

Name: _____

Instructor Check-Off Date: _____ Score: _____

Excellence in Career & Technical Studies

LEARNING PACKET
Injection Molding Safety



**National Standards: OSHA (Occupational Safety and Health Administration);
ANSI (American National Standards Association)
PA Academic Standards: Science and Technology, 3.7.12A, Reading, 1.1.11A,D**

Introduction: One of the main forms of thermoplastic processing is the process called Injection Molding. The injection molding machine is capable of quickly producing a diverse range of plastic products, by utilizing heat, high hydraulic pressure, high voltage, and high speed moving machine components. However, the same factors that are essential to the process of injection molding can also pose serious safety hazards. This

learning packet will help you to learn about these hazards, the machinery safety features and procedures that will protect you as a technician working on the shop floor.

Performance Objective: Before working on the injection molding machine, you will complete all learning guide activities, obtaining a minimum score of 80%. Grades for each part of this packet will be averaged to provide the final overall score.

Materials and Supplies:

A pen or pencil

The videotape “Injection Molding Machine Safety”

A printed copy of “The Injection Molding Machine Safety Review”

A printed copy of the “Injection Molding Machine Safety Tour Review Sheet”

A printed copy of the “Hands on Activity Review Sheet”

A printed copy of the “Fatal Machinery Incidents & Investigation Reports Review Sheet”

Internet Access and Computer

Complete the following activities. Place a checkmark on the line to the left of each activity as you complete them.

- ____ 1. Before reading this packet, complete the Anticipation Guide on page 3. You will come back to this later to see if your prior assumptions were correct.
- ____ 2. View the video entitled “Injection Molding Machine Safety”
- ____ 3. After obtaining a printed copy of The Injection Molding Machine Safety Review” from the instructor, answer all the questions.
- ____ 4. Have your instructor check your review before proceeding.
- ____ 5. Go to Part 2 on page 11 of this learning guide. After obtaining a printed copy of the” Injection Molding Machine Safety Tour Review Sheet”, you will take the Injection Molding Machine Safety Tour by clicking on the link provided. After reading the information on the website, answer the questions on the review sheet and turn it in to the instructor for grading
- ____ 6. Go to Part 3 on page 16. Obtain a copy of the “Hands on Activity Review Sheet” from the instructor. Follow the instructions, answer the questions, and return the review sheet to the instructor for grading.
- ____ 7. Go to Part 4 on page 20. Obtain a copy of the “Fatal Machinery Incidents & Investigation Reports Review Sheet” from the instructor and read the information provided by clicking on the links. Answer the questions on the review sheet and return it to the instructor for grading.

ANTICIPATION GUIDE

Directions: Place a T for true or an F for false on the line to the left of each statement. Let's see what you already know about injection molding machines!

- ____ 1. There are four categories of hazards associated with the injection molding process.
- ____ 2. Most injection molds consist of two halves.
- ____ 3. Liquid plastic is usually heated to 150 degrees Fahrenheit.
- ____ 4. Training is the first essential step before working on the shop floor.
- ____ 5. There are several hazardous areas on the injection molding machine which do not have guards.
- ____ 6. Foot protection is optional when working on or around the injection molding machine.
- ____ 7. The nozzle area is not typically protected by a guard.
- ____ 8. Molding machines typically run on 110 volts.
- ____ 9. Spilled resin pellets, oil or water can present a safety hazard.
- ____ 10. Some molding machines are not equipped with emergency stops.

INJECTION MOLDING SAFETY TRAINING VIDEO REVIEW

Student Name _____ Date _____

The Basic Molding Process

1. All plastic molds consist of at least _____ halves.
2. These are called the _____ side and the _____ side.
3. Resin _____ are melted together to form a very hot liquid.
4. Molten plastic is forced through the mold. First through the _____ then through the _____ and _____ finally on into the cavity
5. The closed mold is cooled by water which removes _____ from the plastic
6. When the plastic cools and shrinks it usually sticks to the _____ side
7. Core half has a moveable _____ plate with pins mounted to it.
8. Plastic from sprue and runner channels is still _____ to the molded part
9. In the process, a large _____ is closed.
10. Plastic is _____ heated and melted, and then it is injected into the mold under a very high pressure.
11. After a while, the plastic is cooled by the _____ and ejected.
12. The time taken for all this to occur is called the molding _____.

Machine Safety Features

13. A metal _____ encloses the entire clamp and mold assembly.
14. This is equipped with various _____ and safety _____, which stop the machinery if the access doors are opened.
15. Similar guards to protect you from the _____ and other hazardous areas of the machine.
16. In addition these machines also have emergency stop buttons, lockouts, and warning placards placed near _____ machine areas.

Categories of the Main Hazards found on the Machine

17. How many categories of hazards are found on the injection-molding machine?

18. List the categories:
19. Name the first of the categories.
_____ hazards.
20. The _____, which melts and injects plastic into the mold
21. Another area is the Nozzle, through which the material is injected into the mold. A metal shield called the _____ protects this area.
22. At the beginning and end of every run, the injection unit must be cleared or emptied of plastic. This operation is called _____.
23. The liquid plastic that is purged out is extremely hot. In fact oftentimes it is as hot as 300 degrees C or _____ degrees F!
24. After the purging has cooled, you must wear _____ and long sleeves as well as use a tool to remove it.
25. Some Molds may have very hot exposed surfaces. One such area is the _____—_____ on stack molds.
26. What is the second type of hazard mentioned?
_____ hazards.
27. The _____ heaters are an area to watch out for, especially if the barrel cover is removed, and the electrical connections are exposed.
28. These machines run on a high voltage, typically _____ to _____ volts.
29. _____, which are equipped with a hot-sprue bushing or a hot runner system, also use a high voltage to heat plastic flowing through them.

30. If you see any exposed wiring or connections you should report these immediately to your _____.
31. What is the third type of hazard found on an injection molding machine?
_____ hazards.
32. Molding machines operate at pressures of _____ psi or 130 BAR.
33. These pressures are generated by the hydraulic pumps and are present not only in the _____ coming out of the pump, but also in those around the machine.
34. Damaged hoses or connections can present a serious hazard if they leak, so they should be _____ regularly
35. Another high-pressure area to watch out for is at the connection between the injection _____ and the mold _____.
36. Molten plastic is injected at pressures up to _____ psi or 1300 Bar.
37. The fourth type of Hazard mentioned is from:
_____.
38. Pinch points are found in the areas where the _____
or in the area where the _____ move forward and back to eject the parts.
39. _____ and other devices move quickly into the mold area to remove parts.

Safety: The Basics

40. _____ is the first, essential step before working on the production floor or operating equipment
41. _____ - _____ can be stylish and comfortable as long as they protect your feet.
42. _____ and _____ to protect you from possible hot plastic splashes.
43. There should be no loose _____ or _____, which can get caught in machinery.

When you get on the production floor there are also several things you need to be aware of:

44. Stay within the _____, and watch for lift trucks, automatic guided vehicles, and other people who might not see you.
45. Watch out for things like spilled water or _____, resin pellets, cables, and _____, which may be on the floor.
46. You should also be aware of what is overhead. You need to be aware of _____ and _____, which may be moving objects nearby .
47. Before operating the machine you should use a _____ to perform a quick safety check.
48. Check that the machines safety _____ are working.
49. Look for broken or damaged _____.
50. Look for _____, which are broken, may have fallen off, or even deliberately disconnected to bypass them
51. Is there any loose _____ apparent?
52. Are there any oil or coolant _____?
53. Are there any missing _____, which might expose you to hazards?
54. Make sure that you know the location of all the _____ stops on the machine and other equipment
55. What should you use to load material pellets into the machine hopper?

56. What is the first thing you should do when you spill material on the floor?

57. What two items should you use when removing spilled materials?

58. Some resins can give off _____, which can be hazardous to your health in doses higher than the recommended levels.

59. A face-shield, safety glasses, heat resistant gloves, long sleeves and pants should be kept _____ and used during these operations.
60. Don't purge through an _____ mold.
61. When purging, retract the injection unit and purge onto the _____ or a container.
62. If a nozzle freezes off or becomes blocked, don't try to clear it yourself unless you have been properly _____ and are wearing the appropriate Personal Protective Equipment (PPE).
63. Hot plastic can build up pressure from gases, which can cause it to _____ suddenly
64. Others near the machine should _____ while purging or clearing the feed throat beneath the hopper.
65. Don't _____ into the hot gate when clearing it

Part Removal and Handling Safety Tips

66. You should always wear your safety glasses when snipping off sprues and runners as plastic could _____.
67. When trimming a part with a sharp knife, _____ may need to be worn.
68. Do not put these tools down with the _____!
69. When removing parts from the mold by hand, be aware of the pinch points, which may be present in the _____ mechanism
70. Never try to remove any parts while the machine is in operation by reaching _____ or _____ the guards
71. Never attempt to fix anything unless you have been properly _____ and _____ to do so.
72. If you do need to work in a _____ area, never enter the area while the machine is in operation.

73. Never _____ or _____ any safety switches!
74. While it is your employer's responsibility to provide a safe work environment, your _____ is ultimately your own _____!

**STOP! HAVE YOUR INSTRUCTOR GRADE THIS REVIEW
BEFORE PROCEEDING WITH THE REST OF THIS PACKET**

Part 2

Click on the following link and take the following safety tour and follow the directions below the link.

[Horizontal Injection Molding Machine Safety Tour](#)

Injection Molding Machine Safety Tour Review Sheet

Locate the hopper, click on the photo and fill in the following blanks from the text.

When in place, the _____ guards the _____ opening, which connects the hopper to the _____ unit, and does not allow workers' _____ or _____ to enter the area where the _____ is turning. When the hopper is removed, workers should follow the _____ to avoid exposure to _____. Wear appropriate _____ equipment (PPE) and do not place your _____ into the _____ area. In addition, to avoid the possibility of being _____ by _____ material, do not _____ down the feed throat directly. _____ should be posted to alert _____ of potential hazards. If servicing and maintenance is needed, workers should follow appropriate _____ / _____ procedures.

Locate the purge guard, click on the large photo and fill in the following blanks from the text.

The purge guard covers the _____ of the injection molding machine and helps prevent _____ injuries or _____ from the splatter of _____ material. The purge guard should be _____. _____ an interlocked purge guard interrupts _____ operation and prevents _____ and _____ of the injection unit.

Click on the highlighted areas on the photo above the text and fill in the blanks in the following text

The purge guard

During _____, molten plastic material is injected under _____ through the _____ into the _____. When purging, workers should wear a _____, _____, and other necessary _____.

The barrel cover

The barrel cover blocks _____ to the injection unit in order to prevent worker contact with _____ and _____.

Locate the electrical cabinet, click on the large photo and fill in the following blanks from the text.

The electrical cabinet guards the machine's _____ and protects _____ people from _____.

Click on the highlighted area on the photo above the text and fill in the blanks in the following text

The Electric Lockable Disconnect

This _____ is the electrical lockable disconnect device for the machine. _____/_____ procedures must be followed during _____ or _____ when the worker is exposed to potential _____ from unexpected _____ or release of _____ energy. It must be used to control all _____ of _____ (such as _____, _____, _____). Do not attempt to _____ a machine that is locked out and/or tagged out.

Locate the control panel, click on the large photo and fill in the following blanks from the text.

The control panel on the _____ of the injection molding machine features a red _____ that prevents all machine _____ when pressed.

Locate the operator's gate, click on the large photo and fill in the following blanks from the text.

The operator's gate allows the _____ access to the _____ and should be equipped with _____ (such as _____, _____, and _____) that allow the machine to operate only when the _____ is _____. Do not attempt to _____ any of the interlocks or to reach _____, _____, or _____ the operator's gate (or other guards) while the machine is operating.

Locate the robot, click on the large photo and fill in the following blanks from the text.

A robot can be _____ to, or placed _____ to, an injection molding machine to automate _____ or potentially _____ tasks. The robot in the image to the left is placed on top of the injection molding machine for _____ entry. The robot must be guarded to prevent workers from _____ or _____ into its space during _____.

Locate the personal protective equipment (PPE), click on the large photo and fill in the following blanks from the text.

Personal protective equipment (PPE), such as a _____, _____, and other _____ equipment should be worn while performing _____ or _____ activities when a _____ may be present.

Locate the area below the operator's gate, where a guard should be placed, click on the large photo and fill in the following blanks from the text.

Place a _____ at the opening for parts _____ to prevent an employee from _____ the operator's gate and into the _____ area. A _____, _____, or _____ can take the place of a guard attached to the machine if it _____ to this area.

Locate the hydraulic safety interlock valve, click on the large photo and fill in the following blanks from the text.

The _____ prevents the clamp from _____ when the operator's gate is _____.

Click on the Hydraulic Safety Interlock Demo Go button to view how the safety operates.

Locate the moveable guard, click on the large photo and fill in the following blanks from the text

This movable guard prevents access to the _____ and _____ mechanisms as well as other _____ of the _____ and _____. Do not _____ a machine or leave a machine _____ unless this guard is in place. This guard may be _____ on some machine designs, requiring a _____ to remove it

At this point, press the button with the left arrow below the photo of the machine. Stop when the clamp end of the machine is facing you. Then you can click on the reveal featured areas button and it will highlight the clamp end safety features.

Click on either the right or left fixed guard, and fill in the following blanks from the text.

_____ guards require a tool for removal and do not require _____. These guards are typically used where _____ is _____. Do not start a machine or leave a machine operating unless fixed guards are _____.

Click on the hydraulic fittings and hoses shown in the photo on the clamp end, and fill in the blanks on the following text.

Fittings can _____ and hoses may become _____, _____, or _____. This can result in workers getting _____ with _____ or other substances at high _____. Oil sprays may cause _____ and may result in _____ hazards. Inspect _____ and _____ as recommended by the manufacturer for _____ and _____ and _____ them as needed.

Now press the button with the left arrow again, stop when the non-operator side of the machine is facing you. Then you can click on the reveal featured areas button and it will highlight the non-operator side safety features.

Click on the moveable guard closest to the clamp unit on the non-operator's side of the machine and fill in the blanks on the following text.

This _____ guard prevents _____ to the clamping and ejector mechanisms as well as other moving parts of the machine and mold. Do not start a machine or leave a machine operating unless this guard _____ _____. This guard may be _____ on some machine designs, requiring a tool to remove it

Click on the moveable guard closest to the injection unit on the non-operator's side of the machine and fill in the blanks on the following text.

The movable rear guard should be equipped with at least two _____ that _____ when the guard is _____. This guard should only be opened for _____ and _____ activities. Use the front operator's gate for _____ to the mold space.

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Part 3

Hands on Activity Review Sheet

Every injection molding machine has placards or signs posted on it to warn personnel of potential hazards. In this activity you will be required to inspect each one of the molding machines in our lab and answer the following questions:

Tan 75 ton Van Dorn

1. How many warning signs are mounted to this machine? ____
2. How many signs are posted on the operator's safety gate? ____
3. What are the signs warning about?
4. How many signs are posted on the non operator's moveable and fixed safety gates? ____
5. What are the signs warning about?
6. How many signs are posted on the barrel cover? ____
7. What are the signs warning about?

Green 75 ton Van Dorn

1. How many warning signs are mounted to this machine?
2. How many signs are posted on the operator's safety gate?
3. What are the signs warning about?
4. How many signs are posted on the non operator's moveable and fixed safety gates?
5. What are the signs warning about?
6. How many signs are posted on the electrical cabinet?
7. What are the signs warning about?
8. How many signs are posted on the barrel cover?
9. What are the signs warning about?

110 ton Sumitomo machine

1. How many warning signs are mounted to this machine? _____
2. How many signs are mounted to the barrel cover and injection unit of this machine? _____
3. What are they warning about?
4. How many signs are mounted to the operator's side safety gate? _____
5. What are they warning about?
6. How many signs are mounted to the operator's side of the electrical panel? _____
7. What are they warning about?
8. There are two other areas on this machine which have warning signs posted. Where are they located?
9. What are these signs warning about?

Part 4

FATAL MACHINERY RELATED INCIDENTS AND INVESTIGATION REPORTS

The links below are from the National Institute for Occupational Safety and Health (NIOSH) program website called FACE: "Fatality Assessment and Control Evaluation".

Three of the four stories are true accounts of industrial accidents, one is an account of a company which was fined for not obeying safety laws.. Click on the links, read the story to find answers the questions below. Obtain a printed copy of the "Fatal Machinery Incidents & Investigation Reports Review Sheet" and fill in the answers. After you have completed the review, give them to the instructor for grading.

Supervisor has head crushed by an injection molding machine when it cycles during set-up in California

[California FACE Report No. 98CA001](#)

1. How many years of experience did the victim have in this industry prior to the accident?
2. Explain how an experienced employee could be involved in such an accident.
3. What was the victim doing when the accident occurred?
4. Did the employer have written instructions for performing the set up procedure?
5. Did the employer have an Injury and Illness Prevention Program (IIPP)?

6. The victim was trained on-the-job, did the employer have any written safety or training information?
7. This injection molding machine had three safety devices which prevent the operation of the machine under certain circumstances. What were they?
8. What was listed as the official cause of death?
9. During the accident investigation inconsistencies in the witness story allowed the investigators to come up with only some of the causes of the fatality. What three recommendations were made to avoid such an occurrence in the future?

Supervisor at Plastics Company Crushed in Injection Molding Machine

California FACE Report No. 03CA006

1. How many years of experience did the victim have in this industry prior to the accident?
2. According to the text, how often were safety meetings held in this company?

3. Did the employer of the victim have a written safety program with written task specific safe work procedures?
4. How was training accomplished at this company and who monitored this training?
5. Describe what the victim was doing when the accident occurred?
6. How was training accomplished in this company and who monitored the training?
7. What did they do wrong in their training?
8. If you were the supervisor, how would you improve on this company's employee training program?
9. What was listed as the official cause of death?
10. What recommendations were made by the investigators to avoid such an occurrence in the future?

Injection Mold "Set-Up" Man Electrocuted in Tennessee

1. Did the employer hold safety meetings?
2. Was there a designated safety officer?
3. Did the company have and make use of a safety manual?
4. What was the victim doing when the accident occurred? Briefly describe the accident.
5. What was listed as the official cause of death?
6. What recommendations were made by the investigators to avoid such an occurrence in the future?

2001 - 02/12/2001 - FALCON PLASTICS CITED FOR ALLEGED SAFETY AND HEALTH VIOLATIONS; OSHA PROPOSES \$161,000 IN PENALTIES

1. What caused OSHA to initiate an inspection at this company?
2. According to Robert Szymanski, area director of the OSHA Pittsburgh, why did the two accidents mentioned occur?

3. List the serious violations cited by the investigators.
4. According to the article, what constitutes a serious safety violation?
5. According to the article, what constitutes a willful safety violation?
6. List the willful violations that were filed against this company
7. What other-than-serious violations did OSHA cite the company for?

Go back to the Anticipation Guide. Read each question again and see if your previous answers have changed. Turn your completed packet in to your instructor for grading.