FORSTA FILTERS
Self Cleaning Water Filters

CASE STUDY - INDUSTRIAL WATER FILTRATION: Injection Molding

Based out of Wolfeboro, New Hampshire, GI Plastek specializes in large to medium, high aesthetic complex molded products. Their core capabilities include standard injection molding, structural foam molding, gas assist and gas counter pressure molding, finishing, painting, EMI shielding, assembly, and graphics.

GI Plastek takes pride in being recognized for their attention to detail; supplying high quality products to the medical, military, industrial, construction, material handling, leisure and recreation markets.

Jon Riebau, maintenance supervisor for GI Plastek was looking for a way to reduce the total suspended solids (TSS) in the process water stream. Riebau wanted to prevent the plugging of water channels in the plastic injection molds, provide an unrestricted water flow throughout their entire process, and reduce corrosion due to conductivity.

Water is used to cool, or sometimes heat, components of the injection molding machines, molds and ancillary equipment. GI Plastek's eleven injection molding machines and associated support equipment were subject to freed sediment that dislodged from the plant's plumbing system. Riebau explained that in the past they would, "recycle that sediment through the whole process water system until it settled out in the bottom of the tower water holding tank or in the molds and machinery water paths." Only a small amount of the sediment would be captured in a 200 micron sidestream bag filter that had an involved manual cleaning process. TSS in the process water stream was repeatedly reported in in the low to mid 30s in ppm.

Riebau described his filter research saying, "The use of sand filters was considered. The reasons we ruled them out was because of initial unit cost, installation plumbing, backwash water requirements, unit footprint with limited existing space and maintenance. Forsta was an early choice. An inline, whole process, flow through filter was sought through online searches. The Forsta website is comprehensive and the timely replies to initial inquiries were helpful."

FILTER SELECTION & INSTALLATION

Maximum flow capacity of GI Plastek's process water system was reported between 300-380gpm. The location that was selected for the filter had an operating pressure from approximately 35-50psi, making it suitable for Forsta's hydraulically-driven 180 Series filters.

Forsta engineers sized a filter for the maximum flow at 100micron filtration to have less than 1psi of pressure loss across a clean screen. The B4-180 model filter would provide 5.25 sq. ft of screen area and integrate easily with the straight 4" pipeline.

A team of 4 conducted the vertical installation at the Wolfeboro facility

The B4-180 self-cleaning filter was installed in November of 2015. Riebau contacted Forsta Filters after installation to report that, "The filter has been operational for approximately two-and-one-half weeks. The results were immediately obvious with our process water clearing up quickly after weekly plant start-ups. The installation was done almost entirely in-house and went smoothly."

PERFORMANCE REVIEW

Once a new filter is up and running, there are several performance checkpoints that help to guarantee success in operation. As part of a typical installation review Forsta runs through these basic points:

- ✓ **Inlet Pressure During Backwash**

The B4-180 model filter requires a minimum of 35-40psi at the inlet of the filter during backwash. GI Plastek reported approximately 38psi during backwash.

- ✓ **Flush Outlet Pressure During Backwash**
  Oversized flush piping ensured that pressure at the flush outlet dropped to 0psi during backwash.
- ✓ **Flush Duration Matches Piston Stroke**
  GI Plastek set the backwash duration to 20 seconds based on the time it took the particle remover (and therefore piston pin) to complete full travel with their supply pressure and filter orientation.

Riebau stated that the advantages of the new self-cleaning system in comparison with the sidestream bag filter are incomparable. “The sidestream filter captured only a sample of the process water from the tower water holding tank and the bag filter cleaning process was more involved. That bag filter was 200 micron; the Forsta Filter is half that, so we capture tinier particles too. Now, every ounce of our process water goes through the Forsta B4-180 filter. It is during startup that the return water, which empties back into the tower water holding tank, carries sediment from the process plumbing back to the tank. Obviously, before we were cleaning only a small amount of that from our process water, now we clean virtually all of it.”

The process system at GI Plastek operates 24 hours a day for five to six and often 7 days a week. Riebau added that, “As the filter continues to remove freed sediment from our plant plumbing, we expect to experience clog free molds, injection molding machine heat exchangers and ancillary equipment; all leading to improved heat transfer in each unit. We also anticipate reduced corrosive effect by reducing conductivity and our water system becoming more stable, allowing our chemical water treatment to be more effective.”

Backwash frequency of the B4-180 varies. The highest frequency occurs during start-up after a normal weekend shutdown when the filter will discharge up to ten times in the first half hour. According to Riebau, the frequency drops off significantly as the day and then the week progresses. “It is normal for our B4-180 to backwash 30 to 80 times in the first 36-48 hours after startup. By the end of the week the frequency is usually reduced to 2-4 times per 24-hour period.”

PARTICLE REMOVAL EFFICIENCY

In order to get a clear picture of debris removal in GI Plastek's system, Riebau collected representative samples upstream and downstream of the filter equipment.

Sample #1[BEFORE], the upstream sample, was collected at the process holding tank.

Water is pumped directly from the tank, through the filter to the process machinery.

1 Gallon Samples BEFORE & AFTER the B4-180 Self-Cleaning Filter

Sample #2[AFTER], the downstream sample was collected from a process water supply line downstream of the filter.

Samples were analyzed for Total Suspended Solids (TSS) values, and a particle size distribution analysis. TSS was reduced from 210mg/l to 13 mg/l with an additional 76% particle count reduction below the screen size. Particle reduction in the 1-100u range (below the degree of filtration) is attributed to the filter cake effect wherein the pore size of the screen becomes smaller as the screen accumulates dirt. Filtration in these lower ranges continues until the filter reaches its differential pressure set point that triggers backwash.

See lab reports at the end of the article for complete, laser-based, particle size analysis data.[i]

BACKWASH WATER RECOVERY

In many industrial applications, it is increasingly important to minimize make-up water demand and the amount of discharged wastewater. This was precisely what Riebau had in mind when he decided to run the backwash discharge line from the B4-180 filter into the tower water overflow tank.

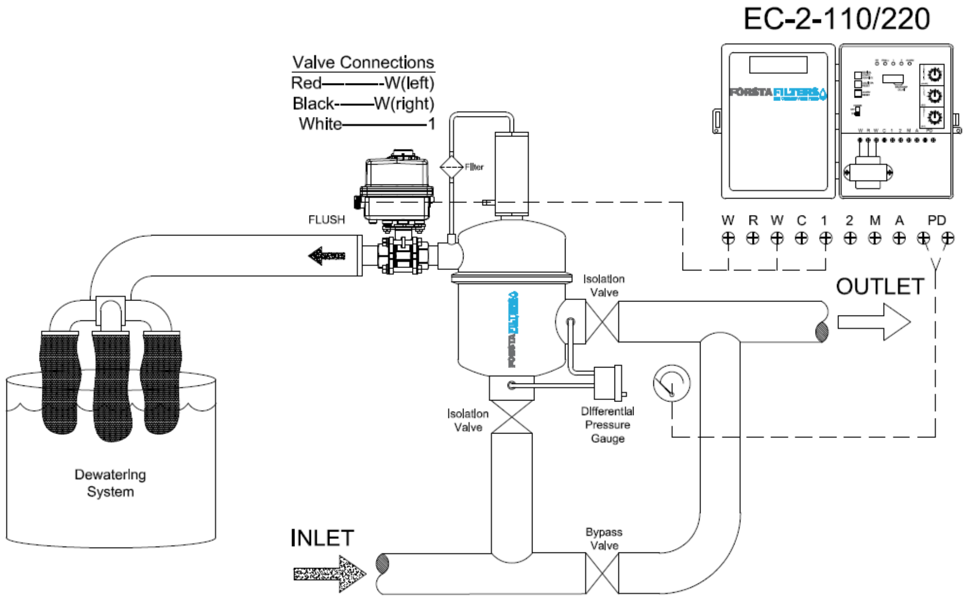
The backwash water is sent through a 75 micron bag filter suspended in the overflow tank at the end of the backwash discharge line. The water level in the overflow tank

Backwash Water Recovery System

triggers the sump pump and the filtered water is returned to the tower main water tank.

Riebau explained that, “the dirty filters from the overflow tank are simply switched out with clean ones. They are then turned inside-out and rinsed clean with domestic supply water in a basin which drains to the septic system…this method greatly reduces make-up water demand and the amount of wastewater dumped into our septic system.”

After startup, when the filter is backwashing with its highest frequency, the backwash recovery system is saving GI Plastek approximately 660 gallons of filtered water per hour.



The backwash water recovery system design ensures that routine maintenance is external to the main system flow. In other words, the bag filter change outs that are required do not cause any interruption to the main system flow. Although the recovery system at GI Plastek utilizes a single bag, it is possible to expand on this same concept (by increasing the number of filter bags) in order to further reduce maintenance frequency:

CONCLUSIONS

With the ongoing successful operation of their B4-180 model filter GI Plastek has been able to achieve their goals set forth at the outset of their project; prevent plugging of water channels in the plastic injection molds, and provide an unrestricted water flow throughout their entire process. As time goes on, they anticipate seeing reduced corrosion due to conductivity.

Approaching one year of operation, Riebau followed up with Forsta saying, “I was meaning to email you recently just to inform you how well the filter is working. This time of year, we experience heavy pollen and trees budding out along with insects. The debris we are removing/preventing from entering the system is excellent.

We have replaced the 75 micron backwash discharge filter in our overflow tank with a 5 micron filter during normal operations.

I don't believe the samples we sent you, though representative really did justice to indicate the effectiveness of our Forsta 180 filter.

…the channels are less clogged - one mold in particular that is used as a bellwether, had less buildup of silt like debris found in the water channels compared with previous inspections. We have reduced ancillary equipment down time due to clogged valves. We spend less time cleaning those pieces of equipment and since molds are less clogged, the time cleaning them is reduced. Those together mean more problem free production.”

Riebau says he would recommend Forsta to others with similar applications.

Contact Forsta Filters today for the solution to your industrial water filtration needs.

About the Author:
Polly Stenberg is Director of Sales with Forsta Filters Inc. - A California-based original equipment manufacturer. Stenberg has conducted case study reviews with customers using Forsta self-cleaning filters in drinking water, wastewater, cooling, agricultural/landscape irrigation and industrial process systems. Polly can be reached at 310-837-7177 x 405 or by emailing polly@forstafilters.com Visit Forsta on the web at www.forstafilters.com

[i] The Spectrex Laser Particle Counter analyzes particle size distribution in the particle size range of 1-100u. Total Suspended Solids values are based on a separate TSS test done by weight: Spectra Laboratories method SM 2450-D.

SPECTRA Laboratories
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04/26/2016

Forsta Filters Inc.
8072 San Fernando Rd.
Sun VAlley, CA 91352

Project: GI Plastek "Before" & "After"
Sample Matrix: Water
Date Sampled: 03/28/2016
Date Received: 04/08/2016
Spectra Project: 2016040214

Client ID	Spectra #	Analyte	Result	Units	Method
Before	1	Particle Count by LASER	426,800*	#/cc	NSF
Before	1	Total Suspended Solids	210	mg/L	SM 2540-D
After	2	Particle Count by LASER	103,700*	#/cc	NSF
After	2	Total Suspended Solids	13	mg/L	SM 2540-D

*Please see attached scans.

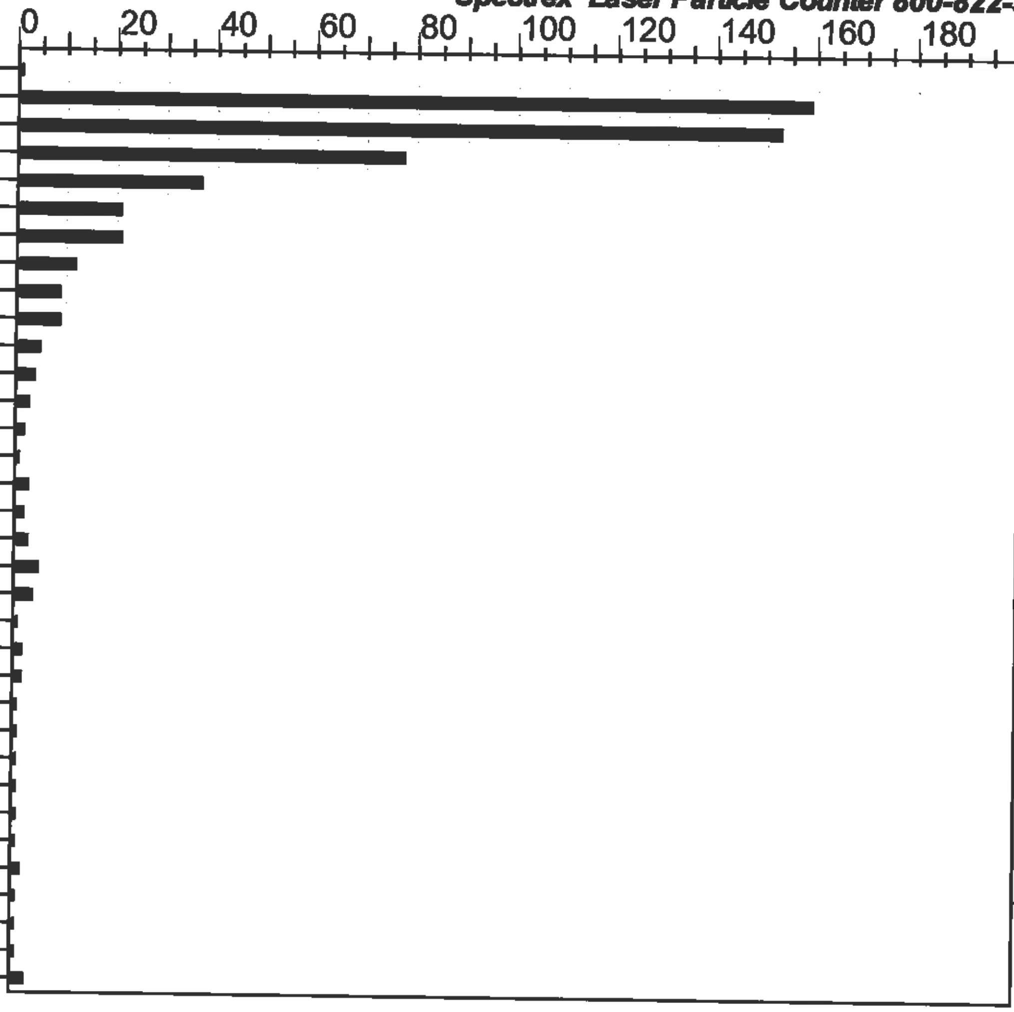
SPECTRA LABORATORIES

Steve Hibbs, Laboratory Manager
a7/jlm

04-26-2016
Forsta Filters Inc.
Spectra # 2016040214-1
Client ID: Before

Spectrex Laser Particle Counter 800-822-3940 v12.5

#	um	%	Interim Count
	<	0.00	0
1	1	29.95	159
2	2	28.73	153
3	3	14.52	77
4	4	6.75	36
5	5	3.86	20
6	6	3.92	20
7	7	2.12	11
8	8	1.61	8
9	9	1.54	8
10	10	0.84	4
11	11	0.71	3
12	12	0.51	2
13	13	0.19	1
14	14	0.13	0
15	15	0.39	2
16	16	0.19	1
17	17	0.45	2
18	22	0.75	4
19	27	0.67	3
20	32	0.15	0
21	37	0.30	1
22	42	0.22	1
23	47	0.15	0
24	52	0.15	0
25	57	0.00	0
26	62	0.15	0
27	67	0.15	0
28	72	0.07	0
29	77	0.22	1
30	82	0.00	0
31	87	0.15	0
32	92	0.00	0
	>	0.45	2



Filter
0%

A-T
0 s

S-T
32 s

Dilut'n
800.0:1

Offset
0.00V

Gain
5.55x

Counts
426800

NSF
Groups

Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
	< 1	0.00	0.00%	0.00%	0.00%	0.0000
1	1-5	341,220.57	79.95%	4.69%	0.55%	1.8471
2	5-15	65,830.33	15.42%	10.64%	2.87%	9.6499
3	15-30	10,468.85	2.45%	13.70%	7.75%	26.0519
4	30-50	3,520.09	0.82%	15.80%	13.77%	46.2990
	50-100	3,840.10	0.90%	55.17%	75.07%	252.4318

Total counts: 426,800.00/cc
Total suspended solids: 336.28ppm (mg/liter)
Dilution factor: 800.00:1
Spec. gravity: 1.00
Mean size: 4.17um
Standard dev: 8.05um

Sample taken on April 26, 2016 at 11:51

04-26-2016
Forsta Filters Inc.
Spectra # 2016040214-1
Client ID: Before

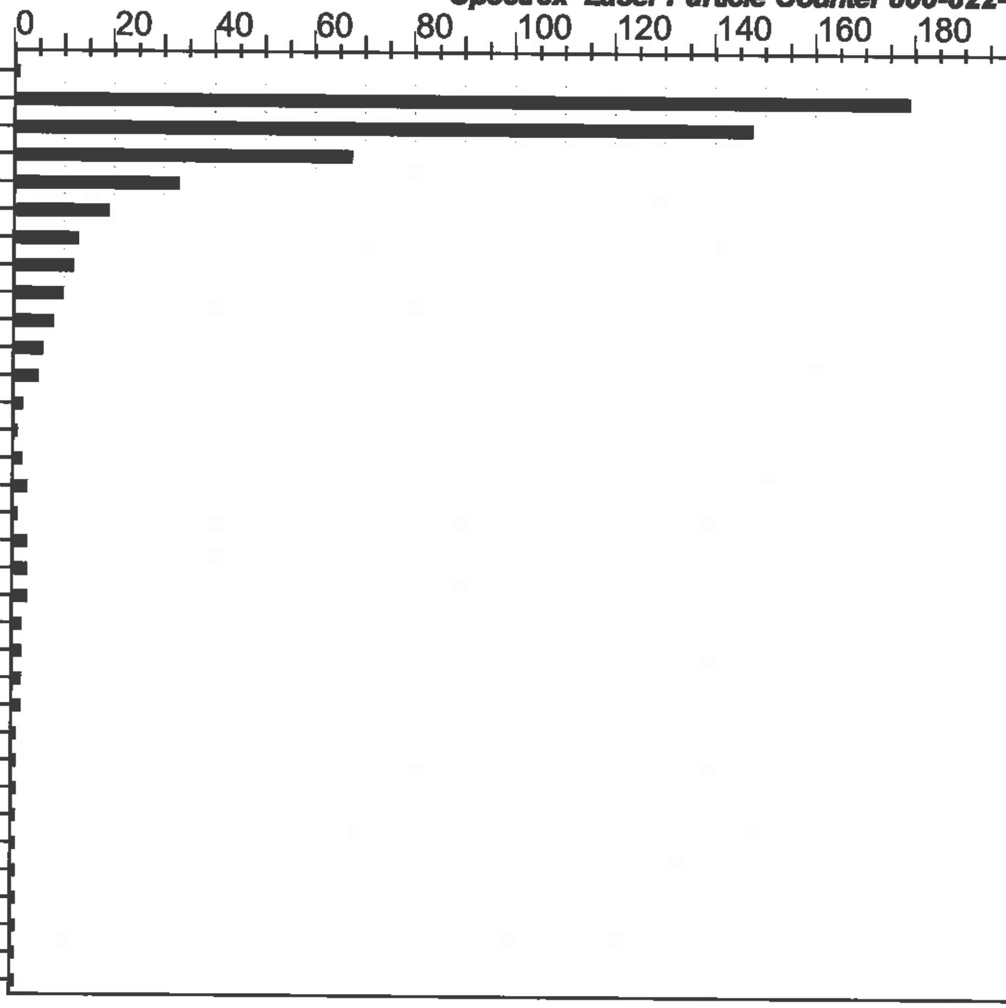
Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
	<	0.00	0.00%	0.00%	0.00%	0.0000
1	1um	127,820.57	29.95%	0.37%	0.02%	0.0669
2	2um	122,609.00	28.73%	1.40%	0.13%	0.4319
3	3um	61,990.23	14.52%	1.60%	0.20%	0.6659
4	4um	28,800.77	6.75%	1.32%	0.20%	0.6824
5	5um	16,457.58	3.86%	1.18%	0.21%	0.7203
6	6um	16,731.88	3.92%	1.73%	0.36%	1.2091
7	7um	9,051.67	2.12%	1.27%	0.30%	0.9994
8	8um	6,857.33	1.61%	1.26%	0.33%	1.0931
9	9um	6,583.03	1.54%	1.53%	0.43%	1.4507
10	10um	3,565.81	0.84%	1.02%	0.31%	1.0499
11	11um	3,017.22	0.71%	1.05%	0.34%	1.1546
12	12um	2,194.34	0.51%	0.91%	0.32%	1.0667
13	13um	822.88	0.19%	0.40%	0.15%	0.4985
14	14um	548.59	0.13%	0.31%	0.12%	0.4075
15	15um	1,645.76	0.39%	1.06%	0.44%	1.4778
16	16um	822.88	0.19%	0.60%	0.26%	0.8824
17	17um	1,920.05	0.45%	1.59%	0.72%	2.4325
18	22um	3,200.09	0.75%	4.44%	2.45%	8.2380
19	27um	2,880.08	0.67%	6.01%	3.87%	13.0213
20	32um	640.02	0.15%	1.88%	1.37%	4.6169
21	37um	1,280.03	0.30%	5.02%	4.09%	13.7650
22	42um	960.03	0.22%	4.85%	4.35%	14.6291
23	47um	640.02	0.15%	4.05%	3.95%	13.2880
24	52um	640.02	0.15%	4.96%	5.22%	17.5469
25	57um	0.00	0.00%	0.00%	0.00%	0.0000
26	62um	640.02	0.15%	7.05%	8.46%	28.4621
27	67um	640.02	0.15%	8.23%	10.48%	35.2286
28	72um	320.01	0.07%	4.75%	6.38%	21.4696
29	77um	960.03	0.22%	16.31%	23.04%	77.4695
30	82um	0.00	0.00%	0.00%	0.00%	0.0000
31	87um	640.02	0.15%	13.88%	21.49%	72.2550
32	92um	0.00	0.00%	0.00%	0.00%	0.0000
	>	1,920.05	0.45%	0.00%	0.00%	0.0000
	TOTALS	426,800.00	100.00%	100.00%	100.00%	336.2798

Sample taken on April 26, 2016 at 11:51

04-26-2016
Forsta Filters Inc.
Spectra # 2016040214-2
Client ID: After

Spectrex Laser Particle Counter 800-822-3940 v12.5

#	um	%	Interim Count
	<	0.00	0
1	1	34.64	179
2	2	28.47	147
3	3	12.96	67
4	4	6.23	32
5	5	3.49	18
6	6	2.43	12
7	7	2.18	11
8	8	1.74	9
9	9	1.37	7
10	10	1.06	5
11	11	0.81	4
12	12	0.31	1
13	13	0.00	0
14	14	0.37	1
15	15	0.56	2
16	16	0.12	0
17	17	0.54	2
18	22	0.43	2
19	27	0.49	2
20	32	0.38	1
21	37	0.22	1
22	42	0.32	1
23	47	0.22	1
24	52	0.00	0
25	57	0.05	0
26	62	0.00	0
27	67	0.11	0
28	72	0.05	0
29	77	0.16	0
30	82	0.00	0
31	87	0.05	0
32	92	0.05	0
	>	0.16	0



Filter 0%

A-T 0 s

S-T 32 s

Dilut'n 200.0:1

Offset 0.00V

Gain 5.55x

Counts 103700

NSF Groups

Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
	< 1	0.00	0.00%	0.00%	0.00%	0.0000
1	1-5	85,350.59	82.31%	5.56%	0.68%	0.4203
2	5-15	14,278.94	13.77%	12.58%	3.70%	2.2816
3	15-30	2,222.60	2.14%	13.36%	7.79%	4.8018
4	30-50	1,175.91	1.13%	26.37%	24.34%	15.0062
	50-100	503.96	0.49%	42.13%	63.49%	39.1465

Total counts: 103,700.00/cc
Total suspended solids: 61.66ppm (mg/liter)
Dilution factor: 200.00:1
Spec. gravity: 1.00
Mean size: 3.80um
Standard dev: 7.16um

Sample taken on April 26, 2016 at 13:42

04-26-2016
Forsta Filters Inc.
Spectra # 2016040214-2
Client ID: After

Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
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	<	0.00	0.00%	0.00%	0.00%	0.0000
1	1um	35,923.49	34.64%	0.53%	0.03%	0.0188
2	2um	29,527.04	28.47%	1.73%	0.17%	0.1040
3	3um	13,439.00	12.96%	1.78%	0.23%	0.1444
4	4um	6,461.06	6.23%	1.52%	0.25%	0.1531
5	5um	3,618.19	3.49%	1.33%	0.26%	0.1584
6	6um	2,519.81	2.43%	1.33%	0.30%	0.1821
7	7um	2,261.37	2.18%	1.63%	0.40%	0.2497
8	8um	1,809.10	1.74%	1.70%	0.47%	0.2884
9	9um	1,421.43	1.37%	1.69%	0.51%	0.3133
10	10um	1,098.38	1.06%	1.61%	0.52%	0.3234
11	11um	839.94	0.81%	1.49%	0.52%	0.3214
12	12um	323.05	0.31%	0.68%	0.25%	0.1570
13	13um	0.00	0.00%	0.00%	0.00%	0.0000
14	14um	387.66	0.37%	1.12%	0.47%	0.2879
15	15um	581.50	0.56%	1.92%	0.85%	0.5222
16	16um	129.22	0.12%	0.49%	0.22%	0.1386
17	17um	559.96	0.54%	2.38%	1.15%	0.7094
18	22um	447.97	0.43%	3.18%	1.87%	1.1532
19	27um	503.96	0.49%	5.40%	3.70%	2.2785
20	32um	391.97	0.38%	5.89%	4.59%	2.8276
21	37um	223.98	0.22%	4.50%	3.91%	2.4086
22	42um	335.98	0.32%	8.70%	8.30%	5.1197
23	47um	223.98	0.22%	7.27%	7.54%	4.6503
24	52um	0.00	0.00%	0.00%	0.00%	0.0000
25	57um	56.00	0.05%	2.67%	3.21%	1.9761
26	62um	0.00	0.00%	0.00%	0.00%	0.0000
27	67um	111.99	0.11%	7.38%	10.00%	6.1644
28	72um	56.00	0.05%	4.26%	6.09%	3.7568
29	77um	167.99	0.16%	14.63%	21.99%	13.5558
30	82um	0.00	0.00%	0.00%	0.00%	0.0000
31	87um	56.00	0.05%	6.22%	10.25%	6.3217
32	92um	56.00	0.05%	6.96%	11.96%	7.3718
	>	167.99	0.16%	0.00%	0.00%	0.0000
		---------	---------	---------	--------	----------
	TOTALS	103,700.00	100.00%	100.00%	100.00%	61.6564

Sample taken on April 26, 2016 at 13:42