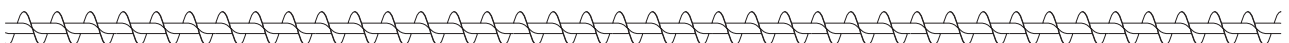
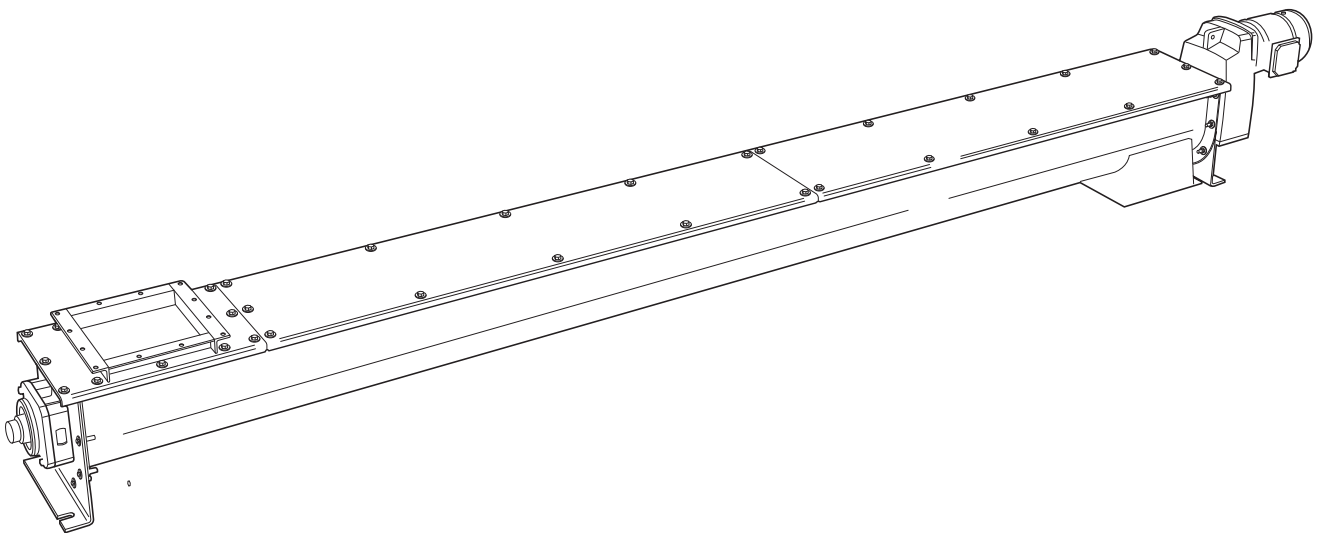


SCREW CONVEYOR

SAFETY, OPERATION & MAINTENANCE GUIDE



INTRODUCTION

This guide contains warnings and instructions for the safe installation, operation and maintenance of screw conveyors. The reliability and service life depend on the proper care taken while installing and preparing the equipment for its intended use.

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

For assistance with safety concerns or general questions, please contact Artisan Precision at (717) 807-6165



DISCLAIMER

The information provided herein is advisory only.

These recommendations provided by CEMA are general in nature and are not intended as a substitute for professional advice. Users should seek the advice, supervision and/or consultation of qualified engineers, safety consultants, and other qualified professionals.

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SAFETY

Screw conveyor 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 screw conveyors.

CEMA has a comprehensive safety program that includes:

- CEMA Technical Document SC 2018-01: Warning and Safety Reminder for Screw, Drag, Bucket Elevators Conveyors.
- CEMA Brochure No. 201: Safety Label Brochure.
- CEMA Safety Label Placement Guidelines by Product:
 - Screw Conveyors (SC-2)
 - Vertical Screw Conveyors (SC-3)
- CEMA Screw Conveyor Safety Poster
- CEMA AV 6: Screw Conveyor, Drag Conveyor, and Bucket Elevator Safety Video - This video describes key safety practices that personnel must follow when operating and maintaining screw conveyors, drag conveyors, and bucket elevators.

Screw conveyor accidents can be avoided by the implementation and enforcement of an in-plant safety program. A number of safety precautions are included in this guide. Carefully study and follow the safety precautions.

Remember:

Accidents are usually caused by negligence or carelessness.

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 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. ANSI/ASSE Z590.3 (American Society of Safety Engineers)
3. MIL-STD-822 (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.
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 the 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 the 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 the 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 the area around the 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 the 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, the 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, the 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 the 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, railing, walkways, arrangements 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.

CEMA has produced a video presentation entitled "Screw Conveyor, Drag Conveyor, and Bucket Elevator Safety Video" and encourages the acquisition and use of this source of safety information to supplement your safety program.

SEE NEXT PAGE FOR SAFETY LABELS

SAFETY LABELS

To help ensure safe operation and prevent serious injury, the Screw Conveyor comes with many warning labels. Some labels may look identical, but have different numbers because of orientation or different wording.

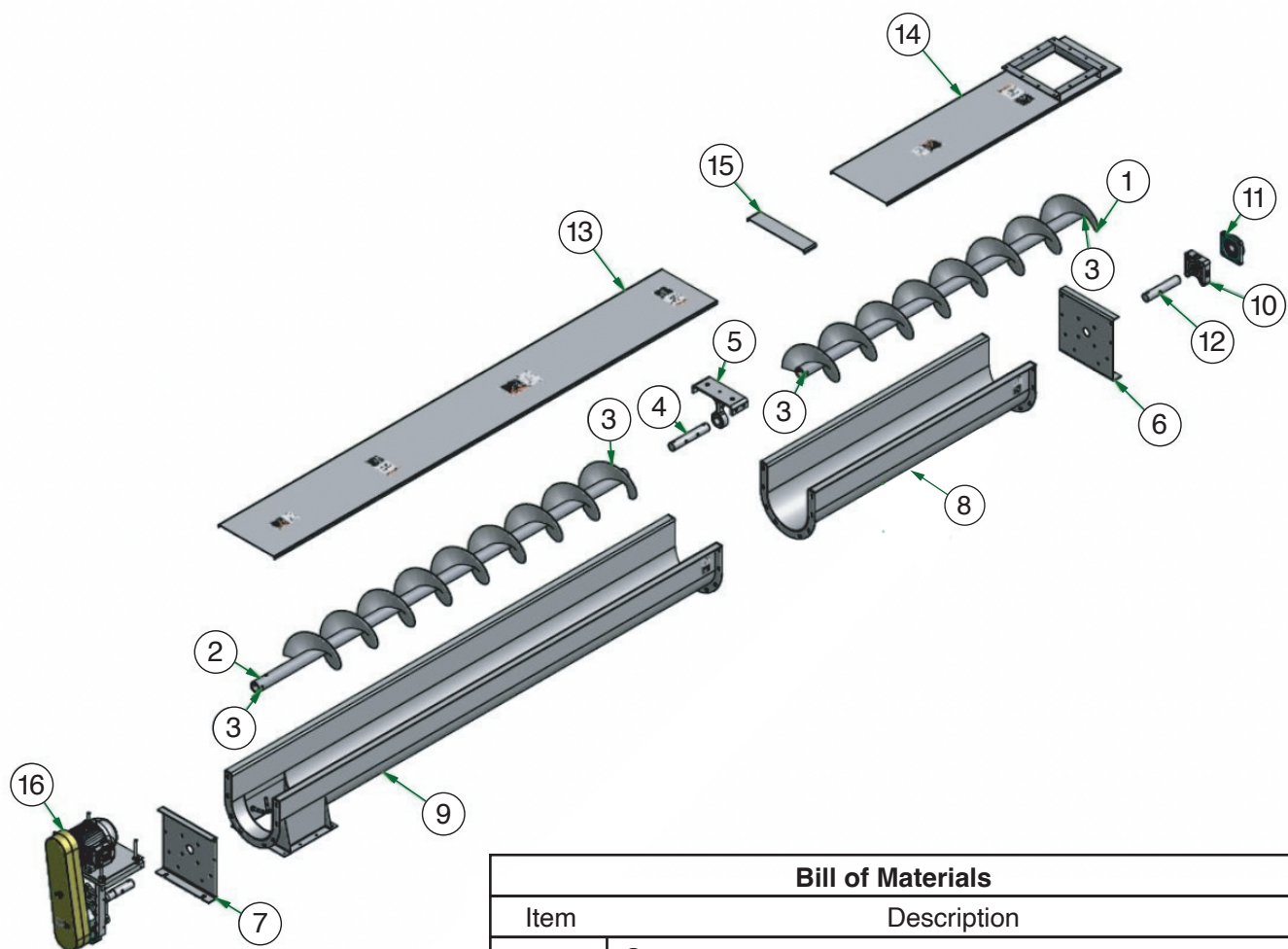
These labels should be prominently displayed on installed equipment like screw conveyors, drag conveyors and bucket elevators. Safety labels should be placed on inlets, discharges, troughs, covers, inspection doors and drive guards.

Contact Artisan Precision at (717) 807-6165



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SCREW CONVEYOR COMPONENTS



Bill of Materials	
Item	Description
1	Screw
2	Screw with Bare Pipe at Discharge
3	Coupling Bolts (Not Shown)
4	Coupling Shaft
5	Hanger with Bearing
6	Tail End Trough End
7	Trough End for Screw Conveyor Drive
8	Trough End for Screw Conveyor Drive
9	Trough with Discharge Spout
10	Seal
11	Bearing
12	Tail Shaft
13	Flanged Cover
14	Flanged Cover with Inlet
15	Buttstrap
16	Screw Conveyor Drive Unit with Motor Mount, V-Belt.

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SCREW CONVEYOR LABEL LOCATION

TOP OF CONVEYOR

Label A

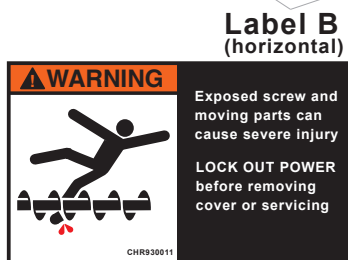


Label B
(horizontal) -or-



Label B
(vertical)

BOTH SIDES OF CONVEYOR

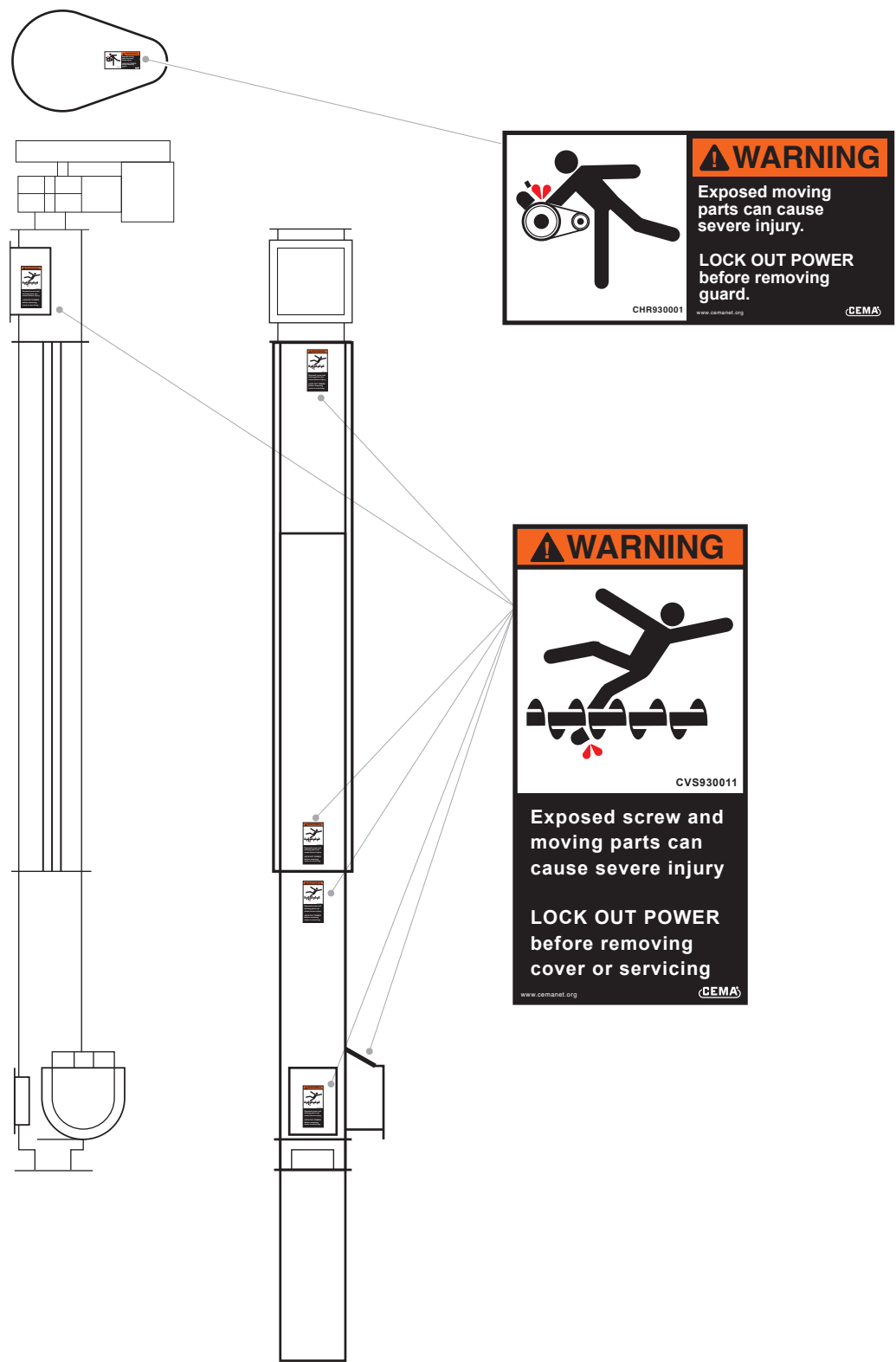


Label B -or- Label B
(horizontal) (vertical)



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VERTICAL SCREW CONVEYOR LABEL LOCATION



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INSTALLATION

Receiving

1. Screw conveyors may be ordered as individual components with all the assembly operations performed in the field, or assembled completely by the manufacturer, with drawings and a bill of materials.
2. Immediately upon receipt all items in the shipments should be checked against shipping papers for shortages and inspected for damage.
3. Items to be inspected include troughs, screws, covers and drive units.
4. DO NOT ATTEMPT TO INSTALL DAMAGED COMPONENTS OR ASSEMBLIES.

Lifting and Moving

1. Extreme care must be taken to prevent damage when moving assembled conveyors or components.
2. Spreader bars with slings are the recommended support method for lifting.
3. Unsupported span should be no greater than 12 feet.
4. NEVER LIFT A CONVEYOR WITH ONLY ONE SUPPORT POINT.
5. Unusually heavy items such as drives or gates shall be considered when choosing support points because of load balance and their bending effect.
6. Shop-assembled conveyors are typically match-marked and shipped in the longest sections from practical shipment.

Assembly

1. The mounting surface for supporting the conveyor must be level and true.
2. Screw conveyor troughs must be assembled straight and true with no distortion.
3. Place troughs in proper sequence with the discharge spout properly located.
4. Connect the joints loosely. DO NOT TIGHTEN BOLTS.
5. Assemble each trough end to the proper end of the conveyor.
6. Attach the piano wire full length of the conveyor at the centerline. Make sure the piano wire is pulled tight. Refer to *Figure 1* at the end of this section.
7. Tighten trough flange bolts keeping the trough assembly true to the piano wire. Alignment must be checked in both horizontal and vertical directions. The maximum deviation in either direction at any point along the length of the conveyor is 1/8 inch. Torque bolts to proper torque rating per Chart A.
8. Anchor trough assembly to the mounting surface. Make sure the entire length of the trough is straight and true. CEMA recommends supporting trough assemblies every 10 to 12 feet. Saddles and feet may be required.
9. Mount the drive or thrust unit on the correct trough end. Drive or thrust units are normally located at the discharge end of the conveyor. Make sure the drive or thrust unit is centered in the seal and trough end openings. Torque bolts to proper torque rating per Chart A.
10. Place the first screw section in the trough starting at the drive or thrust end. Install screw so end lugs are on opposite carrying side of the flight.
11. Insert the screw onto the drive shaft and install coupling bolts. DO NOT TIGHTEN COUPLING BOLTS.
12. Insert the coupling shaft into the opposite end of the screw and install coupling bolts. DO NOT TIGHTEN COUPLING BOLTS.
13. Pull the screw section away from the drive or thrust unit to the seat thrust connection.
14. Insert hanger onto coupling shaft.
15. Raise the hanger and screw section until the hanger top bar is flush with the top of the trough. Make sure correct clearance exists between the outside diameter of the screw and the inside of the trough. Match mark and drill troughs to mount hanger assembly. Insert hanger assembly bolts and hand tighten.
16. Assemble screw sections, couplings and hangers until all are installed by repeating steps 10 through 15. Install screw sections so flighting is 180 degrees from the end of the flighting of the previous screw section.

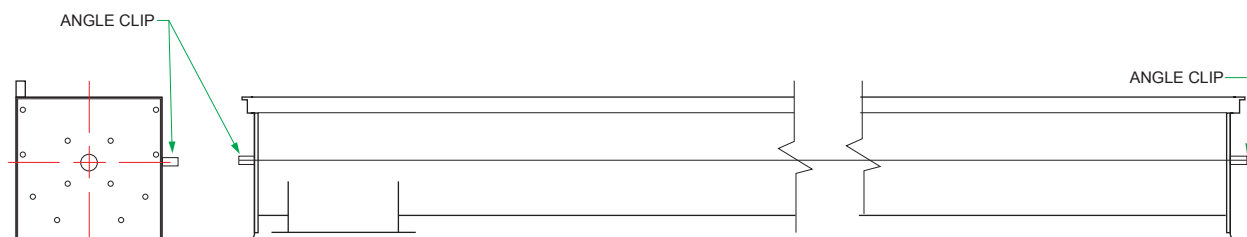
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INSTALLATION

17. Center hanger bearing between screw sections. Torque hanger assembly bolts to proper torque rating per Chart A.
18. Assemble the seal and bearing to the opposite trough end. Make sure the end shaft is centered in the seal and trough end openings. Torque bolts to proper torque rating per Chart A.
19. Insert the end shaft through the end bearing and into the last screw section and install coupling bolts. DO NOT TIGHTEN COUPLINGS BOLTS.
20. Rotate the entire screw assembly to check alignment and adjust hanger assemblies as required.
21. Torque ALL coupling bolts to proper torque rating. Over-tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate the over-tightening of coupling bolts.
22. Adjust seals as required.
23. Remove all debris from the conveyor.
24. Install covers in proper sequence starting at the inlet end and attach them with provided fasteners.
25. Lubricate the drive and all bearings following the manufacturer's instructions. DRIVES ARE GENERALLY SHIPPED WITHOUT OIL.
26. MAKE SURE ALL CEMA SAFETY LABEL ARE IN THE PROPER LOCATIONS.



CEMA COMMONLY USED PIANO WIRE SETUP
Piano wire attached to top of conveyor on side



OPTIONAL PIANO WIRE SETUP
Piano wire attached to centerline of conveyor on side

Figure 1. Piano Wire Setup Diagrams

Proper equipment alignment is critical to successful long-term operation. Alignment must be checked in both horizontal and vertical directions. The maximum deviation in either direction is 1/8 inch. Please refer to the Manufacturer's Operation and Maintenance Manual for additional information.

OPERATION

Before initial start-up

1. LOCKOUT/TAGOUT ALL POWER.
2. Lubricate all bearings following the manufacturer's instructions.
3. Lubricate all gear reducers following the manufacturer's instructions. Gear reducers are normally shipped without lubrication.
4. Check the conveyor to ensure all tools and foreign materials have been removed.
5. Turn the drive unit by hand to check for alignment and obstructions.
6. Check the conveyors to ensure all covers, guards and safety devices are installed and operating properly.
7. Attach gates to inlet and discharge chutes, where applicable.

Initial start-up (without material)

1. Reenergize power to the conveyor.
2. Start the conveyor momentarily to check for proper conveyor rotation. If conveyor or rotation is NOT correct, quickly shutdown and have a qualified electrician change the wiring.
3. Operate the conveyor without material for several hours as a break-in period. Observe for excessive bearing temperature, unusual noise or drive misalignment. If these conditions occur refer to the Troubleshooting Section of this document.
4. Stop the conveyor and LOCKOUT/TAGOUT ALL POWER.
5. Remove covers and check the tightness of coupling bolts. Torque bolts to proper torque rating. Over-tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate the over-tightening of coupling bolts. Replace covers.
6. Check all assembly and mounting bolts. Torque bolts to proper torque rating.
7. Check conveyor discharge. Discharge must be clear to ensure that material flow out of the conveyor will not be impeded.

Initial start-up (with material)

1. Reenergize power to the conveyor.
2. Start the conveyor and operate it without material for several minutes.
3. Feed material gradually until design capacity is reached.
4. DO NOT EXCEED CONVEYOR SPEED, CAPACITY AND MATERIAL DENSITY.
5. Start and stop the conveyor several times. Operate conveyor for several hours with material.
6. Check motor amperage when conveying at design capacity and compare to full load amperage of motor. Problems may exist if the amperage is excessive. Check voltage to ensure that it is within normal operating limits.
7. Stop the conveyor and LOCKOUT/TAGOUT ALL POWER.
8. Remove covers and check the tightness of coupling bolts. Torque bolts to proper torque rating. Over-tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate the over-tightening of coupling bolts. Replace covers.
9. Check hanger bearings and realign if necessary.
10. Replace covers.
11. Check all assembly and mounting bolts. Torque bolts to proper torque rating per Chart A.

OPERATION

Practice good housekeeping. Keep the area around the conveyor clean and free of obstacles to provide easy access and avoid interference with the function of the conveyor.

Establish routine periodic inspections of the entire conveyor to ensure continuous maximum operating performance. LOCKOUT/TAGOUT ALL POWER BEFORE INSPECTION CONVEYORS. Periodic inspections should be made of the following:

- Bearings - Check for proper lubrication. Lubricate all bearings following the manufacturer's instructions. Check hanger bearings for proper alignment and excessive wear. Replace hanger bearings when wear exceeds 1/8 inch.
- Gear Reducers - Check for proper lubrication. Lubricate all gear reducers following the manufacturer's instructions.
- Drives - Check for wear on belts and proper tension. Check for lubrication on chains and proper tension. Replace belts or chains as necessary.
- Screws - Check for damage, excessive wear and material buildup. Replace screw sections as necessary.
- Troughs - Check for damage, excessive wear and material buildup. Check trough alignment using piano wire as described in the installation section of this document. Replace trough sections as necessary.
- Shafts - Check for bolt-hole elongation and wear. Check for run-out. Replace shafts when wear exceeds 1/8 inches.
- Seals - Check for leakage. Adjust the seal or replace the packing as necessary.
- Coupling Bolts - Check for wear. Replace worn couplings bolts as necessary. It is recommended to replace coupling bolts and lock nuts when replacing screw sections. Torque all coupling bolts to proper torque rating. Over-tightening of coupling bolts could result in failure in tension. CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** (Chart A) to eliminate the over-tightening of coupling bolts.
- Assembly Bolts - Check for tightness. Torque ALL assembly bolts to proper torque rating per Chart A.
- Guards - Check for clearance and bolt tightness. Check the oil level on oil-tight guards.

Replacing screw conveyor components

1. LOCKOUT/TAGOUT ALL POWER.
2. Removal of a screw section must proceed from the end opposite the drive thrust unit.
3. Remove the trough end, screw sections, coupling shafts and hangers until the damaged screw section is reached and removed.
4. Reassemble conveyor components following the Installation Section of this document.

Note :Quick disconnect screws can be removed at intermediate locations without first removing adjacent sections.

SHUTDOWN AND STORAGE

Emergency shutdown

An emergency shutdown may be necessary to clear obstructions or to replace damaged or worn components.

1. LOCKOUT/TAGOUT ALL POWER.
2. Remove all covers.
3. Remove all obstructions and products from the conveyor.
4. Inspect all components for damage or wear. Check conveyor components in accordance with the Maintenance Section of this document.
5. Replace all damaged or worn components. Replace conveyor components in accordance with the Installation Section of this document.
6. Turn the drive unit by hand to check for alignment and obstructions.
7. Replace all covers and guards.
8. Restart the conveyor in accordance with the Operation Section of this document.

Extended shutdown

An extended shutdown may be necessary if the conveyor is not in operation for long period of time.

1. Operate the conveyor until all product is removed.
2. LOCKOUT/TAGOUT ALL POWER.
3. Remove all covers.
4. Remove all obstructions and products from the conveyor.
5. Inspect all components for damage or wear. Check conveyor components in accordance with the Maintenance Section of this document.
6. Replace all damaged or worn components. Replace conveyor components in accordance with the Installation Section of this document.
7. Lubricate the drive and all bearings following the manufacturer's instructions.
8. Coat all exposed metal surfaces with rust preventative.
9. Rotate screws by hand every week. Screws may sag and permanently deform if not rotated.

Note: When the operation is to resume, restart the conveyor in accordance with the Operation Section of this document.

Storage

1. Protect the conveyor from weather, moisture and extreme temperatures. DO NOT use coverings that promote condensation.
2. Coat all exposed metal surfaces with rust preventative.
3. Rotate screws by hand every week. Screws may sag and permanently deform if not rotated.

Note: When the operation is to resume, restart the conveyor in accordance with the Operation Section of this document.

TROUBLESHOOTING GUIDE

Problem	Cause	Remedy
1. Accelerated flight wear	Flight thickness too light	Increase flight thickness. Use abrasion-resistant materials or hardfacing.
	rpm too high or trough loading too high	Reduce speed. Consult ANSI/CEMA standard No. 350 to determine the recommended speed and trough loading.
2. Hanger bearing failure	Incorrect alignment	Realign trough assembly and hangers in accordance with the assembly section of this document.
	Improper speed and troughloading	Consult ANSI/CEMA standard No.350 to determine the recommended speed and trough loading.
	Improper hanger bearing material	Consult ANSI/CEMA standard No.350 to determine the recommended bearing material.
	Excessive bearing wear	Replace the hanger bearing.
3. Premature trough failure	Trough thickness too light	- Increase trough thickness. - Use abrasion-resistant material. - Consult ANSI/CEMA Standard No.350 to determine recommended trough thickness.
	Screw deflection	Consult ANSI/CEMA Standard No.350 to determine the proper pipe size and screw length.
	Bent Screw	Straighten or replace the screw.
4. Shaft hole elongation	Insufficient number of coupling bolts	Increase the number of coupling bolts.
	Conveyor subject to frequent stop/start	Cease frequent stops/starts. Increase the bearing capacity of the shaft and/or increase the number of coupling bolts.
	Frequent overloads	
5. Drive shaft breakage	Excessive torque	Consult ANSI/CEMA Standard No.350 to determine the proper torque rating.
6. Motor overload	Motor undersized	Consult ANSI/CEMA Standard No.350 to determine the proper horsepower requirements.
	Upset loading condition	Empty trough, control feed and operate under design specifications.
7. Trough End Bearing Failure	Bearing contamination	Upgrade or replave the seal. Change to the outboard bearing.
	Insufficient lubrication	Lubricate in accordance with the maintenance section of this document.
	Improper shaft runout	Check screw straightness and replace as necessary.
8. Coupling Shaft Breakage	Excessive torque	Consult ANSI/CEMA Standard No.350 to determine the proper torque rating.
	Incorrect alignment	Realign trough assembly and hangers in accordance with the assembly section of this document.
	Excessive shaft wear	Replace the coupling shaft.

General Bolt Tightening Torque (ft-lbs)

Bolt Diameter (in)	Threads Per Inch (UNC)	SAE 2	SAE 5	SAE 8	18-8 & 316 Stainless Steel
1/4	20	5	9	12	6
5/16	18	11	18	25	11
3/8	16	18	31	44	20
7/16	14	28	49	69	29
1/2	13	44	73	105	40
9/16	12	63	108	149	52
5/8	11	96	147	212	86
3/4	10	158	252	351	115
7/8	9	219	389	552	180
1	8	316	589	784	240

All bolted applications should be evaluated to determine optimum tightening torque.

The K factor in the formula below is considered an estimate.

The most commonly used K factor is 0.20 for plain finished bolts.

Formula: $T = K \times D \times P$

- T Target tighten torque (the result of this formula is in-lbs, dividing by 12 yields ft-lbs)
- K Coefficient of friction (nut factor), always an estimation in this formula
- D Bolts nominal diameter (in)
- P Bolt's desired tensile load (in-lbs) (generally 75% of yield strength)

$$P \text{ (lbs)} = (75\%) \text{ Yield Strength} \times \text{Tensile Stress Area}$$

Bolt Torque Guide is for fasteners used to assemble screw conveyors and does not include coupling bolts. Over tightening of coupling bolts could result in failure in tension.

CEMA recommends tightening coupling bolts to 75% of the values given in the **Bolt Torque Guide** to eliminate the over-tightening of coupling bolts.



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