belt conveyor elevators, screens and power transmissions. In 1905, they added pulleys, clutches, plain bearings, sprockets, wheels and chains to their product offering. In 1911, the company introduced the first anti-friction belt conveyor idler, establishing Stephens-Adamson as a leader in the belt conveyor industry. By 1927, they had opened two locations in Belleville, Ontario, and Los Angeles, California. In 1938, the Sealmaster bearing product line was initiated. In 1950, the Speedwalk and Speedramp were developed, creating the world's first moving sidewalk for use in airports, sports stadiums, shopping centers, and theme parks.

By 1960, the company was operating seven manufacturing plants in the United States, Canada, Europe and Australia.

In 1962, Stephens-Adamson developed and patented the exclusive curve crown pulley, followed by the squeeze-lock hub shortly after. In 1969, the company was acquired by Borg Warner, with the bulk material handling operations being sold to Allis-Chalmers in 1974. Borg Warner continued to develop and lead the conveyor and feeder industry, launching various products over the decades. They became a member of the Svedala Conveying Division in 1998, which became Metso shortly after.

National Iron Company (NICO), founded in 1898 in Duluth, Minnesota, was a pioneer in the design and manufacture of heavy machinery. The company played a vital role in the development of the US iron range and steel industry. By 1916, NICO employed nearly 200 workers. Through the years, NICO's engineering excellence and durable designs earned a reputation that endured well beyond its original operations. In 1997, the company was acquired by Universal-NICO.

The company's apron feeder technology and engineering DNA were absorbed into Metso's product portfolio, creating a global leader in bulk material handling solutions. Today, NICO lives on as a foundational legacy brand within Metso's apron feeder offerings. The company's influence remains visible in the robust, reliable equipment that continues to serve mining and industrial operations worldwide.

Apron feeder basics

Apron feeders and their application
An apron feeder (also known as a pan feeder) is a mechanical feeder used in material handing operations to transfer (or feed) material such as ore or rock at a controlled rate of speed to other equipment, or extract it from storage stockpiles, bins or hoppers.

Apron feeders can be used in a variety of applications in primary, secondary and tertiary crushing, grinding and reclaim operations, as well as rotary car dumper and port operations. Apron feeders are preferred across various applications given their ability to both provide better feed control to prevent material feed choking in downstream equipment, and to absorb the high impact shock of material loaded directly on a feeder with a shallow bed. Apron feeders can also reclaim a variety of dry or wet materials of different sizes at a uniform rate, providing a flexibility relevant to many applications.

Tractor chain-style apron feeders are common in the mining and aggregates industries. The tractor chain style refers to the undercarriage chain, rollers and tail wheels, which are also used in bulldozers and excavators. This style dominates the market in industries where users require feeders that can extract materials with varying characteristics. Tractor chain-style feeders have polyurethane seals in the chain to prevent abrasive materials from entering the internal pin and bushing components, which reduces wear and extends equipment life compared to a dry chain (non-lubricated) style.

Tractor chain-style apron feeders generally provide increased reliability, require fewer spare parts and less maintenance, and better feed control, which can lead to more productivity as a result of fewer bottlenecks within a mineral processing circuit. They also create less noise pollution. The chain links are heat treated, which can also extend service life.

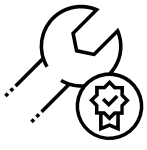
Apron feeders and ore size and type
Apron feeders have ore type and size limitations. The material feed size and type that a feeder can handle vary, but material should never be dumped directly onto the empty feeder. General industry rules indicate that apron feeder pan width (inside skirt) dimensions should be twice the maximum material lump size.

Other factors, such as open hoppers that incorporate turning plates, can affect pan size in select circumstances. For example, it is not unusual for 1500 mm of material to be extracted if a 3000 mm wide feeder is used. Material of minus 300 mm from crusher ore stockpiles or storage/blending bins is typically extracted with apron feeders to feed secondary crushers.

Optimal apron feeder speed
When considering apron feeder applications, faster is not always better. Optimal speed is the balance between efficiency and transportation speed.

The optimal apron feeder speed ranges between 0.05 – 0.40 m/second (10–80 fpm). A feeder carrying non-abrasive ore can be operated at speeds exceeding 0.30 m/second, as this material creates less deterioration. Operating apron feeders at high rates of speed increases the risk of accelerated component wear (e.g., sprockets, chain, pans, etc.) while decreasing energy efficiency due to increased energy demand. Operating apron feeders at high speeds also generates fines created by the grinding effect between the material and the pans. Fines also create more airborne fugitive dust, which creates hazardous air quality in the work environment. Speed optimization is therefore not only important for productivity, but also operational plant safety.

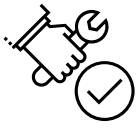
Heavy duty, robust design



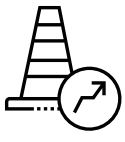
High reliability

Lower OPEX and improved profitability

Increased uptime



Ease of maintenance



Improved safety

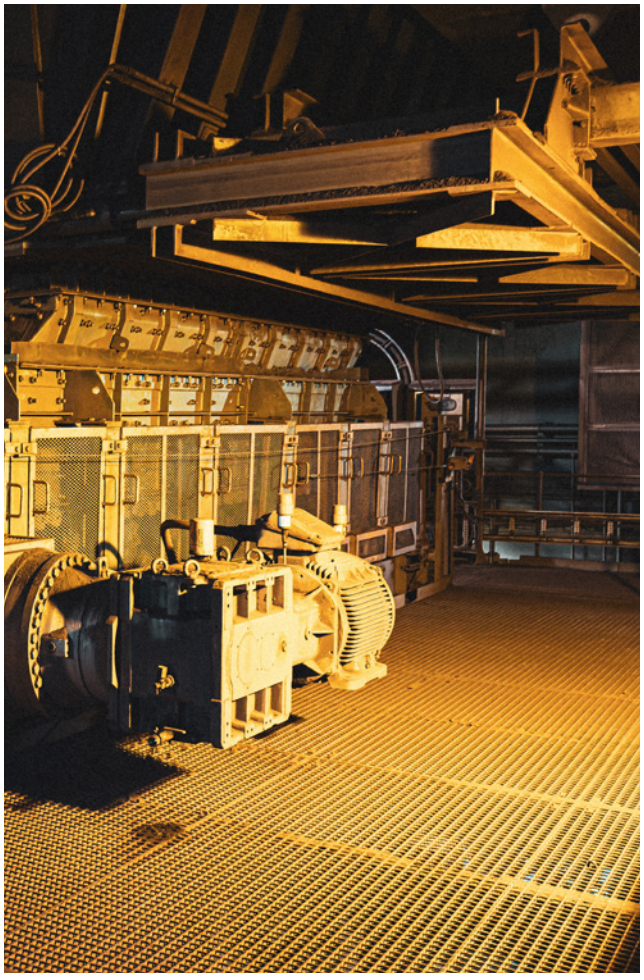
Sizing and selection

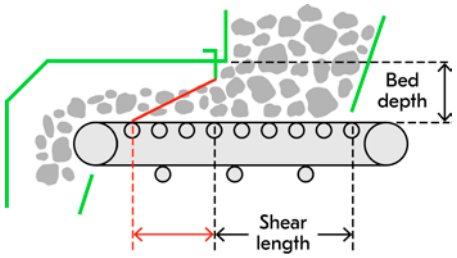
For best results, apron feeders must be properly sized and selected according to the application. Proper apron feeder sizing and selection requires more than simple calculations.

Information required when sizing an apron feeder
The proper equipment footprint is essential in any plant. Apron feeders can be installed flat or on an incline to save space. Selecting the correct apron feeder length can reduce CAPEX, power consumption and OPEX.

The proper apron feeder length the shortest possible length in which it can fulfill its duty. In some cases, the feeder may be longer than strictly necessary to convey materials to reach downstream equipment and eliminate a transfer point (and unnecessary component wear costs).

Determining the shortest and most optimal feeder size requires positioning the apron feeder under the hopper. After determining the shear length and bed depth, the overall length can then be minimized just enough to prevent self-flushing over the discharge end when the feeder is idle.





Bed depth
L > shear length x cos A
A = material angle of repose

Bulk density and apron feeder sizing
Bulk ore/rock density is a basic criteria requirement for proper apron feeder sizing. Bulk density is used for apron feeders and not solid density, as in for other mineral processing equipment.

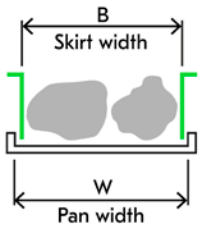
Because apron feeders are volumetric-type feeders, density is used to determine the speed and power (torque) needed to extract a certain material tonnage per hour (tph). Minimum bulk density determines apron feeder speed and maximum bulk density establishes power (torque) needed.

It is important that the correct "bulk" density and not "solid" density is used for apron feeders. If these calculations are incorrect, this could jeopardize the resulting feed rate for the downstream process.

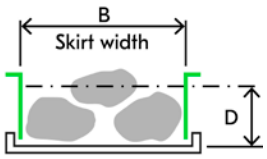
How to determine the optimal apron feeder length
When sizing an apron feeder and drive system, it is important to have experience of the entire mining process. Apron feeder sizing requires basic knowledge of plant process data to accurately determine the proper feeder length for the process application.

When sizing an apron feeder, basic criteria should include peak and normal feed rate, moisture, gradation, shape and other material characteristics, maximum ore/rock lump size, maximum and minimum bulk ore/rock density, and feed and discharge conditions.

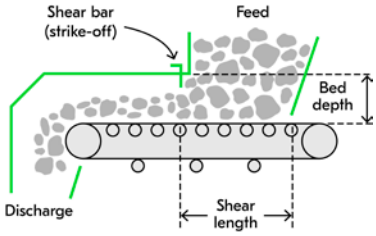
Additional variables include hopper configuration and the hopper shear length opening directly above the apron feeder. Hopper configuration is not only applicable to proper apron feeder sizing, but the drive system as well.

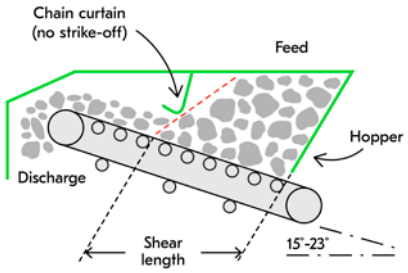


Pan width
W ≈ 2 x maximum lump size



Bed depth
D ≈ 1.5 x maximum lump size





Determining the apron feeder hopper shear length
Hopper shear length is key to identifying the correct apron feeder and drive system. This should not be confused with the dimensions at the top of the hopper where material is loaded.

The goal of identifying the hopper shear length is to establish the material shear plane line and where material inside the skirts is separated (sheared) from the material inside the hopper. The material shear resistance is estimated at between 50-70% of the total feeder operating force/power. Improper shear length will result in either insufficient power (lost production) or excessive power (increased OPEX costs).

Selecting the apron feeder drive system
Selecting the proper apron feeder drive system depends on the feeder operation and goals. Apron feeders are designed to be run at variable speeds to extract material from storage for downstream feeding at a controlled speed for maximum efficiency. The material can vary depending on the season of the year, ore body, or blasting and blending patterns.

Two drive types function best for variable speed operation: a mechanical drive with a gear reducer, inverter duty motor and variable frequency drive (VFD) or a hydraulic motor and power unit with a variable pump. Today, variable speed mechanical drives are the preferred drive system due to technological advancements and cost efficiency.

Hydraulic drive systems are sufficient, but not a preferred option.

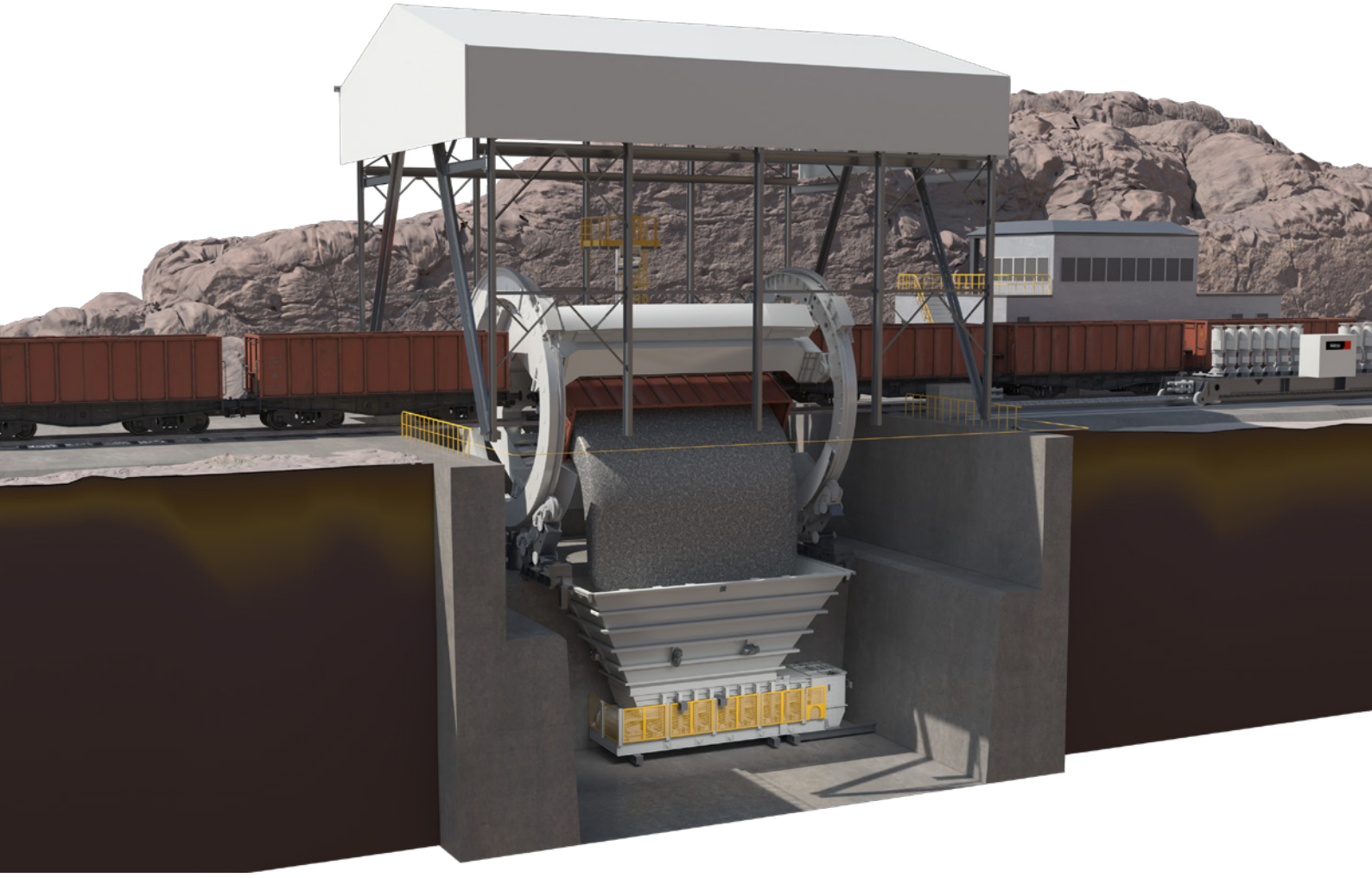
Apron feeder installation and ownership management

Tractor chain-style feeders and regular lubrication
Tractor chain-style apron feeders are robust and minimize wear and maintenance. This chain style does not require regular lubrication because the design is nearly 100% "sealed for life" lubricated.

The only tractor chain apron feeder components that require lubrication are the two head shaft pillow block bearings, which require grease lubrication semi-regularly. By eliminating the need for complicated lubrication systems, the tractor chain-style apron feeder helps to reduce operating costs (OPEX).

Drop height
Apron feeders are robust machines designed to feed and extract material under harsh operating conditions, including high impact material deposits directly onto the feeders. Each apron feeder is designed with impact rails under the feeder pans to ensure the feeder can properly feed material with less downtime for maintenance.

It is recommended that the feeder retain a bed of material on the feed end when the hopper, stockpile or bin is loaded to soften the material impact load onto the feeder. This helps to reduce wear and avoid permanent damage from large feeder material deposits. A bed of material should also remain in the hopper at the end of a shift or apron feeder operating cycle in preparation for the next day.



Apron feeder maintenance and access considerations
Apron feeders require minimal maintenance, however, maintenance best practices should allow adequate space around machines for general access and rigging lift beams for component removal and re-installation, when needed.

Examples include: Common apron feeder access points include the sides, front and rear discharge areas. Space should be provided on each side to allow access to the top, return rollers and drive system. There should also be additional space for personnel to position themselves under the machine to examine beneath the equipment. Front discharge access should be provided at the head chute for general inspection inside the machine through a small inspection door. Rear access should allow an additional 1,500mm at the tail end of the feeder for pan flight removal and installation.

Additional best practices include lift beam and trolley assembly installation above the apron feeder drive system and across the back end for pan removal. Additional walkway platforms may need to be installed for larger apron feeders to facilitate inspections.

Managing fine material dribble and carryback
Pans are designed to overlap and articulate around the head and tail assemblies to ensure minimal material loss. A dribble belt or scraper conveyor should be incorporated into the feeder design to prevent the need to clear spillage under the feeder.

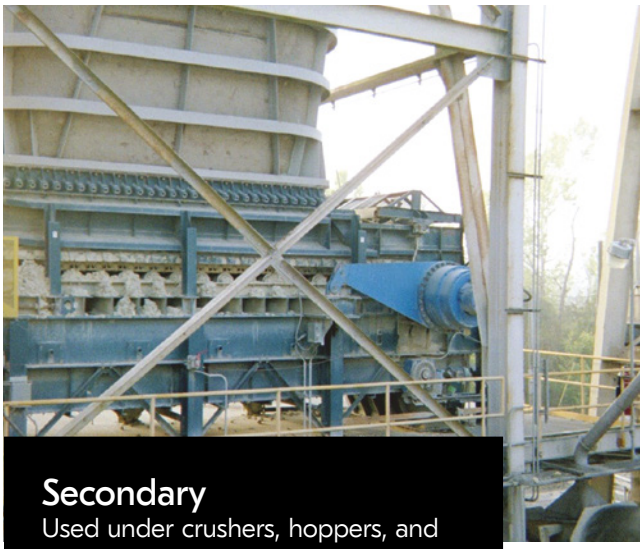
The dribble belt or scraper conveyor ensures that material will not be wasted. Where a feeder is installed at a 90-degree angle from downstream equipment, a scavenger conveyor or dribble belt may be needed for dry or semi-wet material. Similarly, a drag conveyor could be used for wet sticky material. Both conveyor types operate on a small drive set on an automatic timer and do not run continuously. Apron feeders using these systems can save on lost production and create a more energy efficient operation.

Feeder types (application overview)

Feeders are widely used in mining operations and in aggregates and recycling applications to transfer materials from one process to another, or to extract materials from storage stockpiles.

Primary

Used to control the feed of +1500 mm x 0 run of mine materials to primary crushers or dump station

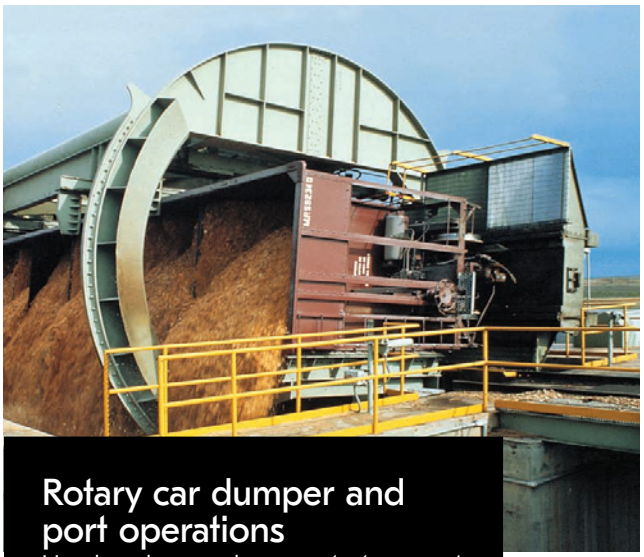


Secondary

Used under crushers, hoppers, and bins to act as a buffer to downstream equipment by controlling surges and regulating feed of 300 mm x 0 material

Tertiary

Typically utilized under silos and stockpiles to reclaim 250 mm x 0 materials from storage



Rotary car dumper and port operations

Used under car dumpers to transport material to storage, and in port operations to feed material to sea vessels

Pre-configured feeders

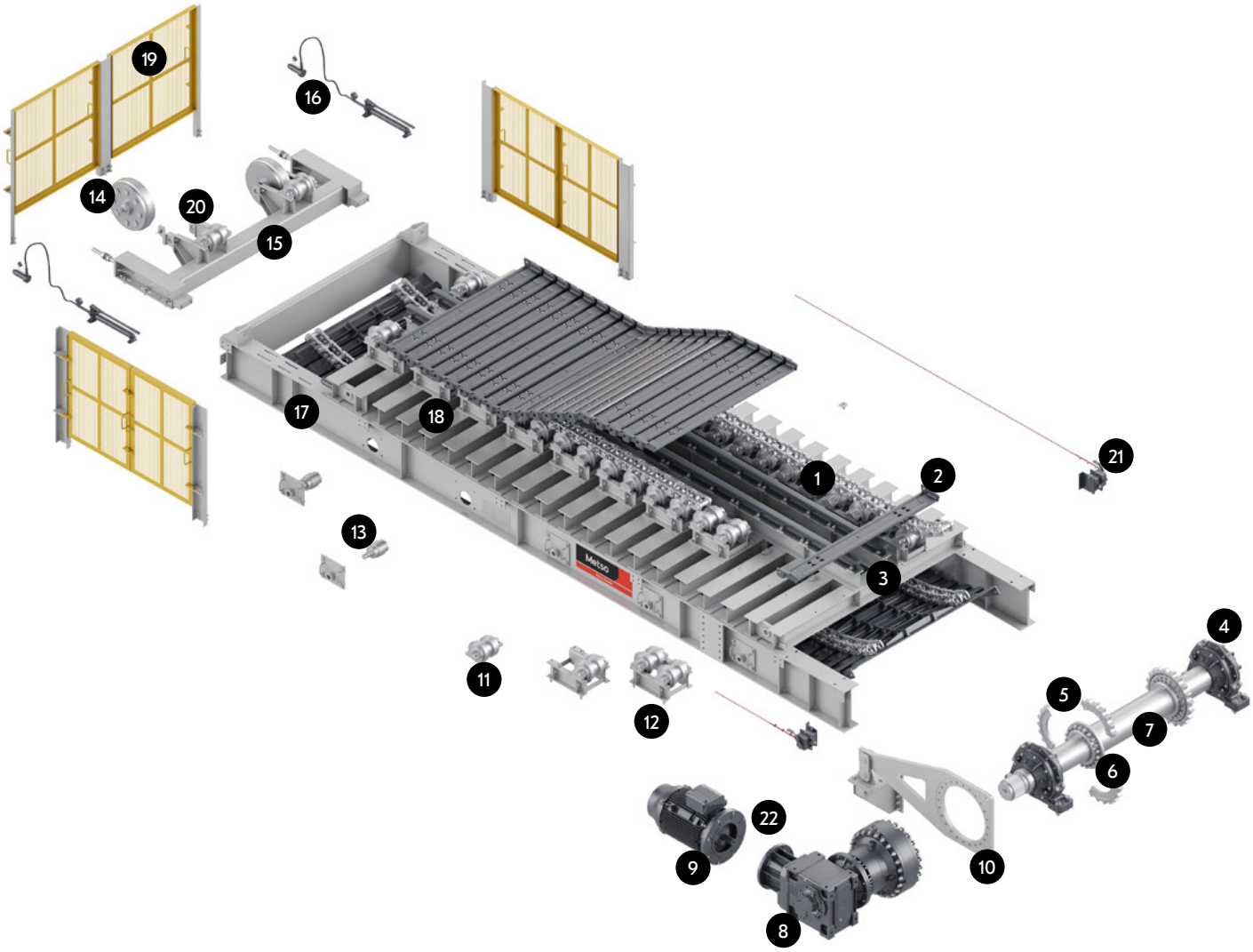
Metso offers apron feeders in various standard sizes featuring modular designs to fit any operational need.

MODEL	*AF4	*AF5	*AF8	*AF10	AF12	AF14	AF16	AF18
Technical specifications								
*Width (mm)	914-1524	1219-2134	1524-2438	2134-3048	2134-3048	2438-3353	2438-3353	*
*Length (mm)	2500-7900	3400-9700	8000-12200	8800-13000	8800-13000	10000-*	10000-*	*

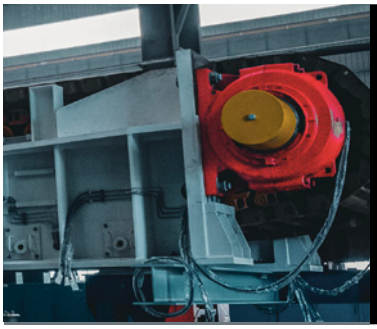
* Preconfigured equipment configuration
* Lengths are available for each feeder width

Apron feeder parts

Metso apron feeders are complex machines, comprised of a wide range of carefully engineered components.



1	**Chain**	Tractor style, sealed and greased for life
2	**Pans (flight)**	Cast manganese with deep profile, lifting holes and wear indication
3	**Impact rail(s)**	Hardened steel and reinforced for high impact
4	**Bearings**	30 degree split housings with spherical roller bearings and taconite seals
5	**Sprockets**	Hardened and reversible with odd number of teeth
6	**Hubs**	Precision machined with keyway
7	**Head shaft**	Forged high alloy shaft with precision spline drive connection
8	**Reducer / Gearbox**	Planetary style with spline connection from industry OEM
9	**Motor**	Inverter duty, constant torque $\geq$ IP55 NEMA and IE4 premium efficiency
10	**Torque arm / Linkage**	Connects to mainframe / no foundation interface required
11	**Carry rollers**	Tractor type / sealed and lubricated for life
12	**Roller modules**	Modular frames to simplify removal
13	**Return rollers**	Tractor type / sealed and lubricated for life
14	**Idler tail wheel**	Shaftless design / sealed and lubricated for life
15	**Take-up frame**	Heavy duty take-up weldment with idler wheel mounting blocks
16	**Take-up system**	Hydraulic cylinders and manual tensioning screw take-up
17	**Frame**	Robust heavy duty welded or bolted construction frame with lifting lug
18	**Crossbeams**	Properly spaced and aligned of supports with stiffeners
19	**Guards**	Hinged and removable safety tail and side guards requiring tool to open
20	**Zero speed switch**	Non-contact detection of zero/under speed tail wheel movement
21	**Emergency pullcord**	Safety pullcord for emergency trip and guard security
22	**Lubrication system**	Manual one point centralized header (automatic lubrication unit optional)



Metso high-quality components together ensure maximum productivity and uptime. Because every part is manufactured to the same exacting standards, and is built to last the harshest working conditions, there is no weak link.

Frame

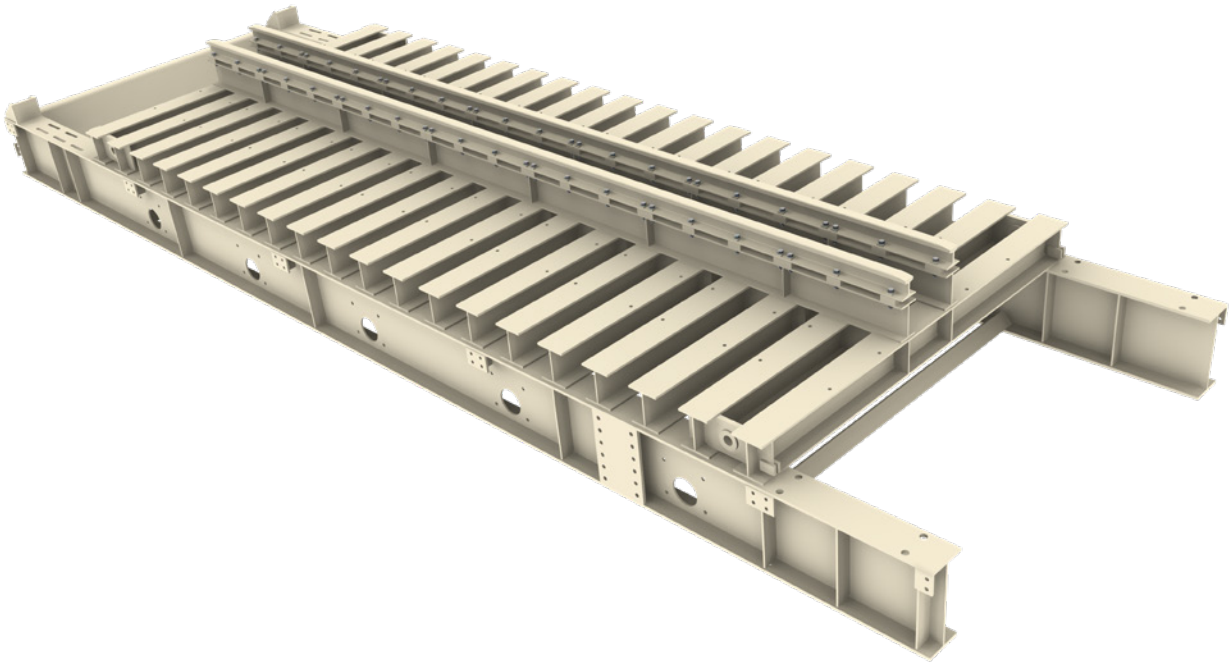
The heavy duty frame is bolted or welded and includes beams and cross members to provide rigid carrying roller and skirt support. Apron feeder frames are sized to handle the material load, heavy truck dump chock loads, dead material load and material build-up on the frame.

Impact rails are used to prevent permanent pan deformation during impact loading and provide clearance to prevent dragging flights.

Lifting lugs are welded near each corner of the feeder frame for lifting and transport.

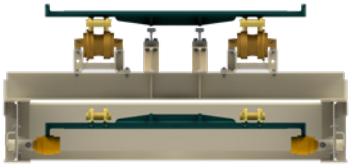
Main components		
S.No	Descriptions	Qty
1.	Main beam	2
2.	Cross beam	-
3.	Impact beam	1,2,3
4.	**Impact rail**	**1,2,3**

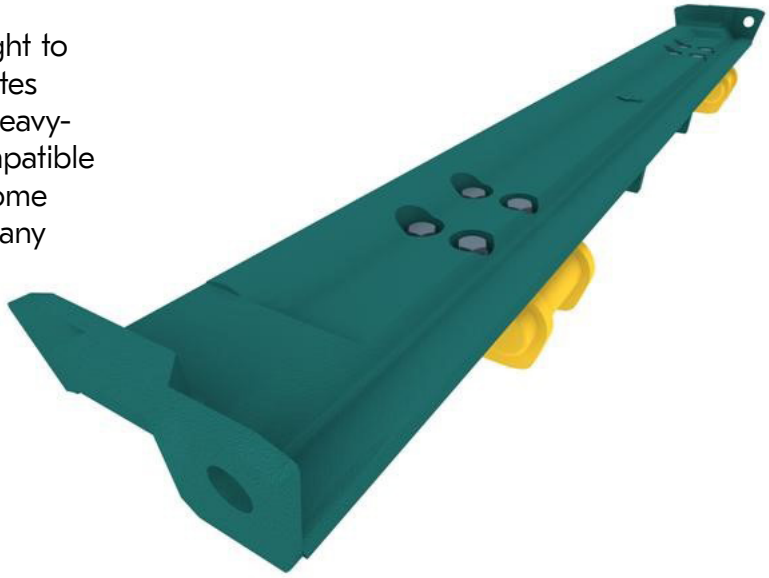
Impact rails		
S.No	Feeder width	No. of rails
1.	< 1524 mm	2
2.	1524 mm	1,2
3.	> 1524 mm	2
4.	> 2743 mm*	**3**



Feeder pans

Cast manganese pans are suitable for light to medium-duty applications from aggregates (e.g., minerals, sands and limestone) to heavy-duty mining (e.g., iron ore). Pans are compatible with legacy brands such as NICO and some Stephens-Adamson feeders as well as many third-party manufacturers.





Technical description

- Material: Cast manganese steel
- Color: Painted; varies
- Hardness: 500+ BHN
- Fastening method: Bolted
- Pan types: Standard and master pan

Installation

- Deck speed: < 0.45 m/s

Material properties

This standard product is made of cast manganese steel that hardens to over 500 BHN.

Cast pans/flights																			
AF model	AF4	AF4	AF5	AF5	AF8	AF8	AF8	AF8	AF10	AF10	AF10	AF12	AF12	AF12.5	AF14	AF14	AF16	AF16	AF18
Pan Thk	18	25	25	38	25	32	38	51	25	38	51	32	38	38	38	51	38	51	59
AF Width																			
610	✓	✓																	
762	✓	✓																	
914	✓	✓	✓	✓															
1067	✓	✓	✓	✓															
1219	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓					✓	
1372	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓			✓		✓	
1524	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓			✓		✓	
1829	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	
2134			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	
2438			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
2743						✓				✓	✓		✓	✓	✓	✓	✓	✓	✓
3048						✓				✓	✓		✓	✓	✓	✓		✓	
3353						✓				✓					✓				✓

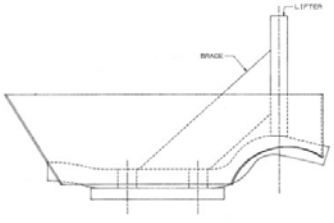
Formed stl. pans/flights									
AF model	AF4	AF4	AF5	AF5	AF5	AF8	AF10	AF10	AF12
Pan Thk	12	16	12	16	25	16	16	25	16
AF Width									
610	✓	✓	✓	✓	✓	✓			
762	✓	✓	✓	✓	✓	✓			
914	✓	✓	✓	✓	✓	✓			
1067	✓	✓	✓	✓	✓	✓			
1219	✓	✓	✓	✓	✓	✓	✓		
1372	✓	✓	✓	✓	✓	✓	✓	✓	✓
1524	✓	✓	✓	✓	✓	✓	✓	✓	✓
1829	✓		✓	✓		✓	✓	✓	✓
2134	✓		✓	✓		✓		✓	
2438	✓		✓	✓		✓		✓	
2743	✓		✓	✓					
3048	✓		✓	✓					
3353									

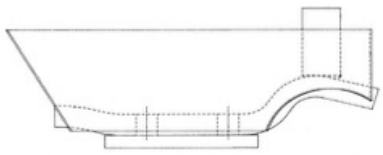
Metso can customize pans to meet any customer requirement or to suit third party apron feeders.

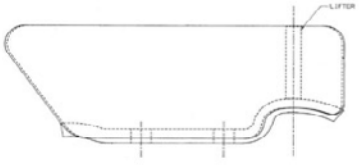
Optional pan customizations:

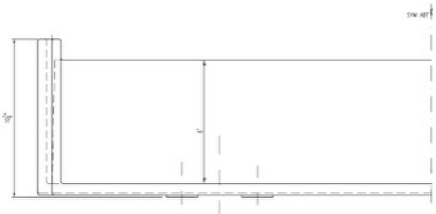
Side height

- 2″ (51 mm)
- 3″ (76 mm)
- 4″ (102 mm)
- 8″ (203 mm)
- 10″ (250 mm)









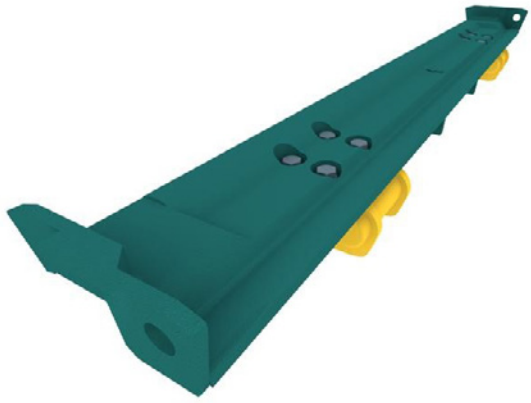
Lifter bar

Lifter bars are used when extracting fine and free flowing material and/or when the machine is inclined greater than 18 degrees.

Feeder pan hardware

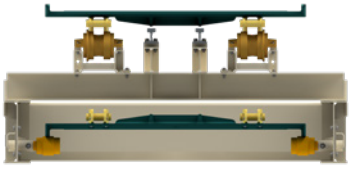
Cast manganese pans are fastened to the track chain with track hardware (rather than heavy duty bolts) and hex nuts with washers.

Metso hardware is compatible with major track chain manufacturers and legacy NICO & Stephens-Adamson components.



Description	AF model	Chain pitch (mm)	Weight (kg)	Pan thickness C (mm)
TRACK BOLTS w/ SQ NUT	AF4	140	0.1	18
TRACK SHOE BOLT, w/ SQ NUT	AF4	140	0.1	25
TRACK BOLTS w/ SQ NUT	AF5	171.4	0.2	25
TRACK BOLTS w/ SQ NUT	AF5	171.4	0.2	38
SCREW, CAP, HEX LG w/ SQ NUT	AF8	203.2	0.3	
HEX BOLT NYLOCK HEX NUT, FLAT WASHER	AF8	203.2	0.3	
SCREW, CAP, HEX LG w/ ELASTIC STOP NUT	AF10	215.9	0.5	38

The above table covers the standard Metso-supported models within the AF range.



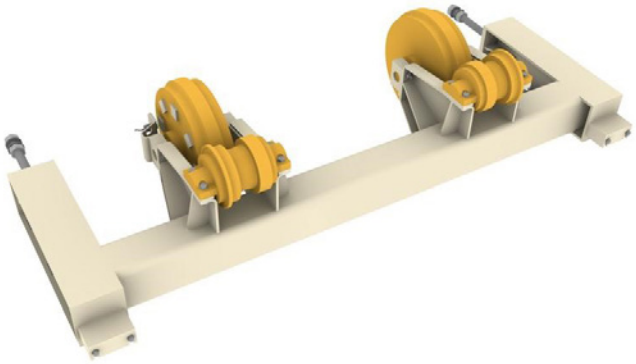
Technical description

- Material: Steel
- Color: Black oxide coating
- Hardness: 38-44 HRC
- Tensile strength: 122 kgf/mm
- Yield strength: 110 kgf/mm
- Pan types: Standard and master pan

Tail wheels

Return rollers are heat-treated, forged alloy steel hardened for long rim-wear.

The modular tail wheel design is compatible with current and legacy designs across all apron feeder models. Retrofit options available.



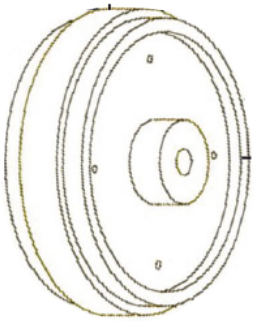
Description	AF model	Chain pitch (mm)	Weight (kg)	Mounting dimensions stub shaft Ø x bolt hole Ø
TAIL WHEEL	AF4	140		Support brackets
IDLER WHEEL 380MM DIA	AF4	140		Support brackets
IDLER WHEEL 380MM DIA	AF4	140		Support brackets
WHEEL, IDLER 475MM DIA	AF5	171.4	98.4	Stub shaft
IDLER	AF5	171.4	89.0	Stub shaft
IDLER WHEEL, 20" DIA	AF5	171.4	77.8	Stub shaft
IDLER WHEEL, 20" DIA	AF5	171.4	77.8	Stub shaft
IDLER WHEEL 475MM TREAD DIA	AF5	171.4	78.0	Stub shaft
		202.8		
IDLER WHEEL	AF10	215.9		
IDLER WHEEL 720MM DIA	AF10	215.9		
TAIL WHEEL ASSEMBLY	AF10	215.9		Mounting blocks
IDLER FRONT IDLER	AF14	260.3		
IDLER	AF14	260.3		

Technical description

- Material: Steel alloy
- Color: Black or yellow
- Hardness: 38-44 HRC

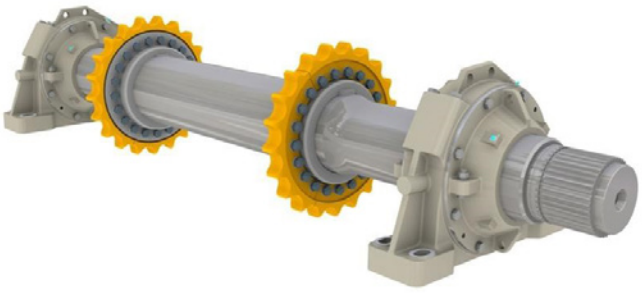
Installation

- Deck speed: < 0.45 m/s



Bearing assembly

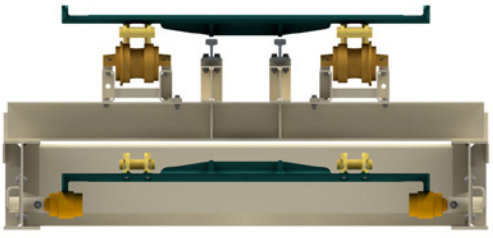
Spherical roller bearings are mounted on the head shaft. The bearings are grease lubricated, and grease reservoirs are included in the bearing housing and end cap design. The bearing design also includes adapter sleeves, and newer bearing designs have a 30 degree split to increase load-carrying capacity.

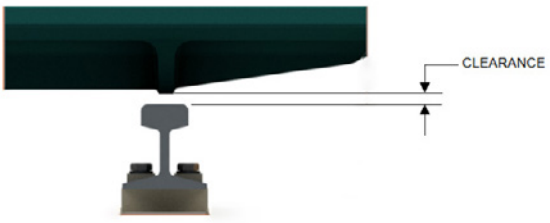


Impact rails

Apron feeders may have one, two or three impact rails mounted between the top carrying rollers. Impact rails are designed to prevent permanent flight deformation during heavy material loading and impact.

The feeder is normally supplied with a 3 mm (1/8") gap between the bottom of the pan flight and the top of the impact rail. This clearance should be maintained during normal operation.

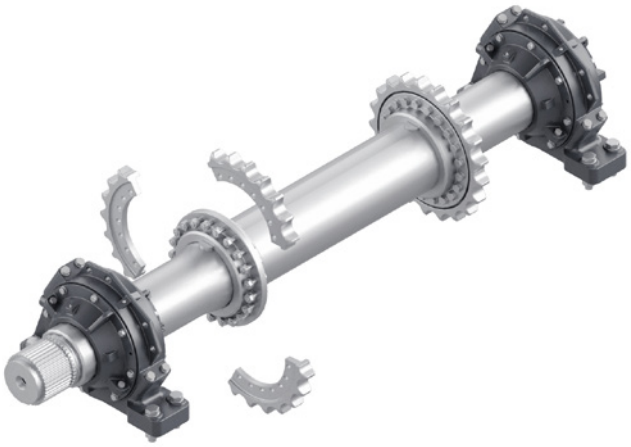




Impact rails		
S.No	Feeder width	No. of rails
1.	< 1524 mm	2
2.	1524 mm	1,2
3.	> 1524 mm	2
4.	> 2743 mm*	3

Sprockets

Segmented, reversible cast alloy steel sprockets are compatible with all major track chain manufacturers.



Description	AF model	Chain pitch (mm)	Weight (kg)	Teeth nos.	Pitch dia. (mm)	Sprocket mounting (no. x bolt Ø x bolt circle Ø)
SEGMENT , SEGMENTAL	AF4	140	33.1	21	474.660	9 x M18 x 324
SEGMENTAL SPROCKET, 21 TOOTH AF4 SALT	AF4	140	23.2	21	474.630	9 x M20 x 324
SPROCKET FL4 - 21 TEETH - 475 PD	AF4	140	24.9	21	475.000	15 x M16 x 325
SPROCKET SEGMENTAL FD4	AF5	171.4	58.5	21	581.025	9 x 3/4"-16 UNF x 400
SPROCKET SEGMENT SPROCKET, SEGMENTAL FO@	AF5	171.4	49.4	21	580.365	9 x 3/4"-16 UNF x 400
SPROCKET SEGMENTED, 21 TEETH	AF5	171.4	38.8	21	580.991	21 x M20 x 400
SPROCKET SEGMENTAL, DWG. FW-150, MK. FW@	AF8	203.2	105.0	21	688.975	15 x 3/4"-16 UNF x 467
SPROCKET - D6 - 21 TEETH	AF8	203.2	73.6	21	689.000	21 x M24 x 500
SPROCKET , AF8, 21 TOOTH	AF8	203.2	128	21	688.980	15 x M20 x 467
SPROCKET SEGMENT AL , FAB, DWG. AF8-F-23	AF8	203.2	102.6	23	751.840	21 x 3/4"-16 UNF x 502
SPROCKET D7 - 21 TEETH	AF10	215.9	76.5	21	732.470	24 x M24 x 520
	AF10	215.9				
	AF10	215.9				

The above table covers the standard Metso-supported models within the AF range.

Material properties

This basic standard product is made of cast alloy steel with a hardness of approximately 330 BHN.

Drive

Apron feeders are powered by one of two drive assembly types:
the electro-mechanical drive assembly or the hydraulic drive assembly.

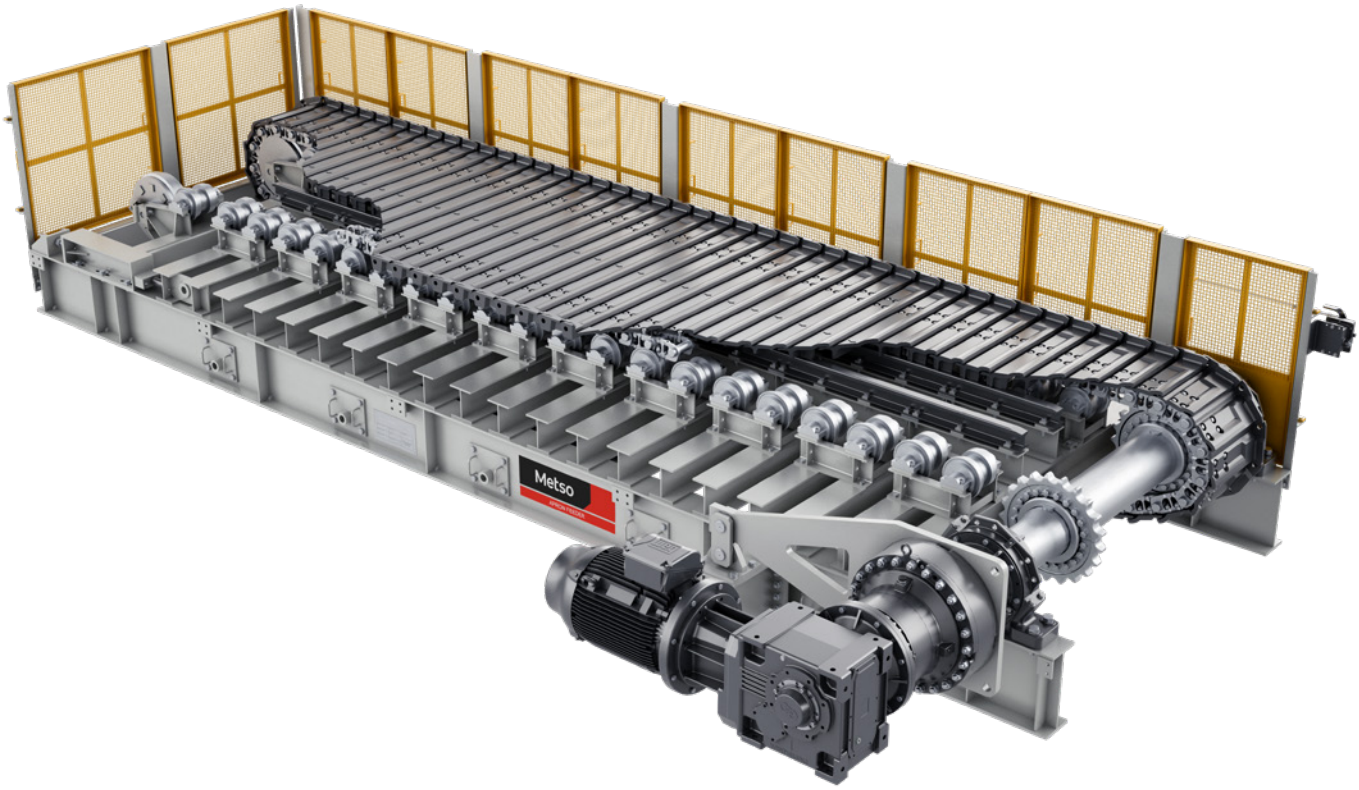
The electro-mechanical drive assembly is comprised of an electric motor, gearbox and variable frequency drive. These assemblies operate at speeds ranging between 10% to 110% of nominal speed with approximately five to six stops per hour. The electro-mechanical assembly requires less of an overall floor footprint and is easier to mount and remove. These are also typically less expensive than hydraulic drives and do not require specialized maintenance personnel.

A hydraulic drive assembly is comprised of the hydraulic motor, HPU and required piping. Hydraulic drives operate at variable speeds ranging from 1% to 100% of operating speed with infinite stops and starts per hour. High pressure relief valves protect the internal system and accumulators even out the drive's energy requirements.

The hydraulic pump motor can be sized to meet the average system load, which can be significantly smaller than those of electro-mechanical systems, where the motor is sized for peak loads.

The overhang weight mounted on the head shaft is normally smaller than electro-mechanical torque arm-mounted drives.

With a cost of approximately four times that of an electro-mechanical drive, hydraulic drive assemblies also require specialized maintenance personnel.



Carrying rollers

Return rollers are heat-treated, forged alloy steel rollers hardened for long rim-wear.

The modular carrying roller design is compatible with current and legacy designs across all apron feeder models. Retrofit options available.

Description	AF model	Chain pitch (mm)	Weight (kg)	No. of flanges	Outer roller dia. (mm)
ROLLER, TRACK VA1839	AF4	140	15.7	1	160
CARRYING ROLLER , FOR FL4 CHAIN (VA380A)	AF4	140	16.0	1	160
CARRYING ROLLER T010519 USCO/TSI	AF4	140	16.1	1/2	160
ROLLER, TRACK CR7415	AF5	171.4	36.4	1/2	203
ROLLER, CARRY APRON FEEDER, D4	AF5	171.4	36.0	1/2	203
ROLLER, TRACK A01040A2M00U@	AF5	171.4	36.7	2	203
ROLLER UPPER TRACK, CR-1328-E/N	AF5	171.4	37.0	2	203
CARRYING ROLLER D6, TRACTOR TYPE	AF8	202.8	52.6	1	247
ROLLER UPPER TRACK, CR6088	AF8	202.8	45.4	1	247
ROLLER, TRACK 2880934	AF8	202.8	45.4	1	240
ROLLERS CR7591	AF8	202.8	49.3	1/2	246
ROLLER, CARRY D7	AF10	215.9	61.3	1	260

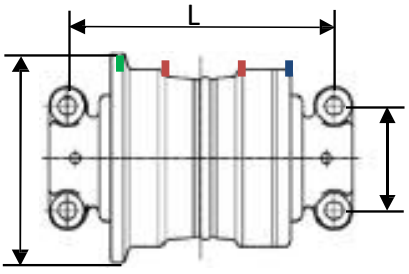
The above table covers the standard Metso-supported models within the AF range.

Technical description

- Material: Steel alloy
- Color: Black or yellow
- Hardness: 38-44 HRC

Installation

- Deck speed: < 0.45 m/s

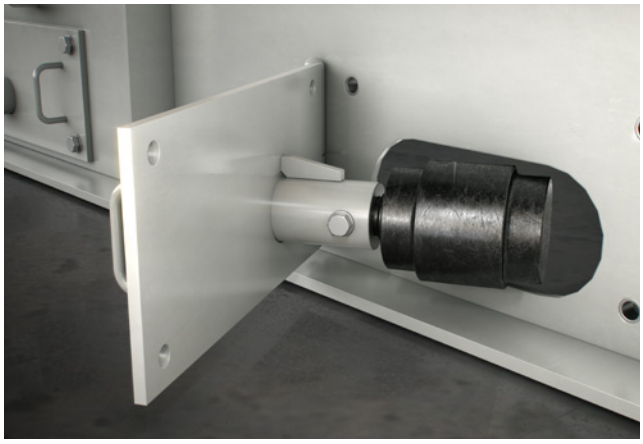


Only Green = Half flange
Green + Blue = Single flange
Green + Blue + Red = Double flange

Return rollers

Return rollers are heat-treated, forged alloy steel rollers hardened for long rim-wear.

The modular design is compatible with current and legacy designs across multiple apron feeder models. Retrofit options available.



Description	AF model	Chain pitch (mm)	Weight (kg)	Outer roller dia. (mm)	Mounting dimension stub shaft Ø x bolt hole Ø
ROLLER ,SUB-ASSEMBLY 942-0-4-302-02	AF4	140	32.4	228	41.2 x 12
TIRE AND ROLLER ASSEMBLY , DWG. FX1164	AF4	140	10.4	181	
ROLLER, RETURN ,DRILLED	AF4, AF5, AF8	Varies	20.4	140	46 x 17.5
ROLLER RETURN 140 DIA	AF4, AF5, AF8	Varies	18.7	140	46 x 17.5
ROLLER , RETURN DETAIL	AF4, AF5, AF8	Varies	20.4	140	46 x 17.5
ROLLER 6K9880 / CR2880A	AF5	171.4	16.3	151	41.4 x 12
ROLLER , RETURN BERCO KB-90A	AF5	171.4	20.8	140	46 x 17.5
ROLLER, RETURN	AF5	171.4	38.1	209	41.4 x 12
	AF8	202.8			
	AF8	202.8			
	AF8	202.8			
	AF8	202.8			
	AF10	215.9			

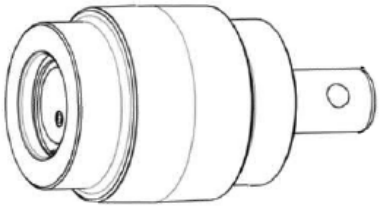
The above table covers the standard Metso-supported models within the AF range.

Technical description

- Material: Alloy steel
- Color: Yellow
- Hardness: 38-44 HRC
- Tensile strength: 122 kgf/mm
- Apron feeder models: Varies

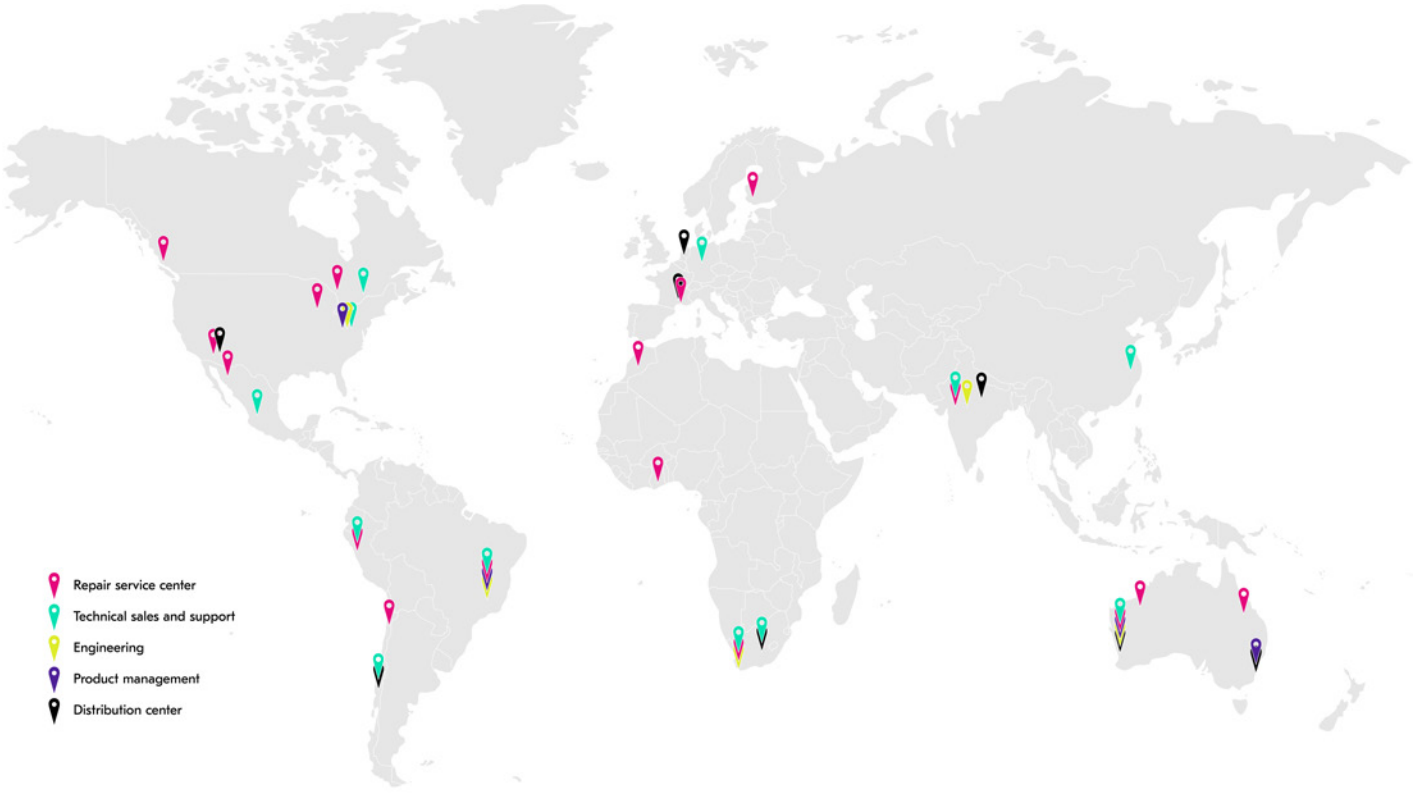
Installation

- Deck speed: < 0.45 m/s



A comprehensive product range including Life Cycle Services, maintenance, inspections and training help ensure the integrity of your operations.

BMH global resources



Inspection services

Feeder inspection packages

Regular inspections help prevent unplanned mechanical and electrical failures from having a direct effect on apron feeder availability and productivity.

Equipment inspections include data analysis and preparation, on-site equipment evaluation and a full inspection report. Follow-up actions are agreed with the customer. Inspection services can be included as part of a long-term maintenance agreement.

Inspection data is collected digitally and allows inspectors to capture thermal images to support decision-making. A preliminary report is provided by email when the inspection is complete, followed by a full report of all equipment data gathered during the inspection and analyzed by Metso experts in-depth.

	1. Visuals and vitals	2. Mechanical verification	3. Comprehensive
Core benefit	A quick way to understand the overall condition of your equipment	Maximized feeder availability through a more detailed inspection with additional adjustments and services	Maximized apron feeder performance and equipment longevity
Time required	Total inspection time - 1 shift	Total inspection time - 2 shifts	Total inspection time - 3 to 4 shifts
Inspection frequency recommendation	Quarterly	Annually during planned shutdown	Every 2-3 years and immediately for older machines that have not been inspected recently
Inspection offering	Inspection done during operation and quick shutdown. OEM visual inspection of the equipment, mainly during operation. Identify safety hazards, overall performance results, maintenance intervals, misalignment, leakages and hydraulic pressures. Completed over 1 shift with equipment running including short stoppages. Historical data used to help predict equipment component performance over time. Detailed future inspections recommended if needed	Full mechanical inspection with apron feeder operating and shutdown. Inspection package includes visual and vitals inspection as well as OEM inspection with guards and covers removed, structures/ components inspection, additional tests, measurements and services, and mechanical adjustments as required	Full visual, vitals and mechanical inspections including the adjustment on structures and hydraulics. Performed over 3-4 shifts with apron feeder stopped. Additional inspections, measurements and services performed such as: hydraulic and mechanical components condition inspection - including gear, electrical motor detailed measurements and condition analysis, structural and component wear analysis, oil and lubrication analysis, and integrated process for digital gear inspection available on request. Modernizations and upgrade recommendations, spare parts audit and availability check

			Package 1	Package 2	Package 3
Component	Task	Status	Visuals and vitals	Mechanical	Comprehensive
General					
Visual check: service platforms and drive guards	Guard tags, handrails and platform condition			■	■
Visual check: spills, oil and grease leaks	Oil/grease spillage on the working platforms, pathways			■	■
Visual check: condition of hydraulic hoses	Physical damages, leaks from ends and open areas			■	■
Deck frame assembly					
Visual inspection: main frame, impact rails, carrying and return rollers	Structural condition, missing rails, fasteners, physical wear and tear			■	■
Measure: alignment/condition of carrying rollers	Contact with chain, fasteners, bolts, wear on surface and flange			■	■
Check: free movement of carrying rollers	Free movement of rollers (internal bearing condition)			■	■
Measure: alignment of return rollers	Contact with chain, fasteners, bolts, wear on surface and roller edge			■	■
Measure: wear and alignment of impact rail	Wear on the rail head, damaged rails, straightness, missing bolts			■	■
Measure: gap between impact rails and pads	Gap as per the minimum clearance to be maintained			■	■
Measure: alignment of main frame	Level of main frame, squareness of frame, bolt tightness				■
Headshaft assembly (drive unit)					
Check: condition of driveshaft & segmental sprockets	Physical damage, deformity, rust, pitting, sprocket contact with chain			■	■
Visual inspection: input & output coupling	Smooth operation			■	■
Visual inspection: torque arm	Unusual vibrations, missing bolts			■	■
Visual inspection: plummer blocks & bearings	Physical damage, unusual noise in bearings, improper lubrication			■	■
Check: mounting of sprocket with hub and hub assembly	Tightness of sprocket, bolts and the hub assembly with driveshaft			■	■
Measure: bearing temperature	Bearing temperature during operation			■	■
Visual inspection: motor	Mounting bolts, abnormal noise, bearing failure, fans, vibrations			■	■
Measure: motor for operational condition	Current voltage, bearing and coil temperature			■	■
Visual inspection: reducer	Mounting fasteners, condition of couplings			■	■
Visual inspection: reducer oil level and leaks	Oil level, viscosity, leaks from shaft, bearings			■	■
Measure: reducer temperature and noise	Temperature and noise from bearings and intermediate gears			■	■
Measure: bearing tightness	Tightness of bearing with driveshaft (condition of sleeve)			■	■
Visual inspection: internal gears	Tooth damage, pitting, deformation, missing teeth				■
Check: alignment of input and output couplings	Fit of couplings with input and output shaft				■
Measure: sprocket segments wear	Wear of sprocket tooth and contact with chain				■
Measure: condition of headshaft	Physical condition (ultrasound testing)				■
Tail wheel assembly					
Visual inspection: tail wheel and takeup frame	Any physical deformation, structural damage or misalignment			■	■
Check: condition of take-up screw	Condition of threads and proper measurement of both screws			■	■
Check: condition of bearings/plummer blocks (if applicable)	Bearing temperature during operation/ proper lubrication			■	■
Check: mounting and alignment of tail wheel	Proper mounting, bolts, rotation, frame alignment, squareness			■	■
Measure: take-up frame	Alignment of take-up frame with tail wheel frame				■
Measure: tail wheel	Head wear (present condition with respect to new)				■

			Package 1	Package 2	Package 3
Component	Task	Status	Visuals and vitals	Mechanical	Comprehensive
Pan & chain					
Visual inspection: pan and chain	Excessive sag in chain, deformation of pan, missing pans	Operation	■	■	■
Check: condition of master pin	Loose or missing pins	Operation	■	■	■
Check: condition of master pan	Wear, deformation and proper fit	Shutdown		■	■
Measure: physical condition of the pans	Damaged, worn or bent pans	Shutdown		■	■
Measure: pan pad wear	Pad wear	Shutdown		■	■
Measure: gap between pan and impact rail	Gap as per drawings/manual	Shutdown		■	■
Measure: gap between pan pads & side skirt	Sufficient gap to be maintained	Shutdown		■	■
Measure: chain elongation and quantity of worn sections	Chain elongation, marked links to be replaced	Shutdown			■
Measure: chain wear & sagginess	Worn links, bushes, chain tension	Shutdown			■
Dribble conveyor					
Measure: belt condition and alignment on pulleys and rollers	Tracking and trailing on the rollers and pulleys	Operation	■	■	■
Measure: pulley bearings operational condition	Check for any unwanted noise	Operation	■	■	■
Visual inspection: pulley bearings condition	Lubrication and physical condition	Shutdown	■	■	■
Measure: missing rollers and alignment of frames	Alignment of brackets, tightness of mounting fasteners	Operation	■	■	■
Measure: rollers for wear	Wear and tear of outer shell, bearings condition	Shutdown	■	■	■
Visual inspection: drive arrangement	Proper operation	Operation	■	■	■
Check: condition of motor/geared motor	Proper input current, abnormality in the gearbox	Shutdown	■	■	■
Visual inspection: belt condition	Trailing marks, belt surface, cracks, cuts, splices and edges	Shutdown		■	■
Visual inspection: pulley condition	Physical condition of drums, shaft, liners	Shutdown		■	■
Measure: pulley linings	Thickness of liners, missing ceramic bits	Shutdown		■	■
Measure: pulley operational condition and alignment	Eccentricity, alignment, block levels, ringfeeder tightness	Operation			■
Scraper chain (if applicable)					
Visual inspection: scraper chain	Damaged or missing chain links	Operation	■	■	■
Visual inspection: scraper chain drive	Proper operation	Operation	■	■	■
Measure: condition of scrapers	Damaged or bent scraper arms	Operation	■	■	■
Inspection: geared motor	Proper lubrication & operation	Operation	■	■	■
Measure: elongation of scraper chain links	Elongation of the chain links with respect to original	Shutdown		■	■
Side skirts					
Visual inspection: skirt pads	Gap and material leakage	Operation	■	■	■
Check: condition of skirt material	Deformation, liner wear or missing bolts	Shutdown		■	■
Hydraulic power pack unit (if applicable)					
Visual inspection: hydraulic power unit	Physical damages, leaks, motor and pump condition	Shutdown		■	■
Inspection: motor and pump	Motor condition, mounting and pump mounting with coupler	Shutdown		■	■
Check: main manifold block	Condition and leakage, solenoid & proportional valves	Shutdown		■	■
Check: other safety switches	Operation of float and pressure switch, gauges and feedback	Shutdown		■	■

More than a century of customer collaboration

In addition to apron feeder parts and refurbishments, Metso offers comprehensive services.

Life Cycle Services

Life Cycle Services (LCS) take the entire range of Metso services and bundles them into customizable, manageable packages, ranging from basic to more complete solutions, depending on need. Packages are equipped to cover single-event equipment shutdowns or span multiple years, measured against strict KPIs.

Field services

Metso offers field services for maintenance, repair, installation and refurbishment needs. Each service is fully customizable and covers all Metso and third party apron feeders.

Inspections and equipment audits

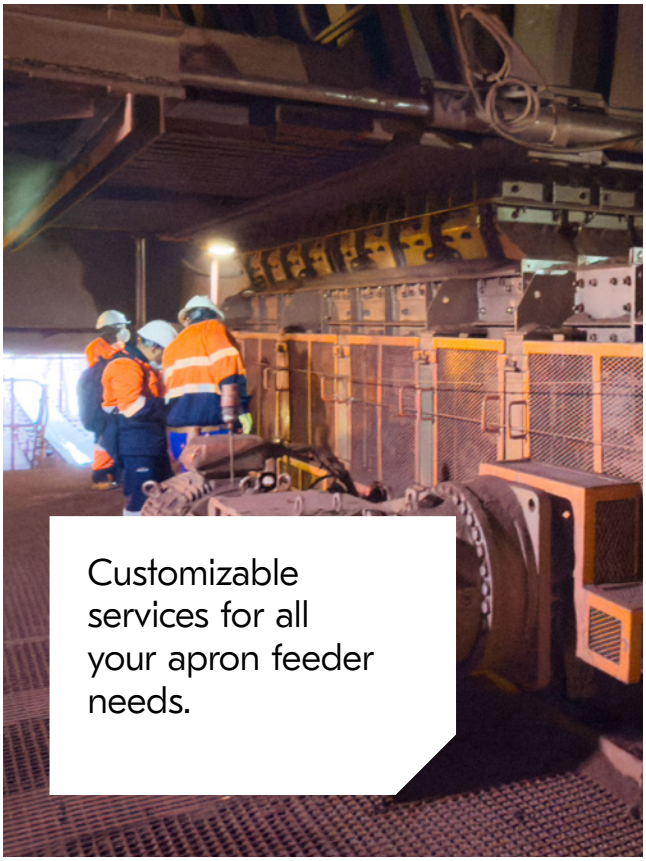
Regular inspections help prevent unplanned mechanical and electrical failures from having a direct effect on an apron feeder's availability and productivity.

- Certified global service team
- Expert assessment and recommendations
- Minimized downtime

Training

Metso offers training programs based on expert knowledge of equipment and maintenance procedures. Training programs include online e-training, hands-on modules, specialized courses on apron feeder, along with safety and maintenance training in accordance with global best practices.

- Improved employee motivation
- Full utilization of equipment features
- Maximized productivity
- Safer operation



Customizable services for all your apron feeder needs.

Maintenance inspection schedule

Metso's scheduled maintenance services make it easier to ensure that your equipment is running safely, securely, and efficiently over its entire lifetime.

MONTHLY MAINTENANCE SCHEDULE	
PANS & CHAIN	Check chain/pan bolts for proper tightness 100 hours after start-up, then as needed
	Check system alignment
	Check clearance between pans and hopper skirt liners (about 13 mm)
PILLOW BLOCKS	Check for grease leakages
	Check vibration and temperature level
DRIVE	Check oil level in gear box
	Check coupling misalignment

SEMI-ANNUAL MAINTENANCE SCHEDULE	
PILLOW BLOCKS	Check for overheating
	Check for grease contamination
	Inspect retainers
LUBE SYSTEM	Make sure all components are working properly (if applicable)
SPROCKETS	Check wear on teeth
REDUCER	Check oil level in gear box

ANNUAL MAINTENANCE SCHEDULE	
PILLOW BLOCKS	Replace grease
CHAIN	Check sag between chain and rollers (40-70 mm)
	Check clearance between pans and impact rails (3 mm or 1/8")
ROLLERS	Check the wear
BOLTS	Check all bolted connections for proper tightness

Critical spare parts

Maximizing productivity means keeping spare parts on hand. In the event of a part malfunction, good stock-keeping minimizes downtime and gets you running quickly.

Apron feeder AF5, AF8 and AF10

2 years recommended spares

	Description	Quantity	Spares Type			Remarks
			E	O	S	
1	Feeder pans	Refer below	•			
2	Carrying rollers	Refer below	•			
3	Return rollers	Refer below	•			
4	Tail/Idler wheel	2	•			
5	Track chain with fasteners	2 strands		•		Complete set
6	Segmented sprocket	2	•			
7	Head shaft bearing	2		•		
8	Gearbox	1			•	Consult Metso
9	Motor	1			•	Consult Metso

E: Emergency
O: Operational
S: Strategic

	Model	Length (mm)										
	AF5	3400	4300	5200	6100	7000	7900	8800	9700			
	AF8						8000	9050	10100	11150	12200	
	AF10							8800	9850	10900	11950	13000
Feeder pans	AF5	2	2	3	3	4	4	5	5			
	AF8						2	2	3	3	4	
	AF10							5	5	6	6	7
Carrying rollers	AF5	4	4	6	6	8	8	10	10			
	AF8						4	4	6	6	8	
	AF10							10	10	12	12	14
Return rollers	AF5	2	2	2	2	4	4	4	4			
	AF8						2	2	2	2	4	
	AF10							4	4	6	6	6

- These are suggested spare parts for the stated apron feeder.
- The stated quantities are for per feeder.
- A detailed list of drive component parts is issued after order placement.
- When replacing feeder pans, track chain fasteners also need to be replaced and can be ordered separately.

Apron feeder refurbishment

Apron feeders are critical to the continuous flow of material through a plant. Apron feeder parts and services keep equipment operating at peak efficiency.

Metso offers an apron feeder repair to refurbish equipment components and extend machine service life.

Refurbishment services include careful disassembly, inspection, repair and replacement of worn or damaged components to return the apron feeder to optimal working condition. Units are restored using OEM parts to ensure Metso quality and performance, backed by our global professional technical support team.

Working toward sustainability
The apron feeder restoration program minimizes the need to manufacture new parts to support sustainability targets. The refurbishment program also helps to improve equipment reliability and reduce operating costs.

Equipment warranty
Metso offers a standard factory warranty on all parts and services performed during apron feeder restoration.

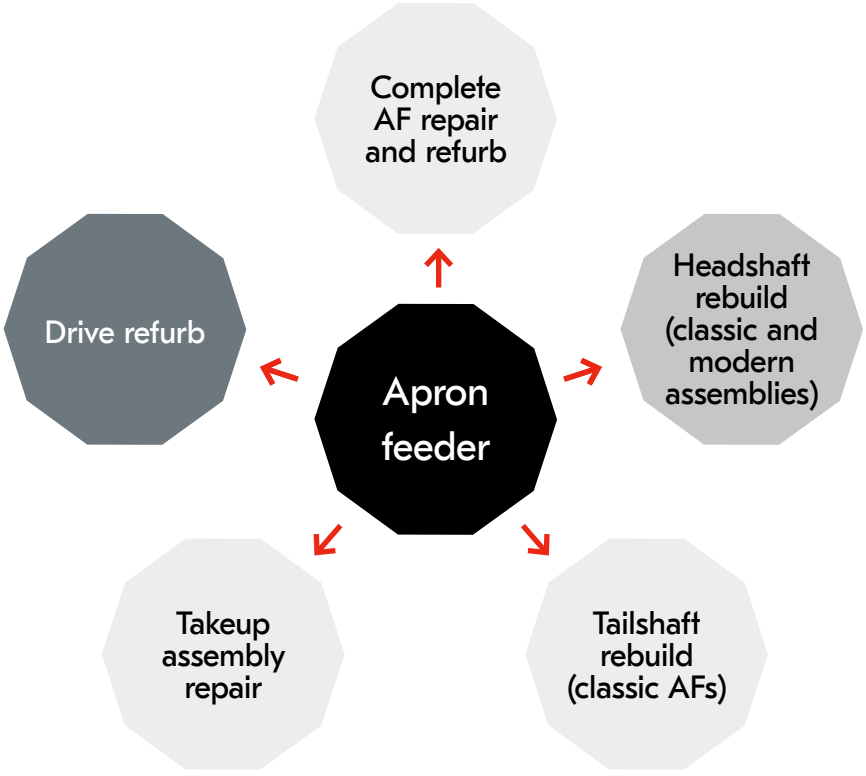
Optional upgrade
In addition to a full unit restoration plan, optional upgrades are available to improve apron feeder performance.

Refurbishment process

Condition evaluation
During the apron feeder refurbishment process, a comprehensive evaluation lubrication system and frame is performed to assess its condition. A detailed report is provided to describe the required refurbishment details.

Return
The restored apron feeder or assemblies are prepared for shipping and short term storage for return to the customer.

Repairs product portfolio



Complete AF repair and refurb
- Parts description: all AF parts, frame excluded
- Labor description: complete teardown, inspect all parts, weld repair, machining (possibly), sandblast and paint, assembly, alignment, final inspection
- Priority of repair: average; repeatable, however not many sold per year, high margin parts and labor

Headshaft rebuild (classic and modern AFs)
- Parts description: sprockets, bearings, bearing housings, seals, hubs (possibly), shaft (possibly)
- Labor description: teardown, inspect, (possibly) blast and paint, assembly, final inspection
- Priority of repair: high; most common refurb, high margin parts, repeatable labor and sales

Tailshaft rebuild (classic AFs)
- Parts description: idlers, bearings, bearing housings, seals, shaft (possibly)
- Labor description: teardown, inspect, (possibly) blast and paint, assembly, final inspection
- Priority of repair: low; classic equipment, minimal sales

Takeup assembly repair and refurb
- Parts description: idlers, carry rollers, frame mods
- Labor description: teardown, inspect, (possibly) blast and paint, assembly, final inspection
- Priority of repair: low; minimal sales, not typically repaired (wear parts are easy to replace)

Drive refurb
- Parts description: reducer, motor
- Labor description: 3rd party strip and quote
- Priority of repair: low; low margin, low possibility of sales, 3rd party interactions

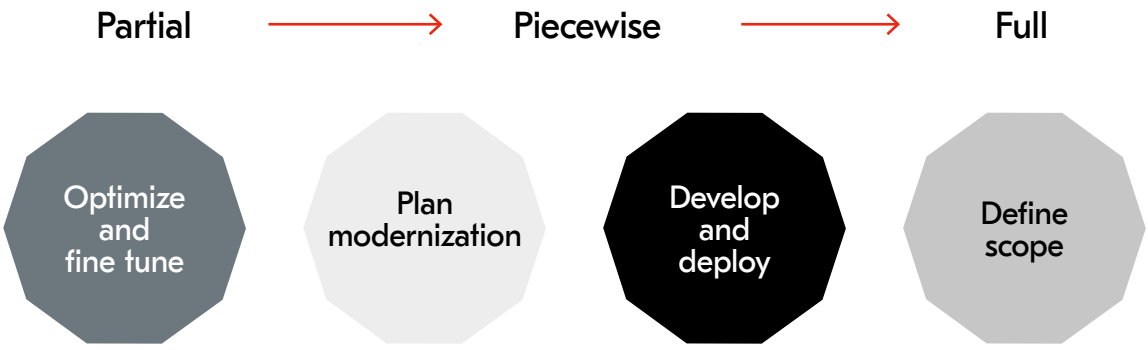
Full suite of upgrade and modernization options for aging machines

Efficient strategic modernization

Metso's bulk materials handling electrical and instrumentation team has the experience and expertise to make your legacy system upgrades smarter and more efficient, including:

- Control system architecture, design, development, testing and integration
- PLC, SCADA and HMI software development
- Functional safety IEC61508 design consultancy
- AC/DC motor migration
- VSD/VFD drive solutions
- MV/LV switchgear and MCC design
- Panel design calculations, cabling and mounting strategies
- Documentation

Our team has standard, plug-and-play hardware and reusable control logic library modules that can be optimized to suit your needs. Our goal is to provide a packaged solution that fits your existing ecosystem and delivers better return on your investment.



Metso is an industry leader in delivering solutions to tier 1 mining companies and non-mining industries worldwide.

In mining, time is money, and sudden controller or I/O module obsolescence or end-of-life notifications can happen at any time. That's why early modernization planning is essential to keep your systems running and achieving your production targets.

Metso's modernization solutions feature advanced platforms from Rockwell, Siemens, Schneider, ABB and others, and can integrate custom requirements from other preferred manufacturers on request. Our expertise allows us to provide end-to-end support including hardware, software and architecture upgrades using advanced technologies to best serve our customers. We can work with you to develop partial, staged or full system updates.

Key drivers for PLC modernization:

- End of life
- System upgrades
- Obsolescence
- Retrofits and overhauls
- New technology
- Plant expansion

SCADA faceplates

Hardware engineering
- Upgrade legacy PLC controlled systems
- VSD/AC-DC motor migration
- Relay logic conversion
- Controller upgrades
- Communication module upgrades
- I/O module upgrades

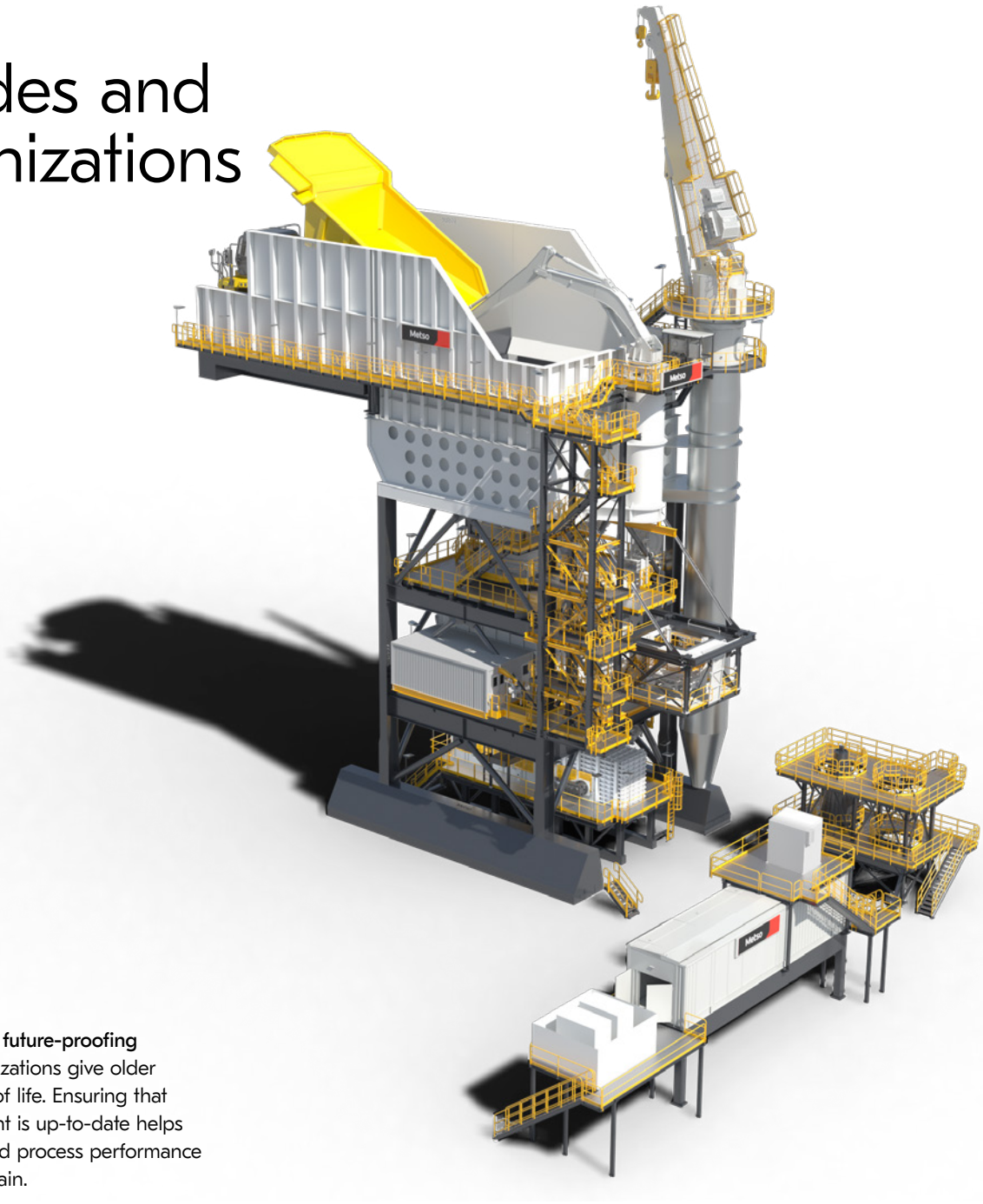
Software engineering
- Software upgrades
- Communication protocol upgrades
- Code conversion
- HMI faceplate updates
- Security updates
- Software patches

Site audits / recommendations
- Installation / commissioning
- Enhanced network connectivity
- Resolution of pain points

Sensor upgrades

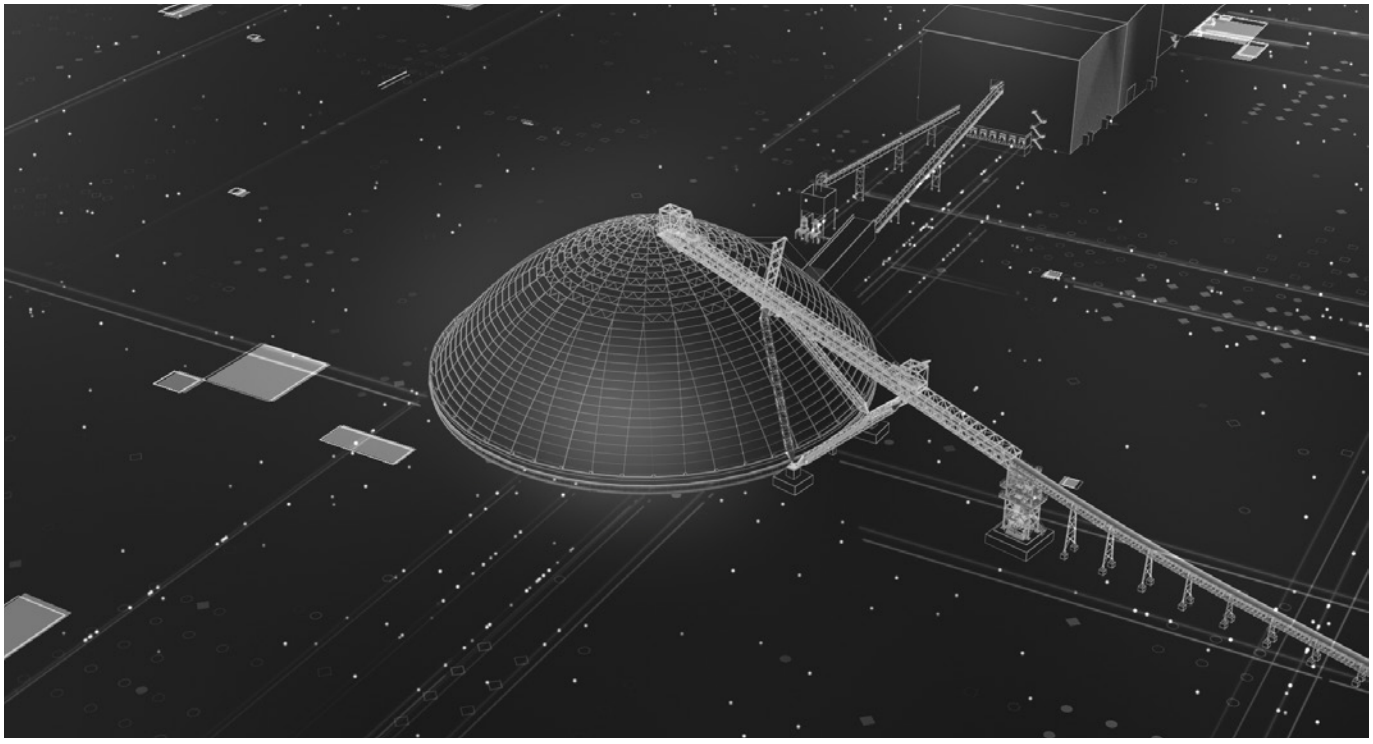
Sensors | Field devices | VSD | Motors

Upgrades and modernizations



Lifespan extension and future-proofing
Upgrades and modernizations give older machines a new lease of life. Ensuring that apron feeder equipment is up-to-date helps to increase machine and process performance throughout the flow chain.

Upgrade	Upgrade Features	Core benefit
Drive and head shaft	Direct drive, variable speed, support base not needed	Reduced footprint, less spares required, easier to maintain
Head shaft bearings	Self aligning bearings, mounted in cast steel housings	Minimizes chances for misalignment, increased bearing life
Modular top rollers	Modular rollers sealed and lubricated for life	Easier to change out modular sections.
Improved drive sprockets	Three piece segmented design	Longer life, easier to replace than older solid piece sprockets
Tail wheel assembly	Shaftless design with tractor wheel	No need for tail shaft or traditional bearings, easier to change out and maintain
Cast manganese pans	"Work hardened" to 500 brinell, skirt seal built into pan	Minimizes thinning or flexing of the pans through wear and tear
Return rollers	Tractor style rollers sealed and lubricated for life	Less lubrication, can replace without removing long shafts or bearings



Apron feeder upgrades

Improve reliability, maintenance, efficiency and safety with customized retrofit solutions

Existing apron feeders may provide limited reliability and performance, require extensive repairs or difficult maintenance tactics, and have poor parts availability due to obsolescence. This can increase unexpected failure risks and impact throughput due to unplanned downtime.

The Metso solution

Metso can identify apron feeder parts that are worn, prone to failure, or need immediate attention, and recommend upgrade, retrofit and refurbishment options to get equipment back up and running.

These may include:

- Main drive and head shaft
- Tail wheel and take-up
- Manganese pans
- Modular carrying and return rollers

A hopper/bin material flow study is available to optimize machine performance.

Additional services include key component inspections, parts installation and repairs, and Life Cycle Services including long-term service agreements.

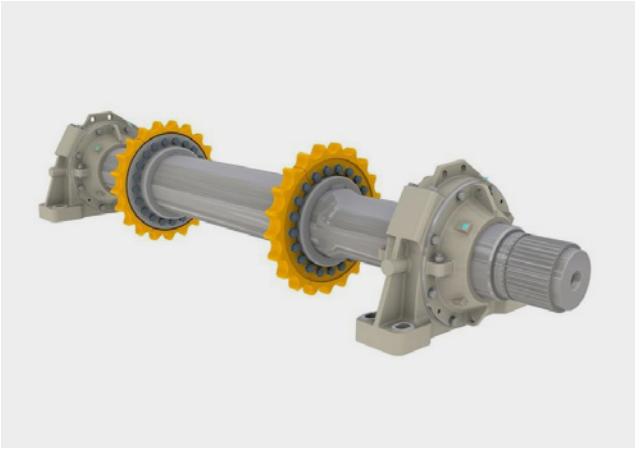
Benefits

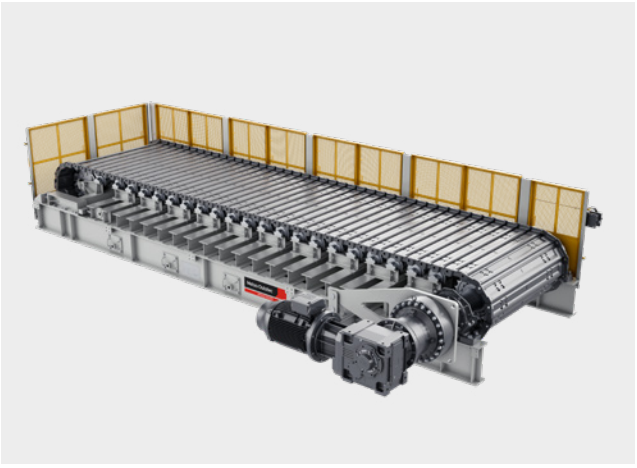
- Maximize equipment performance with a cost-effective solution
- Gain new functionality with state-of-the-art technology
- Highest equipment reliability and longevity
- Improve ease of maintenance
- Eliminate health and safety risks

Apron feeder upgrades

Main drive and head shaft assembly

Apron feeder upgrades allow operators to improve safety, maintenance efficiency and equipment reliability.





Older high-torque low-speed apron feeder applications generally use multiple reducers, chain and sprocket sets, open gearing and countershafts to achieve the mechanical power required. Spare parts inventory requirements and obsolete parts can be difficult to source.

The Metso solution

Drive system and head shaft assembly upgrades can minimize the number of moving parts with a single, compact multi-stage planetary reducer to drive the head shaft and eliminate the need for makeshift solutions to replace obsolete components. The reducer is mounted directly to the head shaft by either a spline or shrink disc connection and torque arm connected to the feeder frame, removing the need to mount to the floor steel. The head shaft assembly (including the bearings) will be upgraded as part of the modernization. A splined shaft connection provides high torque carrying capacity to facilitate maintenance. The proprietary inclined split type bearing housing design increases load carrying capability while taconite seals improve sealing performance. The sprocket segments are reversible and designed for quick installation and removal.

Expected results

- Consistent throughput and improved reliability
- Ease of maintenance
- Reduced maintenance cost
- Minimized spare parts inventory

Apron feeder upgrades

Shaftless tail wheel assembly

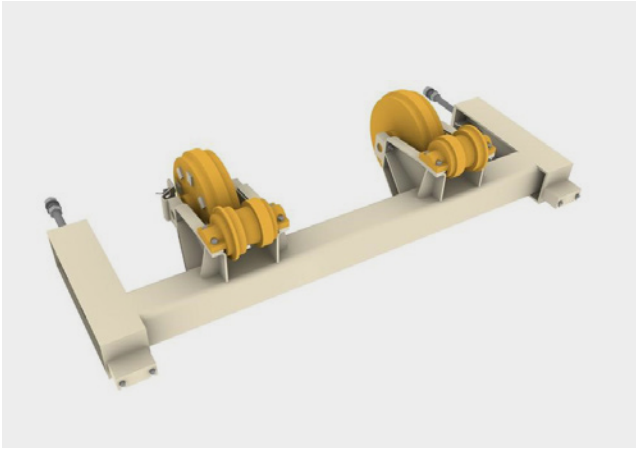
Apron feeder tail wheel and take-up arrangements can be challenging to service, need regular lubrication and involve large and cumbersome shaft manipulation during regular maintenance and change-outs.

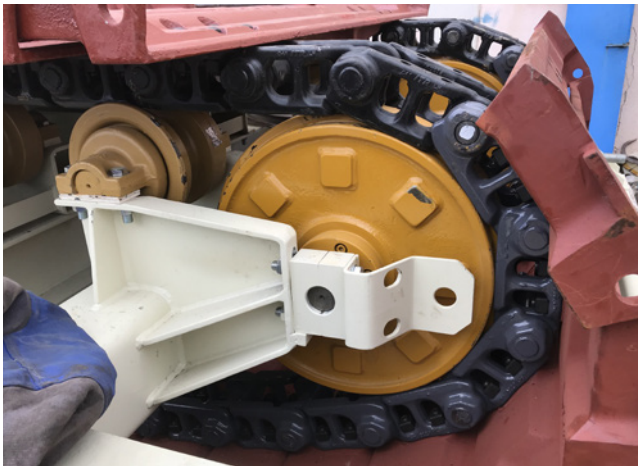
The Metso solution

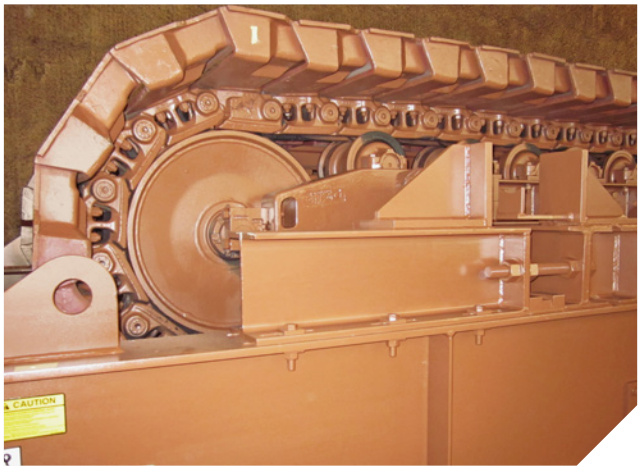
Metso's tail wheel assembly upgrade does not require a rotating shaft and sprockets or custom wheels, and eliminates outboard pillow block bearing assemblies. The 'shaftless' design includes a tail wheel to carries the bottom of the chain links and prevent contact between the chain bushing and tail wheel. The assembly does not require regular lubrication since the wheel is 'sealed-for-life' lubricated. A hydraulic cylinder and pump are included for easy take-up adjustment.

Expected results

- Improved service life and reliability
- Lower maintenance cost
- Simpler operation
- No lubrication required
- Reduced spare parts inventory



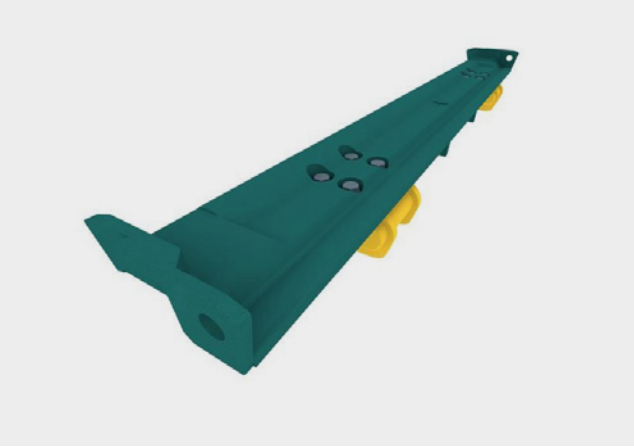




Apron feeder upgrades

Manganese pans

Severe impact and wear during day-to-day operation can cause apron feeders pans to become thin, flex or breaking, causing spillage of fines, lengthy downtime, and unsafe operating and maintenance conditions.



The Metso solution

Pans can be upgraded to cast manganese pans that are 'work hardened' to achieve a hardness up to 600 BHN and suitable for high-impact loading and extremely abrasive operations. The pans are cast from high-quality austenitic manganese steel with stiffened underside for increased strength and impact resistance. Overlapping design and pan wings minimize material spillage and overflow. Optional wear indicators are also available to monitor pans' real-time condition. The pan design integrates lifting holes and eyes for safer and easier handling. Longitudinal central rib(s) provide a close tolerance gap to the rail under the pan deck assembly and prevent excessive flexing. Adjusting or replacing impact rail(s) is strongly recommended when changing the pans to ensure appropriate working clearance between the pans and the rail(s).

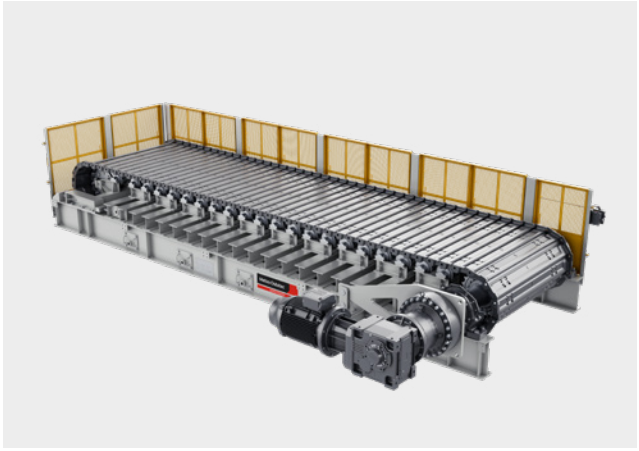
Expected results

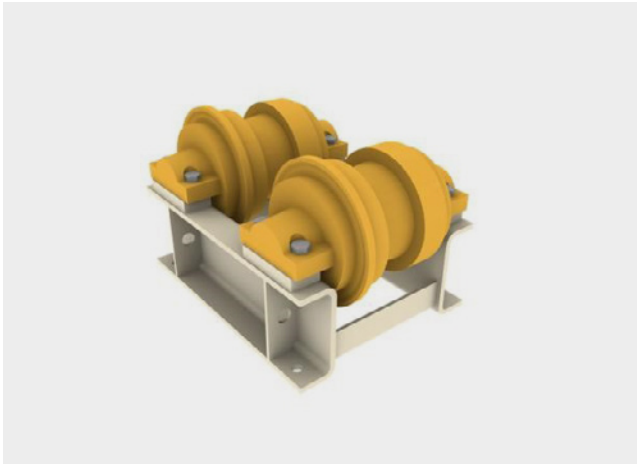
- Longer life and increased reliability
- Reduced maintenance and downtime
- Reduced friction between pans for lower energy consumption
- Reduced spillage
- Safer and easier handling

Apron feeder upgrades

Carrying rollers

Replacing the complete carrying roller assembly during apron feeder service can be a challenge. Older designs commonly use a single channel support with single flanged rollers bolted on both the inner and outer sides of the feeder, which poses accessibility and handling challenges.





The Metso solution

The carrying roller can be upgraded with a new assembly that includes a heat-treated, forged alloy steel hardened for long rim-wear life. Its half flange carrying rollers (the inner flange is removed for ease of maintenance) are lubricated and sealed for life. The rollers' modular design eliminates hard-to-access bolts with clips to hold down the inner structure. Assembly parts can be easily accessed without having to remove material from the feeder or lift the chain from the carrying rollers. The carrying rollers also provide high load carrying capacity for trouble-free service.

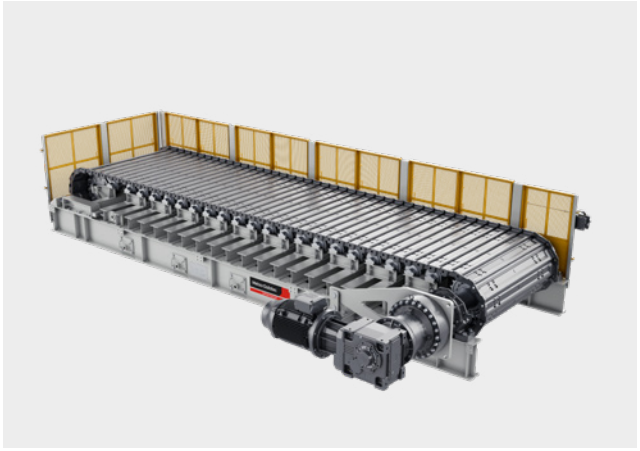
Expected results

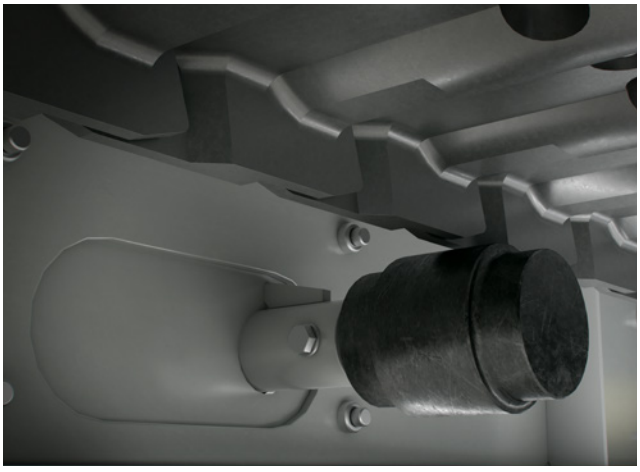
- Better service life and reliability
- Reduced downtime
- Easier maintenance with reduced cost
- No lubrication required
- Minimum spare parts inventory

Apron feeder upgrades

Return rollers

Complete return roller replacement during apron feeder maintenance can be difficult. Existing designs may require regular bearing assembly and shaft lubrication that make regular maintenance and change-outs more challenging.





The Metso solution

The return roller assembly upgrade includes heat-treated, forged alloy steel return rollers hardened for long rim-wear, with a modular design that is lubricated and sealed for life. Return rollers can also be upgraded to a hinged design to improve safety and maintenance accessibility. The upgrade is available for all Metso, legacy and third-party apron feeders.

Expected results

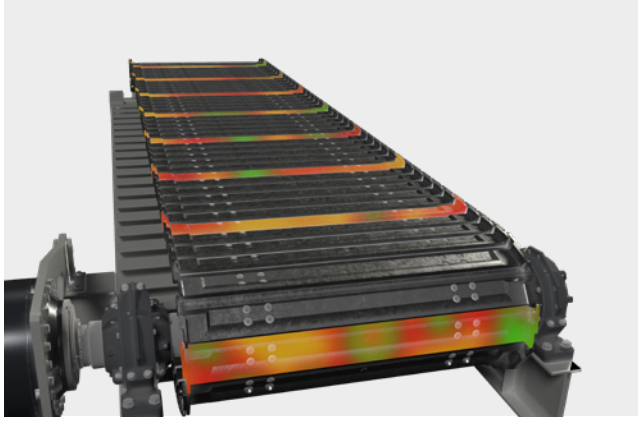
- Better service life and reliability
- Reduced downtime
- Easier maintenance with reduced cost
- No lubrication required
- Minimum spare parts inventory

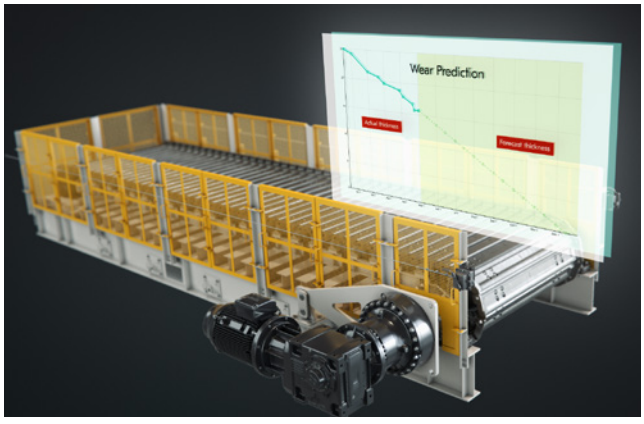
Intelligent condition monitoring system - pan wear module

The intelligent condition monitoring system (ICMS) provides real-time apron feeder operating data that can be useful for repair and maintenance planning, and to reduce risks associated with manual equipment inspection.

The system includes a smart pan wear detection module that uses the data to monitor apron feeder pan thickness and wear condition. The module uses proprietary wireless sensor technology to transmit pan thickness and wear rate data to anticipate remaining pan life and maintenance. The system includes a cloud-based interface to provide data at the feeder terminal or via handheld phone or tablet device.

The intelligent condition monitoring system includes the following components as a complete hardware and software package tailored to suit your apron feeder configuration:
Metso WearSense hugger pan sensors: Low-profile, wireless sensors with a minimum five-year battery life1 mounted directly to the feeder pans to measure real-time thickness and wear trends.
Receiver junction box: A remote, DC-powered enclosure mounted on the feeder frame that contains Metso's proprietary wireless transceiver capable of supporting up to 80 sensors and communicating wirelessly with each.
Gateway enclosure: A mine-spec, single-phase AC permanently-powered unit with LTE, wireless and Ethernet connectivity that links the remote receivers to the cloud-based monitoring platform. The pre-configured gateway system communicates with Metso's web application via cellular signal and is accessible to Metso-authorized personnel only. The gateway is independent of the customer network, providing an increased level of data security.
Web-based user interface (Metso WearSense application): A platform-independent application accessible to authorized users via web browsers on PC, tablet or smartphone, offering:
Interactive sensor elements geo-tagged to the asset
Adjustable settings for pan wear margin and alarm thresholds
Real-time graphical representation of sensor readings to chart wear data and alerts
Historical and predictive pan wear analytics
Configurable dashboards and automated reporting
Multi-asset monitoring with an authenticated and secure log-in
System and sensor maintenance prediction
Leaky feeder cable: A 10-meter antenna, or "leaky feeder cable," is provided to boost and amplify wireless transceiver signal reception within the junction box
Ethernet cabling and RJ45 connectors: Ethernet Cat 5e/Cat 6 cables are provided for secure, reliable and integrated power as well as data transmission between system components supporting distances of approximately 90 meters. RJ45 connectors are to be crimped, cable-prepped and routed through cable trays as per site and asset requirements.





Modular variable speed drive solutions

Bulk material handling variable speed drives (VSDs) and variable frequency drives (VFDs) can have limitations, including reliability and performance issues, extensive repairs, difficult maintenance requirements and poor parts availability due to obsolescence or end of life

Business transformation migration and transition support
They can also present a higher risk of unexpected machine failures that can impact overall drive capability and throughput, causing unplanned downtime. Smart modular VSD solutions can mitigate these challenges to improve equipment availability.

Metso's modular VSD motor control solutions include compact, pre-engineered systems and custom-engineered complex offerings. A drive system analysis identifies parts, subparts and accessories that are obsolete, prone to failure or need immediate attention, as well as the upgrades, retrofits and refurbishments needed to return equipment to operating condition. A panel design analysis detects necessary thermal and part replacements for extended equipment longevity.

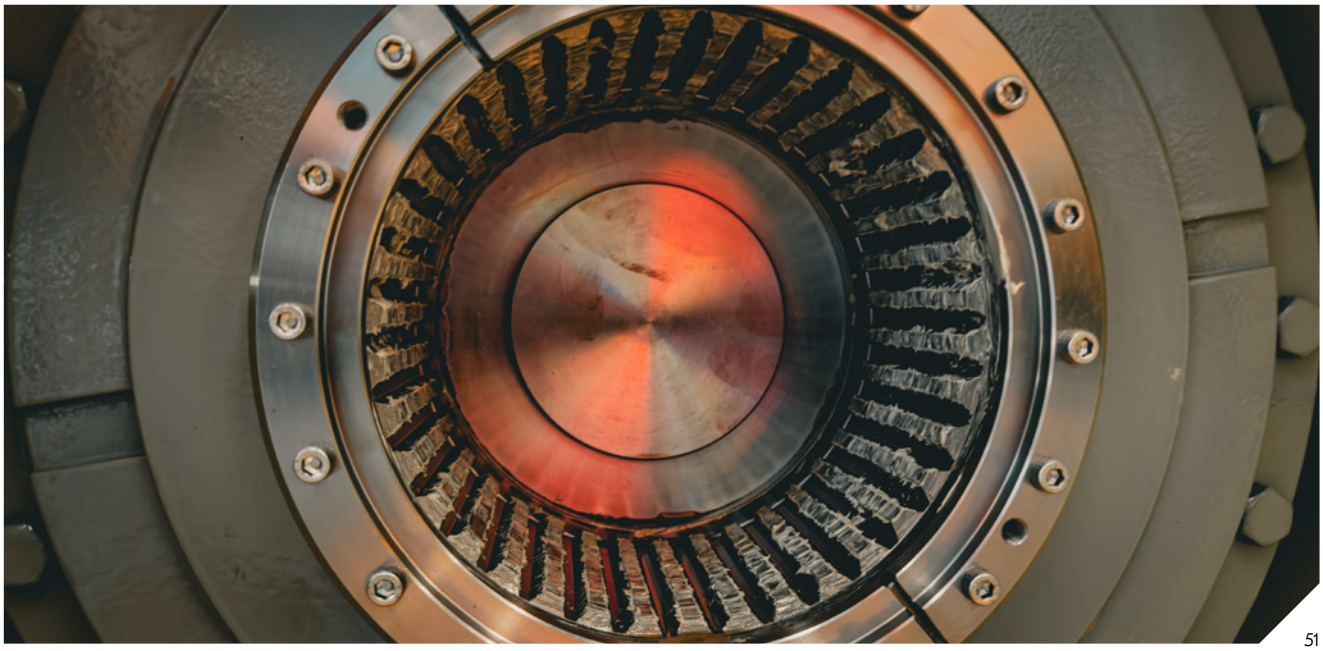
Modular controls software libraries work with the VSD components to make configurable applications. Full turnkey DC to AC system migrations can replace a complete system with motor migration, cables, contactors, starters (including safety torque off features) and all related accessories.

Delivery and commissioning services include enhanced diagnostics and asset management. All smart modular VSD and system designs are easily replicated and scalable to fit current and future needs.

- Supported communication protocols:
  - HART-IP®
  - EtherNetI/P®
  - IO-Link
  - ProfiNet®
  - PROFIBUS
  - Modbus
  - OPC UA
  - DeviceNet®

Full lifecycle support through industry expertise
Load sharing schemes can be calculated to estimate and reduce mechanical wear and tear and optimize performance (e.g., reduce car dumper cycle times).

The smart modular VSD panel is comprised of 20% customizable components that are reusable across any bulk material handling application, including apron feeders, car dumpers and stacker reclaimers. Bluetooth® /NFC connectivity facilitates commissioning and troubleshooting and artificial intelligence (AI) capabilities help to predict and display capacitor, fan and filter components' remaining useful life data. This data can be monitored and timed for future part replacements. With tuned load signatures, load abnormalities can be detected and generate alarms to avoid plant shutdowns and lost productivity.



Case studies

Around the world, customers count on Metso to provide and adapt equipment to meet specific challenges. Decades of expertise and flexible mindset allow us to offer bespoke solutions to reduce costs and improve machine performance.

Metso delivers apron feeder retrofit for improved performance

An iron ore mine customer's critical primary crushing feeder was experiencing performance and reliability issues. The customer sought to upgrade the feeder to increase capacity, reliability and component service life while considering budget and operating costs. Following an inspection, Metso recommended replacing non-OEM components and developed a custom-designed pan to improve process performance and service life, resulting in a 20 percent capacity increase and longer service life.

Challenges

- Iron ore customer apron feeder pans and components wearing faster than planned
- Reduce operating costs and extend component life
- Improve apron feeder performance and capacity
- Customer budget constraints

Solution

- Equipment inspection and analysis
- Refurbishment and replacement of structural support members, pans, and carrying rollers
- Custom-designed pan for improved strength and wear resistance

Results

- Smooth and successful installation
- 20% material capacity increase
- 15% availability increase over next four years
- 15% operating cost reduction

Feeder frame upgrade improves performance and reliability

A mining customer's apron feeder was producing significantly larger ore than specified for its design. A visual and mechanical inspection revealed deformed structural steel and severely worn components. Metso designed a custom frame to increase the equipment strength and impact resistance and supplied new components for field installation. The team provided site supervision for feeder removal and disassembly, as well as installation and commissioning of the new equipment.

Challenges

- The customer's run of mine ore was significantly larger than original design specifications
- Larger product caused accelerated wear and tear on the feeder frame and components

Solution

- Performed visual and mechanical frame and component inspection
- Designed custom frame for improved strength and impact resistance
- Provided on-site supervision for feeder removal and disassembly and new feeder installation

Results

- Smooth feeder installation under schedule
- Performance and reliability improvement

Metso uses feeder splicing to accommodate installation

A bauxite mining customer acquired an apron feeder without considering the required space and procedure for installation. They sought assistance from Metso to facilitate equipment installation without modifying the equipment or extending the outage. Metso's engineering team evaluated the situation and developed a solution with drawings and procedures to field splice the feeder, allowing it to fit through the available space within the expected outage available for installation.

Challenges

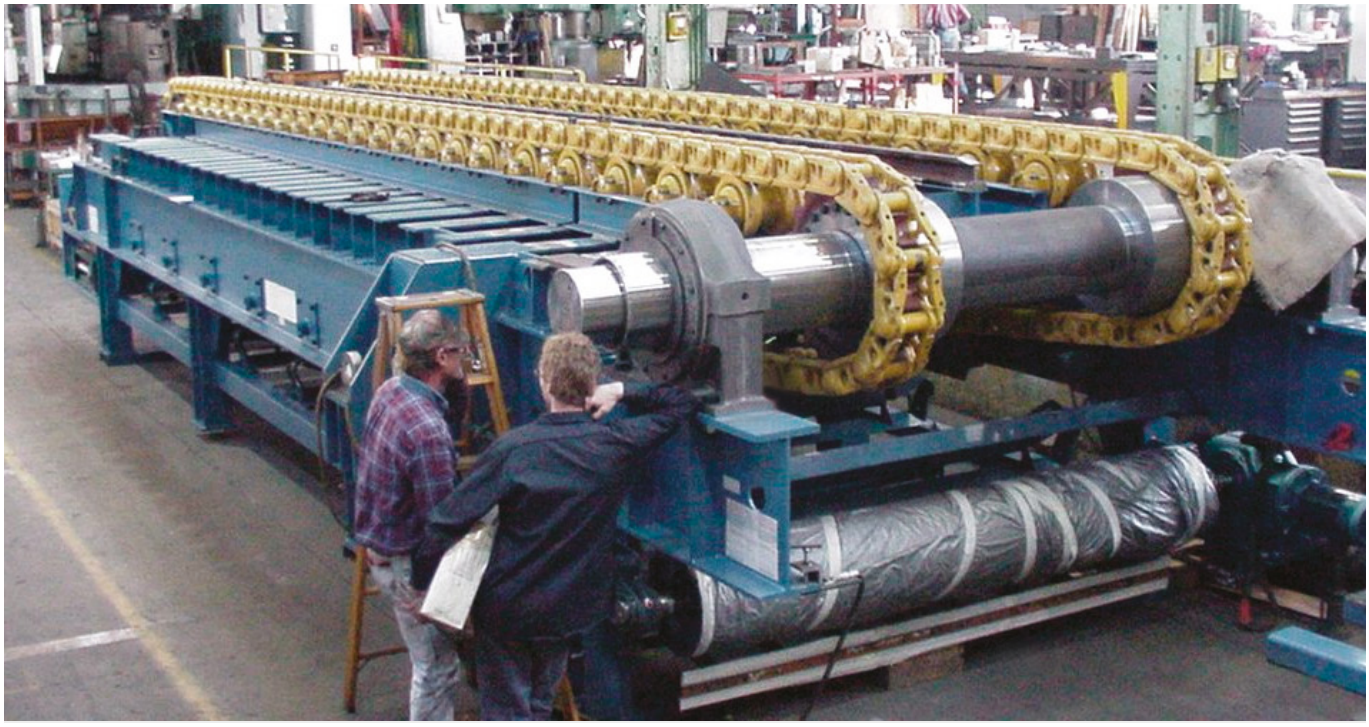
- The customer planned to install a 42-foot long apron feeder through a small space that required equipment adjustments to facilitate installation

Solution

- The engineering team analyzed options to fit the AF5 and dribble drag conveyor in the available space
- Metso developed a solution to field splice the equipment to resolve the space constraint
- The team also provided installation support

Results

- The equipment was installed without further modification or delay to the project



Metso refurbishes feeder for best fit and functionality

A mine operator requested an inspection and quote for parts and refurbishment of an apron feeder experiencing accelerated wear. Metso inspected the feeder and recommended refurbishment and component replacement instead of a full machine replacement. The project involved replacing structural support members, pans and carrying rollers, and designing a custom pan to ensure proper fit and functionality, meeting the machine's service life goal.

Challenges

- Iron ore customer apron feeder pans and components wearing faster than planned
- Reduce operating costs and extend component life
- Improve apron feeder performance and reliability
- Non-Metso OEM
- Customer budget constraints

Solution

- Equipment inspection and analysis
- Refurbishment and replacement of structural support members, pans, and carrying rollers
- Custom-designed pan for improved strength and wear resistance

Results

- Smooth and successful installation under schedule
- Performance and reliability to be observed over next two to four years

Metso modernizes feeder for significant savings

An aluminum mine operator requested a competitive quote from Metso for a new AF5 apron feeder to be delivered within four to five months. After examining the customer's equipment, Metso recommended refurbishing an unused apron feeder purchased 10 years ago to meet the budget and time constraints. Metso successfully renovated and modernized the feeder to the specified configuration, resulting in significant cost savings.

Challenges

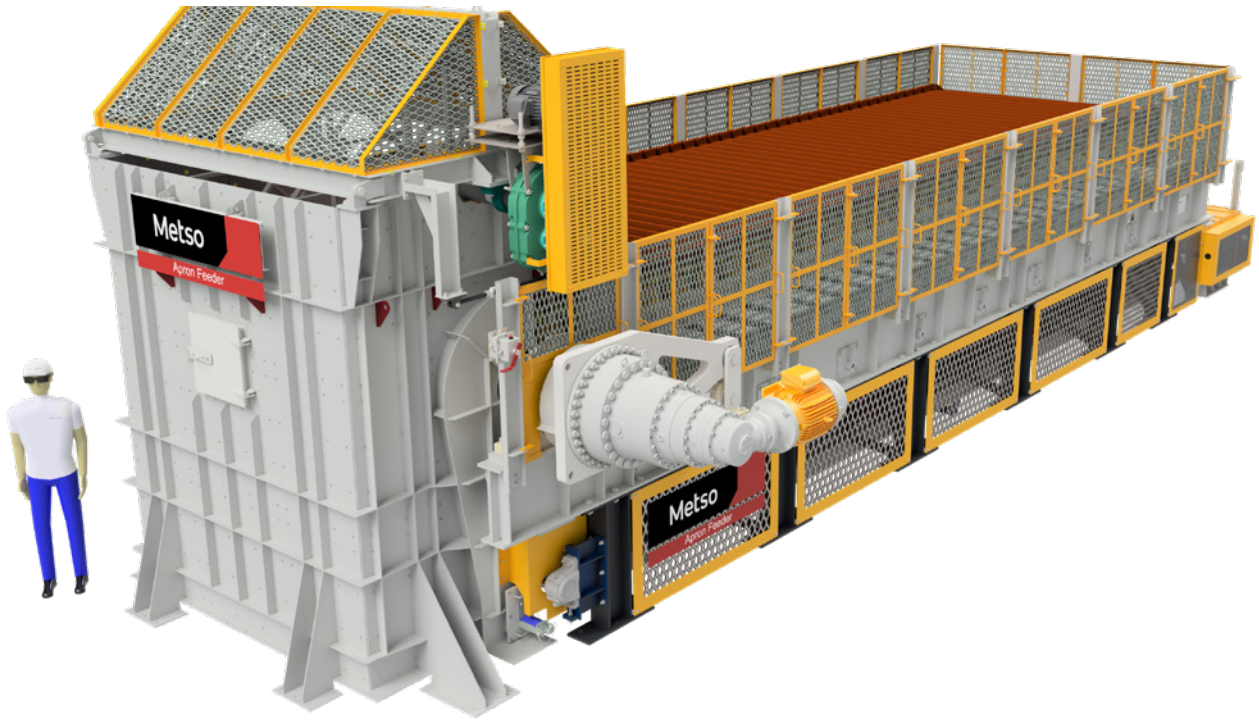
- Supply new apron feeder with a firm four month delivery deadline
- Effectively manage and deliver the apron feeder within limited budget

Solution

- Customer equipment inspection and analysis
- The customer's ten-year old unused apron feeder, previously held for scrap, is recommended for refurbishment instead of buying new equipment
- Equipment renovated and feeder chutes and skirts modified to suit the customer configuration

Results

- Apron feeder refurbishment and modernizations completed within designated time frame
- Refurbishment resulted in significant cost savings compared to purchase of a new apron feeder



Metso replaces a third apron feeder at Canadian gold mine

When it comes to reliability, Metso apron feeders are unmatched. After having two apron feeders already replaced with the Metso solution, the team at Agnico Eagle's Meliadine mine appreciated the economic, production, and efficiency benefits that the reliable apron feeders provide.

Near the north-western shore of Hudson Bay lies the Agnico Eagle Meliadine gold mine. The site is located in the Kivalliq District of Nunavut, Canada, which, due to its unpredictable and extremely cold temperatures, comes with its own set of challenges. Scheduling the transport of equipment to the site by both road and water is also very challenging, as the site must avoid early freezing of waterways in the lower Arctic region.

Agnico Eagle approached Metso in 2020 to replace the first of three originally installed apron feeders of a different brand at its Meliadine site after three years in operation due to their high operating cost. Following this first successful replacement with Metso's high-quality, durable, and reliable apron feeder, the second apron feeder was replaced later that same year and the third in 2022.

"The heavy-duty design remains the preferred choice of material handling for the mineral processing industry around the world," says Robert Wakefield, Manager of Mineral Sales Canada at Metso. "This is why we were not surprised by Agnico Eagle's request to replace their Meliadine paste plant apron feeder in June 2022 after it had just experienced a major failure."

"The site reports a reduction of the equipment's OPEX in the range of 83% to 92% over two years since replacing the initial feeders. These savings are primarily attributed to a reduction of major repairs and downtime, significantly reducing the average cost per ton after the Metso feeders were installed."






The initial implementation had yielded such remarkable results that Agnico Eagle knew they could trust Metso to perform another successful project

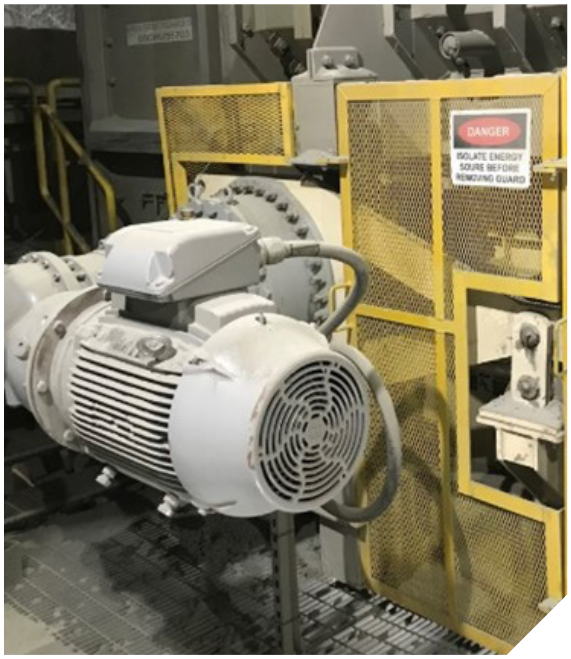
"Metso already had tractor chain style feeders successfully operating at another one of Agnico Eagle's sites, enabling us to demonstrate the quality of our products and service," says Marty Yester - Product Manager, Feeders at Metso. "When a customer's satisfaction and confidence in Metso's products is high enough to request more of our offering, it's a true testament to the portfolio."

Though deemed another successful venture in their partnership, this project did not come without its challenges. There was a need for specific engineering, as Metso had to not only adapt its pre-configured AF8 to match the original product's footprint, but also keep the same material discharge output to the downstream equipment.

"Upon analyzing customer operational data, we noticed the original drive was not properly sized, leading to a very low speed operation with highly inefficient motors," says Henrique Oliveira, Engineering Manager, Feeders at Metso.

"We worked together with the customer to optimize the drives, allowing the motors to operate at the speed where they are more efficient and reducing installed power by over 30%." Metso replaced the third apron feeder design to meet the customer's demanding application. The scope of the third apron feeder replacement expanded to include dual drives, a dribble belt conveyor, a discharge chute, and a lump cutter device.

Metso's Apron Feeder technology keeps operations running smoothly by increasing uptime, efficiency, production, and sustainability, contributing to operational excellence at Agnico Eagle's Meliadine mine.

Troubleshooting can be carried out quickly on-site without the need for extensive diagnostic checks

Troubleshooting

Below are typical issues that might occur throughout the life of the apron feeder. This list is not exhaustive, but can be used as a reference to help identify and resolve common issues.

Assembly	Issue	Check
Take-up	Chain too loose or too tight	Incorrect take-up frame positioning
Head shaft	Pillow block heating	Incorrect lubrication quantity or contamination
	Grease leakage	Bearing assembled incorrectly or crack in housing
	Shaft is not rotating freely	Contaminated grease, damaged bearing or insufficient radial clearance
	Damaged housing	Too much load
	Unusual bearing noise/vibration	Misalignment, damaged bearing, excessive wear
	Unusual bearing noise/vibration	Misalignment, excessive wear
Carrying rollers	Roller is not rotating freely	No contact with chain, seal leakage, material build up

Assembly	Issue	Check
Return rollers	Roller is not rotating freely	No contact with chain and pans, seal leakage, material build up
Chain and flights	Unusual noise or vibration	Misalignment of chain, frame, rollers or sprockets
	Material leakage	Excessive clearance between flights and skirts/chutes, loose flights
	Damaged flights	Excessive impact load, insufficient material depth
Drive	High torques	Change in material, material build-up, excessive component wear
	Unusual noise or vibration	Coupling misalignment, lack of gearbox lubrication, loose fasteners

NOTE: Material build up is a common, recurring issue. If material gets lodged between the chutes and skirts, reverse jog the feeder to dislodge the material.

Troubleshooting

The following information is intended to serve as an aid in locating and eliminating defects and faults. In some cases, problems may be caused by the plant or machine to which the gear unit is attached and the cause and remedy will therefore be described in the manufacturer's technical documentation for the machine/plant in question.

Fault	Cause	Remedy
Bearing temperature too high	Oil level too low	Top up oil level
	Oil spent	Replace oil
	Defective bearings	Contact authorized workshop
Operating temperature too high	Oil level too high	Contaminant in oil
	Oil spent	Replace oil
	Contaminant in oil	Replace oil
Abnormal running noise	Gears damaged	Contact authorized workshop
	Bearing axial backlash too high	Contact authorized workshop
	Bearing defective or worn	Contact authorized workshop
	Excessive load applied	Correct load to rated values given in sales catalogue
	Contaminant in oil	Replace oil
Abnormal noise at gear unit mounting	Mounting bolts loose	Tighten bolts to specified torque
	Mounting bolts worn	Replace bolts
Oil leaks	Oil level too high	Check oil level
	Casing/coupling seals inadequate	Contact authorized workshop
	Gaskets worn	Contact authorized workshop
Gear unit does not run or runs with difficulty	Oil viscosity too high	Replace oil
	Oil level too high	Check oil level
	Excessive load applied	Redesign drive for actual load required
Output shaft does not turn with motor running	Gears damaged	Contact authorized workshop

Metso is a frontrunner in sustainable technologies, end-to-end solutions and services for the aggregates, minerals processing and metals refining industries globally. We improve our customers' energy and water efficiency, increase their productivity, and reduce environmental risks with our product and service expertise. We are the **partner for positive change.**

metso.com