

Downloadable Resources

PROCESS CARDS | EXCEL WORKSHEET





Kepner
Tregoe

*Challenges
Opportunities
Results*

Troubleshooting

Case



Mrs. Walther's Square Donuts



Individually
Read your information.

Finish by ____.

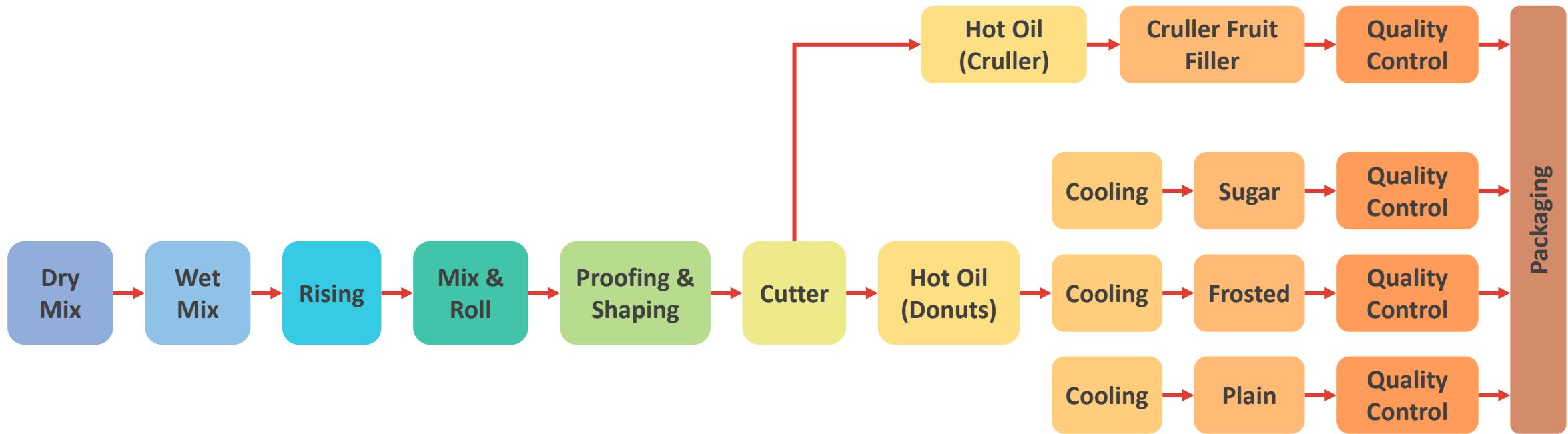
Mrs. Walther's Square Donut Factory, Inc. is one of the largest, most modern bakeries in the world. It turns out more than a quarter of a million square donuts a day.

The average production rate is 18,000 donuts per hour. Mrs. Walther's produces plain, frosted, and sugar donuts, as well as fruit-filled crullers.

Square donuts are produced on a precise schedule. The factory operates on a two-shift basis, seven days a week. The third shift is used for shut-down, clean-up, maintenance, and start-up.

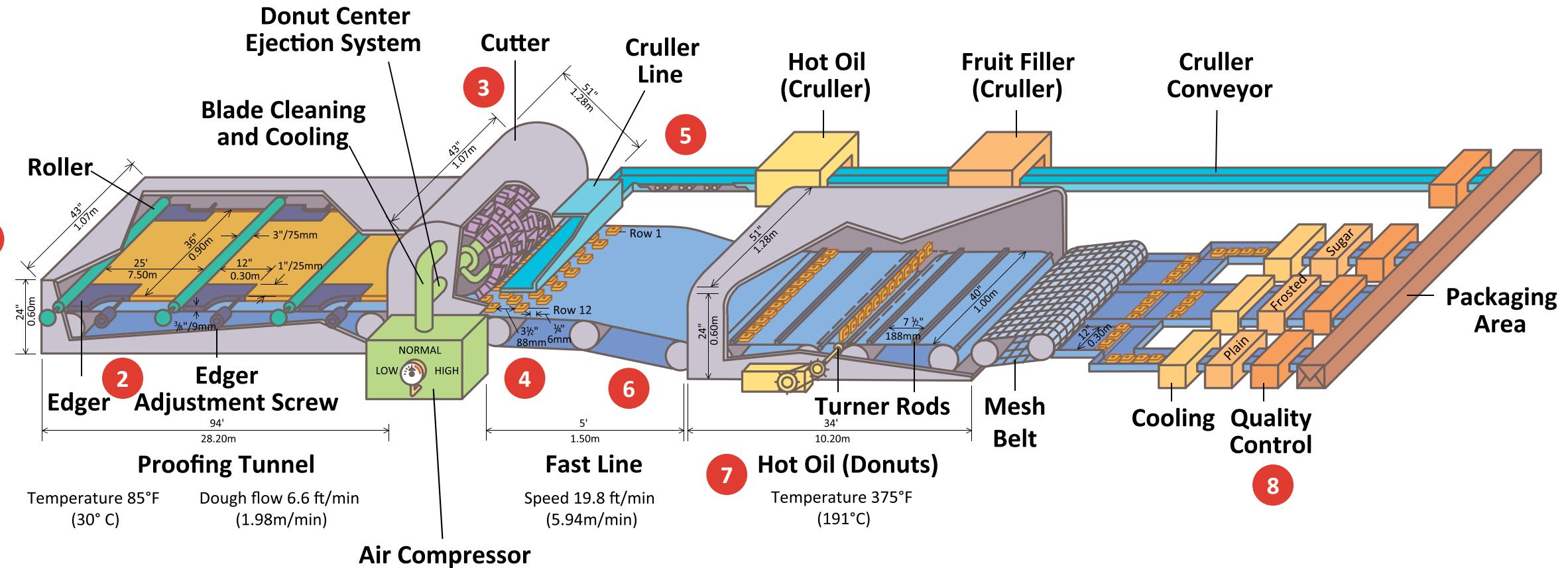
Mrs. Walther's Square Donuts

Donut Production Flow



Mrs. Walther's Square Donuts

Donut Production Flow



Mrs. Walther's Square Donuts

Donut Production Flow

1

Up to the enclosed proofing tunnel, the system is computer controlled. The tunnel has removable covers for inspection and maintenance. In the tunnel, the dough is shaped by a series of rollers and edgers (guides). The rollers control the thickness of the dough.

2

There is a pair of edgers after each roller. The edgers keep the width of the dough at exactly 36 inches (90 cm). This is important because the cutter has no outside blades. The edgers sometimes vibrate loose. This can result in round edges in Row 1, Row 12, or both.

3

The cutting blades are kept at 25°F (-4°C) so the donuts don't stick. Very cold air, at high pressure, is directed at the blades from a series of holes. This keeps the blades clean. The entire cutter is covered with an insulated cover. If donuts stick to the blades, they fall out of the cutter onto the belt. This can cause one or two round edges. When donuts fall, they may touch each other. If uncooked donuts touch each other, they stick together. When pulled apart, the dough stretches out 1/2 inch (1.2 cm) or so. This produces a "spike" on the cooked donuts. These donuts are rejected by quality control.

4

The hard rubber cutting surface under the cutter wears down with use. If it gets too low, the blades don't cut completely through the dough. Spikes result when the fast line pulls apart the donuts. If film builds up on the cutting surface, then it can slow the dough, causing donuts to be too thick.

5

Donut centers are blown out of the cutter on to the cruller belt. Air pressure in the center-blowing system decreases from Row 12 to Row 1, so that the centers are blown different distances on to the belt. This reduces the chance of any centers touching.

The center-blowing system and the cleaning-cooling system are interconnected. This means the pressure on the cleaning-cooling system also decreases from Row 12 to Row 1.

About a week ago, the air-pressure system was modified to help equalize the cleaning-cooling air pressure.

Pressure control is critical. If the pressure is too high, the centers will be blown together on the far side of the cruller belt. If the pressure is too low, the blades may get dirty on the low pressure side of the line.

Low pressure may also mean that the Row 1 centers aren't blown out. When they cut again, these dough-filled blades push the dough aside. This causes donuts on Row 1 to have a high, round edge.

Mrs. Walther's Square Donuts

Donut Production Flow

6

The line between the cutter and the cooking oil moves three times as fast as the dough strip. This puts space between the donuts. Rows are separated by 1/4 inch (0.6 cm). Donuts in the same row are separated by 3 1/2 inches (8.4 cm).

7

The oil is kept at a temperature of 375°F (191°C). After the dough is wet-mixed, it must continue on schedule through the hot oil cooker. Donuts can stay in the hot oil only five seconds over schedule.

8

About three weeks ago, a large CO₂ fire-suppression system was installed in the hot oil area. Due to safety regulations, the cover can be opened only after the temperature has dropped to 350°F (177°C). The oil takes about 10 minutes to cool to this temperature after the heat is turned off.

Mrs. Walther's Square Donuts

Sample Page from the Cutter Maintenance Manual

Cutter Maintenance

To clean the blades:

Lower the proofing tunnel.
Run the dough into the waste bins under the cutter.
Feed a piece of #546 sponge through the cutter from above the lowered tunnel.

To inspect and clean the blades:

Run the dough into the waste bins.
Disconnect the air and cutter drive chain.
Remove the cutter cover.
Inspect the blades.
If necessary, clean the blades with a wet brush and soda solution.

To clear the cleaning-cooling and center-blowing systems:

Remove the cutter cover.
Clean the air holes with a thin wire.

To replace the cutting surface:

Remove the rubber cutting surface.
Extras are in stock—#6G2.





*Challenges
Opportunities
Results*

Find True Cause



Clear thinking for tough problems

Cases

ArmorTex

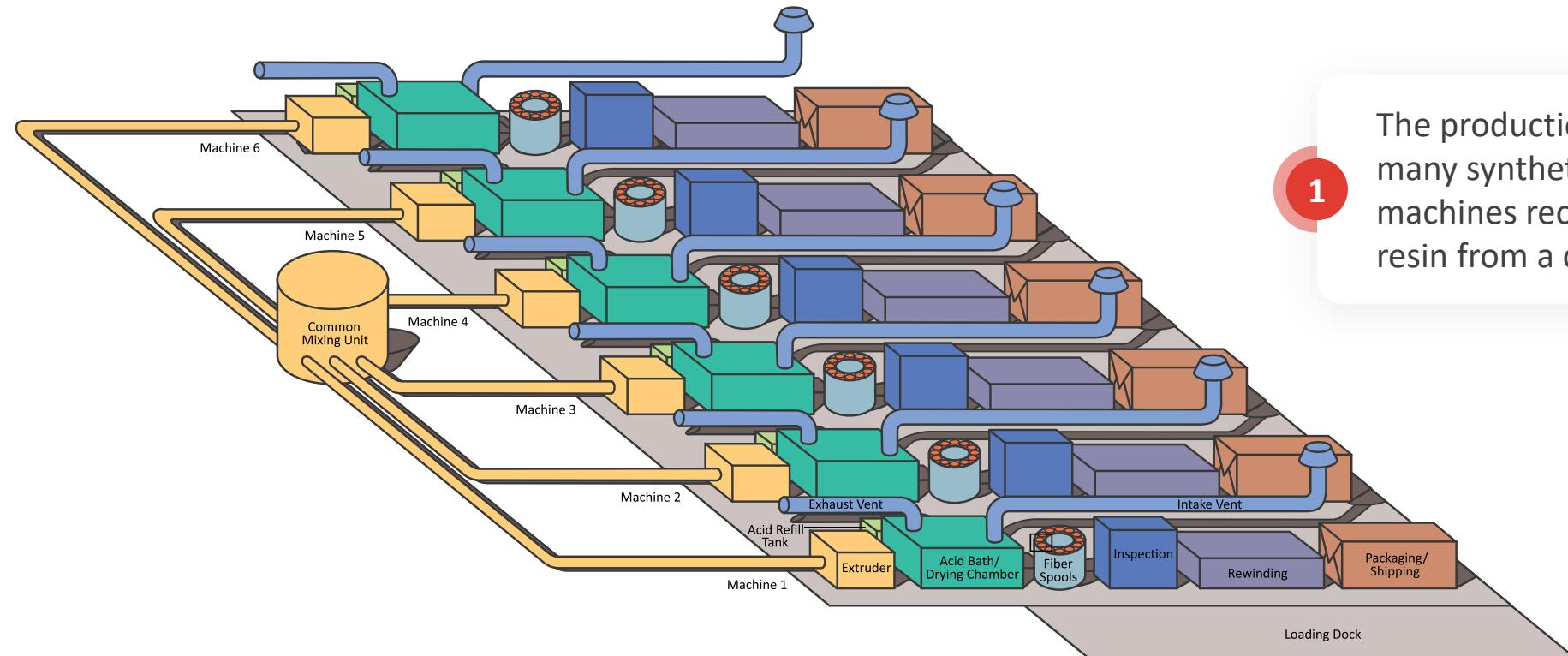


*Read your information.
Work in teams.
Show work on easels.
Write a Problem Statement.
Develop a Specification.
Identify any missing information.*

*Finish by _____.
-----*

ArmorTex is a new, super-strong, lightweight, synthetic fiber manufactured by the plastics division of the Excella Chemical Company. The largest potential markets for ArmorTex are backing fabric for automotive seat covers and commercial furniture.

ArmorTex is currently manufactured at one plant. Since ArmorTex is not yet profitable, it is produced on six old machines that used to produce plastic filament. The first machine is next to the loading dock. Other machines are positioned evenly across the plant floor. Because of the long start-up procedure for each machine, production is continuous. ArmorTex is produced on three shifts, seven days a week. To help employees avoid local traffic, shifts change at 11:00 a.m., 7:00 p.m., and 3:00 a.m.



1

The production of ArmorTex is similar to many synthetic fibers. All six ArmorTex machines receive a supply of thick liquid resin from a common mixing unit.

2

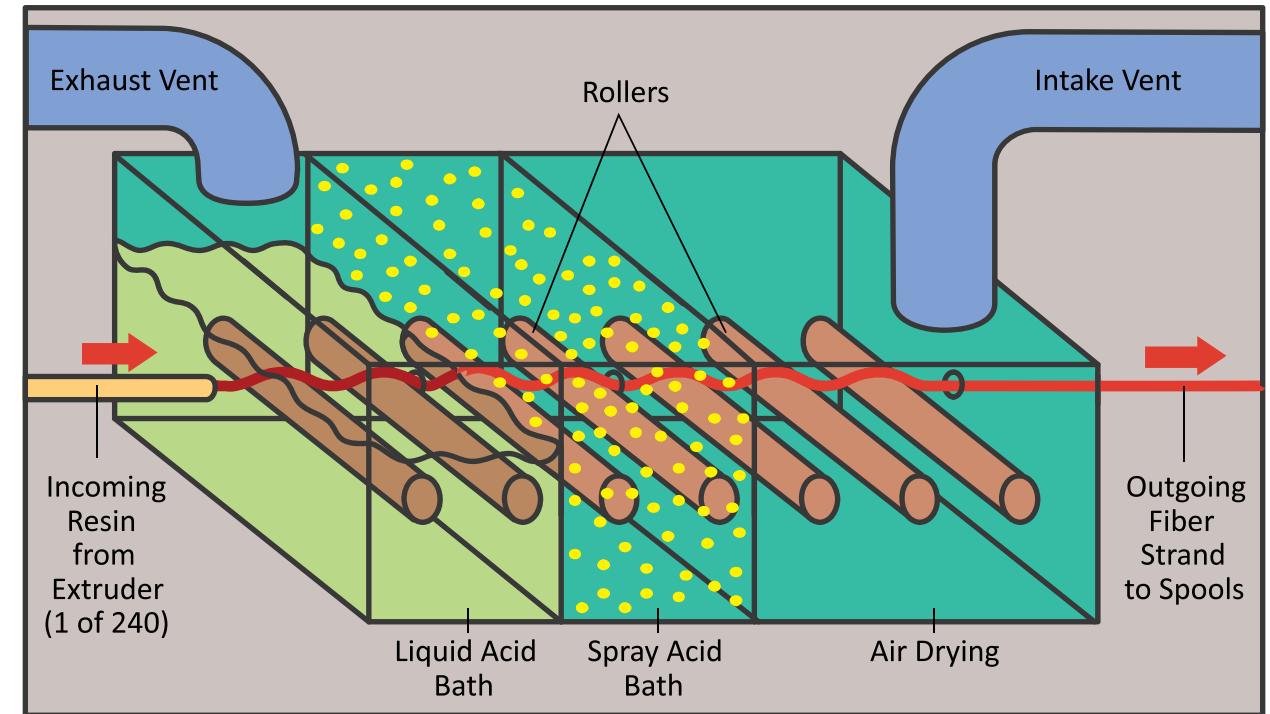
Each machine produces 240 strands of ArmorTex simultaneously. Each strand is produced by forcing the thick liquid resin through a tiny nozzle into an acid bath which hardens it.

3

The acid for the machine is constantly circulated through a high-capacity filter. Each strand is kept separated from the others by a series of ferrules and hard rubber rollers as it goes through the acid bath.

4

After the acid bath, each strand goes through the drying chamber. Each machine has its own air system, so it can be started and stopped independently.

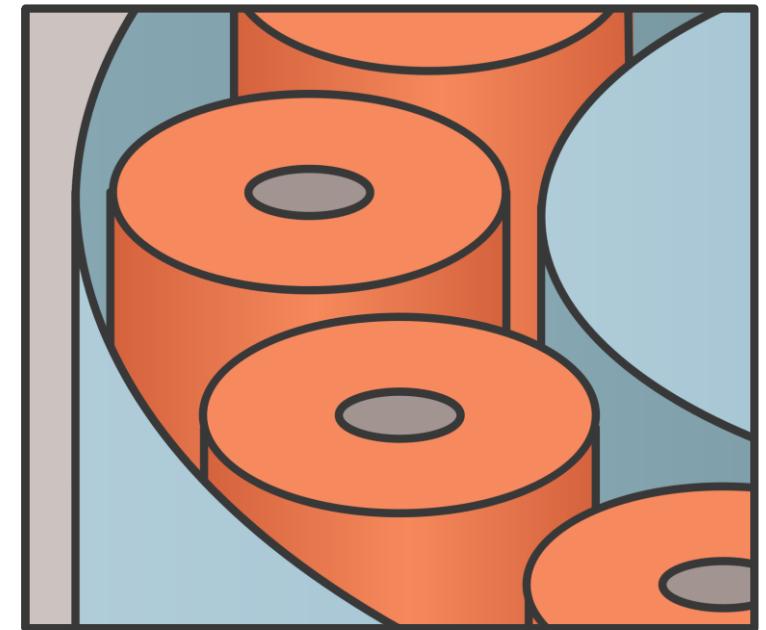


Acid Bath/Drying Chamber

After ArmorTex has dried, it is spun into spools which are arranged in a large circle next to the drying chamber. Production is regulated so that one spool is filled every two minutes.

5

An operator replaces full spools with empty ones. Full spools are placed on a cart which is pushed from spool to spool. One operator per shift can remove and replace all 240 spools.



Fiber Spools

Last week, production almost stopped when the third shift nearly ran out of raw materials. The supplier agreed to keep one of their older diesel trucks loaded and available. They can make an emergency delivery within 30 minutes.

This is a good thing because at 3:30 a.m. today, third shift ran low on raw materials again. The supplier was called to make an emergency delivery.

At 3:52 a.m., the Machine 1 operator, a new employee, replaced one of the spools. The fiber on the outside was a dirty black, instead of clear. There was more black fiber on the next spool and the next. When the operator touched the fiber, black powder came off on the fingers, revealing clear fiber.

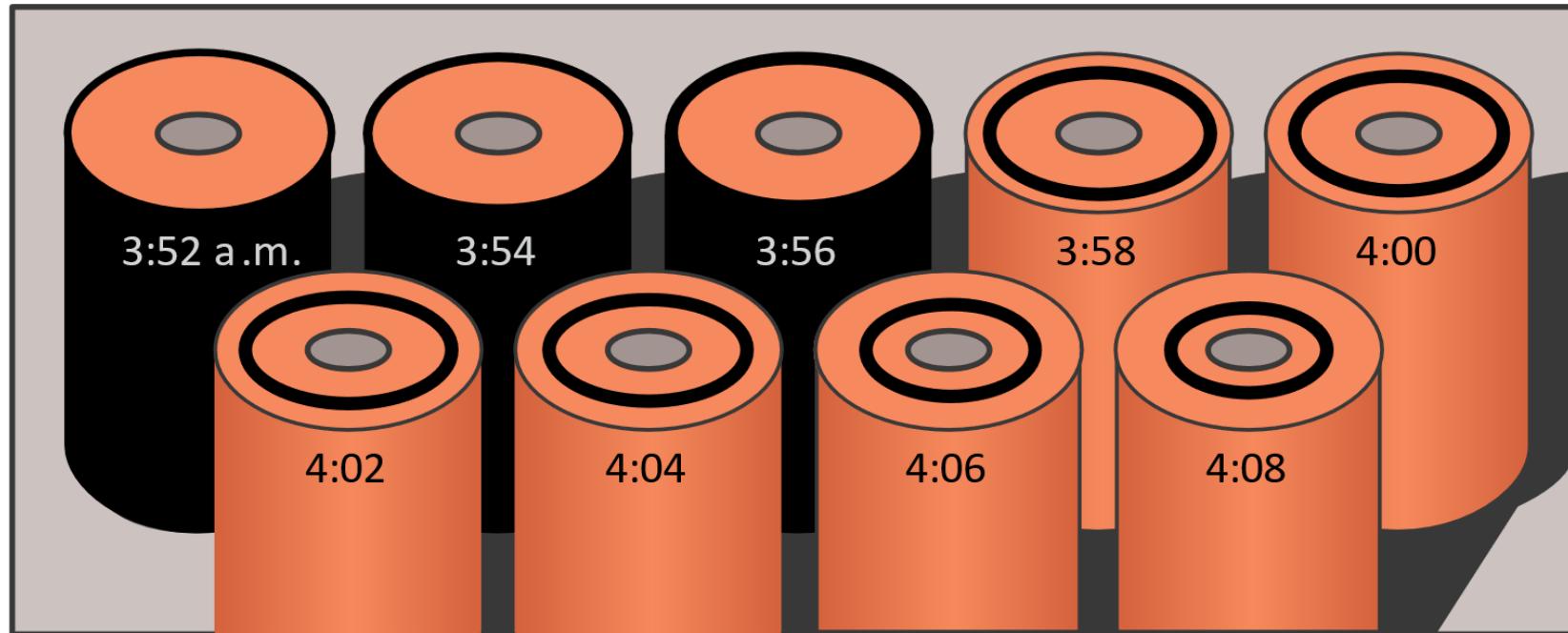
The operator called the relief operator. The relief operator took one look and went to get the senior supervisor on the shift. The senior supervisor arrived at 3:59 a.m.

The black fiber on the outside of the last spool filled was overlaid by a few strands of clear fiber. The next spool showed more clear fiber on top of the black. With each successive spool, the ring of black fiber was buried deeper and deeper. There was a ring of black plastic somewhere in the spool for each of the 240 strands.

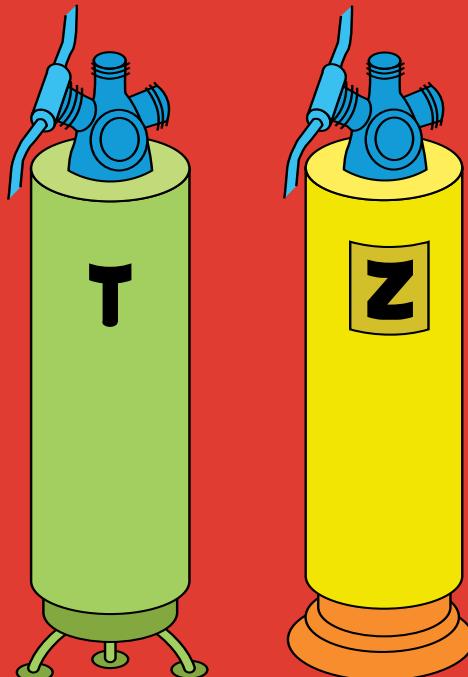
So far, everything appears to be all right on the other five machines. The operator thinks it is something in the drying area. Perhaps the ferrule guides that separate the strands are defective, or the hard rubber rollers are worn, or something is in the air. The supervisor has seen fiber discoloured by defects in raw materials and by contaminated acid.

The spools which contain black fiber have to be discarded. ArmorTex fiber is expensive and it's important to minimize scrap. Until they find the cause, nobody knows whether Machine 1 will produce more black fiber or whether black fiber will be produced by the other machines. It is extremely critical not to shut down or restrict production.

What would you do?



Typhoon Compressor Questioner



Solve the maintenance problem.

Read your information.

Work in pairs.

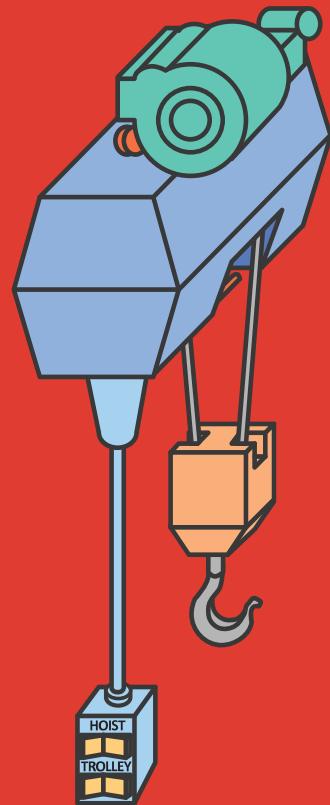
The Questioner asks process questions and records information on a worksheet.

Finish by _____.

You just started as maintenance mechanic for a boiler shop and welding shop. You have been asked to find out why the Typhoon air compressors are causing trouble. The rings were replaced an average of nine times per Typhoon last year.

You don't know very much about these compressors. You have to ask questions to find out what has been happening.

Hefto Hoist



Read your information.
Work in teams.
Show work on easels.
Write a Problem Statement.
Develop a Specification.
Identify any missing information.

Finish by _____.

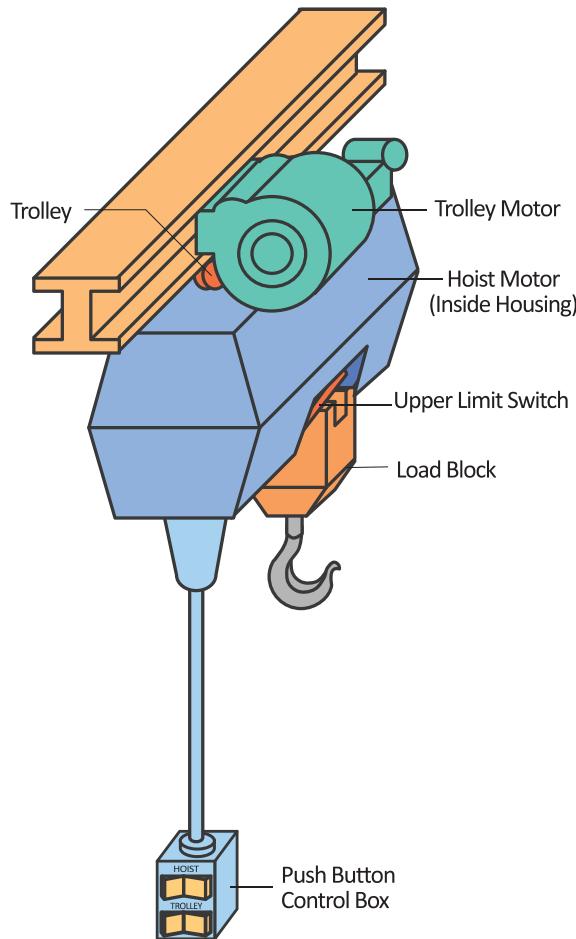
In your organization, boxes and light-weight crates are moved in and out of the storage area by forklift trucks. Heavier loads are moved by wire-rope (cable) hoists. Two forklifts and three hoists are assigned permanently to the storage area.

The three hoists were purchased from Hefto Hoist five years ago, and are all the same model: 2-ton, 230/460 volts, 3-phase, 60 Hertz. They have 3 horsepower hoist motors and run at a single speed. All are mounted on identical motorized trolleys, and have a 35-foot (10.6 m) lift capacity. The storage area has its own electrical power supply and all the motors are fed from it.

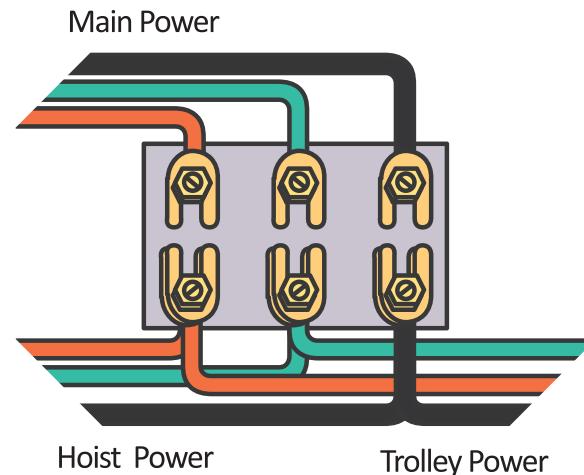
Once a year the hoists and trolleys are dismantled for maintenance. All motors are taken to the electrical shop and overhauled there. Back in the storage area, pushbutton control boxes are opened and the wiring is checked. When the hoists are reinstalled, the wire rope cables are run out all the way and removed. New cables are attached and run up.

This year, hoists A and B were working fine when they were taken down for the routine check, but C had been slipping. The overhaul was completed yesterday. Before being returned to the storage area, the motors were taken to the electrical shop's quality control inspection station. They were tested there, passed for operation and rotation, and reinstalled this morning.

Close-up of Jammed Hoist



Hoist Input Power Terminal Block



1

Under normal operation, there is an upper limit switch that prevents the load block from being taken up too high. This is a paddle which automatically moves up when the block gets close to the top, and shuts off the power to the up circuit only. There is no lower limit switch so the cable can be run out to its full length.

2

For greater stopping and holding power, each hoist is equipped with a direct-acting motor brake. The brake engages instantly when the operator releases the control button.

The first time hoist A was used this morning, it went down when the “up” button was hit. The operator then reversed it by pushing the “down” button and ran it to the top, where the limit switch should have stopped it. It didn’t though, and the hoist jammed. Trying hoist B, the operator found that it too ran down when the “up” button was pushed. While running it back up (using the “down” button) to test the limit switch, it kept going and jammed just like A. Hoist C was checked by another operator and found to operate perfectly. All three trolleys are working fine, too.

You checked with maintenance and were told that A’s and B’s motors had been rewired. Hoist C needed such extensive repairs that it was scrapped and replaced with an identical, factory-new hoist. New units are not tested before the first use. The replacement went straight from the Hefto factory to installation and use in the storage area.

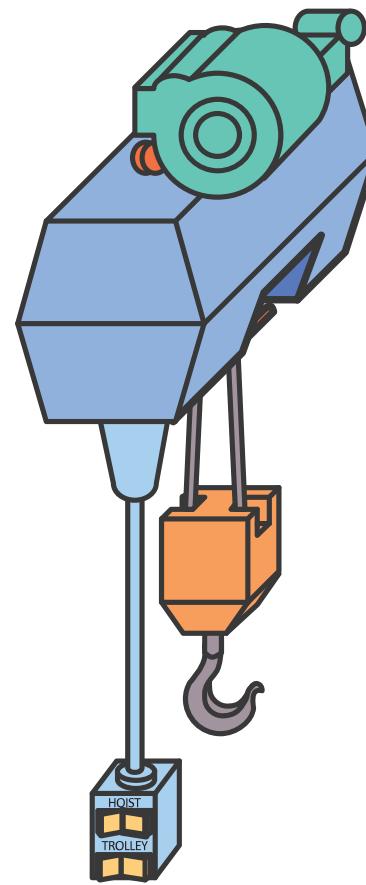
The two old hoist motors and the three old trolley motors were rewired by an apprentice in the electrical shop. Then they were sent to the shop quality control inspector, who passed them all. Next they were reinstalled by an experienced electrician, who also checked the wiring in the pushbutton control boxes. An apprentice rigger replaced the cables on both A and B, ran them up and down a few times, and everything seemed okay.

Even with hoist C in constant use all morning, loads are piling up and the storage area is a mess. Everyone on the floor is sure they know what caused the problem.

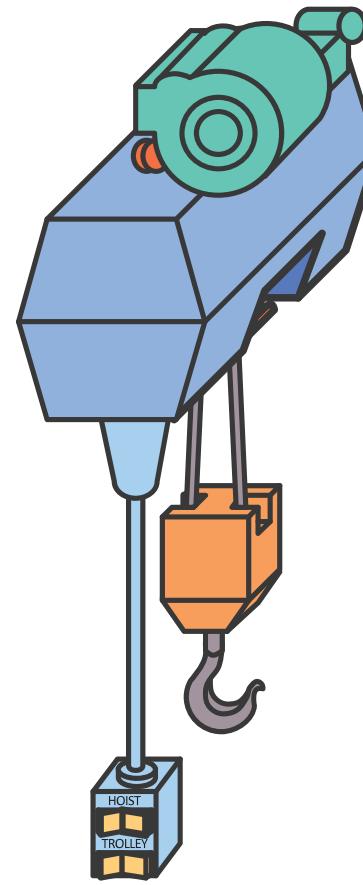
Hefto Hoist

The Problem

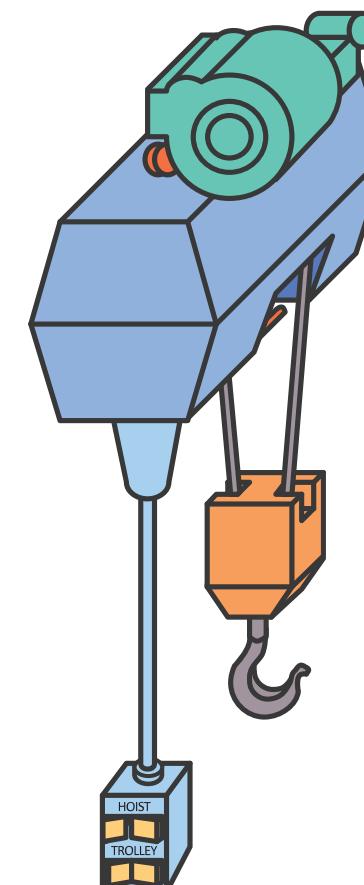
A



B



C



Sampson: "It's the motors! That dumb apprentice crossed the leads and wired them in reverse. That's why they're running backwards.
(Chief Electrician) Apprentices these days are good for nothing. You can't trust them to sweep the floor, never mind rewire a motor!"

Bradley: "Are you kidding? I watched that electrician install the motors. He couldn't wait to get down to the cafeteria before coffee
(Hoist Operator) break time. Want to bet that's who crossed the leads?"

Watson: "How about that rigger? Another apprentice. They don't know up from down—probably pushed the wrong button when
(Storage Supervisor) running the new cable up."

Polo: "Listen, anybody could make that mistake. Those buttons are five years old and the letters are just about rubbed off. There's
(Chief Rigger) no way to tell which is which until you push them. Even then either one will send the cable up if it's been run all the way out.
But my people aren't the only ones who handle the switches. You heard Bradley—that electrician's mind was on coffee
break. He could have opened the control boxes to check them and reversed the leads then."

Earle: "You know, a couple of years ago we had a bunch of motors that were turning the wrong way. We found out someone had
(Forklift Driver) reversed the bench power in the shop so it was out of phase. I'd check the shop power before I chewed out those
apprentices."

Baxley: "Earle's got something there. But it could be the bench power's reversed at the test station, too."
(Apprentice Electrician)

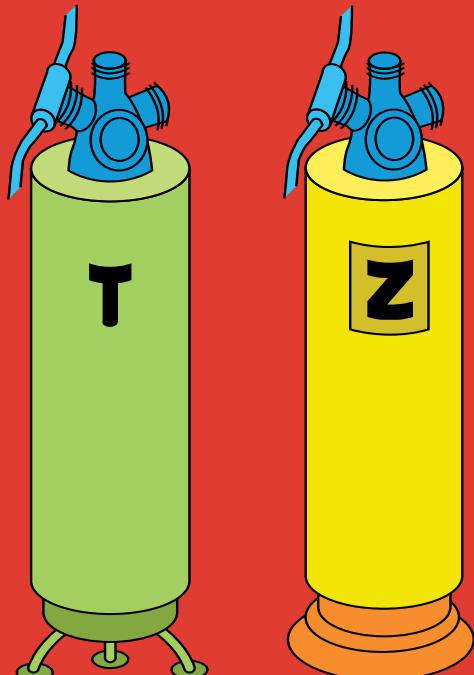
Burns: "Or maybe our power supply to the hoists is reversed. They're always coming in from the main shops and
(Hoist Operator) doing something to our power. They never tell us what they're doing."



Who do you think is right?

Typhoon Compressor

Information Source



Read your information.

Work in pairs.

The Information Source answers the questions.

Finish by _____.

You have worked in maintenance for seven years. You know the welding shop and boiler shop inside and out.

The new maintenance mechanic wants to ask you some questions about the Typhoon air compressors. The mechanic wants to know why so many rings are being replaced on these compressors.

You haven't given much thought to the problem. You'll answer any questions the mechanic asks you, but you're not about to volunteer any information. Here's what you know.

Typhoon Compressor

What

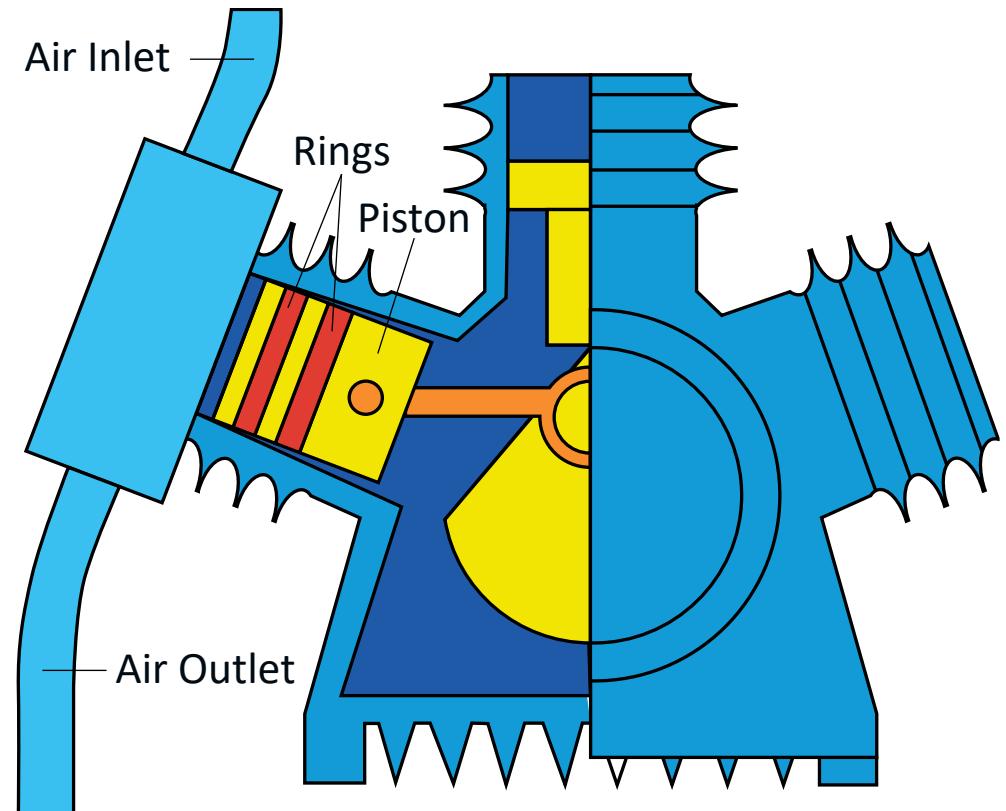
There are three Typhoon air compressors and six Zephyr air compressors in the plant.

The problem is excessive ring changes on the Typhoons. The Zephyrs are not showing excessive ring changes.

Of the three Typhoons, two need excessive ring changes, the other does not.

The rings must be changed because they are wearing. They are not breaking or seizing.

Specifically, Typhoon numbers T1357 and T1586 wear out rings too quickly. Typhoon T1361 shows normal ring wear.



Typhoon Compressor

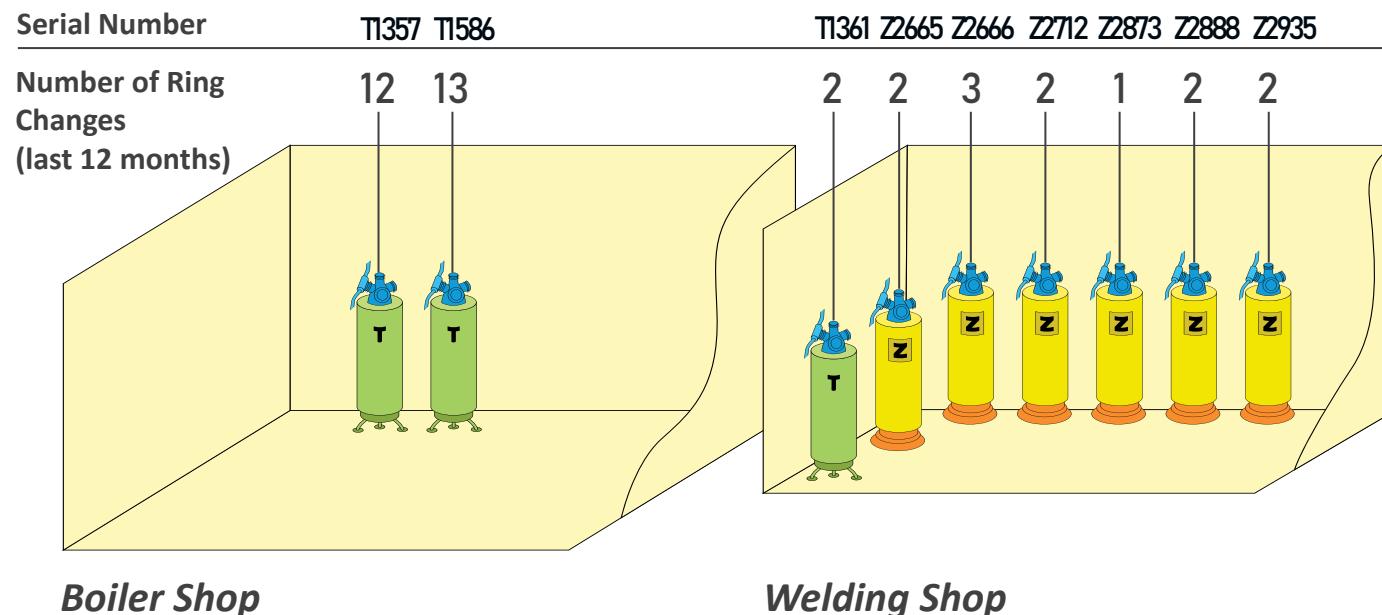
Where

The Typhoons and the Zephyrs are all located in either the boiler shop or the welding shop.

The boiler shop has two Typhoons; the welding shop has one Typhoon and six Zephyrs.

See drawing for location by serial number.

The wear is seen on the compressor rings. No ring measurements were taken. No specific location on the rings is known to be worn.



Note: If Questioner asks for drawings of details of the compressors or location of the compressors by serial number, show them the images on the pages after the When / Extend page.

Typhoon Compressor

When

The crew in the shops said that both the Typhoons and the Zephyrs were running fine until about five months ago. Then the Typhoons started to need rings frequently.

Since that time, the Zephyrs have been fine but the Typhoons have been wearing out rings over and over. It seems like they are changed every week or two.

All of the compressors were bought from the same manufacturer. They were purchased in one's and two's. The newest compressors were delivered 18 months ago.

Extent

Two out of nine compressors are having the problem.

Specifically, two out of three Typhoons are having the problem.

There is no data on the size or amount of wear on the rings. The rings were just replaced without measuring the wear.

Since they started wearing rings so fast, it seems like the rings on a Typhoon need to be changed every week or two. That has been constant since the problem started.

Typhoon Compressor

Other Information for Finding and Testing Causes

The Typhoon and Zephyr take the same type of carbon steel piston ring.

At the last maintenance inspection ten months ago, the three Typhoons did not have filters in their air intakes. Maintenance decided to leave them alone since they were working fine.

Typhoons T1357 and T1586 are used in the boiler shop. T1361 is used in the welding shop.

Within the last seven months, 10 of the 50 people who worked in the boiler shop have left. Four retired and six transferred to other shops.

In the welding shop, steel plate is cut, fabricated, and welded. Most of their air-powered tools are used on and off. The welding shop's Typhoon is used to run hand grinders which are used almost constantly to smooth welds.

In the boiler shop, new boilers are built and old ones reconditioned. The two Typhoon compressors run air-driven scaling tools. The tools are used to grind rust and scale from the old boilers.

Typhoon Compressor

The boiler shop is larger than the welding shop and is located across the hall. It has a different crew. Both shops are hot and noisy.

The boiler shop has been a lot worse since the contract to salvage some really old boilers began six months ago. It was bad enough when new boilers were being built and used ones were being cleaned. Now it is almost impossible to breathe with all the dust in the air.

Over the last six months, there have been constant complaints and a dozen requests for transfer from people in the boiler shop.

You are wondering if the turnover has something to do with the problem. Maybe inexperienced workers are not handling the air-powered tools properly.

Microcomputer Cabinets



*Read your information.
Work in teams.
Solve the problem.
Show your work on easels.*

Take ____ min. Finish by ____.

You're a trouble-shooter. Your company makes three kinds of microcomputers: the 1025, the 1035, and the 1045. The company sells more 1025s than the other two models combined and this is the peak period. In the last two weeks the reject rate for 1025s has risen. The company wants to know why.

Microcomputer Cabinets

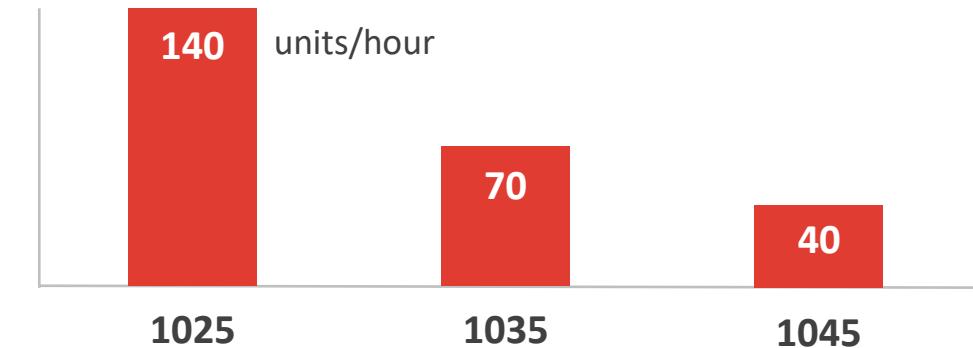
Background

The demand for computers varies over the year. Your company can usually cope with the changes in demand. You are now in the middle of your peak period which is six weeks long.

You took on new employees two weeks before the start of the peak period. They work with experienced people on both assembly lines. This provides on-job training and helps prevent mishandling of the units.

All three models are produced in a similar way. The basic process involves assembly, cabinet painting and quality control. The 1025 is produced on Line 1. The 1035 and 1045 are both produced on Line 2.

This week's production rate

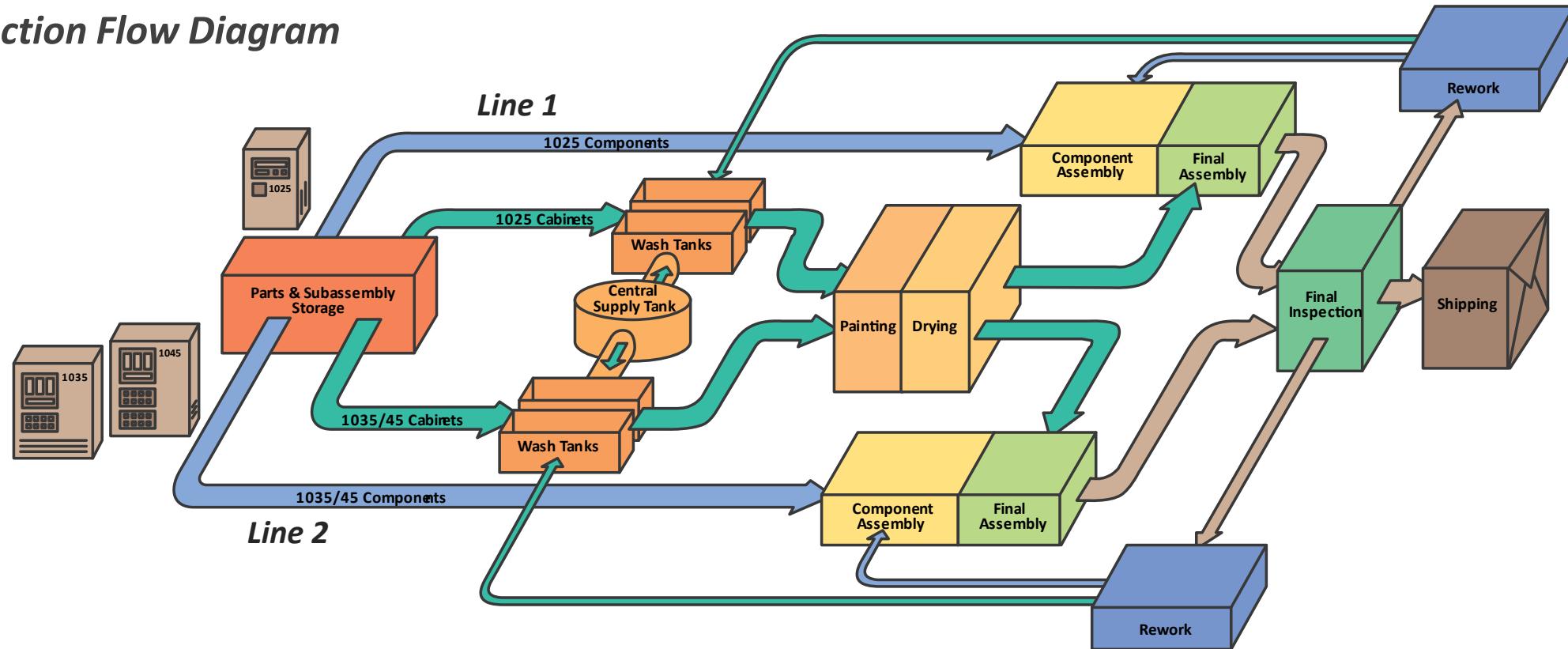


During your peak period, production rates increase weekly. Each line has increased production in each of the last three weeks. Here are this week's production rates. Rates will increase again tomorrow. They will continue to rise for three more weeks.

Microcomputer Cabinets

The Production Process

Production Flow Diagram



1

- Each line has its own supply of components, which are assembled into the computer chassis. Components are tested during assembly. While the components are being assembled, the metal cabinets go through wash, paint, and dry operations.

2

The cabinets are washed by dipping them in a cleaning solution that removes contaminants and oils. The cleaning solution is changed every half hour. Each line has two wash tanks. One is used while the other is drained and filled with fresh solution. The tanks on both lines are filled from a central supply tank.

3

After washing, the cabinets are hung by hand on the Line 1 and Line 2 conveyors. The cabinets are hung from grounded (earthed) hooks. Both conveyors move at the same speed through the paint booth. Electrostatically charged paint is sprayed onto the cabinets. After painting, the units enter the drying section.

4

After drying, the cabinets go to final assembly. There the chassis are put into the cabinets. The finished units are sent to quality control, then to shipping.

5

Final inspection is done in three stages: electronic, operational, and visual. Computers rejected in final inspection are sent to the rework sections. Faulty components are repaired or returned to the supplier. Faulty cabinets are stripped, washed, and returned to the washing operation for recycling through production.

Microcomputer Cabinets

The Problem

The 1025 reject rate is normally 0.15%. It is currently over 6% and still rising.

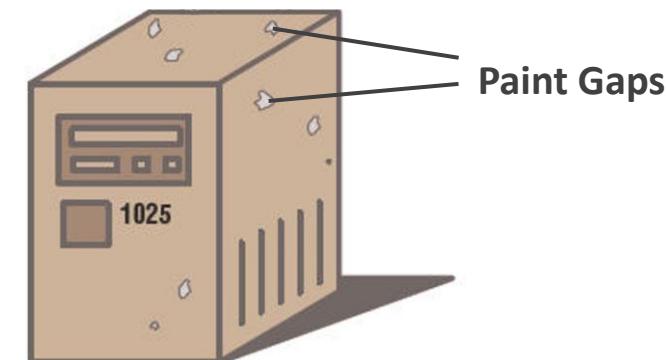
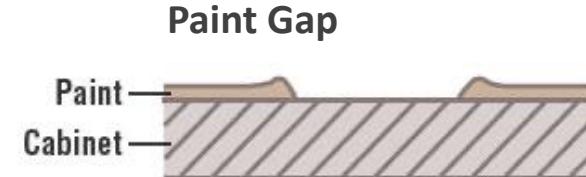
Every microcomputer goes through all three final inspection stages. Lately, a significant number of 1025s are being rejected periodically at final visual inspection due to gaps in the paint. A rejected cabinet may have as many as 11 different gaps in the paint coverage. These gaps appear randomly on the painted surface of the cabinets.

This is frustrating for experienced people who saw the same kind of reject rate on 1025s during last year's peak period. After a few weeks, they learned that some employees were wearing a silicone hand cream which can prevent paint from sticking. Management posted a list of acceptable hand creams in the washrooms. Within a week, the reject rate returned to normal.

The reject rate for 1025s has been increasing over the last two weeks. The reject rate for 1035s and 1045s is normal.

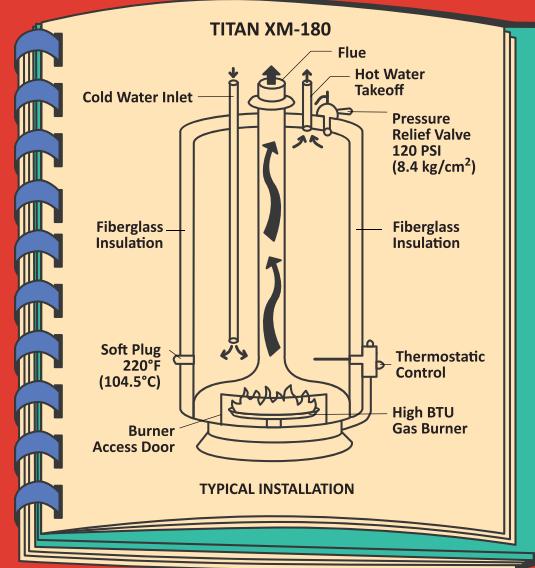
The operation of the microcomputers is unaffected, but the units cannot be sent to customers. The rejected cabinets are stripped and repainted, so there is no increase in scrap. However, key customers are complaining about late delivery of their 1025s.

How can you fix this problem?



The New Water Heater

Questioner



**Titan XM-180
Installation Manual**

Solve the new water heater problem.

Read your information.

Work in pairs.

The Questioner asks process questions and records information on a worksheet.

Take ____ min. Finish by ____.

You are a troubleshooter. You look after all the equipment in a new quality control and testing station. A year ago, a 100-gallon (380 liter) hot water heater was installed in the station. The heater wasn't large enough to meet the needs of the station. Four months ago, it was replaced by a Titan XM-180 hot water heater.

The Titan XM-180 is a 180-gallon (684 liter) quick-recovery water heater. It produces a large volume of very hot water at a constant temperature. The water is only 2°F (1.1°C) below boiling. A diagram from the Titan XM-180 Installation Manual is provided.

The heater is protected from explosion in two ways. There's a pressure relief valve set at 120 PSI. There's also a soft plug screwed into the side of the tank. The plug melts and blows out at 220°F (104.5°C).

You just got a message about the new water heater. "The heater is making bubbling noises. I think we're going to have another blowout." You called to say you would be right there.

Mrs. Walther's Square Donuts

The Problem

Read your information.

Write your questions on the Question Sheet.

Program Leader will give you written answers.

Ask as many questions as you want.

Finish by ____.

You are the troubleshooter for the second shift at Mrs. Walther's Donut Factory. You are responsible for correcting all equipment problems.

There have been many problems with the sugaring equipment. These have been corrected. The manufacturer installed a new sugaring system two weeks ago. Since then, the sugaring system seems to run smoothly.

Just over an hour ago, you were called to the hot oil cooker. The chain that drives the donut turner was broken. You ran the dough strip into the waste bin, then you moved the donuts that were already in the oil through manually.

Within five minutes, you replaced the chain and the system was running smoothly. The production loss was nearly 1,500 donuts.

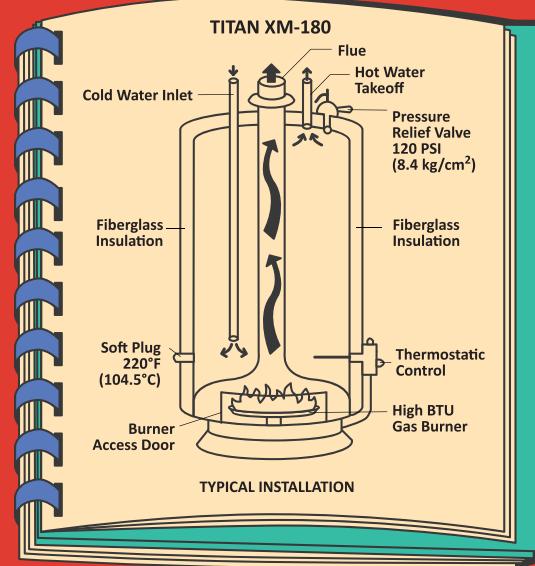
Now you have a bigger problem. The quality control inspector just called. Since start-up after the chain breakdown, the reject rate for sugar donuts has been about 25%. It is continuing at the same rate. The worst rejects have a round edge and "spikes" of dough on two edges.

You know Mrs. Walther's will lose a lot of money if the problem isn't fixed quickly.

What do you do?

The New Water Heater

Information Source



Titan XM-180
Installation Manual

Individually

Read your information.

Work in pairs.

The Information Source answers the questions.

Take _____ min. Finish by _____.

You're in charge of a new quality control and testing station. A year ago, a 100-gallon (380 liter) hot water heater was installed in the station. That heater wasn't large enough to meet the needs of the station. Four months ago, it was replaced by a Titan XM-180 hot water heater.

The Titan XM-180 is a 180-gallon (684 liter) quick-recovery water heater. It produces a large volume of very hot water at a constant temperature. The water is only 2°F (1.1°C) below boiling.

You just called the troubleshooter who looks after your equipment. Your new hot water heater is making the same bubbling noises as before, and you're afraid the soft plug is going to blow again. The troubleshooter is coming right over.

The New Water Heater

What

The problem is with our Titan XM-180 water heater. This is the only water heater in the station.

The problem is overheating.

Specifically, the problem is that the soft plug melts and blows out. This floods the room with boiling water and steam, doing lots of damage. We have a picture of the water heater and the worst damage from the insurance adjuster.

The manufacturer has inspected the heater. They have many other XM-180s installed and none of them have had any trouble like this.

Where

The unit is located in the station supply room. The space is very small, but there is no other place to put the water heater.

We have a diagram the insurance adjuster made, showing the location of the water heater in the room.

The soft plug is located on the side of the XM-180 at the bottom. If you look at the adjuster' photograph, you can see the plug on the lower right.

The New Water Heater

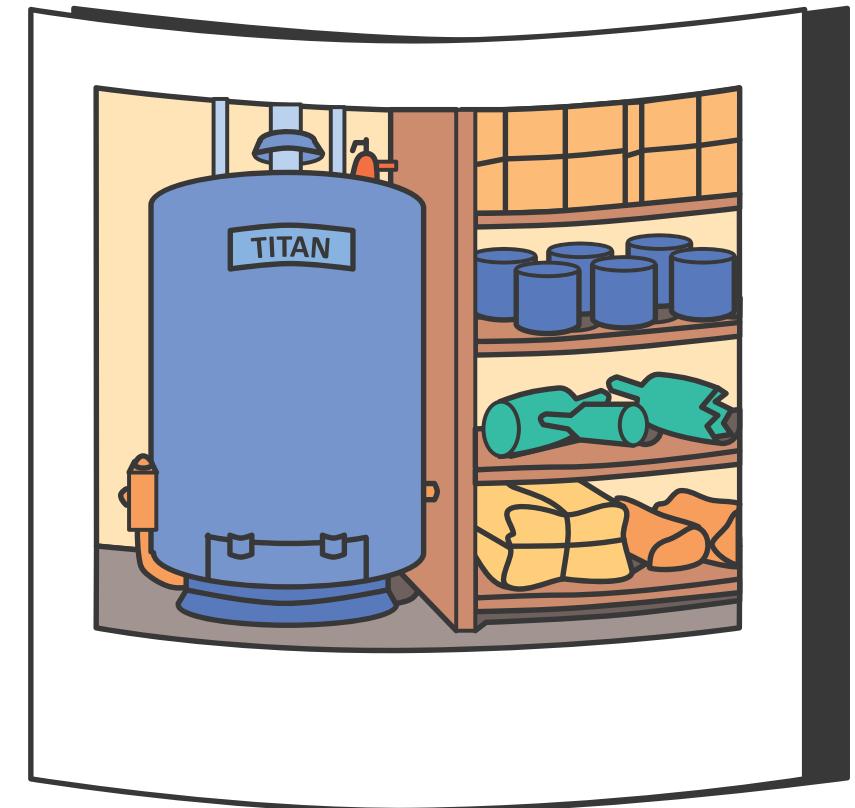
When

The heater was installed four months ago. It has blown its soft plug twice since then. Both blowouts happened on days when the station was using a lot of hot water.

The first time a plug blew was only 20 days after the heater was installed.

The second problem happened five weeks ago. That was when we decided to either fix the heater or replace it with a more reliable one.

Note: If Questioner asks for pictures of either the actual water heater and the damage it has caused, please show them the images after the Extent page.



Insurance Adjuster's Photograph

The New Water Heater

Extent

The problem is just with this one Titan XM-180. Of course we only have one water heater.

The soft plug has melted and blown completely.

The soft plug has blown twice.

We don't have enough information to see a trend. It won't matter anyway because if it fails again we'll replace it with a different heater.

Other Information for Finding and Testing Causes

The XM-180 delivers hot water only 2°F (1.1°C) below boiling. That is why it has both a pressure relief valve and a soft plug to protect it from explosion.

The plumbers made some modifications when they installed the water heater because the space was so small.

The thermostatic control is extremely sensitive. It has been replaced twice and adjusted several times.

The soft plug blows if the water temperature reaches 220°F (104.5°C). The pressure relief valve blows when the pressure in the tank reaches 120 PSI.

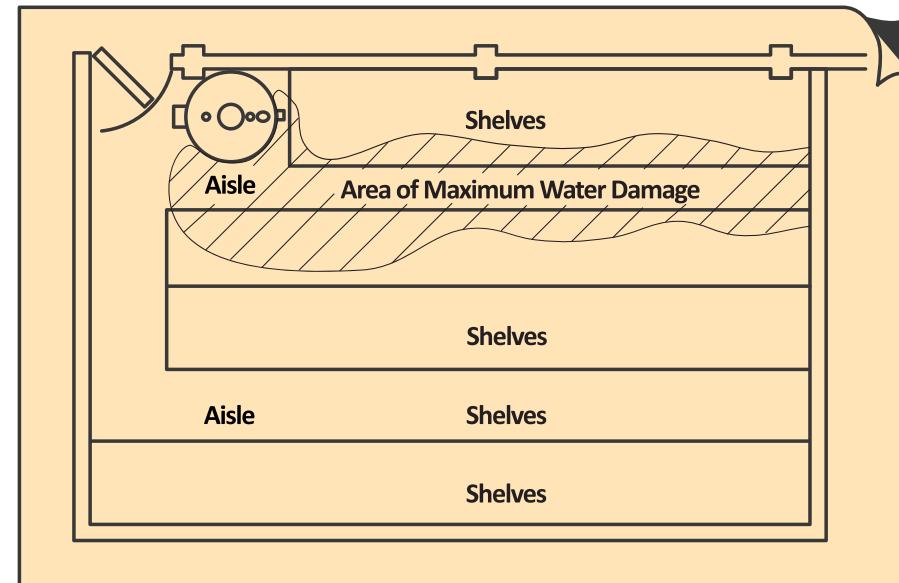
The New Water Heater

The times when the soft plug blew were times when the station was using the most hot water.

The station's demand for hot water has never exceeded the rated capacity of the Titan XM-180.

People from Titan have looked at the heater. They have no idea why the soft plug is blowing out. They say that they have not seen this kind of problem with any other Titan XM-180s.

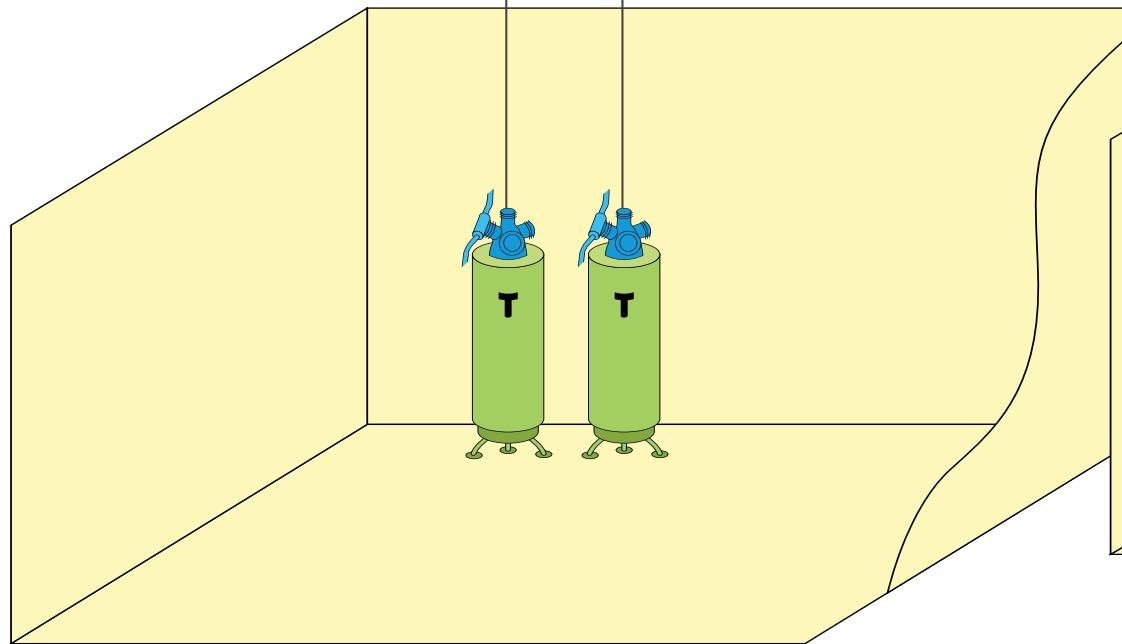
Insurance Adjuster's Photograph



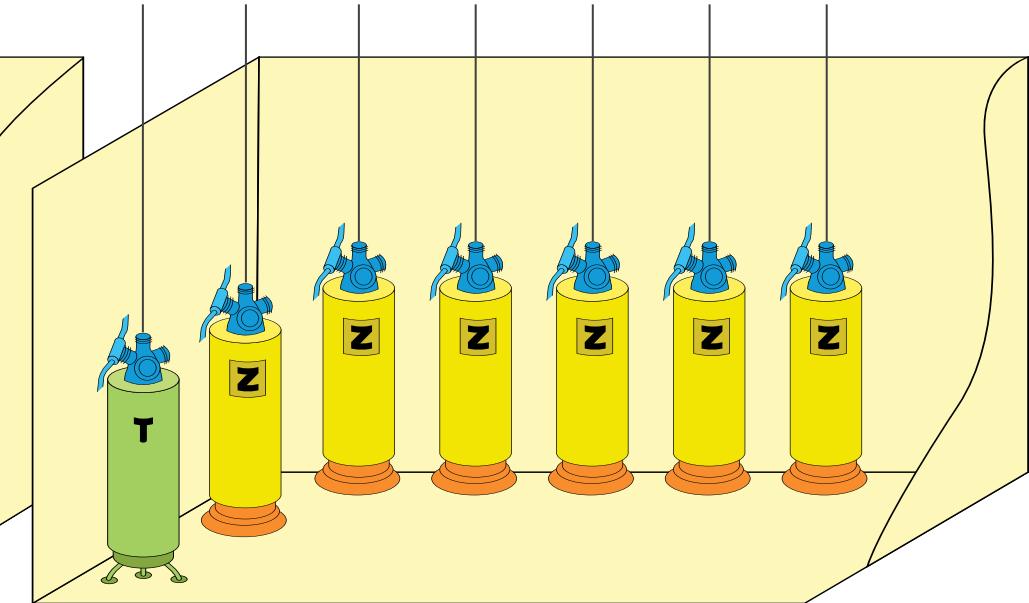
Typhoon Compressor

Serial Number

T1357 T1586

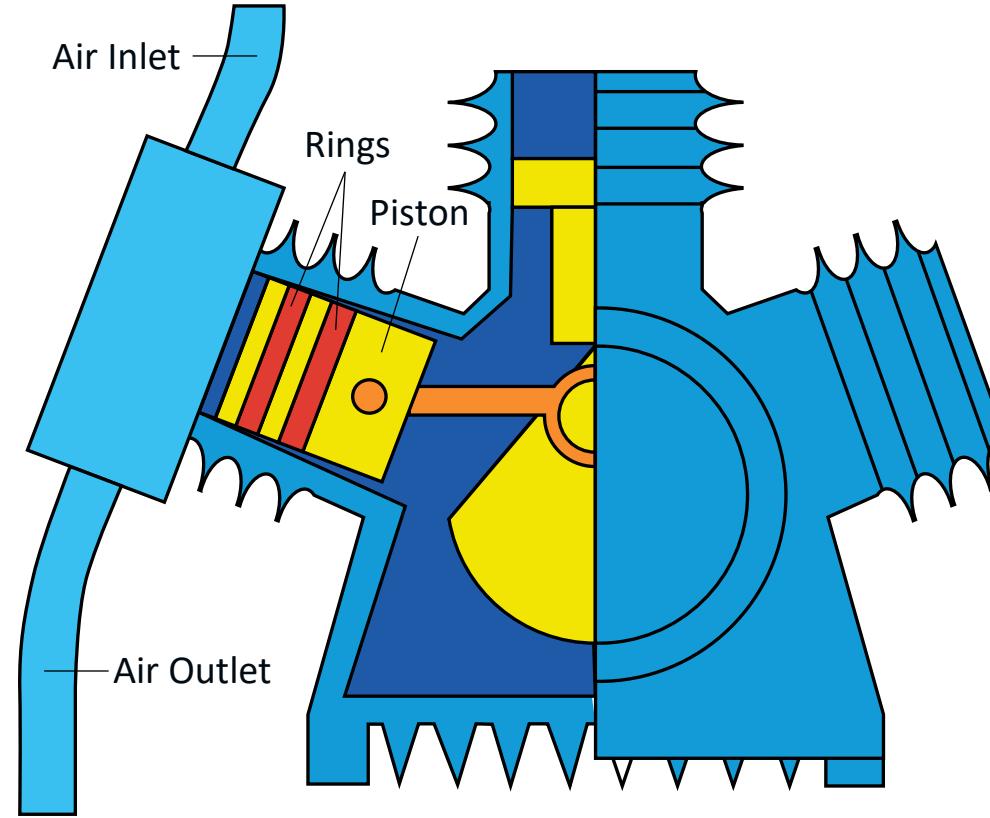


T1361 Z2665 Z2666 Z2712 Z2873 Z2888 Z2935



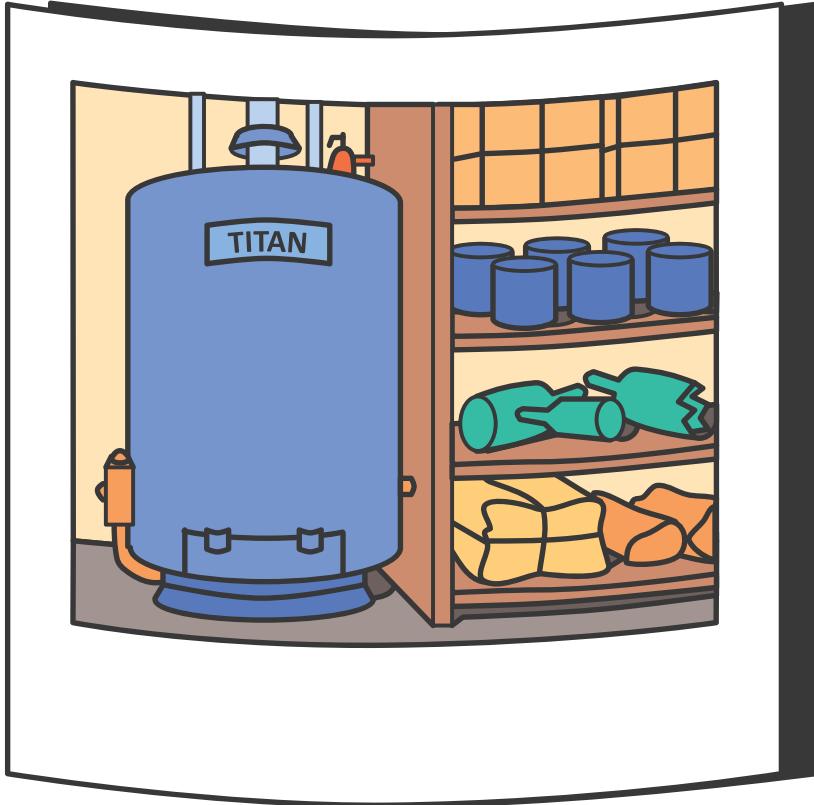
Typhoon Compressors

Typhoon Compressor



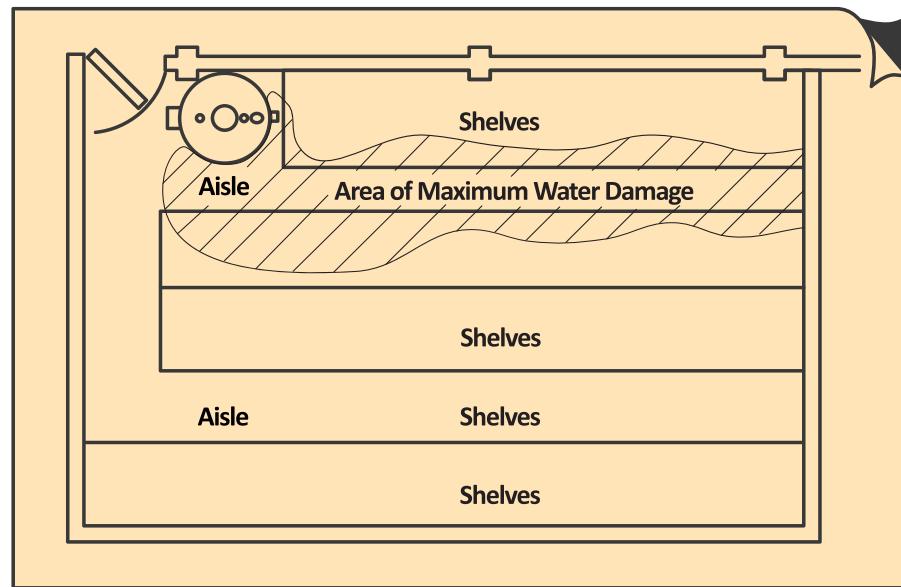
Detail of Typhoon and Zephyr Compressors





Insurance Adjuster's Photograph

Insurance Adjuster's Photograph





Kepner
Tregoe

*Challenges
Opportunities
Results*

Select a Fix



Clear thinking for difficult decisions

Cases

Fixing the Donut Machine (A)

First Shift Supervisor

Individually

Read your information.

In teams

State the Decision.

Develop objectives.

Classify your objectives.

Show your work on easels.

Finish by ____.

Mrs. Walther's Square Donut Factory needs to do something about the vibration around the donut machine cutter.

Last week, an edger on Row 1 vibrated loose. It fell off, went through the cutter and bent several blades. The edger travelled down the fast line and fell into the hot oil bath. It blocked the turner bar and broke the turner chain.

Since then, the edgers are checked more frequently. Two more edgers have vibrated loose, but they were quickly tightened.

Fixing the Donut Machine (A)

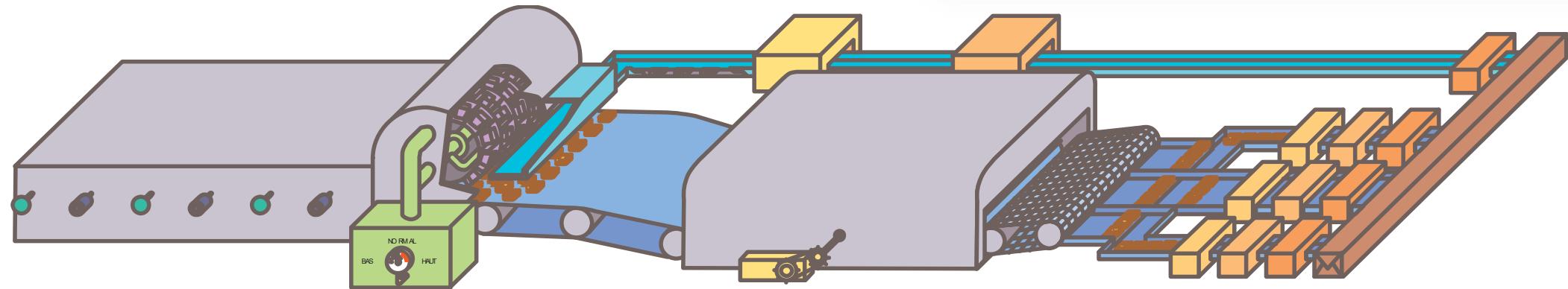
Background

The troubleshooters have proof that the vibration is created in the air-system manifold. Years of regular cleaning have worn away the metal. This has created a harmonic vibration in the high-pressure air system.

Consulting engineers have come up with four options for fixing this problem. We need to choose one of these fixes. The consulting engineers recommend building a new cutter assembly. They have offered to submit a proposal for designing and building the new assembly.

- 1 Metalize and rework the existing high-pressure air manifold.

- 2 Redesign the high-pressure air manifold, adding baffles to prevent harmonic vibrations.



- 3 Lower the air pressure to eliminate the vibration.

- 4 Build a new cutter assembly.

Fixing the Donut Machine (A)

Background

The Operations Manager is away at the National Baker's Convention. Before she left, she arranged a meeting to choose the best option. She asked the following people to attend:

- Pat Oliverio, First Shift Supervisor
- Chris Boyd, First Shift Operator
- Al Martinez, Mechanic
- Jim O'Briant, Second Shift Supervisor

Since the Operations Manager won't be back until after the meeting, she emphasized these things:

- The group's recommendation for a permanent fix will probably be implemented.
- The fix cannot cost over \$54,000. That's all the budget can spare this year.
- If possible, minimize the downtime needed to implement the fix.
- If possible, the fix should not require additional people. She will consider adding people, but only as a last resort.

Fixing the Donut Machine (A)

Pat Oliverio
First Shift Supervisor

MRS. WALTHER'S SQUARE DONUTS

Name: Pat Oliverio

Title: First Shift Supervisor

Employee no. 453-0021

You are glad the donut machine will be fixed. You believe there are several factors to consider before a fix is chosen.

Mrs. Walther's is planning a special donut promotion. Therefore, the timing for fixing the machine is important. The donut machine needs to be fixed within six weeks.

It may not be possible to completely eliminate the vibration, but the fix should minimize it. The option that reduces the vibration the most is best.

The current donut production rate is 18,000 donuts per hour. It is important to keep the donut production rate as high as possible.

Minimizing costs is also important.

You're ready to recommend the best fix for the donut machine. You are glad that the group's recommendation will probably be implemented.



Fixing the Donut Machine (A)

First Shift Operator

Individually

Read your information.

In teams

State the Decision.

Develop objectives.

Classify your objectives.

Show your work on easels.

Finish by ____.

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Since then, the edgers are checked more frequently. Two more edgers have vibrated loose, but they were quickly tightened.

Fixing the Donut Machine (A)

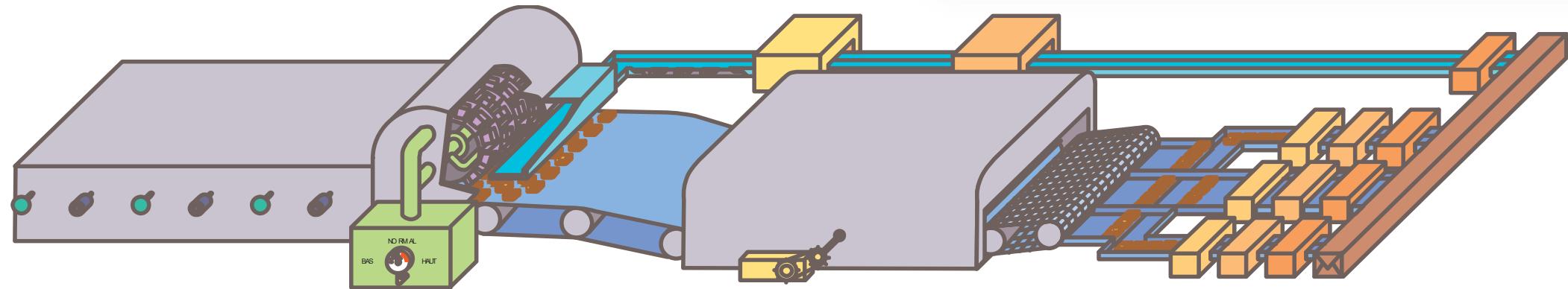
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- 1 Metalize and rework the existing high-pressure air manifold.

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- 3 Lower the air pressure to eliminate the vibration.

- 4 Build a new cutter assembly.

Fixing the Donut Machine (A)

Background

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Fixing the Donut Machine (A)

Chris Boyd
First Shift Operator

MRS. WALTHER'S SQUARE DONUTS

Name: Chris Boyd

Title: First Shift Operator

Employee no. 453-0089

You're glad you've been asked to take part in this meeting. You have been thinking about how to fix the donut machine for good. There are several factors to consider before recommending a fix.

The donut machine needs to be in top condition for an upcoming sales promotion. It is important to minimize downtime to implement the fix.

It is also important to reduce downtime for maintenance and cleaning during normal operation.

You hope the option your group recommends eliminates the harmonic vibration. If it can't be eliminated, it should be reduced as much as possible.

It is also important to keep the donut production rate as high as possible.

You are ready for the group meeting to begin. This is a good time to show how the group can work together.



Fixing the Donut Machine (A)

Mechanic

Individually

Read your information.

In teams

State the Decision.

Develop objectives.

Classify your objectives.

Show your work on easels.

Finish by ____.

Mrs. Walther's Square Donut Factory needs to do something about the vibration around the donut machine cutter.

Last week, an edger on Row 1 vibrated loose. It fell off, went through the cutter and bent several blades. The edger travelled down the fast line and fell into the hot oil bath. It blocked the turner bar and broke the turner chain.

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Fixing the Donut Machine (A)

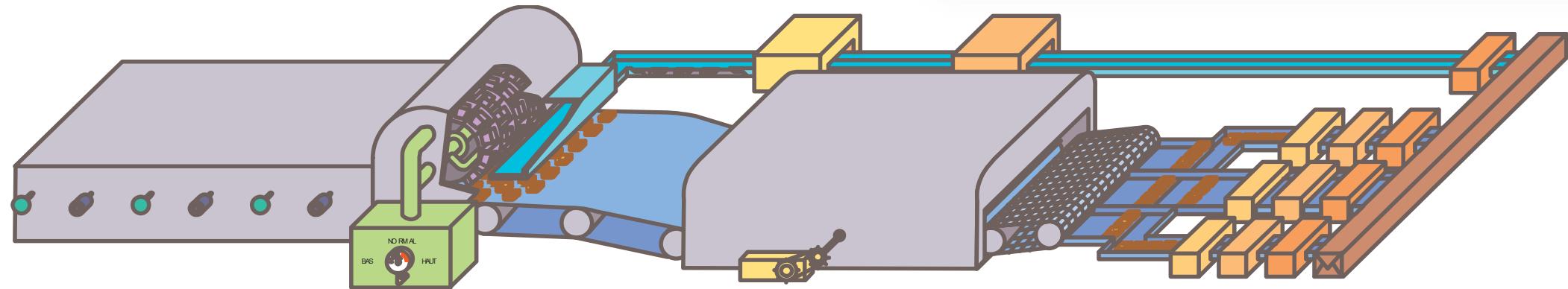
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- 3 Lower the air pressure to eliminate the vibration.

- 4 Build a new cutter assembly.

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Fixing the Donut Machine (A)

Al Martinez
Mechanic

MRS. WALTHER'S SQUARE DONUTS

Name: Al Martinez

Title: Mechanic

Employee no. 453-0038

You are pleased that something will be done to fix the square donut machine. You really like that machine. There are several factors to consider before fixing the donut machine.

Keeping the donut machine running is very important. It is critical to minimize downtime to implement the fix.

It would be nice to reduce downtime for maintenance and cleaning during normal operation.

Keeping installation costs low is also important.

You also heard the donut machine must be running in top condition within six weeks. The fix should be installed by then, or sooner if possible.

You're ready for the meeting to begin. Recommending the best fix for the donut machine is very important.



Fixing the Donut Machine (A)

Second Shift Supervisor

Individually

Read your information.

In teams

State the Decision.

Develop objectives.

Classify your objectives.

Show your work on easels.

Finish by ____.

Mrs. Walther's Square Donut Factory needs to do something about the vibration around the donut machine cutter.

Last week, an edger on Row 1 vibrated loose. It fell off, went through the cutter and bent several blades. The edger travelled down the fast line and fell into the hot oil bath. It blocked the turner bar and broke the turner chain.

Since then, the edgers are checked more frequently. Two more edgers have vibrated loose, but they were quickly tightened.

Fixing the Donut Machine (A)

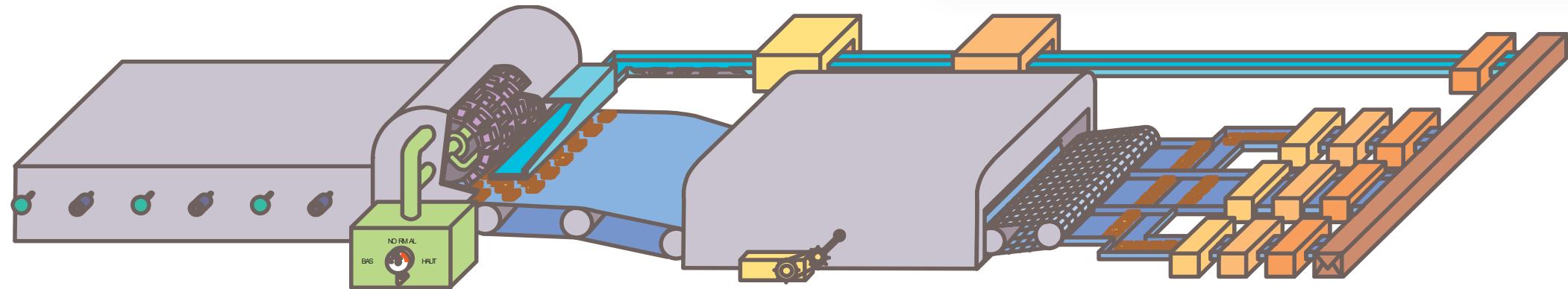
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Fixing the Donut Machine (A)

Background

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- If possible, the fix should not require additional people. She will consider adding people, but only as a last resort.

Fixing the Donut Machine (A)

Jim O'Briant
Second Shift Supervisor

MRS. WALTHER'S SQUARE DONUTS

Name: Jim O'Briant

Title: Second Shift Supervisor

Employee no. 453-0035

Fixing the square donut machine will help the second shift run smoothly. You are glad to be included since the second shift isn't always invited to these meetings.

You have thought about fixing the donut machine. There are several factors that should be considered. Then the group can recommend the best fix.

It may not be possible to completely eliminate the harmonic vibration. The option that reduces the vibration the most is best.

The current donut production rate is 18,000 donuts per hour. It is important to keep the donut production rate as high as possible.

It is important to reduce downtime for maintenance and cleaning during normal operation.

It is also important to minimize downtime to implement the fix. The donut machine needs to be in top condition for an upcoming sales promotion.

You're ready for the meeting to start. Fixing the donut machine will solve many second shift problems.



Fixing the Donut Machine (B)

Information about the four options

Individually

Read your information.

In teams

Consider Alternatives and Risks.

Choose a fix or other action to recommend.

Show your work on easels.

Finish by ____.

This information was gathered about the four options for fixing the donut machine.

Metalize and rework the existing manifold

This is a good idea because it will make the cutters as good as new. The consulting engineers say it will cost almost \$40,000.

If the cutter can be removed without problems, the manifold can be metalized and reworked in five days. The job can be scheduled to start in three weeks.

This option will reduce the vibration by 95%. The donut production rate will stay the same and no more people are needed.

Maintenance for cleaning will be reduced to ten minutes once a week.

There are some risks with this alternative. If there are problems removing or re-installing the cutter wheel, then more than five days' production will be lost. The group will probably be able to prevent these problems.

Fixing the Donut Machine (B)

Redesign the manifold and add baffles

Adding baffles to the high-pressure air manifold will take ten days to install. This can be started immediately. This option will cost \$50,500.

No additional people are required to run the donut machine.

This option will almost certainly eliminate the harmonic vibration, but it will require a 1% reduction in cutter wheel speed.

Maintenance for cleaning will take 35 minutes once a week.

Lower the air pressure

This is another idea worth trying. In fact, the mechanic and first shift supervisor tried it a while back. Lowering the air pressure 5% reduced the vibration 90%. But the cutter blades did not clean as well and you got more reject donuts.

This is by far the cheapest option because it doesn't cost anything to implement. It can be done right away.

No other changes in donut machine operation are required. The same number of people are needed. The production rate is the same.

Downtime for cleaning will probably be two or three times a shift for ten minutes each time. That's about what it is now

There is one bad thing about this option. If the reject rate goes too high, you will need to increase the air pressure again. This may bring back the harmonic vibration that caused the problem.

Fixing the Donut Machine (B)

Build a new cutter assembly

This is probably the best option for reducing harmonic vibration. The consulting engineers guarantee that a new cutter assembly will eliminate the vibration.

It will take at least four weeks to make a new cutter assembly. The new cutter assembly can be installed in three days. The cost is estimated at \$150,000.

A new cutter assembly will probably reduce total downtime for maintenance and cleaning.

The rest of the donut machine operation will not change. For example, the production rate and number of people will be the same.





*Challenges
Opportunities
Results*

Avoid Future Problems



Cases

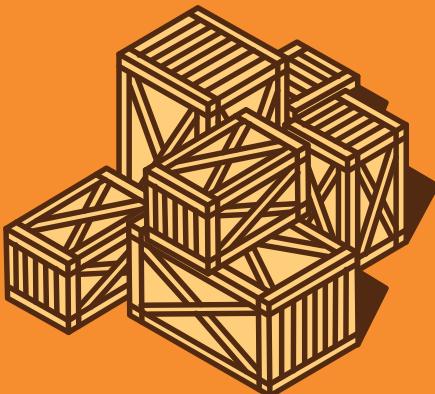
The New Test Equipment

Individually

Read your information.

*List potential problems
for Step 3 of the plan.*

Finish by ____.



You're responsible for supervising the installation of new computerized test equipment. The equipment was developed for one of the technical labs in your organization. The lab was built three years ago, and space for the new equipment was set aside at that time.

The new equipment has just arrived at the main warehouse. It is still in crates. Now it must be moved into the lab and set up.

You've been told, "Everything has been taken care of. Just look in from time to time and make sure the installation goes smoothly."

Here's your action plan for this assignment.

1. Transport the equipment to the lab building.
2. Move the equipment to the technical lab and take it out of the crates.
3. Set up and install the equipment in the room.
4. Test and debug the equipment.
5. Turn the equipment over to the lab manager.

You think that Step 3 (set up and install the equipment in the room) may present problems.

Identify and list the potential problems that might occur at Step 3.



The New Test Equipment

The True Story

The New Test Equipment is a true story. Here's what the troubleshooter told us.

"I listed Potential Problems for each step in my plan, using my experience and judgment. When I reached Step 3 (set up and install the equipment in the room), I listed the potential problems below."

- Room not big enough
- Room in use and not immediately available
- Insufficient electricity
- Voltage not constant
- Not enough air conditioning

When the troubleshooter went over to the lab to see the room for himself, here's what he found:

- 1 The room wasn't big enough. The test equipment needed a space four times as big as the room.
- 2 The air conditioning was totally inadequate for the computerized test equipment.
- 3 The room was being used. The lab work in the room could not be interrupted.



The New Test Equipment

The True Story

4 The electrical power was insufficient for the computerized test equipment.

5 There were no filtered lines with stabilized voltage.

Here is what the troubleshooter said about how the situation was resolved.

“When I told the maintenance engineer, he just laughed. It took six months to relocate the people, knock out the walls, rewire and install air conditioning. We spent \$60,000.

“If our planners had taken a couple of minutes three years ago to ask ‘What could go wrong?’, we would have saved a lot of time and money.”

