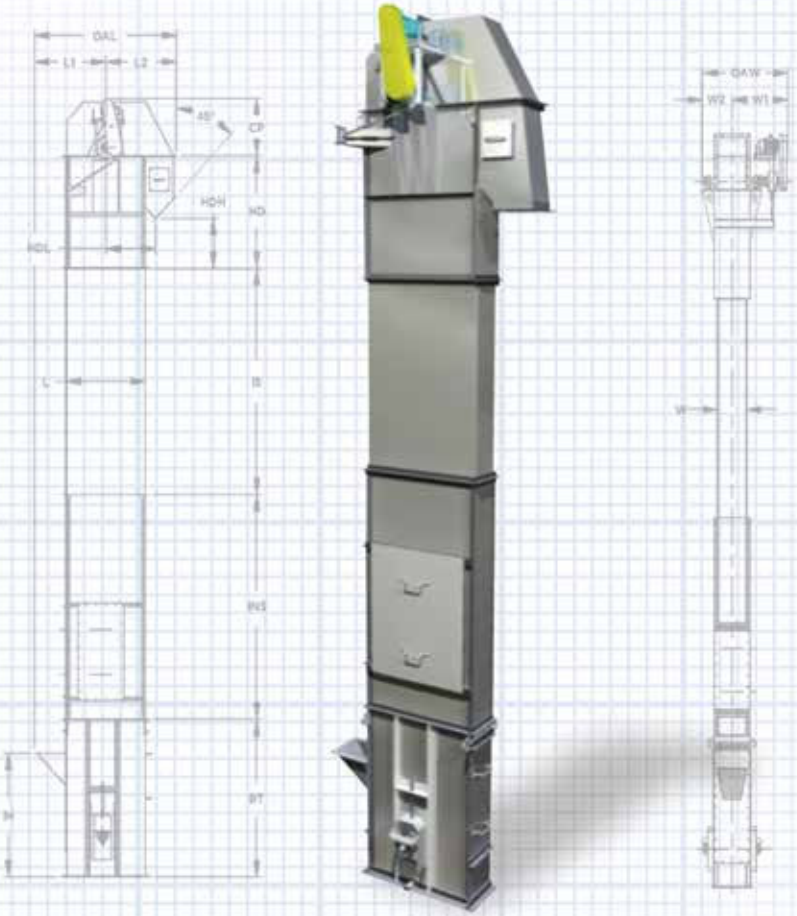
CONVEYING SOLUTIONS

SAFETY, INSTALLATION, OPERATION, AND MAINTENANCE MANUAL FOR BUCKET ELEVATORS



ISO 9001 Certified

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KWS HISTORY

Founded in 1972, KWS Manufacturing Company, Ltd. designs and manufactures conveying equipment for the bulk material handling industry.

Our vast product line includes -

- Screw Conveyors – Shafted and Shaftless
- Screw Feeders – Shafted and Shaftless
- Vertical Screw Conveyors – Shafted and Shaftless
- Live Bottom Feeders – Multiple Screw Feeders
- Belt Conveyors
- Drag Conveyors
- Bucket Elevators
- Slide Gates
- Hoppers, Bins and Silos
- Structural Supports
- CEMA Standard Stock Components
- Made-to-Order Components

Our corporate office and manufacturing facilities are located in Burleson, Texas (convenient to the Dallas/Fort Worth Metroplex). Our manufacturing facility continues to expand and is currently 125,000 square feet.

As an ISO 9001 certified manufacturer, KWS provides the highest quality equipment and service to our customers. Our large number of repeat customers shows our commitment to customer satisfaction. Our quality system ensures that your equipment is designed and manufactured to rigid specifications and validated by exceeding performance expectations.

MARKETS SERVED

Working closely with our customers, KWS provides cost-effective solutions to many markets and industries including aggregate, brewing, cement, chemical, food, gypsum, ice handling, minerals processing, power, pulp & paper, rendering and wastewater treatment.

From complete systems to replacement parts, KWS will meet all of your bulk material handling needs.

MEMBER CEMA CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION

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SAFETY DEVICES: KWS will supply only such safety devices as are specified in customer furnished purchase orders. Any additional safety measures or devices which may be required by law, or which the customer wishes to add, are to be furnished by the customer or, at the customer's written request, the safety devices will be furnished by KWS at additional cost to the customer. The aforementioned safety devices include, but are not limited to; interlocks, limit switches, overflow relief switches, shear pins, emergency stop switches, emergency stop pull cables and point-of-operation switches.

SAFETY

Read **ALL** instructions in this manual and manufacturer's manuals **BEFORE** installing, operating and maintaining the equipment.

Bucket elevator safety begins with a plan that considers every possible danger and potential hazard. Operation and maintenance personnel must be thoroughly trained in safe operating procedures, recognition of possible hazards, and maintenance of a safe area around bucket elevators.

CEMA has a comprehensive safety program that includes:

- Warning and Safety Reminder for Screw Conveyors, Drag Conveyors and Bucket Elevators – (CEMA Document: SC2018-01 Rev. 2004-01)
- CEMA Safety Label Brochure – (CEMA Document: 201)
- CEMA Safety Label Placement Guidelines
- Bucket Elevator Safety Poster – (CEMA Bucket Elevator Safety Poster)
- Screw Conveyor, Drag Conveyor and Bucket Elevator Safety Video – (CEMA Document: AV6) This video describes key safety practices that personnel must follow when operating and maintaining screw conveyors, drag conveyors and bucket elevators.

Bucket Elevator accidents can be avoided by implementation and enforcement of an in-plant safety program. Safety precautions are included in this manual. Carefully study and follow safety precautions. Remember – accidents are usually caused by negligence or carelessness.

SAFETY **REFERENCE – CEMA DOCUMENT SC2018-001 REV. 2004-1**

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

APPROVED FOR DISTRIBUTION BY THE JOINT SCREW CONVEYOR AND BUCKET ELEVATOR 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 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.

Paragraph 5.16 of ANSI B20.1 addresses risk assessment and risk reduction. Risk assessment and related risk reduction should be performed by the owner and user at each phase of a conveyor or conveyor system's life cycle. Examples of risk assessment processes can be found in the following:

1. CEMA Technical Report 2015-01
2. ASSE Z590.3 (American Society of Safety Engineers)
3. MIL-STD-882 (U.S. Military Standard)

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.

SAFETY

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.

SAFETY

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.

SAFETY

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 a DVD presentation entitled “Screw Conveyor, Drag Conveyor, and Bucket Elevator Safety DVD.” CEMA encourages acquisition and use of this source of safety information to supplement your safety program.

> *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

ADDITIONAL SAFETY NOTES

Safety is a basic factor in machinery operation. Most accidents are the result of carelessness or negligence. The following safety instructions are basic guidelines and are to be considered minimum provisions. Additional information can be obtained by purchaser from other sources including the American Society of Mechanical Engineers; Standard ANSI B20.1; Standard ANSI B15.1; Standard ANSI A12.1; Standard ANSI MH4.7; Standard ANSI/ASSP 2244.1-2016.

Contractor, installer, owner and user is responsible for installing, maintaining and operating bucket elevators manufactured and supplied by KWS Manufacturing Company, Ltd. in such a manner as to comply with the Occupational Safety and Health Act (OSHA) and with all state and local laws and ordinances and American National Standard Institute (ANSI) Safety Codes.

PRECAUTIONS:

1. Owner must maintain a safety training and safety equipment operation/maintenance program for all employees.
2. Bucket elevators must not be operated unless elevator housing completely encloses moving elements and power transmission guards are in place. If elevator is be opened for inspection, cleaning or observation, bucket elevator drive unit must be locked out electrically in such a manner that the motor cannot be restarted by anyone, however remote from area, unless elevator housing has been closed and all other guards are in place.
3. Entire bucket elevator must be guarded by railing or fence if bucket elevator must have an open housing as a condition of use and application.

SAFETY

4. Rugged gratings must be used where necessary. If distance between grating and moving elements is less than 4-inches, grating opening must not exceed ½-inch by 2-inch. In all cases, openings must be restrictive to keep any part of body or clothing from contacting moving parts of equipment. Solid covers must be used at all other points and must be designed and installed so that personnel will not be exposed to accidental contact with any moving parts of equipment.
5. All rotating equipment such as drives, gears, shafts and couplings must be guarded by purchaser/owner as required by applicable laws, standards and good practices.
6. Safety devices and controls must be purchased and provided by purchaser/owner as required by applicable laws, standards and good practices.
7. Practice good housekeeping at all times and maintain good lighting around all equipment.
8. Keep all personnel advised of location and operation of all emergency controls and devices. Clear access to emergency controls and devices must be maintained.
9. Frequent inspections of controls and devices, covers, guards, and equipment are required for proper working order and correct installation.
10. Do not walk on elevator hood, gratings or guards.
11. Do not poke or prod material in bucket elevator.
12. Do not place hands, feet or any part of body or clothing in bucket elevator or any opening.
13. Do not overload bucket elevator. Use bucket elevator for intended use only.
14. Inlet and discharge openings must be connected to other equipment to completely enclose moving elements of elevator.

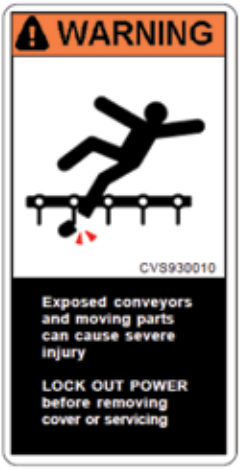
SAFETY

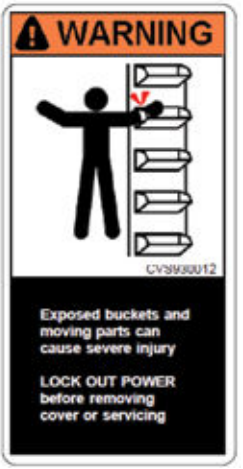
15. Before power is connected to drive, a pre-startup safety check must be performed to ensure equipment and area are safe for operation and all guards are in place and secure.
16. Bucket elevators are not normally designed or manufactured for bulk materials that are hazardous to personnel. Hazardous materials are explosive, flammable, toxic or otherwise dangerous to personnel. Bucket elevators are not designed or manufactured to comply with local, state, or federal codes for unfired pressure vessels. If hazardous bulk materials are to be conveyed or if elevator is to be subjected to internal or external pressure, KWS Manufacturing Company, Ltd., must be consulted prior to any modifications.
17. All equipment must be checked for damage immediately upon arrival. Do not install a damaged component.
18. All bucket elevators manufactured by KWS Manufacturing Company, Ltd., have warning labels affixed in many easily seen locations. Additional stickers are available upon request.

SAFETY

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

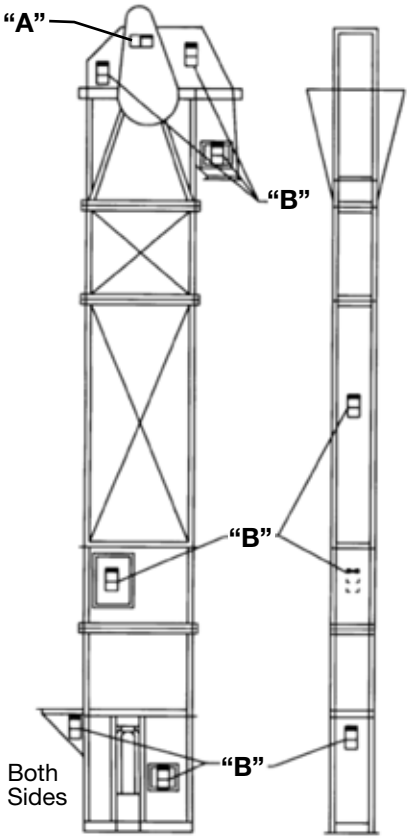
Note: *Labels alone do not substitute for a thorough in-plant safety training program centered on the hazards associated with operating your installed equipment. Contact CEMA or KWS for Replacement Labels.*

SAFETY

Equipment: Bucket Elevator

"A"

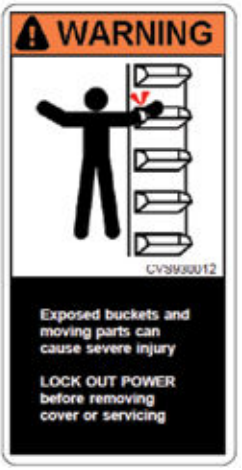
To be placed on removable guards to warn that operation of the machinery with guards removed would expose chains, belts, gears, shafts, pulleys, couplings, etc. which create hazards.



USE LABEL "A" ON BELT GUARD
USE LABEL "B" ON EACH SIDE OF INTAKE, ALL BOLTED PANELS AND INSPECTION DOORS, AND BOTH SIDES OF SPLIT HOOD

Near Side   Far Side

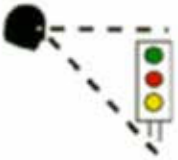
To be placed on intakes, bolted guards and panels, hoods and doors of bucket conveyors to provide warning against exposing buckets and moving parts while in operation.



"B"

SAFETY

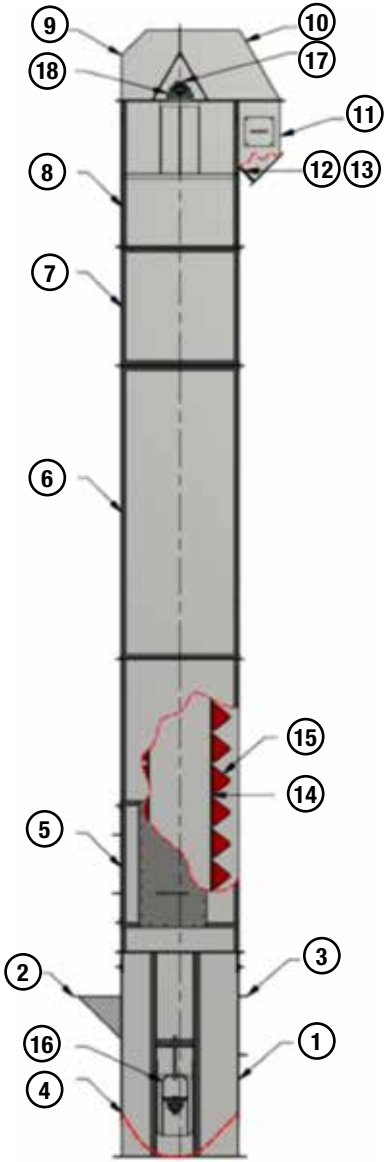
Bucket Elevator Safety

Do Not Climb, Sit, Stand, or Walk on Conveyor at Any Time. 	 Do Not Perform Maintenance on Conveyor Until Electrical, Air, Hydraulic, And Gravity Energy Sources Have Been Locked Out and Blocked	 Operate Equipment Only With all Approved Covers and Guards in Place.
 LOCK OUT ALL Power and Block Gravity Loads Before Servicing.	 Ensure That All Personnel Are Clear Of Equipment Before Starting.	 Allow Only Authorized And Trained Personnel to Operate Conveyors and Accessories.
 Keep Clothing, Body Parts, and Hair Away from Conveyor	 Clean Up Spillage Near Moving Parts ONLY When Power is Locked Out AND Guards Are In Place.	 Do Not Modify Conveyor Or Controls.
 Ensure That All Controls are Visible and Accessible.	 Operate Equipment Only With All Approved Covers, Guards, and Safety Labels in Place.	 Report All Unsafe Conditions.

POST IN PROMINENT AREA

INSTALLATION

Bucket Elevator Components



Bill of Materials	
Item	Description
1.	Boot Assembly
2.	Inlet Spout
3.	Removable Sprocket/Pulley Access Door
4.	Curved Boot Plate
5.	Intermediate Section. Access Doors Maybe Located at Any Convenient Position
6.	Plain Intermediate Section
7.	Plain Intermediate Section. Usually the Odd Length Located Under Lower Head Assembly
8.	Lower Head Assembly
9.	Back Section of Hood
10.	Front Section of Hood
11.	Discharge Spout
12.	Adjustable Throat Plate
13.	Discharge Spout Liner (Optional item)
14.	Elevator Chain or Belt
15.	Elevator Buckets
16.	Boot Take up
17.	Head Shaft Pillow Blocks
18.	Pillow Block Stops (Optional)

Note: Diagram represents typical arrangement. Consult sales order, drawings and BOM for bucket elevator components.

INSTALLATION

Receiving

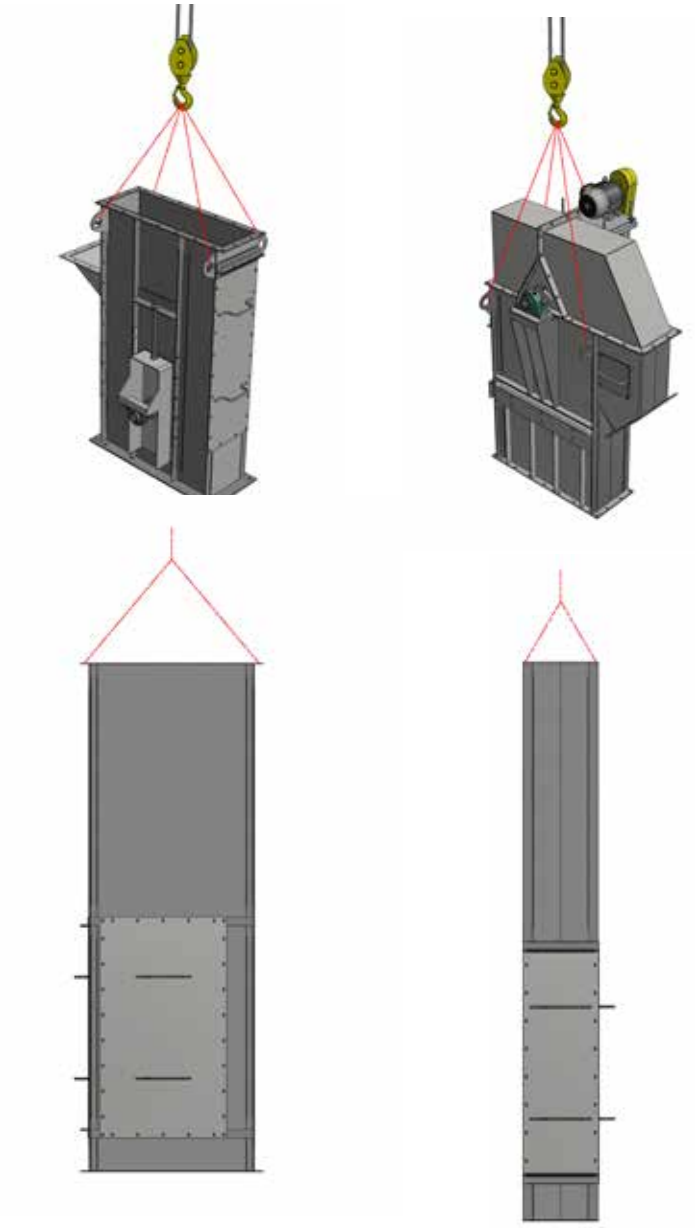
1. Bucket elevators may be ordered as individual components with assembly performed in field or as assembled head and boot sections.
2. Chain or belt, buckets, gaskets, nuts and bolts, special fittings, etc. are usually shipped in separate containers or on pallets/skids. Intermediate casings are shipped separately.
3. Purchaser immediately checks all received components against shipping papers, drawings and BOM for possible shortages and shipping damage. Shortages and shipping damage must be reported immediately to KWS or transportation company. Do not install damaged components or assemblies.
4. Purchaser is responsible for providing bucket elevator foundation and anchor bolts.

Lifting and Moving

1. Purchaser/installer must use proper lifting and handling techniques to prevent damage when moving assembled sections and components.
2. Purchaser/installer must use spreader bars with slings for lifting assembled sections and components. Unsupported span must be no greater than 12-feet.
3. Purchaser/installer must never lift an assembled section or component from one lifting point.
4. Purchaser/installer must consider weight and center of gravity when choosing lifting points.

INSTALLATION

Lifting Casings



INSTALLATION

Boot Section, Casing Sections And Head Section (All Types Of Bucket Elevators)

1. Purchaser/installer properly installs anchor bolts in bucket elevator foundation for boot section mounting holes.
2. Purchaser/installer sets boot section in place. Boot section top flange must be level and casing vertically plumb. Addition of shims under bottom flange of boot section may be necessary. Use shims only next to anchor bolts and not elsewhere along flange. Any gap resulting from shimming is filled with structural grout. The boot section must be set accurately and within 1/8-inch.
3. Purchaser/installer checks drawings to determine correct sequence of erecting intermediate casing sections. Caulk or gasketing must be placed between all casing flanges to provide dust tight sealing.
4. Purchaser/installer ensures every intermediate casing section is level and plumb. Minor deviations are common in fabricated components and can be corrected by rotating each casing section 180-degrees or turning end-for-end. Addition of metal shims at flanged connections may be necessary to maintain level and plumb. Metal shims must extend a minimum of six inches in both directions. Shims cannot project inside of casing. 1/8-inch maximum deviation is allowed for level and plumb.
5. Purchaser/installer must laterally brace the bucket elevator to a rigid structure or use guy wires every 20-feet of vertical height and not more than 4-feet below head section. If a rigid structure is not available, guy wires must be used.
6. Purchaser/installer removes front and back sections of hood on head section. Head section is set in place using same procedures as above.
7. Purchaser/installer ensures head shaft is exactly level. Addition of shims under pillow block bearings may be necessary. Check head shaft pillow block set screws for tightness.

INSTALLATION

Chain Type Bucket Elevators

1. Purchaser/installer removes access door from boot section.
2. Purchaser/installer drops plumb line from head sprocket to boot sprocket to make sure sprockets are centered in casing and are exactly in line with each other.
3. Purchaser/installer verifies correct sprocket spacing from sales order drawings and makes sure tail sprocket set screws are tight. Sprockets must be in line when viewed from narrow side of casing within 1/8-inch. Head and boot shafts are offset when viewed from wide side of casing. Double-strand chain bucket elevators will have no offset as identical sprockets are used at head and boot sections. Double-strand bucket elevators have one boot sprocket keyed to shaft, while other sprocket floats between shaft collars. Verify that shaft collars are tight. After all adjustments are made, it may be necessary to drill a set screw indent into boot shaft to hold shaft collars in position.
4. Purchaser/installer raises boot take-up to uppermost position. Adjustments must be made uniformly to both sides at the same time. Bearings do not accommodate misalignment and damage can occur if procedure is not followed. If bucket elevator is equipped with gravity type take-up, use a come-along or hoist to raise take-up box to the uppermost position.
5. Purchaser/installer preassembles chain and buckets based on maximum lifting load. KWS recommends peening the bolt threads after the buckets are securely in place. Lay out chains and verify equal lengths of parallel strands for double-strand chain bucket elevators. Chains must be matched and tagged left and right.
6. Purchaser/installer lifts chain and bucket assembly in the center and sets over head sprocket. Do not twist chain during handling. When installing offset side bar chain, make sure widest part of side bar (open end) points in direction of chain travel.

INSTALLATION

7. Purchaser/installer installs chain connecting link. It may be necessary to remove several links of chain for initial installation.
8. Purchaser/installer adjusts boot take-up until boot sprocket creates chain tension. If bucket elevator is equipped with internal gravity take-up, add weight to gravity take-up weight box as required for smooth operation. Weight must be uniformly distributed in weight box. Boot sprocket must fully engage chain. Upward movement is available to accommodate chordal action of chain. At least 2 to 3 inches of vertical adjustment is needed in take-up.
9. Purchaser/installer adjusts boot take-up accordingly to provide 1/8-inch to 1/4-inch gap between chain barrel and root of boot sprocket tooth. Gap must occur at 6 o'clock on boot sprocket. Gap is to accommodate chordal action of chain.
10. Purchaser/installer replaces hood sections.

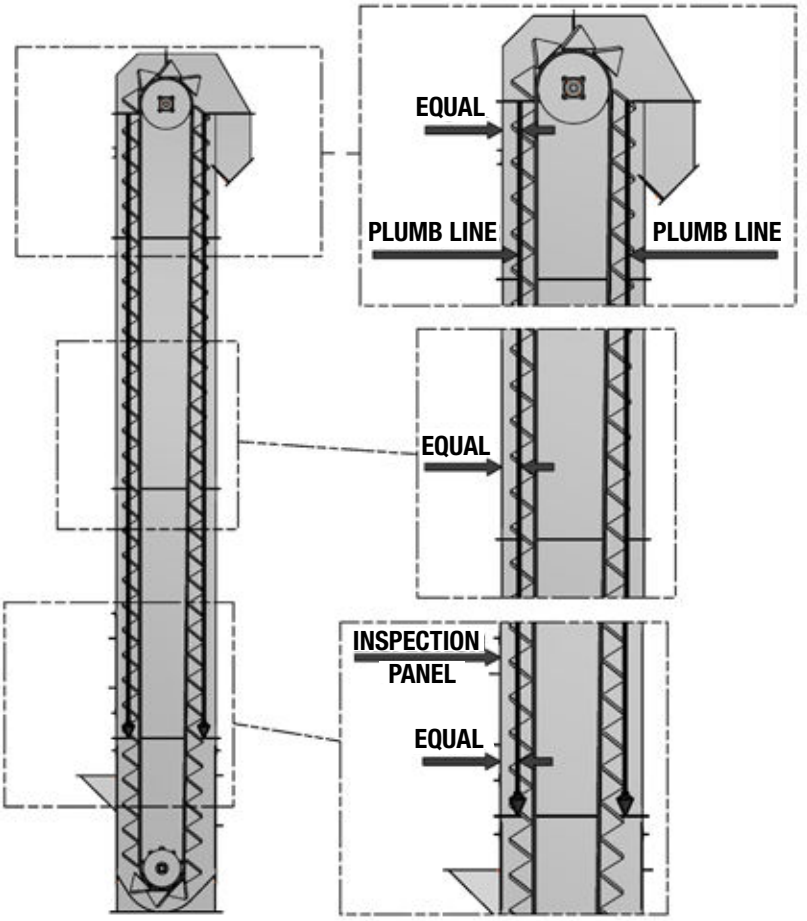
Belt Type Bucket Elevators

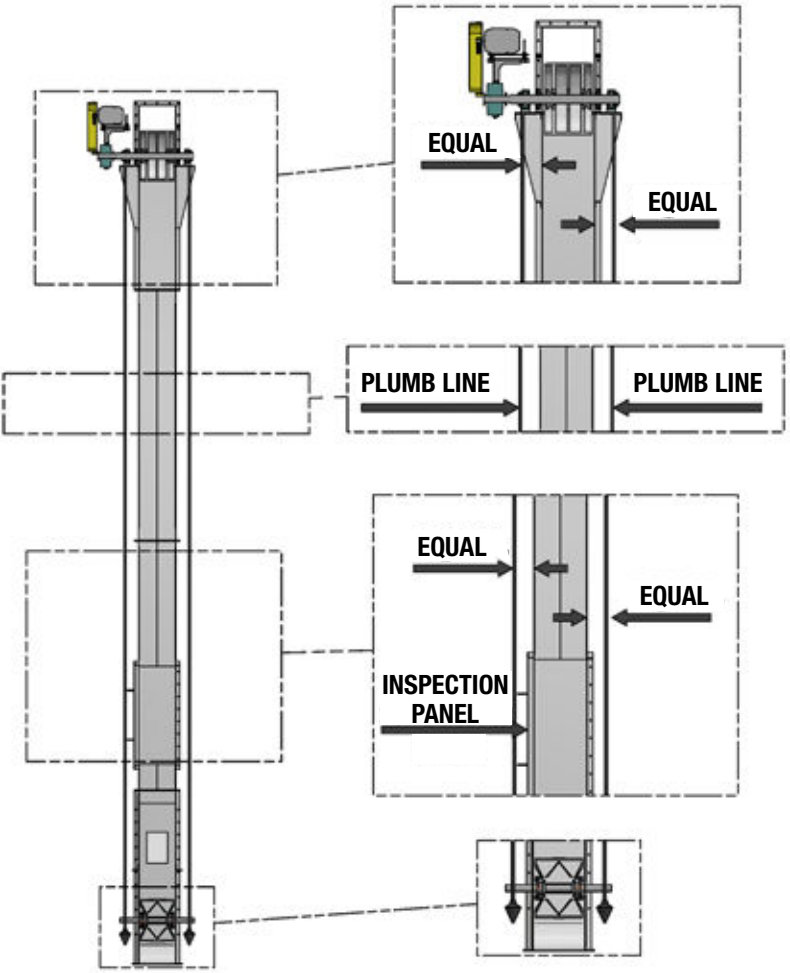
1. Purchaser/installer removes access door from boot section.
2. Purchaser/installer drops plumb line from head pulley to boot pulley to make sure pulleys are centered in casing and are exactly in line with each other.
3. Purchaser/installer tightens tapered bushings on both sides of head and boot pulleys. Pulleys must be in line when viewed from narrow side of casing. Head and boot shafts are offset when viewed from wide side of casing.
4. Purchaser/installer raises boot take-up to uppermost position. Adjustments must be made uniformly to both sides at the same time. Bearings do not accommodate misalignment and damage can occur if procedure is not followed.

INSTALLATION

5. Purchaser/installer preassembles belt and buckets based on maximum lifting load. KWS Recommends peening the bolt threads after the buckets are securely in place. If plastic buckets are being installed, use care to avoid over-tightening. Steel washer backups may be required.
6. Purchaser/installer lifts belt and bucket assembly in the center and sets over head pulley.
7. Purchaser/installer allows belt and bucket assembly to hang for at least 24 hours to relieve stresses resulting from being rolled up and achieve initial belt stretch.
8. Purchaser/installer makes belt splice. It may be necessary to cut belt to proper length for initial installation.
9. Purchaser/installer adjusts boot take-up until boot pulley creates belt tension. Boot pulley must fully engage belt. At least 2 to 3 inches of vertical adjustment is needed in take-up.
10. Purchaser/installer replaces hood sections.

INSTALLATION




EQUAL
EQUAL
PLUMB LINE
PLUMB LINE
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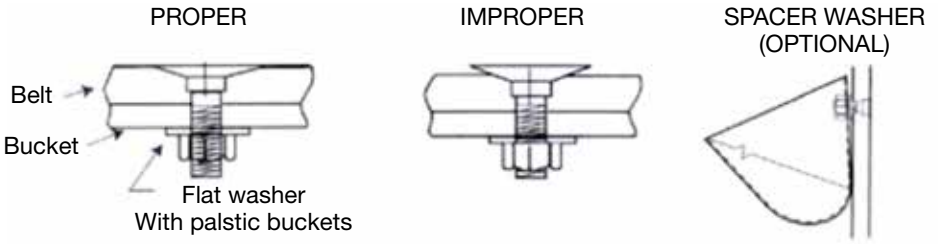
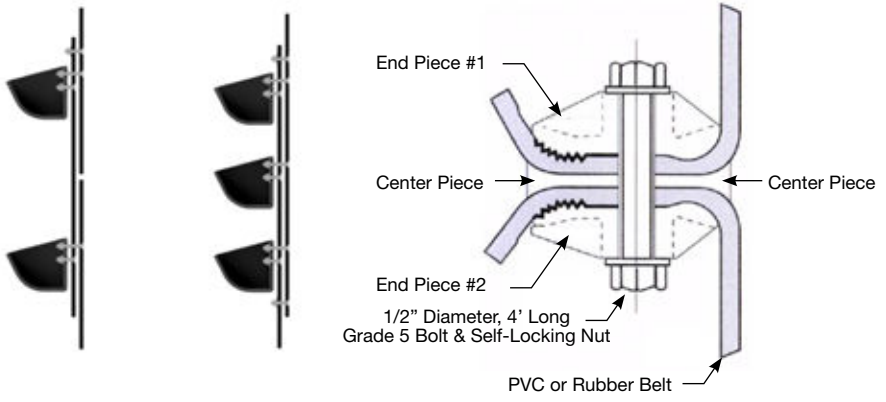
INSPECTION
PANEL

INSTALLATION

Attaching Brackets to Elevators



If rubber covered belt with unequal thickness covers is used, thicker cover is installed on pulley side.



BUTT JOINT LAP JOINT CLAMP SPLICE

INSTALLATION

1. Purchaser/installer selects type of belt splice to be used from illustrations above.
2. Purchaser/installer clamps belt several feet from both ends using clamping angle irons and pull ends together until snug tension is achieved.
3. For Lap Joint and Butt Joint Splices – Purchaser/installer splices belt by installing elevator bolts through pre-punched holes with washers and locknuts. Add one or more rows of additional bolt holes between buckets in splice area by drilling holes while belting is clamped in pre-tensioned condition.
4. For Clamp Splice – Purchaser/installer must follow instructions supplied with clamp splice.
5. Remove belt clamps and adjust take-ups uniformly on both sides to remove any slack in belt. Use caution to avoid overtightening belt. Overtightening belt can cause premature failure of belting, shafts and bearings.
6. Purchaser/installer must operate bucket elevator for a minimum of 4 hours to observe belt tracking and any further initial belt stretch.

DRIVES UNITS (All Types of Bucket Elevators)

Shaft Mounted Gear Reducers

1. Purchaser/installer assembles back stop to reducer in accordance with gear reducer manufacturer's instructions and checks for proper rotation.
2. Purchaser/installer assembles drive assembly to bucket elevator head shaft using bushings and keys provided.
3. Purchaser/installer rotates gear reducer by hand to determine correct back stop installation.

INSTALLATION

Gearmotor Drive Unit with Secondary Chain and Sprocket Drive

1. Purchaser/installer mounts driven sprocket to bucket elevator head shaft with keys and set screws provided.
2. Purchaser/installer mounts driver sprocket on gearmotor drive shaft with keys and set screws provided.
3. Purchaser/installer sets gearmotor in position and lines up drive and driven sprockets. Center distance between shafts is shortened by moving gearmotor closer to bucket elevator head shaft.
4. Purchaser/installer installs chain and connecting links.
5. Purchaser/installer adjust gearmotor slide base to tension chain. Some sag is noted on bottom strand of chain when top strand is tight. Lock gearmotor in position. Check all mounting bolts for tightness.
6. Purchaser/installer installs chain guard and adds lubricant if oil bath guard is furnished.
7. Purchaser/installer fills gearmotor with proper lubricant in accordance with gearmotor manufacturer's instructions.
8. Purchaser/installer rotates gearmotor by hand to determine correct back stop installation.

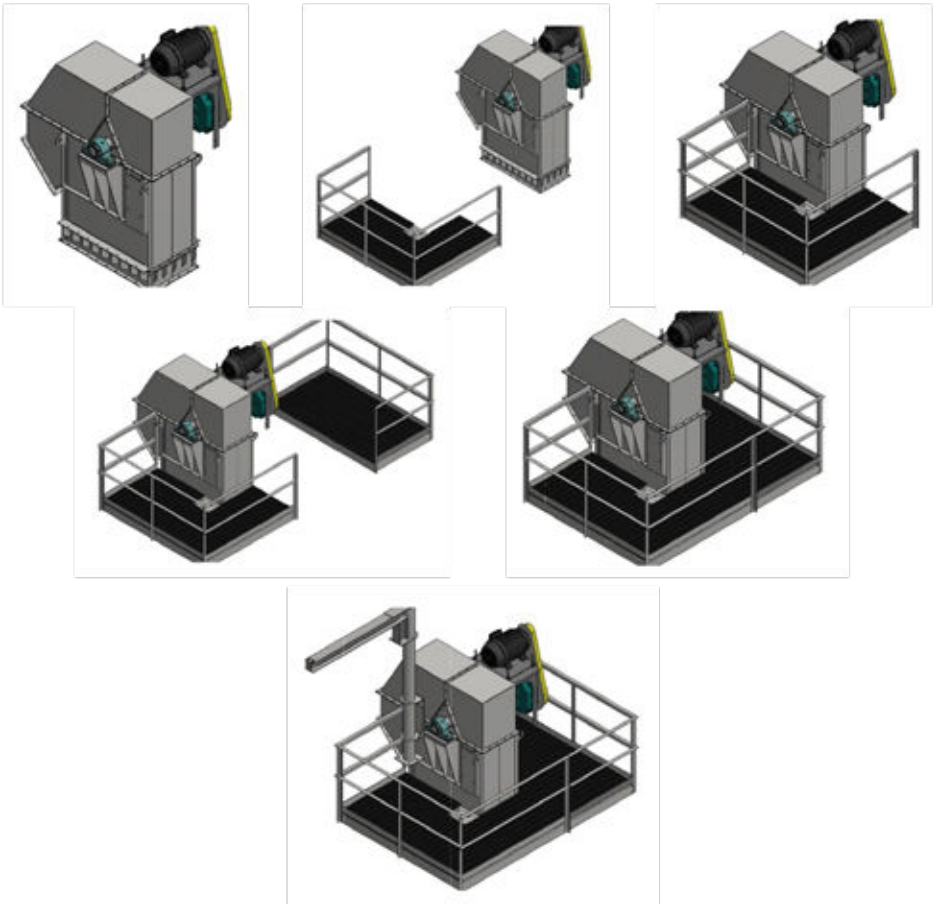
Platforms (Optional)

1. Purchaser/installer installs platform in accordance with sales order drawings.
2. Purchaser/installer erects first section of platform in position and aligns with mounting holes/clips and installs mounting hardware as shown on sales order drawings.
3. Purchaser/installer erects second section of platform in adjacent position and installs mounting hardware as shown on sales order drawings. Do not fully torque bolts as further adjustment may be required to mate platform sections. Tighten fasteners to proper torque specifications once sections are aligned.
4. Purchaser/installer mounts safety gate to platform guardrail according to manufacturer's installation instructions.

INSTALLATION

Jib Crane (Optional)

1. Purchaser/installer erects jib crane in position and installs mounting hardware as shown on sales order drawings.
2. Purchaser/installer adjusts jib crane as required to achieve vertical position and tightens mounting hardware to proper torque specifications.
3. Purchaser/installer attaches lifting device to jib. Jib crane lifting capacity is marked on crane. Do not attempt to lift more than rated capacity. Secure jib and lifting device for storage when not in use.



INSTALLATION

Ladders and Fall Arrest Devices (Optional)

1. Purchaser/installer installs ladder assembly in accordance with sales order drawings.
2. Purchaser/installer places first section of ladder in position in alignment with mounting points and installs mounting hardware as shown on sales order drawings.
3. Purchaser/installer places next section of ladder in position in alignment with mounting points and installs mounting hardware as shown on sales order drawings. Continue placing and securing ladder sections until complete.
4. Purchaser/installer installs fall arrest system according to manufacturer's installation guide.
5. Purchaser/installer ensures all mounting points of ladder and fall arrest device are torqued or welded to bucket elevator as necessary. Touch up paint as required.

OPERATION

Start Up (All Types of Bucket Elevators)

1. Purchaser/installer ensures bucket elevator is free of foreign materials before connecting power.
2. Purchaser/installer ensures all guards, covers, safety devices and controls are in place and operating.
3. Purchaser/installer performs initial start-up of bucket elevator with several short jogs gradually lengthening in duration without material.
4. Purchaser/installer operates bucket elevator for 4 hours without material.
5. Purchaser/installer checks take-up adjustment and chain or belt alignment after 4 hours and realigns sprockets or pulleys as necessary.
6. Purchaser/installer gradually feeds material to bucket elevator, increasing feed rate slowly until design capacity is reached.
7. Purchaser/installer stops feeding material and allows bucket elevator to empty.
8. Purchaser/installer LOCKS OUT ALL POWER.
9. Purchaser/installer checks fastener torque and alignment of sprockets or pulleys. Fastener torque and alignment of sprockets or pulleys must be checked at least once a month.
10. Purchaser/installer adjusts throat plate at discharge to provide $^3/_4$-inch to 1-inch clearance to buckets.
11. Purchaser/installer welds stops at each end of head shaft pillow block bearings to prevent bearing movement after alignment and trial operation.

OPERATION

Operation Notes (Belt and Chain Type Bucket Elevators)

1. Refer to purchase order number, KWS sales order number, year of manufacture and equipment number when consulting KWS regarding a specific bucket elevator.
2. Regular inspection and maintenance will provide satisfactory performance.
3. During normal operations, avoid starting and stopping elevator when loaded with material.
4. Characteristics of the bulk material will affect degree of pulsation. Pulsation is caused by difference in bucket projection.
5. Uniform material feed rates are required for elevator operation. Do not surge load a bucket elevator or flood the boot section.

Operation Notes (Chain Type Bucket Elevator)

1. When elevator is new, it is common to have an occasional tight chain joint, causing some vibration, but will eventually loosen. It is normal to experience some pulsation if plastic buckets are used in conjunction with metal digger buckets.
2. Do not mix old and new chain in parallel strands for dual-strand bucket elevators. Always order matched lengths when replacing chain.

Short and Long Term Storage Notes (Belt and Chain Type Bucket Elevators)

1. If elevator components are to be stored at job site for some time prior to erection, make sure components are protected from elements and rust-preventative is applied to all surfaces that can rust.
2. Do not cover elevator components tightly with plastic wrap. Condensation will collect and cause corrosion and premature motor failure.
3. If elevator is to be erected but not used for a long period of time, operate bucket elevator empty at least one hour per week.

TROUBLESHOOTING

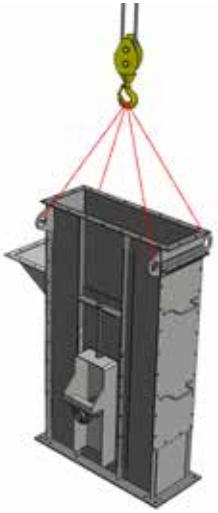
Problem	Cause	Remedy
Elevator vibrates	Foreign material in boot	Remove foreign material
	Chain/belt improperly tightened	Loosen or tighten chain/belt
	Loose or broken buckets	Retighten or replace buckets
	Buckets hitting adjustable throat plate	Adjust throat plate
	Misaligned head and boot shaft	Align head and boot shaft
	Elevator not properly braced	Install or repair bracing
	Chain/belt hitting inside of casing when casing is not plumb	Shim casing to plumb
Elevator will not start	Foreign material in boot	Remove foreign material
	Electrical problem	Ensure wiring is connected and matches diagrams shown in O&M. Replace damaged or deficient electrical items.
	Backstop incorrectly installed	Remove and reinstall per installation instructions
	Broken v-belts, drive chains or reducer failure	Replace broken component
	Boot plugged with material	Stop elevator, lockout power, remove material
	Chain/belt improperly tightened	Loosen or tighten chain/belt
Bearings get hot	Improper lubrication	Lubricate bearings
	Chain/belt improperly tightened	Loosen or tighten chain/belt
	Head shaft bearings misaligned	Align bearings
	Head and boot shaft misaligned	Align shafts
Elevator not discharging properly	Speed incorrect	Consult KWS
	Material affected by static electricity	Ground casing
	Material is too light/fluffy	Reduce speed up to 15%

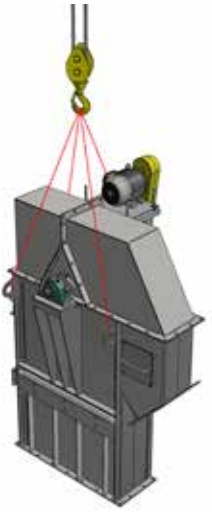
MAINTENANCE

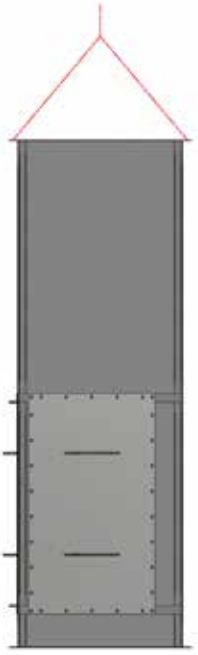
1. Purchaser/installer performs periodic inspections to determine wear rate of chain, buckets, belts and bearings.
2. Purchaser/installer checks alignment of sprockets, pulleys and all drive components.
3. Purchaser/installer retightens fasteners and checks guards, covers and gratings.
4. Purchaser/installer checks controls and safety devices for operation.
5. Purchaser keeps a supply of spare parts. When ordering, refer to KWS sales order number, year of manufacture and equipment number when consulting KWS regarding a specific bucket elevator.
6. WARNING: Removal of backstop may cause unexpected machinery movement. Removal of torque arm from reducer may cause unexpected machinery movement.

MAINTENANCE

Lifting Casings







MAINTENANCE

Bolt Torque Guide

General Bolt Tightening Torque (Ft. Lbs.)						
Bolt Dia. (inches)	Threads Per Inch (UNC)	SAE 2	SAE 5	SAE 8	18-8 & 316 Stainless Steel	Tensile Stress Area (in2)
1/4	20	5	9	12	6	0.0318
5/16	18	11	18	25	11	0.0524
3/8	16	18	31	44	20	0.0775
7/16	14	28	49	69	29	0.106
1/2	13	44	73	105	40	0.142
9/16	12	63	108	149	52	0.182
5/8	11	96	147	212	86	0.226
3/4	10	158	252	351	115	0.334
7/8	9	219	389	552	180	0.462
1	8	316	589	784	240	0.606

K factor in formula is always an estimate.
Typical K factor is 0.20 for plain finished bolts.
See formulas below to calculate torque for bolts not listed.

Formula: T= K x D x P
T = Target tighten torque (the result of this formula is in inch pounds, dividing by 12 yields foot pounds)
K = Coefficient of friction (nut factor), always an estimation in this formula
D = Bolts nominal diameter in inches
P = Bolt's desired tensile load in pounds (generally 75% of yield strength)
P(lbs.) = (75%) Yield Strength * Tensile Stress Area
Tensile Stress Area = ϖ/4 (D - 0.9743/ (Threads Per Inch))2

Above Bolt Torque Guide is for all fasteners unless noted. CEMA recommends tightening bolts to 75-percent of values given in Bolt Torque Guide to eliminate over tightening.

NOTES

What makes KWS different from other manufacturers?

At KWS we understand the needs and exceed the expectations of our Customers. As an ISO-9001 certified company, quality is integrated into every aspect of our processes. Quality is defined by the Customer, and derived from the total KWS Customer experience. It's not just product quality, but quality throughout every step of the Sales, Engineering and Manufacturing processes. Quality starts with our first Customer contact and never ends.

Conveying Solutions

Part No. **Release Date 7.1.20**

ISO 9001 Certified

MADE IN THE USA

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