# SCREW CONVEYOR SAFETY, OPERATION & MAINTENANCE MANUAL

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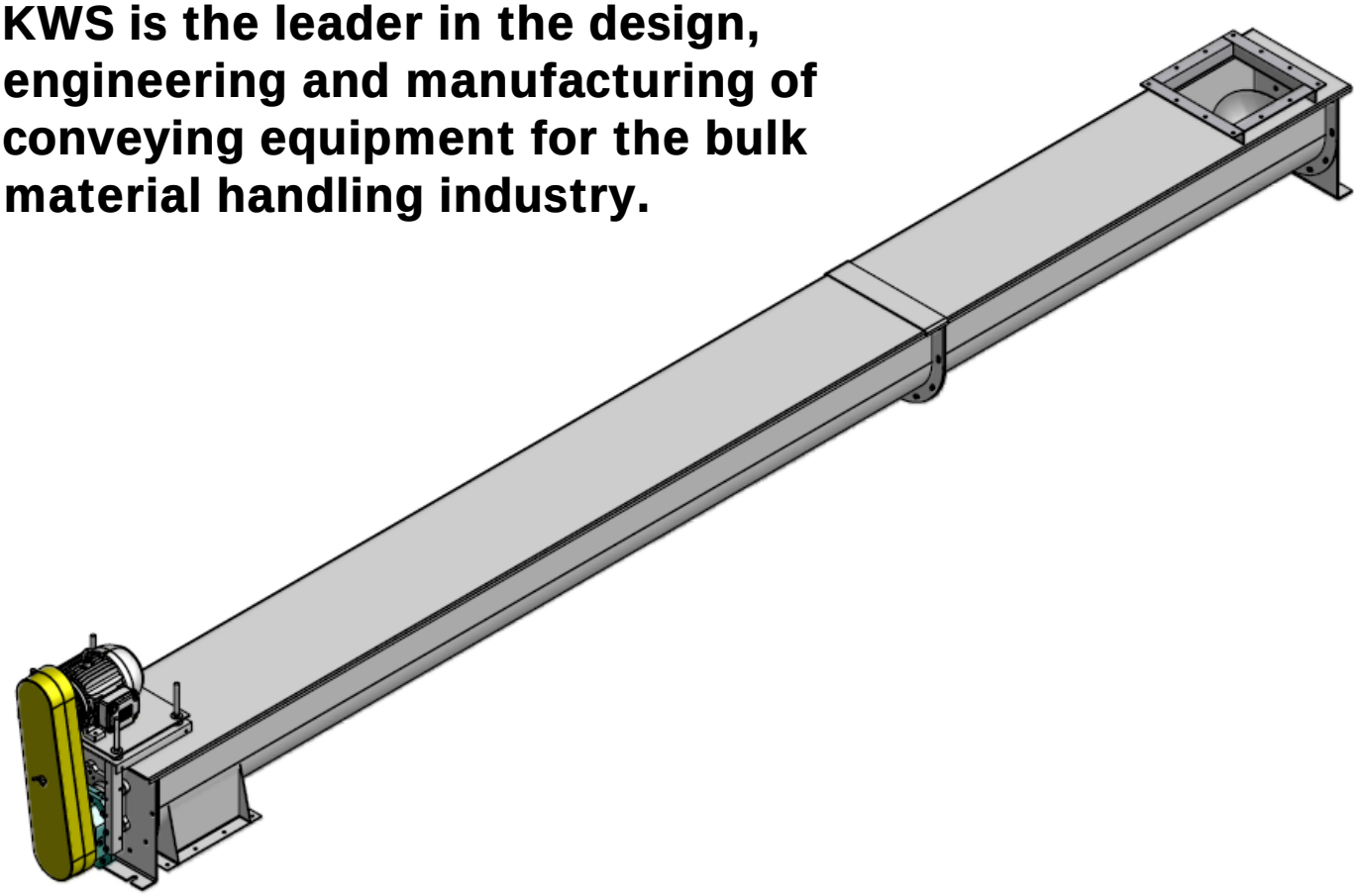

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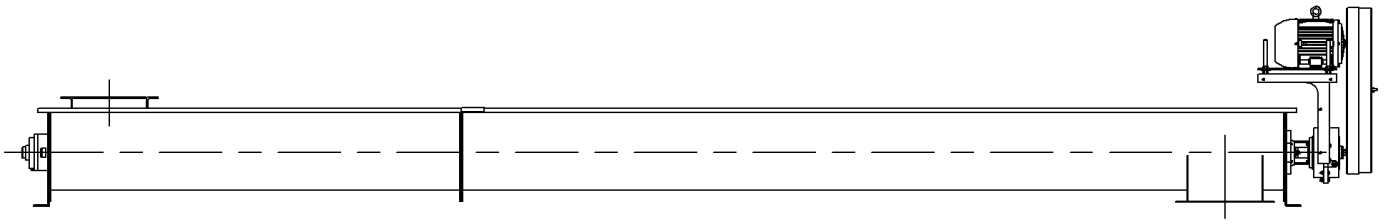

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## INTRODUCTION

The Screw Conveyor Engineering Committee of the CEMA (Conveyor Equipment Manufacturers Association) Engineering Conference was assigned the task of bringing together under one cover the accumulate experience of many individuals and their companies in an effort to provide a common basis for the safety, operation, and maintenance of screw conveyors.

The CEMA Safety, Operation & Maintenance Manual contains instructions for the safe installation, operation and maintenance of screw conveyors. The reliability and service life depends on the proper care taken while installing and preparing the equipment for its intended use.

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

## SECTION A – SAFETY

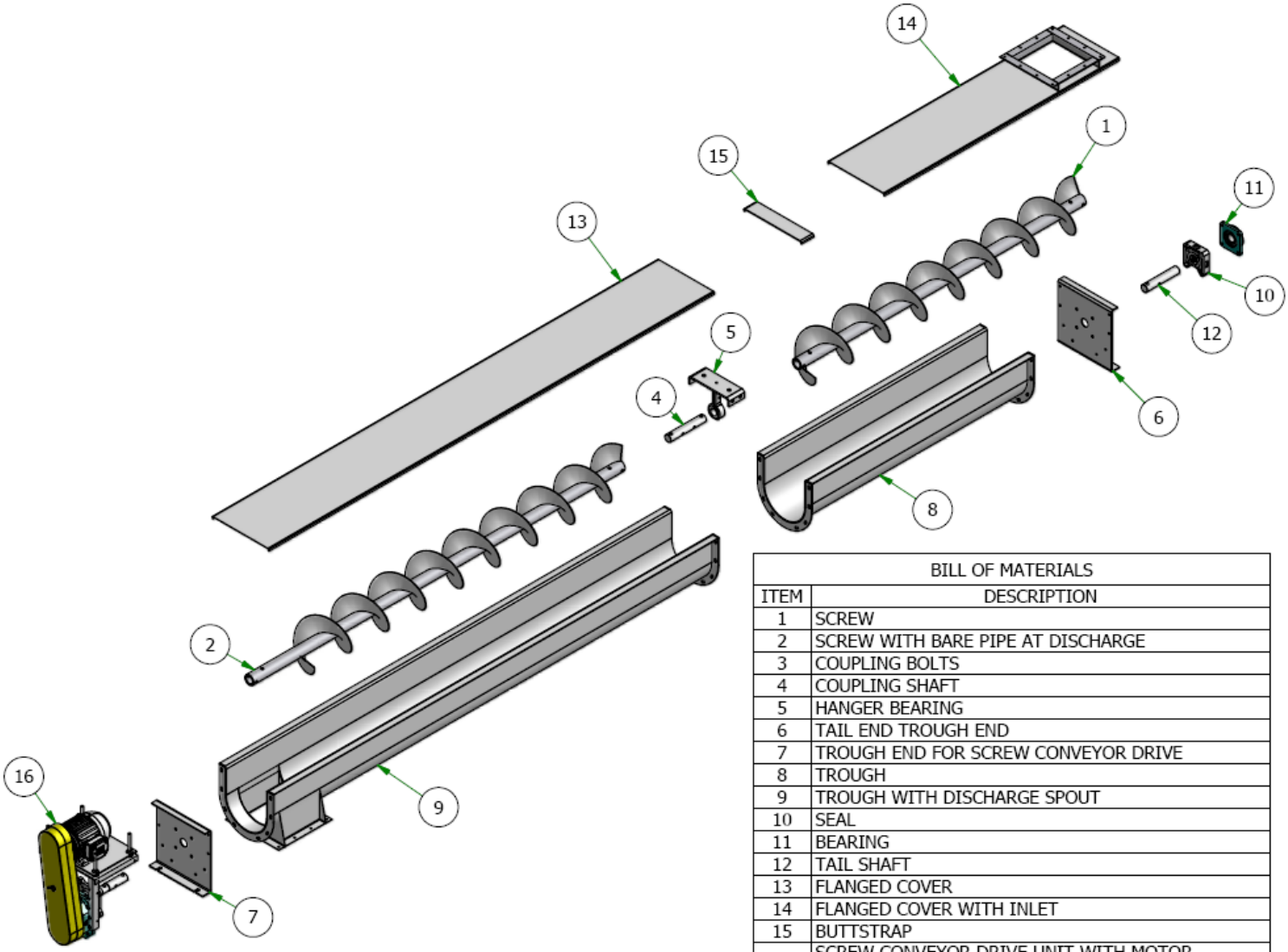
Screw conveyor safety begins with a plan that considers every possible danger and potential hazard. Operation and maintenance personnel must be thoroughly trained in safe operating procedures, recognition of possible hazards, and maintenance of a safe area around screw conveyors.

CEMA has a comprehensive safety program that includes:

- Warning and Safety Reminder for Screw Conveyors, Drag Conveyors and Bucket Elevators – (CEMA Document: SC2004-01)
- CEMA Safety Label Brochure – (CEMA Document: 201)
- CEMA Safety Label Placement Guidelines:
    - Screw Conveyor – (CEMA Document: SC-2)
    - Vertical Screw Conveyor – (CEMA Document: SC-3)
- Screw Conveyor Safety Poster – (CEMA Screw Conveyor 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.

Screw conveyor accidents can be avoided by implementation and enforcement of an in-plant safety program. A number of safety precautions are included in this manual. Carefully study and follow the safety precautions. Remember – accidents are usually caused by negligence or carelessness.

# SCREW CONVEYOR COMPONENTS




| BILL OF MATERIALS | |
|---|---|
| ITEM | DESCRIPTION |
| 1 | SCREW |
| 2 | SCREW WITH BARE PIPE AT DISCHARGE |
| 3 | COUPLING BOLTS |
| 4 | COUPLING SHAFT |
| 5 | HANGER BEARING |
| 6 | TAIL END TROUGH END |
| 7 | TROUGH END FOR SCREW CONVEYOR DRIVE |
| 8 | TROUGH |
| 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 DRIVE AND GUARD |

# SECTION B – INSTALLATION

## RECIEVING

1. Screw conveyors may be ordered as individual components with all the operations performed in the field, or assembled completely by the manufacturer, with drawings and bill of materials.
2. Immediately upon receipt all items in the shipment 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 A 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 drive 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 for 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 discharge spout properly located.
4. Connect the joints loosely. DO NOT TIGHTEN BOLTS.
5. Assemble each trough end to proper end of conveyor.
6. Attach piano wire full length of conveyor at centerline. Make sure 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 piano wire. Torque bolts to proper torque rating.
8. Anchor trough assembly to mounting surface. CEMA recommends supporting trough assemblies every 10 to 12 feet. Saddles and feet may be required.
9. Mount drive or thrust unit on correct trough end. Drive or thrust units are normally located at discharge end of conveyor. Make sure drive or thrust unit is centered in seal and trough end openings. Torque bolts to proper torque rating.
10. Place the first screw section in the trough starting at the drive or thrust end. Install screw so end lugs are opposite carrying side of flight.
11. Insert screw onto drive shaft and install coupling bolts. DO NOT TIGHTEN COUPLING BOLTS.
12. Insert coupling shaft into opposite end of screw and install coupling bolts. DO NOT TIGHTEN COUPLING BOLTS.
13. Pull screw section away from drive or thrust unit to seat thrust connection.
14. Insert hanger onto coupling shaft.
15. Raise hanger and screw section until hanger top bar is flush with top of 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 end of flighting of previous screw section.
17. Center hanger bearings between screw sections. Torque hanger assembly bolts to proper torque rating.
18. Assemble seal and bearing to opposite trough end. Make sure end shaft is centered in seal and trough end openings. Torque bolts to proper torque rating.

19. Insert end shaft through end bearing and into last screw section and install coupling bolts. DO NOT TIGHTEN COUPLING BOLTS.
20. Rotate entire screw assembly to check alignment and adjust hanger assemblies as required.
21. Torque ALL coupling bolts to proper torque rating.
22. Adjust seals as required.
23. Remove all debris from conveyor.
24. Install covers in proper sequence starting at inlet end and attach with provided fasteners.
25. Lubricate drive and all bearings in accordance with manufacturer's instructions. DRIVES GENERALLY SHIPPED WITHOUT OIL.
26. MAKE SURE ALL CEMA SAFETY LABELS ARE IN PROPER LOCATIONS.

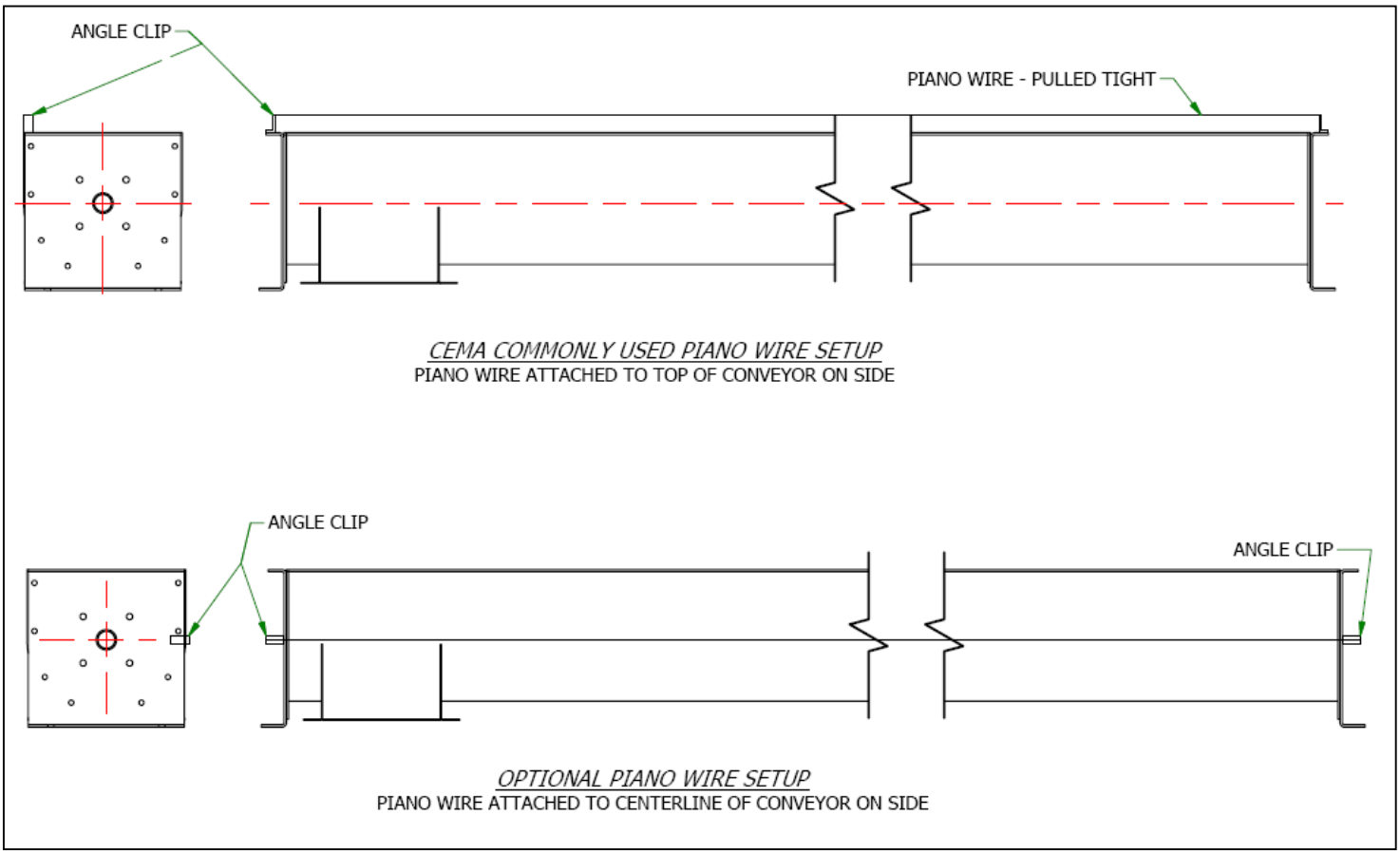



**Figure 1 – Piano wire setup diagrams**

## SECTION C – OPERATION

### BEFORE INITIAL START-UP:

1. LOCKOUT/TAGOUT ALL POWER.
2. Lubricate all bearings in accordance with manufacturer's instructions.
3. Lubricate all gear reducers in accordance with manufacturer's instructions. Gear reducers are normally shipped without lubrication.
4. Check conveyor to insure all tools and foreign materials have been removed.
5. Turn drive unit by hand to check for alignment and obstructions.
6. Check conveyor to insure all covers, guards and safety devices are installed and operating properly.

### INITIAL START-UP (WITHOUT MATERIAL):

1. Reenergize power to conveyor.
2. Start conveyor momentarily to check for proper conveyor rotation. If conveyor rotation is NOT correct, quickly shutdown and have qualified electrician change wiring.
3. Operate 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 Troubleshooting Section of this document.
4. Stop the conveyor and LOCKOUT/TAGOUT ALL POWER.
5. Remove covers and check tightness of coupling bolts. Torque bolts to proper torque rating.
6. Replace covers.
7. Check all assembly and mounting bolts. Torque bolts to proper torque rating.
8. Check conveyor discharge. Discharge must be clear to insure that material flow out of conveyor will not be impeded.

### INITIAL START-UP (WITH MATERIAL):

1. Reenergize power to conveyor.
2. Start conveyor and operate 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 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 amperage is excessive. Check voltage to insure that it is within normal operating limits.
7. Stop the conveyor and LOCKOUT/TAGOUT ALL POWER.
8. Remove covers and check tightness of coupling bolts. Torque bolts to proper torque rating.
9. Check hanger bearings and realign if necessary.
10. Replace covers.
11. Check all assembly and mounting bolts. Torque bolts to proper torque rating.

## SECTION D – MAINTENANCE

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

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

- Bearings – Check for proper lubrication. Lubricate all bearings in accordance with 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 in accordance with 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 Assembly 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 inch.
- Seals – Check for leakage. Adjust seal or replace packing as necessary.
- Coupling Bolts – Check for wear. Replace worn coupling bolts as necessary. Torque ALL coupling bolts to proper torque rating.
- Assembly Bolts - Check for tightness. Torque ALL assembly bolts to proper torque rating.
- Guards – Check for clearance and bolt tightness.

### REPLACING SCREW CONVEYOR COMPONENTS:

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

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

# SECTION E – 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 product from 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 Assembly Section of this document.
6. Turn drive unit by hand to check for alignment and obstructions.
7. Replace all covers and guards.
8. Restart 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 a long period of time.

1. Operate conveyor until all product is removed.
2. LOCKOUT/TAGOUT ALL POWER.
3. Remove all covers.
4. Remove all obstructions and product from 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 Assembly Section of this document.
7. Lubricate drive and all bearings in accordance with 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 operation is to resume, restart conveyor in accordance with the Operation Section of this document.

## STORAGE

1. Protect 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 operation is to resume, restart conveyor in accordance with the Operation Section of this document.

## SECTION F – 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 | REDUCE SPEED. CONSULT CEMA 350 BOOK TO DETERMINE RECOMMENDED SPEED AND TROUGH LOADING. |
| 2. HANGER BEARING FAILURE | INCORRECT ALIGNMENT | REALIGN TROUGH ASSEMBLY AND HANGERS IN ACCORDANCE WITH ASSEMBLY SECTION OF THIS DOCUMENT. |
| | IMPROPER SPEED AND TROUGH LOADING | CONSULT CEMA 350 BOOK TO DETERMINE RECOMMENDED SPEED AND TROUGH LOADING. |
| | IMPROPER HANGER BEARING MATERIAL | CONSULT CEMA 350 BOOK TO DETERMINE RECOMMENDED BEARING MATERIAL. |
| | EXCESSIVE BEARING WEAR | REPLACE HANGER BEARING. |
| 3. PREMATURE TROUGH FAILURE | TROUGH THICKNESS TOO LIGHT | INCREASE TROUGH THICKNESS. USE ABRASION RESISTANT MATERIAL. CONSULT CEMA 350 BOOK TO DETERMINE RECOMMENDED TROUGH THICKNESS. |
| | SCREW DEFLECTION | CONSULT CEMA 350 BOOK TO DETERMINE PROPER PIPE SIZE AND SCRW LENGTH. |
| | BENT SCREW | STRAIGHTEN OR REPLACE SCREW. |
| 4. SHAFT HOLE ELONGATION | INSUFFICIENT NUMBER OF COUPLING BOLTS | INCREASE NUMBER OF COUPLING BOLTS |
| | CONVEYOR SUBJECT TO FREQUENT STOP/START | CEASE FREQUENT STOP/START. INCREASE BEARING CAPACITY OF SHAFT AND/OR INCREASE NUMBER OF COUPLING BOLTS |
| | FREQUENT OVERLOADS | |
| 5. DRIVE SHAFT BREAKAGE | EXCESSIVE TORQUE | CONSULT CEMA 350 BOOK TO DETERMINE PROPER TORQUE RATING. |
| 6. MOTOR OVERLOAD | MOTOR UNDERSIZED | CONSULT CEMA 350 BOOK TO DETERMINE PROPER HORSEPOWER REQUIREMENTS. |
| | UPSET LOADING CONDITION | EMPTY TROUGH. OPERATE UNDER DESIGN SPECIFICATIONS. |

| | | |
|---|---|---|
| 7. TROUGH END BEARING FAILURE | BEARING CONTAMINATION | UPGRADE OR REPLACE SEAL. CHANGE TO OUTBOARD BEARING. |
| | INSUFFICIENT LUBRICATION | LUBRICATE IN ACCORDANCE WITH MAINTENANCE SECTION OF THIS DOCUMENT. |
| | IMPROPER SHAFT RUNOUT | CHECK SCREW STRAIGHTNESS AND REPLACE AS NECESSARY. |
| 8. COUPLING SHAFT BREAKAGE | EXCESSIVE TORQUE | CONSULT CEMA 350 BOOK TO DETERMINE PROPER TORQUE RATING. |
| | INCORRECT ALIGNMENT | REALIGN TROUGH ASSEMBLY AND HANGERS IN ACCORDANCE WITH ASSEMBLY SECTION OF THIS DOCUMENT. |
| | EXCESSIVE SHAFT WEAR | REPLACE COUPLING SHAFT. |