Welcome to Paulson Training Programs, Inc.
SimTech™ Virtual Lab Lessons

SimTech™ is the world's most advanced injection molding simulator you can use to practice machine setup, molded-part problem solving, and cycle reduction all on your computer. Increase the number of molding experts in your facility in a fraction of the time it takes with "on-the-job training" with this powerful, proprietary, physics and math based (not rule-based) simulator. SimTech comes with pre-defined lab lessons depicting different molding scenarios with four levels of difficulty. You can also set up your own "molding scenarios" with FreeMold for your employees to solve, focusing on just the specific problem you want. SimTech will revolutionize the way you train your employees.

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Important Notice

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***All sections of this manual can be downloaded from our website at:**
www.paulsontraining.com/support-center

What is SimTech?

SimTech™ is an Injection molding machine simulator (think Flight simulator for Injection Molding). It is based on physics and mathematics – ***not*** ruled-based and can perform over 26 million calculations. Just like airline pilots practice aviation concepts on a flight simulator before actually flying, injection molders can practice molding skills with SimTech before running an actual molding machine; saving thousands of dollars, valuable machine time, and avoiding potential risk to the machine or operator. You can practice machine set-up, molded part problem solving, and cycle reduction all on your computer or mobile device. Developed by Paulson engineers, SimTech is based on decades of research and testing and will take your employees to a whole new level of understanding the molding process. Supercharge your training with SimTech and dramatically improve quality, production, and profits.

What are some of the Key Features & Benefits of SimTech?

- Runs a cycle in a 1-2 seconds
- 22 fully functioning molding machine controls, including Velocity-to-Pressure transfer (VPT)
- Reports 8 of the most common part problems from molding conditions
- Provides students with "at-the-machine" skills training without:
  - Wasting machine time
  - Wasting plastic
  - Risking damaging the machine or mold
- Interactive
- Units can be either US (English) or SI (Metric)
- Turns learning into a challenging "game"

How is SimTech different than Skillbuilder?

Skillbuilder is a simplified version of SimTech. Pre-programmed lessons lead the student on a specific path to address a pre-defined problem. Skillbuilder serves as the introduction to the use of SimTech.

SimTech allows a student to use their molding knowledge to improve machine set-ups and solve problems by making machine control changes, cycling the machine, and then analyzing the Cycle Results. Paulson provides lab lessons with predefined setups that require molded part problems to be solved along with cycle optimization. With SimTech, managers can also set up their own problem scenarios for the employees to solve.

What is "FreeMold"?

"Freemold" operation lets ***you*** decide your own set-up by choosing your machine size, plastic, mold and dimensional tolerance from the Simtech database. You can set up scenarios for your employees or peers to solve specific molding problems, or just optimize a cycle.

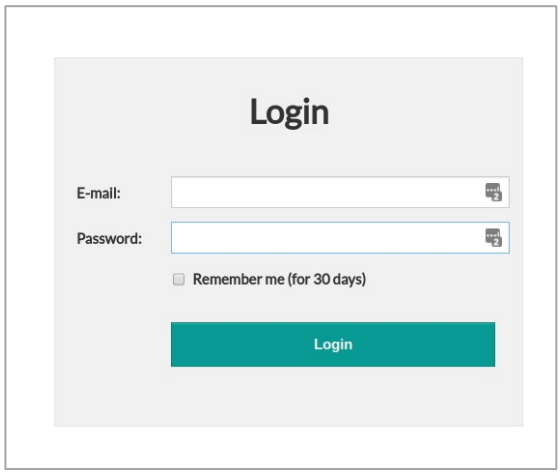
How are my lab scored?

Each lab lesson description states what must be accomplished to complete a lesson.

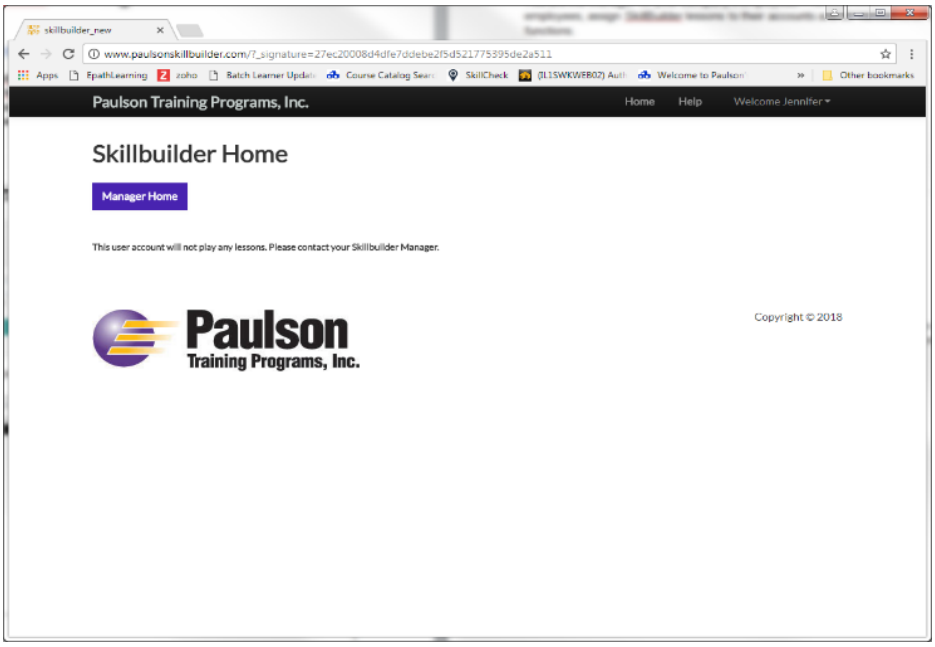
Training Administrator Instructions

Assigning users to SimTech is very similar to assigning users to Skillbuilder.

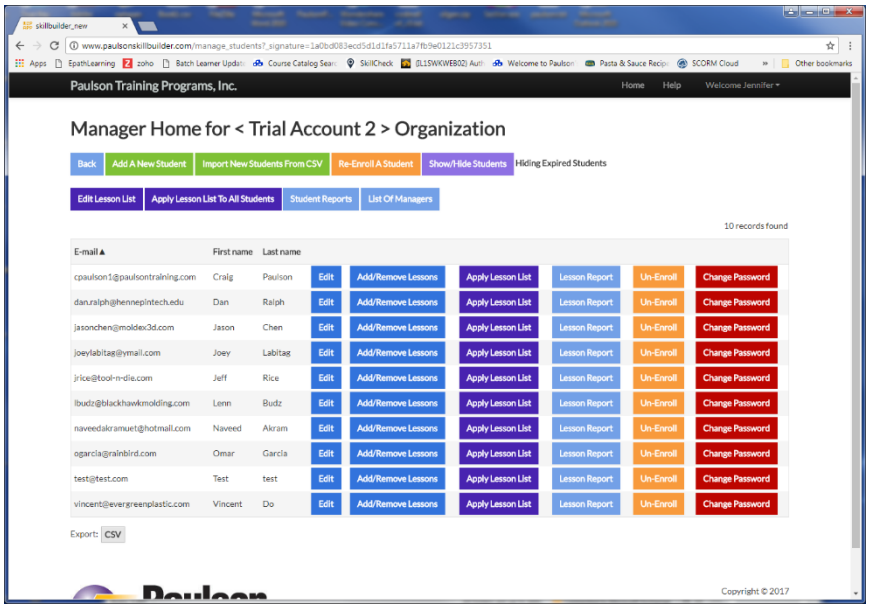
1. Go to www.paulsonskillbuilder.com and login using your provided credentials.



2. Next you'll be at the home page of the Manager. Click on 'Manager Home'.

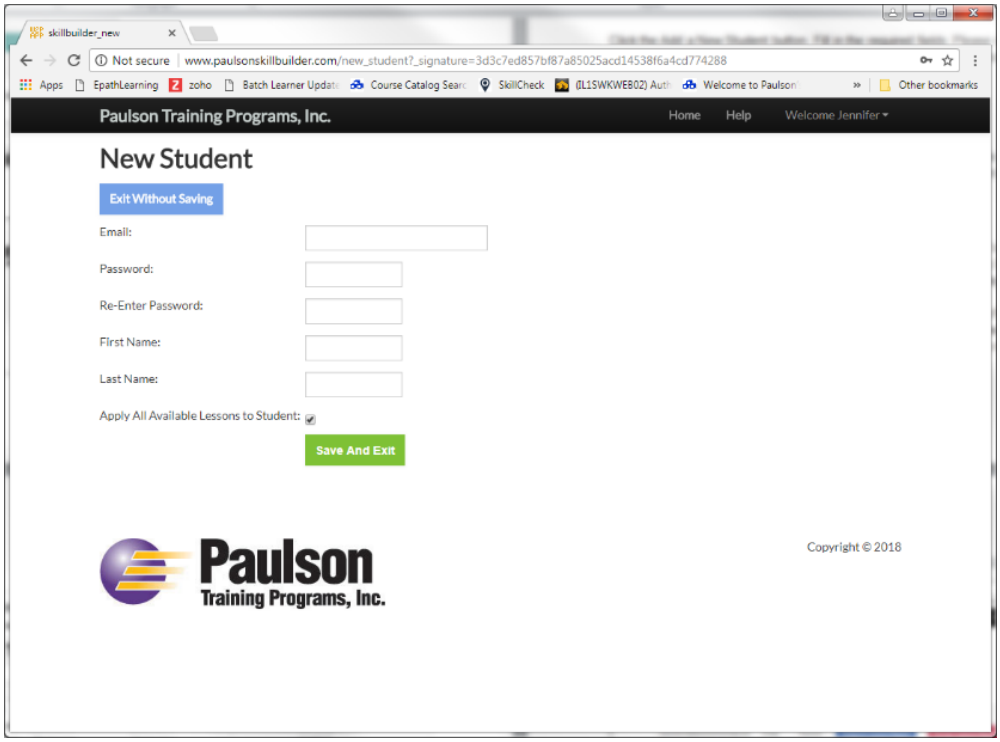


3. As the Manager for your company's employees, you can add new students, assign SimTech lab lessons and FreeMold to their accounts, and do various other Manager functions.



4. To Add a New Student

   Click the 'Add a New Student' button. Fill in the required fields. Please note the email address does not have to be a valid email address, recognizing that not all employees have a company email, but it
   must follow email conventions. Example: tjones@abcco.com

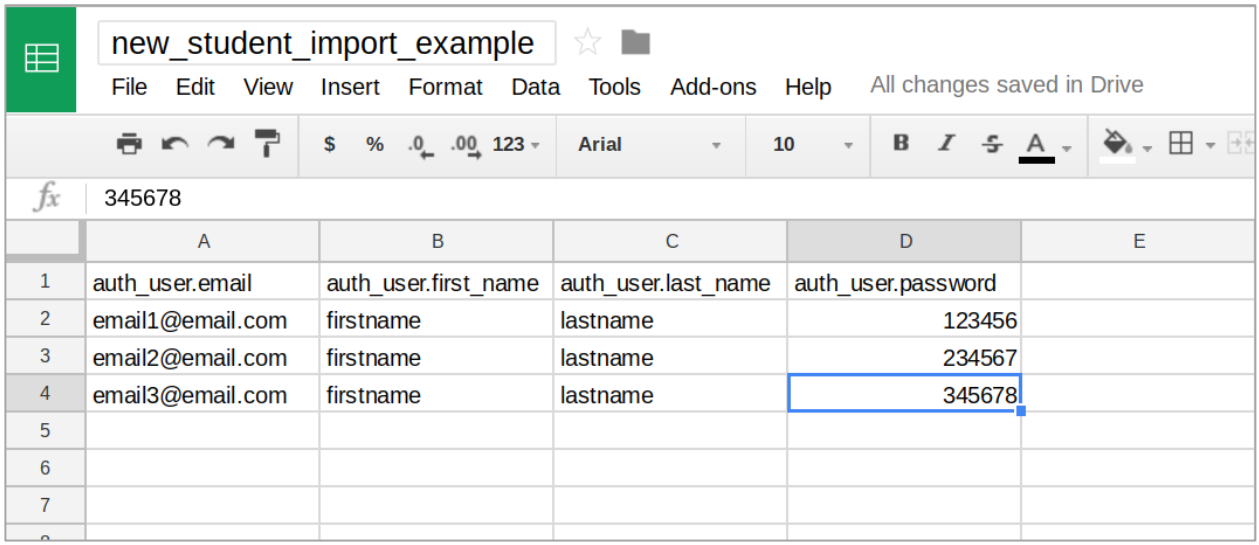


5. Adding Employees to SimTech or SkillBuilder as a Group

To enroll multiple employees into SimTech or SkillBuilder, create a *.csv file with their information and import using the Import 'New Students From CSV' button.

Below is a sample .csv file. At your request we can email you a blank *.csv file as a template. For each employee, you will need to provide an email address, first name, last name, and a password. Each employee can change their password anytime they login.

NOTE: The email address does **not** have be a valid email, recognizing that not all employees have a company email. It just needs to follow email conventions, namely an "@". No email will be sent to that address, it is only used for login purposes. Passwords must be a minimum of six characters.



	A	B	C	D	E
1	auth_user.email	auth_user.first_name	auth_user.last_name	auth_user.password	
2	email1@email.com	firstname	lastname	123456	
3	email2@email.com	firstname	lastname	234567	
4	email3@email.com	firstname	lastname	345678	
5					
6					
7					

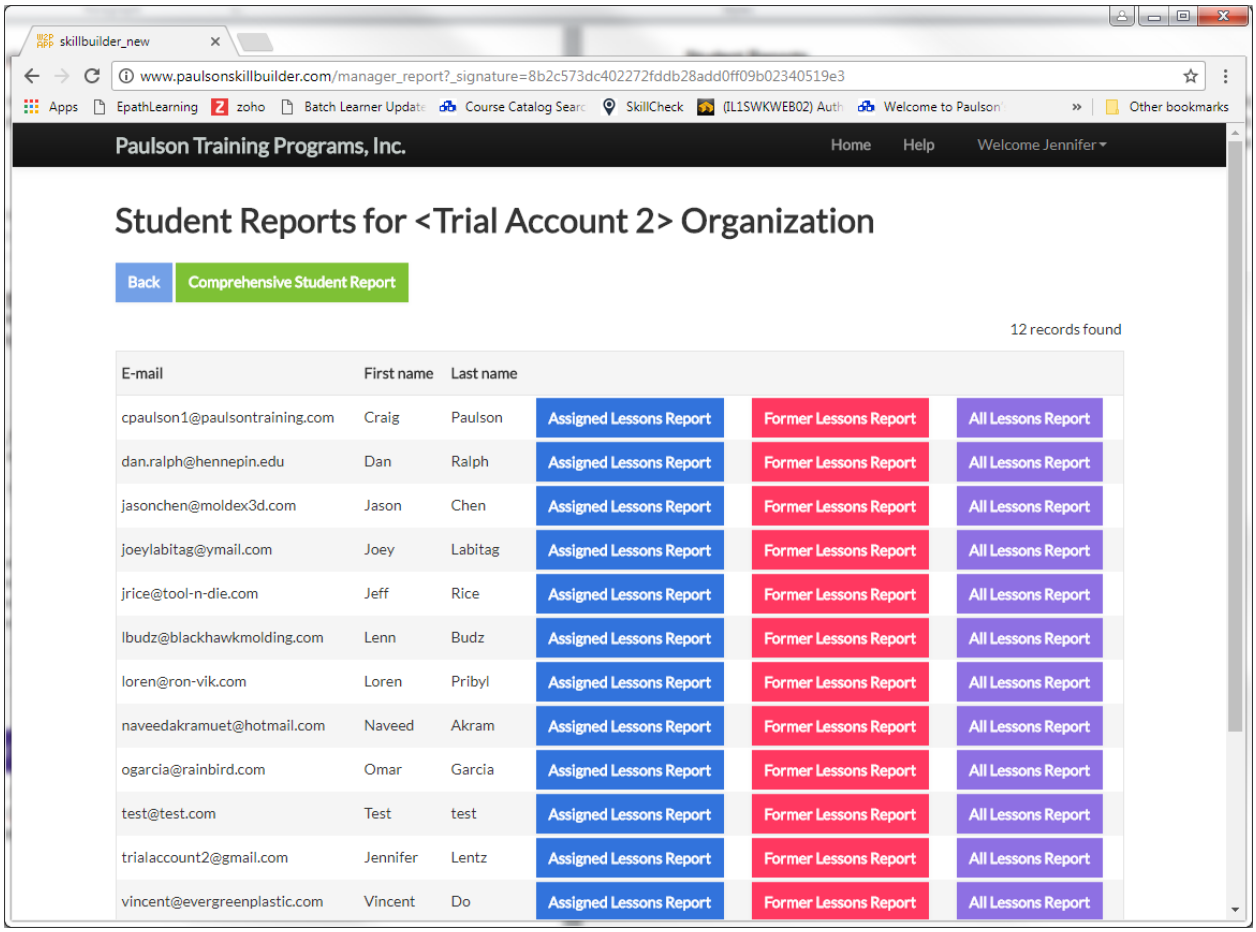
This 

button assigns all the SimTech lab lessons you have purchased, to your employees. So after you have imported all your employees via a *.csv file, click this button to assign them SimTech lab lessons. From this point, all your employees will have access to all their SimTech lab lessons.

6. Student Reports

From the Manager Home page, click on 'Student Reports'. There are four different reports available. Each report indicates if a lesson is assigned, finished, percent complete, and date last accessed.

Comprehensive Student Report – Lists all students
Assigned Lesson Report - Lessons currently assigned to the student
Former Lessons Report - Lessons previously assigned to the student that are no longer assigned
All Lessons Report - Lessons currently assigned and previously assigned



SimTech Tutorial - Getting Started

I. Introduction

This workbook is designed to be used with the Paulson fill rate controlled SimTech™ injection molding simulator. The Student Workbook Tutorial should be taken by all users who are not familiar with how SimTech™ works. If you are already familiar with SimTech™ and how it operates, you can move directly to the SimTech™ lab lessons located at the end of this manual.

The Student Workbook Tutorial is designed to show you how to navigate through the SimTech™ control panel and the effects of each molding machine control on the plastic behavior and on the molded part properties. You will be directed to make specific control changes and then asked to record and explain the results. Provided in the Student section of this manual, is a Student Answer Sheet which you can make copies of for students to write their answers in.

By the end of this tutorial, you should be familiar with how to:

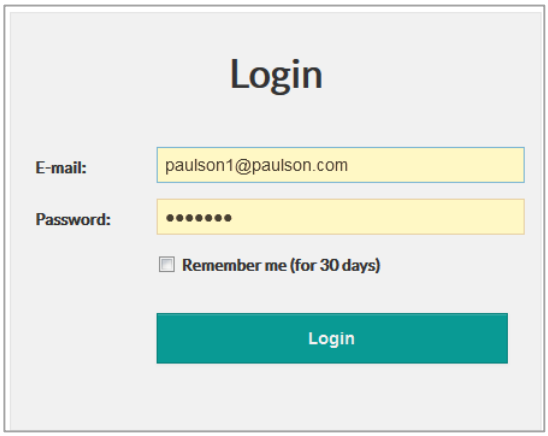
- Make machine control changes
- Cycle the machine
- Read the cycle results
- Identify part problem
- Identify machine alarms
- Will have observed the effects of each control and each alarm

The Student Tutorial Lesson is taken through FreeMold which allows you to pick your machine size, plastic and part. This tutorial lesson uses a 300 ton machine, molding the "cover" using Polystyrene. After completing this tutorial, you can change the type of machine, plastic, or part using the **New Session** button and do a similar evaluation for this new setup.

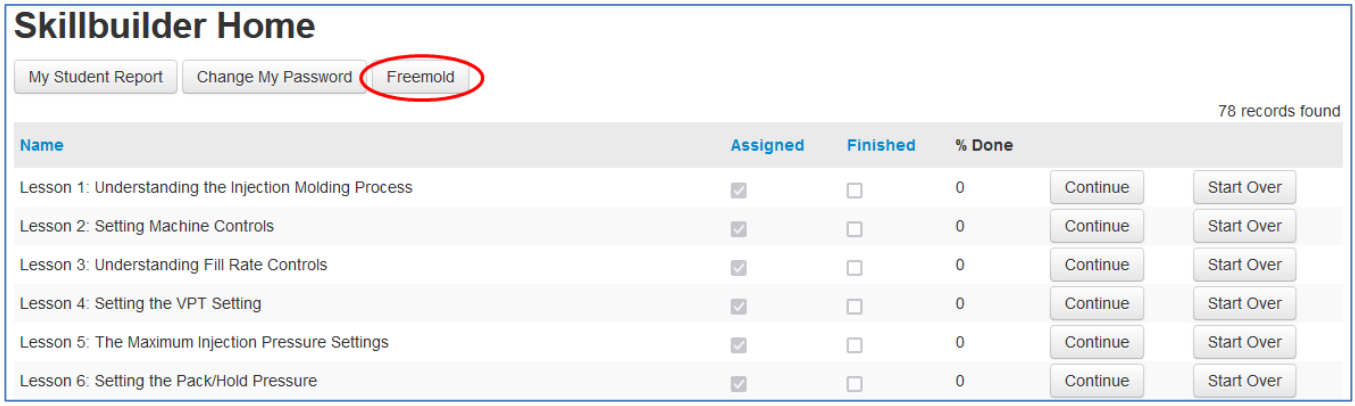
Note: All pressures shown on the SimTech™ control panel are plastic pressures, not hydraulic oil pressures.

II. Starting Instructions

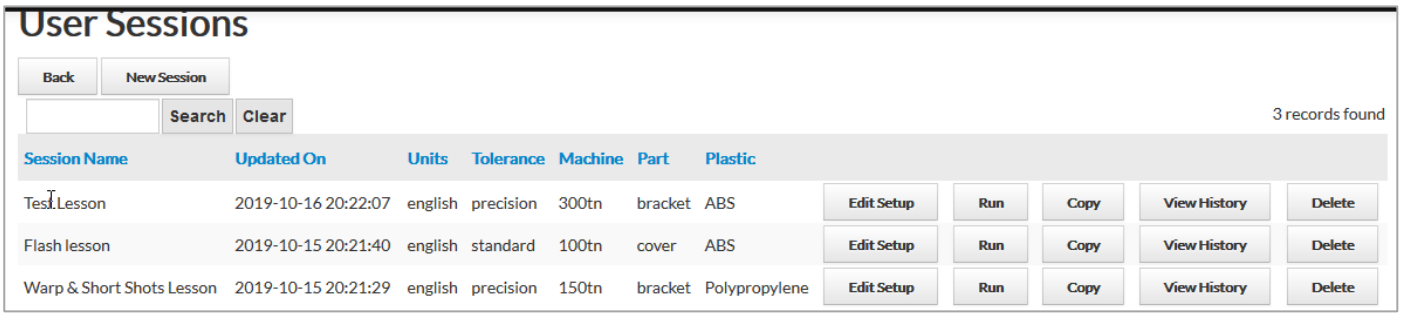
1. To access SimTech "FreeMold" go to www.paulsonskillbuilder.com
2. Login with your email and password.



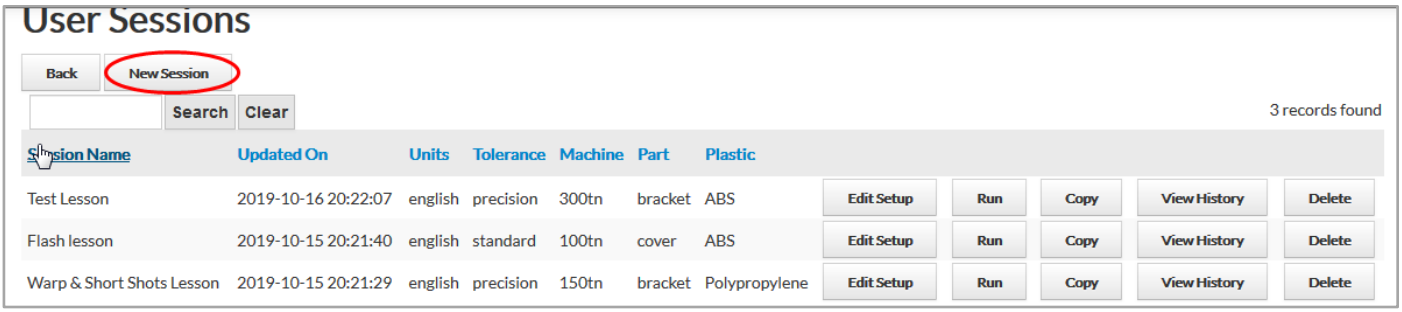
3. This will take you to your Skillbuilder Home page.
   - On this page, you will see all the Skillbuilder and SimTech Lab lessons assigned to you. In addition, you will see FreeMold at the top of the page.



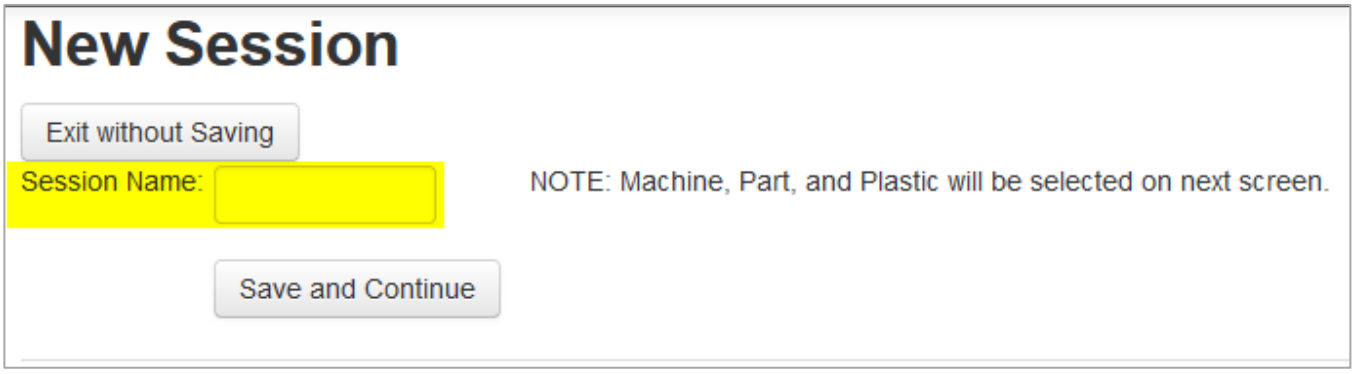
4. Click on FreeMold. You will now be on your User Sessions page.
    - Any sessions you created will be listed here
    - You can run or edit an existing session, or create a new session



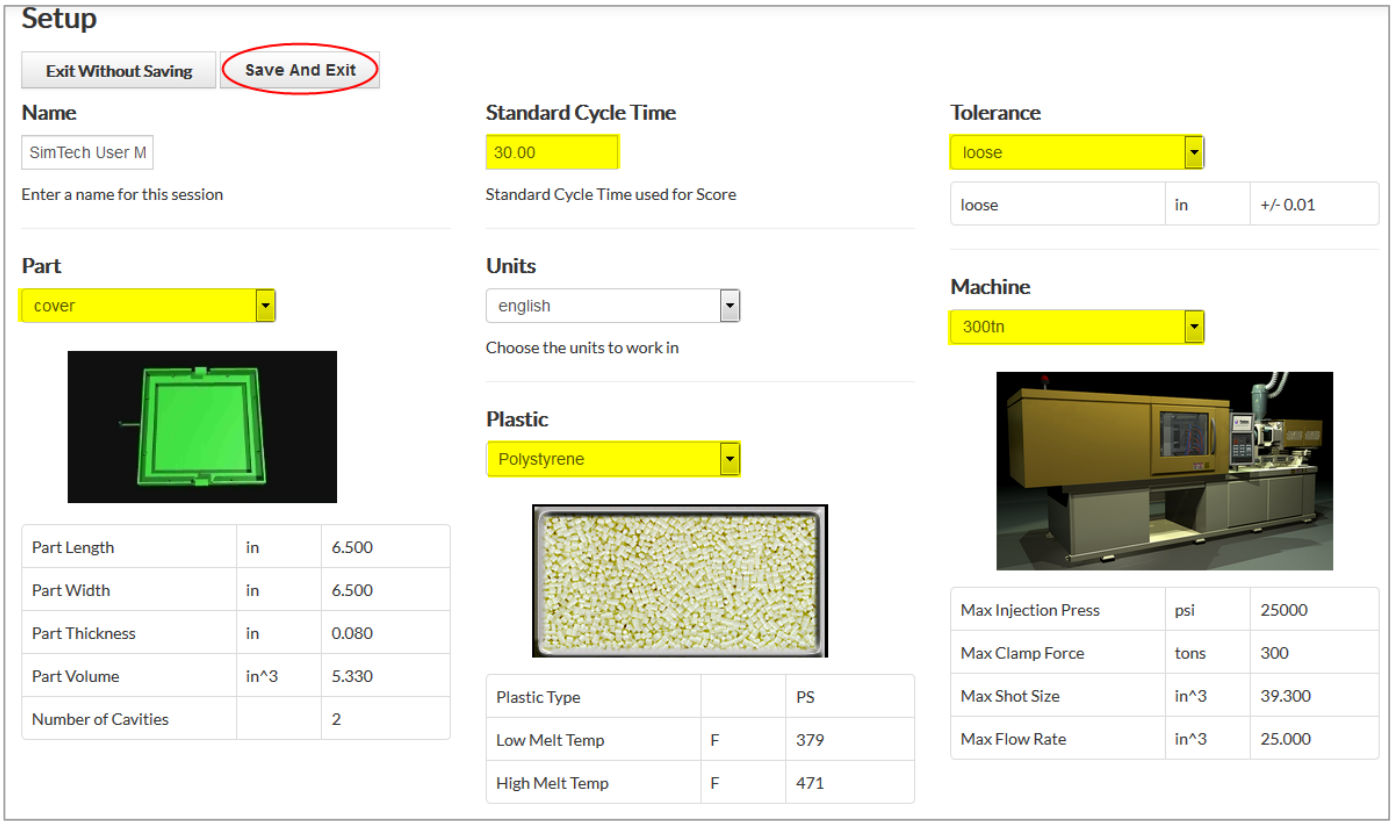
5. To create a new session, click on New Session.



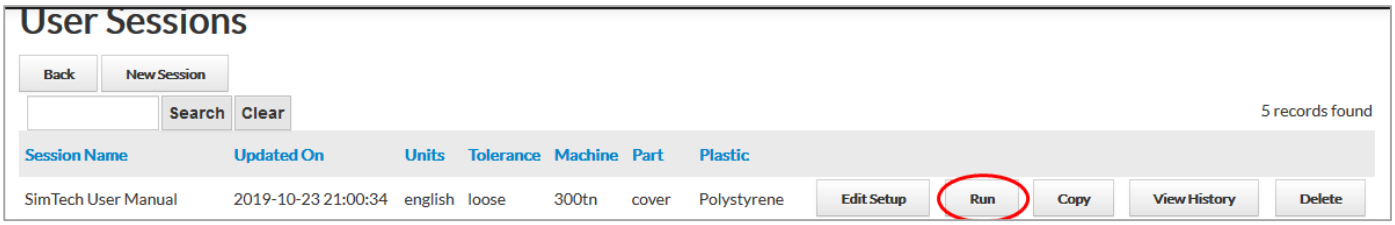
6. Type in a "Session Name" (we're using SimTech User Manual) and click "Save and Continue".



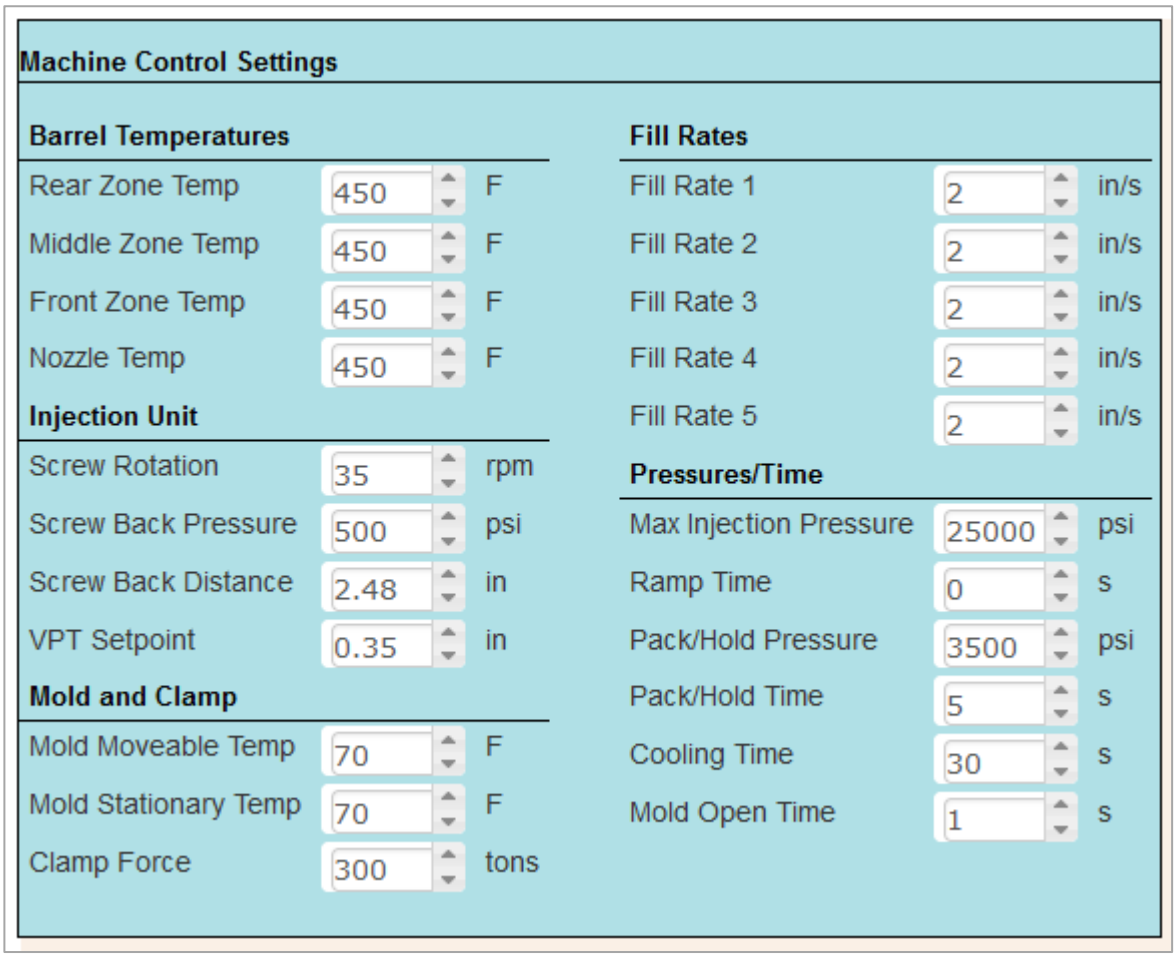
7. You will now be on the Setup page. Configure your setup page to match the setup below. When you have finished, click Save and Exit.



8. Now Click the Run button and you will see the machine controls page.



9. Enter the process data just as you see below.
    - You can type in number values or use the up and down arrows to change the values.



Machine Control Settings

Barrel Temperatures		
Rear Zone Temp	450	F
Middle Zone Temp	450	F
Front Zone Temp	450	F
Nozzle Temp	450	F

Injection Unit		
Screw Rotation	35	rpm
Screw Back Pressure	500	psi
Screw Back Distance	2.48	in
VPT Setpoint	0.35	in

Mold and Clamp		
Mold Moveable Temp	70	F
Mold Stationary Temp	70	F
Clamp Force	300	tons

Fill Rates		
Fill Rate 1	2	in/s
Fill Rate 2	2	in/s
Fill Rate 3	2	in/s
Fill Rate 4	2	in/s
Fill Rate 5	2	in/s

Pressures/Time		
Max Injection Pressure	25000	psi
Ramp Time	0	s
Pack/Hold Pressure	3500	psi
Pack/Hold Time	5	s
Cooling Time	30	s
Mold Open Time	1	s

10. Click on the **Cycle** button. Wait for the molding cycle to end.

- You are molding a part with no defects.

SimTech Tutorial – Student Workbook

A complete step-by-step tutorial that teaches all about successfully operating SimTech™ - the injection molding machine simulator.

I. Effects of Barrel Temperature on Melt Temperature

A. You will now determine the effect on the melt temperature of each of the barrel zone temperatures.

What is the melt temperature? _____ *°F*

II. Determine the Effect of Each Barrel Zone Temperatures on the Melt Temperature

A. You will raise each barrel zone by 20°F to determine which zone has the greatest effect.

1. Raise rear zone barrel temperature to 470°F. [Cycle the machine]

What is the melt temperature? _____ *°F*

2. Raise the middle zone temperature to 470°F and set the rear zone temperature back to 450°F. [Cycle the machine]

What is the melt temperature? _____ *°F*

3. Raise the front zone barrel temperature and nozzle temperature to 470°F and set the middle zone back to 450°F. [Cycle the machine]

What is the melt temperature? _____ *°F*

*Which zone affected the melt temperature the most?*_____

Why?

_____

_____

_____

4. Typical barrel zone settings for this plastic are: 450°F nozzle, 450°F front, 450°F middle, 400°F rear. Set the zones to these settings. [Cycle the machine]

What is the melt temperature? _____ *°F*

III. Determine the Effect of the Back Pressure on the Melt Temperature

A. Increased back pressure causes more heating of the plastic in the barrel.

1. Raise the back pressure and repeat the cycle until melt temperature is the same as the front zone temperature. (i.e. 450°F)

What is the back pressure when the melt temperature is 450°F? _____*psi*

Explain why the melt temperature increased when the back pressure was increased.

_____

_____

Why is it best to have the front zone temperature and the melt temperature the same? _____

_____

IV. Effects of Screw Back Setting

A. The screw back setting determines how far back the screw returns when it rotates. Screw back setting also controls the cushion size.

1. Set the screw back distance to 3.5” and the VPT setpoint to 1.35”. **[Cycle]**

What is the present cushion size? _____*in*

Is the cushion size all Right? _____

*Explain:*_____

_____

2. Reduce the screw back setting to 2.0” and the VPT setpoint to 0.4”. **[Cycle]**

What happened? _____

Why? _____

3. Set the screw back position so that the cushion size is between 0.125” and 0.250” **[Cycle]**.

   Note: In the ProMolder Series we consider an optimized cushion to be in a range of 5-10% of the total shot size.

What is the screw back position you have set? _____

What is the VPT setpoint you have set? _____

What is the melt temperature? _____ *°F*

Note: Do not re-adjust back pressure yet.

V. Determine the Effect of Screw RPM on the Melt Temperature

A. Screw rpm can also affect the plastic temperature, but the magnitude of the affect depends on the screw design and the amount of non-Newtonian viscosity change that occurs.

1. Increase screw rpm to 150. **[Cycle]**

What is the melt temperature? _____ *°F*

Why did the melt temperature increase? _____

_____

2. Adjust the back pressure so that the melt temperature is 450°F. **[Cycle]**

What is the back pressure to achieve 450°F melt temperature? _____ *psi*

VI. Maximum Injection Pressure Alarm

A. The Maximum Injection Pressure Alarm will activate if the machine has tried to exceed its maximum injection pressure.

1. Reduce max injection pressure to 1,100 psi. and reduce the Pack/Hold pressure to 1,000 psi **[Cycle]**

Why did the Low Max Injection Pressure alarm occur? _____

_____

_____

2. Raise the max injection pressure to 10,000 psi and the Pack/Hold pressure to 1,700 psi. **[Cycle]**
   - You should get a good part.

VII. The Screw RPM Alarm

A. The Screw Recovery Alarm will activate if the screw does not rotate fast enough thus, enabling the screw to return to the Screw Back Distance setting before the next shot.

1. Lower the screw speed to 13 rpm. **[Cycle]**

What alarm occurred? _____

Why? _____

2. Raise rpm to 150. **[Cycle]**
   - You should get a good part.

What is the melt temperature? _____ *°F*

VIII. Determine the Effect of the Mold Closed Time on the Melt Temperature

A. You will explore how the mold closed timer can affect the melt temperature.

1. Reduce mold closed time to 15 seconds. **[Cycle]**

(the cooling time is the same thing as the mold closed time)

What is melt temperature? _____ *°F*

Why did the melt temperature decrease? _____

_____

_____

2. Use the back pressure to raise the melt temperature to 450°F ±2°. **[Cycle]**

What is the new back pressure setting? _____*psi*

IX. The Back Pressure and No Cushion Alarms

A. Why the back pressure and no cushion alarms come on

1. Raise back pressure to 6000 psi. **[Cycle]**

What alarms occurred? _____

Why? _____

_____

_____

2. Reset the back pressure to 2,325 psi. **[Cycle]**
   - You should get a good part.

X. Determine the Effect of Mold Open Time on the Melt Temperature

A. You will explore how the mold open timer can affect the melt temperature.

1. Increase the mold open time to 5 seconds. **[Cycle]**

What is the melt temperature? _____ *°F*

Why did the temperature increase? _____

_____

_____

2. Set the mold open time to 1 seconds. **[Cycle]**

XI. Determine the Effect of the Mold Temperature on the Melt Temperature

A. You will explore how the mold temperature can affect the melt temperature.

1. Set mold temperature to 110°F (both halves). **[Cycle]**

What is the melt temperature? _____ *°F*

Does the mold temperature affect the melt temperature in the barrel? _____

XII. Determine the Effects of Fill Rates on the Molded Parts

A. You will explore how fill rates can affect the molded parts.

1. Set barrel rear zone to 380°F, middle zone to 385°F, front and nozzle to 400°F **[Cycle]**
2. Set screw rotation to 65 rpm and screw back pressure to 600 psi. **[Cycle]**
3. Set mold temperature to 60°F (both halves). **[Cycle]**
4. Set all fill rates 4.0 in/sec. **[Cycle]**
5. Set the max injection pressure to 25,000 psi. **[Cycle]**

Note: This molding machine has a maximum fill rate of 25 inches per second.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

6. Set Fill Rates 1, 2, 3, and 4 to 10.0 in/sec.
7. Set Fill Rate 5 to 4.0 in/sec. **[Cycle]**

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What changes occurred to the molded parts? _____

_____

_____

8. Set Fill Rates 1, 2, 3, and 4 to 3.0 in/sec.
9. Set Fill Rate 5 to 6.0 in/sec. **[Cycle]**

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What happened to part weight and dimensions when the final Fill Rate 5 is very fast? _____

_____

Why? _____

_____

10. Set Fill Rates 1, 2, 3, and 4 to 13.0 in/sec.
11. Set Fill Rate 5 to 4.0 in/sec. **[Cycle]**
    - You should get a good part.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What happened to part weight and dimensions when final Fill Rate 5 is reduced?

_____

Why? _____

Fill Rates Conclusions:

- Very high fill rates require high injection pressures.
- Of all the fill rates, the final Fill Rate 5 has the greatest effect on part dimensions and weight.

XIII. Determine the Effects of Clamp Force Setting and Fill Rates on Burn Marks and Flash

A. How does clamp force and the fill rate settings affect burn marks and flash?

1. Set Fill Rates 1, 2, 3, and 4 to 4.0 in/sec. Set Fill Rate 5 to 8.0 in/sec **[Cycle]**

What molded part defect occurred? _____

Why? _____

_____

_____

2. Reduce clamp force to 65 tons. **[Cycle]**

What change occurred in the defects present? _____

_____

Why? _____

_____

3. Set Fill Rates 1, 2, 3, and 4 to 13.0 in/sec. Set Fill Rate 5 to 4.0 in/sec. **[Cycle]**
4. Set the Clamp Force to 75 tons. **[Cycle]**

What happened to the flash? _____

Why? _____

What conclusions would you make concerning the effects of clamp force and fill rate on burn marks and flash?

_____

_____

_____

XIV. Determine the Effects of Pack/Hold pressure on the Molded Part Properties

A. Now we'll examine the effect of pack/hold pressure on part weight and dimensions.

1. Increase the clamp force to 300 tons. (This will avoid flash when we increase the pack/hold pressure.) **[Cycle]**
2. Increase the pack/hold pressure to 5,500 psi. **[Cycle]**

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Why did the part size increase? _____

_____

3. Reduce the pack/hold pressure to 4,500 psi. **[Cycle]**

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Why did the part dimensions and weight decrease when the pack/hold pressure was reduced?

_____

_____

4. Reduce the pack/hold pressure to 6,000 psi. **[Cycle]**

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Notice the part dimensions are now out of spec. Why did this happen?

_____

_____

_____

5. Increase the pack/hold pressure to 2,500 psi. **[Cycle]**

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

XV. Determine the Effects of Pack/Hold Time on the Molded Part Properties

A. Now we'll examine the effect of pack/hold time on part weight and dimensions.

Note: Too short a holding time can cause "discharge".

1. Set the Pack/Hold Pressure back to 5,500 psi.. **[Cycle]**
   - You should have a good part.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Is there any change in the molded parts? _____

2. Set pack/hold time to 3 seconds. **[Cycle]**

What is the fill time? _____*sec*

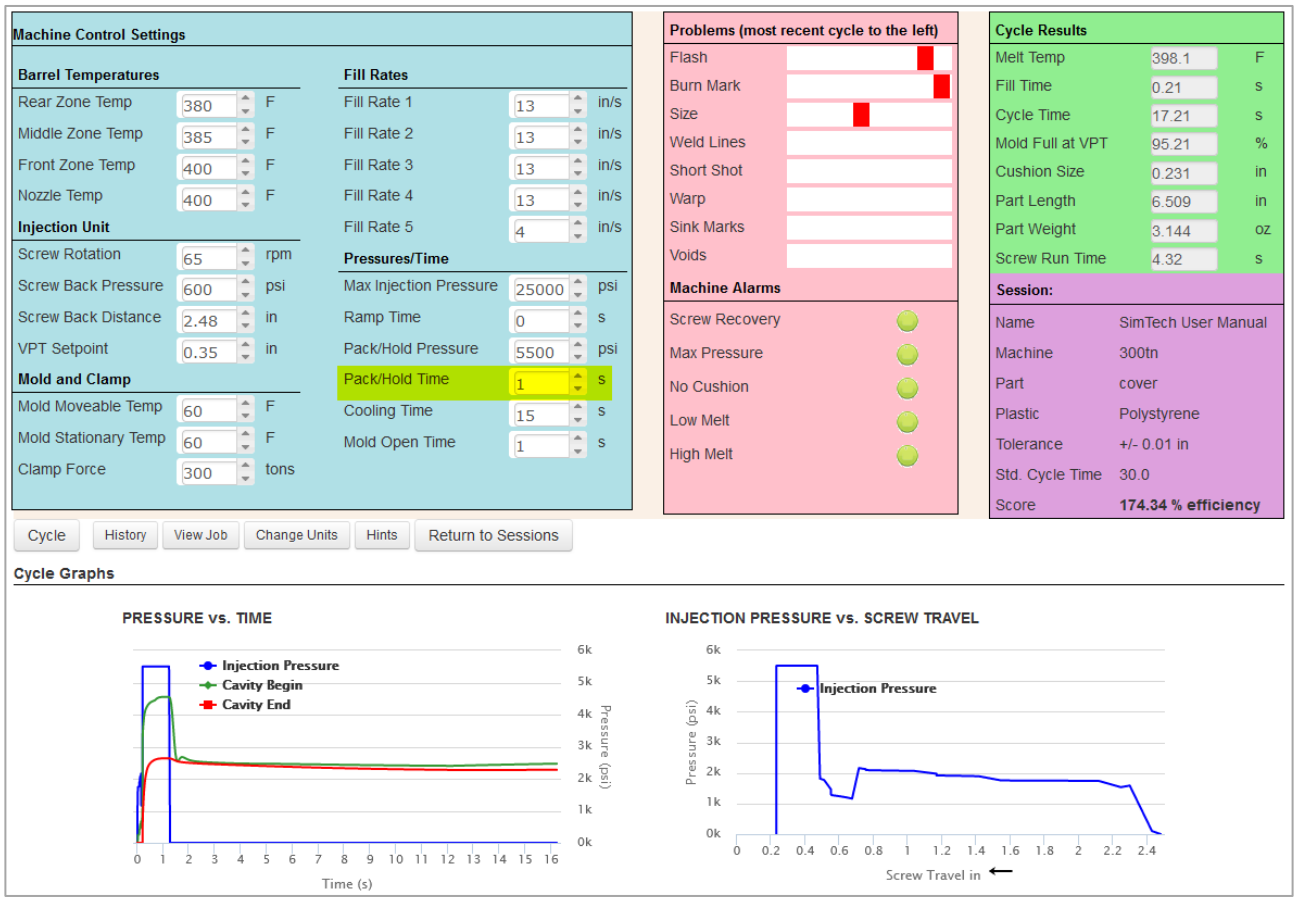
What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Is there any change in the molded parts? _____

3. Set holding time to 1 seconds. **[Cycle]**



What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Is there any change in the molded parts?

_____

_____

XVI. Find the Gate Freeze Time

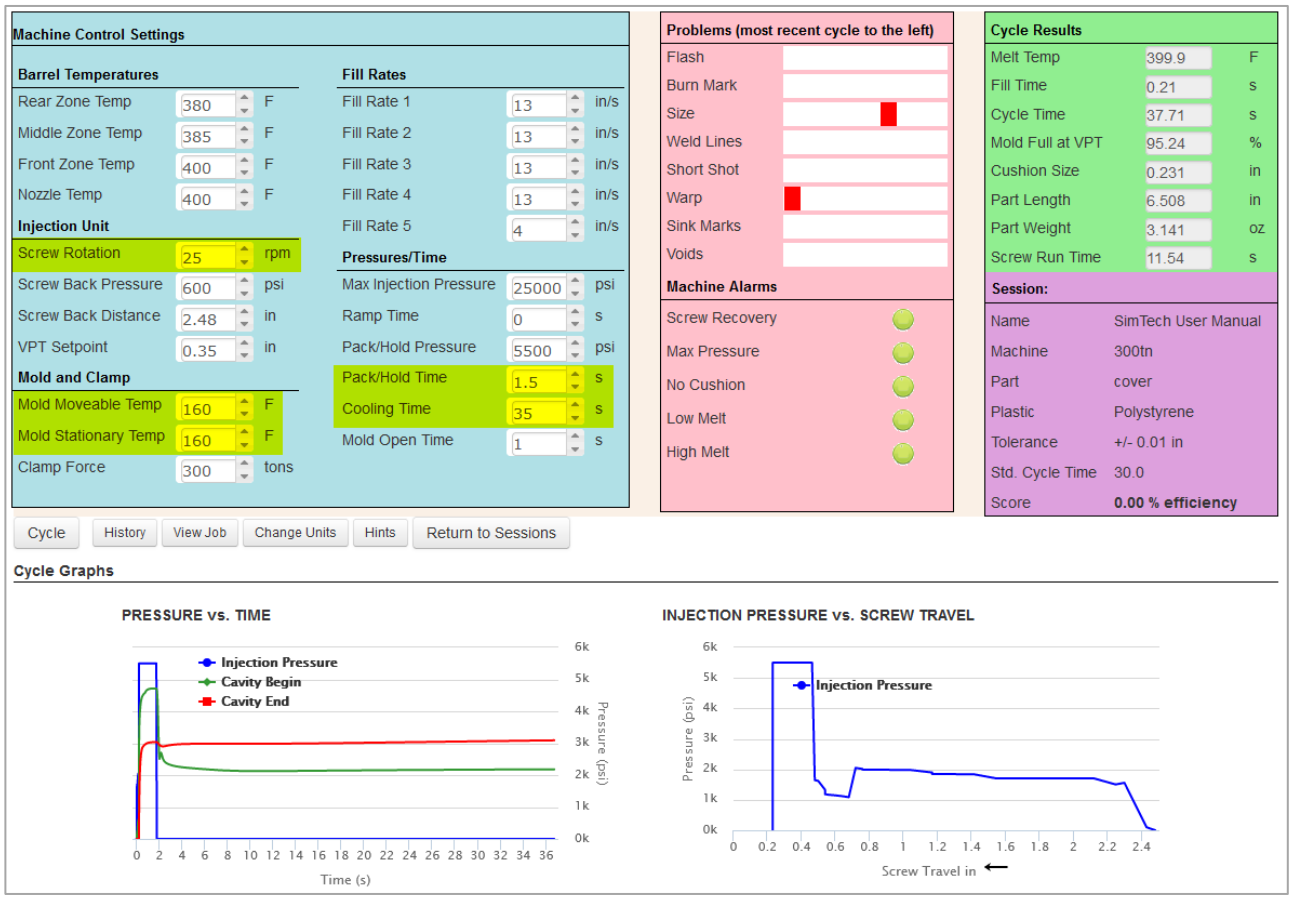
1. Set the Pack/Hold Time to 0.1 second. **[Cycle]**
2. Continue to increase the Pack/Hold Time by 0.1 seconds until you find that the part weight and length does not change.
    - Once the part weight and part length do not change that means the gate has frozen.

At what holding time does the gate freeze? _____ *sec*

XVII. Effects of Mold Temperature on Part Properties and Gate Freeze Time

A. Observe the effect of mold temperature on part dimensions and weight.

1. Set the Screw Rotation to 25 rpm. **[Cycle]**
2. Set Mold Temperature for both mold halves to 160°F. **[Cycle]**
3. Set the Pack/Hold Time to 1.5 seconds. [Cycle}
4. Set Cooling Time to 35 seconds. [Cycle}



What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Determine the gate freeze time at 160° F.

1. Set the Pack/Hold Time to 0.2 second. **[Cycle]**
2. Continue to increase the Pack/Hold Time by 0.2 seconds until you find that the part weight and length does not change.
   - Once the part weight and part length do not change that means the gate has frozen.
   - At this mold temperature (160°F) the part will have warp or "distortion". Disregard this part problem for this exercise.

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What is the gate freeze time? _____ *sec.*

Determine the gate freeze time at 60° F.

1. Set the Mold Temperature for both mold halves to 60°F. **[Cycle]**
2. Set the Pack/Hold Time to 0.2 seconds. **[Cycle]**
3. Increase the Pack/Hold Time by 0.2 seconds until you find that the part weight and length does not change. **[Cycle]**

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

*What is the gate seal time?*_____*sec*

You have now completed one evaluation of the effects of molding conditions on melt temperature, part weight, part dimensions, machine alarms, and you have observed several molded part defects for this plastic and part.

You can now try to improve your production efficiency for this part. Change the machine controls to reduce the cycle time. You should be able to mold to 100% efficiency or better.

When you begin new mold set-ups, you will solve problems and reduce cycle times using the knowledge you have gained in this lesson. To increase your knowledge of the molding process, you can do a similar evaluation using other plastics.

SimTech Tutorial – Student Answer Sheet

This answer sheet can be used to make copies for each student to write down their answers from the Student Tutorial Workbook.

This answer sheet can also be download from our website at:

www.paulsontraining.com/support-center

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Name: _____

Student Answer Sheet

I. Effects of Barrel Temperature on Melt Temperature

What is the melt temperature? _____ *°F*

II. Determine the Effect of Each Barrel Zone Temperatures on the Melt Temperature

A. You will raise each barrel zone by 20°F to determine which zone has the greatest effect.

5. Raise rear zone barrel temperature to 470°F.

   What is the melt temperature? _____ *°F*

6. Raise the middle zone temperature to 470°F and set the rear zone temperature back to 450°F.

   What is the melt temperature? _____ *°F*

7. Raise the front zone barrel temperature and nozzle temperature to 470°F and set the middle zone back to 450°F.

   What is the melt temperature? _____ *°F*

Which zone affected the melt temperature the most? _____

Why? _____

_____

_____

8. Typical barrel zone settings for this plastic are: 450°F nozzle, 450°F front, 450°F middle, 400°F rear. Set the zones to these settings.

   What is the melt temperature? _____ *°F*

III. Determine the Effect of the Back Pressure on the Melt Temperature

A. Increased back pressure causes more heating of the plastic in the barrel.

1. Raise the back pressure and repeat the cycle until melt temperature is the same as the front zone temperature. (i.e. 450°F)

What is the back pressure when the melt temperature is 450°F? _____*psi*

Explain why the melt temperature increased when the back pressure was increased.
_____

_____

Why is it best to have the front zone temperature and the melt temperature the same? _____

_____

IV. Effects of Screw Back Setting

A. The screw back setting determines how far back the screw returns when it rotates. Screw back setting also controls the cushion size.

1. Set the screw back distance to 3.5" and the VPT setpoint to 1.35".

What is the present cushion size? _____*in*

Is the cushion size all Right? _____

*Explain:*_____

_____

2. Reduce the screw back setting to 2.0" and the VPT setpoint to 0.4".

What happened? _____

Why? _____

3. Set the screw back position so that the cushion size is between 0.125" and 0.250".

What is the screw back position you have set? _____

What is the VPT setpoint you have set? _____

What is the melt temperature? _____*°F*

V. Determine the Effect of Screw RPM on the Melt Temperature

A. Screw rpm can also affect the plastic temperature, but the magnitude of the affect depends on the screw design and the amount of non-Newtonian viscosity change that occurs.

1. Increase screw rpm to 150.

What is the melt temperature? _____ *°F*

Why did the melt temperature increase? _____

_____

2. Adjust the back pressure so that the melt temperature is 450°F.

What is the back pressure to achieve 450°F melt temperature? _____ *psi*

VI. Maximum Injection Pressure Alarm

A. The Maximum Injection Pressure Alarm will activate if the machine has tried to exceed its maximum injection pressure.

1. Reduce max injection pressure to 1,100 psi. and reduce the Pack/Hold pressure to 1,000 psi

Why did the Low Max Injection Pressure alarm occur? _____

_____

_____

VII. The Screw RPM Alarm

A. The Screw Recovery Alarm will activate if the screw does not rotate fast enough thus, enabling the screw to return to the Screw Back Distance setting before the next shot.

1. Lower the screw speed to 13 rpm.

What alarm occurred? _____

*Why?*_____

_____

2. Raise rpm to 150.

What is the melt temperature? _____ *°F*

VIII. Determine the Effect of the Mold Closed Time on the Melt Temperature

A. You will explore how the mold closed timer can affect the melt temperature.

1. Reduce mold closed time to 15 seconds.

What is melt temperature? _____ *°F*

Why did the melt temperature decrease? _____

_____

_____

2. Use the back pressure to raise the melt temperature to 450°F ±2°.

What is the new back pressure setting? _____*psi*

IX. The Back Pressure and No Cushion Alarms

A. Why the back pressure and no cushion alarms come on

1. Raise back pressure to 6000 psi.

What alarms occurred? _____

Why? _____

_____

_____

X. Determine the Effect of Mold Open Time on the Melt Temperature

A. You will explore how the mold open timer can affect the melt temperature.

1. Increase the mold open time to 5 seconds.

What is the melt temperature? _____ *°F*

Why did the temperature increase? _____

_____

XI. Determine the Effect of the Mold Temperature on the Melt Temperature

A. You will explore how the mold temperature can affect the melt temperature.

1. Set mold temperature to 110°F (both halves).

What is the melt temperature? _____ *°F*

Does the mold temperature affect the melt temperature in the barrel?

_____

XII. Determine the Effects of Fill Rates on the Molded Parts

A. You will explore how fill rates can affect the molded parts.

1. Set barrel rear zone to 380°F, middle zone to 385°F, front and nozzle to 400°F
2. Set screw rotation to 65 rpm and screw back pressure to 600 psi.
3. Set mold temperature to 60°F (both halves).
4. Set all fill rates 4.0 in/sec.
5. Set the max injection pressure to 25,000 psi.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

6. Set Fill Rates 1, 2, 3, and 4 to 10.0 in/sec.
7. Set Fill Rate 5 to 4.0 in/sec.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What changes occurred to the molded parts? _____

_____

_____

8. Set Fill Rates 1, 2, 3, and 4 to 3.0 in/sec.

9. Set Fill Rate 5 to 6.0 in/sec.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What happened to part weight and dimensions when the final Fill Rate 5 is very fast?

_____

_____

Why? _____

_____

10. Set Fill Rates 1, 2, 3, and 4 to 13.0 in/sec.

11. Set Fill Rate 5 to 4.0 in/sec.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What happened to part weight and dimensions when final Fill Rate 5 is reduced?

_____

Why? _____

_____

_____

_____

XIII. Determine the Effects of Clamp Force Setting and Fill Rates on Burn Marks and Flash

A. How does clamp force and the fill rate settings affect burn marks and flash?

1. Set Fill Rates 1, 2, 3, and 4 to 4.0 in/sec. Set Fill Rate 5 to 8.0 in/sec

What molded part defect occurred? _____

Why? _____

_____

_____

2. Reduce clamp force to 65 tons.

What change occurred in the defects present? _____

_____

Why? _____

_____

_____

3. Set Fill Rates 1, 2, 3, and 4 to 13.0 in/sec. Set Fill Rate 5 to 4.0 in/sec.

4. Set the Clamp Force to 75 tons.

What happened to the flash? _____

Why? _____

What conclusions would you make concerning the effects of clamp force and fill rate on burn marks and flash? _____

_____

_____

_____

_____

XIV. Determine the Effects of Pack/Hold pressure on the Molded Part Properties

A. Now we'll examine the effect of pack/hold pressure on part weight and dimensions.

1. Increase the clamp force to 300 tons. (This will avoid flash when we increase the pack/hold pressure.)
2. Increase the pack/hold pressure to 5,500 psi.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Why did the part size increase? _____

_____

_____

_____

3. Reduce the pack/hold pressure to 4,500 psi.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Why did the part dimensions and weight decrease when the pack/hold pressure was reduced? _____

_____

_____

_____

4. Reduce the pack/hold pressure to 6,000 psi.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Notice the part dimensions are now out of spec. Why did this happen?

_____

_____

_____

5. Increase the pack/hold pressure to 2,500 psi.

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

XV. Determine the Effects of Pack/Hold Time on the Molded Part Properties

A. Now we'll examine the effect of pack/hold time on part weight and dimensions.

1. Set the Pack/Hold Pressure back to 5,500 psi..

What is the fill time? _____*sec*

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Is there any change in the molded parts? _____

2. Set pack/hold time to 3 seconds.

   What is the fill time? _____*sec*

   What is the cycle time? _____*sec*

   What is the part weight? _____*oz.*

   What is the part length? _____*in*

   Is there any change in the molded parts? _____

3. Set holding time to 1 seconds.

   What is the fill time? _____*sec*

   What is the cycle time? _____*sec*

   What is the part weight? _____*oz.*

   What is the part length? _____*in*

   Is there any change in the molded parts? _____

XVI. Find the Gate Freeze Time

1. Set the Pack/Hold Time to 0.1 second.
2. Continue to increase the Pack/Hold Time by 0.1 seconds until you find that the part weight and length does not change.

   At what holding time does the gate freeze? _____ *sec*

XVII. Effects of Mold Temperature on Part Properties and Gate Freeze Time

A. Observe the effect of mold temperature on part dimensions and weight.

1. Set the Screw Rotation to 25 rpm.
2. Set Mold Temperature for both mold halves to 160°F.
3. Set the Pack/Hold Time to 1.5 seconds.
4. Set Cooling Time to 35 seconds.

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

Determine the gate freeze time at 160° F.

1. Set the Pack/Hold Time to 0.2 second.
2. Continue to increase the Pack/Hold Time by 0.2 seconds until you find that the part weight and length does not change.

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What is the gate freeze time? _____ *sec.*

Determine the gate freeze time at 60° F.

1. Set the Mold Temperature for both mold halves to 60°F.
2. Set the Pack/Hold Time to 0.2 seconds.
3. Increase the Pack/Hold Time by 0.2 seconds until you find that the part weight and length does not change.

What is the cycle time? _____*sec*

What is the part weight? _____*oz.*

What is the part length? _____*in*

What is the gate seal time? _____*sec*

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How to Take the SimTech Virtual Lab Lessons

Getting Started

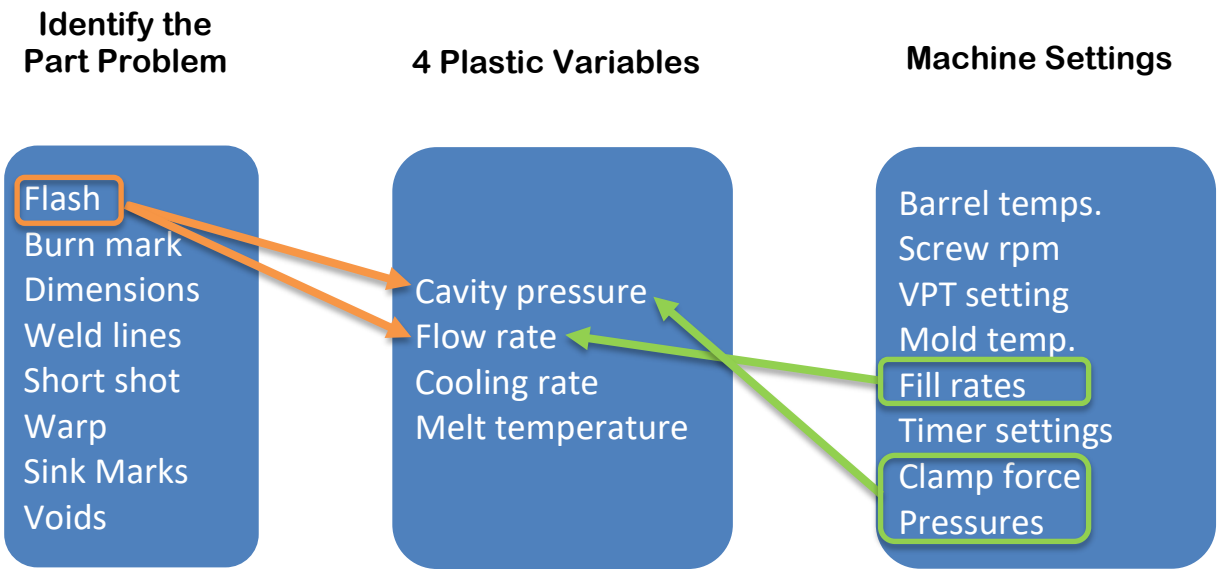
It is now time to apply what you have learned from taking the course lessons. SimTech lab lessons can be taken in any order. We suggest you start with the lessons marked as "Level 1" and work your way up to the "Level 4" labs.

Note: If you are not familiar with how to use SimTech, take the Student Workbook Tutorial first before attempting the Lab Lessons.

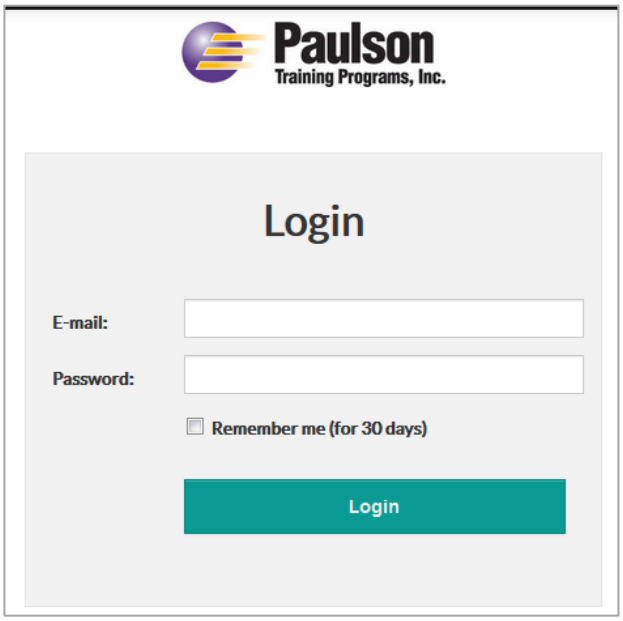
You will benefit the most from these lessons by following the directions carefully. Each lab has a certain set of criteria that needs to be met in order to "complete" a lesson. You will practice machine setup, molded-part problem solving, and cycle time reduction. As you have learned in our training lessons, it is the four basic plastic variables that determine the molded part properties. By understanding how the machine controls affect the four basic plastic variables, you will begin to understand how to fix part problems, and how to set up the most efficient process.

As we teach in our training lessons, you should approach these problems in a scientific and systematic way.

1. Identify the problem(s).
2. Determine which of the four processing variables is causing the problem.
3. Determine which machine controls affect the processing variable(s) in step 2.
4. Make one control change and then Cycle the machine to see the effects of the control change.
5. Continue to make control changes (cycling after each machine control adjustment) until the problem is solved.
6. Then move onto the next problem and follow the same procedure.



1. Login at www.paulsonskillbuilder.com
   - Your administrator will provide you with your password.



2. Scroll down until you see the SimTech Lab Lesson you want to take and click on "Continue" or "Start Over"

   - "Start Over" will reset the machine controls to their starting values
   - "Continue" loads up your last machine control setting for this lesson

3. You will see the control panel and your machine setup. You must click on "**Cycle**" to view the outputs of the current machine control settings.
4. Review the lab lesson from the binder to understand the problems you are trying to solve and the criteria for completing that lesson.

SimTech Virtual Lab Lessons

Lab 1 - Solving Burnmarks (Level 1)

Solving Burnmarks

For this challenge, you are molding a square cover. This customer's dimensional specifications for this rectangular cover part are 6.500" X 6.500" (165.1 x 165.1 mm), with a tolerance of ± 0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has a burnmark. The standard (quoted) cycle time for this job is 24 seconds. The part tolerance for this job is ±.005 (0.127mm).

In order to receive a score in any of our SimTech lab lessons, we require "3 good molding practices" to be in place. They are listed below. In this lesson, we have already set the machine up to include these criteria. In later lessons, you will be asked to achieve one or all of these criteria as part of the exercise.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 1"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a Burnmark problem.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

Note: If you hover over the red block next to the part problem, you will see a number telling you the severity of your problem.

To complete this lesson:

Solve the burnmark problem two different ways.

1. Solve the burnmark by adjusting the Fill rate controls.
    a. Once you have solved the burnmark with Fill Rate, click the "Reset Control" button and **Cycle** the machine. This will reset your controls to the original settings, and you should see a burnmark again.
2. Solve the burnmark by using the clamp force.

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 2 - Solving Flash - (Level 1)

Solving Flash
For this challenge, you are molding a square cover. This customer's dimensional specifications for this rectangular cover part are 6.500" X 6.500" (165.1 x 165.1 mm) with a tolerance of ± 0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has flash. The standard (quoted) cycle time for this job is 24 seconds. The part tolerance for this job is ±.005 (0.127mm).

In order to receive a score in any of our SimTech lab lessons, we require "3 good molding practices" to be in place. They are listed below. In this lesson, we have already set the machine up to include these criteria. In later lessons, you will be asked to achieve one or all of these criteria as part of the exercise.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 2"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a slight Flash problem.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

Note: If you hover over the red block next to the part problem, you will see a number telling you the severity of your problem.

To complete this lesson:

Solve the flash problem two different ways.

1. Solve flash by adjusting one of the Fill rate controls.
    a. Once you have solved the flash with Fill Rate, click the "Reset Control" button and **Cycle** the machine. This will reset your controls to the original settings, and you should see flash again.
2. Solve flash by using the least clamp force possible.

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 3 - Solving Sink Mark and Dimension Problems (Level 1)

Solving Sink Mark and Dimension Problems
For this challenge, you are molding a frame. This customer's dimensional specifications for the part are are 12.00" X 4.00" (304.8 x 101.6 mm) with a tolerance of ± 0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has sink marks and is below the length specification. The standard (quoted) cycle time for this job is 65 seconds.

Just like in labs 1 & 2, we have already set the machine up to include the "3 good molding practice" criteria. In later lessons, you will be asked to achieve one or all of these criteria as part of the exercise.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 3"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a sink mark problem and your part size is too small.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 65 seconds or less

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 4 - Solve Burnmarks, Dimensional, Sink Marks & Process Optimization (Level 3)

Solve Burnmarks, Dimensional, Sink Mark Problems & Process Optimization
You are molding the part called a bezel out of polystyrene using a 300-ton molding machine.

You will see under the **Cycle Results**, the "Mold Full at VPT" is 90.05%. This VPT setting is not optimized. You'll have to correct this. The VPT should occur when the mold is between 94% - 96% full. The part has some problems. The part is burning and has a sink mark. The part is also out of specification. Notice for this part, the tolerance is only ± 0.002" (0.051 mm).

Burning is a critical part problem and must be addressed first in the optimization process. This is because burning creates a high probability of tool damage. Once the burning problem has been corrected, then proceed to the sink mark, optimizing the VPT, cycle time and part dimensions.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 4"
3. "Cycle" the machine.
4. Begin changing machine controls one at a time to solve the part problems and get the cycle time to 23 seconds or below.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 23 seconds or less

In addition to solving all part problems and getting your cycle time to 23 seconds or below, you must also meet the below "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance
- Mold Full at VPT must be between 94% - 96%
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 5 - Solving Flash, Burnmarks, and Dimension Problems (Level 2)

Solving Flash, Burnmarks, and Dimension problems

We are molding a square cover. This customer's dimensional specifications for this rectangular cover part are 6.500" X 6.500" (165.1 x 165.1 mm). The plastic you are using is Polystyrene on a 300-ton machine. Your part has flash, burnmarks, and is out of dimension, it is too big. The standard (quoted) cycle time for this job is 14 seconds. The part tolerance for this job is 6.500" ±.005 (165.1mm ±.127mm).

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 5"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a Flash problem, Burn mark problem, and dimensional problem.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 14 seconds or less

In addition to the above requirements, you must also meet the below "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance
- Mold Full at VPT must be between 94% - 96%
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 6 - Solving Voids and Warp (Level 2)

Solving Voids and Warp
We are molding a cover out of ABS plastic on a 300-ton machine. Your part has voids and warp. The standard (quoted) cycle time for this job is 23 seconds. The part tolerance for this job is 6.500" ±.005" (165.1mm ±.127mm).

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 6"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a warp and voids problem.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems
- Achieve a cycle time of 23 seconds or less

In addition to the above conditions, you must also meet the below "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance
- Mold Full at VPT must be between 94% - 96%
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 7 - Solving Warp, Sinkmarks, and Dimensional Problems (Level 2)

Solving Warp, Sinkmarks, and Dimensional Problems
We are molding a part called a bezel out of Polystyrene on a 300-ton machine. The customer's specifications for this part are 8.000" x 8.000" (203.2 x 203.2mm). The part is too small, it has sink marks and it is warping. The standard (quoted) cycle time for this job is 30 seconds. The part tolerance for this job is ± .005"(±.127mm). You must solve the part problems and then optimize the cycle. Of the three 'good molding practices' two of the conditions are already met. The Mold Full at VPT is currently at 94.89% which is with our specification of 94-96%. The cushion size is less than 10% of the screw back distance, again within our 'good molding practices' specifications. However, the melt temperature is 427.7° (219.8°C), not within 2°F (1.11°C) of the Front Zone and Nozzle temp. setting. This will need to be fixed.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 7"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have warp, sinkmarks, and dimensions problems.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 27 seconds or less

In addition to solving all part problems and getting your cycle time to 27 seconds or below, you must also meet the below "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance
- Mold Full at VPT must be between 94% - 96%
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 8 - Solving Sink Marks, Warp and Dimensions Problems (Level 4)

Solving Sink Marks and Dimensions Problems
We are molding a frame. This customer's dimensional specifications for part are 12.00" X 4.00" (304.8 x 101.6 mm) with a tolerance of ± 0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has sink marks and a dimensional problem, it is too small. The standard (quoted) cycle time for this job is 65 seconds. The part tolerance for this job is ±.005 (0.127mm).

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 8"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a sink mark problem and a size problem.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 65 seconds or less

In addition to solving all part problems and getting your cycle time to 65 seconds or below, you must also meet the below "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 9 - Optimize the Process and Reduce Cycle Time (Level 3)

Optimize the Process and Reduce Cycle Time
In this set-up, we are already making parts without any defects, but the machine settings are not optimized. Your job is to eliminate all part problems, reduce cycle time, and set the controls to "good molding practices" conditions.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 9"
3. "Cycle" the machine.
4. You will not see any part problems or machine alarms, but your cycle time is too high.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 15 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 10 - Solving Flash, Dimensional, and Warp problems & VPT (Level 2)

Solving Flash, Dimensional, and Warp problems & VPT
We are molding a cell cover out of ABS plastic on a 150-ton machine. As you can see from the part problems, we have flash, warp, and the part is too big. The standard (quoted) cycle time for this job is 17 seconds. The part tolerance for this job is ±.005 (± 0.127mm).

You will see under the **Cycle Results**, the "Mold Full at VPT" is 9999 and the max pressure alarm came on which means the maximum pressure was used. This means the VPT setting was never reached. You'll have to correct this. The VPT should occur when the mold is between 94% - 96% full. Because VPT did not occur before the mold was full, the mold flashed and that could cause serious damage to the mold.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 10"
3. "Cycle" the machine.
4. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 17 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

NOTE: Only make one control change at a time and then click the "Cycle" button to see the effects of that particular control change. This is the best practice to follow when making any control changes whether it be in SimTech or on an actual molding machine. The exceptions are the 4 barrel temperatures and 5 fill rates.

Lab 11 - Establishing a Melt Temp. with an Amorphous Plastic (Level 2)

Establishing a Melt Temperature with an Amorphous Plastic
In this lesson, you are molding a bracket on a 300-ton machine using polystyrene which is an amorphous plastic. As you have learned, the melt temperature is one of the four basic molding variables that affect part properties, as well as affecting the cycle time. In this lesson, you will be required to reduce the melt temperature of the plastic without changing the barrel temperature settings. You will also need to solve any machine alarms or part problems that develop as you make adjustments.

Purpose:

Show the effects the back pressure, screw RPM, and cycle time on the melt temperature of the plastic.

Controls to Adjust:

- Back Pressure
- Screw RPM
- Total cycle time

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 11"
3. "Cycle" the machine.
4. After you cycle the machine, under Cycle Results, you will see that the actual melt temperature is 408.6°F (209.2°C) which is higher than allowed in this exercise.
5. For this lesson, you are to leave the barrel zone temperatures settings as they are now, 400°F (204.4°C) for the front and middle zone and 350°F (176.6°C) at the rear zone.

To Complete this lesson:

1. Get a **melt temperature** between 400°F to 402°F (204.4°C – 205.5°C) by using the back pressure control and screw RPM, and cycle time.
2. Reduce the cycle time to 40 seconds or less. You can change any of the machine controls **except** the barrel zone temperatures.
3. Have no part problems or alarms.
4. Meet "3 good molding practices" criteria.
    - Cushion size must be less than 10% of the Screw Back Distance.
    - Mold Full at VPT must be between 94% - 96%.
    - Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

Lab 12 - Establishing a Melt Temp. with a Semi-Crystalline Plastic (Level 2)

Establishing a Melt Temperature with a Semi-Crystalline Plastic
In lab lesson 11, you were molding using an amorphous plastic, polystyrene. Now on this same machine molding the same part, you are running a semi-crystalline plastic, polypropylene, with the screw designed for an amorphous plastic. This situation is quite common in a molding plant. You will see it is much more difficult to get to the 400°F (204.4°C) melt temperature using this semi-crystalline plastic than it was using the amorphous plastic polystyrene. A semi-crystalline plastic has a specific melting temperature. At the melting temperature, the viscosity of the plastic suddenly goes down. The effect of screw RPM and back pressure on the melt temperature can be dramatic. Make the changes to the RPM and back pressure to achieve a melt temperature of 400°F (204.4°C), matching the front and middle zone barrel temperatures. You must use your knowledge from this training course to overcome problems. As an experiment, make drastic changes to the back pressure and screw rpm to see the effects on a semi-crystalline plastic using a screw not designed for it.

Purpose:

The purpose of this lesson is to show you what happens to the melt temperature when changing from an amorphous plastic to semi-crystalline plastic on the same machine with the same setup. It will also demonstrate how much more difficult it is to get to the 400°F (204.4°C) melt temperature using back pressure and screw RPM only.

Controls to Adjust:

- Back Pressure
- Screw RPM
- Total cycle time

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson “Lab 12”
3. “Cycle” the machine.
4. After you cycle the machine, notice the melt temperature is 382.9°F (194.9°C) as compared to 408.6°F (209.2°C) when molding with the amorphous plastic polystyrene. Again, it is desired to have the melt temperature match the front zone barrel temperature of 400°F (204.4°C)
5. For this lesson, you are to leave the barrel zone temperatures settings as they are now, 400°F (204.4°C) for the front and middle zone and 350°F (176.6°C) at the rear zone.

To Complete this lesson:

1. Get a **melt temperature** of 400°F (204.4°C) ±2°F (±1.11°C) by using the back pressure control and screw RPM control only.
2. Reduce the cycle time to 42 seconds or less. You can change any of the machine controls **except** the barrel zone temperatures.

3. Have no part problems or alarms.
4. Meet “3 good molding practices” criteria.
    - Cushion size must be less than 10% of the Screw Back Distance.
    - Mold Full at VPT must be between 94% - 96%.
    - Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

Lab 13 - Setting screw back distance, cushion size and velocity-to-pressure transfer point (VPT) on a molding machine (Level 3)

Setting a screw back distance, cushion size and VPT setting

Understanding the procedure for setting a correct screw back distance, cushion size and Velocity-to-Pressure Transfer Point (VPT) is a critical setup procedure for a machine and mold combination. A wrong procedure can damage a mold and may even be hazardous to personnel.

The procedures in this lesson on setting the screw back distance and VPT setting apply to all modern molding machines that have fill rate control, a VPT setting that allows a molder to control the cushion size and the transfer position from fill rate control to the pack/hold pressure. The procedure used here applies to all modern molding machines regardless of manufacturer. However, the specific control settings may vary. Use your molding plant's specific instructions for the machine setups.

Purpose:

Learn how to calculate the correct screw back distance, cushion size and Velocity-to-Pressure Transfer Point (VPT).

Task:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 13"
3. "Cycle" the machine.
4. Click on the View Job button.

a. This shows the parts being molded, the type of plastic and the molding machine being used.

Scenario:

Your job in this lesson is to find the machine setup for an appropriate screw back distance that will fill the mold and provide a cushion of plastic ahead of the screw. You must also have a VPT setting between 94% and 96% of a completely filled mold. Try to avoid triggering a maximum pressure alarm.

Part 1

Calculate the screw back distance for this two-cavity mold.

The screw diameter is 2.5”.

1. **First calculate the projected (frontal) area of the screw.**

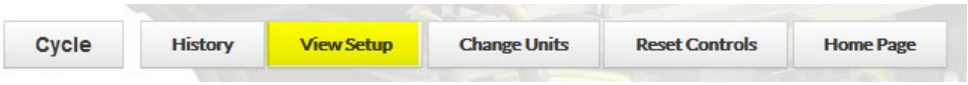
Formula: pi = 3.14 (Diameter^2 ÷ 4) x pi = screw front surface area in square inches.

*User Calculation*_____

*Correct answer*___*4.91 square inches*_____

Did you get the right answer? If not you’d better go back and check your calculation.

2. **Now calculate how many inches the screw back distance needs to be to fill the mold.**



(Click on “View Job” to see the part volume)

Calculation: Total parts volume ÷ Screw front surface area= Screw Back Distance setting

(Total parts volume: This is the volume for all the cavities in the mold. Remember we are molding on a 2 cavity mold so the part volume under View Job will need to be multiplied by 2 to take into account the 2 cavities for the calculation.)

*User calculation*_____ *linear inches*

Correct answer ___*3.16 linear inches*_____

Did you get the right answer? If not, you’d better go back and check your calculation.

Part 2

Your job is to find the machine settings that will:

1. Transfer from fill rate control to pack pressure control when the mold is between 94% - 96% full.
2. Have a final cushion size of less than 10% of the total screw back distance.
3. Avoid setting off the maximum pressure alarm or the no cushion alarm.
4. When you've completed these conditions, adjust the part length to exactly 12 inches

Note: The procedures in this lesson on setting screw back distance, cushion size, and VPT are for operating SimTech. The principles are the same for all molding machines, but the procedures may vary. Your plant may have other methods or additional procedures. Your molding plant's instructions take priority over the procedures used for SimTech.

Adjust Controls Settings

1. **Set a safe Maximum Injection Pressure.** Set a maximum injection pressure that will not cause the mold to flash and possibly damage the mold if that pressure was called for. It is set for 20,000 psi (1379 bar) which is too high. That high a pressure would cause flash and possible damage to the mold if the VPT setting is not reached. The VPT setpoint must be reached before the mold is full.

2. **Set the Screw Back Distance** - The screw back distance is the distance the screw must travel to fill the cavities and provide a cushion ahead of the screw. You calculated the screw back distance as 3.16 inches (80.26 mm). Change the screw back distance to 3.16 (80.26 mm) and Cycle the machine.

3. **Set the VPT Setpoint** - The VPT distance setting is the volume of plastic that's needed to fill the mold after the VPT set point is reached. So if the fill rate control fills 95% of the volume, the additional 5% is done by the pack/hold pressure. Calculate the VPT from the initial screw back distance. Here is the calculation for the initial setting for the VPT set point.

Calculation:	5% x screw back distance = VPT setpoint 0.05 x 3.16 = 0.16"

Set the VPT setpoint to 0.16" (4.06 mm) and Cycle the machine.

4. **Set the Pack/Hold pressure to "0"** - Set a "0" pack/hold pressure to avoid any plastic flow after the VPT is reached. The only plastic flow you want is from the fill rate controls. Cycle the machine.

   What is the length of the part? _____ (*Answer is 11.7 ± 0.1 inches) (296.5 mm)*

   What is your percentage of Mold Full at VPT? _____ (*Answer approx. 93%)*

   What is the cushion size? _____ *(Answer is 0.16 ± 0.1 inches) (4.061 mm)*

5. **Check Cushion Size** – The cushion size should not be more than 10% of the screw back distance. Right now, the screw back distance is 3.16” (80.26 mm). So the cushion size should not be more than 0.316” (3.16 x .10) or (80.26 x .10 = 8.026 mm). Ideally, we want the cushion size to between 5% - 10% of the screw back distance. We are within our ideal range.

6. **Adjust the screw back distance** – We need our Mold Full at VPT to be between 94% - 96%. Increase the screw back distance until the VPT occurs between 94% and 96%.

7. **Set the Pack/Hold Pressure** - To complete the filling and packing of the mold, increase the fill/pack pressure until the part length is exactly 12 inches (304.8 mm). Eliminate any problems that may have developed.
8. **Re-check the Cushion Size** – As we raise the pack/hold pressure, the cushion size will change. It is important to re-check the cushion size as pack/hold pressure is increased. Although the cushion size is still less than 10% of the screw back distance, it is no longer between our ideal range of 5% - 10% of the screw back distance. Try adjusting the cushion size to get within the ideal range.

   NOTE: In order to change the cushion size without changing the Mold Full at VPT, increase or decrease the screw back distance and the VPT Setpoint the same amount. If you use this method, the Mold Full at VPT will remain the same.

Remember: In order to get a score you must also meet all of the “good molding practices” criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature

Lab 14 - Solving Burn Marks, Voids and Dimensional (Level 4)

Solving Burn Mark, Voids and Dimensional
You are molding a Bezel. This customer's dimensional specifications for this Bezel are 8.000" X 8.000" (203.2 x 203.2 mm) with a tolerance of ±0.002" (0.051mm). The plastic you are using is Acrylic on a 300-ton machine. Your part has a burn mark, voids and dimensional errors. The standard (quoted) cycle time for this job is 20 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 14"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have a Burn Mark, Voids, and Dimensional (Size) Issues.
5. Burn marks are a critical part problem and must be addressed first in the optimization process. This is because this part problem creates a high probability of tool damage.
6. Once the burning is corrected, begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 20 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 15 - Solving Sink Marks, Shorts, Warp and Dimensional (Level 2)

Solving Burn Mark, Voids and Dimensional
You are molding a Box. This customer's dimensional specifications for this Box are 10.000" X 4.000" (254.0 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has a sink marks, warp, short and dimensional errors. The standard (quoted) cycle time for this job is 28 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 15"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have a Sink Mark, Warp, Shorts and Dimensional (Size) Issues.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 28 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 16 - Solving Burn Marks, Flash Warp and Dimensional (Level 4)

Solving Burn Mark, Voids and Dimensional
You are molding a Box. This customer's dimensional specifications for this Box are 10.000" X 4.000" (254.0 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has burn marks, flash, warp, and dimensional errors. The standard (quoted) cycle time for this job is 28 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 16"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a Burn Mark, Voids, and Dimensional (Size) Issues.
5. Burn marks are a critical part problem and must be addressed first in the optimization process. This is because this part problem creates a high probability of tool damage.
6. Once the burning is corrected, begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 28 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 17 - Solving Burn Marks, Flash Warp and Dimensional (Level 4)

Solving Burn Mark, Sink Marks, Warp and Dimensional Problems
You are molding a Frame. This customer's dimensional specifications for this Frame are 12.000" X 4.000" (304.0 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polypropylene on a 300-ton machine. Your part has burn marks, sink marks, warp, and dimensional errors. The standard (quoted) cycle time for this job is 38 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 17"
3. "Cycle" the machine.
4. After you cycle the machine you will see under Part Problems you have a Burn Mark, Sink Mark, Warp and Dimensional (Size) Issues.
5. Burn marks are a critical part problem and must be addressed first in the optimization process. This is because this part problem creates a high probability of tool damage.
6. Once the burning is corrected, begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 38 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 18 - Solving VPT and Cushion Size (Level 1)

Solving VPT and Cushion Size Problems
You are molding a Frame. This customer's dimensional specifications for this Frame are 12.000" X 4.000" (304.0 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polystyrene on a 300-ton machine. Your part does not have any part "defect" problems. However, the "Mold Full at VPT" is not between 94 - 96% and the Cushion Size is not less than 10% of the Screw Back Distance. The standard (quoted) cycle time for this job is 38 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 18"
3. "Cycle" the machine.
4. After you cycle the machine you will see under no Part Problems. However, the Mold Full at VPT and the Cushion Size are not "optimized".
5. Use the Screw Back Distance setting and the VPT Setpoint setting to correct the Mold Full at VPT and Cushion Size.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 38 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 19 - Solving Cycle Time (Level 1)

Solving Cycle Time Problems
You are molding a Cell Phone Cover. This customer's dimensional specifications for this Cell Phone are 8.000" X 3.000" (203.2 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is High Density Polyethylene (HDPE) on a 150-ton machine. Your part does not have any part "defect" problems and it currently meets the "3 good molding practices" we require.

- "Mold Full at VPT" is between 94% - 96%
- Cushion Size is less than 10% of the Screw Back Distance
- Melt temp is within ±2°F (1.11°C) of front zone barrel temperature

The quoted cycle time for this job is 10 seconds. This setup is currently running close to a 14 second cycle. You must reduce the cycle time to 10 seconds or better while maintaining the "3 good molding practices" and continue to have no part defects.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 19"
3. "Cycle" the machine.
4. After you cycle the machine you will see there are no Part Problems
5. Mold Full at VPT, the Cushion Size and the Melt Temperature are "optimized".

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 10 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Hint: Adjust Cooling Time for lowering cycle time and adjust Screw Rotation rpm to maintain melt temperature.

Lab 20 - Solving Cycle Time, Part Dimensions and Sink Marks (Level 3)

Solving Cycle Time Problems

You are molding a Cell Phone Cover. This customer's dimensional specifications for this Cell Phone are 8.000" X 3.000" (203.2 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is High Density Polyethylene (HDPE) on a 150-ton machine. Your part does have some "defect" problems you need to correct. Two of the three "good molding practices" have been met; the "Mold Full at VPT" is between 94 - 96% and the Cushion Size is less than 10% of the Screw Back Distance, however, the Melt Temperature is not within ±2°F (1.11°C) of front zone barrel temperature.

The quoted cycle time for this job is 10 seconds. This setup is currently running close to a 14.5 second cycle. You must fix the part problems, reduce the cycle time to 10 seconds or better, and get the Melt Temperature within ±2°F (1.11°C) of front zone barrel temperature while maintaining the other 2 "good molding practices".

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 20"
3. "Cycle" the machine.
4. After you cycle the machine, you will see you have two Part Problems. However, the Mold Full at VPT and the Cushion Size are "optimized".
5. Take note that the Melt Temperature is not "optimized".

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 10 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 21- Solving Sink Marks (Level 1)

Solving Sink Marks

You are molding a Bezel. This customer's dimensional specifications for this Bezel are 8.000" X 8.000" (203.2 x 203.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part does have a part "defect" problem (sink marks). The "Mold Full at VPT" is between 94 - 96% and the Cushion Size is less than 10% of the Screw Back Distance. The standard (quoted) cycle time for this job is 50 seconds. The actual Melt Temperature is not optimized.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 21"
3. "Cycle" the machine.
4. After you cycle the machine you will see there is a Part Problem.
5. Mold Full at VPT, the Cushion Size are "optimized". The actual Melt Temperature is not optimized.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 50 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

- Hint: Adjust Rear Zone, Middle Zone, Front Zone and Nozzle Temperatures to achieve optimized actual Melt Temperature in the Cycle Results outputs.

Lab 22 – Solving for Flash, Burnmarks, Warp, and Dimensions (Level 4)

Solving Flash, Burnmarks, Warp, and Dimensional problems
You are molding a Bezel. This customer's dimensional specifications for this Frame are 8.000" X 8.000" (203.2.0 x 203.2 mm) with a tolerance of ±0.002" (0.0508mm). The plastic you are using is ABS on a 300-ton machine. Your part has Flash, Burn Marks, Warp, and Dimensional Size errors. The standard (quoted) cycle time for this job is 45 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 22"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Flash, Burn Mark, Sink Mark, Warp and Dimensional (Size) Issues.
5. Burn marks are a critical part problem and must be addressed first in the optimization process. This is because this part problem creates a high probability of tool damage.
6. Flash is also a critical part problem and must be addressed first in the optimization process in order to avoid tool damage.
7. You must work to eliminate both Burn Marks and Flash simultaneously to guard against any tooling damage.
8. Once the burning and flashing is corrected, begin to make machine control changes to correct the warp and dimensional problems you have.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 45 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 23 - Solving for (Level 4)

Solving
You are molding a Bracket. This customer's dimensional specifications for this Bracket are 10.000" X 3.000" (254.0.0 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polycarbonate on a 300-ton machine. Your part has Burn Marks, Warp, Voids and Dimensional Size errors. The standard (quoted) cycle time for this job is 40 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 23"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Mark, Warp, Voids, and Dimensional (Size) Issues.
5. Burn marks are a critical part problem and must be addressed first in the optimization process. This is because this part problem creates a high probability of tool damage.
6. You must work to eliminate both Burn Marks and Flash simultaneously to guard against any tooling damage.
7. Once the burning and flashing is corrected, begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 40 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 24 - Solving for (Level 2)

Solving
You are molding a Bracket. This customer's dimensional specifications for this Bracket are 10.000" X 3.000" (254.0.0 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polycarbonate on a 300-ton machine. Your part has Voids and Dimensional Size errors. The standard (quoted) cycle time for this job is 40 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 23"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Voids, and Dimensional (Size) Issues.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 40 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

- Hint: Adjust the Fill Rate settings to achieve optimized Flowrate of the plastics to eliminate the Voids and Dimensional Size in the Cycle Results outputs.

Lab 25 - Solving for Sink Marks (Level 1)

Solving

You are molding a Cell Cover. This customer's dimensional specifications for this Cell Cover are 8.000" X 3.000" (203.2 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polystyrene on a 150-ton machine. Your part has Sink marks. The standard (quoted) cycle time for this job is 13 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 25"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Sink marks issues.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 13 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

- Hint: Adjust the Barrel Temperature settings to achieve optimized Plastic Melt Temperature to help eliminate the Sink Mark in the Cycle Results outputs.

Lab 26 - Solving for Sink Marks, Short Shots and Dimensions (Level 3)

Solving

You are molding a Cell Cover. This customer's dimensional specifications for this Cell Cover are 8.000" X 3.000" (203.2 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polystyrene on a 150-ton machine. Your part has Sink Marks, Short Shots and Dimensional Size errors. The standard (quoted) cycle time for this job is 9 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 26"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Sink Marks, Short Shots and Dimensional Size Issues.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 9 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 27 - Solving for Burn Marks, Sink Marks, Dimensions (Level 3)

Solving

You are molding a Bezel. This customer's dimensional specifications for this Bezel are 8.000" X 8.000" (203.2 x 203.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polypropylene on a 300-ton machine. The machine does have a semi-crystalline screw. Your part has Burn Marks, Sinks, and Dimensional Size errors. The standard (quoted) cycle time for this job is 23 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 27"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks, Sinks, and Dimensional (Size) Issues.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 23 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 28 - Solving for Burn Marks, Flash, Warp, and Dimensions (Level 4)

Solving

You are molding a Bezel. This customer's dimensional specifications for this Bezel are 8.000" X 8.000" (203.2 x 203.2 mm) with a precision tolerance of ±0.002" (0.05 mm). The plastic you are using is Polypropylene on a 300-ton machine. The machine does have a semi-crystalline screw. Your part has Burn Marks, Flash, Warp and Dimensional Size errors. The machine also has a Maximum Pressure alarm. The standard (quoted) cycle time for this job is 20.5 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 28"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks, Flash, and Dimensional (Size) Issues.
5. Burn Marks and Flash are critical part problems and must be addressed first in the optimization process. This is because these part problems create a high probability of tool damage.
6. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 20.5 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 29 – Optimizing VPT and Cushion Size (Level 1)

Solving

You are molding a Box with a living hinge. This customer's dimensional specifications for this Box are 10.000" X 4.000" (254.0.0 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is HD Polyethylene on a 300-ton machine equipped with a screw designed for semi-crystalline material. The standard (quoted) cycle time for this job is 12 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 29"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have no part problems.
5. However, the VPT and cushion do not meet the "good molding practices". This will need to be corrected.
6. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 12 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 30 - Solving for Flash, Burn Marks, Warp, and Dimensions (Level 3)

Solving

You are molding a Box with a living hinge. This customer's dimensional specifications for this Box are 10.000" X 4.000" (254.0.0 x 101.6 mm) with a tolerance of ±0.002" (0.0508mm). The plastic you are using is HD Polyethylene on a 300-ton machine equipped with a screw designed for semi-crystalline material. The standard (quoted) cycle time for this job is 9 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 30"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Flash, Burn Marks, Dimensional (Size) Issues and Warp.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 9 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 31 - Solving for Sink Marks, Warp, and Dimensions (Level 2)

Solving

You are molding a Frame. The customer's dimensional specifications for this Frame are 12.000" X 4.000" (304.8 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polystyrene on a 300-ton machine. Your part has Sink Marks, Warp and Dimensional Size problems. The standard (quoted) cycle time for this job is 32 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 31"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Sink Marks, Warp and Dimensional Size problems.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 32 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 32 - Solving for Flash, Burn Marks, Sink Marks, Warp, and Dimensions (Level 4)

Solving

You are molding a Frame. The customer's dimensional specifications for this Frame are 12.000" X 4.000" (304.8 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has Flash, Burn Marks, Sink Marks, Warp and Dimensional Size problems. The standard (quoted) cycle time for this job is 65 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 32"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Flash, Burn Marks, Sink Marks, Warp and Dimensional Size problems.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 65 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 33 - Solving for Burn Marks (Level 1)

Solving

You are molding a Cell Cover. The customer's dimensional specifications for this Cell Cover are 8.000" X 3.000" (203.2 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polystyrene on a 150-ton machine. Your part has Burn Marks and the Overall Cycle is above the Standard Cycle Time. The standard (quoted) cycle time for this job is 10 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 33"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 10 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 34 - Solving for Burn Marks, Sink Marks and Dimensions (Level 2)

Solving

You are molding a Cell Cover. The customer's dimensional specifications for this Cell Cover are 8.000" X 3.000" (203.2 x 76.2 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is Polystyrene on a 150-ton machine. Your part has Burn Marks, Sink Marks, Dimensional Size and the Overall Cycle Time is above the Standard Cycle Time. The standard (quoted) cycle time for this job is 10 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 34"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks, Sink Marks, and Dimensional Size problems.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 10 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 35 - Solving for Burnmarks, Dimensions, Warp, and Sink Marks (Level 3)

Solving

You are molding a Frame. The customer's dimensional specifications for this Frame are 12.000" X 4.000" (304.8 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has Burn Marks, Sink Marks, Dimensional Size issues, and is warped. The Overall Cycle Time is above the Standard Cycle Time. The standard (quoted) cycle time for this job is 68 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 35"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks, Sink Marks, Dimensional Size problems and Warp.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 68 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 36 - Solving for Flash, Burn Marks, Dimensions, and Warp (Level 4)

Solving

You are molding a Bezel. The customer's dimensional specifications for this Bezel are 8.000" X 8.000" (203.2 x 203.2 mm) with a tolerance of ±0.002" (0.0508 mm). The plastic you are using is Polypropylene on a 300-ton machine configured with a semi-crystalline screw. Your part has Burn Marks, Flash, Dimensional Size issues, Warp and a machine alarm. The Overall Cycle Time is below the Standard Cycle Time. The standard (quoted) cycle time for this job is 22 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 36"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks, Flash, Dimensional Size issues, Warp and a machine alarm.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 22 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 37 - Solving for Burnmarks, and Sink Marks (Level 1)

Solving

You are molding a Frame. The customer's dimensional specifications for this Frame are 12.000" X 4.000" (304.8 x 101.6 mm) with a tolerance of ±0.005" (0.127mm). The plastic you are using is ABS on a 300-ton machine. Your part has Burn Marks and Sink Marks. The Overall Cycle Time is above the Standard Cycle Time. The standard (quoted) cycle time for this job is 68 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 37"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks and Sink Marks.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 68 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.

Lab 38 - Solving for Burnmarks, Warp and Sink Marks (Level 2)

Solving

You are molding a Bezel. The customer's dimensional specifications for this Bezel are 8.000" X 8.000" (203.2 x 203.2 mm) with a tolerance of ±0.002" (0.0508 mm). The plastic you are using is Polypropylene on a 300-ton machine configured with a semi-crystalline screw. Your part has Burn Marks, Sink Marks, and Warp. The Overall Cycle Time is below the Standard Cycle Time. The standard (quoted) cycle time for this job is 22 seconds.

Instructions:

1. Log into your Virtual Lab Lessons site (www.paulsonskillbuilder.com)
2. Open lesson "Lab 38"
3. "Cycle" the machine.
4. After you cycle the machine, you will see under Part Problems you have Burn Marks, Sink Marks and Warp.
5. Begin to make machine control changes and Cycle the machine after each control adjustment to see how your machine control changes have affected your cycle/part properties.

To complete this lesson:

- Have no part problems or alarms
- Achieve a cycle time of 22 seconds or less

Meet "good molding practices" criteria.

- Cushion size must be less than 10% of the Screw Back Distance.
- Mold Full at VPT must be between 94% - 96%.
- Melt temp must be ±2°F (1.11°C) of front zone barrel temperature.