Introduction to Packaging

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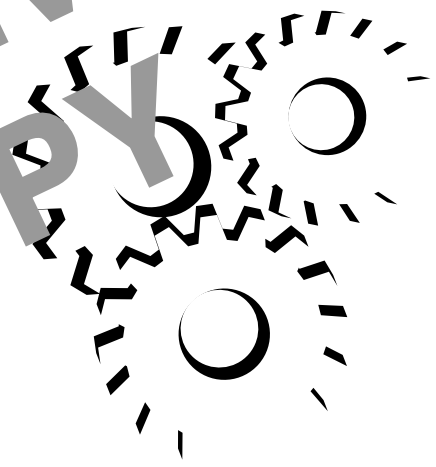
INTRODUCTION TO PACKAGING

Lesson One

The Packaging Mechanic



TPC Training Systems

31101

Lesson

1 The Packaging Mechanic

TOPICS

What is Packaging
Packaging Operations
Packaging Machinery Maintenance
Planned Maintenance
Lubrication

OBJECTIVES

After studying this Lesson, you should be able to…

- Describe types of machines for packing and filling.
- Describe packaging machinery breakdown maintenance procedures.
- List specific requirements for planned packing machinery maintenance.
- Explain packaging machinery lubrication selection, scheduling, and correct application.

KEY TECHNICAL TERMS

Packaging machinery 1.02 machinery used to enclose a product in a container
Skin packing 1.04 a method in which thermofilm is drawn down over a product and board
Blister packing 1.06 a method in which a product is sealed into a preformed blister
Shrink packing 1.08 a method in which a product is sealed within a bag, which then is shrunk around it

To understand more fully what is meant by packaging machinery, think of some of the products shipped to your own plant in containers. Weld rod, lubricants, bearings, gears, seals, nuts and bolts, steel, books, paper, and many other items arrive packaged by one method or another. Your own plant probably has several types of packaging machines. The term packaging machinery can be used to describe any piece of equipment used to put one or more products in a container.

This Lesson describes some of the general duties and responsibilities of a competent packaging mechanic. In most cases, the duties of a packaging mechanic are separated into three distinct areas—the initial setup or preparation of the machine to package a product, preventive maintenance, and troubleshooting. To perform your work better and to be a better mechanic, you must understand these duties thoroughly.

What Is Packaging?

1.01 The packaging equipment in your plant might consist of only one or of several different kinds of packaging machines. These machines can perform various packaging functions, including casing, uncasing, filling, and gathering. In addition to these major machines, there are secondary machines that function as cleaners, washers, cappers, labelers, unscramblers, coders, gluing devices, wrappers, strappers, and palletizing units. Secondary conveyors and material handling devices also are required to carry prime and finished products, both to and away from the packaging machines. Whether all or only part of this equipment is your responsibility, the maintenance procedures that apply to any one piece of packaging equipment can apply to almost any piece of packaging equipment.

1.02 The term *packaging machinery* can be used to describe the machinery used to handle products and containers, bringing them together in such a manner that the products are enclosed by the containers. The container can be a flexible bag or pouch, a paperboard box, a bottle, an aerosol can, or a blister-pack. The general operation of some packaging machines is described in the following paragraphs. The actual method by which these and other machines function is covered in other Lessons.

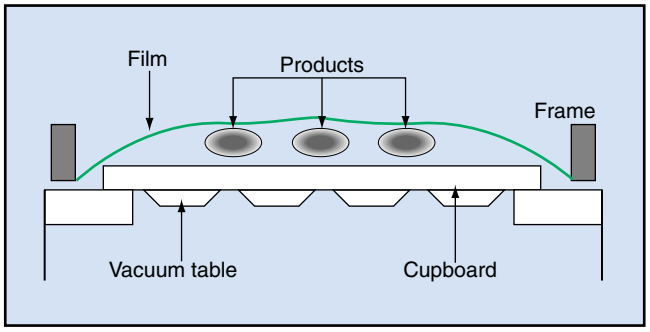
Packaging Operations

1.03 If you have been working around packaging equipment, you probably understand the fundamentals of packaging machinery. Although packaging machinery looks complicated and performs many operations quickly, the basic operating principles are simple. Not only are they simple and easy to understand, they frequently are repeated from machine to machine. For this reason, you do not have to be afraid of a machine because it looks complex. It only *looks* complex.

1.04 One type of machine is used for packaging the replacement light bulbs that serve as pilot or indicator lights on most automatic equipment. When the bulbs are shipped, they are affixed to a flat piece of chipboard by a covering film. This method is called *skin packing*.

1.05 When being made up, the master sheet is marked where the bulbs are to be placed. A sheet of thermofilm then is stretched across a framework over the bulbs and locked in place. A heating unit softens the film, and the film is brought down over the bulbs to the top of the chipboard. As shown in Fig. 1-1, a vacuum is created through a porous board (a board with holes in it), drawing the film down tightly around the bulbs. The heated film adheres to the card, making a permanent seal.

Fig. 1-1. Skin packing closure



1.06 A close relative of skin packing is called *blister packing.* This method again uses a coated chipboard card. However, instead of having a coating of film pulled down tightly around the item, the item usually is placed in a pocket or *blister.* The blister is formed by heating the film and then vacuum-drawing it over a wood or aluminum mold. The blisters then are cut apart and the parts to be packaged are dropped into them. Next, a card is set on top of the blister and the two are heat-sealed. The machine can be semiautomatic or fully automatic, depending on the production needs.

1.07 Polyethylene bags, which often are used for packaging bolts, nuts, and other loose products, are filled by several methods. One method uses polyethylene bags produced and printed in roll form. The roll of film is perforated between each bag, and one side of the perforation remains open. The roll of bags is placed in the machine. As the bags are pulled out, they are opened beneath a funnel. The nuts and bolts are dropped in, either manually or automatically, and then the bag is sealed. Another method of filling uses automatic machines that take flat film from a roll, make the bag, drop the parts into it automatically, seal it, and drop it onto a conveyor belt for secondary packing.

1.08 Another style of packaging is called *shrink packing.* The machine used for this style of packing uses a pouch (or top and bottom layer) of clear, shrinkable film. The item being packaged is placed in the film, and a loose bag is formed by sealing the open ends, as shown in Fig. 1-2. Usually the sealing devices consist of an L-shaped frame with a nichrome wire heating element. As the wire heats up, it melts the film, forming a sealing bag around the item. The bag then passes through a tunnel, which is heated to 250 to 350°F and has high-velocity air circulating inside of it. As an item passes through the tunnel, the high-temperature air shrinks the film tightly around the item.

1.09 Other types of machines are used to package powders and bulk products. Basically, there are four types of filling units used for powdered and granular products—auger, weighing, volumetric, and dump fillers.

1.10 The *auger* filler can be used either with products that flow easily or with those that do not flow easily. It consists of a coarse screw that withdraws the product from a hopper. The volume is controlled by the speed of the auger. When used with products that flow easily, hold-back screens or disks at the end of the auger prevent the product from dribbling when the auger stops turning.

1.11 *Weighing* units usually consist of a scale fed by a vibrating tray or feeder. A bulk vibrating feeder, which is usually large in size, feeds most of the product rapidly. After a given period of time, this unit stops, and a smaller feeder (called a *dribbler)* finishes filling the container. Weighing is probably the most

Fig. 1-2. Using an "L" sealer

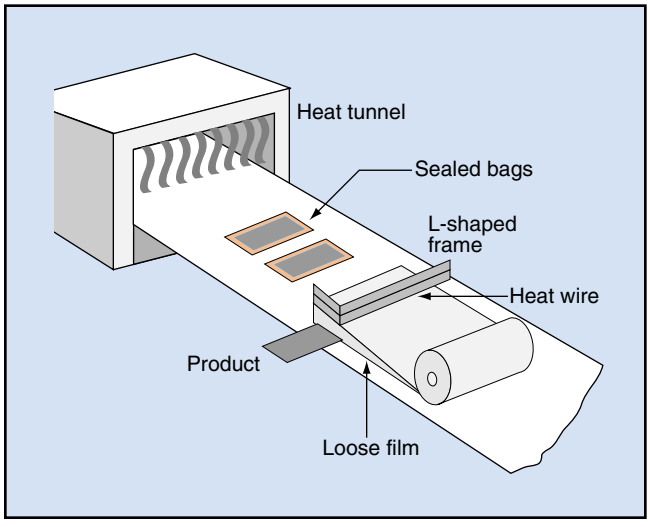
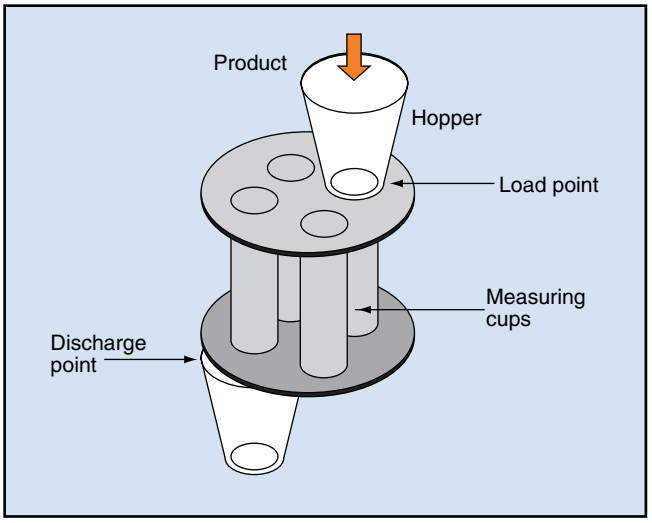


Fig. 1-3. Volumetric filling



accurate type of filling, but it is fairly slow unless done by large, multiple-filler machines.

1.12 The *volumetric* filler uses predetermined-sized cups rotating beneath a hopper. Often, the size of these cups can be changed to vary the amount of product dispensed. As the cups rotate, they are cut off from the hopper at the point above the discharge section, as shown in Fig. 1-3. At this point, the product is discharged into the container.

1.13 *Dump* filling is another type of weigh filling. It is used only for filling large containers, such as bags or drums. The product is preweighed by hanging scales. When the preset scale weight is reached, a trap door on the bottom of the hopper opens, dumping the product into the bag or drum.

1.14 Liquid fillers are manufactured in a variety of forms. Almost all are in-line, intermittent-motion fillers, or rotary-motion, continuous fillers. Whatever method is used, the liquid is allowed to flow into each individual bottle through a separate fill spout. If the liquid is thick or viscous, the material may be pumped into the container by a metering pump.

Packaging Machinery Maintenance

1.15 The maintenance of packaging machinery can be separated into the number of ways that machinery maintenance is carried out. A lot of the mechanic's time is spent taking care of problems that occur while the machine is operating. In most plants, though, a program of scheduled maintenance is followed. In these plants, major maintenance on the machinery is scheduled several weeks in advance. Small routine maintenance jobs, such as lubrication and adjustments, also can be scheduled many weeks in advance. The schedule can be rearranged, however, if problems requiring immediate attention come up.

1.16 A long-term program of major maintenance usually allows you to make an inspection of the machine some time before you actually have to work on it. This pre-shutdown inspection allows you to order such special items as drive components, cams, and other actuating devices that might be required during the teardown period.

1.17 Usually, a well-organized preventive maintenance program provides longer machine life with fewer breakdowns than a haphazard, catch-as-catch-can program does. These scheduled maintenance programs also benefit you, because they make your job easier, and keep the production line workers from complaining that their machinery is always breaking down. The way maintenance scheduling is carried out varies from plant to plant. The one in your plant should be set up to be the most beneficial to your equipment.

1.18 Since breakdown maintenance is not scheduled, it must be approached in a different manner. In some ways, the approach is similar to a planned maintenance overhaul. Some of the breakdown procedures to follow are:

- Determine the problem.
- Make sure you can repair it.
- Make sure you have the proper tools.
- Carry out all repairs in an organized manner.

1.19 When a packaging machine breaks down, you (as the maintenance repairperson) have your hands full. You may have spilled product, jammed containers, and a production line waiting to get back to work. Usually, your first thought is to get the machine running again as soon as you can. However, it is more important that you try to analyze the problem. Then try to figure out what caused the problem. When you do this, you are troubleshooting properly. Just starting to work on the machine usually ends up with a lot of time wasted and very little accomplished.

1.20 In many plants, if a machine starts to short fill or does not seal the containers properly, you cannot shut the machine down until you have cleared it with the proper production or management personnel first. This is done to make sure that only people who have the authority to shut down a machine or a line do so. To obtain permission, you first must estimate how long the line will be down, and what you are going to do to it. Of course, if the line jams and stops, shut it down immediately.

1.21 After you have figured out how to correct the problem, check to make sure that you have the necessary parts or supplies on hand to complete the job. For example, if you are working on an electrical panel and you think that a solenoid coil is burned out, make

sure you have the part on hand before you start the job. If you shut down a machine and the part is not on hand, you wind up having unnecessary machine downtime.

1.22 In addition to making sure that you have all of the proper parts, check to see that you have all of the proper tools necessary to complete the job once you start. Having all of the proper tools reduces the amount of lost production time. It also benefits you by allowing you more time to do your regular work. In addition, it helps identify you as a person who is qualified to do a good job.

1.23 If you work in a large plant, it is a good idea to have a small tool dolly for carrying your tools around. If possible, this dolly should have a medium-sized vise, general-purpose grease and oil, larger tools such as pipe wrenches or hammers, some pipe fittings, an assortment of nuts and bolts, and any special parts that you use frequently. Then you can handle almost any average maintenance job. Always use tools (hand or power) properly. Carrying only an adjustable wrench in hopes of lightening your load of tools usually results in bruised knuckles, rounded-off nuts, and wasted time.

1.24 Packaging machinery maintenance also occurs whenever you make minor adjustments to the machinery. Although making adjustments may not seem like maintenance, it is. In fact, it is closely related to the maintenance you perform when tightening loose machine parts or bolts. Both of these operations can be considered maintenance because both are needed to keep the machine running. When performing minor maintenance, always try to determine why the part required attention. Also, check the entire machine over for other loose or maladjusted items before you finish. Often, this procedure will save you from having to return every few days to take care of other problems.

The Programmed Exercises on the next page will tell you how well you understand the material you have just read. Before starting the exercises, remove the Reveal Key from your Trainee's Guide. Read the instructions printed on the Reveal Key. Follow these instructions as you work through the Programmed Exercises.

1-1. A packaging machine is used to _____.	1-1. ENCLOSE PRODUCTS IN CONTAINERS Ref: 1.01
1-2. The basic operating principles of packaging machines are simple, easy to understand, and frequently _____.	1-2. REPEATED Ref: 1.03
1-3. Skin packaging is accomplished by the use of a(n) _____ coating placed on a(n) _____.	1-3. THERMOFILM; CARDBOARD Ref: 1.05
1-4. Blister packing makes use of a(n) _____ blister.	1-4. PREFORMED Ref: 1.06
1-5. Shrink packing is accomplished with the aid of high- _____, high- _____ air.	1-5. TEMPERATURE; VELOCITY Ref: 1.08
1-6. Volumetric fillers control the amount of product with _____-sized cups.	1-6. PREDETERMINED Ref: 1.12
1-7. When troubleshooting a packaging machine, it is important that you _____ the problem.	1-7. ANALYZE Ref: 1.19
1-8. Before repairing a machine, make sure you have all of the proper _____ and parts.	1-8. TOOLS Ref: 1.22

Planned Maintenance

1.25 When establishing a planned maintenance program, the first thing to do is to make a list of all the equipment that you are responsible for in your plant. A description of each piece of equipment should be recorded on separate maintenance record cards. As shown in Fig. 1-4, the card should show the machine description, serial number, and location. It also should include the motor size, operating speed, and other useful or important data, such as repairs that have been made previously. This card is necessary because it is hard to remember just what you did to a piece of equipment the last time you worked on it. By referring to the card, you can see if the same trouble has occurred before. This makes it a lot easier to analyze a breakdown, and reduces the time required to solve a machine problem.

1.26 Although packaging machines are designed to have a long service life with relatively minor maintenance, there are certain parts of the machine that require periodic adjustment and replacement. Some of these items are: chain drives, sprockets, V-belts, cams, actuating devices, clutches, and bearings. The wear that takes place in these items often is not noticed until it is too late. The first sign of wear will be frequent spillage of the product or improper cycling of the machine. When this happens, it is almost impossible to bring the machine back into its proper sequence without repair.

1.27 When setting up the specific time intervals at which scheduled maintenance should be performed, always take into account the wear life of the different parts. Those that have sliding or contacting surfaces should be inspected more frequently than those that do not. Items such as motors and electrical switches that are located in dusty or moist atmospheres also should be inspected frequently to make sure that the insulation has not broken down. However, this does not mean that

Fig. 1-4. Maintenance record card

MAINTENANCE RECORD CARD

MACHINE _____ SER. NO. _____

LOCATION _____ DATE INSTALLED _____ AGE _____

MANUFACTURER _____ OPERATING SPEED _____

MOTOR HP _____ OPERATIONS PERFORMED _____

MAINTENANCE SCHEDULE	MAINTENANCE PERFORMED
SEMI-ANNUALLY 1. Check anchors 2. Check shaft alignment 3.	
QUARTERLY 1. Check timing 2. Adjust drive belt tension 3.	
MONTHLY 1. Lubricate all bearings 2. Clean machine internally 3. 4.	

those items that have little or no wear rates should be neglected. It is a good idea to inspect the machine frame, anchor bolts, and drive shafts at least once or twice a year. This should be done more frequently, however, if the machine is not anchored solidly.

1.28 Preventive maintenance includes special attention to belts. These include both driving and conveying belts. One of the main causes of belt wear is misalignment of the pulleys. The pulleys for the conveying belts can be aligned by sight, and by using a straightedge for V-belt drives. If a straightedge is used, both pulleys should be affixed securely to the shafts. In variable-speed drives, where one pulley is fixed and one pulley is adjustable, alignment is a little more difficult. The best way to align this type of drive is to spread the adjustable pulley to the extreme open or wide position. At this point, take a straightedge and measure from the center of the fixed pulley to the center of the open pulley. This should be done on both sides of the pulleys. If necessary, adjust only one of the pulleys so that the belt tracks evenly.

1.29 In addition, check the belts for aging cracks. These cracks may be caused by heat, improper tension, or lubricant dripping on the belt. Lubricant usually causes the belt to rot, and cracks will appear all of a sudden. If the belt of a variable-speed drive is bottomed tightly in the pulley, the belt will be damaged quickly. The best method of preventing belt failures is to inspect the belts every two to three months. Do this by turning the belt inside out. If there are any cracks, they will be clearly visible at that time.

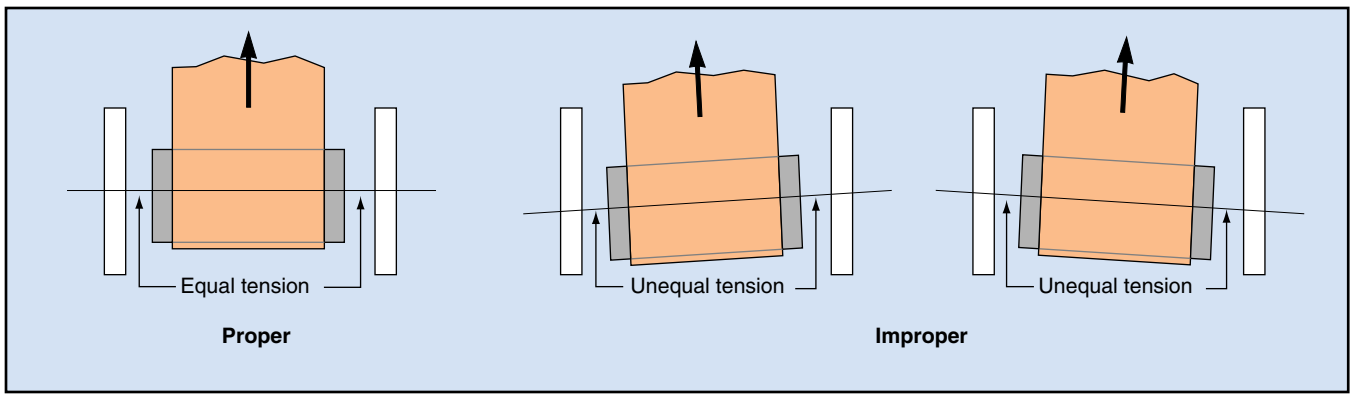
1.30 Also, have spares on hand for the belts of different sizes on the machinery. This will reduce the amount of downtime if a belt suddenly breaks. If your plant uses a large number of different drive belts, spare belts in the form of a makeup or link-type belt will reduce the amount of spare belts required.

1.31 Main conveyor belts usually present few problems. The two major problems are tracking and belt tension. Low belt tension is spotted easily because the belt does not travel at the proper speed. Water, oil, grease, or just stretch in the belt permits slippage between the drive pulley and belt. This usually is corrected by adjusting the takeup on the conveyor. Adjusting the takeup (or sometimes a snubbing pulley) will cause the belt to track properly. This is shown more clearly in Fig. 1-5.

1.32 Improper tracking of a conveyor belt also may be caused by a poor belt splice or a poorly manufactured belt. When the belt is not properly spliced, it should be respliced. Take care when splicing a belt to make sure that the corners are not loose or ragged. Ragged edges can cause hangups, which prevent proper tracking. Dirt or material buildups also affect the belt's tracking ability. When adjusting the belt for proper tracking, always let the belt run for several minutes after each adjustment. This allows the belt to adjust slowly to the correction and prevents it from overrunning.

1.33 Flat or plate top metal conveyor belts or chains also require preventive maintenance, especially where they ride over the sprockets. Check the conveyor for wear and stiff joints. If the metal top conveyor peaks or pops up during operation, it usually means that the metal top chain needs lubrication. If lubrication does not correct the problem, take the chain apart

Fig. 1-5. Conveyor belt adjusting



and clean it to remove any rust or buildup that may be present. Proper lubrication of the chain ways or track also will reduce wear and extend the operating life of the chain.

1.34 If a plate top conveyor shows excessive wear or seems to be out of alignment, it is a good idea to check the level of the conveyor. Many times, a conveyor will get out of level after it has been bumped or jarred. This can cause many problems, which are usually hard to find. Therefore, as part of your preventive maintenance program, it is good practice to check the level of the equipment.

1.35 Roller or rollerless drive chains also require periodic checks for wear and rust. This maintenance is very important to the operation of the machine, because if the drive chain is not flexing properly, it will overload other drive components, thereby reducing their service life significantly. After the drive chain has been installed and aligned, the only maintenance to be performed is periodic lubrication and slack removal. Remember that all chains stretch after being in operation for a while.

Lubrication

1.36 Planned lubrication is another phase of planned maintenance. In a small plant, lubrication scheduling is often the responsibility of the maintenance mechanic. In a large plant, it may be the responsibility of a maintenance or lubrication engineer. No matter how the scheduling is done, and no matter who does the job, it is essential that a routine schedule for lubrication be established. Scheduled lubrication serves two purposes. First, it ensures regular lubrication. Second, it helps ensure that all parts are lubricated, but that none is overlubricated.

1.37 When setting up a lubrication schedule, it is important to remember that some machine parts require more frequent lubrication than others. For example, the areas that carry the largest part of the load of the machine's movement will require lubrication often. A lubrication schedule can be set up by using any of the following:

- check-off cards
- color-coded fittings
- color-coded caps
- labels or stickers
- automatic lubrication systems.

If the lubrication fitting is difficult to reach, the best thing to do is to extend the lubrication fitting outward to a position on the machine where it is accessible.

1.38 When using cards for identifying the lubrication cycle, enter specific dates for lubrication rather than a time interval ("May 1," for example, rather than "every two months"). Color-coded fittings usually mean that a certain color represents certain months of the year. For example, all blue fittings are lubricated in March, June, September, and December.

1.39 Another way to make sure that lubrication schedules are being followed is to use a colored grease cap system. These systems use a colored plastic cap that snaps over the top of the lubrication fitting. Whenever you lubricate a fitting, you snap on a different colored cap than the one previously used. This system serves two purposes. First, it lets you know which fittings have been greased and which have not. Second, having the caps snapped over each lubrication fitting helps keep the dust out of the fitting, extending bearing life. It is helpful to have a card or tag made up for each machine, showing how many lubrication fittings are on the machine.

1.40 Colored labels can be used to identify lubrication fittings in much the same way as colored caps. Some systems use stickers with dates instead of color coding. In a way, automatic lubrication is similar to color coding because it can be controlled or cycled to lubricate at specific times. The lubrication can be actuated manually or by a timeclock arrangement. When a timeclock is used, it will actuate once a day, once a week, or at some other interval, depending on the type used.

1.41 The proper selection of lubricants is very important in making a scheduled maintenance program work. In most cases, the lubricant selected for a piece of equipment is based on the manufacturer's recommendation. These recommendations should be followed if at all possible. However, if you cannot

find the particular lubricant specified, obtain its equivalent. If the equipment manufacturer does not suggest a specific lubricant, call in a lubricant supplier for a recommendation.

1.42 For example, if you have a vibratory feeder or mixer, there are special greases and oils that will not separate when subjected to vibration. These lubricants usually are not suitable for normal operating machinery. If the wrong lubricant is used, more harm can be done to the equipment than if it were not lubricated. The same precautions apply for temperature extremes. Always check to make sure that the lubricant you are using is suitable for lubricating the specific piece of equipment.

1.43 The proper application of lubricants is also very important. In most cases, too much lubrication does more harm than too little lubrication. This is especially true in dusty areas. One way of preventing overlubrication is to check the manufacturer's recommendations for the frequency and quantity of lubricant. Generally, about two pumps of a manual or air-operated greasing gun is sufficient. With packaging machinery, be very careful not to overlubricate and blow out the bearing seals. This can allow dust and moisture to enter and ruin the bearing.

1.44 Preventive maintenance also includes the gear boxes and transmissions. The same schedule-identifying procedures can be followed here as with other lubricants. Applying labels to a machine, using a card system, and color coding are all acceptable methods. Sometimes it is necessary to show when the gear box was last drained and refilled. When abrasive materials are found in the area of the gear box, it is a good idea to flush it and refill it periodically with the proper lubricant.

1.45 Include chains in scheduled lubrication. Because of the many ways of lubricating chains, they may have to be handled separately. Some systems use automatic brushes that brush a coat of lubricant on the chain from a reservoir. Others use timed dripping systems. On machines that are used in dust-free areas, a light coat of oil on the chain while the machine is in motion is usually sufficient. If the machine is in an area where there is a lot of steam or moisture, or where packaging of corrosive materials is being done, more thorough lubrication is required. To do this, remove the chain, wash it in a flushing oil or kerosene, and then soak it overnight in SAE10 or 20 oil. The next morning, wipe off the excess oil and place the chain on the machine. Oil sumps or pans can be used to provide continuous chain lubrication.

1-9. The first thing you should do to establish a maintenance program is to make a(n) _____.	1-9. LIST OF ALL THE EQUIPMENT FOR WHICH YOU ARE RESPONSIBLE Ref: 1.25
1-10. When you are to set up a maintenance schedule, always take into account the _____ of the parts.	1-10. WEAR LIFE Ref: 1.27
1-11. One of the main causes of belt wear is _____ of the pulleys.	1-11. MISALIGNMENT Ref: 1.28
1-12. Slippage of a drive belt can be prevented by proper belt _____.	1-12. TENSION Ref: 1.31
1-13. Maintenance of drive chains usually is limited to lubrication and _____.	1-13. SLACK REMOVAL Ref: 1.35
1-14. Cards used for identifying a lubrication cycle should have a specific lubrication _____.	1-14. DATE Ref: 1.38
1-15. A lubricant specified for a machine usually is recommended by the _____.	1-15. MACHINE MANUFACTURER Ref: 1.41
1-16. Automatic chain lubrication usually is accomplished by the use of automatic brushes or _____ systems.	1-16. TIMED DRIPPING Ref: 1.45

Answer the following questions by marking an "X" in the box next to the best answer.

1-1. Most packaging machines have several similar

- ☐ a. filling methods
- ☐ b. operating principles
- ☐ c. sealing methods
- ☐ d. conveying methods

1-2. Packaging machines of the weigh-fill type usually are furnished with

- ☐ a. a metering pump
- ☐ b. a volumetric filling unit
- ☐ c. single filling heads
- ☐ d. more than one size weighing unit

1-3. The best way of improving machine life is through the use of

- ☐ a. a preventive maintenance program
- ☐ b. equalizing machine time
- ☐ c. production line timesharing
- ☐ d. a variety of product weight schedules

1-4. The first step to take when troubleshooting is to

- ☐ a. get the machine running
- ☐ b. clean up the spilled product
- ☐ c. analyze the problem
- ☐ d. analyze the cause

1-5. Before you repair a machine breakdown, make sure you have the necessary

- ☐ a. blueprints and tools
- ☐ b. blueprints and parts
- ☐ c. parts and tools
- ☐ d. parts and lubricant

1-6. Preparing a list of all the equipment for which you are responsible is the first step in

- ☐ a. establishing a good maintenance program
- ☐ b. understanding your job
- ☐ c. learning about each machine
- ☐ d. classifying the lubricant requirement

1-7. Scheduled maintenance time intervals should be based on the

- ☐ a. age of the machine
- ☐ b. the supervisor's responsibilities
- ☐ c. miscellaneous repairs
- ☐ d. planned maintenance

1-8. Planned or scheduled lubrication is a part of

- ☐ a. the lubricator's problems
- ☐ b. the supervisor's responsibilities
- ☐ c. miscellaneous repairs
- ☐ d. planned maintenance

1-9. If lubrication is scheduled on cards, the cards should specify

- ☐ a. only the lubrication interval
- ☐ b. a lubrication date
- ☐ c. the name of the lubricator
- ☐ d. the lubricant supplier

1-10. When you lubricate special machines, make sure that the

- ☐ a. lubrication is done more frequently
- ☐ b. lubricant is of the general-purpose type
- ☐ c. lubricant is suitable
- ☐ d. unit is shut down

SUMMARY

The term *packaging machinery* describes the machinery used to enclose a product in a container. *Skin packing* is a method in which thermofilm is drawn down over a product into a preformed blister. *Shrink packing* seals the product in a bag, then shrinks the bag around the product.

***Auger filling* is one method used in packing bulk materials. A screw raises the product from a hopper. Sometimes bulk products are weighed or are measured with a *volumetric* filler. *Dump filling*, another type of weigh filling, is limited to filling large containers.**

Packaging machinery maintenance consists of both planned, preventive maintenance and breakdown maintenance. Two important aspects of planned maintenance are inspection and lubrication. Both should be scheduled carefully. Proper lubrication selection is important and overlubrication should be avoided. When a breakdown occurs, analyze the problem carefully before you start work, and make sure that you have all the necessary parts and tools.

Answers to Self-Check Quiz

1-1. b. Operating principles. Ref: 1.03

1-2. d. More than one size weighing unit. Ref: 1.11

1-3. a. Preventive maintenance program. Ref: 1.17

1-4. c. Analyze the problem. Ref: 1.19

1-5. c. Parts and tools. Ref: 1.21, 1.22

1-6. a. Establishing a good maintenance program. Ref: 1.25

1-7. b. Component wear life. Ref: 1.27

1-8. d. Planned maintenance. Ref: 1.35

1-9. b. Lubrication date. Ref: 1.38

1-10. c. Lubricant is suitable. Ref: 1.42