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METHODOLOGY TO REDUCE
FAILURES IN THE DUST
FILTRATION SYSTEM IN THE
CEMENT INDUSTRY**

*APLICACIÓN DE LA METODOLOGÍA 8D PARA
REDUCIR FALLOS EN EL SISTEMA DE FILTRACIÓN
DE POLVO EN LA INDUSTRIA DEL CEMENTO*

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Application of the 8D Methodology to Reduce Failures in the Dust Filtration System in the Cement Industry

Aplicación de la Metodología 8D para Reducir Fallos en el Sistema de Filtración de Polvo en la Industria del Cemento

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ABSTRACT

In the present investigation, the 8D methodology was used to solve a problem of filter bag breakage in a complex dust collection system caused mainly by premature wear of the filters, this generated inefficiency in both the operating process due to material losses causing environmental damage when particles leak out of the system. In addition to this, it is a fundamental quality requirement to maintain a controlled process with a purity level $> 99\%$. The application of the tool showed that due to the complexity of the problem it was necessary to integrate a broad methodology that included a multidisciplinary group of experts, determining 3 root causes; improper basket design, poor filter media quality, and improper operation of the cleaning system. Derived from the main findings, a future control and prevention plan was designed.

Keywords: ishikawa, 8D methodology, quality, dust collector, filters

Resumen

En la presente investigación se empleó la metodología 8D para resolver un problema de rotura de las bolsas filtrantes en un sistema complejo de colección de polvos provocado principalmente por el desgaste prematuro de los filtros, esto generó ineficiencia tanto en el proceso operativo debido a las pérdidas de material provocando daños ambientales al momento de fugarse partículas al exterior del sistema. Aunado a eso es requisito fundamental de calidad mantener un proceso controlado y con un nivel de pureza $> 99\%$. La aplicación de la herramienta mostró que debido a la complejidad del problema era necesario integrar una metodología amplia que incluyera a un grupo multidisciplinario de expertos, determinando 3 causas raíz; diseño inadecuado de la canastilla, calidad deficiente del medio filtrante y operación incorrecta del sistema de limpieza. Derivado de los principales hallazgos se diseñó un plan de control y prevención a futuro.

Palabras clave: ishikawa, metodología 8D, calidad, colector de polvos, filtros

INTRODUCTION

The cement industry currently faces significant production-related challenges due to rising demand in recent years; according to Morales Zambrano (2022), cement production in Mexico will increase in 2020, driven by the construction sector's response to government social programs. Cement is considered one of the most widely used materials globally, as it is essential for infrastructure development in the construction of housing, buildings, roads, and bridges (Arena, Correa & de Rosa, 2002).

Due to its rapid growth, this industry has faced significant challenges in both operational and environmental areas. The production of this material involves crushing, calcination, and grinding processes that generate large quantities of dust; consequently, it is essential to have an adequate filtration system capable of capturing these particles to reintroduce them into the process rather than releasing them into the environment. Among the most widely used filtration systems are filter bags, which consist of a synthetic fiber filtering surface designed to retain particulate matter (Díaz & Velázquez, 2019) and a metal structure, known as a cage and located inside the bag, that provides rigidity and prevents deformation (Sosa, 2022).

Filter bags operate via a system in which a dust-laden air stream enters and passes through the bags; dust particles are trapped on the bag walls, while clean air exits the system. Periodically, a burst of compressed air is released, dislodging the trapped dust and causing it to fall into a hopper located at the bottom of the filtration system (Rivera, 2019). This entire process enables the recovery and reintroduction of a significant portion of the material, thereby reducing the waste generated.

Filtration systems are constantly subjected to extreme operating conditions, including high temperatures and continuous contact with abrasive particles generated during the process. These factors directly affect the equipment's durability, and consequently, various problems often arise that prevent the system from functioning correctly. Among the most common problems are filter saturation, filter bag rupture, excessive cleaning, cage deterioration, abrasion, and corrosion. Of the numerous possible failures, filter bag rupture plays a critical role in system performance: ruptures allow particles to escape into the environment, resulting in the loss of material that should have been recovered.

Filter bag rupture is considered a critical failure in the cement industry due to the associated environmental and production complications; therefore, a detailed analysis of the multiple potential causes of this issue is required. In this article, we employ the Eight Disciplines (8D)

problem-solving methodology, which is designed to address problems of unknown origin with the aim of process improvement (Kaplík, Prístavka, Bujna & Viderňan, 2013), by following a sequential process until the issue is resolved through the implementation of a permanent solution (Barosani, Bhalwankar, Deshmukh, Kokane & Kulkarni, 2017). Beyond addressing the specific problem at hand, this approach prevents the emergence of further complications resulting from the system failure (Rathi, Reddy, Narayana, Narayana & Rahman, 2022).

Against this backdrop, this article analyzes filter bag rupture failures in the cement industry using the 8D methodology, aiming to identify the root cause of the issue and devise an optimal solution that eliminates the problem at its source.

METHODOLOGY

This study focused on a dust collection system serving the calcination process in the cement industry. During system operation, premature failures were observed in the collector's filter bags; specifically, tears appeared at the top of the bag (the collar), allowing a portion of the generated emissions to escape into the atmosphere. This reduced the capture system's efficiency and necessitated unscheduled shutdowns to replace the damaged filter bags. To identify the root causes of the problem, the 8D (Problem-Solving Process) methodology was employed. By assembling a competent, multidisciplinary team and following a structured analysis process, utilizing various quality tools and sound decision-making, we were able to resolve the issue.

Table 1. 8D methodology

8D METHODOLOGY	
D0	Problem assessment.
D1	Team formation.
D2	Problem description.
D3	Containment actions.
D4	Root cause identification.
D5	Permanent corrective actions.
D6	Implementation of corrective actions.
D7	Prevention of recurrence.
D8	Closure and recognition.

Source: own elaboration.

D0: Here, a problem directly impacting the company is identified, and the severity of the situation is assessed to determine whether this methodology needs to be applied.

D1: In this stage, a team is assembled possessing knowledge and skills related to the process or product, specifically the area under review and those affected by the problem. Team members must have the authority to implement changes and the capacity to provide responses that drive improvement. It is necessary to assign roles to each team member and clearly define their responsibilities.

D2: Data collection takes place, presenting specific and historical information. A clear and precise explanation is provided regarding what is happening, where the failure occurs, the number of defective parts, who performs the operation, and when and how the problem occurred, all without yet addressing the root cause of the problem.

D3: An emergency response is created by implementing interim measures to ensure the customer is not affected while a definitive solution is reached.

D4: Quality tools such as the Ishikawa diagram, the "5 Whys," or the Pareto chart are used here to rule out potential causes of the failure and identify the root cause of the problem.

D5: The root cause is analyzed to determine and select the best possible solution. It is essential to ensure that the corrective actions permanently resolve the root cause of the problem.

D6: Permanent corrective actions are implemented based on a plan; it is important to verify that the actions taken are effective in resolving the problem. The containment action should be eliminated once it is confirmed that the corrective actions are functioning properly.

D7: Now that actions have been taken to fix the failure, the system, processes, or procedures are analyzed to prevent the failure from recurring in the future, thereby avoiding a repeat of the same problem.

D8: Upon completion of the 8D's process, the results are documented, and the efforts of the individuals involved in resolving the issue are recognized; this motivates team members to participate in future situations that may arise.

Case study

The study was conducted at the facilities of a cement manufacturing company; its operations range from the extraction and processing of raw materials such as limestone, clay, and other minerals to their transformation into cement through industrial processes.

D0: Problem Assessment: The production process utilizes various dust filtration systems to ensure the reincorporation of collected material and compliance with environmental regulations. In recent weeks, recurring atmospheric emissions have been detected from one of the main filters, compromising operational efficiency and causing unscheduled shutdowns.

D1: Team Formation: A multidisciplinary team was assembled to gather information for analyzing and resolving the problem. The company's General Manager serves as the team leader, and the team is composed of the following members:

Table 2. Work team

PLANT MANAGER	Provides the necessary resources for the investigation and approves corrective actions involving investments or modifications to the filtration system.
PRODUCTION MANAGER	Responsible for providing information regarding the collector's operating conditions.
MAINTENANCE MANAGER	Coordinates all technical activities related to the inspection and repair of the filtration system.
FILTRATION SPECIALISTS	Provide expertise on the operation of collectors and filter elements. They analyze the physical condition of the bags, cages, and cleaning system, as well as the collector's operating conditions.
MAINTENANCE ASSISTANTS	Perform tasks such as removing filter bags, replacing damaged elements, and assisting in the implementation of corrective actions.

Source: own elaboration.

D2. Problem description: As shown in Table 3, the emissions resulted from damage to various bags. During April and May 2026 a period spanning eight weeks inspections of the collector were conducted to assess the impact of the failure and replace the damaged bags.

Table 3. Percentage of damaged bags

	WEEK							
BAGS	1	2	3	4	5	6	7	8
Total	4,620	4,620	4,620	4,620	4,620	4,620	4,620	4,620
Defects	25	34	20	24	29	21	15	34
%	0.54	0.74	0.43	0.52	0.63	0.45	0.32	0.74

Source: own elaboration.

Based on this data collection, it can be observed that, on average, 0.55% of the bags rupture due to various causes. Although 0.55% may seem low, this percentage of ruptured bags represents an increase in emissions resulting from the direct passage of unfiltered dust.

Inspections of the various compartments reveal that the primary bag failure occurs in the upper section, as shown in Figure 1.

Figure 1. Breakage of upper part 1.



Source: own elaboration.

Figure 2. Ruptured bags



Source: own elaboration.

Figure 3. Breakage of upper part 2

Source: own elaboration.

Figure 4. Upper part breakage 3

Source: own elaboration.

Currently, the company operates its cleaning system on a continuous basis, that is, over a fixed time interval, involving set cleaning cycles and discharge pressures. This system is very simple; it operates for a predetermined duration regardless of the actual cleanliness of the bags. This results in inefficient cleaning, as the system continues to discharge compressed air unnecessarily, wasting electricity even when the plant generates less dust during a shift.

Table 4. Continuous cleaning cycles

<i>CYCL E</i>	<i>ΔP</i>	<i>CYC LE</i>	<i>ΔP</i>	<i>CYC LE</i>	<i>ΔP</i>	<i>CYCL E</i>	<i>ΔP</i>
1	5.53	9	7.64	17	4.17	25	6.85
2	5.24	10	3.14	18	4.28	26	5.79
3	3.04	11	3.52	19	5.57	27	6.41
4	7.43	12	5.61	20	7.05	28	5.07
5	2.80	13	7.81	21	6.79	29	4.75
6	4.40	14	2.18	22	6.77	30	2.31
7	5.98	15	4.06	23	3.18	31	5.45

8	5.84	16	4.43	24	6.50	32	3.96
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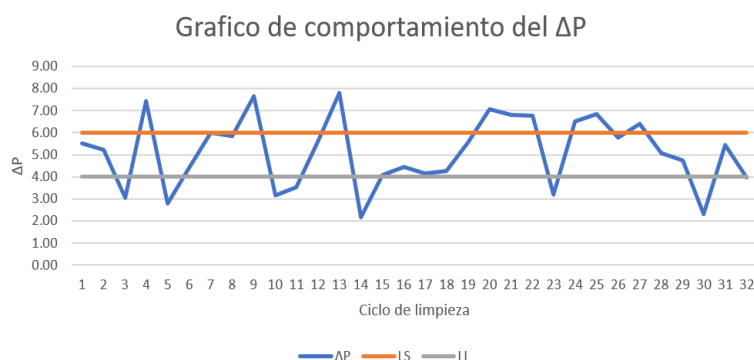
Note: * ΔP = Pressure differential.

Source: own elaboration.

The manufacturer establishes a critical operating limit of 6 inH₂O, as a high pressure differential results in increased energy consumption; the exhaust fan must work harder to move the same volume of air. For this reason, specialists recommend configuring the cleaning system based on pressure differential rather than time, setting upper and lower limit values. Graph 1 illustrates these limits as well as the measurements from Table 4.

* inH₂O = Inches of water column; measures the pressure exerted by a column of water one inch high.

Graph 1. Pressure difference limits



Note: LS: Upper limit, 6 in H₂O. LI: Lower limit, 2.4 in H₂O. LC: Center limit, 4.4 in H₂O. ΔP : Pressure differential, current ranges.

Source: own elaboration.

As shown in Graph 1, the cleaning cycles run continuously, causing the bags to undergo cleaning even when not required. In instances of higher dust loads, filter pressure rises; consequently, the company decided to increase the pulse pressure from 4 bar to 6 bar.

D3: Containment actions. Based on the observed differential pressure behavior, it is recommended to switch from time-based cleaning cycles to differential pressure (ΔP) based cycles. This will prevent unnecessary cleaning cycles; the cycle will initiate when the differential pressure reaches 6 inH₂O and stop at 4 inH₂O, thereby mitigating the fatigue bags experienced during each cycle due to compression and tension stresses. Additionally, the pulse pressure should be reduced from 6 bar to 3 bar, as higher cleaning pressures increase fatigue stress, leading to premature bag damage.

D4: Root cause identification. To understand the root cause of the problem, the team has decided to use analysis tools such as the Ishikawa diagram; this will enable the team to identify the various factors contributing to the issue.

Figure 2. Ishikawa diagram for the analysis of causes of filter bag failure



Source: own elaboration.

Labor: It was found that the filter bags in the filtration system were improperly installed due to inadequate staff training; furthermore, the inspections being conducted were deficient.

Machine: The cages installed in the filtration system are poorly designed, as they lack a venturi to accelerate fluid flow; consequently, the air does not move at the proper speed to traverse the entire bag. This results in uneven cleaning, as the bag is too large. Additionally, the connection between the collar and the cage's vertical ribs is exposed and in direct contact with the bag, causing weld defects to tear the bag at the top, as shown in Figure 3.

Figure 5. Bag torn at the neck



Source: own elaboration.

Figure 6. Welding defect.



Source: own elaboration.

Material: A bag was sampled for laboratory analysis, yielding the following results. Microscope images reveal the deterioration of the PTFE membrane and dust accumulation within the fabric structure, leading to saturation, as shown in Figure 4.

Figure 7. Surface of the bag



Source: own elaboration.

Figure 8. Dust penetration



Source: own elaboration.

As shown in Table 5, the mass per unit area indicates significant particle accumulation and dust impregnation within the fiber structure as can be seen in Figure 5 since the cleaning process failed to restore the nominal value. Regarding air permeability, the results fall within the reference range; however, these values are very low compared to the quality of other filter fibers. Permeability doubles after cleaning; this fact, combined with the visual inspection, confirms the observed deterioration of the membrane.

Table 5. Weight control and air permeability

SECTION	WEIGHT (G/M ²)		PERMEABILITY (L/DM ² /MIN)		
	MEASURED	REFERENCE	SUPERIOR	LOWER	REFERENCE
As received	873.33	770	13.59	14.05	9 - 30
After cleaning	854.66		29.74	36.03	

Note: *The reference values are taken from the bag manufacturer's technical data sheet.

Source: own elaboration.

The rupture test values presented in Table 6 demonstrate a significant decline in the mechanical properties of the bags compared to the reference values; this indicates that the bags are already substandard and compromises system performance due to premature ruptures.

Table 6. Breaking load and elongation at break

SECTION	BREAKING LOAD (DAN/5CM)			ELONGATION AT BREAK (%)		
	SUPERIOR	LOWE R	REFERENC E	SUPERIOR	LOWE R	REFERENC E
Longitudinal	234.95	220.85	Length: ≥ 400 Width: ≥ 300	10.88	10.39	—
Cross	286.92	201.97		4.38	5.88	

Note: *The reference values are taken from the bag manufacturer's technical data sheet.

Source: own elaboration.

Based on the results obtained during the visual inspection and laboratory tests, it is concluded that the fiberglass filter bag exhibits a level of deterioration that compromises its performance.

Laboratory test methods for filter fabrics

Air permeability: [In accordance with standard SFS-EN ISO 9237]: The airflow rate passing perpendicularly through a specific area of the fabric is measured at a specific pressure difference across the test area over a set period of time.

Equipment: Air permeability tester.

Test area: 20 cm²

Pressure drop: 200 Pa

Area density (weight per unit area): [In accordance with standard SFS-EN 12127]: The mass of a known area of the fabric is divided by that area, expressed in grams per square meter.

Equipment: Precision balance, accuracy ± 3 mg.

Test result: Mean mass per unit area, in grams per square meter.

Tenacidad de rotura y alargamiento de rotura: [De acuerdo a la norma SFS-EN ISO 13934-1]

Breaking tenacity and elongation at break: [In accordance with standard SFS-EN ISO 13934-1]

Method: A test specimen of specific dimensions is subjected to extension at a constant speed until rupture. The maximum force and the elongation at the point of maximum force are recorded.

Equipment: Tensile testing machine for strength and elongation.

Test speed: 300 mm/min

Gauge length: 100 mm

Test results: Arithmetic mean of the maximum force in daN/5 cm in the longitudinal and transverse directions, as well as the arithmetic mean of the elongation at the point of maximum force, expressed as a percentage in both directions.

Method: The company establishes its cleaning frequency based on time; this results in the system being cleaned when not yet required, subjecting the bags to unnecessary stress.

D5: Permanent corrective actions. Based on the results of the root cause analysis, the necessary corrective actions are established to mitigate and eliminate the fundamental causes of the bag failures. Replacing the filter medium with a higher-quality one is proposed; this will help significantly improve the collector's performance.

It is proposed to replace the filter medium with one of higher quality. This will help significantly improve the collector's performance.

Table 7. Comparison of filter media

CHARACTERISTICS	CURRENT	PROPOSAL
Raw material	100% Fiberglass	100% Fiberglass
Weight	770 g/m ²	750 g/m ²
Thickness	0.8 - 1.1 mm	0.9 mm
Density	— — —	0.83
Permeability	9 - 30 l/dm ² /min	25 - 45 l/dm ² /min
Temperature resistance	260°C continuous flow (dry heat)	240°C continuous flow (dry heat)

Finish	Polytetrafluoroethylene (PTFE) membrane	Microporous polytetrafluoroethylene (PTFE) membrane
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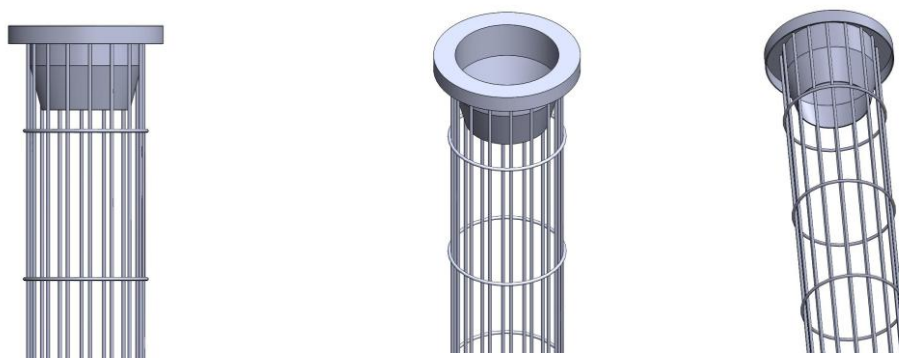
Source: own elaboration.

Table 7 shows a decrease in temperature resistance, dropping from 260°C (with the currently used material) to 240°C (with the proposed material); this poses no risk, as the system's operating conditions indicate a maximum gas temperature of 220°C, meaning the reduction in the proposed material's resistance does not affect the system. The new material offers a significant improvement in filter medium permeability increasing from a range of 9–30 L/dm²/min to 25–45 L/dm²/min which indicates higher airflow through the medium and, consequently, better filter performance. Furthermore, the incorporation of a microporous PTFE membrane ensures atmospheric emissions of less than 10 mg/m³.

The cage is a critical component, and a poor design compromises the performance of the filter medium; therefore, a complete redesign of the cage is proposed.

Figure 6 illustrates the current cage design, which features a short, funnel-style collar and a junction point where the longitudinal wires connect to the collar; this area remains exposed and in direct contact with the filter bag seal.

Figure 9. Current design of the basket



Source: own elaboration.

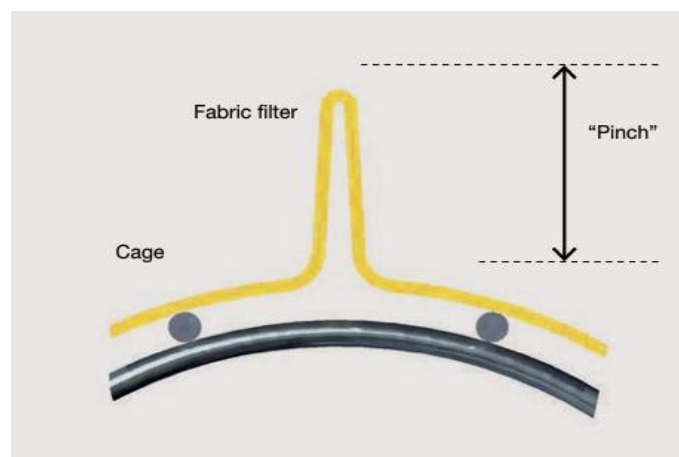
Figure 9 illustrates the new proposed design, which incorporates a three-piece assembly (cage, straight collar, and venturi). This configuration ensures better distribution during bag cleaning, thereby improving filter performance; additionally, the straight collar protects the top of the bag, preventing tears caused by direct contact with weld seams.

Figure 10. Proposed design

Source: own elaboration.

The fit between the filter bag and the cage is crucial for optimal pulse-jet filter performance. A filter that is too tight or too loose will result in poor dust collection and is prone to premature failure. Therefore, parameters exist to determine the ideal fit often referred to as the "pinch" between the bag and the cage, as shown in Figure 8.

Figure 10. The "pinch" is calculated by subtracting the actual cage circumference from the bag circumference (flat) and then multiplying the result by Pi divided by 2



Source: Parker Hannifin Corporation (2018).

Table 8 shows the clamping tolerance according to tissue type.

Table 8. Nominal clamping recommendation

<i>TELA</i>	<i>PINCH</i>
Fieltros	0.25" - 0.75" (6.4 - 19 mm)
PPS	0.25" - 0.5" (6.4 - 12.7 mm)
P84	0.125" - 0.375" (3.2 - 9.5 mm)
Fibra de Vidrio con membrana de PTFE	0.0" - 0.1875" (0.0 - 4.8 mm)

Source: Parker Hannifin Corporation (2018).

The previous cage had a diameter of 126 mm, based on the dimensions of the filter bag (which had a lay-flat width of 200 mm); this ratio resulted in a "pinch" of 4.7 mm. Although this value fell within acceptable parameters, it was at the upper limit of the permitted range. Consequently, it was proposed to increase the cage diameter to 128 mm, thereby reducing the pinch to 0.6 mm. In pulse-jet cleaning filters, bags are subjected to thousands of air pulses throughout their service life; with each pulse, the bag inflates and, upon completion of the cleaning cycle, contracts against the cage, generating considerable tension. Reduced pinch especially with fiberglass bags provides superior mechanical support, which decreases fabric fatigue and extends service life.

D6: Implementation of corrective actions. The filter bag material was modified: fiberglass bags with a standard PTFE membrane finish were replaced with bags made of the same base material but featuring a superior-quality microporous PTFE membrane finish. This change extended the bags' service life and improved filter efficiency by capturing more particles and optimizing overall performance. Additionally, cages with a new design were installed; this design allows for full airflow circulation around the bag, ensuring uniform dust distribution along its entire length. The redesigned cage features welds on the inner face of the collar, preventing direct contact with the bag and resolving the issue of premature wear. Furthermore, maintenance personnel received training on the correct installation of bags and cages to ensure optimal pinch, thereby minimizing mechanical stress on the bags and extending their durability. Finally, periodic inspections are conducted to ensure the proper functioning of the entire system.

Table 9. Percentage of damaged bags after the implemented improvements

	WEEKS							
BAGS	1	2	3	4	5	6	7	8
Total	4,620	4,620	4,620	4,620	4,620	4,620	4,620	4,620
Defects	0	0	0	0	0	0	0	0
%	0	0	0	0	0	0	0	0

Source: own elaboration.

As shown in Table 9, the implemented improvements resulted in a significant reduction in premature bag failures; this notably reduced unplanned downtime, increased filtration efficiency, and simultaneously lowered unforeseen costs.

D7: Prevention of recurrence. As shown in Figure 9, a control plan was established to verify the proper condition of system components from receipt of materials from suppliers through to installation and operation in the filtration equipment using direct measurement and visual inspection as control methods.

Figure 11. Control Plan

PART NUMBER / PROCESS	PROCESS NAME / OPERATION DESCRIPTION	MACHINE, DEVICE, TOOL			METHOD			RESPONSE PLAN
			PRODUCT	PROCESS	SPECIFICATION / TOLERANCE	FREQUENCY	CONTROL METHOD	
1	RECEIPT OF FILTER BAGS	FLEXOMETER AND SCANTILLION OF 134 MM DIAMETER	TECHNICAL SPECIFICATIONS	RECEIPT OF MATERIAL	DIAMETRO DE BARRENO: 134 MM LONGITUD: 7,315 MM, +15 MM -0 MM FLAT: 206 MM	EACH LOT	INSPECTION	REJECT THE LOT
2	RECEIPT OF CAGES	FLEXOMETER AND SCANTILLION OF MM DIAMETER	TECHNICAL SPECIFICATIONS	RECEIPT OF MATERIAL	DIAMETRO: LONGITUD: 7,315 MM, +15 MM -0 MM	EACH LOT	INSPECTION	REJECT THE LOT
3	COLLECTOR INSPECTION	LAMP	NO DUST PRESENT ON THE CLEAN SIDE.	PHYSICAL CONDITION OF THE BAGS AND COMPONENTS	0 BOLSAS ROTAS	ONLY DURING A STOP OF ACTIVITIES	INSPECTION	Replace torn bags
4	INSTALLATION OF BAGS AND CAGES	PPE, NECK PROTECTOR	PROPER INSTALLATION	CORRECT POSITION, FIT, AND SEAL	BOLSA SIN PLIEGUES NI TORSIONES	WHENEVER THE BAGS ARE CHANGED	CHECKLIST	STOP THE INSTALLATION TO CORRECT THE POSITION AND ADJUSTMENT.
		HOOK	PROPER INSTALLATION	PROPER FIT	SIN REBABAS DE SOLDADURA NI DEFORMACIONES	WHENEVER THE BAGS ARE CHANGED	CHECKLIST	REPLACE DEFECTIVE CAGE
5	OPERATION	PRESSURE GAUGE	INTEGRITY OF THE BAGS	PRESSURE DIFFERENTIAL WITHIN THE OPERATING RANGE	ENTRE 4 - 6 InCA	EACH CLEANING CYCLE	TREND RECORD	CHECK BAGS AND CLEANING SYSTEM.

Source: own elaboration.

D8: Closure and recognition. Upon completion of the analysis using the 8D methodology, the problem was resolved favorably for the company. Consequently, team members are recognized for contributing their ideas, knowledge, and skills to ensure the filtration systems operate with

the desired efficiency; this achievement was made possible through the effort, perseverance, and dedication of each individual.

RESULTS AND DISCUSSION

According to Morales (2022), the 8D tool proved highly effective in resolving a customer complaint regarding a fuel module that failed a flow performance test, thereby eliminating the root cause of the complaint. This research followed the same steps as the aforementioned author, with the distinction that the team was multidisciplinary; as in that study, the problem was eliminated by identifying the root cause and implementing preventive measures.

Similarly, Montiel (2025) found that applying the 8D method led to a 37.48% reduction in total tool consumption, optimizing operating costs and resource management efficiency, while also surpassing the benchmark standard established within the Hoshin Kanri framework. Like that author, this study succeeded in reducing maintenance and operating costs by completely eradicating the root cause of the problem.

Zamudio (2025) implemented containment actions to prevent the shipment of non-conforming parts to the customer; these measures ensured operational continuity and maintained customer satisfaction while the origin of the problem was investigated. Likewise, similar actions were carried out in the present case, focusing corrective measures on the cleaning system by reducing the frequency and pressure of discharge pulses. This decreased fatigue on the filter medium, allowing the system to remain operational while the root cause was identified.

Rosas (2025) applied the 8D methodology at the company Pardalix to identify the root cause of workplace inefficiencies using analysis tools; The proposed corrective action involved an ergonomic workstation designed to improve operator performance. The study identified the filter material and basket design as the primary causes of filtration system failures; consequently, the filter medium was replaced and the basket redesigned to enhance performance and extend service life.

Izaguirre (2017) applied Failure Mode and Effects Analysis (FMEA) to prevent failures in refrigeration equipment, identifying potential issues and establishing preventive actions based on their criticality. Additionally, this project utilized a control plan to prevent the recurrence of bag failures by implementing inspection methods and reaction plans that covered everything from material receipt to actual operations.

The 8D methodology is widely used across various industrial sectors, as it facilitates problem-solving through a systemic approach, leading to the proposal of solutions and the prevention of recurrence. By employing this methodology, Escalona (2024) achieved a 50% reduction in the consumption of personal protective equipment (PPE) at an automotive company, thereby optimizing its budget. Similarly, the present study achieved a significant reduction in the use of filter bags.

CONCLUSIÓN

The application of improvement tools and techniques has proven effective in resolving complex problems that could not otherwise be solved without a systematic, methodological, analytical, and engineering-based approach. Among these tools, the 8D methodology has once again demonstrated that a problem's root cause can stem from multiple factors, highlighting the advantages and merits of such a comprehensive approach. Furthermore, the constant and ongoing changes in products, inputs, and technology compel us to adapt and employ methodologies like 8D in any environment.

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