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# DRYVAC02, DRYVAC03



PELLERIN MILNOR CORPORATION POST OFFICE BOX 400, KENNER, LOUISIANA 70063-0400, U.S.A.



# MKDLUH01U1/25223A

## **1. English**

Maintenance Guide - Lint Collector for Pass-through Dryers  
(DRYVAC)

MKDLUH01EN/2021495



English

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# Maintenance Guide

## Lint Collector for Pass-through Dryers (DRYVAC)



# Contents

1 Machine Description and Identification .....	3
1.1 About This Manual and Your Milnor® Machine .....	3
1.1.1 Description .....	3
1.1.2 Machine Identification.....	3
• Machine Data Plate .....	3
• About Machines With Multiple Data Plates .....	4
2 Safety .....	5
2.1 Safety — Pass Through Dryer .....	5
2.1.1 Safety Alert Messages—Internal Electrical and Mechanical Hazards .....	5
2.1.2 Cylinder and Processing Hazards .....	6
2.1.3 Safety Alert Messages—Unsafe Conditions .....	6
2.1.3.1 Hazards Resulting from Inoperative Safety Devices.....	6
2.1.3.2 Hazards Resulting from Damaged Mechanical Devices .....	7
2.1.4 Careless Use Hazards .....	7
2.1.4.1 Careless Operation Hazards—Vital Information for Operator Person- nel (see also operator hazards throughout manual) .....	7
2.1.4.2 Careless Servicing Hazards—Vital Information for Service Personnel (see also service hazards throughout manuals) .....	7
2.2 Fire Safety System Operation and Maintenance .....	8
2.2.1 Fire Safety Functions and Components.....	8
2.2.2 About the <b>Min Fire</b> and <b>Outlet Temperature Exceeded 220°</b> Faults .....	11
2.2.2.1 Min Fire (MINF) .....	11
2.2.2.2 Outlet Temperature Exceeded 220° (degrees Fahrenheit).....	11
2.2.3 How to Prevent Water Flow When No Fire Occurs .....	12
2.2.4 How to Do a Test of the Fire Safety System .....	12
2.2.5 If Water Flow Occurs .....	13
3 Routine Maintenance .....	16
3.1 Routine Maintenance .....	16
3.1.1 Maintenance Summary .....	16
3.1.1.1 Guards and Related Components .....	17
3.1.1.2 Filters, Screens, and Sensitive Components.....	17
3.1.1.3 Components that Become Worn .....	18
3.1.1.4 Bearings and Bushings .....	18
3.1.1.5 Motor Grease Schedule .....	18
3.1.1.6 Mechanisms and Settings .....	18
3.1.2 How To Remove Contamination .....	19
3.1.3 Lubricant Identification .....	20
3.1.4 Grease Gun Procedures .....	20
3.1.5 Procedures for Motors .....	21
3.1.6 How To Show the Maintenance On a Calendar .....	23
3.2 Maintenance Components—Machines and Controls Group .....	24
3.2.1 How to Examine V-belts and Pulleys .....	24
3.2.2 Inverters .....	26
3.2.3 How to Examine Compressed Air Mechanisms.....	26
3.2.4 Photoeyes and Proximity Switches .....	29
3.2.5 How to Do a Test of Emergency Stop Mechanisms .....	29



3.3 Maintenance Components—Dryer and Dryvac Group .....	30
3.3.1 How Particle Contamination Occurs in the Dryvac Lint Collector.....	30

## Figures

Figure 1	Machine Data Plate.....	3
Figure 2	Component Locations for 6464_ Models .....	10
Figure 3	View of ST550A, ST550B and T2.....	10
Figure 4	View of ST225-1.....	10
Figure 5	View of ST225-2 and T3 .....	11
Figure 6	View of STBB.....	11
Figure 7	Motor Grease Maintenance Conditions .....	22
Figure 8	Belt and Pulley Conditions To Look For .....	24
Figure 9	How to Adjust Belt Tension On a Machine That Uses Spring Tension .....	25
Figure 10	Electric Box and Inverter. These are examples. Your machine can look different.....	26
Figure 11	Compressed Air Inlet Strainers. These are examples. Your machine can look different.....	27
Figure 12	Self-purging Air Line Filter to Remove Moisture and Other Contamination. These are examples. Your machine can look different.....	27
Figure 13	Compressed Air Mechanisms These are examples. Your machine can look different. ....	28
Figure 14	Photoeyes. These are examples. Your machine can look different.....	29
Figure 15	Dryvac Maintenance Areas (Model DRYVAC02 shown).....	31

## Tables

Table 1	Fire Safety Functions for 6464_ and 7272_ Dryer Models .....	8
Table 2	Guards and Related Components .....	17
Table 3	Filters, Screens, and Sensitive Components .....	17
Table 4	Components that Become Worn .....	18
Table 5	Bearings and Bushings .....	18
Table 6	Motor Grease Schedule .....	18
Table 7	Mechanisms and Settings .....	18
Table 8	Contamination Types, Cleaning Agents, and Procedures .....	19
Table 9	Lubricant Identification .....	20
Table 10	Motor Grease Intervals and Quantities .....	23
Table 11	Where to Put Marks On a Calendar .....	24

# 1 Machine Description and Identification

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## 1.1 About This Manual and Your Milnor® Machine

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This manual applies to two or more models that share the mechanical characteristics stated below. If you received this manual with your machine, your machine is one of the applicable models. However, before using this manual, verify that your machine does have these characteristics.

### 1.1.1 Description

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This product is a laundering system machine. Most such machines are fully automated. This machine is the specific type described below.

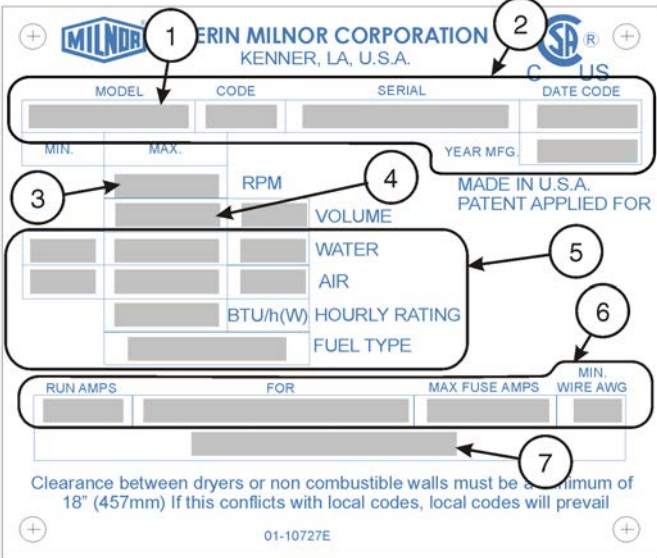
**DRYVAC Lint Collector for Pass-through Dryers** A machine of this type removes lint from a bank of pass-through dryers sequentially by a vacuum applied to the dryer lint screen.

### 1.1.2 Machine Identification

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**Machine Data Plate** — Find the model number and other data for your machine on the machine data plate affixed to the machine and described below.

**Figure 1. Machine Data Plate**

View of Data Plate (English text shown)		Legend
		<ul style="list-style-type: none"><li>1. Model number.</li><li>2. Data that uniquely identifies your machine</li><li>3. Cylinder maximum rotation speed in revolutions per minute</li><li>4. Cylinder volume in the units of measure shown</li><li>5. Piped utility requirements</li><li>6. Electrical requirements</li><li>7. Part number for multi-unit machine, if applicable.</li></ul>

**About Machines With Multiple Data Plates** — Machines shipped as multiple units for assembly on site (example: CBW® tunnel washer) will have multiple data plates—one for each unit and a master plate for the complete machine, located on the primary unit. Although each unit can have a different model number, they will all share the same basic serial number. The basic serial number is usually 8 digits. Some of the units will have a two-digit suffix at the end of the serial number.

## 2 Safety

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### 2.1 Safety — Pass Through Dryer

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#### 2.1.1 Safety Alert Messages—Internal Electrical and Mechanical Hazards

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The following are instructions about hazards inside the machine and in electrical enclosures.



**WARNING: Electrocutation and Electrical Burn Hazards** — Contact with electric power can kill or seriously injure you. Electric power is present inside the cabinetry unless the main machine power disconnect is off.



- ▶ Do not unlock or open electric box doors.
- ▶ Do not remove guards, covers, or panels.
- ▶ Do not reach into the machine housing or frame.
- ▶ Keep yourself and others off of machine.
- ▶ Know the location of the main machine disconnect and use it in an emergency to remove all electric power from the machine.



**WARNING: Entangle and Crush Hazards** — Contact with moving components normally isolated by guards, covers, and panels, can entangle and crush your limbs. These components move automatically.



- ▶ Do not remove guards, covers, or panels.
- ▶ Do not reach into the machine housing or frame.
- ▶ Keep yourself and others off of machine.
- ▶ Know the location of all emergency stop switches, pull cords, and/or kick plates and use them in an emergency to stop machine motion.



**CAUTION: Burn Hazards** — Contact with hot goods or machine components can burn you.



- ▶ Do not remove guards, covers, or panels.
- ▶ Do not reach into the machine housing or frame.

## 2.1.2 Cylinder and Processing Hazards

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## 2.1.3 Safety Alert Messages—Unsafe Conditions

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### 2.1.3.1 Hazards Resulting from Inoperative Safety Devices

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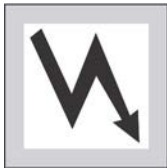


**WARNING: Multiple Hazards** — Operating the machine with an inoperative safety device can kill or injure personnel, damage or destroy the machine, damage property, and/or void the warranty.

- ▶ Do not tamper with or disable any safety device or operate the machine with a malfunctioning safety device. Request authorized service.



**WARNING: Electrocutation and Electrical Burn Hazards** — Electric box doors—Operating the machine with any electric box door unlocked can expose high voltage conductors inside the box.



- ▶ Do not unlock or open electric box doors.



**WARNING: Entangle and Crush Hazards** — Guards, covers, and panels—Operating the machine with any guard, cover, or panel removed exposes moving components.



- ▶ Do not remove guards, covers, or panels.



**WARNING: Fire Hazards** — Sprinkler and overheat control—Failure to supply water to the sprinkler or to open the manual valve, or failure of the overheat control, eliminates the machine's internal fire protection. Normally the machine stops and water is sprayed into the cylinder if outlet temperature reaches 240 degrees Fahrenheit (116 degrees Celsius).



- ▶ Verify the overheat control system and plant fire extinguishers are functioning before operating the machine. Be sure to turn water supply on after testing.

- ▶ Keep the manual shut-off test valve open except when testing.
- ▶ Test or inspect the system after every automatic actuation, or monthly.



**WARNING: Explosion and Fire Hazards** — Gas train—Operating the machine with damaged or malfunctioning gas valves, safeties, controls, or piping can permit gas to escape into the fire box, cylinder, or laundry room. The enclosure will explode if gas comes in contact with any spark or flame.



- ▶ Do not operate the machine with any evidence of damage or malfunction.
- ▶ Stop the machine immediately and alert authorities if you smell gas.

### 2.1.3.2 Hazards Resulting from Damaged Mechanical Devices

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**WARNING: Multiple Hazards** — Operating a damaged machine can kill or injure personnel, further damage or destroy the machine, damage property, and/or void the warranty.

- ▶ Do not operate a damaged or malfunctioning machine. Request authorized service.

### 2.1.4 Careless Use Hazards

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#### 2.1.4.1 Careless Operation Hazards—Vital Information for Operator Personnel (see also operator hazards throughout manual)

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**WARNING: Multiple Hazards** — Careless operator actions can kill or injure personnel, damage or destroy the machine, damage property, and/or void the warranty.

- ▶ Do not tamper with or disable any safety device or operate the machine with a malfunctioning safety device. Request authorized service.
- ▶ Do not operate a damaged or malfunctioning machine. Request authorized service.
- ▶ Do not attempt unauthorized servicing, repairs, or modification.
- ▶ Do not use the machine in any manner contrary to the factory instructions.
- ▶ Use the machine only for its customary and intended purpose.
- ▶ Understand the consequences of operating manually.



**CAUTION: Goods Damage and Wasted Resources** — Entering incorrect cake data causes improper processing, routing, and accounting of batches.

- ▶ Understand the consequences of entering cake data.

#### 2.1.4.2 Careless Servicing Hazards—Vital Information for Service Personnel (see also service hazards throughout manuals)

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**WARNING: Electrocution and Electrical Burn Hazards** — Contact with electric power can kill or seriously injure you. Electric power is present inside the cabinetry unless the main machine power disconnect is off.



- ▶ Do not service the machine unless qualified and authorized. You must clearly understand the hazards and how to avoid them.
- ▶ Abide by the current OSHA lockout/tagout standard when lockout/tagout is called for in the service instructions. Outside the USA, abide by the OSHA standard in the absence of any other overriding standard.



**WARNING: Entangle and Crush Hazards** — Contact with moving components normally isolated by guards, covers, and panels, can entangle and crush your limbs. These components move automatically.



- ▶ Do not service the machine unless qualified and authorized. You must clearly understand the hazards and how to avoid them.
- ▶ Abide by the current OSHA lockout/tagout standard when lockout/tagout is called for in the service instructions. Outside the USA, abide by the OSHA standard in the absence of any other overriding standard.



**WARNING: Confined Space Hazards** — Confinement in the cylinder can kill or injure you. Hazards include but are not limited to panic, burns, poisoning, suffocation, heat prostration, biological contamination, electrocution, and crushing.



- ▶ Do not enter the cylinder until it has been thoroughly purged, flushed, drained, cooled, and immobilized.

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## 2.2 Fire Safety System Operation and Maintenance

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**NOTICE:** If the fire safety system is in operation (if there is a flow of water from the rear of the dryer)—go to [Section 2.2.5 : If Water Flow Occurs, page 13](#).

**fire safety system** the water nozzles and related equipment that put water in the dryer to stop a fire in the basket.

Water flow will start automatically if the temperature becomes too high, as told in [Section 2.2.1 : Fire Safety Functions and Components, page 8](#). You can also start it manually. Pull the operation handle or use the control panel as told in [Section 2.2.4 : How to Do a Test of the Fire Safety System, page 12](#). The system will start a flow of water. The water will go into the basket through the perforations. Do a test of this system at the intervals given in the routine maintenance schedule.

### 2.2.1 Fire Safety Functions and Components

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This section gives the fire safety functions and components for 6464\_ and 7272\_ models. Components and their locations can be different on other dryer models but the functions are the same.

**Table 1. Fire Safety Functions for 6464\_ and 7272\_ Dryer Models**

Sensor type	Temperature switch (closes at specified temperature)			Thermocouple (gives continuous temperature data to the controller)
Sensor name	ST225-1 & 2	ST550A & B	STBB	T3
Location	Basket/outlet duct (Figure 2, page 10, Figure 4, page 10, Figure 5, page 11)	Inlet duct (Figure 2, page 10, Figure 3, page 10)	At burner (Figure 2, page 10, Figure 6, page 11)	Outlet duct (Figure 4, page 10)

**Table 1 Fire Safety Functions for 6464\_ and 7272\_ Dryer Models (cont'd.)**

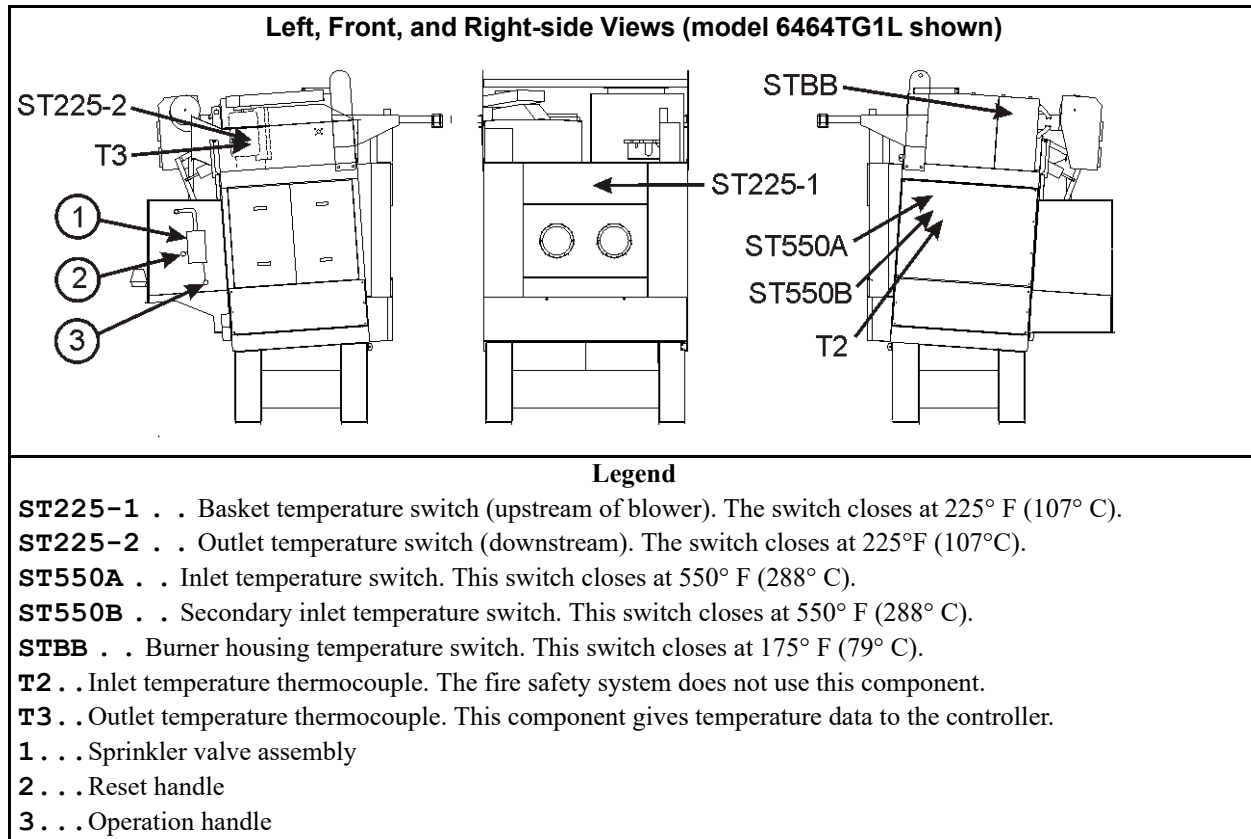
Sensor type	Temperature switch (closes at specified temperature)			Thermocouple (gives continuous temperature data to the controller)		
Safety limit (the temperature or condition that causes the given result)	225° F (107° C)	550° F (288° C)	175° F (79° C)	–Three safety limits in software–		
				5° F increase for 15 seconds or 15° F increase for 5 seconds during min fire*	Higher than 220° F (104° C) for 5 seconds**	240°F (116°C)
Occurs when temperature is too high	Water flows and all dryer actions stop.	Flame goes off. If the flame will not come on, see the line below this one.		Each step before the cooldown is subsequently cancelled while the condition continues.		Water flows and all dryer functions stop.
Display when temperature is too high	THREE WIRE DISABLED error and operator alarm.	Initially none. If the flame will not come on, the CHECK ERROR LIGHTS error and operator alarm occur.		The controller shows “MINF” and puts data in the record of dry cycle details.	The controller shows “>220” and puts data in the record of dry cycle details.	OUTLET TEMP EXCEEDED 240 Df - POWER DOWN error and operator alarm.
Necessary procedure	See <a href="#">Section 2.2.5 : If Water Flow Occurs, page 13</a>	If the error given in the line above this one occurs, see “Error Messages” in the operator guide.		See <a href="#">Section 2.2.2 : About the Min Fire and Outlet Temperature Exceeded 220° Faults, page 11</a>		See <a href="#">Section 2.2.5 : If Water Flow Occurs, page 13</a>

\* This does not apply to steam dryers.

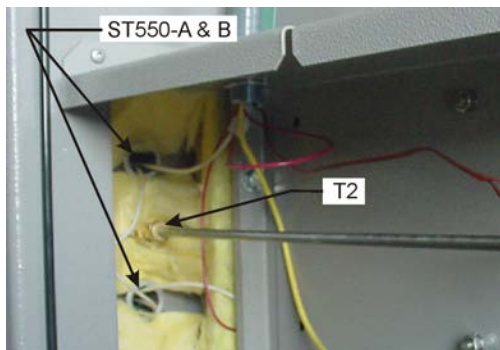
\*\* This does not apply to steam dryers if they do not use modulation.



**Figure 2. Component Locations for 6464\_ Models**



**Figure 3. View of ST550A, ST550B and T2**



**Figure 4. View of ST225-1**

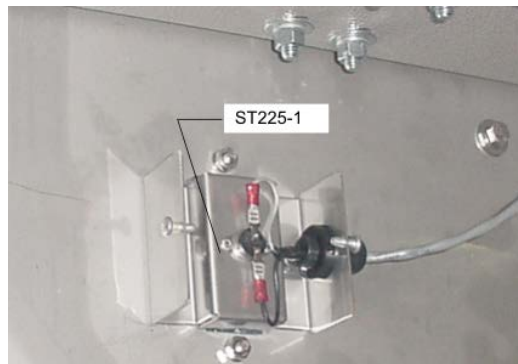


Figure 5. View of ST225-2 and T3

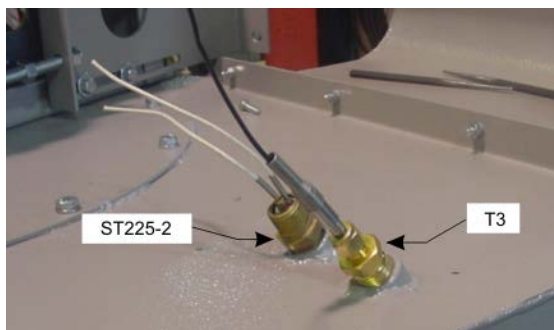


Figure 6. View of STBB



## 2.2.2 About the Min Fire and Outlet Temperature Exceeded 220° Faults

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The function of these faults is to prevent conditions that can cause a fire. The controller does the necessary steps. There are no other steps for the operator to do immediately. But the controller puts data about the fault in the record of dry cycle details. These faults usually cause unsatisfactory operation. To prevent these faults, it can be necessary to change some procedures as told in the subsequent sections. Heat system adjustments and repairs are not routine maintenance. Speak to your dealer or Milnor®.

### 2.2.2.1 Min Fire (MINF)

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This condition applies to dryers that use gas or propane. Minimum fire is when the controller tells the modulating gas valve to go to the position 000. The correct condition is when the gas valve is open a small, stable increment. Under this condition, a **min fire** fault occurs if the controller senses that the outlet temperature increases. This fault usually shows that the goods became too hot and could catch fire. (One more symptom is if the goods have a burned smell.) When this fault occurs, the controller immediately goes to the subsequent cool down step. Some causes of **min fire** faults include:

- **The goods are held against the basket**—The correct condition is that the goods tumble in the basket. If the basket speed is too high, centrifugal force can hold the goods against the basket. Then the part of the goods that is against the basket can become too hot.
- **The gas valve does not operate correctly**—For example, the valve throttle cannot move down fully because it is damaged. This can prevent the min fire position.
- **Min fire is set too high**—The min fire position must be adjusted correctly when the gas and air as told in the procedure to set the heat system. Damage to components can cause this adjustment to change.

### 2.2.2.2 Outlet Temperature Exceeded 220° (degrees Fahrenheit)

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This fault applies to all dryers except those with steam valves that do not modulate. The value 220° F (104° C) is 5° F (3° C) below the temperature that will close the outlet temperature switches (Fenwal switches) and start water flow. It cancels each subsequent heat step if the outlet

temperature is higher than 220° F (104° C) for five seconds or more at the start of the step. This fault can also occur if the goods are held against the cylinder or the gas valve is damaged. The function of this fault is to make water flow not necessary, if the goods are not on fire. But if the goods catch fire, the temperature switches will quickly close to start water flow.

### 2.2.3 How to Prevent Water Flow When No Fire Occurs

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If water flow occurs when there is no fire, two possible causes are:

- **A temperature switch is damaged.** This is the usual cause. For example, material can hit a temperature probe and bend it. This can be a piece of goods that goes through a space where seals are worn. It is necessary to replace a damaged probe. The probe can also give an incorrect value if it has plastic contamination. It is necessary to remove the contamination.
- **Temperatures are not in the correct range.** The conditions described in [Section 2.2.2.1 : Min Fire \(MINF\), page 11](#) can cause water flow if they are severe enough.

If water flow occurs when there is no fire, correct the cause. **Do not remove the fire safety system from operation.** If a fire occurs, this system is your first and best protection against a fire that is out of control.

### 2.2.4 How to Do a Test of the Fire Safety System

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1. **Prevent a new load:** Set the Load Allowed/ Not Allowed () switch to **Not Allowed** () to prevent a new load.
2. **Let the dryer empty:** Let the dryer operate until it releases the load it has.
3. **Close the manual water valve:** Close the valve to prevent water flow. This valve is on the sprinkler assembly. The assembly is usually on the side of the dryer discharge shroud.
4. **Start a test of sprinkler AUTOMATIC operation:**
  - If there is a controller on the dryer, see “Manual Mode Menu Functions” in the reference manual.
  - If this dryer is part of a Dryer/Shuttle (Drynet™) system, do the steps listed below at the Drynet™ controller:
    - a. Select **Admin Logon** and enter the administrator password.
    - b. Select (click) the display for the dryer you will do the test on.
    - c. Select (click) **Manual** mode.
    - d. Go to **Sprinkler Functions** on the right side of the screen and select (click) **Sprinkler [Off]** to release the sprinkler valve. This is a toggle. The display shows **Sprinkler [On]**.
5. Examine the automatic sprinkler valve.



**CAUTION:** **Sluggish valve operation** — can interfere with fire suppression.



- ▶ Remove any build-up of foreign matter on components.
- ▶ Make sure components move freely.

6. **Let the water flow for a short while:** Open the manual valve on the sprinkler assembly. Make sure that water flows from the rear of the dryer. Close the valve for the subsequent part of the test.
7. **Set the system again:** Pull the sprinkler reset handle down fully. It must latch.
8. **Start a test of sprinkler MANUAL operation:** Select a dry code and run it manually.



**CAUTION:** The manual water valve must be closed to prevent water flow during this test.

9. **Operate the fire safety system manually:** When the heat source starts to make heat, pull down the sprinkler operation handle.
10. **Make sure that a shutdown occurs:**
  - The automatic valve opens (the reset handle releases).
  - The THREE WIRE DISABLED message appears.
  - The operator alarm sounds.
  - All dryer functions stop.
11. **Stop the dry code.**
12. **Set the system again:** Pull the sprinkler reset handle down fully. It must latch.
13. **Open the manual valve.**



**WARNING:** A closed manual valve — will prevent water flow in an emergency.



- ▶ Make sure the manual valve is open and remains open during operation.

14. **Put the dryer in operation again.**

This concludes the fire safety system test.

## 2.2.5 If Water Flow Occurs

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A serviceable fire safety system will operate if a fire in the basket occurs. But it can also operate for other causes. Temperature switches (Fenwal switches) in the outlet duct operate the system at 225° F (107° C). If the Fenwal switches are not serviceable, the dryer software operates the system at 240° F (116° C).

1. **Examine the dryer condition:** If there is a fire, let water flow continue until the fire is extinguished.



**CAUTION:** Use extreme care if you must look through the door glass or get near a part of the machine.

2. **Set the system again when it is safe:**

- a. Turn the Master switch off (⊗), then on (⊙) again. If the software caused the fire safety system to operate, this is necessary to remove the "Desires Sprinkler" output signal.
- b. Pull the sprinkler reset handle down fully. It must latch.

This step helps to keep water damage to a minimum and allows you to use the manual controls.

3. **Did a fire occur?**

- **NO:** Put the dryer in operation again.
- **YES:** Continue these steps.

4. **Do a test of basket movement:**

- a. Set the **Load Allowed/Not Allowed** (⬆ / ⬇) switch to **Not Allowed** (⬇) to prevent a new load.
- b. Press **Start** (①). The operator alarm stops and the display shows WAITING FOR LOAD . LOADING NOT ALLOWED.
- c. Set the **Automatic/Manual Rotation** switch (↔ / ↘) to **Manual Rotation** (↘).
- d. Hold the **Jog Direction** switch (↺ / ↻) in one of the two directions **no longer than necessary to make sure that the basket turns**.

5. **Did the basket turn?**

- **NO:** Stop. Repairs are necessary. Consult your dealer or the Milnor® factory.
- **YES:** Continue these steps.

6. **Carefully remove the goods:** Use the manual controls to release the goods.



**WARNING:** Hot goods — can catch fire spontaneously,



- ▶ Keep fire equipment available.
- ▶ Stay away from the goods.


7. **Remove power. Look for damage.** With power removed from the machine, examine the full machine for damage.

Look carefully at the air seals, support rollers, primary blower, and electrical cables on top of the machine. Also examine electrical components for moisture.

8. **Connect power. Examine dryer functions:** In the manual mode, operate all outputs. For example, the gas valve, lint removal.

9. **Damage?**

- **YES:** Stop. Repairs are necessary. Consult your dealer or the Milnor® factory.
- **NO:** Continue.

10. **Put the dryer in operation again:** Put all manual controls in the automatic position () again.

# 3 Routine Maintenance

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## 3.1 Routine Maintenance

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Do the maintenance in [Section 3.1.1 : Maintenance Summary, page 16](#) to make sure that the machine is safe, keeps the warranty, and operates correctly. This will also decrease repair work and unwanted shutdowns. Speak to your dealer or the Milnor® Service department if repairs are necessary.



**WARNING:** Mechanisms — can pull in and mutilate body parts.



- ▶ Do not service the machine unless qualified and authorized. You must clearly understand the hazards and how to avoid them.
- ▶ Do not service the machine with power on except when explicitly called for in the service instructions. Use extreme care when working near moving components.

- ▶ Replace guards and covers that you remove for maintenance.

If you use software to keep the maintenance schedule for your plant, add the items in the following maintenance summary to that schedule. If not, you can put marks on a calendar that work with the tables in the maintenance summary. See [Section 3.1.6 : How To Show the Maintenance On a Calendar, page 23](#)

### 3.1.1 Maintenance Summary

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Each of the following sections is for a type of maintenance. For example, the section “Guards and Related Components” says “Examine these items. If an item is damaged, missing, or has the wrong setting, correct this discrepancy immediately to prevent injury.” A table in each section identifies the applicable items and the frequency. The “More Data” column gives special instructions if necessary.

\* If the machine operates more than 12 hours each day, do the “day” items two times each day. Do the other items at the given hours or on the days that you show on a calendar (see Section 1). **Do all items in all sections for the maintenance intervals that apply (for example, day, 40 to 60 hours, and 200 hours).**



**TIP:** The maintenance summary has many links to the sections that follow the summary. These sections give more information about the maintenance items. After you learn this information, it is only necessary to look at the summary to do the maintenance.

### 3.1.1.1 Guards and Related Components

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Examine these items. If an item is damaged, missing, or has the wrong setting, correct this discrepancy immediately to prevent injury.

**Table 2. Guards and Related Components**

Mark						Do this each	Component	More Data
1	2	3	4	5	6			
x						day*	guards, covers	Speak to your dealer or Milnor for replacement components.
x						day*	safety placards	
		x				200 hours	fasteners	Fasteners must be tight.
		x				200 hours	anchor bolts and grout	Grout must be good. Bolts must be tight.
x						day*	emergency stop mechanism	See <a href="#">Section 3.2.5</a> , page 29. Do a test of the control.
		x				200 hours	fire safety system (sprinkler)	Do a test of the system. See <a href="#">Section 2.2.4</a> , page 12
x						day*	machine area	Examine this area for materials that can burn or explode. Remove them.
x						day*	door interlock	See <a href="#">Figure 15</a> , page 31. Repair immediately if the machine does not stop when you open the door to remove lint.

### 3.1.1.2 Filters, Screens, and Sensitive Components

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Remove contamination from these items to prevent damage and unsatisfactory performance.

**Table 3. Filters, Screens, and Sensitive Components**

Mark						Do this each	Component	More Data. See also <a href="#">Section 3.1.2</a> , page 19
1	2	3	4	5	6			
	x					40 to 60 hours	inverter fans, vents, filters	See <a href="#">Figure 10</a> , page 26. Keep good air flow.
			x			600 hours	motors	Keep good air flow.
					x	2400 hours	entire machine	Remove excessive dust and dirt.
x						day*	self-purging filter (and regulator) for compressed air	See <a href="#">Figure 12</a> , page 27. Make sure the bowl drains automatically.
		x				200 hours	filter element for the filter (and regulator)	Replace the filter if you cannot remove contamination.
				x		1200 hours	mufflers, quick exhaust valves	See <a href="#">Figure 13</a> , page 28
		x				200 hours	strainer(s) for air inlet	See <a href="#">Figure 11</a> , page 27
x						day*	photoeyes	See <a href="#">Figure 14</a> , page 29
	x					40 to 60 hours	Dryvac cabinet	See <a href="#">Figure 15</a> , page 31
			x			600 hours	lint bag	Turn the bag inside out to remove dust and dirt. Use a vacuum or use compressed air to push the lint out. If necessary, remove dirt with soap and water. Flush the bag with water. Make sure that it is fully dry before operation.



### 3.1.1.3 Components that Become Worn

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Examine these items. Tighten or replace the item if necessary, to prevent shutdowns and unsatisfactory performance. Speak to your dealer for replacement parts.

**Table 4. Components that Become Worn**

Mark						Do this each	Component	More Data
1	2	3	4	5	6			
		x				200 hours	drive belts and pulleys	See <a href="#">Section 3.2.1</a> , page 24

### 3.1.1.4 Bearings and Bushings

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Unless the item is sealed, apply grease to prevent damage. See the next section for motors.

**Table 5. Bearings and Bushings**

Mark						Do this each	Component	More Data . See also <a href="#">Section 3.1.3</a> , page 20
1	2	3	4	5	6			
			x			600 hours	motor and pump bearings	See <a href="#">Section 3.1.5 : Procedures for Motors</a> , page 21
						none	blower shaft bearings	These are sealed bearings. No grease maintenance is necessary.

### 3.1.1.5 Motor Grease Schedule

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Use the data in [Table 10: Motor Grease Intervals and Quantities](#), page 23 to complete this table.

**Table 6. Motor Grease Schedule**

Motor Identification (example: main drive)	Interval		Quantity		Dates When Grease is Added							
	Years	Hours	fl oz	mL								

### 3.1.1.6 Mechanisms and Settings

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Make sure mechanisms are serviceable and settings are correct to prevent unsatisfactory performance.

**Table 7. Mechanisms and Settings**

Mark						Do this each	Component	More Data
1	2	3	4	5	6			
					x	2400 hours	controller circuitry	Examine wiring and connections in electrical boxes. Look for corrosion, loose connections. See <a href="#">Section 3.1.2</a> , page 19
		x				200 hours	compressed air mechanisms	See <a href="#">Section 3.2.3</a> , page 26

### 3.1.2 How To Remove Contamination

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**Table 8. Contamination Types, Cleaning Agents, and Procedures**

Material or Component	Usual Contamination	Example	Cleaning Agent	More Data
machine housing	dust, dirt	—	compressed air or shop vacuum	Air—no more than 30 psi (207 kpa). Do not push dust in mechanisms.
fins and vents on electrical components	dust	motors, inverters, braking resistors	shop vacuum, soft bristle brush, canned air for electrical components	Do not push dust in mechanisms.
electric box interior	dust	all electric boxes		
electrical connections	corrosion, varnish	spade connector, molex connector, plug-in relay	spray solvent for electrical components	Disconnect then connect it again. Use solvent if the bad connection continues.
electronic sensors	dust	photoeye lens, reflector, laser, proximity switch, temperature probe	none	Use a clean, soft, dry cloth.
	dirt		warm water with soap, then water flush	Use clean, soft cloths.
stainless steel	chemical spill	shell, supply injector	water	Use a hose to flush the chemical supply from the surface fully. Do not get water on electrical components or mechanisms.
300 series stainless steel	chemical corrosive attack	shell interior, cylinder	pickling and passivation	Speak to your dealer or Milnor. This is not routine maintenance.
painted metal, unpainted aluminum	dust, dirt, grease	frame members	warm water with soap, then water to flush	Use clean cloths. Do not get water in electrical components.
rubber	dirt, oil, grease	drive belts, hoses	warm water with soap, then water to flush	Use clean cloths. Flush fully. Oil or soap must not stay on drive belts. Make sure that drive belts are serviceable.
clear plastic, acrylic	discoloration (yellowing)	compressed air filter bowl, visual flow meter	warm water with soap, then water to flush, then acrylic cleaner. Do not use ammonia.	Use only the necessary cleaning agents. Wash and rinse with clean, soft cloths. Follow instructions on acrylic cleaner.
glass	discoloration (yellowing)	door glass, site glass	ammonia and water solution and water rinse then acetone	Use clean, soft cloths. Use only the necessary cleaning agents. If necessary, soak in cleaner.
soft air filter, lint filter,	dust, lint	on inverter electric box door, in air line filter bowl, in dryers	shop vacuum	Replace the used with a new filter when the vacuum cannot remove contamination.
rigid strainers, screens for water, steam	mineral particles	in water line, y-strainer	water	Use a rigid bristle brush. Flush with a flow of water.
rigid strainers, screens for oil	metal shavings	in hydraulic line	carburetor cleaner or equivalent solvent	Soak. Use a rigid bristle brush.
steel drive components	dirt, hardened lubricant	bearings, roller chains, sprockets, gears	carburetor cleaner or equivalent solvent	Soak. Use a cloth or soft bristle brush.

### 3.1.3 Lubricant Identification

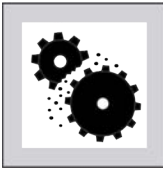
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The table below identifies the lubricant for each lubricant code given in the maintenance summary. Get these or equivalent lubricants from your local lubricant supplier.

When you add grease, always use the procedures given in [Section 3.1.4 : Grease Gun Procedures, page 20](#). When you add grease to motors, also use the procedures given in [Section 3.1.5 : Procedures for Motors, page 21](#).



**CAUTION:** **Bad lubricant** — will decrease the life of components.



- ▶ Make sure that all equipment and fittings used to apply lubricants are clean.
- ▶ Use only the given lubricants or equivalent lubricants that have the same specifications.

**Table 9. Lubricant Identification**

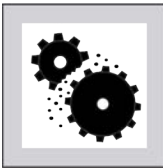
Code	Type	Trademark Name	Application Example
CG	grease	Shell Alvania CG or equivalent AG-MA CG-1 or CG-2	drive couplings
EM	grease	Mobil Polyrex EM or as given on the motor nameplate	motor bearings
EPLF2	grease	Shell Alvania EP (LF) Type 2	drive shaft bearings and bushings, ball joints, chain drives
23	oil	Shell Tellus 23	air line lubricator
220	oil	Shell Morlina 220	small bearing housings, gear reducers, Hydro-cushion™ cylinders

### 3.1.4 Grease Gun Procedures

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**CAUTION:** **Hydraulic pressure** — can push out seals and push grease into unwanted areas (example: motor windings).



- ▶ Use a hand grease gun. A power grease gun gives too much pressure.
- ▶ Know the quantity of grease your grease gun gives each cycle (each stroke).
- ▶ Operate the grease gun slowly (10 to 12 seconds for one cycle).
- ▶ Add only the specified quantity. Stop if new grease come out of a drain port or other opening.
- ▶ Remove spilled grease from belts and pulleys.

The tables give grease quantities in fluid ounces (fl oz) and milliliters (mL). You can also use grease gun cycles (strokes). A cycle is each time that you pull the trigger. One cycle is usually approximately 0.06 fl oz (1.8 mL). Your grease gun can give more or less than this. Measure the output of your grease gun as follows:

- Make sure that the grease gun operates correctly.

- Operate the grease gun to put grease into a small container with fluid ounce or milliliter increments. Pull the trigger fully and slowly.
- Add a sufficient quantity of grease to measure accurately. Count the number of cycles of the grease gun (the number of times that you pull the trigger).
- Calculate the quantity for each cycle of the grease gun, as in the following examples.

*Example: 2 fl oz / 64 cycles = 0.031 fl oz for each cycle*

*Example: 59 mL / 64 cycles = 0.92 mL for each cycle*

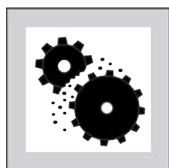
### 3.1.5 Procedures for Motors

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If a motor on your machine does not have grease fittings, no grease maintenance is necessary. If a motor on your machine has grease fittings, it is necessary to add grease. But the interval is usually longer than for other maintenance. [Table 10: Motor Grease Intervals and Quantities, page 23](#) gives motor grease intervals and quantities for motors with specified frame sizes and speeds. You get this data from the motor nameplate. Use [Table 6: Motor Grease Schedule, page 18](#) to record the data for the motors on your machine.

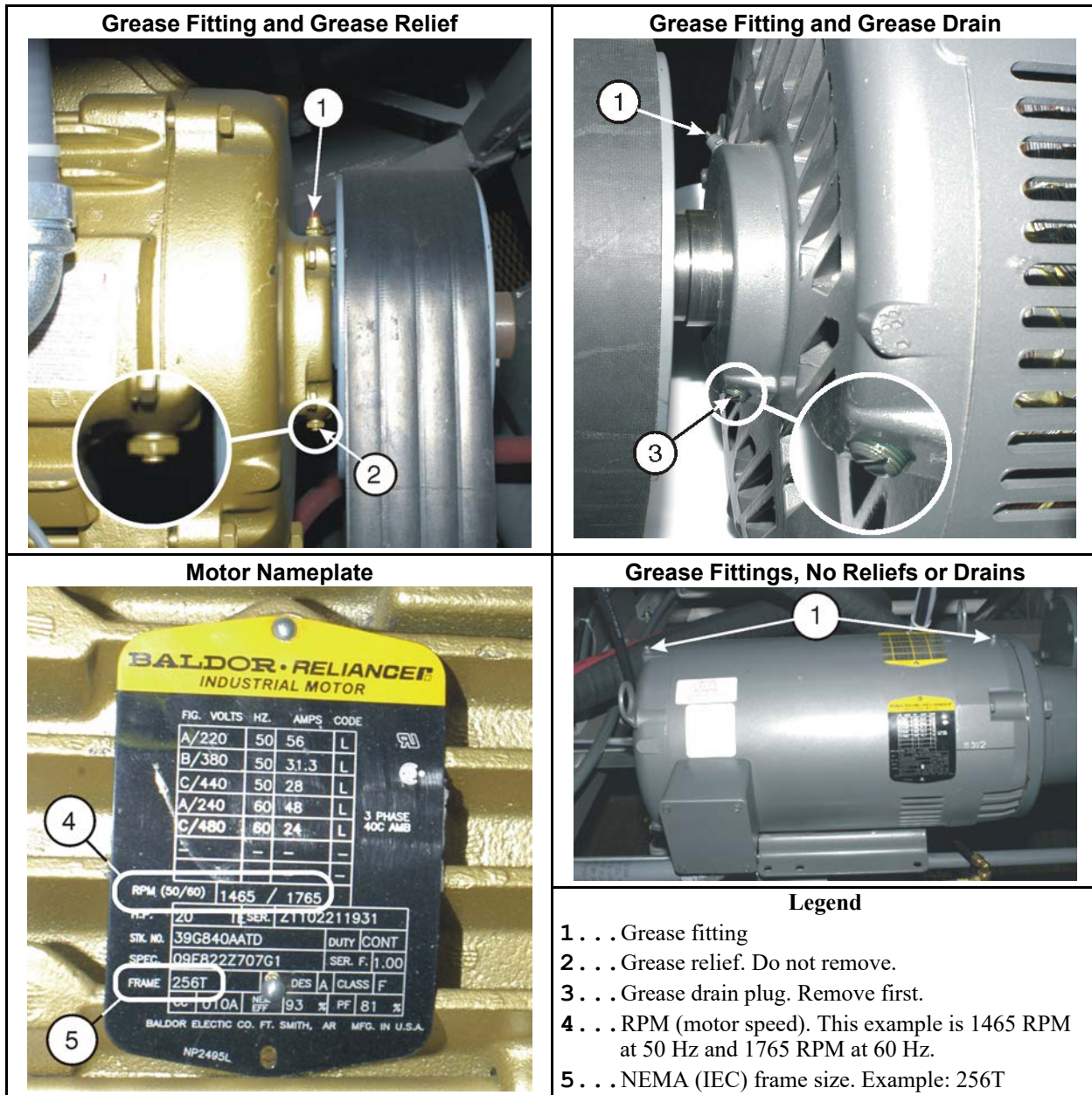


**CAUTION:** **Failure to remove grease drain plugs** — can cause grease to enter the windings and burn out the motor.



- If the motor has grease drain plugs, remove them before you add grease. If the motor has grease relief fittings, it is not necessary to remove them.

**Figure 7. Motor Grease Maintenance Conditions**



Apply grease as follows:

1. Operate the machine or use manual functions to operate the motor until it is warm.
2. Remove power from the machine.
3. If the motor has grease drain plugs, remove them. See the caution statement above..
4. Add grease EM ([Table 9: Lubricant Identification, page 20](#)) with the motor stopped. If the motor with the nameplate in the above figure operates at 60 Hz, the specified grease quantity for each grease fitting is 0.65 fl oz (18.4 mL).

5. If the motor has a grease drain plugs, operate the machine or use manual functions to operate the motor for two hours. Replace the drain plug.

**Table 10. Motor Grease Intervals and Quantities**

On Motor Nameplate (see <a href="#">Figure 7: Motor Grease Maintenance Conditions, page 22</a> )		Interval		Quantity	
NEMA (IEC) Frame Size	RPM Less Than or Equal To	Years	Hours	Fluid Ounces	mL
Up to 210 (132)	900	5.5	11000	0.34	9.5
	1200	4.5	9000		
	1800	3	6000		
	3600	1.5	3000		
>210 to 280 (132 to 180)	900	4.5	9000	0.65	18.4
	1200	3.5	7000		
	1800	2.5	5000		
	3600	1	2000		
>280 to 360 (180 to 200)	900	3.5	7000	0.87	24.6
	1200	3	6000		
	1800	2	4000		
	3600	0.5	1000		
>360 to 5000 (200 to 300)	900	2.5	5000	2.23	63.2
	1200	2	4000		
	1800	1	2000		
	3600	0.5	1000		

### 3.1.6 How To Show the Maintenance On a Calendar

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You can put marks on a calendar that work with the tables in [Section 3.1.1, page 16](#). The marks are the numbers 2, 3, 4, 5, and 6. It is not necessary to show the number 1 (items you do each day) on the calendar. The number 2 = items you do each 40 to 60 hours, 3 = each 200 hours, 4 = each 600 hours, 5 = each 1200 hours, and 6 = each 2400 hours. These are the "Mark" numbers at the top of the narrow columns on the left of each table in [Section 3.1.1, page 16](#).

The table below shows where to put the marks on a calendar. For example, if your machine operates between 41 and 60 hours each week, the first three marks are 2, 2, and 3. Put these marks on the first, second, and third weeks after the machine starts operation. If you do routine maintenance on a given day of the week, put the mark on that day of each week. Continue to put marks on the subsequent weeks. **It can be necessary to do the 40 to 60 hour (2) maintenance more than one time each week.** If the machine operates between 61 and 100 hours, put a 2 on two days of the week. If the machine operates 101 or more hours, put a 2 on three days of the week.

On each date with a 3, do the items with an x in the 3 or the 2 column of each table in [Section 3.1.1, page 16](#). On each date with a 4, do the items with an x in the 4, 3, or 2 column. Continue this pattern.



**Table 11. Where to Put Marks On a Calendar**

Hours / Week	Week Number																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Up to 40	2	2	2	2	3	2	2	2	2	3	2	2	2	2	4	2	2	2	2	3	2	2	2	2	3	2	2	2	2	5
41 - 60	2	2	3	2	2	2	3	2	2	4	2	2	3	2	2	2	3	2	2	5	2	2	3	2	2	2	3	2	2	4
61 - 80	2	2	3	2	3	2	4	2	2	3	2	2	3	2	5	2	3	2	2	3	2	4	2	2	3	2	2	3	2	6
81 - 100	2	3	2	3	2	4	2	3	2	3	2	5	2	3	2	3	2	4	2	3	2	3	2	6	repeat					
101 - 120	2	3	2	3	4	2	3	2	3	5	2	3	2	3	4	2	3	2	3	6	repeat									
121 - 140	2	3	2	3	4	3	2	3	5	2	3	2	3	4	3	2	3	6	repeat											
Hours / Week	Week Number, continued																													
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Up to 40	2	2	2	2	3	2	2	2	2	3	2	2	2	2	4	2	2	2	2	3	2	2	2	2	3	2	2	2	2	6
41 - 60	2	2	3	2	2	2	3	2	2	6	repeat																			

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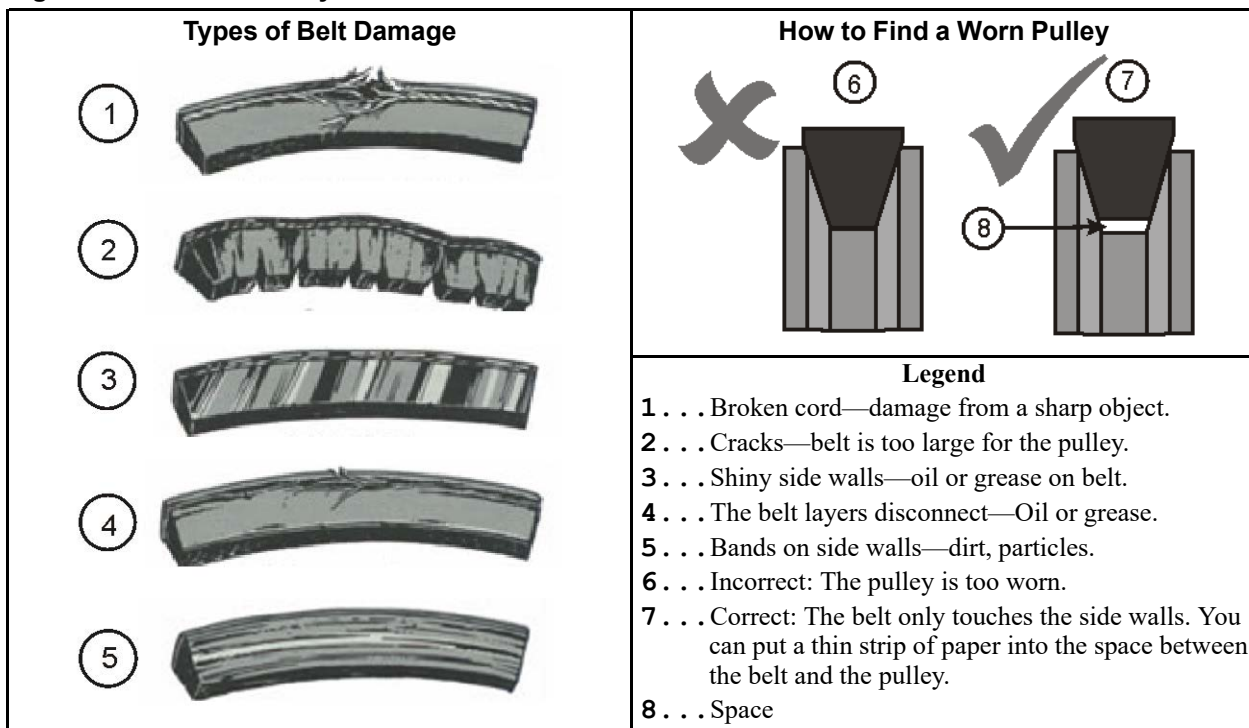
## 3.2 Maintenance Components—Machines and Controls Group

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### 3.2.1 How to Examine V-belts and Pulleys

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**Figure 8. Belt and Pulley Conditions To Look For**



#### With power removed:

- Look for dirt, dust, oil, and grease. Remove contamination.

- Look for belt damage as shown in the figure above.
- Look for worn pulleys as shown in the figure above.

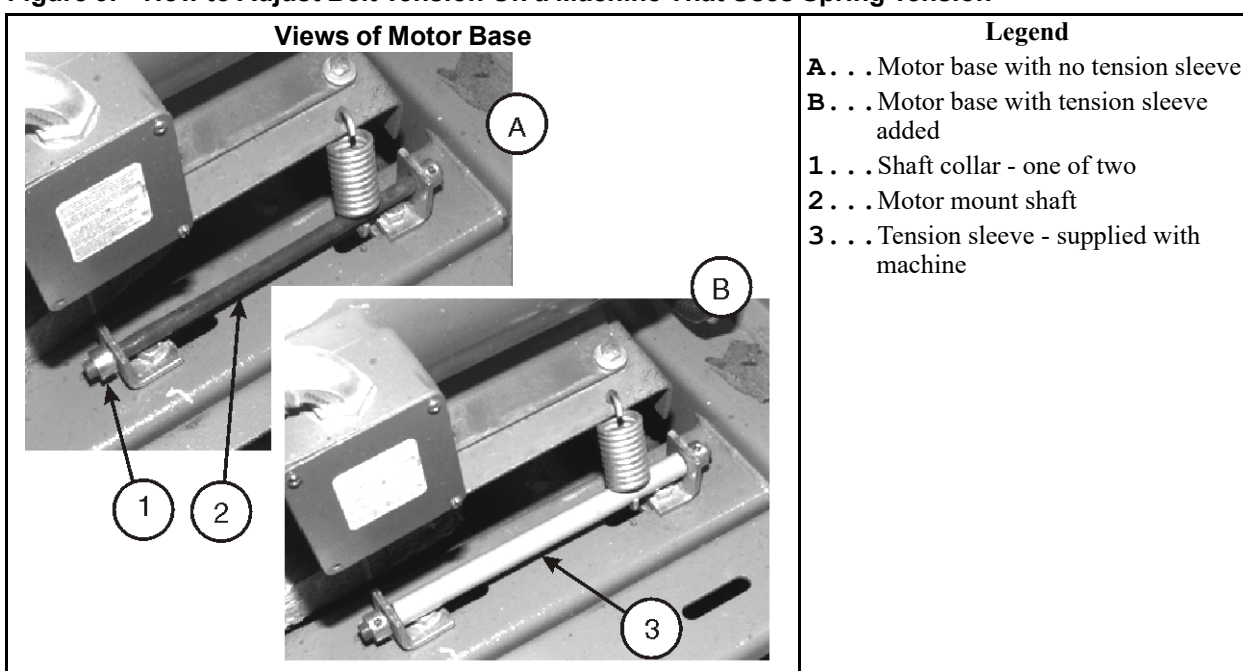
**With the machine in operation—Do not touch the machine.** Look and listen:

- A belt can have some vibration and not cause damage. It is necessary to correct this condition only if the vibration is large.
- A belt must have sufficient tension that there is no slippage on the pulley during operation. If slippage occurs, you can usually tell from the noise.

**About Component Replacement and Tension Adjustment**—Correct adjustment is very important to the service life of components and operation of the machine. Your Milnor® dealer can do this work. If you know how to do this work (for example, correctly align belts and pulleys), and you want to do it, speak to your dealer or Milnor® for part numbers. Replace worn components before you make tension adjustments.

- Machines that use rods with full threads and nuts to hold the position of the motor base—Turn the nuts on the rods as necessary to adjust tension. Tighten the nuts.
- Machines that use a spring to hold tension on the motor base—Use the belt tension sleeve supplied with the machine. Put the sleeve on the rod that the spring is attached to or remove the sleeve to increase or decrease tension (see the figure below). Replace the spring if necessary.

**Figure 9. How to Adjust Belt Tension On a Machine That Uses Spring Tension**





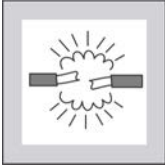
### 3.2.2 Inverters

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**CAUTION:** **Insufficient airflow** — will cause the inverter to burn out.

- Keep fans, filter, vents, and braking resistors clean.



**Figure 10. Electric Box and Inverter. These are examples. Your machine can look different.**

30022X_ Washer-extractor	48040F_ Washer-extractor	76039 CBW® Tunnel Washer
<b>Legend</b>		
<p>1 . . . Air filter</p> <p>2 . . . Fan on electric box door. Tip: Put streamers in front of the fan to make sure the fan operates.</p> <p>3 . . . Inverter cooling vanes and vents. See caution statement below.</p> <p>4 . . . Braking resistor, if applicable</p>		

### 3.2.3 How to Examine Compressed Air Mechanisms

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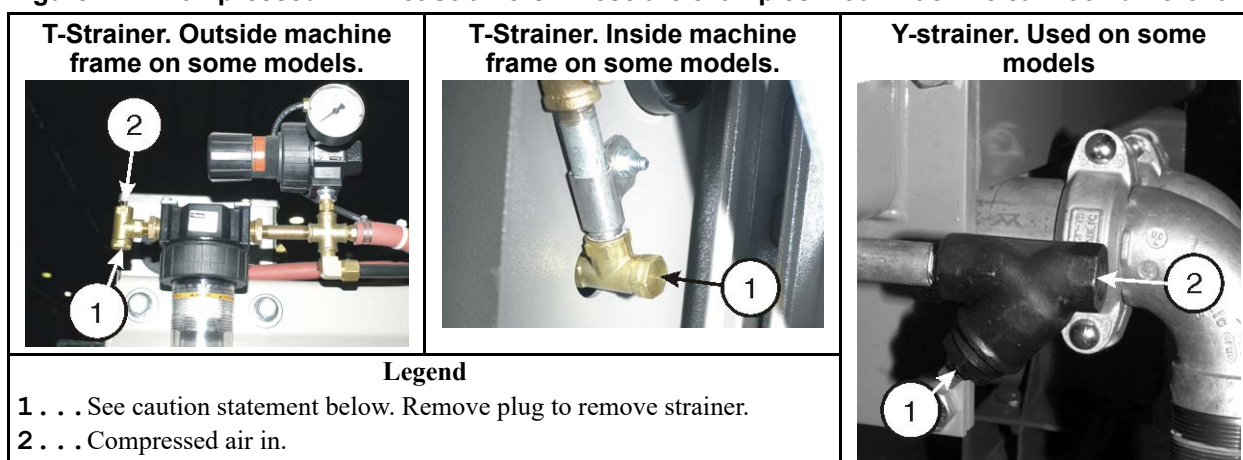


**CAUTION:** **Compressed air pressure** — can cause components to fly apart forcefully.

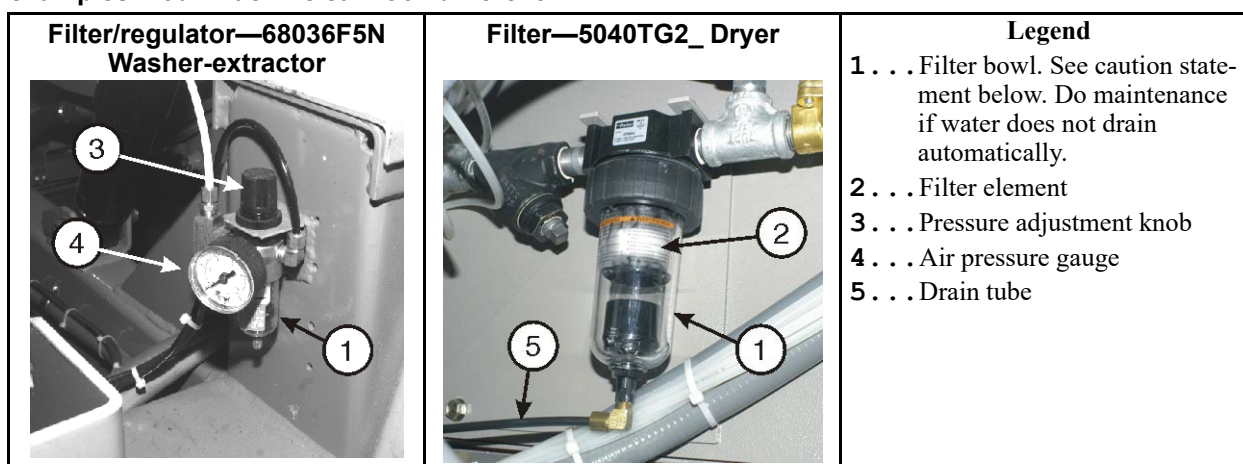
- Close the external shutoff valve and release remaining pressure before you do maintenance.



**Figure 11. Compressed Air Inlet Strainers. These are examples. Your machine can look different.**



**Figure 12. Self-purging Air Line Filter to Remove Moisture and Other Contamination. These are examples. Your machine can look different.**



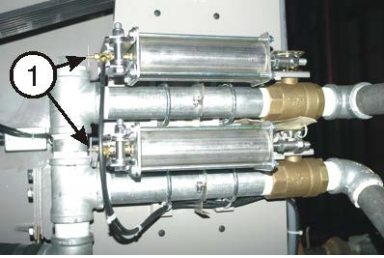

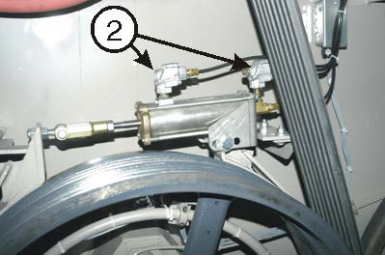
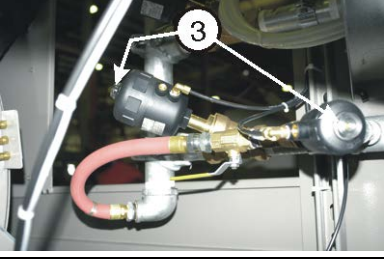
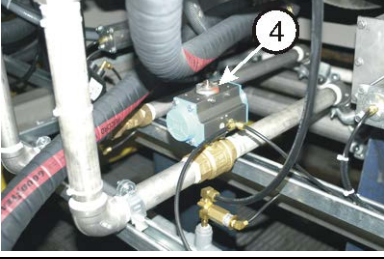
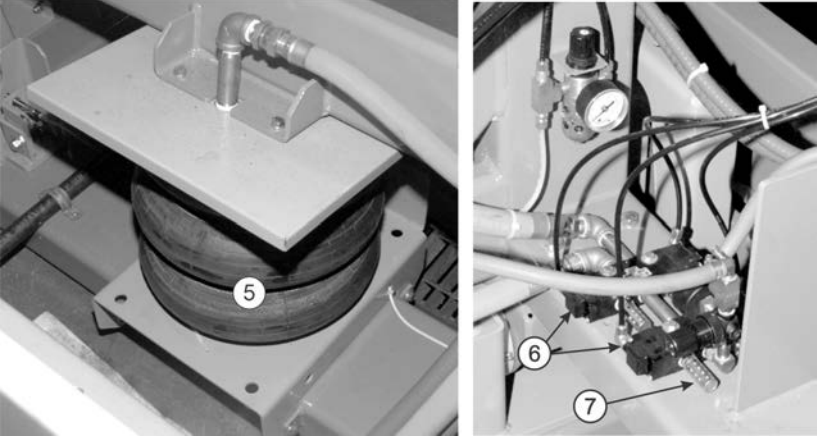
Your machine has one or more mechanisms that use compressed air for movement. [Figure 13, page 28](#) shows some examples. See the related figure in document BNVUUH01. To examine a compressed air mechanism, look at the mechanism and listen to it in operation. **Do not touch the mechanism or put your hand in the machine.** Usually you can see movement directly or on a position indicator. Frequently, you can hear a valve open and close. When a signal from the controller to operate the mechanism occurs, the air pressure must increase sufficiently before movement occurs. When the signal stops, the system must release the compressed air. You can usually hear the sound of the exhaust air for a short time.

When a compressed air mechanism operates correctly, its time of movement is usually less than two seconds. The movement is smooth. It does not shake, change speed, or stop in the middle of travel. A mechanism that does not operate correctly will cause unsatisfactory performance. If the mechanism does not operate correctly and you cannot repair the problem, speak to your dealer or Milnor®. Possible causes are as follows:

- a blockage or a leak in the air tube,
- a worn pilot air valve,
- worn components in the mechanism,

- air pressure supplied to the machine is not sufficient,
- a component used to remove contamination from the air line is clogged,
- a quick exhaust valve or muffler is clogged,
- on machines with an air line lubricator, a malfunction or incorrect adjustment prevents sufficient lubrication.

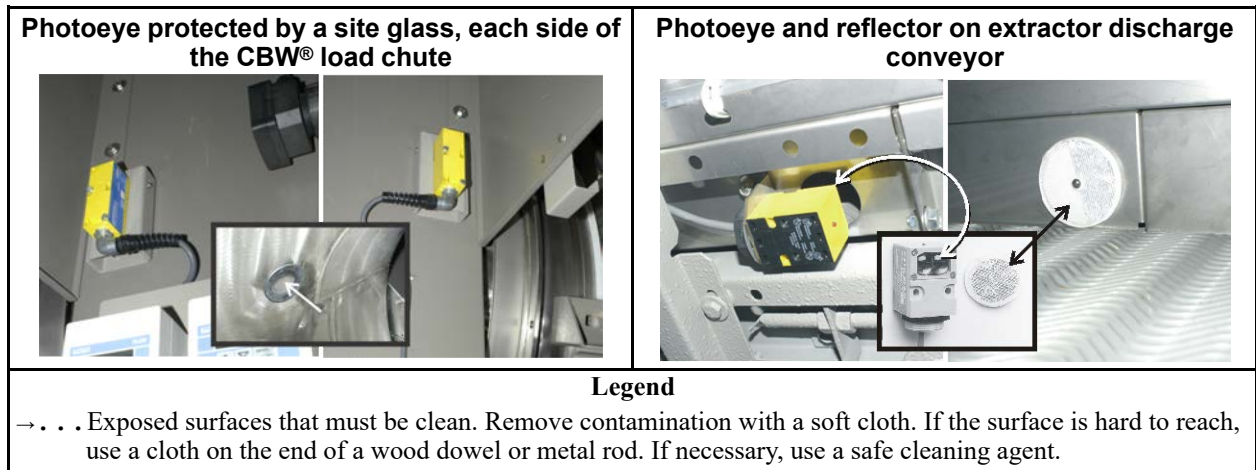
**Figure 13. Compressed Air Mechanisms** These are examples. Your machine can look different.

<p><b>Air Operated Water Valves - Milnor® Air Cylinder Type</b></p>  <p>Image showing two air cylinders connected to water valves. A circled number 1 points to a factory-set needle valve.</p>	<p><b>Air Operated Drain Valve - Milnor® Air Cylinder Type</b></p>  <p>Image showing an air cylinder connected to a drain valve.</p>	<p><b>Air Operated Band Brake - Milnor® Air Cylinder Type</b></p>  <p>Image showing an air cylinder connected to a band brake. A circled number 2 points to a quick exhaust valve.</p>
<p><b>Air Operated Water and Steam Valves - Angle Type</b></p>  <p>Image showing an air cylinder connected to an angle valve. A circled number 3 points to a position indicator.</p>	<p><b>Air Operated Water Valve - Ball Valve Type</b></p>  <p>Image showing an air cylinder connected to a ball valve. A circled number 4 points to an arrow position indicator.</p>	<p><b>Legend</b></p> <p>1 . . . Factory-set needle valves to cause two air cylinders to move together. Do not adjust.</p> <p>2 . . . Quick exhaust valves</p> <p>3 . . . Position indicator. Yellow when valve is open.</p> <p>4 . . . Arrow position indicator</p> <p>5 . . . Tilt air bag</p> <p>6 . . . Air valve</p> <p>7 . . . muffler</p>
<p><b>Air Tilt Components</b></p>  <p>Two images showing air tilt components. The left image shows a tilt air bag (5) under a platform. The right image shows an air valve (6) and a muffler (7).</p>		

### 3.2.4 Photoeyes and Proximity Switches

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**Figure 14. Photoeyes.** These are examples. Your machine can look different.



### 3.2.5 How to Do a Test of Emergency Stop Mechanisms

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This test applies to machines that have one or more stop mechanisms in addition to the Stop button (⓪). Do this test at the intervals given in the maintenance summary.

Definitions:

**3-wire circuit** a series electrical circuit on a Milnor® machine that must close before the machine can operate. If a switch in the circuit opens, machine movement stops and the operator alarm (a buzzer and a display message) comes on. When you push the start button (①), this closes the 3-wire circuit, which stops the operator alarm and lets the machine operate.

**emergency stop mechanism** a manual control that opens the 3-wire circuit when a person or object operates the control. Examples - emergency stop button, kick plate, pull cord.

**emergency stop button** a red push button on a yellow field that locks when a person pushes it (the electrical contacts stay open). It is necessary to turn the button clockwise to unlock it. A machine can have zero or more emergency stop buttons.

**kick plate** a metal plate on a shuttle conveyor that operates a switch when an object applies sufficient force to the plate. The kick plate is usually the first component of the shuttle to hit an object in the shuttle path. All Milnor® shuttles that go left/right on a path have kick plates on the two sides of the machine.



**WARNING:** — You can be killed or severely injured if a shuttle strikes you even if you come in contact with the kick plate first.



- ▶ Never do a test of the kick plate when the shuttle operates.



**pull cord** a wire on a conveyor that operates a switch when a person pulls the wire. All Milnor® free-stand conveyors (a conveyor that is not a component of a larger machine) have pull cords on the two sides of the conveyor.

Do a test of all emergency stop mechanisms on the machine as follows:

1. Apply power to the machine (⏻).
2. Push the start button (①). **Do not cause the machine to operate.** For example, do not start a formula or operate the machine manually. It is not necessary to do the test when the machine operates.
3. Operate an emergency stop mechanism (examples - button, kick plate, pull cord). If the mechanism operates correctly, the operator alarm comes on. Did this occur?
  - Yes—Release the emergency stop mechanism if necessary. For example, if this is an emergency stop button, turn the button clockwise to unlock it. Push the start button (①). Do the test on a different emergency stop mechanism. Continue until you do the test on all emergency stop mechanisms on the machine.
  - No—An electrical component is defective. Shut down the machine. Do not let the machine operate until you correct the problem.

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## 3.3 Maintenance Components—Dryer and Dryvac Group

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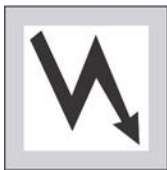
### 3.3.1 How Particle Contamination Occurs in the Dryvac Lint Collector

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When the Dryvac controller senses that the lint bag is full, it gives a signal. When this occurs, it is necessary to replace the lint bag with an empty one or dryer operation will stop. When the system operates correctly, all of the lint goes in the bag and the signal occurs when the bag is full. Particle contamination occurs when lint goes in the cabinet, not in the bag. The signal can occur before the bag is full or not at all.



**WARNING: Multiple Hazards** — A strong flow of hot air, lint, and other material goes in the cabinet when the Dryvac unit operates. When you open the cabinet door, the interlock switch on the door prevents or stops operation. If you remove the grill on the exhaust outlet for the blower fan, this does not stop operation. The blower fan is a strong, high speed fan.



- ▶ If the door interlock switch does not operate correctly, repair the machine immediately.
- ▶ Remove power to the machine before you do maintenance in the blower housing.

The maintenance summary gives the intervals to examine the Dryvac cabinet. Look at [Figure 15: Dryvac Maintenance Areas \(Model DRYVAC02 shown\), page 31](#).) Correct any of these conditions:

- clogged pressure sensors
- lint or other material on temperature sensors, air nozzles, or water nozzles
- lint bag dirty or worn
- a large quantity of lint in the cabinet (not in the bag). Possible causes are:
  - damage to the lint bag
  - bag not held by all hooks
  - belt at the top of the bag not tight

If a large quantity of lint is in the Dryvac cabinet, the lint is also in the blower fan and housing. See the warning statement above. Remove the lint from the blower fan and housing.

**Figure 15. Dryvac Maintenance Areas (Model DRYVAC02 shown)**

