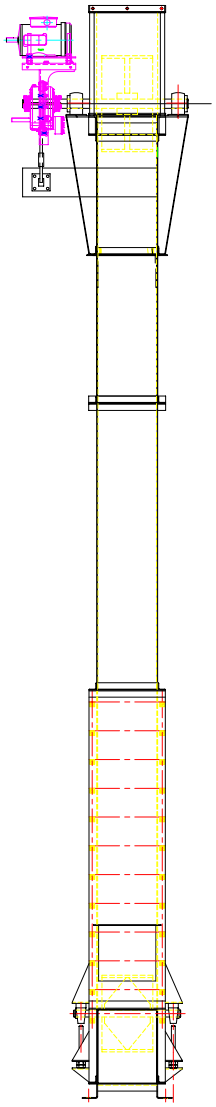
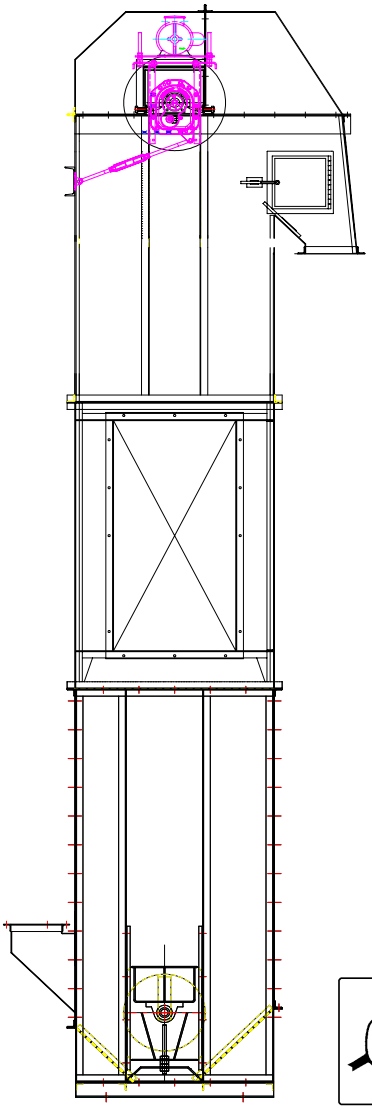
A Division of Orthman Manufacturing Inc. Lexington, NE

601 BUSINESS LOOP 70 WEST Suite 130, COLUMBIA, MO. 65203

BUCKET ELEVATOR

INSTALLATION, & OPERATIONAL MAINTENANCE MANUAL.





PTDA Member

MEMBER CEMA CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION

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WARNING AND SAFETY REMINDERS FOR SCREW , DRAG , AND BUCKET ELEVATOR CONVEYORS

APPROVED FOR DISTRIBUTION BY THE SCREW CONVEYOR SECTION OF THE CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION (CEMA)

It is the responsibility of the contractor, installer, owner and user to install, maintain and operate the conveyor, components and, conveyor assemblies in such a manner as to comply with the Williams-Steiger Occupational Safety and Health Act and with all state and local laws and ordinances and the American National Standards Institute (ANSI) B20.1 Safety Code.

In order to avoid an unsafe or hazardous condition, the assemblies or parts must be installed and operated in accordance with the following minimum provisions.

1. Conveyors shall not be operated unless all covers and/or guards for the conveyor and drive unit are in place. If the conveyor is to be opened for inspection cleaning, maintenance or observation, the electric power to the motor driving the conveyor must be LOCKED OUT in such a manner that the conveyor cannot be restarted by anyone; however remote from the area, until conveyor cover or guards and drive guards have been properly replaced.

2. If the conveyor must have an open housing as a condition of its use and application, the entire conveyor is then to be guarded by a railing or fence in accordance with ANSI standard B20.1.(Request current edition and addenda)

3. Feed openings for shovel, front loaders or other manual or mechanical equipment shall be constructed in such a way that the conveyor opening is covered by a grating. If the nature of the material is such that a grating cannot be used, then the exposed section of the conveyor is to be guarded by a railing or fence and there shall be a warning sign posted.

4. Do not attempt any maintenance or repairs of the conveyor until power has been LOCKED OUT.

5. Always operate conveyor in accordance with these instructions and those contained on the caution labels affixed to the equipment.

6. Do not place hands, feet, or any part of your body, in the conveyor.

7. Never walk on conveyor covers, grating or guards.

8. Do not use conveyor for any purpose other than that for which it was intended.

9. Do not poke or prod material into the conveyor with a bar or stick inserted through the openings.

10. Keep area around conveyor drive and control station free of debris and obstacles.

11. Eliminate all sources of stored energy (materials or devices that could cause conveyor components to move without power applied) before opening the conveyor

12. Do not attempt to clear a jammed conveyor until power has been LOCKED OUT.

13. Do not attempt field modification of conveyor or components.

14. Conveyors are not normally manufactured or designed to handle materials that are hazardous to personnel. These materials which are hazardous include those that are explosive, flammable, toxic or otherwise dangerous to personnel. Conveyors may be designed to handle these materials. Conveyors are not manufactured or designed to comply with local, state or federal codes for unfired pressure vessels. If hazardous materials are to be conveyed or if the conveyor is to be subjected to internal or external pressure, manufacturer should be consulted prior to any modifications.

CEMA insists that disconnecting and locking out the power to the motor driving the unit provides the only real protection against injury. Secondary safety devices are available; however, the decision as to their need and the type required must be made by the owner-assembler as we have no information regarding plant wiring, plant environment, the interlocking of the screw conveyor with other equipment, extent of plant automation, etc. Other devices should not be used as a substitute for locking out the power prior to removing guards or covers. We caution that use of the secondary devices may cause employees to develop a false sense of security and fail to lock out power before removing covers or guards. This could result in a serious injury should the secondary device fail or malfunction.

There are many kinds of electrical devices for interlocking of conveyors and conveyor systems such that if one conveyor in a system or process is stopped other equipment feeding it, or following it can also be automatically stopped.

Electrical controls, machinery guards, railings, walkways, arrangement of installation, training of personnel, etc., are necessary ingredients for a safe working place. It is the responsibility of the contractor, installer, owner and user to supplement the materials and services furnished with these necessary items to make the conveyor installation comply with the law and accepted standards.

Conveyor inlet and discharge openings are designed to connect to other equipment or machinery so that the flow of material into and out of the conveyor is completely enclosed.

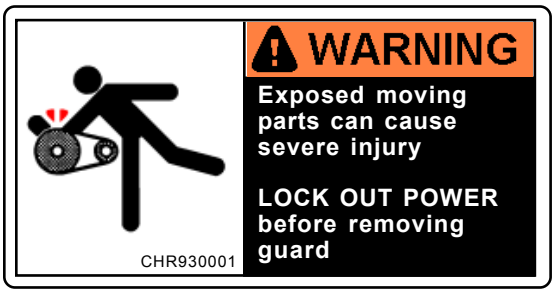
One or more warning labels should be visible on conveyor housings, conveyor covers and elevator housings. If the labels attached to the equipment become illegible, please order replacement warning labels from the OEM or CEMA.

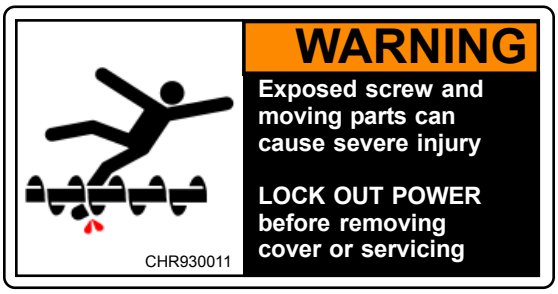
The Conveyor Equipment Manufacturers Association (CEMA) has produced an audio-visual presentation entitled “Safe Operation of Screw Conveyors, Drag Conveyors, and Bucket Elevators.” CEMA encourages acquisition and use of this source of safety information to supplement your safety program.

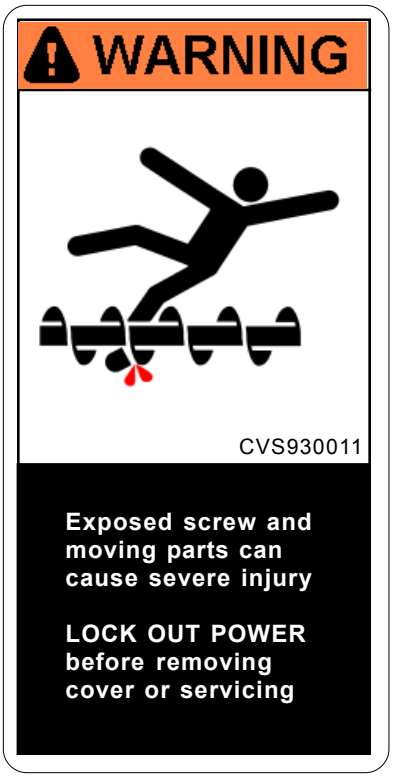
SEE OTHER SIDE FOR SAFETY LABELS

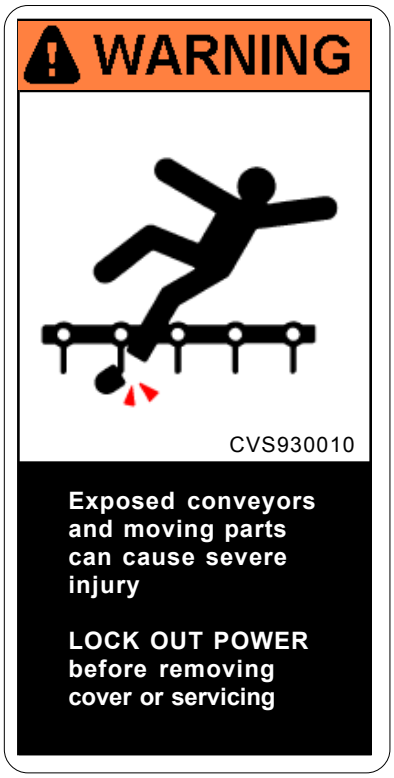
CEMA Safety Labels

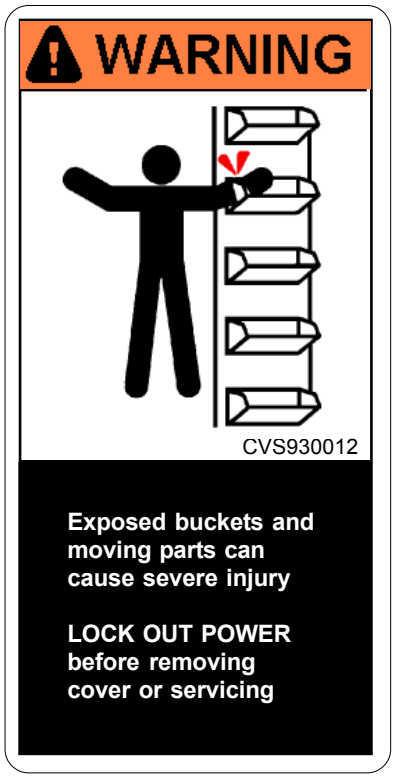
The CEMA safety labels shown below should be used on screw conveyors, drag conveyors, and bucket elevators. Safety labels should be placed on inlets, discharges, troughs, covers, inspection doors & drive guards. See CEMA Safety Label Placement Guidelines on CEMA Web Site: http://www.cemanet.org/safety/guidelines.html











PROMINENTLY DISPLAY THESE SAFETY LABELS ON INSTALLED EQUIPMENT

SEE OTHER SIDE FOR SAFETY REMINDERS

Note: Labels alone do not substitute for a thorough in-plant safety training program centered on the hazards associated with operating your installed equipment.

Contact CEMA or Your Equipment Manufacturer for Replacement Labels

CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION
6724 Lone Oak Blvd., Naples, Florida 34109
239-514-3441

INSTALLATION, OPERATION, AND MAINTENANCE OF BELT ELEVATORS

INSTALLATION

Assembling Casing:

1. A bucket elevator is actually a belt and pulley transmission enclosed within a casing.

2. For proper operation care must be taken to maintain belt and shaft alignment.

3. Although the manufacturer checks alignment prior to shipment, correct and proper care must be maintained during erection to assure a straight and plumb casing from head to boot section. A twisted or leaning casing would prevent proper tracking of belt on the pulleys.

4. Bucket elevators are comprised of three main assemblies; namely, head terminal, boot terminal, and intermediate assemblies and components. All terminals are factory assembled and shipped assembled. For safety and shipping considerations the drive assembly is usually not mounted on the head. The intermediate casing is shipped in individual pieces.

5. Assemble casing by first setting boot section and ten to twenty feet of intermediate leg casing. Use a plumb line from top to bottom to check vertical and level setting of boot on base, using shims if necessary near anchor bolt holes (not at corners). Grout under boot after elevator is completely assembled.

6. Assemble remaining intermediate leg sections respectively as marked by the manufacturer. Usually the boot will be marked “A”, then the first leg section “B”, second “C”, et cetera. These marking will be located in the lower right corner of each section and after assembly can be readily checked by sight from top to bottom.

Take-ups:

Take-ups, a mechanical device for adjusting shaft center distances should be provided for all elevators to compensate for elongation as wear occurs and to provided temporary slack for installation and maintenance work.

Wherever possible, take-ups on elevators should be mounted at the foot end. This eliminates the troublesome adjustment of the drive, as would be the case if the take-up were mounted on the head end.

For elevators, caution must be used when adjusting take-ups to prevent statically over-stressing belt and terminal equipment. A proper amount of slack should be allowed to obtain smooth belt travel motion. On all belt elevators the adjustment should be made while the elevator is in operation to insure the adjustment, which will meet the above conditions.

Shaft and Pulley Alignment:

Proper alignment of pulley and shaft greatly lengthens belt life. To assure correct alignment, the following steps are necessary:

1. Carefully level the shafts. Use a machinist's level directly on the shaft.

2. Align the shaft for parallelism, using a line for long centers. Recheck the level adjustment. Tighten all securing bolts and nuts to assure maintenance of shaft alignment.

3. Align the pulley axially on the shafts. A plumb bob should be used to check the alignments of head and foot pulleys and shafting after leveling shafts.

Installing Belt:

In the installation of Elevator belts, certain general practices should be followed. The first is to be sure you select the best type of belt for the service to be performed. Consult your belt catalog or call or nearest belt distributor to check your selection.

Install the elevator belt with boot take-ups positioned at upper end of travel, and head take-ups at lower end of travel to provide for maximum adjustment.

1. Where it is possible to lower belt from the top of the elevator casing, the following method can be applied: Make lifting hitch off center, to make one leg long enough to go around the boot pulley and up to the inspection door. Lower belt in casing from top. When belt is positioned, snub the head shaft. Connect at inspection door using a come-along or chain fall to draw belt ends together. Adjust take-up.

2. If belt cannot be lowered from the t op of the elevator casing, assemble and feed belt through inspection door: Drop a line into the far side (opposite inspection door) of casing at the top. Feed the belt around the bottom of the boot pulley and upward to top of the head pulley. Next, drop line down nearside of casing. Hitch line 3 or 4 feet from the end of the elevator belt leaving the end free to make the final connection at the inspection door. Before making the final connection be sure that the take-up is set properly. Cut belt length for splice and achieve the proper take-up setting.

The method of installation is dependent to a large extent on the height of the elevator and the available hoisting equipment.

After the belt is assembled, mount the buckets. After the unit has been run-in the units should be retightened, and the bolt threads should be prick punched to prevent loosening of nuts.

INSTALLATION, OPERATION AND MAINTENANCE OF BELT ELEVATORS, BELT SPLICING, AND BUCKET MAINTENANCE

Belt Splicing:

The method used to splice a belt is determined by the number of plies and the severity of service required.

For most elevators plate type fasteners can be used.

For belt thicknesses up through three ply, the belt ends are lapped for a minimum of five buckets. These buckets are bolted through both thicknesses of the belt lap. For thicknesses of four ply or more, a butt strap joint is more satisfactory than the lap type splice because severe stresses are set up in the outer plies as the belt passes around the head and boot pulleys. These stresses are minimized when the two end of the belt are butted together and a layer of strong and flexible nylon fabric belting is placed over the joint extending under a minimum of two buckets in each direction. These buckets are bolted through both layers of belting.

Mounting Elevator Buckets on Belt:

Elevator buckets are generally secured to belts by means of flat head bolts known as elevator bolts, No. 1 head, having American standard square nuts. These bolts are called Norway bolts.

No. 2 oval head bolts are used with the heaviest belts and buckets.

The belt carrying the buckets should be at least one inch wider than the bucket for lengths up to 16 inches, and 2 inches wider than the bucket for lengths 16 inches and over.

When two lines of buckets are used on the same belt they should be staggered with respect to each other.

Operation and Maintenance of Belt Elevators:

Prevent Overload

For a bulk material handling conveyor or elevator, flow of the material should always be regulated at a rate within elevator capacity. Where surging and overloading are inevitable, a surge hopper of adequate size should be provided from which material can be withdrawn by a suitable feeder or regulating gate. Overload protection can also be provided by the installation of shear pin hubs. Backstops or a handbrake can be provided to prevent back run of a loaded elevator in the event of a power failure.

Starting and Stopping

To assure long life, whenever possible elevator should be empty when starting and should be stopped only when again empty. Starting under a load not only places strain on the equipment, but frequently contributes directly to breakdowns. This is particularly true when handling bulk material that tends to set or freeze, since a very great pull may be required to

break the load loose. Elevators, unless empty, will run backwards. A backstop can be provided to prevent this. Elevators should be operated at regular intervals during any extended down period to avoid freeze-ups. (At least once a week, and preferably turned over once each day when sticky materials are handled.)

Maintenance

Preventive maintenance and periodic inspection will do much to prolong the life of your elevators belts. A regular inspection should be set up on a periodic basis. The frequency of inspection will depend entirely on the type of operation and the operating conditions. If the elevator is operating in exposed, dusty or dirty conditions, inspection should be conducted at more frequent intervals.

The following maintenance tips should add to the life of your bucket elevator:

1. On large elevators, provide suitable walkways and where necessary, platforms with stairways or permanent ladders.

2. Provide proper protection against the elements: extreme cold, rain, or snow and sleet.

3. Provide pipe extension for difficult to reach grease fittings or an automatic greasing system.

4. Provide adequate cleanup of dribble and spillage.

5. Set up a specific lubrication program and fix definite responsibilities for carrying out procedure. One successful method for accomplishing this is to prepare a mater lubrication check sheet or card for each important conveyor or elevator.

6. Establish a definite program of inspection.

7. Elevator belts should be checked for wear, stretch, edge wear (indicating misalignment, material build up on pulleys or belt.)

8. Pulleys should be examined for alignment and positioning.

9. Buckets should be examined for looseness or damage.

10. All belts should be checked for proper tension (enough slack to flex slightly) and if too much slack is present, take-ups should be adjusted to take up excess slack.

INSTALLATION, OPERATION AND MAINTENANCE OF CHAIN ELEVATORS

Type of Chain:

Installation of Chain Elevators:

Assembling Casing

1. A bucket elevator is actually chain and sprocket transmission enclosed within a casing.
2. For proper operation care must be taken to maintain chain and shaft alignment.
3. Although alignment is checked by the manufacturer prior to shipment correct and proper care must be maintained during erection to assure a straight and plumb casing from head to boot section, as a twist or leaning casing would prevent proper tracking of belt on the pulleys.
4. Bucket elevators are comprised of three main assemblies; namely, head terminal, boot terminal, and intermediate assemblies and components. All terminals are factory assembled and shipped assembled. For safety and shipping considerations the drive assembly is usually not mounted on the head. The intermediate casing is shipped in individual pieces.
5. Assemble casing by first setting boot section and ten to twenty feet of intermediate leg casing. Use a plumb line from top to bottom to check vertical and level setting of boot on base, using shims if necessary near anchor bolt holes (not at corners). Grout under boot after elevator is completely assembled.
6. Assemble remaining intermediate leg sections respectively as marked by the manufacturer. Usually the boot will be marked “A”, then the first leg section “B”, second “C”, et cetera. These marking will be located in the lower right corner of each section and after assembly can be readily checked by sight from top to bottom.

In the installation of elevator chains, certain general practices should be followed:

Chain Selection

Select the best type of chain for the service to be performed. Consult your chain catalog or your nearest chain distributor to check for your selection.

Proper Direction of Chain Travel

Straight side bar chains operate equally well in either direction. No special instruction need be followed.

Take-Ups

Take-ups, a mechanical device for adjusting shaft center distances, should be provided for all elevators to compensate for elongation as joint wear occurs and to provide temporary slack for installation and maintenance work.

Wherever possible, take-ups on elevators should be mounted at the boot end. This eliminates the troublesome adjustment of the drive if the take-up were mistakenly mounted on the head end.

Caution must be used when adjusting take-ups to prevent statically over- stressing chain and terminal equipment. A proper amount of slack should be allowed to obtain smooth chain travel motion. On all chain elevators the adjustment should be made while the elevator is in operation to insure the adjustment, which will meet the above conditions.

Shaft and Sprocket Alignment

Proper alignment of sprocket and shaft greatly lengthen sprocket and chain life.

To assure correct alignment, the following steps are necessary:

1. Carefully level the shafts. Use a machinist's level directly on the shaft.
2. Align the shaft for parallelism, using a line for long centers. Recheck the level adjustment. Tighten all securing bolts and nuts to assure maintenance of shaft alignment. Weld bearing stop blocks to the elevator frame.
3. Align the sprockets axially on the shafts. A plumb bob should be used to check the alignments of head and foot sprockets and shafting after leveling of shafts.
4. With a shaft giving some end play (as the shaft of an electric motor), align the sprockets with the shaft in its running position. To determine the running position, chalk the shaft, run the motor at operating speed, and scribe a line in the chalk opposite a convenient fixed point. Adjust the alignment with the shaft blocked in this position.
5. Secure each sprocket against axial end play by means of a setscrew, or by collars setscrewed to the shaft. Do not depend on setscrews to prevent the sprockets from turning on the shaft…use keys.
6. Sprocket arrangement: Driving sprockets on a double strand chain conveyor or elevator should be keyed on the head shaft and with the teeth of sprocket directly in line with teeth of the other. One-foot shaft sprocket should be keyed on its shaft so that the shaft will turn in its bearings. The other sprocket is allowed to turn freely, being held in position by means of set collars. This permits this sprocket to position itself automatically if uneven wear takes place in the chain strands.
7. Installing Chains: Install the elevator chain with the open end of the link forward in the direction of chain travel. Have foot take ups positioned at upper end of travel, and head end take-ups at lower end of travel to provide for maximum adjustment.

    a. **Where it is possible to lower chain from the top of elevator casing, the following method can be applied:** Assemble chain to form a single strand. Make lifting hitch off center of strand, to make one leg long enough to go around the foot sprocket and up to the inspection door. Lower assembled strand of chain into casing from top. When chain is positioned, snub the head shaft. Connect at inspection door using a come-along or chain fall to draw chain ends together. Adjust take-up.

b. **If chain cannot be lowered from the top of the elevator casing, assemble and feed chain through inspection door:** Drop a line into the far side (opposite inspection door) of casing at the top. Using an air tugger, feed the chain around the bottom of the boot sprocket and upward to top of the head sprocket. Snub this leg. Next, drop line down nearside of casing. Hitch line 3 or 4l inks from the end of elevator chain leaving the end free to make the final connection at the head sprocket. Before making the final connection, be sure that the take up is set properly. One or two of the links may have to be removed to achieve the proper take up setting.

The method of installation is dependent to a large extent on the height of the elevator and the available hoisting position.

After the chain is assembled. Mount the buckets. After the unit has been run in the bolts should be retightened, and the bolt threads should be prick-punched to prevent loosening of nuts.

Mounting Elevator Buckets on Chain:

Elevator buckets are generally attached to chains by means of Hex or square head machine bolts with nuts. Spring lock washers or self locking nuts are recommended for all bolts used to attach buckets to chain to keep the bolts tight. On overlapping continuous buckets, a bevel washer is used between attachment and bucket.

Operation and Maintenance of Chain Elevators

Prevent Overload

For a bulk material handling conveyor or elevator, flow of the material should always be regulated at a rate within elevator capacity. Where surging and overloading are inevitable, a surge hopper of adequate size should be provided from which material can be withdrawn by a suitable feeder or regulating gate. Overload protection can also be provided by the installation of shear pin hubs. Backstops or a handbrake can be provided to prevent back run of a loaded elevator in the event of a power failure.

Starting and Stopping

To assure long life, whenever possible elevator should be empty when starting and should be stopped only when again empty. Starting under a load not only places strain on the equipment, but frequently contributes directly to breakdowns. This is particularly true when handling bulk material that tends to set or freeze, since a very great pull may be required to break the load loose. Elevators, unless empty, will run backwards. A backstop can be provided to prevent this. Elevators should be operated at regular intervals during any extended down period to avoid freeze-ups. (At least once a week, and preferably turned over once each day when sticky materials are handled.)

Maintenance

Preventive maintenance and periodic inspection will do much to prolong the life of your conveyor and elevator chains. A regular inspection will depend entirely on the type of operation and the operating conditions. If the elevator is operating in exposed, dirty or dusty conditions, inspection should be conducted at more frequent intervals.

The following maintenance tips will do much to add life to your chains:

1. On large elevators, provide suitable walkways and where necessary, platforms with stairways or permanent ladders for access.

2. Provide proper protection against the elements: cold, rain, or snow and sleet.

3. Provide pipe extension for difficult to reach grease fittings or an automatic greasing system.

4. Provide adequate cleanup of dribble and spillage.

5. Set up a specific lubrication program and fix definite responsibilities for carrying out procedure. One successful method for accomplishing this is to prepare a master lubrication check sheet or card for each important conveyor or elevator.

6. Establish a definite program of inspection.

7. Chains should be checked for: (a) wear on side bar inner faces (indicating misalignment); (b) worn pins, bushing, and/or rollers…frozen rollers; (c) loose or unseated pins; (d) missing cotters; (e) lubrication; (f) material build up in chain and attachment.

8. Sprockets should be examined for alignment and excessive tooth wear.

9. Attachments and buckets should be examined for looseness or damage.

10. All chains should be checked for proper tension (enough slack to flex slightly) and if too much slack is present, take up should be adjusted to take up excess slack.

Sprocket Inspection

Chain is subjected to unnecessary abuse if used with worn or faulty sprockets. It is there fore important to inspect sprockets regularly for wear and alignment

There is a danger in using worn sprockets. When new chain is installed, sprockets with worn teeth will ruin it rapidly. Sprockets having teeth with a marked hook shape should be replaced promptly.

Improper fitting of chains and sprockets results in improper interaction. This causes excessive wear on both chain and sprockets, and high internal loads, which can lead to chain breakage. Incorrect sprockets should be replaced immediately.

Chain Cleaning and Storage

New Chains: Keep unused chain in its box or wrapping. Store it indoors in a protected location, away from excessive heat and moisture.

Chains on Idle Equipment: In the equipment is to be idle for any length of time; the following measures will protect it from deterioration and prolong its life considerably.

1. On light elevator, remove chain from sprockets if possible. Clean by dipping in petroleum spirits or other suitable cleaning fluid. On heavy elevators where removal of chain is impractical, clean by brushing or swabbing if possible, or with a steam hose.

2. Cover chain with heavy grease.

3. Wrap unmounted chain in heavy paper and store inside.

4. Apply a coating of grease to all finished surfaces of the sprockets.

Chains in Service:

When putting chain back into service, clean chains and sprockets. Excessive dirt and gummy storage lubricants cause excessive chain and sprocket wear.

Periodic dip, swab or steam cleaning and re-lubrication will add to the life of both chain and sprockets.

OPERATIONS AND MAINTENANCE OF CHAIN ELEVATORS

Lubrication

Proper lubrication of elevator chains is important for long, satisfactory service. Proper lubrication not only reduces friction, but helps prevent corrosion and aids in cushioning the joints against shock.

The frequency of cleaning and lubrication depends on the type of application and the operating conditions. Where practical, chains should be cleaned by dipping them in petroleum spirits or kerosene, or by swabbing. Chains used in applications prohibiting lubrication should be brushed periodically to remove dirt or grit.

Non-Roller Chain

Here lubrication is important in the pin joint and also on the outer surface, which comes in contact with the track or trough. These chains should be swabbed with SAE 30 or 40 oil, which will work into the bearing areas. Frequency will depend on the conditions existing at each installation. Sprocket teeth should also be swabbed with a lubricant. An oil cup drip system can also be installed for lubricating the chain.

Where chain is in contact with the material being handled in encased units, such as bucket elevators, it is usually not feasible to lubricate after installation except at general overhaul periods or shutdowns.

Roller Chain

Standard and double pitch roller chains require lubrication at the roller bore as well as at the pin joint. Chain without high pressure or self lubricating features should be swabbed with SAE 30 oil as often as necessary to penetrate roller bore and pin joint. Application may be made with an oil can or drip system.

It should be recognized that chain should be lubricated whenever it is possible to do so. Adequate lubrication is essential to maximum chain life. In most cases, without proper lubrication, the life of the chain will be shortened.

A. Excessive Noise

Possible Causes	*What to Do*
1. Misalignment	1.Check alignment & correct
2. Too little/much slack	2. Adjust take up
3. Improper lubrication	3. Lubricate properly
4. Loose casing or sprockets	4. Draw up all bolts, brace housings
5. Worn chain or sprockets	5. Replace chain & sprocket

B. Wear on Chain Side of Bars and Sides of Sprocket Teeth

Possible Causes	*What to Do*
1. Misalignment	1. Realign sprockets & shafts
2. Obstruction in guides, ways or casing	2. Remove obstruction & repair

C. Chain Climbs Sprocket

Possible Causes	*What to Do*
1. Poorly lifting sprockets	1. Replace sprockets, (chain if necessary)
2. Chain worn out	2. Replace chain
3. Insufficient chain wrap or excessive slack	3. Increase chain wrap w/ idler or adjust center
4. Material build up in sprocket tooth pockets	4. Remove material build up
5. Loose or broken buckets	5. Tighten, repair or replace buckets

D. Broken Rollers and Pins

Possible Causes	*What to Do*
1. Elevator speed too high	1. Use chain of shorter pitch or sprocket with more teeth
2. Shock or suddenly applied loads	2. Reduce shock loads, easy starts give long life
3. Inadequate lubrication	3. Lubricate properly
4. Material build up in sprocket pocket	4. Remove material build up
5. Buckets striking casing	5. Check bucket clearance & adjust

E. Pulsation

Possible Causes	*What to Do*
1. Chain tension too low	1. Adjust take ups to restore proper tension
2. Chain speed too low	2. Increase size of sprocket or increase elevator speed
3. Obstruction	3. Remove obstruction & be sure lower strand is not striking foreign obstruction, ways or casings
4. Heavy or tacky lubricants	4. Lubricate correctly
5. Sprockets with too few number of teeth	5. Replace sprocket with correct one

F. Chain gets Stiff Joints

Possible Causes	*What to Do*
1. Misalignment	1. Check sprocket & shaft alignment & correct
2. Material in chain joint	2. Remove foreign material
3. Improper lubrication	3. Lubricate properly
4. Corrosion	4. Protect chain with case, lubricate more often
5. Peening of side bars	5. Check for interference between chain & another member & correct excessive overloads

G. Broken Teeth Sprocket

Possible Causes	*What to Do*
1. Excessive shock loads	1. Avoid shocks, easy starts give long life
2. Objects wedged between chain and sprocket	2. Remove and protect from foreign objects
3. Chain climbing sprocket teeth	3. (see C1 – C5)

H. Rapid Wear on Troughs, Ways, or Casings

Possible Causes	*What to Do*
1. Abrasive material or obstruction in trough, ways, or casings	1. Remove obstructions
2. Bent/damaged buckets, attachments or links	2. Replace or repair
3. Insufficient casing lubrication	3. Lubricate properly

I. Damage to Conveyed Articles

Possible Causes	*What to Do*
1. Bent or damaged buckets, attachments or links	1. Repair of replace damaged parts
2.Improper timing	2. Check timing sequence, chain elongation, chain selection
3. Obstruction in ways or casings	3. Remove obstruction

J. Chain Clings to Sprocket

Possible Causes	*What to Do*
1. Incorrect or badly worn sprockets	1. Replace chain & sprockets
2. Heavy or tacky lubricants	2. Clean & lubricate properly
3. Material build up in drive sprocket tooth pockets	3. Remove material build up

BUCKET ELEVATOR MAINTENANCE

Evaluate at regular intervals:

- **CHECK BELT FOR TEARS, CUTS, ETC.** Sudden signs of unusual damage calls for immediate action.

- **CHECK CUPS FOR LOOSE OR MISSING BOLTS.** A loose dangling cup is the necessary lever to start a busted belt rip.

- **REPLACE BELT CUPS.** Cups with a pronounced forward bend hold the belt in a vertical arc, which is a contradiction of forces. When the belt is bent in a horizontal arc around the pulleys, cause lengthwise cracks to appear at the bolt holes.

- **CHECK BELT TENSION.** This is a possible source of drive slippage and excessive wear. Belts running loose in a leg are put to severe flex due to lack of full contact with the boot pulley. A loose belt may swing causing the cups to catch and tear the belt.

- **CHECK ALIGNMENT.** Belts not running true due to out-of-plumb pulleys, idlers or casing cause edge wear and pave the way for costly accidents.

- **CHECK SLIPPAGE ON DRIVE PULLEYS.** Proper lagging of pulleys can increase efficiency and belt life appreciably.

- **CHECK BUCKET ELEVATORS FOR UNEVEN LOADING.** This can cause the belt to crawl across the head pulley and cause edge wear or break the belt fabric.

- **CHECK BOOT FOR WATER.** A belt allowed to sit in water will rot and tear very easily.

- **CHECK DISCHARGE THROAT.** The throat to the down leg should be closed as much as possible with a piece of rubber belting adjusted close to the cups. This will prevent back legging.

Elevator Belt Service Problems and Corrections

Many times elevator belt problems can quickly and simply be corrected if the repair man knows what to look for. On these pages the most common forms of elevator belt problems are discussed. These findings are the results of the experience of hundreds of servicemen working on thousands of elevator belt installations.

Observation	Cause	Correction
Wear of bucket cover on the bucket side.	Buckets abrade against belt cover when passing around terminal pulleys.	Rubber washers between buckets and belt help cushion buckets.
	Fine abrasive material between belt cover and bucket.	Space between bucket and belt when washers are used permits fine material to pass through.
	If washers are used and material still is held between bucket and belt causing abrasive wear.	Rubber pad is occasionally used between bucket and belt. Material between bucket and pad wears only the pad. Material between pad and belt cover does not cause as serious abrasive wear because it is between two rubber surfaces.
	Abrasive wear caused by excess material in the boot.	If feed of material to the boot can be controlled, jamming and turbulence can be reduced.
	Cover gauge on bucket side may be too light or quality too low.	On future belts, bucket side cover gauge may be increased or higher quality used or both.
Wear of belt cover on pulley side.	Abrasive material carried between belt and boot pulley.	Some type of slatted or self-cleaning boot pulley may be used.
		A conventional smooth faced boot pulley can be lagged with soft rubber lagging.
		Improve design of discharge point, increase belt speed and do not overload buckets so that amount of material falling back down through casing into the boot is minimized.
	Belt slips at drive pulley.	If drive pulley is bare, lagging this pulley will usually sufficiently reduce belt slip. For moist operating conditions, lagging may be grooved to reduce slippage.
		In rare cases, even with lagged drive pulley, additional tension may have to be applied to the belt. In this case belt permissible operating tension should not be exceeded.
	Cover gauge on pulley side may be too light or quality too low.	On future belts, pulley side cover gauge may be increased or higher quality used or both.

Observation	Cause	Correction
Rubber cover separates from belt.	Cover distortion caused by bucket bolt heads can start pulley side cover separation from belt.	Improve cover adhesion. Use higher quality belt and/or breaker ply between carcass and cover. A regular "Leno" breaker is an improvement; a cord breaker is a greater improvement.
	Generally severe service with large size lumps of heavy abrasive material being handled.	
	Slip at drive can start pulley side cover separation.	Increase drive efficiency by lagging bare drive pulley. If belt will not be over stressed, additional tension for driving may be applied.
Belt ply separation.	One of the terminal pulleys may be too small.	Pulley diameter should be increased, but casing design often eliminates this possibility.
	Severe flexing service.	Higher quality belt carcass should be use in the future. This should include ample rubber skin coat between plies.
Breaks in belt carcass.	Lumps of material carried between belt and pulley.	Deflectors over boot pulley have helped in some cases. Some types of slatted or self-cleaning boot pulley may be used.
	Operating tension too high for existing belt.	Lagged drive pulley permits minimum operating tension.
	Carcass weakened due to mildew growth.	Mildew resistant belt should be used.
Buckets pull loose from belt or belt is torn at bolt hole.	Belt construction inadequate for proper bolt holding.	Besides withstanding necessary operating tension, proper belt recommendations should have considered bolt holding.
	Bucket and bolts not kept tight.	Bucket bolts should be kept tight. If bucket bolts come loose, bucket may snag and be torn from belt.
	Jammed boot.	Controlled feed should help eliminate jams and turbulence in the boot.
	Improper clearance or obstruction in casing.	Redesign if at all possible. Be certain that terminal pulleys are aligned properly for straight running belt.
	Pulleys are too small so that bolts are strained as belt flexes.	Possibly a larger drive pulley cannot be installed in existing design. Belt construction may be improved. Washers cushion the buckets so if not already used, they might be tried here.
Material not discharged cleanly from a spaced bucket, centrifugal discharge type of elevator	Belt speed and head pulley diameter not correctly related.	For any material there is a pulley diameter and belt speed relationship that must be considered to obtain clean discharge from a centrifugal type bucket elevator.
	Sticky material not discharging freely.	Higher belt speed may help.

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