

Minimizing Risks in Entering the Tunnel

1. About Tunnel Jams and How to Prevent Them

The Milnor® CBW® tunnel washer will not jam if the following conditions exist:

1. **Correct water levels are maintained.**
2. **All loads are sized correctly.**
3. **Correct cylinder rotation is maintained.**

- 1.1. **Correct Water Levels**—Immediately after each transfer, the Mentor™ controller verifies that the water levels are correct in each module that monitors water levels. Countdown does not start unless all the monitored levels are correct. Also, immediately before each transfer, the Mentor™ controller again reads all the monitored levels and prevents transfer if any level is not correct. Water levels are always monitored in the first module, in each module with a drain valve, and in each module that does not (or may not) receive its water from, or send its water to, its adjacent module. Depending on the specific water flow and the number of modules, additional water level monitors may be installed at the factory.

The tunnel will jam if it transfers without enough water in each module.

Do not attempt to “fix” a low water level condition by holding the float lever up mechanically or by merely readjusting the level switch. (With float-type level switches, cutting off the float rod above the two top clips will discourage readjusting.) Instead, check for logical reasons for loss of water flow (shut off water valves or pumps, lint-blocked pumps or strainers, etc.).

Make sure the float tube connection is not blocked with lint, as this can cause the Mentor™ controller to think the water level is correct when it is not. Periodically purge each float tube connection with air as explained in How to Purge Float-tube Type Level Switches in the service manual.

Weir boxes must be checked periodically for lint build-up. If the water flow through the weir box is reduced, wash quality will diminish, the blocked module may overflow opposite the flow of incoming water, and the water level may become too low for a safe transfer in any modules that depend upon water from the blocked module.

Water levels are controlled by weirs as explained in Using the Water Flow Features of the Milnor Continuous Batch Washer in manual MATCBWTRAE. This section also explains how to set the level switches.

- 1.2. **Correct Load Sizes**—Because the Milnor® CBW® tunnel washer is usually able to transfer occasional loads much larger than its rated capacity, the load sizes actually employed are generally dictated by the capability of the extracting equipment (press or centrifugal) and the material-handling equipment after the tunnel.

However, exceptions to this rule include—but are not necessarily limited to—“stiff jeans” or similar products that do not readily absorb water, certain new goods, and goods that are lightweight yet bulky (e.g., micro-filament 100% polyester barrier goods), etc. The load sizes for such goods must be reduced proportionately, similar to the proportional reduction that must be observed in washers and washer-extractors.

Multiple or repeated over-size loads can cause jams. Monitor and frequently recalibrate the load-sizing method in your plant. The tunnel can often handle a **single** “double-size” load (usually caused by a rail or loading conveyor malfunction) without incident—although a fault will likely

occur in the press or centrifugal extractor. However, repeated multiple loads will cause a jam, especially in tunnels with date codes prior to Miltdate 88297 (December 15, 1988). This is less likely (but not impossible) with tunnels manufactured on or after this date because newer machines have a photo-eye in the load scoop to prevent transfer when the entire load has not flushed into the first module.

Jams can also be caused by insufficient wet-down or flushing water in the first module. Check the reuse water flush pump, the level switch setting in the first module, and the minimum commanded time for the flush valve to remain open. This minimum time is controlled by output timer CRST2.

- 1.3. **Correct Cylinder Rotation**—Although unlikely, it is conceivable that one or more of the four rotation-control proximity switches might malfunction, or the proximity switch or its target might become maladjusted causing a jam. However, the Mentor™ controller is programmed to recognize an error if any of the four proximity switches is not seen, or seen in an incorrect order, or if the time to transit from each switch to the next varies from the standards commanded in output timers Top Dead Center to Safety, Counter-clockwise to Top Dead Center, and Clockwise to Counter-clockwise in the Mentor™ software. Moreover, a separate, non-computer, electromagnetic “watch dog timer” in the controller will stop the tunnel if the machine rotates too long in the transfer direction. (Jams usually do not occur if the tunnel rotates continuously in the non-transfer direction.)

2. Clearing Tunnel Jams Safely and Efficiently

2.1. Guidelines for Management

1. A tunnel jam, no matter how minor, incapacitates the tunnel and requires entering the machine to service it.
2. **A competent supervisor must be present outside of the tunnel at all times.** The supervisor must use these methods to track the status and location of each worker and the progress of the jam-clearing operation:
 - a. Establish a distress signal, such as banging five times (international danger signal) on the cylinder wall, to be used by any worker who runs into trouble.
 - b. Frequently talk through the module vent on top of each module to each worker inside the tunnel.



DANGER [1]: Prepare thoroughly—Do not enter the tunnel until all safety hazards are eliminated. Supervisor must be present outside the tunnel at all times. Potential safety hazards include, but are not necessarily limited to the conditions stated in the following safety statements.



DANGER [2]: Panic and Isolation Hazards—Confined space, dampness, heat, odor, darkness, etc. can induce panic. **Workers cannot be readily evacuated.**

- Take measures to minimize adverse working conditions.
- Permit only smaller, agile, completely healthy, non-claustrophobic workers to enter the tunnel.



DANGER [3]: Chemical Burn Hazards—If not thoroughly purged, flushed, cooled, and drained, modules may contain toxic substances that can burn your skin or eyes.

- Before permitting anyone to enter, thoroughly purge, flush, cool, and drain the tunnel as explained in this document.



DANGER [4]: Poison and Suffocation Hazards—If not thoroughly purged, flushed, cooled, and drained, modules may contain toxic gases that can kill or injure you if inhaled.

- Test for and purge gases.
- Ventilate tunnel continuously.



DANGER [5]: Burn and Heat Prostration Hazards—If modules are not thoroughly purged, flushed, cooled, and drained, cylinder surfaces, goods, and bath may be hot enough to burn you on contact. You can become ill while working in a hot tunnel.

- Do not enter the tunnel unless all goods and surfaces are cool.



DANGER [6]: Biological Hazards—Even if thoroughly purged, flushed, cooled, and drained, modules may contain disease organisms carried in with the goods.

- Never enter the tunnel with open wounds.
- Beware of sharp objects carried in with the goods.



DANGER [7]: Electrocution Hazard—Use only air or battery powered tools and lights.

- Never attempt to illuminate the tunnel by carrying in any non-battery powered electrical devices.
- Never carry in plug-in tools.



DANGER [8]: Crush Hazard—Unless electrically disabled and mechanically restrained, tunnel cylinder can rotate without warning, entrapping and even crushing you.

- Lock main fusible disconnect and Mentor™ fusible disconnect in OFF position.
- Use wood or metal restraints held by C-clamps to block chain drives on both sides of the small sprocket, so an off-center weight distribution in the cylinder will not cause it to drift or turn by itself in either direction. See Figure 2.



DANGER [9]: Other Unknown Hazards—There may be additional hazards, perhaps (but not necessarily) peculiar to a particular installation, that are unknown as of this writing. It is solely the responsibility of the owner/user to recognize and cope with any such hazards.

2.2. What to Do Before Entering the Tunnel

1. **Disable all hot water and chemical feeds to the tunnel.**
2. **Provide natural light and ventilation to each module.** Remove any vent covers or vent piping, etc. on the top of each module to provide natural light and ventilation inside each module. Open all weir box covers. These measures will provide ventilation and communication benefits and a means to monitor any odors in each module. See Item 7 below.
3. **Drain, purge, flush, and cool the tunnel.**
 - a. First drain each module completely, including **both** sides of **each** drain trough in **each** module. A pipe plug in the bottom of each drain trough is provided for this purpose when the module has no drain valves (or only one drain valve). If the tunnel has been in service a long time, the pipe plug drains may be blocked with sediment. If water does not come out, use a screwdriver or small rod to penetrate the blockage.

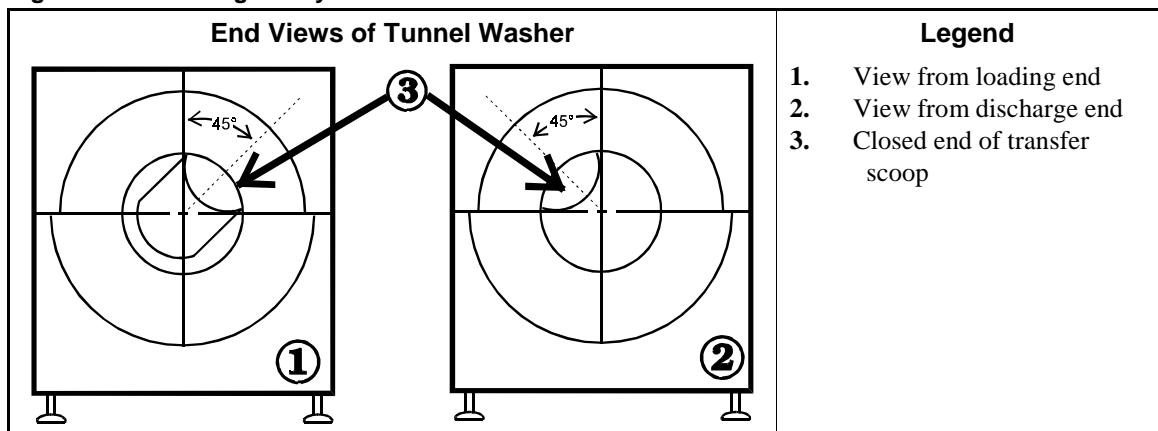
Drain any overhead tanks that can feed the tunnel.

- b. Reinstall the pipe plugs (hand tight), and close the module drain valves.

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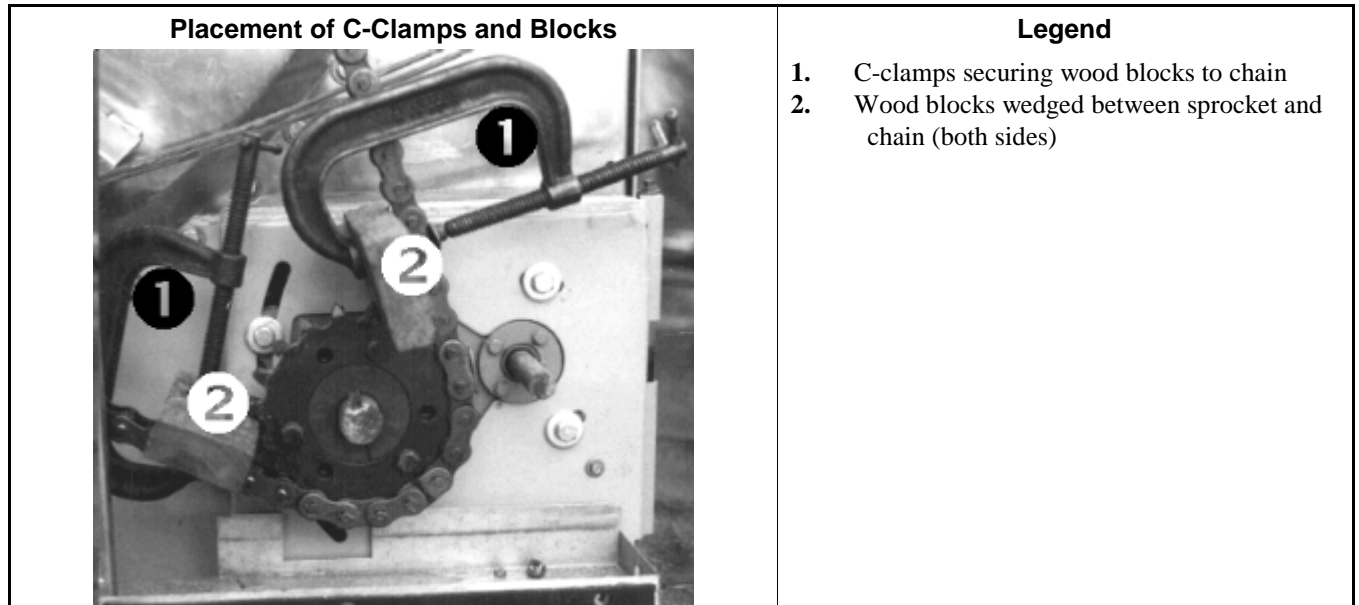
- c. Flush the tunnel with **cold** water, ensuring **every** module is sufficiently flushed. (If necessary, use water hoses directed into each weir box to accomplish this.) The tunnel and its contents must be totally flushed and cooled. All chemicals in the water and goods must be completely removed before anyone can be allowed to enter the tunnel. (Permitting the tunnel to turn normally—**without transferring**—should expedite this process without worsening the jam; but **the tunnel must not transfer**.) Place the TUNNEL RUN-HOLD switch on the controller at HOLD to command the tunnel not to transfer. Now start the tunnel in the normal way and observe that it reverses normally. **Stop the tunnel at once if it turns only in one direction!**
 - d. Once the goods are cold and all chemicals have been purged from every module, again drain **both** sides of **each** drain trough in **each** module per Item 3.a above. Ensure each module is **fully** drained and totally empty of all water before entering the tunnel. No water must remain standing in any module. If any drain valve or module overflow is connected directly to a sewer without a “P-trap,” special ventilation measures must be employed so that sewer gases cannot enter the tunnel. These ventilation measures can vary depending upon local conditions and are solely the responsibility of the owner/user.
4. **Position the cylinder for easiest transit, as shown in Figure 1.**

Figure 1: Positioning the Cylinders



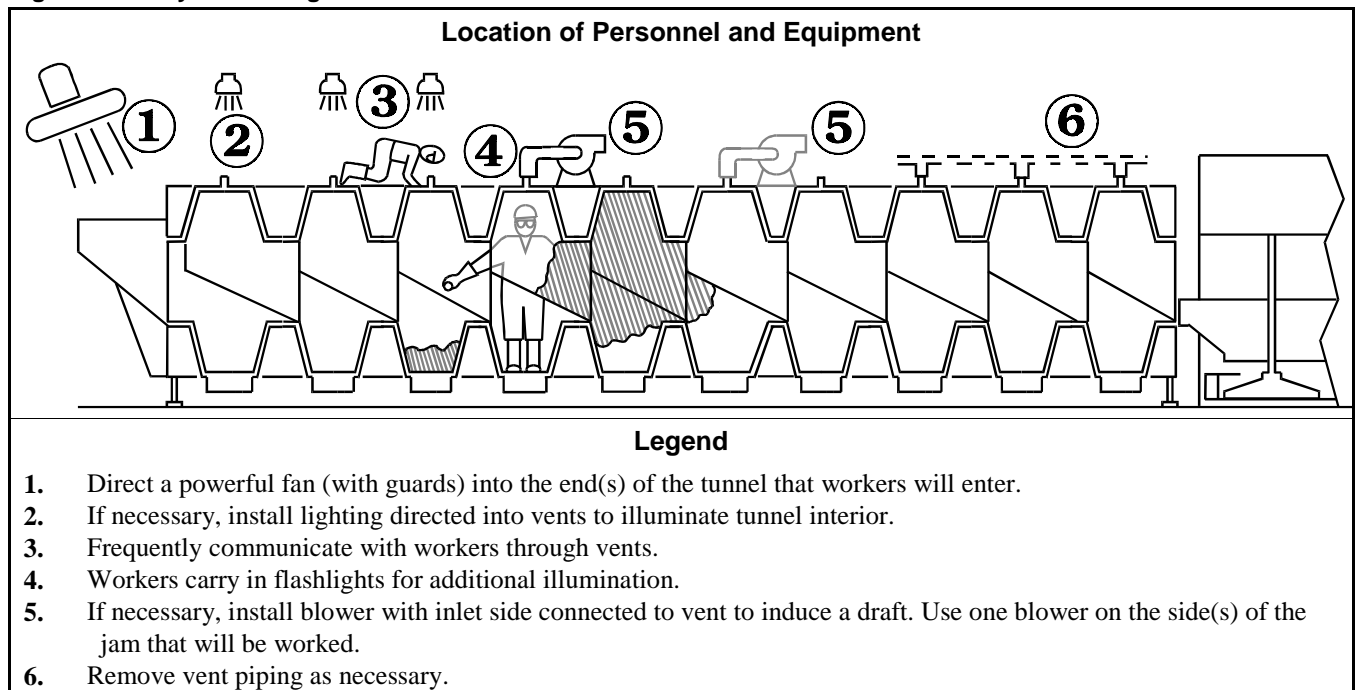
5. **Restrain the tunnel chain drives so the tunnel cannot drift or turn by itself in either direction.** See Figure 2.

Figure 2: Blocking the Cylinders



6. **Disable main electrical power to the tunnel, to the Mentor™, and to all appropriate electrically operated devices (e.g., the press, etc.) directly before and after the tunnel.** Open (disconnect), lock open, and tag all electrical services to the above indicated devices.
7. **Provide additional lighting and ventilation for the worker(s) who will enter.** See Figure 3.

Figure 3: Safety in Clearing Tunnel Jams



- 2.3. **Which End of the Tunnel to Enter**—Generally, one should enter the loading end because the jammed goods will be less tightly packed at that end. However, exceptions to this general rule should be considered in the following situations:

1. The goods are dropped into the tunnel from the floor above via a tall drop chute with no quickly accessible or convenient means to enter and exit the drop chute at the level of the loading chute on the tunnel. (Without a convenient means to enter and exit the drop chute, it may be impossible to climb out.)
2. The jam is much nearer the discharge end.
3. The jam is so tightly packed that it becomes necessary to clear it from both sides.

2.4. Clearing the Jam

1. Because the goods will likely be less tightly jammed toward the loading end, it is usually better to pull the jammed goods, piece by piece, toward the loading end. However, it may be necessary to station workers on both sides of the jam to clear it from both sides at the same time. In extreme cases, it may save time to cut away some of the jammed goods—but the cost of doing this must be weighed against the benefit of returning the tunnel to service sooner. If cutting is required, use retractable utility knives, and caution all workers to use extreme care to avoid injury.
2. Additional workers may need to be stationed in other modules to pass the goods along.
3. If the jam is to be cleared by simply spreading the goods among the empty cylinders, remember that the wet, compacted goods will appear to be a smaller load than they actually are. To prevent another jam, never re-start the tunnel with a larger-than-standard load in any module, and always be sure the correct water levels exist in every module before restarting.

2.5. **Which End of the Tunnel to Exit**—It is generally believed that the shortest way out is the best. However, some prefer to exit through the discharge end.

2.6. Safety Procedures if the Tunnel Must be Entered and/or Exited from the Discharge End

1. **For a Milnor® Press**—Place the **bell and the pre-press tamper full down**. Turn the air off and **actually disconnect the air line** to the press so, even if the air line shut-off valve should leak, there is no chance of the tamper rising without warning.
2. **For a single Milnor® Centrifugal Extractor**—Tilt the cylinder full up, and install the factory-supplied safety stands securely so the cylinder cannot come down.
3. **For a Milnor® COBUK Conveyor**—Move the conveyor well away from the tunnel.
4. **For any non-Milnor® Device**—Use good judgment, and follow the manufacturer's recommendations.

After completing the above procedures, completely disable electrical service to the device™ as previously explained.

3. Electric Welding Inside the Tunnel

1. Because safety regulations vary at different localities, it is solely the responsibility of the owner/user to establish safe working procedures by using good common sense and by adhering to all safety standards and regulations.
2. There must be absolutely no water or goods in the cylinder to be welded. The inside of the cylinder must be completely dry and absolutely empty of all goods and water. The welder must not stand in water or on wet goods.
 - a. If the tunnel is modular in design, it is best to separate the modules.
 - b. If the tunnel has multiple modules welded together, it is absolutely necessary to remove the top before sending a welder inside.

3. The cylinder to be welded must be **securely grounded to the grounding point on the welding machine.**
4. The welder must wear dry, non-conducting protective clothing and shoes.
5. Adequate ventilation is an absolute necessity.

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