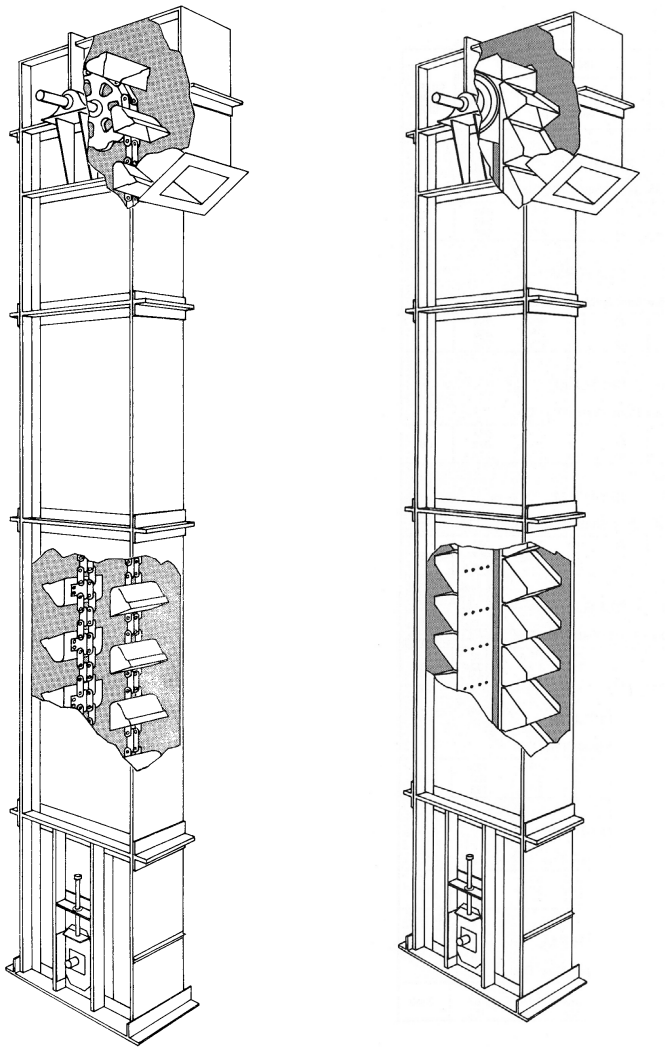
BUCKET ELEVATOR MANUAL

Installation / Operation / Maintenance



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NOTE – Safety instructions contained within are basic guidelines and should be considered as minimum provisions. Additional information shall be obtained by the purchaser from other sources including the latest editions of American Society of Mechanical Engineers; Standard ANSI B20.1; Standard ANSI B15.1; Standard ANSA A12.1; Standard ANSI MH4.7; Standard ANSI Z244.1-1982.

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BUCKET ELEVATORS

FOUNDATION

Because most bucket elevators are self-supporting for vertical loads, the foundation must be designed to take the total weight of the elevator and the material that is to be lifted by the bucket elevator. The foundation must be level to provide the proper support for the elevator and the casing must be braced for wind loads at intervals shown on the drawings.

CASING COUNSTRUCTION

Bucket elevators are furnished with three types of construction. Please refer to your general arrangement drawing for the type of construction used on your elevator. The following is the list of types of construction and how the filed connection joints must be made for each type.

1. STANDARD CONSTRUCTION – 2" on 20" centers welds for inside casing joints, outside of casing sheets will be skip welded 2" on 12" centers to angles. No gaskets or caulking will be provided for any joints.

2. DUST TIGHT CONSTRUCTION – 2" on 20" centers welds for casing inside joints, outside casing sheets will be skip welded 2" on 12" centers to angles. Inside joints will be caulked with compound between welds to seal joints. Gaskets will be provided at all bolted joints.

3. WEATHER TIGHT CONSTRUCTION – All inside casing joints will be welded continuously, outside of casing sheets will be skip welded 2" on 12" centers to angles. Gaskets will be provided at all bolted joints.

INSTALLATION OF BUCKET ELEVATORS

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 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 pulleys.
4. Bucket elevators are comprised of three main assemblies: head terminal, boot terminal, and intermediate assemblies and components. All terminals are factory assembled and shipped assembled. All intermediate casings are shipped in individual pieces.

5. Assemble casing first by 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', etc. These markings will be located in the lower right corner of each section and after assembly can be readily checked by sight from bottom to top.

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 provide temporary slack for installation or maintenance work.

Wherever possible, take-ups on elevators should be mounted at the foot end. This eliminates the troublesome adjustment of the drives 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 the 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 to 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 your nearest belt distributor to check your selection.
Install the elevator belt with foot take-ups positioned at upper end of travel, and head end take-ups at lower end of travel to provide 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 foot pulley and up to the inspection door. Lower belt into casing from top. When belt is positioned, snub the headshaft. Connect at inspection door using a come-along or chain fall to draw belt end together. Adjust take-ups.
2. If belt can not be lowered from the top of the elevator casing, assemble and feed the belt around the bottom of the foot pulley and forward to the top of the head pulley. Next, drop line down near side 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 re-tightened, and the bolt threads should be prick-punched to prevent loosening of the nuts.

BELT SPLICING AND BUCKET MOUNTING

BELT SPLICING

Method of belt splicing is determined by the number of plies and the severity of service required. For most elevators, plate type fasteners can be used. For belt thickness up through six ply, the belt ends are lapped for a minimum of three buckets. These buckets are bolted though both thicknesses of the belt lap. For belt thicknesses of seven 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 ends 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 though both layers of belting.

TYPES OF BELT SPLICES

THE LAP JOINT

The lap joint is shown in Figure 1 and usually requires the lapping of at least three buckets.

BUTT SPLICE

This type of splice is shown in Figure 2 and will normally use a section of belt for the butt section or a piece of nylon butt strapping.

FLEXCO SPLICE

This type of splice is shown in Figure 3 and is made according to the instructions that come with the Flexco fasteners.

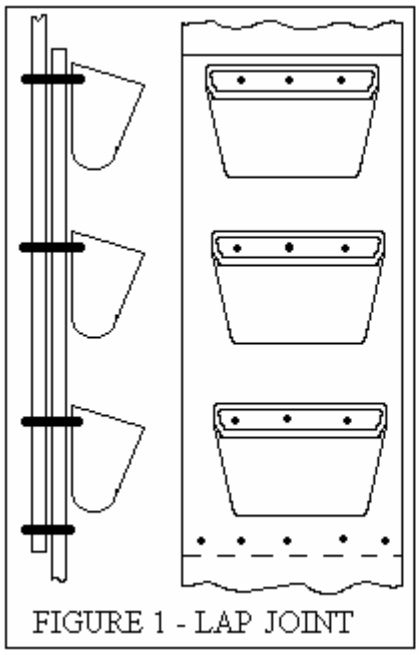

FIGURE 1 - LAP JOINT

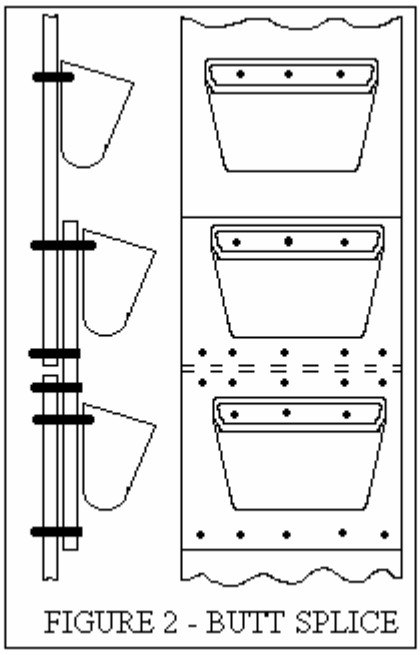

FIGURE 2 - BUTT SPLICE

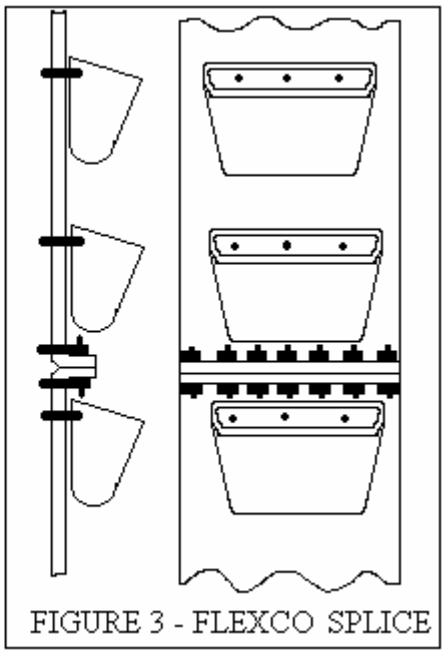

FIGURE 3 - FLEXCO SPLICE

MOUTNING ELEVATOR BUCKETS ON BELT

Elevator buckets are generally secured to belts by means of flat head bolts know as elevator bolts number 1 head(also called Norway bolts), having American standard square nuts. Number 2 oval head bolts are used with the heaviest belts and buckets. Leather washers are regularly used between the bucket and the belt to absorb shock when the buckets pass over the pulleys. They also serve to reduce accumulation of material between the bucket and belt, and help seal the bolt holes against moisture. One washer is used per bolt. The belt carrying the buckets should be at least 1 inch wider than the bucket for length up to 16 inches, and 2 inches wider than the bucket for length 16 inches and over. When two lines of buckets are used on the same belt they should be staggered with respect to each other.

BUCKET ATTACHMENTS

CHAIN

The buckets are attached to the chain by the use of hex head type bolts with lockwashers. The bolt head is inside the bucket. Figure 4

BELTS

Normally a Norway bolt or ovalhead type of bolt is used to attach the buckets to the belt. The flat of ovalhead is placed on the pulley side of the belt with the attachment to the bucket made by use of a lockwasher and nut. Normally the bucket will have a pliable washer between the bucket and the belt. Figure 5.

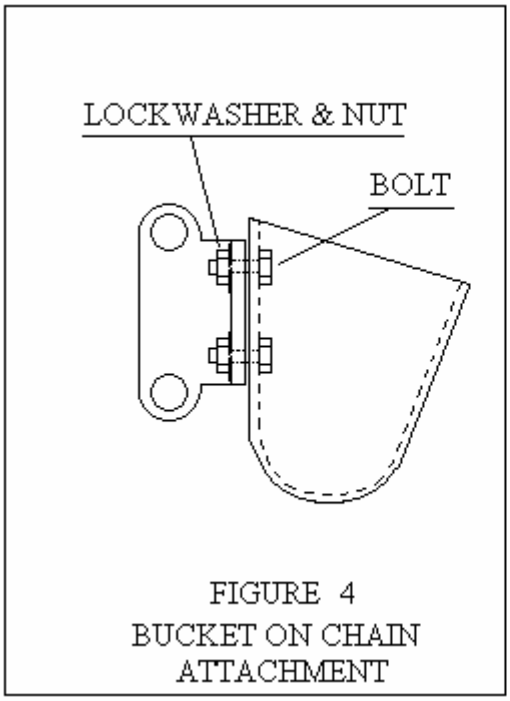

FIGURE 4
BUCKET ON CHAIN
ATTACHMENT

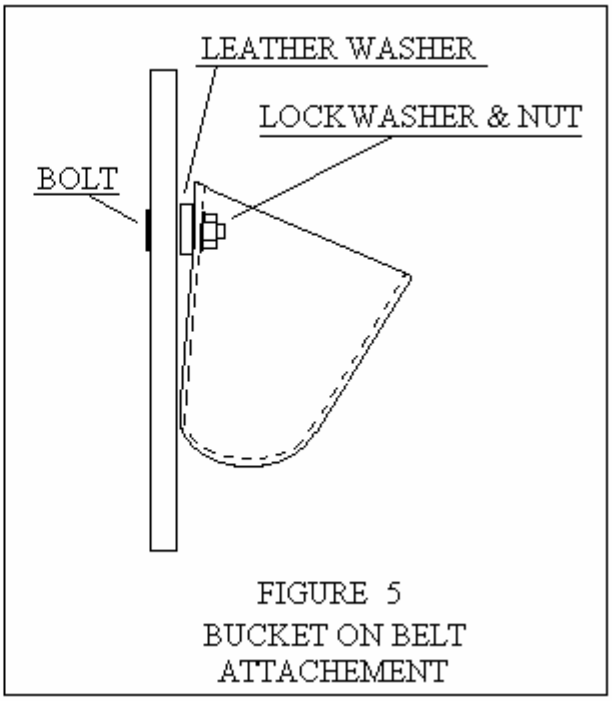

FIGURE 5
BUCKET ON BELT
ATTACHEMENT

OPERATION AND MAINTANENCE OF BELT ELEVATORS

PREVENT OVERLOAD

For a bulk material handling conveyor or elevator, flow of 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. Overload protection can also be provided by the installation of shear pin hubs. Backstops or a handbrake can be provided to prevent backrun of a loaded elevator in the event of a power failure.

STARTING AND STOPPING

To assure long life, wherever 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 also 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

1. On large elevators, provide suitable walkways and, where necessary, platforms with stairs 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 fitting 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 master 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 (indication misalignment or material build up on pulleys).
8. Pulleys should be examined for alignment and positioning.
9. Bucket 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.

MACHINERY ERECTION

BOOT SECTION

The shaft, bearings, and pulleys or sprocket are shop assembled in the boot section. The boot is furnished with either screw type take-up, a gravity type take-up, or with a fixed boot shaft. Please note that the boot is normally not furnished with any bottom plate except for the fixed type boot. With the fixed type of booth there is a curved bottom plate supplied.

HEAD SECTION

The shaft, bearings, and pulleys or sprocket are shop assembled in the head section. The head shaft should erected so that the shafting is horizontal and the carrying side of the elevator belt or chain is plum with the tail sprocket or pulley. Note that in all elevators the head shaft pulley or sprocket is normally larger than the boot shaft pulley or sprocket.

CHAIN

The chain is furnished with special attachments at various pitches of the chain to allow proper spacing of the buckets. Be sure the chain is erected with the proper number of pitches of chain as listed on the general arrangement drawing. Also make sure the chain is running in the right direction.

BELTS

The following suggestions for the erection of belts are made to reduce the number of splices required in the field due to belt stretch. 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 some initial stretching. Then the belt should be move 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 prepunched for the attachment of the buckets. When making the permanent splice, be certain the belt is pulled as tightly as possible. The take-up should be in its far up position to allow for tensioning (if take-up is located in boot section) and the belt spliced with the proper spacing of prepunched holes for attachment of buckets. If a belt is furnished with a different cover thickness on each side, the thickest cover should be on the pulley side of the belt.

OPERATION

A continuous or centrifugal bucket elevator must have a controlled load delivered to it for proper and trouble free operation. If the load is not fed uniformly but delivered in surges, the elevator can be overloaded. This causes the boot to flood resulting in excessive overload to the machinery.

ALIGNMENT

CENTRIFUGAL ELEVATORS

CHAIN – With a chain, the alignment of the elevator is normally very easy to maintain. The sprocket on the tailshaft normally is tightened down enough so the sprocket engages the chain and guides the chain in the loading area. No tension is required in the chain to develop driving friction because this is taken care of in the sprocket itself.

BELT – When a belt is used, the tail pulley should be tightened enough to provide the training effect of the tail pulley itself. In some instances, it is necessary to develop the driving friction or some part of the driving friction from the tail pulley. If the weight of buckets and belt is not enough to develop friction at the head pulley, then the screw take-up should be tightened enough so that no spillage occurs in handling the design capacity of bucket elevator. Note that the boot shaft must rotate at all times while the elevator is in operation, showing that the belt is in contact with the pulley and is being trained by it.

CONTINUOUS ELEVATORS

CHAIN – When using a chain with this type of elevator, the alignment is the same as for a centrifugal elevator. Be sure to note the continuous elevator has a loading leg in the boot section and the buckets must enter this loading leg properly to prevent interference. Normally, with sprocket on the boot shaft, there should be no problem with training of the unit.

BELT – With a belt elevator, training is critical and the tail pulley must be tightened as mentioned for the centrifugal elevator. Since the continuous elevator has a loading leg, the buckets must enter this loading leg properly to prevent interference. It is very critical that the belt train properly with this type of elevator. Proper alignment and tensioning of the tail pulley is one of the principle means of training the belt.

We recommend the use of a rotary speed switch on the boot shaft to be interlocked with the drive of the unit. This will make it necessary for the take-up to be properly tensioned before the unit will operate, along with preventing damage to the elevator if the boot shaft stops rotating as a result of a problem.

GRAVITY TAKE-UPS

When gravity take-ups are furnished in the boot sections, the take-up weight is normally just sufficient to engage the sprocket or pulley and provide proper tension. When hot materials are handled in elevators, the gravity take-ups insure proper engagement of the sprocket on the chain when the chain elongates due to the increased temperature. It is possible that the gravity take-up is also used to create driving friction on belt elevators, with the general arrangement drawing giving the maximum counterweight of the take-up for the particular application.

SCREW TAKE-UPS IN BOOT SECTION

When screw take-ups are tightened, they should be adjusted so the tail shaft rotates, or in the case of driving friction, tightened enough to create the required driving friction between the belt and the head pulley.

CAUTION If the take-up is tightened too much, it can cause excessive load in the belting or chain and possibly bend the boot shaft.

When adjusting the screw take-up, it is important to take up evenly both sides, as uneven tension will throw the belt out of alignment.

HEAD END TAKE-UPS

When an elevator is furnished with head end take-ups, it is very important to take up both sides evenly to maintain alignment. It is also necessary to tighten the head end take-ups enough to insure that the tail pulley or sprocket rotates to aid in the training of the belt or chain in the boot section.

BREAK-IN PERIOD

All elevators should be run empty for a period of time to be certain the elevators are training properly and there is no interference with any part of the casing or discharge chute.

ELEVATOR CAPACITY

Many times under operating conditions the capacity of the elevator is less than stated on the design drawings. If this appears to be true, check the following three items:

1. Make sure there is no back-legging of material. If there is backlegging set the rubber lip at the discharge chute as close to the buckets as possible.
2. Check the density of the material being handled. If the density of the material is less than shown on the design drawings, the capacity handled will be decreased proportionally.
3. The capacity of the elevator shown on the design drawings is its maximum capacity (based on 75% bucket loading). The elevator must be at this capacity continuously to be able to deliver its rated capacity.

MAINTENANCE

BUCKETS - The elevator should be checked to be sure all buckets are attached to the chain or belt and that all bolts are tight. Many times a foreign object will get into the elevator and tear off buckets. This can cause additional buckets to be torn off causing improper operation of the elevator.

CHAIN - The chain should be checked for wear at the barrels, pins, and/or bushings. The best indication of excessive chain wear is when the chain pitch and sprocket become more and more out of phase and the chain barrels or bushings ride higher and higher on the sprocket teeth. Another indication of excessive chain wear is when a continual adjustment of the take-up is required.

BELTS - Belts will continue to stretch throughout their service life, but the greatest increase in length will occur during the first part of operation. Be sure to check the boot shaft at frequent intervals to be sure that it is turning. This will indicate the tail pulley is engaged and helping train the belt.

A general purpose inspection should be made periodically on all parts of the elevator to insure proper operation of the unit. Be certain to keep the rubber lip located at the discharge chute adjusted as close to the bucket lips as possible. This will help prevent back-legging of material into the boot.

LUBRICATION

REDUCERS - Reducers are shipped without oil and should be lubricated per the reducer manufacturer's name tag instructions or the instructions attached to the reducer.

MOTORS - Motors should be lubricated per motor manufacturer's instructions.

BEARINGS - Bearings are factory lubricated and should be relubricated about every 250 hours of operation. The head and tail shaft bearings should be lubricated while the unit is running, adding grease slowly until a slight bleeding of lubricant appears at the seals.