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PERFORMANCE COMPARATION BETWEEN SELF-CLEANING POLYURETHANE SCREENS AND STEEL SCREENS APPLIED IN NATURAL MOISTURE SCREENING OF IRON ORE

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Abstract: Screening screens are basically of 3 types: steel, polyurethane and rubber, with only the first two being used for damp or natural humidity operations. Steel screens are commonly adopted mainly because they have a larger open area and lower cost, but have a short useful life when compared to polyurethane. Thus, to compare the performance of these screens in the treatment of iron ore, two equal screens were used, one with steel screens and the other with polyurethane screens. Despite the smaller open area, both in terms of feed rate, cost, production of metal scrap, weight, useful life and cleaning time, polyurethane screens had superior performance, especially the useful life 6x longer than steel. Thus, considering productivity, polyurethane screens perform greater physical use and physical availability in addition to sustainability, due to less scrap generation, as well as greater safety and ergonomics in the movement of screens for employees.
Keywords: Screening; Performance; Polyurethane; Screens.

INTRODUCTION

Mining companies have the maintenance of their future dependent on investments in specific research and innovation, in order to survive in a volatile, uncertain market, with increased demand from stakeholders and a reduction in essential resources such as water and energy. This way, traditional business models focused solely on production are no longer enough, requiring strategies with sustainable and social growth, in addition to the use of best practices and benchmarking combined with leveraging productivity.

According to the consulting firm Deloitte (2019), in its study on mining trends, to prosper in the future, companies must question the status quo, making use of a plurality of points of view, taking the risk of doing things differently. way different from what is commonly practiced. As an example, one can cite the use of alternative materials, such as the replacement of traditionally steel equipment parts with alternative materials.

Based on this, this article brings the main comparative results obtained by replacing the screen modules in steel vibrating screens, a material commonly used in this process, by polyurethane (PU) screens in an iron processing plant at natural humidity (without the use of washing water or pulpy material), in the secondary screening stage, at the Carajás mining complex located in the southeast of the state of Pará.

Sieving is the operation that is part of the classification stage of mineral processing and aims to separate particles with different sizes based on predetermined openings. These templates can vary from parallel bars in grids, perforated plates to screens or braided wires in the case of sieves. Particles retained in the template are known as oversize and those passing through are known as undersize (CHAVES, 2003).

Still according to the author, the size and format characteristics of the templates consist of the mesh and can have different shapes such as square, rectangular, diamond, elongated, ellipsoid. To support the jigs, there are several types of equipment such as trolleys, grids and, the most common, sieves, which can be static and fixed or vibrating, also being horizontal or inclined and the choice depends on the service to be performed.

The natural moisture screening process is similar to wet screening, the main difference being the absence of water injection into the circuit through washing sprays or even with the feed already in pulp format. Processing without water, despite being more complex, has emerged as a solution for many operations to remain open, in view of the greater restrictions on the use of water and generation of ore tailings to be stored in dams (NUNES FILHO, 2017). However, it is worth mentioning that for the process under study in this article, the ROM ore from the feed contains a considerable natural moisture content, reaching up to about 9%.

Still on sieving concepts, the arrangement of screens on sieve decks is called configuration and can be composed of one or more types or models of screen, identified by lines and columns. Screens without openings can also be used, such as blind and spout screens. Blind type screens are generally used at the beginning of the first deck, a region where there is no direct feed, but it is essential to prevent material loss. As for spouts, they function as a transition between modules and at the beginning of the second deck (LUZ, 2018).

In this study, the aim is to understand the main differences in the use of steel screens and polyurethane screens. Thus, in general, according to the literature, synthetic meshes such as PU or rubber are more cost-effective than steel meshes, mainly due to their useful life, which is up to 6 times greater than that of steel meshes. In addition, PU fabrics are lighter, emit less noise and are more resistant to abrasion and wear. On the other hand, these meshes have a smaller open area when compared to steel meshes and tend to be more expensive, and the needs of each operation must be evaluated. In general, this difference in an open area tends to be compensated by the downtime due to the need to replace it due to breakage, wear or clogging in the steel screens (M&T, 2016).

Thus, considering the advantages and disadvantages of each type of screen, the objective of this study was to compare the operational performance between the two materials, steel and PU, applied to screening in iron mining under natural humidity, seeking continuous improvement of processes and security.

METHODOLOGY

In the case of this article, the equipment used for testing was an inclined, eccentric modular vibrating screen, composed of two modules and two decks, as shown in figure 1, adding 4 modules per screen and each module comprising 80 screens, 320 in total. The results were measured based on the second deck, keeping the first standardized.

For the results presented in this article, the screens compared in the test were applied on the second deck and of two types: one made of steel with a diamond shape or profile and one made of polyurethane (PU) with a rectangular shape combined with the self-cleaning characteristic that gives it a profile similar to the letter "H", as shown in Figures 2 and 3 below. The opening of the two types of screens was 19 mm and, for identification purposes, the sieve with steel screens will be considered as Line A and the sieve with PU screens as Line B.

The first deck of both screens was patterned with PU screens with a 42 mm square profile opening like figure 4 below. It is important to emphasize that screening on this deck is not the scope of this article and therefore it was standardized in order not to interfere with the performance results according to the evaluated deck of the screens.

The test carried out lasted 30 days (one month) using two equal sieves as shown in figure 1 and with the same operating conditions. The feeding of the two sieves is done through the same silo, only with an equal division of flow between the two test lines, ensuring that the same material feeds both. The comparative performance evaluation was carried out according to the analysis of the following dimensions:

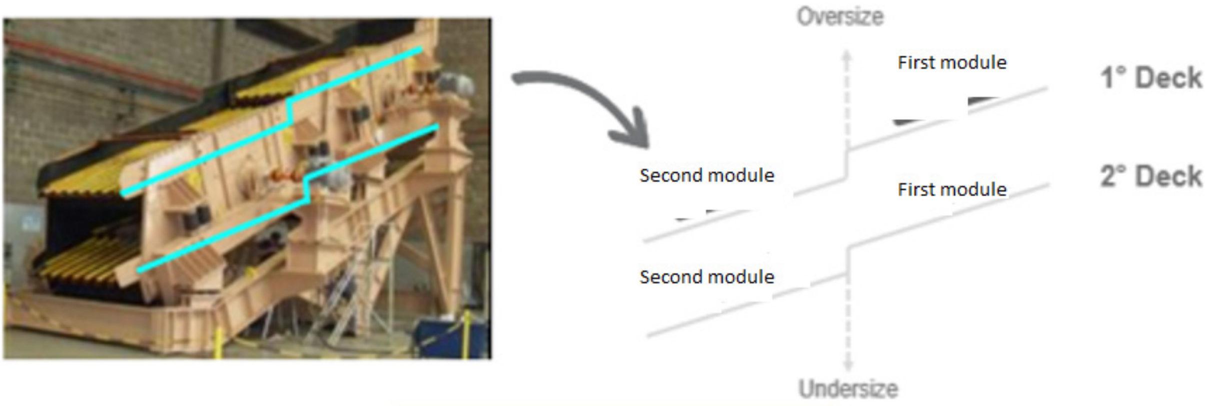

Figure 1. Model of sieve used.

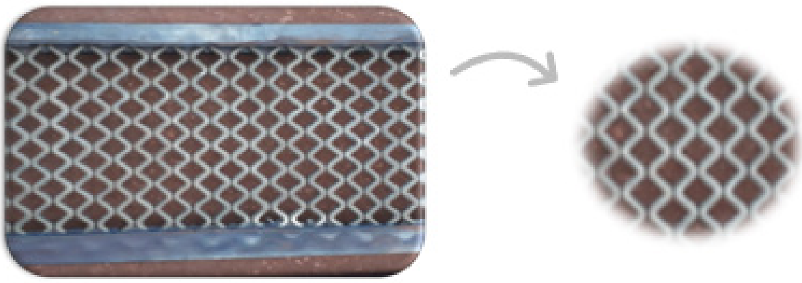

Figure 2. Steel mesh with diamond profile (Line A).

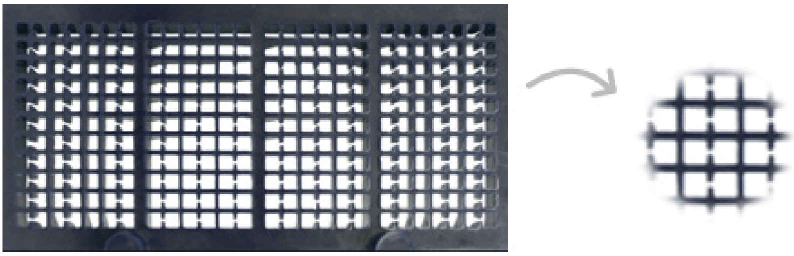

Figure 3. PU screen with rectangular “H” profile (Line B).

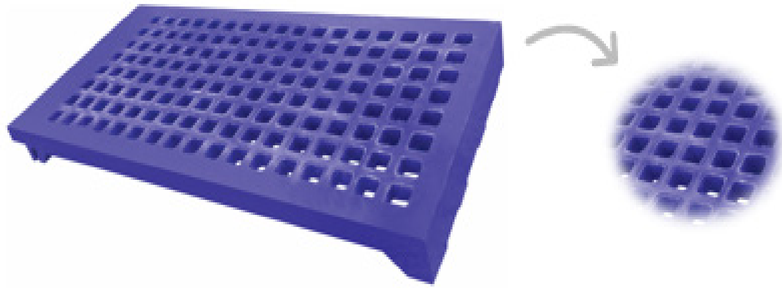

Figure 4. Square profile PU screen used on the first deck of the test sieves.

- Feed rate;
- Cleaning time;
- Useful life of screens;
- Weight of screens and
- Open area.

The feed rate was monitored using a specific software system that updates information every minute and computes the daily and monthly average feed for each line. Cleaning time is timed and posted on the same system.

Service life was measured in the field, based on visual inspection to identify wear or breakage events, in the case of line A (steel) and deformation or in the case of line B (PU). Once the first defect is identified, the useful life of the screens is computed.

As for the information on the open area and weight of the screens, data from the suppliers were used. Screen drop events were also indicated through visual inspection, in order to avoid the presence of non-crushable scrap in the circuit and comparison of screen attachment.

The configuration of the first deck, as previously mentioned, is standard and shown in figure 5 below.

The second deck is where the screens for the comparative test are located, with the configuration of Line A (steel) as shown in figure 6 in green and Line B (PU) in figure 7 in blue.

As for the cleaning of the screens, routine of the operation, it is important to point out that it is carried out periodically at the beginning of

1 DECK (FIRST MODULE)

1º DECK 1º Módulo

A Bica de PU	B Bica de PU	C Bica de PU	D Bica de PU	E Bica de PU	F Bica de PU	G Bica de PU	H Bica de PU
A1 42x42 PU	B1 42x42 PU	C1 42x42 PU	D1 42x42 PU	E1 42x42 PU	F1 42x42 PU	G1 42x42 PU	H1 42x42 PU
A2 42x42 PU	B2 42x42 PU	C2 42x42 PU	D2 42x42 PU	E2 42x42 PU	F2 42x42 PU	G2 42x42 PU	H2 42x42 PU
A3 42x42 PU	B3 42x42 PU	C3 42x42 PU	D3 42x42 PU	E3 42x42 PU	F3 42x42 PU	G3 42x42 PU	H3 42x42 PU
A4 42x42 PU	B4 42x42 PU	C4 42x42 PU	D4 42x42 PU	E4 42x42 PU	F4 42x42 PU	G4 42x42 PU	H4 42x42 PU
A5 42x42 PU	B5 42x42 PU	C5 42x42 PU	D5 42x42 PU	E5 42x42 PU	F5 42x42 PU	G5 42x42 PU	H5 42x42 PU
A6 42x42 PU	B6 42x42 PU	C6 42x42 PU	D6 42x42 PU	E6 42x42 PU	F6 42x42 PU	G6 42x42 PU	H6 42x42 PU
A7 42x42 PU	B7 42x42 PU	C7 42x42 PU	D7 42x42 PU	E7 42x42 PU	F7 42x42 PU	G7 42x42 PU	H7 42x42 PU
A8 42x42 PU	B8 42x42 PU	C8 42x42 PU	D8 42x42 PU	E8 42x42 PU	F8 42x42 PU	G8 42x42 PU	H8 42x42 PU
73 Bica PU	74 Bica PU	75 Bica PU	76 Bica PU	77 Bica PU	78 Bica PU	79 Bica PU	80 Bica PU
BICA DE DESCARGA							

1 DECK (SECOND MODULE)

1º DECK 2º Módulo

A10 Bica PU	B10 Bica PU	C10 Bica PU	D10 Bica PU	E10 Bica PU	F10 Bica PU	G10 Bica PU	H10 Bica PU
A11 42x42 PU	B11 42x42 PU	C11 42x42 PU	D11 42x42 PU	E11 42x42 PU	F11 42x42 PU	G11 42x42 PU	H11 42x42 PU
A12 42x42 PU	B12 42x42 PU	C12 42x42 PU	D12 42x42 PU	E12 42x42 PU	F12 42x42 PU	G12 42x42 PU	H12 42x42 PU
A13 42x42 PU	B13 42x42 PU	C13 42x42 PU	D13 42x42 PU	E13 42x42 PU	F13 42x42 PU	G13 42x42 PU	H13 42x42 PU
A14 42x42 PU	B14 42x42 PU	C14 42x42 PU	D14 42x42 PU	E14 42x42 PU	F14 42x42 PU	G14 42x42 PU	H14 42x42 PU
A15 42x42 PU	B15 42x42 PU	C15 42x42 PU	D15 42x42 PU	E15 42x42 PU	F15 42x42 PU	G15 42x42 PU	H15 42x42 PU
A16 42x42 PU	B16 42x42 PU	C16 42x42 PU	D16 42x42 PU	E16 42x42 PU	F16 42x42 PU	G16 42x42 PU	H16 42x42 PU
A17 42x42 PU	B17 42x42 PU	C17 42x42 PU	D17 42x42 PU	E17 42x42 PU	F17 42x42 PU	G17 42x42 PU	H17 42x42 PU
A18 42x42 PU	B18 42x42 PU	C18 42x42 PU	D18 42x42 PU	E18 42x42 PU	F18 42x42 PU	G18 42x42 PU	H18 42x42 PU
A19 Bica PU	B19 Bica PU	C19 Bica PU	D19 Bica PU	E19 Bica PU	F19 Bica PU	G19 Bica PU	H19 Bica PU
BICA DE DESCARGA							

Figure 5. Standardized configuration of the first deck of Lines A and B.

2 DECK (FIRST MODULE) 2 DECK (SECOND MODULE)

2º DECK 1º Módulo

A Cega P	B Cega P	C Cega P	D Cega P	E Cega P	F Cega P	G Cega P	H Cega P
A1 19X19 ACO	B1 19X19 ACO	C1 19X19 ACO	D1 19X19 ACO	E1 19X19 ACO	F1 19X19 ACO	G1 19X19 ACO	H1 19X19 ACO
A2 19X19 ACO	B2 19X19 ACO	C2 19X19 ACO	D2 19X19 ACO	E2 19X19 ACO	F2 19X19 ACO	G2 19X19 ACO	H2 19X19 ACO
A3 19X19 ACO	B3 19X19 ACO	C3 19X19 ACO	D3 19X19 ACO	E3 19X19 ACO	F3 19X19 ACO	G3 19X19 ACO	H3 19X19 ACO
A4 19X19 AÇO	B4 19X19 AÇO	C4 19X19 AÇO	D4 19X19 AÇO	E4 19X19 AÇO	F4 19X19 AÇO	G4 19X19 AÇO	H4 19X19 AÇO
A5 19X19 ACO	B5 19X19 ACO	C5 19X19 ACO	D5 19X19 ACO	E5 19X19 ACO	F5 19X19 ACO	G5 19X19 ACO	H5 19X19 ACO
A6 19X19 AÇO	B6 19X19 AÇO	C6 19X19 AÇO	D6 19X19 AÇO	E6 19X19 AÇO	F6 19X19 AÇO	G6 19X19 AÇO	H6 19X19 AÇO
A7 19X19 ACO	B4 19X19 ACO	C4 19X19 ACO	D4 19X19 ACO	E4 19X19 ACO	F4 19X19 ACO	G4 19X19 ACO	H7 19X19 ACO
A8 19X19 ACO	B4 19X19 ACO	C4 19X19 ACO	D4 19X19 ACO	E4 19X19 ACO	F4 19X19 ACO	G4 19X19 ACO	H8 19X19 ACO
A9 Bica PU	B9 Bica PU	B9 Bica PU	D9 Bica PU	E9 Bica PU	F9 Bica PU	G9 Bica PU	H9 Bica PU

2º DECK 2º Módulo

A10 Bica PU	B10 Bica PU	C10 Bica PU	D10 Bica PU	E10 Bica PU	F10 Bica PU	G10 Bica PU	H10 Bica PU
A11 19X19 ACO	B11 19X19 ACO	C11 19X19 ACO	D11 19X19 ACO	E11 19X19 ACO	F11 19X19 ACO	G11 19X19 ACO	H11 19X19 ACO
A12 19X19 AÇO	B12 19X19 AÇO	C12 19X19 AÇO	D12 19X19 AÇO	E12 19X19 AÇO	F12 19X19 AÇO	G12 19X19 AÇO	H12 19X19 AÇO
A13 19X19 ACO	B13 19X19 ACO	C13 19X19 ACO	D13 19X19 ACO	E13 19X19 ACO	F13 19X19 ACO	G13 19X19 ACO	H13 19X19 ACO
A14 19X19 AÇO	B14 19X19 AÇO	C14 19X19 AÇO	D14 19X19 AÇO	E14 19X19 AÇO	F14 19X19 AÇO	G14 19X19 AÇO	H14 19X19 AÇO
A15 19X19 AÇO	B15 19X19 AÇO	C15 19X19 AÇO	D15 19X19 AÇO	E15 19X19 AÇO	F15 19X19 AÇO	G15 19X19 AÇO	H15 19X19 AÇO
A16 19X19 AÇO	B16 19X19 AÇO	C16 19X19 AÇO	D16 19X19 AÇO	E16 19X19 AÇO	F16 19X19 AÇO	G16 19X19 AÇO	H16 19X19 AÇO
A17 19X19 ACO	B17 19X19 ACO	C17 19X19 ACO	D17 19X19 ACO	E17 19X19 ACO	F17 19X19 ACO	G17 19X19 ACO	H17 19X19 ACO
A18 19X19 AÇO	B18 19X19 AÇO	C18 19X19 AÇO	D18 19X19 AÇO	E18 19X19 AÇO	F18 19X19 AÇO	G18 19X19 AÇO	H18 19X19 AÇO
A19 Bica PU	B19 Bica PU	C19 Bica PU	D19 Bica PU	E19 Bica PU	F19 Bica PU	G19 Bica PU	H19 Bica PU

Figure 6. Configuration of Line A for second deck with steel mesh.

2º DECK 1º Módulo

A Cega P	B Cega P	C Cega P	D Cega P	E Cega P	F Cega P	G Cega P	H Cega P
A1 19x19 PU	B1 19x19 PU	C1 19x19 PU	D1 19x19 PU	E1 19x19 PU	F1 19x19 PU	G1 19x19 PU	H1 19x19 PU
A2 19x19 PU	B2 19x19 PU	C2 19x19 PU	D2 19x19 PU	E2 19x19 PU	F2 19x19 PU	G2 19x19 PU	H2 19x19 PU
A3 19x19 PU	B2 19x19 PU	C3 19x19 PU	D3 19x19 PU	E3 19x19 PU	F3 19x19 PU	G2 19x19 PU	H3 19x19 PU
A4 19x19 PU	B4 19x19 PU	C4 19x19 PU	D4 19x19 PU	E4 19x19 PU	F4 19x19 PU	G4 19x19 PU	H4 19x19 PU
A5 19X19 PU	B5 19x19 PU	C5 19x19 PU	D5 19x19 PU	E5 19x19 PU	F5 19x19 PU	G5 19x19 PU	H5 19X19 PU
A6 19x19 PU	B6 19x19 PU	C6 19x19 PU	D6 19x19 PU	E6 19x19 PU	F6 19x19 PU	G6 19x19 PU	H6 19x19 PU
A7 19X19 PU	B4 19x19 PU	C4 19x19 PU	D4 19x19 PU	E4 19x19 PU	F4 19x19 PU	G4 19x19 PU	H7 19X19 PU
A8 19X19 PU	B4 19x19 PU	C4 19x19 PU	D4 19x19 PU	E4 19x19 PU	F4 19x19 PU	G4 19x19 PU	H8 19X19 PU
A9 Bica PU	B9 Bica PU	B9 Bica PU	D9 Bica PU	E9 Bica PU	F9 Bica PU	G9 Bica PU	H9 Bica PU

2º DECK 2º Módulo

A10 Bica PU	B10 Bica PU	C10 Bica PU	D10 Bica PU	E10 Bica PU	F10 Bica PU	G10 Bica PU	H10 Bica PU
A11 19x19 PU	B11 19x19 PU	C11 19x19 PU	D11 19x19 PU	E11 19x19 PU	F11 19x19 PU	G11 19x19 PU	H11 19x19 PU
A12 19x19 PU	B12 19x19 PU	C12 19x19 PU	D12 19x19 PU	E12 19x19 PU	F12 19x19 PU	G12 19x19 PU	H12 19x19 PU
A13 19x19 PU	B13 19x19 PU	C13 19x19 PU	D13 19x19 PU	E13 19x19 PU	F13 19x19 PU	G13 19x19 PU	H13 19x19 PU
A14 19x19 PU	B14 19x19 PU	C14 19x19 PU	D14 19x19 PU	E14 19x19 PU	F14 19x19 PU	G14 19x19 PU	H14 19x19 PU
A15 19x19 PU	B15 19x19 PU	C15 19x19 PU	D15 19x19 PU	E15 19x19 PU	F15 19x19 PU	G15 19x19 PU	H15 19x19 PU
A16 19x19 PU	B16 19x19 PU	C16 19x19 PU	D16 19x19 PU	E16 19x19 PU	F16 19x19 PU	G16 19x19 PU	H16 19x19 PU
A17 19x19 PU	B17 19x19 PU	C17 19x19 PU	D17 19x19 PU	E17 19x19 PU	F17 19x19 PU	G17 19x19 PU	H17 19x19 PU
A18 19x19 PU	B18 19x19 PU	C18 19x19 PU	D18 19x19 PU	E18 19x19 PU	F18 19x19 PU	G18 19x19 PU	H18 19x19 PU
A19 Bica PU	B19 Bica PU	C19 Bica PU	D19 Bica PU	E19 Bica PU	F19 Bica PU	G19 Bica PU	H19 Bica PU

Figure 7. Configuration of Line B for the second deck with PU screens.

each hour and whenever necessary, according to what was identified in inspections and characteristics of the material. There was no change in this routine for the test in question.

The construction of the tables and graphs presented, as well as the analysis with data processing, was carried out using Excel software.

RESULTS AND DISCUSSIONS

Considering the objective of the comparative test between steel and polyurethane meshes and according to the performance dimensions to be analyzed, the main results are presented below, as well as the respective discussions about them.

OPEN AREA AND WEIGHT

The results below were obtained according to the supplier's specifications, with the open area provided in percentage and the weight in kilograms, compiled in Table 2.

Screen type	Steel (A)	Polyurethane (B)
Open área	46 %	42,7 %
Weight	6,8 kg	5,1 kg

Table 1. Open area and weight of the two types of screen used.

The open area is the main disadvantage of polyurethane screens compared to steel screens, considering the reduction of 3.3%. According to the size of the operation and together with the other results, it must be observed whether this reduction would impact the total production and thus choose or not to replace one by the other or even the possibility of mixed configurations. Therefore, historically, this difference in open area has contributed to many operations still not being interested in the use of polyurethane.

As for weight, a polyurethane screen is 1.7 kg lighter than a steel screen. It is important to point out that, in this operation, the screens are moved manually or using trolleys. That is, changing the screens of an entire screen requires transporting about 320 screens through the operational area and passing through stairs. The gains, this way, are considerable in terms of transport ergonomics and in times and movements due to the weight of each screen.

Still dealing with the handling and transport of the screens, the analysis regarding safety is also valid considering that with steel screens there is a risk of cutting hands and fingers through sharp and rusty parts. This risk is eliminated with the use of polyurethane screens.

FEED RATE

According to the rate tracking system, figure 8 brings the average monthly feed rate results for the two test lines, in tons per hour (t/h) of ore. It is worth remembering that the operating conditions for both equipment were maintained.

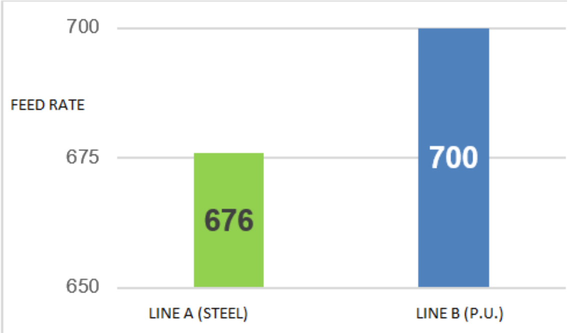

Figure 8. Graph indicating the average monthly feed rate (t/hr) of the two test lines.

The positive result of the polyurethane screen, with an increase of 24 t/h in average monthly rate in relation to the result of the steel screen is quite interesting, because it shows that despite operating with a smaller open area than Line A, Line B still obtained a superior result. This total gain of 3% reflects both the self-cleaning characteristic of the "H" profile PU screens, since even with the larger open area, the steel screens have a greater tendency to blind or clog, and the useful life that involves downtime. power supply to replace faulty screens. This matter will be analyzed in the next topic.

Thus, the expectation that the smaller open area of the PU H screens would considerably reduce the feed rate was not confirmed. This is mainly due to the reduction of screen clogging events compared to steel screens. Often, steel screens present obstruction in the mesh, which leads to a consequent reduction in the rate to avoid excess fines in the oversize, the same occurs with the presence of high humidity or clay in the feed. Therefore, the PU screens, despite having a smaller open area, achieved not only the equivalence in feeding rates but also a slightly higher gain.

LIFESPAN AND SCREEN DROP

During the 30 days of the test, all Steel Screens on Line A had their useful life ended between 18 and 25 days of the test, being replaced whenever wear or breakage events were identified during the inspections. Therefore, the second deck of Line A, disregarding the blind screens and spouts, was entirely replaced. An example of the start of the wear process on steel wires is shown in figure 9 below. Changing the screen when identifying wear is preventive, since the next step is the breakage, which can mainly cause granulometric contamination of the product.

Figure 9. Beginning of the wear process in A-line steel wire mesh.

Considering these events during the test period, the proportion of steel screens changed due to wear and tear and screens changed due to breakage is as indicated in Figure 10, confirming the preventive character of the identification of wear.

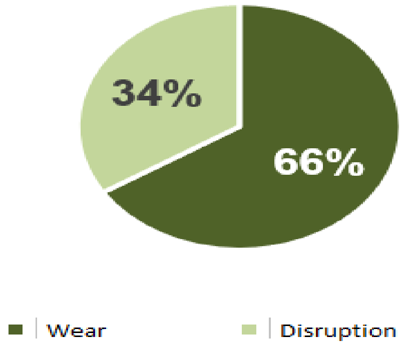

Figure 10. Graph of proportion of occurrence of wear events and breakage of steel meshes during the test period.

On the other hand, Line B PU screens were not changed once during the test. No deformation or breakage events were identified even with the same inspection frequency performed on Line A. Thus, it was understood that the useful life is longer than the 30-day test and, therefore, the PU screens were not removed after the end of the month so that it was possible to properly determine the useful life.

After 151 days of operation, screens on the PU Line broke and several signs of impact deformation were identified, which already implied contamination and loss of product specification. So, the useful life was determined to be 5 months for Line B screens.

The result shows that polyurethane screens have a service life 6 times longer than steel, which is an experimental result that is equivalent to the value provided by the M&T bibliography (2026). This is equivalent to saying that in the 5-month period of this operation, there would be no need to change any screens on Line B, while the screens on

Line A would already have had to be replaced at least 8 times.

The impact of this useful life result is relevant mainly in terms of costs with the acquisition of screens and downtime to change screens, directly interfering with the physical availability of the sieve and, consequently, productivity. Considering that the steel mesh is cheaper than the PU mesh, comparing the installation cost of both shows a gain of R$ 6000.00. However, over time, due to the need for replacement and the high useful life of PU, in 1 month, the Line B screen becomes more financially advantageous and the gain is even more noticeable after 5 months. These results can be seen in Figure 11, in which we have the gains of polyurethane meshes in relation to steel meshes.

Another important analysis to be carried out concerns sustainability and scrap generation. The reduction in the need to replace screens consequently generates an equal reduction in waste generation, making the operation more sustainable and safer. With steel screens, in 1 month, around 320 screens in the form of metallic scrap would be discarded and extrapolating for the 5 months the value exceeds 2000. For the same periods considering the PU screens, in 1 month there would be no disposal of screens and after 5 months it would be around 300. Figure 12 provides such information in a visual form.

It is also worth pointing out that screen drop events were only identified on Line A with steel screens, being a recurring problem in vibrating screens with non-pinned screens. The PU screens, on the other hand, due to their greater flexibility, did not have this behavior.

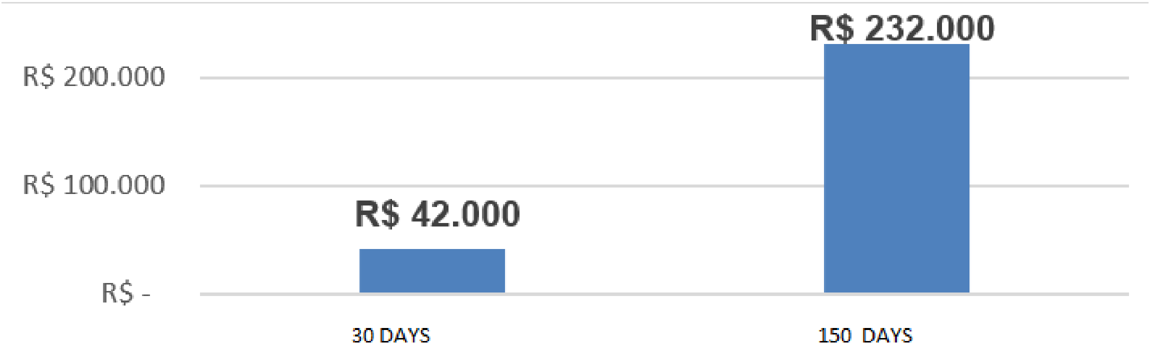

Figure 11. Estimated financial earnings of line B (PU) in relation to line A (steel) over time.

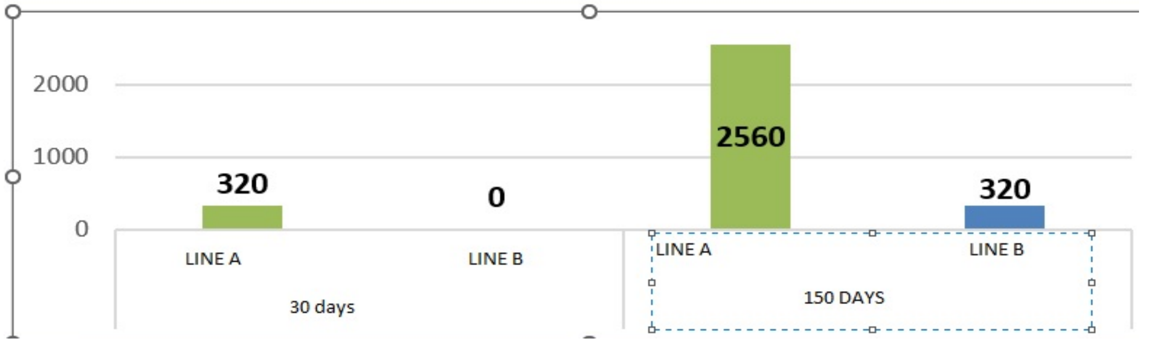

Figure 12. Graph with the number of discarded screens per line over time.

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CLEANING TIME

Due to the self-cleaning characteristic of the "H" profile PU screens, a reduction in cleaning time was noted when compared to steel screens, which tend to blind or clog. The standard average time registered for cleaning the steel screens was 5 minutes, while with the Line B screens the average value was 3 minutes. The 2-minute reduction in cleaning brings gains in the physical use of the sieves as well as, in the case of sieving with natural humidity, it reduces the injection of water into the circuit due to cleaning.

CONCLUSION

The lower cost and larger open area advantages of steel meshes compared to polyurethane meshes are not sustainable in the long term. Events of breakage, fall and wear of steel screens make it necessary to replace them between 18 and 25 days of use. On the other hand, PU screens have a useful life 6 times longer and, therefore, even though they are more expensive, in one month they are already more financially advantageous, contributing to a better cost-benefit ratio.

In addition, these events on steel screens directly affect the availability and physical use of the sieves and interfere with the productivity of these equipment in general, demonstrating yet another advantage of PU screens, not to mention the 2-minute reduction in cleaning time and, consequently, in the water consumption of the plant.

Furthermore, the slight advantage of 3% of open area for the steel screens also did not prevent the feed rate results for the PU line from being higher. The results regarding sustainability through the generation of waste, such as discarded metallic screen scraps, also follow the same pattern, with a great advantage for PU screens, which reduce this value by around 87%.

This way, the need for constant development of mineral operations is clearly seen. The substitution of material for the sieving screens promoted a significant gain for the process and profitability. PU screens also have environmental advantages, since consumption is lower due to their useful life. Finally, and most importantly, the safety and ergonomics of employees is also benefited, with lighter screens for transport and with less risk of cutting hands and fingers.

Thus, the importance of industrial tests and continuous improvement of processes must be constant, that is, new materials, new formats and configuretions are examples of what can be done for the development of screening. The support of the organization and leadership in these projects is of paramount importance, encouraging innovation and disseminating the results in order to reach the entire production chain and mineral sector. Partnerships with suppliers, academics and even startup companies are also part of this process, maintaining the competitiveness, productivity and safety of operations.

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