NERCON

www.nerconconveyors.com

LIVE DRUM SPIRAL
INSTALLATION AND SERVICE MANUAL

ISSUE DATE: 11/5/2013

600 S. Commercial Street | Neenah, WI 54956 | PH: 844-293-2814 | www.nerconconveyors.com

NERCON PROPRIETARY STATEMENT

The following information is proprietary information of NERCON and must not be used except in connection with our work, nor in any manner disclosed to any third party without the prior written consent of NERCON. All rights of design and invention are reserved.

Recipient of this manual acknowledges that they will abide by the instructions contained in this manual and in any optional training classes purchased from NERCON. Installation and startup supervision services are also available for purchase from NERCON. Recipient will not tolerate any operation that is contrary to these instructions. If the recipient observes equipment that presents a hazard, he will promptly inform NERCON so that a solution can be achieved.

Warning

Failure to follow these rules can result in injury

Note: The safety standards outlined in this section have NOT been exactly duplicated from the latest issue of the ANSI booklet, *Safety Standards for Conveyors and Related Equipment B20.1-20--*. We recommend that all operators and maintenance personnel review this booklet, which you can obtain by contacting the American Society of Mechanical Engineers at the following address:

American Society of Mechanical Engineers
United Engineering Center
345 East 47th Street
New York, NY 10017

Table of Contents

Section: 1 - Introduction

1-1: How to Use this Manual

This manual is supplied to assist you in installing, maintaining and servicing NERCON LIVE DRUM SPIRALS. It is essential for safe and efficient operation that the information and guidelines presented here are properly understood and implemented. Following is a brief description of the information contained in each section:

1. *Introduction*: Basic information about the manual and the system and trademarks/servicemarks (if any) used in the manual.

2. *Safety*: Safety precautions for Live Drum Spiral operation and maintenance.

3. *Installation*: Mechanical and Electrical information about the installation of the Live Drum Spiral.

5. *Periodic Inspection Guide*: One of the most important factors in the overall cost effectiveness of your Live Drum Spiral is the periodic inspection; that is, eliminating the cause of potential trouble before the trouble occurs. This concept makes it possible to perform maintenance and repair operations on a predetermined schedule rather than according to chance. Implementing a periodic inspection program on your NERCON equipment serves to increase its dependability, longevity, and efficiency, all of which add up to lower operating costs.

6. *Troubleshooting*: Despite the best operating techniques and preventive maintenance program, machines do sometimes fail. This section contains suggested step-by-step methods to aid in detecting the cause or causes of these failures.

Observe the equipment when it is functioning properly in order to detect failure and/or to perform maintenance or adjustment on the equipment.

1-2: Integration

- The live drum spiral is designed to raise or lower product without accumulation. Therefor care must be taken to prevent the unintended accumulation of product on the unit. If the equipment directly downstream of the spiral is no longer taking product away, the spiral must be stopped or paused. Nercon recommends using a photo eye to detect any jams on the conveyor as well as monitoring the drive signal of the downstream equipment. Likewise the same care must be taken with the upstream equipment as to not overload the infeed of the spiral. If the spiral belt is stopped or pauses, the infeed equipment must also stop. The infeed equipment should not be allowed to restart until the spiral has reached its normal operating speed.

- It is recommended that the belt speed of the spiral run at the same speed as the infeed and discharge equipment. It is not recommended to be used to pull a gap between products. For this reason consideration must be given to the product shape and spacing as it is fed into the spiral. If the products are too close they will touch each other as the belt collapses around the drum, causing skewed or possibly damaged products.

1-3: Operational Concepts

- The live drum spiral is powered by 2 motors. One to drive the drum and one to drive the belt.

- The drum rotates faster than the inside edge of the belt. This is referred to as the "Overdrive" or "Overtravel" of the drum.

- This overdrive provides the majority of driving force for the belt via friction between the belt edge and the drum surface. For this reason some amount of friction is desired on the belt and **no lubricants should be applied to either the belt or surface of the drum.**

- The magnitude of overdrive greatly affects the performance of the belt. See troubleshooting section 6-1 for improper overdrive characteristics.

- Note: During initial break in period, adjustments to the amount of overtravel are common.

Section: 2 - Safety

2-1: General Safety

Note: The safety procedures/policies listed in this chapter are not intended to address fire-related considerations. Your system must comply with any applicable national, state, and local codes.

Follow safety precautions for industrial work at all times. With any piece of industrial equipment, conditions exist that might cause injury to you or your co-workers. Because it is not possible to describe each potentially hazardous situation that might develop, you must be alert at all times for unsafe conditions. To avoid injury, use maximum possible care and common sense and adhere to all safety standards.

Take special care while maintaining and inspecting electrical equipment and devices. All personnel working on or around the system should be aware of, and adhere to, all **CAUTION**, **DANGER**, and **WARNING** signs. These signs are posted to reduce the risk of injury to all personnel. Maintain signs in a legible condition. Contact your supervisor to post additional safety signs if you feel they are necessary.

Follow these general safety rules, as well as specific regulations and guidelines listed in this publication:

2-2: Mechanical Safety Guidelines

- Do not touch moving parts.
- Do not walk, ride or climb on the belt.
- Do not operate the live drum spiral with the protective guards removed or with personnel inside a customer defined safety perimeter.
- Keep jewelry, clothing, hair, etc., away from any and all moving parts.
- Know the location and function of all start/stop devices and keep those devices free from obstruction.
- Clear all personnel from the equipment before starting.
- Do not attempt to clear product jams while the spiral is running.
- Allow only trained and authorized personnel to maintain or repair the spiral.
- Do not load the spiral beyond the specified design limits.
- Do not attempt to make repairs to the spiral while it is running
- Do not modify equipment without checking with the manufacturer.
- Do not operate or perform maintenance on the equipment when taking any type of drug or sedative, or when over fatigued or under the influence of alcohol.
- Do not operate the spiral if any part is damaged or improperly installed.
- Be sure that all replacement parts are interchangeable and of equal quality as original parts supplied.

When the spiral is stopped for maintenance or repair purposes, you must lock out or tag out the starting devices, prime movers, or powered accessories in accordance with a formalized procedure designed to protect everyone involved against an unexpected restart. Also, alert all personnel to the hazard of stored energy, which can exist after the power source is locked out. For additional information, refer to the latest issue of ANSI Z244.1-20--, American National Standard for Personnel Protection - *Lockout/Tagout of Energy Sources - Minimum Safety Requirements*. Also, OSHA 29CRF Part 1910.147 *"Control of Hazardous Energy sources (Lockout/Tagout)"*, which includes requirements for release of stored energy

2-3: Electrical Safety Guidelines

When an equipment problem occurs, the first priority is to ensure that power is disconnected from the affected area, as well as from the control panel where troubleshooting and repairs are performed.

Once you verify that power is locked out, make sure you inform other personnel in the area of the situation so they do not unexpectedly restore power.

After you inform your co-workers, recheck the power supply to ensure that power is disconnected in the affected control panel. Remove fuses only with insulated fuse pullers and check terminal strips for current-carrying wires. Before you perform any repairs with an exposed conductor or terminal, use an approved voltmeter to check for continuity to ground and continuity between other current-carrying conductors.

When you perform any kind of maintenance or repair involving electrical components, follow the guidelines listed below:

- **NEVER** reset a circuit breaker or replace an open fuse before determining and correcting the cause of the circuit interruption.
- **NEVER** bypass or use a jumper to replace any limit switch, fuse, circuit breaker, or other circuit protection or safety device.
- **NEVER** replace an open fuse with another that is not rated at the proper current and voltage. Always double check correct fuse specifications rather than replace the open fuse with one of the same current and voltage rating.
- **NEVER** rest tools on motors, transformers, terminal strips, or other control panel or electrical components. All tools used should be kept in a tool box or pouch.
- **NEVER** restore power or restart equipment before verifying that all tools, spare parts, etc., are removed from the work area and are safely stored.
- **NEVER** restore power or restart equipment before verifying that ALL personnel are aware of the condition and are safely clear of the equipment.
- **ALWAYS** replace any safety devices or guards removed during maintenance or repair before you restore power or restart equipment.
- **ALWAYS** use extreme caution and follow recommended safety procedures while you perform any electrical inspection or maintenance operations

2-3.1: Electrical Code

All electrical installations and wiring must conform to the National Electrical Code (Article 670 and other applicable articles) published by the National Fire Protection Association and approved by the American National Standards Institute, Inc.

2-3.2: Control Stations

Arrange control stations so that equipment operation is visible from the stations and clearly mark or label each station to indicate its function.

The emergency stop devices installed with your system are designed so that they cannot be overridden from other locations. Keep the area around your control station clear. Remove all miscellaneous equipment (such as inactive and unused actuators, controllers, and wiring) from control stations and panel boards, as well as obsolete diagrams, indicators, control labels, and other material that might confuse the operator.

2-3.3: Safety Devices

All safety devices, including wiring of electrical safety devices, are designed to operate in a "fail-safe" manner; that is, if power or the device fails, a hazardous condition will not result.

2-3.4: Emergency Stops and Restarts

In case of an emergency stop, first determine the cause of the stoppage and correct the situation that warranted the stop. To resume operation after a stoppage, manually reset or start at the location where the emergency stop occurred.

Note: Before you try to correct the situation, lock out or tag out the starting device, unless it must be operated to determine the cause or to safely remove the stoppage. For additional information, refer to the latest issue of ANSI Z244.1-20--, American National Standard for Personnel Protection Lockout/Tagout of Energy Sources - Minimum Safety Requirements.

2-4: Application Safety

The equipment used in your system is designed to convey specified commodities or materials within a certain rate and speed. It might not be possible to safely use the equipment outside of the intended capacities or speeds. Check with your supervisor if you have questions regarding the safe operation of the equipment.

2-5: Transfer, Loading, and Discharge Points

Prevent free-falling material that might result from flooding, ricocheting, or uncontrolled free-fall from occurring.

At transfer, loading, and discharge points, prevent unconfined and uncontrolled free-fall of material resulting from flooding, ricocheting, overloading, trajectory, leakage, or a combination thereof, if the material would create a hazard to personnel

Section 3: Installation

Note: All equipment must be installed to conform to the National and Local Safety Codes. In the event that any caution or warning labels affixed to the equipment are damaged in shipping or obscured from vision because of the position of the equipment on site, you should order the appropriate replacement labels before operating the equipment.

3-1: Installation

Nercon pre-assembles and pre-tests all live drum spirals prior to shipment. This allows us to ship the unit nearly completely assembled. The units are laid down on their sides, resting on the support structure. Additional bracing is added to support any critical non-removable parts. To protect certain areas during shipping they will be removed and packaged separately. This often includes the large gearbox that drives the drum and the infeed and discharge conveyor sections. These sections are clearly labeled when shipped and can be easily installed per the detail drawings provided.

3-1.1: Unloading

The live drum spiral will arrive on a single skid and it is recommended to be pushed or pulled with a fork truck. Each unit is custom and an estimated weight will be provided so that the installation contractor may plan for appropriate fork truck capacity. The detail drawings provided indicate acceptable points of connection for moving/or lifting the units. (See section 7-2) Use straps to connect to these locations as well as the skid and move the unit as required.

3-1.2: Standing Up

Once the unit is located near its final position, and all cross bracing and tie down straps have been removed the unit can be stood up. The proper and most common method to stand these units up is shown in drawing of section 7-2.

Note: Adequate ceiling clearance is critical to allow the drum to swing to an upright position. Typical nominal clearance required is 5 feet. Special care and consideration should be taken when clearances are less than 5 feet.

3-1.3: Completing Assembly

Connect all remaining joints, carefully check conveyor for correct elevation and level, and then tighten the fasteners to secure the section being installed. Ideally every transition from one conveyor to the next should have a slight drop in elevation so that the products do not snag or hang up. Typically 1/16" is adequate from conveyor to conveyor. Once the spiral is positioned as required, the infeed and discharge elevations have been verified, the unit should be lagged to the floor and any other bracing added.

3-1.4: Wiring

As noted above in section 2-5, be sure to follow all National Electrical Code and any local stated codes. Also be sure to follow all recommendations noted above in sections 2-3 through 2-8.

Nercon will provide local enclosures that will house the VFD's for the belt drive and the drum drive. These will be mounted on the structure and both motors will be wired back to this enclosure. The customer will be responsible for connecting the power and control wiring at this location.

Note: Brake Motors
Some units require a brake motors on the belt drive to ensure stoppage of the belt. Brake motors will be prewired and programmed accordingly to the Nercon supplied enclosure.

The wiring, programing, and sequencing for all the drives in the live drum system should be aligned with the recommendations noted above and all provided schematics. Failure to do so will lead to premature belt wear and possible product or equipment damage.

3-1.5: System Sensors

The live drum spiral units have 3 sensors that continually monitor the drums performance while in operation. The over torque sensor is located at the belt drive, the take-up sensor is located on the take-up frame work and the zero speed (no belt movement) sensor is located at the infeed pulley. If any of these sensors are signaled the system will perform a safe shut down. This means the belt will stop moving and the drum will stop a set time later. The over torque sensor, is designed to prevent high tension in the belt. The take-up sensor is designed to stop the unit if too much or too little belt is in the system. The zero speed (no belt

movement) sensor is designed to stop the unit should the belt ever unexpectedly stop while in production. All sensor locations are shown on the support drawing in section 7-1.

After all connections are made, check both motor rotations and I/O functions prior to moving to the belt installation section below.

3-1.6: Belt Installation

Before installing the belt become familiar with the manufacturer's installation and maintenance manual provided in addition to this manual. For installation convenience, proper belt orientation is also noted on the detailed drawings.

After the unit has been properly positioned, lagged, and wired, the belt can be installed. The most effective way to install the belt is to start at the infeed of the unit as described on the detailed drawing. Carefully feed the belt around the drum while manually jogging the drum from the local enclosure. Using the jog function on drum VFD will rotate the drum at a very low speed while it is depressed. This will help to pull the belt through the system and speed up installation time. The belt will need to be manually guided and tensioned against the drum. Think of a winch in a ship yard pulling a large vessel, only slight tension is needed after a few wraps have been made around the drum. As you pull on the leading edge of the belt, the drum will drive the belt up or down the unit depending on your configuration. Once the belt is completely coiled around the drum, route the belt through the rest of the unit. Be sure to follow the belt path as exactly shown on the detail drawings supplied for your specific unit.

3-1.7: Proper Belt Quantity

To initially obtain the proper amount of belt in the system, be sure the belt is pulled taught by hand throughout the system and the take-up is located in the upper third of the take-up slot. This will require monitoring as the system completes its break in period. Reference the periodic inspection guide for schedule and cleaning requirements.

Tip: The take-up can be pinned in the up position to allow for easy installation of belt.
See support drawing in section 7-1 for location & size of pin required.

Once the belt has been properly installed you can move onto the initial on-site start-up. (Note: Nercon runs all units in house prior to shipping.)

Section 4: Initial Start-up

4-1: Initial Start-up Check List

- Spiral is securely fastened to the floor and all supplied cross bracing and tie brackets are mounted.
- Check that the proper amount of belt is in the system. (Section 3-2.7)
- Check the entire belt path for any obstructions, snags, or tight spots that may have been created during shipping or installation.
- Be sure there is nothing on the belt before initial on-site start-up. (i.e. tools, computers, etc.)
- Check that the sensors are functioning properly.
- E-stop relay must be set.
- All faults must be identified and cleared.
- Ensure shipping bolts are removed from weighted take-up and that it moves freely up and down the take-up slot.

Section 5: Periodic Inspection Guide

5-1: Introduction

NERCON equipment is designed to operate with a minimum of maintenance. Downtime on any part of a system involves both time and money. Certainly not all breakdowns or failures can be detected before they occur; however, many can be prevented if you follow a regular periodic inspection program. When you install new equipment, you should establish a schedule of periodic inspection. The inspection procedures outlined in this manual provide an easy means of determining the operational status of the equipment. This will enable you to identify possible trouble areas, so that the suspect condition does not deteriorate to the point of equipment failure.

5-2: Purpose

The objective of the periodic inspection schedule is to ensure that the equipment performs at maximum efficiency over a long period of time. This helps to eliminate costly repairs. Do not assume that trouble will occur and, therefore, pass over inspection items. Standardized procedures ensure effective control over maintenance operations and enable you to compare equipment in order to evaluate the inspection program.

Note: Replace any faulty parts immediately upon discovery during scheduled inspections.

5-3: Periodic Inspection

In the course of spiral operation, periodic inspection of the system is required to detect problems and make repairs before serious damage occurs. The important thing is to set up a regular inspections and maintenance schedule.

Spiral belt Checklist: (Daily/Weekly/Monthly)

D: During operation monitor belt performance for any irregularities.
D: Check for any product spillage or build up that would affect belt performance.
D: Monitor the surface of the drum for any contaminants that could affect the friction relationship between the belt and the drum.
D: Belt length / take-up position. (Daily for first 500 hours of operation only)
W: Belt length / take-up position. (Weekly after 500 hours of operation only)
W: Inspect entire belt length for any damaged or missing belt modules.
W: Check for any foreign debris on or around the belt path.
W: Look for unusual wear patterns on the belt surface and inner edge.
W: Examine sprockets for signs of dirt build-up in tooth pockets.
M: Examine drive sprockets for signs of excessive wear.
M: Check the carry ways and return way wearstrips for excessive wear.

5-4: Cleaning

In general, the live drum spiral conveyor can be treated like most other conveyor in the plant. Some major differences apply based on the level of washdown you have purchased. This is directly related to the operational environment your drum spiral will reside in. Regardless of environment, **at no point should any lubricants be applied to the spiral belt or drum.** Some friction between belt and drum is required, however if anything comes in contact with the drum to increase or decrease the friction (i.e. spilled product) it should be immediately cleaned off.

5-4.1: Non-Washdown Spirals

- Non-washdown spirals are not intended to be completely sprayed down. However if absolutely required "spot" rinsing can be an effective way to clean isolated areas of contaminants. These areas should be dried immediately when cleaning is complete to prevent any unwanted corrosion.
- Non-washdown units are recommended to be wiped down with clean rags until clean.
- Special attention should be paid to the cleanliness of the drum. During the first weeks of operation a black film or dust may develop on the drum surface and belt edge due to the polishing action of the belt. This will decrease over time, but should be wiped away with a clean damp rag from both the belt and the drum itself. This may need to be done as frequently as once a day on new machines.

5-4.2 Washdown Spirals

- In washdown environments it is advisable to clean the live drum spiral unit by means of a spraying system with a cleaning agent followed by a clean water rinse. This should be done while the unit is running to help the cleaning process. The unit should also be allowed adequate time to dry before returning to production.
- Follow belt manufacturer's recommendations regarding appropriate cleaning compounds for the plastic belt. (Mild foaming agents recommended)
- While all electrical components used are rated for wash-down duty, it is not recommended to directly spray any photo eyes, proximity sensors, etc. with high pressure water.
- Special attention should be paid to the cleanliness of the drum. During the first weeks of operation a black film may develop on the drum and belt edge surfaces due to the polishing action of the belt. This will decrease over time, but should be rinsed with hot water as it accumulates, possibly as frequently as daily on new machines.

Section 6: Troubleshooting

Problem	Possible Cause
Belt is “Christmas Treeing”. (inside edge of belt lifts)	2, 5, 6, 7, 8
Belt is not running smooth, seems to pulse.	Normal
Belt seems to have an occasional pulse that travels over several tiers.	Normal unless excessive, 6, 7
Belt stops for a second then snaps loose.	6, 7
Take-up roller is running higher than normal.	1, 6, 8
Take-up fault signal with the take-up roller in the upper position.	1, 6, 8
Take-up roller is running lower than normal.	2, 5, 6
Take-up fault signal with the take-up roller in the lower position.	2, 5, 6, 10
Increasing overdrive does not seem to effect the tension.	1, 6, 7, 8
Inside edge lifts at the first tangent.	2, 3, 4, 5
Belt, it takes a considerable force to pull the belt away from the drive more than a fraction of an inch.	2, 4, 7, 8
Outside edge lifts at infeed tangent of drum.	2, 3, 4, 5, 9
Outside edge lifts at intermediate tier(s).	2, 6, 7, 8, 9
Outside edge lifts at discharge tangent of drum.	2, 6, 7, 9
Belt drive “over torque” faults.	2, 3, 6, 7, 8,
Surging at the infeed.	1
Tight belt at infeed.	2, 3, 4, 5
Zero Speed Sensor Fault	5, 11

	Possible Cause	Corrective Action
1	Too much overdrive	A
2	Too little overdrive	B
3	Bearing Failure	D, E
4	Excessive take-up weight	D, E, F
5	Belt obstruction between the take-up and infeed	G
6	Belt obstruction	G
7	Drum to belt friction factor change	D,
8	High carry way friction	D, E, F
9	Carry way is not radially level	C
10	Chain Stretch/Elongation Limits	E
11	Infeed sprocket jumping teeth.	E, G

Corrective Actions:

A Reduce overdrive
B Increase overdrive
C Correct Structure
D Clean
E Replace
F Replace with proper design component
G Correct cause condition

Section 7: Support Drawings

7-1: Live Drum Spiral Nomenclature

NOMENCLATURE

7-2: Live Drum Spiral Standing Up Procedure

STANDING UP PROCEDURE

Section 8: Detailed Mechanical Drawings

ADD REQUIRED ZIPPED FOLDERS

Section 9: Electrical Drawings

ADD REQUIRED DRAWINGS

Section 10: Spare Parts List

ADD SPARE PARTS LIST

Section 11: Supplemental Manuals

11-1: Belting
ADD DATA SHEETS

11-2: Drives
ADD DATA SHEETS

11-3: Motors
ADD DATA SHEETS

11-6: Bearings
ADD DATA SHEETS

11-7: Coupling
ADD DATA SHEETS