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CHAIN-BUCKET ELEVATOR INSTALLATION AND MAINTENANCE

Bulletin 300/700.IOM

INSTALLATION OF CHAIN ELEVATORS

ASSEMBLING CASING

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 proper chain and shaft alignment.
3. Although alignment is checked by Sinclair 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 the chain on the sprocket.
4. Bucket Elevators are comprised of four main assemblies; namely, head terminal, boot terminal, intermediate assemblies and components. All terminals are factory assembled and shipped assembled. All intermediate casings are shipped in individual pieces.
5. Assemble casing by first setting the 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 and the head section as marked on the arrangement drawing.

PROPER DIRECTION OF CHAIN TRAVEL

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

Offset side-bar chains should operate with the open end of the link forward. Since shaft centers normally are long and speed slow, flexing of the chain is less frequent and wear is more likely to occur on the head sprocket. Running these chains open end forward reduces wear on the drive sprocket.

Where the elevator involves the use of two or more strands, it is necessary to use carefully matched strands. Use of matched strands assures perfect alignment across the strands and is particularly important where through-rods or other carrying attachments are used. Strands operating out of alignment throw the load onto one chain, causing excessive wear on chain attachments and sprockets. Periodic checks of multi-strand chain elevators should be made to make sure chains are operating in proper alignment with each other. When reordering chains for multiple-strand elevators, be sure to specify that matched strands are to be furnished.

TAKE-UPS

Take-ups are a mechanical device for adjusting shaft center distances and are provided for all elevators to compensate for elongation as joint wear occurs. They also provide temporary slack for installation or maintenance work. Wherever possible, take-ups on elevators will be mounted at the foot ends. This eliminates the troublesome adjustment of the drive as would be the case if the take-up were mounted on the head end.

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

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:

- A. Carefully level the shafts. Use a machinist's level directly on the shaft.
- B. 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.
- C. Align the sprockets axially on the shafts. A plumb bob should be used to check the alignment of

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head and foot sprockets and shafting after leveling shafts.

D. When a shaft has some end play (as does the shaft of an electric motor), align the sprockets with the shaft in it's running position.

E. 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.

CHAIN INSTALLATION

A. 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.

B. 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 the top whenever possible. When chain is positioned, snub the headshaft. Connect at the inspection door using a come-along fall to draw chain ends together. Adjust take-up.

C. 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 foot sprocket and upward to top of the headsprocket. Snub this leg. Next, drop line down nearside of casing. Hitch line three or four 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.

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

OPERATION

For a bulk material handling elevator, flow of material should always be regulated. 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. Back-stops are provided to prevent backrun of a loaded elevator in the event of a power failure.

To assure long life, whenever possible the elevator should be empty when starting and should be stopped only when again empty. Starting under load not only places extra 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 great pull may be required to break the load loose. Elevators should be operated at regular intervals during any extended down period to avoid freeze-ups.

MAINTENANCE

Preventive maintenance and periodic inspection will do much to prolong the life of your elevator 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 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: extreme cold, rain, or snow and sleet.
3. Provide pipe extension for difficult-to-reach grease fittings or an automatic greasing system.

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4. Provide adequate cleanup of dribble and spillage.
5. Set up a specific lubrication program and fix definite responsibilities for carrying out such procedures. 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. Chains should be checked for: (a) Wear on side-bar inner faces (indicating misalignment); (b) Worn pins, bushings 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 remove excess slack.

SPROCKET INSPECTION

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

There is 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 oleum spirits or other suitable cleaning fluid. On heavy elevators where removal of chain is impractical, clean by brushing or swabbing 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 or the sprockets.

Chains in Service

When putting chains 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 relubrication will add to the life of both chain and sprockets.

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 in oleum spirits or kerosene, or by swabbing. Chains used in applications prohibiting lubrication should be brushed periodically to remove dirt and grit.

Lubrication is important in the pin joint and also on the outer surface which comes in contact with the track and trough. These chains should be swabbed with SAE30 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 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.

CHAIN-BUCKET ELEVATOR INSTALLATION AND MAINTENANCE

TROUBLESHOOTING

A. EXCESSIVE NOISE

Possible causes 1. Misalignment 2. Too little or too much slack 3. Improper lubrication 4. Loose casing of sprockets 5. Worn chain or sprocket **What to Do** 1. Check alignment and correct 2. Adjust take-up 3. Follow instructions in lubrication section 4. Draw up all bolts...brace housings if necessary 5. Replace chain and sprocket

B. WEAR ON CHAIN SIDE BARS AND SIDES OF SPROCKET TEETH

Possible Causes 1. Misalignment 2. Obstruction of guides, ways or casing. **What to do** 1. Correct alignment of sprockets and shafts 2. Remove obstruction, repair or replace damaged part

C. CHAIN CLIMBS SPROCKET

Possible Causes 1. Poorly fitting sprockets 2. Chain worn long in pitch...or worn out 3. Insufficient chain wrap or excessive slack 4. Material build-up in sprocket tooth 5. Loose or broken bucket **What to Do** 1. Replace sprockets (and chain if necessary) 2. Replace chain 3. Increase chain wrap with idler or adjust center for proper slack 4. Remove material build-up 5. Tighten, repair or replace buckets

D. BROKEN PINS AND ROLLERS

Possible Causes 1. Elevator speed too high for chain 2. Shock or suddenly applied loads 3. Inadequate lubrication 4. Material build-up in sprocket tooth pockets 5. Buckets striking casing **What to do** 1. Use chain of shorter pitch or sprocket with more teeth 2. Reduce shock loads 3. Follow instructions in lubrication section 4. Remove material build-up 5. Check bucket clearance with casing or tighten loose buckets

E. PULSATION

Possible Causes 1. Chain tension too low 2. Chain speed too slow 3. Obstruction 4. Heavy or tacky lubricants 5. Sprockets with too few number of teeth, resulting in a large amount of chordal action **What to do** 1. Adjust take-ups to restore proper tension 2. Increase size of sprocket or increase elevator speed 3. Remove obstruction and be sure lower strand is not striking foreign obstruction, ways or casing 4. Lubricate correctly 5. Replace with sprockets having correct number of teeth

F. BROKEN SPROCKET TEETH

Possible Causes 1. Excessive shock loads 2. Objects wedged between chain and sprocket teeth 3. Chain climbing sprocket teeth **What to Do** 1. Avoid shocks...easy starts give long life 2. Remove and protect from foreign objects...alter trough at discharge point to prevent dropping of objects into sprocket teeth 3. (See C1 to C-5)

G. CHAIN GETS STIFF JOINTS

Possible Causes 1. Misalignment 2. Material in chain joint 3. Improper lubrication 4. Corrosion 5. Peening of side bars 6. Excessive overloads **What to Do** 1. Check sprocket and shaft alignment, and correct...replace damaged chain if necessary 2. Remove foreign material 3. Lubricate properly 4. Protect chain from corrosion with case...clean and lubricate more often 5. Check for interference between chain and another member, and correct.

H. RAPID WEAR ON TROUGHS, WAYS OR CASINGS

Possible Causes 1. Abrasive material or obstruction in casing, ways or guides 2. Bent or damaged buckets, attachments or links 3. Insufficient casing lubrication **What to Do** 1. Remove obstructions and try to avoid assimilation of abrasive material 2. Replace or repair damaged buckets attachments and links 3. Lubricate properly where lubrication is permitted.

I. CHAIN CLINGS TO SPROCKETS

Possible Causes 1. Incorrect or badly worn sprockets 2. Heavy or tacky lubricants 3. Material build-up in driver sprocket tooth pockets **What to Do** 1. Replace chain and sprockets 2. Clean and lubricate properly 3. Remove material build-up...protect from contact with foreign material, or use sprockets with mud relief, pitch line clearance