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Wedge-Wire Screens for Continuous Centrifugals

Monitor Sugar[1] (now a part of Michigan Sugar) began testing a new screen design for continuous centrifugals for Johnson Screens[2] in 2003. This novel screen is a one-piece basket built with solid stainless steel wedge-wire. The intrinsic benefit of this concept should be a much longer service life than the standard chrome-plated nickel screens.

We chose a BMA K1100 centrifugal for our original test. This was a logical choice: Since this is one of the most common machines in use worldwide, the development efforts to build this screen would be directly applicable to a large market.

The first screen we tested was installed in high raw service. This station normally has consistent operation so we could make a side-by-side comparison with another machine running conventional screens.

The Bay City factory has five K1100 centrifugals in high raw service. In our first test, we installed one K1100 screen with 90 micron slots and tracked its performance in comparison to the conventional 90 micron screens in the rest of our machines. For this evaluation we monitored the brix and purity of the machine syrup from each machine. These measurements would show if we were having to use more wash water on a screen to produce acceptable sugar. This first test showed we got as good or better results with the new screen. Shortly afterward, we installed two more K1100 screens, one similar to the original and the other with the slots running horizontally instead of vertically. Weekly comparisons of syrup brix and purity were run on each Johnson screen and one conventional screen (table 1). It was interesting to learn that the angle of the slots, vertical to horizontal, did not have any apparent affect on screen performance. Physical examination of the screens after campaign showed no detectable wear.

Following the initial success in high raw service, we were interested to try the new screens in our low raw centrifugals. Our low raw station has five BMA K2300 centrifugals. In a previous effort to improve molasses purity we had changed from 60 micron to 40 micron screens and also monitored screen wear so that screens could be changed before they affected molasses purity. Some screens were being changed in as little as 30 days when wear in the chrome plating was detected. It was hoped that the wedge-wire screens would be durable enough to provide several campaigns of service. This would save the downtime and labor that go with changing screens during campaign.

Johnson Screens had the ability to produce wedge-wire screen as fine as 40 microns, so a screen was built to test in a low raw machine in 2004. We found in low raw service we were getting molasses purity equal to the standard 40 micron screens. Test data is shown in Table 2.

We were now confident that we

Table 1: K1100 high raw centrifugal Johnson Screen test

	Vertical Slots		Horizontal		Vertical					
	Johnson Screen		Johnson Screen		Johnson Screen		STD Screen		Difference	
	Brix	Purity	Brix	Purity	Brix	Purity	Brix	Purity	Brix	Purity
	84.6	70.2	84.2	70.7	83.8	70.9	81.5	73.2	3.1	-3.0
	83.9	70.8	83.3	70.9	84.4	71.1	81.1	71.3	2.8	-0.5
	83.9	71.1	83.9	70.8	83.1	71.0	83.0	71.5	0.9	-0.4
	85.9	71.8	85.2	71.8	84.6	72.4	83.6	71.9	2.3	-0.1
	81.2	70.2	85.2	70.3	83.7	70.9	85.6	71.8	-4.4	-1.6
	83.4	71.2	85.0	71.8	83.6	72.4	84.4	72.3	-1.0	-1.1
	82.2	72.1	81.4	72.5	84.0	72.0	82.2	72.6	0.0	-0.5
	83.0	72.3	84.5	71.3	81.7	71.4	83.4	72.8	-0.4	-0.5
	78.8	70.1	78.7	71.5	78.0	71.8	80.6	70.7	-1.8	-0.6
	84.2	67.3	84.7	67.1	84.1	66.1	84.3	66.3	-0.1	1.0
	82.0	71.9	83.7	71.4	82.3	72.3	82.7	71.6	-0.7	0.3
	84.1	71.1	84.7	70.6	84.8	70.8	83.8	71.1	0.3	0.0
	80.0	69.9	79.4	69.6	79.9	69.0	80.4	69.4	-0.4	0.5
	78.1	69.7	78.2	70.5	77.7	70.0	78.0	69.1	0.1	0.6
	78.0	75.2	78.7	76.1	78.5	75.0	78.7	76.0	-0.7	-0.8
	85.4	71.4	84.9	69.3	86.7	71.1	86.0	70.6	-0.6	0.8
Average	**82.4**	**71.0**	**82.9**	**71.0**	**82.6**	**71.1**	**82.5**	**71.4**	**0.0**	**-0.4**

Table 2

	Johnson Screen		Conventional	
	Brix	Purity	Brix	Purity
	86.8	63.7	88.5	63.3
	89.7	58.8	89.4	58.8
	88.6	59.9	87.9	60.1
	89.1	58.4	89.0	59.0
	89.8	57.8	89.1	57.0
	89.5	58.8	88.2	58.8
	89.1	57.9	89.3	58.0
	89.5	56.8	89.4	57.3
	87.4	58.0	91.6	58.4
	91.5	59.4	86.6	56.7
	88.5	55.7	87.4	57.8
	90.7	59.3	90.7	58.6
	83.6	59.2	84.9	58.2
	88.2	59.4	87.1	59.3
	89.0	59.2	89.1	59.9
	90.1	59.6	88.2	59.6
	89.0	62.1	87.9	62.8
	88.3	57.8	89.1	60.4
	89.9	57.8	89.3	58.2
Average	**88.9**	**58.9**	**88.6**	**59.1**

would not jeopardize our molasses purity with the Johnson Screens and furthermore would benefit from the durability of the wedge-wire construction. The following year two more K2300 screens were installed. We had problems with vibration after installing a new screen, but after carefully centering the one-piece screen it has run as smooth as expected. Then in 2006 the last two K2300's had Johnson screens installed. The Sugar End crew in particular has seen the benefit of having the wedge-wire screens on the whole bank of low raw centrifugals: they did not have to change a single screen during the entire campaign. The first low raw screen has run for three campaigns and remains in good enough condition to be left in place for next year.

The oldest high raw screen has run four full campaigns. At the end of the third campaign it was showing some wear with some dents and one small 2mm hole and some cracks at the top of the seams. We chose to continue to test it and see if it would complete the campaign, which it did. Based on our experience to date, we expect a minimum service life of four campaigns from the Johnson screens. This is enough to offset a significant price difference between the two types of screens, if economics were to be used as the deciding factor in selecting screens.

In general there are two characteristics of a continuous centrifugal screen that will determine its performance in quality and throughput. First is the slot size; recognizing that larger slots will allow more fine sugar crystals to pass through. With low raw sugar this sugar will be lost to molasses and this is why smaller slots of 40 or 60 micron are used in low raw versus 90 micron in high raw. For greater throughput more open area provides more potential to purge syrup off the sugar crystals. This can be particularly important for factories that have limited capacity at one or more of their centrifugal stations. Variations in screen designs that are available offer some range in the percent open area. It is also important to consider slot size here as well because larger slots provide more open area. Each factory needs to balance the quality versus throughput in selecting slot sizes that will best suit their factories operation. Overall our findings were what we expected to see. By matching the slot size of the Johnson Screens with the screens we had been using, the resulting syrup purities were essentially the same. With the same slot sizes, the percent open areas are believed to be similar enough, and we saw no apparent difference in throughput on our centrifugals when we installed the new screens. I would suggest that if throughput was the primary issue in a factory, wedge wire screens with large enough slots to provide the desired open area could be installed and they also would gain some incremental capacity by avoiding the downtime experienced when changing worn screens of the conventional design. This is a novel idea that has been working in the Bay City factory, providing satisfactory results in sugar, syrup and molasses with greater durability and service life.

[1]Monitor Sugar Company joined the Michigan Sugar Company in October 2004.

[2]Johnson Screens, 1950 Old Hwy. 8 N.W., New Brighton, MN 55112, www.johnsonscreens.com.

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