## Welcome to Paulson Training Programs, Inc. SimTech<sup>™</sup> Virtual Lab Lessons



SimTech<sup>™</sup> 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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\*All sections of this manual can be downloaded from our website at: www.paulsontraining.com/support-center



### What is SimTech?

SimTech<sup>™</sup> is an Injection molding machine simulator (think Flight simulator for Injection Molding). It is based on physics and mathematics – <u>not</u> 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 setups 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 <u>www.paulsonskillbuilder.com</u> and login using your provided credentials.

E-mail: Password: Remember me (for 30 days)		Login	
Password:	E-mail:		2
Remember me (for 30 days)	Password:		1 _2
		Remember me (for 30 days)	
Login		Login	

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.



hee skillbuilder_new X		-	- :						×			
← → C (① www.paulsonskillbuilder.com/m	anage_studen	ts?_signature=	1a0bd083	Secd5d1d1fa5711a7fb9e012	1c3957351				☆ :			
Paulson Training Program	Equiprimenting and the state where the state of the st											
Manager Home	for < 1	Trial Ac		nt 2 > Organ	IZATION	xpired Students						
Edit Lesson List Apply Lesson	List To All Stu	dents Stude	ent Repor	ts List Of Managers				10 records fou	nd			
E-mail 🛦	First name	Last name										
cpaulson1@paulsontraining.com	Craig	Paulson	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
dan.ralph@hennepintech.edu	Dan	Ralph	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
jasonchen@moldex3d.com	Jason	Chen	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
joeylabitag@ymail.com	Joey	Labitag	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
jrice@tool-n-die.com	Jeff	Rice	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
lbudz@blackhawkmolding.com	Lenn	Budz	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
naveedakramuet@hotmail.com	Naveed	Akram	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
ogarcia@rainbird.com	Omar	Garcia	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
test@test.com	Test	test	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
vincent@evergreenplastic.com	Vincent	Do	Edit	Add/Remove Lessons	Apply Lesson List	Lesson Report	Un-Enroll	Change Password				
Export: CSV		•						Copyright © 20	17 •			

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

skillbuilde	new X	
← → C	Not secure www.paulsonskillbuilder.com/new_student?_signature=3d3c7ed857bf87a85025acd14538f6a4cd774288	~☆:
👯 Apps 🗋	EpathLearning 💈 zoho 📋 Batch Learner Update 🚓 Course Catalog Searc 💡 SkillCheck 🌠 (JL1SWKWE802) Auth 🚓 Welcome to Pa	aulson 🔅 🔹 Nother bookmarks
	Paulson Training Programs, Inc. Home Help	Welcome Jennifer 🕶
	New Student	
	Exit Without Saving	
	Email:	
	Password:	
	Re-Enter Password:	
	First Name:	
	Last Name:	
	Apply All Available Lessons to Student: 👦	
	Save And Exit	
	alison 🔁 🖉	Copyright © 2018
	Training Programs, Inc.	
L		



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.

Import New Students From CSV

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 <u>not</u> 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.

Ħ	new_student_i File Edit View	mport_example Insert Format Data	a Tools Add-ons	Help All changes sa	ved in Drive		
		\$ % .0 .0 123 -	Arial - 1	0 - B Z S	<u>A</u> - 🌺 - 🖽 - 🖽		
fx	345678						
	A	В	С	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							
0							

This

Apply Lesson List To All Students

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<sup>™</sup> injection molding simulator. The Student Workbook Tutorial should be taken by all users who are not familiar with how SimTech<sup>™</sup> works. If you are already familiar with SimTech<sup>™</sup> and how it operates, you can move directly to the SimTech<sup>™</sup> lab lessons located at the end of this manual.

The Student Workbook Tutorial is designed to show you how to navigate through the SimTech<sup>™</sup> 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<sup>™</sup> control panel are plastic pressures, not hydraulic oil pressures.



#### **II. Starting Instructions**

- 1. To access SimTech "FreeMold" go to <u>www.paulsonskillbuilder.com</u>
- 2. Login with your email and password.

	Login
E-mail:	paulson1@paulson.com
Password:	•••••
	Remember me (for 30 days)
	Login

- 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.

Skillbuilde	er Home					
My Student Report	Change My Password Freemold					
						78 records found
Name		Assigned	Finished	% Done		
Lesson 1: Understandir	ng the Injection Molding Process			0	Continue	Start Over
Lesson 2: Setting Mach	ine Controls			0	Continue	Start Over
Lesson 3: Understandir	ng Fill Rate Controls			0	Continue	Start Over
Lesson 4: Setting the V	/PT Setting			0	Continue	Start Over
Lesson 5: The Maximur	n Injection Pressure Settings			0	Continue	Start Over
Lesson 6: Setting the F	ack/Hold Pressure			0	Continue	Start Over

- 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

User Session	IS										
Back New Session											
Search	Clear										3 records found
Session Name	Updated On	Units	Tolerance	Machine	Part	Plastic					
Test.Lesson	2019-10-16 20:22:07	english	precision	300tn	bracket	ABS	Edit Setup	Run	Сору	View History	Delete
Flash lesson	2019-10-15 20:21:40	english	standard	100tn	cover	ABS	Edit Setup	Run	Сору	View History	Delete
Warp & Short Shots Lesson	2019-10-15 20:21:29	english	precision	150tn	bracket	Polypropylene	Edit Setup	Run	Сору	View History	Delete

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

User Sessions											
Back New Session											
Search	Clear										3 records found
Shysion Name	Updated On	Units	Tolerance	Machine	Part	Plastic					
Test Lesson	2019-10-16 20:22:07	english	precision	300tn	bracket	ABS	Edit Setup	Run	Сору	View History	Delete
Flash lesson	2019-10-15 20:21:40	english	standard	100tn	cover	ABS	Edit Setup	Run	Сору	View History	Delete
Warp & Short Shots Lesson	2019-10-15 20:21:29	english	precision	150tn	bracket	Polypropylene	Edit Setup	Run	Сору	View History	Delete

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.

Setup	Save Ar	nd Exit									
Name			Standard Cycle Tin	ne		Tolerance	Tolerance				
SimTech User M			30.00			loose	loose 🗸				
Enter a name for this sess	sion		Standard Cycle Time use	d for Score		loose	in	+/-0.01			
Part			Units								
cover	-		english	•		Machine					
			Choose the units to work	cin		3000					
Part Length	in	6.500	Plastic Polystyrene	· Anne A							
Part Width	in	6.500				Max Injection Press	psi	25000			
Part Thickness	in	0.080	建建料路路	的影响		Max Clamp Force	tons	300			
Part Volume	in^3	5.330	PlasticTure		DS	Max Shot Size	in^3	39 300			
Number of Cavities		2	Low Melt Temp	E	379	Max Flow Rate	in^3	25.000			
			Low Mert Temp	r	3/7	Max FIOW Nate	in 5	23.000			
			High Melt Temp	F	471						

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

User S	Ses	sion	S						
Back	New S	ession							
		Search	Clear						5 records found
Session Nam	ne		Updated On	Units	Tolerance	Machine	Part	Plastic	
SimTech Use	er Manu	al	2019-10-23 21:00:34	english	loose	300tn	cover	Polystyrene	Edit Setup Run Copy View History Delete



- 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 Setting	15									
Barrel Temperatures				Fill Rates						
Rear Zone Temp	450	+	F	Fill Rate 1	2	+	in/s			
Middle Zone Temp	450	÷	F	Fill Rate 2	2	+	in/s			
Front Zone Temp	450	÷	F	Fill Rate 3	2	÷	in/s			
Nozzle Temp	450	+	F	Fill Rate 4	2	+	in/s			
Injection Unit				Fill Rate 5	2	÷	in/s			
Screw Rotation	35	÷	rpm	Pressures/Time						
Screw Back Pressure	500	÷	psi	Max Injection Pressure	25000	+	psi			
Screw Back Distance	2.48	÷	in	Ramp Time	0	÷	s			
VPT Setpoint	0.35	÷	in	Pack/Hold Pressure	3500	+	psi			
Mold and Clamp				Pack/Hold Time	5	÷	s			
Mold Moveable Temp	70	÷	F	Cooling Time	30	*	s			
Mold Stationary Temp	70	+	F	Mold Open Time	1	*	s			
Clamp Force	300	+	tons							



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

• You are molding a part with no defects.

Machine Control Setting	gs					Problems (most recent cycle to the left) Cycle Results				
			5.0.0			Flash	Melt Temp	445.7	F	
Barrel Temperatures		A =	Fill Rates		1 - 4 -	Burn Mark	Fill Time	1.08	S	
Rear Zone Temp	450	- F	FIII Rate 1	2 📮	in/s	Size	Cycle Time	37.08	s	
Middle Zone Temp	450	‡ F	Fill Rate 2	2 🗘	in/s	Weld Lines	Mold Full at VPT	94.90	%	
Front Zone Temp	450	‡ F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.231	in	
Nozzle Temp	450	‡ F	Fill Rate 4	2 🌲	in/s	Warp	Part Length	6.510	in	
Injection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.149	oz	
Screw Rotation	35	🗘 rpm	Pressures/Time			Voids	Screw Run Time	8.36	s	
Screw Back Pressure	500	🌻 psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:			
Screw Back Distance	2.48	🗘 in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual	
VPT Setpoint	0.35	🌲 in	Pack/Hold Pressure	3500 🗘	psi	Max Pressure	Machine	300tn		
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover		
Mold Moveable Temp	70	‡ F	Cooling Time	30	s		Plastic	Polystyrene		
Mold Stationary Temp	70	ţ F	Mold Open Time	1	s		Tolerance	+/- 0 01 in		
Clamp Force	300	1 tons		-		High Melt	Std. Cycle Time	30.0		
		-					Score	0.00 % efficie	ncv	
Cycle History	View Job	Change L	Units Hints Return to S	Sessions						
Gvele Granke										
Cycle Graphs										
PRESS	URE vs.	TIME				INJECTION PRESSURE vs. SCREW TRA	VEL			
	🗕 İn	iection Pres	sure	4k		4k				
	- Ca	wity Begin	Suic	21.		3k Injection Pressure				
	-Ca	wity End		JK.	Pre	(js 0)				
				2k	ssure	2k				
					e (ps	Less				
				1k	0	- 1k				
				0k		0k		~		
0 2	4 6 8	10 12 14	16 18 20 22 24 26 28 30	32 34 36		0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2. utia ←	2 2.4		
			Time (s)			Screw Trav	erin '			



### SimTech Tutorial – Student Workbook

A complete step-by-step tutorial that teaches all about successfully operating SimTech<sup>™</sup> - 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.

Machine Control Setting	15						Problems (most re	ecent cycle to the left)	Cycle Results		
	<u> </u>			510 D /			Flash		Melt Temp	445.7	F
Barrel Temperatures				Fill Rates		in /c	Burn Mark		Fill Time	1.08	s
Real Zone Temp	450	-	-		2	• III/S	Size		Cycle Time	37.08	s
Middle Zone Temp	450	÷	F	Fill Rate 2	2	in/s	Weld Lines		Mold Full at VPT	94.90	%
Front Zone Temp	450	÷	F	Fill Rate 3	2	🗯 in/s	Short Shot		Cushion Size	0.231	in
Nozzle Temp	450	÷	F	Fill Rate 4	2	in/s	S Warp		Part Length	6.510	in
Injection Unit				Fill Rate 5	2	🗯 in/s	Sink Marks		Part Weight	3.149	oz
Screw Rotation	35	÷	rpm	Pressures/Time			Voids		Srew Run Time	8.36	s
Screw Back Pressure	500	÷	psi	Max Injection Pressure	25000	🏮 psi	Machine Alarms		Session:		
Screw Back Distance	2.48	÷	in	Ramp Time	0	\$ s	Screw Recovery	0	Name	SimTech User	Manual
VPT Setpoint	0.35	\$	in	Pack/Hold Pressure	3500	🏮 psi	Max Pressure		Machine	300tn	
Mold and Clamp				Pack/Hold Time	5	\$ s	No Cushion	a de la companya de la	Part	cover	
Mold Moveable Temp	70	-	F	Cooling Time	30	≜ s	Low Melt		Plastic	Polystyrene	
Mold Stationary Temp	70	1	F	Mold Open Time	1	≜ s	LOW WEIL	<u> </u>	Tolerance	+/- 0.01 in	
Clamp Force	300	•	tons		(=)		High Melt		Std. Cycle Time	30.0	
									Score	0.00 % efficie	ncv
Cycle History	View Job	С	hange Units	Hints Return to S	essions						
Cycle Graphs											
		TINAL	-								
FRESS	UKE VS.	TIVI	E				INJECTION PRES	SORE VS. SCREW TRAVEL			
	🔶 In	jectio	on Pressure			4K	4K				
		avity	Begin			3k	3k	<ul> <li>Injection Pressure</li> </ul>			
		IVILY	LIIU			Press	, c)				
						2k l	2h 2k	1			
						(psi)	تَّلِّ ۱ k				
<u>N</u>						1 K					
■ 35.173.69.207 ×						0k	0k	04.06.08.1.10.1	4 16 18 2 2	2 24	
0 2	4 6 8	10	12 14 16 1	8 20 22 24 26 28 30 3	2 34 36		0 0.2	0.4 0.6 0.8 T T.2 T	.4 1.6 1.8 2 2.	.2 2.4	



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

- A. You will raise each barrel zone by  $20^{\circ}$ F to determine which zone has the greatest effect.
  - 1. Raise rear zone barrel temperature to 470°F. [Cycle the machine]

Machine Control Settin	as					Problems (most recent cycle to the left)	Cycle Results	
machine control setan	95					Flash	Melt Temp	447.0 F
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	1.08 s
Rear Zone Temp	470 🗘	F	Fill Rate 1	2	in/s	Size	Cycle Time	37.08 s
Middle Zone Temp	450 🗘	F	Fill Rate 2	2	in/s	Weld Lines	Mold Full at VPT	94.90 %
Front Zone Temp	450 🗘	F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.231 ir
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s	Warp	Part Length	6.510 ir
Injection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.149 0
Screw Rotation	35 🗘	rpm	Pressures/Time			Voids	Screw Run Time	8.37 s
Screw Back Pressure	500 🗘	psi	Max Injection Pressure	25000	psi	Machine Alarms	Session:	
Screw Back Distance	2.48	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User Manua
VPT Setpoint	0.35	in	Pack/Hold Pressure	3500	psi	Max Pressure	Machine	300tn
Mold and Clamp	0.00		Pack/Hold Time	5	s	No Cushian	Part	cover
Mold Moveable Temp	70 1	F	Cooling Time	20	s		Plastic	Polystyrene
Mold Stationary Temp	70	F	Mold Open Time		s	Low Melt	Tolerance	+/ 0.01 in
Clamp Force	200	tons	mold open nine	L .	Ŭ	High Melt	Ctd. Cyalo Timo	
	500							30.0
							Score	0.00 % efficiency
Cycle History	VIEW JOD	Change Uni	ts Hints Return to S	essions				
Cycle Graphs								
PRESS	URE vs. TI	ΛE				INJECTION PRESSURE vs. SCREW TH	AVEL	
					1k	4k		
	- Injec - Cavit	tion Pressu y Begin y End			Pressure (psi)	3k Injection Pressure		
<b>35.173.69.207</b> ×	4 6 8 1	0 12 14 10	5 18 20 22 24 26 <u>2</u> 8 30 3	32 34 36	)k	0k 0 0.2 0.4 0.6 0.8 1 1	.2 1.4 1.6 1.8 2 2	.2 2.4

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

**Cycle Results** Problems (most recent cycle to the left) Machine Control Settings Flash Melt Temp 448.7 F Barrel Temperatures Fill Rates Fill Time Burn Mark 1.08 s Rear Zone Temp Fill Rate 1 🏮 in/s 450 2 Size Cycle Time 37.08 s 🌲 in/s Middle Zone Temp Fill Rate 2 2 470 Weld Lines Mold Full at VPT 94.89 % Front Zone Temp Fill Rate 3 + \* F in/s 450 2 Short Shot Cushion Size 0.231 in Nozzle Temp Fill Rate 4 🌲 in/s 1 F Warp 450 2 Part Length 6.510 in Fill Rate 5 Injection Unit 🏮 in/s Sink Marks Part Weight 2 3.148 οz 🏮 rpm Screw Rotation Voids 35 Pressures/Time Screw Run Time 8 38 s Screw Back Pressure Max Injection Pressure 🌲 psi 500 25000 🌻 psi Machine Alarms Session: Screw Back Distance 🌲 in Ramp Time 🌲 s 2.48 0 Screw Recovery Name SimTech User Manual VPT Setpoint 🌐 in Pack/Hold Pressure 3500 🌻 psi 0.35 Max Pressure Machine 300fn Mold and Clamp Pack/Hold Time 2 S 5 No Cushion Part cover Mold Moveable Temp ‡ F 70 Cooling Time 🌲 s Plastic 30 Polystyrene Low Melt Mold Stationary Temp ‡ F 70 Mold Open Time +/- 0.01 in 1 🌲 S Tolerance High Melt Clamp Force 🄶 tons 300 Std. Cycle Time 30.0 Score 80.91 % efficiency Cycle History View Job Change Units Hints Return to Sessions Cycle Graphs PRESSURE vs. TIME INJECTION PRESSURE vs. SCREW TRAVEL 4k 4k Injection Pressure Cavity Begin Injection Pressure 3k 3k Cavity End (isd) 7 ure 2k 2k H (psi Pre 1k 1 k■ 35.173.69.207 × 0k 0k 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 Ó



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]

lachine Control Settin	gs					Problems (most recent cycle to the left)	Cycle Results		
	<u> </u>					Flash	Melt Temp	458.5	F
Barrel Temperatures			Fill Rates		in to	Burn Mark	Fill Time	1.08	s
Rear Zone Temp	450 📮	F	Fill Rate 1	2 📮	in/s	Size	Cycle Time	37.08	s
Middle Zone Temp	450	F	Fill Rate 2	2	in/s	Weld Lines	Mold Full at VPT	94.87	%
Front Zone Temp	470	F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.231	in
Nozzle Temp	470	F	Fill Rate 4	2	in/s	Warp	Part Length	6.510	in
njection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.149	07
Screw Rotation	35	rpm	Pressures/Time			Voids	Screw Run Time	8.47	s
Screw Back Pressure	500 🗘	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35	in	Pack/Hold Pressure	3500 🗘	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover	
Nold Moveable Temp	70	F	Cooling Time	30	s	Low Molt	Plastic	Polystyrene	
Nold Stationary Temp	70	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300	tons		-		High Melt	Std. Cycle Time	30.0	
							Score	0.00 % efficie	nev
Cycle History	View Job	Change U	Hints Return to S	Sessions					
PRESS	SURE vs. TI	ME				INJECTION PRESSURE vs. SCREW TRA	VEL		
	🔶 Inie	ction Press	ure	4	k	4k			
	- Cavi	ity Begin ity End		3	Pressure (psi)	3k Injection Pressure 3k 4 S 2k 1k			
0 2	4 6 8	10 12 14	16 18 20 22 24 26 28 30 Time (s)	32 34 36	ık.	0k 0 0.2 0.4 0.6 0.8 1 1.2 Screw Tra	1.4 1.6 1.8 2 2 relin ←	.2 2.4	

*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]

Machina Control Sattings				Problems (most recent cycle to the left)	Cycle Results	
Machine Control Settings				Flash	Melt Temp	441.7 F
Barrel Temperatures	Fill Rates			Burn Mark	Fill Time	1.08 S
Rear Zone Temp	Fill Rate 1	2	in/s	Size	Cycle Time	37.08 s
Middle Zone Temp 450 🗘 F	Fill Rate 2	2	in/s	Weld Lines	Mold Full at VPT	94.91 %
Front Zone Temp 450 🗘 F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.231 in
Nozzle Temp 450 🗘 F	Fill Rate 4	2	in/s	Warp	Part Length	6.510 in
Injection Unit	Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.149 OZ
Screw Rotation 35 Crpm	Pressures/Time			Voids	Screw Run Time	8.32 s
Screw Back Pressure 500 🗘 psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:	
Screw Back Distance 2.48 🗘 in	Ramp Time	0	s	Screw Recovery	Name	SimTech User Manual
VPT Setpoint 0.35 🗘 in	Pack/Hold Pressure	3500 🗘	psi	Max Pressure	Machine	300tn
Mold and Clamp	Pack/Hold Time	5	s	No Cushion	Part	cover
Mold Moveable Temp 70 🗘 F	Cooling Time	30	s		Plastic	Polystyrene
Mold Stationary Temp 70 📮 F	Mold Open Time	1	s		Tolerance	+/- 0.01 in
Clamp Force 300 🗘 tons				High Meit	Std. Cycle Time	30.0
					Score	0.00 % efficiency
Cycle History View Job Change Unit	s Hints Return to S	essions				,
Civele Craphs						
PRESSURE vs. TIME				INJECTION PRESSURE vs. SCREW TRAVE	L	
		4	k	4k	N	
- Injection Pressur - Cavity Begin	e			- Injection Pressure	6	
- Cavity End		3	ik Pre	G SK		
		2	ssur	ў 2к		
			e (ps	Les s		
		1	k 😳	1k		
			N le	0k		~
0 2 4 6 8 10 12 14 16	18 20 22 24 26 28 30 3	32 34 36	/ K.	0 0.2 0.4 0.6 0.8 1 1.2 1	.4 1.6 1.8 2 2.	2 2.4
т	ime (s)			Screw Travel	n 🕶	



#### 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

Machine Control Setting	15					Problems (most recent cycle to the	left)	Cycle Results		
	<u>-</u>					Flash		Melt Temp	450.0	F
Barrel Temperatures			Fill Rates			Burn Mark		Fill Time	1.08	s
Rear Zone Temp	400 📮	F	Fill Rate 1	2 📮	ın/s	Size		Cycle Time	37.08	s
Middle Zone Temp	450 🗘	F	Fill Rate 2	2	in/s	Weld Lines		Mold Full at VPT	94.89	%
Front Zone Temp	450 🗘	F	Fill Rate 3	2	in/s	Short Shot		Cushion Size	0.231	in
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s	Warp		Part Length	6.510	in
Injection Unit			Fill Rate 5	2	in/s	Sink Marks		Part Weight	3.149	oz
Screw Rotation	35 🗘	rpm	Pressures/Time			Voids		Screw Run Time	12.97	s
Screw Back Pressure	1955 🗘	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms		Session:		
Screw Back Distance	2.48 🗘	in	Ramp Time	0	S	Screw Recovery		Name	SimTech User N	lanual
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	3500 🗘	psi	Max Pressure		Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	5	Part	cover	
Mold Moveable Temp	70 🗘	F	Cooling Time	30 🗘	s	Low Melt		Plastic	Polystyrene	
Mold Stationary Temp	70 🗘	F	Mold Open Time	1	s			Tolerance	+/- 0.01 in	
Clamp Force	300 🗘	tons		(				Std. Cycle Time	30.0	
								Score	80.91 % efficie	ncv
Cycle History	View Job	Change Unit	s Hints Return to S	Sessions						-
Cycle Graphs										
		-								
PRESS	URE VS. III	VIE				INJECTION PRESSURE VS. SCREW	W IRAVEL			
	🔶 Injec	tion Pressur	e	4k	¢	4k				
	- Cavit	y Begin		31	c	3k Injection Pres	sure			
	Cavit	LY ENG			Pres	(psi				
				2	sure	2k				
					(psi)	قد الله الم				
X				1k	c		~			
	<b>_</b>			- 01	k	0k	1 1 2 1	161822	2 24	
0 2	4 6 8 1	0 12 14 16	18 20 22 24 26 28 30 3	32 34 36		0 0.2 0.4 0.6 0.8 I	ew Travel in	← 1.0 1.0 2 2.	۷ ۲.4	

#### 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:\_\_\_\_\_

						1						
Machine Control Setting	gs						Problems (most rec	ent cycle to	the left)	Cycle Results		
Rarral Tomporaturos			Fill Patos				Flash			Melt Temp	450.2	F
Door Zono Tomp			Fill Rate 1	-	in/c		Burn Mark			Fill Time	1.09	S
Real Zolle Tellip	400 🚽	Г 	Fill Rate 1	2	11/5		Size			Cycle Time	37.09	s
Middle Zone Temp	450 🤤	F	Fill Rate 2	2	in/s		Weld Lines			Mold Full at VPT	95.77	%
Front Zone Temp	450 🗘	F	Fill Rate 3	2	in/s		Short Shot			Cushion Size	1.251	in
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s		Warp			Part Length	6.510	in
Injection Unit			Fill Rate 5	2	in/s		Sink Marks			Part Weight	3.148	oz
Screw Rotation	35 🗘	rpm	Pressures/Time				Voids			Screw Run Time	13.04	s
Screw Back Pressure	1955 🌲	psi	Max Injection Pressure	25000	psi		Machine Alarms			Session:		
Screw Back Distance	3.5 🗘	in	Ramp Time	0	s		Screw Recovery		0	Name	SimTech User	Manual
VPT Setpoint	1.35 🗘	in	Pack/Hold Pressure	3500	psi		Max Pressure		0	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s		No Cushion			Part	cover	
Mold Moveable Temp	70 🗘	F	Cooling Time	30	s		Low Melt			Plastic	Polystyrene	
Mold Stationary Temp	70 🗘	F	Mold Open Time	1	s					Tolerance	+/- 0.01 in	
Clamp Force	300 🗘	tons					rigit Meit		<b>•</b>	Std. Cycle Time	30.0	
										Score	0.00 % efficie	ncy
Cycle History	View Job C	hange Unit	B Hints Return to S	essions								
Cycle Graphs												
		-										
PRESS	URE VS. IIM	E					INJECTION PRESS	URE VS. SC	REW IRAVE	L		
	🔶 Injecti	on Pressur	e	4	łk		4k		_			
	- Cavity	Begin			l k		_ 3k	<ul> <li>Injection</li> </ul>	Pressure			
	- Cavity	End			Pre		jsd)					
					2k F		2k		μ –			
					e (p		ress					
	_				k S		□ 1k					
							0k				<u> </u>	
	4 6 8 10	12 14 16	18 20 22 24 26 28 30 3	2 34 36	)k		0 0? 0 <sup>A</sup>	6 0 v 1	× , 9 , 9	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		
0 2		Ti	me (s)						Screw Travel	n ←		



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

What happened?\_\_\_\_\_\_

lachine Control Setting	gs					Problems (most recent cyc	le to the left)	Cycle Results		
	,					Flash		Melt Temp	450.8	F
Barrel Temperatures			Fill Rates			Burn Mark		Fill Time	0.83	s
Rear Zone Temp	400	- F	Fill Rate 1	2 📮	in/s	Size		Cycle Time	36.83	s
Middle Zone Temp	450	F	Fill Rate 2	2	in/s	Weld Lines		Mold Full at VPT	71.61	%
Front Zone Temp	450	F	Fill Rate 3	2	in/s	Short Shot		Cushion Size	0.000	ir
Nozzle Temp	450	F	Fill Rate 4	2	in/s	Warp		Part Length	6.269	ir
njection Unit			Fill Rate 5	2	in/s	Sink Marks		Part Weight	3.128	o
Screw Rotation	35	🗯 rpm	Pressures/Time			Voids		Screw Run Time	11.48	s
Screw Back Pressure	1955	🏮 psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms		Session:		
Screw Back Distance	2	🗧 in	Ramp Time	0	s	Screw Recovery	0	Name	SimTech User	Manua
VPT Setpoint	0.4	in	Pack/Hold Pressure	3500 🗘	psi	Max Pressure		Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion		Part	cover	
Nold Moveable Temp	70	F	Cooling Time	30	s	Low Molt		Plastic	Polystyrene	
Mold Stationary Temp	70	F	Mold Open Time	1	s	Low Men		Tolerance	+/- 0.01 in	
Clamp Force	300	tons		-		High Melt	-	Std. Cycle Time	30.0	
								Score	0.00 % efficie	ncv
Cycle History	View Job	Change U	nits Hints Return to S	Sessions						
ycle Graphs										-
PRESS	URE vs. T	IME				INJECTION PRESSURE V	s. SCREW TRAVE	EL		
				4	k	4k				
1	Inje Cav	ection Press	sure			- Il mine	tion Process			
- <b>-</b>	- Cav	/ity End		3	k P		tion rressure			
	$\rightarrow$			2	essu	1 2k				
					(p	re s s				
				1	k E	1k				
<b>/</b>						0k				
/										
	4 6 8	10 12 14	16 18 20 22 24 26 28 30	32 34 36	k	00,00000000	0.00,0000	, <sup>2</sup> , <sup>3</sup> , <sup>6</sup> , <sup>2</sup> , <sup>6</sup> , <sup>1</sup> , <sup>6</sup>	0 v	



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.

						Broblems (most recent evelo to the left)	Cuelo Posulta		
Machine Control Setting	gs						Molt Tomp	450.0	E
Barrel Temperatures			Fill Rates			Purp Mark	Fill Time	430.0	1
Rear Zone Temp	400	F	Fill Rate 1	2	in/s	Burn Wark	Fill time	1.08	s
Middle Zone Temp	450	F	Fill Rate 2		in/s	Size	Cycle Time	37.08	S
Front Zone Temp	450	F	Fill Date 3		in/s	Weld Lines	Mold Full at VPT	94.89	%
Nerrie Temp	450 -	-	Fill Date 4	2	in/5	Short Shot	Cushion Size	0.231	in
Nozzie temp	450 📮	F	FIII Rate 4	2	in/s	Warp	Part Length	6.510	in
Injection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.149	oz
Screw Rotation	35 🗘	rpm	Pressures/Time			Voids	Screw Run Time	12.97	S
Screw Back Pressure	1955 🗘	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48 🗘	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	3500 🗘	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover	
Mold Moveable Temp	70	F	Cooling Time		s		Plastic	Polystyrene	
Mold Stationary Temp	70	F	Mold Open Time	50 +	-	Low Melt	Teleranae		
Clamp Force		tone	word open nine	1 .	3	High Melt 🥥	Tolerance	+/- 0.01111	
olamp i oree	300	10113					Std. Cycle Time	30.0	
	10						Score	80.91 % efficie	ency
Cycle History	View Job	Change Unit	s Hints Return to S	essions					
Cycle Graphs									
PRESS	URE vs. TIN	1E				INJECTION PRESSURE vs. SCREW TRAV	EL		
				4	k	4k			
	- Inject	tion Pressur	e						
	Cavit	y segin y End		3	k	3k Injection Pressure			
					ress	á .			
				2	k Te	5 S			
				1	(isd)	<sup>2</sup> 1k			
					n.			~	
	4 6 8 10	12 14 16	18 20 22 24 26 28 30 3	32 34 36	k	0k 0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2	2.2 2.4	
		т. т	ime (s)			Screw Trave	in ←		

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? \_\_\_\_\_





Fill Rates         Fill Rates         Rear Zone Temp       400 °       F       Fill Rate 1       2       in/s         Middle Zone Temp       450 °       F       Fill Rate 2       2       in/s         Nozzle Temp       450 °       F       Fill Rate 3       2       in/s         Nozzle Temp       450 °       F       Fill Rate 4       2       in/s         Injection Unit       Fill Rate 5       2       in/s       Sink Marks       Part         Screw Rotation       150 °       rpm       Pressures/Time       Sink Marks       Part         Screw Back Pressure       1335 °       psi       Max Injection Pressure       25000 °       psi         Mold and Clamp       0.35 °       in       Pack/Hold Pressure       3500 °       psi         Mold Moveable Temp       70 °       F       Cooling Time       30 °       s         Mold Stationary Temp       70 °       F       Mold Open Time       1 °       s         Clamp Force       300 °       tons       tons       tole       tole	It Temp Time Time Id Full at VPT shion Size t Length t Weight ew Run Time sion: ne SimT chine 300tt	450.0 1.08 37.08 94.89 0.231 6.510 3.149 2.14 Tech User Manu
Partie runperaturesPrin RatesRear Zone Temp400FFill Rate 12in/sRear Zone Temp450FFill Rate 12in/sMiddle Zone Temp450FFill Rate 32in/sModd Joane Temp450FFill Rate 32in/sNozzle Temp450FFill Rate 42in/sNozzle Temp450FFill Rate 42in/sNozzle Temp450FFill Rate 52in/sStorew Rotation150rpmPressures/TimeSink MarksPartScrew Back Distance2.48inRamp Time0\$Screw Back Distance2.48inRamp Time0\$Mold And Clamp70FCooling Time30\$Mold Moveable Temp70FCooling Time30\$Mold Stationary Temp70FMold Open Time1\$Clamp Force300tonstonstonstole	Time Time Time Time Time Time Time Time	1.08 37.08 94.89 0.231 6.510 3.149 2.14 Tech User Manu
Vield Zohe Temp       400       1	cle Time Id Full at VPT shion Size t Length t Weight ew Run Time sion: ne SimT chine 300tr	37.08 94.89 0.231 6.510 3.149 2.14 Tech User Manu
Aldoe Zone Temp       450       F       Fill Rate 2       2       In/s       Weld Lines       Mode         Front Zone Temp       450       F       Fill Rate 3       2       in/s       Short Shot       Part         Nozzle Temp       450       F       Fill Rate 4       2       in/s       Short Shot       Part         njection Unit       Fill Rate 5       2       in/s       Sink Marks       Part         Screw Rotation       150       rpm       Pressures/Time       Voids       Screw         Screw Back Distance       2.48       in       Ramp Time       0       \$       s         Aloid And Clamp       Pack/Hold Pressure       3500       psi       Max Pressure       Max Pressure       Max Pressure         Aloid Moveable Temp       70       F       Cooling Time       30       \$       s         Aloid Stationary Temp       70       F       Mold Open Time       1       \$       s         Clamp Force       300       tons       Instance       s       std.       std.	Id Full at VPT shion Size t Length t Weight ew Run Time sion: ne SimT chine 300tr	94.89 0.231 6.510 3.149 2.14 Fech User Manu
ront Zone Temp       450       F       Fill Rate 3       2       in/s       Short Shot       Part         lozzle Temp       450       F       Fill Rate 4       2       in/s       Short Shot       Part         njection Unit       Fill Rate 5       2       in/s       Sink Marks       Part         screw Rotation       150       rpm       Pressures/Time       Voids       Screw         screw Back Distance       2.48       in       Ramp Time       0       s       Screw Recovery       Max Injection Pressure       Screw Recovery       Max Max       Max Pressure       Max       Max       Part         Kold and Clamp       Pack/Hold Time       5       \$       S       No Cushion       Part         Kold Stationary Temp       70       F       Cooling Time       30       \$       Low Melt       Part         Kold Stationary Temp       70       F       Mold Open Time       1       \$       \$       High Melt       Toler         Kold more align force       300       tons       Sont S       S	shion Size t Length t Weight ew Run Time sion: ne SimT :hine 300tr	0.231 6.510 3.149 2.14 Tech User Manu
Jozzle Temp       450 *       F       Fill Rate 4       2 *       in/s       Warp       Part         njection Unit       Fill Rate 5       2 *       in/s       Sink Marks       Part         screw Rotation       150 *       rpm       Pressures/Time       Volds       Screw         screw Back Pressure       1335 *       psi       Max Injection Pressure       25000 *       psi       Machine Alarms       Serew         Screw Back Distance       2.48 *       in       Ramp Time       0 *       s       Screw Recovery       Max       Name         Mold And Clamp       Pack/Hold Time       5 *       s       No Cushion       Part       Part         Mold Moveable Temp       70 *       F       Cooling Time       30 *       s       Low Melt       Plast         Mold Stationary Temp       70 *       F       Mold Open Time       1 *       s       High Melt       Toler         Statu       300 *       tons       F       Mold Open Time       1 *       s       High Melt       Statu	t Length t Weight ew Run Time ision: the SimT thine 300tr	6.510 3.149 2.14 Tech User Manu
njection Unit       Fill Rate 5       2       in/s       Sink Marks       Part         Screw Rotation       150       rpm       Pressures/Time       Voids       Screw       Screw       Screw       1335       psi       Max Injection Pressure       25000       psi       Machine Alarms       Serew       Machine Alarms       Serew       Serew       Screw Recovery       Max       Name       Name </td <td>t Weight ew Run Time ision: ne SimT chine 300tr</td> <td>3.149 2.14 Tech User Manu</td>	t Weight ew Run Time ision: ne SimT chine 300tr	3.149 2.14 Tech User Manu
Interface       Interface       Pressures/Time       Voids       Screet	rew Run Time ssion: ne SimT chine 300tr	2.14
Crew Back Pressure       1335       psi       Max Injection Pressure       25000       psi       Machine Alarms       Sess         Crew Back Distance       2.48       in       Ramp Time       0       \$       Screw Recovery       Max       Name         PT Setpoint       0.35       in       Pack/Hold Pressure       3500       \$       Screw Recovery       Max       Name         Iold and Clamp       Pack/Hold Time       \$       \$       \$       No Cushion       Part       Part         Iold Adveable Temp       70       F       Cooling Time       30       \$       Low Mett       Part       Plast         Iold Stationary Temp       70       F       Mold Open Time       1       \$       \$       High Melt       Toler         Idamp Force       300       tons       -       -       *       High Melt       *       *       *	ne SimT chine 300tr	Fech User Manu
crew Back Distance       2.48       in       Ramp Time       0       \$ s       Screw Recovery       Nam         PT Setpoint       0.35       in       Pack/Hold Pressure       3500       \$ pSi       Max Pressure       Max         told and Clamp       Pack/Hold Time       \$       \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	ne SimT chine 300tr	fech User Mani
rPT Setpoint       0.35       in       Pack/Hold Pressure       3500       psi       Max Pressure       Max Pressure       Pack/Hold Pressure       Max Pressure       Pack/Hold Pressure	chine 300ti	
Indid and Clamp     Pack/Hold Time     5     \$     No Cushion     Part       Indid Moveable Temp     70     F     Cooling Time     30     \$     Indication and the part     Indication and the part </td <td></td> <td>n</td>		n
Aold Moveable Temp     70     F     Cooling Time     30     s     Low Melt     Plast       Aold Stationary Temp     70     F     Mold Open Time     1     s     High Melt     Toler       Clamp Force     300     tons     s     s     High Melt     std.	t cove	er
Iold Stationary Temp     70     F     Mold Open Time     1     s     High Melt     Toler       Stamp Force     300     tons     Toler     Std.     Std.     Std.	stic Poly:	styrene
Slamp Force 300 tons High Melt Std. 1	erance +/- 0	.01 in
	. Cvcle Time 30.0	
Scor	ore 80.9	1 % efficiency
Cycle History View Job Change Units Hints Return to Sessions ycle Graphs		
PRESSURE VS. TIME INJECTION PRESSURE VS. SCREW TRAVEL		
Injection Pressure     Cavity Begin     Cavity End     Sk     Pressure     Lik     Sk     Cavity End     Cavity End		 
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6	1.8 2 2.2 2.4	4

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]** 

Machine Control Setting	as						Problems (most recent cycle to the left)	Cycle Results		
	5-						Flash	Melt Temp	450.0	F
Barrel Temperatures			Fill Rates				Burn Mark	Fill Time	0.00	s
Rear Zone Temp	400	€ F	Fill Rate 1	2	÷ I	n/s	Size	Cycle Time	36.00	s
Middle Zone Temp	450	‡ F	Fill Rate 2	2	÷ i	n/s	Weld Lines	Mold Full at VPT	94.74	%
Front Zone Temp	450	‡ F	Fill Rate 3	2	‡ i	n/s	Short Shot	Cushion Size	0.330	in
Nozzle Temp	450	‡ F	Fill Rate 4	2	‡ i	n/s	Warp	Part Length	6.418	in
Injection Unit			Fill Rate 5	2	‡ i	n/s	Sink Marks	Part Weight	3.170	oz
Screw Rotation	150	🗘 rpm	Pressures/Time				Voids	Screw Run Time	2.14	s
Screw Back Pressure	1335	🌻 psi	Max Injection Pressure	1100	Û F	osi	Machine Alarms	Session:		
Screw Back Distance	2.48	🏮 in	Ramp Time	0	÷ s	\$	Screw Recovery	Name	SimTech User I	Manual
VPT Setpoint	0.35	🌲 in	Pack/Hold Pressure	1000	Û. F	osi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	÷ s	\$	No Cushion	Part	cover	
Mold Moveable Temp	70	‡ F	Cooling Time	30	‡ s	3	Low Melt	Plastic	Polystyrene	
Mold Stationary Temp	70	‡ F	Mold Open Time	1	t s	3	High Molt	Tolerance	+/- 0.01 in	
Clamp Force	300	🔶 tons						Std. Cycle Time	30.0	
								Score	0.00 % efficier	ncy
Cycle History	View Job	Change Un	its Hints Return to S	essions						
Cycle Graphs										
PRESS	URE vs.	TIME					INJECTION PRESSURE vs. SCREW TRAV	EL		
					2k		2k			
	🔶 Inj	jection Pressu	ire							
	- Ca	wity End			:	P	- injection Pressure			
л					16	Disse	9 2 1k			
J-					11. 1	re (p	es se	_		
<u> </u>						<u>-</u>	L.		<u> </u>	
<b>1</b>							OF			
0 2	4 6 8	10 12 14	16 18 20 22 24 26 28 30	32 34	0k		0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2	.2 2.4	
			Time (s)	/			Screw Trave	∣in ←		

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.

						Problems (most recent cycle to the left)	Cyclo Posults		
Machine Control Setting	ļs					Flash	Melt Temp	450.0	F
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	1 10	
Rear Zone Temp	400	‡ F	Fill Rate 1	2	🏮 in/s	Size	Cycle Time	27.10	5
Middle Zone Temp	450	‡ F	Fill Rate 2	2	🌲 in/s	Weld Lines	Mold Full at VPT	04.90	0/2
Front Zone Temp	450	‡ F	Fill Rate 3	2	🗘 in/s	Short Shot	Cushion Size	0 231	in
Nozzle Temp	450	‡ F	Fill Rate 4	2	🌲 in/s	Warp	Part Length	6.506	in
Injection Unit			Fill Rate 5	2	1 in/s	Sink Marks	Part Weight	3.132	oz
Screw Rotation	150	🔶 rpm	Pressures/Time		×	Voids	Screw Run Time	2.14	s
Screw Back Pressure	1335	🏮 psi	Max Injection Pressure	10000	🏮 psi	Machine Alarms	Session:		
Screw Back Distance	2.48	🗘 in	Ramp Time	0	‡ s	Screw Recovery	Name	SimTech User I	Manual
VPT Setpoint	0.35	🗘 in	Pack/Hold Pressure	1700	🏮 psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	∱ s	No Cushion	Part	cover	
Mold Moveable Temp	70	‡ F	Cooling Time	30	1 s		Plastic	Polvstvrene	
Mold Stationary Temp	70	‡ F	Mold Open Time	1	^ s		Tolerance	+/- 0.01 in	
Clamp Force	300	tons		(±	*	High Melt	Std. Cycle Time	30.0	
							Score	80.66 % effici	encv
Cycle History	View Job	Change Un	its Hints Return to S	essions					,
					J				
Cycle Graphs									
PRESS	URE vs.	TIME				INJECTION PRESSURE vs. SCREW TRAVE	iL		
					2k	2k			
	← Inj → Ca	jection Pressu wity Begin	ire						
	- Ca	wity End			Pre				
						2 1k			
					e (pg	Les st			
					÷	₽.		_	
						0k		L	
0 2	4 6 8	10 12 14 1	6 18 20 22 24 26 28 30 3	2 34 36	0k	0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2.2	2.4	
			Time (s)			Screw Travel	in ←		



#### 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? \_\_\_\_\_

Machine Control Settings						Problems (most recent cycle to the left)	Cycle Results		
D. I.T. I			E'll Deter			Flash	Melt Temp	448.1	F
Barrel Temperatures			Fill Rates		in /o	Burn Mark	Fill Time	1.05	s
Rear Zone Temp	400 🚽	-		2	III/S	Size	Cycle Time	37.05	s
Middle Zone Temp	450 🤤	F	Fill Rate 2	2 🗘	in/s	Weld Lines	Mold Full at VPT	76.94	%
Front Zone Temp	450 🗘	F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.000	in
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s	Warp	Part Length	0.000	in
Injection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	0.000	oz
Screw Rotation	13	rpm	Pressures/Time			Voids	Screw Run Time	30.00	s
Screw Back Pressure	1335 🗘	psi	Max Injection Pressure	10000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48 🗘	in	Ramp Time	0 ‡	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover	
Mold Moveable Temp	70 🗘	F	Cooling Time	30	s		Plastic	Polystyrene	
Mold Stationary Temp	70 🗘	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300 🗘	tons				High Melt	Std. Cycle Time	30.0	
							Score	0.00 % efficie	ncv
Cycle History V	iew Job	Change U	nits Hints Return to S	essions			00010		,
Cycle Graphs									
PRESSU	IRE vs. TIN	ΛE				INJECTION PRESSURE vs. SCREW TR	AVEL		
				2	k	2k			
	<ul> <li>Inject</li> <li>Cavit</li> </ul>	tion Press v Beain	ure						
	- Cavit	y End			Pr				
				11	essu				
					) G	es su			
					si)	È.			
						04			
	4 6 8 1	0 12 14	16 18 20 22 24 26 28 30 3	32 34 36	k	0 0.2 0.4 0.6 0.8 1 1	2 1.4 1.6 1.8 2 2	2 2.4	
			Time (s)			Screw Tr	avel in ←		



### 2. Raise rpm to 150. **[Cycle]**

• You should get a good part.

Machine Control Settings						Problems (most rec	ent cycle to the left)	Cycle Results		
Barrel Temperatures			Fill Rates			Flash		Melt Temp	450.0	F
Rear Zone Temp	400	F	Fill Rate 1	6	in/s	Burn Mark		Fill Time	1.19	S
Middle Zone Tomp	400 -		Fill Date 2	Z	in/c	Size		Cycle Time	37.19	S
	450 -	Г _		2.		Weld Lines		Mold Full at VPT	94.89	%
Front Zone Temp	450 🤤	F	Fill Rate 3	2	in/s	Short Shot	▋▖▕▋▕▎	Cushion Size	0.231	in
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s	Warp		Part Length	6.506	in
Injection Unit			Fill Rate 5	2	in/s	Sink Marks		Part Weight	3.132	oz
Screw Rotation	150 🗘	rpm	Pressures/Time			Voids		Screw Run Time	2.14	s
Screw Back Pressure	1335 🗘	psi	Max Injection Pressure	10000	psi	Machine Alarms		Session:		
Screw Back Distance	2.48 🗘	in	Ramp Time	0	s	Screw Recovery	0	Name	SimTech User N	lanual
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	1700	psi	Max Pressure	0	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	ŏ	Part	cover	
Mold Moveable Temp	70 🗘	F	Cooling Time	30	s	Low Melt		Plastic	Polystyrene	
Mold Stationary Temp	70 🗘	F	Mold Open Time	1	s	LOW WICh		Tolerance	+/- 0.01 in	
Clamp Force	300	tons				High Melt	<u> </u>	Std. Cycle Time	30.0	
								Score	80.66 % efficie	ncv
Cycle History	View.lob	Change Unit	s Hints Return to S	essions						
Cycle Graphs										
Cycle Graphs										
PRESS	URE vs. TIN	/IE				INJECTION PRESS	URE vs. SCREW TRAV	EL		
					2k	2k				
	- Inject	y Begin	e				- Injection Pressure			
	🔶 🕂 Cavit	y End			P	(js	injection recource			
					essu	9 2 1k				
						esser	7	_		
					osi)	Ē.				
					0k	0k 0 0 2 0	4 0.6 0.8 1 12	1.4 1.6 1.8 2 2	2 2.4	
0 2	4 6 8 1	0 12 14 16	18 20 22 24 26 28 30 3	2 34 36		5 0.2 0	Screw Trave	1.0 1.0 2 2. Lin ←		
		Т	ime (s)							



#### 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)

Machine Control Sotting						Problems (most recent cycle to the left)	Cycle Results					
Machine Control Setting	yə					Flash	Melt Temp	442.9	F			
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	1.22	s			
Rear Zone Temp	400	🗘 F	Fill Rate 1	2	in/s	Size	Cycle Time	22.22	s			
Middle Zone Temp	450	🗘 F	Fill Rate 2	2	in/s	Weld Lines	Mold Full at VPT	94.91	%			
Front Zone Temp	450	‡ F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.231	in			
Nozzle Temp	450	‡ F	Fill Rate 4	2	in/s	Warp	Part Length	6.507	in			
Injection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.134	oz			
Screw Rotation	150	🗘 rpm	Pressures/Time			Voids	Screw Run Time	2.11	s			
Screw Back Pressure	1335	🌻 psi	Max Injection Pressure	10000 🗘	psi	Machine Alarms	Session:					
Screw Back Distance	2.48	🗘 in	Ramp Time	0	s	Screw Recovery	Name	SimTech User M	Manual			
VPT Setpoint	0.35	🌲 in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn				
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover				
Mold Moveable Temp	70	🔶 F	Cooling Time	15	s		Plastic	Polystyrene				
Mold Stationary Temp	70	‡ F	Mold Open Time	1	s		Tolerance	+/- 0.01 in				
Clamp Force	300	🔶 tons				High Melt	Std. Cycle Time	30.0				
							Score	0.00 % efficier	ncy			
Cycle History	View Job	Change Uni	ts Hints Return to S	Sessions								
Cycle Graphs												
PRESS												
FRESS	URE VS.					INJECTION PRESSURE VS. SCREW TRAVE						
	🔶 Inj	ection Pressu	re		ĸ	JK						
	-+ Ca	vity Begin vity End			_	<ul> <li>Injection Pressure</li> </ul>						
					k ress							
					ure (							
- <b>/</b> -				1	k [j	Ľ 1k						
1								~				
				0	k	0k 0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2	2.2 2.4				
0 1	2 5 4 5	с 7 8 9 г	iu ii i2 i3 i4 i5 i6 i7 i8 ime (s)	19 20 21		Screw Travel in ←						

What is melt temperature? \_\_\_\_\_\_°F

Why did the melt temperature decrease? \_\_\_\_\_



2. Use the back pressure to raise	the melt temperature to $450^{\circ}F \pm 2^{\circ}$ .	[Cycle]
-----------------------------------	--	---------

Machine Control Settings						Problems (most recent cycle to	o the left)	Cycle Results			
						Flash		Melt Temp	449.6	F	
Barrel lemperatures			Fill Rates		1 1	Burn Mark		Fill Time	1.19	S	
Rear Zone Temp	400 🚽	F	FIII Rate 1	2 📮	in/s	Size		Cycle Time	22.19	s	
Middle Zone Temp	450 🗘	F	Fill Rate 2	2	in/s	Weld Lines		Mold Full at VPT	94.89	%	
Front Zone Temp	450 🗘	F	Fill Rate 3	2	in/s	Short Shot		Cushion Size	0.231	in	
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s	Warp		Part Length	6.506	in	
Injection Unit			Fill Rate 5	2	in/s	Sink Marks		Part Weight	3.133	oz	
Screw Rotation	150 🗘	rpm	Pressures/Time			Voids		Screw Run Time	2.57	s	
Screw Back Pressure	2325 🌲	psi	Max Injection Pressure	10000 🗘	psi	Machine Alarms		Session:			
Screw Back Distance	2.48 🌲	in	Ramp Time	0	s	Screw Recovery	0	Name	SimTech User M	Manual	
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure		Machine	300tn		
Mold and Clamp			Pack/Hold Time	5	s	No Cushion		Part	cover		
Mold Moveable Temp	70 2	F	Cooling Time	15	s	No odsmon		Plastic	Polystyrene		
Mold Stationary Temp	70	F	Mold Open Time	1	s	Low Melt		Tolerance	+/- 0 01 in		
Clamp Force	300	tons				High Melt		Std. Cycle Time	30.0		
	500							Sta. Cycle Time	425 47 % offici	ienev	
Cycle History	View Job	Change Uni	ts Hints Return to S	Sessions							
TRESS	ORE VS. III			2	L.	24		•			
Injection Pressure     Cavity Begin     Cavity End     Cavity						(iso) auns saud	Pressure				

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]

Machine Control Settings						Problems (most recent cycle to the left)	Cycle Results		
	5					Flash	Melt Temp	473.3	F
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	0.25	s
Rear Zone Temp	400	F	Fill Rate 1	2	in/s	Size	Cycle Time	21.25	s
Middle Zone Temp	450	F	Fill Rate 2	2	in/s	Weld Lines	Mold Full at VPT	7.76	%
Front Zone Temp	450 🗘	F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.000	in
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s	Warp	Part Length	2.915	in
Injection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.090	oz
Screw Rotation	150	rpm	Pressures/Time			Voids	Screw Run Time	2.39	s
Screw Back Pressure	6000 🗘	psi	Max Injection Pressure	10000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35	in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover	
Mold Moveable Temp	70 🗘	F	Cooling Time	15	s		Plastic	Polystyrene	
Mold Stationary Temp	70	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300	tons					Std. Cvcle Time	30.0	
							Score	0.00 % efficie	ncv
Cycle History	View Job	Change Unit	ts Hints Return to S	essions					,
Cycle Graphs									
PRESS	URE vs. TI	ME				INJECTION PRESSURE vs. SCREW TRAV	EL		
				2	2k	2k			
	-+ Inje -+ Cavi	ction Pressui ity Begin	re			- Injection Pressure		Λ	
	Cavity End				Pre	(is)		<b>'</b>	
				1	k In			<u> </u>	
					e (ps	sa			
~					Ü	E.		L	
						0k		1	
0 1	2 3 4 5	6789	10 11 12 13 14 15 16 17	18 19 20	)K	0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2.2	2.4	
Time (s)						Screw Trave	in ←		

What alarms occurred? \_\_\_\_\_

Why? \_\_\_\_\_


# 2. Reset the back pressure to 2,325 psi. [Cycle]

• You should get a good part.

Machine Control Settin	as					Problems (most recent cycle to the left)	Cycle Results				
	<u>.</u>					Flash	Melt Temp	449.6	F		
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	1.19	s		
Rear Zone Temp	400 🗘	F	Fill Rate 1	2	in/s	Size	Cycle Time	22.19	s		
Middle Zone Temp	450 🇘	F	Fill Rate 2	2	in/s	Weld Lines	Mold Full at VPT	94.89	%		
Front Zone Temp	450 🗘	F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.231	in		
Nozzle Temp	450 🗘	F	Fill Rate 4	2	in/s	Warp	Part Length	6.506	in		
Injection Unit			Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.133	οz		
Screw Rotation	150 🗘	rpm	Pressures/Time			Voids	Screw Run Time	2.57	s		
Screw Back Pressure	2325 🗘	psi	Max Injection Pressure	10000 🗘	psi	Machine Alarms	Session:				
Screw Back Distance	2.48 🗘	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User M	/lanual		
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn			
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover			
Mold Moveable Temp	70 🗘	F	Cooling Time	15 🗘	s		Plastic	Polystyrene			
Mold Stationary Temp	70 🗘	F	Mold Open Time	1	s	Ligh Molt	Tolerance	+/- 0.01 in			
Clamp Force	300 🗘	tons					Std. Cycle Time	30.0			
							Score	135.17 % effici	iency		
Cycle History	View Job	Change Uni	ts Hints Return to S	essions							
Cycle Graphs											
PRESS	SURE vs. TIN	16				INJECTION PRESSURE vs. SCREW TRAV	EL				
				2	k	2k					
L	- Inject	ion Pressu	re								
r i	- Cavit	/ End			P	G Injection Pressure					
					ressu	<u>с</u> 2 и					
					K IFe (fr		_				
K					(iso	£.					
1											
				0	k	0k 0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2	.2 2.4			
0 1	2 3 4 5 6	, , , , , , , , , , , , , , , , , , ,	io ii iz is i4 15 16 17 18	19 20 21		Screw Travel in ←					



### 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.

Machine Control Setting	gs					Problems (most recent cycle	e to the left)	Cycle Results		
	5					Flash		Melt Temp	452.0	F
Barrel Temperatures			Fill Rates			Burn Mark		Fill Time	1.19	s
Rear Zone Temp	400	F	Fill Rate 1	2 📮	in/s	Size		Cycle Time	26.19	s
Middle Zone Temp	450	€ F	Fill Rate 2	2	in/s	Weld Lines		Mold Full at VPT	94.89	%
Front Zone Temp	450	‡ F	Fill Rate 3	2	in/s	Short Shot		Cushion Size	0.231	in
Nozzle Temp	450	€ F	Fill Rate 4	2	in/s	Warp		Part Length	6.506	in
Injection Unit			Fill Rate 5	2	in/s	Sink Marks		Part Weight	3.133	οz
Screw Rotation	150	🗘 rpm	Pressures/Time			Voids		Screw Run Time	2.59	s
Screw Back Pressure	2325	🏮 psi	Max Injection Pressure	10000 🌲	psi	Machine Alarms		Session:		
Screw Back Distance	2.48	🌲 in	Ramp Time	0	s	Screw Recovery		Name	SimTech User	Manual
VPT Setpoint	0.35	🗅 in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	ŏ	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion		Part	cover	
Mold Moveable Temp	70	ţ F	Cooling Time	15	s	No ousmon		Plastic	Polystyrene	
Mold Stationary Temp	70	f F	Mold Open Time	<b>5</b>	s	Low Melt	<u> </u>	Tolerance	+/- 0 01 in	
Clamp Force	300	tons				High Melt		Std. Cycle Time	30.0	
	000	×						Scoro		nov
Cyclo History	View Job	Change L	nite Hinte Doturn to 9	Possions				5000	0.00 % entre	ncy
Cycle	view 30b	Change O	Return to v	363510115						
Cycle Graphs										
PRESS	URE vs. 1	пме				INJECTION PRESSURE vs.	SCREW TRAVE	L		
-	- Ini	action Press	1179	2 k		2k				
	-+- Ca	vity Begin	uic				on Pressure			
	- Ca	vity End			Pre	() sci				
				1k	ssun	й 1k				
V					e (ps	ress				
					0	ш.			<u> </u>	
l c						0k			L	
0 1	2345	6789	10 11 12 13 14 15 16 17 18	0k		0 0.2 0.4 0.6	0.8 1 1.2	1.4 1.6 1.8 2 2.	2 2.4	
			Time (c)				Screw Travel	in ←		

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.

							Deckleme (meet		46 - 1-60	Cuele Desults		
Machine Control Setting	gs						Froblems (most	recent cycle to	o the left)		440.0	-
Barrel Temperatures			Fill Rates				Flash			weit temp	449.6	F
Rear Zone Temp	400	F	Fill Rate 1		2	in/s	Burn Mark	_	_	Fill Time	1.15	s
Middle Zone Temp	450	F	Fill Rate 2			in/s	Size		_	Cycle Time	22.15	S
Front Zone Temp	450	F	Fill Date 3			in/e	Weld Lines	-	_	Mold Full at VPT	94.86	%
Nerrie Temp	450	- ' -	Fill Date 4		2	in/3	Short Shot			Cushion Size	0.231	in
	450 🖵	F	Fill Rate 4		2	in/s	Warp	-		Part Length	6.505	in
Injection Unit			Fill Rate 5		2	in/s	Sink Marks			Part Weight	3.127	OZ
Screw Rotation	150 📮	rpm	Pressures/T	lime			Voids			Screw Run Time	2.57	S
Screw Back Pressure	2325 🌻	psi	Max Injectio	on Pressure	10000	psi	Machine Alarms	i		Session:		
Screw Back Distance	2.48 🗘	in	Ramp Time		0	s	Screw Recovery			Name	SimTech User	Manual
VPT Setpoint	0.35 🗘	in	Pack/Hold F	Pressure	1700	psi	Max Pressure			Machine	300tn	
Mold and Clamp			Pack/Hold 1	Time	5	s	No Cushion			Part	cover	
Mold Moveable Temp	110	F	Cooling Tim	ne	15	s	Low Melt			Plastic	Polystyrene	
Mold Stationary Temp	110	F	Mold Open	Time	1	s	Low Weit			Tolerance	+/- 0.01 in	
Clamp Force	300	tons	· · · ·		-		High Melt			Std. Cycle Time	30.0	
										Score	0.00 % officio	DOV
Quelo History	View Job	Change Unite	Hinto	Dotum to S	lossions					50010	0.00 % emcle	ney
Cycle	VIEW JOD	Change Onits		Return to 5	essions							
Cycle Graphs												
PRESS	URE vs. TI	ME					INJECTION PRE	SSURE vs. S	CREW TRAVEL			
						2k	2k					
l F	- Injec	ction Pressure ity Begin					r		Pressure			
n	- Cavi	ity End				P	(isi	injection	Tressure			
						1 k L	 ≝_1k					
						(p	ns sə.			_		
						si)	۵.				_	
	2 2 4 5	6 7 8 9 1		1 15 16 17 19	10 20 21	Dk	0k 0 0.2	0.4 0.6 0.	8 1 1.2 1.	4 1.6 1.8 2 2.	2 2.4	
	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 Time (s)								Screw Travel in	←		

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.

Machine Control Settings					Problems (most recent cycle to the	e left)	Cycle Results				
					Flash		Melt Temp	400.2	F		
Barrel Temperatures		Fill Rates			Burn Mark		Fill Time	0.62	s		
Rear Zone Temp	<b>C</b> F	Fill Rate 1	4 📮	in/s	Size		Cycle Time	21.62	s		
Middle Zone Temp 385	Ç F	Fill Rate 2	4	in/s	Weld Lines		Mold Full at VPT	94.88	%		
Front Zone Temp 400	Ç F	Fill Rate 3	4	in/s	Short Shot		Cushion Size	0.230	in		
Nozzle Temp 400	🗘 F	Fill Rate 4	4	in/s	Warp		Part Length	6.503	in		
Injection Unit		Fill Rate 5	4	in/s	Sink Marks		Part Weight	3.117	oz		
Screw Rotation 65	🔶 rpm	Pressures/Time			Voids		Screw Run Time	4.32	s		
Screw Back Pressure 600	🌻 psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms		Session:				
Screw Back Distance 2.48	🌲 in	Ramp Time	0	s	Screw Recovery		Name	SimTech User N	/lanual		
VPT Setpoint 0.35	🌲 in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure		Machine	300tn			
Mold and Clamp		Pack/Hold Time	5	s	No Cushion		Part	cover			
Mold Moveable Temp 60	🗘 F	Cooling Time	15	s	Low Melt		Plastic	Polystyrene			
Mold Stationary Temp 60	Ç F	Mold Open Time	1	s			Tolerance	+/- 0.01 in			
Clamp Force 300	🌲 tons						Std. Cycle Time	30.0			
							Score	138.79 % effici	iency		
Cycle History View Job	Change Unit	s Hints Return to S	essions								
Cycle Graphs											
PRESSURE vs.	TIME				INJECTION PRESSURE vs. SCRE	W TRAVEL					
	P	-	3	k	3k						
	avity Begin	E			- Injection Pres	ssure					
- 0	Cavity End		2	k P	ig 2k						
				ssure		_					
			1	k (psi	1k						
				0	_		``				
				١Ŀ	0k			L			
0 1 2 3 4	56789	10 11 12 13 14 15 16 17 1	8 19 20	~~~	0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4						
	Ti	me (s)			Scr	rew Travel in	`				

 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]

Machine Control Setting	<u>js</u>					Problems (most recent cycle to the left)	Cycle Results		
D			FIL Datas			Flash	Melt Temp	400.2	F
Barrel Temperatures	<b></b>	A E	Fill Rates		in/o	Burn Mark	Fill Time	0.32	s
	380	· ·		10		Size	Cycle Time	21.32	s
Middle Zone Temp	385	Ţ F	Fill Rate 2	10 🖵	in/s	Weld Lines	Mold Full at VPT	95.19	%
Front Zone Temp	400	€ F	Fill Rate 3	10 🗘	in/s	Short Shot	Cushion Size	0.230	in
Nozzle Temp	400	‡ F	Fill Rate 4	10 🗘	in/s	Warp	Part Length	6.501	in
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.109	oz
Screw Rotation	65	🗘 rpm	Pressures/Time			Voids	Screw Run Time	4.32	S
Screw Back Pressure	600	🌻 psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48	🌲 in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35	🗘 in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover	
Mold Moveable Temp	60	‡ F	Cooling Time	15	s	Low Melt	Plastic	Polystyrene	
Mold Stationary Temp	60	‡ F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300	🔶 tons		-		Hign Melt	Std. Cvcle Time	30.0	
							Score	140.75 % effic	iency
Cycle History	View Job	Change Un	its Hints Return to s	Sessions					,
Cuelo Crenho		_							
Cycle Graphs									
PRESS	URE vs.	ТІМЕ				INJECTION PRESSURE vs. SCREW TRAV	/EL		
1	🔶 İn	iection Press	Ire	2k	L.	2k			
	-+ Ca	wity Begin				- Injection Pressure	_		
	+ Ca	avity End			Pres			4	
		<u> </u>		1k	ssure	lk		+	
					(psi	Pres			
					-				
$\sim$						0k			
0 1	2 3 4	5 6 7 8 9	9 10 11 12 13 14 15 16 17	18 19 20	-	0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2. -Lin ←	2 2.4	
			Time (s)			Screw Frav	erin '		

What is the fill time?	_sec
What is the cycle time?	_sec
What is the part weight?	0Z.
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]

Machine Control Setting	15					Problems (most recent cycle to the left)	Cycle Results					
						Flash	Melt Temp	400.2	F			
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	0.72	s			
Rear Zone Temp	380 📮	F	FIII Rate 1	3 📮	in/s	Size	Cycle Time	21.72	s			
Middle Zone Temp	385 🗘	F	Fill Rate 2	3	in/s	Weld Lines	Mold Full at VPT	95.99	%			
Front Zone Temp	400 🗘	F	Fill Rate 3	3	in/s	Short Shot	Cushion Size	0.230	in			
Nozzle Temp	400 🗘	F	Fill Rate 4	3	in/s	Warp	Part Length	6.503	in			
Injection Unit			Fill Rate 5	6	in/s	Sink Marks	Part Weight	3.118	οz			
Screw Rotation	65 🗘	rpm	Pressures/Time			Voids	Screw Run Time	4.32	s			
Screw Back Pressure	600 ‡	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:					
Screw Back Distance	2.48 🗘	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User M	lanual			
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn				
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover				
Mold Moveable Temp	60 🗘	F	Cooling Time	15	s		Plastic	Polystyrene				
Mold Stationary Temp	60 🗘	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in				
Clamp Force	300 🗘	tons					Std. Cycle Time	30.0				
							Score	0.00 % efficien	cy			
Cycle History	View Job	Change Unit	s Hints Return to S	essions								
Cycle Graphs												
cycle Graphs												
PRESS	URE vs. TIM	NE				INJECTION PRESSURE vs. SCREW TRAVE	L					
	• Inite			3	k	3k						
	- Cavit	ty Begin	e			- Injection Pressure						
	- Cavit	y End		2	k P	نَقَ 2k						
					ssure							
				1	k (psi	2 1k						
(/					<u> </u>			$\sim$				
					k	0k	· · · · · · · ·	L				
0 1	2345	6789	10 11 12 13 14 15 16 17 18	3 19 20		0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4						
		Т	ime (s)			Screw Travel	n ·					

 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.

Machine Control Setting	ļs					Problems (most recent cycle to the left)	Cycle Results					
D 17 .	-		511.0			Flash	Melt Temp	400.2	F			
Barrel Temperatures			Fill Rates		i (	Burn Mark	Fill Time	0.24	s			
Rear Zone Temp	380 📮	F	Fill Rate 1	13 🗸	in/s	Size	Cycle Time	21.24	s			
Middle Zone Temp	385 🗘	F	Fill Rate 2	13	in/s	Weld Lines	Mold Full at VPT	95.19	%			
Front Zone Temp	400 🗘	F	Fill Rate 3	13	in/s	Short Shot	Cushion Size	0.230	in			
Nozzle Temp	400 🗘	F	Fill Rate 4	13 🗘	in/s	Warp	Part Length	6.500	in			
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.106	oz			
Screw Rotation	65 🗘	rpm	Pressures/Time			Voids	Screw Run Time	4.32	s			
Screw Back Pressure	600 🗘	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:					
Screw Back Distance	2.48 🗘	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User I	Manual			
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn				
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover				
Mold Moveable Temp	60 ‡	F	Cooling Time	15 🗘	s	Low Melt	Plastic	Polystyrene				
Mold Stationary Temp	60 🗘	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in				
Clamp Force	300 🗘	tons					Std. Cycle Time	30.0				
							Score	141.24 % effic	iency			
Cycle History	View Job	Change Units	s Hints Return to S	essions								
Cycle Graphs												
PRESS	URE vs. TII	ME				INJECTION PRESSURE vs. SCREW TRAV	EL					
	- Inier	tion Pressur	a.	3	k	3k						
	- Cavit	y Begin	-			Injection Pressure						
	- Cavit	ty End		2	k Pre	(jg 2k	~					
					ssure			7				
	$\rightarrow$			1	k (psi	2 1k		$\rightarrow$				
					0							
$\sim$				0	k	0k		<u> </u>				
0 1	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20					0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4						
		Ti	me (s)			Screw Trave	in -					

 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]

Machine Control Settin	gs					Problems (most recent cycle to the left)	Cycle Results				
D 17 (			511 D (			Flash	Melt Temp	400.2	F		
Barrel Temperatures	(	A E	Fill Rates	A	in/c	Burn Mark	Fill Time	0.53	S		
Real Zone temp	380			4	11/5	Size	Cycle Time	21.53	S		
Middle Zone Temp	385	- F	Fill Rate 2	4 🗸	in/s	Weld Lines	Mold Full at VPT	96.27	%		
Front Zone Temp	400	‡ F	Fill Rate 3	4	in/s	Short Shot	Cushion Size	0.230	in		
Nozzle Temp	400	‡ F	Fill Rate 4	4	in/s	Warp	Part Length	6.502	in		
Injection Unit			Fill Rate 5	8	in/s	Sink Marks	Part Weight	3.113	οz		
Screw Rotation	65	🏮 rpm	Pressures/Time			Voids	Screw Run Time	4.32	s		
Screw Back Pressure	600	🌻 psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:				
Screw Back Distance	2.48	🌲 in	Ramp Time	0 ‡	s	Screw Recovery	Name	SimTech User	Manual		
VPT Setpoint	0.35	🌲 in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn			
Mold and Clamp		_	Pack/Hold Time	5 🗘	s	No Cushion	Part	cover			
Mold Moveable Temp	60	🗘 F	Cooling Time	15 🗘	s		Plastic	Polystyrene			
Mold Stationary Temp	60	‡ F	Mold Open Time	1	s		Tolerance	+/- 0.01 in			
Clamp Force	300	🔶 tons					Std. Cvcle Time	30.0			
							Score	0.00 % efficie	ncv		
Cycle History	View Job	Change Ur	its Hints Return to S	Sessions							
Cycle Graphs											
PRESS	URE vs.	TIME				INJECTION PRESSURE vs. SCREW TRAN	ΈL				
				3	k	3k					
1	-+ In	jection Pressi avity Begin	Ire			Injection Pressure					
_	🗕 Ca	avity End		2	k P	₩ <sup>1</sup> / <sub>20</sub> 2k					
		<b>-</b>			essu						
					, (j)	Se 1k					
0					ĸ ÷	<u>~</u>		<u>`</u>			
						0k		L			
0 1	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20					0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4					
	Time (s)					Screw Travel in ←					

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]

Machine Control Setting	js					Problems (most recent cycle to the left)	Cycle Results				
Derrol Terror terror			Cill Datas			Flash	Melt Temp	400.2	F		
Barrel Temperatures		-	Fill Rates		in /o	Burn Mark	Fill Time	0.24	s		
Rear Zone Temp	380 -	F	Fill Rate 1	13 🗸	in/s	Size	Cycle Time	21.24	s		
Middle Zone Temp	385 🗘	F	Fill Rate 2	13 🗘	in/s	Weld Lines	Mold Full at VPT	95.19	%		
Front Zone Temp	400 🗘	F	Fill Rate 3	13 🗘	in/s	Short Shot	Cushion Size	0.230	in		
Nozzle Temp	400 🗘	F	Fill Rate 4	13 🗘	in/s	Warp	Part Length	6.500	in		
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.106	oz		
Screw Rotation	65	rpm	Pressures/Time			Voids	Screw Run Time	4.32	s		
Screw Back Pressure	600 🗘	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:				
Screw Back Distance	2.48 🗘	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User I	Manual		
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	1700 🗘	psi	Max Pressure	Machine	300tn			
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover			
Mold Moveable Temp	60 🗘	F	Cooling Time	15 🗘	s	Low Melt	Plastic	Polystyrene			
Mold Stationary Temp	60 🗘	F	Mold Open Time	1	s	High Molt	Tolerance	+/- 0.01 in			
Clamp Force	75 🗘	tons					Std. Cycle Time	30.0			
							Score	141.24 % effic	iency		
Cycle History	View Job	Change Units	Hints Return to S	essions							
Cycle Graphs											
PRESS	URE vs. TII	ИE				INJECTION PRESSURE vs. SCREW TRAV	EL				
				3	k	3k					
	<ul> <li>Injec</li> <li>Cavit</li> </ul>	tion Pressure ty Regin	e			Injustion Processo					
	- Cavi	ty End		2	k P	i 2k					
				-	essu			~			
					re (p						
				1	k S	È.					
~											
	2 3 4 5	6789	10 11 12 13 14 15 16 17	0	k	0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4					
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 Time (s)						Screw Travel in ←					

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]

Machine Control Settin	as					Problems (most recent cycle to th	e left)	Cycle Results		
	5		5 W D . (			Flash		Melt Temp	400.2	F
Barrel Temperatures			Fill Rates		≜ in/o	Burn Mark		Fill Time	0.21	S
Niddle Zone Temp	380	-	Fill Date 2	13	• in/s	Size		Cycle Time	21.21	S
Front Zone Temp	385 -	F	Fill Rate 2	13	in/s	Weld Lines		Mold Full at VPT	95.19	%
Front Zone Temp	400 -	F	Fill Rate 3	13	in/s	Short Shot	_	Cushion Size	0.230	in
Nozzie lemp	400 📮	F	Fill Rate 4	13	in/s	Warp	_	Part Length	6.510	in
Injection Unit		rom	Fill Rate 5	4	ț in/s	SINK Marks	_	Part Weight	3.148	OZ
Screw Rock Drossuro	65 🗸	nci	Pressures/Time		≜ nci	Voids		Screw Run Time	4.32	S
Screw Back Distance	600	in	Ramp Time	25000	↓ psi ▲ c		<u> </u>	Session:		
	2.48	in		0	• DOI	Screw Recovery		Name	SimTech User I	Manual
VPT Selpoint	0.35 🖕	IN	Pack/Hold Pressure	5500	psr	Max Pressure	•	Machine	300tn	
Mold and Clamp		F	Pack/Hold Time	5	- S	No Cushion		Part	cover	
Mold Stationany Temp	60 -	F	Cooling Time	15	Ţ S	Low Melt	Image: A start of the start	Plastic	Polystyrene	
	60 🗸	tone	Mold Open Time	1	Ç S	High Melt	<u> </u>	Tolerance	+/- 0.01 in	
Clamp Force	300 🖵	tons						Std. Cycle Time	30.0	
	Injecti     Cavity     Cavity     2 3 4 5 6	5 7 8 9	re 10 11 12 13 14 15 16 17 1	8 19 20	6k 5k 4k Pressure (psi) 2k 1k 0k	6k 5k 1njection Pre 3k 2k 1k 0 0.2 0.4 0.6 0.8 5c	25SURE	1.6 1.8 2 2. ←	2 2.4	
Wha Wha Wha	t is the t is the t is the	fill ti cycle part	ime? e time? weight?		_sec _sec oz					
Wha	t is the	part	length?		in					
Why	did the	e part	t 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]
--	---------

						Problems (most recent cycle to the left)	Cycle Results		
Machine Control Setting	gs					Flash	Melt Temp	400.2	F
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	0.21	s
Rear Zone Temp	380 🗘	F	Fill Rate 1	13	🗘 in/s	Size	Cycle Time	21.21	s
Middle Zone Temp	385 🗘	F	Fill Rate 2	13	in/s	Weld Lines	Mold Full at VPT	95.19	%
Front Zone Temp	400 🗘	F	Fill Rate 3	13	in/s	Short Shot	Cushion Size	0.230	in
Nozzle Temp	400 🗘	F	Fill Rate 4	13	in/s	Warp	Part Length	6.511	in
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.155	oz
Screw Rotation	65 🗘	rpm	Pressures/Time			Voids	Screw Run Time	4.32	s
Screw Back Pressure	600 🗘	psi	Max Injection Pressure	25000	🏮 psi	Machine Alarms	Session:		
Screw Back Distance	2.48 🗘	in	Ramp Time	0	\$ s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	6000	🏮 psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	∱ s	No Cushion	Part	cover	
Mold Moveable Temp	60 ‡	F	Cooling Time	15	^ s		Plastic	Polvstvrene	
Mold Stationary Temp	60 2	F	Mold Open Time	1	* s	Low Men	Tolerance	+/- 0 01 in	
Clamp Force	300 1	tons		(±)	*	High Meit	Std. Cycle Time	30.0	
							Score	0.00 % efficie	ncv
Cycle History	View Job	Change Unit	s Hints Return to S	essions			00010	0.00 % 0.000	
Cycle Graphs									
PRESS	URE vs. TIM	ЛE				INJECTION PRESSURE vs. SCREW TRAN	'EL		
					6k	6k			
	- Injec	tion Pressur y Begin	e		5k	5k			
	🗕 Cavit	y End			4k 🖥	(jg 4k			
					3k II	lig 3k			
					0 21 0	SS 2k			
					11			$\neg$	
					TK.	0k		$\mathbf{\lambda}$	
0 1	2 3 4 5	6 7 8 9	10 11 12 13 14 15 16 17	18 19 20	0k	0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2.	.2 2.4	
		Т	ime (s)			Screw Trav	elin ←		

What is the fill time?\_\_\_\_\_\_secWhat is the cycle time?\_\_\_\_\_secWhat 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.

Machine Control Sottin	as					Problems (most recent cycle to the left)	Cycle Results		
Machine Control Setting	<u>ys</u>					Flash	Melt Temp	400.2	F
Barrel Temperatures			Fill Rates			Burn Mark	Fill Time	0.21	s
Rear Zone Temp	380 🇘	F	Fill Rate 1	13	in/s	Size	Cycle Time	21.21	s
Middle Zone Temp	385 🗘	F	Fill Rate 2	13	in/s	Weld Lines	Mold Full at VPT	95,19	%
Front Zone Temp	400 🗘	F	Fill Rate 3	13	in/s	Short Shot	Cushion Size	0.230	in
Nozzle Temp	400 🗘	F	Fill Rate 4	13	in/s	Warp	Part Length	6.510	in
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.148	οz
Screw Rotation	65 🗘	rpm	Pressures/Time			Voids	Screw Run Time	4.32	s
Screw Back Pressure	600 ‡	psi	Max Injection Pressure	25000	psi	Machine Alarms	Session:		
Screw Back Distance	2.48 ‡	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User M	/lanual
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	5500	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	5	s	No Cushion	Part	cover	
Mold Moveable Temp	60 🗘	F	Cooling Time	15	s		Plastic	Polystyrene	
Mold Stationary Temp	60 🗘	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300 🗘	tons					Std. Cycle Time	30.0	
							Score	141.46 % effici	ency
Cycle History	View Job	Change Unit	s Hints Return to S	essions					
Cycle Graphs									
PRESS		ME.					=1		
T NESS	ORE VS. III				61	Ste State St			
	- Injec	tion Pressur	e		OK.				
	+ Cavit	ty Begin			5k	SK - Injection Pressure			
	- Cavn	y-cnu			4k Pres				
					3k g	2 3k			
					2k (psi	2k			
					- 1k	1k 🛁 💆			
					0k	0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2	.2 2.4	
0 1	2345	6 / 8 9 T	10 11 12 13 14 15 16 17	18 19 20		Screw Trave	in ←		

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? \_\_\_\_\_\_secWhat is the cycle time? \_\_\_\_\_secWhat 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?	0Z.
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.

Machine Control Setting	15					Problems (most recent cycle to the left)	Cycle Results		
`	<u> </u>		511 D (			Flash	Melt Temp	398.2	F
Barrel Temperatures			Fill Rates	A	in/c	Burn Mark	Fill Time	0.21	S
	380 -	-		13		Size	Cycle Time	17.41	S
	385 🖵	F	Fill Rate 2	13 -	in/s	Weld Lines	Mold Full at VPT	95.21	%
Front Zone Temp	400 🤤	F	Fill Rate 3	13 🗘	in/s	Short Shot	Cushion Size	0.231	in
Nozzle Temp	400 🇘	F	Fill Rate 4	13 🇘	in/s	Warp	Part Length	6.509	in
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.147	ΟZ
Screw Rotation	65 🗘	rpm	Pressures/Time			Voids	Screw Run Time	4.32	S
Screw Back Pressure	600 🗘	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48 🗘	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User N	lanual
VPT Setpoint	0.35 🗘	in	Pack/Hold Pressure	5500 🗘	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	1.2 🗘	s	No Cushion	Part	cover	
Mold Moveable Temp	60 🗘	F	Cooling Time	15	s	Low Melt	Plastic	Polystyrene	
Mold Stationary Temp	60 🗘	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300 🗘	tons					Std. Cycle Time	30.0	
							Score	172.33 % effici	ency
Cycle History	View Job	Change Unit	ts Hints Return to S	essions					
Cycle Graphs									
Cycle Graphs									
PRESS	URE vs. TIN	/IE				INJECTION PRESSURE vs. SCREW TRAVEL			
				6	k	6k			
	- Inject	tion Pressui y Begin	e	5	k	5k Injection Pressure			
	- Cavit	y End		4	k P	is 4k			
				3	k Ir	Зк			
				2	e (ps	2k			
				-	k	- 1k		$\neg$	
				1		0k		$\mathbf{\lambda}$	
0 1	2 3 4	567	8 9 10 11 12 13 14	15 16	К	0 0.2 0.4 0.6 0.8 1 1.2 1	4 1.6 1.8 2 2	2 2.4	
		Т	ime (s)			Screw Travel in	, <del>C</del>		

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]

Machine Control Settin	qs					Problems (most recent cycle to the left	) Cycle Results		
	<u> </u>					Flash	Melt Temp	399.9	F
Barrel lemperatures		A 5	Fill Rates		in te	Burn Mark	Fill Time	0.21	S
Rear Zone Temp	380	- F	Fill Rate 1	13 .	in/s	Size	Cycle Time	37.71	s
Middle Zone Temp	385	Ç F	Fill Rate 2	13	in/s	Weld Lines	Mold Full at VPT	95.24	%
Front Zone Temp	400	‡ F	Fill Rate 3	13	in/s	Short Shot	Cushion Size	0.231	in
Nozzle Temp	400	🗘 F	Fill Rate 4	13	in/s	Warp	Part Length	6.508	in
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.141	oz
Screw Rotation	25	🔶 rpm	Pressures/Time			Voids	Screw Run Time	11.54	S
Screw Back Pressure	600	🏮 psi	Max Injection Pressure	25000	psi	Machine Alarms	Session:		
Screw Back Distance	2.48	🌲 in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35	🌲 in	Pack/Hold Pressure	5500	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	1.5	s	No Cushion	Part	cover	
Mold Moveable Temp	160	‡ F	Cooling Time	35	s	Low Melt	Plastic	Polystyrene	
Mold Stationary Temp	160	Ç F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300	🔶 tons			-	High Melt	Std. Cycle Time	30.0	
							Score	0.00 % efficie	ncv
Cycle History	View Job	Change Ur	its Hints Return to S	Sessions					-
Cycle Graphs									
PRESS	URE vs.	TIME				INJECTION PRESSURE vs. SCREW T	RAVEL		
					6k	6k			
	- Inj - Ca	ection Pressi vity Begin	ire		5k	5k			
n	🗕 Ca	vity End			4k 7	(is 4k	-		
					3k ur	ر) ۲ 3k			
					ri ⊋kr	2k			
					÷			$\neg$	
					1.6	0k		$\mathbf{\lambda}$	
0 2	4 6 8	10 12 14 1	6 18 20 22 24 26 28 30 3	2 34 36	0k	0 0.2 0.4 0.6 0.8 1	1.2 1.4 1.6 1.8 2 2.3	2 2.4	
			T (-)			Screw T	ravel in ←		

 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.

Machine Control Setting	qs					Problems (most recent cycle to the left)	Cycle Results		
	<u>.</u>		5'II D (			Flash	Melt Temp	399.6	F
Barrel Temperatures		E	Fill Rates		in/o	Burn Mark	Fill Time	0.21	S
	380	-		13		Size	Cycle Time	36.41	s
Middle Zone Temp	385	F	FIII Rate 2	13 🗸	in/s	Weld Lines	Mold Full at VPT	95.24	%
Front Zone Temp	400	F	Fill Rate 3	13 🗘	in/s	Short Shot	Cushion Size	0.231	in
Nozzle Temp	400 🌲	F	Fill Rate 4	13 🗘	in/s	Warp	Part Length	6.497	in
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.093	OZ
Screw Rotation	25	rpm	Pressures/Time			Voids	Screw Run Time	11.53	S
Screw Back Pressure	600 🗘	psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48	in	Ramp Time	0	S	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35	in	Pack/Hold Pressure	5500 🗘	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	0.2	S	No Cushion	Part	cover	
Mold Moveable Temp	160	F	Cooling Time	35 🗘	s	Low Melt	Plastic	Polystyrene	
Mold Stationary Temp	160	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300	tons				High Meit	Std. Cvcle Time	30.0	
							Score	0.00 % efficie	ncy
Cycle History	View Job	Change Uni	ts Hints Return to S	essions					
Cycle Graphs									
PRESS	URE vs. TI	ME				INJECTION PRESSURE vs. SCREW TRAV	EL		
				61	c	6k			
	- Inje	ction Pressu ity Regin	re	51	k	5k Jainstin Processo			
	Cavi	ity End		41	2	is 4k			
$\sim$				31	essu	은 3k			
					) e (p	75 S2 2k			
				21	ŝ			$\neg$	
				11	¢	04		$\mathbf{\lambda}$	
	4 6 8	10 12 14 1	5 18 20 22 24 26 28 30	32 34	¢.	0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2.	2 2.4	
02		т	ïme (s)			Screw Trave	in ←		

What is the cycle time? \_\_\_\_\_\_secWhat is the part weight? \_\_\_\_\_\_oz.What is the part length? \_\_\_\_\_\_inWhat 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]**

Machine Control Settin	gs					Problems (most recent cycle to the left)	Cycle Results		
D			CIU Deter			Flash	Melt Temp	399.6	F
Barrel Temperatures			Fill Rates		in la	Burn Mark	Fill Time	0.21	S
Rear Zone Temp	380 .	- [		13	in/s	Size	Cycle Time	36.41	S
Middle Zone Temp	385	F	Fill Rate 2	13	in/s	Weld Lines	Mold Full at VPT	95.21	%
Front Zone Temp	400	F	Fill Rate 3	13	in/s	Short Shot	Cushion Size	0.231	in
Nozzle Temp	400	F	Fill Rate 4	13	in/s	Warp	Part Length	6.500	in
Injection Unit			Fill Rate 5	4	in/s	Sink Marks	Part Weight	3.108	οz
Screw Rotation	25	🗘 rpm	Pressures/Time			Voids	Screw Run Time	11.53	s
Screw Back Pressure	600	🏚 psi	Max Injection Pressure	25000 🗘	psi	Machine Alarms	Session:		
Screw Back Distance	2.48	🗯 in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35	in	Pack/Hold Pressure	5500	psi	Max Pressure	Machine	300tn	
Mold and Clamp			Pack/Hold Time	0.2	s	No Cushion	Part	cover	
Mold Moveable Temp	60	🗧 F	Cooling Time	35	s	Low Malt	Plastic	Polystyrene	
Mold Stationary Temp	60	F	Mold Open Time	1	s	Low Men	Tolerance	+/- 0 01 in	
Clamp Force	300	tons		L .		High Melt	Std. Cycle Time	30.0	
		×.					Score	82.40 % offici	anev
Cycle History	View Job	Change Lin	ts Hints Deturn to S	essions			ocore	02.40 % emon	ency
Cycle	100 305	onange on		103310113					
Cycle Graphs									
PRESS	URE vs. T	IME				INJECTION PRESSURE vs. SCREW TRAVE	L		
	- Inic	action Process	ra		šk	6k			
	- Cav	ity Begin			i k	5k Injection Pressure			
	- Cav	/ity End			IK 7	G 4k			
				:	ssur	l 3k			
					e (ps	Se 2k			
								$\overline{}$	
						0k		$\mathbf{\lambda}$	
0 2	4 6 8	10 12 14 1	6 18 20 22 24 26 28 30	32 34	JK	0 0.2 0.4 0.6 0.8 1 1.2	1.4 1.6 1.8 2 2	.2 2.4	
		1	Time (s)			Screw Travel	in ←		

 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	??
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  $450^{\circ}F \pm 2^{\circ}$ .

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?

I/	What molded part defect occurred?	
v		
V	Vhy?	
_		
_		_
2. Re	educe clamp force to 65 tons.	
V	Vhat change occurred in the defects present?	
	1/hu2	
V	vny:	
_		
_		
3. Se	t Fill Rates 1, 2, 3, and 4 to 13.0 in/sec. Set Fill Rate 5 to 4.0 in/sec.	
4. Se	t the Clamp Force to 75 tons.	
V	Vhat happened to the flash?	
V	Why?	
r T	What conclusions would you make concerning the effects of clamp force and f	:11
v 0	n burn marks and flash?	iii ra
_		
_		



### 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 p	si.
---------------	------	-------	---------------------	-----

# 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?
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

3.

- 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 <u>www.paulsonskillbuilder.com</u>
  - Your administrator will provide you with your password.

	Paulson Training Programs, Inc.
	Login
E-mail:	
Password:	
	Remember me (for 30 days)
	Login

- 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

Simtech Lab 1 (Level 1)	$\checkmark$	0%	Continue	Start Over
Simtech Lab 2 (Level 1)	<b>V</b>	0%	Continue	Start Over
Simtech Lab 3 (Level 1)	<b>V</b>	0%	Continue	Start Over



- 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.

Machine Control Setting	js						Problems (most recent cycle to the left)	Cycle Results		
D1 T				CIII Deter			Flash	Melt Temp	445.7	F
Barrel Temperatures				Fill Rates		in/c	Burn Mark	Fill Time	1.08	S
Real Zone Temp	450	Ŧ	г -	Fill Rate 1	2 .	11/5	Size	Cycle Time	37.08	S
Midale Zone Temp	450	-	F	Fill Rate 2	2	in/s	Weld Lines	Mold Full at VPT	94.90	%
Front Zone Temp	450	Ŷ	F	Fill Rate 3	2	in/s	Short Shot	Cushion Size	0.231	in
Nozzle Temp	450	÷	F	Fill Rate 4	2	in/s	Warp	Part Length	6.510	in
Injection Unit				Fill Rate 5	2	in/s	Sink Marks	Part Weight	3.149	OZ
Screw Rotation	35	÷	rpm	Pressures/Time			Voids	Screw Run Time	8.36	S
Screw Back Pressure	500	÷	psi	Max Injection Pressure	25000	psi	Machine Alarms	Session:		
Screw Back Distance	2.48	÷	in	Ramp Time	0	s	Screw Recovery	Name	SimTech User	Manual
VPT Setpoint	0.35	\$	in	Pack/Hold Pressure	3500	psi	Max Pressure	Machine	300tn	
Mold and Clamp				Pack/Hold Time	5	s	No Cushion	Part	cover	
Mold Moveable Temp	70	4	F	Cooling Time	30	s	Low Molt	Plastic	Polystyrene	
Mold Stationary Temp	70	÷	F	Mold Open Time	1	s		Tolerance	+/- 0.01 in	
Clamp Force	300	÷	tons		(-		High Melt	Std. Cycle Time	30.0	
								Score	0 00 % efficie	ncv
Cycle History	Curle History View lob Change Linite Hinte Deturn to Sessions									
Cycle History			onange om		03310113					
Cycle Graphs										
PRESS	URE vs.	ті№	1E				INJECTION PRESSURE vs. SCREW TRAVE	L		
						4k	4k			
Injection Pressure										
		avity	y End			3k _P	3k Injection Pressure			
						essu	요 본 2k			
						2K 7	es			
0 2	- 0 0	. 10	12 14 10		12 34 30		Screw Travel	in ←		



# 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  $6.500^{\circ}$  X  $6.500^{\circ}$  (165.1 x 165.1 mm), with a tolerance of  $\pm 0.005^{\circ}$  (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  $\pm .005$  (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  $6.500'' \times 6.500''$  (165.1 x 165.1 mm) with a tolerance of  $\pm 0.005''$  (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  $\pm .005$  (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  $12.00'' \times 4.00'' (304.8 \times 101.6 \text{ mm})$  with a tolerance of  $\pm 0.005'' (0.127 \text{ mm})$ . 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  $\pm$  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"  $\pm$ .005 (165.1mm  $\pm$ .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" ( $304.8 \times 101.6 \text{ mm}$ ) with a tolerance of  $\pm 0.005$ " (0.127 mm). 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  $\pm.005$  (0.127 mm).

#### 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

- 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  $\pm .005$  ( $\pm 0.127$ mm).

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

- 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 semicrystalline 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 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 Velocityto-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).

#### <u>Task:</u>

- 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.



#### <u>Part 1</u>

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<sup>2</sup> ÷ 4) x pi = screw front surface area in square inches.

User Calculation

Correct answer <u>4.91 square inches</u>

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 "Vie	ew Job" to see t	the part volume)			
Calculation Total par	: rts volume	e ÷ Screw fro	ont surface are	ea= Screw Bac	k Distance :	setting
(Total part cavity mol	ts volume: Th d so the par r the calcula	his is the volum t volume under tion.)	ne for all the cavi r View Job will ne	ties in the mold. F eed to be multipli	Remember we ed by 2 to take	e are molding o e into account
cavities fo						

Correct answer <u>3.16 linear inches</u>

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

#### <u>Part 2</u>

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

- 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 <u>after</u> 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)
What is your percentage of Mold Full at VPT? _	(Answer approx. 93%)
What is the cushion size? mm)	_ (Answer is 0.16 ± 0.1 inches) (4.061



- 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

- 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  $\pm 0.005$ " (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

- 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  $\pm 0.005$ " (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

- 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  $12.000'' \times 4.000'' (304.0 \times 101.6 \text{ mm})$  with a tolerance of  $\pm 0.005'' (0.127 \text{ mm})$ . 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

- 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

- 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  $8.000^{\circ}$  X  $3.000^{\circ}$  (203.2 x 76.2 mm) with a tolerance of  $\pm 0.005^{\circ}$  (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  $\pm 0.005$ " (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  $\pm 2^{\circ}$ 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  $\pm 2^{\circ}F$  (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

- 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  $\pm 0.005$ " (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

- 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

- 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

- 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  $10.000'' \times 3.000'' (254.0.0 \times 76.2 \text{ mm})$  with a tolerance of  $\pm 0.005'' (0.127 \text{ mm})$ . 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

- 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

- 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

- 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  $\pm 0.005$ " (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.

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# 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 semicrystalline 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

- 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  $10.000'' \times 4.000'' (254.0.0 \times 101.6 \text{ mm})$  with a tolerance of  $\pm 0.005'' (0.127 \text{ mm})$ . 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

- 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  $10.000'' \times 4.000'' (254.0.0 \times 101.6 \text{ mm})$  with a tolerance of  $\pm 0.002'' (0.0508 \text{ mm})$ . 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

- 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

- 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

- 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  $8.000^{\circ}$  X  $3.000^{\circ}$  (203.2 x 76.2 mm) with a tolerance of  $\pm 0.005^{\circ}$  (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

- 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

- 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

- 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

- 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

- 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  $\pm 0.002$ " (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

- 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.

