

Seal Reduction and Strength Profile Testing



**Customer
Name
1/1/2023**

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Project Summary

Project Details

Date	January 1, 2023
Customer Name	Customer Name
Customer Address	123 Main St, Anytown OH, 12345
Contact	Customer Contact Info
Lako Technician	Technician Name
Lako Contact	+1 (419) 662-5256 7400 Ponderosa Rd, Perrysburg, OH 43552
Project Number	FT-24-0XX
Lako Estimate Number	12345
Customer PO	12345

Project Summary (continued)

Supplied Materials (continued)

Material	Description	Film Thickness	Package Dimensions
Film 1	Printed Metallized Film	0.003" [0.076 mm]	1" [25.4mm] x 2" [50.8mm] x 3" [76.2mm]



Supplied Parameters

Material	Film 1
Existing Seal on Supplied Packages	12-Pitch, 12 mm WOS
Product	Product
Current Dwell Time	Approximately 300 - 500 ms
Current Seal Temperature	250° F [177° C]
Average Leak Rate of Supplied Packages	0.5 mbar·L/s

Project Summary (continued)

Scope of Work

One of the main considerations when reducing the end seal on a package is how the end-seal peels apart, specifically where the highest peel force is found. This will vary on different film structures. Finding how the strength is affected by the size of the seal is crucial for success.

Another one of the main parameters to consider when reducing the end seal relies on the Hot Tack properties of the film. The amount the hot end-seal is peeled apart when the product weight is dropped on it is very important. If the seal moons or peels under normal production conditions, this will affect the amount of reduction that can be applied. Testing the Hot Tack properties of each film will give a good understanding of the initial seal strength that is available.

Test Step	Test Procedure Performed
Ultimate Seal Strength Profile	ASTM F88-00
Hot-Tack Seal Strength Profile	ASTM F1921-12
Sealed Package Vacuum Decay	ASTM F2338-09

Equipment used:

		
TMI – Hot-Tack Tester and Seal Tester SL-10 75-50	Technopack – MS-405 Impulse Sealer	Inficon – Contura S400

Results

Summary of Results

Seal testing was performed to find the temperature range with the highest Hot Tack strength and Ultimate Seal Strength. Based on the observed results, the strongest seals are made with seal temperatures ranging from 240° F [115.6° C] to 260° F [126.7° C].

The highest force was found in the range of 0.05 in [1.27 mm] to 0.15 in [3.81 mm] of the start of the peel.

With a reduced seal width of 0.25 in [6.35 mm], the leak rate was marginally improved when compared to the full-size seal width.

Recommendation

Based on the observed results, LAKO would recommend reducing the seal width from 12 mm to 6.35 mm, further testing may prove the possibility of reducing the seal size more. Testing of the reduced seal width in a production environment is recommended to verify the reduced seal width still produces acceptable results.

Results (continued)

Preliminary Testing Details

Preliminary Setup Testing Details:

Sample Width	Dwell Time	Pressure
1" [25.4 mm]	500 ms	40 psi

Preliminary Setup Testing Results:

Material	Temperature	Observations
Film 1	200° F [93.3° C]	Weak Seal
	225° F [107.2° C]	Good Seal – Cohesive Failure
	250° F [121.1° C]	Film sealed with no distortions
	275° F [135.0° C]	Strong Seal – Minor Deformation
	300° F [148.9° C]	Very Strong Seal - Deformation
	325° F [162.8° C]	Film Melted – Lots of Shrinkage

Preliminary Setup Testing Summary:

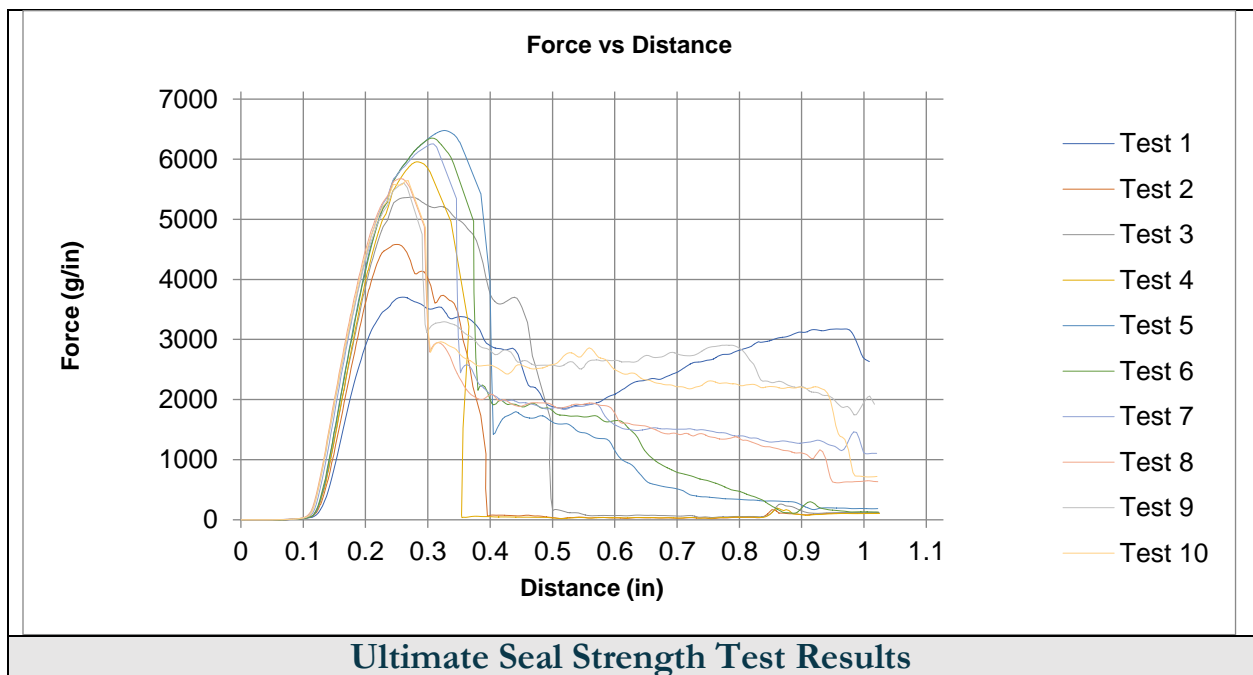
Based on observations from the preliminary testing, the recommended temperature range for Seal Strength Profile Testing is **200° F to 300° F** [93.3° C to 148.9° C].

Results (continued)

Ultimate Seal Strength Profile Test

Machine Details:

Title:	Sample Test	Name:	Est 12345 FT-01-023 Sample Test
Machine S/N:	SL10S131102	Date:	01/01/2023 12:00:00 AM
Laboratory Temp:	74°F [23.3°C]	Operator:	XXX
Laboratory Humidity:	45%	Material:	Clear Film 0.003"
Upper Starting Temp:	200° F [93.3° C]	Lower Starting Temp:	200° F [93.3° C]
Upper Ending Temp:	300 °F [148.9° C]	Lower Ending Temp:	300 °F [148.9° C]
Seal Length:	1.000 in	Pressure Request:	50.0 PSI
Seal Width:	0.750 in	Jaw Pattern:	Steel Upper/ Steel Lower
Dwell Time:	0.500 sec	Peel Velocity:	0.20 in/sec
Cool Delay:	20.00 sec	Selection Method:	Peak

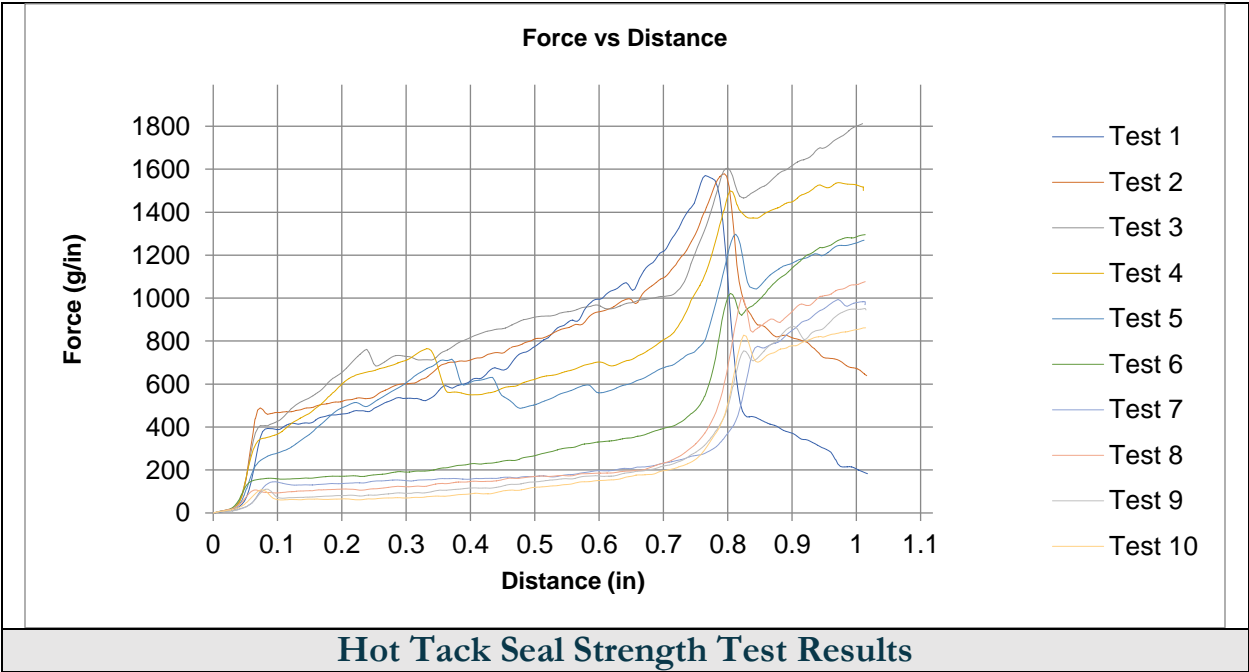


Results (continued)

Hot Tack Seal Strength Profile Test

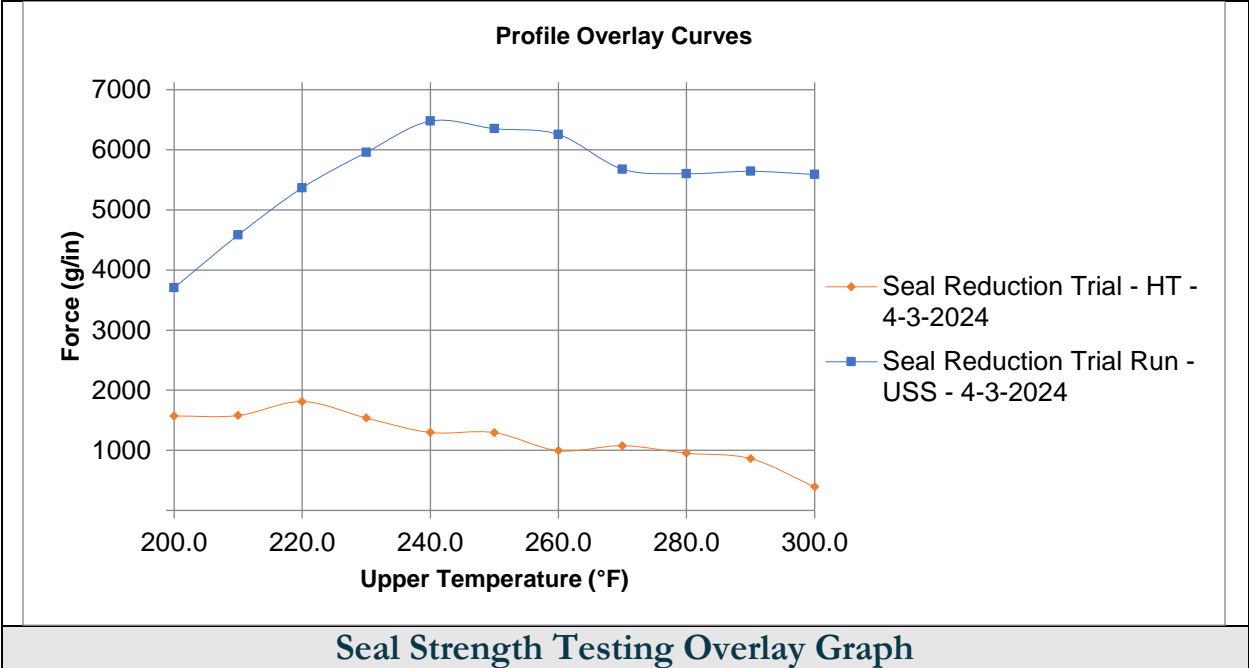
Machine Details:

Title:	Sample Test	Name:	Est 12345 FT-01-023 Sample Test
Machine S/N:	SL10S131102	Date:	01/01/2023 12:00:00 AM
Laboratory Temp:	74°F [23.3°C]	Operator:	XXX
Laboratory Humidity:	45%	Material:	Clear Film 0.003"
Upper Starting Temp:	200° F [93.3° C]	Lower Starting Temp:	200° F [93.3° C]
Upper Ending Temp:	300 °F [148.9° C]	Lower Ending Temp:	300 °F [148.9° C]
Seal Length:	1.000 in	Pressure Request:	50.0 PSI
Seal Width:	0.375 in	Jaw Pattern:	Steel Upper/ Steel Lower
Dwell Time:	0.500 sec	Peel Velocity:	0.20 in/sec
Cool Delay:	Immediate	Selection Method:	Peak



Results (continued)

Combined Seal Strength Test Results



Seal Strength Testing Summary



Samples of each film were cut into strips 1.0"x13" (25.4mm x 330.2mm) and two layers sealed with the SL10 Lab sealer with a .75" (19mm) seal width. For the Ultimate Seal Strength Tests, the seal was cooled for approximately 20 seconds prior to peeling. The seal was peeled immediately for the Hot Tack tests.

The Temperature with the highest overall seal strength was determined to be 240° F [115.6° C], so that will be the temperature used for Leak testing of the full size and reduced width seals.

Results (continued)

Seal Tooth Profile Examples

		
<p>Lako Seal Profile #H78</p>	<p>Package Seal – 0.5-inch Width of Seal</p>	<p>Package Seal – 0.25-inch Width of Seal</p>

	
<p>Sealed Package – 0.5-inch Width of Seal</p>	<p>Sealed Package – 0.25-inch Width of Seal</p>

Results (continued)

Vacuum Decay Testing

Dwell Time	Seal Length	Temperature	Notes
0.5 s	6.5 in [165.1 mm]	240° F [115.6° C]	None

Seal Width	Leak Rate [mbar·l/s]	Notes
0.5 in [12.7 mm]	0.005	None
	0.003	None
	0.003	None
	0.003	None
0.25 in [6.35 mm]	0.002	None
	0.001	None
	0.001	None
	0.001	None

Sealed Package Testing Summary

During sealed package testing, the reduced width seals had an average leak rate of 0.0013 mbar·l/s vs 0.0035 mbar·l/s for the full-size seals.

All testing was completed at LAKO. Equipment and operating conditions vary greatly between the LAKO lab and the client's facility and can be expected to account for some variation in the results achieved at LAKO.