

AirFlex Aeration System Information and Glue Savings Data

A Patented Technology from

**WESTERN
TECHNOLOGY**

The logo graphic for Western Technology consists of a thick red horizontal line. On the left side, a black line branches off from the red line, curving upwards and then downwards, creating a stylized 'W' or 'T' shape.

and

M-Pak Technology

Table of Contents

| | |
|---------------------------------|----|
| 1) System Overview | 4 |
| 2) AirFlex Aeration System | 5 |
| 3) AirFlex Aeration Loop | 6 |
| 4) The Control Tower | 7 |
| 5) Important Parts | 8 |
| 6) Flexo Machine Glue Savings | 9 |
| 7) Label Laminator Glue Savings | 11 |
| 8) Glue Line Strength Test | 13 |
| 9) Service Contact Information | 16 |

AirFlex Aeration System Overview

Overview

The AirFlex Aeration System, a patented technology designed by Western Technology and M-Pak Technology, injects 20-micron air bubbles into adhesive to reduce adhesive consumption by approximately 30%. The AirFlex System, designed for use in a variety of applications and industries, features an Aerator to inject air and an In-Line Mixer to ensure an optimum blend of air and adhesive at all times. In addition to reduced adhesive consumption, the easy to maintain system delivers faster adhesive drying time and a stronger bond that can help increase machine speed and overall plant production.

How It Works

The AirFlex Aeration System (*pictured right*) features a 30-gallon stainless steel drum connected by 1-inch hose to a standard adhesive tote. Adhesive is pumped from the storage tote, through the patented Aeration Loop, and into the 30-gallon drum, where it is stored until needed by the adhesive application machine. Adhesive is constantly pumped through the Aeration Loop to maximize the air content in the adhesive and the effectiveness of the AirFlex System. Three way valves are used to easily pump water through the Aeration Loop for cleaning without compromising adhesive quality or disrupting adhesive application machine.

Application

The AirFlex Aeration System is designed to be used on any glue application machine, including:

- Laminators
- Flexo
- Carton Machines

System Requirements

The AirFlex Aeration System requires the following in close proximity to the glue application machine:

- Stacked Glue Totes
- Dedicated Air Source
- Water Source for cleaning

AirFlex System Includes

- Installation and Start Up Service
- Maintenance Plan
- License to practice Patent
- Air Hoses
- Cleaning buckets/brush



The AirFlex Aeration System

Benefits of Aerated Adhesive

Benefits of using the patented AirFlex Aeration System to aerated adhesive include:

- 30% Reduction in Adhesive Consumption
- Increased Adhesive Bond Strength
- Faster Drying Time
- Thinner/Firmer Adhesive Line

These benefits can help increase machine speed, plant production, and quality all while decreasing adhesive consumption up to 30%.

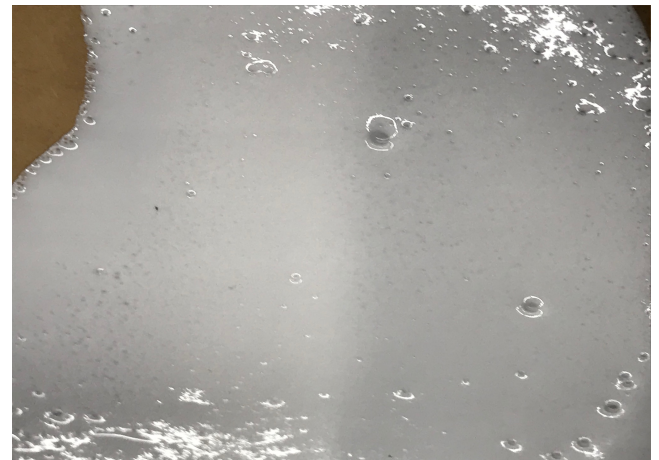
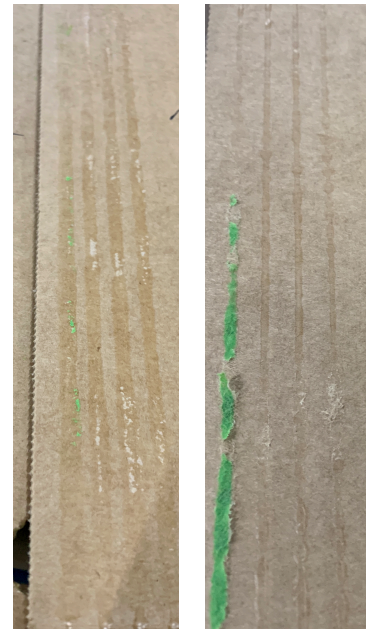


Glue Lines Off Machine

Left: Unaerated Glue
Right: Aerated Glue

Notice fiber tear with Aerated Adhesive directly off applicator

Dried Glue Lines
Left: Unaerated Glue Lines
Right: Aerated Glue Lines



Aerated Adhesive
Notice small air bubbles
Trapped within the glue film

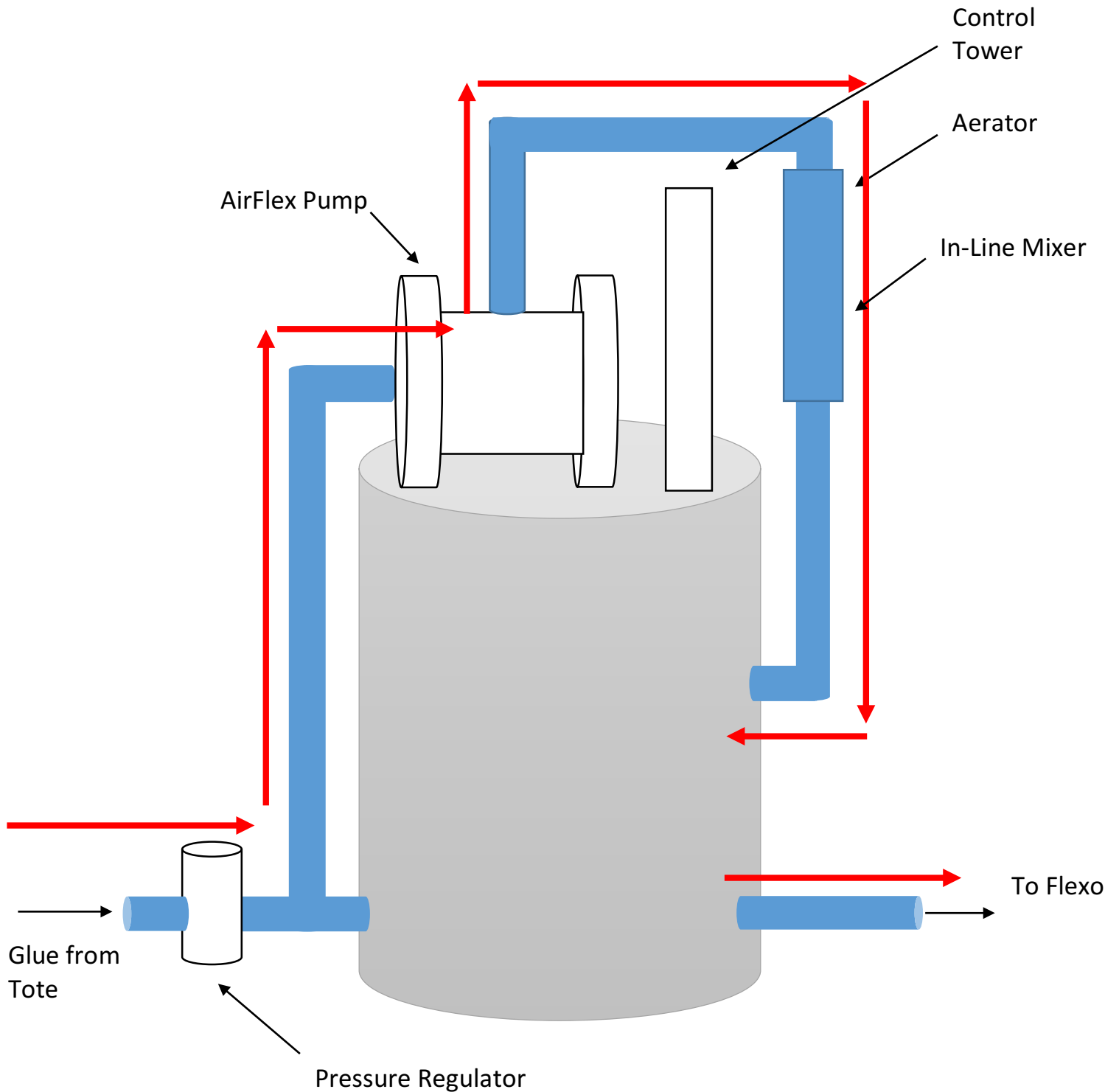
Why AirFlex Aeration System?

In addition to the benefits of Aerated Adhesive listed above, The AirFlex Aeration System's patented and innovative design offers maximum benefits with minimal maintenance and is superior to other aeration systems in the market today. AirFlex Aeration System patented and Innovative designs include:

| | |
|------------------------|--|
| Aerator | Specially designed air injector that Injects 20-micron bubbles into adhesive. |
| Aeration Loop | Adhesive is continually pumped through AirFlex System loop to build air content in adhesive up to 30%. |
| 30-gallon Reservoir | 30-gallon tank of aerated adhesive to be pumped to adhesive applicator. |
| Cleaning System | 3-way valves enable water to be pumped easily through Aeration Loop. |
| Automatic Refill | Adhesive will automatically be refilled without operator involvement |
| Stainless Steel Design | Will not be affected by corrosive adhesive |

AirFlex Aeration Loop

This diagram follows the glue as it moves through the AirFlex System to be aerated. Aerated glue is stored in the 30-gallon drum reservoir until it is called by the glue application machine.



The Control Tower

Pressure Valve
Refill Pump

Rotameter

Pressure Valve
AirFlex Pump

On/Off Valve
Refill Pump

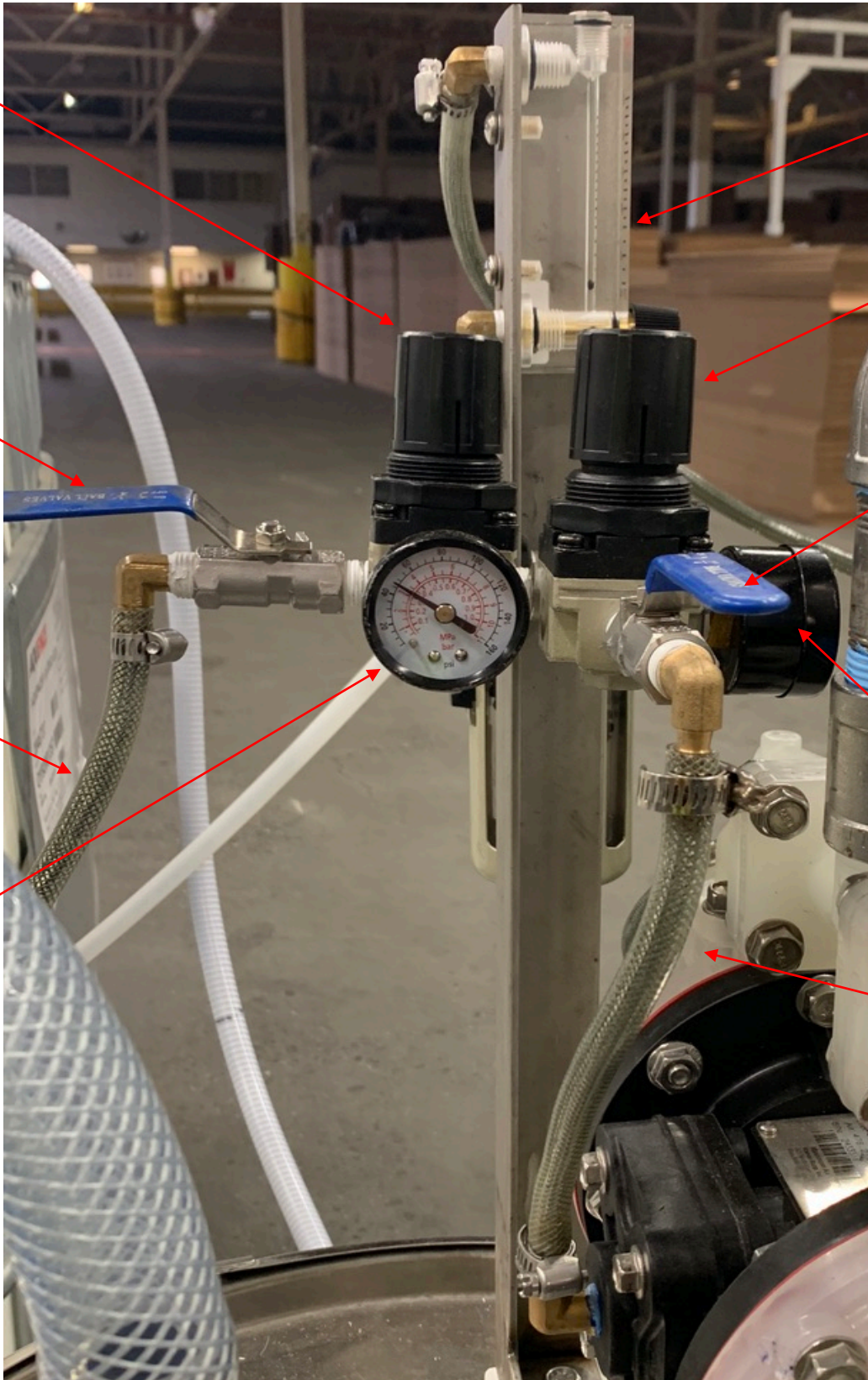
On/Off Valve
AirFlex Pump

Air Hose
Refill Pump

Air Gauge
AirFlex Pump

Air Gauge
Refill Pump

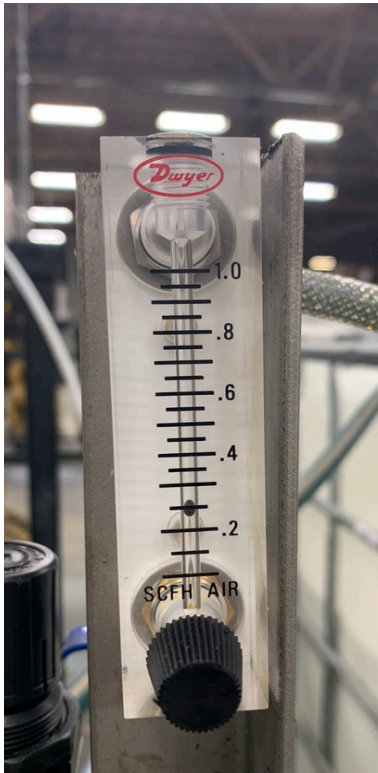
Air Hose
AirFlex Pump



Important Parts

Rotameter

Controls Rate of Air Injected in Glue



Aerator

Injects 20-micron Air Bubbles



Refill Pump

Automatically Refills AirFlex System



Tote Connection

Allows easy tote change



In-Line Mixer

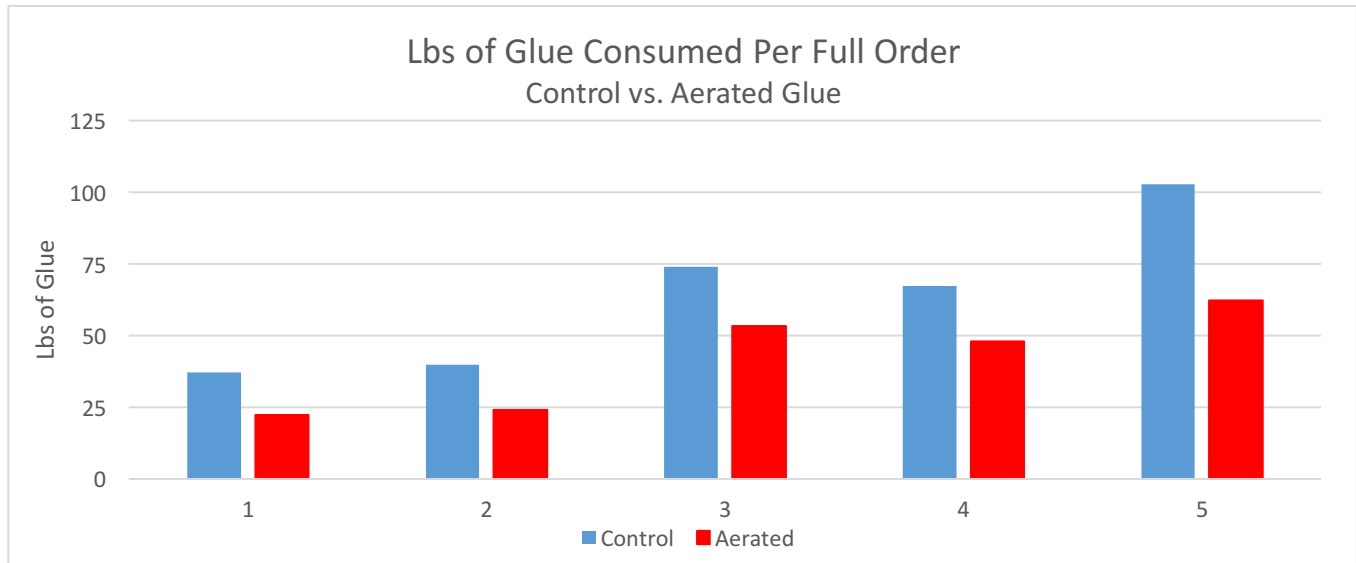
Incorporates Air into Glue



Flexo Machine Glue Savings

An average of 35% less glue was used when glue was aerated across four orders on a Flexo Machine.

| | 1 | 2 | 3 | 4 | 5 | Average |
|-----------|-----|-----|-----|-----|-----|---------|
| % Savings | 40% | 40% | 28% | 28% | 39% | 35% |



Order Information

| Order | Order Quantity | Total Sq. Ft. | Box Sq. Ft. | Box Dimensions |
|-------|----------------|---------------|-------------|----------------|
| 1 | 20,000 | 192,587 | 9.6289 | 21.12 x 63.12 |
| 2 | 21,500 | 200,477 | 9.3245 | 21.01 x 63.12 |
| 3 | 86,000 | 529,098 | 6.1523 | 15.12 x 56.04 |
| 4 | 44,000 | 258,135 | 5.8667 | 16.11 x 50.10 |
| 5 | 72,000 | 433,506 | 6.1589 | 15.14 x 55.14 |

Usage Calculations

The values below were used to calculate glue usage in gallons and pounds for the full order. 20% of glue weight is added for aerated calculations to take into account the air that has been injected into the glue.

Glue Information

Tote Weight: 2450 Lbs.

Specific Gravity: 0.91 when H2O is 1

Full Tote: 322.43 gal.

1 gallon of Glue: 7.5985 lbs.

Unaerated Glue Weight

1 in. of Glue (Gallons): 9.77 gal.

1 in. of Glue (Lbs.): 74.24 lbs.

Aerated Glue Weight

1 in. of Glue (gallons): 11.73 gal.

1 in. of Glue (lbs.): 89.09 lbs.

Cup Weights

Cup Weights calculate the air content of glue by weighing the same volume of aerated and unaerated glue. The difference in weight is the % of injected air and is an estimation of glue savings.

| 1 | | | 2 | | | 3 | | |
|-------|---------|-------|------|---------|-------|-------|---------|-------|
| Time | Aerated | % Air | Time | Aerated | % Air | Time | Aerated | % Air |
| 9:20 | 956 | 6.4 | 3:45 | 952 | 6.8 | 10:20 | 956 | 6.4 |
| 9:45 | 952 | 6.8 | 4:00 | 948 | 7.2 | 11:00 | 950 | 7.0 |
| 10:20 | 950 | 7.0 | 4:45 | 943 | 7.7 | 12:30 | 946 | 7.3 |
| 11:00 | 945 | 7.4 | 5:00 | 940 | 7.9 | 2:18 | 940 | 7.9 |

| 4 | | | 5 | | |
|------|---------|-------|------|---------|-------|
| Time | Aerated | % Air | Time | Aerated | % Air |
| 1:20 | 955 | 6.5 | 3:25 | 772 | 24.4 |
| 2:00 | 952 | 6.8 | 3:55 | 773 | 24.3 |
| 3:30 | 949 | 7.1 | 4:10 | 769 | 24.7 |
| 3:45 | 944 | 7.5 | 4:25 | 764 | 25.2 |

Unaerated Cup Weight – 1021 g

Tank Drop

Tank drop data was collected by measuring the drop in tote glue level over the course of an order. Each order was split in half; half the order was run with unaerated glue (control) from the top tote and the other half was run using aerated glue (test) from the bottom tote.

| Order | Quantity | Inches | | Gallons | | Pounds | |
|-------|----------|---------|---------|---------|---------|---------|---------|
| | | Control | Aerated | Control | Aerated | Control | Aerated |
| 1 | 10,000 | 1/4 | 1/8 | 2.44 | 1.47 | 18.56 | 11.13 |
| 2 | 10,000 | 1/4 | 1/8 | 2.44 | 1.47 | 18.56 | 11.13 |
| 3 | 27,000 | 5/16 | 3/16 | 3.05 | 2.20 | 23.20 | 16.70 |
| 4 | 15,000 | 5/16 | 3/16 | 3.05 | 2.20 | 23.20 | 16.70 |
| 5 | 13,000 | 1/4 | 1/8 | 2.44 | 1.47 | 18.56 | 11.14 |

Full Order Glue Use

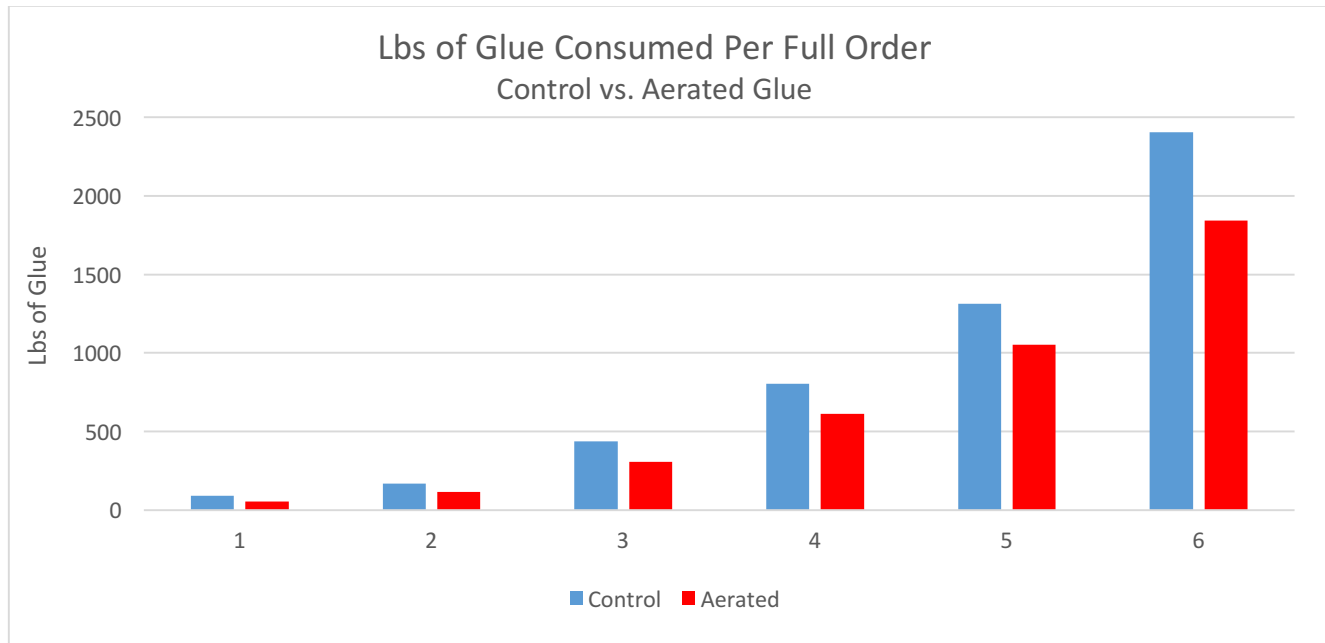
Full Order glue usage values were calculated using information taken from SDS sheets provided by the plant.

| Order | Quantity | Inches | | Gallons | | Pounds | |
|-------|----------|---------|---------|---------|---------|---------|---------|
| | | Control | Aerated | Control | Aerated | Control | Aerated |
| 1 | 20,000 | 0.50 | 0.25 | 4.88 | 2.93 | 37.16 | 22.27 |
| 2 | 21,500 | 0.54 | 0.27 | 5.25 | 3.17 | 39.90 | 24.05 |
| 3 | 86,000 | 1.00 | 0.60 | 9.74 | 7.04 | 74.01 | 53.45 |
| 4 | 44,000 | 0.91 | 0.54 | 8.85 | 6.33 | 67.28 | 48.11 |
| 5 | 72,000 | 1.39 | 0.70 | 13.52 | 8.21 | 102.82 | 62.36 |

Label Laminator Glue Savings

An average of 28% less glue was used when glue was aerated across four orders.

| | 1 | 2 | 3 | 4 | 5 | 6 | Average |
|-----------|-----|-----|-----|-----|-----|-----|---------|
| % Savings | 40% | 32% | 30% | 24% | 20% | 24% | 28% |



Order Information

| Order # | Quantity | Total Sq. Ft. | Label Sq. Ft. | Label Dimensions | Flute |
|---------|----------|---------------|---------------|------------------|-------|
| 1 | 3000 | 35376 | 11.792 | 40 x 42 | 32E |
| 2 | 6250 | 79680 | 13.280 | 36 x 52 | 32E |
| 3 | 6250 | 90516 | 15.086 | 41 x 51 | 32E |
| 4 | 9250 | 114792 | 16.088 | 43 x 52 | 32E |
| 5 | 21000 | 339024 | 16.114 | 53 x 44 | N/A |
| 6 | 5270 | 29850 | 5.970 | 22 x 36 | 40E |

Usage Calculations

The values below were used to calculate glue usage in gallons and pounds for the full order. 20% of glue weight is added for aerated calculations to take into account the air that has been injected into the glue.

Glue Information

Tote Weight: 2450 Lbs.
 100 gal of Glue: 13.5 in. in Tote
 1 gallon of Glue: 9.1 lbs.

Unaerated Glue Weight

1 in. of Glue (Gallons): 7.07 gal.
 1 in. of Glue (Lbs.): 73.04 lbs.

Aerated Glue Weight

1 in. of Glue (gallons): 8.88 gal.
 1 in. of Glue (lbs.): 87.65 lbs.

Cup Weights

Cup Weights calculate the air content of glue by weighing the same volume of aerated and unaerated glue. The difference in weight is the % of injected air and is an estimation of glue savings.

| 1 | | | 2 | | | 3 | | |
|-------|---------|-------|------|---------|-------|-------|---------|-------|
| Time | Aerated | % Air | Time | Aerated | % Air | Time | Aerated | % Air |
| 8:10 | 962 | 0 | 2:00 | 757 | 20.7 | 8:00 | 952 | 0 |
| 9:43 | 750 | 21.4 | 2:20 | 747 | 24.9 | 11:40 | 767 | 19.7 |
| 10:30 | 739 | 22.6 | 2:40 | 745 | 25.1 | 12:00 | 755 | 20.9 |
| 10:45 | 730 | 23.6 | 3:00 | 744 | 25.2 | 12:55 | 762 | 20.2 |

| 4 | | | 5 | | | 6 | | |
|------|---------|-------|-------|---------|-------|-------|---------|-------|
| Time | Aerated | % Air | Time | Aerated | % Air | Time | Aerated | % Air |
| 2:45 | 783 | 18.1 | 6:30 | 793 | 20.6 | 11:05 | 773 | 23.5 |
| 3:10 | 771 | 19.3 | 7:00 | 785 | 21.4 | 11:30 | 757 | 24.9 |
| 3:25 | 767 | 19.7 | 9:00 | 748 | 25.1 | 12:10 | 738 | 29.4 |
| 3:35 | 762 | 20.2 | 10:00 | 754 | 24.5 | 12:30 | 733 | 30.2 |

Unaerated Cup Weight – 955 g

Tank Drop

Tank drop data was collected by measuring the drop in tote glue level over the course of an order. Each order was split in half; half the order was run with unaerated glue (control) from the top tote and the other half was run using aerated glue (test) from the bottom tote.

| | | Inches | | Gallons | | Pounds | |
|-------|----------|---------|---------|---------|---------|---------|---------|
| Order | Quantity | Control | Aerated | Control | Aerated | Control | Aerated |
| 1 | 1,500 | 1 ½ | 7/8 | 11.1 | 5.55 | 91.25 | 54.78 |
| 2 | 2,000 | 7/8 | ½ | 6.5 | 4.4 | 63.9 | 43.3 |
| 3 | 3,000 | 3 | 1 ¾ | 22.2 | 15.5 | 219 | 153.4 |
| 4 | 3,000 | 5 ½ | 3 ½ | 40.7 | 31.1 | 401 | 306.8 |
| 5 | 1,500 | 3 | 2 | 22.2 | 17.76 | 219 | 175.3 |
| 6 | 5,000 | 8 ½ | 5 | 63 | 44.4 | 573 | 438.3 |

Full Order Glue Use

Full Order glue usage values were calculated using information taken from SDS sheets provided by the plant.

| | | Inches | | Gallons | | Pounds | |
|-------|----------|---------|---------|---------|---------|---------|---------|
| Order | Quantity | Control | Aerated | Control | Aerated | Control | Aerated |
| 1 | 3,000 | 3 | 1 ¼ | 22.2 | 11.1 | 91.25 | 54.78 |
| 2 | 5,270 | 2 ¼ | 1 ¼ | 17.16 | 11.62 | 168.7 | 115.7 |
| 3 | 6,250 | 6 | 3 ½ | 44.4 | 31.1 | 438 | 306.8 |
| 4 | 6,250 | 11 | 7 | 81.4 | 62.2 | 802 | 613.6 |
| 5 | 9,250 | 18 | 12 | 133.2 | 106.6 | 1,314 | 1,052 |
| 6 | 21,000 | 35 ¾ | 21 | 264.4 | 186.5 | 2,406 | 1,841 |

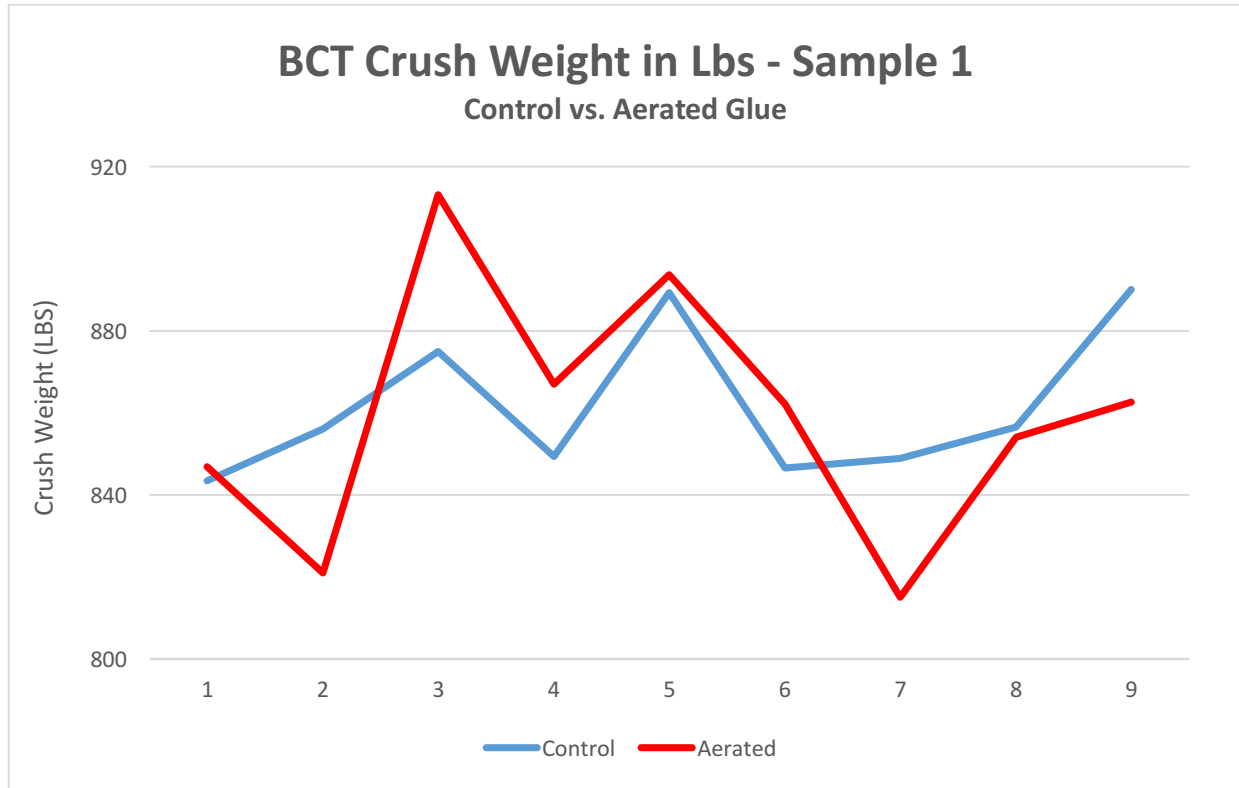
Glue Line Strength Test

Glue strength was tested using the Box Crush Test (BCT) performed to the TAPPI Standards by an independent lab. Crush Tests were conducted on at least 10 control (Non-Aerated Glue) box samples and 10 Aerated (Aerated Glue) box samples. Box samples were collected from different orders on different glue applicators.

Sample 1

Box Information

| Box Sq. Ft. | Box Dimensions | Glue Joint Width (In.) | Board Combination |
|-------------|----------------|------------------------|-------------------|
| 6.1598 | 15.14 x 55.14 | 15 | 45VK/36MED/45VK |



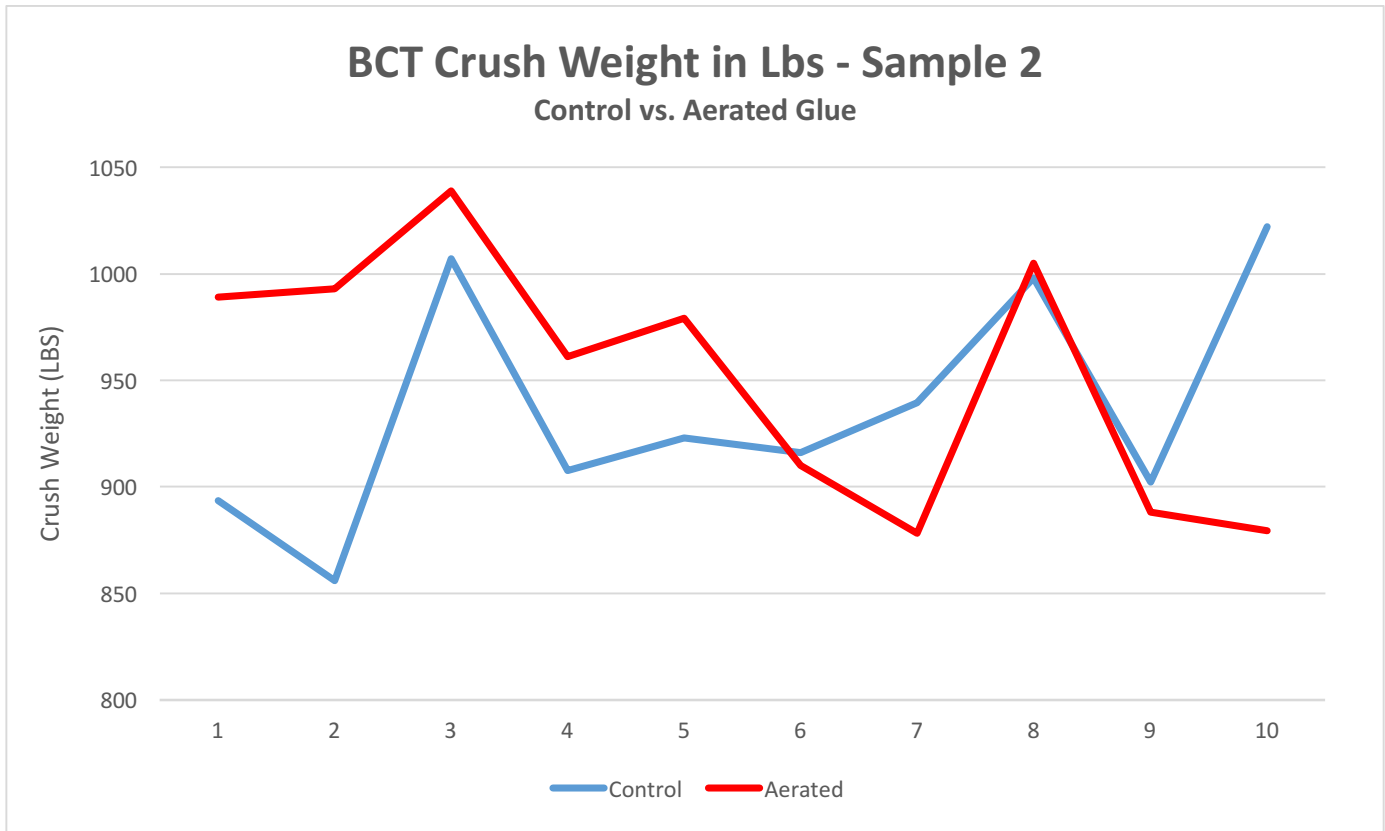
Box Crush Test Data – Aerated vs. Non Aerated

| Sample | Control BCT (Lbs.) | Aerated BCT (Lbs.) |
|--------------------|--------------------|--------------------|
| 1 | 843.5 | 846.9 |
| 2 | 856.1 | 821.0 |
| 3 | 875.0 | 913.1 |
| 4 | 849.4 | 867.0 |
| 5 | 889.3 | 893.6 |
| 6 | 846.5 | 862.1 |
| 7 | 848.9 | 815.0 |
| 8 | 856.5 | 854.0 |
| 9 | 890.1 | 862.6 |
| Average | 861.1 | 859.5 |
| Standard Deviation | 18 | 31 |

Sample 2

Box Information

| Box Sq. Ft. | Box Dimensions | Glue Joint Width (In.) | Board Combination |
|-------------|----------------|------------------------|-------------------|
| 11.1016 | 24.08 x 65.04 | 13 3/8 | 42VK/36MED/55VK |



Box Crush Test Data – Aerated vs. Non Aerated

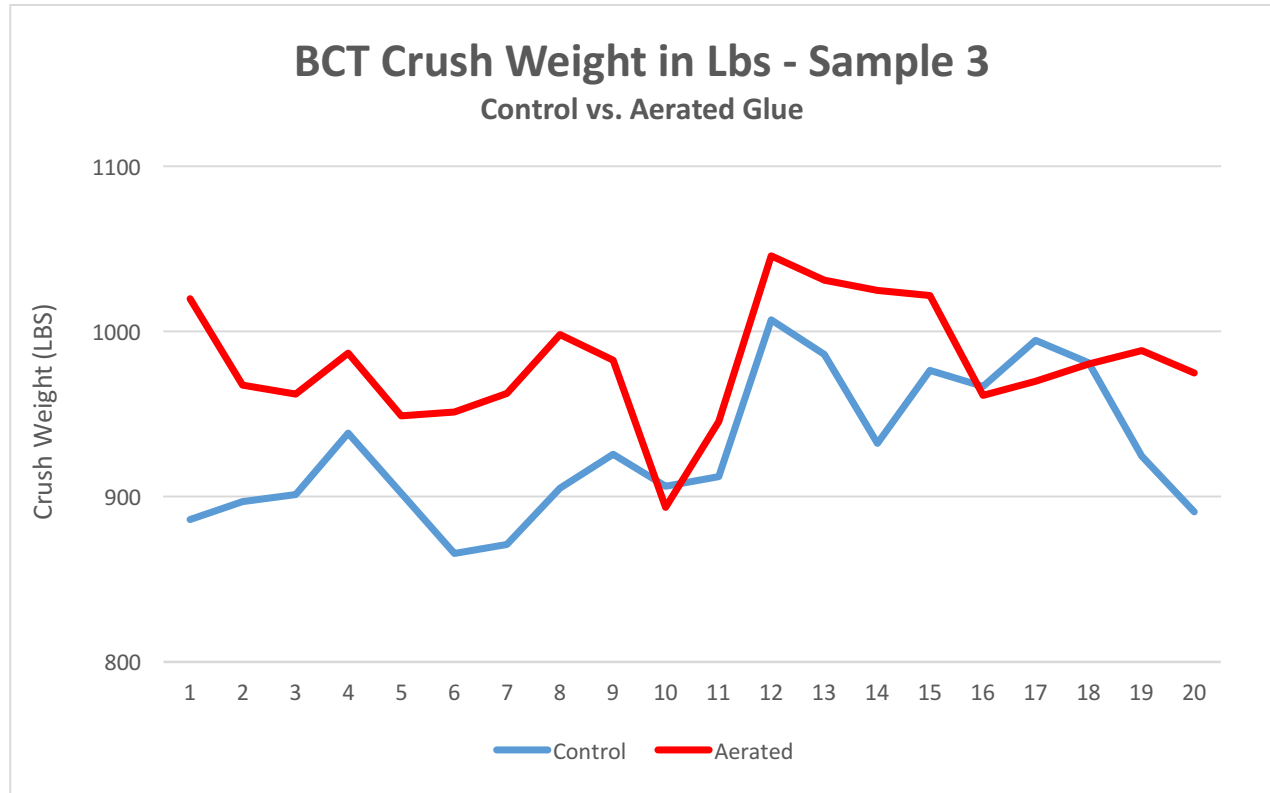
| Sample | Control BCT (Lbs.) | Aerated BCT (Lbs.) |
|--------------------|--------------------|--------------------|
| 1 | 893.6 | 989.1 |
| 2 | 855.8 | 992.9 |
| 3 | 1007.0 | 1039.0 |
| 4 | 907.7 | 961.0 |
| 5 | 922.9 | 979.3 |
| 6 | 916.2 | 909.9 |
| 7 | 939.5 | 878.1 |
| 8 | 998.0 | 1005.0 |
| 9 | 902.3 | 888.0 |
| 10 | 1022.0 | 879.3 |
| Average | 937 | 952 |
| Standard Deviation | 54 | 58 |

Sample 3

20 Box Sample Size

Box Information

| Box Sq. Ft. | Box Dimensions | Glue Joint Width (In.) | Board Combination |
|-------------|----------------|------------------------|-------------------|
| 9.1585 | 20.11 x 63.12 | 11 | 42VK/36MED/55VK |



Box Crush Test Data – Aerated vs. Non Aerated

| Sample 1 | | | | Sample 2 | |
|--------------------|--------------------|-------------|----|--------------------|--------------------|
| Control BCT (Lbs.) | Aerated BCT (Lbs.) | Box Sample | | Control BCT (Lbs.) | Aerated BCT (Lbs.) |
| 886.2 | 1020.0 | 1 | 11 | 912.3 | 945.5 |
| 897.2 | 967.7 | 2 | 12 | 1007.0 | 1046.0 |
| 901.3 | 962.3 | 3 | 13 | 986.2 | 1031.0 |
| 938.6 | 986.9 | 4 | 14 | 932.3 | 1025.0 |
| 902.2 | 948.8 | 5 | 15 | 976.3 | 1022.0 |
| 865.7 | 951.1 | 6 | 16 | 966.8 | 961.3 |
| 870.9 | 962.4 | 7 | 17 | 994.7 | 969.9 |
| 905.2 | 998.2 | 8 | 18 | 981.3 | 980.5 |
| 925.8 | 982.5 | 9 | 19 | 924.6 | 988.4 |
| 906.5 | 893.6 | 10 | 20 | 890.9 | 974.8 |
| 900 | 967 | Average | | 957 | 995 |
| 22 | 34 | Stand. Dev. | | 39 | 35 |

Contact Information

WESTERN TECHNOLOGY

A graphic element consisting of a thick red line that starts with a small horizontal segment, then curves downwards and to the right, ending in a long horizontal segment that runs across the width of the logo.

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