# BUCKET ELEVATOR

## INSTALLATION, OPERATION & MAINTENANCE MANUAL

**BUCKET ELEVATOR GEN - 9/24/26**

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FRONT MATTER

# Warranty Policy

Orthman Conveying Systems (“OCS”) warrants the whole goods products it manufactures to be free from defects in material or workmanship for a period of one (1) year from the date of shipment of the product(s) to the original user. Products not manufactured, but supplied by OCS conform with and are subject to the warranty of our suppliers.

OCS warrants the parts it manufactures to be free from defects in material or workmanship for a period of ninety (90) days from the date of delivery of the product(s) to the original user. Products not manufactured, but supplied by OCS conform with and are subject to the warranty of our suppliers.

Warranty of OCS whole goods and/or parts applies only to material and workmanship. Misuse, misapplication, neglect, alteration, accident, normal wear, or acts of God affecting OCS products are not eligible for warranty.

WARRANTY CLAIMS: A warranty claim and request to return defective products(s) must be presented to OCS describing the defect in material or workmanship of the OCS product(s) within in ten (10) days of its discovery. The claim may be made via phone, e-mail, fax or written request.

OCS will proceed in making a preliminary decision as to the eligibility of the claim for warranty consideration. After OCS deems it necessary to proceed with warranty consideration, a Return of Goods Authorization (“RGA”) will be issued. Defective product(s) must be sent, freight prepaid, within sixty (60) days of the discovery of the failure and initial warranty claim.

Any variation in the above procedure is at the sole discretion of OCS. No products will be accepted at OCS without all proper paperwork completed including the Warranty Claim, Registration and RGA(s). Parts returned to OCS without proper authorization will be returned to sender at the sender’s expense.

OCS agrees to handle all warranty claims in a timely manner and will inform customer of any revisions or modifications to the Warranty Policy. Eligible warranty claims will be processed by OCS within sixty (60) days of receiving failed product(s) or a valid service or repair labor claim.

If a warranty claim is found to be ineligible for warranty coverage, OCS will be responsible to inform the customer in order to determine the course of action to be taken. OCS reserves the right to make changes in specification and design without incurring any obligations to owners of products previously sold.

SAFETY

# Warning and Safety Reminders

*CEMA Document: SC 2004-01*

## 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**

NOTICE: This document is provided by CEMA as a service to the industry in the interest of promoting safety. It is advisory only and it is not a substitute for a thorough safety program. Users should consult with qualified engineers and other safety professionals. CEMA makes no representations or warranties, either expressed or implied, and the users of this document assume full responsibility for the safe design and operation of equipment.

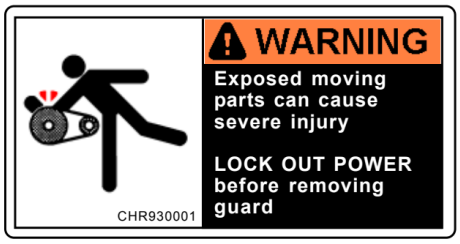
SAFETY

# CEMA Safety Labels

*CEMA Document: SC 2004-01*

## CEMA Safety Labels

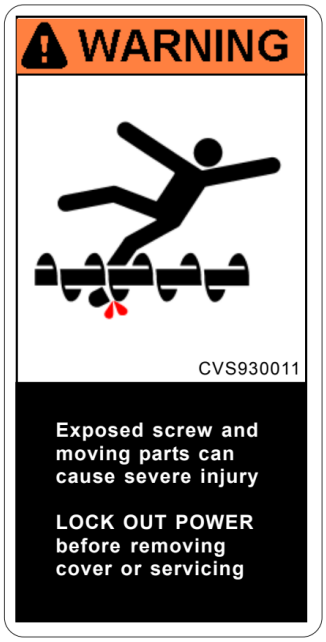
The CEMA safety labels shown below should be used on screw conveyors, drag conveyors, and bucket elevators. Safety labels should be placed on inlets, discharges, troughs, covers, inspection doors & drive guards. See CEMA Safety Label Placement Guidelines on CEMA Web Site: http://www.cemanet.org/safety/guidelines.html

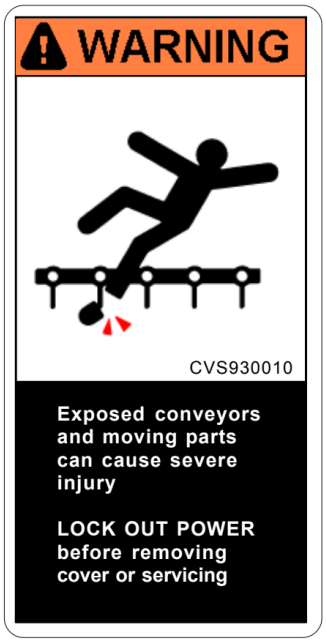


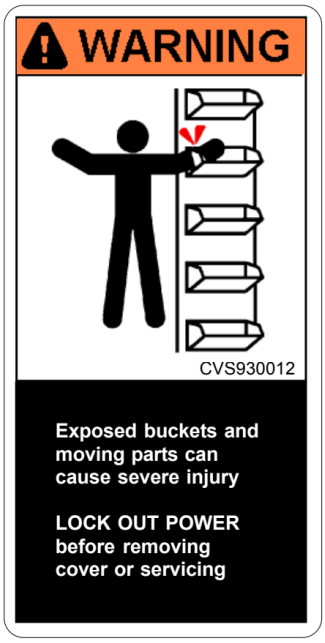







***PROMINENTLY DISPLAY THESE SAFETY LABELS ON INSTALLED EQUIPMENT***

***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

BELT ELEVATORS

# Installation of Belt Elevator Structure

## Assembling Elevator Structure

### General Notes

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: head section, boot section, and intermediate assemblies. All sections are factory assembled. For safety and shipping considerations the drive assembly is not mounted on the head. The intermediate assemblies are shipped in individual pieces.

### Installation

1. Ensure that anchor bolts are securely placed and conform to the pattern of the boot section mounting holes.
2. Set boot in place ensuring the boot section top flange is level and casing is plumb. This is accomplished by shimming under the bottom flange. Use shims only next to anchor bolts—not elsewhere along flange. Any gap resulting from shimming should be sealed with a strong structural grout. It is essential that the boot be set accurately.
3. Check General Arrangement drawings to determine the correct sequence of erecting intermediate casings. Caulk or gasketing should be placed between all casing flanges to provide dust tight sealing as shown in Figure 1.
4. Normally the erection crew should build a lifting bracket to avoid distortion to fabricated assemblies.

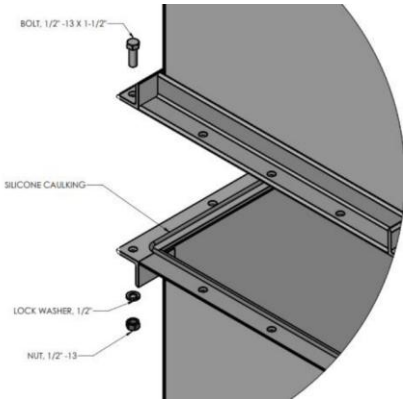



Figure 1

BELT ELEVATORS

# Structure Installation and Take-ups

5. Every intermediate section must be level and plumb. It is common to find minor deviations in these types of fabricated assemblies. Most often they can be corrected by rotating 180°, turning end for end or changing out sections, if possible. If this does not solve an out of level or out of plumb condition it will be necessary to use metal shims and caulk the resulting gap. When a gap occurs in a corner of the casing, metal shims should be used and should extend a minimum of six inches in both directions. Ensure that shims do not project inside of casing. Each intermediate section must be plumbed to less than 1/8” deviation before proceeding to the next section. Casings must be braced or anchored to a rigid structure every 25 ft. and not more than 4 ft. below the head section. If a rigid structure is not available, guy wires may be used with the same spacing.
6. After all intermediate sections are correctly placed, remove the front and back sections of the hood and set the lower head assembly using the same procedures as with the intermediate sections.
7. It is critical that the head shaft be level. Minor pillow block shimming may be necessary. Check head shaft pillow block set screws for tightness.
8. Drop a plumb line from the head pulley to boot pulley.
9. Ensure that pulleys are centered in casing and are in line with each other.
10. Check to ensure that the pulley taper locks are tight.
11. Pulleys should be in line when viewed from the narrow side of the casing.
12. Head and boot shafts are generally offset when viewed from the wide dimension of the casing. Check factory drawings for offset.
13. Replace hood sections after performing all installation steps including installation of belt.

### Take-ups

Take-ups are a mechanical device for adjusting shaft center distances. They are provided for all elevators to compensate for elongation of the belt as wear occurs and to provide temporary slack for installation and maintenance work. Take-ups are provided either as a mechanical screw or gravity system. In either case, ensure the take-up is adjusted for shaft and pulley alignment as described in the following section.

Caution must be used when adjusting take-ups to prevent over stressing belt and elevator equipment. A proper amount of slack should be allowed to obtain a smooth belt travel motion. There should be just enough tension from the pulley to pulley to keep the belt tracking and to keep the head pulley from slipping. On all belt elevators the adjustment should be made while the elevator is in operation to ensure the adjustment, which will meet the above conditions.

BELT ELEVATORS

# Installation of Belt, Buckets, and Belt Splice

## 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 maintain shaft alignment.
3. Align the pulleys axially on the shafts. A plumb bob should be used to check the alignment of head and boot pulleys and shafting after leveling shafts.

## Installing Belt, Buckets, and Belt Splice

### Installing Belt into Elevator

Note: Buckets may be attached to the belt before the belt is installed into elevator.

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 the nearest belt distributor to check your selection if belt is not provided from manufacturer. Replacement belts should meet or exceed manufacturer's original specifications to ensure functionality and safety of the elevator equipment.

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.

The following suggestions for the erection of belts are made to reduce the number of splices required in the field due to belt stretch.

1. It is suggested that the belt be put in the elevator and a temporary belt splice made. The belt should then be hung for a period of one or two days to allow initial stretching. Then the belt should be moved in about quarter increments and allowed to hang a couple of days in each quarter to insure stretch through its full length. Be sure the belt is not erected in a very cold environment as this will tend to shrink the belt and after it is warmed up, the belt will elongate and require re-splicing. The belt is pre-punched for the attachment of the buckets. When making the permanent splice, be certain the belt is pulled as tight as possible with take-up relaxed.
2. 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 into elevator 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.

BELT ELEVATORS

# Bucket Attachment and Belt Splicing

3. If belt cannot be lowered from the top of the elevator casing, assemble and feed the 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 and can allow for belt elongation over time. 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.

IMPORTANT: If a belt is furnished with a different cover thickness on each side, the thinnest cover should be on the pulley side of the belt or belt may pre-maturely fail. Belting companies usually roll the belt in the correct manner but cannot be guaranteed. Always double check.

## Installing Buckets to Belt

Again, note that the buckets can be mounted onto belt before or after belt is installed into elevator. The buckets should be installed as shown in Figure 2. Keep in mind the buckets should go on the thickest cover side of the belt. After the elevator has been run-in the buckets should be checked for loose hardware and if needed, retightened.

## Belt Splicing

There are a number of different ways to splice a belt. The most commonly used splice in a bucket elevator is a mechanical clamping device shown in Figure 3.

Installation instructions are as follows:

1. First ensure the belt ends are square and even. If using the splice template tape, apply the tape to mark the punching. Be sure to apply the tape squarely on the belt ends; then proceed to Step 4. If you are not using the tape, go to Step 2.
2. Draw a line approximately 4-1/4” from the belt end to use as the center line for hole punching. Proper installation for even width belts will begin just inside the belt edge. Odd belt widths require installation 1/2” from the belt edge.

| RECOMMENDED TORQUE FOR ELEVATOR BOLTS | | | | |
|---|---|---|---|---|
| SHANK DIAMETER | STEEL | | STAINLESS | |
| | IN./LBS. | KGM/M. | IN./LBS. | KGM/M. |
| 1/4" | 50 | 7 | 86 | 12 |
| 5/16" | 96 | 13 | 177 | 25 |
| 3/8" | 180 | 25 | - | - |

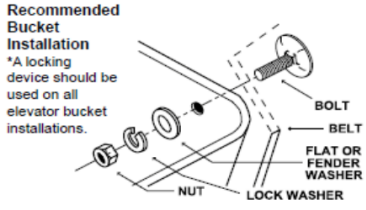



Figure 2

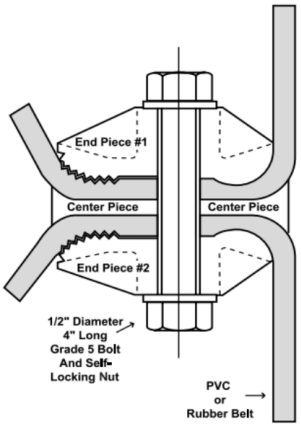



Figure 3

BELT ELEVATORS

# Belt Splicing and Initial Operation

3. Use the Maxi-Splice as a template to mark the hole locations for punching.

After marking the first hole, move over 2” and mark each consecutive hole.

4. Punch both belt ends for 1/2” diameter bolts.
5. The two end plates and center plate are used for firm belt gripping. The end plates have two gripping areas – the slotted gripping area is mounted toward the face of the belt and is followed by a series of gripping teeth. These teeth are always mounted toward the tail of the belt. The center plate is symmetrical and cannot be improperly installed.
6. IMPORTANT: We have supplied a 1/2” diameter, 4” long Grade 5 bolt and nylon locking nut. The bolts must be torqued for MaxiSplice to effectively clamp. The torque requirement is 75 foot pounds for belts up to and including 600 PIW – belts greater than 600 PIW require 100 foot pounds of torque.
7. Run the belt for thirty minutes; stop the leg and re-torque the bolts.
8. When reinstalling the Maxi-Splice always use new Nylock nuts

### Throat Plate

The bucket elevator throat plate (AR plate) is designed to reduce the amount of backlegging of material from the buckets. The throat plate is slotted and bolted down using carriage bolts. Access to the nuts is available from the outside of the elevator underneath the discharge. The throat plate should be adjusted to be approximately 1/2” from the line of the lip of buckets. Make sure the buckets will not hit the throat plate to avoid damaging the elevator components.

## OPERATION AND MAINTENANCE OF BELT ELEVATORS

### Prevent Overload

For a bulk material handling 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 or a motor overcurrent switch. Backstops or a handbrake are provided to prevent back run of a loaded elevator in the event of a power failure.

## WARNING: GEAR REDUCER LUBRICATION

Before startup, verify gearbox lubricant type, fill level and mounting-position requirements using the supplied gearbox manufacturer documentation.

Depending on gear reducer manufacture, gear reducers do not ship from Orthman Conveying Systems filled with oil.

Gear reducers must be positioned, verified and filled to the proper level by the installer or user before startup.

BELT ELEVATORS

# Operation and Maintenance of Belt Elevators

## 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 is 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 master lubrication check sheet or card for each elevator.
6. Establish a definite program of inspection.
7. Elevator belts should be checked for a) wear, b) stretch, c) edge wear (indicating misalignment) & d) 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.

BELT ELEVATORS

# Bucket Elevator Maintenance Checklist

## 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 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 AR plate adjusted close to the cups (approximately 1/2" from cups). This will help prevent back legging.

BELT ELEVATORS

# 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. |

BELT ELEVATORS

# Belt Service Problems and Corrections Continued

| 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. |

CHAIN ELEVATORS

# Installation of Chain Elevator Structure

## Assembling Elevator Structure

### General Notes

1. A bucket elevator is actually a chain and sprocket transmission enclosed within a casing.
2. For proper operation care must be taken to maintain chain 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 chain on the sprockets.
4. Bucket elevators are comprised of three main assemblies; head section, boot section, and intermediate assemblies. All sections are factory assembled. For safety and shipping considerations the drive assembly is not mounted on the head. The intermediate assemblies are shipped in individual pieces.

### Installation

1. Ensure that anchor bolts are securely placed and conform to the pattern of the boot section mounting holes.
2. Set boot in place ensuring that the boot section top flange is level and casing is plumb. This is accomplished by shimming under the bottom flange. Use shims only next to anchor bolts—not elsewhere along flange. Any gap resulting from shimming should be sealed with a strong structural grout. It is essential that the boot be set accurately.
3. Check General Arrangement drawings to determine correct sequence of erecting intermediate casings. Caulk or gasketing should be placed between all casing flanges to provide dust tight sealing as shown in Figure 4.
4. Normally the erection crew should build a lifting bracket to avoid distortion to fabricated assemblies.

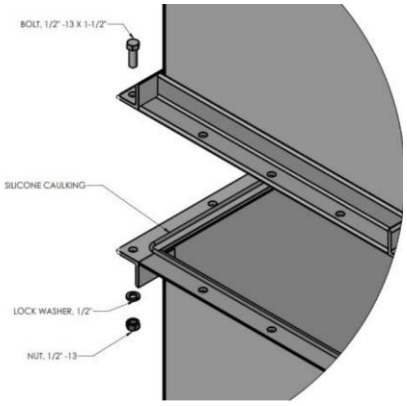



Figure 4

CHAIN ELEVATORS

# Structure Installation and Take-ups

5. Every intermediate section must be level and plumb. It is common to find minor deviations in these types of fabricated assemblies. Most often they can be corrected by rotating 180°, turning end for end or changing out sections, if possible. If this does not solve an out of level or out of plumb condition it will be necessary to use metal shims and caulk the resulting gap. When a gap occurs in a corner of the casing, metal shims should be used and should extend a minimum of six inches in both directions. Ensure that shims do not project inside of casing. Each intermediate section must be plumbed to less than 1/8” deviation before proceeding to the next section. Casings must be braced or anchored to a rigid structure every 25 ft. and not more than 4 ft. below the head section. If a rigid structure is not available, guy wires may be used with the same spacing.
6. After all intermediate sections are correctly placed, remove the front and back sections of the hood and set the lower head assembly using the same procedures as with the intermediate sections.
7. It is critical that the head shaft be level. Minor pillow block shimming may be necessary. Check head shaft pillow block set screws for tightness.
8. Drop a plumb line from the head sprocket to the boot sprocket.
9. Ensure that sprockets are centered in casing and are exactly in line with each other.
10. Check to ensure that the sprocket taper locks or setscrews are tight.
11. Sprockets should be in line when viewed from the narrow side of the casing.
12. Head and boot shafts are generally offset when viewed from the wide dimension of the casing. Check factory drawings for offset.
13. Replace hood sections after performing all installation steps including installation of belt.

### Take-ups

Take-ups are a mechanical device for adjusting shaft center distances. They are provided for all elevators to compensate for elongation of the chain as wear occurs and to provide temporary slack for installation and maintenance work. Take-ups are provided either as a mechanical screw or gravity system. In either case, ensure the take-up is adjusted for shaft and sprocket alignment as described in the following section.

Caution must be used when adjusting take-ups to prevent statically over stressing chain and elevator equipment. A proper amount of slack should be allowed to obtain a smooth chain travel motion. There should be just enough tension from sprocket to sprocket to keep the chain tracking and to keep the head sprocket from slipping. On all chain elevators the adjustment should be made while the elevator is in operation to ensure the adjustment, which will meet the above conditions.

CHAIN ELEVATORS

# Installation of Chain, Buckets, and Chain Splice

## Shaft and Sprocket Alignment

Proper alignment of sprocket and shaft greatly lengthens 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.
3. Align the sprockets axially on the shafts. A plumb bob should be used to check the alignments of head and boot sprockets and shafting after leveling.
4. 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.
5. 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.

## Installing Chain, Buckets, and Chain Splice

## Installing Chain into Elevator

Note: Buckets may be attached to the chain before the chain is installed into elevator.

In the installation of elevator chains certain general practices should be followed. The first is to be sure you select the best type of chain for the service to be performed. Consult your chain catalog or call the nearest chain distributor to check your selection if chain is not provided from manufacturer. Replacement chains should meet or exceed the manufacturer's original specifications to ensure functionality and safety of the elevator equipment.

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

Proper direction of chain travel is important on some chains. Consult your chain catalog or nearest chain distributor for proper chain travel. If your chain has straight side bars, the chain operates equally as well in either direction.

CHAIN ELEVATORS

# Chain Splicing and Bucket Attachment

1. 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.
2. 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 4 links 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 equipment.

## Chain Splicing

The chain should be properly spliced to prevent premature failure of the chain resulting in damage to the equipment, human injury or death. Make sure chain is linked together according to the chain manufacturer's original specifications. Consult your chain catalog or call the nearest chain distributor if you have questions.

## Installing Buckets to Chain

Buckets can be assembled to the chain before or after the chain has been installed into the elevator, depending on customer's preference. Elevator buckets are generally attached to chains by means of Hex-head 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. After the unit has been run, the bolts should be checked and retightened, if necessary.

## Throat Plate

The bucket elevator throat plate (AR plate) is designed to reduce the amount of backlegging of material from the buckets. The throat plate is slotted and bolted down using carriage bolts. Access to the nuts is available from the outside of the elevator underneath the discharge. The throat plate should be adjusted to be approximately 1/2" from the line of the lip of buckets. Make sure the buckets will not hit the throat plate to avoid damaging the elevator components.

CHAIN ELEVATORS

# Operation and Maintenance of Chain Elevators

## Prevent Overload

For a bulk material handling 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 or a motor overcurrent switch. Backstops or a handbrake are 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 is 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 chains. 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 will do much to add life to your chain elevator:

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 or elevator.
6. Establish a definite program of inspection.

CHAIN ELEVATORS

# Inspection, Cleaning and Storage

7. Chains should be checked for: (a) wear on side bar inner faces (indicating misalignment); (b) worn pins, bushing, rollers and/or 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 therefore 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: If 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.

# Chain Lubrication

## 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 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.

CHAIN ELEVATORS

# Troubleshooting of Chain Elevators

## 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 | 4. Remove material build up tooth pockets |
| 5. Loose or broken buckets buckets | 5. Tighten, repair or replace |

## 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 |

CHAIN ELEVATORS

# Troubleshooting of Chain Elevators Continued

## 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 or 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 |

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