Orthman
CONVEYING SYSTEMS

INSTALLATION, OPERATION, AND OPERATION MANTENANCE MANUAL FOR SCREW CONVEYORS

PTDA Member

MEMBER CEMA CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION

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

APPROVED FOR DISTRIBUTION BY THE SCREW CONVEYOR SECTION OF THE CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION (CEMA)

It is the responsibility of the contractor, installer, owner and user to install, maintain and operate the conveyor, components and, conveyor assemblies in such a manner as to comply with the Williams-Steiger Occupational Safety and Health Act and with all state and local laws and ordinances and the American National Standards Institute (ANSI) B20.1 Safety Code.

In order to avoid an unsafe or hazardous condition, the assemblies or parts must be installed and operated in accordance with the following minimum provisions.

1. Conveyors shall not be operated unless all covers and/or guards for the conveyor and drive unit are in place. If the conveyor is to be opened for inspection cleaning, maintenance or observation, the electric power to the motor driving the conveyor must be LOCKED OUT in such a manner that the conveyor cannot be restarted by anyone; however remote from the area, until conveyor cover or guards and drive guards have been properly replaced.

2. If the conveyor must have an open housing as a condition of its use and application, the entire conveyor is then to be guarded by a railing or fence in accordance with ANSI standard B20.1.(Request current edition and addenda)

3. Feed openings for shovel, front loaders or other manual or mechanical equipment shall be constructed in such a way that the conveyor opening is covered by a grating. If the nature of the material is such that a grating cannot be used, then the exposed section of the conveyor is to be guarded by a railing or fence and there shall be a warning sign posted.

4. Do not attempt any maintenance or repairs of the conveyor until power has been LOCKED OUT.

5. Always operate conveyor in accordance with these instructions and those contained on the caution labels affixed to the equipment.

6. Do not place hands, feet, or any part of your body, in the conveyor.

7. Never walk on conveyor covers, grating or guards.

8. Do not use conveyor for any purpose other than that for which it was intended.

9. Do not poke or prod material into the conveyor with a bar or stick inserted through the openings.

10. Keep area around conveyor drive and control station free of debris and obstacles.

11. Eliminate all sources of stored energy (materials or devices that could cause conveyor components to move without power applied) before opening the conveyor

12. Do not attempt to clear a jammed conveyor until power has been LOCKED OUT.

13. Do not attempt field modification of conveyor or components.

14. Conveyors are not normally manufactured or designed to handle materials that are hazardous to personnel. These materials which are hazardous include those that are explosive, flammable, toxic or otherwise dangerous to personnel. Conveyors may be designed to handle these materials. Conveyors are not manufactured or designed to comply with local, state or federal codes for unfired pressure vessels. If hazardous materials are to be conveyed or if the conveyor is to be subjected to internal or external pressure, manufacturer should be consulted prior to any modifications.

CEMA insists that disconnecting and locking out the power to the motor driving the unit provides the only real protection against injury. Secondary safety devices are available; however, the decision as to their need and the type required must be made by the owner-assembler as we have no information regarding plant wiring, plant environment, the interlocking of the screw conveyor with other equipment, extent of plant automation, etc. Other devices should not be used as a substitute for locking out the power prior to removing guards or covers. We caution that use of the secondary devices may cause employees to develop a false sense of security and fail to lock out power before removing covers or guards. This could result in a serious injury should the secondary device fail or malfunction.

There are many kinds of electrical devices for interlocking of conveyors and conveyor systems such that if one conveyor in a system or process is stopped other equipment feeding it, or following it can also be automatically stopped.

Electrical controls, machinery guards, railings, walkways, arrangement of installation, training of personnel, etc., are necessary ingredients for a safe working place. It is the responsibility of the contractor, installer, owner and user to supplement the materials and services furnished with these necessary items to make the conveyor installation comply with the law and accepted standards.

Conveyor inlet and discharge openings are designed to connect to other equipment or machinery so that the flow of material into and out of the conveyor is completely enclosed.

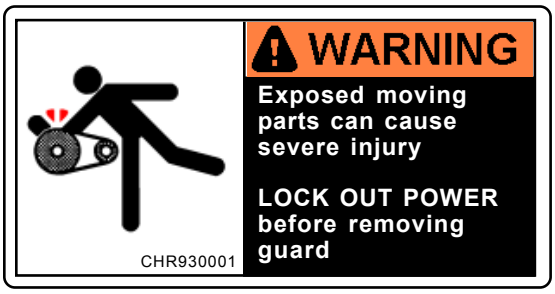
One or more warning labels should be visible on conveyor housings, conveyor covers and elevator housings. If the labels attached to the equipment become illegible, please order replacement warning labels from the OEM or CEMA.

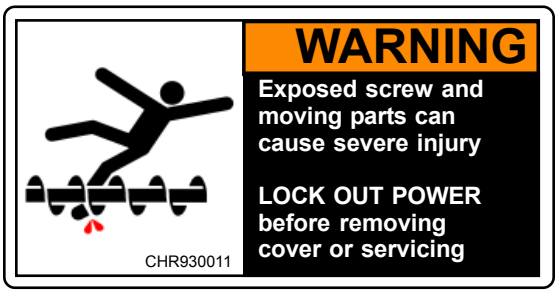
The Conveyor Equipment Manufacturers Association (CEMA) has produced an audio-visual presentation entitled “Safe Operation of Screw Conveyors, Drag Conveyors, and Bucket Elevators.” CEMA encourages acquisition and use of this source of safety information to supplement your safety program.

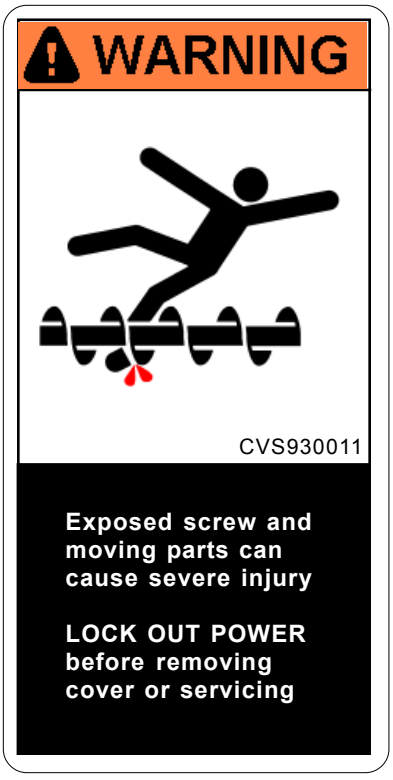
SEE OTHER SIDE FOR SAFETY LABELS

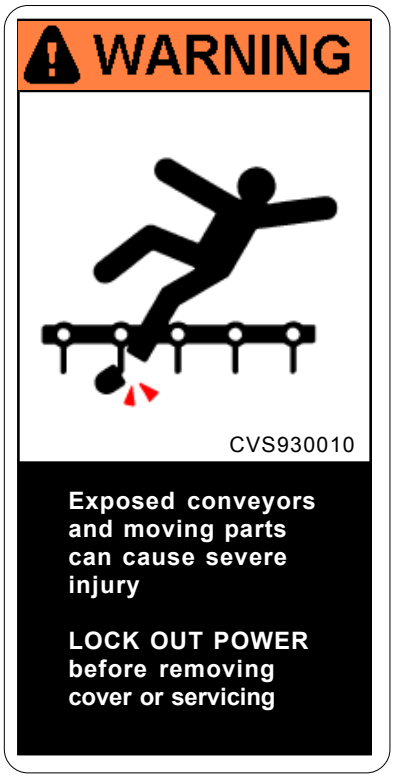
CEMA Safety Labels

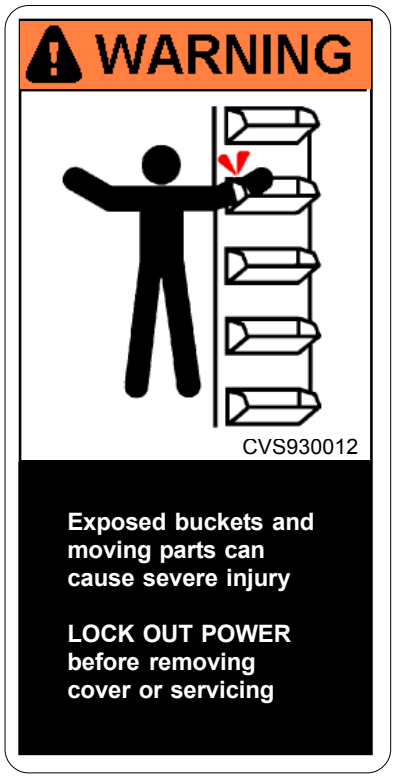
The CEMA safety labels shown below should be used on screw conveyors, drag conveyors, and bucket elevators. Safety labels should be placed on inlets, discharges, troughs, covers, inspection doors & drive guards. See CEMA Safety Label Placement Guidelines on CEMA Web Site: http://www.cemanet.org/safety/guidelines.html











PROMINENTLY DISPLAY THESE SAFETY LABELS ON INSTALLED EQUIPMENT

SEE OTHER SIDE FOR SAFETY REMINDERS

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

Contact CEMA or Your Equipment Manufacturer for Replacement Labels

CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION
6724 Lone Oak Blvd., Naples, Florida 34109
239-514-3441

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INTRODUCTION

Screw conveyors may be ordered by individual components with all assembly operations performed in the field, or assembled completely by the manufacturer, with drawings and material list.

In the latter case, long conveyors are separated into convenient shipping lengths and match marked for proper reassembly.

Factory assembled screw conveyors are furnished with all required nuts and bolts, except anchor bolts.

When individual parts are ordered for complete field assembly, nuts and bolts are not furnished unless ordered.

The installation instructions should be adequate for complete field assembly of individual components. These should also be reviewed for assistance in the proper installation of factory assembled units and installation of replacement components.

The safety section must be reviewed before actual start up of the screw conveyor. See page 9.

RECEIVING AND INSPECTION

Immediately upon receipt, all conveyor units and components should be checked against shipping papers for shortages and inspected for any damage.

In the event of shortage or damage, a claim should be filed promptly with the carrier.

LIFTING AND MOVING

Extreme care must be exercised in lifting and moving sections of pre-assembled conveyors or individual conveyor screws longer than 12 feet. Use of a spreader bar with slings is recommended for lifting. Standard conveyor components are designed for support at 10 to 12 foot intervals; otherwise misalignment and permanent bending may result.

When unloading from trucks, the conveyors should be lifted at two points separated sufficiently to provide equal overhang at each end, not in excess of 10 feet. Midspan between lifting points should not be more than the total overhang at end. (maximum of 20' with 10' overhang at each end)

If hoisting, as described above, cannot unload conveyors they may be pulled out lengthwise. The trailing end must be supported at the same elevation as the leading while withdrawing. Once the conveyor is withdrawn to an overhang of approximately 10', the conveyor should be supported at that point before withdrawing further.

CAUTION
Never lift only one end of a conveyor assembly or screw if its length exceeds 12 feet.

If unusually heavy components, such as drive units, are attached to one end of the conveyor assembly, consideration must be given to their bending effect when hoisting points are selected.

ERECTION

Place conveyor troughs in correct order with discharge spouts and inlets properly located. Connect trough end flanges loosely; do not tighten bolts. Align trough bottom centerlines, using the piano wire technique (or similar method). Tighten anchor flange bolts.

THRUST BEARINGS

When conveying material, conveyor screws tend to move in the opposite direction from which they are pushing in the material. To prevent this screw movement, the end shaft must be secured (fixed) through a suitable thrust bearing (or screw conveyor drive) to the rigid trough end.
This thrust bearing, if at all possible, should be at the discharge end of the conveyor. With the thrust bearing in its location the screw is in tension when conveying material. If the thrust bearing is located at the inlet end, the screw is in compression when conveying an will tend to buckle under heavy loading, which results in undue loads on hanger bearing and possible bending of the conveyor pipe.

The drive may be located at either end, but is preferred at the discharge end. When using a conveyor drive unit that is bolted directly to the conveyor end plate, the drive is shaft mounted so that the gear unit bearings will accommodate the conveyor thrust loads and eliminate the necessity of a thrust bearing.

NOTE: when the above drive is not used, and thrust loads are high, a special conveyor thrust bearing may be required. In this case, the specifications should be consulted.

1. Begin assembly of the conveyor screws at the discharge end (or fixed shaft end).

2. If shaft seal units are provided for the conveyor end plate, slightly oil the shaft and carefully slide the seal assembly onto the thrust-bearing shaft. Check seal instructions and drawings to be certain that the seal is facing the proper direction.
3. Bolt thrust bearing assembly, with shaft and seal units required, to conveyor end plate (discharge end). When the screw conveyor drive shaft is part of the reducer assembly, mount the reducer assembly into the position aligned with the thrust bearing assembly.
4. Install the discharge conveyor screw section by slipping it onto the drive shaft, insert coupling bolts and tighten nuts.

NOTE: Flight supporting end lugs must be opposite the conveying side of the flight.

5. Insert a coupling shaft into the opposite end of the conveyor screw and secure coupling bolts with nuts.
6. Slide hanger bearing on coupling shaft to within approximately 1/16" of screw conveyor pipe and clamp hanger top slightly to trough on both sides with C clamps.
7. Continue assembly of remaining conveyor screws, couplings and temporary clamping of hangers as described above. During assembly, each conveyor screw section should be rotated so that the end flight is approximately 180 degrees from the adjacent conveyor end flight.
8. When all conveyor screws and hangers are in place assemble the end shaft with the required bearing or drive. Do not secure the shaft with setscrews furnished with bearings or drive.
9. If a seal is required see step "2".
10. Insert shaft through conveyor end plate into conveyor screw and bolt drive or bearing to end plate. Secure end shaft to conveyor with coupling bolts and nuts.
11. Return to the first conveyor hanger installed at the thrust end. Remove any slack, due to manufacturing tolerances, from the conveyor screws and coupling by pulling the second conveyor screw section away from the thrust end.

12. Gently strike the hanger bearing top to position the screw for proper clearance from trough bottom and move the bearing away from the thrust end, until it has only running clearance (1/16") from the second conveyor screw.
13. Tighten clamps securely and drill necessary hanger mounting holes in trough, using the hanger as a drill template. Determine the proper hole size from the hanger mounting holes.
14. Bolt hanger tightly and remove clamps. For inside mounted hangers, bolts should by installed with heads on inside of trough (nuts outside). For top mounted hangers, bolts should be installed with heads on top and extended down through the trough flange.
15. Repeat steps "11" through "14" for each successive hanger bearings, progressing away from the thrust (discharge) end.
16. It is not necessary to tighten setscrews or other securing devices between shaft end bearing and bearing in drive opposite the thrust (discharge) end.
17. Rotate the conveyor by hand to check for free rotation. If any binding occurs check hanger and end bearings by loosening mounting bolts. Re-align bearing where necessary and tighten all bolts.

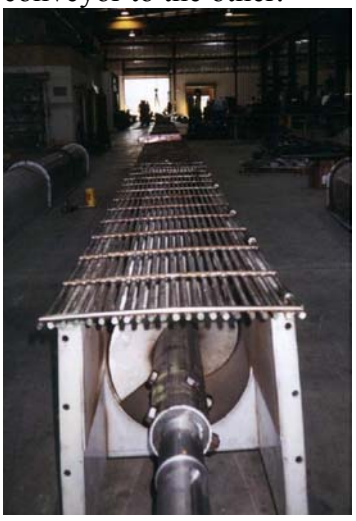
TROUGH COVER

1. Place cover sections on assembled trough in proper sequence. Use gaskets between cover and trough flange.
2. Align cover at inlet end and secure with required fasteners.

NOTE: Do not over tighten fasteners when gaskets are used. This may cause buckling of the trough covers resulting in material leakage.

3. Repeat the above step for each successive cover panel.

NOTE: If drilling is required for fasteners, clamp cover to trough and tighten each fastener as holes are drilled. Drilling of holes should be alternated from one side of the conveyor to the other.



OPERATION

INITIAL STARTING

1. After locking off power, check conveyor and drive for proper lubrication.
2. After locking off power, turn drive unit by hand to check for alignment and obstructions.
3. Once conveyor and drive turn freely, momentarily start the motor for a few revolutions and check for proper screw rotation. (Review safety procedures before startup page 9).
4. Start unit and operate empty for a few minutes to check for unusual noise, vibrations or loose fasteners.
5. When unit is operating smoothly, begin conveying material and check system for proper operation.
6. It is recommended that motor amperage be checked when conveying at design capacity to determine if unit is overloaded. The amperage rating is located on the motor nameplate. The voltage should also be checked to insure it is within normal limits, since low voltage can cause a high amperage as will overloading.

ROUTINE OPERATION

1. Unless otherwise specified, conveyors are designed to start empty and should be operated until empty before stopping. Drives can be designed to start under load if specified by the customer.

NOTE: Repeated or routine starting under load may result in damage and reduce life of equipment.

2. Operating conveyors with material loading in trough higher than design specifications may results in accelerated wear on internal bearings and undue load on drive components.

ROUTINE ISPECTION & MAINTENANCE

1. Periodic inspection should be made of the following components to plant replacement before unexpected failure occurs during operation.
    a. All internal and external bearings for wear of bearings or shaft.
    b. Flight edge thicknesses for wear or damage.
    c. Remove coupling bolts at drive shaft

and inspect bearings and hole for wear.

d. All coupling bolts and nuts for external wear or loss.
e. Seals for leakage.
f. Bearing, flange, and cover bolts for loose or missing nuts.
g. Gasket joints for leakage.

2. Several types of bearings may be used on screw conveyors, some of which require periodic lubrication. Frequency of lubrication varies depending upon material being conveyed, temperature, speed and operating time.
    a. Ball bearings in hangers, or at tail end or discharge end are furnished with grease fittings (for periodic lubrication).
    b. Roller bearings, when used on conveyor ends for drives or thrust loads, should be routinely lubricated. Over greasing may cause seal damage and early failure.
    c. The following bearing material may or may not require lubrication, depending on application.

-Babbitt
-Bronze
-Graphite Impregnated Phenolic
-Hard Iron
-Hard Surfaced Bearings
-Oil or Graphite Impregnated Bronze
-Oil Impregnated Wood
-Nylon
-Teflon

MALFUNCTION	CAUSE	CORRECTION
Hanger Bearing Failure	A. Incorrect bearing material	A. Change to accepted bearing with proven reliability for material, % loading, & conveyor speed
	B. Incorrect alignment	B. Install new hanger, consult the installation section
	C. Due to excessive % loading	C. Restrict inlet of conveyor, speed up conveyor, change to appropriate larger conveyor
	D. Lubricant becomes contaminated with dust & dirt particles	D. Change to non-lubricated insert.
	E. Excessive heat	E. Change to appropriate expansion hanger or change bearing material.
	F. Bent pipe causing eccentric loading & angular misalignment	F. Possibly pipe bent during shipment or handling. Always pre-run conveyor immediately after installation to insure pipe straightness.
	G. Thrust due to elongated coupling bolt holes	G. Always use screw conveyor coupling bolts. Check to see if collars are required.
	H. Wear pattern on one side (axially) of insert generally due to deflection of pipe	H. Lengths of pipe should not exceed CEMA standards.
Drive Shaft Failure	A. Twisting- caused by excessive torque or installing conveyor with some obstruction	A. Recalculate required torque based on ammeter (HP) & RPM readings, make appropriate corrections on % loading or speed up conveyors. Check conveyor screws for straightness after such occurrences.
	B. Longitudinal scratches in thrust bearing due to thrust loading	B. Use snap ringed thrust bearing or change type to "H" thrust bearing.
Coupling Shaft Failure	A. Insufficient torque capacity	A. Change to higher capacity shaft or to larger diameter, consider each segment of conveyor individually.
	B. Standard coupling shaft used in conjunction with hardened bearing	B. Change to hardened coupling shaft or non-hardened bearing.

MALFUNCTION	CAUSE	CORRECTION
(4)Premature trough failure	A. Thickness of trough too light	A. Change to recommended thickness stated in engineering manual.
	B. Shaft deflection	B. Follow recommended engineering practices on longer than standard lengths of pipe.
	C. Bent pipe	C. Run conveyor after installation to insure proper alignment.
(5)Premature flight tip wear pattern	A. Thickness of flight too light	A. Change to heavier flights.
	B. RPM's too high	B. Slow conveyor down with consideration given to % loading & torsion capacities of components.
(6)Inlet bearing failure	A. Material getting into bearing seal	A. Isolate bearing with waste pack seal. If material is liquid, change to outboard bearing with slinger waste pack seal and bearing.
	B. Misalignment due to shaft deflection, bent pipe, etc.	B. See procedures 4 B and C.
(7)Discharge bearing failure	A. Flight extending past center of discharge pumping material against bearing.	A. Cut off flight at center of end discharge.

SAFETY

Screw conveyor safety begins with a plan that considers every possible danger and potential hazard.

Operating and maintenance personnel should be thoroughly trained in safe operating procedure, recognition of possible hazards, and maintenance of a safe area around the screw.

The following safety guidelines should be followed. THESE ARE GUIDELINES ONLY ANDCOMPLIANCE WITH SAFETY STANDARDS-LOCAL, STATE, AND FEDERAL INCLUDING OSHA- IS THE RESPONSIBILITY OF THE USER OF THE SCREW CONVEYOR EQUIPMENT.

* Maintain a safety program for all operating personnel.

* Screw conveyors should not be operated unless the conveyor housing completely encloses the conveyors moving elements and power transmission guards are in place. If the conveyor cover or housing is to be opened, the motor must be locked out electrically in such a way that is cannot be restarted by anyone in the vicinity or remote from the conveyor. Overflow cover sections or doors should not be opened while the conveyor is operating.

* All operating personnel should be advised of the location of all emergency controls and safety devices. Clear access should be made to these controls and devices.

* Good lighting, housekeeping, and maintenance contribute to a safe work area around the screw conveyor.

* Frequent inspections should be made of all emergency controls and safety devices. Clear access should be made to these controls and devices.

* Conduct a pre-startup safety check of the conveyor equipment to determine that the machinery and area are safe for operation and that guards and warning devices are in place.

* There should be absolutely no reckless actions or horseplay in the vicinity of screw conveyors. Most accidents are caused by lack of proper safety training, carelessness, horseplay, and a lack of awareness of possible hazards.

* If, because of its application, the conveyor must have open housing, then the entire conveyor must be separated from personnel areas by a fence and warning signs must be posted.

* Open feed hoppers or spouts for shovel; front-end loaders or other manual or mechanical loading must incorporate a grating. If the characteristics of the material being handled are such that a grating can't be used, then the exposed portion of the conveyor must by guarded by a fence and warning signs posted.

*Do not walk or stand on conveyor cover or grating, or power transmission guards.

ELECTRICAL EQUIPMENT

Emergency stop switches, safety shut-off switches, zero speed switches, overflow and overload devices, and other electrical controls are all necessary considerations for a safe conveyor installation (controls and switches are usually furnished by conveyor user).